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NCR DECISION MATE V HARDWARE SYSTEM TECHNICAL MANUAL

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Power Supply

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NCR DECISION MATE V

System Technical Manual -Hardware

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FOREWORD

The NCR DECISION MATE V System Technical Manuals are designed to provide both hardware and software information: they are intended for designers, system integrators, programmers, and other interested persons who require detailed information on the construction and operation of the NCR DECISION MATE V.

Problems arising from any changes that you make to the hardware or software of the NCR DECISION MATE V are your responsibility. NCR cannot assist in resolving problems that may arise when making changes to the hardware or software.

The first manual provides general information on the NCR DECISION MATE V and its various options. Information is included on how to identify the various models and kits that are available. The hardware description includes information about the I/O bus, signal levels, power requirements, and plug/pin assignments.

The other manuals provide information on the various operating system software used with the NCR DECISION MATE V. The software descriptions include information for using system routines at machine code level.

The appendices provide schematics, component locations, software listings, and other information that may be helpful to the user of these manuals.

NCR DECISION MATE V
SYSTEM TECHNICAL MANUALS

System Technical Manual
Hardware

System Technical Manual
CP/M®-80

System Technical Manual
MS™ -DOS

System Technical Manual
CP/M®-86

In the NCR DECISION MATE V System Technical Manual series, the chapters are arranged in numeric sequence and the appendices in alphabetic sequence:

Hardware — Chapters 1 and 2, Appendix A

CP/M-80 — Chapter 3, Appendix B

MS-DOS — Chapter 4, Appendix C

CP/M-86 — Chapter 5, Appendix D

NCR DECISION MATE V
SYSTEM TECHNICAL MANUAL
HARDWARE

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SYSTEM OVERVIEW

GENERAL DESCRIPTION

The NCR DECISION MATE V is the first of a new generation of NCR business/professional personal computer systems. It is designed to act as the control center for systems that fulfill a wide range of user requirements. Industry standard interfaces are used to provide the user with a wide selection of peripherals. This system approach provides a powerful tool to use in business applications, scientific calculations, and in various technological fields.

The processor and all supporting logic, CRT screen, disk drives, power supply, and I/O bus are all integrated into a single cabinet: this provides a system that requires the minimum of space and connecting cables. The separate keyboard is connected by a coiled cable to the processor unit.

Most of the electronics are contained on the controller board, where possible LSI components are used providing a high degree of reliability. Included on this board are the Z80 microprocessor, DMA, flexible disk controller, keyboard controller, and 64K bytes RAM. Also, the I/O bus, complete with seven user accessible sockets, is integrated into the controller board. Two additional sockets are available for the factory installation of some features. In this configuration the NCR DECISION MATE V uses CP/M®-80 operating system software and any compatible 8-bit application packages. A 16-bit board, with an Intel 8088 microprocessor, can be connected to the controller board making the computer into a dual 8/16-bit system. In this configuration the system can still use CP/M-80 and 8-bit application software, or it can use either CP/M-80 or MS-DOS™ operating system software and any compatible 16-bit application packages.

The system may have either a monochrome CRT with a green display on a dark background, or a color CRT capable of displaying eight different colors. The CRTs can display 25 lines of data, with up to 80 characters per line, or in the graphics mode, various figures, charts, and plans.

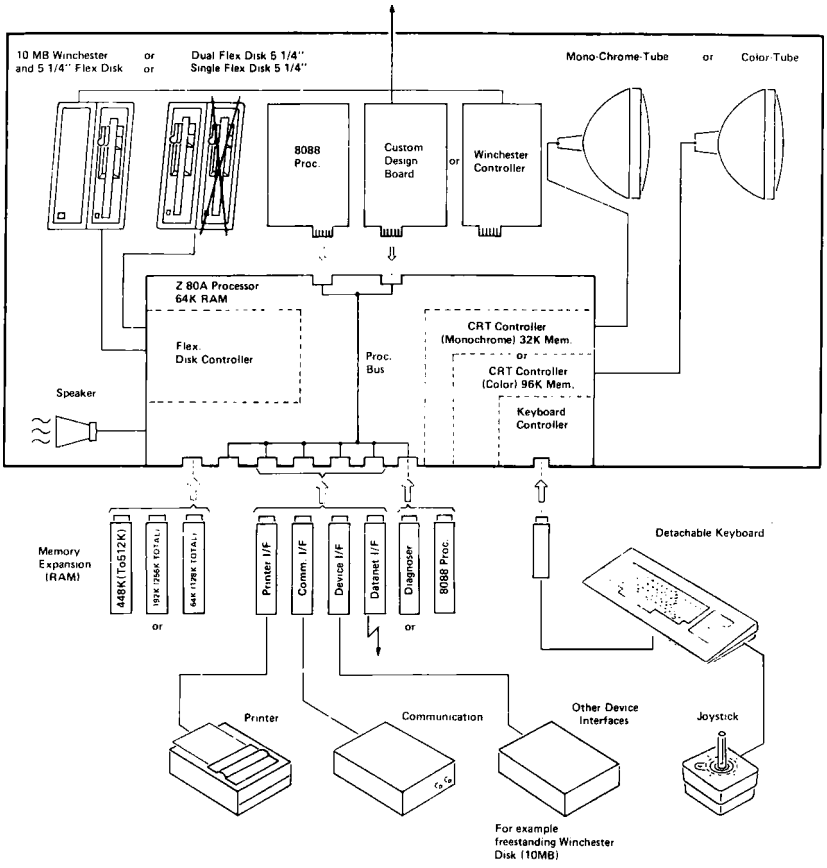


Figure 1.1 System overview

The integrated disk drives are available in the following combinations:

- One 5 1/4-inch flexible disk drive
- Two 5 1/4-inch flexible disk drives
- One 5 1/4-inch flexible disk drive and one 5 1/4-inch fixed Winchester disk drive

The I/O bus is an integral part of the controller board; it includes seven sockets that allow the user to connect the various peripheral adapters and options to the bus. These adapters and options all use a common style of housing, permitting flexibility in configuring the hardware. The cabinet design is such that the adapters/options are fully recessed into the rear of the cabinet when installed. The adapters/options do not require any preparation and can be plugged directly into the bus by the user. The peripheral adapters are used to connect industry standard printers, modems, and terminals to the bus. The bus is also used for the connection of the memory expansion modules and other special purpose modules.

Different versions of a "switcher" type power supply are used depending on the power requirements of the different models of the NCR DECISION MATE V. The power supply also provides logical voltages to the bus for use by the peripheral adapters and options.

NCR DECISION NET

The NCR DECISION NET System is a local area network system, typically consisting of the following components:

- An NCR MODUS File Sharer
- An NCR OMNINET local area network
- A number of NCR DECISION MATE V personal computers (up to 63)

To connect an NCR DECISION MATE V into the NCR DECISION NET System, a special adapter, known as a transporter, is required. This transporter (3273-K600) connects directly into an I/O bus slot at the rear of the NCR DECISION MATE V.

KIT DESCRIPTIONS

Various kits are available to enhance the capabilities or change the hardware configuration of the NCR DECISION MATE V. Many of these kits can be plugged directly into the I/O bus by the user: others require installation by a service engineer.

Integrated Fixed Disk

This kit (K012) provides for the integration of a fixed (Winchester) disk drive. The kit includes the necessary changes for the power supply. When installed, the system has one fixed disk drive (capacity 10M bytes) and one flexible disk drive (capacity 320/360K bytes).

Second Integrated Flexible Disk

These kits upgrade an NCR DECISION MATE V from a system with one flexible disk drive to a system with two flexible disk drives. Kit K018 is for systems produced in the DIN color scheme, kit K019 is for systems in the Corporate Appearance Plan (CAP) color scheme.

Memory Expansion Modules

These kits (K200, 202, and 208) can be installed, by the user, directly into slot 1 of the I/O bus. It is only possible to install one kit into a system. The kits provide the following memory capacities:

- K200 increases memory capacity from 64K to 128K bytes
- K202 increases memory capacity from 64K to 256K bytes
- K208 increases memory capacity from 64K to 512K bytes

Centronics Peripheral Adapter

This kit (K210) can be installed, by the user, directly into the I/O bus (slots 2 to 6). The kit includes a 2 metre (6.6 ft.) cable complete with plug, that allows connection to a Centronics compatible (parallel input) printer.

RS-232-C (Communications) Peripheral Adapter

This kit (K211) can be installed, by the user, directly into the I/O bus (slots 2 to 6). The kit includes a 2 metre (6.6 ft.) cable complete with plug, that allows connection to an RS-232-C compatible (serial) communications device.

RS-232-C (Printer) Peripheral Adapter

This kit (K212) is similar to K211, but is used for the connection of RS-232-C compatible (serial) printers.

RS-232-C (Plotter) Peripheral Adapter

This kit (K213) is used for the connection of a compatible plotter (e.g. NCR 5403) to the NCR DECISION MATE V.

Blank Interface Adapters

These kits (K214, 217, and 218) comprise a housing, an I/O bus connector, and a blank printed circuit board. They provide the necessary hardware to help the system integrator to develop custom interfaces or adapters.

- K214 provides hardware for one adapter
- K217 provides hardware for five adapters
- K218 provides hardware for 25 adapters

Integrated Modem

This kit (K219) can be installed, by the user, directly into the I/O bus (slots 2 to 6). It is designed to support the following modems:

- Bell 103 (300 baud)
- Bell 2035 (1200 baud)

Built into the modern housing are two sockets for the connection of standard telephone type plugs: a cable is included for the connection of a telephone.

Diagnostic Module

This module (K220) can be installed directly into slot 7 of the I/O bus, and is intended for service engineers and other persons interested in diagnosing problems. The module tests the computer and provides information on failures. It also monitors the logical voltages (+5 and +12 Vdc) and indicates whether the voltages are within or outside the specified limits. For a full description, refer to the NCR DECISION MATE V Service Manual.

8/16-Bit Processor

Kit K231 can be installed, by the user, directly into slot 7 of the I/O bus. It converts the NCR DECISION MATE V from an 8-bit system to a dual 8/16-bit system that is capable of using either 8-bit or 16-bit operating system and application software.

Kit 230 functions similarly to K231, but is connected internally to the controller board. This kit should be installed by a field engineer; it is not suitable for installation by the user.

Tilt Mechanism

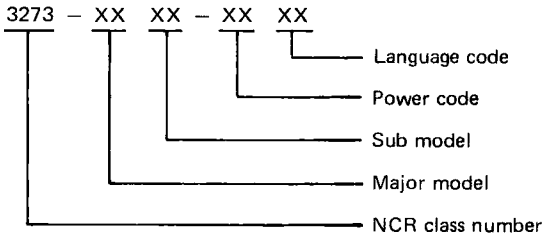
This kit (K240) provides a means of tilting the NCR DECISION MATE V by seven degrees. The user can easily install the device by fixing a base plate to the bottom of the computer, using the existing holes in the base of the cabinet.

NCR OMNINET Transporter

This kit (K600) can be installed, by the user, directly into the I/O bus (slots 2 to 6). The adapter has twice the thickness of other adapters, therefore it requires two slot positions for installation. The adapter provides the interface between the NCR DECISION MATE V and the DECISION NET System.

MODEL AND KIT IDENTIFICATION

The configuration of the hardware is defined by the model number. The standard arrangement of the model number is shown below:



The model number of the NCR DECISION MATE V is shown in Figure 1.2. The optional features are shown in Figure 1.3. An asterisk indicates a planned development not released at the time of printing, but included for reference.

Class	3273	NCR Class Number
Major Model	01	8-bit Proc./12" CRT Monochrome
	11	8/16-bit Proc./12" CRT Monochrome
	12	8/16-bit Proc./12" CRT Color
Sub-Model	01	One 5 1/4" Flex Disk Drive
	02	Two 5 1/4" Flex Disk Drives
	03	One 5 1/4" Flex Disk Drive and one 5 1/4" Winchester Fixed Disk
Power Code	60	120V, 50/60Hz
	65	220V, 50/60Hz
	70	100V, 50/60Hz
	74	230V, 50/60Hz
	75	240V, 50/60Hz
Language Code	00	US English
	01	International English
	02	UK English
	03	Spanish
	04	Portuguese
	05	French
	06	German
	07	Dutch
	08	Flemish
	09	Swedish
	10	Danish
	11	Norwegian
	12	Italian
	13	Greek
	14	Yugoslavian
	15*	Japanese/Katakana
	16*	Taiwanese
	17*	Arabic
	18*	Iranian
	19*	Hebrew
	20	Finnish
	25	Latin American/Spanish
	42	Canadian
	33	South African
	40	Swiss

* Not yet released but shown for reference purposes

Figure 1.2 Model number description

Kit Number	Description
3273-K012*	Integrated 10 MB Winchester disk (CAP)
3273-K018	Second flexible disk upgrade (DIN)
3273-K019	Second flexible disk upgrade (CAP)
3273-K090	Integrated 10 MB Winchester disk (DIN)
3273-K200	64 to 128KB memory upgrade
3273-K202	64 to 256KB memory upgrade
3273-K208	64 to 512KB memory upgrade
3273-K210	Centronics parallel I/F & cable
3273-K211	RS-232C serial I/F & modem cable
3273-K212	RS-232C serial I/F & printer cable
3273-K213	RS-232-C serial I/F & plotter cable
3273-K214	Blank interface adapter & bus connector
3273-K217	5 blank interface adapters bus connectors
3273-K218	25 blank interface adapters bus connectors
3273-K219	Integrated modem
3273-K220	Diagnostic module
3273-K230	Dual 8/16-bit processor upgrade (internal)
3273-K231	Dual 8/16-bit processor upgrade (external)
3273-K240	Tilt mechanism
3273-K600	NCR OMNINET transporter

* Not yet released but shown for reference purposes

Figure 1.3 Kits

ENVIRONMENTAL CONSIDERATIONS

The NCR DECISION MATE V is designed to operate in a normal "office-type" environment, without the need for special heating or air conditioning. The environmental requirements are shown in Figure 1.4; operating the computer at or beyond these limits may cause errors or damage to the hardware.

Operating Temperature	10°C to 35°C (50°F - 95°F) at 500 metres (derated 3.3°C per 1000 metres)
Temperature Change	10°C (50°F) per hour
Relative Humidity	20% to 80%
Transit Temperature	-40°C to 60°C (-40°F to 140°F)
Storage Temperature	10°C to 50°C (50°F to 120°F)

Figure 1.4 Environmental requirements

SAFETY STANDARDS

The NCR DECISION MATE V is designed and built to conform to the following standards:

Product Safety
- USA — UL 478 UL listing mark used
- Canada — CSA 22.2 — 15.4, CSA monogram used
- Europe — IEC 380, Inhouse verification
- Germany — VDE 0806, GS label granted by trade association

Radio Protection
- USA — FCC Docket No. 20780, Class B
- Germany — VDE 0871, Class A certified by German Federal Post (FTZ)

Radiation Emission
- USA — Public Law 90 - 602, DHEW Publication No. (FDA) 75 — 8003
- Germany — X-Ray Emission Regulations

It is the responsibility of those making changes to the system to ensure that these standards are not contravened.

NCR 3282 WINCHESTER DISK DRIVES

These units are freestanding Winchester disk drives for connection to the NCR DECISION MATE V. They are intended for connection to systems with either one or two integrated flexible disk drives, and cannot be connected to systems with an integrated Winchester disk drive. Each unit has a formatted capacity of 10M bytes, and up to three units may be connected to a system, in a daisy-chain arrangement.

Three models of the NCR 3282 Winchester Disk Drive are available:

- NCR 3282-0101 — this model includes an interface for connection to the NCR DECISION MATE V. It is intended for the user who wishes to connect only one freestanding drive to the system. It is not possible to connect additional drives to this model.
- NCR 3282-0102 — this model includes an interface for connection to the NCR DECISION MATE V, also a connector is included to allow the connection of an NCR 3282-0103 in a daisy-chain arrangement.

- NCR 3282-0103 — this model connects to the NCR 3282-0102 and also has a connector permitting the connection of another NCR 3282-0103.

All models are supplied with a cabinet that includes the drive, power supply, fan, power cables, and the appropriate interconnection cables to provide for easy assembly of the units in a daisy-chain configuration. Technical data for the NCR 3282 Winchester Disk Drive is provided in Figure 1.5.

Capacity (formatted) :	10 Mbytes 612 tracks/unit 17 sectors/track (one used as alternative sector) 512 bytes/sector
Track Density:	345 tpi
Transfer Rate:	5Mbits/sec.
Access Time:	track to track: 3 msec. average: 85 msec.
Motor Start Time:	15 sec.
Encoding Method:	MFM
Sectoring:	Soft
Host Interface:	8 bit bi-directional bus

Figure 1.5 NCR 3282 Technical data

HARDWARE DESCRIPTION

CONTROLLER MODULE

The controller module consists of two printed circuit boards, the controller board and the graphics controller board. Two types of graphic controller boards are used: one, with 32Kbytes of RAM for systems with a monochrome CRT, the other, with 96Kbytes of RAM for systems with color CRT.

CONTROLLER BOARD

The controller is a 300mm x 290mm printed circuit board and utilizes a Z80A microprocessor and auxiliary logic to drive and control a family of 8-bit common memory and peripheral modules. Figure 2.1 shows a block diagram of the controller board.

- Z80A microprocessor is operated with a 4 MHz clock.
- The LSI flexible disk controller contains the circuitry and control functions for interfacing one or two flexible disk drives. It is capable of supporting double density format including double sided recording. Hand shaking signals are provided which make DMA operation easy to incorporate with the aid of the DMA controller integrated circuit.
- The RAM controller provides mulitplexed addresses and address strobes, as well as refresh access arbitration for the 64Kbytes dynamic RAM contained on the controller board, and also for the memory expansion modules. (Up to a maximum of 256Kbytes, or 512Kbytes with the multi-layer controller board).
- The loudspeaker is designed to produce tones for keyboard acceptance click, bell, and music demonstration. A separate circuit provides the frequencies from 110Hz to 1174.7Hz. The small audio speaker is housed on the controller board. The loudness is adjusted by a user-accessible potentiometer.
- The keyboard interface connects the ASCII encoded keyboard to the controller board by a four-wire cable carrying logic ground, frame ground, +5V, and data signal. The keyboard is polled by the controller. When a key is pressed, the serial data is returned on the same line. For a detailed description see the keyboard description.

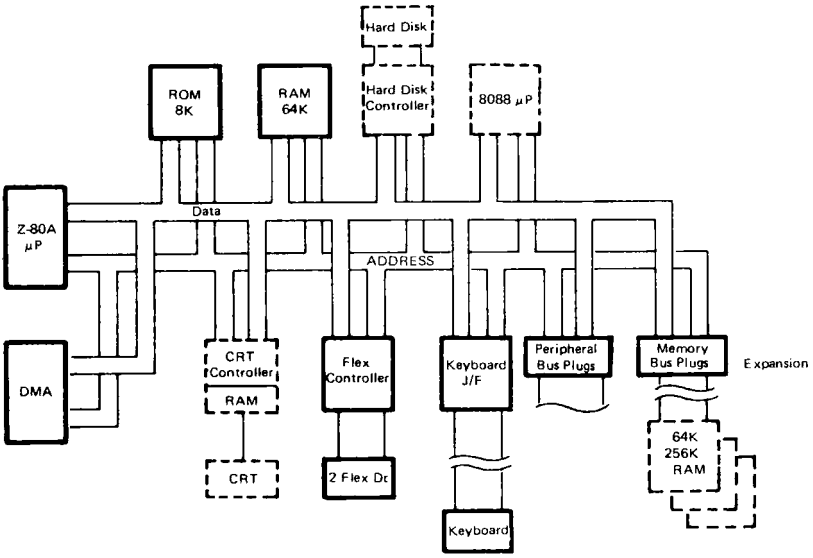


Figure 2.1 Controller block diagram

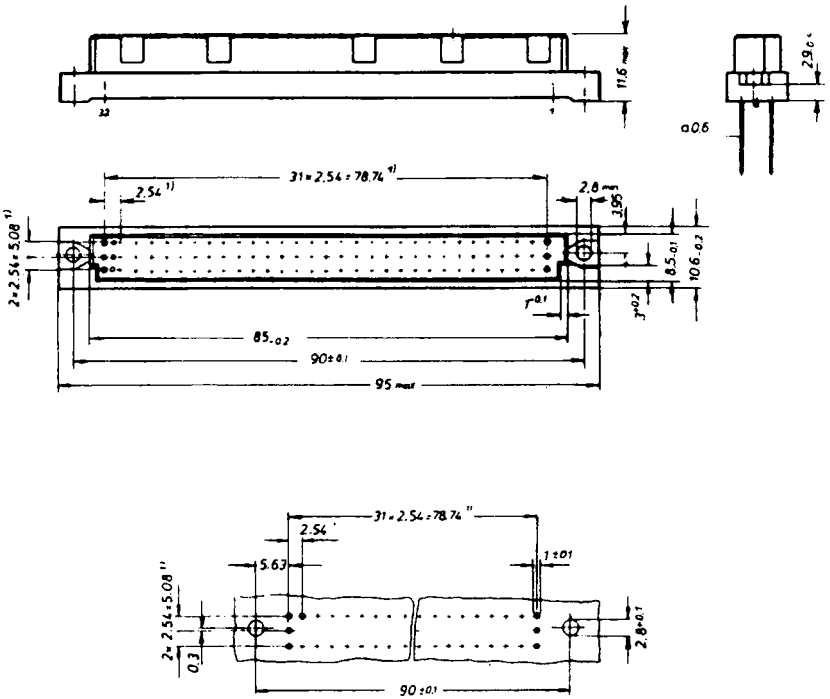
I/O Bus

The lower part of the controller board contains the I/O bus together with seven user-accessible connectors. These connectors are identified on the board as J1 through J7 (reading from left to right), and correspond to the seven slots (numbers 1 through 7) at the rear of the cabinet.

Position J1 is reserved for the connection of any one of the memory expansion modules (K200, K202, K208).

Position J7 is reserved for the connection of either the diagnostic module (K220), or the customer-installable 16-bit processor module (K231).

Positions J2 through J6 are the general purpose slots for the connection of the peripheral adapter and other interfaces to the computer. These five positions are identical, and Figure 2.2 defines the type of connector, while the pin assignments are shown in Figure 2.3.



Controller board bus connector (J2 -J6)

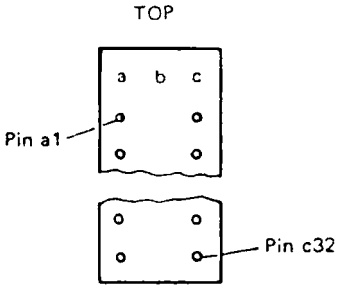


Figure 2.2 Bus connector

a		c
+5 V	1	+5 V
	2	+12 V
RESET/	3	RESET IN/
IOW/	4	IOR/
MEMW/	5	MEMR/
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
READY DMA	10	ABTRI/
EOP/	11	
INTACK/	12	IFSEL 4/
AUTO/	13	DIR/
THOLD/	14	HLDA
PCLK/	15	CLK1
LGRD	16	TRAMD/
BA19	17	BA18
BA17	18	BA16
BA15	19	BA14
BA13	20	BA12
BA11	21	BA10
BA9	22	BA8
BA7	23	BA6
BA5	24	BA4
BA3	25	BA2
BA1	26	BA0
IFSEL3/	27	IFSEL2/
IFSEL1/	28	IFSEL0/
DRQ1	29	DRQ0
DACK1/	30	DACK0/
WAIT/	31	INT/
LGRD	32	LGRD

Figure 2.3 Bus (J2-J6) pin assignments

Two additional plug/socket connections are possible on the bus. These are made on the solder side of the controller board and are designated J2A and J7A. These connectors are not considered to be user accessible, rather for factory use, or for use by field engineers and system integrators. Normally, these two connectors are used for:

- J2A — The connection of the fixed disk interface board, or a custom design board.
- J7A — The connection of the 16-bit processor board (factory option and kit K230).

The power requirements for the I/O bus plugs are:

- For each peripheral plug + 5V ± 5% max. Current 0.5A
  +12V ± 5% max. Current 0.1A

  or
- For all plugs (J1, J2, J2A, J3, J4, J5, J6, J7 and J7A)
  + 5V ± 5% max. 5.0A
  +12V ± 5% max. 0.6A

The DC voltage levels for the I/O bus plugs are:

- Input/Output HIGH-Voltage V_H = 2.4 to 5.5 Volts
- Input/Output LOW-Voltage V_L = -0.5 to 0.8 Volts

Timing charts are provided in Figures 2.4 to 2.8.

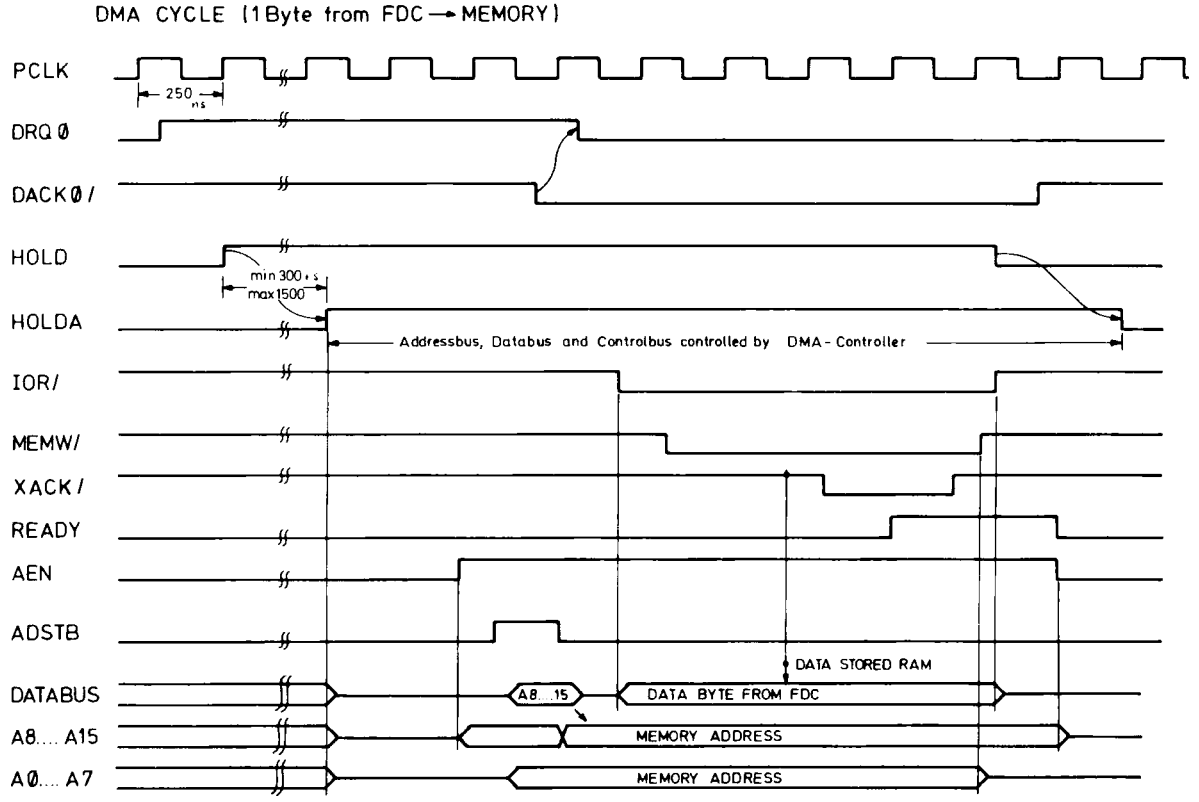
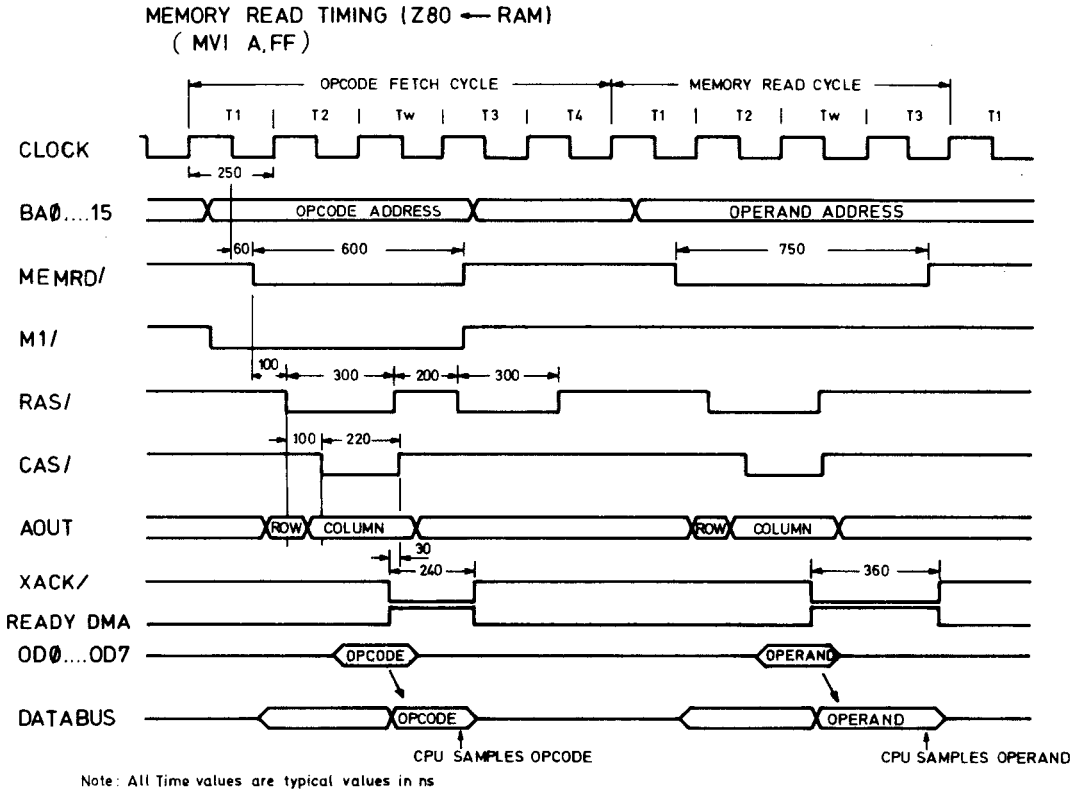


Figure 2.4 DMA cycle timing



Note: All Time values are typical values in ns

Figure 2.5 Memory read timing

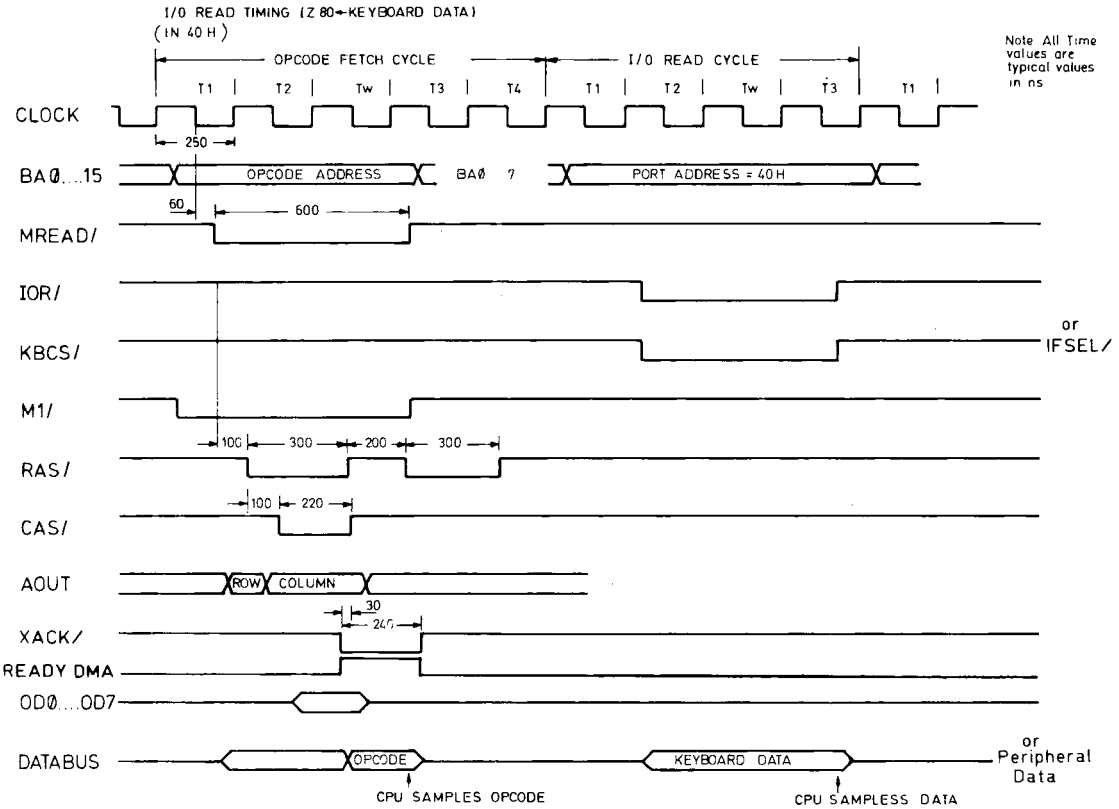


Figure 2.6 I/O read timing

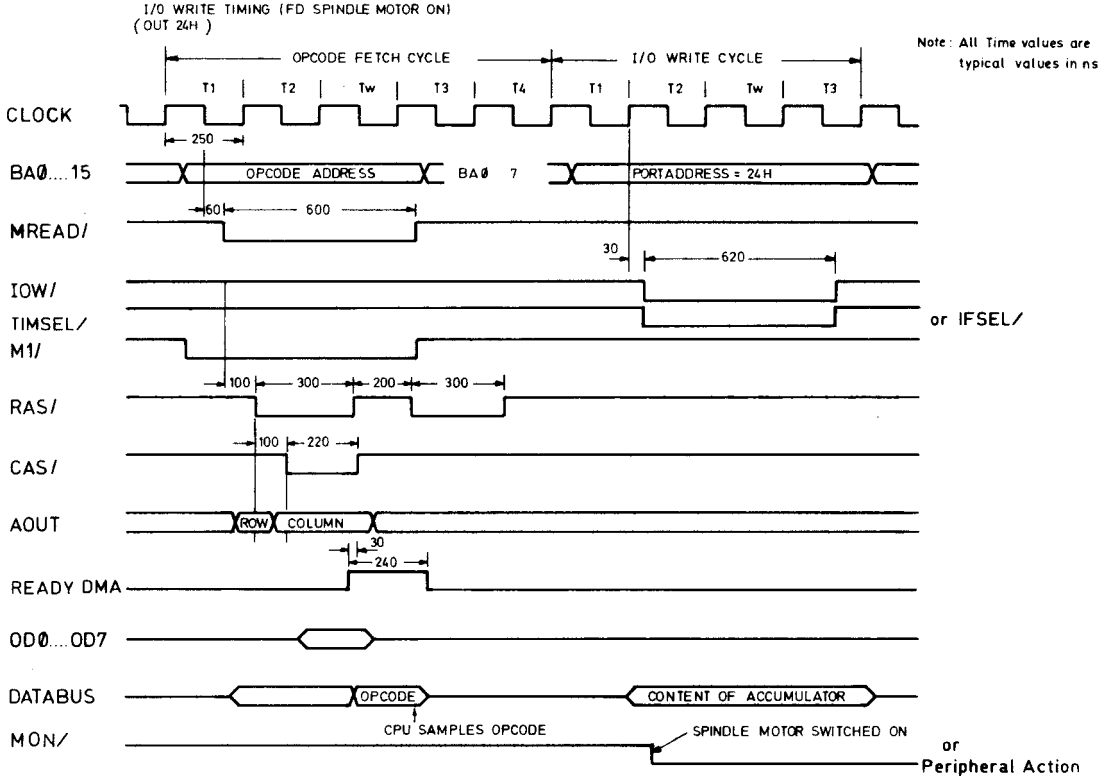


Figure 2.7 I/O write timing

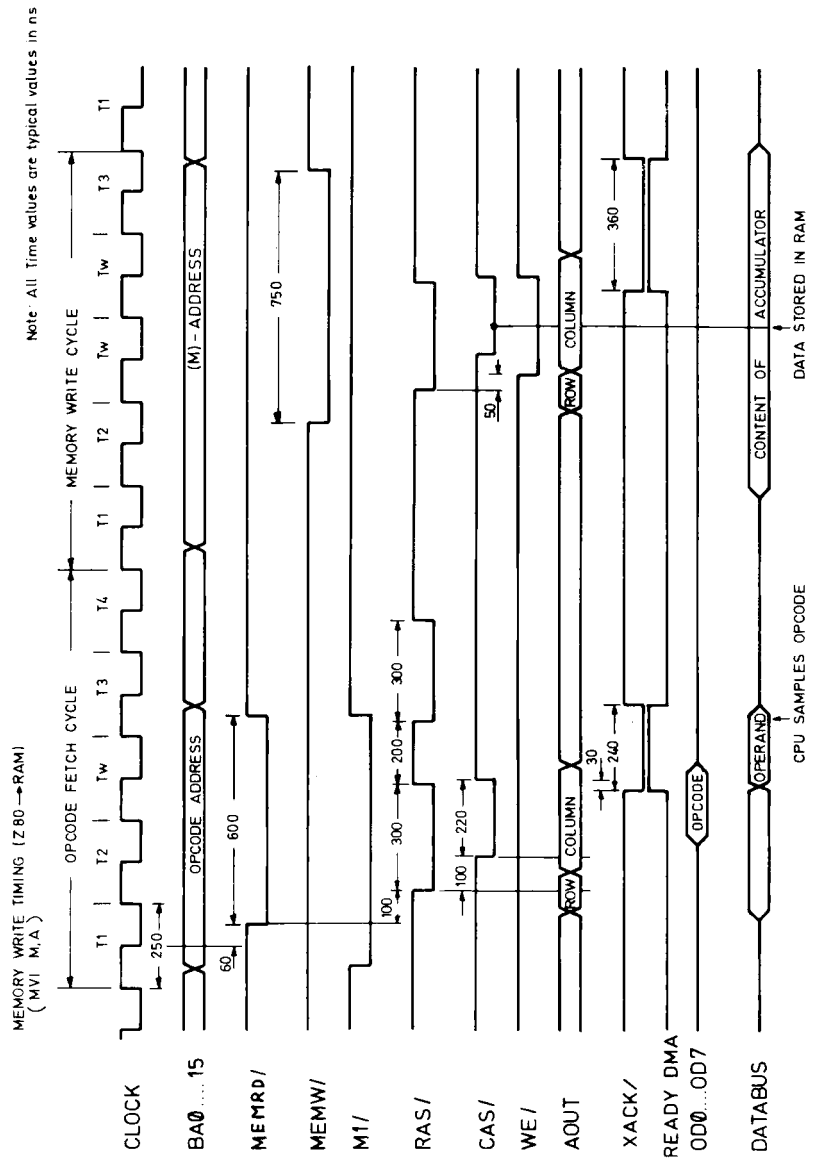


Figure 2.8 Memory write timing

I/O Signals

The signals for the NCR DECISION MATE V I/O bus are defined in Figure 2.9. The distribution of the signals is shown in Figure 2.10.

Pin Name	Pin Number	I/O	Description	DC Characteristics Driver or Receiver Requirements of each Peripheral
+5	a1 c1	– –	+5V Supply	I max. = 0.5A
+12	c2	–	+12V Supply	I max. = 0.1A
LGRD	c16 a32 c32	– –	Logic ground	
BD0	c6	I/O	Data-Bus lines (8-bit) bidirectional, active high	Driver: I_L>2mA
BD1	a6	I/O		or I_L>1.6mA
BD2	c7	I/O	Bus-Driver to peripheral BUS (LS245), automatic direction.	by V_L<0.45V
BD3	a7	I/O		I_H>-0.2mA
BD4	c8	I/O	Switch by IFSEL (I/O-Read). Normal output.	Receiver: I_L<-0.2mA
BD5	a8	I/O		I_H<20µA
BD6	c9	I/O	Direction can be changed by DIR/ signal.	
BD7	a9	I/O	Typical IC's in the interfaces are 74LS245 or Port 8255.	

Figure 2.9 I/O signals (1 of 5)

Pin Name	Pin Number	I/O	Description	DC Characteristics Driver or Receiver Requirements of each Peripheral
BA0	c26	0	Buffered 20-bit Address Bus	Receiver: I_L<-1.2mA
		0		I_H<60uA
		0	Range to 1MB Normal output, active high	Spec. Operation
		0		Driver: (Only Tristate)
		0	Tri-State possible with ABTRI/ signal.	I_L>24mA
BA19	a17	0		I_H>-10mA
IOW/	a4	0	I/O WRITE	Receiver: I_L<-1.2mA
IOR/	c4	0	I/O READ	I_H<60uA
			Processor control lines, active low. Tri-state possible	Special Operation
MEMW/	a5	0	MEMORY WRITE	Driver: I_L>24mA
MEMR/	c5	0	MEMORY READ	(Only Tristate) I_H>-5mA
RESET/	a3	0	System Reset Output, active low.	Receiver: I_L<-0.4mA
				I_H<20uA

Figure 2.9 I/O signals (2 of 5)

Pin Name	Pin Number	I/O	Description	DC Characteristics Driver or Receiver Requirements of each Peripheral
RESET IN/	c3	I	RESET IN/ is an active low signal, which is used to general system RESET. Internal is a RC circuit and a Schmitt trigger input. A RESET is possible for example by a switch to GRD.	Driver open collector I_L>40mA Short protection
ABTRI/	c10	I	Address Bus Tri-state, active low signal.	Driver only open collector I_L>8mA
READY DMA	a10	0	Ready Signal from the memory controller (XACK), active high.	Receiver: I_L<-1mA I_H<50uA
DIR/	c13	I	Direction of the databus driver. Low signal change to input.	Driver open collector I_L>8mA
THOLD/	a14	I	Test Hold. External request to set the Z80 in hold state.	Driver open collector I_L>8mA
HLDA	c14	0	Hold Acknowledge. A response from Z80 processor. The Z80 processor is in hold state, active high.	Receiver: I_L<-0.8mA I_H<40uA
PCLK/	a15	0	Processor-Clock: Inverse signal of the processor lock (Z80) with a frequency of 4MHz.	Receiver: I_L<-0.8mA I_H<40uA

Figure 2.9 I/O signals (3 of 5)

Pin Name	Pin Number	I/O	Description	DC Characteristics Driver or Receiver Requirements of each Peripheral
CLK1/	c15	0	Clock output 1MHz.	I_L< -0.8mA I_H< 40uA
TRAMD/	c16	I	Test RAM-Disable. For external ROM or RAM extension. Switching with the system RAM. The RAM output will be disabled. Used by the Diagnostic module. The signal is active low.	Driver only, open collector I_L> 8mA
INT/	c31	I	INTERRUPT. Interrupt for Z80, active low.	Driver only, open collector I_L> 8mA
INTACK/	a12	0	INTERRUPT ACKNOWLEDGE from the Z80 Processor, active low.	Receiver: I_L< -1.2mA I_H<60uA
WAIT/	a31	I	WAIT/ set the Z80, 8088, and DMA controller in Wait-State (not ready), active low	Driver only, open collector I_L>8mA
DRQ0 DRQ1	c29 a29	1 1	DMA-Request for Channel 0, active high DMA Request for Channel 1, active high. Asynchronous channel request inputs are used by peripherals to request DMA service.	Driver only Tristate I_H> -2mA I_L>2mA
DACK0/ DACK1/	c30 a30	0 0	DMA-Acknowledge Channel 0, active low. DMA-Acknowledge Channel 1, active low. These lines indicate an active DMA channel.	Receiver: I_L< -0.5mA I_H<20uA

Figure 2.9 I/O signals (4 of 5)

Pin Name	Pin Number	I/O	Description	DC Characteristics Driver or Receiver Requirements of each Peripheral
EOP/	a11	I/O	End of Process-EOP signals that DMA service has been completed. Also input active low. For details 8237A-5 Spec.	Receiver: I_L<-0.4mA I_H<20uA only for 3 Peripherals Driver open Collector I_L>5mA
IFSEL0/ IFSEL1/ IFSEL2/ IFSEL3/ IFSEL4/	c28 a28 c27 a27 c12	0 0 0 0 0	Interface select 0 to 4, active low. The Interface does not need own address decoder. The Select of the I/O ports in the peripherals is made by any IFSEL and BA3 (BA3/). (10 Peripherals). Automatic change of the data bus direction. This change is not possible while a DMA function is being performed.	Receiver: I_L<-0.8mA I_H<40uA
AUTO/	a13		Change peripheral from board type 1 to board type 2. Not connected on board type 1.	Receiver: I_L< 1.2mA I_H< 60μA Pull-up resistor 1-10 Kohm to +5V

Figure 2.9 I/O signals (5 of 5)

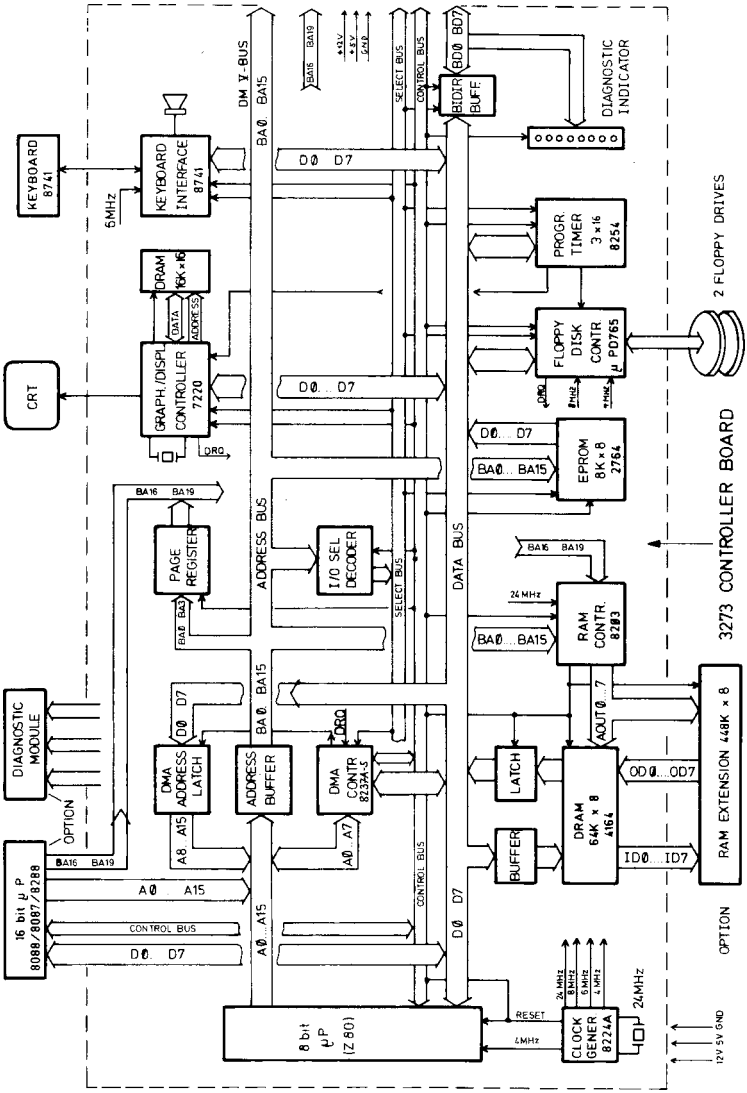


Figure 2.10 Signal distribution

Interface Configuration

The configuration of the I/O interface and information on the interface select signals is provided in Figure 2.11.

NCR-DECISION MATE V Interface Configuration

Interface Selects **Family:**

IFSEL/ PIN's on DM V BUS	0A 0B IFSEL 0/ c28		1A 1B IFSEL 1/ a28		2A 2B IFSEL 2/ c27		3A 3B IFSEL 3/ a27		4A 4B IFSEL 4/ c12		SLOT	DMA CHANNEL 0 or 1
PRINTER 1 serial/parallel K212 K210	■										2-6	
PLOTTER (See Note 2) K213	■										2-6	
COMMUNICATION K211			■								2-6	
SWITCHABLE RS-232C K801	■	■	■	■	(See Note 1)		■	■	■	■	2-6	
PLOTTER (See Note 2) K801	■			(WITH CP/M or MS-DOS)							2-6	
PLOTTER (See Note 2) K801					(WITH p-SYSTEM)		■				2-6	
BUFFERED SYNC/ ASYNC (See Note 3) K215			■								2-6	
REAL-TIME-CLOCK (See Note 3) K803										■	2-6	
IEEE 488 (See Note 3) K804						■					2-6	
MOUSE INTERFACE (See Note 3) K806					■						2-6	
DECISION NET K600								■			2-6	1
HARD DISK ext. (NCR 3282)									■		2-6	
HARD DISK int.									■		2-A	
PORT ADDRESS	60H 67H	68H 6FH	70H 77H	78H 7FH	30H 37H	38H 3FH	B0H B7H	B8H BFH	C0H C7H	C8H CFH		

No IFSEL for 16-Bit – Ext., Diagnoser, Memory 64K, 192K, 448K.

■ = Software and Hardware, ■ = Hardware.

Note 1: Must be strappable by hardware and software
Note 2: Use either K213 or K801
Note 3: Any software must be able to select all 10 port addresses
Note 4: Any port address cannot be used more than once in a system

Figure 2.11 Interface configuration

GRAPHICS CONTROLLER BOARD

With the 32Kbytes of graphics memory, the system can create a 640 x 400 resolution image. Upper and lower case characters are displayed in a 6 x 9 dot pattern on a 8 x 16 dot matrix which allows for descended lower case characters. The graphic controller operates in mixed mode. It can draw the following figures: horizontal and vertical lines, vectors, rectangles, arcs, circles, graphic character symbols, line pattern or area pattern, and slanted figures (+n x 45). Also, the CRT controller supports scrolling, zooming set mask, reset mask, replace complement and clear screen. Reverse and normal video, blink attribute and half intensity are also available. (See NEC 7220 data sheets)

The graphics controller board is connected directly onto the controller board with two connectors, J/P 113, and J/P 114. The pin assignments for these connectors are shown in Figure 2.12.

a		c
+5 V	1	+5 V
LGRD	2	LGRD
LPEN	3	LPENSW
+12 V	4	+12 V
+12 V	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14	
	15	LGRD
LGRD	16	LGRD

Pin assignments P114

a		c
+5V	1	+5V
	2	
D1	3	D0
D3	4	D2
D5	5	D4
D7	6	D6
	7	
HSYNCX	8	HSYN
VSYNCX	9	LGRD
BA1	10	BA0
	11	
GDCIOW/	12	GDCIOR/
DACK2/	13	GDRQ2
	14	
	15	WCLK
LGRD	16	LGRD

Pin assignments P113

Figure 2.12 Graphic controller connections

The graphics controller board for color systems has a memory capacity of 96Kbytes, and can display eight colors — black, white, red, green, blue, yellow, magenta, and cyan.

In the text mode the characteristics are:

- 25 lines, 80 characters per line
- Characters in any of the eight colors
- Background in any of the eight colors
- Blinking attribute

In the graphics mode the characteristics are:

- Each dot position in any of the eight colors
- No attributes

16-BIT PROCESSOR

The 16-bit processor can be installed in an NCR DECISION MATE V, allowing the computer to function as either an 8- or a 16-bit processor.

The 16-bit processor is availabe in two versions; both versions function identically. The two versions are:

- A factory-installed feature (F230), or an engineer-installed kit (K230); the board is connected to the solder side of the controller board at P/J7A. This version is not installable by the user.
- A self-contained module (K231) which the user can plug directly into the controller bus at slot 7.

The configuration of the 16-bit processor board is:

- 8088 processor with 5MHz clock
- Bus controller
- 4K x 8 PROM
- Spare socket for a co-processor (e.g. 8087)
- Switch logic for dual processor concept

Because the Z80A and the 8088 processor use the same bus, only one processor will work at a time. The other processor is in HOLD state. Both processors have equal rights and will perform all memory and I/O operations.

Only the operating processor can perform switching to the other processor.

The 16-bit processor operates in maximum mode.

Contents of the PROM:
Address range FF000-FFFFF
Start address after Reset FFFF0
Jump to start point of the operating system
Jump to start point of the operating system Level 0 diagnostic

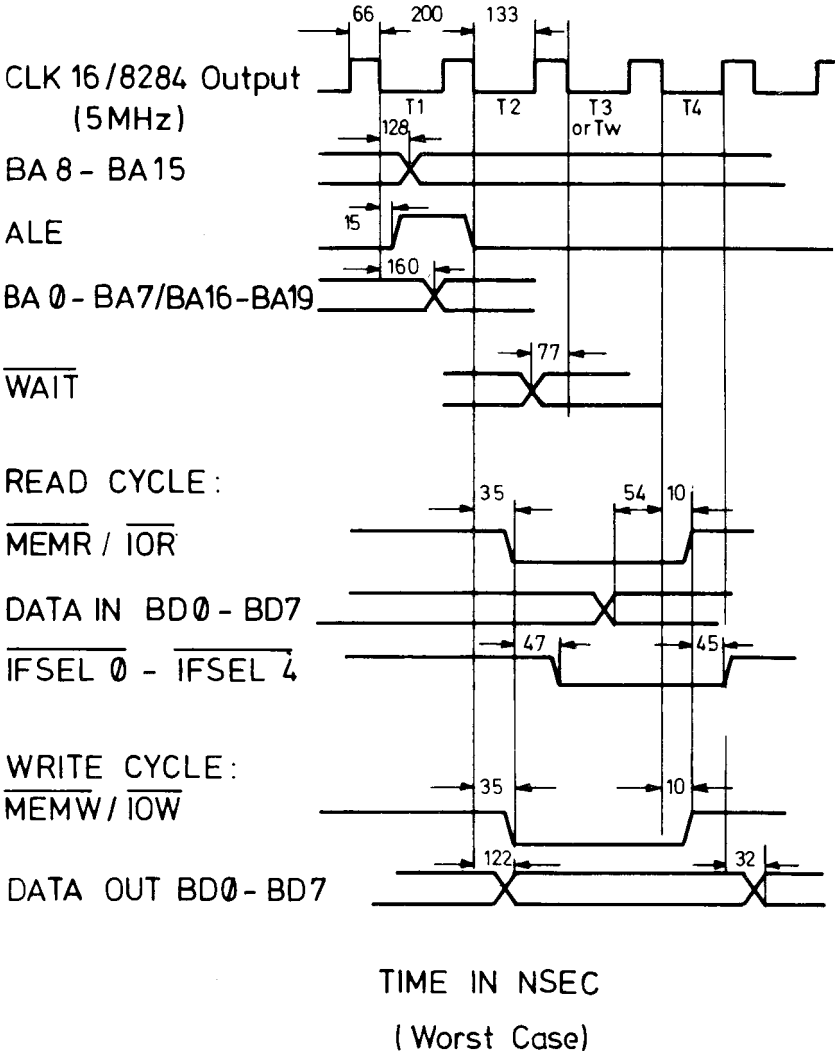


Figure 2.13 16-bit processor timing

The processor timing of the 16-bit processor is shown in Figure 2.13, and the pin assignments in Figure 2.14.

	a	b	c
1	+5 V	+5 V	+5 V
2	OPT 2		+12 V
3	RESET/		RESETIN/
4	IOW/		IOR/
5	MEMW/		MEMR/
6	D1		D0
7	D3		D2
8	D5		D4
9	D7		D6
10	READYDMA	READYP	ABTRI/
11	EOP/	HOLD	
12	INTACK/	SWITCH 16/	IFSEL4/
13	AUTO/	HLDA 16	DIR/
14	THOLD/	16 BITAV/	HLDA
15	PCLK/	STDMARQ/	CLK1
16	LGRD	LGRD	TRAMD/
17	BA19	16 BITSET/	BA18
18	BA17		BA16
19	A15		A14
20	A13	MEMRQ/	A12
21	A11		A10
22	A9		A8
23	A7		A6
24	A5		A4
25	A3		A2
26	A1		A0
27	IFSEL3/		IFSEL2/
28	IFSEL1/		IFSEL0/
29	DRQ1		DRQ0
30	DACK1/		DACK0/
31	WAIT/		INT/
32	LGRD	LGRD	LGRD

Figure 2.14 16-bit processor pin assignments

POWER SUPPLY

The power supply comprises the following modules:

- Power connector
- Primary fuse
- Transformer
- Rectifier
- Switcher (+5V, +12V)
- 1 Secondary Fuse for unregulated output voltage

The power supply is capable of operating with the following ac power sources.

Frequency	Nominal Voltage	Range
49 to 61 Hz	100	90 — 107
	120	104 — 127
	220	198 — 235
	230	207 — 246
	240	216 — 257

The average ac input wattage is 70W (Basic Model w/o peripherals). The outputs of the standard power supply are:

Supply	Regulated	Max. Current	Ripple
+18V to +35V	+ 5.1V± 3%	10.0 A	< 50mVpp
+18V to +35V	+12.2V± 3%	3.2 A	<120mVpp

Models with hard/flexible disk combination require a larger transformer and switcher assembly. The outputs of these are:

Supply	Regulated	Max. Current	Ripple
+18V to +35V	+ 5.1V± 3%	13.0 A	< 50mVpp
+18V to +35V	+12.2V± 3%	4.1 A	<120mVpp

The color CRT also requires a larger transformer, but the standard switcher and rectifier can be used for controller board, flexible disks, keyboard, and I/Fs. The rectifier and switcher for the color CRT are placed on the CRT board.

Output power requirements for the color CRT are:

Regulated	Max. Current	Ripple
107V± 2V	0.5 A	<400mVpp

Current limiting and over voltage protection are provided. The electrical power is enough for both the computer and its interfaces and options, but printers and free-standing disk drives require their own ac power source. The following power line transients should not affect the specified performance:

Input Voltage	Duration	Frequency of Occurrence
50% of nominal	1/2 cycle	Once in 10 seconds

The power supply assembly is available in three models:

- For a power source with a nominal voltage of 120Vac
- For a power source with a nominal voltage of 220Vac
- A model that can be strapped to suit power sources with nominal voltages of 100, 230, or 240Vac

These different models of the power supply are identified by the "Power Code," which is a part of the model number.

Power Code	Nominal Voltage
60	120 Vac
65	220 Vac
70*	100 Vac
74*	230 Vac
75*	240 Vac

* Selectable by transformer strapping

The strapping of the transformer for power supplies with power codes 70, 74, and 75 is shown in Figure 2.15.

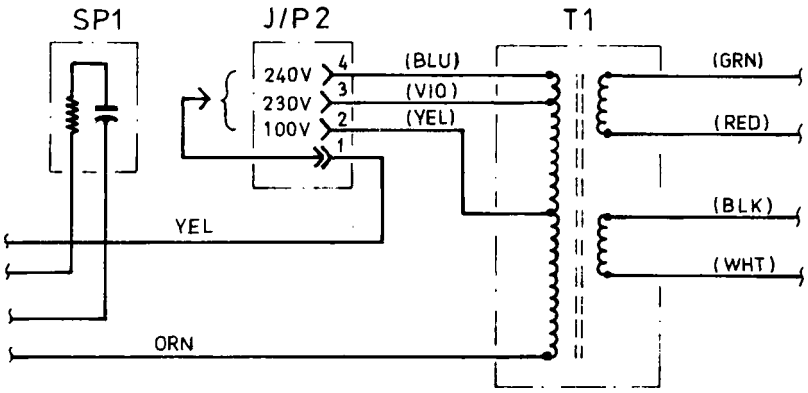


Figure 2.15 Transformer connections

FLEXIBLE DISK DRIVES

Integrated in the computer are one or two 5 1/4-inch flexible disk drives to provide mass storage of programs and data for the computer. The drives contain read/write electronic controller electronics, driver mechanics, read/write heads, and headpositioning mechanism. The disk drive on the left is called A, the second drive on the right side is called B. For maximum motor life, if no commands have been issued to the drives within 15 seconds after completion of a previous command, the drive motor is turned off. The head load mechanism is coupled with motor on signal.

Systems with an integrated fixed disk have only one flexible disk drive, this is mounted on the rightmost side of the computer and is called drive A.

Power requirements for the flexible disk drive are given in Figure 2.16, and technical data in Figure 2.17.

Voltage	Current	Ripple
+ 5V +5%	Typical 0.5 A max. 0.8 A	<100 mVpp
+12V +5%	Typical 0.25 A max. 0.9 A	<200 mVpp
Max. power dissipation: less than 10W.		

Figure 2.16 Power requirements

Capacity (double-sided, double density) unformatted Formatted (CP/M) Formatted (MS-DOS)	 500 Kbytes 320 Kbytes 360 Kbytes
Tracks per inch Tracks per disk side	48 40
Sectors per track (CP/M) Sectors per track (MS-DOS)	8 9
Bytes per sector	512
Motor start time Head movement (track to track)	<400 msec <6 msec
Data transfer time	250 bits/sec

Figure 2.17 Technical data

The flexible disk drives use the standard pin assignments as shown in Figure 2.18.

READY/	34	33	GRD
SIDESEL/	32	31	GRD
RDDATA/	30	29	GRD
WRPROT/	28	27	GRD
TRACK0/	26	25	GRD
WREN/	24	23	GRD
WRDATA/	22	21	GRD
STEP/	20	19	GRD
DIR/	18	17	GRD
MOTORON/	16	15	GRD
	14	13	GRD
SEL1/	12	11	GRD
SEL0/	10	9	GRD
INDEX/	8	7	GRD
	6	5	GRD
	4	3	GRD
HDLOAD/	2	1	GRD

Figure 2.18 Pin assignments

The input and output signals to the disk drive are standard, industry-compatible signals. These signals are:

Drive Select (0.1.2.3)

Active low input signal to select one of four FDD. Drive Select active turns the motor on, loads the heads, and turns on the front panel LED of the selected drive.

Index

Active low output signal which is at an active level each time the index hole is sensed. This signal is active for one pulse each disk revolution to indicate the beginning of a track. Index should be held active when no flexible disk is inserted in the system.

Motor On

Active low input signal to turn the motor on. Time is allowed by the system before reading or writing to allow the motor to start. The line is deactivated after 2 seconds (nominal) following the last command. This turn off signal may be varied by the host system depending on application.

Direction Select

Input signal to define the direction the heads move when the Step line is pulsed. Active low causes the head to move toward the center of the disk. Active high causes the head to move toward the outside of the disk.

Step

Active low input signal to move the head in the direction specified by Direction Select. Minimum pulse width for step is 0.8μs. Direction Select is not changed within 1ms on each side of the trailing edge of Step. Each step pulse is delayed by 6ms from the preceding step.

Write Data

Input signal to provide the data to be written on the flexible disk. Each transition from high to low causes the current through the read/write heads to reverse, causing a data bit to be written. This line is enabled by Write Gate active. Write Data is not active during a read operation. Write pulse width for both data bit and clock pulse shall range more than 0.25μs.

Write Gate

Active low input signal to enable data to be written on the flexible disk. Write Gate not active enables the stepper logic and read data logic.

Track 00

Active low output signal to indicate when the read/write heads are positioned at track zero. Track 00 is not active when the read/write heads are not at track zero.

Write Protect

Active low output signal to indicate when a write protected disk is installed in the drive. The drive inhibits writing and provides the write protect signal.

Read Data

Output signal containing the "Raw Data" (clock and data together) as detected by the drive electronics. The Read Data signals are composite clock and data pulses of 1 microsecond, ±250 nanoseconds.

In Use

Active low input signal indicates that all of the daisy changed FDDs are under the control of the system, and the indicator on the front panel is on. (not used)

Ready

Active low output signal indicates that the FDD is in ready state; it is satisfied when the FDD is powered on, the disk is installed, the disk rotates at nominal speed, and two Index pulses have been counted after disk starts rotation. Required time for this signal to become true after the Motor On signal becomes true is less than 800 ms.

FIXED (WINCHESTER) DISK

The Winchester disk drive uses two non-removable 5 1/4-inch disks as storage media. The total fomatted capacity of the four surfaces is 10 Mbytes. The two disks are called disk B and disk C. The Western Digital Winchester disk controller interfaces the disk drive to the host processor. All necessary buffers and receivers/drivers are included on the Winchester disk controller board to allow direct connection to the drive. Between the disk controller board and main controller board, a small interface board for bus adaption is included.

Power requirements for the fixed disk drive are given in Figure 2.19, and technical data in Figure 2.20.

Voltage	Current	Ripple
+12V ±5%	1.6 A typical, 3.5 A max.	>50mVpp
+ 5V ±5%	1.1 A typical, 1.7 A max.	>50mVpp

Figure 2.19 Power requirements

Capacity (formatted)	10 Mbytes
Tracks per inch Tracks per unit	345 612
Sectors per track (1 as alternative sector)	17
Bytes per sector	512
Motor start time Head movement (track to track) (average)	15 sec 3msec 85msec
Date transfer time	5 Mbits/sec

Figure 2.20 Technical data

The technical details of the Western Digital disk controller are shown in Figure 2.21.

Encoding method	MFM
Sectoring	Soft
Host Interface	8-bit bi-directional bus
Data Transfer Rate	5.000 Mbits/sec.
Power Requirements	5V±5%, 3A max.

Figure 2.21 Controller technical data

The input and output signals for the drive are:

Write Gate

The active state of this signal, or logical one level, enables data to be written on the disk. The inactive state of this signal, or logical zero level, enables data to be transferred from the drive. During power fail or power up, all data recorded on the drive shall be retained reliably, regardless of the frequency of occurrence of dc power transitions at the drive itself, and regardless of the sequence and rate of dc voltage decay or rise; the user must provide the WRITE GATE input with an open circuit (inactive, high impedance driver) during these conditions.

Head Select 2^0 and 2^1

These two lines provide for the selection of each individual read/write head in a binary coded sequence. Head Select 2^0 is the least significant line. Heads are numbered 0 through 3. When both Head Select lines are false, head 0 will be selected.

Direction In

This signal defines direction of motion of the R/W head when the Step line is pulsed. A logical zero defines the direction as "out" and if a pulse is applied to the Step line, the R/W heads will move away from the center of the disk. If this line is a logical one, the direction of motion is defined as "in" and the R/W heads will move toward the center of the disk. Direction must not change during step time.

Step

This interface line is a control signal which causes the R/W head to move with the direction of motion defined by the Direction In line. Any change in the Direction In line must be made at least 100ns before the leading edge of the step pulse. The buffered seek mode is automatically selected any time step pulses are issued at a rate between 25 and 500 μsec. The minimum time between successive steps is 3.0mS. In the slow step mode, the R/W heads will move at the rate of the incoming step pulses.

Drive Select 1-4

Drive Select, when a logical one connects the drive interface to the control lines and activates the LED on the front panel of the drive. Shunts are provided on the drive which can be cut in a specified pattern so as to determine which unique select line (DS1-4) on the interface will activate that particular drive.

MFM Write Data

This is a differential pair that defines the transitions to be written on the track. The transition of +MFM Write Data line going more positive than the -MFM Write Data will cause a flux reversal on the track, provided Write Gate is active. This signal must be driven to an inactive state (+MFM Write Data more negative than -MFM Write Data) by the host system when in a read mode.

To ensure data integrity at the error rate specified, the write data presented by the host must be pre-compensated on tracks 128 through 305. Data patterns which cause a large amount of bit shift will have appropriate data bits shifted early or late with respect to the nominal bit cell position. Bit shift compensation, whether early or late with respect to the nominal bit cell position, will be 12ns.

Seek Complete

This line will go from a logic zero to a one when the R/W heads have settled on the final track at the end of a seek. Reading or writing should not be attempted when Seek Complete is a logic zero.

Seek Complete must go inactive for any of the following cases:

1. A recalibration sequence is initiated (by drive logic) at power on or after power failure because R/W heads are not over track zero.
2. 12 μsec (typical) after the leading edge of a step pulse or series of step pulses.
3. The dc voltage fault portion of the write fault circuit is activated.

Track 0

This interface signal indicates a logic one only when the drive's R/W heads are positioned at track zero (the outermost data track). When the Track zero signal goes 'true,' it shall always be 'true' prior to Seek Complete 'true.'

Write Fault

This signal indicates that a condition exists at the drive that will cause improper writing on the disk. When this line is a logic one, further writing shall be inhibited at the drive until the condition is corrected. It cannot be reset via the interface.

There are four conditions which will cause Write Fault to be activated:

- Write current malfunction:

  Write current in a head without Write Gate active

  or

  Write Gate and Drive Select active with no write current in a head.
- A drive malfunction causing more than, or less than, one head to be selected, or a malfunction causing a head to be selected for read during write or for write during read.
- dc voltages are grossly out of tolerance.
- Write Gate and an inactive condition on Seek Complete.

Index

This interface signal is provided by the drive once each revolution (16.67mS nom.) to indicate the beginning of the track. This signal is normally logic zero (normally high) and makes the transition to logical one to indicate Index. Only the transition from high to low is valid.

Ready

This interface signal when a logic one together with Seek Complete, indicates that the drive is ready to read, write, or seek, and that the I/O signals are valid. When this line is a logic zero, all writing, reading, and seeking are inhibited. Ready shall be inactive only as a result of and during recovery from a power off condition or whenever the dc voltage monitor portion of the Write Fault circuit is activated.

MFM Read Data

The data recovered by reading a pre-recorded track is transmitted to the host system via a differential pair of MFM Read Data lines. The transition of the +MFM Read Date line going more positive than the -MFM Read Data line represents a flux reversal on the track of the selected head.

KEYBOARD

The low profile ASCII encoded keyboard is designed according to NCR Corporate Appearance Plan (CAP) styling and newest ergonometric requirements. It is connected to the system logic by a four-wire twisted cable, non-extended length 0.5m.

Key arrangement consists of standard alpha keys, the 10-key numeric keypad, cursor control keys, 20 programmable function keys with escutcheon for function key description, and following features:

- Automatic repeat entry on all data keys
- Rollover key feature for fast operation
- Double zero key
- Word processing mode (shift inversion lock for alpha keys only)
- 8-byte FIFO buffer (plus 20 bytes on controller)
- Simple decimal point/comma exchange

The keyboard is currently available in two versions to provide the languages shown in Figure 2.22.

VERSION 1

Language Code	1	2	3
US English	O	O	O
UK/Int. English	●	O	O
Danish	O	●	O
German	●	●	O
Swedish/Finnish	O	O	●
Norwegian	●	O	●
Spanish	O	●	●
Italian	●	●	●

O = off ● = on

VERSION 2

Language Code	1	2	3
Swiss-German	O	O	O
Swiss-French	●	O	O
French	O	●	O
Canadian/Australian	●	●	O
Canadian(Bilingual)	O	O	●
South African	●	O	●
Portuguese	O	●	●
Yugoslavian	●	●	●

O = off ● = on

Figure 2.22 Keyboard languages

The selection of the required language is made by the switch assembly mounted under the base of the keyboard, see Figure 2.23.

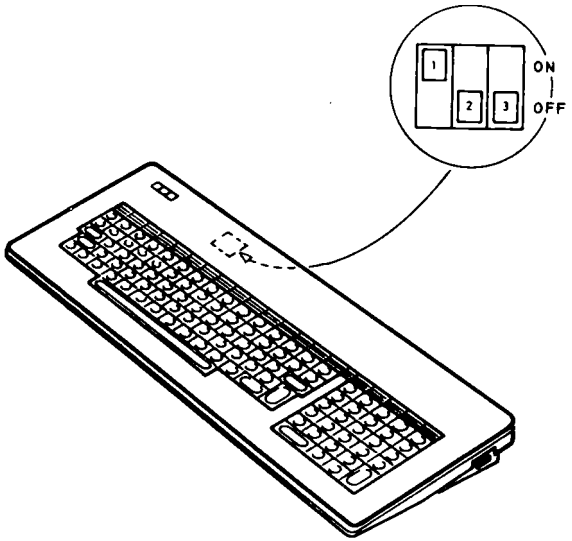
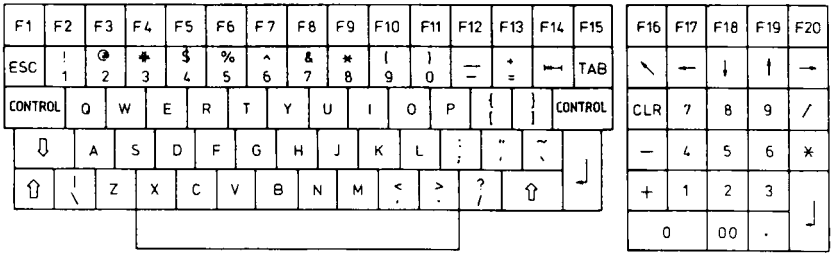
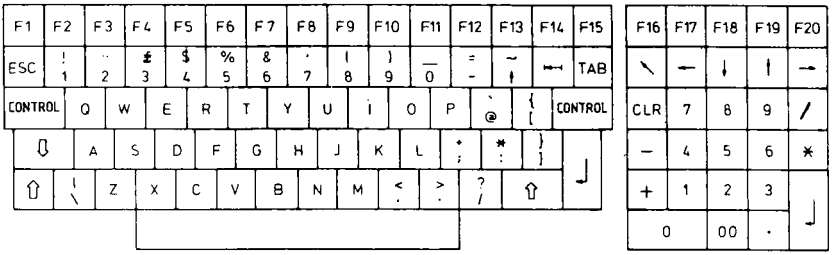


Figure 2.23 Language code selection

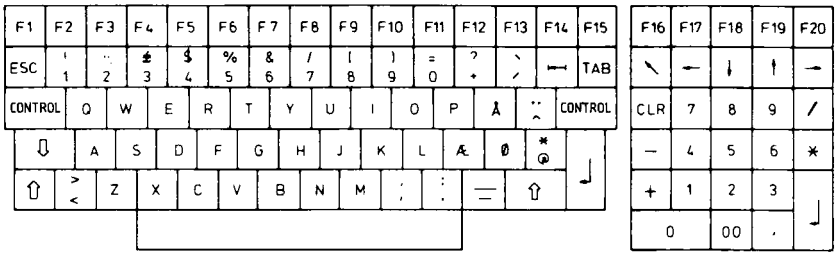
Keytip sets are provided so that the keyboard layout matches the standard national layouts; see Figure 2.24 for version 1 keyboard, and Figure 2.25 for version 2.



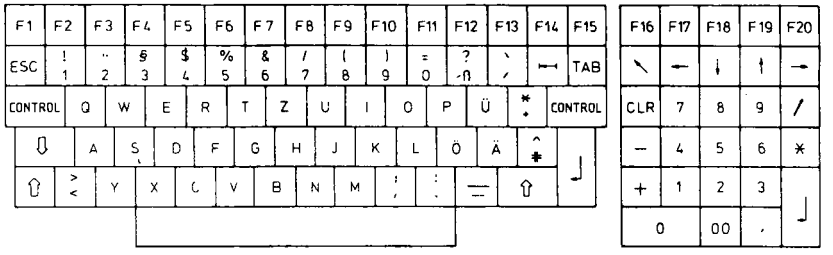
US ENGLISH



UK/INTERNATIONAL ENGLISH

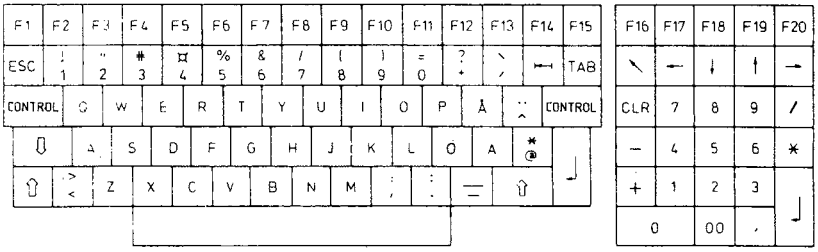


DANISH

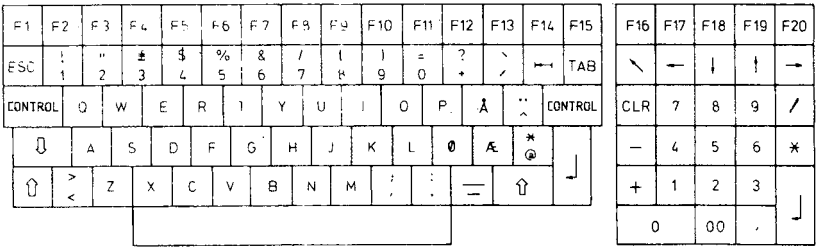


GERMAN

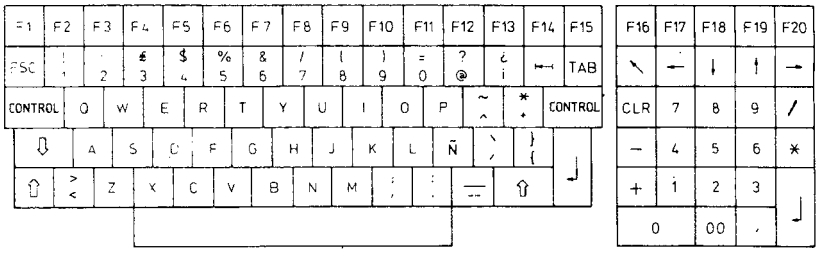
Figure 2.24 Keyboard layouts (1 of 2)



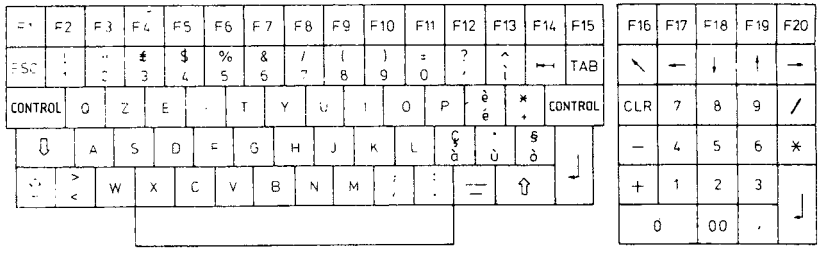
SWEDISH,FINNISH



NORWEGIAN

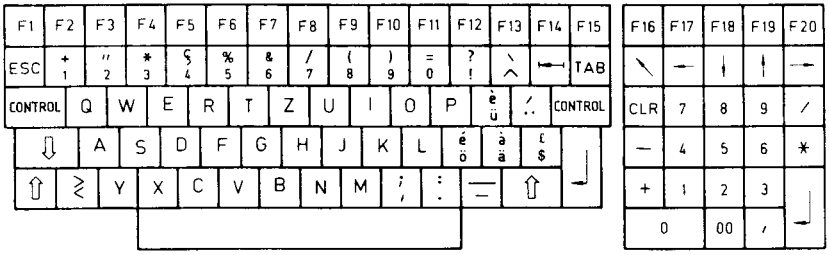


SPANISH

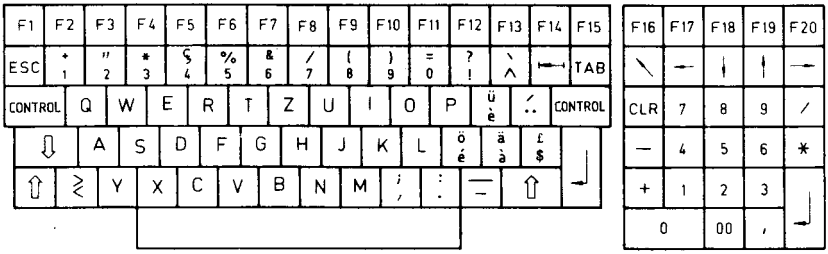


ITALIAN

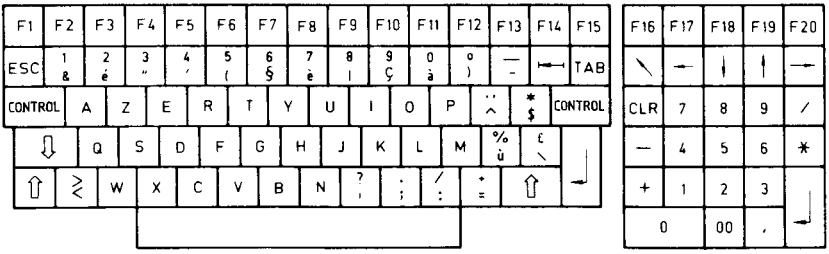
Figure 2.24 Keyboard layouts (2 of 2)



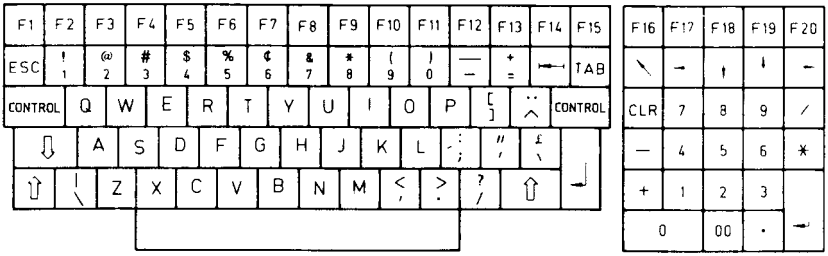
SWISS-GERMAN



SWISS-FRENCH

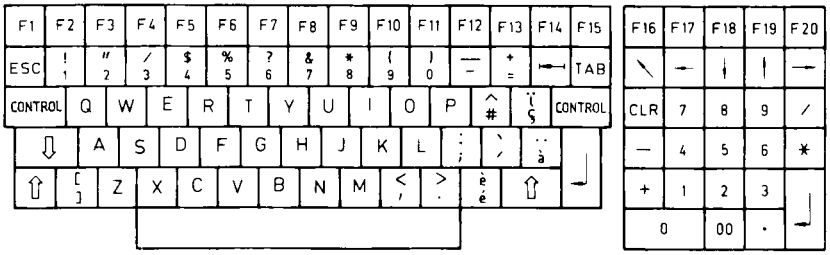


FRENCH

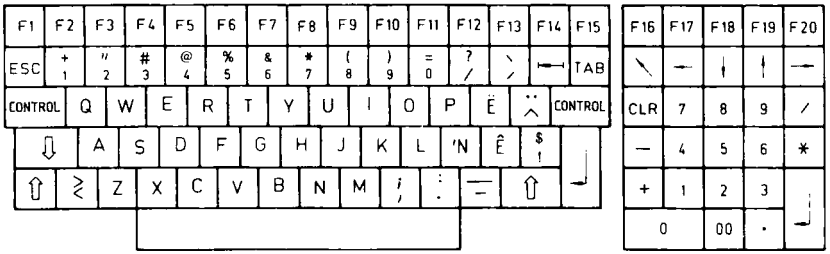


AUSTRALIAN (PRELIMINARY)

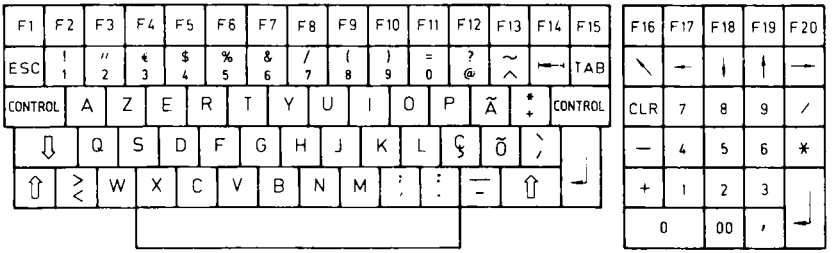
Figure 2.25 Keyboard layouts (1 of 2)



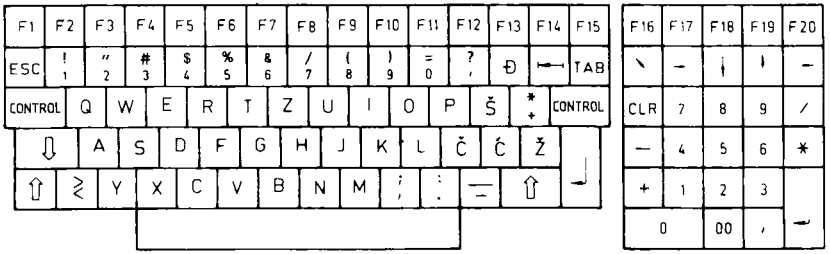
CANADIAN (BILINGUAL — PRELIMINARY)



SOUTH AFRICAN



PORTUGUESE



YUGOSLAVIAN

Figure 2.25 Keyboard layouts (2 of 2)

Technical details of the keyboard are provided in Figures 2.26 to 2.28.

Width	429 mm (16.9 in.)
Height	38 mm (1.5 in.)
Depth	216 mm (8.5 in.)
Weight	2 kg (4.4 lb.)

Figure 2.26 Keyboard dimensions and weight

Supply voltage	+5 Vdc
Current	100 mA (max.)
Logic level '1'	2.4 to 5.3 Vdc at max. 3mA
Logic level '0'	0 to 0.5 Vdc at max. 30mA

Figure 2.27 Keyboard voltage requirements

J109 Pin	Function	Color	Keyboard PCB (TB1)
1	Logic Gnd	black	4
2	Frame Gnd	shield	5
3	+5V	white	2
4	SDPOLL/ poll/data line	yellow	3
5	Reserved	red	1

Figure 2.28 Keyboard cable pin assignments

The joy stick is an option for program games. Functionally, the joy stick is connected parallel to the cursor keys, with a relationship between the arrows on the keyboard and the direction in which the joy stick is moved. The pin assignments for the joy stick connector are shown in Figure 2.29.

Pin	Assignment
1	Col 10
2	Col 9
3	Col 11
4	Col 12
5	Log. Gnd
6	Col 4
7	+5V
8	Row 4
9	Reserved

Figure 2.29 Joy stick pin assignments

KEYBOARD CODES

The layout of the keyboard is shown in Figure 2.31 and gives the key-switch position number for each of the 100 keys in the keyboard. Each key-switch can generate up to three different codes depending upon whether it is pressed alone, together with the shift key, or together with the Control key.

The codes generated by the alphabetic keys are changed from lower to uppercase or upper to lowercase when the Capital Mode key is pressed, for example, pressing the key in position C5 on the US English version of the keyboard produces the keycodes and characters shown in Figure 2.30.

Key(s)	Keycode	Character
C5	67	g
C5 with Shift	47	G
C5 with Capital Mode	47	G
C5 with Capital Mode and Shift	67	g
C5 with Control	17	

Figure 2.30 Keycode example

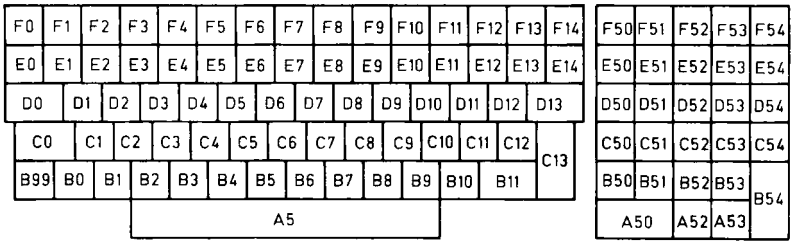


Figure 2.31 Keyboard switch positions

The keycodes for version 1 keyboards are shown in Figure 2.32, and for version 2 keyboards in Figure 2.33.

POSITION	US ENGLISH			UK/INT ENGLISH			DANISH			GERMAN		
	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED1	CONTROL	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED	CONTROL
A5	20	20	20	20	20	20	20	20	20	20	20	20
A50	30	30	30	30	30	30	30	30	30	30	30	30
A52	30	30	30	30	30	30	30	30	30	30	30	30
A53	2E	2E	–	2E	2E	–	2E	2E	–	2E	2E	–
B99	–	–	–	–	–	–	–	–	–	–	–	–
B0	5C	7C	1C	5C	7C	1C	3C	3E	–	3C	3E	–
B1	7A	5A	1A	7A	5A	1A	7A	5A	1A	79	59	19
B2	78	58	18	78	58	18	78	58	18	78	58	18
B3	63	43	03	63	43	03	63	43	03	63	43	03
B4	76	56	16	76	56	16	76	56	16	76	56	16
B5	62	42	02	62	42	02	62	42	02	62	42	02
B6	6E	4E	0E	6E	4E	0E	6E	4E	0E	6E	4E	0E
B7	6D	4D	0D	6D	4D	0D	6D	4D	0D	6D	4D	0D
B8	2C	3C	–	2C	3C	–	2C	3B	–	2C	3B	–
B9	2E	3E	–	2E	3E	–	2E	3A	–	2E	3A	–
B10	2F	3F	–	2F	3F	–	2D	5F	1F	20	5F	1F
B11	–	–	–	–	–	–	–	–	–	–	–	–
B50	2B	DB	BB	2B	DB	BB	2B	DB	BB	2B	DB	BB
B51	31	DC	BC	31	DC	BC	31	DC	BC	31	DC	BC
B52	32	DD	BD	32	DD	BD	32	DD	BD	32	DD	BD
B53	33	DE	BE	33	DE	BE	33	DE	BE	33	DE	BE
B54	88	88	98	88	88	98	88	88	98	88	88	98
C0	–	–	–	–	–	–	–	–	–	–	–	–
C1	61	41	01	61	41	01	61	41	01	61	41	01
C2	73	53	11	73	53	13	73	53	13	73	53	13

Figure 2.32 Version 1 key-switch codes (1 of 8)

POSITION	US ENGLISH UNSHIFTED	US ENGLISH SHIFTED	US ENGLISH CONTROL	UK/INT ENGLISH UNSHIFTED	UK/INT ENGLISH SHIFTED1	UK/INT ENGLISH CONTROL	DANISH UNSHIFTED	DANISH SHIFTED	DANISH CONTROL	GERMAN UNSHIFTED	GERMAN SHIFTED	GERMAN CONTROL
C3	64	44	04	64	44	04	64	44	04	64	44	04
C4	66	46	06	66	46	06	66	46	06	66	46	06
C5	67	47	07	67	47	07	67	47	07	67	47	07
C6	68	48	08	68	48	08	68	48	08	68	48	08
C7	6A	4A	0A	6A	4A	0A	6A	4A	0A	6A	4A	0A
C8	6B	4B	0B	6B	4B	0B	6B	4B	0B	6B	4B	0B
C9	6C	4C	0C	6C	4C	0C	6C	4C	0C	6C	4C	0C
C10	3B	3A	—	3B	2B	—	7B	5B	1B	7C	5C	1C
C11	27	22	00	3A	2A	—	7C	5C	1C	7B	5B	1B
C12	60	7E	1E	5D	7D	1D	40	2A	—	23	5E	1E
C13	88	88	98	88	88	98	88	88	98	88	88	98
C50	2D	F4	F5	2D	F4	F5	2D	F4	F5	2D	F4	F5
C51	34	D4	B4	34	D4	B4	34	D4	B4	34	D4	B4
C52	35	D5	B5	35	D5	B5	35	D5	B5	35	D5	B5
C53	36	D6	B6	36	D6	B6	36	D6	B6	36	D6	B6
C54	2A	DA	BA	27	DA	BA	2A	DA	BA	2A	DA	BA
D0	—	—	—	—	—	—	—	—	—	—	—	—
D1	71	51	11	71	51	11	71	51	11	71	51	11
D2	77	57	17	77	57	17	77	57	17	77	57	17
D3	65	45	05	65	45	05	65	45	05	65	45	05
D4	72	52	12	72	52	12	72	52	12	72	52	12
D5	74	54	14	74	54	14	74	54	14	74	54	14
D6	79	59	19	79	59	19	79	59	19	7A	5A	1A
D7	75	55	15	75	55	15	75	55	15	75	55	15
D8	69	49	09	69	49	09	69	49	09	6A	4A	0A

Figure 2.32 Version 1 key-switch codes (2 of 8)

POSITION	US ENGLISH			UK/INT ENGLISH			DANISH			GERMAN		
	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED1	CONTROL	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED	CONTROL
D9	6F	4F	0F	6F	4F	0F	6F	4F	0F	6F	4F	0F
D10	70	50	10	70	50	10	70	50	10	70	50	10
D11	5B	7B	1B	40	60	00	7D	5D	1D	7D	5D	1D
D12	5D	7D	1D	5B	7B	1B	5E	7E	1E	2B	2A	–
D13	–	–	–	–	–	–	–	–	–	–	–	–
D50	86	7F	96	86	7F	96	86	7F	96	86	7F	96
D51	37	D7	B7	37	D7	B7	37	D7	B7	37	D7	B7
D52	38	D8	B8	38	D8	B8	38	D8	B8	38	D8	B8
D53	39	D9	B9	39	D9	B9	39	D9	B9	39	D9	B9
D54	2F	DF	BF	2F	DF	BF	2F	DF	BF	2F	DF	BF
E0	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B
E1	31	21	–	31	21	–	31	21	–	31	21	–
E2	32	40	–	32	22	–	32	22	–	32	22	–
E3	33	23	–	33	23	–	33	23	–	33	40	–
E4	34	24	–	34	24	–	34	24	–	34	24	–
E5	35	25	–	35	25	–	35	25	–	35	25	–
E6	36	5E	–	36	26	–	36	26	–	36	26	–
E7	37	26	–	37	27	–	37	2F	–	37	2F	–
E8	38	2A	–	38	28	–	38	28	–	38	28	–
E9	39	28	–	39	29	–	39	29	–	39	29	–
E10	30	29	–	30	5F	1F	30	3D	–	30	3D	–
E11	2D	5F	1F	2D	3D	–	2B	3F	–	7E	3F	–
E12	3D	2B	–	5E	7E	1E	27	60	00	27	60	00
E13	8B	8B	9B	8B	8B	9B	8B	8B	9B	8B	8B	9B
E14	09	09	09	09	09	09	09	09	09	09	09	09

Figure 2.32 Version 1 key-switch codes (3 of 8)

POSITION	US ENGLISH UNSHIFTED	US ENGLISH SHIFTED	US ENGLISH CONTROL	UK/INT ENGLISH UNSHIFTED	UK/INT ENGLISH SHIFTED1	UK/INT ENGLISH CONTROL	DANISH UNSHIFTED	DANISH SHIFTED	DANISH CONTROL	GERMAN UNSHIFTED	GERMAN SHIFTED	GERMAN CONTROL
E50	81	81	91	81	81	91	81	81	91	81	81	91
E51	82	82	92	82	82	92	82	82	92	82	82	92
E52	83	83	93	83	83	93	83	83	93	83	83	93
E53	84	84	94	84	84	94	84	84	94	84	84	94
E54	85	85	95	85	85	95	85	85	95	85	85	95
F0	E0	C0	A0	E0	C0	A0	E0	C0	A0	E0	C0	A0
F1	E1	C1	A1	E1	C1	A1	E1	C1	A1	E1	C1	A1
F2	E2	C2	A2	E2	C2	A2	E2	C2	A2	E2	C2	A2
F3	E3	C3	A3	E3	C3	A3	E3	C3	A3	E3	C3	A3
F4	E4	C4	A4	E4	C4	A4	E4	C4	A4	E4	C4	A4
F5	E5	C5	A5	E5	C5	A5	E5	C5	A5	E5	C5	A5
F6	E6	C6	A6	E6	C6	A6	E6	C6	A6	E6	C6	A6
F7	E7	C7	A7	E7	C7	A7	E7	C7	A7	E7	C7	A7
F8	E8	C8	A8	E8	C8	A8	E8	C8	A8	E8	C8	A8
F9	E9	C9	A9	E9	C9	A9	E9	C9	A9	E9	C9	A9
F10	EA	CA	AA	EA	CA	AA	EA	CA	AA	EA	CA	AA
F11	EB	CB	AB	EB	CB	AB	EB	CB	AB	EB	CB	AB
F12	EC	CC	AC	EC	CC	AC	EC	CC	AC	EC	CC	AC
F13	ED	CD	AD	ED	CD	AD	ED	CD	AD	ED	CD	AD
F14	EE	CE	AE	EE	CE	AE	EE	CE	AE	EE	CE	AE
F50	EF	CF	AF	EF	CF	AF	EF	CF	AF	EF	CF	AF
F51	F0	D0	B0	F0	D0	B0	F0	D0	B0	F0	D0	B0
F52	F1	D1	B1	F1	D1	B1	F1	D1	B1	F1	D1	B1
F53	F2	D2	B2	F2	D2	B2	F2	D2	B2	F2	D2	B2
F54	F3	D3	B3	F3	D3	B3	F3	D3	B3	F3	D3	B3

Figure 2.32 Version 1 key-switches (4 of 8)

POSITION	SWEDISH /FINNISH			NOR-WEGIAN			SPANISH			ITALIAN		
	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED1	CONTROL	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED	CONTROL
A5	20	20	20	20	20	20	20	20	20	20	20	20
A50	30	30	30	30	30	30	30	30	30	30	30	30
A52	30	30	30	30	30	30	30	30	30	30	30	30
A53	2E	2E	–	2E	2E	–	2E	2E	–	2E	2E	–
B99	–	–	–	–	–	–	–	–	–	–	–	–
B0	3C	3E	–	2C	3E	–	3C	3E	–	3C	3E	–
B1	7A	5A	1A	7A	5A	1A	7A	5A	1A	77	57	17
B2	78	58	18	78	58	18	78	58	18	78	58	18
B3	63	43	03	63	43	03	63	43	03	63	43	03
B4	76	56	16	76	56	16	76	56	16	76	56	16
B5	62	42	02	62	42	02	62	42	02	62	42	02
B6	6E	4E	0E	6E	4E	0E	6E	4E	0E	6E	4E	0E
B7	6D	4D	0D	6D	4D	0D	6D	4D	0D	6D	4D	0D
B8	2C	3B	–	2C	3B	–	2C	3B	–	2C	3B	–
B9	2E	3A	–	2E	3A	–	2E	3A	–	2E	3A	–
B10	2D	5F	1F	2D	5F	1F	2D	5F	1F	2D	5F	1F
B11	–	–	–	–	–	–	–	–	–	–	–	–
B50	2B	DB	BB	2B	DB	BB	2B	DB	BB	2B	DB	BB
B51	31	DC	BC	31	DC	BC	31	DC	BC	31	DC	BC
B52	32	DD	BD	32	DD	BD	32	DD	BD	32	DD	BD
B53	33	DE	BE	33	DE	BE	33	DE	BE	33	DE	BE
B54	88	88	98	88	88	98	88	88	98	88	88	98
C0	–	–	–	–	–	–	–	–	–	–	–	–
C1	61	41	01	61	41	01	61	41	01	61	41	01
C2	73	53	13	73	53	13	73	53	13	73	53	13

Figure 2.32 Version 1 key-switch codes (5 of 8)

POSITION	SWEDISH/FINNISH UNSHIFTED	SWEDISH/FINNISH SHIFTED	SWEDISH/FINNISH CONTROL	NORWEGIAN UNSHIFTED	NORWEGIAN SHIFTED	NORWEGIAN CONTROL	SPANISH UNSHIFTED	SPANISH SHIFTED	SPANISH CONTROL	ITALIAN UNSHIFTED	ITALIAN SHIFTED	ITALIAN CONTROL
C3	64	44	04	64	44	04	64	44	04	64	44	04
C4	66	46	06	66	46	06	66	46	06	66	46	06
C5	67	47	07	67	47	07	67	47	07	67	47	07
C6	68	48	08	68	48	08	68	48	08	68	48	08
C7	6A	4A	0A	6A	4A	0A	6A	4A	0A	6A	4A	0A
C8	6B	4B	0B	6B	4B	0B	6B	4B	0B	6B	4B	0B
C9	6C	4C	0C	6C	4C	0C	6C	4C	0C	6C	4C	0C
C10	7C	5C	1C	7C	5C	1C	7C	5C	1C	7B	5C	1C
C11	7B	5B	1B	7B	5B	1B	27	60	00	60	5B	1B
C12	40	2A	—	40	2A	—	7B	7D	1D	7C	40	00
C13	88	88	98	88	88	98	88	88	98	88	88	98
C50	2D	F4	F5	2D	F4	F5	2D	F4	F5	2D	F4	F5
C51	34	D4	B4	34	D4	B4	34	D4	B4	34	D4	B4
C52	35	D5	B5	35	D5	B5	35	D5	B5	35	D5	B5
C53	36	D6	B6	36	D6	B6	36	D6	B6	36	D6	B6
C54	2A	DA	BA	2A	DA	BA	2A	DA	BA	2A	DA	BA
D0	—	—	—	—	—	—	—	—	—	—	—	—
D1	71	51	11	71	51	11	71	51	11	71	51	11
D2	77	57	17	77	57	17	77	57	17	7A	5A	1A
D3	65	45	05	65	45	05	65	45	05	65	45	05
D4	72	52	12	72	52	12	72	52	12	72	52	12
D5	74	54	14	74	54	14	74	54	14	74	54	14
D6	79	59	19	79	59	19	79	59	19	79	59	19
D7	75	55	15	75	55	15	75	55	15	75	55	15
D8	69	49	09	69	49	09	69	49	09	69	49	09

Figure 2.32 Version 1 key-switch codes (6 of 8)

POSITION	SWEDISH/FINNISH UNSHIFTED	SWEDISH/FINNISH SHIFTED	SWEDISH/FINNISH CONTROL	NOR-WEGIAN UNSHIFTED	NOR-WEGIAN SHIFTED1	NOR-WEGIAN CONTROL	SPANISH UNSHIFTED	SPANISH SHIFTED	SPANISH CONTROL	ITALIAN UNSHIFTED	ITALIAN SHIFTED	ITALIAN CONTROL
D9	6F	4F	0F	6F	4F	0F	6F	4F	0F	6F	4F	0F
D10	70	50	10	70	50	10	70	50	10	70	50	10
D11	7D	5D	1D	7D	5D	1D	5E	7E	1E	5D	7D	1D
D12	5E	7E	1E	5E	7E	1E	2B	2A	–	2B	2A	–
D13	–	–	–	–	–	–	–	–	–	–	–	–
D50	86	7F	96	86	7F	96	86	7F	96	86	7F	96
D51	37	D7	B7	37	D7	B7	37	D7	B7	37	D7	B7
D52	38	D8	B8	38	D8	B8	38	D8	B8	38	D8	B8
D53	39	D9	B9	39	D9	B9	39	D9	B9	39	D9	B9
D54	2F	DF	BF	2F	DF	BF	2F	DF	BF	2F	DF	BF
E0	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B
E1	31	21	–	31	21	–	31	21	–	31	21	–
E2	32	22	–	32	22	–	32	22	–	32	22	–
E3	33	23	–	33	23	–	33	23	–	33	23	–
E4	34	24	–	34	24	–	34	24	–	34	24	–
E5	35	25	–	35	25	–	35	25	–	35	25	–
E6	36	26	–	36	26	–	36	26	–	36	26	–
E7	37	2F	–	37	2F	–	37	2F	–	37	2F	–
E8	38	28	–	38	28	–	38	28	–	38	28	–
E9	39	29	–	39	29	–	39	29	–	39	29	–
E10	30	3D	–	30	3D	–	30	3D	–	30	3D	–
E11	2B	3F	–	2B	3F	–	40	3F	–	27	3F	–
E12	27	60	00	27	60	00	5B	5D	1B	7E	5E	1E
E13	8B	8B	9B	8B	8B	9B	8B	8B	9B	8B	8B	9B
E14	09	09	09	09	09	09	09	09	09	09	09	09

Figure 2.32 Version 1 key-switch codes (7 of 8)

POSITION	SWEDISH/FINNISH UNSHIFTED	SWEDISH/FINNISH SHIFTED	SWEDISH/FINNISH CONTROL	NOR-WEGIAN UNSHIFTED	NOR-WEGIAN SHIFTED1	NOR-WEGIAN CONTROL	SPANISH UNSHIFTED	SPANISH SHIFTED	SPANISH CONTROL	ITALIAN UNSHIFTED	ITALIAN SHIFTED	ITALIAN CONTROL
E50	81	81	91	81	81	91	81	81	91	81	81	91
E51	82	82	92	82	82	92	82	82	92	82	82	92
E52	83	83	93	83	83	93	83	83	93	83	83	93
E53	84	84	94	84	84	94	84	84	94	84	84	94
E54	85	85	95	85	85	95	85	85	95	85	85	95
F0	E0	C0	A0	E0	C0	A0	E0	C0	A0	E0	C0	A0
F1	E1	C1	A1	E1	C1	A1	E1	C1	A1	E1	C1	A1
F2	E2	C2	A2	E2	C2	A2	E2	C2	A2	E2	C2	A2
F3	E3	C3	A3	E3	C3	A3	E3	C3	A3	E3	C3	A3
F4	E4	C4	A4	E4	C4	A4	E4	C4	A4	E4	C4	A4
F5	E5	C5	A5	E5	C5	A5	E5	C5	A5	E5	C5	A5
F6	E6	C6	A6	E6	C6	A6	E6	C6	A6	E6	C6	A6
F7	E7	C7	A7	E7	C7	A7	E7	C7	A7	E7	C7	A7
F8	E8	C8	A8	E8	C8	A8	E8	C8	A8	E8	C8	A8
F9	E9	C9	A9	E9	C9	A9	E9	C9	A9	E9	C9	A9
F10	EA	CA	AA	EA	CA	AA	EA	CA	AA	EA	CA	AA
F11	EB	CB	AB	EB	CB	AB	EB	CB	AB	EB	CB	AB
F12	EC	CC	AC	EC	CC	AC	EC	CC	AC	EC	CC	AC
F13	ED	CD	AD	ED	CD	AD	ED	CD	AD	ED	CD	AD
F14	EE	CE	AE	EE	CE	AE	EE	CE	AE	EE	CE	AE
F50	EF	CF	AF	EF	CF	AF	EF	CF	AF	EF	CF	AF
F51	F0	D0	B0	F0	D0	B0	F0	D0	B0	F0	D0	B0
F52	F1	D1	B1	F1	D1	B1	F1	D1	B1	F1	D1	B1
F53	F2	D2	B2	F2	D2	B2	F2	D2	B2	F2	D2	B2
F54	F3	D3	B3	F3	D3	B3	F3	D3	B3	F3	D3	B3

Figure 2.32 Version 1 key-switch codes (8 of 8)

POSITION	SWISS-GERMAN			SWISS-FRENCH			FRENCH			CANAD./AUSTRAL.		
	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED1	CONTROL	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED	CONTROL
A5	20	20	20	20	20	20	20	20	20	20	20	20
A50	30	30	30	30	30	30	30	30	30	30	30	30
A52	30	30	30	30	30	30	30	30	30	30	30	30
A53	2E	2E	–	2E	2E	–	2E	2E	–	2E	2E	–
B99	–	–	–	–	–	–	–	–	–	–	–	–
B0	3C	3E	–	3C	3E	–	3C	3E	–	5C	7C	1C
B1	79	59	19	79	59	19	77	57	17	7A	5A	1A
B2	78	58	18	78	58	18	78	58	18	78	58	18
B3	63	43	03	63	43	03	63	43	03	63	43	03
B4	76	56	16	76	56	16	76	56	16	76	56	16
B5	62	42	02	62	42	02	62	42	02	62	42	02
B6	6E	4E	0E	6E	4E	0E	6E	4E	0E	6E	4E	0E
B7	6D	4D	0D	6D	4D	0D	2C	3F	–	6D	4D	0D
B8	2C	3B	–	2C	3B	–	3B	2E	–	2C	3C	–
B9	2E	3A	–	2E	3A	–	3A	2F	–	2E	3E	–
B10	2D	5F	1F	2D	5F	1F	3D	2B	–	2F	3F	–
B11	–	–	–	–	–	–	–	–	–	–	–	–
B50	2B	DB	BB	2B	DB	BB	2B	DB	BB	2B	DB	BB
B51	31	DC	BC	31	DC	BC	31	DC	BC	31	DC	BC
B52	32	DD	BD	32	DD	BD	32	DD	BD	32	DD	BD
B53	33	DE	BE	33	DE	BE	33	DE	BE	33	DE	BE
B54	88	88	98	88	88	98	88	88	98	88	88	98
C0	–	–	–	–	–	–	–	–	–	–	–	–
C1	61	41	01	61	41	01	71	51	11	61	41	01
C2	73	53	13	73	53	13	73	53	13	73	53	13

Figure 2.33 Version 2 key-switch codes (1 of 8)

POSITION	SWISS-GERMAN UNSHIFTED	SWISS-GERMAN SHIFTED	SWISS-GERMAN CONTROL	SWISS-FRENCH UNSHIFTED	SWISS-FRENCH SHIFTED1	SWISS-FRENCH CONTROL	FRENCH UNSHIFTED	FRENCH SHIFTED	FRENCH CONTROL	CANAD./AUSTRAL. UNSHIFTED	CANAD./AUSTRAL. SHIFTED	CANAD./AUSTRAL. CONTROL
C3	64	44	04	64	44	04	64	44	04	64	44	04
C4	66	46	06	66	46	06	66	46	06	66	46	06
C5	67	47	07	67	47	07	67	47	07	67	47	07
C6	68	48	08	68	48	08	68	48	08	68	48	08
C7	6A	4A	0A	6A	4A	0A	6A	4A	0A	6A	4A	0A
C8	6B	4B	0B	6B	4B	0B	6B	4B	0B	6B	4B	0B
C9	6C	4C	0C	6C	4C	0C	6C	4C	0C	6C	4C	0C
C10	7C	5C	1C	5C	7C	1C	6D	4D	0D	3B	3A	—
C11	7B	5B	1B	5B	7B	1B	7C	25	1C	27	22	20
C12	24	23	—	24	23	—	60	23	1D	60	7B	1B
C13	88	88	98	88	88	98	88	88	98	88	88	98
C50	2D	F4	F5	2D	F4	F5	2D	F4	F5	2D	F4	F5
C51	34	D4	B4	34	D4	B4	34	D4	B4	34	D4	B4
C52	35	D5	B5	35	D5	B5	35	D5	B5	35	D5	B5
C53	36	D6	B6	36	D6	B6	36	D6	B6	36	D6	B6
C54	2A	DA	BA	2A	DA	BA	2A	DA	BA	2A	DA	BA
D0	—	—	—	—	—	—	—	—	—	—	—	—
D1	71	51	11	71	51	11	61	41	01	71	51	11
D2	77	57	17	77	57	17	7A	5A	1A	77	57	17
D3	65	45	05	65	45	05	65	45	05	65	45	05
D4	72	52	12	72	52	12	72	52	12	72	52	12
D5	74	54	14	74	54	14	74	54	14	74	54	14
D6	7A	5A	1A	7A	5A	1A	79	59	19	79	59	19
D7	75	55	15	75	55	15	75	55	15	75	55	15
D8	69	49	09	69	49	09	69	49	09	69	49	09

Figure 2.33 Version 2 key-switch codes (2 of 8)

POSITION	SWISS-GERMAN			SWISS-FRENCH			FRENCH			CANAD./AUSTRAL.		
	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED1	CONTROL	UNSHIFTED	SHIFTED	CONTROL	UNSHIFTED	SHIFTED	CONTROL
D9	6F	4F	0F	6F	4F	0F	6F	4F	0F	6F	4F	0F
D10	70	50	40	70	50	10	70	50	10	70	50	10
D11	7D	5D	1D	5D	7D	1D	5E	7E	1E	5D	5B	1D
D12	7E	27	1E	7E	27	1E	24	2A	–	5E	7E	1E
D13	–	–	–	–	–	–	–	–	–	–	–	–
D50	86	7F	96	86	7F	96	86	7F	96	86	7F	96
D51	37	D7	B7	37	D7	B7	37	D7	B7	37	D7	B7
D52	38	D8	B8	38	D8	B8	38	D8	B8	38	D8	B8
D53	39	D9	B9	39	D9	B9	39	D9	B9	39	D9	B9
D54	2F	DF	BF	2F	DF	BF	2F	DF	BF	2F	DF	BF
E0	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B
E1	31	2B	–	31	2B	–	26	31	–	31	21	–
E2	32	22	–	32	22	–	7B	32	–	32	40	–
E3	33	2A	–	33	2A	–	22	33	–	33	23	–
E4	34	7D	–	34	7D	–	27	34	–	34	24	–
E5	35	25	–	35	25	–	28	35	–	35	25	–
E6	36	26	–	36	26	–	50	36	–	36	7D	–
E7	37	2F	–	37	2F	–	7D	37	–	37	26	–
E8	38	28	–	38	28	–	21	38	–	38	2A	–
E9	39	29	–	39	29	–	5C	39	–	39	28	–
E10	30	3D	–	30	3D	–	40	30	00	30	29	–
E11	21	3F	–	21	3F	–	29	5B	1B	2D	5F	1F
E12	5E	60	00	5E	60	00	2D	5F	1F	3D	2B	–
E13	8B	8B	9B	8B	8B	9B	8B	8B	9B	8B	8B	9B
E14	09	09	09	09	09	09	09	09	09	09	09	09

Figure 2.33 Version 2 key-switch codes (3 of 8)

POSITION	SWISS-GERMAN UNSHIFTED	SWISS-GERMAN SHIFTED	SWISS-GERMAN CONTROL	SWISS-FRENCH UNSHIFTED	SWISS-FRENCH SHIFTED1	SWISS-FRENCH CONTROL	FRENCH UNSHIFTED	FRENCH SHIFTED	FRENCH CONTROL	CANAD./AUSTRAL. UNSHIFTED	CANAD./AUSTRAL. SHIFTED	CANAD./AUSTRAL. CONTROL
E50	81	81	91	81	81	91	81	81	91	81	81	91
E51	82	82	92	82	82	92	82	82	92	82	82	92
E52	83	83	93	83	83	93	83	83	93	83	83	93
E53	84	84	94	84	84	94	84	84	94	84	84	94
E54	85	85	95	85	85	95	85	85	95	85	85	95
F0	E0	C0	A0	E0	C0	A0	E0	C0	A0	E0	C0	A0
F1	E1	C1	A1	E1	C1	A1	E1	C1	A1	E1	C1	A1
F2	E2	C2	A2	E2	C2	A2	E2	C2	A2	E2	C2	A2
F3	E3	C3	A3	E3	C3	A3	E3	C3	A3	E3	C3	A3
F4	E4	C4	A4	E4	C4	A4	E4	C4	A4	E4	C4	A4
F5	E5	C5	A5	E5	C5	A5	E5	C5	A5	E5	C5	A5
F6	E6	C6	A6	E6	C6	A6	E6	C6	A6	E6	C6	A6
F7	E7	C7	A7	E7	C7	A7	E7	C7	A7	E7	C7	A7
F8	E8	C8	A8	E8	C8	A8	E8	C8	A8	E8	C8	A8
F9	E9	C9	A9	E9	C9	A9	E9	C9	A9	E9	C9	A9
F10	EA	CA	AA	EA	CA	AA	EA	CA	AA	EA	CA	AA
F11	EB	CB	AB	EB	CB	AB	EB	CB	AB	EB	CB	AB
F12	EC	CC	AC	EC	CC	AC	EC	CC	AC	EC	CC	AC
F13	ED	CD	AD	ED	CD	AD	ED	CD	AD	ED	CD	AD
F14	EE	CE	AE	EE	CE	AE	EE	CE	AE	EE	CE	AE
F50	EF	CF	AF	EF	CF	AF	EF	CF	AF	EF	CF	AF
F51	F0	D0	B0	F0	D0	B0	F0	D0	B0	F0	D0	B0
F52	F1	D1	B1	F1	D1	B1	F1	D1	B1	F1	D1	B1
F53	F2	D2	B2	F2	D2	B2	F2	D2	B2	F2	D2	B2
F54	F3	D3	B3	F3	D3	B3	F3	D3	B3	F3	D3	B3

Figure 2.33 Version 2 key-switch codes (4 of 8)

POSITION	CANAD. BILING. UNSHIFTED	CANAD. BILING. SHIFTED	CANAD. BILING. CONTROL	SOUTH AFRICAN UNSHIFTED	SOUTH AFRICAN SHIFTED1	SOUTH AFRICAN CONTROL	PORTUGUESE UNSHIFTED	PORTUGUESE SHIFTED	PORTUGUESE CONTROL	JUGOSLAVIAN UNSHIFTED	JUGOSLAVIAN SHIFTED	JUGOSLAVIAN CONTROL
A5	20	20	20	20	20	20	20	20	20	20	20	20
A50	30	30	30	30	30	30	30	30	30	30	30	30
A52	30	30	30	30	30	30	30	30	30	30	30	30
A53	2E	2E	–	2E	2E	–	2E	2E	–	2E	2E	–
B99	–	–	–	–	–	–	–	–	–	–	–	–
B0	5C	7C	1C	2C	3E	–	3C	3E	–	3C	3E	–
B1	7A	5A	1A	7A	5A	1A	77	57	17	79	59	19
B2	78	58	18	78	58	18	78	58	18	78	58	18
B3	63	43	03	63	43	03	63	43	03	63	43	03
B4	76	56	16	76	56	16	76	56	16	76	56	16
B5	62	42	02	62	42	02	62	42	02	62	42	02
B6	6E	4E	0E	6E	4E	0E	6E	4E	0E	6E	4E	0E
B7	6D	4D	0D	6D	4D	0D	6D	4D	0D	6D	4D	0D
B8	2C	3C	–	2C	3B	–	2C	3B	–	2C	3B	–
B9	2E	3E	–	2E	3A	–	2E	3A	–	2E	3A	–
B10	2F	3F	–	2D	5F	1F	2D	5F	1F	20	5F	1F
B11	–	–	–	–	–	–	–	–	–	–	–	–
B50	2B	DB	BB	2B	DB	BB	2B	DB	BB	2B	DB	BB
B51	31	DC	BC	31	DC	BC	31	DC	BC	31	DC	BC
B52	32	DD	BD	32	DD	BD	32	DD	BD	32	DD	BD
B53	33	DE	BE	33	DE	BE	33	DE	BE	33	DE	BE
B54	88	88	98	88	88	98	88	88	98	88	88	98
C0	–	–	–	–	–	–	–	–	–	–	–	–
C1	61	41	01	61	41	01	71	51	11	61	41	01
C2	73	53	13	73	53	13	73	53	13	73	53	13

Figure 2.33 Version 2 key-switch codes (5 of 8)

POSITION	CANAD. BILING. UNSHIFTED	CANAD. BILING. SHIFTED	CANAD. BILING. CONTROL	SOUTH AFRICAN UNSHIFTED	SOUTH AFRICAN SHIFTED1	SOUTH AFRICAN CONTROL	PORTU-GUESE UNSHIFTED	PORTU-GUESE SHIFTED	PORTU-GUESE CONTROL	JUGO-SLAVIAN UNSHIFTED	JUGO-SLAVIAN SHIFTED	JUGO-SLAVIAN CONTROL
C3	64	44	04	64	44	04	64	44	04	64	44	04
C4	66	46	06	66	46	06	66	46	06	66	46	06
C5	67	47	07	67	47	07	67	47	07	67	47	07
C6	68	48	08	68	48	08	68	48	08	68	48	08
C7	6A	4A	0A	6A	4A	0A	6A	4A	0A	6A	4A	0A
C8	6B	4B	0B	6B	4B	0B	6B	4B	0B	6B	4B	0B
C9	6C	4C	0C	6C	4C	0C	6C	4C	0C	6C	4C	0C
C10	3B	3A	—	7C	5C	1C	7D	5D	1D	7C	5C	1C
C11	27	22	00	7B	5B	1B	7C	5C	1C	7B	5B	1B
C12	60	7B	1B	21	41	—	27	60	00	7E	5E	1E
C13	88	88	98	88	88	98	88	88	98	88	88	98
C50	2D	F4	F5	2D	F4	F5	2D	F4	F5	2D	F4	F5
C51	34	D4	B4	34	D4	B4	34	D4	B4	34	D4	B4
C52	35	D5	B5	35	D5	B5	35	D5	B5	35	D5	B5
C53	36	D6	B6	36	D6	B6	36	D6	B6	36	D6	B6
C54	2A	DA	BA	2A	DA	BA	2A	DA	BA	2A	DA	BA
D0	—	—	—	—	—	—	—	—	—	—	—	—
D1	71	51	11	71	51	11	61	41	01	71	51	11
D2	77	57	17	77	57	17	7A	5A	1A	77	57	17
D3	65	45	05	65	45	05	65	45	05	65	45	05
D4	72	52	12	72	52	12	72	52	12	72	52	02
D5	74	54	14	74	54	14	74	54	14	74	54	14
D6	79	59	19	79	59	19	79	59	19	7A	5A	1A
D7	75	55	15	75	55	15	75	55	15	75	55	15
D8	69	49	09	69	49	09	69	49	09	69	49	09

Figure 2.33 Version 2 key-switch codes (6 of 8)

POSITION	CANAD. BILING. UNSHIFTED	CANAD. BILING. SHIFTED	CANAD. BILING. CONTROL	SOUTH AFRICAN UNSHIFTED	SOUTH AFRICAN SHIFTED1	SOUTH AFRICAN CONTROL	PORTUGUESE UNSHIFTED	PORTUGUESE SHIFTED	PORTUGUESE CONTROL	JUGOSLAVIAN UNSHIFTED	JUGOSLAVIAN SHIFTED	JUGOSLAVIAN CONTROL
D9	6F	4F	0F	6F	4F	0F	6F	4F	0F	6F	4F	0F
D10	70	50	10	70	50	10	70	50	10	70	50	10
D11	5D	5B	1D	7D	5D	1D	7B	5B	1B	7D	5D	1D
D12	5E	7E	1E	5E	7E	1E	2B	2A	—	2B	27	—
D13	—	—	—	—	—	—	—	—	—	—	—	—
D50	86	7F	96	86	7F	96	86	7F	96	86	7F	96
D51	37	D7	B7	37	D7	B7	37	D7	B7	37	D7	B7
D52	38	D8	B8	38	D8	B8	38	D8	B8	38	D8	B8
D53	39	D9	B9	39	D9	B9	39	D9	B9	39	D9	B9
D54	2F	DF	BF	2F	DF	BF	2F	DF	BF	2F	DF	BF
E0	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B
E1	31	21	—	31	2B	—	31	21	—	31	21	—
E2	32	40	—	32	22	—	32	22	—	32	22	—
E3	33	23	—	33	23	—	33	23	—	33	23	—
E4	34	24	—	34	40	—	34	24	—	34	24	—
E5	35	25	—	35	25	—	35	25	—	35	25	—
E6	36	7D	—	36	26	—	36	26	—	36	26	—
E7	37	26	—	37	2A	—	37	2F	—	37	2F	—
E8	38	2A	—	38	28	—	38	28	—	38	28	—
E9	39	28	—	39	29	—	39	29	—	39	29	—
E10	30	29	—	30	3D	—	30	3D	—	30	3D	—
E11	2D	5F	1F	2F	3F	—	40	3F	—	27	3F	—
E12	3D	2B	—	27	60	00	5E	7E	1E	40	60	00
E13	8B	8B	9B	8B	8B	9B	8B	8B	9B	8B	8B	9B
E14	09	09	09	09	09	09	09	09	09	09	09	09

Figure 2.33 Version 2 key-switch codes (7 of 8)

POSITION	CANAD. BILING. UNSHIFTED	CANAD. BILING. SHIFTED	CANAD. BILING. CONTROL	SOUTH AFRICAN UNSHIFTED	SOUTH AFRICAN SHIFTED1	SOUTH AFRICAN CONTROL	PORTU-GUESE UNSHIFTED	PORTU-GUESE SHIFTED	PORTU-GUESE CONTROL	JUGO-SLAVIAN UNSHIFTED	JUGO-SLAVIAN SHIFTED	JUGO-SLAVIAN CONTROL
E50	81	81	91	81	81	91	81	81	91	81	81	91
E51	82	82	92	82	82	92	82	82	92	82	82	92
E52	83	83	93	83	83	93	83	83	93	83	83	93
E53	84	84	94	84	84	94	84	84	94	84	84	94
E54	85	85	95	85	85	95	85	85	95	85	85	95
F0	E0	C0	A0	E0	C0	A0	E0	C0	A0	E0	C0	A0
F1	E1	C1	A1	E1	C1	A1	E1	C1	A1	E1	C1	A1
F2	E2	C2	A2	E2	C2	A2	E2	C2	A2	E2	C2	A2
F3	E3	C3	A3	E3	C3	A3	E3	C3	A3	E3	C3	A3
F4	E4	C4	A4	E4	C4	A4	E4	C4	A4	E4	C4	A4
F5	E5	C5	A5	E5	C5	A5	E5	C5	A5	E5	C5	A5
F6	E6	C6	A6	E6	C6	A6	E6	C6	A6	E6	C6	A6
F7	E7	C7	A7	E7	C7	A7	E7	C7	A7	E7	C7	A7
F8	E8	C8	A8	E8	C8	A8	E8	C8	A8	E8	C8	A8
F9	E9	C9	A9	E9	C9	A9	E9	C9	A9	E9	C9	A9
F10	EA	CA	AA	EA	CA	AA	EA	CA	AA	EA	CA	AA
F11	EB	CB	AB	EB	CB	AB	EB	CB	AB	EB	CB	AB
F12	EC	CC	AC	EC	CC	AC	EC	CC	AC	EC	CC	AC
F13	ED	CD	AD	ED	CD	AD	ED	CD	AD	ED	CD	AD
F14	EE	CE	AE	EE	CE	AE	EE	CE	AE	EE	CE	AE
F50	EF	CF	AF	EF	CF	AF	EF	CF	AF	EF	CF	AF
F51	F0	D0	B0	F0	D0	B0	F0	D0	B0	F0	D0	B0
F52	F1	D1	B1	F1	D1	B1	F1	D1	B1	F1	D1	B1
F53	F2	D2	B2	F2	D2	B2	F2	D2	B2	F2	D2	B2
F54	F3	D3	B3	F3	D3	B3	F3	D3	B3	F3	D3	B3

Figure 2.33 Version 2 key-switch codes (8 of 8)

MONOCHROME CRT

With the monochrome 12-inch CRT, text with 25 horizontal lines across the screen can be displayed. Each line has 80 character positions. It also has graphics capability to draw complex pictures. This graphics capability makes the screen all points addressable (APA). (640 points horizontally and 400 points vertically.) The tube uses a green-colored phosphor for a green display on a dark background. An anti-reflection surface is provided. The screen is refreshed at 56.2Hz, the horizontal frequency is 23.8k Hz. The CRT requires a supply voltage of +12Vdc± 5% and a maximum current of 1.5A. Brightness and contrast controls are conveniently located on the front of the unit, allowing easy adjustment for different user's preference and room lighting.

The dimensions of the character field on the CRT screen are shown in Figure 2.34.

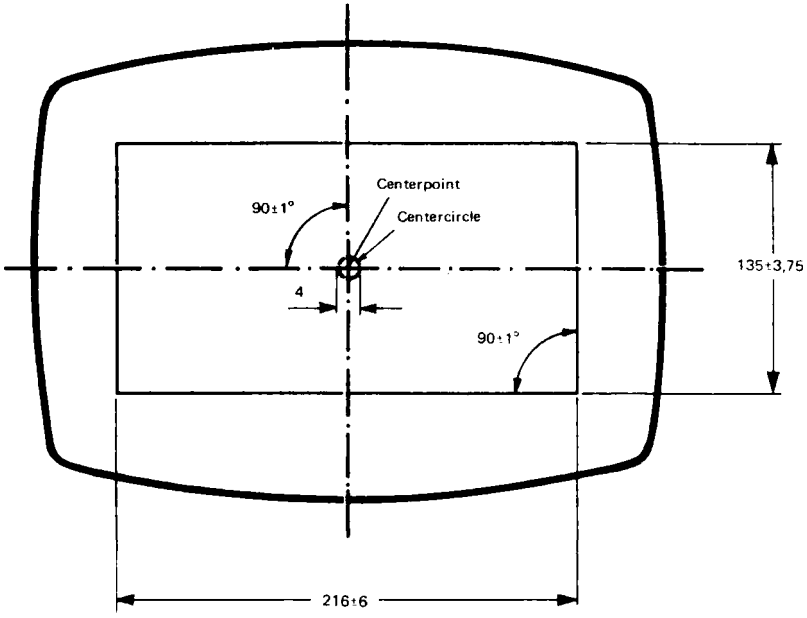


Figure 2.34 CRT character field

The signals and pin assignments between the controller board and the CRT are shown in Figure 2.35, and a timing diagram in Figure 2.36.

Controller Board (TB 101)	Signal	CRT Board (J/P 1)
Pin 1	HSYNC	Pin 5
2	+12V	4
3	VIDEO	3
4	VSYNC	2
5	LGRD	1

Figure 2.35 CRT signals

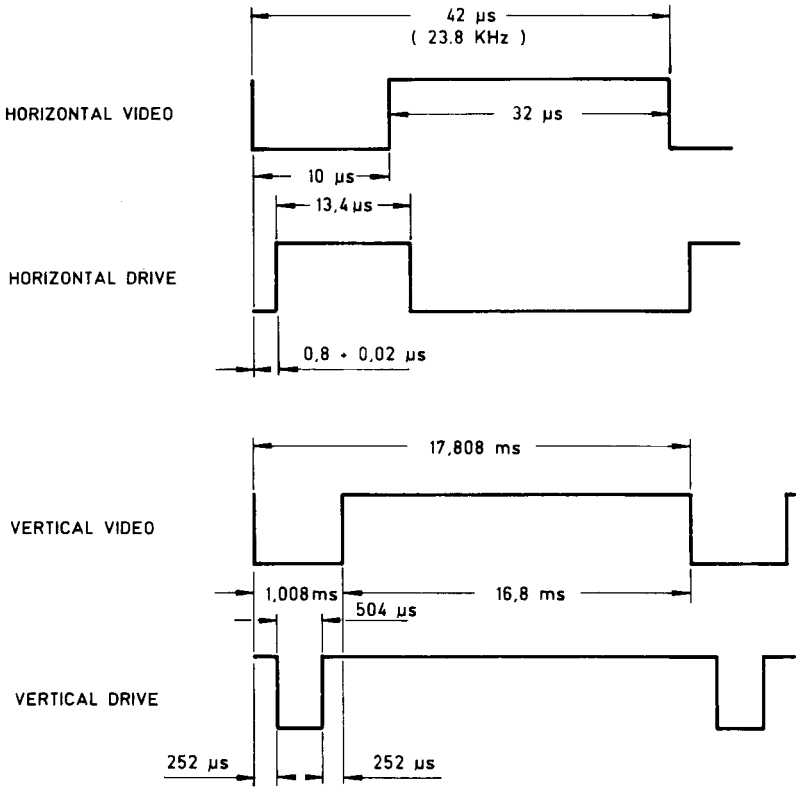


Figure 2.36 CRT (monochrome) timing

COLOR CRT

The 12-inch color CRT displays 25 horizontal lines with 80 characters per line. In the graphics mode, the CRT is all points addressable with 640 pixels horizontally and 400 pixels vertically. Characters are in a 6 x 9 matrix on an 8 x 16 box. The CRT can display eight colors: black, white, red, green, blue, yellow, magenta, and cyan. The selection of color is controlled by the software. Screen refresh is at 56.06 Hz, the horizontal frequency is 24.27 KHz.

The CRT requires a supply voltage of 107 Vac± 2V with a maximum current of 0.45A. The CRT monitor accepts separate direct drive inputs at TTL level to video blue, video green, video red, horizontal drive, and vertical drive circuits.

Technical details of the color CRT are shown in Figure 2.37.

Deflection angle	90 Degrees
CRT surface	Non-glare, anti-reflection, high-contrast
Phospor	P22 (red, green, blue)
Dot trio pitch	0.31 mm
Number of colors	8

Figure 2.37 CRT Technical details

RS-232-C PERIPHERAL ADAPTERS

The adapter consists of a small printed circuit board, containing a 2651 programmable communications interface and support logic, a connecting cable and plug, and a housing that allows direct connection to the I/O bus of the NCR DECISION MATE V.

Three versions of the adapter are available, K211, K212, and K213:

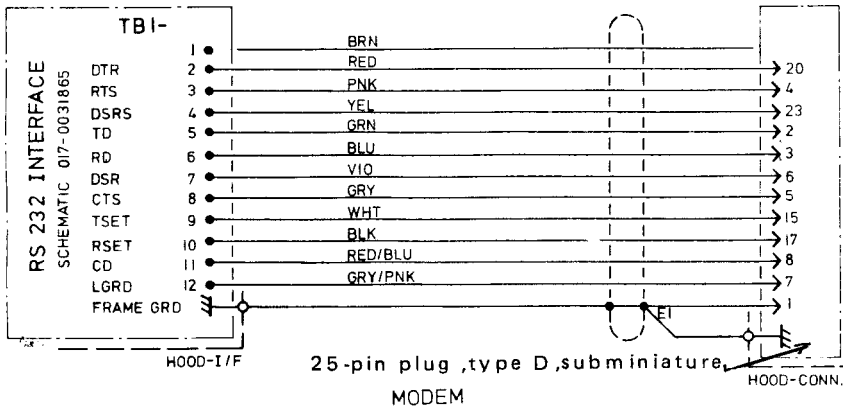
- K211 for the connection of communications devices such as modems and line couplers
- K212 for the connection of serial printers and terminals
- K213 for the connection of serial plotters

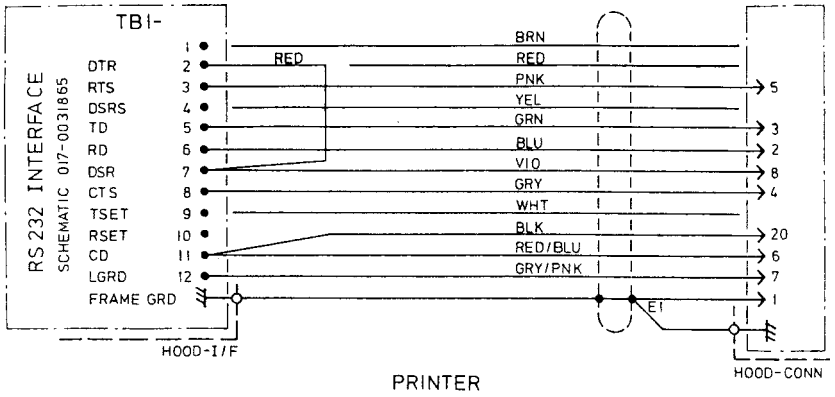
Functionally, the adapters are similar: the differences being in the connecting cables and plugs, and the straps on the printed circuit board. The 2651 programmable communications integrated circuit supports many serial data communication disciplines in full or half-duplex mode. The interface is capable of transmission rates from 50 to 19200 baud.

The pin assignments for the I/O bus connector are shown in Figure 2.38. These signals match those of the I/O bus and are defined in the I/O bus description in this manual. The differences in the cables are shown in Figure 2.39.

a		c
+5 V	1	+5 V
IRQ	2	+12 V
RESET/	3	
IOW/	4	IOR/
	5	
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
	10	
	11	
	12	
	13	
	14	
	15	
LGRD	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	BA2
BA1	26	BA0
	27	
IFSEL1/	28	IFSEL0/
	29	
	30	
	31	
LGRD	32	LGRD

Figure 2.38 RS-232C pin assignments





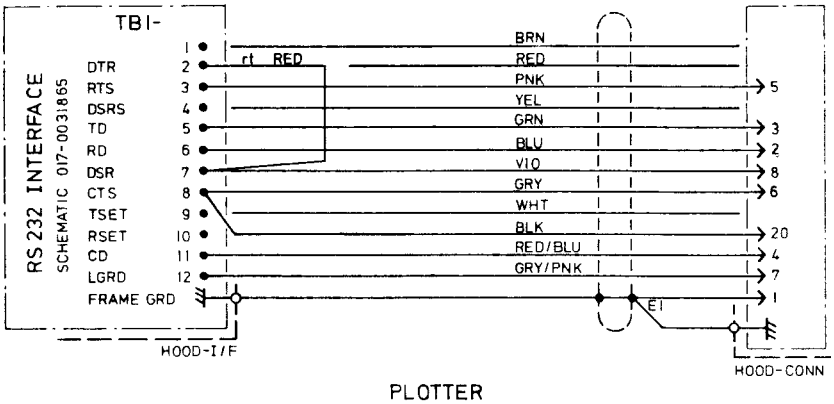


Figure 2.39 RS-232C cables (1 of 2)

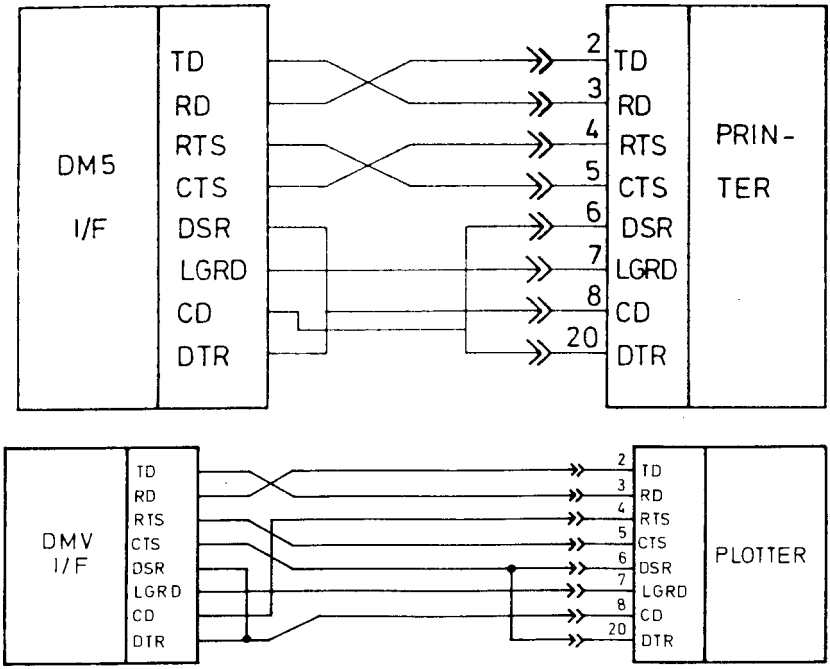


Figure 2.39 RS-232C cables (2 of 2)

The signals to and from the adapter are standard RS-232-C signals; Figure 2.40 defines the required voltage levels for correct operation; Figure 2.41 defines the standard RS-232-C interface signals.

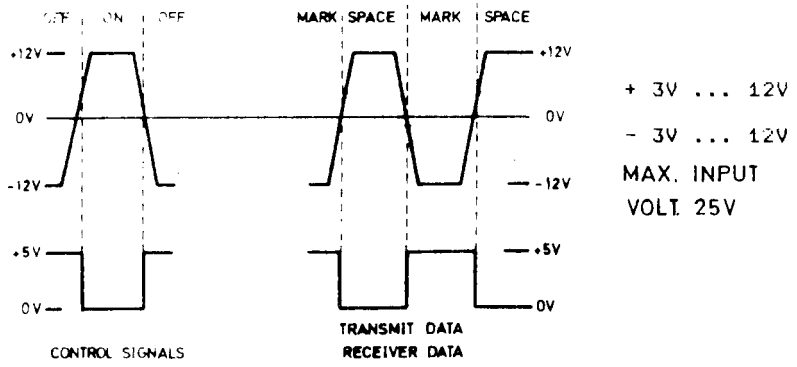


Figure 2.40 RS-232C voltage levels

TRANSMIT DATA (TD)	Serial (5-8 Bit) data transmitted by the computer. Logic '1' is low, logic '0' is high. Between character transmissions this signal will be low.
RECEIVE DATA (RD)	Serial (5-8 Bit) data received by the terminal. Logic '1' is low, logic '0' is high. Between characters this signal must be low.
CLEAR TO SEND (CTS)	Input to the computer, must be high for data transmission.
REQUEST TO SEND (RTS)	This output indicates that the terminal wishes to transmit. In the no modem mode this signal is always high. In the modem and half duplex modes, this signal is low, when there is no data for the terminal to transmit, and high when the terminal wishes to transmit.
DATA SET READY (DSR)	Input to the computer, must be high for data transmission in the modem mode. This signal is ignored in the no modem mode.
DATA TERMINAL READY (DTR)	Output indicating that the computer is ready to receive data.
DATA SIGNAL RATE SELECT (DSRS)	Controls a feature of some modems which allows them to transmit at two different signalling rates. On = high signal rate. This signal (ON state = 12V) can also be used for jumpers in modemless operations.
TRANSMITTER SIGNAL ELEMENT TIMING (TSET)	External clock for transmitter
RECEIVER SIGNAL ELEMENT TIMING (RSET)	External clock for receiver
CARRIER DETECT (CD)	Input from the modem. This signal indicates that the (CD) modem is correctly receiving the data carrier signal from the remote modem. This line must be high for receiving data.

Figure 2.41 RS-232-C signals

SOFTWARE STRAPPING

The following asynchronous communications features are selected by the operating system software:

- 5, 6, 7, or 8-bit data characters
- 1, 1 1/2, or 2 stop bits
- Odd, even, or no parity
- Baud rates at —

50	1800
75	2000
110	2400
134.5	3600
150	4800
300	7200
600	9600
1200	19200

- Line break signal generation and detection
- False start bit detection
- Parity overrun, and framing error detection
- Internal diagnostics

HARDWARE STRAPPING

Hardware straps are used to indicate K211, K212, or K213, see Figure 2.42.

	J1	J2
K211 (Modem)	Closed	Open
K212 (Printer)	Open	Closed
K213 (Plotter)	Open	Closed

Figure 2.42 RS-232-C Hardware strapping

CENTRONICS PERIPHERAL ADAPTER

The adapter (K210) provides an interface between the computer and Centronics-compatible (parallel) printers.

The adapter consists of a small printed circuit board, containing an 8255 programmable communications interface and support logic, a connecting cable and plug, and a housing that allows direct connection to the I/O bus of the NCR DECISION MATE V.

The wiring of the connecting cable and plug is shown in Figure 2.43, and the pin assignments for the I/O bus connector are shown in Figure 2.44. The signals match those of the I/O bus and are defined in the I/O bus description in this manual.

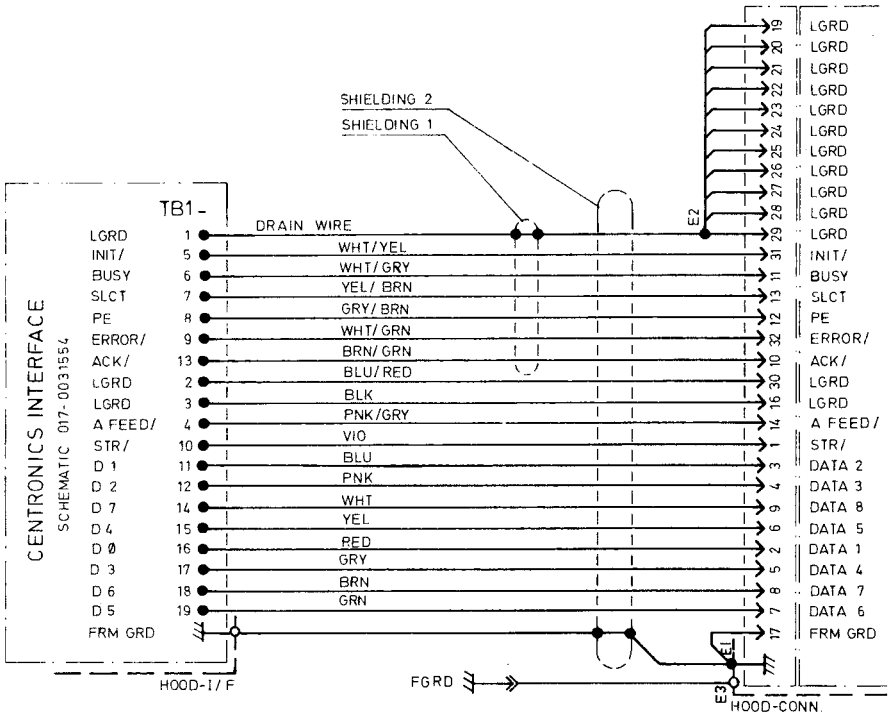


Figure 2.43 Centronics cable

a		c
+5 V	1	+5 V
IRQ	2	
RESET/	3	
IOW/	4	IOR/
	5	
BD1	6	BD0
BD3	7	BD2
BD5	8	BD4
BD7	9	BD6
	10	
	11	
	12	
	13	
	14	
	15	CLK1
LGRD	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	
BA1	26	BA0
	27	
	28	IFSEL0/
	29	
	30	
	31	
LGRD	32	LGRD

Figure 2.44 Centronics pin assignments

The signals to and from the adapter are standard TTL level. The rise and fall time of the signals must be less than 0.2μsec. The interface timing is shown in Figure 2.45.

The Centronics interface signals are defined in Figure 2.46.

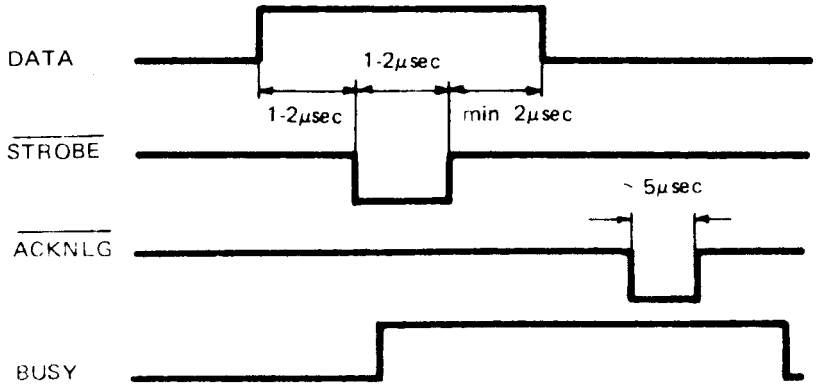


Figure 2.45 Centronics interface timing

STROBE/	Pulse is used to clock read data in. The pulse width must be more than 1 μsec at receiving printer. Read in of data is performed at the "low" level of this signal.
ACKNLG/	Indicates that data has been received by the printer. New data cannot be received before ACKNLG is reset. Pulse width 2.5 μsec to 10 μsec.
BUSY	When "HIGH" the printer indicates that it cannot receive data. The signal becomes "HIGH" in the following cases: - During data entry (depending on printer) - During printing operation - In off-line state - During printer error status - During line feed
DATA 1-8	Signals represent information of parallel data "HIGH" = log 1; "LOW" = log 0.
PE	"HIGH" signal indicates that the printer is out of paper.
SLCT	(Input) Printer is in selected mode (option).
AUTO FEED/	(Output) Auto line feed (option).
INIT/	(Output) Printer reset (option).
ERROR/	(Input) Indicates printer error (option) for example at paper end, off-line, safety switch open, failure status.
TEST 1-4	Optional loop test inputs.

Figure 2.46 Centronics signals

MEMORY EXPANSION MODULES

The memory expansion modules (K200, K202, and K208) are contained in small housings that fit directly into the I/O bus of the NCR DECISION MATE V. Three different modules are available; however, only one at a time may be installed; and this must be fitted to slot 1.

The modules contain semiconductor memory ICs (dynamic RAM) and a bus interface connector. They are available in the following sizes:

- 64K bytes — to provide a system capacity of 128K bytes
- 192K bytes — to provide a system capacity of 256K bytes
- 448K bytes — to provide a system capacity of 512K bytes

a		c
+5V	1	+5 V
	2	
AOUT7	3	
AOUT6	4	AOUT5
AOUT4	5	AOUT3
	6	
	7	
	8	
	9	
	10	AOUT2
	11	AOUT1
OD0	12	AOUT0
OD1	13	OD2
OD3	14	
	15	
LGRD	16	LGRD
	17	
	18	
ID0	19	
ID1	20	
ID2	21	
ID3	22	
ID4	23	CAS7/
ID5	24	CAS6/
ID6	25	CAS5/
ID7	26	CAS4/
CAS2/	27	CAS1/
CAS3/	28	
OD4	29	OD5
RAS/	30	WE/
OD6	31	OD7
LGRD	32	LGRD

Figure 2.47 Memory expansion pin assignment

BLANK INTERFACE ADAPTER

This adapter provides the system integrator with the basic hardware to allow him to develop and install custom-built interfaces or options for special requirements.

The adapter consists of a small printed circuit board (blank) complete with an I/O bus connector, contained in a small housing that permits direct connection to the I/O bus of the NCR DECISION MATE V. The dimensions of the blank board are given in Figure 2.48. The developer must consider the standard bus I/O arrangement and the power limitations as specified in the I/O bus description of this manual.

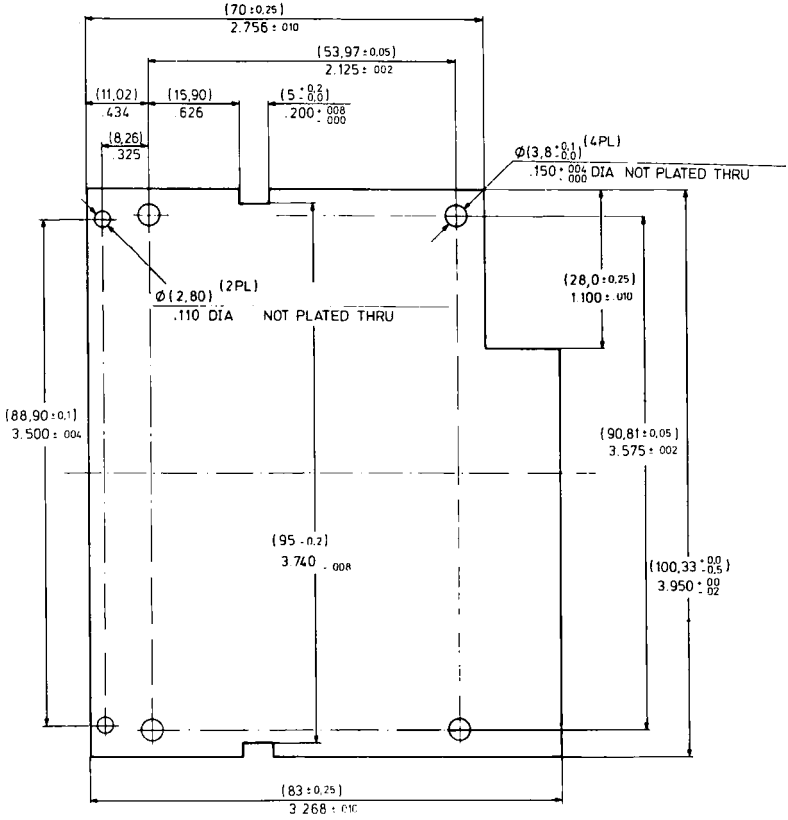


Figure 2.48 Blank interface board dimension

HINTS ON PRINTER CONNECTION

Printers (and other devices) recommended by NCR are fully compatible with the NCR DECISION MATE V; with the appropriate adapter the device can be connected to the computer, without any modifications, and it will function correctly. Many other devices, that have not been tested by NCR, are also fully compatible and can be connected without any modifications being carried out. Other RS-232C and Centronics-compatible devices may require some modifications to make them fully compatible with the NCR DECISION MATE V.

This section provides some hints on how to connect non-recommended devices.

- Study the descriptions and schematics in the hardware part of this manual
- Read the section "Interfacing Printers"
- Study the documentation provided with the device that is being connected to the computer
- Select the adapter kit that matches your requirements as near as possible
- Only one printer or plotter may be connected to the computer at a time

CENTRONICS PERIPHERAL ADAPTER (K210)

Generally, Centronics-compatible printers can be connected without difficulty. This type of interface offers the following advantages:

- No strapping required
- High transmission speed
- Status signals (e.g. out-of-paper) easily controlled by application software

NOTE: Some printers (e.g. Epson) are Centronics and RS-232C compatible and it may be necessary to make a printer hardware change; check the printer documentation. Many printers will not function until the operating system software has been loaded.

RS-232C PERIPHERAL ADAPTERS (K212, K213)

Using RS-232C compatible printers generally requires more careful selection of printer and interface. Some form of strapping is often required in three different areas:

- The printer
- The peripheral adapter
- The NCR DECISION MATE V software

Even when these three parts of the system appear to be compatible, it may be that the system does not function correctly. The following information should help in resolving some of the problems that may be encountered.

The operating system software used by the NCR DECISION MATE V (CP/M and MS-DOS) supports the X On — X Off protocol. The CONFIG utility in these operating systems allows for:

- Number of bits
- Parity selection
- Number of start/stop bits
- Baud rate

These must be set to match the settings in the printer exactly. It is possible that many printers do not meet these requirements except at certain baud rates and when they are in the "full-duplex" mode.

The NCR versions of CP/M and MS-DOS do not support the ETX/ACK protocol.

The kit K212 is designed to match the X On — X Off protocol and expects the printer to provide ON signals (+12V, space) at:

- Pin 20, Data Terminal Ready (DTR)
- Pin 4, Request to Send (RTS)

PRINTERS NOT SUPPORTING X ON– X OFF

If a printer does not send control data back to the computer, then control is achieved by a control line controlling the printer buffer. This line does not have a standard pin assignment, and may be connected to many different pins (e.g. 2, 4, 11, 13, 19, 20). Check the printer documentation to determine which pin is used.

Kit K212 is prepared for control by pin 4, Request To Send (RTS). See Figure 2.49.

Status Pin 4	NCR DECISION MATE V	Printer
On (+12V)	Transmit data	Printer ready
Off (-12V)	Stop data transmission	Printer busy

Figure 2.49 Printer control

In the RS-232C interface the signal RTS corresponds to Clear To Send (CTS), and this signal is used to control the Programmable Communication Interface 2651.

If the printer uses pin 20, Data Terminal Ready (DTR) for control, then the kit K213 may be used without further modification.

Printers that use other pins for control (2, 11, 13, 19) require either a change to the cabling, or a special intermediate connecting cable.

PRINTER FAILS TO PRINT

1. Check software strapping (CONFIG)
2. Check strapping of J1, J2 on RS-232C interface board
3. Check printer strapping
4. Check pin 5 (RTS) is on, +12V
5. Monitor interface with an oscilloscope or a digital analyser

INCORRECT PRINTING

In the X On — X Off mode, check:

1. Pin 20 (DTR) is on (+12V)
2. All strappings
3. Connect a bridge between TB1-4 and TB1-8 on the RS-232C interface board
4. Monitor interface with an oscilloscope or digital analyser

In other modes of operation check if TB1-8 (CTS) on the RS-232C interface board changes state when the printer buffer is full. If TB1-8 does not change state, connect this pin to the line that provides the printer buffer status.

APPENDIX A

INITIALIZATION FIRMWARE (CONTROLLER BOARD)

```
    ø4                  ;EPROM LOCATED FROM ADR 0000H TO 0FFFH IS USED FO
R:
    ø5                  ; - RAM-TEST (1000H- OFFFFH)
    ø6                  ; - DRIVER FOR KEYBOARD
    ø7                  ; - DRIVER FOR FLEX CONTR.
    ø8                  ; - DRIVER FOR CRT
    ø9                  ; - LEVELO-DIAGNOSTIC
    70                  ; - SYSTEM-LOADER
```

```
                                ;
                                ;
                                ; *** SYSTEM EQUATES ***
                                ; **********************
                                ;
                                ;
F000                            STK     EQU 0F000H   ;STACK-POINTER
0000                            RAMEND  EQU 00H   ;RAM ENDADR +1 (MSB)
                                ;
                                ;
                                ;
                                ; *** "OUT" EQUATES ***
                                ; **********************
                                ;
                                ;
0000                            ERRDIS  EQU 00H   ;LED SELECT
0010                            RAMSEL  EQU 10H   ;LOWER RAM SELECT
0011                            ROMSEL  EQU 11H   ;ROM SELECT
0020                            DMASEL  EQU 20H   ;DMA CONTR BASE ADR
0050                            FDCSEL  EQU 50H   ;FLEX CONTR BASE ADR
0060                            PRISEL  EQU 60H   ;PRINTER
0012                            SETTC   EQU 12H
0013                            SYSSTA  EQU 13H   ;SYSTEM-STATUS-SELECT
0014                            MON     EQU 14H         ;DISK MOTOR ON
0D00                            PROCCH  EQU 0D0H         ;PROCESSOR CHANGE SWITCH
0080                            TIM0    EQU 80H          ;COUNTER 0
0081                            TIM1    EQU 81H          ;COUNTER 1
0082                            TIM2    EQU 82H          ;COUNTER 2
0083                            TIMMO   EQU 83H          ;COUNTERS MODE
                                ;
                                ;
                                ; *** LED-ERROR EQUATES ***
                                ; **************************
                                ;
LED S
                                ;
*****
                                ;                                                    J
    8
00FC                            MEMERR  EQU 0FCH   ;MEMORY-ERROR                     -
--- --xx
00FA                            DMAERR  EQU 0FAH   ;DMA-ERROR                        -
--- -x-x
00F6                            KEYERR  EQU 0F6H   ;KEYBOARD-ERROR                   -
--- x--x
00DE                            FDCERR  EQU 0DEH   ;FLEX-ERROR                       -
-x- ---x
00BE                            GDCERR  EQU 0BEH   ;GDC-ERROR                        -
x-- ---x
00EE                            P16ERR  EQU 0EEH   ;16 BIT PROCESSOR ERROR           -
--x ---x
0000                            PROERR  EQU 00H    ;PROZESSOR-ERROR                  x
xxx xxxx
007E                            SUMERR  EQU 7EH    ;SUMCHECK-ERROR                   x
--- ---x
00FF                            DIACOM  EQU 0FFH   ;LEVEL0 COMPLETE                  -
--- ----
                                ;
                                ;
                                ;                                                    b
1000                            VV200   EQU 01000H
F80D                            VV205   EQU 0F80DH
F80E                            VV206   EQU 0F80EH
F820                            VV207   EQU 0F820H
                                ;
                                ;
                                ;       DIAGNOSTIC BOx EQUATES
                                ;       **********************
                                ;
2006                            ROMADR  EQU     2006H
2000                            ANFDIA  EQU     2000H
F700                            DIASTK  EQU     0F700H
                                ;
```

```
                        ;
                        ;
                        ;***********************************************
**********************
                        ;
                        ;  FUNCTION OF FLEX DRIVES 5 1/4"
                        ;
                        ;***********************************************
**********************
                        ;
                        ;
                        ; ENTRY CONDITION: VIA CALL
                        ;    <HL> = ADR. OF PARAMETER-BLOCK
                        ;    <DE> = ADR. OF RESULT=BLOCK
                        ;
                        ; PARAMETER-BLOCK: XX  FUNCTION
                        ;    XX  DON'T CARE
                        ;    XX  DON'T CARE
                        ;    XX  UNIT NR
                        ;    XX  TRACK NR
                        ;    XX  SECTOR NR
                        ;    XX  HEAD NR
                        ;    XX  DENSITY
                        ;    XX  DMA ADR LOW
                        ;    XX  DMA ADR HIGH
                        ;
                        ; EXIT CONDITION:  VIA RET
                        ;
                        ; RESULT BLOCK:  1-7 STATUS BYTES FROM 8272
                        ;
                        ;
                        ; *** PARAMETER BLOCK OFFSET ***
                        ;     **********************
                        ;
                        ;
0000                    FPARAM  EQU 0000H   ;FUNCTION
0001                    LPARAM  EQU 0001H   ;NOT USED
0003                    UPARAM  EQU 0003H   ;UNIT NR
0004                    TPARAM  EQU 0004H   ;TRACK NR
0005                    SPARAM  EQU 0005H   ;SECTOR NR
0006                    HPARAM  EQU 0006H   ;HEAD
0007                    DPARAM  EQU 0007H   ;DENSITY
0008                    ALPARA  EQU 0008H   ;DMA ADR LOW
0009                    AHPARA  EQU 0009H   ;DMA ADR HIGH
                        ;
                        ;
```

```
                        ;
                        ;
                         *** ADDRESS EQUATES FOR FDC ***
                        ;     **********************
                        ;
                        ;
0050                    RDMST   EQU 50H
0050                    FDCST   EQU 50H   ;MAIN-STATUS-REGISTER
0051                    FDCRA   EQU 51H   ;READ DATA
0051                    FDCWR   EQU 51H   ;WRITE DATA
0008                    FDCIN   EQU 08H   ;FDC INT BIT IN SYSTEM STATUS
                        ;
                        ;
                         *** FDC-FUNCTION EQUATES ***
                        ;     ********************
                        ;
0042                    FRTRK   EQU 42H   ;READ A TRACK
                        ;
0003                    FDCSPE  EQU 03H   ;SPECIFY
0004                    FDCSEN  EQU 04H   ;SENSE DRIVE STATUS
0045                    FDCWD   EQU 45H   ;WRITE DATA
0046                    FDCRD   EQU 46H   ;READ DATA
0007                    FDCRE   EQU 07H   ;RECALIBRATE
0008                    FDCSIS  EQU 08H   ;SENSE INTERRUPT STATUS
004A                    FDCRID  EQU 4AH   ;READ ID
004D                    FDCFT   EQU 4DH   ;FORMAT A TRACK
000F                    FDCSEE  EQU 0FH   ;SEEk
                        ;
                        ;
                         *** FDC STRING EQUATES ***
                        ;     ******************
                        ;
                        ;
0008                    FDCEOT  EQU  8H   ;FINAL SECTOR NR OF A TRACK
                        ;
                        ;
                        ;
                        ;
                        ;
```

```
   221                          ;
   222                          ;
   223                          ; *** JUMPS TO TESTS,DRIVERS AND SUBROUTINES FROM
 CRT ***
   224                          ;     ****************************************
****
   225                          ;
   226                          ;
   227                          ;
   228 0000 3E 00                       LD      A,GDCRES
   229 0002 D3 A1                       OUT     (GDCCOM),A
   230 0004 21 D0 04                    LD      HL,INTPAR       ;RESET PARAMETER
LIST
   231 0007 06 08                       LD      B,08H
   232 0009 0E A0                       LD      C,GDCPAR
   233 000B ED B3                       OTIR                    ;SEND PARAMETER
   234                          ;
   235 000D 3E 6F                       LD      A,VSYNCM        ;MASTERMODE
   236 000F D3 A1                       OUT     (GDCCOM),A
   237 0011 3E 52                       LD      A,01010010B     ;COUNTER 1 ONE-SH
OT (MODE 1)
   238 0013 D3 83                       OUT     (TIMMD),A
   239 0015 3E 20                       LD      A,32
   240 0017 D3 81                       OUT     (TIM1),A        ;MONO = 12,8 US
   241                          ;
   242 0019 3E 01                       LD      A,.HIGH.BEGIN
   243 001B ED 47                       LD      I,A
   244 001D ED 56                       IM      1               ;INTERRUPT-MODE1
   245                          ;
   246 001F 06 05                       LD      B,5
   247 0021 AF                          XOR     A               ;CLEAR DIAG.INDIC
ATION-RAM(2006H-200AH)
   248 0022 21 06 20                    LD      HL,ROMADR
   249 0025 77                  DGT1:   LD      (HL),A
   250 0026 23                          INC     HL
   251 0027 10 FC                       DJNZ    DGT1
   252                          ;
   253 0029 18 17                       JR      DGTEST
   254                          ;
   255                          ;
   256                          ;*********************************************
**********************
   257                          ;
   258 0038                             ORG     38H             ;INTERRUPT
   259                          ;
   260 0038 E5                          PUSH    HL
   261 0039 F5                          PUSH    AF
   262 003A ED 57                       LD      A,I
   263 003C 67                          LD      H,A
   264 003D 2E 12                       LD      L,18
   265 003F F1                          POP     AF
   266 0040 E3                          EX      (SP),HL
   267 0041 C9                          RET
   268                          ;
   269                          ;*********************************************
**********************
   270                          ;
   271                          ;
   272 0042 3E 82               DGTEST: LD      A,10000010B             ;INIT DIA
G-PORT
   273 0044 D3 0F                       OUT     (0FH),A         ;PORTA,C - OUTPUT
/MODO
   274                          ;                               ;PORTB
- INPUT /MODO
   275 0046 3E 03                       LD      A,3
   276 0048 D3 0E                       OUT     (0EH),A         ;DIAGBOX ROM/RAM
ENABLE
   277                          ;
   278 004A 31 00 F7                    LD      SP,DIASTK       ;STACK FROM DIAG
   279                          ;
   280 004D 21 06 20                    LD      HL,ROMADR
   281 0050 7E                          LD      A,(HL)
   282 0051 23                          INC     HL
   283 0052 86                          ADD     A,(HL)
   284 0053 23                          INC     HL
```

```
   285 0054 86                  ADD     A,(HL)
   286 0055 FE FE               CP      0FEH
   287 0057 CC 00 20            CALL    Z,ANFDIA                ;CALL DIA
G-BOX
   288                          ;
   289 005A AF                  XOR     A
   290 005B D3 0E               OUT     (0EH),A         ;DIAG-BOX ROM/RAM
 DISABLE
   291 005D C3 FD 02            JP      LEVELO
   292                          ;***********************************************
**********************
```

358

```
   294
   295 0100                     ;
                                        ORG     100H
   296                          ;
   297 0100 C3 FD 02            BEGIN:  JP      LEVELO          ;START OF ANY PRO
GRAM
   298 0103 C3 13 01                    JP      KEYINP          ;DRIVER FOR KEYBO
ARD
   299 0106 C3 AB 07                    JP      FDCDR1          ;DRIVER FOR FLEXD
ISC
   300 0109 C3 24 01                    JP      MODCRT          ;MODIFIES CRT-BUF
FER/CURSORPOSITION
   301 010C C3 70 06                    JP      STARTS          ;START OF LOAD SY
STEM
   302                          ;
   303 0112                             ORG     112H
   304                          ;
   305 0112 C9                          RET
   307                          ;
   308                          ;
   309                          ;***********************************************
**********
   310                          ;
   311                          ;  DRIVER FOR KEYBOARD-CONTROLLER 8741
   312                          ;
   313                          ;***********************************************
**********
   314                          ;
   315                          ;
   316                          ; *** "IN/OUT" EQUATES ***
   317                          ;     ***************
   318                          ;
   319 0040                     KEYDAT  EQU 40H   ;READ KEYBOARD DATA
   320 0041                     KEYSTA  EQU 41H   ;READ     "     STATUS
   321 0041                     KEYCOM  EQU 41H   ;WRITE    "     COMMAND
   322                          ;
   323                          ;
   324                          ; EXIT COND: <A>=ASCII-CHARACTER
   325                          ;
   326                          ;
   327 0113 DB 41               KEYINP: IN      A,(KEYSTA)      -- RET
   328 0115 1F                          RRA
   329 0116 30 FB                       JR      NC,KEYINP
   330 0118 DB 40                       IN      A,(KEYDAT)      ;READ KEYBOARD-CH
ARACTER
   331 011A C9                          RET
   332                          ;
   333 011B DB 41               KYLOOK: IN      A,(KEYSTA)
   334 011D 1F                          RRA
   335 011E 3E 00                       LD      A,0
   336 0120 D0                          RET     NC
   337 0121 DB 40                       IN      A,(KEYDAT)
   338 0123 C9                          RET
   339                          ;
```

```
                        ;
                        ;***********************************************
**********************
                        ;
                        ;  CRT-ROUTINES
                        ;
                        ;***********************************************
**********************
                        ;
                        ;
                        ;
                        ; *** CRT-BUFFER EQUATES ***
                        ;     ******************
                        ;
                        ;
F800                    CURSX   EQU 0F800H    ;CURSOR - X - POSITION
F801                    CURSY   EQU 0F801H    ;CURSOR - Y - POSITION
F830                    BUFSTA  EQU 0F830H      ;CRT-BUFFER START ADR.
0050                    CHARA   EQU 80    ;80 CHARACTER/LINE
0018                    ROWS    EQU 24    ;24 LINES/SCREEN
F900                    CEADL   EQU 0F900H      ;LOW BYTE OF CURSOR
F901                    CEADH   EQU 0F901H      ;HIGH BYTE OF CURSOR
F902                    CDAD    EQU 0F902H      ;POS OF PIXEL
F903                    SP1     EQU 0F903H      ;START OF PAGE 1
F905                    LP11    EQU 0F905H      ;LENGTH OF PAGE 1 LOW
F906                    LP12    EQU 0F906H      ;   "    "    "   1 HIGH
F907                    SP2     EQU 0F907H      ;START OF PAGE 2
F909                    LP21    EQU 0F909H      ;LENGTH OF PAGE 2 LOW
F90A                    LP22    EQU 0F90AH      ;  "    "    "   2 HIGH
F90B                    INVFLG  EQU 0F90BH
0002                    WDAT1   EQU 02H
FA00                    CHRRAM  EQU 0FA00H
                        ;
                        ;
                        ; *** CONTROL CHARACTER EQUATES ***
                        ;     *************************
                        ;
                        ;
0088                    NEWL    EQU 88H   ;NEW LINE
0001                    HOME    EQU 01H   ;HOME POSITION
000C                    SCRER   EQU 0CH   ;SCREEN ERASE
0000                    NOMOV   EQU 00H   ;NO CURSOR MOVE
                        ;
                        ;
                        ;       ***ATTRIBUTES ***
                        ;          **********
                        ;
                                IF      FARBE-1
                        ;
                        ;       MONO
                        ;       ====
                        ;
0001                    INVER   EQU     1       ;SCREEN INVERSE
0002                    BLINK   EQU     2       ;SCREEN BLINKING
0004                    HLFIN   EQU     4       ;HALF INDENSITY
                        ;
                                ENDIF
                        ;
                                IF      FARBE
                        ;
                        ;       COLOR
                        ;       =====
                        ;
0001                    NC      EQU     1       ;NOT USED
0002                    BLINK   EQU     2
0004                    FR      EQU     4       ;FRONT RED
```



```
0008                    FG      EQU     8       ; "     GREEN
0010                    FB      EQU     10H     ; "     BLUE
0020                    BR      EQU     20H     ;BACK   RED/
0040                    BG      EQU     40H     ; "     GREEN/
0080                    BB      EQU     80H     ; "     BLUE/
                        ;
                                ENDIF
                        ;
```

```
   414                          ;
   415                          ;
   416                          ;*********************************************
**********************
   417                          ;*********************************************
**********************
   418                          ;
   419                          ;                GDC-EQUATES
   420                          ;
   421                          ;
   422                          ;*********************************************
**********************
   423                          ;*********************************************
**********************
   424                          ;
   425                          ;
   426                          ;       *** GDC PORT EQUATES ***
   427                          ;           ***************
   428                          ;
   429 00A2                     GDCPAZ  EQU     0A2H    ;WRITE ZOOM-PARAMETER + Z
OOM-REG.
   430 00A1                     GDCCOM  EQU     0A1H    ;WRITE COMMAND
   431 00A0                     GDCPAR  EQU     0A0H    ;WRITE PARAMETER
   432 00A0                     GDCSTA  EQU     0A0H    ;READ STATUS
   433 00A1                     FIFO    EQU     0A1H    ;READ DATA
   434                          ;
   435                          ;       *** GDC STATUS EQUATES ***
   436                          ;           ****************
   437                          ;
   438 0001                     DATRDY  EQU     01H     ;A BYTE IS AVAILABLE FOR
READ
   439 0002                     FIFULL  EQU     02H     ;FIFO IS FULL
   440 0004                     FIFEMP  EQU     04H     ;FIFO IS EMPTY
   441 0008                     DRWINP  EQU     08H     ;DRAWING IN PROCESS
   442 0010                     DMAEXC  EQU     10H     ;DMA DATA TRANSFER IN PRO
CESS
   443 0020                     VERETR  EQU     20H     ;VERTICAL RETRACE IN PROC
ESS
   444 0040                     HORETR  EQU     40H     ;HORIZONTAL RETRACE IN PR
OCESS
   445 0080                     LIPDET  EQU     80H     ;LIGHT PEN DEDECTED (ADDR
ESS VALID)
   446                          ;
   447                          ;
   448                          ;       *** GDC COMMAND EQUATES ***
   449                          ;           ******************
   450                          ;
   451 0000                     GDCRES  EQU     00H     ;RESET-BLANK DISPLAY,IDLE
-MODE,INIT
   452 006E                     VSYNCS  EQU     6EH     ;SLAVE-MODE
   453 006F                     VSYNCM  EQU     6FH     ;MASTER-MODE
   454 004B                     CCHAR   EQU     4BH     ;CURSOR/CHARACTER CHARACT
ERISTICS
   455 006B                     START   EQU     6BH     ;START DISPLAY/END IDLE-M
ODE
   456 0046                     ZOOM    EQU     46H     ;SPECIFY ZOOM-FACROR
   457 0049                     CURS    EQU     49H     ;SPECIFY CURSOR-POSITION
   458 0047                     PITCH   EQU     47H     ;PITCH SPECIFY
   459 004A                     MASK    EQU     4AH     ;LOAD MASK-REGISTER
   460 004C                     FIGS    EQU     4CH     ;SPECIFY FIGURE DRAWING-P
ARAMETER
   461 006C                     FIGD    EQU     6CH     ;START FIGURE DRAW
   462 0068                     GCHRD   EQU     68H     ;START GRAPHICS CHARACTER
 DRAW
   463 00E0                     CURD    EQU     0E0H    ;READ CURSOR-ADDRESS
   464 00C0                     LPRD    EQU     0C0H    ;READ LIGHT-PEN ADDRESS
   465 0070                     PRAM    EQU     70H     ;LOAD PARAMETER-RAM
   466 0000                     PRAMSA  EQU     00H     ;LOWER 4 BITS ARE STARTIN
G ADR. IN RAM
   467 0020                     WDAT    EQU     20H     ;WRITE DATA INTO DISPLAY
MEMORY
   468                                                  ;(COMMAND+TYPE+MODE)
   469 0000                     TYWORD  EQU     00H     ;DATA TRANSFER BYTES
   470 0010                     TYLOBY  EQU     10H     ;LOW BYTE OF WORD
   471 0018                     TYHIBY  EQU     18H     ;HIGH BYTE " "
   472                                                  ;MODE OF RMW MEMORY CYCLE
   473 0000                     MOREPL  EQU     00H     ;REPLACE WITH PATTERN
   474 0001                     MOCOMP  EQU     01H     ;COMPLEMENT
   475 0002                     MORES   EQU     02H     ;RESET TO 0
   476 0003                     MOSET   EQU     03H     ;SET TO 1
   477 00A0                     RDAT    EQU     0A0H    ;READ DATA FROM DISPLAY M
EM.
```

```
   478 00A4                    DMAR    EQU     0A4H    ;DMA-READ-REQUEST
   479 0024                    DMAW    EQU     24H     ;DMA WRITE-REQUEST
   480 0050                    NRWAPL  EQU     80      ;# OF WORD ADDRESSES/LINE
   481 000A                    LPC     EQU     10      ;LINES PER CHARACTER
   482 000D                    SCRON   EQU     0DH     ;SCREEN ON
   483 000C                    SCROFF  EQU     0CH     ;SCREEN OFF
   484 000F                    SYNCON  EQU     0FH
   485 000E                    SYNCOF  EQU     0EH
   486                         ;
   487                         ;
   488                         ;       *** GDC RESET PARAMETER ***
   489                         ;           ******************
   490                         ;
   491 0000                    RESMOP  EQU     00H     ;MODE OF OPERATION SELECT
 BITS
   492                                                 ;(RESMOP+DISPLAY+FRAME+DY
NRAM+WINDOW)
   493                                                 ;DISPLAY-MODE
   494 0000                    MIXGAC  EQU     00H     ;MIXED-MODE
   495 0002                    GRAMOD  EQU     02H     ;GRAPHIC-MODE
   496 0020                    CHAMOD  EQU     20H     ;CHARACTER-MODE
   497 0000                    NOINTL  EQU     00H     ;NON INTERLACED
   498 0008                    INLRPF  EQU     08H     ;
   499 0009                    INTLAC  EQU     09H     ;INTERLACED
   500 0000                    STATRM  EQU     00H
   501 0004                    DYNRAM  EQU     04H     ;REFRESH
   502 0000                    DRWALL  EQU     00
   503 0010                    DRWRET  EQU     10H     ;DRAWING ONLY DURING RETR
ACE BLANKING
   504                         ;
```

```
                                ;
                                ;
0124
0124 E5                 MODCRT: PUSH    HL
0125 C5                         PUSH    BC
0126 D5                         PUSH    DE
0127 F5                         PUSH    AF      ;SAVE ASCII-CHARACTER
                                ;
                                ; *** CHECK IF ANY CONTROL CHARACTER ***
                                ;     ******************************
                                ;
                                ;
0128 FE 00                      CP      NOMOV
012A CA 9C 01                   JP      Z,GETRE         ;NO CURSOR MOVE
012D FE 88                      CP      NEWL
012F CA 3F 01                   JP      Z,CARRET        ;CARRIDGE RETURN
0132 FE 01                      CP      HOME
0134 CA 58 01                   JP      Z,CHP           ;HOME POSITION
0137 FE 0C                      CP      SCRER
0139 CA A2 01                   JP      Z,SCERA         ;SCREEN ERASE
                                ;
013C C3 A8 01                   JP      SETCHA  ;SET CHARACTER INTO CRT-B
UFFER DEPENDING
013F AF                 CARRET: XOR     A
0140 32 00 F8                   LD      (CURSX),A
0143 3A 01 F8                   LD      A,(CURSY)
0146 3C                         INC     A
0147 FE 19                      CP      25              ;SCROLL IF = 25
0149 C2 52 01                   JP      NZ,CAR1
014C F5                         PUSH    AF
014D CD 30 02                   CALL    SCROLM
0150 F1                         POP     AF
0151 3D                         DEC     A
0152 32 01 F8           CAR1:   LD      (CURSY),A
0155 C3 9C 01                   JP      GETRE
                                ;
                                ; *** CURSOR HOME POSITION ***
                                ;     ********************
                                ;
                                ;
0158 AF                 CHP:    XOR     A
0159 32 00 F8                   LD      (CURSX),A
015C 32 01 F8                   LD      (CURSY),A
015F C3 9C 01                   JP      GETRE
                                ;
                                ;
                                ; *** SREEN ERASE ***
                                ;     ************
                                ;
                                ;
0162 CD 13 02           SCERA:  CALL    MCLSCR
0165 C3 58 01                   JP      CHP
                                ;
                                ;
                                ; *** SET CHARACTER ***
                                ;     **************
                                ;
                                ;
0168 3A 00 F8           SETCHA: LD      A,(CURSX)
016B FE 50                      CP      80
016D C2 78 01                   JP      NZ,CHA1
0170 3A 01 F8                   LD      A,(CURSY)
0173 3C                         INC     A
0174 32 01 F8                   LD      (CURSY),A
0177 AF                         XOR     A
```

```
   570 0178 32 00 F8          CHA1:   LD      (CURSX),A
   571 017B 4F                        LD      C,A
   572 017C 3A 01 F8                  LD      A,(CURSY)
   573 017F FE 19                     CP      25
   574 0181 F5                        PUSH    AF              ;<A> = Y POSITION
   575 0182 C5                        PUSH    BC              ;<C> = X POSITION

   576 0183 CC 30 02                  CALL    Z,SCROLM
   577 0186 C1                        POP     BC
   578 0187 F1                        POP     AF
   579 0188 C2 8C 01                  JP      NZ,CHA2
   580 018B 3D                        DEC     A
   581 018C 47                CHA2:   LD      B,A             ;<B> = Y POSITION
   582 018D 32 01 F8                  LD      (CURSY),A
   583 0190 3A 00 F8                  LD      A,(CURSX)
   584 0193 3C                        INC     A
   585 0194 32 00 F8                  LD      (CURSX),A
   586 0197 F1                        POP     AF
   587 0198 F5                        PUSH    AF
   588 0199 CD A1 01                  CALL    WRMCHR          ;<A> = ASCII CHAR
ACTER
   589                                                        ;<B>=Y-POS,<C> =
X-POS
   590 019C F1                GETRE:  POP     AF
   591 019D D1                        POP     DE
   592 019E C1                        POP     BC
   593 019F E1                        POP     HL
   594 01A0 C9                        RET
   595                        ;
   596                        ;
```

```
                                ;
                                ;
                                ;*********************************************
**********************
                                ;
                                ;       G D C - CHARACTER - MODE-DRIVER
                                ;               (IN MIXED-MODE)
                                ;
                                ;*********************************************
**********************
                                ;
                                ;
                                ;       ENTRY:  <A> =.ASCII-CHARACTER
                                ;               <B> = Y-POSITION
                                ;               <C> = X-POSITION
                                ;
                                ;
                                ;       **** WRITE CHARACTER INTO CRT-RAM ****
                                ;            ***************************
                                ;
                                ;
01A1 E5                 WRMCHR: PUSH    HL
01A2 D5                         PUSH    DE
01A3 C5                         PUSH    BC
01A4 F5                         PUSH    AF
                                ;
01A5 CD E5 01                   CALL    CALCHR          ;CALCULATE CHARAC
TER-POS.
01A8 CD C2 02                   CALL    SETCU
01AB CD C1 01                   CALL    SETCCA          ;SEND CHARACTER
01AE 3E 20                      LD      A,WDAT+TYWORD+MOREFL
01B0 CD A0 04                   CALL    OUTCMD
01B3 F1                         POP     AF              ;<A>=ASCII-CHARAC
TER
01B4 CD A6 04                   CALL    OUTPAR
01B7 3A 0B F9                   LD      A,(INVFLG)      ;FETCH ATTRIBUT
01BA CD A6 04                   CALL    OUTPAR
01BD C1                         POP     BC
01BE D1                         POP     DE
01BF E1                         POP     HL
01C0 C9                         RET
                                ;
                                ;
01C1 CD A4 02           SETCCA: CALL    SETMSK          ;SET LENGTH FOR W
RITE CHARACTER
01C4 3E 4C                      LD      A,FIGS
01C6 CD A0 04                   CALL    OUTCMD
01C9 3E 02                      LD      A,2
01CB CD A6 04                   CALL    OUTPAR
01CE AF                         XOR     A
01CF CD A6 04                   CALL    OUTPAR
01D2 C9                         RET
                                ;
01D3 CD A4 02           REACCA: CALL    SETMSK          ;SET LENGTH FOR R
EAD CHARACTER
01D6 3E 4C                      LD      A,FIGS
01D8 CD A0 04                   CALL    OUTCMD
01DB 3E 02                      LD      A,2
01DD CD A6 04                   CALL    OUTPAR
01E0 3D                         DEC     A
01E1 CD A6 04                   CALL    OUTPAR
01E4 C9                         RET
                                ;
01E5 2A 03 F9           CALCHR: LD      HL,(SP1)
01E8 7D                         LD      A,L
01E9 B4                         OR      H
01EA C2 FB 01                   JP      NZ,CALCH1
01ED 21 50 00                   LD      HL,80           ;Y*80 + X = <CEAD
L>
01F0 78                         LD      A,B             ;<B>= Y-POS
01F1 CD 68 0A                   CALL    MULT
```

```
   662 01F4 06 00          CALCH2: LD      B,0
   663 01F6 09                     ADD     HL,BC
   664 01F7 22 00 F9               LD      (CEADL),HL
   665 01FA C9                     RET
   666                     ;
   667 01FB EB             CALCH1: EX      DE,HL
   668 01FC 78                     LD      A,B             ;<B>=Y-POS
   669 01FD 21 50 00               LD      HL,80
   670 0200 CD 68 0A               CALL    MULT            ;Y * 80
   671 0203 19                     ADD     HL,DE           ;<SP1> + (Y*80)=H
L
   672 0204 11 D0 07               LD      DE,25*80
   673 0207 CD 8A 0A               CALL    COMPDH
   674 020A DA F4 01               JP      C,CALCH2
   675 020D CD 91 0A               CALL    SUBHD
   676 0210 C3 F4 01               JP      CALCH2
   677                     ;
   678                     ;
   679                     ;
   680                     ;       **** CLEAR SCREEN ****
   681                     ;            ************
   682                     ;
   683                     ;
   684 0213 CD 89 02       MCLSCR: CALL    SETCR           ;SET CURSOR IN HO
ME-POS.
   685 0216 CD 20 02               CALL    CLRL            ;CLEAR SCREEN
   686 0219 CD 76 02               CALL    INIT1A
   687 021C CD DA 02               CALL    SCROL1          ;SET PARTITION
   688 021F C9                     RET
   689                     ;
   690                     ;
   691 0220 3E 20          CLRL:   LD      A,WDAT+TYWORD+MOREPL
   692 0222 CD A0 04               CALL    OUTCMD
   693 0225 3E 20                  LD      A,              ;SPACE-WRITE
   694 0227 CD A6 04               CALL    OUTPAR
   695 022A 3E E8                  LD      A,0E8H          ;FRONT GREEN- BAC
K BLACK
   696 022C CD A6 04               CALL    OUTPAR          ;CLEAR ATTRIB.
   697 022F C9                     RET
   698                     ;
   699                     ;
   700                     ;
   701                     ;       **** SCROLL SCREEN ****
   702                     ;            *************
   703                     ;
   704                     ;
   705 0230 2A 03 F9       SCROLM: LD      HL,(SP1)
   706 0233 22 00 F9               LD      (CEADL),HL
   707 0236 CD C2 02               CALL    SETCU           ;SET CURSOR
   708 0239 CD A4 02               CALL    SETMSK          ;SET WORD-TRANSFE
R
   709                     ;
   710 023C 3E 4C                  LD      A,FIGS          ;SET LENGTH (80-C
HAR)
   711 023E CD A0 04               CALL    OUTCMD          ;FOR DELETE 1 LIN
E
   712 0241 3E 02                  LD      A,2
   713 0243 CD A6 04               CALL    OUTPAR
   714 0246 3E 4F                  LD      A,80-1
   715 0248 CD A6 04               CALL    OUTPAR
   716 024B AF                     XOR     A
   717 024C CD A6 04               CALL    OUTPAR
   718                     ;
   719 024F CD 20 02               CALL    CLRL            ;CLEAR LAST LINE
   720 0252 2A 00 F9               LD      HL,(CEADL)      ;SET CURSOR
   721 0255 CD C2 02               CALL    SETCU
   722                     ;
   723 0258 2A 03 F9               LD      HL,(SP1)
   724 025B 11 50 00               LD      DE,80           ;POINTER + 80-CHA
R.
   725 025E 19                     ADD     HL,DE
```

```
   726 025F 22 03 F9                    LD      (SP1),HL
   727                          ;
   728 0262 3A 06 F9                    LD      A,(LP12)
   729 0265 3D                          DEC     A               ;LENGTH1 - 1
   730 0266 CA E8 02                    JP      Z,INI10
   731 0269 32 06 F9                    LD      (LP12),A
   732                          ;
   733 026C 3A 0A F9                    LD      A,(LP22)
   734 026F 3C                          INC     A               ;LENGTH2 + 1
   735 0270 32 0A F9                    LD      (LP22),A
   736 0273 C3 DA 02                    JP      SCROL1
   737 0276
   738                          ;
   739                          ;
   740                          ;
   741                          ;
   742 0276 21 00 00            INIT1A: LD      HL,0
   743 0279 22 03 F9                    LD      (SP1),HL
   744 027C 22 07 F9                    LD      (SP2),HL
   745 027F AF                          XOR     A
   746 0280 32 0A F9                    LD      (LP22),A
   747 0283 3E 19                       LD      A,25
   748 0285 32 06 F9                    LD      (LP12),A
   749 0288 C9                          RET
   750                          ;
   751 0289 CD B2 02            SETCR:  CALL    CUHOM1          ;WHOLE GRAPHIC HO
ME
   752 028C CD A4 02                    CALL    SETMSK
   753 028F 3E 4C                       LD      A,PIGS          ;SET DIRECTION AN
D NUMBER AND WORDS
   754 0291 CD A0 04                    CALL    OUTCMD
   755 0294 3E 02                       LD      A,2             ;DIR = 2
   756 0296 CD A6 04                    CALL    OUTPAR
   757 0299 3E FF                       LD      A,0FFH          ;LENGTH 16K WORD
   758 029B CD A6 04                    CALL    OUTPAR
   759 029E 3E 3F                       LD      A,3FH           ;HIGH BYTE
   760 02A0 CD A6 04                    CALL    OUTPAR
   761 02A3 C9                          RET
   762                          ;
   763 02A4 3E 4A               SETMSK: LD      A,MASK          ;SET MASK TO STOR
ED VALUES
   764 02A6 CD A0 04                    CALL    OUTCMD
   765 02A9 3E FF                       LD      A,0FFH          ;LOAD LOW BYTE
   766 02AB CD A6 04                    CALL    OUTPAR
   767 02AE CD A6 04                    CALL    OUTPAR
   768 02B1 C9                          RET
   769                          ;
   770 02B2 3E 49               CUHOM1: LD      A,CURS
   771 02B4 CD A0 04                    CALL    OUTCMD          ;CURSOR HOME
   772 02B7 AF                          XOR     A
   773 02B8 CD A6 04                    CALL    OUTPAR
   774 02BB CD A6 04                    CALL    OUTPAR
   775 02BE CD A6 04                    CALL    OUTPAR
   776 02C1 C9                          RET
   777                          ;
   778 02C2 3E 49               SETCU:  LD      A,CURS
   779 02C4 CD A0 04                    CALL    OUTCMD          ;SET CURSOR
   780 02C7 3A 00 F9                    LD      A,(CEADL)       ;LOW BYTE OF CURS
OR
   781 02CA CD A6 04                    CALL    OUTPAR
   782 02CD 3A 01 F9                    LD      A,(CEADH)       ;HIGH BYTE OF CUR
SOR
   783 02D0 CD A6 04                    CALL    OUTPAR
   784 02D3 3A 02 F9                    LD      A,(CDAD)        ;POSITON OF PIXEL
   785 02D6 CD A6 04                    CALL    OUTPAR
   786 02D9 C9                          RET
   787                          ;
   788 02DA 3E 70               SCROL1: LD      A,PRAM+0
   789 02DC CD A0 04                    CALL    OUTCMD          ;SET START AND LE
NGTH OF
```

```
   790 02DF 06 08                LD      B,8             ;PAGE 1 AND PAGE
2
   791 02E1 21 03 F9             LD      HL,SP1
   792 02E4 CD C6 04             CALL    SENPAR
   793 02E7 C9                   RET
   794                      ;
   795 02E8 21 00 00        INI10: LD     HL,0
   796 02EB 22 03 F9             LD      (SP1),HL
   797 02EE 22 07 F9             LD      (SP2),HL        ;START OF PAGE 1
= 0
   798 02F1 AF                   XOR     A
   799 02F2 32 0A F9             LD      (LP22),A        ;LENGTH OF PAGE 2
 = 0
   800 02F5 3E 19                LD      A,25
   801 02F7 32 06 F9             LD      (LP12),A        ;LENGTH OF PAGE 1
 = 25
   802 02FA C3 DA 02             JP      SCROL1
   803                      ;
   804                      ;
   805                      ;
```

```
   812                          ;***********************************************
**********************
   813                          ;
   814                          ;  POWER UP POUTINE
   815                          ;
   816                          ;***********************************************
**********************
   817                          ;
   818                          ;
   819 02FD 3E 00      358      LEVELO: LD      A,00
   820 02FF D3 00                       OUT     (ERRDIS),A              ;SWITCH O
N DIAGNOSTIC-LED
   821 0301 3E 00                       LD      A,GDCRES
   822 0303 D3 A1                       OUT     (GDCCOM),A              ;RESET GD
C
   823                          ;
   824 0305 3E 00              PROCHK: LD      A,PROERR
   825 0307 D3 00                       OUT     (ERRDIS),A              ;SWITCH O
N PROZESSOR-ERROR-LED
   826                          ;
   827                          ;
   828                          ;       *** SUMCHECK ***
   829                          ;           ********
   830                          ;
   831                          ;
   832 0309 3E 7E              SUMCHK: LD      A,SUMERR
   833 030B D3 00                       OUT     (ERRDIS),A              ;SUMCHECK
-ERROR
   834 030D AF                          XOR     A
   835 030E 21 00 00                    LD      HL,0
   836 0311 11 00 20                    LD      DE,2000H                ;ROM-TEST
 OVER 8K
   837 0314 86                 SUM1:    ADD     A,(HL)
   838 0315 23                          INC     HL
   839 0316 1D                          DEC     E
   840 0317 C2 14 03                    JP      NZ,SUM1
   841 031A 15                          DEC     D
   842 031B C2 14 03                    JP      NZ,SUM1
   843 031E C6 00                       ADD     A,0
   844 0320 C2 14 06                    JP      NZ,ENDLO                ;JUMP IF
SUMCHECK-ERROR
   845                          ;
   846                          ;
   847                          ;
   848                          ; *** RAM-TEST ***
   849                          ;     ********
   850                          ;
   851 0323 3E FC              RAMTST: LD      A,MEMERR
   852 0325 D3 00                       OUT     (ERRDIS),A
   853 0327 21 00 20                    LD      HL,2000H
   854 032A 06 00                       LD      B,RAMEND
   855                          ;
   856                          ;
   857 032C 36 55              LL124    LD      (HL),055H               ;TEST BYTE 55H
   858 032E 23                          INC     HL
   859 032F 36 AA                       LD      (HL),0AAH
   860 0331 23                          INC     HL
   861 0332 7C                          LD      A,H
   862 0333 B8                          CP      B
   863 0334 C2 2C 03                    JP      NZ,LL124                ;MEMORY WRITE COM
PLETE ?
   864 0337 06 1F                       LD      B,01FH
   865                          ;
   866 0339 2B                 LL125    DEC     HL
   867 033A 7C                          LD      A,H
   868 033B B8                          CP      B       ;MEMORY READ COMPLETE ?
   869 033C CA 4F 03                    JP      Z,LL126 ;YES - NEXT TEST
   870 033F 7E                          LD      A,(HL)
```

```
871 0340 FE AA                  CP      0AAH
872 0342 C2 14 06               JP      NZ,ENDLO
873 0345 2B                     DEC     HL
874 0346 7E                     LD      A,(HL)
875 0347 FE 55                  CP      055H
876 0349 CA 39 03               JP      Z,LL125 ;JUMP IF OK
877 034C C3 14 06               JP      ENDLO   ;JUMP IF ERROR
878                     ;
879 034F 23             LL126   INC     HL      ;<HL>= RAM START ADR.
880 0350 06 00                  LD      B,RAMEND        ;RAM ENDADR. + 1
881                     ;
882 0352 36 AA          LL127   LD      (HL),0AAH
883 0354 23                     INC     HL
884 0355 36 55                  LD      (HL),055H
885 0357 23                     INC     HL
886 0358 7C                     LD      A,H
887 0359 B8                     CP      B
888 035A C2 52 03               JP      NZ,LL127        ;MEMORY WRITE COM
PLETE ?
889 035D 06 1F                  LD      B,01FH  ;YES !
890                     ;
891 035F 2B             LL128   DEC     HL
892 0360 7C                     LD      A,H
893 0361 B8                     CP      B
894 0362 CA 75 03               JP      Z,NEXT1 ;JUMP IF TEST COMPLETE
895 0365 7E                     LD      A,(HL)
896 0366 FE 55                  CP      055H
897 0368 C2 14 06               JP      NZ,ENDLO        ;JUMP IF MEMORY-E
RROR
898 036B 2B                     DEC     HL
899 036C 7E                     LD      A,(HL)
900 036D FE AA                  CP      0AAH
901 036F CA 5F 03               JP      Z,LL128
902 0372 C3 14 06               JP      ENDLO
903                     ;
904                     ;
```

```
                                ; *** KEYBOARD-CONTROLLER-TEST ***
                                ;     **********************
                                ;
                                ;
0375 3E F6                      NEXT1:  LD      A,KEYERR
0377 D3 00                              OUT     (ERRDIS),A
                                ;
0379 31 00 F0                   KEYTST: LD      SP,STK          ;*** SET STACK-PO
INTER ***
037C CD A7 03                           CALL    INVAL1          ;GET INVALID CHAR
ACTER'S
                                ;
037F DB 41                      KEY1:   IN      A,(KEYSTA)
0381 1F                                 RRA
0382 1F                                 RRA
0383 DA 75 03                           JP      C,NEXT1         ;WAIT IF INPUTBUF
FER EMPTY
0386 3E 00                              LD      A,0
0388 D3 41                              OUT     (KEYCOM),A      ;SEND SELF-CHECK-
COMMAND
                                ;
038A DB 41                      KEY2:   IN      A,(KEYSTA)
038C 1F                                 RRA
038D D2 8A 03                           JP      NC,KEY2
0390 DB 40                              IN      A,(KEYDAT)      ;GET SELF-TEST-ST
ATUS
0392 FE 55                              CP      55H
0394 C2 14 06                           JP      NZ,ENDLO        ;KEYBOARD-CONTROL
LER NOT O.K.
                                ;
0397 DB 41                      KEY3:   IN      A,(KEYSTA)
0399 1F                                 RRA
039A D2 97 03                           JP      NC,KEY3
039D DB 40                              IN      A,(KEYDAT)      ;GET COUNTRY-CODE
 1111EVVV
039F CB 5F                              BIT     3,A             ;E=0 --- ERROR ON
 KEYBOARD
03A1 C2 BF 03                           JP      NZ,NEXT2        ;JUMP IF KEYBOARD
-TEST O.K.
03A4 C3 14 06                           JP      ENDLO
                                ;
                                ;
                                ;
03A7 DB 41                      INVAL1: IN      A,(KEYSTA)
03A9 1F                                 RRA
03AA D0                                 RET     NC
03AB DB 40                              IN      A,(KEYDAT)      ;DUMMY READ !!
03AD 16 05                              LD      D,5             ;MULTIPLIER OF 10
 MS
03AF 01 FE 04                   INVAL2: LD      BC,4FEH
03B2 0B                         INVAL3: DEC     BC
03B3 78                                 LD      A,B
03B4 B1                                 OR      C
03B5 C2 B2 03                           JP      NZ,INVAL3       ;WAIT 10MS
03B8 15                                 DEC     D
03B9 C2 AF 03                           JP      NZ,INVAL2
03BC C3 A7 03                           JP      INVAL1          ;GET NEXT CHARACT
ER
                                ;
                                ;
```

```
                                ;
                                ;
                                ;***********************************************
**********
                                ;
                                ;  DMA-CONTROLLER 8237
                                ;
                                ;***********************************************
**********
                                ;
                                ;
                                 *** DMA EQUATES ***
                                ;     **********
                                ;
                                ;
0028                            DMAST   EQU 28H   ;DMA-STATUS
0028                            DMACOM  EQU 28H   ;DMA-COMMAND
0028                            DMAMD   EQU 28H   ;DMA-MODE
002C                            DMAFF   EQU 2CH   ;DMA-FIRST/LAST-FF
0024                            C2AD    EQU 24H   ;DMA-CHANNAL 2 ADDRESS-BUFFER
0025                            C2TC    EQU 25H   ;DMA-CHANNAL 2 BLOCKLENGTH
0020                            C0AD    EQU 20H   ;DMA-CHANNAL 0 ADDRESS-BUFFER
002A                            DMAMB   EQU 2AH   ;DMA-START/STOP-CHANNAL
0026                            C3AD    EQU 26H   ;DMA-CHANNAL 3 ADDRESS-BUFFER
0027                            C3TC    EQU 27H   ;DMA-CHANNAL 3 BLOCKLENGTH
                                ;
                                ;
                                ;
                                ; *** TEST OF DMA-CONTROLLER ***
                                ;     **********************
                                ;
                                ;
03BF 3E FA                      NEXT2:  LD      A,DMAERR
03C1 D3 00                              OUT     (ERRDIS),A
03C3 D3 2D                              OUT     (2DH),A                 ;RESET DM
A
                                ;
03C5 3E 10                      DMATS:  LD      A,10H
03C7 D3 28                              OUT     (DMACOM),A
03C9 3E 0B                              LD      A,00001011B
03CB D3 2B                              OUT     (DMAMD),A
03CD DB 28                              IN      A,(DMAST)               ;READ STA
TUS
03CF E6 0F                              AND     0FH                     ;MUST BE
X0
03D1 FE 00                              CP      0
03D3 C2 EE 03                           JP      NZ,ERRDMA
03D6 3E 55                              LD      A,55H
03D8 D3 26                              OUT     (C3AD),A
03DA 3E AA                              LD      A,0AAH
03DC D3 26                              OUT     (C3AD),A
03DE D3 2C                              OUT     (DMAFF),A
03E0 DB 26                              IN      A,(C3AD)
03E2 FE 55                              CP      55H
03E4 C2 EE 03                           JP      NZ,ERRDMA
03E7 DB 26                              IN      A,(C3AD)
03E9 FE AA                              CP      0AAH
03EB CA F3 03                           JP      Z,GDCINT
                                ;
03EE D3 2C                      ERRDMA: OUT     (DMAFF),A
03F0 C3 14 06                           JP      ENDLO
                                ;
                                ;
```

```
  1020                          ;***********************************************
**********************
  1021                          ;
  1022                          ;       INITIALISATION OF 7220 (GDC)
  1023                          ;
  1024                          ;***********************************************
**********************
  1025                          ;       *** CLEAR GDC-RAM-PARAMETER-ARRAY***
  1026                          ;           ****************************
  1027                          ;
  1028                          ;
  1029 03F3 3E BE               GDCINT: LD      A,GDCERR
  1030 03F5 D3 00                       OUT     (ERRDIS),A
  1031 03F7 21 00 F8                    LD      HL,CURSX        ;CLEAR RAM (00) F
ROM 0F800H TO 0FFFFH
  1032 03FA AF                          XOR     A
  1033 03FB 77                  CLRRA:  LD      (HL),A
  1034 03FC 2C                          INC     L
  1035 03FD C2 FB 03                    JP      NZ,CLRRA
  1036 0400 24                          INC     H
  1037 0401 C2 FB 03                    JP      NZ,CLRRA
  1038 0404 3E E8                       LD      A,0E8H          ;SET GREEN OF BLA
CK
  1039 0406 32 0B F9                    LD      (INVFLG),A
  1040                          ;
  1041                          ;
  1042 0409 3E 00                       LD      A,GDCRES
  1043 040B D3 A1                       OUT     (GDCCOM),A
  1044 040D 21 D0 04                    LD      HL,INTPAR       ;RESET PARAMETER
LIST
  1045 0410 06 08                       LD      B,08H
  1046 0412 CD C6 04                    CALL    SENPAR          ;SEND PARAMETER
  1047                          ;
  1048 0415 3E 6F               INIT10: LD      A,VSYNCM        ;MASTERMODE
  1049 0417 CD A0 04                    CALL    OUTCMD
  1050 041A 3E 47                       LD      A,PITCH
  1051 041C CD A0 04                    CALL    OUTCMD
  1052 041F 3E 50                       LD      A,NRWAPL        ;# OF WORD-ADDRES
SES IN HOR. DIR.
  1053 0421 CD A6 04                    CALL    OUTPAR
  1054                          ;
  1055 0424 3E 70                       LD      A,PRAM+PRAMSA
  1056 0426 CD A0 04                    CALL    OUTCMD          ;LOAD PARAMETER R
WAM
  1057 0429 21 D8 04                    LD      HL,PRMPAR
  1058 042C 06 04                       LD      B,4             ;# OF PARAMETER S
  1059 042E CD C6 04                    CALL    SENPAR
  1060                          ;
  1061 0431 3E 4B                       LD      A,CCHAR         ;DEFINE CURSOR
  1062 0433 CD A0 04                    CALL    OUTCMD          ;OUT COMMAND
  1063 0436 3E 8F                       LD      A,8FH
  1064 0438 CD A6 04                    CALL    OUTPAR
  1065                          ;
  1066 043B 3E CE                       LD      A,0CEH          ;INIT CURSOR
  1067 043D CD A6 04                    CALL    OUTPAR          ;UNDERLINE BLINKI
NG
  1068 0440 3E 72                       LD      A,72H
  1069 0442 CD A6 04                    CALL    OUTPAR
  1070                          ;
  1071 0445 3E 46                       LD      A,ZOOM
  1072 0447 CD A0 04                    CALL    OUTCMD
  1073 044A AF                          XOR     A
  1074 044B CD 9A 04                    CALL    OUTPAZ          ;ZOOM-FACTOR = 0
  1075                          ;
```

```
  1077                          ;*****************************************
*****************************
  1078                          ;
  1079                          ;       GDC-TEST
  1080                          ;
  1081                          ;*********************************************
*****************************
  1082                          ;
  1083                          ;
  1084 044E CD B2 02                    CALL    CUHOM1          ;SET CURSOR TO 00
00
  1085 0451 CD C1 01                    CALL    SETCCA
  1086 0454 3E 20                       LD      A,WDAT+TYWORD+MOREPL
  1087 0456 CD A0 04                    CALL    OUTCMD
  1088                          ;
  1089 0459 3E 55                       LD      A,55H           ;WRITE CHARACTER
55H
  1090 045B CD A6 04                    CALL    OUTPAR
  1091 045E 2F                          CPL                     ;WRITE ATTRIB. 0A
AH
  1092 045F CD A6 04                    CALL    OUTPAR
  1093                          ;
  1094 0462 3E E0                       LD      A,CURD          ;READ CURSOR
  1095 0464 CD A0 04                    CALL    OUTCMD
  1096 0467 CD C0 04                    CALL    INPAR           ;MUST BE 01
  1097 046A FE 01                       CP      01
  1098 046C C2 14 06                    JP      NZ,ENDLO        ;CURSOR READ/WRIT
E-ERROR
  1099 046F CD C0 04                    CALL    INPAR
  1100 0472 A7                          AND     A
  1101 0473 C2 14 06                    JP      NZ,ENDLO        ;CURSOR READ/WRIT
E-ERROR
  1102                          ;
  1103 0476 CD B2 02                    CALL    CUHOM1          ;CURSOR - 1
  1104 0479 CD D3 01                    CALL    REACCA
  1105 047C 3E A0                       LD      A,RDAT          ;READ WRITTEN CHA
RACTER
  1106 047E CD A0 04                    CALL    OUTCMD
  1107 0481 CD C0 04                    CALL    INPAR           ;MUST BE 55H AND
0AAH
  1108 0484 47                          LD      B,A
  1109 0485 CD C0 04                    CALL    INPAR
  1110 0488 80                          ADD     A,B
  1111 0489 3C                          INC     A
  1112 048A C2 14 06                    JP      NZ,ENDLO        ;CHARACTER READ/W
RITE-ERROR
  1113                          ;
  1114                          ;
  1115                          ;
  1116 048D 3E 0C               INIT20: LD      A,SCRER
  1117 048F CD 24 01                    CALL    MODCRT          ;CLEAR SCREEN
  1118                          ;
  1119 0492 3E 6B                       LD      A,START         ;START DISPLAY
  1120 0494 CD A0 04                    CALL    OUTCMD
  1121 0497 C3 DE 04                    JP      INITTI          ;INIT OF GDC FINI
SHED
  1122                          ;
  1123                          ;
  1124                          ;
```

```
1128                    ;       *** SUBROUTINES OF GDC ***
1129                    ;           ******************
1130                    ;
1131                    ;
1132 049A CD AC 04     OUTPAZ: CALL    FIFRDY
1133 049D D3 A2                OUT     (GDCPAZ),A
1134 049F C9                   RET
1135                    ;
1136 04A0 CD AC 04     OUTCMD: CALL    FIFRDY          ;PUT A COMMAND IN
 FIFO
1137 04A3 D3 A1                OUT     (GDCCOM),A
1138 04A5 C9                   RET
1139                    ;
1140 04A6 CD AC 04     OUTPAR: CALL    FIFRDY          ;PUT A PARAMETER
TO FIFO
1141 04A9 D3 A0                OUT     (GDCPAR),A
1142 04AB C9                   RET
1143                    ;
1144 04AC F5           FIFRDY: PUSH    AF
1145 04AD DB A0        FIFO10: IN      A,(GDCSTA)      ;READ GDC-STATUS
1146 04AF E6 02                AND     FIFULL
1147 04B1 C2 AD 04             JP      NZ,FIFO10       ;JUMP IF FIFO FUL
L
1148 04B4 F1                   POP     AF
1149 04B5 C9                   RET
1150                    ;
1151 04B6 F5           CKDATR: PUSH    AF              ;CHECK AND WAIT F
OR DATA READY
1152 04B7 DB A0        CKDA10: IN      A,(GDCSTA)      ;READ GDC-STATUS
1153 04B9 E6 01                AND     DATRDY
1154 04BB CA B7 04             JP      Z,CKDA10        ;JUMP IF DATA-BYT
E NOT READY
1155 04BE F1                   POP     AF
1156 04BF C9                   RET
1157                    ;
1158 04C0 CD B6 04     INPAR:  CALL    CKDATR          ;READ FROM FIFO
1159 04C3 DB A1                IN      A,(FIFO)
1160 04C5 C9                   RET
1161                    ;
1162 04C6 7E           SENPAR: LD      A,(HL)          ;LOAD PARAMETER
1163 04C7 CD A6 04             CALL    OUTPAR          ;OUTPUT PARAMETER
1164 04CA 23                   INC     HL
1165 04CB 05                   DEC     B
1166 04CC C2 C6 04             JP      NZ,SENPAR       ;LOOP UNTIL END O
F PARAMETER-LIST
1167 04CF C9                   RET
1168                    ;
1169                    ;
1170                    ;
1171                    ;
1172                    ;
```

```
  1176                          ;***********************************************
**********************
  1177                          ;
  1178                          ;       GDC DATA ARRAY
  1179                          ;
  1180                          ;***********************************************
**********************
  1181                          ;
  1182                                  IF      FARBE-1
  1183                          ;
  1184                          ;
  1185                          ;       INITIALIZE PARAMETER OF GDC
  1186                          ;       ===================================
  1187                          ;
  1188                          ;       WCLK=2.5 MHz            PIXCLK = 20 MHZ
  1189                          ;       TWORD= 400 NS           TDOT   = 50 US
  1190                          ;
  1191                          ;       T-LINE = 42.00 US (F=23,80 KHZ)
  1192                          ;       T-FRAME= 17808 US (F=56,20 HZ)
  1193                          ;       TDISPH = 32,00 US
  1194                          ;       TDISPV = 16,8  MS
  1195                          ;       T-HBLANK = 10,00 US     ( GDC )
  1196                          ;       T-VBANLK = 1008  US
  1197                          ;
  1198                          ;
  1199                          HSYNC   EQU     3       ;1,20 US : HORIZONT. SYNC
  1200                          HFP     EQU     3       ;1,20 US :   "  -FRONT-PO
RCH
  1201                          HBP     EQU     19      ;7,60 US :   "  -BACK -PO
RCH
  1202                          VSYNC   EQU     12      ;504  US : VERTICAL-SYNC
  1203                          VFP     EQU     6       ;252  US :   "  -FRONT-P
ORCH
  1204                          VBP     EQU     6       ;252  US :   "  -BACK-PO
RCH
  1205                          PIXEL   EQU     640     ;    PIXEL/ROW
  1206                          ADWPR   EQU     PIXEL/8 ;32 US  : ACTIVE DISPL. W
ORDS/ROW
  1207                          AL      EQU     400     ;16,8 MS :   "     LINES
  1208                          ;
  1209                                  ENDIF
  1210                          ;
  1211 04D0
  1212                          ;
  1213                          ;
  1214                                  IF      FARBE
  1215                          ;
  1216                          ;       INITIALIZE PARAMETER OF GDC COLOR

  1217                          ;       ====================================
====
  1218                          ;
  1219                          ;       WCLK=2.5 MHz            PIXCLK = 20 MHZ
  1220                          ;       TWORD= 400 NS           TDOT   = 50 US
  1221                          ;
  1222                          ;       T-LINE = 41.20 US (F=24,27 KHZ)
  1223                          ;       T-FRAME= 17840 US (F=56,06 HZ)
  1224                          ;       T-HBLANK = 10,00 US     ( GDC )
  1225                          ;       T-VBANLK = 1008  US
  1226                          ;
  1227                          ;
  1228 0007                     HSYNC   EQU     7       ;2,80 US : HORIZONT. SYNC
  1229 0006                     HFP     EQU     6       ;2,40 US :   "  -FRONT-PO
RCH
  1230 000A                     HBP     EQU     10      ;4,00 US :   "  -BACK -PO
RCH
  1231 0008                     VSYNC   EQU     8       ;330  US : VERTICAL-SYNC
  1232 000A                     VFP     EQU     10      ;412  US :   "  -FRONT-P
ORCH
  1233 000F                     VBP     EQU     15      ;618  US :   "  -BACK-PO
RCH
  1234 0280                     PIXEL   EQU     640     ;    PIXEL/ROW
  1235 0050                     ADWPR   EQU     PIXEL/8 ;32 US  : ACTIVE DISPL. W
ORDS/ROW
  1236 0190                     AL      EQU     400     ;16,8 MS :   "     LINES
  1237                          ;
```

```
  1238                          ENDIF
  1239                  ;
  1240                  ;
  1241                  ;
  1242 04D0 14           INTPAR: DEFB    RESMOP+MIXGAC+NOINTL+DRWRET+DYNRA
M
  1243 04D1 4E                  DEFB    ADWPR-2
  1244 04D2 06                  DEFB    (VSYNC.AND.00000111B).SHL.5.OR.(H
SYNC-1)
  1245 04D3 15                  DEFB    (HFP-1).SHL.2.OR.(VSYNC.SHR.3)
  1246 04D4 09                  DEFB    HBP-1
  1247 04D5 0A                  DEFB    VFP
  1248 04D6 90                  DEFB    .LOW.AL
  1249 04D7 3D                  DEFB    VBP.SHL.2.OR.(.HIGH.AL)
  1250                  ;
  1251                  ;
  1252 04D8 00 00       PRMPAR: DEFW    0               ;START ADDRESS OF
 D-PARTITION 1
  1253 04DA F0                  DEFB    0F0H            ;LENGTH OF DP 1
  1254 04DB 3F                  DEFB    3FH             ;PART IS GRAPHIC
AREA
  1255 04DC 00 00               DEFW    0               ;DP 2
  1256                  ;
```

```
  1261                          ;***********************************************
**********************
  1262                          ;
  1263                          ;       *** INIT TIMER 8253 ***
  1264                          ;
  1265                          ;***********************************************
**********************
  1266                          ;
  1267                          ;
  1268                          ;       *** TIMER 1 ***
  1269                          ;           *******
  1270                          ;
  1271                          ;
  1272                          ;
  1273                          ;
  1274 04DE 3E 52               INITTI: LD      A,01010010B     ;COUNTER 1 ONE-SH
OT (MODE 1)
  1275 04E0 D3 83                       OUT     (TIMMD),A
  1276 04E2 3E 20                       LD      A,32
  1277 04E4 D3 81                       OUT     (TIM1),A        ;MONO = 12,8 US
  1278                          ;
  1279                          ;
  1280                          ;       *** TIMER 2 ***
  1281                          ;           *******
  1282                          ;
  1283                          ;
  1284                          ;       *** TIMER 0 ***
  1285                          ;           *******
  1286                          ;
  1287                          ;
  1288                          :
  1289 04E6 3E 3A                       LD      A,00111010B     ;COUNTER 0 HARDWA
RE TRIGGER STROBE (MODE 5)
  1290 04E8 D3 83                       OUT     (TIMMD),A
  1291 04EA 3E 46                       LD      A,046H          ;MONO FOR 15 SEC
  1292 04EC D3 80                       OUT     (TIM0),A        ;CLOCK=VSYNC (56,
20 HZ )
  1293 04EE 3E 03                       LD      A,03H
  1294 04F0 D3 80                       OUT     (TIM0),A
  1295 04F2 16 03                       LD      D,3             ;WAIT 300MS
  1296 04F4 CD 95 0A                    CALL    TIM100
  1297 04F7 C3 FA 04                    JP      NEXT5
  1298                          :
```

```
  1301                          ;***********************************************
**********************
  1302                          ;
  1303                          ;  TEST OF DISK-CONTROLLER 8272
  1304                          ;
  1305                          ;***********************************************
**********************
  1306                          ;
  1307                          ;
  1308 04FA 3E DE               NEXT5:  LD      A,FDCERR
  1309 04FC D3 00                       OUT     (ERRDIS),A
  1310                          ;
  1311 04FE DB 50               FLEXTS  IN      A,(RDMST)       ;GET MAIN-STATUS
  1312 0500 FE 80                       CP      10000000B       ;MUST BE 80H
  1313 0502 CA 08 05                    JP      Z,LL140
  1314 0505 C3 14 06                    JP      ENDLO
  1315                          ;
  1316 0508 21 17 F8            LL140   LD      HL,COMBLO
  1317 050B 36 03                       LD      (HL),FDCSPE
  1318 050D 23                          INC     HL
  1319 050E 36 D6                       LD      (HL),11010110B  ;SRT= 6MS / HULT=
200MS
  1320 0510 23                          INC     HL
  1321 0511 36 2C                       LD      (HL),00101100B  ;HLT= 88MS DMA
  1322 0513 06 03                       LD      B,03H
  1323 0515 CD 01 09                    CALL    SENBY1          ;SEND BYTES TO FD
C
  1324 0518 C3 DE 05                    JP      TST16
  1325
  1326
```

```
1331                    ;***********************************************
**********************
1332                    ;
1333                    ;       *** LANGUAGE BOARD TEST (16 BIT PROCESSOR
) ***
1334                    ;
1335                    ;***********************************************
**********************
1336                    ;
1337 FE00              CB8     EQU     0FE00H
1338 FE01              SB8     EQU     0FE01H
1339 FE02              ADD8    EQU     0FE02H
1340                    ;
1341 FE04              CB16    EQU     0FE04H
1342 FE05              SB16    EQU     0FE05H
1343 FE06              ADD16   EQU     0FE06H
1344                    ;
1345                    ;
1346 051B CD A7 03     DIAG16: CALL    INVAL1
1347 051E 3E 01        DIA16:  LD      A,01
1348 0520 32 01 F8              LD      (CURSY),A
1349 0523 AF                    XOR     A
1350 0524 32 00 F8              LD      (CURSX),A
1351 0527 21 96 05              LD      HL,PHMES
1352 052A CD 5E 0A              CALL    DISPL
1353                    ;
1354 052D CD 13 01              CALL    KEYINP
1355 0530 F5                    PUSH    AF
1356 0531 CD 24 01              CALL    MODCRT
1357 0534 3E FF                 LD      A,0FFH
1358 0536 32 05 FE              LD      (SB16),A
1359 0539 F1                    POP     AF
1360                    ;
1361 053A 32 04 FE              LD      (CB16),A
1362 053D FE 30                 CP      '0'
1363 053F CA 5E 05              JP      Z,PHASE0                ;MONITOR
1364 0542 FE 31                 CP      '1'
1365 0544 CA 7A 05              JP      Z,PHASE1
1366 0547 FE 32                 CP      '2'
1367 0549 CA 7D 05              JP      Z,PHASE2
1368 054C FE 33                 CP      '3'
1369 054E CA 5E 05              JP      Z,PHASE0
1370 0551 FE 34                 CP      '4'
1371 0553 CA AC 0A              JP      Z,MONI
1372                    ;
1373 0556 3E 0C        DIAGE:   LD      A,0CH
1374 0558 CD 24 01              CALL    MODCRT
1375 055B C3 1E 05              JP      DIA16
1376                    ;
1377 055E D3 D0        PHASE0:  OUT     (PROCCH),A
1378 0560 00                    NOP
1379 0561 3A 05 FE              LD      A,(SB16)
1380 0564 A7                    AND     A
1381 0565 C2 71 05              JP      NZ,BRUN
1382                    ;
1383 0568 21 B6 05      GRUN:   LD      HL,GOODST
1384 056B CD 5E 0A              CALL    DISPL
1385 056E C3 1E 05              JP      DIA16
1386                    ;
1387 0571 21 D2 05      BRUN:   LD      HL,BADSTA
1388 0574 CD 5E 0A              CALL    DISPL
1389 0577 C3 1E 05              JP      DIA16
1390                    ;
1391 057A C3 80 05      PHASE1: JP      PRJUMP
```

```
  1392                          ;
  1393 057D C3 70 06            PHASE2: JP      STARTS
  1394                          ;
  1395                          ;
  1396                          ;
  1397                          ;
  1398                          ;
  1399                          ;
  1400                          ; *** PROGRAM FOR SWITCH CONTROL TO 16 BIT SOFTWA
RE ***
  1401                          ;     ****************************************
**
  1402                          ;
  1403 F10C                     RAMTOP  EQU     0F10CH
  1404                          ;
  1405 0580 11 0C F1            PRJUMP: LD      DE,RAMTOP
  1406 0583 21 8E 05                    LD      HL,PROGRA
  1407 0586 01 08 00                    LD      BC,8
  1408 0589 ED B0                       LDIR
  1409 058B C3 0C F1                    JP      RAMTOP
  1410                          ;
  1411 058E D3 10               PROGRA: OUT     (RAMSEL),A
  1412 0590 D3 D0                       OUT     (PROCCH),A
  1413 0592 00                          NOP                     ;CONTROL TO 16 BI
T
  1414                          ;
  1415 0593 C3 11 F1                    JP      RAMTOP+5        ;ENTRY POINT 8 BI
T I/O
  1416                          ;
  1417                          ;
  1418                          ;
  1419 0596 1F                  PHMES   DEFB    31,'SELECT THE SWITCH PHASE (0-2)

       0597 53
       0598 45
       0599 4C
       059A 45
       059B 43
       059C 54
       059D 20
       059E 54
       059F 48
       05A0 45
       05A1 20
       05A2 53
       05A3 57
       05A4 49
       05A5 54
       05A6 43
       05A7 48
       05A8 20
       05A9 50
       05AA 48
       05AB 41
       05AC 53
       05AD 45
       05AE 20
       05AF 28
       05B0 30
       05B1 2D
       05B2 32
       05B3 29
       05B4 20
       05B5 20
  1420 05B6 1B                  GOODST  DEFB    27,'SUCCESSFUL PROCESSOR SWITCH'
       05B7 53
       05B8 55
       05B9 43
       05BA 43
```

```
                05BB 45
                05BC 53
                05BD 53
                05BE 46
                05BF 55
                05C0 4C
                05C1 20
                05C2 50
                05C3 52
                05C4 4F
                05C5 43
                05C6 45
                05C7 53
                05C8 53
                05C9 4F
                05CA 52
                05CB 20
                05CC 53
                05CD 57
                05CE 49
                05CF 54
                05D0 43
                05D1 48
1421            05D2 0B                 BADSTA  DEFB    11,'BAD BAD BAD
                05D3 42
                05D4 41
                05D5 44
                05D6 20
                05D7 42
                05D8 41
                05D9 44
                05DA 20
                05DB 42
                05DC 41
                05DD 44
1422                                    ;
1423                                    ;
```

```
  1427                          ;***********************************************
**********************
  1428                          ;
  1429                          ;       TEST 8088
  1430                          ;
  1431                          ;***********************************************
**********************
  1432                          ;
  1433                          ;
  1434 05DE DB 13               TST16:  IN      A,(SYSSTA)
  1435 05E0 E6 02                       AND     2
  1436 05E2 3E FF                       LD      A,0FFH
  1437 05E4 C2 06 06                    JP      NZ,TSTEND
  1438                          ;
  1439 05E7 3E EE                       LD      A,P16ERR
  1440 05E9 D3 00                       OUT     (ERRDIS),A
  1441                          ;
  1442 05EB 3E FF                       LD      A,0FFH
  1443 05ED 32 05 FE                    LD      (SB16),A
  1444 05F0 3E 00                       LD      A,0             ;(SB8)=9 THEN RAM
-TEST TILL 512K (REDESIGN-BOARD)
  1445 05F2 32 01 FE                    LD      (SB8),A
  1446 05F5 3E 33                       LD      A,'3            ;LEVEL 0 TEST PHA
SE 16 BIT
  1447 05F7 32 04 FE                    LD      (CB16),A
  1448 05FA D3 D0                       OUT     (PROCCH),A      ;SWITCH TO 16 BIT
  1449 05FC 3A 05 FE                    LD      A,(SB16)
  1450 05FF 32 01 FE                    LD      (SB8),A         ;STORE STATUSFLAG
  1451 0602 A7                          AND     A               ;CHECK STATUS
  1452 0603 C2 0D 06                    JP      NZ,ENDLO2       ;JMP IF NOT 0
  1453 0606 3E FF               TSTEND: LD      A,DIACOM
  1454 0608 D3 00                       OUT     (ERRDIS),A
  1455 060A C3 70 06                    JP      STARTS
  1456                          ;
  1457                          ;
  1458                          ;
  1459 060D 3E EF               ENDLO2: LD      A,0EFH          ;SWITCH DIAG-LED
OFF
  1460 060F D3 00                       OUT     (ERRDIS),A      ;LED-8
  1461 0611 C3 70 06                    JP      STARTS
  1462                          ;
  1463                          ;
  1464                          ;***********************************************
******************************
  1465                          ;
  1466 0614 18 FE               ENDLO:  JR      $               ;LEVEL0-ERROR DET
ECTED
  1467                          ;
  1468                          ;***********************************************
******************************
  1469                          ;
```

```
1471                                    ;
1472                                    ;
1473                                    ;
1474                                    ;
1475                                    ; *** RESET DISK-DRIVE 0 ***
1476                                    ;
1477                                    ;
1478 0616 21 06 F8                      REST:   LD      HL,PARAME
1479 0619 36 07                                 LD      (HL),FDCRE
1480 061B 23                                    INC     HL
1481 061C 23                                    INC     HL
1482 061D 23                                    INC     HL
1483 061E 77                                    LD      (HL),A          ;UNIT = 0
1484 061F 23                                    INC     HL
1485 0620 36 00                                 LD      (HL),000H       ;TRACK = 0
1486 0622 23                                    INC     HL
1487 0623 36 01                                 LD      (HL),001H       ;SECTOR = 1
1488 0625 21 06 F8                      LL141   LD      HL,PARAME
1489 0628 11 10 F8                              LD      DE,RESULT
1490 062B CD AB 07                              CALL    FDCDR1 ;RESTORE
1491 062E 21 10 F8                              LD      HL,RESULT
1492 0631 7E                                    LD      A,(HL)          ;GET RESULT
1493 0632 1F                                    RRA
1494 0633 1F                                    RRA
1495 0634 1F                                    RRA
1496 0635 1F                                    RRA
1497 0636 D2 53 06                              JP      NC,REST3        ;GOOD STATUS
1498 0639 3E 18                                 LD      A,18H
1499 063B 32 01 F8                              LD      (CURSY),A
1500 063E AF                                    XOR     A
1501 063F 32 00 F8                              LD      (CURSX),A
1502 0642 21 59 06                              LD      HL,NOTRM
1503 0645 CD 5E 0A                              CALL    DISPL
1504 0648 CD 13 01                      REST2:  CALL    KEYINP
1505 064B FE 88                                 CP      NEWL
1506 064D C2 48 06                              JP      NZ,REST2
1507 0650 C3 25 06                              JP      LL141
1508 0653 3E 0C                         REST3:  LD      A,SCRER
1509 0655 CD 24 01                              CALL    MODCRT
1510 0658 C9                                    RET
1511                                    ;
1512                                    ;
1513 0659 16                            NOTRM:  DEFB    22,'DISK A: NOT READY (CR)'
     065A 44
     065B 49
     065C 53
     065D 4B
     065E 20
     065F 41
     0660 3A
     0661 20
     0662 4E
     0663 4F
     0664 54
     0665 20
     0666 52
     0667 45
     0668 41
     0669 44
     066A 59
     066B 20
     066C 28
     066D 43
     066E 52
     066F 29
```

```
  1517                          ;
  1518                          ;
  1519 0670 FB                  STARTS: EI
  1520 0671 CD 1B 01                    CALL    KYLOOK
  1521 0674 FE 0D                       CP      0DH             ;"^M"
  1522 0676 CA A5 0A                    JP      Z,MONIT
  1523 0679 3E 00                       LD      A,0
  1524 067B CD 16 06                    CALL    REST            ;RESTORE DISK UNI
T 0
  1525                          ;
  1526                          ;
  1527                          ;*********************************************
**********************
  1528                          ;
  1529                          ;  SYSTEM LOADER
  1530                          ;
  1531                          ;*********************************************
**********************
  1532                          ;
  1533                          ;
  1534 067E 21 06 F8            SLOAD   LD      HL,PARAME       ;SET FUNCTION (RE
AD A TRACK)
  1535 0681 36 42                       LD      (HL),FRTRK
  1536 0683 23                          INC     HL
  1537 0684 23                          INC     HL
  1538 0685 23                          INC     HL
  1539 0686 36 00                       LD      (HL),000H       ;UNIT = 0
  1540 0688 23                          INC     HL
  1541 0689 36 00                       LD      (HL),000H       ;TRACK = 0
  1542 068B 23                          INC     HL
  1543 068C 36 01                       LD      (HL),001H       ;SECTOR = 1
  1544 068E 23                          INC     HL
  1545 068F 36 00                       LD      (HL),000H       ;HEAD = 0
  1546 0691 23                          INC     HL
  1547 0692 36 40                       LD      (HL),40H        ;DENSITY = DOUBLE
  1548 0694 21 00 20                    LD      HL,2000H
  1549 0697 22 0E F8                    LD      (PARAME+8),HL   ;DMA ADDRESS=2000
H
  1550                          ;
  1551                          ;
  1552                          ; *** LOAD 12K FROM TRACK 0 SECTOR 1 TO MEMORY 10
00H ***
  1553                          ;
  1554                          ;
  1555 069A AF                  SLOAD5  XOR     A
  1556 069B 32 20 F8                    LD      (RETRY),A       ;SET RETRY-COUNTE
R
  1557                          ;
  1558 069E 21 06 F8            SLOAD6  LD      HL,PARAME
  1559 06A1 11 10 F8                    LD      DE,RESULT
  1560 06A4 CD A8 07                    CALL    FDCDR1          ;READ TRACK
  1561 06A7 21 10 F8                    LD      HL,RESULT
  1562 06AA 7E                          LD      A,(HL)
  1563 06AB E6 C0                       AND     0C0H
  1564 06AD CA CD 06                    JP      Z,SLOAD7        ;JUMP IF OK
  1565 06B0 23                          INC     HL
  1566 06B1 7E                          LD      A,(HL)
  1567 06B2 E6 24                       AND     024H
  1568 06B4 C2 BD 06                    JP      NZ,SLOAD8       ;JUMP IF DATA-ERR
OR
  1569 06B7 CD FF 09                    CALL    DISSTA          ;DISPLAY ERROR-ME
SSAGE
  1570 06BA C3 9E 06                    JP      SLOAD6          ;TRY IT AGAIN
  1571                          ;
  1572 06BD 21 20 F8            SLOAD8  LD      HL,RETRY
  1573 06C0 34                          INC     (HL)
  1574 06C1 7E                          LD      A,(HL)
  1575 06C2 FE 0A                       CP      00AH
  1576 06C4 C2 9E 06                    JP      NZ,SLOAD6       ;RETRY
  1577 06C7 CD FF 09                    CALL    DISSTA          ;DISPLAY ERROR-ME
SSAGE
  1578 06CA C3 9A 06                    JP      SLOAD5          ;RETRY
  1579                          ;
  1580 06CD 2A 0E F8            SLOAD7  LD      HL,(PARAME+8)
```

```
1581 06D0 11 00 10              LD      DE,1000H
1582                            ;
1583 06D3 19            SLOAD9  ADD     HL,DE           ;UPDATED LOAD-ADD
RESS
1584 06D4 7C                    LD      A,H
1585 06D5 FE 50                 CP      050H
1586 06D7 CA E4 06              JP      Z,SLOADA        ;JUMP TO EXECUTE
PROGRAM
1587 06DA 22 0E F8              LD      (PARAME+8),HL   ;SET NEW DMA-ADDR
ESS
1588 06DD 21 0A F8              LD      HL,PARAME+4
1589 06E0 34                    INC     (HL)            ;TRACK# + 1
1590 06E1 C3 9A 06              JP      SLOAD5          ;READ NEXT TRACK
1591                            ;
1592 06E4 11 93 07      SLOADA: LD      DE,IDENT1
1593 06E7 CD 3D 07              CALL    CHECKI
1594 06EA CA 00 20              JP      Z,2000H         ;8-BIT-SYSTEM (CP
M 2.2)
1595 06ED 11 A1 07              LD      DE,IDENT3
1596 06F0 CD 3D 07              CALL    CHECKI
1597 06F3 CA 00 20              JP      Z,2000H         ;8-BIT-SYSTEM (CP
M 3.0)
1598 06F6 11 9A 07              LD      DE,IDENT2
1599 06F9 CD 3D 07              CALL    CHECKI
1600 06FC CA 02 07              JP      Z,SLOADB        ;16-BIT-SYSTEM
1601 06FF C3 1E 07              JP      SLOADD          ;OTHER SOFTWARE
1602                            ;
1603 0702 DB 13         SLOADB: IN      A,(SYSSTA)
1604 0704 E6 02                 AND     2
1605 0706 C2 18 07              JP      NZ,NO16         ;JMP IF NO 16 BIT
1606 0709 3A 01 FE              LD      A,(SBB)
1607 070C A7                    AND     A
1608 070D C2 18 07              JP      NZ,NO16         ;16 BIT PROCESSOR
 ERROR
1609                            ;
1610 0710 3E 32                 LD      A,'2'
1611 0712 32 04 FE              LD      (CB16),A        ;COMMAND EXEC SOF
TWARE
1612 0715 C3 80 05              JP      PRJUMP          ;CONTOL TO 16 BIT
1613                            ;
1614 0718 21 62 07      NO16:   LD      HL,MESN16
1615 071B C3 21 07              JP      SL2
1616                            ;
1617 071E               SLOADC:
1618 071E 21 4A 07      SLOADD: LD      HL,SLMESS
1619 0721 3E 18         SL2:    LD      A,18H
1620 0723 32 01 F8              LD      (CURSY),A
1621 0726 AF                    XOR     A
1622 0727 32 00 F8              LD      (CURSX),A
1623 072A CD 5E 0A              CALL    DISPL
1624 072D CD 13 01      SL3:    CALL    KEYINP
1625 0730 FE 88                 CP      NEWL
1626 0732 C2 2D 07              JP      NZ,SL3
1627 0735 3E 0C                 LD      A,SCRER
1628 0737 CD 24 01              CALL    MODCRT
1629 073A C3 70 06              JP      STARTS
1630                            ;
1631 073D 21 03 20      CHECKI: LD      HL,2003H
1632 0740 06 07                 LD      B,7
1633                            ;
1634 0742 1A            CHECK1: LD      A,(DE)
1635 0743 BE                    CP      (HL)
1636 0744 C0                    RET     NZ
1637 0745 13                    INC     DE
1638 0746 23                    INC     HL
1639 0747 10 F9                 DJNZ    CHECK1
1640 0749 C9                    RET
1641                    ;
1642                    ;
1643                    ;
```

```
1644 074A 17                SLMESS  DEFB    23, A: MOUNT O.S. DISK (CR)
     074B 41
     074C 3A
     074D 20
     074E 4D
     074F 4F
     0750 55
     0751 4E
     0752 54
     0753 20
     0754 4F
     0755 2E
     0756 53
     0757 2E
     0758 20
     0759 44
     075A 49
     075B 53
     075C 4B
     075D 20
     075E 28
     075F 43
     0760 52
     0761 29
1645 0762 30                MESN16  DEFB    48, 16 BIT NOT IMPLEMENTED,
     0763 31
     0764 36
     0765 20
     0766 42
     0767 49
     0768 54
     0769 20
     076A 4E
     076B 4F
     076C 54
     076D 20
     076E 49
     076F 4D
     0770 50
     0771 4C
     0772 45
     0773 4D
     0774 45
     0775 4E
     0776 54
     0777 45
     0778 44
     0779 2C
     077A 20
1646 077B 54                        DEFB     TRY 8 BIT O.S. DISK (CR)'
     077C 52
     077D 59
     077E 20
     077F 38
     0780 20
     0781 42
     0782 49
     0783 54
     0784 20
     0785 4F
     0786 2E
     0787 53
     0788 2E
     0789 20
     078A 44
```

```
                078B 49
                078C 53
                078D 4B
                078E 20
                078F 28
                0790 43
                0791 52
                0792 29
1647            0793 43                 IDENT1  DEFB    'CPM 2.2'
                0794 50
                0795 4D
                0796 20
                0797 32
                0798 2E
                0799 32
1648            079A 31                 IDENT2  DEFB    '16BIT'
                079B 36
                079C 42
                079D 49
                079E 54
                079F 20
                07A0 20
1649            07A1 43                 IDENT3  DEFB    'CPM 3.0'
                07A2 50
                07A3 4D
                07A4 20
                07A5 33
                07A6 2E
                07A7 30
```

```
  1655                          ;***********************************************
**********************
  1656                          ;
  1657                          ;  DECIDE WHAT FUNCTION IS TO DO
  1658                          ;
  1659                          ;***********************************************
**********************
  1660                          ;
  1661                          ;
  1662 07A8 22 02 F8            FDCDR1  LD      (PARADR),HL     ;SAVE PARAMETER-B
LOCK-ADDRESS
  1663 07AB EB                          EX      DE,HL
  1664 07AC 22 04 F8                    LD      (RESADR),HL     ;SAVE RESULT-BLOC
K-ADDRESS
  1665 07AF EB                          EX      DE,HL
  1666 07B0 7E                          LD      A,(HL)          ;GET FUNCTION
  1667 07B1 FE 45                       CP      FDCWD
  1668 07B3 CA DF 07                    JP      Z,WRDAT1        ;WRITE DATA
  1669 07B6 FE 46                       CP      FDCRD
  1670 07B8 CA F0 07                    JP      Z,RDDAT1        ;READ DATA
  1671 07BB FE 07                       CP      FDCRE
  1672 07BD CA 01 08                    JP      Z,RECAL1        ;RECALIBRATE
  1673 07C0 FE 4A                       CP      FDCRID
  1674 07C2 CA 4C 08                    JP      Z,RDSID1        ;READ ID
  1675 07C5 FE 4D                       CP      FDCFT
  1676 07C7 CA 6E 08                    JP      Z,WRFOR1        ;FORMAT A TRACK
  1677 07CA FE 04                       CP      FDCSEN
  1678 07CC CA CB 08                    JP      Z,DRIVES        ;GET SENSE-STATUS
  1679 07CF FE 42                       CP      FRTRK
  1680 07D1 CA 9F 08                    JP      Z,READTR        ;READ A TRACK
  1681 07D4 23                          INC     HL
  1682 07D5 23                          INC     HL
  1683 07D6 23                          INC     HL
  1684 07D7 7E                          LD      A,(HL)          ;GET UNIT
  1685 07D8 F6 80                       OR      080H
  1686 07DA 2A 04 F8                    LD      HL,(RESADR)
  1687 07DD 77                          LD      (HL),A          ;INVALID COMMAND
  1688 07DE C9                          RET
```

```
  1694                          ;***********************************************
******************
  1695                          ;
  1696                          ;  WRITE DATA
  1697                          ;
  1698                          ;***********************************************
******************
  1699                          ;
  1700                          ;
  1701                          ; *** FUNCTION/DENSITY ***
  1702                          ;     ***************
  1703                          ;
  1704                          ;
  1705 07DF CD CC 08            WRDAT1: CALL    FUBLK
  1706 07E2 CD 92 09                    CALL    DMA1            ;ACTIVATE DMA
  1707 07E5 06 09                       LD      B,009H
  1708 07E7 CD 11 09                    CALL    SENDB1          ;SEND BYTES TO FD
C
  1709 07EA 06 07                       LD      B,007H
  1710 07EC CD 2B 09                    CALL    GETBY1          ;GET STATUS-BYTES
  1711 07EF C9                          RET
  1712                          ;
  1716                          ;***********************************************
**********************
  1717                          ;
  1718                          ;  READ DATA
  1719                          ;
  1720                          ;***********************************************
**********************
  1721                          ;
  1722                          ;
  1723                          ;
  1724                          ;
  1725 07F0 CD CC 08            RDDAT1: CALL    FUBLK
  1726 07F3 CD 92 09                    CALL    DMA1            ;ACTIVATE DMA
  1727 07F6 06 09                       LD      B,009H
  1728 07F8 CD 11 09                    CALL    SENDB1          ;SEND BYTES TO FD
C
  1729 07FB 06 07                       LD      B,007H
  1730 07FD CD 2B 09                    CALL    GETBY1          ;GET STATUS-BYTES
  1731 0800 C9                          RET
  1732                          ;
```

```
1736                    ;***********************************************
**********************
1737                    ;
1738                    ;  RECALIBRATE
1739                    ;
1740                    ;***********************************************
**********************
1741                    ;
1742                    ;
1743 0801 CD 38 09     RECAL1: CALL DMON       ;SWITCH DISC-MOTOR ON
1744                    ;
1745 0804 CD 71 09             CALL    FDCRD1
1746 0807 3E 0F                LD      A,FDCSEE        ;SEEK-COMMAND
1747 0809 D3 51                OUT     (FDCWR),A
1748 080B 11 03 00             LD      DE,UPARAM
1749 080E 2A 02 F8             LD      HL,(PARADR)
1750 0811 19                   ADD     HL,DE
1751 0812 CD 71 09             CALL    FDCRD1
1752 0815 7E                   LD      A,(HL)  ;GET UNIT
1753 0816 D3 51                OUT     (FDCWR),A
1754 0818 CD 71 09             CALL    FDCRD1
1755 081B 3E 04                LD      A,004H  ;TRACK
1756 081D D3 51                OUT     (FDCWR),A
1757 081F CD 87 09             CALL    FDCIN1
1758                    ;
1759 0822 3E 08                LD      A,FDCSIS                ;SENSINTE
RRUPT-STATUS
1760 0824 D3 51                OUT     (FDCWR),A
1761 0826 06 02                LD      B,2
1762 0828 CD 2B 09             CALL    GETBY1
1763                    ;
1764 082B CD 71 09             CALL    FDCRD1
1765 082E 3E 07                LD      A,FDCRE                 ;RECALIBR
ATE-COMMAND
1766 0830 D3 51                OUT     (FDCWR),A
1767 0832 11 03 00             LD      DE,UPARAM
1768 0835 2A 02 F8             LD      HL,(PARADR)
1769 0838 19                   ADD     HL,DE
1770 0839 CD 71 09             CALL    FDCRD1
1771 083C 7E                   LD      A,(HL)  ;GET UNIT
1772 083D D3 51                OUT     (FDCWR),A
1773 083F CD 87 09             CALL    FDCIN1
1774                    ;
1775 0842 3E 08                LD      A,FDCSIS
1776 0844 D3 51                OUT     (FDCWR),A       ;SENSE INTERRUPT-
STATUS-COMMAND
1777 0846 06 02                LD      B,002H
1778 0848 CD 2B 09             CALL    GETBY1
1779 084B C9                   RET
1780                    ;
```

```
  1784                          ;***********************************************
**********************
  1785                          ;
  1786                          ;  READ ID
  1787                          ;
  1788                          ;***********************************************
**********************
  1789                          ;
  1790                          ;
  1791                          ; *** FUNCTION/DENSITY ***
  1792                          ;     ***************
  1793                          ;
  1794                          ;
  1795 084C                     RDSID1:
  1796 084C FD 2A 02 F8                 LD      IY,(PARADR)
  1797 0850 21 17 F8                    LD      HL,COMBLO
  1798 0853 FD 7E 00                    LD      A,(IY+0)        ;GET FUNCTION
  1799 0856 77                          LD      (HL),A          ;FILL COMBLO
  1800                          ;
  1801                          ;
  1802                          ; *** UNIT/HEAD ***
  1803                          ;     *********
  1804                          ;
  1805                          ;
  1806 0857 23                          INC     HL              ;NEXT COMBLO
  1807 0858 FD 46 03                    LD      B,(IY+3)        ;GET UNIT
  1808 085B FD 7E 06                    LD      A,(IY+6)        ;GET HEAD
  1809 085E B0                          OR      B               ;COMBINE WITH UNI
T
  1810 085F 77                          LD      (HL),A          ;FILL COMBLO
  1811 0860 CD 44 09                    CALL    SEEK1
  1812 0863 06 02                       LD      B,002H
  1813 0865 CD 01 09                    CALL    SENBY1  ;SEND BYTES TO FDC
  1814 0868 06 07                       LD      B,007H
  1815 086A CD 2B 09                    CALL    GETBY1  ;GET STATUS-BYTES
  1816 086D C9                          RET
  1817                          ;
```

```
  1821                          ;***********************************************
**********************
  1822                          ;
  1823                          ;   FORMAT A TRACK
  1824                          ;
  1825                          ;***********************************************
**********************
  1826                          ;
  1827                          ;
  1828                          ; *** FUNCTION/DENSITY ***
  1829                          ;     ***************
  1830                          ;
  1831                          ;
  1832 086E                     WRFOR1:
  1833 086E FD 2A 02 F8                 LD      IY,(PARADR)
  1834 0872 21 17 F8                    LD      HL,COMBLO
  1835 0875 FD 7E 00                    LD      A,(IY+0)                ;GET FUNC
TION
  1836 0878 77                          LD      (HL),A                  ;FILL COM
BLO
  1837                          ;
  1838                          ;
  1839                          ; *** UNIT/HEAD ***
  1840                          ;     *********
  1841                          ;
  1842                          ;
  1843 0879 23                          INC     HL                      ;NEXT COMBLO
  1844 087A FD 46 03                    LD      B,(IY+3)                ;GET UNIT
  1845 087D FD 7E 06                    LD      A,(IY+6)                ;GET HEAD
  1846 0880 80                          OR      B                       ;COMBINE WITH UNI
T
  1847 0881 77                          LD      (HL),A                  ;FILL COMBLO
  1848                          ;
  1849                          ;
  1850                          ; *** N ***
  1851                          ;     *
  1852                          ;
  1853                          ;
  1854 0882 23                          INC     HL      ;NEXT COMBLO
  1855 0883 36 02                       LD      (HL),002H               ;FILL COMBLO FOR
DOUBLE
  1856                          ;
  1857                          ;
  1858                          ; *** SC ***
  1859                          ;     **
  1860                          ;
  1861                          ;
  1862 0885 23                          INC     HL                      ;NEXT COMBLO
  1863 0886 36 08                       LD      (HL),FDCEOT             ;FILL COMBLO
  1864                          ;
  1865                          ;
  1866                          ; *** GPL ***
  1867                          ;     ***
  1868                          ;
  1869                          ;
  1870 0888 23                          INC     HL                      ;NEXT COMBLO
  1871 0889 36 50                       LD      (HL),050H               ;FILL COMBLO FOR
DOUBLE
  1872                          ;
  1873                          ;
  1874                          ; *** D ***
  1875                          ;
  1876                          ;
  1877 088B 23                          INC     HL                      ;NEXT COMBLO
  1878 088C 36 E5                       LD      (HL),0E5H               ;FILL COMBLO
  1879 088E CD 44 09                    CALL    SEEK1
  1880 0891 CD 92 09                    CALL    DMA1                    ;ACTIVATE DMA
  1881 0894 06 06                       LD      B,006H
  1882 0896 CD 11 09                    CALL    SENDB1                  ;SEND BYTES TO FD
C
  1883 0899 06 07                       LD      B,007H
  1884 089B CD 28 09                    CALL    GETBY1                  ;GET STATUS-BYTES
  1885 089E C9                          RET
  1886
```

```
  1890                          ;***********************************************
**********************
  1891                          ;
  1892                          ;       READ A TRACK
  1893                          ;
  1894                          ;***********************************************
**********************
  1895                          ;
  1896                          ;
  1897                          ;
  1898                          ;
  1899 089F CD CC 08            READTR: CALL    FUBLK
  1900                          ;
  1901                          ;
  1902                          ; *** ACTIVATE DMA ***
  1903                          ;     ************
  1904                          ;
  1905                          ;
  1906 08A2 2A 02 F8                    LD      HL,(PARADR)
  1907 08A5 3E 47                       LD      A,01000111B     ;WRITE MEMORY
  1908 08A7 D3 2B .                     OUT     (DMAMO),A       ;OUT MODE
  1909 08A9 11 08 00                    LD      DE,ALPARA
  1910 08AC 19                          ADD     HL,DE
  1911 08AD 7E                          LD      A,(HL)
  1912 08AE D3 26                       OUT     (C3AD),A
  1913 08B0 23                          INC     HL
  1914 08B1 7E                          LD      A,(HL)
  1915 08B2 D3 26                       OUT     (C3AD),A
  1916 08B4 3E FF                       LD      A,0FFH
  1917 08B6 D3 27                       OUT     (C3TC),A
  1918 08B8 3E 0F                       LD      A,0FH
  1919 08BA D3 27                       OUT     (C3TC),A
  1920 08BC 3E 03                       LD      A,3
  1921 08BE D3 2A                       OUT     (DMAMB),A       ;ENABLE CH 0
  1922 08C0 06 09                       LD      B,09
  1923 08C2 CD 11 09                    CALL    SENDB1          ;SEND BYTES TO FD
C
  1924 08C5 06 07                       LD      B,07
  1925 08C7 CD 2B 09                    CALL    GETBY1          ;GET BYTES FROM F
DC
  1926 08CA C9                          RET
  1927                          ;
  1928                          ;
  1929                          ;***********************************************
**********************
  1930                          ;
  1931                          ;   SENSE DRIVE STATUS
  1932                          ;
  1933                          ;***********************************************
**********************
  1934                          ;
  1935                          ;
  1936 08CB C9                  DRIVES  RET
  1937                          ;
```

```
  1941                          ;***********************************************
**********************
  1942                          ;
  1943                          ;       FUNCTION-BLOCK
  1944                          ;
  1945                          ;***********************************************
**********************
  1946                          ;
  1947                          ;
  1948                          ;       PREPARE FUNCTION-BLOCK FOR FDC (8272)
  1949                          ;
  1950 08CC FD 2A 02 F8         FUBLK:  LD      IY,(PARADR)
  1951 08D0 21 17 F8                    LD      HL,COMBLO
  1952 08D3 FD 7E 00                    LD      A,(IY+0)        ;GET FUNCTION
  1953 08D6 77                          LD      (HL),A          ;FILL COMBLO
  1954                          ;
  1955                          ; *** UNIT/HEAD ***
  1956                          ;     *********
  1957                          ;
  1958                          ;
  1959 08D7 23                          INC     HL              ;NEXT COMBLO-ADR.
  1960 08D8 FD 46 03                    LD      B,(IY+3)        ;GET UNIT
  1961 08DB FD 7E 06                    LD      A,(IY+6)        ;GET HEAD
  1962 08DE B0                          OR      B               ;COMBINE WITH UNI
T
  1963 08DF 77                          LD      (HL),A          ;FILL COMBLO
  1964                          ;
  1965                          ;
  1966                          ; *** C ***
  1967                          ;     *
  1968                          ;
  1969                          ;
  1970 08E0 23                          INC     HL              ;NEXT COMBLO-ADR.
  1971 08E1 FD 7E 04                    LD      A,(IY+4)        ;GET CYLINDER
  1972 08E4 77                          LD      (HL),A          ;FILL COMBLO
  1973                          ;
  1974                          ;
  1975                          ; *** H ***
  1976                          ;     *
  1977                          ;
  1978                          ;
  1979 08E5 23                          INC     HL              ;NEXT COMBLO-ADR
  1980 08E6 FD 7E 06                    LD      A,(IY+6)        ;GET HEAD
  1981 08E9 0F                          RRCA
  1982 08EA 0F                          RRCA
  1983 08EB 77                          LD      (HL),A          ;FILL COMBLO
  1984                          ;
  1985                          ;
  1986                          ; *** R ***
  1987                          ;     *
  1988                          ;
  1989                          ;
  1990 08EC 23                          INC     HL              ;NEXT COMBLO-ADR.
  1991 08ED FD 7E 05                    LD      A,(IY+5)        ;GET SECTOR
  1992 08F0 77                          LD      (HL),A          ;FILL COMBLO
  1993                          ;
  1994                          ;
  1995                          ; *** N ***
  1996                          ;     *
  1997                          ;
  1998 08F1 23                          INC     HL              ;NEXT COMBLO-ADR.
  1999 08F2 36 02                       LD      (HL),002H       ;FILL COMBLO FOR
DOUBLE
  2000                          ;
  2001                          ;
  2002                          ; *** EOT ***
```

```
2003                            ;       ***
2004                            ;
2005                            ;
2006 08F4 23                    LL157   INC     HL              ;NEXT COMBLO-ADR.
2007 08F5 36 08                         LD      (HL),FDCEOT     ;FILLCOMBLO
2008                            ;
2009                            ;
2010                            ; *** GPL/DTL ***
2011                            ;       *******
2012                            ;
2013                            ;
2014 08F7 23                            INC     HL              ;NEXT COMBLO-ADR.
2015 08F8 36 2A                         LD      (HL),02AH       ;GPL FOR DOUBLE
2016 08FA 23                            INC     HL
2017 08FB 36 FF                         LD      (HL),0FFH       ;DTL FOR DOUBLE
2018 08FD CD 44 09                      CALL    SEEK1           ;SEEK TRACK
2019 0900 C9                            RET
2020                            ;
```

```
  2023                          ;***********************************************
**********************
  2024                          ;
  2025                          ;  SEND COMMAND-BYTES TO FDC
  2026                          ;  B = NUMBER OF BYTES TO SEND
  2027                          ;
  2028                          ;***********************************************
**********************
  2029                          ;
  2030                          ;
  2031 0901 CD 38 09            SENBY1: CALL    DMON            ;SWITCH DISK-MOTO
R ON
  2032 0904 21 17 F8                    LD      HL,COMBLO
  2033 0907 CD 71 09            LL175   CALL    FDCRD1          ;WAIT UNTIL READY
  2034 090A 7E                          LD      A,(HL)
  2035 090B D3 51                       OUT     (FDCWR),A       ;SEND BYTE TO FDC
  2036 090D 23                          INC     HL
  2037 090E 10 F7                       DJNZ    LL175
  2038 0910 C9                          RET
  2039                          ;
  2040                          ;
  2041                          ;***********************************************
**********************
  2042                          ;
  2043                          ;  SEND COMMAND-BYTES TO FDC WITH DMA REQUIRED
  2044                          ;  B = NUMBER OF BYTES TO SEND
  2045                          ;
  2046                          ;***********************************************
**********************
  2047                          ;
  2048                          ;
  2049 0911 CD 38 09            SENDB1: CALL    DMON            ;SWITCH DISK-MOTO
R ON
  2050 0914 21 17 F8                    LD      HL,COMBLO
  2051 0917 05                          DEC     B
  2052 0918 CD 71 09            LL177   CALL    FDCRD1          ;WAIT UNTIL READY
  2053 091B 7E                          LD      A,(HL)
  2054 091C D3 51                       OUT     (FDCWR),A       ;SEND BYTE TO FDC
  2055 091E 23                          INC     HL
  2056 091F 10 F7                       DJNZ    LL177
  2057 0921 CD 71 09                    CALL    FDCRD1
  2058 0924 7E                          LD      A,(HL)
  2059 0925 D3 51                       OUT     (FDCWR),A       ;SEND LAST BYTE
  2060 0927 CD E5 09                    CALL    DMA01
  2061 092A C9                          RET
  2062
```

```
  2066                          ;***********************************************
**********************
  2067                          ;
  2068                          ;  GET STATUS BYTES FROM FDC
  2069                          ;  B = NUMBER OF BYTES
  2070                          ;
  2071                          ;***********************************************
**********************
  2072                          ;
  2073                          ;
  2074 092B 2A 04 F8           GETBY1  LD      HL,(RESADR)     ;GET RESULT-BLOCK
-ADR.
  2075 092E CD 7C 09           LL179   CALL    FDCRD2
  2076 0931 DB 51                      IN      A,(FDCRA)       ;READ STATUS
  2077 0933 77                         LD      (HL),A          ;SAVE RESULT-BLOC
K
  2078 0934 23                         INC     HL
  2079 0935 10 F7                      DJNZ    LL179
  2080 0937 C9                         RET
  2081                          ;
  2082                          ;
  2083                          ;
  2084                          ;***********************************************
**********************
  2085                          ;
  2086                          ;       *** DISC-MOTOR-ON ***
  2087                          ;
  2088                          ;***********************************************
**********************
  2089                          ;
  2090                          ;
  2091 0938 DB 13               DMON:   IN      A,(SYSSTA)      ;TEST IF MOTOR ON
  2092 093A 1F                          RRA
  2093 093B D3 14                       OUT     (MON),A         ;SWITCH DISK MOTO
R ON
  2094 093D D0                          RET     NC              ;RETURN IF MOTOR
IS ALREADY ON
  2095 093E 16 0A                       LD      D,10            ;WAIT 1 SEC
  2096 0940 CD 95 0A                    CALL    TIM100
  2097 0943 C9                          RET
  2098                          ;
  2099                          ;
  2100                          ;
  2101                          ;***********************************************
**********************
  2102                          ;
  2103                          ;   SEEK SPECIFIED TRACK
  2104                          ;
  2105                          ;***********************************************
**********************
  2106                          ;
  2107                          ;
  2108 0944 CD 71 09            SEEK1   CALL    FDCRD1
  2109 0947 3E 0F                       LD      A,FDCSEE
  2110 0949 D3 51                       OUT     (FDCWR),A       ;SEND COMMAND
  2111 094B 11 03 00                    LD      DE,UPARAM
  2112 094E 2A 02 F8                    LD      HL,(PARADR)
  2113 0951 19                          ADD     HL,DE
  2114 0952 CD 71 09                    CALL    FDCRD1
  2115 0955 7E                          LD      A,(HL)  ;GET UNIT
  2116 0956 D3 51                       OUT     (FDCWR),A       ;SEND UNIT
  2117 0958 23                          INC     HL
  2118 0959 CD 71 09                    CALL    FDCRD1
  2119 095C 7E                          LD      A,(HL)  ;GET TRACK
  2120 095D D3 51                       OUT     (FDCWR),A       ;SEND TRACK
  2121 095F CD 87 09                    CALL    FDCIN1  ;WAIT FOR INTERRUPT
  2122 0962 3E 08                       LD      A,FDCSIS
  2123 0964 D3 51                       OUT     (FDCWR),A       ;SEND COMMAND
  2124 0966 CD 7C 09                    CALL    FDCRD2
  2125 0969 DB 51                       IN      A,(FDCRA)       ;GET STATUS
  2126 096B CD 7C 09                    CALL    FDCRD2
  2127 096E DB 51                       IN      A,(FDCRA)
  2128 0970 C9                          RET
  2129                          ;
```

```
  2133                          ;***********************************************
**********************
  2134                          ;
  2135                          ;  WAIT UNTIL FDC IS READY TO BE WRITE
  2136                          ;
  2137                          ;***********************************************
**********************
  2138                          ;
  2139                          ;
  2140 0971 DB 50               FDCRD1: IN      A,(FDCST)       ;GET MAINSTATUS
  2141 0973 17                          RLA
  2142 0974 D2 71 09                    JP      NC,FDCRD1       ;JUMP IF NOT READ
Y
  2143 0977 17                          RLA
  2144 0978 DA 71 09                    JP      C,FDCRD1        ;JUMP IF FDC WANT
 NO INFO
  2145 097B C9                          RET
  2146                          ;
  2147                          ;
  2148                          ;***********************************************
**********************
  2149                          ;
  2150                          ;       WAIT UNTIL FDC IS READY TO BE READ
  2151                          ;
  2152                          ;***********************************************
**********************
  2153                          ;
  2154                          ;
  2155 097C DB 50               FDCRD2: IN      A,(FDCST)       ;GET MAINSTATUS
  2156 097E 17                          RLA                     ;TEST IF FDC IS R
EADY TO BE READ
  2157 097F D2 7C 09                    JP      NC,FDCRD2
  2158 0982 17                          RLA
  2159 0983 D2 7C 09                    JP      NC,FDCRD2
  2160 0986 C9                          RET
  2161                          ;
  2162                          ;
  2163                          ;***********************************************
**********************
  2164                          ;
  2165                          ;  WAIT UNTIL FDC HAS BEEN INTERRUPTED
  2166                          ;
  2167                          ;***********************************************
**********************
  2168                          ;
  2169                          ;
  2170 0987 DB 13               FDCIN1  IN      A,(SYSSTA)      ;GET SYSTEM-STATU
S
  2171 0989 E6 08                       AND     FDCIN   ;MASK FOR FDC-INT
  2172 098B CA 87 09                    JP      Z,FDCIN1                ;IF INTRR
UPT
  2173 098E CD 71 09            FDC1:   CALL    FDCRD1
  2174 0991 C9                          RET
  2175                          ;
  2176                          ;
```

```
  2180                          ;***********************************************
**********************
  2181                          ;
  2182                          ;  ACTIVATE DMA-CHANNEL 0 FOR FLEX
  2183                          ;
  2184                          ;***********************************************
**********************
  2185                          ;
  2186                          ;
  2187 003F                     DMAID   EQU 3FH   ;64 BYTES OF ID'S FOR 16 SECTOR
S
  2188 007F                     DMADAS  EQU 7FH   ;128 BYTES FOR SINGLE
  2189 00FF                     DMADAD  EQU 0FFH   ;256 BYTES FOR DOUBLE
  2190                          ;
  2191                          ;
  2192                          ;
  2193 0992 2A 02 F8            DMA1    LD      HL,(PARADR)
  2194 0995 7E                          LD      A,(HL)
  2195 0996 1F                          RRA
  2196 0997 DA 9F 09                    JP      C,LL184 ;JUMP IF WRITE-FUNCTION
  2197 099A 06 04                       LD      B,004H  ;WRITE MEMORY
  2198 099C C3 A1 09                    JP      LL185
  2199 099F 06 08               LL184   LD      B,008H  ;READ MEMORY
  2200 09A1 3E 43               LL185   LD      A,043H
  2201 09A3 B0                          OR      B
  2202 09A4 D3 28                       OUT     (DMAMO),A       ;OUT MODE
  2203 09A6 11 08 00                    LD      DE,ALPARA
  2204 09A9 19                          ADD     HL,DE
  2205 09AA 7E                          LD      A,(HL)
  2206 09AB D3 26                       OUT     (C3AD),A
  2207 09AD 23                          INC     HL
  2208 09AE 7E                          LD      A,(HL)
  2209 09AF D3 26                       OUT     (C3AD),A
  2210 09B1 2A 02 F8                    LD      HL,(PARADR)
  2211 09B4 7E                          LD      A,(HL)
  2212 09B5 E6 0F                       AND     00FH
  2213 09B7 FE 0D                       CP      00DH
  2214 09B9 C2 C3 09                    JP      NZ,LL186        ;JUMP IF NOT FORM
AT
  2215 09BC 3E 3F                       LD      A,DMAID
  2216 09BE D3 27                       OUT     (C3TC),A        ;64 BYTES
  2217 09C0 C3 DD 09                    JP      LL188
  2218 09C3 11 07 00            LL186   LD      DE,DPARAM
  2219 09C6 2A 02 F8                    LD      HL,(PARADR)
  2220 09C9 19                          ADD     HL,DE
  2221 09CA 7E                          LD      A,(HL)  ;GET DENSITY
  2222 09CB FE 00                       CP      000H
  2223 09CD CA D9 09                    JP      Z,LL187 ;JUMP IF SINGLE
  2224 09D0 3E FF                       LD      A,DMADAD
  2225 09D2 D3 27                       OUT     (C3TC),A        ;SET 512 BYTES
  2226 09D4 3E 01                       LD      A,01
  2227 09D6 C3 DE 09                    JP      LL1881
  2228 09D9 3E 7F               LL187   LD      A,DMADAS
  2229 09DB D3 27                       OUT     (C3TC),A        ;128 BYTES
  2230 09DD AF                  LL188   XOR     A
  2231 09DE D3 27               LL1881: OUT     (C3TC),A
  2232 09E0 3E 03                       LD      A,3
  2233 09E2 D3 2A                       OUT     (DMAMB),A       ;ENABLE CHANNEL 0
  2234 09E4 C9                          RET
  2235                          ;
  2236                          ;
  2237                          ;
  2238 09E5 DB 50               DMA01   IN      A,(FDCST)
  2239 09E7 17                          RLA
  2240 09E8 DA F2 09                    JP      C,LL190 ;JUMP IF MASTER REQUEST
  2241 09EB DB 28                       IN      A,(DMAST)
  2242 09ED E6 08                       AND     008H
  2243 09EF CA E5 09                    JP      Z,DMA01 ;JUMP IF NO TC
  2244 09F2 D3 12               LL190   OUT     (SETTC),A
  2245 09F4 3E 07                       LD      A,007H
  2246 09F6 D3 2A                       OUT     (DMAMB),A       ;DISABLE CHANNEL
0
  2247 09F8 DB 50               LL191   IN      A,(FDCST)
  2248 09FA 17                          RLA
  2249 09FB D8                          RET     C
  2250 09FC C3 F8 09                    JP      LL191
  2251                          ;
```

```
  2253                          ;*********************************************
**********************
  2254                          ;
  2255                          ;  DISPLAY STATUS BYTES ON CRT
  2256                          ;
  2257                          ;*********************************************
**********************
  2258                          ;
  2259                          ;
  2260                          ; *** FLEX DRIVER FOR 5 1/4 " ***
  2261                          ;     **********************
  2262                          ;
  2263                          ;
  2264 F802                     PARADR  EQU 0F802H    ;ADR OF PARAMETER BLOCK
  2265 F804                     RESADR  EQU 0F804H    ;ADR OF RESULT BLOCK
  2266 F806                     PARAME  EQU 0F806H    ;PARAMETER BLOCK
  2267 F810                     RESULT  EQU 0F810H    ;RESULT BLOCK
  2268 F817                     COMBLO  EQU 0F817H    ;COMAND BLOCK
  2269 F820                     RETRY   EQU 0F820H    ;RETRY COUNTER
  2270                          ;
  2271 0030                     CRTBUL  EQU 30H
  2272 00F8                     CRTBUH  EQU 0F8H
  2273                          ;
  2274                          ;  LOCATION IS CURSOR POSITION
  2275                          ;  STATUS BYTES ARE IN RESULT-
  2276                          ;  BLOCK B=STATUS BYTE-COUNTER
  2277                          ;
  2278                          ;
  2279 09FF 3E 17               DISSTA  LD      A,017H
  2280 0A01 32 01 F8                    LD      (CURSY),A
  2281 0A04 AF                          XOR     A
  2282 0A05 32 00 F8                    LD      (CURSX),A
  2283 0A08 21 52 0A                    LD      HL,DIERRM
  2284 0A0B 06 0C                       LD      B,12
  2285 0A0D 7E                  LL117   LD      A,(HL)
  2286 0A0E CD 24 01                    CALL    MODCRT  ;SEND CHARACTER TO CRT
  2287 0A11 23                          INC     HL
  2288 0A12 05                          DEC     B
  2289 0A13 C2 0D 0A                    JP      NZ,LL117
  2290 0A16 06 07                       LD      B,007H
  2291 0A18 2A 04 F8                    LD      HL,(RESADR)     ;ADR OF STATUS-BL
OCK
  2292 0A1B 7E                  LL118   LD      A,(HL)  ;GET STATUS
  2293 0A1C 1F                          RRA
  2294 0A1D 1F                          RRA
  2295 0A1E 1F                          RRA
  2296 0A1F 1F                          RRA
  2297 0A20 E6 0F                       AND     00FH
  2298 0A22 FE 0A                       CP      00AH
  2299 0A24 DA 2E 0A                    JP      C,LL119
  2300 0A27 D6 09                       SUB     009H
  2301 0A29 F6 40                       OR      040H
  2302 0A2B C3 30 0A                    JP      LL120
  2303 0A2E F6 30               LL119   OR      030H
  2304 0A30 CD 24 01            LL120   CALL    MODCRT
  2305 0A33 7E                          LD      A,(HL)
  2306 0A34 E6 0F                       AND     00FH
  2307 0A36 FE 0A                       CP      00AH
  2308 0A38 DA 42 0A                    JP      C,LL121
  2309 0A3B D6 09                       SUB     009H
  2310 0A3D F6 40                       OR      040H
  2311 0A3F C3 44 0A                    JP      LL122
  2312 0A42 F6 30               LL121   OR      030H
  2313 0A44 CD 24 01            LL122   CALL    MODCRT
  2314 0A47 3E 2E                       LD      A,02EH
  2315 0A49 CD 24 01                    CALL    MODCRT
  2316 0A4C 23                          INC     HL      ;NEXT STATUSADR.
  2317 0A4D 05                          DEC     B
  2318 0A4E C2 1B 0A                    JP      NZ,LL118        ;ALL STATUS DISPL
AYED ?
  2319 0A51 C9                          RET
  2320                          ;
  2321 0A52 44                  DIERRM  DEFB    'DISK ERROR
       0A53 49
       0A54 53
       0A55 4B
       0A56 20
       0A57 45
       0A58 52
       0A59 52
       0A5A 4F
       0A5B 52
       0A5C 20
       0A5D 20
  2322
```

```
  2326                          ;***********************************************
**********************
  2327                          ;
  2328                          ;       *** DISPLAY ROUTINE ***
  2329                          ;
  2330                          ;***********************************************
**********************
  2331                          ;
  2332                          ;
  2333 0A5E 46                  DISPL:  LD      B,(HL)
  2334 0A5F 23                          INC     HL
  2335 0A60 7E                          LD      A,(HL)
  2336 0A61 CD 24 01                    CALL    MODCRT
  2337 0A64 10 F9                       DJNZ    DISPL+1
  2338 0A66 23                          INC     HL
  2339 0A67 C9                          RET
  2340                          ;
  2341                          ;
```

```
                                ;***********************************************
                                ;***********************************************
                                ;
                                ;  SUBROUTINES
                                ;
                                ;***********************************************
                                ;***********************************************
                                ;
                                ;
                                ;
                                ;
                                ;
                                ;***********************************************
                                ;
                                ;   MULTIPLY ROUTINE
                                ;
                                ;***********************************************
                                ;
                                ;
                                ; CALLING ARGUMENTS :  <HL>= FIRST OPERAND
                                ;         <DE>= SECOND OPERAND
                                ;
                                ;
                                ; RETURN ARGUMENTS  :  <HL>= RESULT
                                ;
                                ;
                                ;
                                ;
0A68 C5                         MULT:   PUSH    BC
0A69 D5                                 PUSH    DE
0A6A EB                                 EX      DE,HL
0A6B 21 00 00                           LD      HL,0
0A6E 01 00 08                           LD      BC,800H
0A71 29                         MUL1:   ADD     HL,HL
0A72 D2 76 0A                           JP      NC,MUL2
0A75 0C                                 INC     C
0A76 07                         MUL2:   RLCA
0A77 D2 7F 0A                           JP      NC,MUL3
0A7A 19                                 ADD     HL,DE
0A7B D2 7F 0A                           JP      NC,MUL3
0A7E 0C                                 INC     C
0A7F 05                         MUL3:   DEC     B
0A80 C2 71 0A                           JP      NZ,MUL1
0A83 79                                 LD      A,C
0A84 B7                                 OR      A
0A85 D1                                 POP     DE
0A86 C1                                 POP     BC
0A87 C8                                 RET     Z
0A88 37                                 SCF
0A89 C9                                 RET
```

```
2398                    ;***********************************************
**********************
2399                    ;
2400                    ;   DOUBLE BYTE COMPARE
2401                    ;
2402                    ;***********************************************
**********************
2403                    ;
2404                    ;
2405                    ; COMPARES <DE> WITH <HL>
2406                    ; ANSWER RETURNS IN FLAGS :
2407                    ;
2408                    ;   CARRY ZERO
2409                    ;   ------------
2410                    ;             C   Z
2411                    ;
2412                    ; DE < HL     0   0
2413                    ; DE = HL     0   1
2414                    ; DE > HL     1   0
2415                    ;
2416                    ;
2417 0A8A 7C           COMPDH: LD      A,H
2418 0A8B BA                   CP      D
2419 0A8C D8                   RET     C
2420 0A8D C0                   RET     NZ
2421 0A8E 7D                   LD      A,L
2422 0A8F BB                   CP      E
2423 0A90 C9                   RET
2424                    ;
2425                    ;
2426 0A91 A7           SUBHD:  AND     A
2427 0A92 ED 52                SBC     HL,DE
2428 0A94 C9                   RET
2429                    ;
2430                    ;
2431                    ;
2432                    ;***********************************************
**********************
2433                    ;
2434                    ;  TIMER ROUTINE
2435                    ;
2436                    ;***********************************************
**********************
2437                    ;
2438                    ;
2439                    ; ENTRY CONDITION : <A> = MULTIPLIER OF 100MSEC I
F
2440                    ;     PROCESSOR-CLOCK-CYCLE = 325NSEC
2441                    ;
2442                    ;
2443                    ;
2444 0A95 C5           TIM100  PUSH    BC
2445 0A96 01 14 32     LL197   LD      BC,03214H
2446 0A99 0B           LL198   DEC     BC
2447 0A9A 78                   LD      A,B
2448 0A9B B1                   OR      C
2449 0A9C C2 99 0A             JP      NZ,LL198
2450 0A9F 15                   DEC     D
2451 0AA0 C2 96 0A             JP      NZ,LL197
2452 0AA3 C1                   POP     BC
2453 0AA4 C9                   RET
2454                    ;
```

```
  2458                          ;***********************************************
**********************
  2459                          ;
  2460                          ;       *** MONITOR-ROUTINEN ***
  2461                          ;
  2462                          ;***********************************************
**********************
  2463                          ;
  2464                          ;
  2465                          ;
  2466 A000                     BUFFER  EQU     0A000H          ;DISK READ BUFFER
  2467 5000                     BUFCON  EQU     5000H
  2468 5100                     BUFTRK  EQU     5100H
  2469 F600                     RETRY1  EQU     0F600H
  2470 F603                     RETRY2  EQU     0F603H
  2471                          ;
  2472                          ;
  2473                          ;
  2474                          ;
  2475                          ;
  2476 0AA5 DB 13               MONIT:  IN      A,(SYSSTA)
  2477 0AA7 E6 02                       AND     2
  2478 0AA9 CA 1B 05                    JP      Z,DIAG16        ;JUMP   TO 16 BIT
  2479 0AAC 3E 0C               MONI:   LD      A,SCRER
  2480 0AAE CD 24 01                    CALL    MODCRT          ;CLEAR SCREEN
  2481 0AB1 3E 21                       LD      A,33
  2482 0AB3 32 00 F8                    LD      (CURSX),A
  2483                          ;
  2484                                  IF      FARBE-1
  2485                                  LD      A,INVER
  2486                                  ENDIF
  2487                          ;
  2488                                  IF      FARBE
  2489 0AB6 3E 84                       LD      A,10000100B             ;RED OF Y
ELLOW
  2490                                  ENDIF
  2491                          ;
  2492 0AB8 32 0B F9                    LD      (INVFLG),A      ;MESSAGE INVERSE
  2493 0ABB 21 53 0D                    LD      HL,MESS
  2494 0ABE CD 5E 0A                    CALL    DISPL
  2495 0AC1 3E 24                       LD      A,36
  2496 0AC3 32 00 F8                    LD      (CURSX),A
  2497 0AC6 3E 01                       LD      A,01
  2498 0AC8 32 01 F8                    LD      (CURSY),A
  2499 0ACB 3E E8                       LD      A,0E8H
  2500 0ACD 32 0B F9                    LD      (INVFLG),A
  2501 0AD0 CD 5E 0A                    CALL    DISPL
  2502 0AD3 AF                          XOR     A
  2503 0AD4 32 00 F8                    LD      (CURSX),A
  2504 0AD7 3E 05                       LD      A,5
  2505 0AD9 32 01 F8                    LD      (CURSY),A
  2506 0ADC 16 05                       LD      D,5             ;DISPLAY-COUNTER
  2507                          ;
  2508 0ADE                     MONIT1:
  2509                                  IF      FARBE-1
  2510                                  LD      A,06H
  2511                                  ENDIF
  2512                          ;
  2513                                  COND    FARBE
  2514 0ADE 3E E6                       LD      A,11100110B
  2515                                  ENDC
  2516                          ;
  2517 0AE0 32 0B F9                    LD      (INVFLG),A
  2518 0AE3 CD 5E 0A                    CALL    DISPL
  2519 0AE6 3E E8                       LD      A,0E8H
  2520 0AE8 32 0B F9                    LD      (INVFLG),A
  2521 0AEB CD 5E 0A                    CALL    DISPL
  2522 0AEE 3E 88                       LD      A,NEWL
  2523 0AF0 CD 24 01                    CALL    MODCRT
  2524 0AF3 15                          DEC     D
  2525 0AF4 C2 DE 0A                    JP      NZ,MONIT1
  2526                          ;
  2527 0AF7 CD 13 01                    CALL    KEYINP
  2528 0AFA FE 31                       CP      '1'
  2529 0AFC CA 70 06                    JP      Z,STARTS        ;LOAD SYSTEM
  2530 0AFF FE 33                       CP      '3'
  2531 0B01 CA 0C 0B                    JP      Z,RS1           ;RESTORE DRIVE
  2532 0B04 FE 35                       CP      '5'
  2533 0B06 CA 2F 0B                    JP      Z,READD         ;READ SECTOR
  2534 0B09 C3 A5 0A                    JP      MONIT
  2535                          ;
  2536                          ;
```

```
2537                    ;*********************************************
**********************
2538                    ;
2539                    ;       RESTORE DRIVE
2540                    ;
2541                    ;*********************************************
**********************
2542                    ;
2543                    ;
2544 0B0C 3E 0C         RS1:    LD      A,SCRER         ;CLEAR SCREEN
2545 0B0E CD 24 01              CALL    MODCRT
2546 0B11 3E 0A                 LD      A,10
2547 0B13 32 01 F8              LD      (CURSY),A
2548 0B16 32 00 F8              LD      (CURSX),A
2549 0B19 21 BF 0D              LD      HL,TXI
2550 0B1C CD 5E 0A              CALL    DISPL
2551 0B1F CD 13 01              CALL    KEYINP
2552 0B22 D6 30                 SUB     30H
2553 0B24 FE 02                 CP      2
2554 0B26 D2 A5 0A              JP      NC,MONIT
2555 0B29 CD 16 06              CALL    REST
2556 0B2C C3 A5 0A              JP      MONIT
2557                    ;
2558                    ;
```

```
                                ;***********************************************
****************
                                ;
                                ;       READ SECTOR
                                ;
                                ;***********************************************
****************
                                ;
                                ;
0B2F 3E 0C              READD:  LD      A,SCRER
0B31 CD 24 01                   CALL    MODCRT
0B34 3E 1E                      LD      A,30
0B36 32 00 F8                   LD      (CURSX),A
0B39 21 AD 0D                   LD      HL,TX6
0B3C CD 5E 0A                   CALL    DISPL
0B3F 3E 05                      LD      A,5
0B41 32 01 F8                   LD      (CURSY),A
0B44 AF                         XOR     A
0B45 32 00 F8                   LD      (CURSX),A
                                ;
0B48 3E 40                      LD      A,40H           ;DOUBLE DENSITY
0B4A 32 0D F8                   LD      (PARAME+7),A
0B4D 3E 46                      LD      A,FDCRD
0B4F 32 06 F8                   LD      (PARAME),A
0B52 21 00 A0                   LD      HL,BUFFER
0B55 22 0E F8                   LD      (PARAME+8),HL
                                ;
0B58 21 E8 0D                   LD      HL,TX3
0B5B CD 5E 0A                   CALL    DISPL           ;GET SECTOR
0B5E CD 11 0C                   CALL    GET
0B61 32 0B F8                   LD      (PARAME+5),A
                                ;
0B64 DD 21 00 51                LD      IX,BUFTRK
0B68 3E 88                      LD      A,NEWL
0B6A CD 24 01                   CALL    MODCRT
0B6D 21 F6 0D                   LD      HL,TX4
0B70 CD 5E 0A                   CALL    DISPL
0B73 CD 11 0C                   CALL    GET             ;GET TRACK
0B76 32 0A F8                   LD      (PARAME+4),A
                                ;
0B79 3E 88                      LD      A,NEWL          ;GET HEAD
0B7B CD 24 01                   CALL    MODCRT
0B7E 21 04 0E                   LD      HL,TX5
0B81 CD 5E 0A                   CALL    DISPL
0B84 CD 13 01           GHD1:   CALL    KEYINP
0B87 CD 32 0C                   CALL    CHECKA
0B8A DA 84 0B                   JP      C,GHD1
0B8D FE 02                      CP      2
0B8F D2 84 0B                   JP      NC,GHD1
0B92 FE 00                      CP      0
0B94 CA 99 0B                   JP      Z,GHD2
0B97 3E 04                      LD      A,4
0B99 32 0C F8           GHD2:   LD      (PARAME+6),A
0B9C 78                         LD      A,B
0B9D CD 24 01                   CALL    MODCRT
                                ;
0BA0 3E 88                      LD      A,NEWL          ;GET UNIT
0BA2 CD 24 01                   CALL    MODCRT
0BA5 21 DA 0D                   LD      HL,TX2
0BA8 CD 5E 0A                   CALL    DISPL
0BAB CD 13 01           GU1:    CALL    KEYINP
0BAE CD 32 0C                   CALL    CHECKA
0BB1 DA AB 0B                   JP      C,GU1
0BB4 FE 02                      CP      2
0BB6 D2 AB 0B                   JP      NC,GU1
```

```
2625 0BB9 32 09 F8              LD      (PARAME+3),A
2626 0BBC 78                    LD      A,B
2627 0BBD CD 24 01              CALL    MODCRT
2628                            ;
2629 0BC0 3E 06                 LD      A,6
2630 0BC2 32 00 F6              LD      (RETRY1),A
2631 0BC5 32 03 F6              LD      (RETRY2),A
2632 0BC8 21 06 F8      RDD1:   LD      HL,PARAME
2633 0BCB 11 10 F8              LD      DE,RESULT
2634 0BCE CD A8 07              CALL    FDCDR1
2635                            ;
2636 0BD1 21 10 F8      RDD3:   LD      HL,RESULT
2637 0BD4 3A 00 F6              LD      A,(RETRY1)
2638 0BD7 3D                    DEC     A
2639 0BD8 32 00 F6              LD      (RETRY1),A
2640 0BDB 7E                    LD      A,(HL)
2641 0BDC E6 C0                 AND     0C0H            ;TEST IF ERROR
2642 0BDE CA 06 0C              JP      Z,RDD2          ;JUMP IF NO DISK-
ERROR
2643 0BE1 CD FF 09      RDD4:   CALL    DISSTA          ;DISPLAY ERROR
2644 0BE4 21 12 0E              LD      HL,TX7
2645 0BE7 CD 5E 0A              CALL    DISPL
2646 0BEA 3A 00 F6              LD      A,(RETRY1
2647 0BED C6 30                 ADD     A,30H
2648 0BEF CD 24 01              CALL    MODCRT
2649 0BF2 CD 13 01      RDD5:   CALL    KEYINP
2650 0BF5 FE 88                 CP      NEWL
2651 0BF7 C2 F2 0B              JP      NZ,RDD5
2652 0BFA 3A 00 F6              LD      A,(RETRY1)
2653 0BFD 06 00                 LD      B,0
2654 0BFF B8                    CP      B
2655 0C00 C2 C8 0B              JP      NZ,RDD1
2656 0C03 C3 A5 0A              JP      MONIT
2657                            ;
2658 0C06 23            RDD2:   INC     HL
2659 0C07 7E                    LD      A,(HL)
2660 0C08 2B                    DEC     HL
2661 0C09 E6 24                 AND     24H             ;TEST IF NO DATA
2662 0C0B CA 55 0C              JP      Z,DIDI          ;JUMP IF READ O.K

2663 0C0E C3 E1 0B              JP      RDD4
2664                            ;
2665                            ;
2666                            ;
2667 0C11 21 00 50      GET:    LD      HL,BUFCON
2668 0C14 16 02                 LD      D,2
2669 0C16 CD 13 01      GET2:   CALL    KEYINP
2670 0C19 CD 32 0C              CALL    CHECKA
2671 0C1C DA 16 0C              JP      C,GET2
2672 0C1F 77                    LD      (HL),A
2673 0C20 78                    LD      A,B
2674 0C21 DD 77 00              LD      (IX+0),A
2675 0C24 DD 23                 INC     IX
2676 0C26 CD 24 01              CALL    MODCRT
2677 0C29 23                    INC     HL
2678 0C2A 15                    DEC     D
2679 0C2B C2 16 0C              JP      NZ,GET2
2680 0C2E CD 40 0C              CALL    CONVER
2681 0C31 C9                    RET
2682                            ;
2683                            ;
2684 0C32 47            CHECKA: LD      B,A
2685 0C33 FE 30                 CP      30H
2686 0C35 D8                    RET     C
2687 0C36 FE 3A                 CP      3AH
2688 0C38 DA 3D 0C              JP      C,CHECKB
2689 0C3B 37                    SCF
2690 0C3C C9                    RET
2691 0C3D E6 0F         CHECKB: AND     0FH
2692 0C3F C9                    RET
2693                            ;
2694                            ;
2695 0C40 21 00 50      CONVER: LD      HL,BUFCON
2696 0C43 7E                    LD      A,(HL)
2697 0C44 47                    LD      B,A
2698 0C45 FE 00                 CP      0
2699 0C47 3E 00                 LD      A,0
2700 0C49 CA 52 0C              JP      Z,C1
2701 0C4C C6 0A         C2:     ADD     A,10
2702 0C4E 05                    DEC     B
2703 0C4F C2 4C 0C              JP      NZ,C2
2704 0C52 23            C1:     INC     HL
2705 0C53 86                    ADD     A,(HL)
2706 0C54 C9                    RET
2707                            ;
2708                            ;
2709                            ;
```

```
2714                    ;***********************************************

2715                    ;
2716                    ;       DISPLAY A SECTOR
2717                    ;
2718                    ;***********************************************
;
2719                    ;
2720                    ;
2721 0C55 21 00 A0     DIDI:   LD      HL,BUFFER
2722 0C58 CB 82                RES     0,D
2723                    ;
2724 0C5A E5           DIDIA:  PUSH    HL
2725 0C5B 3E 0C                LD      A,SCRER
2726 0C5D CD 24 01             CALL    MODCRT          ;ERASE CRT
2727                    ;
2728 0C60 21 41 0E             LD      HL,TXU
2729 0C63 CD 5E 0A             CALL    DISPL           ;DISPLAY UNIT NR.
2730 0C66 3A 09 F8             LD      A,(PARAME+3)
2731 0C69 CD 34 0D             CALL    CVOUT
2732 0C6C 21 4E 0E             LD      HL,TXH
2733 0C6F CD 5E 0A             CALL    DISPL           ;DISPLAY HEAD NR.
2734 0C72 3A 0C F8             LD      A,(PARAME+6)
2735 0C75 CD 34 0D             CALL    CVOUT
2736 0C78 21 5C 0E             LD      HL,TXT
2737 0C7B CD 5E 0A             CALL    DISPL           ;DISPLAY TRACK NR

2738 0C7E 3A 00 51             LD      A,(BUFTRK)
2739 0C81 CD 24 01             CALL    MODCRT
2740 0C84 3A 01 51             LD      A,(BUFTRK+1)
2741 0C87 CD 24 01             CALL    MODCRT
2742 0C8A 21 6B 0E             LD      HL,TXS
2743 0C8D CD 5E 0A             CALL    DISPL           ;DISPLAY SECTOR N
R.
2744 0C90 3A 0B F8             LD      A,(PARAME+5)
2745 0C93 CD 34 0D             CALL    CVOUT
2746 0C96 E1                   POP     HL
2747                    ;
2748 0C97 3E 88                LD      A,NEWL          ;CR,LF,LF
2749 0C99 CD 24 01             CALL    MODCRT
2750 0C9C 3E 88                LD      A,NEWL
2751 0C9E CD 24 01             CALL    MODCRT
2752 0CA1 3E 88                LD      A,NEWL
2753 0CA3 CD 24 01             CALL    MODCRT
2754                    ;
2755                    ;
2756 0CA6 7C           DIDI1:  LD      A,H
2757 0CA7 CD 34 0D             CALL    CVOUT           ;DISPLAY H.ORDER
ADDRESS
2758 0CAA 7D                   LD      A,L
2759 0CAB CD 34 0D             CALL    CVOUT           ;DISPLAY L.ORDER
ADDRESS
2760 0CAE 06 10                LD      B,10H
2761 0CB0 3E 20                LD      A,020H
2762 0CB2 CD 24 01             CALL    MODCRT          ;SPACE
2763                    ;
2764 0CB5 3E 20        DIDI2:  LD      A,020H
2765 0CB7 CD 24 01             CALL    MODCRT          ;SPACE
2766 0CBA 7E                   LD      A,(HL)
2767 0CBB CD 34 0D             CALL    CVOUT           ;DISPLAY A DATABY
TE (HEX)
2768 0CBE 23                   INC     HL
2769 0CBF 10 F4                DJNZ    DIDI2           ;LOOP UNTIL 16 BY
TES DISPLAYED
2770 0CC1 7D                   LD      A,L
2771 0CC2 D6 10                SUB     10H             ;RET TO ADDR. OF
FIRST BYTE OF LINE
2772 0CC4 6F                   LD      L,A
2773 0CC5 D2 C9 0C             JP      NC,DIDI7
2774 0CC8 25                   DEC     H
2775                    ;
2776 0CC9 06 10        DIDI7:  LD      B,10H
```

```
 2777 0CCB 3E 20                LD      A,020H
 2778 0CCD CD 24 01             CALL    MODCRT          ;SPACE
 2779 0CD0 3E 20                LD      A,020H
 2780 0CD2 CD 24 01             CALL    MODCRT          ;SPACE
 2781                           ;
 2782 0CD5 7E           DIDI3:  LD      A,(HL)
 2783 0CD6 FE 20                CP      20H
 2784 0CD8 DA E0 0C             JP      C,SUBST         ;JUMP IF <20H
 2785 0CDB FE 80                CP      80H
 2786 0CDD DA E2 0C             JP      C,VALID
 2787 0CE0 3E 2E        SUBST:  LD      A,2EH           ;SET DOT
 2788 0CE2 CD 24 01     VALID:  CALL    MODCRT          ;DISPLAY A ASCII
CHAR.
 2789 0CE5 23                   INC     HL
 2790 0CE6 10 ED                DJNZ    DIDI3           ;LOOP UNTIL 16 CH
AR. DISPLAYED
 2791 0CE8 3E 8B                LD      A,NEWL
 2792 0CEA CD 24 01             CALL    MODCRT          ;CR,LF
 2793                           ;
 2794 0CED CB 42                BIT     0,D
 2795 0CEF C2 15 0D             JP      NZ,DIDI5
 2796 0CF2 CB 44                BIT     0,H
 2797 0CF4 CA A6 0C             JP      Z,DIDI1
 2798 0CF7 CB C2                SET     0,D
 2799 0CF9 3E 18                LD      A,24
 2800 0CFB 32 01 F8             LD      (CURSY),A       ;CURSOR TO LINE 2
5
 2801 0CFE AF                   XOR     A
 2802 0CFF 32 00 F8             LD      (CURSX),A       ;CURSOR TO LEFT
 2803 0D02 E5                   PUSH    HL
 2804 0D03 21 1A 0E             LD      HL,TX10
 2805 0D06 CD 5E 0A             CALL    DISPL           ;DISPLAY TX10 MES
SAGE AT LAST LINE
 2806 0D09 E1                   POP     HL
 2807 0D0A CD 13 01     DIDI4:  CALL    KEYINP
 2808 0D0D FE 8B                CP      NEWL
 2809 0D0F C2 0A 0D             JP      NZ,DIDI4        ;WAIT UNTIL NL IS
 DEPRESSED
 2810 0D12 C3 5A 0C             JP      DIDIA
 2811                           ;
 2812 0D15 CB 4C        DIDI5:  BIT     1,H
 2813 0D17 CA A6 0C             JP      Z,DIDI1
 2814 0D1A 3E 18                LD      A,24
 2815 0D1C 32 01 F8             LD      (CURSY),A       ;CURSOR DOWN AND
LEFT
 2816 0D1F AF                   XOR     A
 2817 0D20 32 00 F8             LD      (CURSX),A
 2818 0D23 21 30 0E             LD      HL,TX11
 2819 0D26 CD 5E 0A             CALL    DISPL           ;DISPLAY TX11 MES
SAGE
 2820 0D29 CD 13 01     DIDI6:  CALL    KEYINP
 2821 0D2C FE 8B                CP      NEWL
 2822 0D2E C2 29 0D             JP      NZ,DIDI6        ;WAIT UNTIL NL IS
 DEPRESSED
 2823 0D31 C3 A5 0A             JP      MONIT
 2824                           ;
 2825                           ;
 2826                           ;
 2827                           ;       CONVERT HEX TO ASCII AND DISPLAY IT
 2828                           ;       **********************************
 2829                           ;
 2830 0D34 F5           CVOUT:  PUSH    AF
 2831 0D35 0F                   RRCA
 2832 0D36 0F                   RRCA
 2833 0D37 0F                   RRCA
 2834 0D38 0F                   RRCA                    ;UPPER 4BITS TO L
OWER POSIT.
 2835 0D39 E6 0F                AND     00FH            ;MASK OUT UPPER 4
 BITS
 2836 0D3B CD 4B 0D             CALL    HEASCI          ;CONVERT TO ASCI
 2837 0D3E CD 24 01             CALL    MODCRT          ;SEND TO CRT
 2838 0D41 F1                   POP     AF
 2839 0D42 E6 0F                AND     00FH
 2840 0D44 CD 4B 0D             CALL    HEASCI          ;CONVERT TO ASCII
 2841 0D47 CD 24 01             CALL    MODCRT          ;SEND TO CRT
 2842 0D4A C9                   RET
 2843                           ;
 2844 0D4B B7           HEASCI: OR      A
 2845 0D4C C6 90                ADD     A,090H
 2846 0D4E 27                   DAA
 2847 0D4F CE 40                ADC     A,040H
 2848 0D51 27                   DAA
 2849 0D52 C9                   RET
 2850                           ;
 2851                           ;
 2852                           ;
 2853                           ;
```

```
2855                                ;
2856                                ;
2857 0D53 0D                       MESS:   DEFB    13,' DM5 MONITOR
     0D54 20
     0D55 44
     0D56 4D
     0D57 35
     0D58 20
     0D59 4D
     0D5A 4F
     0D5B 4E
     0D5C 49
     0D5D 54
     0D5E 4F
     0D5F 52
     0D60 20
2858 0D61 06                               DEFB    6,'(V0.6)'
     0D62 28
     0D63 56
     0D64 30
     0D65 2E
     0D66 36
     0D67 29
2859 0D68 01                               DEFB    1,'1'
     0D69 31
2860 0D6A 0C                               DEFB    12,' LOAD SYSTEM'
     0D6B 20
     0D6C 4C
     0D6D 4F
     0D6E 41
     0D6F 44
     0D70 20
     0D71 53
     0D72 59
     0D73 53
     0D74 54
     0D75 45
     0D76 4D
2861 0D77 01                               DEFB    1,'2'
     0D78 32
2862 0D79 0C                               DEFB    12,' FORMAT DISK'
     0D7A 20
     0D7B 46
     0D7C 4F
     0D7D 52
     0D7E 4D
     0D7F 41
     0D80 54
     0D81 20
     0D82 44
     0D83 49
     0D84 53
     0D85 4B
2863 0D86 01                               DEFB    1,'3'
     0D87 33
2864 0D88 0D                               DEFB    13,' RESTORE DISK
     0D89 20
     0D8A 52
     0D8B 45
     0D8C 53
     0D8D 54
     0D8E 4F
     0D8F 52
     0D90 45
     0D91 20
     0D92 44
     0D93 49
     0D94 53
     0D95 4B
2865 0D96 01                               DEFB    1, 4'
     0D97 34
2866 0D98 12                               DEFB    18,' WRITE DISK-SECTOR'
     0D99 20
     0D9A 57
     0D9B 52
     0D9C 49
     0D9D 54
     0D9E 45
     0D9F 20
     0DA0 44
     0DA1 49
     0DA2 53
     0DA3 4B
     0DA4 2D
     0DA5 53
     0DA6 45
     0DA7 43
```

```
                0DA8 54
                0DA9 4F
                0DAA 52
2867            0DAB 01                 DEFB    1,'5'
                0DAC 35
2868            0DAD 11         TX6:    DEFB    17,' READ DISK-SECTOR'
                0DAE 20
                0DAF 52
                0DB0 45
                0DB1 41
                0DB2 44
                0DB3 20
                0DB4 44
                0DB5 49
                0DB6 53
                0DB7 4B
                0DB8 2D
                0DB9 53
                0DBA 45
                0DBB 43
                0DBC 54
                0DBD 4F
                0DBE 52
2869                            ;
2870            0DBF 1A         TX1:    DEFB    26, RESTORE DRIVE A(0) OR B(1)
                0DC0 52
                0DC1 45
                0DC2 53
                0DC3 54
                0DC4 4F
                0DC5 52
                0DC6 45
                0DC7 20
                0DC8 44
                0DC9 52
                0DCA 49
                0DCB 56
                0DCC 45
                0DCD 20
                0DCE 41
                0DCF 28
                0DD0 30
                0DD1 29
                0DD2 20
                0DD3 4F
                0DD4 52
                0DD5 20
                0DD6 42
                0DD7 28
                0DD8 31
                0DD9 29
2871            0DDA 0D         TX2:    DEFB    13, UNIT (0/1) :
                0DDB 55
                0DDC 4E
                0DDD 49
                0DDE 54
                0DDF 20
                0DE0 28
                0DE1 30
                0DE2 2F
                0DE3 31
                0DE4 29
                0DE5 20
                0DE6 3A
                0DE7 20
2872            0DE8 0D         TX3:    DEFB    13,'SECTOR 1-8 :
                0DE9 53
                0DEA 45
                0DEB 43
                0DEC 54
                0DED 4F
                0DEE 52
                0DEF 20
                0DF0 31
                0DF1 2D
                0DF2 38
                0DF3 20
                0DF4 3A
                0DF5 20
2873            0DF6 0D         TX4:    DEFB    13,'TRACK 0-39 :
                0DF7 54
                0DF8 52
                0DF9 41
                0DFA 43
                0DFB 4B
                0DFC 20
                0DFD 30
```

```
      0DFE 2D
      0DFF 33
      0E00 39
      0E01 20
      0E02 3A
      0E03 20
2874  0E04 0D                TX5:    DEFB    13,'HEAD (0/1) :
      0E05 48
      0E06 45
      0E07 41
      0E08 44
      0E09 20
      0E0A 28
      0E0B 30
      0E0C 2F
      0E0D 31
      0E0E 29
      0E0F 20
      0E10 3A
      0E11 20
2875  0E12 07                TX7:    DEFB    7,'  (CR)
      0E13 20
      0E14 20
      0E15 28
      0E16 43
      0E17 52
      0E18 29
      0E19 20
2876  0E1A 15                TX10:   DEFB    21,'HIT NL FOR NEXT PAGE
      0E1B 48
      0E1C 49
      0E1D 54
      0E1E 20
      0E1F 4E
      0E20 4C
      0E21 20
      0E22 46
      0E23 4F
      0E24 52
      0E25 20
      0E26 4E
      0E27 45
      0E28 58
      0E29 54
      0E2A 20
      0E2B 50
      0E2C 41
      0E2D 47
      0E2E 45
      0E2F 20
2877  0E30 10                TX11:   DEFB    16,'HIT NL FOR EXIT
      0E31 48
      0E32 49
      0E33 54
      0E34 20
      0E35 4E
      0E36 4C
      0E37 20
      0E38 46
      0E39 4F
      0E3A 52
      0E3B 20
      0E3C 45
      0E3D 58
      0E3E 49
      0E3F 54
      0E40 20
2878  0E41 0C                TXU:    DEFB    12,'DISK UNIT :
      0E42 44
      0E43 49
      0E44 53
      0E45 4B
      0E46 20
      0E47 55
      0E48 4E
      0E49 49
      0E4A 54
      0E4B 20
      0E4C 3A
      0E4D 20
2879  0E4E 0D                TXH:    DEFB    13,'  HEAD NO.:
      0E4F 20
      0E50 20
      0E51 20
      0E52 48
      0E53 45
      0E54 41
```

```
                0E55 44
                0E56 20
                0E57 4E
                0E58 4F
                0E59 2E
                0E5A 3A
                0E5B 20
    2880        0E5C 0E             TXT:    DEFB    14,'    TRACK NO.:
                0E5D 20
                0E5E 20
                0E5F 20
                0E60 54
                0E61 52
                0E62 41
                0E63 43
                0E64 4B
                0E65 20
                0E66 4E
                0E67 4F
                0E68 2E
                0E69 3A
                0E6A 20
    2881        0E6B 0F             TXS:    DEFB    15,'    SECTOR NO.:
                0E6C 20
                0E6D 20
                0E6E 20
                0E6F 53
                0E70 45
                0E71 43
                0E72 54
                0E73 4F
                0E74 52
                0E75 20
                0E76 4E
                0E77 4F
                0E78 2E
                0E79 3A
                0E7A 20
    2882                        :
```

```
                        ;***********************************************
**********************
                        ;
                        ;       VERSIONS-NUMBER
                        ;
                        ;***********************************************
**********************
                        ;
                        ;
                                ORG     1000H-9
                        ;
                                IF      FARBE-1
                        ;
VERSIO: DEFB    8,' M.05.01'
                        ;
                                ENDIF
                        ;
                                COND    FARBE
                        ;
VERSIO: DEFB    8,' C.05.01'
                        ;
                                ENDC
                        ;
                                END
```

ADD16	FE06	ADDB	FE02	ADWPR	0050	AHPARA	0009
AL	0190	ALPARA	0008	ANFDIA	2000	BADSTA	05D2
BB	0080	BEGIN	0100	BG	0040	BLINK	0002
BR	0020	BRUN	0571	BUFCON	5000	BUFFER	A000
BUFSTA	F830	BUFTRK	5100	COAD	0020	C1	0C52
C2	0C4C	C2AD	0024	C2TC	0025	C3AD	0026
C3TC	0027	CALCH1	01FB	CALCH2	01F4	CALCHR	01E5
CAR1	0152	CARRET	013F	CB16	FE04	CB8	FE00
CCHAR	004B	CDAD	F902	CEADH	F901	CEADL	F900
CHA1	0178	CHA2	018C	CHAMOD	0020	CHARA	0050
CHECK1	0742	CHECKA	0C32	CHECKB	0C3D	CHECKI	073D
CHP	0158	CHRRAM	FA00	CKDA10	04B7	CKDATR	04B6
CLRL	0220	CLRRA	03FB	COMBLO	F817	COMPDH	0A8A
CONVER	0C40	CRTBUH	00F8	CRTBUL	0030	CUHOM1	02B2
CURD	00E0	CURS	0049	CURSX	F800	CURSY	F801
CVOUT	0D34	DATRDY	0001	DBT1	0025	DBTEST	0042
DIA16	051E	DIACOM	00FF	DIAG16	051B	DIAGE	0556
DIASTK	F700	DIDI	0C55	DIDI1	0CA6	DIDI2	0CB5
DIDI3	0CD5	DIDI4	0D0A	DIDI5	0D15	DIDI6	0D29
DIDI7	0CC9	DIDIA	0C5A	DIERRM	0A52	DISPL	0A5E
DISSTA	09FF	DMA01	09E5	DMA1	0992	DMACOM	0028
DMADAD	00FF	DMADAS	007F	DMAERR	00FA	DMAEXC	0010
DMAFF	002C	DMAID	003F	DMAMB	002A	DMAMO	002B
DMAR	00A4	DMASEL	0020	DMAST	0028	DMATS	03C5
DMAW	0024	DMON	0938	DPARAM	0007	DRIVES	08CB
DRWALL	0000	DRWINP	0008	DRWRET	0010	DYNRAM	0004
ENDLD	0614	ENDLD2	060D	ERRDIS	0000	ERRDMA	03EE
FARBE	0001	FB	0010	FDC1	098E	FDCDR1	07AB
FDCEOT	0008	FDCERR	00DE	FDCFT	004D	FDCIN	0008
FDCIN1	0987	FDCRA	0051	FDCRD	0046	FDCRD1	0971
FDCRD2	097C	FDCRE	0007	FDCRID	004A	FDCSEE	000F
FDCSEL	0050	FDCSEN	0004	FDCSIS	0008	FDCSPE	0003
FDCST	0050	FDCWD	0045	FDCWR	0051	FG	0008
FIFEMP	0004	FIFO	00A1	FIFO10	04AD	FIFRDY	04AC
FIFULL	0002	FIGD	006C	FIGS	004C	FLEXTS	04FE
FPARAM	0000	FR	0004	FRTRK	0042	FUBLK	08CC
GCHRD	0068	GDCCOM	00A1	GDCERR	00BE	GDCINT	03F3
GDCPAR	00A0	GDCPAZ	00A2	GDCRES	0000	GDCSTA	00A0
GET	0C11	GET2	0C16	GETBY1	092B	GETRE	019C
GHD1	0B84	GHD2	0B99	GOODST	05B6	GRAMOD	0002
GRUN	0568	GU1	0BAB	HBP	000A	HEASCI	0D4B
HFP	0006	HOME	0001	HORETR	0040	HPARAM	0006
HSYNC	0007	IDENT1	0793	IDENT2	079A	IDENT3	07A1
INI10	02E8	INIT10	0415	INIT1A	0276	INIT20	048D
INITT1	04DE	INLRPF	0008	INPAR	04C0	INTLAC	0009
INTPAR	04D0	INVAL1	03A7	INVAL2	03AF	INVAL3	03B2
INVFLG	F90B	KEY1	037F	KEY2	038A	KEY3	0397
KEYCOM	0041	KEYDAT	0040	KEYERR	00F6	KEYINP	0113
KEYSTA	0041	KEYTST	0379	KYLOOK	011B	LEVELO	02FD
LIPDET	0080	LL117	0A0D	LL118	0A1B	LL119	0A2E
LL120	0A30	LL121	0A42	LL122	0A44	LL124	032C
LL125	0339	LL126	034F	LL127	0352	LL128	035F
LL140	0508	LL141	0625	LL157	08F4	LL175	0907
LL177	0918	LL179	092E	LL184	099F	LL185	09A1
LL186	09C3	LL187	09D9	LL188	09DD	LL1881	09DE
LL190	09F2	LL191	09F8	LL197	0A96	LL198	0A99
LP11	F905	LP12	F906	LP21	F909	LP22	F90A
LPARAM	0001	LPC	000A	LPRD	00C0	MASK	004A
MCLSCR	0213	MEMERR	00FC	MEMORY M	0000	MESN16	0762
MESS	0D53	MIXGAC	0000	MOCOMP	0001	MODCRT	0124
MON	0014	MONI	0AAC	MONIT	0AA5	MONIT1	0ADE
MOREPL	0000	MORES	0002	MOSET	0003	MUL1	0A71
MUL2	0A76	MUL3	0A7F	MULT	0A68	NC	0001
NEWL	0088	NEXT1	0375	NEXT2	03BF	NEXT5	04FA
NO16	0718	NOINTL	0000	NOMOV	0000	NOTRM	0659
NRWAPL	0050	OUTCMD	04A0	OUTPAR	04A6	OUTPAZ	049A
P16ERR	00EE	PARADR	F802	PARAME	F806	PHASE0	055E
PHASE1	057A	PHASE2	057D	PHMES	0596	PITCH	0047
PIXEL	0280	PRAM	0070	PRAMSA	0000	PRISEL	0060
PRJUMP	0580	PRMPAR	04D8	PROCCH	00D0	PROCHK	0305
PROERR	0000	PROGRA	058E	RAMEND	0000	RAMSEL	0010
RAMTOP	F10C	RAMTST	0323	RDAT	00A0	RDD1	0BC8
RDD2	0C06	RDD3	0BD1	RDD4	0BE1	RDD5	0BF2
RDDAT1	07F0	RDMST	0050	RDSID1	084C	REACCA	01D3
READD	0B2F	READTR	089F	RECAL1	0B01	RESADR	F804
RESMOP	0000	REST	0616	REST2	0648	REST3	0653
RESULT	F810	RETRY	F820	RETRY1	F600	RETRY2	F603
ROMADR	2006	ROMSEL	0011	ROWS	0018	RS1	0B0C
SB16	FE05	SB8	FE01	SCERA	0162	SCRER	000C
SCROFF	000C	SCROL1	02DA	SCROLM	0230	SCRON	000D
SEEK1	0944	SENBY1	0901	SENDB1	0911	SENPAR	04C6
SETCCA	01C1	SETCHA	0168	SETCR	0289	SETCU	02C2
SETMSK	02A4	SETTC	0012	SL2	0721	SL3	072D
SLMESS	074A	SLOAD	067E	SLOAD5	069A	SLOAD6	069E
SLOAD7	06CD	SLOAD8	06BD	SLOAD9	06D3	SLOADA	06E4
SLOADB	0702	SLOADC	071E	SLOADD	071E	SP1	F903

SP2	F907	SPARAM	0005	STACK	S 0000	START	006B
STARTS	0670	STATRM	0000	STK	F000	SUBHD	0A91
SUBST	0CE0	SUM1	0314	SUMCHK	0309	SUMERR	007E
SYNCOF	000E	SYNCON	000F	SYSSTA	0013	TIM0	0080
TIM1	0081	TIM100	0A95	TIM2	0082	TIMM0	0083
TPARAM	0004	TST16	05DE	TSTEND	0606	TX1	0DBF
TX10	0E1A	TX11	0E30	TX2	0DDA	TX3	0DE8
TX4	0DF6	TX5	0E04	TX6	0DAD	TX7	0E12
TXH	0E4E	TXS	0E6B	TXT	0E5C	TXU	0E41
TYHIBY	0018	TYLOBY	0010	TYWORD	0000	UPARAM	0003
VALID	0CE2	VBP	000F	VERETR	0020	VERSIO	0FF7
VFP	000A	VSYNC	0008	VSYNCM	006F	VSYNCS	006E
VV200	1000	VV205	F80D	VV206	F80E	VV207	F820
WDAT	0020	WDAT1	0002	WRDAT1	07DF	WRFOR1	0B6E
WRMCHR	01A1	ZOOM	0046				

KEYBOARD FIRMWARE
(VERSION 1)

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             000010 ;    ***********************************************
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                             000080 ;
                             000090 ;        ************************************
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                             000190 ;        *                                  *
                             000200 ;        ************************************
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             000290 ;          ************************
                             000300 ;          *                      *
                             000310 ;          * PERSONAL-COMP.-KEYBOARD*
                             000320 ;          *                      *
                             000330 ;          * ASCII ENCODED PLL/SER. *
                             000340 ;          *                      *
                             000350 ;          *       APRIL 83       *
                             000360 ;          *                      *
                             000370 ;          *    X-TAL= 6.00 MHZ   *
                             000380 ;          *                      *
                             000390 ;          ************************
                             000400 ;
                             000410 ;
                             000420 ;  REGISTER BANK 0             REGISTER BANK 1
                             000430 ;  -------------------         --------------------
                             000440 ;  R0...TEMPORARY STORAGE      R0...TEMPORARY STORAGE
                             000450 ;  R1...STATUS ARRAY POINTER   R1...TEMPORARY STORAGE
                             000460 ;  R2...TEMPORARY STORAGE      R2...ERRCNT(BELL MULTIPLIER)
                             000470 ;  R3...TABLE STORAGE          R3...XMIT BIT COUNTER
                             000480 ;  R4...REPEAT DELAY CTR       R4...BAUD CLOCK (BEEP CYCLES)
                             000490 ;  R5...QUEUE TAIL POINTER     R5...XMIT CHARACTER BUFFER
                             000500 ;  R6...QUEUE HEAD POINTER     R6...XMIT SHIFT REGISTER
                             000510 ;  R7...8 KEY STATUS           R7...SAVE ACC DURING INTRPTS
                             000520 ;
                             000530 ;  RAM: 26...3F  KEY STATUS 2 BITS/KEY  4 KEYS/BYTE
                             000540 ;               STATUS TURNAROUND 2 BITS LEFT FOR EACH KEY
                             000550 ;       10...17  QUEUE OF CODES TO BE SENT (FIFO)
                             000560 ;
                             000570 ;  TABLES: 300...36C MARKBIT-TABLE
                             000580 ;
                             000590 ;       360....3DB  ASCII CODE TABLE
                             000600 ;  FD  SERIAL KB TOGGLE
                             000610 ;
                             000620 ;  MARKBIT ASSIGNMENTS:
                             000630 ;  BIT 0...ö
                             000640 ;  BIT 1...ö
                             000650 ;  BIT 2... > EXCEPTION OFFSET
                             000660 ;  BIT 3...ö
                             000670 ;  BIT 4.../         SHIFKY(B7=1)
                             000680 ;  BIT 5...IGNORE SHIFT(B0..4,7=0)/CTLKY(B7=1)/
                             000690 ;        IF B0..4>0 EXCEPTION CODES UN-/SHIFT-FLAG DEPEND.
                             000700 ;  BIT 6...IGNORE CTRL-FLAG/LOCKKY(B7=1)/SPEZ.XLAT(B0..4>0)
                             000710 ;  BIT 7...FUNCTION KEY/NO AUTOREPEAT INDICATOR/SHF,CTL,LOCK-
                             000720 ;
                             000730 ; 80(FUNCTION KEYS F1...F20)    90(SHIFT KEYS) A0(CONTROL KEY
                             000740 ; C0(ALPHA LOCK KEY)  20(SHIFT COND.IGNORED) 40(CTRL.COND IGN
                             000750 ; 1...38 (SINGLE CODE EXCEPTIONS) 4X(SPECIAL EXCEPTIONS)
                             000760 ; 00 NO EXCEPTIONS,NORMAL CODE CALCULATION:
                             000770 ;   UNSHIFT CODE  EXORED BY SHIFT OR CONTROL FLAG,
                             000780 ;   SHIFT FLAG INVERTED FOR LETTER CODES DURING ALPHA LOCK ON
                             000790 ;   AND CONTROL FLAG OFF,
                             000800 ;   CONTROL MODE IGNORED FOR CHARACTERCODES < §
                             000810 ;   SHIFT- AND CONTROL-MODE COINCIDENCE DISABLED FOR ALL KEYS
```

```
ERR-C ADDR   OBJ-CD        PG-LIN LABEL   CMD   OPERAND          COMMENT

                           000830 ;  RB0  EQUATES
                           000840 ;  ------------
                           000850 ;
              0001         000860 STPTR   EQU   R1         ;STATUS POINTER
                           000870 ;             BIT 0=0  KEY UP AT LAST SCAN
                           000880 ;                  1  KEY DOWN AT LAST SCAN
                           000890 ;             AFTER CHECKING KEY DOWN BIT 6&7 ARE ROTATED TO
                           000900 ;
              0003         000910 TBLPTR  EQU   R3         ;POINTER TO R/C VALUE IN PAGE 3
              0004         000920 REPDLY  EQU   R4         ;REPEAT DELAY COUNTER FOR AUTO REPEA
              0005         000930 QTPTR   EQU   R5         ;QUEUE TAIL POINTER
              0006         000940 QHPTR   EQU   R6         ;QUEUE HEAD POINTER
              0007         000950 KYDWN   EQU   R7         ;8 KEY DOWN REGISTER
                           000960 ;             TIMES HOW LONG KEYS LOCKED OUT
                           000970 ;
                           000980 ;  RB1  EQUATES
                           000990 ;  ------------
                           001000 ;
              0002         001010 ERRCNT  EQU   R2         ;BEEP MULTIPLIER FOR LONG TONE(.5SEC
              0003         001020 BITCTR  EQU   R3         ;COUNTS SERIAL BITS SHIFTED OUT
              0004         001030 BDCLK   EQU   R4         ;BIT COUNTER FOR BAUD CLOCK
              0005         001040 CHARBF  EQU   R5         ;CHARACTERBUFFER FOR SERIAL OUTPUT
              0006         001050 SHFTRG  EQU   R6         ;SHIFT REGISTER
              0007         001060 ATEMP   EQU   R7         ;SAVE ACC DURING INTERRUPT
                           001070 ;
                           001080 ;  OTHERS
                           001090 ;  ------
                           001100 ;
              007E         001110 CAFLG   EQU   F1         ;CHARACTER AVAILABLE FLAG
              0060         001120 LONGDLY EQU   96
              0008         001130 REPRAT  EQU   8          ;APPROX. 11 HZ
              FFFD         001140 TMRCNT  EQU   -3
              0008         001150 DOUBLO  EQU   11         ;DOUBLE ZERO DISPLACEMENT
              0020         001160 STRAPS  EQU   32         ;STRAPPING INFO
              0021         001170 FLAGB   EQU   33         ;WP-,CTL-,SHIFT FLAGB
              0022         001180 LASTCD  EQU   34         ;INTERIM STORAGE CELL
              0023         001190 LASTKY  EQU   35         ;LAST KEY POSITION
              0010         001200 FIFO    EQU   16         ;FIFO STARTADDRESS
              0017         001210 FIFOEND EQU   23         ;LAST ADDRESS
              0024         001220 DECPOI  EQU   36         ;SOFTADDRESS OF DEC.POINT/COMMA
```

```
ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0000               001240          ORG   0
                          001250 ;
                          001260 ;  RESTART, INTERRUPT VECTORS
                          001270 ;
       0000               001280 RESTRT:
       0000   35          001290          DIS   TCNTI       ;DISABLE TIMER INTERRUPT
       0001   0484        001300          JMP   START       ;START KB SCAN
                          001310 ;
       0003               001320 INTRUPT:
       0003   D5          001330          SEL   RB1
       0004   AF          001340          MOV   ATEMP,A
       0005   042A        001350          JMP   INTRPT
                          001360 ;
                          001370 ;  TIMER INTERRUPT
                          001380 ;  ***************
                          001390 ;
                          001400 ;THIS INTERRUPT IS EVERY 240MYSEC(XTAL=6 MHZ) OR 4MSEC
                          001410 ; TMRCNT=3  IT SERVES TWO FUNCTIONS:
                          001420 ;
                          001430 ;       1) BEEP TONE GENERATION(240MYSEC)
                          001440 ;       2) EMPTY KB QUEUE  (4MS)
                          001450 ;
       0007               001460 TIMER:
       0007   05          001470          SEL   RB1
       0008   AF          001480          MOV   ATEMP,A     ;SAVE ACC
       0009   23CE        001490          MOV   A,#-50      ;4MS PAUSE
       000B   62          001500          MOV   T,A
                          001510 ;
                          001520 ; OUTPUT BAUD CLOCK TO PORT 26
                          001530 ;
       000C   FC          001540          MOV   A,BDCLK     ;ODD/EVEN COUNT TEST
       000D   F221        001550          JB7   $4
       000F   9617        001560          JNZ   $5          ;BEEP TONE IS SET
       0011   FA          001570          MOV   A,ERRCNT    ;TEST BEEP MULTIPLIER
       0012   C617        001580          JZ    $5          ;NO, CONTINUE NORMAL
       0014   CA          001590          DEC   ERRCNT      ;ELSE DECREMENT EERROR COUNTER
       0015   BC3C        001600          MOV   BDCLK,#60   ;SET COUNT OF CYCLES FOR BEEP
       0017               001610 $5:
       0017   0A          001620          IN    A,P2        ;LOAD BEEP CONDITION
       0018   D340        001630          XRL   A,#40H      ;SWAP PHASE
       001A   3A          001640          OUTL  P2,A
       001B   CC          001650          DEC   BDCLK
       001C               001660 $1:
       001C   23FD        001670          MOV   A,#TMRCNT   ;RELOAD TIMER REGISTER
       001E   62          001680          MOV   T,A
       001F   046B        001690          JMP   EXINT
       0021               001700 $4:
       0021   D63D        001710          JNIBF MTKB0       ;TEST ON BELL LATCH SET
       0023   22          001720          IN    A,DBB       ;RESET BELL LATCH
       0024   BA23        001730          MOV   ERRCNT,#35  ;SET MULTIPLIER
       0026   BC3C        001740          MOV   BDCLK,#60
       0028   041C        001750          JMP   $1
                          001760 ;
```

```
ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD   OPERAND          COMMENT

       002A               001780 INTRPT:                  ;IBF IS SET
       002A   B668        001790         JNIBF EXINT      ;IBF OFF BUT INT.REQUEST PENDING
       002C   22          001800         IN    A,DBB      ;CLEAR IBF
       002D   B82C        001810         MOV   R0,#44     ;SET DELAY COUNTER 300 USEC
       002F   E82F        001820         DJNZ  R0,$
       0031   063D        001830         JNIBF MTKBQ      ;THERE WAS NO 2ND POLL(WR/) SIGNAL
       0033   8820        001840         MOV   R0,#STRAPS ;LOAD LANGUAGE CODE
       0035   F0          001850         MOV   A,@R0
       0036   43E0        001860         ORL   A,#-32     ;SET UP UPPER BITS +ASSUME 6000 KB S
       0038   53EF        001870         ANL   A,#-17
       003A   A0          001880         MOV   CHARBF,A
       003B   046D        001890         JMP   SEND
                          001900 ;
                          001910 ; MTKBQ- EMPTY KEYBOARD QUEUE
                          001920 ; ----------------------
                          001930 ; LOOKS INTO QUEUE ONCE EVERY INTERRUPT.
                          001940 ; IF THERE IS A CODE, IT IS PUT INTO CHARBF
                          001950 ; THE CHARACTER AVAILABLE FLAG IS SET
                          001960 ; THE QUEUE POINTER IS UPDATED UNTIL EMPTY CONDITION
                          001970 ;
       003D               001980 MTKBQ:
       003D   8820        001990         MOV   R0,#STRAPS ;SELECT SERIAL INTERFACE
       003F   F0          002000         MOV   A,@R0
       0040   37          002010         CPL   A          ;INVERT INDICATOR
       0041   AB          002020         MOV   R3,A       ;SAVE FOR FURTHER USE
       0042   9246        002030         JB4   $+4        ;SKIP MASTER SLAVE IF RESPECTS
       0044   8668        002040         JOBF  EXINT      ;EXIT IF LAST KEY NOT YET FETCHED
       0046   8805        002050         MOV   R0,#QTPTR  ;ELSE LOOK INTO QUEUE TO FIND CODES
       0048   F0          002060         MOV   A,@R0      ; FOR TRANSMIT
       0049   18          002070         INC   R0
       004A   D0          002080         XRL   A,@R0      ; HEAD=TAIL MEANS EMPTY
       004B   C66B        002090         JZ    EXINT      ;FIFO EMPTY
                          002100 ;         ELSE GET A CODE FROM QUEUE
       004D   F0          002110         MOV   A,@R0      ;PUT POINTER INTO R1
       004E   A9          002120         MOV   R1,A
       004F   F1          002130         MOV   A,@R1      ;GET THE CODE
       0050   A0          002140         MOV   CHARBF,A   ;PUT INTO BUFFER
       0051   F0          002150         MOV   A,@R0      ;UPDATE HEAD POINTER
       0052   17          002160         INC   A
       0053   5317        002170         ANL   A,#17H     ;MAKE RING COUNTER
       0055   A0          002180         MOV   @R0,A      ;AND REPLACE
       0056               002190 $1:
       0056   F8          002200         MOV   A,R3       ;RELOAD STRAPINFO
       0057   F260        002210         JB7   SEND
       0059   18          002220         INC   R0         ;POINT TO FLAGB
       005A   F0          002230         MOV   A,@R0
       005B   F25F        002240         JB7   $3         ;IF TRUE THEN SKIP
       005D   8C3C        002250         MOV   BDCLK,#60  ;OTHERWISE INITIATE A BEEP
       005F               002260 $3:
       005F   F0          002270         MOV   A,CHARBF   ;LOAD CODE
       0060   D3E0        002280         XRL   A,#0E0H    ;INVERT UPPER 3 BITS
       0062   02          002290         OUT   DBB,A      ;AND OUTPUT TO BUS PORT
       0063   9ADF        002300         ANL   P2,#0DFH   ;SWITCH ON BUSDRIVER
       0065   9AEF        002310         ANL   P2,#0EFH   ;AND NOW SET STROBE ACTIVE
       0067   8A10        002320         ORL   P2,#16     ;SETOFF STROBE PULSE
```

```
ERR-C ADDR   OBJ-CD      PG-LIN  LABEL   CMD   OPERAND        COMMENT

      0069   8A20        002330          ORL   P2,#32     ;SET BUS TO TRISTATE
      006B               002340 EXINT:                    ;EXIT TIMER INTERRUPT
      006B   FF          002350          MOV   A,ATEMP
      006C   93          002360          RETR
                         002370 ;
      006D               002380 SEND:
      006D   B808        002390          MOV   BITCTR,#8  ;SET COUNTER FOR 8 BITS
      006F               002400 $1:
      006F   9A7F        002410          ANL   P2,#7FH    ;SET SYNCH BIT
      0071   1491        002420          CALL  CNTDWN+2   ;TIME IS 25 USEC
      0073   F0          002430          MOV   A,CHARBF
      0074   77          002440          RR    A          ;SEND LSB FIRST
      0075   A0          002450          MOV   CHARBF,A
      0076   F287        002460          JB7   $4         ;HOLD ON BIT
      0078   8A80        002470          ORL   P2,#80H    ;ELSE RESET IT
      007A               002480 $2:
      007A   1489        002490          CALL  BITIME     ;TIME IS NOW 80 USEC
      007C   8A80        002500          ORL   P2,#80H    ;RESET NOW UNCONDITIONAL
      007E   148D        002510          CALL  PAUSE      ;WAIT NOW 100 USEC
      0080   CB          002520          DEC   BITCTR
      0081   FB          002530          MOV   A,BITCTR
      0082   966F        002540          JNZ   $1         ;REPEAT 8 TIMES
      0084   22          002550          IN    A,DBB      ;CLEAR IBF FROM TRANSM.ACTIONS
      0085               002560 $3:
      0085   046B        002570          JMP   EXINT
                         002580 ;
      0087   047A        002590 $4:      JMP   $2         ;ROUTINE LENGTH EGALIZATION
                         002600 ;
      0089               002610 BITIME:
      0089   B808        002620          MOV   R0,#11
      008B   048F        002630          JMP   CNTDWN
                         002640 ;
      008D               002650 PAUSE:
      008D   B80E        002660          MOV   R0,#14
      008F               002670 CNTDWN:
      008F   E88F        002680          DJNZ  R0,$
      0091   83          002690          RET
                         002700 ;
      0092               002710 LDKBQ:                    ;LOAD A RECOGNIZED CODE INTO FIFO
                         002720 ;
      0092   23B3        002730          MOV   A,#0B3H    ;SELECT RESET CODE
      0094   DA          002740          XRL   A,R2
      0095   9698        002750          JNZ   $1
      0097   BD10        002760          MOV   @TPTR,#FIFO
      0099   BE10        002770          MOV   @HPTR,#FIFO          ;SET FIFO EMPTY
      009B               002780 $1:
      009B   F0          002790          MOV   A,@TPTR    ;TEST FOR PLACE
      009C   17          002800          INC   A
      009D   5317        002810          ANL   A,#17H     ;MASK MODULO 8
      009F   DE          002820          XRL   A,@HPTR    ;COMPARE WITH HEAD POINTER
      00A0   C6AB        002830          JZ    $2         ;FULL,IGNORE ENTRY AND INITIATE ERRT
                         002840 ;
      00A2   F0          002850          MOV   A,@TPTR    ;PUT POINTER INTO R0
      00A3   A8          002860          MOV   R0,A
      00A4   FA          002870          MOV   A,R2       ;GET CODE FOR FIFO
```

```
ERR-C  ADDR   OBJ-CD      PG-LIN  LABEL   CMD   OPERAND        COMMENT

       00A5   A0          002880          MOV   @R0,A
       00A6   FD          002890          MOV   A,@TPTR    ;UPDATE POINTER
       00A7   17          002900          INC   A
       00A8   5317        002910          ANL   A,#17H     ;MASK INTO FIFO AREA
       00AA   AD          002920          MOV   @TPTR,A
       00AB               002930 $2:
       00AB   83          002940          RET
                          002950 ;
       00AC               002960 N5P0:
       00AC   030C        002970          ADD   A,#12      ;SELECT F5..FF
       00AE   E6B2        002980          JNC   $+4
       00B0   441A        002990          JMP   TRANS-2
       00B2   2491        003000          JMP   N3
                          003010 ;
                          003020 ;***************INITIALIZE SCAN*****************
                          003030 ;
       00B4               003040 START:
       00B4   9ABF        003050          ANL   P2,#0BFH   ;PREPARE MATRIX READ STRAP INFO
                          003060 ;
                          003070 ;
       00B6   95          003080          CPL   F0         ;PRESET GOOD KB
       00B7   B83F        003090          MOV   R0,#63     ;SET RAM MSLOCATION
       00B9               003100 CLEAR:
       00B9   27          003110          CLR   A
       00BA   37          003120          CPL   A
       00BB   A0          003130          MOV   @R0,A
       00BC   00          003140          XRL   A,@R0      ;TEST FF
       00BD   C6C0        003150          JZ    $1
       00BF   85          003160          CLR   F0         ;SET RAM ERROR FLAG
       00C0               003170 $1:
       00C0   A0          003180          MOV   @R0,A      ;CLEAR RAM
       00C1   F0          003190          MOV   A,@R0      ;AND TEST
       00C2   C6C5        003200          JZ    $2
       00C4   85          003210          CLR   F0
       00C5               003220 $2:
       00C5   E8B9        003230          DJNZ  R0,CLEAR
       00C7   22          003240          IN    A,DBB      ;CLEAR IBF
                          003250 ;
                          003260 ;PRESET POINTERS,TIMER
                          003270 ;
       00C8   B010        003280          MOV   @TPTR,#FIFO        ;FIFO ADDRESS
       00CA   BE10        003290          MOV   @HPTR,#FIFO
                          003300 ;DIAGNOSTIC CHECK SUM ROUTINE
       00CC   27          003310 ROMCK:   CLR   A
       00CD   A8          003320          MOV   R0,A
       00CE               003330 $1:
       00CE   A3          003340          MOVP  A,@A       ;GET A ROM BYTE
       00CF   6A          003350          ADD   A,R2
       00D0   AA          003360          MOV   R2,A       ;SAVE SUM
       00D1   18          003370          INC   R0
       00D2   F8          003380          MOV   A,R0       ;REPEAT 256 TIMES
       00D3   96CE        003390          JNZ   $1
       00D5   34F9        003400          CALL  CKSU1      ;CONTINUE IN PAGE 1
       00D7               003410 CKSU3:
       00D7               003420 $1:                     ;COMPUTE LAST PAGE
```

```
ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD    OPERAND          COMMENT

       00D7   E3           003430          MOVP3  A,@A        ;GET A ROM BYTE
       00D8   6A           003440          ADD    A,R2
       00D9   AA           003450          MOV    R2,A         ;SAVE SUM
       00DA   18           003460          INC    R0
       00DB   F8           003470          MOV    A,R0         ;REPEAT 256 TIMES
       00DC   96D7         003480          JNZ    $1
       00DE   FA           003490          MOV    A,R2         ;TEST RESULT
       00DF   C6E2         003500          JZ     $+3          ;GOOD
       00E1   85           003510          CLR    F0
       00E2   8820         003520          MOV    R0,#STRAPS   ;CHANGE GOOD FLAG
                           003530 ;READ NOW  STRAPPING INFO
                           003540 ;
       00E4   09           003550          IN     A,P1
       00E5   4308         003560          ORL    A,#8         ;SET GOOD FLAG
       00E7   86EB         003570          JF0    $+4          ;SKIP
       00E9   53F7         003580          ANL    A,#-9        ;CLEAR BIT3 TO BAD STATUS
       00EB   9AFD         003590          ANL    P2,#-3       ;SET PORT2 TO LAST COLUMN+1
       00ED   85           003600          CLR    F0           ;CLEAR FLAG AGAINST MULTIPLE KEY ENT
       00EE   A0           003610          MOV    @R0,A
       00EF   F2F4         003620          JB7    $2           ;TEST PLL-CABLE PLUGGED
       00F1   05           003630          EN     I            ;ELSE ALLOW IBF INTERRUPTS VIA POLL
       00F2   04FA         003640          JMP    $3
                           003650 ;
       00F4                003660 $2:
       00F4   55           003670          STRT   T            ;INITIATE TIMER
       00F5   25           003680          EN     TCNTI        ;AND ALLOW TO INTERRUPT
       00F6   B81A         003690          MOV    R0,#26       ;POINT TO  ERRCNT IN REG.BANK 1
       00F8   B023         003700          MOV    @R0,#35      ;SET BEEP MULTIPLIER
       00FA                003710 $3:
       00FA   8824         003720          MOV    R0,#DECPOI   ;PRESET DECIMAL POINT
       00FC   B02E         003730          MOV    @R0,#2EH
       00FE   5306         003740          ANL    A,#6         ;SELECT ALL NON-ENGLISH COUNTRIES
       0100   C604         003750          JZ     $+4          ;US+UK  SKIP
       0102   B02C         003760          MOV    @R0,#2CH     ;ELSE CHANGE TO COMMA
```

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             003780 ;*****************ACTUAL SCAN****************
                             003790 ;
                             003800 ;A NEW SCAN  STARTS AT NEWS.
                             003810 ;THE 4 LSB'S OF PORT2 SELECTS A COLUMN OF 8 KEYS.
                             003820 ;PORT1 INPUTS THEN DATA FROM MATRIX ROWS.
                             003830 ;KEYS ACTUATED IN COLUMN SELECTED RESPONDS WITH
                             003840 ;LOGICAL 1. DATA IS SAVED IN REGISTER 7.
                             003850 ;A 2 BIT HISTORY IS RESERVED FOR EACH KEY IN THE
                             003860 ;MATRIX.LSB WILL BE SET AS LONG A KEY HAS BEEN FOUND
                             003870 ;ACTIVE, 2ND BIT INDICATES STATUS KEY HAS GONE FIRST
                             003880 ;TIME DOWN OR UP.  PROPER RECOGNITION OF KEY IS AC-
                             003890 ;CEPTED AFTER FIRST KEY GOING DOWN AND  WITH NEXT
                             003900 ;SCAN CYCLE THIS KEY IS FURTHERON ACTIVE. SUCH WAY
                             003910 ;NOISE AND DEBOUNCE IS PERFORMED OVER A WHOLE SCAN CYCLE.
                             003920 ;4 KEYS ARE CONTAINED IN EACH BYTE OF STATUS ARRAY.
                             003930 ;A TABLE POINTER  IS USED FOR GETTING MARKBITS FOR EACH KEY
                             003940 ;AND ALSO CODE.SYNCHRONIZATION IS FROM TABLEPOINTER TO
                             003950 ;STATUS POINTER EVERY  4TH KEY AND TO MATRIXCOLUMN EVERY
                             003960 ;8TH KEY.
                             003970 ;KEYS ACCEPTED ARE SELECTED IN GROUPS:
                             003980 ; SHIFT-,CONTROL-,FUNCTION-,ALPHA-,NUMERIC-,SPECIAL-KEYS
                             003990 ;THE INDICATION WHERE ANY KEY ACCOMPONIES IS CONTAINED IN
                             004000 ;MARKBIT TABLE.
                             004010 ;THE SHIFT-  AND CONTROL-KEYS ACTIVATED ARE SETTING FLAGB
                             004020 ;(20H,40H,80H) WHICH ARE STORED AT ADDR.21H.
                             004030 ;SHIFT CODE 20H IS EXORED WITH UNSHIFT ASCII CODE IF MARK-
                             004040 ;BIT ENABLES. CONTROL CODE 40H IS EXORED WITH UNSHIFTED
                             004050 ;ASCII CODE ALSO ENABLED BY MARKBIT.IF BOTH SHIFT AND CTL-
                             004060 ;FLAG ARE SET AND STRAPPING BIT 4 IS NOT ACTIVE,THEN A 80H
                             004070 ;IS EXORED WITH ACCORDING ASCII CODE OF KEY.
                             004080 ;IF WORDPROCESSING FLAG (80H) IS SET ,THEN UPPER AND LOWER
                             004090 ;CASE  CHARACTERS A..Z ARE EXCHANGED SYNCHRONOUS WITH
                             004100 ;SHIFT POSITION,E.G. LOWER CASE IN UNSHIFT- AND UPPER CASE
                             004110 ;LETTERS IN SHIFT MODE.IF SHIFT LOCK KLEY IS RELEASED VICE
                             004120 ;VERSA.
                             004130 ;FOR  COUNTRY VERSIONS WHICH REQUIRES MODIFIED LAYOUTS
                             004140 ;OF KEY DISPLACEMENTS THE  STRAPPING SWITCHES ARE SET TO
                             004150 ;A SPECIFIED COUNTRY CODE (0...7).BEFORE TRANSLATIONING
                             004160 ;THE TABLE OFFSET INTO ASCII-CODES, DEPENDING ON STRAP-
                             004170 ;INFO A SEARCH ROUTINE IS EXERCISED WHETHER THE ACCORDING
                             004180 ;KEYPOSITION IS CONTAINED IN THE MODIFY TABLE OR NOT.
                             004190 ;IF TRUE ,THEN THE INSTANT OFFSET IS REPLACED BY ANOTHER
                             004200 ;AS SPECIFIED.A ZERO CONTENT IN THESE TABLES MEANS END OF
                             004210 ;TABLE CONDITION AND CODE REMAINS UNCHANGED.
                             004220 ;MOST KEYS ARE AUTO REPEATABLE ELSE ASSOCIATED MARKBIT
                             004230 ;DETERMINES OTHERWISE. AFTER KEY FIRST GOING DOWN A LONG
                             004240 ;REPEAT DELAY IS SET(600MS),IF KEY IS HOLD DOWN FURTHERON
                             004250 ;THEN  ACCORDING ASCII  CODES ARE ISSUED DEPENDING ON
                             004260 ;SHIFT  AND CONTROL KEY STATUS,WITH AN REPEAT RATE OF
                             004270 ;APPROX. 12 HZ.
                             004280 ;CODES TO BE ISSUED TO A MAIN STATION ARE FIRST PUT INTO
                             004290 ;A QUEUE WHICH WORKS LIKE  A FIFO(FIRST IN FIRST OUT)
                             004300 ;STORAGE BUFFER.
                             004310 ;THIS USEFUL FOR THE N-KEY ROLL OVER  FEATURE WITH FAST
                             004320 ;KEY DEPRESSIONS AND GIVES THE MAIN STATION SUFFICIENT
```

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ERR-C ADDR   OBJ-CD       PG-LIN LABEL   CMD  OPERAND        COMMENT


                          004330 ;TIME TO POLL THE DATA FROM KEYBOARD AND INCREASES PRO-
                          004340 ;CESSOR THRUPUT BY NONINTERUPTIVE INTERFACING.
                          004350 ;IF FIFO GOES OVERFLOW A LONG ERROR TONE IS INITIATED
                          004360 ;LAST CODE ENTERED  IS LOST!
                          004370 ;THE KEYS IN THE  F-ROW ARE PROVIDED FOR FUNCTION KEY
                          004380 ;ASSIGNMENTS ITS CODES ARE FOR  FREE PROGRAMMING AND
                          004390 ;ALL SHIFT MODES ARE ALLOWED.
                          004400 ;
0104                      004410 NEWS:
0104      B940            004420       MOV   STPTR,#64  ;TOP STATUS BYTE
0106      BB68            004430       MOV   TBLPTR,#KEYS        ;LAST KEY ADDRESS
0108      CC              004440       DEC   REPDLY     ;COUNT DOWN REPEAT DELAY EVERY NEW S
0109      8A0D            004450       ORL   P2,#13
0108                      004460 SCAN:
0108      97              004470       CLR   C          ;RESET CARRY FOR POSSIBLE ROTATES TH
010C      CB              004480       DEC   TBLPTR
010D      FB              004490       MOV   A,TBLPTR
010E      F204            004500       JB7   NEWS        ;TABLE POINTER UNDER FLOW
0110      37              004510       CPL   A          ;TEST BIT0+1 FOR STATUSPOINTER SYNCH
0111      1221            004520       JB0   $1
0113      3221            004530       JB1   $1
0115      C9              004540       DEC   STPTR      ;POINT TO NEXT  4KEY GROUP
0116      5221            004550       JB2   $1         ;ODD,SKIP MULTIPLEXER UPDATE
0118      65              004560       STOP  TCNT       ;TISR MAY NOT OCCUR IN NEXT ROUTINE
0119      0A              004570       IN    A,P2       ;ELSE DO
011A      07              004580       DEC   A
011B      3A              004590       OUTL  P2,A
011C      55              004600       STRT  T          ;LET TIMER RUN AGAIN
011D      A3              004610       MOVP  A,§A       ;SPEND A SHORT DELAY
011E      09              004620       IN    A,P1       ;READ NEW MATRIX ROW DATA
011F      37              004630       CPL   A
0120      AF              004640       MOV   R7,A       ;SAVE INFO FOR SHIFT AROUND
0121                      004650 $1:
0121      FF              004660       MOV   A,R7       ;ROTATE KEY DATA SYNC KEY TO SAME BI
0122      E7              004670       RL    A
0123      AF              004680       MOV   R7,A
0124      F1              004690       MOV   A,§STPTR   ;ROTATE ALSO STATUS
0125      E7              004700       RL    A
0126      E7              004710       RL    A
0127      A1              004720       MOV   §STPTR,A
0128      324A            004730       JB1   UNLOCK
012A      1238            004740       JB0   KYDOWN
012C      FF              004750       MOV   A,R7       ;TEST KEY IS DOWN
012D      1208            004760       JB0   SCAN       ;NO
012F      B60B            004770       JF0   SCAN       ;INHIBIT MULTIPLE KEY ENTRIES
0131      95              004780       CPL   F0         ;ELSE SET INHIBITOR
0132                      004790 LOCKY:
0132      F1              004800       MOV   A,§STPTR   ;ELSE SET  STATUS BITS
0133      D303            004810       XRL   A,#3
0135      A1              004820       MOV   §STPTR,A
0136      240B            004830       JMP   SCAN
0138                      004840 KYDOWN:
0138      FC              004850       MOV   A,REPDLY   ;LOCK OUT KEY NEXT 8 SCANS
0139      53F8            004860       ANL   A,#-8
013B      D358            004870       XRL   A,#58H
```

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ERR-C  ADDR   OBJ-CD      PG-LIN  LABEL    CMD    OPERAND          COMMENT

       013D   C60B        004880          JZ     SCAN  ;DON'T CHECK KEY ON ACTIVE
       013F   FF          004890          MOV    A,R7       ;TEST KEY HOLD DOWN
       0140   37          004900          CPL    A
       0141   12A2        004910          JBO    REPCK      ;THEN CHECK REPEAT COND.MET
       0143   FB          004920          MOV    A,TBLPTR   ;ELSE FIRST KEY UP CONDITION
       0144   E3          004930          MOVP3 A,§A        ;SELECT SHIFT/CTL KEYS
       0145   F7          004940          RLC    A
       0146   F6F2        004950          JC     RESHFG     ;RESET SHIFT FLAGB
       0148   2432        004960          JMP    LOCKY      ;ALL OTHERS KEYUP DEBOUNCE
       014A               004970 UNLOCK:
       014A   85          004980          CLR    F0         ;CLEAR MULTIPLE KEY INHIBITOR
       014B   F1          004990          MOV    A,§STPTR   ;CLEAR DEBOUNCE LOCK
       014C   D302        005000          XRL    A,#2
       014E   A1          005010          MOV    §STPTR,A
       014F   37          005020          CPL    A
       0150   120B        005030          JBO    SCAN       ;WAS KEYUP UNLOCK
       0152   FF          005040          MOV    A,R7       ;TEST KEY STILL DOWN
       0153   1232        005050          JBO    LOCKY      ;NO
       0155               005060 ACCPTKY:
       0155   BC60        005070          MOV    REPDLY,#LONGDLY     ;SET UP 600MS DELAY
       0157               005080 REPEAT:
       0157   B821        005090          MOV    R0,#FLAGB
       0159   F0          005100          MOV    A,§R0
       015A   37          005110          CPL    A
       015B   5360        005120          ANL    A,#60H
       015D   C60B        005130          JZ     SCAN       IGNORE CTL/SHIFT COINCIDENCE
       015F   B823        005140          MOV    R0,#LASTKY ;POINT TO LASTKY
       0161   FB          005150          MOV    A,TBLPTR
       0162   A0          005160          MOV    §R0,A
       0163   5456        005170          CALL   NATVLNG    ;CHECK NATIVE LANGU.XLAT
       0165   B822        005180          MOV    R0,#LASTCD ;INTERIM SAVE
       0167   A0          005190          MOV    §R0,A
       0168   C8          005200          DEC    R0         ;POINT TO FLAGB
       0169   F2E0        005210          JB7    SPZEXC
       016B   E3          005220          MOVP3 A,§A        ;GET MARKBIT INFO
       016C   AA          005230          MOV    R2,A       ;SAVE INTERIM
       016D   F2B3        005240          JB7    FUNKY      ;SELECT FUNCTION- SHIFT- CTL-LOCK-KE
       016F   531F        005250          ANL    A,#31      ;TEST EXCEPTION INDICATION
       0171   9689        005260          JNZ    EXCEPT     ;IF SO TEST LANGUAGE,SHIFT COND.
       0173   FA          005270          MOV    A,R2       ;RELOAD MARKS
       0174               005280 NORMLS:                   ;ALL OTHERS HANDLE NORMALLY
       0174   D360        005290          XRL    A,#60H     ;INVERT DISABLES TO ENABLES
       0176   AA          005300          MOV    R2,A       ;PRESAVE
       0177   F0          005310          MOV    A,§R0      ;GET FLAGB AGAIN
       0178   5A          005320          ANL    A,R2       ;COINCIDE WITH MARKS
       0179               005330 NO:
       0179   AA          005340          MOV    R2,A       ;FLAG IS CODE CHANGE OPERAND
       017A   18          005350          INC    R0         ;GET LAST KEY AGAIN
       017B   F0          005360          MOV    A,§R0
       017C   036D        005370          ADD    A,#ASCITB  ;RELATE TO ASCII TABLE
       017E   E3          005380          MOVP3 A,§A        ;GET UNSHIFTED CODE
       017F   D288        005390          JB6    $1         ;SELECT LETTER CODES SKIP SHIFT/CTL
       0181   2A          005400          XCH    A,R2
       0182   C68B        005410          JZ     $1
       0184   B289        005420          JB5    $1-2       ;SELECT SHIFTS
```

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ERR-C ADDR   OBJ-CD      PG-LIN  LABEL   CMD   OPERAND         COMMENT

      0186   FA          005430          MOV   A,R2        ;TEST CTL FOR 20..3F CODES
      0187   B208        005440          JB5   SCAN        ;IF TRUE IGNORE
      0189   2310        005450          MOV   A,#10H      ;MAY BE CHANGED TO 10
      018B               005460 $1:
      018B   DA          005470          XRL   A,R2        ;MAY  CHANGE CODE ACCORDING SHIFT MO
      018C               005480 N1:
      018C   AA          005490          MOV   R2,A
      018D   F29C        005500          JB7   N4          ;EXTRACT FUNCTIONAL KEYS
      018F   542C        005510          CALL  TXTCHG      ;TEST UPPER/LOWER CASE LETTER EXCHAN
      0191               005520 N3:
      0191   1492        005530          CALL  LDKBQ       ;PUT IT NOW INTO FIFO
                         005540 ;
      0193   FB          005550          MOV   A,TBLPTR
      0194   D308        005560          XRL   A,#DOUBLD   ;SELECT DOUBLE ZERO KEY
      0196   9608        005570          JNZ   SCAN
      0198   1492        005580          CALL  LDKBQ       ;IF TRUE OUTPUT A 2ND 0
      019A   2408        005590          JMP   SCAN        ;NEXT KEY
                         005600 ;
      019C               005610 N4:
      019C   D2A0        005620          JB6   N5
      019E   4408        005630          JMP   COND        ;SELECT DEC.POINT FEATURE
                         005640 ;
      01A0   04AC        005650 N5:      JMP   N5P0        ;GO INTO PAGE 2
                         005660 ;
                         005670 ;
                         005680 ;CHECK ON REPEAT FUNCTION
      01A2               005690 REPCK:
      01A2   FC          005700          MOV   A,REPDLY    ;TEST COUNTER ZERO
      01A3   9608        005710          JNZ   SCAN        ;NO,IGNORE
      01A5   FB          005720          MOV   A,TBLPTR
      01A6   E3          005730          MOVP3 A,@A        ;GET  MARKBITS
      01A7   F208        005740          JB7   SCAN        ;EXIT IF NON REPEATABLE KEYS
                         005750 ;
      01A9               005760 $1:
      01A9   8823        005770          MOV   R0,#LASTKY  ;GET LAST KEY
      01AB   F0          005780          MOV   A,@R0
      01AC   D8          005790          XRL   A,TBLPTR    ;IS  INSTANT KEY=LAST KEY OUTPUT
      01AD   9608        005800          JNZ   SCAN
      01AF   8C08        005810          MOV   REPDLY,#REPRAT      ;SET REPEAT RATE AGAIN
      01B1   2457        005820          JMP   REPEAT
                         005830 ;
      01B3               005840 FUKY:
      01B3   F7          005850          RLC   A
      01B4   96EE        005860          JNZ   STSHFG      ;SET SHIFT,OR CTL OR ALPHALOCK FLAG
      01B6   27          005870          CLR   A
      01B7   2474        005880          JMP   NORMLS      ;RECEIVE WITH 0 MARKS
                         005890 ;
      01B9               005900 EXCEPT:                   ;TEST ON EXCEPTIONAL CONDITIONS
      01B9   FA          005910          MOV   A,R2        ;SELECT SPECIAL EXCHANGES
      01BA   D2DF        005920          JB6   SPIEXC-1
      01BC   D0          005930          XRL   A,@R0       ;TEST SHIFT-COND COINCIDENCE
      01BD   D2B6        005940          JB6   EXCEPT-3    ;HANDLE NORMAL IN CTL-MODE
      01BF   B2B6        005950          JB5   EXCEPT-3    ;HANDLE NORMAL NO SHIFT COINCIDENCE
      01C1   C8          005960          DEC   R0          ;LOAD LANGUAGE
      01C2   F0          005970          MOV   A,@R0
```

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ERR-C  ADDR   OBJ-CD        PG-LIN  LABEL    CMD   OPERAND          COMMENT

       01C3   5307          005980           ANL   A,#7
       01C5   A8            005990           MOV   R0,A
       01C6   18            006000           INC   R0          ;CLUDGE
       01C7   2380          006010           MOV   A,#128
       01C9                 006020 $1:
       01C9   E7            006030           RL    A           ;MAKE MASK
       01CA   E8C9          006040           DJNZ  R0,$1
       01CC   A8            006050           MOV   R0,A        ;SAVE RESULT
       01CD   FA            006060           MOV   A,R2
       01CE   531F          006070           ANL   A,#31
       01D0   03CB          006080           ADD   A,#MSKTB-1 ;REFER TO LANGUAGE MASKTABLE
       01D2   AA            006090           MOV   R2,A        ;SAVE INTERIM
       01D3   546C          006100           CALL  XL
       01D5   58            006110           ANL   A,R0        ;MASK NOW
       01D6   B821          006120           MOV   R0,#FLAGB   ;RELOAD POINTER
       01D8   C674          006130           JZ    NORMLS      ;LANGUAGE NOT CONTAINED
       01DA   FA            006140           MOV   A,R2
       01DB   031A          006150           ADD   A,#XLCD-MSKTB       ;CALCULATE EXCEPT.CODE OFF
       01DD   441C          006160           JMP   TRANS       ;GET CODE FROM NEXT PAGE
                            006170 ;
       01DF   E7            006180           RL    A
       01E0                 006190 SPZEXC:
       01E0   AA            006200           MOV   R2,A
       01E1   F0            006210           MOV   A,@R0       ;GET FLAGB
       01E2   5360          006220           ANL   A,#60H
       01E4   77            006230           RR    A
       01E5   47            006240           SWAP  A
       01E6   6A            006250           ADD   A,R2
       01E7   6A            006260           ADD   A,R2
       01E8   6A            006270           ADD   A,R2
       01E9   035A          006280           ADD   A,#SPZXCD-128
       01EB   E3            006290           MOVP3 A,@A
       01EC   4410          006300           JMP   TRANS+1
                            006310 ;
       01EE                 006320 STSHFG:
       01EE   40            006330           ORL   A,@R0       ;SET UP BIT
       01EF   A0            006340           MOV   @R0,A       ;AND STORE
       01F0   240B          006350           JMP   SCAN
                            006360 ;
       01F2                 006370 RESHFG:
       01F2   B821          006380           MOV   R0,#FLAGB
       01F4   37            006390           CPL   A
       01F5   50            006400           ANL   A,@R0       ;CLEAR FLAG
       01F6   A0            006410           MOV   @R0,A       ;STORE BACK
       01F7   2432          006420           JMP   LOCKY
       01F9                 006430           ORG   1F9H
       01F9                 006440 CKSU1:
       01F9                 006450 $1:
       01F9   A3            006460           MOVP  A,@A        ;GET A ROM BYTE
       01FA   6A            006470           ADD   A,R2
       01FB   AA            006480           MOV   R2,A        ;SAVE SUM
       01FC   18            006490           INC   R0
       01FD   F8            006500           MOV   A,R0        ;REPEAT 256 TIMES
       01FE   96F9          006510           JNZ   $1
       0200                 006520 CKSU2:
```

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ERR-C  ADDR   OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0200                  006530 $1:
       0200   A3             006540         MOVP  A,§A
       0201   6A             006550         ADD   A,R2
       0202   AA             006560         MOV   R2,A          ;SAVE SUM
       0203   18             006570         INC   R0
       0204   F8             006580         MOV   A,R0          ;REPEAT 256 TIMES
       0205   9600           006590         JNZ   $1
       0207   83             006600         RET
       0208                  006610 COND:
       0208   B824           006620         MOV   R0,#DECPOI
       020A   D38A           006630         XRL   A,#8AH        ;SELECT DECIMAL POINT ORIGINAL CODE
       020C   9611           006640         JNZ   $1
       020E   F0             006650         MOV   A,§R0         ;GET POINT OR COMMA
       020F   4410           006660         JMP   TRANS+1
       0211   D310           006670 $1:     XRL   A,#16         ;SELECT ^DECPOI
       0213   961E           006680         JNZ   TRANS+2       ;IS ANOTHER FUNCTIONCODE
       0215   F0             006690         MOV   A,§R0
       0216   0302           006700         XRL   A,#2          ;SWAP POINT TO COMMA OR BACK
       0218   24EF           006710         JMP   STSHFG+1      ;STORE AND GO SCAN
       021A   0320           006720         ADD   A,#SUPLFU
       021C                  006730 TRANS:
       021C   A3             006740         MOVP  A,§A
       021D   AA             006750         MOV   R2,A
       021E   2491           006760 $1:     JMP   N3
                             006770 ;
                             006780 ;
       0220                  006790 SUPLFU:
       0220   343536373839   006800         DB    '456789*+123/'
              2A2B3132332F
```

```
ERR-C  ADDR   OBJ-CD        PG-LIN  LABEL   CMD   OPERAND        COMMENT

       022C                 006820 TXTCH6:
       022C   37            006830          CPL   A
       022D   0235          006840          JB6   UNCH           ;NO LETTER CODE
       022F   C8            006850          DEC   R0
       0230   F0            006860          MOV   A,@R0          ;GET WP-FLAG
       0231   37            006870          CPL   A
       0232   F236          006880          JB7   UNCH+1         ;TRUE
       0234   FA            006890          MOV   A,R2
       0235                 006900 UNCH:
       0235   83            006910          RET
       0236                 006920 $1:
       0236   C8            006930          DEC   R0
       0237   FA            006940          MOV   A,R2
       0238   531F          006950          ANL   A,#1FH
       023A   C635          006960          JZ    UNCH
       023C   03E2          006970          ADD   A,#-30         ;SELECT ALL ) 0
       023E   F635          006980          JC    UNCH
       0240   0303          006990          ADD   A,#3           ;SELECT ALL >Z
       0242   E651          007000          JNC   $3
       0244   F0            007010          MOV   A,@R0          ;GET LANGUAGE CODE
       0245   07            007020          DEC   A
       0246   07            007030          DEC   A
       0247   37            007040          CPL   A
       0248   5251          007050          JB2   $3
       024A                 007060 $2:
       024A   37            007070          CPL   A
       024B   07            007080          DEC   A
       024C   5235          007090          JB2   UNCH
       024E   FA            007100          MOV   A,R2
       024F   1235          007110          JB0   UNCH   ;CAN'T BE 5C OR 7C(FOR SPAIN
       0251                 007120 $3:
       0251   2320          007130          MOV   A,#32          ;SET EXCHANGE OPERATOR
       0253   DA            007140          XRL   A,R2
       0254   AA            007150          MOV   R2,A
       0255   83            007160          RET
```

```
ERR-C ADDR   OBJ-CD        PG-LIN LABEL   CMD   OPERAND          COMMENT

                           007180 ;
                           007190 ;LANGUAGE DEPENDENT KEY LOCATION EXCHANGE
                           007200 ;
                           007210 ; US(0)   UK(1)   Dk(2)   Ge(3)  Sw(4) Nw(5) Sp(6)   It(7)
                           007220 ;
                           007230 ; E7 ^X1                  D6 ^B1                    D2 ^B1
                           007240 ; E10^X2  E10^S6           B1 ^D6                    B1 ^D2
                           007250 ; E11^B10 E11^E10          E11^X6            E11^X9  E11^X7
                           007260 ; E12^X3  E12^C12                           E12^C11 E12^S9
                           007270 ; B00^C10 B00^C10
                           007280 ; D11^C11 D11^E12                           D11^C12
                           007290 ; D12^D11 D12^C11 D12^C12          D12^C12
                           007300 ; C10^X4  C10^X4  C10^C11                          C10^S2
                           007310 ; C11^S5  C11^D12 C11^C10                  C11^E12 C11^S4
                           007320 ;         C12^D11 C12^X8 C12^S11  C12^X8   C12^D11 C12^S7
                           007330 ; B10^E11 B10^E11
                           007340 ;
0256                       007350 NATVLNG:
0256   AA                  007360         MOV   R2,A       ;SAVE TABLE OFFSET
0257   B820                007370         MOV   R0,#STRAPS
0259   F0                  007380         MOV   A,@R0      ;GET LANGUAGE CODE
025A   5307                007390         ANL   A,#7
025C   036E                007400         ADD   A,#LNGOFS  ;GET OFFSET TO TABLES
025E   A3                  007410         MOVP  A,@A
025F   A8                  007420         MOV   R0,A       ;SAVE IN REG
0260                       007430 $1:
0260   F8                  007440         MOV   A,R0
0261   A3                  007450         MOVP  A,@A       ;ADDRESS INTO PROG.MEMORY
0262   C634                007460         JZ    UNCH-1     ;END OF TABLE REACHED
0264   DA                  007470         XRL   A,R2       ;COMPARE WITH ORIGINAL DISPLACEMENT
0265   18                  007480         INC   R0
0266   C66B                007490         JZ    $2         ;FOUND CONDITION
0268   18                  007500         INC   R0         ;SKIP TO NEXT CODE
0269   4460                007510         JMP   $1         ;LOOP
026B                       007520 $2:
026B   F8                  007530         MOV   A,R0       ;ADDRESS TO SUBSEQUENT CODE
026C   A3                  007540 XL:     MOVP  A,@A       ;LOAD REPLACE CODE
026D   83                  007550         RET
026E                       007560 LNGOFS:
026E   768BA9ADADA0        007570         DB    $1,$2,$3,$4,$5,$6,$7,$8
       B2B0
0276                       007580 $1:                      ;US-ENGLISH
0276   4E345E4A3E3B        007590         DB    78,52,94,074,62,59,10,73,93,89,61,93
       0A4950593D50
                           007600 ;         E10X2,E11B10,E12X3,B00C10,D11C11,D12D11
0282   493C59854A5E        007610         DB    73,60,89,133,74,094,86,51,0
       563300
                           007620 ;           C10X4,C11S5,B10E11,E7X1
0288                       007630 $2:                      ;;UK+INT'L ENGLISH
0288   4E865E4E0A49        007640         DB    78,134,94,78,10,73,93,62,61,89,73,60
       5D3E3D59493C
                           007650 ;         E10S6,E11E10,B00C10,D11E12,D12C11,C10X4
0297   593D395D4A5E        007660         DB    89,61,57,93,74,94,62,57,0
       3E3900
                           007670 ;           C11D12,C12D11,B10E11,E12C12
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ERR-C  ADDR    OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

       02A0                    007680 $4:                      ;GERMAN AUSTRIAN
       02A0     452A2A455E69   007690          DB    69,42,42,69,94,105,57,139,0
                398B00
                                007700 ;               D6B1,B1D6,E11X6,C12S11
                                007710 ; DANISH
       02A9     49595949       007720 $3:      DB    73,89,89,73
                                007730 ;SWEDISH,FINNISH
       02A0                    007740 $5:
       02AD                    007750 $6:                      ;NORWEGIAN
       02A0     3D39396B00     007760          DB    61,57,57,107,0
                                007770 ;               D12C12,C12X8
       02B2                    007780 $7:                      ;SPANISH
       02B2     5D39593E395D   007790          DB    93,57,89,62,57,93,62,89,94,108,0
                3E595E6C00
                                007800 ;              D11C12,C11E12,C12D11,E12C11,E11X9
       02BD                    007810 $8:                      ;ITALIAN
       02B0     49825984252A   007820          DB    73,130,89,132,37,42,42,37,62,137
                2A253E89
                                007830 ;              C10S4,C11S6,D2B1,B1D2,E12S10
       02C7     5E6A398700     007840          DB    94,106,57,135,0
                                007850 ;              E11X7,C12S7
       02CC                    007860 MSKTB:
       02CC     FCFCFCFCFCC8   007870          DB    -4,-4,-4,-4,-4,-56
       02D2     FF0008344008   007880          DB    -1,0,8,052,64,8,124,64,128
                7C4080
       02DB 0009               007890          DS    9,1
       02E4     3440           007900          DB    52,64       ;SKANDIN.,SPAIN
       02E6                    007910 XLCD:
       02E6     2F303E383A28   007920          DB    '/0>::+ü§+üß',39,123,39,'§^&*()+:\§§'
                7F5D4D2B5D7E
                277B27405E26
                2A28292B3A60
                4040
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             007940 ; EXCEPTIONAL KEYCODE MODIFICATION EXPLANATION
                             007950 ; LANGUAGE CODE AND BIT ASSIGNMENT:
                             007960 ; 0=US-ENGLISH(BIT0=1)  1=UK+INT'L ENGLISH(BIT1=2)
                             007970 ; 2=DANISH    (BIT2=4)  3=GERMAN,AUSTRIAN (BIT3=8)
                             007980 ; 4=SWED/FINN.(BIT4=16) 5=NORWEGIAN       (BIT5=32)
                             007990 ; 6=SPANISH   (BIT6=64) 7=ITALIAN         (BIT7=128)
                             008000 ;
                             008010 ; OFFS  MARK  LANGU. EXC.COD -SYMB. NORM-CD  -SYMB. POSITION
                             008020 ;
                             008030 ;  1     21     FC     2F     7 /  37 2F      7 '   E7
                             008040 ;  2     02     FC     30     0 =  2D 30      - =   E10
                             008050 ;  3     23     FC     3E     < >  3C 3E      < >   B00
                             008060 ;  4     24     FC     3B     , ;  2B 3B      , <   B8
                             008070 ;  5     25     FC     3A     . :  2E 3E      . >   B9
                             008080 ;  6     06     C8     2B     + *  3A 2A      : *   D12,C11
                             008090 ;  7     27     FF     7F     CLR  86 7F 96   CLR   D50
                             008100 ;  8     28     00     5D     3Par 33 23      3 #   E3,X5
                             008110 ;  9     29     08     40     3Par 33 23      3 #   E3
                             008120 ; 10     0A     34     2B     + ?  2F 3F      / ?   E11,B10
                             008130 ; 11     2B     40     5D     ì ?/ 5B 7B 1B   Ä ä   E12,C11
                             008140 ; 12     0C     08     7E     ss ?  2F 3F     / ?   E11,X6
                             008150 ; 13     00     7C     27     ' `  40 60 00   § `   E12,C11
                             008160 ; 14     0E     40     7B 'ee`ä ü  5D 7D 1D   Ü ü   D11,C12
                             008170 ; 15     0F     80     27     ' ?  2F 3F      / ?   E11,X7
                             008180 ; 16     30     01     40     2 §  32 22      2 "   E2
                             008190 ; 17     31     01     5E     6 ^  36 26      6 &   E6
                             008200 ; 18     32     01     26     7 &  37 27      7 '   E7,X1
                             008210 ; 19     33     01     2A     8 *  38 28      8 (   E8
                             008220 ; 20     34     01     28     9 (  39 29      9 )   E9
                             008230 ; 21     35     01     29     0 )  30         0     E10,X2
                             008240 ; 22     36     01     2B     = +  3D 2D       = -  E12,X3
                             008250 ; 23     37     01     3A     ; :  3B 2B      ; +   C10,X4
                             008260 ; 24     38     01     60     ' ß  5E 7E 1E   ^ ß   D12,C12
                             008270 ; 25     19     34     40     § *  3A 2A      : *   C12,X8
                             008280 ; 26     1A     40     40     § ?  2F 3F      / ?   E11,X9
                             008290 ;
                             008300 ; SPECIAL EXCEPTIONS:
                             008310 ;
                             008320 ; 00     80     04     60 23 00    ` #             C12,S0
                             008330 ; 01     81     04     40 5C 1C    a`c,            D11,S1
                             008340 ; 02     82     80     7B 5C 1C    a`c,            C10,S2
                             008350 ; 03     83     04     7C 5B 1B    u`,             C11,S3
                             008360 ; 04     84     80     60 5B 1B    u`,             C11,S4
                             008370 ; 05     85     01     27 22 00    ' "             C11,S5
                             008380 ; 06     86     02     30 5F 1F    0 _             E10,S6
                             008390 ; 07     87     80     7C 40 00    o`Par           C12,S7
                             008400 ; 08     44     F0     20 5F 1F    - _             B10,E11
                             008410 ; 09     89     80     7E 5E 1E    ì`^             E12,S9
                             008420 ; 10     45     FF     20 F4 F5    -               B51
                             008430 ; 11     8B     08     23 5E 1E    # ^             C12,S11
                             008440 ;
                             008450 ; MARKBIT 5 ON MEANS EXCEPT IN SHIFTMODE,OFF MEANS EXCEPT UNS
                             008460 ; MARKBIT 6 OR 7 ON MEANS EXCEPT IN ALL MODES
```

```
ERR-C  ADDR   OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0300                   008480          ORG   300H
       0300                   008490 MRKTBL:
       0300   A000000000000   008500          DB    160,,,,,,,128      ;D13CB4D51D53DEF4
              0080
       0308   60C0236020A0    008510          DB    96,-64,35,96,32,160,96,128   ;A50CB0A5253DEF0
              6080
       0310   270000000000    008520          DB    39,,,,,,41,128     ;D50CB3D5254DEF3
              2980
       0318   600000000000    008530          DB    96,,,,,,,128       ;AC85C5153DEF5
              0080
       0320   900000002000    008540          DB    144,,,,32,,48,128  ;B99CB2B51540EF2
              3080
       0328   000000000000    008550          DB    0,,,,,,,128        ;B50CB1B5253DEF1
              0080
       0330   200025323500    008560          DB    32,,37,50,53,,52,128 ;E13CB9X1X2DEF9
              3480
       0338   801820363706    008570          DB    128,24,32,54,55,6,13,128     ;F13C1213X3X40EF
              0D80
       0340   450000000000    008580          DB    69,,,,,,,49,128    ;C50CB6C5254DEF6
              3180
       0348   800044802000    008590          DB    128,,68,128,20H,,2,128       ;F50CB10FE520EF1
              0280
       0350   600000802000    008600          DB    96,,,128,32,,33,128  ;E14CB7FE530EF7
              2180
       0358   802890802O0E    008610          DB    128,43,144,128,32,14,10,128  ;F14CB11FE510EF1
              0A80
       0360   200024802000    008620          DB    32,,36,128,32,,51,128        ;E50CB8FE540EF8
              3380
            0068              008630 KEYS     EQU   $-MRKTBL
       0368   280C0F191A      008640          DB    40,12,15,25,26     ;X5..9
       036D                   008650 ASCITB:
       036D   004656F7F952    008660          DB    0,'FV',-9,-7,'R4',-28  ;D13CB4D5153DEF4
              34E4
       0375   30003C308A00    008670          DB    48,'<0',8AH,,27,-32  ;A50CB0A52530EF0
              1BE0
       037D   864443F8FF45    008680          DB    134,'DC',-8,-1,'E3',-29   ;D50CB3D5254DEF3
              33E3
       0385   204742F4F654    008690          DB    ' GB',-12,-10,'T5',-27  ;AC85C5153DEF5
              35E5
       038D   005358FC8857    008700          DB    'SX',-4,88H,'W2',-30 ;B99CB2B51540EF2
              32E2
       0395   FB415AFDFE51    008710          DB    -5,'AZ',-3,-2,'Q1',-31   ;B50CB1B52530EF1
              31E1
       039D   8B4C2E37304F    008720          DB    139,'L.7009',-23  ;E13CB9X1X20EF9
              39E9
       03A5   ED5E883D3B3A    008730          DB    -19,94,136,'=::§',-20  ;F13C1213X3X40EF12
              4DEC
       03AD   2D484EF5FA59    008740          DB    45,'HN',-11,-6,'Y6',-26  ;C50CB6C52540EF6
              36E6
       03B5   EF5C2DF18350    008750          DB    -17,'\-',-15,131,80,45,-22  ;F50CB10FE520EF10
              2DEA
       03BD   094A40F28455    008760          DB    9,'JM',-14,84H,'U7',-25  ;E14CB7FE53DEF7
              37E7
       03C5   EE5B00F08250    008770          DB    -18,91,,-16,130,93,47,-21    ;F14CB11FE510EF1
              2FEB
```

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ERR-C ADDR   OBJ-CD          PG-LIN  LABEL    CMD   OPERAND          COMMENT

      03C0   814B2CF38549    008780           DB    81H,'K',-13,85H,'I8',-24  ;E50CB8FE54DEF8
             38E8
      03D5   332F2F3A2F      008790           DB    '3//:/'
      03DA                   008800 SPZXCD:
      03DA   602300405C1C    008810           DB    96,35,,64,92,28,123,92,28,124,91,27
             7B5C1C7C5B1B
      03E6   605B1B272200    008820           DB    96,91,27,39,34,,48,95,31,124,64,0,45,95,31
             305F1F7C4000
             2D5F1F
      03F5   7E5E1E2DF4F5    008830           DB    126,94,30,45,-12,-11,35,94,30
             235E1E
      03FE   00              008840 CHKSUM:   DB    0
                             008850 ;
                             008860 ;
                             008870 ;CROSS REFERENCE   WIRING/KEY LOCATIONS
                             008880 ;
                             008890 ; COLUMN/ROW   R0   R1   R2   R3   R4   R5   R6   R7
                             008900 ;
                             008910 ; 0 COL 0      D13  C4   B4   D51  D53  D4   E4   F4
                             008920 ;
                             008930 ; 1 COL 1      A50  C0   ßB0  A52 +A53  D0   E0   F0
                             008940 ;
                             008950 ; 2 COL 2     +D50  C3   B3   D52  D54  D3   ßE3  F3
                             008960 ;
                             008970 ; 3 COL 3      A5   C5   B5   C51  C53  D5   E5   F5
                             008980 ;
                             008990 ; 4 COL 4      B99  C2   B2   B51 +B54  ßD2  ßE2  F2
                             009000 ;
                             009010 ; 5 COL 5      B50  ßC1  ßB1  B52  B53  D1   E1   F1
                             009020 ;
                             009030 ; 6 COL 6     +E13  C9   ßB9  X1   X2   D9   ßE9  F9
                             009040 ;
                             009050 ; 7 COL 7      F13  ßC12 +C13  X3   X4   ßD12 ßE12 F12
                             009060 ;
                             009070 ; 8 COL 8      C50  C6   B6   C52  C54  ßD6  ßE6  F6
                             009080 ;
                             009090 ; 9 COL 9      F50  ßC10 ßB10  F52 +E52  D10 ßE10 F10
                             009100 ;
                             009110 ; A COL 10     E14  C7   B7   F53 +E53  D7   ßE7  F7
                             009120 ;
                             009130 ; B COL 11     F14  ßC11  B11  F51 +E51 ßD11 ßE11  F11
                             009140 ;
                             009150 ; C COL 12    +E50  C8   ßB8   F54 +E54  D8   ßE8  F8
                             009160 ;
                             009170 ;PSEUDO 12     X5   X6   X7
                             009180 ;
                             009190 ; KEY LOCATIONS WITH ß  ARE RELOCATED LANGUAGE DEPENDENT
                             009200 ; KEY LOCATIONS WITH +  TRANSLATABLE FOR 7900,7901 USAGE
```

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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             009220 ;NUMERIC KEY PAD PART
                             009230 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             009240 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             009250 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             009260 ;     ---------------------   MATRIXCODE COMBINED:
                             009270 ;     !F50!F51!F52!F53!F54!    HO-DIGIT  COLUMN#
                             009280 ;     ! 90! B3! 93! A3! C3!    LO-DIGIT  ROW-#
                             009290 ;     ! 80! 80! 80! 80! 80!
                             009300 ;     !F16!F17!F18!F19!F20!
                             009310 ;     ! AF! B0! B1! B2! B3!
                             009320 ;     ! CF! D0! D1! D2! D3!
                             009330 ;     ! EF! F0! F1! F2! F3!
                             009340 ;     !---+---+---+---+---!
                             009350 ;     !E50!E51!E52!E53!E54!
                             009360 ;     ! C0! B4! 94! A4! C4!
                             009370 ;     ! 20! 20! 20! 20! 20!
                             009380 ;     Home!<--!Dwn!Up !-->!
                             009390 ;     ! 91! 92! 93! 94! 95!
                             009400 ;     ! 81! 82! 83! 84! 85!
                             009410 ;     ! 81! 82! 83! 84! 85!
                             009420 ;     !---+---+---+---+---!
                             009430 ;     !D50!D51!D52!D53!D54!
                             009440 ;     ! 20! 03! 23! 04! 24!
                             009450 ;     ! 27! 00! 00! 00! 00!
                             009460 ;     !CLR!7  !8  !9  !/  !
                             009470 ;     ! 96! B7! B8! B9! BF!
                             009480 ;     ! 7F! D7! D8! D9! DF!
                             009490 ;     ! 86! 37! 38! 39! 2F!
                             009500 ;     !---+---+---+---+---!
                             009510 ;     !C50!C51!C52!C53!C54!
                             009520 ;     ! 80! 33! 83! 34! 84!
                             009530 ;     ! 00! 00! 00! 00! 00!
                             009540 ;     !- !4  !5  !6  !*  !
                             009550 ;     ! F5! B4! B5! B6! BA!
                             009560 ;     ! F4! D4! D5! D6! DA!
                             009570 ;     ! 20! 34! 35! 36! 2A!
                             009580 ;     !---+---+---+---+---!
                             009590 ;     !B50!B51!B52!B53!B54!
                             009600 ;     ! 50! 43! 53! 54! 44!
                             009610 ;     ! 00! 00! 00! 00! 20!
                             009620 ;     !+ !1  !2  !3  !ET !
                             009630 ;     ! 88! BC! B0! BE! 98!
                             009640 ;     ! DB! DC! DD! DE! 88!
                             009650 ;     ! 28! 31! 32! 33! 88!
                             009660 ;     !-------+---+---!   !
                             009670 ;     !A50    !A52!A53!   !
                             009680 ;     ! 10    ! 13! 14!   !
                             009690 ;     ! 60    ! 60! 20!   !
                             009700 ;     !0      !00 !, !   !
                             009710 ;     ! 30    !*30! 9A!<------used to switch f* . to , or back
                             009720 ;     ! 30    !*30! BA!<------OUTPUT: 2EH(.) or 2CH(,) as set
                             009730 ;     ! 30    !*30! 8A!   !
                             009740 ;     ---------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             009760 ;  US-ENGLISH
                             009770 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             009780 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             009790 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             009800 ;-------------------------------------------------------
                             009810 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             009820 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
                             009830 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             009840 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
                             009850 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             009860 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             009870 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             009880 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             009890 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             009900 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             009910 ; 60! 00! 30! 29! 00! 00! 31! 32! 33! 34! 35! 44! 36! 20! 60!
                             009920 ;ESC!1! !2§ !3# !4$ !5% !6^ !7& !8* !9( !0) !-_ !=+ !BSP!TAB!
                             009930 ; 1B!  !  !  !  !  !  !  !  !  !  !  ! 1F!  ! 9B! 09!
                             009940 ; 1B! 21! 40! 23! 24! 25! 5E! 26! 2A! 28! 29! 5F! 2B! 88! 09!
                             009950 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2D! 3D! 88! 09!
                             009960 ;-------------------------------------------------------
                             009970 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
                             009980 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  D0 !
                             009990 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 2B! 0E!  A0 !
                             010000 ;     !q0 !wW !eE !rR !Tt !yY !uU !iI !oO !pP !Aä !00 !     !
                             010010 ;     ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1B! 10!     !
                             010020 ;CONTL! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 7B! 7D!CONTL!
                             010030 ;     ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 5B! 5D!     !
                             010040 ;-------------------------------------------------------
                             010050 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             010060 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             010070 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 37!95 ! 38! 20!
                             010080 ;!     !aA !sS !dD !fF !gG !hH !jJ !kK !lL !:: !'" !\| !   !
                             010090 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C!   ! 00! 1E! 98!
                             010100 ;!LOCK*! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 3A! 22! 7E! 88!
                             010110 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 68! 6C! 38! 27! 60! 88!
                             010120 ;------------------------------------------------------- FT!
                             010130 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
                             010140 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
                             010150 ;! 90! 00! 00! 00! 00! 00! 00! 00! 00! 24! 25! 0A! 90  !   !
                             010160 ;!   !0ö !zZ !xX !cC !vV !bB !nN !aM !,< !.> !/? !     !   !
                             010170 ;! * ! 1C! 1A! 18! 03! 16! 02! 0E! 00!   !   !   ! *  !   !
                             010180 ;!SHF! 7C! 5A! 58! 43! 56! 42! 4E! 4D! 3C! 3E! 3F!SHIFT!   !
                             010190 ;!   ! 5C! 7A! 78! 63! 76! 62! 6E! 60! 2C! 2E! 2F!     !   !
                             010200 ;!-------------------------------------------------------
                             010210 ;            !              A05              !
                             010220 ;            !               30              !
                             010230 ;            !               60              !
                             010240 ;            !                               !
                             010250 ;            !               20              !
                             010260 ;            !               20              !
                             010270 ;            !               20              !
                             010280 ;            --------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             010300 ;  UK-ENGLISH
                             010310 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             010320 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             010330 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             010340 ;-----------------------------------------------------
                             010350 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             010360 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
                             010370 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             010380 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
                             010390 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             010400 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             010410 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             010420 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             010430 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             010440 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             010450 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34!56 ! 02! 38! 20! 60!
                             010460 ;ESC!1! !2" !3# !4$ !5% !6& !7' !8( !9) !0_ !-= !^~ !BSP!TAB!
                             010470 ; 1B!   !   !   !   !   !   !   !   !   ! 1F!   ! 1E! 9B! 09!
                             010480 ; 1B! 21! 22! 23! 24! 25! 26! 27! 28! 29! 5F! 3D! 7E! 8B! 09!
                             010490 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2D! 5E! 8B! 09!
                             010500 ;-----------------------------------------------------
                             010510 ; 000 !001!002!003!004!005!006!007!008!009!010!011!012! 013 !
                             010520 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
                             010530 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 2B!  A0 !
                             010540 ;      !q@ !wW !eE !rR !tT !yY !uU !iI !oO !pP !{[ !Aä !      !
                             010550 ;      ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 00! 1B!      !
                             010560 ;CNTL! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 60! 7B!CNTL!
                             010570 ;      ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 40! 5B!      !
                             010580 ;-----------------------------------------------------
                             010590 ;!CAP  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             010600 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             010610 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 37! 06! 0E! 20!
                             010620 ;!     !aA !sS !dD !fF !gG !hH !jJ !kK !lL !;+ !:* !Üü !   !
                             010630 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C!   !   ! 10! 98!
                             010640 ;!LOCK^! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 2B! 2A! 7D! 8B!
                             010650 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 3B! 3A! 5D! 8B!
                             010660 ;-----------------------------------------------------  FT!
                             010670 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
                             010680 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
                             010690 ;! 90! 00! 00! 00! 00! 00! 00! 00! 00! 00! 24! 25! 0A! 90  !   !
                             010700 ;!   !66 !zZ !xX !cC !vV !bB !nN !mM !,< !.> !/? !     !   !
                             010710 ;! ^ ! 1C! 1A! 18! 03! 16! 02! 0E! 00!   !   !   ! ^ !   !
                             010720 ;!SHF! 7C! 5A! 58! 43! 56! 42! 4E! 40! 3C! 3E! 3F!SHIFT!   !
                             010730 ;!   ! 7C! 7A! 78! 63! 76! 62! 6E! 60! 2C! 2E! 2F!     !   !
                             010740 ;!-----------------------------------------------------
                             010750 ;            !            A05             !
                             010760 ;            !             30             !
                             010770 ;            !             60             !
                             010780 ;            !                            !
                             010790 ;            !             20             !
                             010800 ;            !             20             !
                             010810 ;            !             20             !
                             010820 ;            ---------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


010840 ;DANISH
010850 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
010860 ;       3RD LINE MARKBITS     4TH SYMBOLS
010870 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
010880 ;-----------------------------------------------------------------
010890 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
010900 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
010910 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
010920 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
010930 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
010940 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
010950 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
010960 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
010970 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
010980 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
010990 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34! 02! 0A! 00! 20! 60!
011000 ;ESC!1! !2" !3 !4$ !5% !66 !7/ !8( !9) !0= !+? !'` !BSP!TAB!
011010 ; 18!   !   !   !   !   !   !   !   !   !   !   ! 00! 9B! D9!
011020 ; 1B! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 60! 88! D9!
011030 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2B! 27! 88! D9!
011040 ;-----------------------------------------------------------------
011050 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
011060 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  DD !
011070 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 18!  A0 !
011080 ;      !q@ !wW !eE !rR !tT !yY !uU !iI !oO !pP !aA.!^B !     !
011090 ;      ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1D! 1E!     !
011100 ;CONTL! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 5D! 7E!CONTL!
011110 ;      ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 7D! 5E!     !
011120 ;-----------------------------------------------------------------
011130 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
011140 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
011150 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 2B! 19! 20!
011160 ;!     !aA !sS !dD !fF !gG !hH !jJ !kK !lL !aeA!oO/!%# !   !
011170 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1B! 1C!   ! 9B!
011180 ;!LOCK^! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5B! 5C! 2A! 88!
011190 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7B! 7C! 40! 88!
011200 ;-------------------------------------------------------- FT!
011210 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
011220 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
011230 ;! 90! 23! 00! 00! 00! 00! 00! 00! 00! 24! 25! 44! 90  !   !
011240 ;!   !<> !zZ !xX !cC !vV !bB !nN !mM !,;!.: !-_ !     !   !
011250 ;! ^ !   ! 1A! 18! 03! 16! 02! 0E! 00!   !   !   ! 1F!  ^  !   !
011260 ;!SHF! 3E! 5A! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!SHIFT!   !
011270 ;!   ! 2C! 7A! 78! 63! 76! 62! 6E! 60! 2C! 2E! 20!     !   !
011280 ;!-------------------------------------------------------------
011290 ;           !            A05             !
011300 ;           !             30             !
011310 ;           !             60             !
011320 ;           !                            !
011330 ;           !             20             !
011340 ;           !             20             !
011350 ;           !             20             !
011360 ;           ----------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

011380 ;GERMAN,AUSTRIAN
011390 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
011400 ;       3RD LINE MARKBITS     4TH SYMBOLS
011410 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
011420 ;-----------------------------------------------------------------
011430 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
011440 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
011450 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
011460 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
011470 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
011480 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
011490 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
011500 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
011510 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
011520 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
011530 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34! 02! 0C! 00! 20! 60!
011540 ;ESC!1! !2" !3§ !4$ !5% !6& !7/ !8( !9) !0= !ß?!´ !BSP!TAB!
011550 ; 1B!   !   !   !   !   !   !   !   !   !   !   ! 00! 9B! 09!
011560 ; 1B! 21! 22! 40! 24! 25! 26! 2F! 28! 29! 30! 3F! 60! 8B! 09!
011570 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 7E! 27! 8B! 09!
011580 ;-----------------------------------------------------------------
011590 ; 000 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
011600 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
011610 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 06!  A0 !
011620 ;      !a0 !wW !eE !rR !tT !zZ !uU !iI !o0 !pP !üÜ !++ !      !
011630 ;      ! 11! 17! 05! 12! 14! 1A! 15! 0A! 0F! 10! 1B!   !      !
011640 ;CONTL! 51! 57! 45! 52! 54! 5A! 55! 4A! 4F! 50! 5B! 2A!CONTL!
011650 ;      ! 71! 77! 65! 72! 74! 7A! 75! 6A! 6F! 70! 7B! 2B!      !
011660 ;-----------------------------------------------------------------
011670 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
011680 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
011690 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 28!S11! 20!
011700 ;!      !aA !sS !dD !FF !gG !hH !jJ !kK !lL !öÖ !äÄ !#' !    !
011710 ;!      ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 1B! 1E! 9B!
011720 ;!LOCK^! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5C! 5B! 5E! 8B!
011730 ;!      ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7C! 7B! 23! 8B!
011740 ;-------------------------------------------------------- FT!
011750 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !    !
011760 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2!-62! 92! B2  !    !
011770 ;! 90! 23! 00! 00! 00! 00! 00! 00! 00! 24! 25! 44! 90  !    !
011780 ;!   !<> !yY !xX !cC !vv !bB !nN !mM !,; !.: !-_ !      !    !
011790 ;! ^ !   ! 19! 18! 03! 16! 02! 0E! 0D!   !   ! 1F!  ^  !    !
011800 ;!SHF! 3E! 59! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!SHIFT!    !
011810 ;!   ! 3C! 79! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 20!      !    !
011820 ;!-----------------------------------------------------------------
011830 ;                !              A05              !
011840 ;                !               30              !
011850 ;                !               60              !
011860 ;                !                               !
011870 ;                !               20              !
011880 ;                !               20              !
011890 ;                !               20              !
011900 ;                ---------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


011920 ; SWEDISH/FINNISH
011930 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
011940 ;       3RD LINE MARKBITS     4TH SYMBOLS
011950 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
011960 ;-------------------------------------------------------------------
011970 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
011980 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
011990 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
012000 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
012010 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
012020 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
012030 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
012040 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
012050 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
012060 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
012070 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34! 02! 0A! 00! 20! 60!
012080 ;ESC!1! !2" !3# !4¤ !5% !66 !7/ !8( !9) !0= !+? !'` !BSP!TAB!
012090 ; 18!   !   !   !   !   !   !   !   !   !   !   ' 00! 98! 09!
012100 ; 18! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 60! 88! 09!
012110 ; 18! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2B! 27! 88! 09!
012120 ;-------------------------------------------------------------------
012130 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
012140 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
012150 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 18!  A0 !
012160 ;     !q@ !ww !eE !rR !tT !yY !uU !iI !oO !pP !Aa.!^B !     !
012170 ;     ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1D! 1E!     !
012180 ;CONTL! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 5D! 7E!CONTL!
012190 ;     ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 7D! 5E!     !
012200 ;-------------------------------------------------------------------
012210 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
012220 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
012230 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 28! 19! 20!
012240 ;!     !aA !sS !dD !fF !gG !hH !jJ !kk !lL !öö !äÄ !§# !    !
012250 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 1B!    ! 98!
012260 ;!LOCK*! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5C! 5B! 2A! 88!
012270 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7C! 7B! 40! 88!
012280 ;------------------------------------------------------------ FT!
012290 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !     !
012300 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !     !
012310 ;! 90! 23! 00! 00! 00! 00! 00! 00! 00! 24! 25! 44! 90  !     !
012320 ;!   !<> !zZ !xX !cC !vV !bB !nN !mM !,; !.: !-_ !     !     !
012330 ;! ^ ! ° ! 1A! 18! 03! 16! 02! 0E! 00!   !   ! 1F! ^ !     !
012340 ;!SHF! 3E! 5A! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!SHIFT!     !
012350 ;!   ! 3C! 7A! 78! 63! 76! 62! 6E! 60! 2C! 2E! 2D!     !     !
012360 ;!-------------------------------------------------------------------
012370 ;                !              A05              !
012380 ;                !               30              !
012390 ;                !               60              !
012400 ;                !                               !
012410 ;                !               20              !
012420 ;                !               20              !
012430 ;                !               20              !
012440 ;                ---------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             012460 ;NORWEGIAN
                             012470 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             012480 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             012490 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             012500 ;-----------------------------------------------------------
                             012510 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             012520 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
                             012530 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             012540 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
                             012550 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             012560 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             012570 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             012580 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             012590 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             012600 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             012610 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34! 02! 0A! 0D! 20! 60!
                             012620 ;ESC!1! !2" !3#!4$ !5% !66 !7/ !8( !9) !0= !+? !'` !BSP!TAB!
                             012630 ; 1B!   !   !   !   !   !   !   !   !   !   !   ! 00! 9B! 09!
                             012640 ; 1B! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 60! 8B! 09!
                             012650 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2B! 27! 88! 09!
                             012660 ;-----------------------------------------------------------
                             012670 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
                             012680 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
                             012690 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 18!  A0 !
                             012700 ;     !q@ !ww !eE !rR !tT !yY !uU !iI !oO !pP !Aa.!^þ !     !
                             012710 ; .   ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1D! 1E!     !
                             012720 ;CONTL! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 5D! 7E!CONTL!
                             012730 ;     ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 7D! 5E!     !
                             012740 ;-----------------------------------------------------------
                             012750 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             012760 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             012770 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 2B! 19! 20!
                             012780 ;!     !aA !sS !dD !fF !gG !hH !jJ !kk !lL !äÄ !öÖ !§* !   !
                             012790 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1B! 1C!   ! 9B!
                             012800 ;!LOCK^! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5B! 5C! 2A! 8B!
                             012810 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7B! 7C! 40! 8B!
                             012820 ;-----------------------------------------------------------FT!
                             012830 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
                             012840 ;! 4D! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
                             012850 ;! 90! 23! 00! 00! 00! 00! 00! 00! 00! 24! 25! 44! 9B  !   !
                             012860 ;!   !<> !zZ !xX !cC !vV !bB !nN !mM !,;!.: !-_ !     !   !
                             012870 ;! ^ !   ! 1A! 18! 03! 16! 02! 0E! 0D!   !   ! 1F!  ^  !   !
                             012880 ;!SHF! 3E! 5A! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!SHIFT!   !
                             012890 ;!   ! 2C! 7A! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 2D!     !   !
                             012900 ;!-----------------------------------------------------------
                             012910 ;              !            A05             !
                             012920 ;              !             30             !
                             012930 ;              !             60             !
                             012940 ;              !                            !
                             012950 ;              !             20             !
                             012960 ;              !             20             !
                             012970 ;              !             20             !
                             012980 ;              ---------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             013000 ;SPANISH
                             013010 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             013020 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             013030 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             013040 ;-----------------------------------------------------------
                             013050 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             013060 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! 80!
                             013070 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             013080 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
                             013090 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             013100 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             013110 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             013120 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             013130 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             013140 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             013150 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34! 02! 1A! 2B! 20! 60!
                             013160 ;ESC!1! !2" !3# !4$ !5% !6& !7/ !8( !9) !0= !§? !¡?/!BSP!TAB!
                             013170 ; 1B!  !  !  !  !  !  !  !  !  !  !  •!  ! 1B! 9B! 09!
                             013180 ; 1B! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 5D! 8B! 09!
                             013190 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 40! 5B! 8B! 09!
                             013200 ;-----------------------------------------------------------
                             013210 ; 000 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
                             013220 ;  15 ! 55! 45! 25! D5! 35! 85! A5! C5! 65! 95! B5! 75!  D0 !
                             013230 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 38! 06!  A0 !
                             013240 ;     !q@ !ww !eE !rR !tT !yY !uU !iI !o0 !pP !^Ø !+¤ !     !
                             013250 ;     ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1E!  !     !
                             013260 ;CONTL! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 7E! 2A!CONTL!
                             013270 ;     ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 5E! 2B!     !
                             013280 ;-----------------------------------------------------------
                             013290 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             013300 ;!  11 ! 51! 41! 21! D1! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             013310 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 20!
                             013320 ;!     !aA !sS !dD !fF !g6 !hH !jJ !kK !lL !nNB!'` !äü !   !
                             013330 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 00! 1D! 98!
                             013340 ;!LOCK^! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5C! 60! 7D! 88!
                             013350 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7C! 27! 7B! 88!
                             013360 ;----------------------------------------------------- FT!
                             013370 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
                             013380 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
                             013390 ;! 90! 23! 00! 00! 00! 00! 00! 00! 00! 24! 25! 44! 90  !   !
                             013400 ;!   !() !zZ !xX !cC !vV !bB !nN !mM !,;!.: !-_ !     !   !
                             013410 ;! ^ !   ! 1A! 18! 03! 16! 02! 0E! 00!   !   ! 1F!  ^  !   !
                             013420 ;!SHF! 3E! 5A! 58! 43! 56! 42! 4E! 40! 3B! 3A! 5F!SHIFT!   !
                             013430 ;!   ! 2C! 7A! 78! 63! 76! 62! 6E! 60! 2C! 2E! 20!     !   !
                             013440 ;!-----------------------------------------------------------
                             013450 ;           !              A05              !
                             013460 ;           !               30              !
                             013470 ;           !               60              !
                             013480 ;           !                               !
                             013490 ;           !               20              !
                             013500 ;           !               20              !
                             013510 ;           !               20              !
                             013520 ;           ---------------------------------
```

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             013540 ;ITALIAN
                             013550 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             013560 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             013570 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             013580 ;-------------------------------------------------------
                             013590 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             013600 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
                             013610 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             013620 ;F1 !F2 !F3 !F4 !F5 !F6 !F7 !F8 !F9 !F10!F11!F12!F13!F14!F15!
                             013630 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             013640 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             013650 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             013660 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             013670 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             013680 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             013690 ; 60! 00! 30! 29! 00! 00! 31! 21! 33! 34! 02! 0F!S9 ! 20! 60!
                             013700 ;ESC!1! !2" !3 !4$ !5% !6& !7/ !8( !9) !0= !'? !ì'^!BSP!TAB!
                             013710 ; 1B!   !   !   !   !   !   !   !   !   !   !   ! 1E! 9B! 09!
                             013720 ; 1B! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 5E! 8B! 09!
                             013730 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 27! 7E! 8B! 09!
                             013740 ;-------------------------------------------------------
                             013750 ; 000 !001!002!003!004!005!006!007!008!009!010!011!012! 013 !
                             013760 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
                             013770 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 06!  A0 !
                             013780 ;     !o@ !zZ !eE !rR !tT !yY !uU !iI !o0 !pP !ee`!++ !     !
                             013790 ;     ! 11! 1A! 05! 12! 14! 19! 15! 09! 0F! 10! 10!   !     !
                             013800 ;CONTL! 51! 5A! 45! 52! 54! 59! 55! 49! 4F! 50! 7D! 2A!CONTL!
                             013810 ;     ! 71! 7A! 65! 72! 74! 79! 75! 69! 6F! 70! 5D! 2B!     !
                             013820 ;-------------------------------------------------------
                             013830 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             013840 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             013850 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00!S2 !S4 !S7 ! 20!
                             013860 ;!     !aA !sS !dD !fF !gG !hH !jJ !kK !lL !a'c!u'.!o'§!   !
                             013870 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 1B! 00! 9B!
                             013880 ;!LOCK^! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5C! 5B! 40! 8B!
                             013890 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7B! 60! 7C! 8B!
                             013900 ;------------------------------------------------------- FT!
                             013910 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
                             013920 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
                             013930 ;! 90! 23! 00! 00! 00! 00! 00! 00! 00! NN! NN! 2B! 90  !   !
                             013940 ;!   !<> !wW !xX !cC !vV !bB !nN !mM !,;!.: !-_ !     !   !
                             013950 ;! 0 !   ! 17! 18! 03! 16! 02! 0E! 00!   !   ! 1F!  ^  !   !
                             013960 ;!SHF! 3E! 57! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!SHIFT!   !
                             013970 ;!   ! 3C! 77! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 2D!     !   !
                             013980 ;!-------------------------------------------------------
                             013990 ;              !            A05              !
                             014000 ;              !             30              !
                             014010 ;              !             60              !
                             014020 ;              !                             !
                             014030 ;              !             20              !
                             014040 ;              !             20              !
                             014050 ;              !             20              !
                             014060 ;              ------------------------------
```

```
ACCPTK   LABL  0155H   005060
ASCITB   LABL  036DH   008650  005370
ATEMP    EQU   0007H   001060
BDCLK    EQU   0004H   001030
BITCTR   EQU   0003H   001020
BITIME   LABL  0089H   002610  002490
BUS      EQU   0000H   000000
C        EQU   0070H   000080
CAFLG    EQU   007EH   001110
CHARBF   EQU   0005H   001040
CHKSUM   LABL  03FEH   008840
CKSU1    LABL  01F9H   006440  003400
CKSU2    LABL  0200H   006520
CKSU3    LABL  0007H   003410
CLEAR    LABL  00B9H   003100  003230
CNT      EQU   0000H   000000
CNTDWN   LABL  008FH   002670  002420  002630
COND     LABL  0208H   006610  005630
DBB      EQU   001AH   000000
DECPOI   EQU   0024H   001220  003720  006620
DMJ      EQU   00E0H   000000
DOUBLQ   EQU   000BH   001150  005560
ERRCNT   EQU   0002H   001010
EXCEPT   LABL  0189H   005900  005260  005940  005950
EXINT    LABL  006BH   002340  001690  001790  002040  002090  002570
F0       EQU   005EH   000000
F1       EQU   007EH   000000  001110
FIFO     EQU   0010H   001200  002760  002770  003280  003290
FIFOEN   EQU   0017H   001210
FLAGB    EQU   0021H   001170  005090  006120  006380
FLAGS    EQU   00F0H   000000
FUKY     LABL  01B3H   005840  005240
I        EQU   0000H   000000
INTRPT   LABL  002AH   001780  001350
INTRUP   LABL  0003H   001320
KEYS     EQU   0068H   008630  004430
KYDOWN   LABL  0138H   004840  004740
KYDWN    EQU   0007H   000950
LASTCD   EQU   0022H   001180  005180
LASTKY   EQU   0023H   001190  005140  005770
LDKBQ    LABL  0092H   002710  005530  005580
LNGOFS   LABL  026EH   007560  007400
LOCKY    LABL  0132H   004790  004960  005050  006420
LONGDL   EQU   0060H   001120  005070
MB0      EQU   0020H   000000
MB1      EQU   0030H   000000
MRKTBL   LABL  0300H   008490  008630
MSKTB    LABL  02CCH   007860  006080  006150
MTKBQ    LABL  003DH   001980  001710  001830
N0       LABL  0179H   005330
N1       LABL  018CH   005480
N3       LABL  0191H   005520  003000  006760
N4       LABL  019CH   005610  005500
N5       LABL  01A0H   005650  005620
N5P0     LABL  00ACH   002960  005650
```

NATVLN	LABL	0256H	007350	005170						
NEWS	LABL	0104H	004410	004500						
NORMLS	LABL	0174H	005280	005880	006130					
P0	EQU	0000H	000000							
P1	EQU	0001H	000000							
P2	EQU	0002H	000000							
P4	EQU	0004H	000000							
P5	EQU	0005H	000000							
P6	EQU	0006H	000000							
P7	EQU	0007H	000000							
PAUSE	LABL	008DH	002650	002510						
PSW	EQU	00CFH	000000							
QHPTR	EQU	0006H	000940							
QTPTR	EQU	0005H	000930	002050						
R0	EQU	0000H	000000							
R1	EQU	0001H	000000	000860						
R2	EQU	0002H	000000	001010						
R3	EQU	0003H	000000	000910	001020					
R4	EQU	0004H	000000	000920	001030					
R5	EQU	0005H	000000	000930	001040					
R6	EQU	0006H	000000	000940	001050					
R7	EQU	0007H	000000	000950	001060					
RB0	EQU	0000H	000000							
RB1	EQU	0010H	000000							
REPCK	LABL	01A2H	005690	004910						
REPDLY	EQU	0004H	000920							
REPEAT	LABL	0157H	005080	005820						
REPRAT	EQU	0008H	001130	005810						
RESHFG	LABL	01F2H	006370	004950						
RESTRT	LABL	0000H	001280							
ROMCK	LABL	00CCH	003310							
SCAN	LABL	010BH	004460	004760	004770	004830	004880	005030	005130	005440
			005570	005590	005710	005740	005800	006350		
SEND	LABL	0060H	002380	001890	002210					
SHFTRG	EQU	0006H	001050							
SPZEXC	LABL	01E0H	006190	005210	005920					
SPZXCD	LABL	03DAH	008800	006280						
START	LABL	00B4H	003040	001300						
STPTR	EQU	0001H	000860							
STRAPS	EQU	0020H	001160	001840	001990	003520	007370			
STS	EQU	00E8H	000000							
STSHFG	LABL	01EEH	006320	005860	006710					
SUPLFU	LABL	0220H	006790	006720						
T	EQU	004AH	000000							
TBLPTR	EQU	0003H	000910							
TCNTI	EQU	0020H	000000							
TIMER	LABL	0007H	001460							
TMRCNT	EQU	FFFDH	001140	001670						
TRANS	LABL	021CH	006730	002990	006160	006300	006660	006680		
TXTCHG	LABL	022CH	006820	005510						
UNCH	LABL	0235H	006900	006840	006880	006960	006980	007090	007110	007460
UNLOCK	LABL	014AH	004970	004730						
XL	LABL	026CH	007540	006100						
XLCO	LABL	02E6H	007910	006150						

KEYBOARD FIRMWARE (VERSION 2)

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             000010 ;    ***********************************************
                             000020 ;    * THIS DOCUMENT, FILES AND INFORMATION HEREIN *
                             000030 ;    *  ARE CONFIDENTIAL AND PROPRIETARY PROPERTY  *
                             000040 ;    *   OF NCR CORPORATION AND ALL UNAUTHORIZED   *
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                             000070 ;
                             000080 ;
                             000090 ;         ************************************
                             000100 ;         *                                  *
                             000110 ;         *        COPYRIGHT (C) 1983        *
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                             000170 ;         *     CONFIDENTIAL, UNPUBLISHED    *
                             000180 ;         *    PROPERTY OF NCR CORPORATION   *
                             000190 ;         *                                  *
                             000200 ;         ************************************
                             000210 ;
                             000220 ;
                             000230 ;   LANGUAGEGROUP II : Swiss,France,Australia,Canada
                             000240 ;                      South-Africa,Portugal,Yugoslavia
                             000250 ;   PCB must contain 8048/8748 strappings,if 8749 or 8049's
                             000260 ;    are used. No strappings are required,if 8742 or 8742's
                             000270 ;    are used,but firmware is different from 49'ers!
                             000280 ;  Decimal point/comma switching using ctrl+dec.point key
                             000290 ;  ctrl+F20 inforces a clear FIFO ,code B3 hex is trans-
                             000300 ;  mitted to kb-IF chip ,which initiates a COLD-Start-
                             000310 ;  RESET  to the computer. Kb-power-up routine is n o t
                             000320 ;  repeated in this case!!!!
```

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

000340 ;          ************************
000350 ;          *                      *
000360 ;          * PERSONAL-COMP.-KEYBOARD*
000370 ;          *                      *
000380 ;          * ASCII ENCODED PLL/SER. *
000390 ;          *   LANGUAGEGROUP II     *
000400 ;          *        APRIL 83        *
000410 ;          *    USE 8049 OR 8749    *
000420 ;          *     X-TAL= 6.00 MHZ    *
000430 ;          *                      *
000440 ;          ************************
000450 ;
000460 ;
000470 ;  REGISTER BANK 0              REGISTER BANK 1
000480 ;  --------------------        --------------------
000490 ;  R0...TEMPORARY STORAGE       R0...TEMPORARY STORAGE
000500 ;  R1...STATUS ARRAY POINTER    R1...TEMPORARY STORAGE
000510 ;  R2...TEMPORARY STORAGE       R2...ERRCNT(BELL MULTIPLIER)
000520 ;  R3...TABLE STORAGE           R3...XMIT BIT COUNTER
000530 ;  R4...REPEAT DELAY CTR        R4...BAUD CLOCK (BEEP CYCLES)
000540 ;  R5...QUEUE TAIL POINTER      R5...XMIT CHARACTER BUFFER
000550 ;  R6...QUEUE HEAD POINTER      R6...XMIT SHIFT REGISTER
000560 ;  R7...8 KEY STATUS            R7...SAVE ACC DURING INTRPTS
000570 ;
000580 ;  RAM: 26...3F  KEY STATUS 2 BITS/KEY  4 KEYS/BYTE
000590 ;               STATUS TURNAROUND 2 BITS LEFT FOR EACH KEY
000600 ;       10...17  QUEUE OF CODES TO BE SENT (FIFO)
000610 ;
000620 ;  TABLES: 300...367 MARKBIT-TABLE
000630 ;
000640 ;       368....3CF  ASCII CODE TABLE
000650 ;  F0  SERIAL KB TOGGLE
000660 ;
000670 ;  MARKBIT ASSIGNMENTS:
000680 ;  BIT 0...0
000690 ;  BIT 1...0
000700 ;  BIT 2... ) EXCEPTION OFFSET
000710 ;  BIT 3...0
000720 ;  BIT 4.../         SHIFKY(B7=1)
000730 ;  BIT 5...IGNORE SHIFT(B0..4,7=0)/CTLKY(B7=1)/
000740 ;        IF B0..4)0 EXCEPTION CODES FOR SYMBOLCODES 21...3FH
000750 ;  BIT 6...IGNORE CTRL-FLAG/LOCKKY(B7=1)/SPEZ.XLAT(B0..4)0)
000760 ;  BIT 7...FUNCTION KEY/NO AUTOREPEAT INDICATOR/SHF.CTL.LOCK-
000770 ;
000780 ; 80(FUNCTION KEYS F1...F20)    90(SHIFT KEYS) A0(CONTROL KEY
000790 ; C0(ALPHA LOCK KEY)  20(SHIFT COND.IGNORED) 40(CTRL.COND IGN
000800 ; 1...15 (SYMBOL CODE EXCEPTIONS) 4X(SPECIAL EXCEPTIONS)
000810 ; 00 NO EXCEPTIONS,NORMAL CODE CALCULATION:
000820 ;   UNSHIFT CODE  EXORED BY SHIFT OR CONTROL FLAG,
000830 ;   SHIFT FLAG INVERTED FOR LETTER CODES DURING ALPHA LOCK ON
000840 ;   AND CONTROL FLAG OFF.
000850 ;   CONTROL MODE IGNORED FOR CHARACTERCODES ( §
000860 ;   SHIFT- AND CONTROL-MODE COINCIDENCE DISABLED FOR ALL KEYS
```

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL    CMD   OPERAND          COMMENT

                             000880 ;   RB0  EQUATES
                             000890 ;   ------------
                             000900 ;
               0001          000910 STPTR    EQU   R1          ;STATUS POINTER
                             000920 ;                BIT 0=0  KEY UP AT LAST SCAN
                             000930 ;                      1  KEY DOWN AT LAST SCAN
                             000940 ;                AFTER CHECKING KEY DOWN BIT 6&7 ARE ROTATED TO
                             000950 ;
               0003          000960 TBLPTR   EQU   R3          ;POINTER TO R/C VALUE IN PAGE 3
               0004          000970 REPDLY   EQU   R4          ;REPEAT DELAY COUNTER FOR AUTO REPEA
               0005          000980 QTPTR    EQU   R5          ;QUEUE TAIL POINTER
               0006          000990 QHPTR    EQU   R6          ;QUEUE HEAD POINTER
               0007          001000 KYDWN    EQU   R7          ;8 KEY DOWN REGISTER
                             001010 ;                TIMES HOW LONG KEYS LOCKED OUT
                             001020 ;
                             001030 ;   RB1  EQUATES
                             001040 ;   ------------
                             001050 ;
               0002          001060 ERRCNT   EQU   R2          ;BEEP MULTIPLIER FOR LONG TONE(.5SEC
               0003          001070 BITCTR   EQU   R3          ;COUNTS SERIAL BITS SHIFTED OUT
               0004          001080 BDCLK    EQU   R4          ;BIT COUNTER FOR BAUD CLOCK
               0005          001090 CHARBF   EQU   R5          ;CHARACTERBUFFER FOR SERIAL OUTPUT
               0006          001100 SHFTRG   EQU   R6          ;SHIFT REGISTER
               0007          001110 ATEMP    EQU   R7          ;SAVE ACC DURING INTERRUPT
                             001120 ;
                             001130 ;   OTHERS
                             001140 ;   ------
                             001150 ;
               007E          001160 CAFLG    EQU   F1          ;CHARACTER AVAILABLE FLAG
               0060          001170 LONGDLY  EQU   96
               0008          001180 REPRAT   EQU   8           ;APPROX. 11 HZ
               FFFD          001190 TMRCNT   EQU   -3
               0008          001200 DOUBLO   EQU   11          ;DOUBLE ZERO DISPLACEMENT
               0020          001210 STRAPS   EQU   32          ;STRAPPING INFO
               0021          001220 FLAGB    EQU   33          ;WP-,CTL-,SHIFT FLAGB
               0022          001230 LASTCD   EQU   34          ;INTERIM STORAGE CELL
               0023          001240 LASTKY   EQU   35          ;LAST KEY POSITION
               0010          001250 FIFO     EQU   16          ;FIFO STARTADDRESS
               0017          001260 FIFOEND  EQU   23          ;LAST ADDRESS
               0024          001270 DECPOI   EQU   36          ;SOFTADDRESS OF DEC.POINT/COMMA
```

```
ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0000               001290          ORG   0
                          001300 ;
                          001310 ;  RESTART, INTERRUPT VECTORS
                          001320 ;
       0000               001330 RESTRT:
       0000   35          001340          DIS   TCNTI       ;DISABLE TIMER INTERRUPT
       0001   04BA        001350          JMP   START       ;START KB SCAN
                          001360 ;
       0003               001370 INTRUPT:
       0003   D5          001380          SEL   RB1
       0004   AF          001390          MOV   ATEMP,A
       0005   0429        001400          JMP   INTRPT
                          001410 ;
                          001420 ;  TIMER INTERRUPT
                          001430 ;  ***************
                          001440 ;
                          001450 ;THIS INTERRUPT IS EVERY 240MYSEC(XTAL=6 MHZ) OR 4MSEC
                          001460 ; TMRCNT=3  IT SERVES TWO FUNCTIONS:
                          001470 ;
                          001480 ;       1) BEEP TONE GENERATION(240MYSEC)
                          001490 ;       2) EMPTY KB QUEUE  (4MS)
                          001500 ;
       0007               001510 TIMER:
       0007   D5          001520          SEL   RB1
       0008   AF          001530          MOV   ATEMP,A     ;SAVE ACC
       0009   23CE        001540          MOV   A,#-50      ;4MS PAUSE
       000B   62          001550          MOV   T,A
                          001560 ;
                          001570 ; OUTPUT BAUD CLOCK TO PORT 26
                          001580 ;
       000C   FC          001590          MOV   A,BDCLK     ;ODD/EVEN COUNT TEST
       000D   F221        001600          JB7   $4
       000F   9617        001610          JNZ   $5          ;BEEP TONE IS SET
       0011   FA          001620          MOV   A,ERRCNT    ;TEST BEEP MULTIPLIER
       0012   C617        001630          JZ    $5          ;NO, CONTINUE NORMAL
       0014   CA          001640          DEC   ERRCNT      ;ELSE DECREMENT EERUR COUNTER
       0015   BC3C        001650          MOV   BDCLK,#60   ;SET COUNT OF CYCLES FOR BEEP
       0017               001660 $5:
       0017   0A          001670          IN    A,P2        ;LOAD BEEP CONDITION
       0018   0340        001680          XRL   A,#40H      ;SWAP PHASE
       001A   3A          001690          OUTL  P2,A
       001B   CC          001700          DEC   BDCLK
       001C               001710 $1:
       001C   23FD        001720          MOV   A,#TMRCNT   ;RELOAD TIMER REGISTER
       001E   62          001730          MOV   T,A
       001F   0464        001740          JMP   EXINT
       0021               001750 $4:
       0021   0442        001760          JMP   MTKBQ       ;TEST ON BELL LATCH SET
       0023   BA23        001770          MOV   ERRCNT,#35  ;SET MULTIPLIER
       0025   BC3C        001780          MOV   BDCLK,#60
       0027   041C        001790          JMP   $1
                          001800 ;
```

```
ERR-C  ADDR   OBJ-CD      PG-LIN  LABEL   CMD    OPERAND          COMMENT

       0029             001820 INTRPT:                  ;IBF IS SET
       0029   862D       001830         JNI    $+4       ;POLL IS PENDING
       002B   0464       001840         JMP    EXINT     ;ELSE IGNORE INTERRUPT
       002D   23FD       001850         MOV    A,#-3
       002F   B816       001860         MOV    R0,#22    ;SET DELAY COUNTER 300 USEC
       0031   17         001870         INC    A
       0032   8631       001880         JNI    $-1       ;A SECOND POLL IS PENDING
       0034   E832       001890         DJNZ   R0,$-2
       0036   F242       001900         JB7    MTKBQ     ;THERE WAS NO 2ND POLL(WR/) SIGNAL
       0038   B820       001910         MOV    R0,#STRAPS ;LOAD LANGUAGE CODE
       003A   F0         001920         MOV    A,@R0
       003B   530F       001930         ANL    A,#15     ;MASK OUT UPPER STRAP-INFO
       003D   4300       001940         ORL    A,#-48    ;SET UP UPPER BITS +ASSUME GOOD KB S
       003F   AD         001950         MOV    CHARBF,A
       0040   0466       001960         JMP    SEND
                         001970 ;
                         001980 ; MTKBQ- EMPTY KEYBOARD QUEUE
                         001990 ; -------------------------
                         002000 ; LOOKS INTO QUEUE ONCE EVERY INTERRUPT.
                         002010 ; IF THERE IS A CODE, IT IS PUT INTO CHARBF
                         002020 ; THE CHARACTER AVAILABLE FLAG IS SET
                         002030 ; THE QUEUE POINTER IS UPDATED UNTIL EMPTY CONDITION
                         002040 ;
       0042             002050 MTKBQ:
       0042   8820       002060         MOV    R0,#STRAPS ;SELECT SERIAL INTERFACE
       0044   F0         002070         MOV    A,@R0
       0045   37         002080         CPL    A         ;INVERT INDICATOR
       0046   AB         002090         MOV    R3,A      ;SAVE FOR FURTHER USE
                         002100 ;       JB4    $+4       ;SKIP MASTER SLAVE IF RESPECTS
                         002110 ;       JOBF   EXINT     ;EXIT IF LAST KEY NOT YET FETCHED
       0047   B805       002120         MOV    R0,#QTPTR ;ELSE LOOK INTO QUEUE TO FIND CODES
       0049   F0         002130         MOV    A,@R0     ; FOR TRANSMIT
       004A   18         002140         INC    R0
       004B   D0         002150         XRL    A,@R0     ; HEAD=TAIL MEANS EMPTY
       004C   C664       002160         JZ     EXINT     ;FIFO EMPTY
                         002170 ;         ELSE GET A CODE FROM QUEUE
       004E   F0         002180         MOV    A,@R0     ;PUT POINTER INTO R1
       004F   A9         002190         MOV    R1,A
       0050   F1         002200         MOV    A,@R1     ;GET THE CODE
       0051   AD         002210         MOV    CHARBF,A  ;PUT INTO BUFFER
       0052   F0         002220         MOV    A,@R0     ;UPDATE HEAD POINTER
       0053   17         002230         INC    A
       0054   5317       002240         ANL    A,#17H    ;MAKE RING COUNTER
       0056   A0         002250         MOV    @R0,A     ;AND REPLACE
       0057             002260 $1:
       0057   FB         002270         MOV    A,R3      ;RELOAD STRAPINFO
       0058   F266       002280         JB7    SEND
       005A   18         002290         INC    R0        ;POINT TO FLAGB
       005B   F0         002300         MOV    A,@R0
       005C   F260       002310         JB7    $3        ;IF TRUE THEN SKIP
       005E   8C3C       002320         MOV    BDCLK,#60 ;OTHERWISE INITIATE A BEEP
       0060             002330 $3:
       0060   FD         002340         MOV    A,CHARBF  ;LOAD CODE
       0061   D3E0       002350         XRL    A,#0E0H   ;INVERT UPPER 3 BITS
       0063   02         002360         OUTL   BUS,A     ;AND OUTPUT TO BUS PORT
```

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ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0064               002370 EXINT:                   ;EXIT TIMER INTERRUPT
       0064   FF          002380         MOV   A,ATEMP
       0065   93          002390         RETR
                          002400 ;
       0066               002410 SEND:
       0066   B808        002420         MOV   BITCTR,#8  ;SET COUNTER FOR 8 BITS
       0068               002430 $1:
       0068   9A7F        002440         ANL   P2,#7FH    ;SET SYNCH BIT
       006A   1489        002450         CALL  CNTDWN+2   ;TIME IS 25 USEC
       006C   FD          002460         MOV   A,CHARBF
       006D   77          002470         RR    A          ;SEND LSB FIRST
       006E   AD          002480         MOV   CHARBF,A
       006F   F27F        002490         JB7   $4         ;HOLD ON BIT
       0071   8A80        002500         ORL   P2,#80H    ;ELSE RESET IT
       0073               002510 $2:
       0073   1481        002520         CALL  BITIME     ;TIME IS NOW 80 USEC
       0075   8A80        002530         ORL   P2,#80H    ;RESET NOW UNCONDITIONAL
       0077   1485        002540         CALL  PAUSE      ;WAIT NOW 100 USEC
       0079   CB          002550         DEC   BITCTR
       007A   FB          002560         MOV   A,BITCTR
       007B   9668        002570         JNZ   $1         ;REPEAT 8 TIMES
       007D               002580 $3:
       007D   0464        002590         JMP   EXINT
                          002600 ;
       007F   0473        002610 $4:     JMP   $2         ;ROUTINE LENGTH EGALIZATION
                          002620 ;
       0081               002630 BITIME:
       0081   B80B        002640         MOV   R0,#11
       0083   0487        002650         JMP   CNTDWN
                          002660 ;
       0085               002670 PAUSE:
       0085   B80E        002680         MOV   R0,#14
       0087               002690 CNTDWN:
       0087   E887        002700         DJNZ  R0,$
       0089   83          002710         RET
                          002720 ;
       008A               002730 LOKBQ:                  ;LOAD A RECOGNIZED CODE INTO FIFO
       008A   23B3        002740         MOV   A,#0B3H    ;SELECT RESET CODE
       008C   DA          002750         XRL   A,R2
       008D   9693        002760         JNZ   $1
       008F   BD10        002770         MOV   QTPTR,#FIFO
       0091   BE10        002780         MOV   QHPTR,#FIFO        ;SET FIFO EMPTY
       0093               002790 $1:
                          002800 ;
       0093   FD          002810         MOV   A,QTPTR    ;TEST FOR PLACE
       0094   17          002820         INC   A
       0095   5317        002830         ANL   A,#17H     ;MASK MODULO 8
       0097   DE          002840         XRL   A,QHPTR    ;COMPARE WITH HEAD POINTER
       0098   C6A3        002850         JZ    $2         ;FULL,IGNORE ENTRY AND INITIATE ERRT
                          002860 ;
       009A   FD          002870         MOV   A,QTPTR    ;PUT POINTER INTO R0
       009B   A8          002880         MOV   R0,A
       009C   FA          002890         MOV   A,R2       ;GET CODE FOR FIFO
       009D   A0          002900         MOV   @R0,A
       009E   FD          002910         MOV   A,QTPTR    ;UPDATE POINTER
```

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ERR-C  ADDR   OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

       009F   17              002920          INC   A
       00A0   5317            002930          ANL   A,#17H     ;MASK INTO FIFO AREA
       00A2   AD              002940          MOV   @TPTR,A
       00A3                   002950 $2:
       00A3   83              002960          RET
                              002970 ;
       00A4                   002980 N5P0:
       00A4   030C            002990          ADD   A,#12      ;SELECT F5..FF
       00A6   E6AC            003000          JNC   $1
       00A8   03AE            003010          ADD   A,#SUPLFU
       00AA   A3              003020          MOVP  A,@A
       00AB   AA              003030          MOV   R2,A
       00AC   249E            003040 $1:      JMP   N3
                              003050 ;
       00AE                   003060 SUPLFU:
       00AE   343536373839    003070          DB    '456789*+123/'
              2A2B3132332F
                              003080 ;***************INITIALIZE SCAN*****************
                              003090 ;
       008A                   003100 START:
       00BA   9ABF            003110          ANL   P2,#0BFH   ;PREPARE MATRIX READ STRAP INFO
                              003120 ;
                              003130 ;
       00BC   95              003140          CPL   F0         ;PRESET GOOD KB
       00BD   B87F            003150          MOV   R0,#127    ;SET RAM MSLOCATION
       00BF                   003160 CLEAR:
       00BF   27              003170          CLR   A
       00C0   37              003180          CPL   A
       00C1   A0              003190          MOV   @R0,A
       00C2   00              003200          XRL   A,@R0      ;TEST FF
       00C3   C6C6            003210          JZ    $1
       00C5   85              003220          CLR   F0         ;SET RAM ERROR FLAG
       00C6                   003230 $1:
       00C6   A0              003240          MOV   @R0,A      ;CLEAR RAM
       00C7   F0              003250          MOV   A,@R0      ;AND TEST
       00C8   C6CB            003260          JZ    $2
       00CA   85              003270          CLR   F0
       00CB                   003280 $2:
       00CB   E8BF            003290          DJNZ  R0,CLEAR
       00CD   22              003300          IN    A,DBB      ;CLEAR IBF
                              003310 ;
                              003320 ;PRESET POINTERS,TIMER
                              003330 ;
       00CE   BD10            003340          MOV   @TPTR,#FIF0        ;FIFO ADDRESS
       00D0   BE10            003350          MOV   @HPTR,#FIF0
                              003360 ;DIAGNOSTIC CHECK SUM ROUTINE
       00D2   27              003370 ROMCK:   CLR   A
       00D3   A8              003380          MOV   R0,A
       00D4                   003390 $1:
       00D4   A3              003400          MOVP  A,@A       ;GET A ROM BYTE
       00D5   6A              003410          ADD   A,R2
       00D6   AA              003420          MOV   R2,A       ;SAVE SUM
       00D7   18              003430          INC   R0
       00D8   F8              003440          MOV   A,R0       ;REPEAT 256 TIMES
       00D9   96D4            003450          JNZ   $1
```

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ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD   OPERAND          COMMENT


       00D8   34F9         003460          CALL  CKSU1       ;CONTINUE IN PAGE 1
       00DD   94F9         003470          CALL  CKSU4       ;CONTINUE IN PAGE 1
       00DF   D4F9         003480          CALL  CKSU6       ;CONTINUE IN PAGE 1
       00E1                003490 CKSU3:
       00E1                003500 $1:                       ;COMPUTE 3RD  PAGE
       00E1   E3           003510          MOVP3 A,@A        ;GET A ROM BYTE
       00E2   6A           003520          ADD . A,R2
       00E3   AA           003530          MOV   R2,A        ;SAVE SUM
       00E4   18           003540          INC   R0
       00E5   F8           003550          MOV   A,R0        ;REPEAT 256 TIMES
       00E6   96E1         003560          JNZ   $1
       00E8   FA           003570          MOV   A,R2        ;TEST RESULT
       00E9   C6EC         003580          JZ    $+3         ;GOOD
       00EB   85           003590          CLR   F0
       00EC   8820         003600          MOV   R0,#STRAPS ;CHANGE GOOD FLAG
                           003610 ;READ NOW  STRAPPING INFO
                           003620 ;
       00EE   09           003630          IN    A,P1
       00EF   4308         003640          ORL   A,#8        ;SET GOOD FLAG
       00F1   B6F5         003650          JF0   $+4         ;SKIP
       00F3   53F7         003660          ANL   A,#-9       ;CLEAR BIT3 TO BAD STATUS
       00F5   9AFD         003670          ANL   P2,#-3      ;SET PORT2 TO LAST COLUMN+1
       00F7   85           003680          CLR   F0          ;CLEAR FLAG AGAINST MULTIPLE KEY ENT
       00F8   A0           003690          MOV   @R0,A
       00F9   F2FE         003700          JB7   $2          ;TEST PLL-CABLE PLUGGED
       00FB   05           003710          EN    I           ;ELSE ALLOW IBF INTERRUPTS VIA POLL
       00FC   2404         003720          JMP   $3
                           003730 ;
       00FE                003740 $2:
       00FE   55           003750          STRT  T           ;INITIATE TIMER
       00FF   25           003760          EN    TCNTI       ;AND ALLOW TO INTERRUPT
       0100   B81A         003770          MOV   R0,#26      ;POINT TO  ERRCNT IN REG.BANK 1
       0102   B023         003780          MOV   @R0,#35     ;SET BEEP MULTIPLIER
       0104                003790 $3:
       0104   8824         003800          MOV   R0,#DECPOI ;PRESET TO COMMA
       0106   B02C         003810          MOV   @R0,#2CH
       0108   17           003820          INC   A
       0109   37           003830          CPL   A
       010A   5211         003840          JB2   NEWS
       010C   07           003850          DEC   A
       010D   5211         003860          JB2   NEWS
       010F   B02E         003870          MOV   @R0,#2EH    ;CHANGE TO POINT
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                              003890 ;******************ACTUAL SCAN***************
                              003900 ;
                              003910 ;A NEW SCAN  STARTS AT NEWS.
                              003920 ;THE 4 LSB'S OF PORT2 SELECTS A COLUMN OF 8 KEYS.
                              003930 ;PORT1 INPUTS THEM DATA FROM MATRIX ROWS.
                              003940 ;KEYS ACTUATED IN COLUMN SELECTED RESPONDS WITH
                              003950 ;LOGICAL 1. DATA IS SAVED IN REGISTER 7.
                              003960 ;A 2 BIT HISTORY IS RESERVED FOR EACH KEY IN THE
                              003970 ;MATRIX.LSB WILL BE SET AS LONG A KEY HAS BEEN FOUND
                              003980 ;ACTIVE, 2ND BIT INDICATES STATUS KEY HAS GONE FIRST
                              003990 ;TIME DOWN OR UP.  PROPER RECOGNITION OF KEY IS AC-
                              004000 ;CEPTED AFTER FIRST KEY GOING DOWN AND  WITH NEXT
                              004010 ;SCAN CYCLE THIS KEY IS FURTHERON ACTIVE. SUCH WAY
                              004020 ;NOISE AND DEBOUNCE IS PERFORMED OVER A WHOLE SCAN CYCLE.
                              004030 ;4 KEYS ARE CONTAINED IN EACH BYTE OF STATUS ARRAY.
                              004040 ;A TABLE POINTER  IS USED FOR GETTING MARKBITS FOR EACH KEY
                              004050 ;AND ALSO CODE.SYNCHRONIZATION IS FROM TABLEPOINTER TO
                              004060 ;STATUS POINTER EVERY  4TH KEY AND TO MATRIXCOLUMN EVERY
                              004070 ;8TH KEY.
                              004080 ;KEYS ACCEPTED ARE SELECTED IN GROUPS:
                              004090 ; SHIFT-,CONTROL-,FUNCTION-,ALPHA-,NUMERIC-,SPECIAL-KEYS
                              004100 ;THE INDICATION WHERE ANY KEY ACCOMPONIES IS CONTAINED IN
                              004110 ;MARKBIT TABLE.
                              004120 ;THE SHIFT-  AND CONTROL-KEYS ACTIVATED ARE SETTING FLAGB
                              004130 ;(20H,40H,80H) WHICH ARE STORED AT ADDR.21H.
                              004140 ;SHIFT CODE 20H IS EXORED WITH UNSHIFT ASCII CODE IF MARK-
                              004150 ;BIT ENABLES. CONTROL CODE 40H IS EXORED WITH UNSHIFTED
                              004160 ;ASCII CODE ALSO ENABLED BY MARKBIT.IF BOTH SHIFT AND CTL-
                              004170 ;FLAG ARE SET CODE OUTPUT IS DISABLED.
                              004180 ;IF CAPS' LOCK     FLAG (80H) IS SET ,THEN UPPER AND LOWER
                              004190 ;CASE  CHARACTERS A..Z ARE EXCHANGED SYNCHRONOUS WITH
                              004200 ;SHIFT POSITION,E.G. LOWER CASE IN UNSHIFT- AND UPPER CASE
                              004210 ;LETTERS IN SHIFT MODE.IF LOCK KEY IS RELEASED VICE
                              004220 ;VERSA.
                              004230 ;FOR  COUNTRY VERSIONS WHICH REQUIRES MODIFIED LAYOUTS
                              004240 ;OF KEY DISPLACEMENTS THE  STRAPPING SWITCHES ARE SET TO
                              004250 ;A SPECIFIED COUNTRY CODE (0...7).BEFORE TRANSLATIONING
                              004260 ;THE TABLE OFFSET INTO ASCII-CODES, DEPENDING ON STRAP-
                              004270 ;INFO A SEARCH ROUTINE IS EXERCISED WHETHER THE ACCORDING
                              004280 ;KEYPOSITION IS CONTAINED IN THE MODIFY TABLE OR NOT.
                              004290 ;IF TRUE ,THEN THE INSTANT OFFSET IS REPLACED BY ANOTHER
                              004300 ;AS SPECIFIED.A ZERO CONTENT IN THESE TABLES MEANS END OF
                              004310 ;TABLE CONDITION AND POINTER REMAINS UNCHANGED.
                              004320 ;MOST KEYS ARE AUTO REPEATABLE ELSE ASSOCIATED MARKBIT
                              004330 ;DETERMINES OTHERWISE. AFTER KEY FIRST GOING DOWN A LONG
                              004340 ;REPEAT DELAY IS SET(600MS),IF KEY IS HOLD DOWN FURTHERON
                              004350 ;THEN  ACCORDING ASCII  CODES ARE ISSUED DEPENDING ON
                              004360 ;SHIFT  AND CONTROL KEY STATUS,WITH AN REPEAT RATE OF
                              004370 ;APPROX. 12 HZ.
                              004380 ;CODES TO BE ISSUED TO A MAIN STATION ARE FIRST PUT INTO
                              004390 ;A QUEUE WHICH WORKS LIKE  A FIFO(FIRST IN FIRST OUT)
                              004400 ;STORAGE BUFFER.
                              004410 ;THIS USEFUL FOR THE N-KEY ROLL OVER  FEATURE WITH FAST
                              004420 ;KEY DEPRESSIONS AND GIVES THE MAIN STATION SUFFICIENT
                              004430 ;TIME TO POLL THE DATA FROM KEYBOARD AND INCREASES PRO-
```

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ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL   CMD   OPERAND          COMMENT

                          004440 ;CESSOR THRUPUT BY NONINTERUPTIVE INTERFACING.
                          004450 ;IF FIFO GOES OVERFLOW,LAST ENTRY IS LOST.
                          004460 ;THE KEYS IN THE  F-ROW ARE PROVIDED FOR FUNCTION KEY
                          004470 ;ASSIGNMENTS ITS CODES ARE FOR  FREE PROGRAMMING AND
                          004480 ;ALL SHIFT MODES ARE ALLOWED.
                          004490 ;
0111                      004500 NEWS:
0111   B940               004510         MOV   STPTR,#64  ;TOP STATUS BYTE
0113   B868               004520         MOV   TBLPTR,#KEYS        ;LAST KEY ADDRESS
0115   CC                 004530         DEC   REPDLY     ;COUNT DOWN REPEAT DELAY EVERY NEW S
0116   8A00               004540         ORL   P2,#13
0118                      004550 SCAN:
0118   97                 004560         CLR   C          ;RESET CARRY FOR POSSIBLE ROTATES TH
0119   CB                 004570         DEC   TBLPTR
011A   FB                 004580         MOV   A,TBLPTR
011B   F211               004590         JB7   NEWS       ;TABLE POINTER UNDER FLOW
011D   37                 004600         CPL   A          ;TEST BIT0+1 FOR STATUSPOINTER SYNCH
011E   122E               004610         JB0   $1
0120   322E               004620         JB1   $1
0122   C9                 004630         DEC   STPTR      ;POINT TO NEXT  4KEY GRDUP
0123   522E               004640         JB2   $1         ;ODD,SKIP MULTIPLEXER UPDATE
0125   65                 004650         STOP  TCNT       ;TISR MAY NOT OCCUR IN NEXT ROUTINE
0126   0A                 004660         IN    A,P2       ;ELSE DO
0127   07                 004670         DEC   A
0128   3A                 004680         OUTL  P2,A
0129   55                 004690         STRT  T          ;LET TIMER RUN AGAIN
012A   A3                 004700         MOVP  A,@A       ;SPEND A SHORT DELAY
012B   09                 004710         IN    A,P1       ;READ NEW MATRIX ROW DATA
012C   37                 004720         CPL   A
012D   AF                 004730         MOV   R7,A       ;SAVE INFO FOR SHIFT AROUND
012E                      004740 $1:
012E   FF                 004750         MOV   A,R7       ;ROTATE KEY DATA SYNC KEY TO SAME BI
012F   E7                 004760         RL    A
0130   AF                 004770         MOV   R7,A
0131   F1                 004780         MOV   A,@STPTR   ;ROTATE ALSO STATUS
0132   E7                 004790         RL    A
0133   E7                 004800         RL    A
0134   A1                 004810         MOV   @STPTR,A
0135   3257               004820         JB1   UNLOCK
0137   1245               004830         JB0   KYDOWN
0139   FF                 004840         MOV   A,R7       ;TEST KEY IS DOWN
013A   1218               004850         JB0   SCAN       ;NO
013C   B618               004860         JF0   SCAN       ;INHIBIT MULTIPLE KEY ENTRIES
013E   95                 004870         CPL   F0         ;ELSE SET INHIBITOR
013F                      004880 LOCKY:
013F   F1                 004890         MOV   A,@STPTR   ;ELSE SET  STATUS BITS
0140   D303               004900         XRL   A,#3
0142   A1                 004910         MOV   @STPTR,A
0143   2418               004920         JMP   SCAN
0145                      004930 KYDOWN:
0145   FC                 004940         MOV   A,REPDLY   ;LOCK OUT KEY NEXT 8 SCANS
0146   53F8               004950         ANL   A,#-8
0148   D358               004960         XRL   A,#58H
014A   C618               004970         JZ    SCAN  ;DON'T CHECK KEY ON ACTIVE
014C   FF                 004980         MOV   A,R7       ;TEST KEY HOLD DOWN
```

```
ERR-C  ADDR   OBJ-CD       PG-LIN  LABEL    CMD    OPERAND          COMMENT

       014D   37           004990           CPL    A
       014E   12AF         005000           JBO    REPCX       ;THEN CHECK REPEAT COND.MET
       0150   F8           005010           MOV    A,TBLPTR    ;ELSE FIRST KEY UP CONDITION
       0151   E3           005020           MOVP3  A,§A        ;SELECT SHIFT/CTL KEYS
       0152   F7           005030           RLC    A
       0153   F6F2         005040           JC     RESHFG      ;RESET SHIFT FLAGB
       0155   243F         005050           JMP    LOCKY       ;ALL OTHERS KEYUP DEBOUNCE
       0157                005060 UNLOCK:
       0157   85           005070           CLR    F0          ;CLEAR MULTIPLE KEY INHIBITOR
       0158   F1           005080           MOV    A,§STPTR    ;CLEAR DEBOUNCE LOCK
       0159   D302         005090           XRL    A,#2
       015B   A1           005100           MOV    §STPTR,A
       015C   37           005110           CPL    A
       015D   1218         005120           JBO    SCAN        ;WAS KEYUP UNLOCK
       015F   FF           005130           MOV    A,R7        ;TEST KEY STILL DOWN
       0160   123F         005140           JBO    LOCKY       ;NO
       0162                005150 ACCPTKY:
       0162   BC60         005160           MOV    REPDLY,#LONGDLY      ;SET UP 600MS DELAY
       0164                005170 REPEAT:
       0164   BB21         005180           MOV    R0,#FLAGB
       0166   F0           005190           MOV    A,§R0
       0167   37           005200           CPL    A
       0168   5360         005210           ANL    A,#60H
       016A   C618         005220           JZ     SCAN        IGNORE CTL/SHIFT COINCIDENCE
       016C   B823         005230           MOV    R0,#LASTKY  ;POINT TO LASTKY
       016E   FB           005240           MOV    A,TBLPTR
       016F   A0           005250           MOV    §R0,A
       0170   544A         005260           CALL   NATVLNG     ;CHECK NATIVE LANGU.XLAT
       0172   B822         005270           MOV    R0,#LASTCD  ;INTERIM SAVE
       0174   A0           005280           MOV    §R0,A
       0175   C8           005290           DEC    R0          ;POINT TO FLAGB
       0176   F2E1         005300           JB7    SPZEXC
       0178   E3           005310           MOVP3  A,§A        ;GET MARKBIT INFO
       0179   AA           005320           MOV    R2,A        ;SAVE INTERIM
       017A   F2C0         005330           JB7    FUKY        ;SELECT FUNCTION- SHIFT- CTL-LOCK-KE
       017C   531F         005340           ANL    A,#31       ;TEST EXCEPTION INDICATION
       017E   96C6         005350           JNZ    EXCEPT      ;IF SO TEST LANGUAGE,SHIFT COND.
       0180   FA           005360           MOV    A,R2        ;RELOAD MARKS
       0181                005370 NORMLS:                     ;ALL OTHERS HANDLE NORMALLY
       0181   D360         005380           XRL    A,#60H      ;INVERT DISABLES TO ENABLES
       0183   AA           005390           MOV    R2,A        ;PRESAVE
       0184   F0           005400           MOV    A,§R0       ;GET FLAGB AGAIN
       0185   5A           005410           ANL    A,R2        ;COINCIDE WITH MARKS
       0186                005420 NO:
       0186   AA           005430           MOV    R2,A        ;FLAG IS CODE CHANGE OPERAND
       0187   18           005440           INC    R0          ;GET LAST KEY AGAIN
       0188   F0           005450           MOV    A,§R0
       0189   0368         005460           ADD    A,#ASCITB   ;RELATE TO ASCII TABLE
       018B   E3           005470           MOVP3  A,§A        ;GET UNSHIFTED CODE
       018C   D298         005480           JB6    $1          ;SELECT LETTER CODES SKIP SHIFT/CTL
       018E   2A           005490           XCH    A,R2
       018F   C698         005500           JZ     $1
       0191   B296         005510           JB5    $1-2        ;SELECT SHIFTS
       0193   FA           005520           MOV    A,R2        ;TEST CTL FOR 20..3F CODES
       0194   B218         005530           JB5    SCAN        ;IF TRUE IGNORE
```

```
ERR-C  ADDR   OBJ-CD      PG-LIN  LABEL   CMD    OPERAND          COMMENT

       0196   2310        005540          MOV    A,#10H     ;MAY BE CHANGED TO 10
       0198               005550 $1:
       0198   DA          005560          XRL    A,R2       ;MAY  CHANGE CODE ACCORDING SHIFT M0
       0199               005570 N1:
       0199   AA          005580          MOV    R2,A
       019A   F2A9        005590          JB7    N4         ;EXTRACT FUNCTIONAL KEYS
       019C   541E        005600          CALL   TXTCHG     ;TEST UPPER/LOWER CASE LETTER EXCHAN
       019E               005610 N3:
       019E   148A        005620          CALL   LDKBQ      ;PUT IT NOW INTO FIFO
                          005630 ;
       01A0   FB          005640          MOV    A,TBLPTR
       01A1   D3DB        005650          XRL    A,#DOUBLO  ;SELECT DOUBLE ZERO KEY
       01A3   9618        005660          JNZ    SCAN
       01A5   148A        005670          CALL   LDKBQ      ;IF TRUE OUTPUT A 2ND 0
       01A7   2418        005680          JMP    SCAN       ;NEXT KEY
                          005690 ;
       01A9               005700 N4:
       01A9   D2AD        005710          JB6    N5
       01AB   4408        005720          JMP    COMD       ;SELECT DECIMALPOINTCODES
                          005730 ;
       01AD   04A4        005740 N5:      JMP    N5P0       ;GO INTO PAGE 0
                          005750 ;
                          005760 ;
                          005770 ;CHECK ON REPEAT FUNCTION
       01AF               005780 REPCK:
       01AF   FC          005790          MOV    A,REPDLY   ;TEST COUNTER ZERO
       01B0   9618        005800          JNZ    SCAN       ;NO,IGNORE
       01B2   FB          005810          MOV    A,TBLPTR
       01B3   E3          005820          MOVP3  A,@A       ;GET  MARKBITS
       01B4   F218        005830          JB7    SCAN       ;EXIT IF NON REPEATABLE KEYS
                          005840 ;
       01B6               005850 $1:
       01B6   B823        005860          MOV    R0,#LASTKY ;GET LAST KEY
       01B8   F0          005870          MOV    A,@R0
       01B9   0B          005880          XRL    A,TBLPTR   ;IS  INSTANT KEY=LAST KEY OUTPUT
       01BA   9618        005890          JNZ    SCAN
       01BC   BC08        005900          MOV    REPDLY,#REPRAT      ;SET REPEAT RATE AGAIN
       01BE   2464        005910          JMP    REPEAT
                          005920 ;
       01C0               005930 FUKY:
       01C0   F7          005940          RLC    A
       01C1   96EE        005950          JNZ    STSHFG     ;SET SHIFT,OR CTL OR ALPHALOCK FLAG
       01C3   27          005960          CLR    A
       01C4   2481        005970          JMP    NORMLS     ;RECEIVE WITH 0 MARKS
                          005980 ;
       01C6               005990 EXCEPT:                    ;TEST ON EXCEPTIONAL CONDITIONS
       01C6   FA          006000          MOV    A,R2       ;SELECT SPECIAL EXCHANGES
       01C7   D2E0        006010          JB6    SPZEXC-1
       01C9   C8          006020          DEC    R0         ;LOAD LANGUAGE
       01CA   F0          006030          MOV    A,@R0
       01CB   5307        006040          ANL    A,#7
       01CD   0300        006050          ADD    A,#EXCTB   ;REFER TO TABLE
       01CF   94E8        006060          CALL   TRANS4     ;GET OFFSET
       01D1   6A          006070          ADD    A,R2       ;ADD REF.
       01D2   AA          006080          MOV    R2,A
```

```
ERR-C  ADDR   OBJ-CD        PG-LIN  LABEL   CMD   OPERAND        COMMENT

       01D3   18           006090          INC   R0             ;POINT TO FLAGBYTE
       01D4   F0           006100          MOV   A,@R0
       01D5   D218         006110          JB6   SCAN           ;IGNORE CONTROLMODE
       01D7   5320         006120          ANL   A,#32          ;MASK OUT SHIFT MODE
       01D9   77           006130          RR    A              ;MAKE 16 BYTE OFFSET
       01DA   6A           006140          ADD   A,R2
       01DB   94E8         006150          CALL  TRANS4         ;GET NOW CODE
       01DD   AA           006160          MOV   R2,A
       01DE   249E         006170          JMP   N3
                           006180 ;
       01E0   E7           006190          RL    A
       01E1                006200 SPZEXC:
       01E1   AA           006210          MOV   R2,A
       01E2   F0           006220          MOV   A,@R0          ;GET FLAGB
       01E3   5360         006230          ANL   A,#60H
       01E5   77           006240          RR    A
       01E6   47           006250          SWAP  A
       01E7   6A           006260          ADD   A,R2
       01E8   6A           006270          ADD   A,R2
       01E9   6A           006280          ADD   A,R2
       01EA   0384         006290          ADD   A,#SPZXCD-128
       01EC   C400         006300          JMP   TRANS6
                           006310 ;
       01EE                006320 STSHFG:
       01EE   40           006330          ORL   A,@R0          ;SET UP BIT
       01EF   A0           006340          MOV   @R0,A          ;AND STORE
       01F0   2418         006350          JMP   SCAN
                           006360 ;
       01F2                006370 RESHFG:
       01F2   B821         006380          MOV   R0,#FLAGB
       01F4   37           006390          CPL   A
       01F5   50           006400          ANL   A,@R0          ;CLEAR FLAG
       01F6   A0           006410          MOV   @R0,A          ;STORE BACK
       01F7   243F         006420          JMP   LOCKY
       01F9                006430          ORG   1F9H
       01F9                006440 CKSU1:
       01F9                006450 $1:
       01F9   A3           006460          MOVP  A,@A           ;GET A ROM BYTE
       01FA   6A           006470          ADD   A,R2
       01FB   AA           006480          MOV   R2,A           ;SAVE SUM
       01FC   18           006490          INC   R0
       01FD   F8           006500          MOV   A,R0           ;REPEAT 256 TIMES
       01FE   96F9         006510          JNZ   $1
       0200                006520 CKSU2:
       0200                006530 $1:
       0200   A3           006540          MOVP  A,@A
       0201   6A           006550          ADD   A,R2
       0202   AA           006560          MOV   R2,A           ;SAVE SUM
       0203   18           006570          INC   R0
       0204   F8           006580          MOV   A,R0           ;REPEAT 256 TIMES
       0205   9600         006590          JNZ   $1
       0207   83           006600          RET
       0208                006610 COND:
       0208   B824         006620          MOV   R0,#DECPOI ;PRESET SOFTADDRESS POINT/COMMA
       020A   D38A         006630          XRL   A,#8AH     ;SELECT ORIGINAL CODE OF DEC.POINT
```

```
ERR-C  ADDR    OBJ-CD      PG-LIN  LABEL   CMD   OPERAND        COMMENT

       020C    9611        006640          JNZ   $1             ;IS NOT ,SKIP
       020E    F0          006650          MOV   A,@R0          ;GET REPLACEMENT
       020F    441B        006660          JMP   TRANS+1
       0211    D310        006670 $1:      XRL   A,#16          ;SELECT CTRL CODE OF DECPDI.
       0213    961C        006680          JNZ   TRANS+2        ;IS ANOTHER FUNCTIONCODE
       0215    F0          006690          MOV   A,@R0          ;LOAD CODE AND SWAP POINT/COMMA
       0216    D302        006700          XRL   A,#2
       0218    24EF        006710          JMP   STSHFG+1
                           006720 ;
       021A                006730 TRANS:
       021A    A3          006740          MOVP  A,@A
       021B    AA          006750          MOV   R2,A
       021C    249E        006760 $1:      JMP   N3
                           006770 ;
```

```
ERR-C  ADDR   OBJ-CD        PG-LIN  LABEL   CMD   OPERAND        COMMENT

       021E                 006790 TXTCH6:
       021E   37            006800          CPL   A
       021F   D227          006810          JB6   UNCH           ;NO LETTER CODE
       0221   C8            006820          DEC   R0
       0222   F0            006830          MOV   A,@R0          ;GET UP-FLAG
       0223   37            006840          CPL   A
       0224   F228          006850          JB7   UNCH+1         ;TRUE
       0226   FA            006860          MOV   A,R2
       0227                 006870 UNCH:
       0227   83            006880          RET
       0228                 006890 $1:
       0228   C8            006900          DEC   R0
       0229   FA            006910          MOV   A,R2
       022A   531F          006920          ANL   A,#1FH
       022C   C642          006930          JZ    $2
       022E   03E2          006940          ADD   A,#-30         ;SELECT ALL ) Ü
       0230   F642          006950          JC    $2
       0232   0303          006960          ADD   A,#3           ;SELECT ALL )Z
       0234   E63D          006970          JNC   $3
       0236   F0            006980          MOV   A,@R0          ;GET LANGUAGE CODE
       0237   37            006990          CPL   A
       0238   5227          007000          JB2   UNCH
       023A   17            007010          INC   A
       023B   5227          007020          JB2   UNCH
       023D                 007030 $3:
       023D   2320          007040          MOV   A,#32          ;SET EXCHANGE OPERATOR
       023F   DA            007050          XRL   A,R2
       0240   AA            007060          MOV   R2,A
       0241   83            007070          RET
       0242                 007080 $2:
       0242   F0            007090          MOV   A,@R0          ;LANGUAGGE CODE
       0243   37            007100          CPL   A
       0244   5307          007110          ANL   A,#7           ;SELECT YUGOSLAVIA
       0246   9627          007120          JNZ   UNCH
       0248   443D          007130          JMP   $3             ;INCLUDE ALSO CODES 40H,60H,5EH,7EH
                            007140 ;
```

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ERR-C  ADDR    OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

                               007160 ;
                               007170 ;LANGUAGE DEPENDENT KEY LOCATION EXCHANGE
                               007180 ;
                               007190 ;
                               007200 ; CH1(0) CH2(1)  Fr(2)   Can1(3)Can2(4) SA(5) Po(6)  Yu(7)
                               007210 ;
                               007220 ;              E10^S10
                               007230 ;              E11^S05    E11^S4
                               007240 ;    E12^S9    E12^S4     E12^E11    E12^S11 E12^D12 E12^C12
                               007250 ;D11^S2        D11^D12  D11^C11 D11^S16             D11^C11
                               007260 ;    D12^S3    D12^C12  D12^D11 D12^C10       D12^C12 D12^C10
                               007270 ;C10^S1        C10^B7     C10^C12             C10^D11 C10^D12
                               007280 ;C11^S0        C11^S7   C11^S14 C11^S11       C11^C10 C11^D11
                               007290 ;              C12^S8   C12^S15 C12^B0        C12^S11 C12^B10
                               007300 ;              C1^D1                          C1^D1
                               007310 ;              D1^ C1   B0^C10  B00^S13        D1^C1
                               007320 ;    B1^D6     B1^D2                          B1^D2   B1^D6
                               007330 ;              B07^E11
                               007340 ;              B10^E10  B10^B00 B10^S17               B10^E12
                               007350 ;    D6^B1     D2^B1                          D2^B1   D6^B1
 024A                          007360 NATVLNG:
 024A   AA                     007370         MOV   R2,A       ;SAVE TABLE OFFSET
 024B   B820                   007380         MOV   R0,#STRAPS
 024D   F0                     007390         MOV   A,@R0      ;GET LANGUAGE CODE
 024E   5307                   007400         ANL   A,#7
 0250   0362                   007410         ADD   A,#LNGOFS  ;GET OFFSET TO TABLES
 0252   A3                     007420         MOVP  A,@A
 0253   A8                     007430         MOV   R0,A       ;SAVE IN REG
 0254                          007440 $1:
 0254   F8                     007450         MOV   A,R0
 0255   A3                     007460         MOVP  A,@A       ;ADDRESS INTO PROG.MEMORY
 0256   C626                   007470         JZ    UNCH-1     ;END OF TABLE REACHED
 0258   DA                     007480         XRL   A,R2       ;COMPARE WITH ORIGINAL DISPLACEMENT
 0259   18                     007490         INC   R0
 025A   C65F                   007500         JZ    $2         ;FOUND CONDITION
 025C   18                     007510         INC   R0         ;SKIP TO NEXT CODE
 025D   4454                   007520         JMP   $1         ;LOOP
 025F                          007530 $2:
 025F   F8                     007540         MOV   A,R0       ;ADDRESS TO SUBSEQUENT CODE
 0260   A3                     007550 XL:     MOVP  A,@A       ;LOAD REPLACE CODE
 0261   83                     007560         RET
 0262                          007570 LNGOFS:
 0262   6A708CB38FD2           007580         DB    $1,$2,$3,$4,$5,$6,$7,$8
        9E79
 026A                          007590 $1:                     ;SWISS(GERMAN)
 026A   5D8249815980           007600         DB    93,130,73,129,89,128
                               007610 ;               D11S2,C10S1,C11S0
 0270                          007620 $2:                     ;SWISS 2
 0270   3E893D83452A           007630         DB    62,137,61,131,69,42,42,69,0
        2A4500
                               007640 ;              E12S9,D12S3,D6B1,B1D6
 0279                          007650 $8:                     ;YUGOSLAVIA
 0279   452A2A45394A           007660         DB    69,42,42,69,57,74,61,73,62,57
        3D493E39
                               007670 ;             D6B1,B1D6,C12B10,D12C10,E12C12
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```
ERR-C  ADDR    OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0283    5D5959504930    007680          DB    93,89,89,93,73,61,74,62,0
               4A3E00
                               007690  ;             D11C11,C11D11,C10D12,B10E12
       028C                    007700  $3:                   ;FRENCH
       028C    4A4E525E4952    007710          DB    74,78,82,94,73,82,89,135
               5987
                               007720  ;              B10E10,B7E11,C10B7,C11S7
       0294    39885D3D4E8A    007730          DB    57,136,93,61,78,138,94,133,62,132
               5E853E84
                               007740  ;             C12S8,D11D12,E10S10,E11S5,E12S4
       029E                    007750  $7:                   ;PORTUGUESE
       029E    2A25252A292D    007760          DB    42,37,37,42,41,45,45,41,57,139,73,93
               2D29398B495D
                               007770  ;           B1D2,D2B1,C1D1,D1C1,C12S11,C10D11
       02AA    59495D593D39    007780          DB    89,73,93,89,61,57,62,61,0
               3E3D00
                               007790  ;           C11C10,D11C11,D12C12,E12D12
       02B3                    007800  $4:                   ;CANADA
       02B3    0A494A0A598E    007810          DB    10,73,74,10,89,142,57,143,93,89,61,93
               398F5D593D5D
                               007820  ;              B0C10,B10B0,C11S14,C12S15,D11C11,D12D11
                               007830  ; CANADA(BILINGUAL)
       02BF    5D905E843E5E    007840  $5:    DB    93,144,94,132,62,94,73,57,89,139,57,10,10,141
               4939598B390A
               0A8D
                               007850  ;           D11S16,E11S4,E12E11,C10C12,C11S11,C12B0,B0.S13
       02CD    3D494A9100      007860          DB    61,73,74,145,0
                               007870  ;           D12C10,B10S17
       02D2                    007880  $6:                   ;AFRIKAANS
       02D2    3E8B00          007890          DB    62,139,0
                               007900  ;             E12S11
```

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ERR-C  ADDR    OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

                               007920 ; SPECIAL EXCEPTIONS:
                               007930 ;
                               007940 ; OFFS  RELOC. LANGU.  CODES      SYMBOLS      POSITION
                               007950 ; 00     80     01     7B 5B 1B   ä §           C11
                               007960 ; 01     81     01     7C 5C 1C   oe 'e          C10
                               007970 ; 02     82     01     7D 5D 1D   ue e`          D11
                               007980 ; 03     83     03     7E 27 1E   ß  '          D12
                               007990 ; 04     84     FF     2D 5F 1F   -  _          B10,E11
                               008000 ; 05     85     04     29 5B 1B   )  ö          E11
                               008010 ; 06     86     FF     2D F4 F5   -             B51
                               008020 ; 07     87     04     7C 25 1C   ü` Z          C11
                               008030 ; 08     88     04     60 23 1D   `  ÷          C12
                               008040 ; 09     89     03     5E 60 00   ^  `          E12
                               008050 ; 10     8A     04     40 30 00   a` 0          E10
                               008060 ; 11     8B     40     27 60 00   '  `          C12
                               008070 ; 12     46     FF     86 7F 96   CLR           D50
                               008080 ; 13     8D     18     5D 5B 1D   ü  Ä          D11,B0
                               008090 ; 14     8E     08     27 22 00   '  "          C11
                               008100 ; 15     8F     08     60 7E 1E   `  ß          C12
                               008110 ; 16     90     10     23 5E 1E   ÷  ^          D11
                               008120 ; 17     91     10     7B 7D 1B   'e e`         B10
                               008130 ;
                               008140 ; MARKBIT 6 OR 7 ON MEANS EXCEPT IN ALL MODES
0600                           008150         ORG    600H
0600                           008160 TRANS6:
0600   A3                      008170 .       MOVP   A,§A       ;GET BYTE FROM TABLE
0601   AA                      008180         MOV    R2,A
0602   249E                    008190         JMP    W3
                               008200 ;
0604                           008210 SPZXCD:
0604   7B5B1B7C5C1C            008220         DB     7BH,91,27,7CH,92,28,7DH,93,29,7EH,39,30
       7D5D1D7E271E
0610   2D5F1F295B1B            008230         DB     45,95,31,41,91,27,45,244,245,124,37,28,96,35,29
       2DF4F57C251C
       60231D
061F   5E6000403000            008240         DB     94;96,,64,48,,39,96,,134,127,96H,93,91,29
       276000867F96
       505B1D
062E   2722006O7E1E            008250         DB     39,34,,96,126,30,35,94,30,123,125,27
       235E1E7B7D1B
                               008260 ;
```

```
ERR-C  ADDR   OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

       0300                   008280          ORG   300H
       0300                   008290 MRKTBL:
       0300   A000000000000 008300          DB    160,,,,,,4,128       ;D13CB4D51D53DEF4
              0480
       0308   60C000D6020A0 008310          DB    96,-64,13,96,32,160,96,128     ;A50CB0A5253DEF0
              6080
       0310   460000000000 008320          DB    70,,,,,,3,128        ;D50CB3D5254DEF3
              0380
       0318   600000000000 008330          DB    96,,,,,,5,128        ;ACB5C5153DEF5
              0580
       0320   900000002000 008340          DB    144,,,,32,,2,128     ;B99CB2B5154DEF2
              0280
       0328   000000000000 008350          DB    0,,,,,,1,128         ;B50CB1B5253DEF1
              0180
       0330   20000F323500 008360          DB    32,,15,50,53,,9,128  ;E13CB9X1X2DEF9
              0980
       0338   800C20000000 008370          DB    128,12,32,,,,,128    ;F13C1213..DEF12
              0080
       0340   430000000000 008380          DB    67,,,,,,6,128        ;C50CB6C5254DEF6
              0680
       0348   800042802000 008390          DB    128,,66,128,20H,,10,128       ;F50CB10FE52DEF1
              0A80
       0350   600000802000 008400          DB    96,,,128,32,,7,128   ;E14CB7FE53DEF7
              0780
       0358   800090802000 008410          DB    128,,144,128,32,,11,128       ;F14CB11FE51DEF1
              0B80
       0360   20000E802000 008420          DB    32,,14,128,32,,8,128 ;E50CB8FE54DEF8
              0880
            0068              008430 KEYS   EQU   $-MRKTBL
       0368                   008440 ASCITB:
       0368   004656F7F952 008450          DB    0,'FV',-9,-7,'R4',-28  ;D13CB4D5153DEF4
              34E4
       0370   30003C308A00 008460          DB    48,'<0',8AH,,27,-32  ;A50CB0A5253DEF0
              1BE0
       0378   864443F8FF45 008470          DB    134,'DC',-8,-1,'E3',-29   ;D50CB3D5254DEF3
              33E3
       0380   204742F4F654 008480          DB    ' GB',-12,-10,'T5',-27  ;ACB5C5153DEF5
              35E5
       0388   005358FC8857 008490          DB    'SX',-4,88H,'W2',-30 ;B99CB2B5154DEF2
              32E2
       0390   FB415AFDFE51 008500          DB    -5,'AZ',-3,-2,'Q1',-31   ;B50CB1B5253DEF1
              31E1
       0398   8B4C2E37304F 008510          DB    139,'L.7009',-23  ;E13CB9X1X2DEF9
              39E9
       03A0   ED2B883D3B5E 008520          DB    -19,43,136,'=;^§',-20  ;F13C1213....DEF12
              40EC
       03A8   2D484EF5FA59 008530          DB    45,'HN',-11,-6,'Y6',-26  ;C50CB6C5254DEF6
              36E6
       03B0   EF5C2DF18350 008540          DB    -17,'\-',-15,131,80,48,-22  ;F50CB10FE52DEF10
              30EA
       03B8   094A4DF28455 008550          DB    9,'JM',-14,84H,'U7',-25  ;E14CB7FE53DEF7
              37E7
       03C0   EE5B00F0825D 008560          DB    -18,91,,-16,130,93,47,-21      ;F14CB11FE51DEF1
              2FEB
       03C8   81482CF38549 008570          DB    81H,'K,',-13,85H,'I8',-24  ;E50CB8FE54DEF8
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ERR-C ADDR   OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

            38E8
      0400                  008580          ORG   400H
      0400  080828486888 008590 EXCTB:  DB    $1,$2,$3,$4,$5,$6,$7,$8
            A8C8
      0408                  008600 $1:
      0408  003132333435 008610 $2:     DB    '1234567890!$(,.+"*§%&/()=?*);:'
            363738393021
            243C2C2E002B
            222A4025262F
            2829303F233E
            3B3A
      0428  00267B222728 008620 $3:     DB    '&ä"',39,'(üö!ß=,$(;:123456789+?*)./'
            5D7D215C3D2C
            243C3B3A0031
            323334353637
            38392B3F2A3E
            2E2F
      0448  003132333435 008630 $4:     DB    '1234567890=:/,.!§*$^&*()+:?()'
            363738393D3D
            3B2F2C2E0021
            402324255E26
            2A28292B3A3F
            3C3E
      0468  003132333435 008640 $5:     DB    '1234567890=:§,.!"/$%?&*()+:ß()'
            363738393D3D
            3B402C2E0021
            222F24253F26
            2A28292B3A7E
            3C3E
      0488  003132333435 008650 $6:     DB    '1234567890/!(,.+"*§%&*()=?$);:'
            36373839302F
            213C2C2E002B
            22234025262A
            28293D3F243E
            3B3A
      04A8  203132333435 008660 $7:     DB    ' 12345678906+(,.!"*$%&/()=?*);:'
            363738393040
            2B3C2C2E0021
            22232425262F
            2829303F2A3E
            3B3A
      04C8  203132333435 008670 $8:     DB    ' 1234567890',39,'+(,.!"*$%&/()=?*);:'
            363738393027
            2B3C2C2E0021
            22232425262F
            2829303F2A3E
            3B3A
                        008680 ;
      04E8              008690 TRANS4:
      04E8  A3          008700          MOVP  A,§A
      04E9  83          008710          RET
                        008720 ;
```

```
ERR-C  ADDR   OBJ-CD      PG-LIN  LABEL   CMD   OPERAND       COMMENT

       04F9             008740          ORG   4F9H
       04F9             008750 CKSU4:
       04F9             008760 $1:
       04F9   A3         008770          MOVP  A,§A          ;GET A ROM BYTE
       04FA   6A         008780          ADD   A,R2
       04FB   AA         008790          MOV   R2,A          ;SAVE SUM
       04FC   18         008800          INC   R0
       04FD   F8         008810          MOV   A,R0          ;REPEAT 256 TIMES
       04FE   96F9       008820          JNZ   $1
       0500             008830 CKSU5:
       0500             008840 $1:
       0500   A3         008850          MOVP  A,§A
       0501   6A         008860          ADD   A,R2
       0502   AA         008870          MOV   R2,A          ;SAVE SUM
       0503   18         008880          INC   R0
       0504   F8         008890          MOV   A,R0          ;REPEAT 256 TIMES
       0505   9600       008900          JNZ   $1
       0507   83         008910          RET
                         008920 ;
       06F9             008930          ORG   6F9H
       06F9             008940 CKSU6:
       06F9             008950 $1:
       06F9   A3         008960          MOVP  A,§A          ;GET A ROM BYTE
       06FA   6A         008970          ADD   A,R2
       06FB   AA         008980          MOV   R2,A          ;SAVE SUM
       06FC   18         008990          INC   R0
       06FD   F8         009000          MOV   A,R0          ;REPEAT 256 TIMES
       06FE   96F9       009010          JNZ   $1
       0700             009020 CKSU7:
       0700             009030 $1:
       0700   A3         009040          MOVP  A,§A
       0701   6A         009050          ADD   A,R2
       0702   AA         009060          MOV   R2,A          ;SAVE SUM
       0703   18         009070          INC   R0
       0704   F8         009080          MOV   A,R0          ;REPEAT 256 TIMES
       0705   9600       009090          JNZ   $1
       0707   83         009100          RET
```

```
ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             009120 ;
                             009130 ;CROSS REFERENCE   WIRING/KEY LOCATIONS
                             009140 ;
                             009150 ; COLUMN/ROW   R0   R1   R2   R3   R4   R5   R6   R7
                             009160 ;
                             009170 ; 0 COL 0      D13  C4   B4   D51  D53  D4   E4   F4
                             009180 ;
                             009190 ; 1 COL 1      A50  C0  ßB0   A52 +A53  D0   E0   F0
                             009200 ;
                             009210 ; 2 COL 2     +D50  C3   B3   D52  D54  D3  ßE3   F3
                             009220 ;
                             009230 ; 3 COL 3      A5   C5   B5   C51  C53  D5   E5   F5
                             009240 ;
                             009250 ; 4 COL 4      B99  C2   B2   B51 +B54 ßD2  ßE2   F2
                             009260 ;
                             009270 ; 5 COL 5      B50 ßC1  ßB1   B52  B53  D1   E1   F1
                             009280 ;
                             009290 ; 6 COL 6     +E13  C9  ßB9   X1   X2   D9  ßE9   F9
                             009300 ;
                             009310 ; 7 COL 7      F13 ßC12 +C13  X3   X4  ßD12 ßE12  F12
                             009320 ;
                             009330 ; 8 COL 8      C50  C6   B6   C52  C54 ßD6  ßE6   F6
                             009340 ;
                             009350 ; 9 COL 9      F50 ßC10 ßB10  F52 +E52  D10 ßE10  F10
                             009360 ;
                             009370 ; A COL 10     E14  C7   B7   F53 +E53  D7  ßE7   F7
                             009380 ;
                             009390 ; B COL 11     F14 ßC11  B11  F51 +E51 ßD11 ßE11  F11
                             009400 ;
                             009410 ; C COL 12    +E50  C8  ßB8   F54 +E54  D8  ßE8   F8
                             009420 ;
                             009430 ;PSEUDO 12     X5   X6   X7
                             009440 ;
                             009450 ; KEY LOCATIONS WITH ß  ARE RELOCATED LANGUAGE DEPENDENT
                             009460 ; KEY LOCATIONS WITH +  TRANSLATABLE FOR 7900,7901 USAGE
```

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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

                             009480 ;NUMERIC KEY PAD PART
                             009490 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             009500 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             009510 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             009520 ;    --------------------   MATRIXCODE COMBINED:
                             009530 ;    !F50!F51!F52!F53!F54!    HO-DIGIT  COLUMN↓
                             009540 ;    ! 90! B3! 93! A3! C3!    LO-DIGIT  ROW→
                             009550 ;    ! 80! 80! 80! 80! 80!
                             009560 ;    !F16!F17!F18!F19!F20!
                             009570 ;    ! AF! B0! B1! B2! B3!
                             009580 ;    ! CF! D0! D1! D2! D3!
                             009590 ;    ! EF! F0! F1! F2! F3!
                             009600 ;    !---+---+---+---+---!
                             009610 ;    !E50!E51!E52!E53!E54!
                             009620 ;    ! C0! B4! 94! A4! C4!
                             009630 ;    ! 20! 20! 20! 20! 20!
                             009640 ;    Home!(--!Dwn! Up!--)!
                             009650 ;    ! 91! 92! 93! 94! 95!
                             009660 ;    ! 81! 82! 83! 84! 85!
                             009670 ;    ! 81! 82! 83! 84! 85!
                             009680 ;    !---+---+---+---+---!
                             009690 ;    !D50!D51!D52!D53!D54!
                             009700 ;    ! 20! 03! 23! 04! 24!
                             009710 ;    ! 46! 00! 00! 00! 00!
                             009720 ;    !CLR!7  !8  !9  !/  !
                             009730 ;    ! 96! B7! B8! B9! BF!
                             009740 ;    ! 7F! D7! D8! D9! DF!
                             009750 ;    ! 86! 37! 38! 39! 2F!
                             009760 ;    !---+---+---+---+---!
                             009770 ;    !C50!C51!C52!C53!C54!
                             009780 ;    ! 80! 33! 83! 34! 84!
                             009790 ;    ! 43! 00! 00! 00! 00!
                             009800 ;    !- !4  !5  !6  !*  !
                             009810 ;    ! F5! B4! B5! B6! BA!
                             009820 ;    ! F4! D4! D5! D6! DA!
                             009830 ;    ! 2D! 34! 35! 36! 2A!
                             009840 ;    !---+---+---+---+---!
                             009850 ;    !B50!B51!B52!B53!B54!
                             009860 ;    ! 50! 43! 53! 54! 44!
                             009870 ;    ! 00! 00! 00! 00! 20!
                             009880 ;    !+ !1  !2  !3  !ET !
                             009890 ;    ! 88! 8C! 8D! 8E! 98!
                             009900 ;    ! DB! DC! DD! DE! 88!
                             009910 ;    ! 2B! 31! 32! 33! 88!
                             009920 ;    !-------+---+---!   !
                             009930 ;    !A50    !A52!A53!   !
                             009940 ;    ! 10    ! 13! 14!   !
                             009950 ;    ! 60    ! 60! 20!   !
                             009960 ;    !0      !00 !. !   !
                             009970 ;    ! 30    !*30! 9A!(-----USED TO SWAP FM . TO ,
                             009980 ;    ! 30    !*30! 8A!   !  AND BACK
                             009990 ;    ! 30    !*30! 8A!(-----OUTPUT: 2E(.) or 2C(,)
                             010000 ;    --------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             010020 ;  SWISS-GERMAN
                             010030 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             010040 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             010050 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             010060 ;-------------------------------------------------------
                             010070 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             010080 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
                             010090 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             010100 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
                             010110 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             010120 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             010130 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             010140 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             010150 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             010160 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             010170 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! 0B! S9! 20! 60!
                             010180 ;ESC!1+ !2" !3# !4c,!5% !6& !7/ !8( !9) !0= !!? !^` !BSP!TAB!
                             010190 ; 1B!   !   !   !   !   !   !   !   !   !   !   ! 00! 9B! 09!
                             010200 ; 1B! 2B! 22! 2A! 40! 25! 26! 2F! 28! 29! 30! 3F! 60! 8B! 09!
                             010210 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 21! 5E! 8B! 09!
                             010220 ;-------------------------------------------------------
                             010230 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
                             010240 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
                             010250 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! S2! S3!  A0 !
                             010260 ;!CRTL!qQ !wW !eE !rR !tT !yY !uU !iI !oO !pP !Ue`!B' !CTRL !
                             010270 ;     ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1D! 1E!      !
                             010280 ;     ! 51! 57! 45! 52! 54! 5A! 55! 49! 4F! 50! 5D! 27!      !
                             010290 ;     ! 71! 77! 65! 72! 74! 7A! 75! 69! 6F! 70! 7D! 7E!      !
                             010300 ;-------------------------------------------------------
                             010310 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             010320 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             010330 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! S1! S0! 0C! 20!
                             010340 ;!LOCK^!aA !sS !dD !fF !g6 !hH !jJ !kK !lL !Ö'e!äa`!$# !    !
                             010350 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 1B!    ! 98!
                             010360 ;      ! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5C! 5B! 23! 88!
                             010370 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7C! 7B! 24! 88!
                             010380 ;-------------------------------------------------------- FT!
                             010390 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !    !
                             010400 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !    !
                             010410 ;! 90! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 0F! 42! 90  !    !
                             010420 ;!SHF!() !yY !xX !cC !vV !bB !nN !mM !,; !.: !-_ !SHFT^!    !
                             010430 ;!   !   ! 19! 18! 03! 16! 02! 0E! 0D!   !   ! 1F!      !   !
                             010440 ;!   ! 3E! 59! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!      !   !
                             010450 ;!   ! 3C! 79! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 2D!      !   !
                             010460 ;!-------------------------------------------------------------
                             010470 ;                !              A05              !
                             010480 ;                !               30              !
                             010490 ;                !               60              !
                             010500 ;                !                               !
                             010510 ;                !               20              !
                             010520 ;                !               20              !
                             010530 ;                !               20              !
                             010540 ;                 -------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

010560 ;  SWISS-ROMANDE
010570 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
010580 ;       3RD LINE MARKBITS     4TH SYMBOLS
010590 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
010600 ;-----------------------------------------------------------------
010610 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
010620 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
010630 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
010640 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
010650 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
010660 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
010670 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
010680 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
010690 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
010700 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
010710 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! 0B! S9! 20! 60!
010720 ;ESC!1+ !2" !3# !4c,!5Z !6& !7/ !8( !9) !0= !!? !^` !BSP!TAB!
010730 ; 1B!   !   !   !   !   !   !   !   !   !   !   !   ! 00! 9B! 09!
010740 ; 1B! 2B! 22! 2A! 40! 25! 26! 2F! 28! 29! 3D! 3F! 60! 8B! D9!
010750 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 21! 5E! 8B! 09!
010760 ;-----------------------------------------------------------------
010770 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
010780 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
010790 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! S3!  A0 !
010800 ;!CRTL!qQ !wW !eE !rR !tT !yY !uU !iI !oO !pP !e'ü!B` !CTRL !
010810 ;      ! 11! 17! 05! 12! 14! 1A! 15! 09! 0F! 10! 1D! 1E!      !
010820 ;      ! 51! 57! 45! 52! 54! 5A! 55! 49! 4F! 70! 7D! 27!      !
010830 ;      ! 71! 77! 65! 72! 74! 7A! 75! 69! 6F! 50! 50! 7E!      !
010840 ;-----------------------------------------------------------------
010850 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
010860 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
010870 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0C! 20!
010880 ;!LOCK^!aA !sS !dD !fF !gG !hH !jJ !kK !lL !'e0!a`ö!$¥ !    !
010890 ;!      ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 1B!    ! 9B!
010900 ;       ! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 7C! 7B! 23! 88!
010910 ;!      ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 5C! 5B! 24! 88!
010920 ;-----------------------------------------------------------------  FT!
010930 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !    !
010940 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !    !
010950 ;! 90! 0D! 00! 00! 00! 00! 00! 00! 00! 0E! 0F! 0A! 90  !    !
010960 ;!SHF!() !vY !xX !cC !vV !bB !nN !mM !,; !.: !-_ !SHFT^!    !
010970 ;!   !   ! 19! 18! 03! 16! 02! 0E! 0D!   !   ! 1F!      !    !
010980 ;!   ! 3E! 59! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!      !    !
010990 ;!   ! 3C! 79! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 2D!      !    !
011000 ;!-----------------------------------------------------------+---------
011010 ;                !              A05              !
011020 ;                !               30              !
011030 ;                !               60              !
011040 ;                !                               !
011050 ;                !               20              !
011060 ;                !               20              !
011070 ;                !               20              !
011080 ;                ---------------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


                             011100 ;FRENCH
                             011110 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
                             011120 ;       3RD LINE MARKBITS     4TH SYMBOLS
                             011130 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
                             011140 ;-----------------------------------------------------------------
                             011150 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
                             011160 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
                             011170 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
                             011180 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
                             011190 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
                             011200 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
                             011210 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
                             011220 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
                             011230 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
                             011240 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
                             011250 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09!S10! S5! S4! 20! 60!
                             011260 ;ESC!&1 !'e2!"3 !'4 !(5 !§6 !e`7!!8 !c,9!a`0!)o !-_ !BSP!TAB!
                             011270 ; 1B!   !   !   !   !   !   !   !   !   ! 00! 1B! 1F! 98! 09!
                             011280 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 5B! 5F! 8B! 09!
                             011290 ; 1B! 26! 7B! 22! 27! 28! 5D! 7D! 21! 5C! 40! 29! 20! 8B! 09!
                             011300 ;-----------------------------------------------------------------
                             011310 ; 000 !001!002!003!004!005!006!007!008!009!010!011!012! 013 !
                             011320 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
                             011330 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00!  A0 !
                             011340 ; CTRL!aA !zZ !eE !rR !tT !yY !uU !iI !oO !pP !^B !$# !CTRL !
                             011350 ;     ! 01! 1A! 05! 12! 14! 19! 15! 09! 0F! 10! 1E!   !     !
                             011360 ;     ! 41! 5A! 45! 52! 54! 59! 55! 49! 4F! 50! 7E! 2A!     !
                             011370 ;     ! 61! 7A! 65! 72! 74! 79! 75! 69! 6F! 70! 5E! 24!     !
                             011380 ;-----------------------------------------------------------------
                             011390 ;!000  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
                             011400 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
                             011410 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! S7! S8! 20!
                             011420 ;!LOCK^!q@ !sS !dD !fF !g6 !hH !jJ !kK !lL !mM !u`%!^$ !   !
                             011430 ;!     ! 11! 13! 04! 06! 07! 08! 0A! 0B! 0C! 0D! 1C! 1D! 98!
                             011440 ;!     ! 51! 53! 44! 46! 47! 48! 4A! 4B! 4C! 4D! 25! 23! 88!
                             011450 ;!     ! 71! 73! 64! 66! 67! 68! 6A! 6B! 6C! 6D! 7C! 60! 88!
                             011460 ;-------------------------------------------------------- FT!
                             011470 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
                             011480 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
                             011490 ;! 90! 0D! 00! 00! 00! 00! 00! 00! 0B! 0E! 0F! 0A! 90  !   !
                             011500 ;!SHF!() !wW !xX !cC !vV !bB !nN !,? !;. !:/ !=+ !SHFT^!   !
                             011510 ;!   !   ! 17! 18! 03! 16! 02! 0E!   !   !   !   !     !   !
                             011520 ;!   ! 3E! 57! 58! 43! 56! 42! 4E! 3F! 2E! 2F! 2B!     !   !
                             011530 ;!   ! 3C! 77! 78! 63! 76! 62! 6E! 2C! 3B! 3A! 3D!     !   !
                             011540 ;!-----------------------------------------------------------!
                             011550 ;           !            A05            !
                             011560 ;           !             30            !
                             011570 ;           !             60            !
                             011580 ;           !                           !
                             011590 ;           !             20            !
                             011600 ;           !             20            !
                             011610 ;           !             20            !
                             011620 ;           ---------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT


011640 ;AUSTRALIA,CANADA(ENGLISH)
011650 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
011660 ;       3RD LINE MARKBITS     4TH SYMBOLS
011670 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
011680 ;-----------------------------------------------------------------
011690 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
011700 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
011710 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
011720 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
011730 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
011740 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
011750 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
011760 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
011770 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
011780 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
011790 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! 54! 0B! 20! 60!
011800 ;ESC!1! !2§ !3# !4$ !5% !6^ !7& !8* !9( !0) !-_ !=+ !BSP!TAB!
011810 ; 1B!   !   !   !   !   !   !   !   !   !   ! 1F!   ! 9B! 09!
011820 ; 1B! 21! 40! 23! 24! 25! 5E! 26! 2A! 28! 29! 5F! 2B! 8B! 09!
011830 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 20! 30! 8B! 09!
011840 ;-----------------------------------------------------------------
011850 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! 013 !
011860 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
011870 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00!  A0 !
011880 ; CTRL!q@ !wW !eE !rR !tT !yY !uU !iI !oO !pP !Aä !üÜ ! CTRL!
011890 ;     ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1B! 1D!     !
011900 ;     ! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 7B! 7D!     !
011910 ;     ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 5B! 5D!     !
011920 ;-----------------------------------------------------------------
011930 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
011940 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
011950 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0C!S14!S15! 20!
011960 ;!LOCK^!aA !ss !dD !fF !gG !hH !jJ !kK !lL !;: !'" !^~ !    !
011970 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C!   ! 00! 1B! 9B!
011980 ;!     ! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 3A! 22! 7E! 88!
011990 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 3B! 27! 60! 88!
012000 ;-----------------------------------------------------------------FT!
012010 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
012020 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
012030 ;! 90! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 0F! 0D! 90  !   !
012040 ;!SHF!06 !zZ !xX !cC !vV !bB !nN !mM !,( !.) !/? !SHFT^!   !
012050 ;!   ! 1C! 1A! 18! 03! 16! 02! 0E! 0D!   !   !   !     !   !
012060 ;!   ! 5C! 5A! 58! 43! 56! 42! 4E! 4D! 3C! 3E! 3F!     !   !
012070 ;!   ! 5C! 7A! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 2F!     !   !
012080 ;!-----------------------------------------------------------------
012090 ;              !          A05          !
012100 ;              !           30          !
012110 ;              !           60          !
012120 ;              !                       !
012130 ;              !           20          !
012140 ;              !           20          !
012150 ;              !           20          !
012160 ;              -------------------------
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

012180 ; CANADA(BILINGUAL)
012190 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
012200 ;       3RD LINE MARKBITS     4TH SYMBOLS
012210 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
012220 ;-----------------------------------------------------------------
012230 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
012240 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
012250 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
012260 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
012270 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
012280 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
012290 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
012300 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
012310 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
012320 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
012330 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! S4! 0B! 20! 60!
012340 ;ESC!1! !2" !3/ !4$ !5% !6? !7& !8* !9( !0) !-_ !=+ !BSP!TAB!
012350 ; 1B!   !   !   !   !   !   !   !   !   !   ! 1F!   ! 9B! 09!
012360 ; 1B! 21! 22! 2F! 24! 25! 3F! 26! 2A! 28! 29! 5F! 2B! 8B! 09!
012370 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2D! 3D! 8B! 09!
012380 ;-----------------------------------------------------------------
012390 ; B00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
012400 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
012410 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00!S16! 00!  A0 !
012420 ; CTRL!qQ !wW !eE !rR !tT !yY !uU !iI !oO !pP !{^ !ci ! CTRL!
012430 ;      ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1E! 1C!      !
012440 ;      ! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 5E! 7C!      !
012450 ;      ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 23! 5C!      !
012460 ;-----------------------------------------------------------------
012470 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
012480 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
012490 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0C!S11! 0D! 20!
012500 ;!LOCK^!aA !sS !dD !fF !gG !hH !jJ !kK !lL !;: !'" !a`@!    !
012510 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C!   ! 00!   ! 9B!
012520 ;!     ! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 3A! 60! 7E! 8B!
012530 ;!     ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 3B! 27! 40! 8B!
012540 ;-------------------------------------------------------- FT!
012550 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
012560 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
012570 ;! 90!S13! 00! 00! 00! 00! 00! 00! 00! 0E! 0F!S17! 90  !   !
012580 ;!SHF!DA !zZ !xX !cC !vV !bB !nN !mM !,< !.> !ee!SHFT!   !
012590 ;!   ! 1D! 1A! 18! 03! 16! 02! 0E! 0D!   !   ! 1B!      !   !
012600 ;!   ! 5B! 5A! 58! 43! 56! 42! 4E! 4D! 3C! 3E! 7D!      !   !
012610 ;!   ! 50! 7A! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 7B!      !   !
012620 ;!-----------------------------------------------------------------
012630 ;              !              A05              !
012640 ;              !               30              !
012650 ;              !               60              !
012660 ;              !                               !
012670 ;              !               20              !
012680 ;              !               20              !
012690 ;              !               20              !
012700 ;              ---------------------------------
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ERR-C  ADDR    OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

012720 ;AFRIKAANS
012730 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
012740 ;       3RD LINE MARKBITS     4TH SYMBOLS
012750 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
012760 ;-----------------------------------------------------------------
012770 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
012780 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
012790 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
012800 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
012810 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
012820 ; C0! C1! C2! C3! C4! C5! C6! C7! CB! C9! CA! CB! CC! CD! CE!
012830 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
012840 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
012850 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
012860 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 60! A0!
012870 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! 0B!S11! 20! 60!
012880 ;ESC!1+ !2" !3§ !4$ !5% !6& !7/ !8( !9) !0= !/? !^` !BSP!TAB!
012890 ; 1B!   !   !   !   !   !   !   !   !   !   !   ! 00! 9B! 09!
012900 ; 1B! 2B! 22! 23! 40! 25! 26! 2A! 28! 29! 3D! 3F! 60! 8B! 09!
012910 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 2F! 27! 8B! 09!
012920 ;-----------------------------------------------------------------
012930 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
012940 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  00 !
012950 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00!  A0 !
012960 ; CTRL!qQ !wW !eE !rR !tT !yY !uU !iI !oO !pP !eE^!^ß ! CTRL!
012970 ;      ! 11! 17! 05! 12! 14! 19! 15! 09! 0F! 10! 1D! 1E!      !
012980 ;      ! 51! 57! 45! 52! 54! 59! 55! 49! 4F! 50! 5D! 7E!      !
012990 ;      ! 71! 77! 65! 72! 74! 79! 75! 69! 6F! 70! 7D! 5E!      !
013000 ;-----------------------------------------------------------------
013010 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
013020 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
013030 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0C! 20!
013040 ;!     !aA !sS !dD !fF !gG !hH !jJ !kK !lL !'nM!'eE!!$ !    !
013050 ;!     ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1C! 1B!   ! 9B!
013060 ;!     ! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5C! 5B! 24! 8B!
013070 ;!LOCKA! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7C! 7B! 21! 8B!
013080 ;-----------------------------------------------------------------  FT!
013090 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !    !
013100 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !    !
013110 ;! 90! 00! 00! 00! 00! 00! 00! 00! 00! 00! 0E! 0F! 42! 90  !    !
013120 ;!SHF!() !zZ !xX !cC !vV !bB !nN !mM !,; !.: !-_ !SHFT^!    !
013130 ;!   !   ! 1A! 18! 03! 16! 02! 0E! 00!   !   ! 1F!      !    !
013140 ;!   ! 3E! 5A! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!      !    !
013150 ;!   ! 2C! 7A! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 20!      !    !
013160 ;!-----------------------------------------------------------------
013170 ;                 !          A05          !
013180 ;                 !           30          !
013190 ;                 !           60          !
013200 ;                 !                       !
013210 ;                 !           20          !
013220 ;                 !           20          !
013230 ;                 !           20          !
013240 ;                 ---------------------------
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ERR-C  ADDR    OBJ-CD          PG-LIN  LABEL   CMD   OPERAND          COMMENT

013260 ;PORTUGUESE
013270 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
013280 ;       3RD LINE MARKBITS     4TH SYMBOLS
013290 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
013300 ;-----------------------------------------------------------------
013310 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
013320 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 7D! B0!
013330 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
013340 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
013350 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
013360 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
013370 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
013380 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
013390 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
013400 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 6D! A0!
013410 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! 0B! 0D! 20! 60!
013420 ;ESC!!" !2" !3# !4$ !5% !6& !7/ !8( !9) !0= !§? !^ß !BSP!TAB!
013430 ; 1B!   !   !   !   !   !   !   !   !   !   !   ! 1E! 9B! 09!
013440 ; 1B! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 7E! 8B! 09!
013450 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 40! 5E! 8B! 09!
013460 ;-----------------------------------------------------------------
013470 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
013480 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  0D !
013490 ;  A0 ! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D!  A0 !
013500 ; CTRL!aA !zZ !eE !rR !tT !yY !uU !iI !oO !pP !aBA!** ! CTRL!
013510 ;     ! 01! 1A! 05! 12! 14! 19! 15! 09! 0F! 10! 1B!   !     !
013520 ;     ! 41! 5A! 45! 52! 54! 59! 55! 49! 4F! 50! 5B! 2A!     !
013530 ;     ! 61! 7A! 65! 72! 74! 79! 75! 69! 6F! 70! 7B! 2B!     !
013540 ;-----------------------------------------------------------------
013550 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
013560 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
013570 ;!  C0 ! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D!S11! 20!
013580 ;!LOCK^!qQ !sS !dD !fF !gG !hH !jJ !kK !lL !c,C!aQ0!°  !   !
013590 ;!     ! 11! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1D! 1C! 0D! 98!
013600 ;!     ! 51! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5D! 5C! 60! 88!
013610 ;!     ! 71! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7D! 7C! 27! 88!
013620 ;-------------------------------------------------------- FT!
013630 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !   !
013640 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !   !
013650 ;! 90! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0D! 0E! 0F! 42! 90  !   !
013660 ;!SHF!() !wW !xX !cC !vV !bB !nN !mM !,; !.: !-_ !SHFT^!   !
013670 ;!   !   ! 17! 18! 03! 16! 02! 0E! 0D!   !   ! 1F!     !   !
013680 ;!   ! 3E! 57! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 5F!     !   !
013690 ;!   ! 3C! 77! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 2D!     !   !
013700 ;!-----------------------------------------------------------------
013710 ;            !            A05             !
013720 ;            !             30             !
013730 ;            !             60             !
013740 ;            !                            !
013750 ;            !             20             !
013760 ;            !             20             !
013770 ;            !             20             !
013780 ;            ----------------------------
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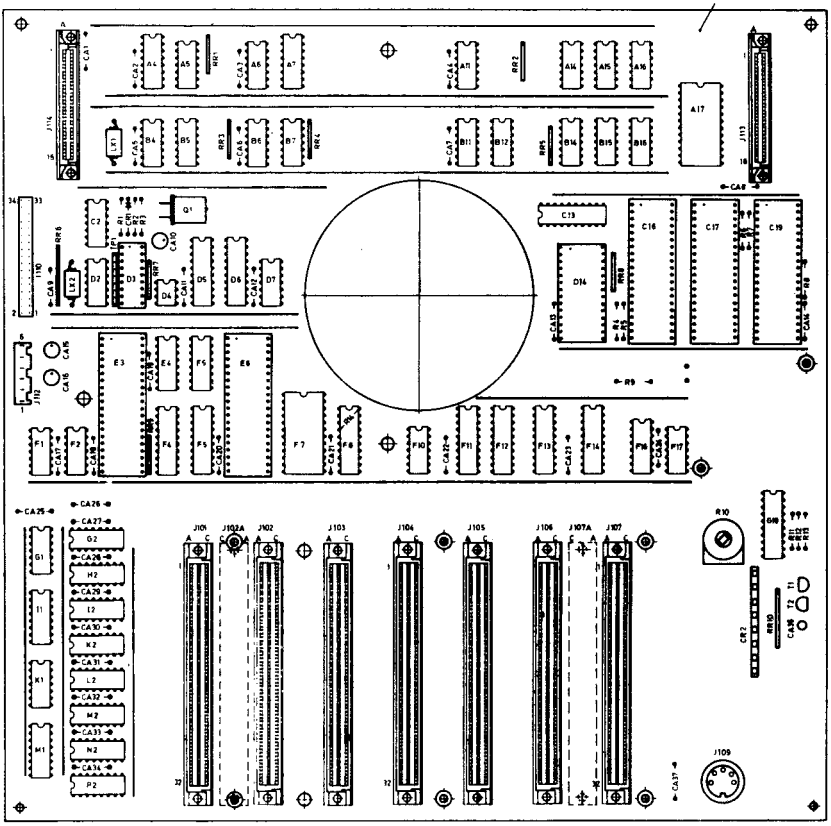
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ERR-C  ADDR    OBJ-CD        PG-LIN  LABEL   CMD   OPERAND          COMMENT

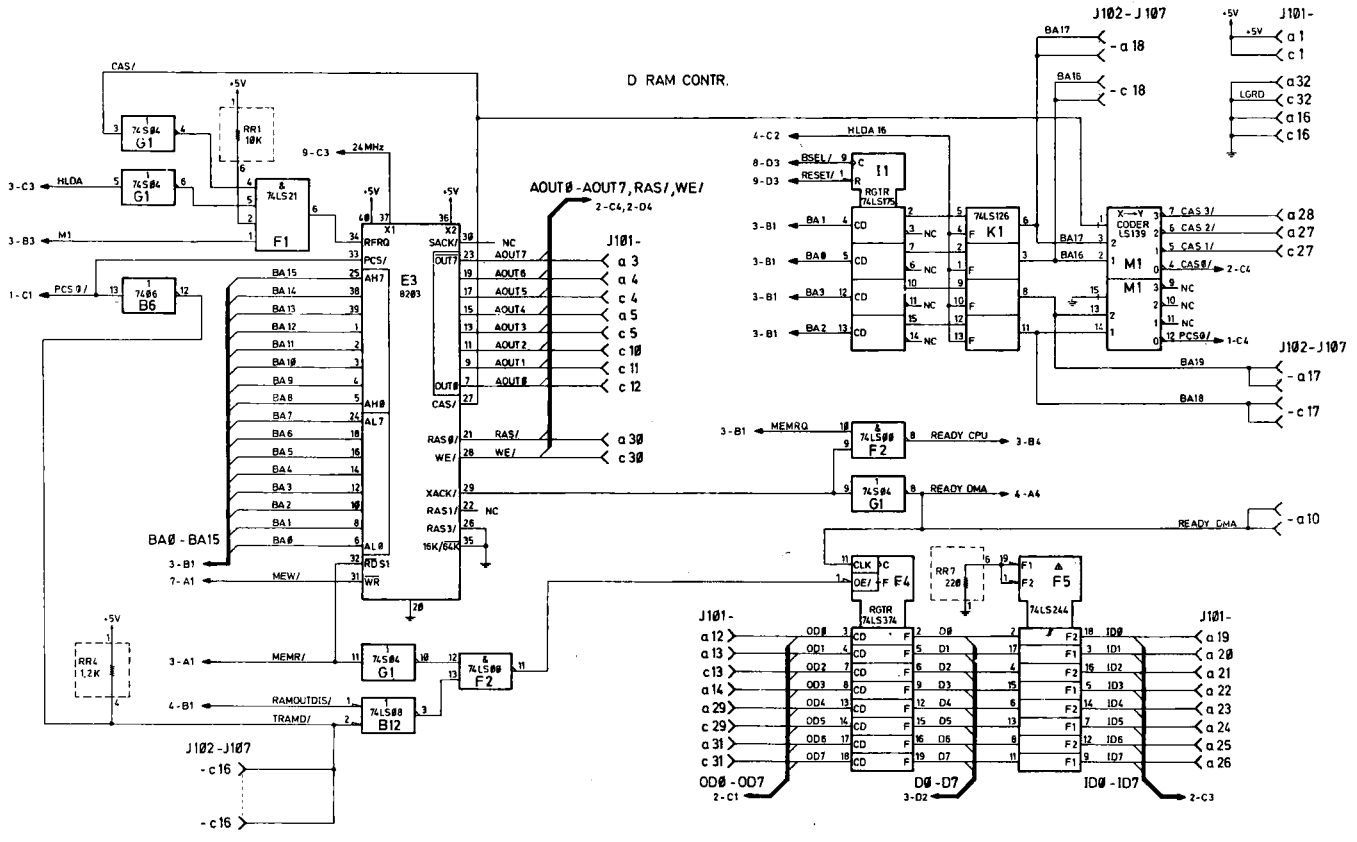
013800 ;YUGOSLAVIAN
013810 ;EXPLANATION: 1ST LINE KEYLOCATION 2ND MATRIXPOSITION
013820 ;       3RD LINE MARKBITS     4TH SYMBOLS
013830 ;       5TH LINE CTL-CODE, 6TH SHIFT-CODE, 7TH UNSHIFT
013840 ;-----------------------------------------------------------------
013850 ;F00!F01!F02!F03!F04!F05!F06!F07!F08!F09!F10!F11!F12!F13!F14!
013860 ; 17! 57! 47! 27! 07! 37! 87! A7! C7! 67! 97! B7! 77! 70! B0!
013870 ; 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80! 80!
013880 ; F1! F2! F3! F4! F5! F6! F7! F8! F9!F10!F11!F12!F13!F14!F15!
013890 ; A0! A1! A2! A3! A4! A5! A6! A7! A8! A9! AA! AB! AC! AD! AE!
013900 ; C0! C1! C2! C3! C4! C5! C6! C7! C8! C9! CA! CB! CC! CD! CE!
013910 ; E0! E1! E2! E3! E4! E5! E6! E7! E8! E9! EA! EB! EC! ED! EE!
013920 ;---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
013930 ;E00!E01!E02!E03!E04!E05!E06!E07!E08!E09!E10!E11!E12!E13!E14!
013940 ; 16! 56! 46! 26! 06! 36! 86! 46! C6! 66! 96! B6! 76! 6D! A0!
013950 ; 60! 01! 02! 03! 04! 05! 06! 07! 08! 09! 0A! 0B! 0C! 2D! 60!
013960 ;ESC!1! !2" !3# !4$ !5% !6& !7/ !8( !9) !0= !'? !+* !BSP!TAB!
013970 ; 1B!   !   !   !   !   !   !   !   !   !   !   !   ! 9B! 09!
013980 ; 1B! 21! 22! 23! 24! 25! 26! 2F! 28! 29! 3D! 3F! 2A! 8B! 09!
013990 ; 1B! 31! 32! 33! 34! 35! 36! 37! 38! 39! 30! 27! 2B! 8B! 09!
014000 ;-----------------------------------------------------------------
014010 ; D00 !D01!D02!D03!D04!D05!D06!D07!D08!D09!D10!D11!D12! D13 !
014020 ;  15 ! 55! 45! 25! 05! 35! 85! A5! C5! 65! 95! B5! 75!  D0 !
014030 ;  A0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00!  A0 !
014040 ; CTRL!qQ !wW !eE !rR !tT !zZ !uU !iI !oO !pP !sS^!-dD! CTRL!
014050 ;      ! 11! 17! 05! 12! 14! 1A! 15! 09! 0F! 10! 1B! 1C!      !
014060 ;      ! 51! 57! 45! 52! 54! 5A! 55! 49! 4F! 50! 5B! 5C!      !
014070 ;      ! 71! 77! 65! 72! 74! 7A! 75! 69! 6F! 70! 7B! 7C!      !
014080 ;-----------------------------------------------------------------
014090 ;!C00  !C01!C02!C03!C04!C05!C06!C07!C08!C09!C10!C11!C12!C13!
014100 ;!  11 ! 51! 41! 21! 01! 31! 81! A1! C1! 61! 91! B1! 71! 72!
014110 ;!  C0 ! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 00! 42! 20!
014120 ;!LOCK^!aA !sS !dD !fF !gG !hH !jJ !kK !lL !c'C!c'C!-_ !    !
014130 ;!      ! 01! 13! 04! 06! 07! 08! 0A! 0B! 0C! 1E! 1D! 1F! 9B!
014140 ;!      ! 41! 53! 44! 46! 47! 48! 4A! 4B! 4C! 5E! 5D! 5F! 8B!
014150 ;!      ! 61! 73! 64! 66! 67! 68! 6A! 6B! 6C! 7E! 7D! 2D! 8B!
014160 ;-------------------------------------------------------- FT!
014170 ;!B99!B00!B01!B02!B03!B04!B05!B06!B07!B08!B09!B10! B11 !    !
014180 ;! 40! 12! 52! 42! 22! 02! 32! 82! A2! C2! 62! 92! B2  !    !
014190 ;! 90! 0D! 00! 00! 00! 00! 00! 00! 00! 0E! 0F! 00! 90  !    !
014200 ;!SHF!() !yY !xX !cC !vV !bB !nN !aM !,;!.: !z'Z!SHFT^!    !
014210 ;!   !   ! 19! 18! 03! 16! 02! 0E! 0D!   !   ! 00!      !    !
014220 ;!   ! 3E! 59! 58! 43! 56! 42! 4E! 4D! 3B! 3A! 40!      !    !
014230 ;!   ! 3C! 79! 78! 63! 76! 62! 6E! 6D! 2C! 2E! 60!      !    !
014240 ;!-----------------------------------------------------------------
014250 ;              !            A05             !
014260 ;              !             30             !
014270 ;              !             60             !
014280 ;              !                            !
014290 ;              !             20             !
014300 ;              !             20             !
014310 ;              !             20             !
014320 ;              ----------------------------
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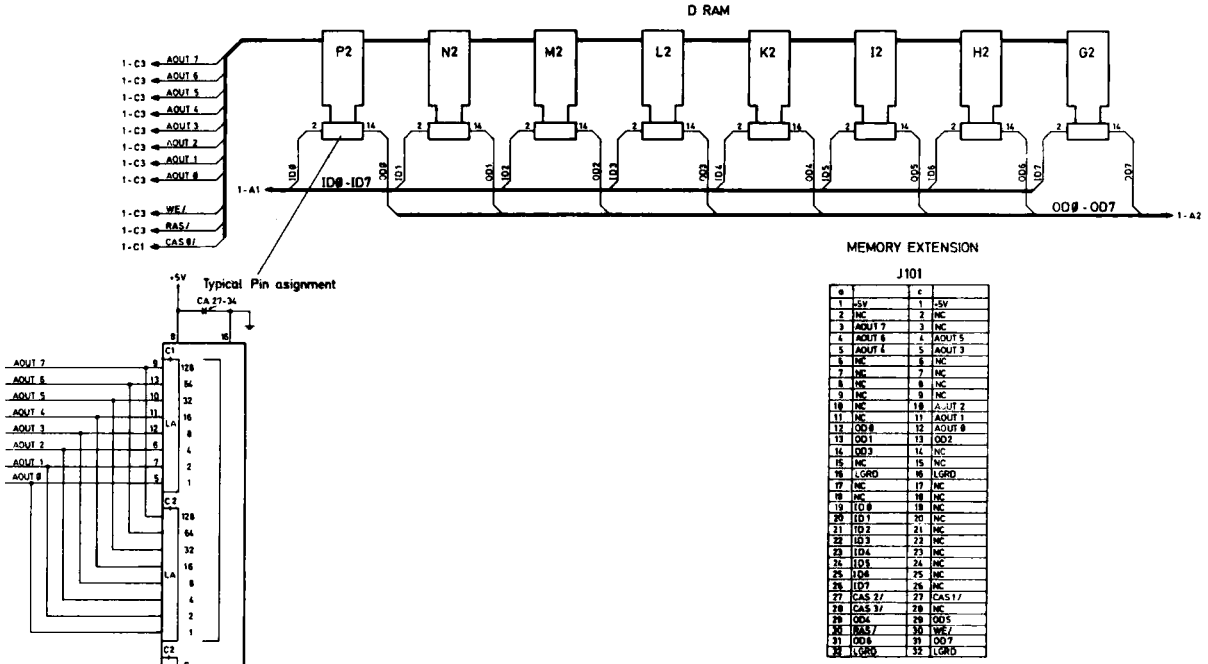
ACCPTK	LABL	0162H	005150					
ASCIT8	LABL	0368H	008440	005460				
ATEMP	EQU	0007H	001110					
BDCLK	EQU	0004H	001080					
BITCTR	EQU	0003H	001070					
BITIME	LABL	0081H	002630	002520				
BUS	EQU	0000H	000000					
C	EQU	0070H	000000					
CAFL6	EQU	007EH	001160					
CHARBF	EQU	0005H	001090					
CKSU1	LABL	01F9H	006440	003460				
CKSU2	LABL	0200H	006520					
CKSU3	LABL	00E1H	003490					
CKSU4	LABL	04F9H	008750	003470				
CKSU5	LABL	0500H	008830					
CKSU6	LABL	06F9H	008940	003480				
CKSU7	LABL	0700H	009020					
CLEAR	LABL	00BFH	003160	003290				
CNT	EQU	0000H	000000					
CNTDWN	LABL	0087H	002690	002450	002650			
COND	LABL	0208H	006610	005720				
DBB	EQU	001AH	000000					
DECPOI	EQU	0024H	001270	003800	006620			
DMJ	EQU	00E0H	000000					
DOUBLO	EQU	000BH	001200	005650				
ERRCNT	EQU	0002H	001060					
EXCEPT	LABL	01C6H	005990	005350				
EXCTB	LABL	0400H	008590	006050				
EXINT	LABL	0064H	002370	001740	001840	002160	002590	
F0	EQU	005EH	000000					
F1	EQU	007EH	000000	001160				
FIFO	EQU	0010H	001250	002770	002780	003340	003350	
FIFOEN	EQU	0017H	001260					
FLAGB	EQU	0021H	001220	005180	006380			
FLAGS	EQU	00F0H	000000					
FUKY	LABL	01C0H	005930	005330				
I	EQU	0000H	000000					
INTRPT	LABL	0029H	001820	001400				
INTRUP	LABL	0003H	001370					
KEYS	EQU	0068H	008430	004520				
KYDOWN	LABL	0145H	004930	004830				
KYDWN	EQU	0007H	001000					
LASTCD	EQU	0022H	001230	005270				
LASTKY	EQU	0023H	001240	005230	005860			
LDKBQ	LABL	008AH	002730	005620	005670			
LNGOFS	LABL	0262H	007570	007410				
LOCKY	LABL	013FH	004880	005050	005140	006420		
LONGDL	EQU	0060H	001170	005160				
MB0	EQU	0020H	000000					
MB1	EQU	0030H	000000					
MRKTBL	LABL	03D0H	008290	008430				
MTKBQ	LABL	0042H	002050	001760	001900			
N0	LABL	0186H	005420					
N1	LABL	0199H	005570					
N3	LABL	019EH	005610	003D40	006170	006760	008190	

```
N4          LABL    01A9H   005700  005590
N5          LABL    01ADH   005740  005710
N5P0        LABL    00A4H   002980  005740
NATVLN      LABL    024AH   007360  005260
NEWS        LABL    0111H   004500  003840  003860  004590
NORMLS      LABL    0181H   005370  005970
P0          EQU     0000H   000000
P1          EQU     0001H   000000
P2          EQU     0002H   000000
P4          EQU     0004H   000000
P5          EQU     0005H   000000
P6          EQU     0006H   000000
P7          EQU     0007H   000000
PAUSE       LABL    0085H   002670  002540
PSW         EQU     00CFH   000000
QHPTR       EQU     0006H   000990
QTPTR       EQU     0005H   000980  002120
R0          EQU     0000H   000000
R1          EQU     0001H   000000  000910
R2          EQU     0002H   000000  001060
R3          EQU     0003H   000000  000960  001070
R4          EQU     0004H   000000  000970  001080
R5          EQU     0005H   000000  000980  001090
R6          EQU     0006H   000000  000990  001100
R7          EQU     0007H   000000  001000  001110
RB0         EQU     0000H   000000
RB1         EQU     0010H   000000
REPCX       LABL    01AFH   005780  005000
REPDLY      EQU     00D4H   000970
REPEAT      LABL    0164H   005170  005910
REPRAT      EQU     00D8H   001180  005900
RESHFG      LABL    01F2H   006370  005040
RESTRT      LABL    0000H   001330
ROMCK       LABL    00D2H   003370
SCAN        LABL    0118H   004550  004850  004860  004920  004970  005120  005220  005530
                            005660  005680  005800  005830  005890  006110  006350
SEND        LABL    0066H   002410  001960  002280
SHFTRG      EQU     00D6H   001100
SPZEXC      LABL    01E1H   006200  005300  006010
SPZXCD      LABL    0604H   008210  006290
START       LABL    00BAH   003190  001350
STPTR       EQU     0001H   000910
STRAPS      EQU     0020H   001210  001910  002060  003600  007380
STS         EQU     00E8H   000000
STSHFG      LABL    01EEH   006320  005950  006710
SUPLFU      LABL    00AEH   003660  003010
T           EQU     004AH   000000
TBLPTR      EQU     0003H   000960
TCNTI       EQU     0020H   000000
TIMER       LABL    0007H   001510
TMRCNT      EQU     FFFDH   001190  001720
TRANS       LABL    021AH   006730  006660  006680
TRANS4      LABL    04E3H   008690  006060  006150
TRANS6      LABL    0600H   008160  006300
TXTCHG      LABL    021EH   006790  005600
UNCH        LABL    0227H   006870  006810  006850  007000  007020  007120  007470
UNLOCK      LABL    0157H   005060  004820
XL          LABL    0260H   007550
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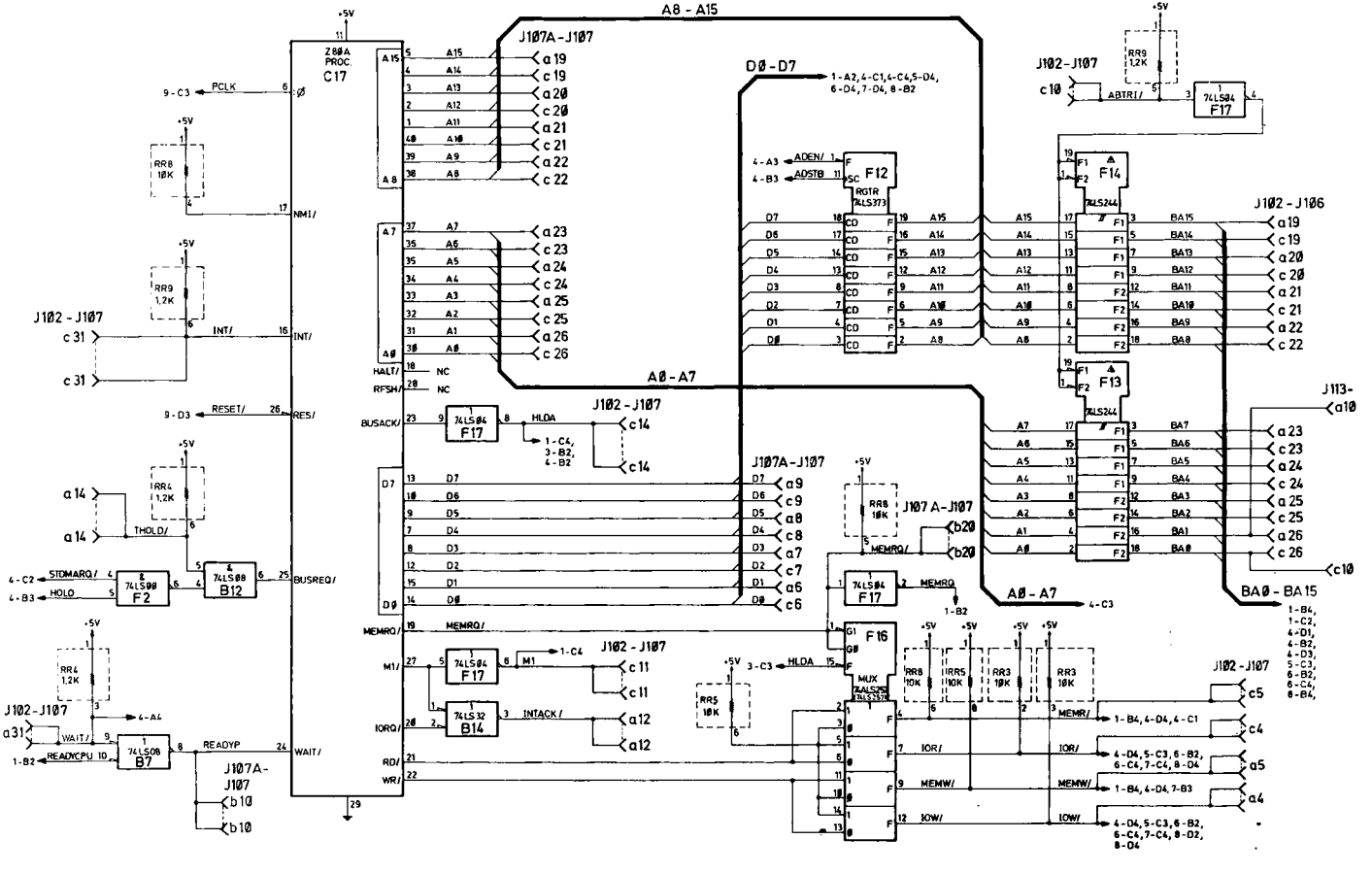
CONTROLLER BOARD

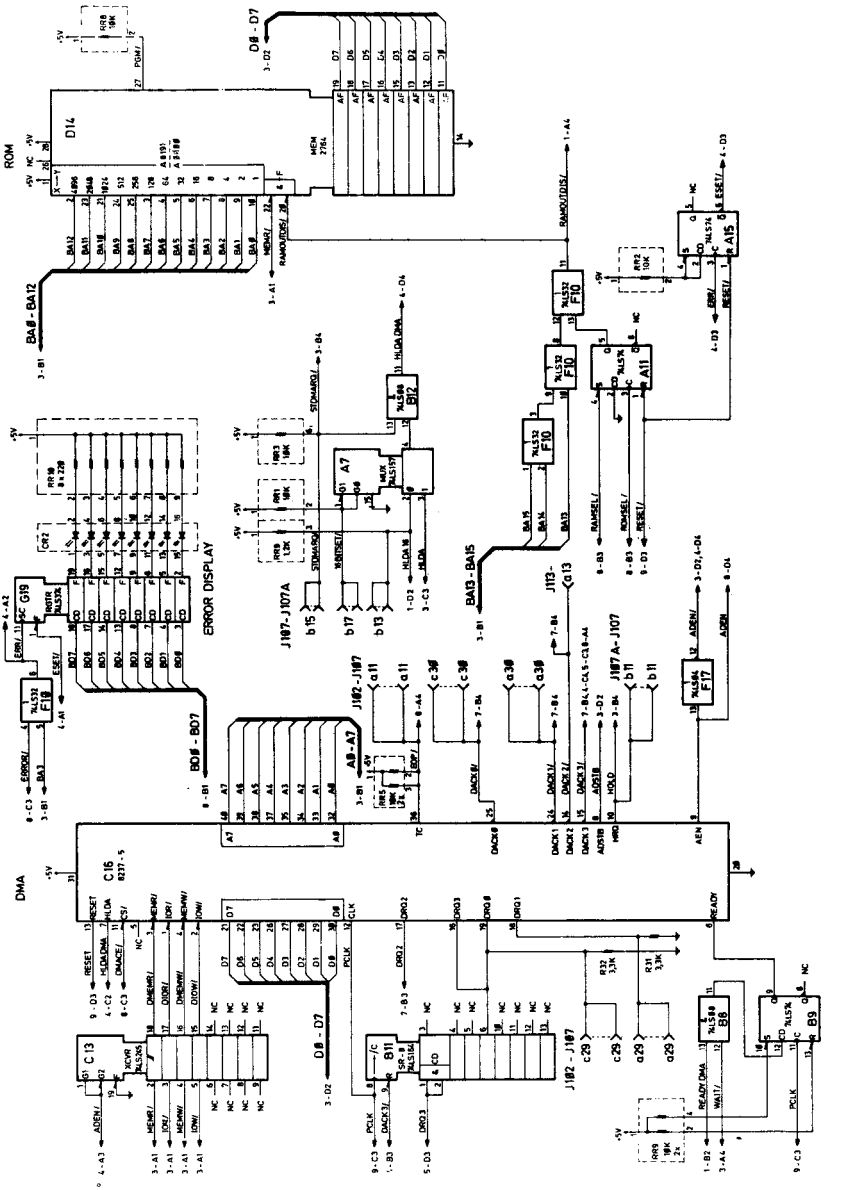


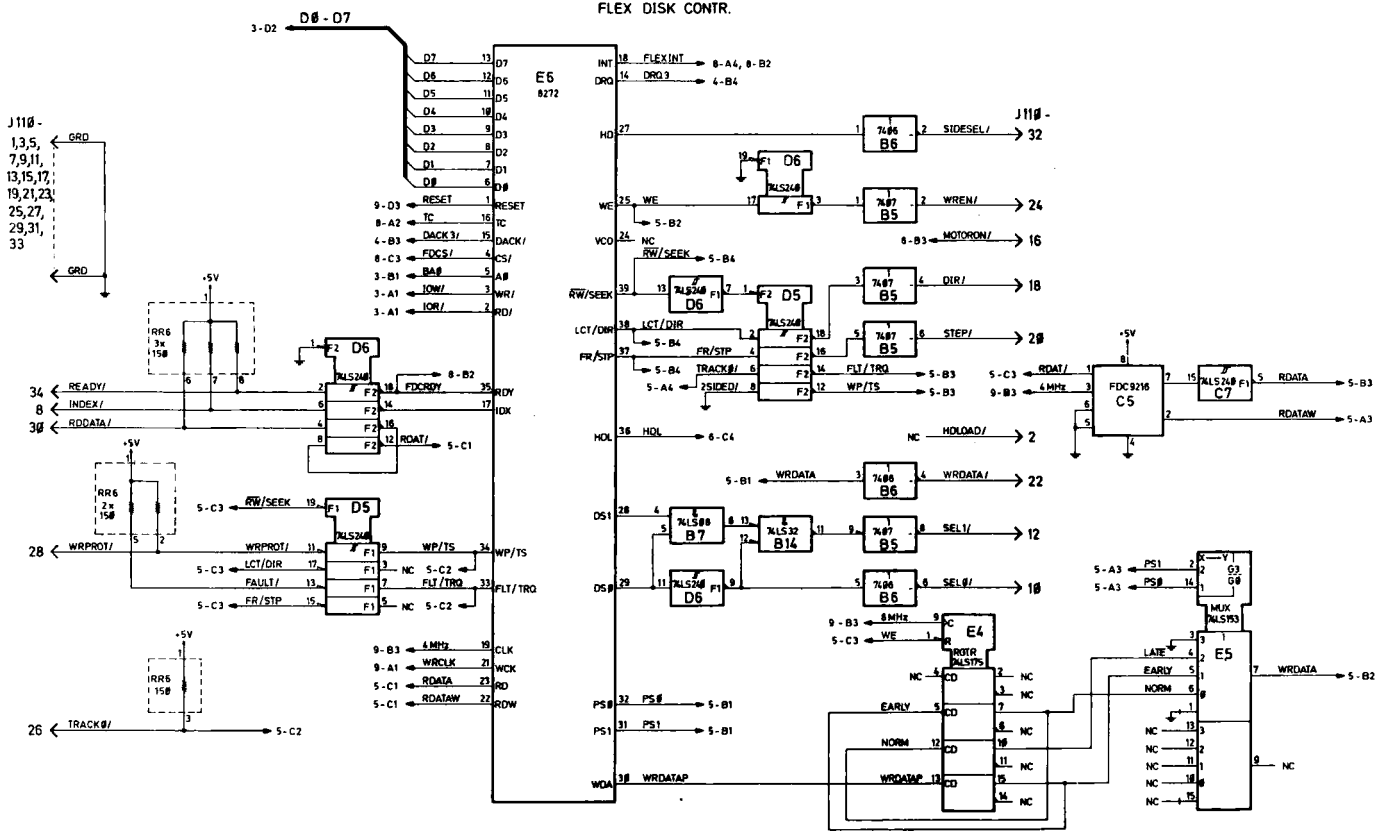

D RAM CONTR.
CAS/
+5V
RR1 10K
74S04 G1
9-C3 24MHz
3-C3 HLDA
74LS21 F1
3-B3 M1
1-C1 PCS 0/
7406 B6
X1
X2
RFRQ
PCS/
AH7
AH0
AL7
AL0
E3 8203
SACK/
OUT7
OUT0
CAS/
RAS0/
WE/
XACK/
RAS1/
RAS3/
16K/64K
NC
AOUT7
AOUT6
AOUT5
AOUT4
AOUT3
AOUT2
AOUT1
AOUT0
AOUT0-AOUT7, RAS/, WE/
2-C4, 2-D4
J101-
a 3
a 4
c 4
a 5
c 5
c 10
c 11
c 12
a 30
c 30
BA15
BA14
BA13
BA12
BA11
BA10
BA9
BA8
BA7
BA6
BA5
BA4
BA3
BA2
BA1
BA0
BA0 - BA15
3-B1
7-A1 MEW/
WR
RD
S1
20
3-A1 MEMR/
74S04 G1
74S08 F2
4-B1 RAMOUTDIS/
TRAMD/
74LS08 B12
RR4 1,2K
J102-J107
- c16
- c16
4-C2 HLDA 16
8-D3 BSEL/
9-D3 RESET/
74LS175 I1
RGTR
3-B1 BA1
3-B1 BA0
3-B1 BA3
3-B1 BA2
CD
NC
74LS126 K1
J102-J107
BA17
- a 18
BA16
- c 18
+5V
J101-
a 1
c 1
LGRD
a 32
c 32
a 16
c 16
X→Y CODER LS139 M1
CAS 3/
CAS 2/
CAS 1/
CAS0/
2-C4
NC
NC
NC
PCS0/
1-C4
a 28
a 27
c 27
J102-J107
BA19
- a 17
BA18
- c 17
3-B1 MEMRQ
74LS00 F2
READY CPU
3-B4
74S04 G1
READY DMA
4-A4
READY DMA
- a 10
CLK
OE/
F4
RGTR 74LS374
RR7 220Ω
F1
F2
F5
74LS244
J101-
a 12
a 13
c 13
a 14
a 29
c 29
a 31
c 31
OD0 - OD7
2-C1
D0 - D7
3-D2
ID0 - ID7
2-C3
J101-
a 19
a 20
a 21
a 22
a 23
a 24
a 25
a 26

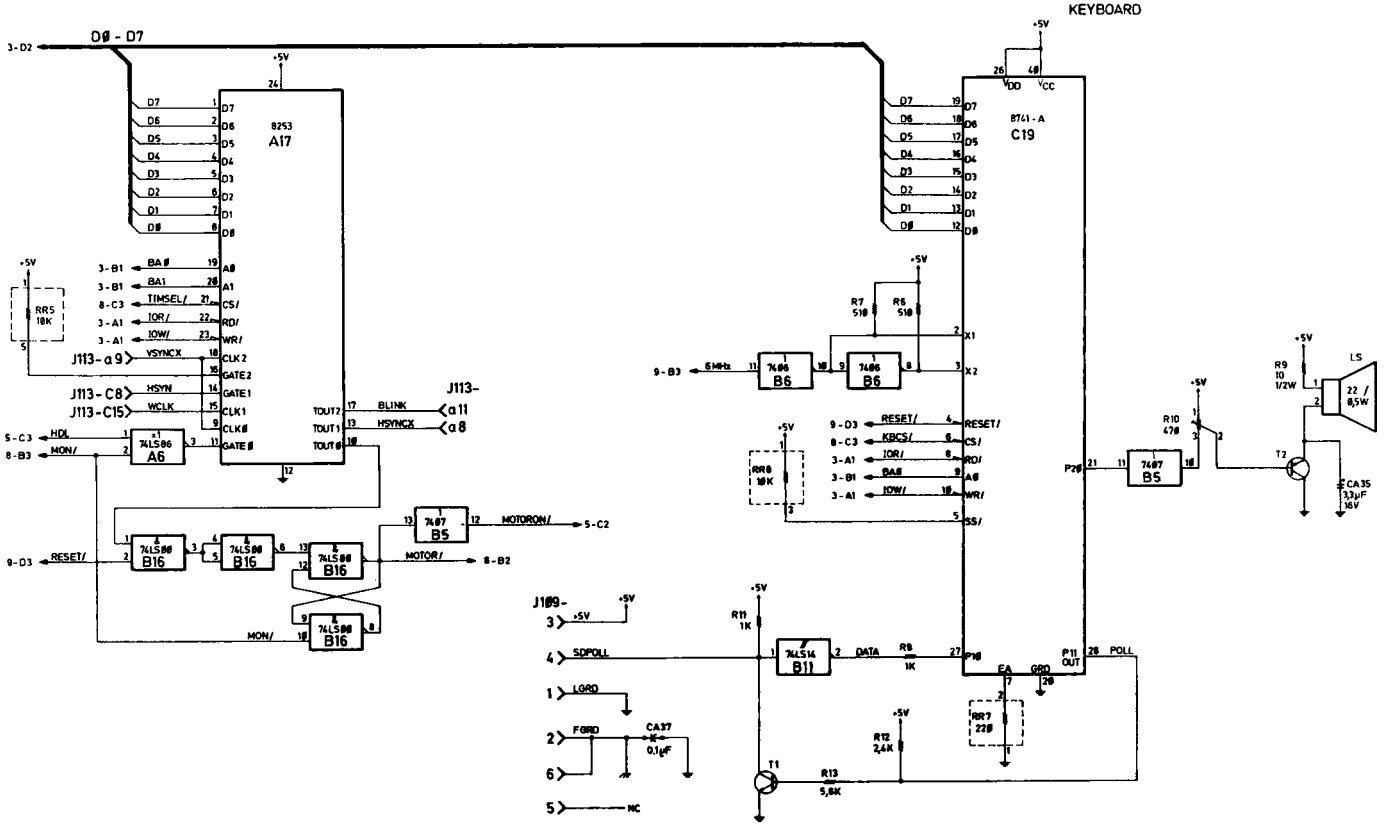


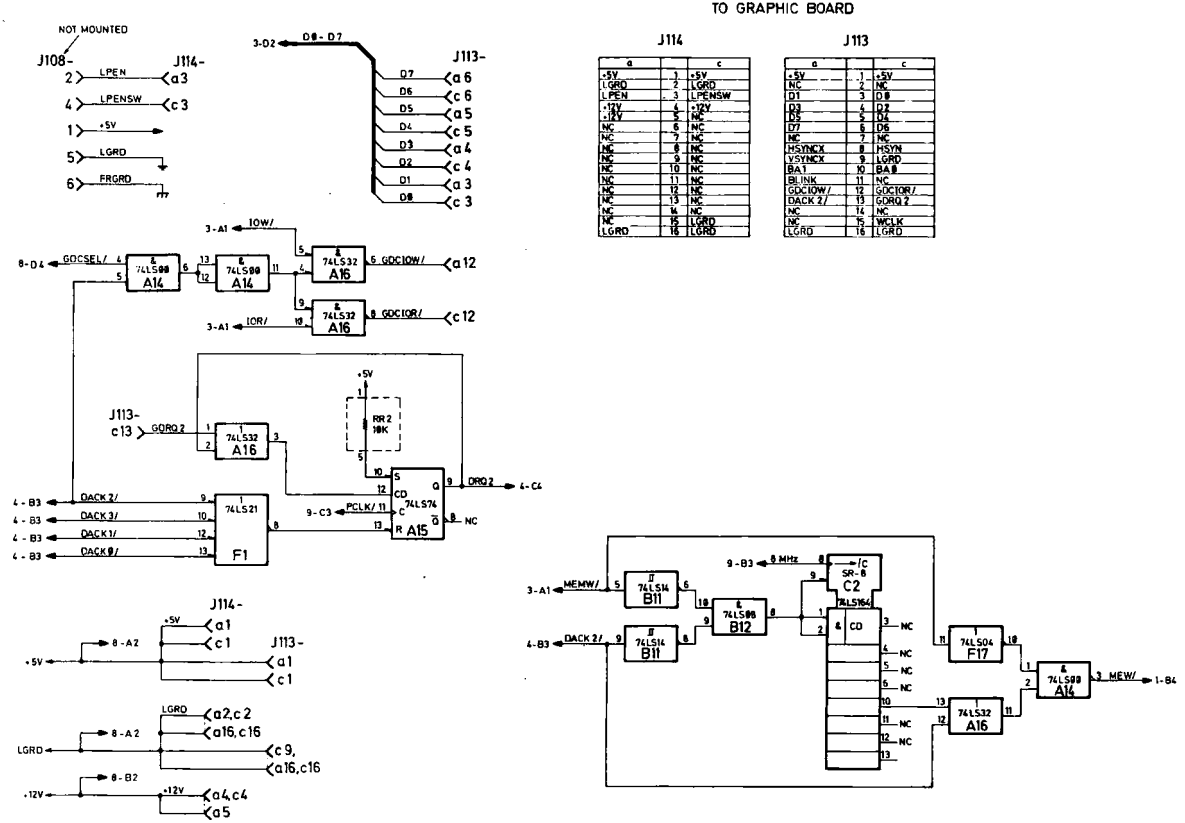
a		c	
1	+5V	1	+5V
2	NC	2	NC
3	AOUT 7	3	NC
4	AOUT 6	4	AOUT 5
5	AOUT 4	5	AOUT 3
6	NC	6	NC
7	NC	7	NC
8	NC	8	NC
9	NC	9	NC
10	NC	10	AOUT 2
11	NC	11	AOUT 1
12	OD0	12	AOUT 0
13	OD1	13	OD2
14	OD3	14	NC
15	NC	15	NC
16	LGRD	16	LGRD
17	NC	17	NC
18	NC	18	NC
19	ID 0	19	NC
20	ID1	20	NC
21	ID2	21	NC
22	ID3	22	NC
23	ID4	23	NC
24	ID5	24	NC
25	ID6	25	NC
26	ID7	26	NC
27	CAS 2/	27	CAS 1/
28	CAS 3/	28	NC
29	OD4	29	OD5
30	RAS/	30	WE/
31	OD6	31	OD7
32	LGRD	32	LGRD

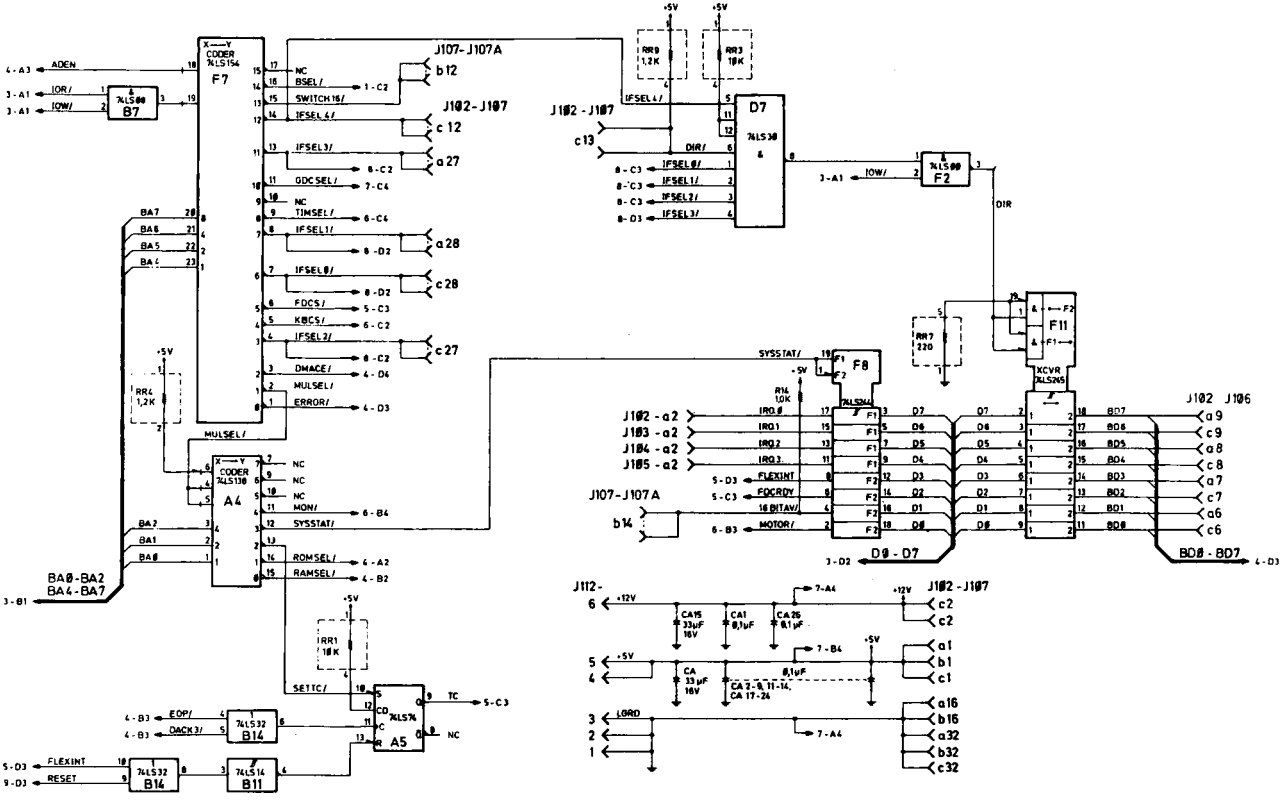

A8 - A15
J107A-J107
D0 - D7
J102-J107
J102-J106
A0 - A7
J107A-J107
J102-J107
J107A-J107
J102-J107
BA0 - BA15
Z80A PROC. C17
PCLK
RESET/
INT/
HALT/
RFSH/
BUSACK/
HLDA
THOLD/
STDMARQ/
HOLD
BUSREQ/
MEMRQ/
M1/
IORQ/
RD/
WR/
WAIT/
READYP
READYCPU
INTACK/
ABTRI/
ADEN/
ADSTB
RGTR 74LS373
MUX 74LS257/74LS258
MEMR/
IOR/
MEMW/
IOW/
RR8 10K
RR9 1.2K
RR4 1.2K
RR5 10K
RR3 10K
74LS04 F17
74LS08 F2
74LS08 B12
74LS08 B7
74LS32 B14
74LS244 F14
74LS244 F13

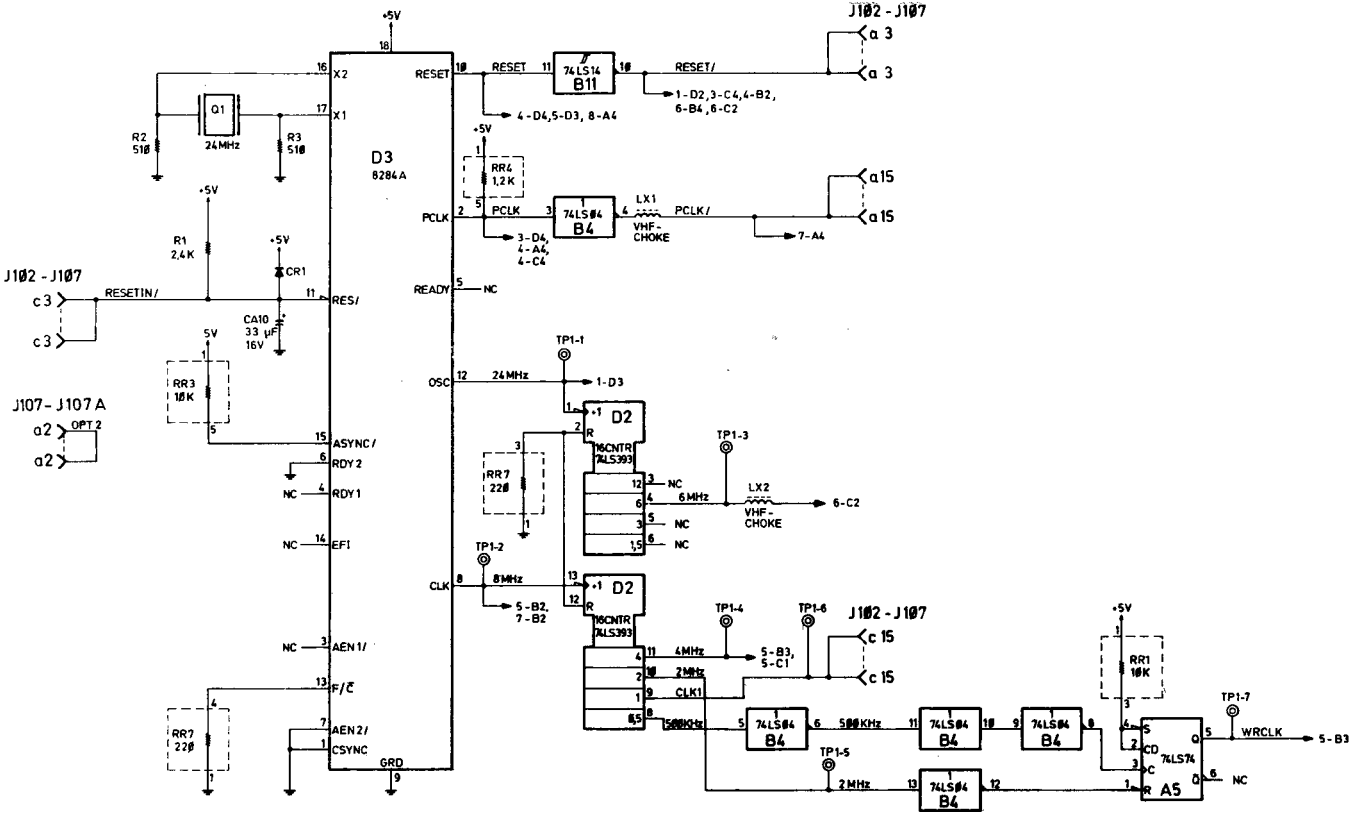

ROM
D14
D8 - D7
BA8 - BA12
ERROR DISPLAY
J107-J107A
BD8 - BD7
AB - A7
BA13 - BA15
DMA
C16
D8 - D7
J102 - J107
J107A - J107
J113-C13
A11
A15
B12
F10
F17
B11
B8
B9
C13
C29
Q29
R31 3.3K
R32 3.3K


FLEX DISK CONTR.
D0 - D7
E6
8272
J11Ø -
1,3,5,
7,9,11,
13,15,17,
19,21,23,
25,27,
29,31,
33
GRD
+5V
RR6
3x
15Ø
RR5
15Ø
RR6
2x
15Ø
READY/
INDEX/
RDDATA/
WRPROT/
TRACKØ/
RESET
TC
DACK3/
FDCS/
BAØ
IOW/
IOR/
RDY
IDX
WP/TS
FLT/TRQ
CLK
WCK
RD
RDW
FLEXINT
DRQ3
HD
WE
VCO
RW/SEEK
LCT/DIR
FR/STP
HDL
DS1
DSØ
PSØ
PS1
WDA
WRDATAP
SIDESEL/
WREN/
MOTORON/
DIR/
STEP/
FLT/TRQ
WP/TS
RDAT/
4MHz
HDLOAD/
WRDATA
WRDATA/
SEL1/
SELØ/
8MHz
WE
LATE
EARLY
NORM
WRDATA
MUX
74LS153
FDC9216
C5
74LS240
74LS244
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7406
7407
7408
7496

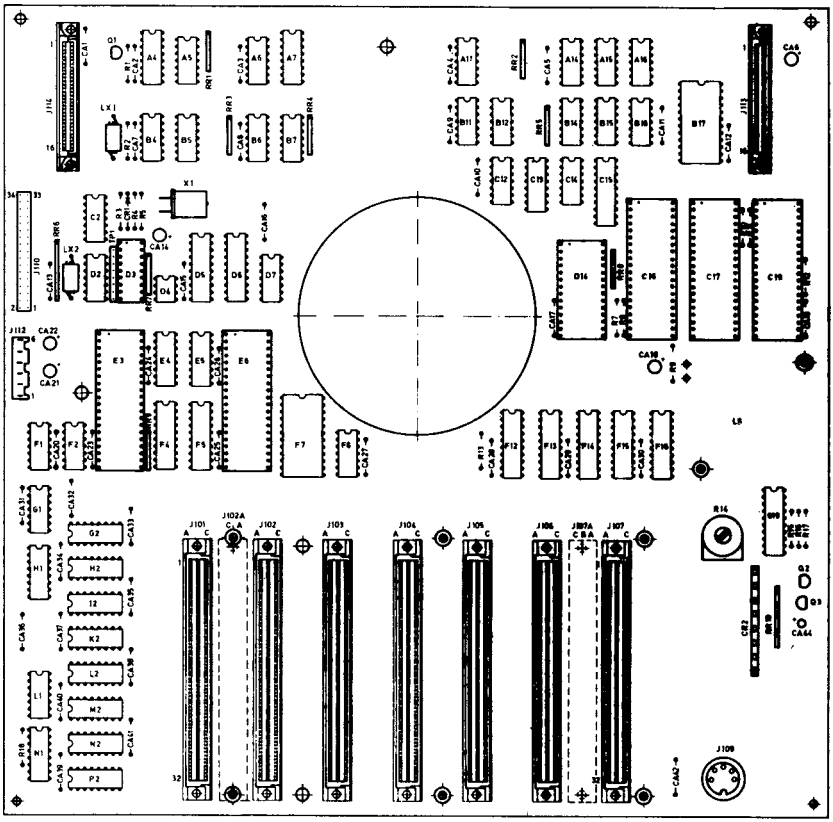

KEYBOARD
D0 - D7
3-D2
8253
A17
8741-A
C19
RR5
10K
RR8
10K
RR7
220
R7
510
R6
510
R9
10
1/2W
R10
470
R11
1K
R12
2,4K
R13
5,6K
R8
1K
LS
22 /
0,5W
CA35
3,3µF
16V
CA37
0,1µF
T1
T2
J113-
J113-C8
J113-C15
J113-a9
J113-a11
J113-a8
J109-
9-B3
6MHz
5-C3
8-B3
9-D3
5-C2
8-B2
P20
P10
P11
P16
P17
P26
SDPOLL
LORD
FORD
DATA
POLL
EA
RESET/
KBCS/
IOR/
IOW/
MON/
MOTORON/
MOTOR/
HDL
HSYN
WCLK
VSYNCX
BLINK
HSYNCX
TIMSEL/
BA0
BA1
CS/
RD/
WR/
CLK2
GATE2
GATE1
CLK1
CLK0
GATE0
TOUT2
TOUT1
TOUT0
A0
A1
X1
X2
SS/
NC
74LS86
A6
74LS00
B16
7406
B6
7407
B5
74LS14
B11


NOT MOUNTED
J108-
J114-
2 LPEN a3
4 LPENSW c3
1 +5V
5 LGRD
6 FRGRD
3-D2 D0-D7
J113-
D7 a6
D6 c6
D5 a5
D4 c5
D3 a4
D2 c4
D1 a3
D0 c3
TO GRAPHIC BOARD
J114
J113
3-A1 IOW/
8-D4 GDCSEL/
74LS00 A14
74LS32 A16
GDCIOW/ a12
IOR/
GDCIOR/ c12
J113-
c13 GDRQ2
74LS21 F1
RR2 10K
74LS74 A15
DRQ2 4-C4
4-B3 DACK2/
4-B3 DACK3/
4-B3 DACK1/
4-B3 DACK0/
9-C3 PCLK/
J114-
8-A2
J113-
LGRD
8-B2
+12V
9-B3 8 MHz
3-A1 MEMW/
4-B3 DACK2/
74LS14 B11
74LS08 B12
SR-8 C2
74LS164
74LS04 F17
MEW/ 1-B4
74LS32 A16

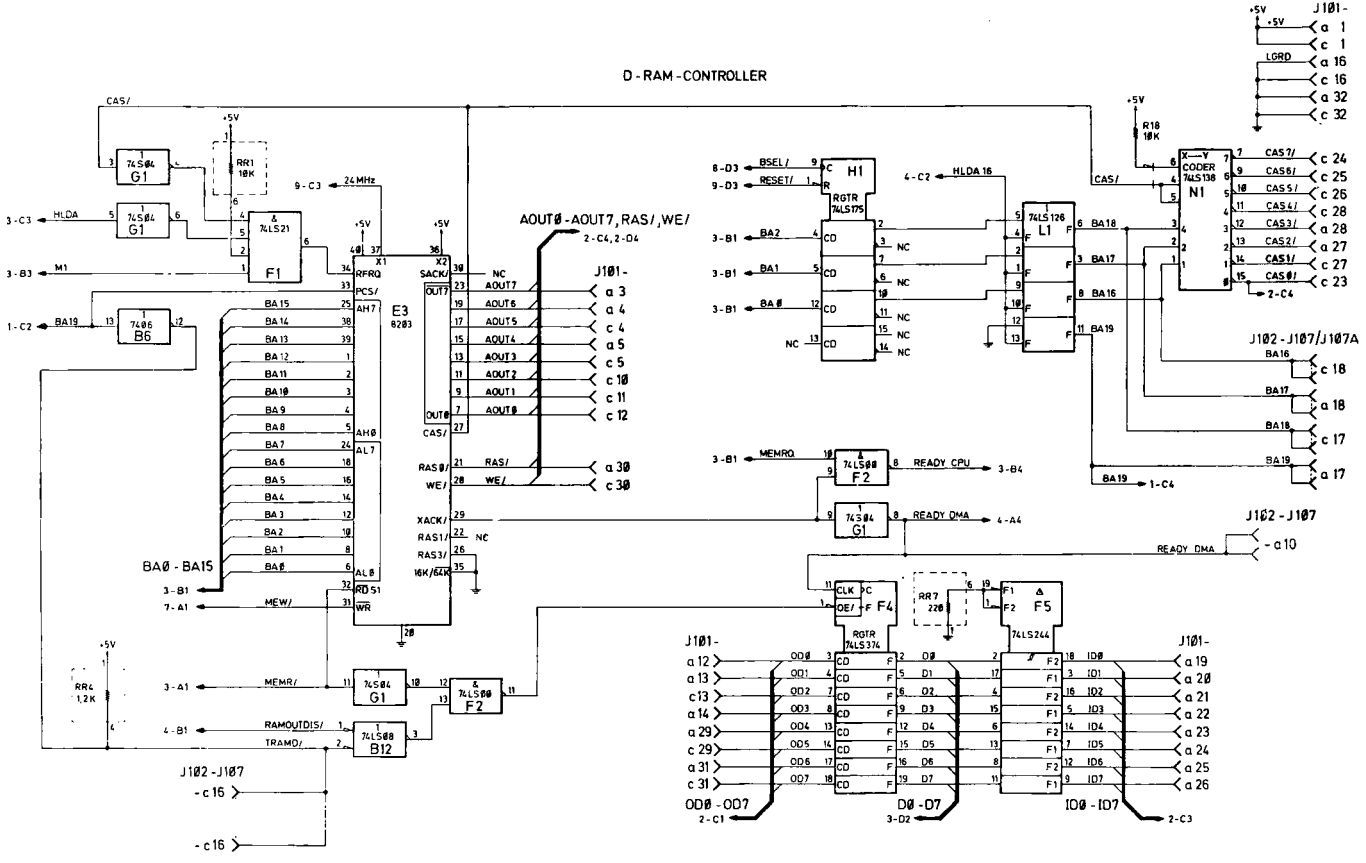

F7
B7
A4
A5
B14
B11
D7
F2
F11
F8
J107-J107A
J102-J107
J102 J106
BA0-BA2
BA4-BA7
BD0-BD7
D0-D7
J112-
ADEN
IOR/
IOW/
MULSEL/
SETTC/
EOP/
DACK3/
FLEXINT
RESET
SYSSTAT/
FLEXINT
FDCRDY
MOTOR/
DIR
LGRD

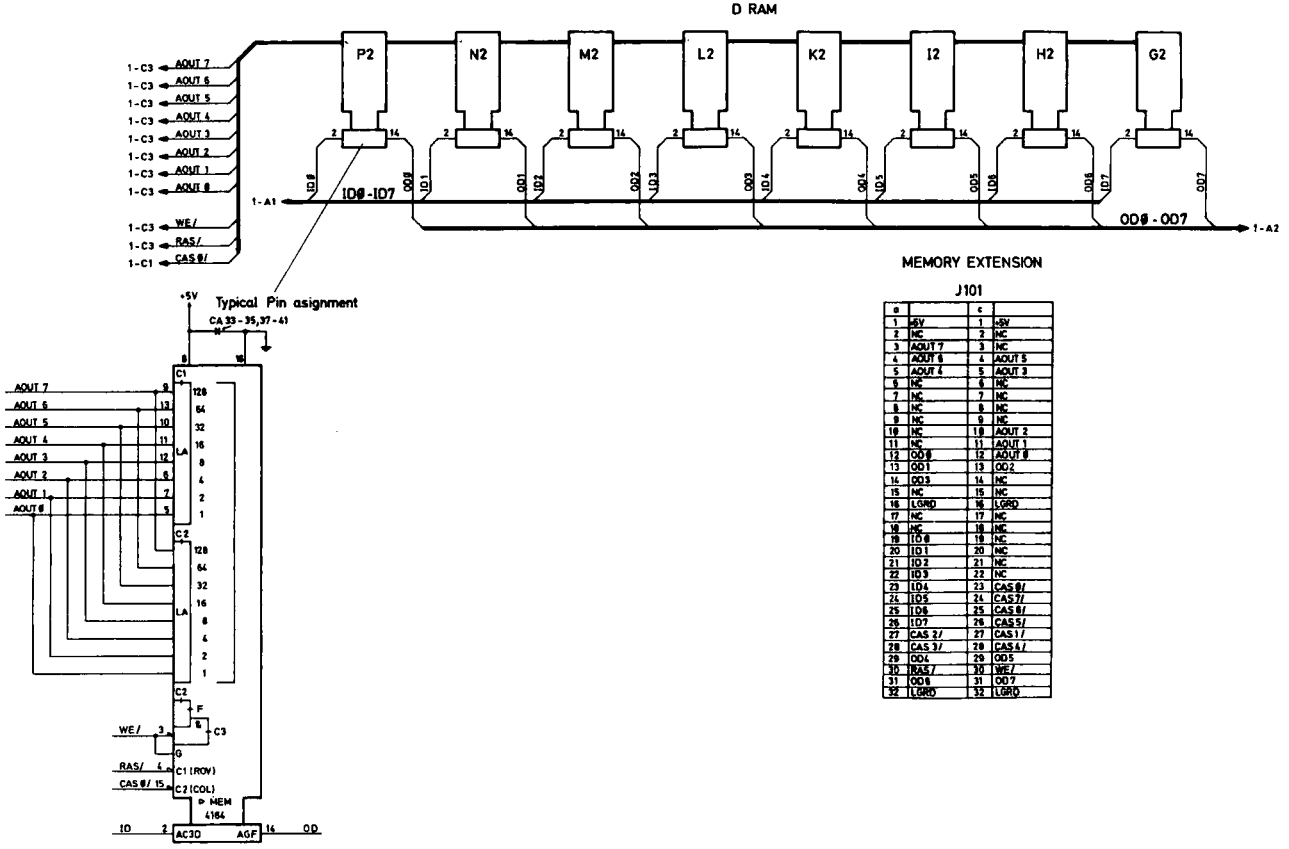

J102 - J107
D3
8284A
Q1
24MHz
R2
510
R3
510
R1
2,4K
CR1
CA10
33 µF
16V
RR3
10K
RR4
1,2K
RR7
220
RR1
10K
J102 - J107
RESETIN/
J107 - J107A
OPT 2
RESET
RESET/
74LS14
B11
1-D2,3-C4,4-B2,
6-B4,6-C2
4-D4,5-D3, 8-A4
PCLK
PCLK/
74LS04
B4
LX1
VHF-
CHOKE
3-D4,
4-A4,
4-C4
7-A4
READY
NC
OSC
24MHz
1-D3
TP1-1
D2
16CNTR
74LS393
TP1-3
6MHz
LX2
6-C2
TP1-2
8MHz
CLK
5-B2,
7-B2
TP1-4
TP1-6
4MHz
5-B3,
5-C1
2MHz
CLK1
500KHz
TP1-5
TP1-7
WRCLK
5-B3
74LS74
A5
RESET/
RESIN/
RES/
ASYNC/
RDY2
RDY1
EFI
AEN1/
F/C
AEN2/
CSYNC
GRD
X2
X1
+5V

CONTROLLER BOARD (MULTI-LAYER)



D-RAM-CONTROLLER

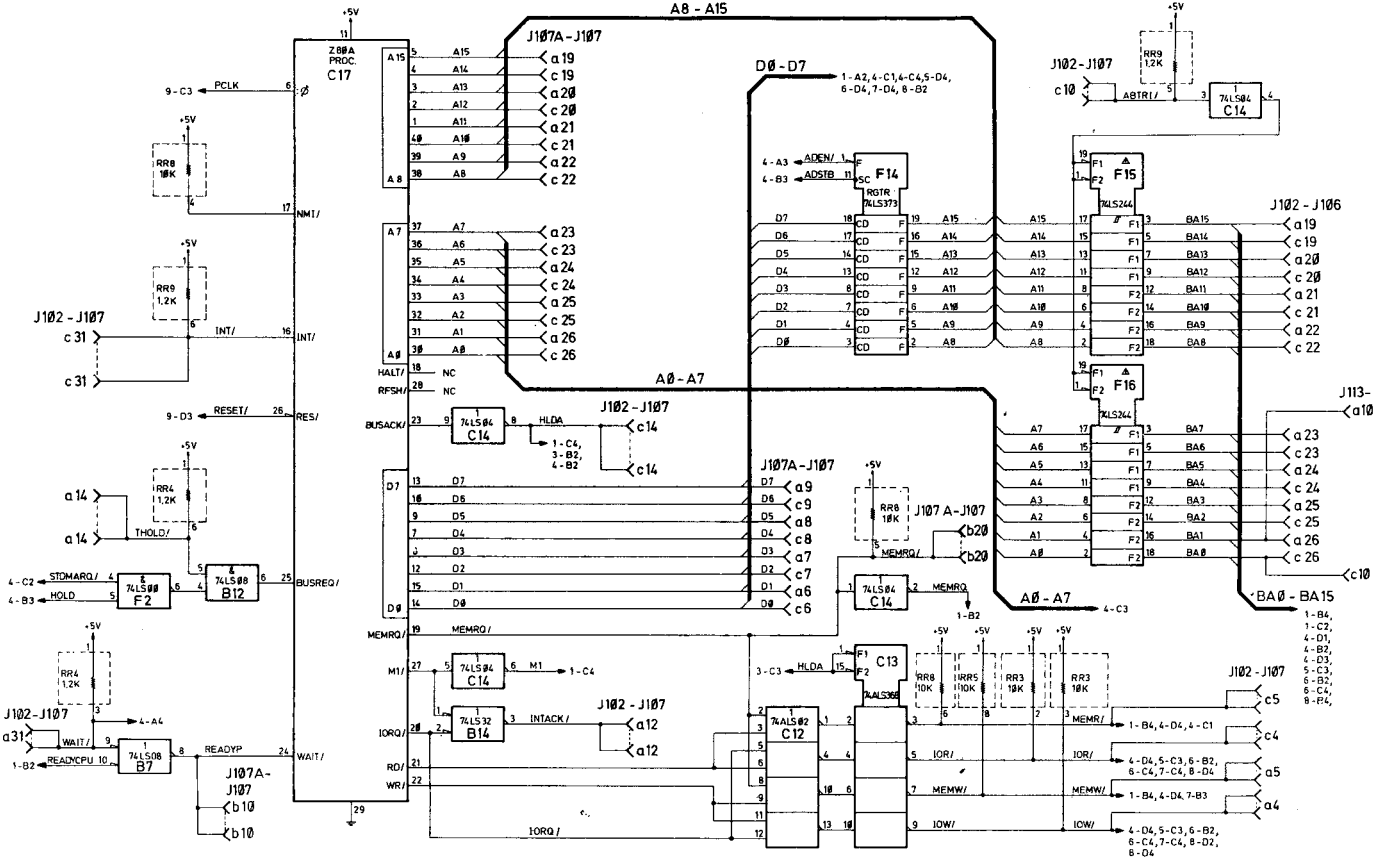


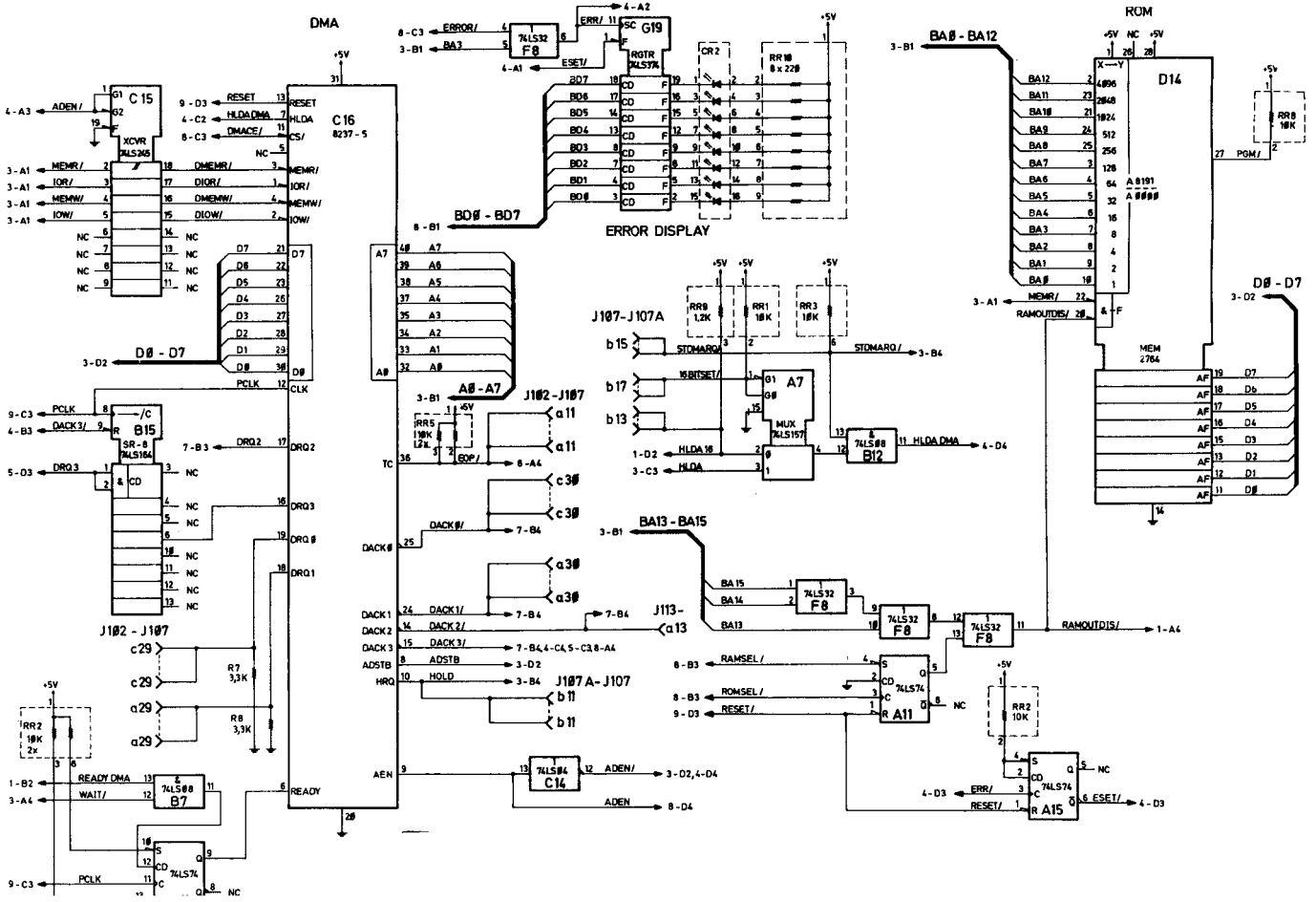


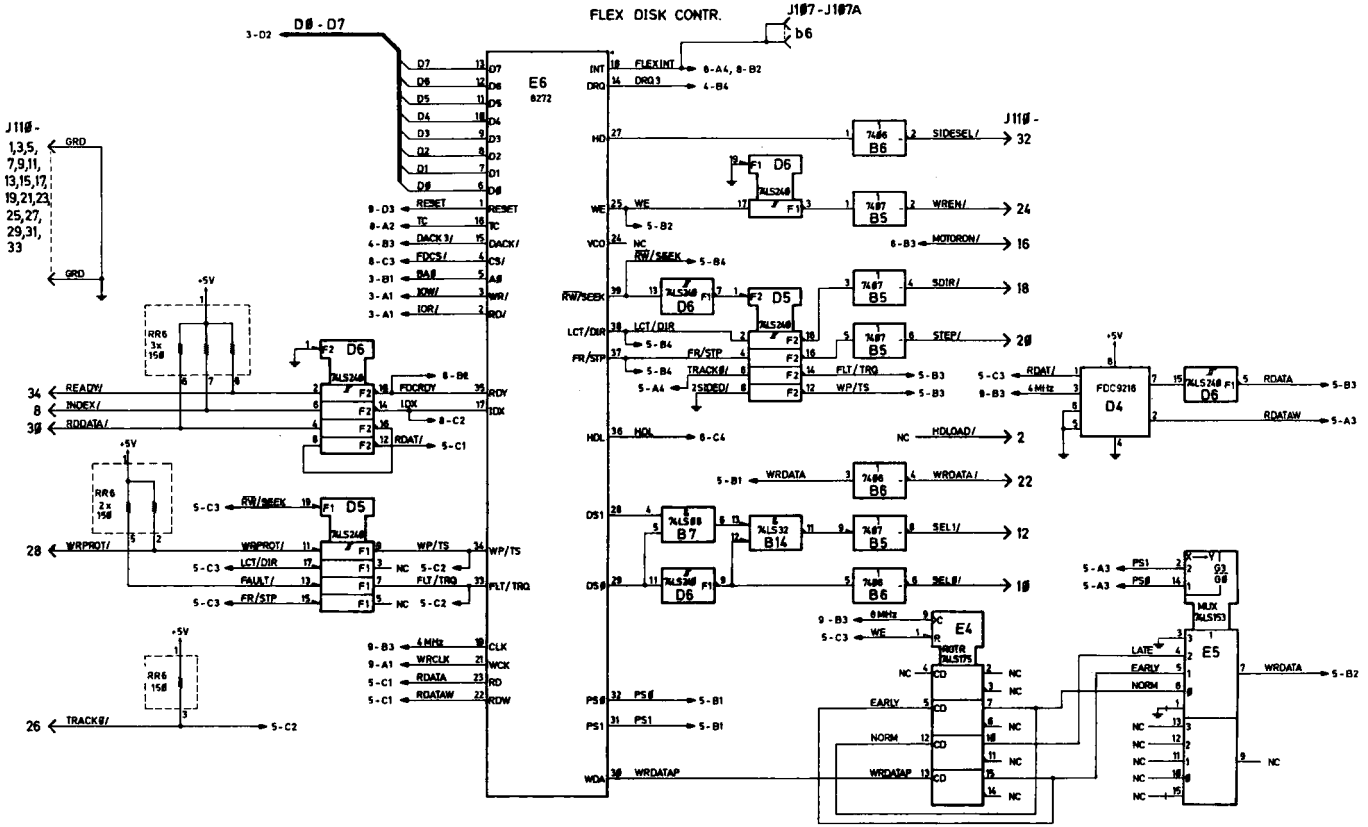
MEMORY EXTENSION

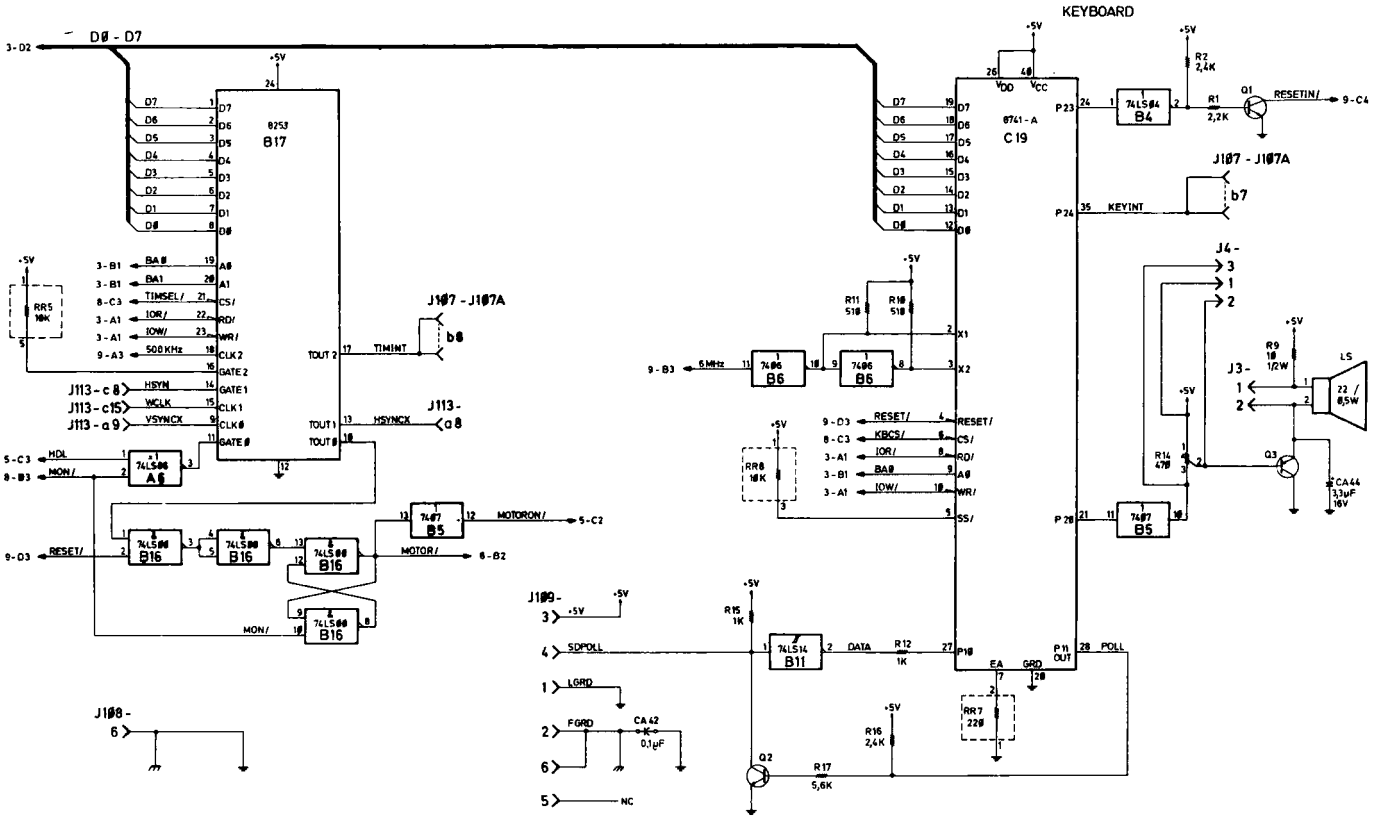
J101

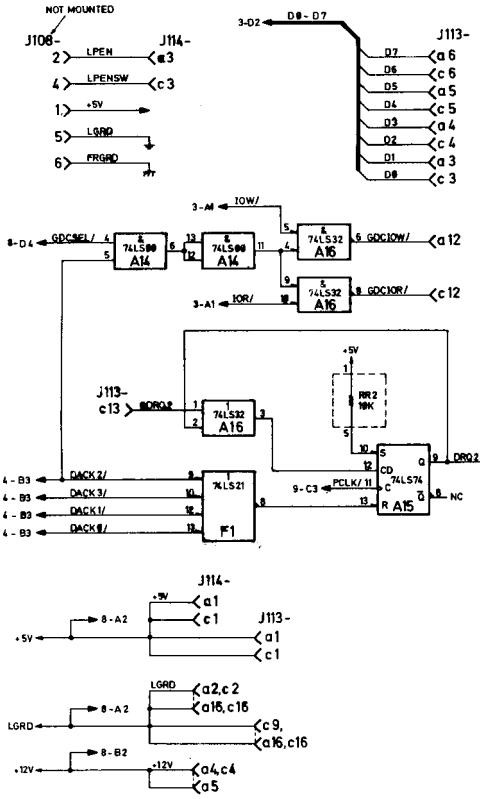
a		c	
1	+5V	1	+5V
2	NC	2	NC
3	AOUT 7	3	NC
4	AOUT 6	4	AOUT 5
5	AOUT 4	5	AOUT 3
6	NC	6	NC
7	NC	7	NC
8	NC	8	NC
9	NC	9	NC
10	NC	10	AOUT 2
11	NC	11	AOUT 1
12	OD0	12	AOUT 0
13	OD1	13	OD2
14	OD3	14	NC
15	NC	15	NC
16	LGRD	16	LGRD
17	NC	17	NC
18	NC	18	NC
19	ID0	19	NC
20	ID1	20	NC
21	ID2	21	NC
22	ID3	22	NC
23	ID4	23	CAS 0/
24	ID5	24	CAS 7/
25	ID6	25	CAS 6/
26	ID7	26	CAS 5/
27	CAS 2/	27	CAS 1/
28	CAS 3/	28	CAS 4/
29	OD4	29	OD5
30	RAS/	30	WE/
31	OD6	31	OD7
32	LGRD	32	LGRD


A8 - A15
J107A-J107
Z80A PROC. C17
PCLK
NMI/
INT/
RESET/
RES/
HALT/
NC
RFSH/
NC
BUSACK/
HLDA
THOLD/
STDMARQ/
HOLD
BUSREQ/
MEMRQ/
M1/
IORQ/
RD/
WR/
WAIT/
READYP
READYCPU
INTACK/
IORQ/
D0 - D7
A0 - A7
ADEN/
ADSTB
RGTR 74LS373
F14
F15
F16
74LS244
BA15
BA14
BA13
BA12
BA11
BA10
BA9
BA8
BA7
BA6
BA5
BA4
BA3
BA2
BA1
BA0
BA0 - BA15
ABTRI/
IOR/
IOW/
MEMR/
MEMW/
HLDA
C12
C13
C14
B7
B12
B14
F2
RR4 1.2K
RR8 10K
RR9 1.2K
RR3 1K
IRR5 10K
74LS74
74LS04
74LS08
74LS32
74LS02
74ALS368
J102 - J107
J102 - J106
J113-
J107 A-J107
J102-J107
J107A-J107


DMA
C16
8237-5
C15
XCVR
74LS245
B15
SR-8
74LS164
B7
C14
F8
G19
ERROR DISPLAY
BØ - BD7
AØ - A7
DØ - D7
J1Ø2 - J1Ø7
J1Ø7 - J107A
J1Ø7A - J107
J113 - a13
BA13 - BA15
BAØ - BA12
ROM
D14
MEM
2764
A11
A15
A12
B12
A7
MUX
74LS157
RR1 18K
RR2 10K
RR3 18K
RR8 18K
RR9 1,2K
RR10 8 x 22Ø
CR2
RR5 18K 2,2K
R7 3,3K
R8 3,3K
RR2 10K
16BITSET/
STOMARQ/
HLDA16
HLDA
HLDA DMA
RAMOUTDIS/
RAMSEL/
ROMSEL/
RESET/
ERR/
ESET/
ADEN/
ADEN
READY DMA
WAIT/
READY
HOLD
HRQ
AEN
ADSTB
DACK1/
DACK2/
DACK3/
DACK0/
DRQ1
DRQ2
DRQ3
DRQ0
PCLK
IOW/
IOR/
MEMW/
MEMR/
DMACE/
HLDA DMA
RESET
PGM/
EOP/
TC


FLEX DISK CONTR.
J10Ø-J10ØA
D0 - D7
E6
8272
J11Ø-
1,3,5,
7,9,11,
13,15,17,
19,21,23,
25,27,
29,31,
33
GRD
+5V
RR6
3x
15Ø
D6
74LS24Ø
READY/
INDEX/
RDDATA/
FDCRDY
IDX
RDAT/
RR6
2x
15Ø
D5
WRPROT/
LCT/DIR
FAULT/
FR/STP
WP/TS
FLT/TRQ
RR6
15Ø
TRACKØ/
RESET
TC
DACK3/
FDCS/
DAØ
IOW/
IOR/
WR/
RD/
4MHz
WRCLK
RDATA
RDATAW
CLK
WCK
RD
RDW
INT
FLEXINT
DRQ
DRQ3
HD
WE
VCO
RW/SEEK
LCT/DIR
FR/STP
HDL
DS1
DSØ
PSØ
PS1
WDA
WRDATAP
B6
SIDESEL/
B5
WREN/
MOTORON/
SDIR/
STEP/
FLT/TRQ
WP/TS
HDLOAD/
WRDATA
WRDATA/
B7
B14
SEL1/
SELØ/
D4
FDC9216
RDATA
RDATAW
E4
PROM
74LS175
EARLY
NORM
WRDATAP
E5
MUX
74LS153
LATE
EARLY
NORM
WRDATA
G3
ØØ


KEYBOARD
D0 - D7
3-D2
8253
B17
C19
8741-A
74LS04
B4
74LS06
A6
74LS08
B16
74LS14
B11
7406
B6
7407
B5
J107 - J107A
J113 - c8
J113 - c15
J113 - a9
J113 - a8
J109 -
J108 -
J4 -
J3 -
RESETIN/
KEYINT
HDL
MON/
RESET/
MOTORON/
MOTOR/
SDPOLL
LGRD
FGRD
DATA
POLL
TIMINT
HSYNCK
VSYNCK
WCLK
HSYN
TIMSEL/
IOR/
IOW/
BA0
BA1
500 KHz
6 MHz
KBCS/
SS/
NC
LS
22 / 0,5W
CA42
0,1µF
CA44
3,3µF 16V



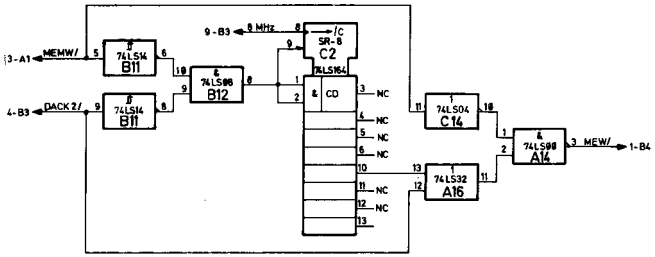
TO GRAPHIC BOARD

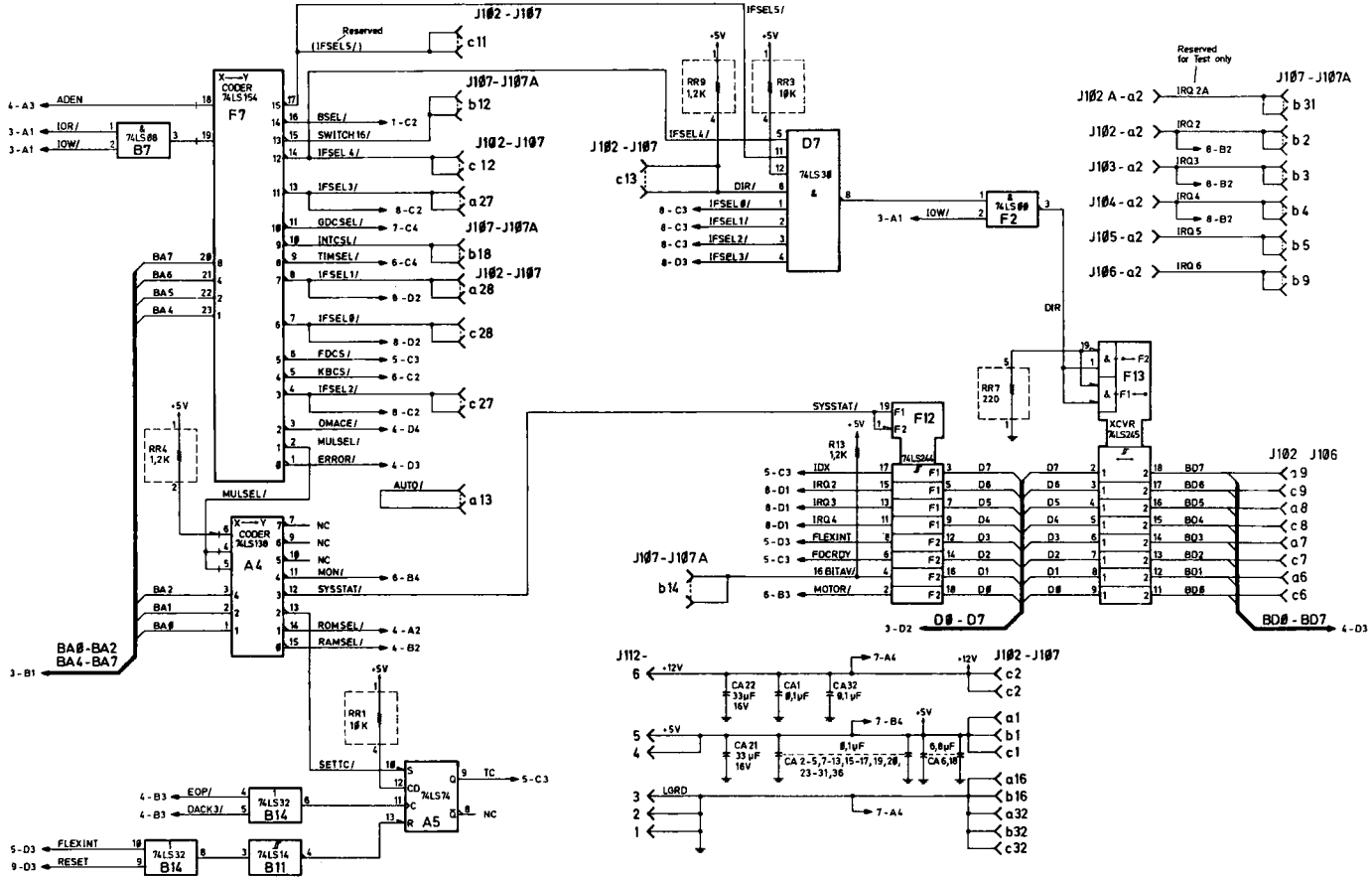
J114

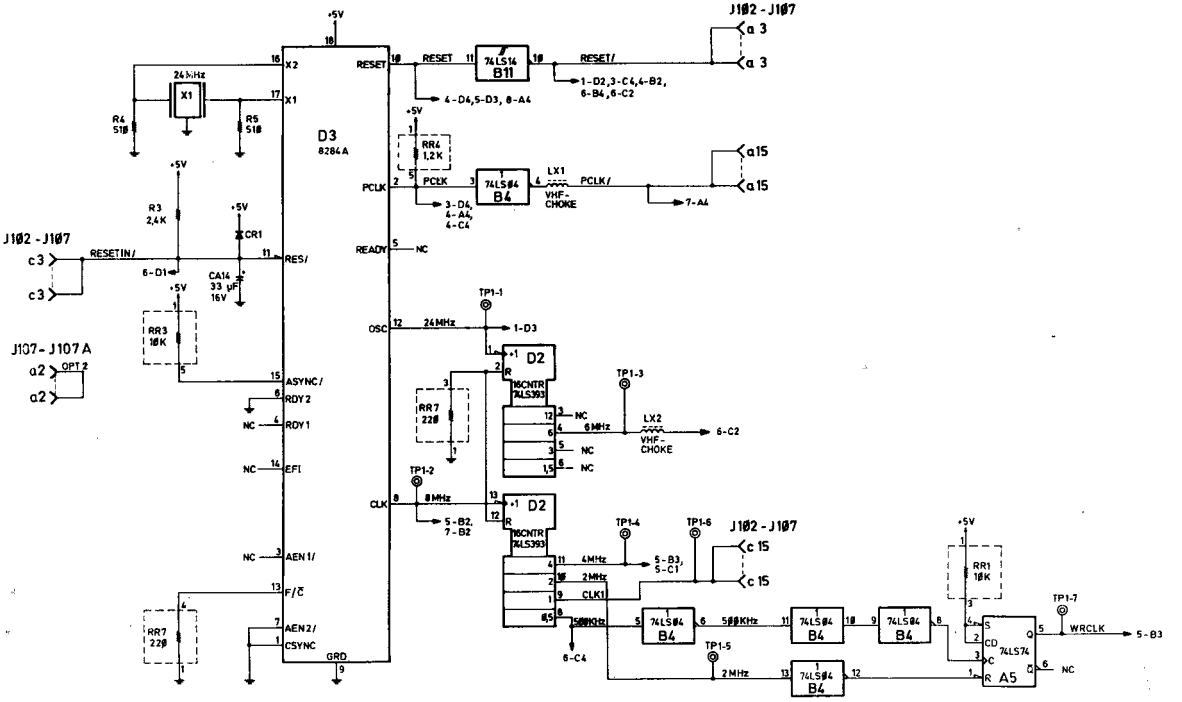
a		c
+5V	1	+5V
LGRD	2	LGRD
LPEN	3	LPENSW
+12V	4	+12V
-12V	5	NC
NC	6	NC
NC	7	NC
NC	8	NC
NC	9	NC
NC	10	NC
NC	11	NC
NC	12	NC
NC	13	NC
NC	14	NC
NC	15	LGRD
LGRD	16	LGRD

J113

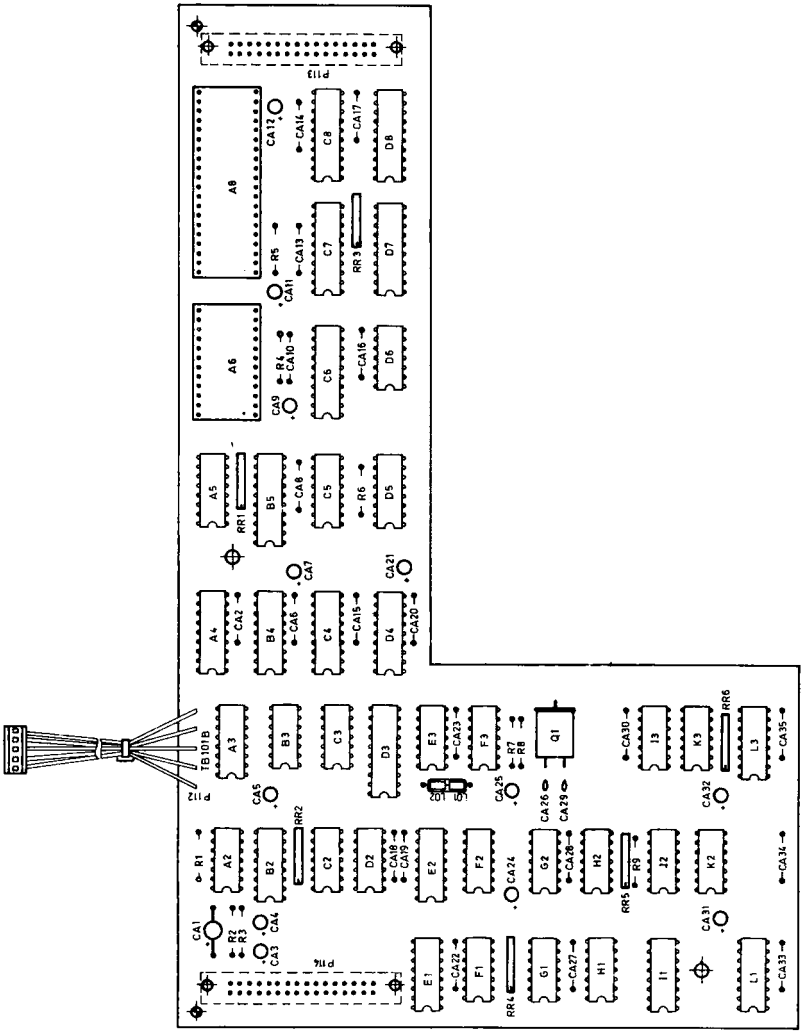
a		c
+5V	1	+5V
NC	2	NC
D1	3	D0
D3	4	D2
D5	5	D4
D7	6	D6
NC	7	NC
HSYNCX	8	HSYN
VSYNCX	9	LGRD
BA1	10	BA0
BLINK	11	NC
GDCIOW/	12	GDCIOR/
DACK2/	13	GDRQ2
NC	14	NC
NC	15	WCLK
LGRD	16	LGRD

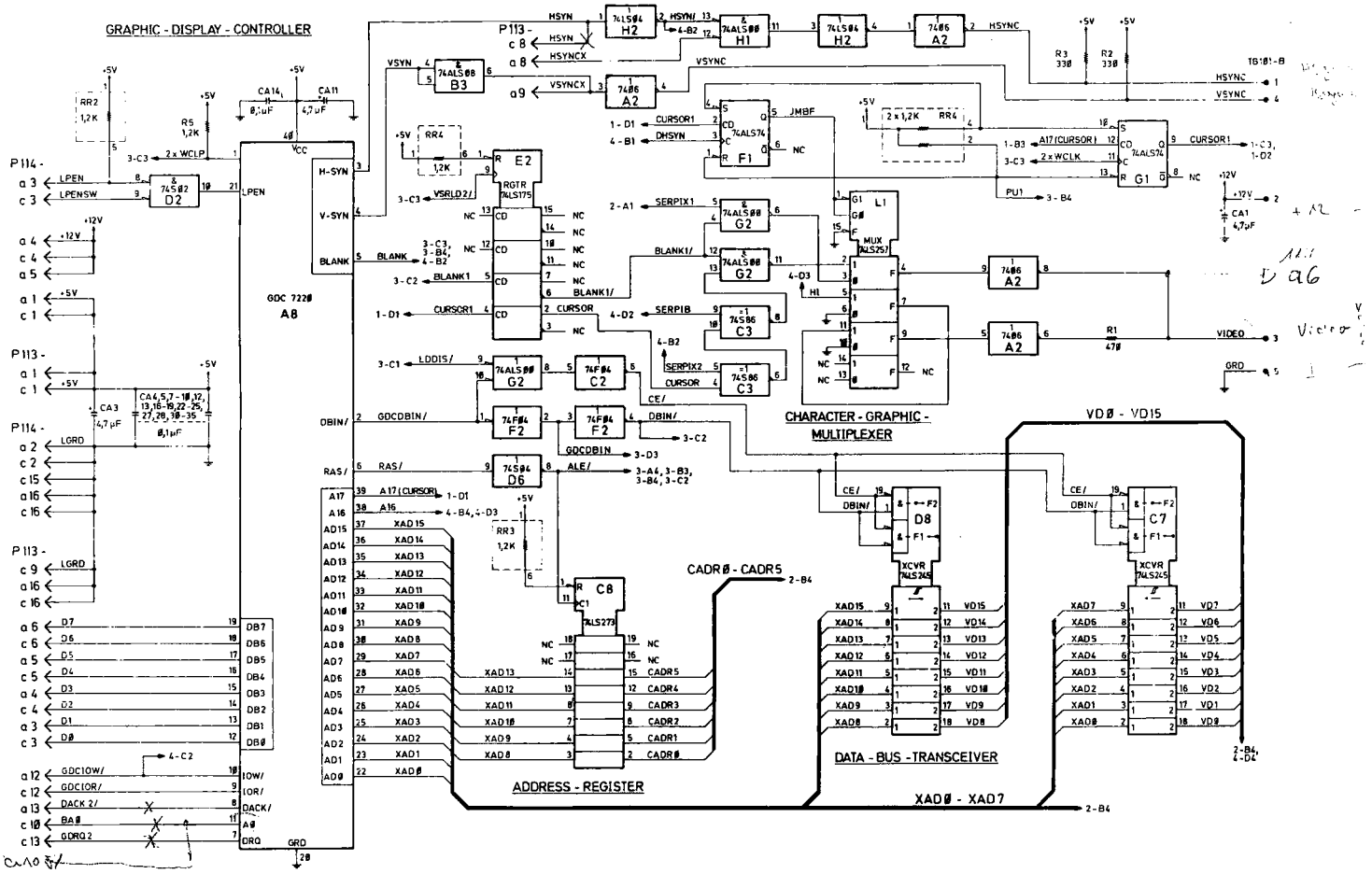


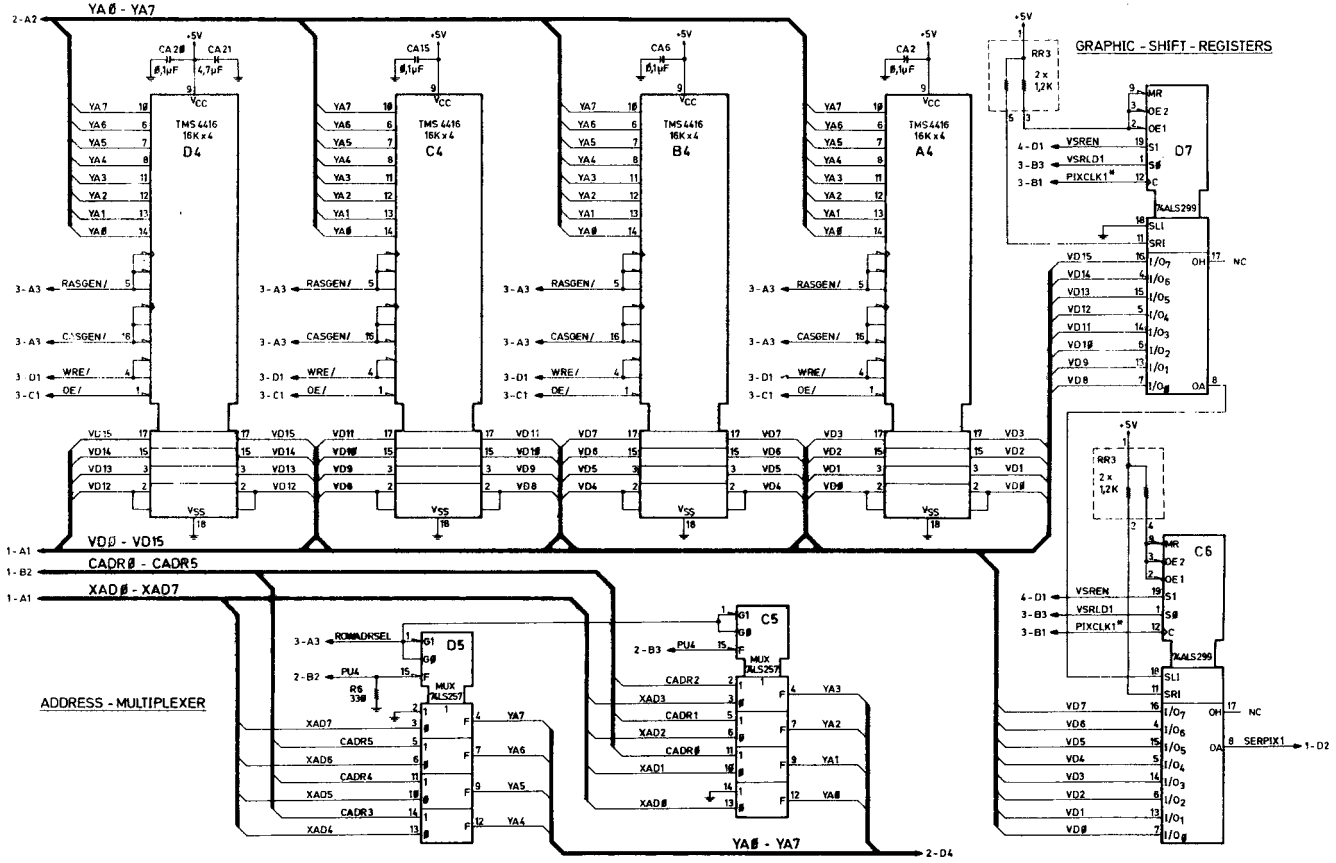

J102 - J107
Reserved
(IFSEL5/)
c11
IFSEL5/
+5V
RR9
1,2K
RR3
10K
J107 - J107A
b12
J102 - J107
c12
IFSEL4/
J102 - J107
c13
DIR/
D7
74LS38
IFSEL0/
IFSEL1/
IFSEL2/
IFSEL3/
F2
IOW/
Reserved
for Test only
J107 - J107A
J102 A - a2
IRQ 2A
b31
J102 - a2
IRQ 2
b2
J103 - a2
IRQ 3
b3
J104 - a2
IRQ 4
b4
J105 - a2
IRQ 5
b5
J106 - a2
IRQ 6
b9
ADEN
IOR/
IOW/
B7
F7
CODER
74LS154
BSEL/
SWITCH16/
IFSEL4/
IFSEL3/
GDCSEL/
INTCSL/
TIMSEL/
IFSEL1/
IFSEL0/
FDCS/
KBCS/
IFSEL2/
OMACE/
MULSEL/
ERROR/
AUTO/
a27
J107-J107A
b18
J102 - J107
a28
c28
c27
a13
BA7
BA6
BA5
BA4
BA2
BA1
BA0
BA0-BA2
BA4-BA7
RR4
1,2K
MULSEL/
A4
CODER
74LS138
NC
NC
NC
MON/
SYSSTAT/
ROMSEL/
RAMSEL/
RR1
10K
SETTC/
A5
74LS74
TC
NC
EOP/
DACK3/
B14
74LS32
FLEXINT
RESET
B14
74LS32
B11
74LS14
DIR
RR7
220
F13
XCVR
74LS245
F12
74LS244
SYSSTAT/
R13
1,2K
IDX
IRQ2
IRQ3
IRQ4
FLEXINT
FDCRDY
16 BITAV/
MOTOR/
D0 - D7
J102 J106
BD7
BD6
BD5
BD4
BD3
BD2
BD1
BD0
BD0 - BD7
J107 - J107A
b14
J112 -
+12V
CA22
33µF
16V
CA1
0,1µF
CA32
0,1µF
CA21
33 µF
16V
0,1µF
CA 2-5,7-13,15-17,19,20,
23-31,36
6,8µF
CA6,18
LORD
J102 - J107
c2
a1
b1
c1
a16
b16
a32
b32
c32

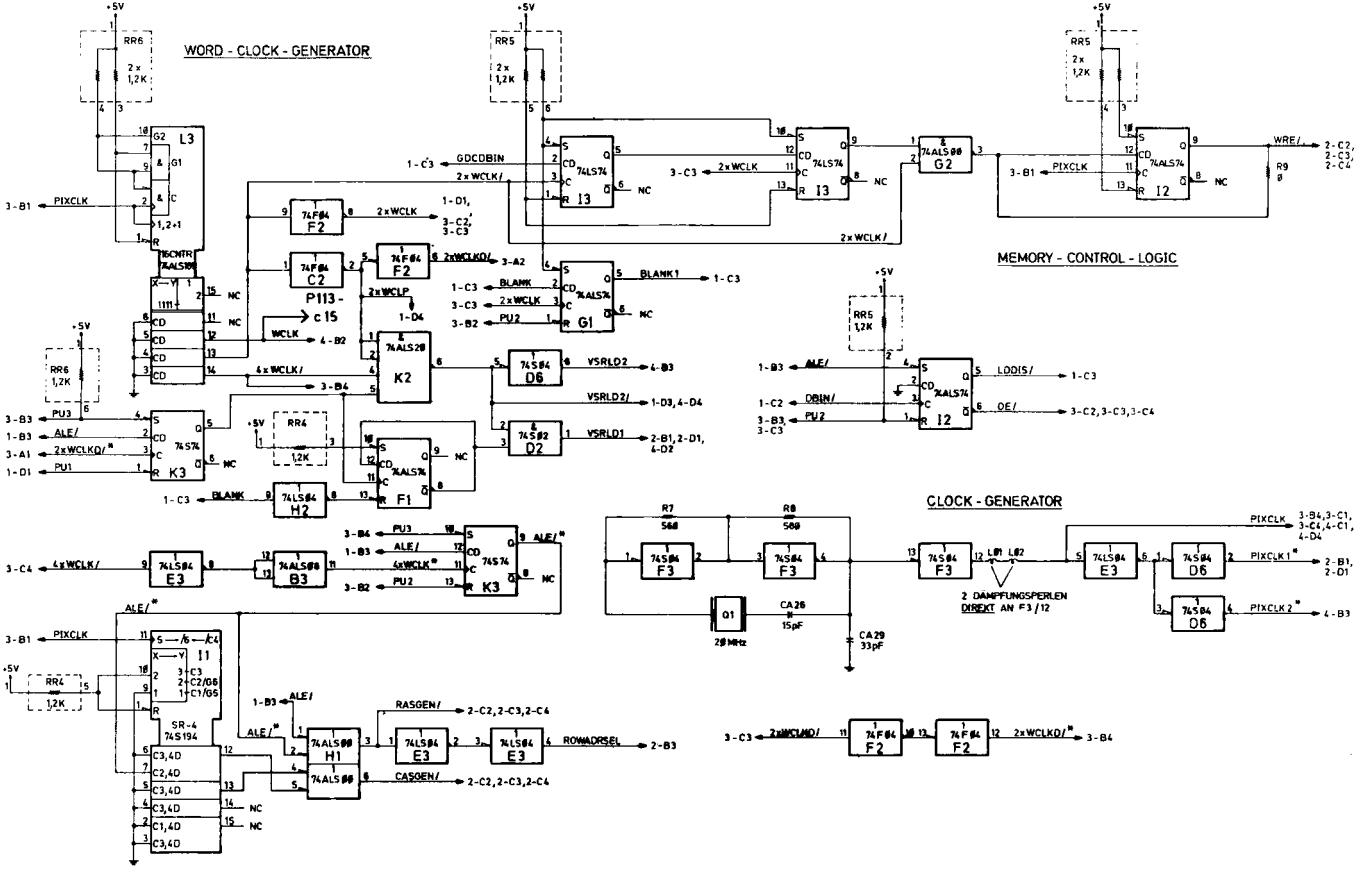

J102 - J107
J102 - J107
J107 - J107A
J102 - J107
+5V
24MHz
X1
X2
X1
R4 510
R5 510
D3
8284A
RESET
RESET/
74LS14
B11
1-D2,3-C4,4-B2,
6-B4,6-C2
4-D4,5-D3, 8-A4
RR4 1,2K
PCLK
PCLK/
74LS04
B4
LX1
VHF-
CHOKE
3-D4,
4-A4,
4-C4
7-A4
R3 2,4K
CR1
RESETIN/
6-D1
CA14
33 µF
16V
RES/
READY
NC
RR3 16K
OPT.2
ASYNC/
RDY2
RDY1
EFI
AEN1/
F/C
AEN2/
CSYNC
GRD
RR7 220
TP1-1
OSC
24MHz
1-D3
D2
16CNTR
74LS393
TP1-3
LX2
6MHz
6-C2
TP1-2
CLK
8MHz
5-B2,
7-B2
TP1-4
TP1-6
4MHz
2MHz
CLK1
500KHz
5-B3,
5-C1'
6-C4
TP1-5
2MHz
RR1 16K
74LS74
TP1-7
WRCLK
5-B3
A5

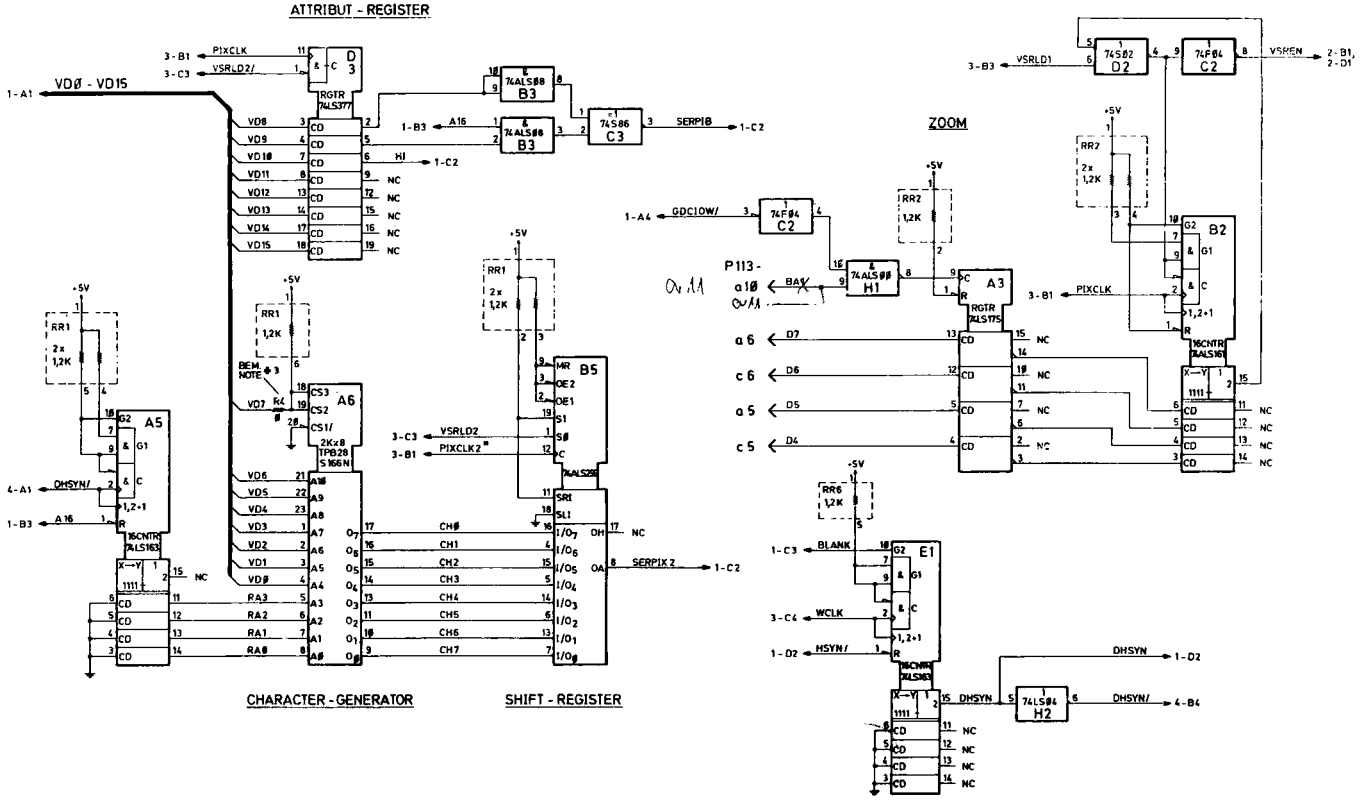
GRAPHICS CONTROLLER (MONOCHROME)



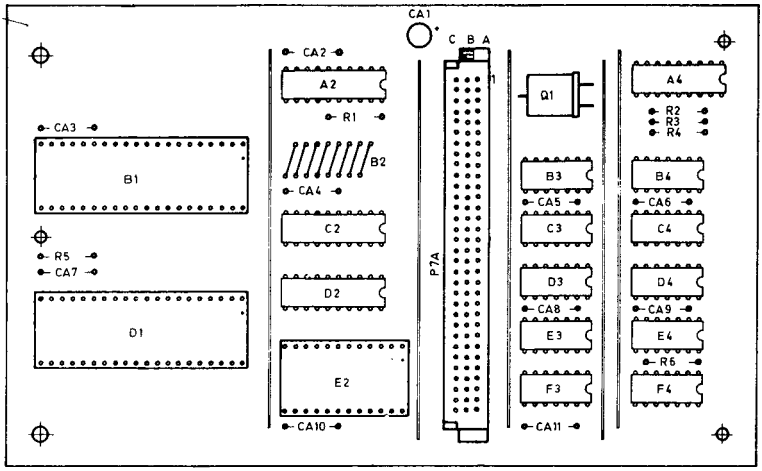

GRAPHIC - DISPLAY - CONTROLLER
GDC 7220 A8
CHARACTER - GRAPHIC - MULTIPLEXER
ADDRESS - REGISTER
DATA - BUS - TRANSCEIVER
VD0 - VD15
XAD0 - XAD7
CADR0 - CADR5
H-SYN
V-SYN
BLANK
LPEN
LPENSW
DBIN/
RAS/
GDCDBIN/
LGRD
GDC10W/
GDC10R/
DACK 2/
BA0
GDRQ2
IOW/
IOR/
DACK/
A0
DRQ
HSYNC
VSYNC
CURSOR1
BLANK1
CURSOR
SERPIX1
SERPIX2
SERPIB
LDDIS/
VSRLD2/
ALE/
CE/
R1
VIDEO
GRD

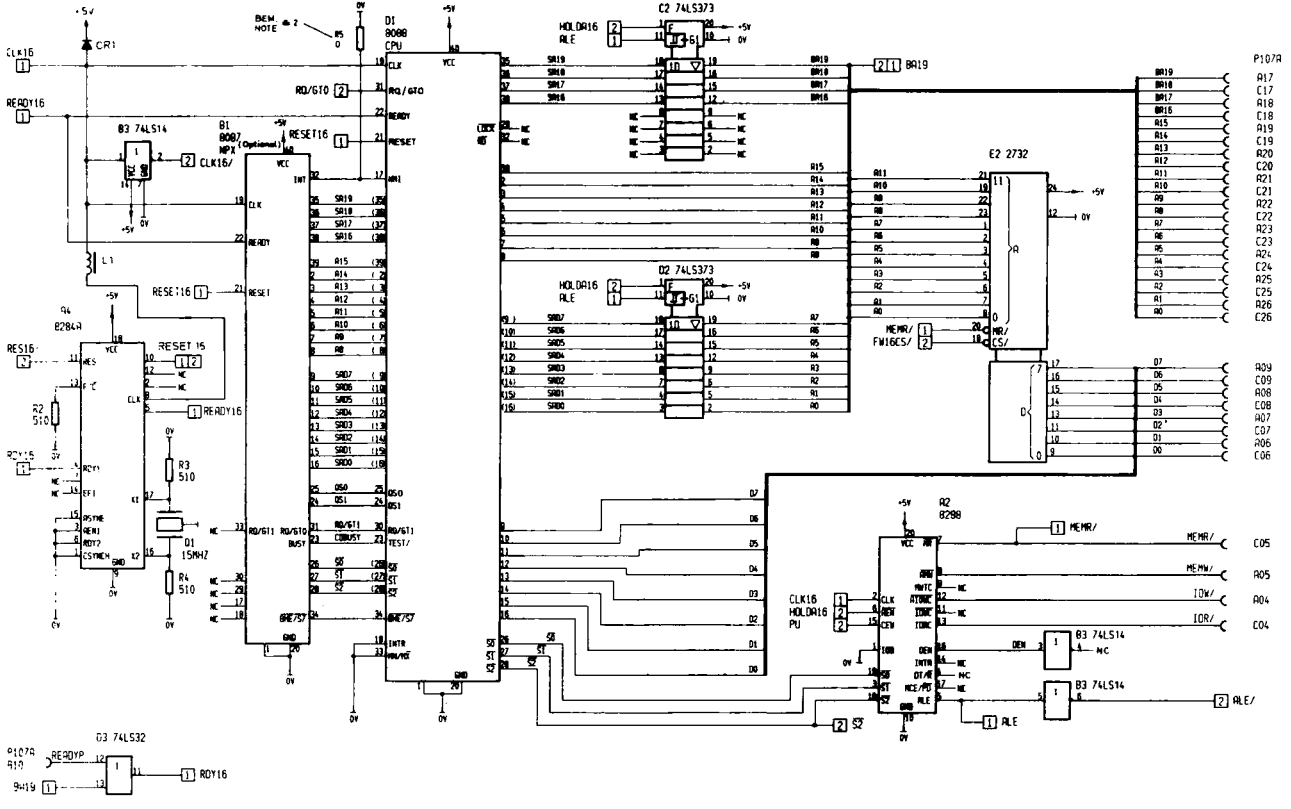

YAØ - YA7
2-A2
+5V
CA2Ø
Ø,1µF
CA21
4,7µF
CA15
CA6
6,1µF
CA2
Ø,1µF
TMS 4416
16K x 4
D4
C4
B4
A4
YA7
YA6
YA5
YA4
YA3
YA2
YA1
YAØ
3-A3 RASGEN/
CASGEN/
3-D1 WRE/
3-C1 OE/
VD15
VD14
VD13
VD12
VD11
VD1Ø
VD9
VD8
VD7
VD6
VD5
VD4
VD3
VD2
VD1
VDØ
VSS
VDØ - VD15
1-A1
CADRØ - CADR5
1-B2
XADØ - XAD7
1-A1
ADDRESS - MULTIPLEXER
3-A3 ROWADRSEL
2-B2 PU4
RS
33Ø
MUX
ALS257
D5
C5
XAD7
CADR5
XAD6
CADR4
XAD5
CADR3
XAD4
CADR2
XAD3
CADR1
XAD2
CADRØ
XAD1
XADØ
YA7
YA6
YA5
YA4
YA3
YA2
YA1
YAØ
YAØ - YA7
2-D4
GRAPHIC - SHIFT - REGISTERS
RR3
2 x
1,2K
D7
C6
MR
OE2
OE1
S1
SØ
C
ALS299
SLI
SRI
I/O7
I/O6
I/O5
I/O4
I/O3
I/O2
I/O1
I/OØ
OH
OA
NC
4-D1 VSREN
3-B3 VSRLD1
3-B1 PIXCLK1*
SERPIX1
1-D2

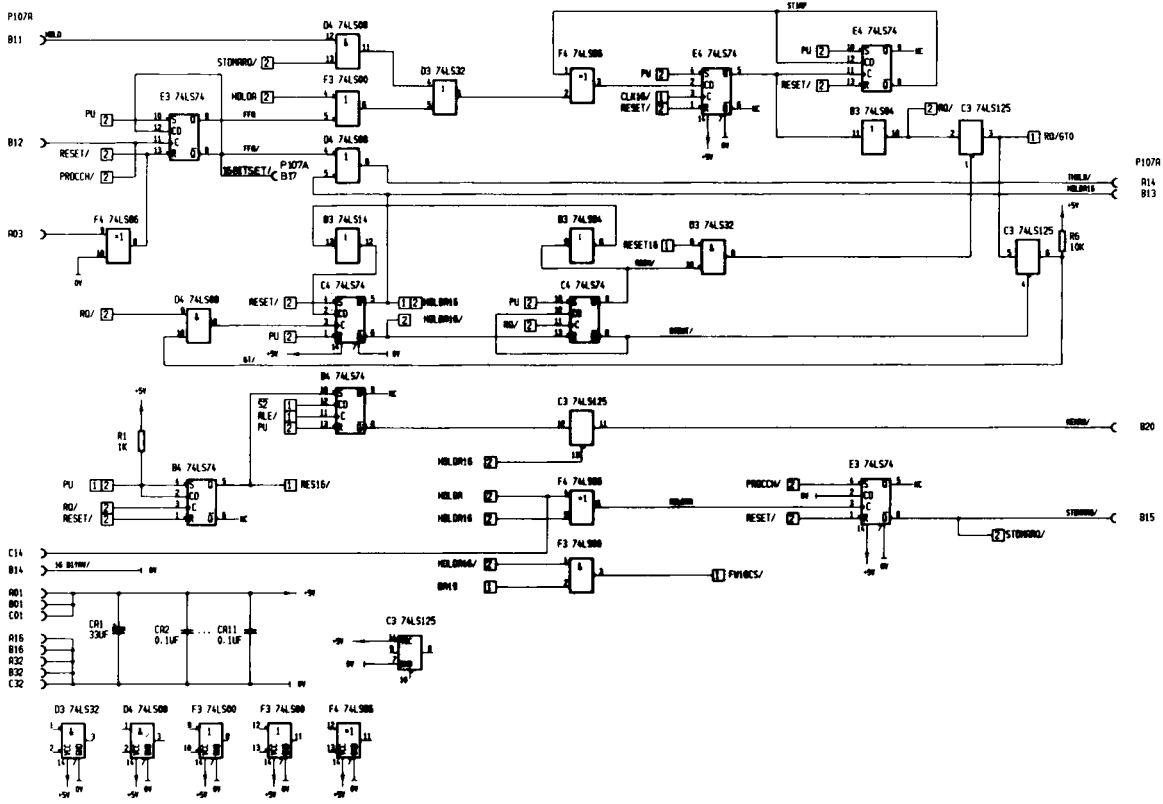

WORD - CLOCK - GENERATOR
MEMORY - CONTROL - LOGIC
CLOCK - GENERATOR
+5V
RR6
2 x 1,2K
RR5
RR4
1,2K
RR6 1,2K
RR5 1,2K
L3
I1
I3
I2
G2
G1
C2
F2
H2
K2
K3
F1
D6
D2
E3
B3
H1
F3
Q1
CA26 15pF
CA29 33pF
28 MHz
SR-4 74S194
74S74
74ALS74
74ALS74
74S04
74ALS04
74ALS08
74S08
74S02
74F04
74ALS29
74LS04
74ALS00
74S00
74LS74
16CNTR 74ALS169
PIXCLK
GDCDBIN
2xWCLK
2xWCLK/
4xWCLK/
ALE/
ALE/*
PU1
PU2
PU3
BLANK
BLANK1
WCLK
2xWCLP
DBIN/
LODIS/
OE/
WRE/
VSRLD1
VSRLD2
RASGEN/
CASGEN/
ROWADRSEL
2xWCLMD/
2xWCLKD/*
4xWCLK*
2xWCLKD/
PIXCLK 1*
PIXCLK 2*
R7 560
R8 560
R9 0
2 DAMPFUNGSPERLEN DIREKT AN F3 / 12
P113 - c15


ATTRIBUT - REGISTER
VDØ - VD15
ZOOM
CHARACTER - GENERATOR
SHIFT - REGISTER
PIXCLK
VSRLD2/
VSRLD1
VSREN
GDCLOW/
BAX
PIXCLK2
BLANK
WCLK
HSYN/
DHSYN
SERPIB
SERPIX 2
OHSYN/
BEM. NOTE ✱ 3
D 3
B3
C3
C2
D2
H1
A3
B2
A5
A6
B5
E1
H2
RGTR 74LS377
RGTR 74LS175
16CNTR 74LS163
TPB28 S 166 N
RR1 2x 1,2K
RR2 2x 1,2K
RR6 1,2K
VD8
VD9
VD10
VD11
VD12
VD13
VD14
VD15
HI
NC
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
RA3
RA2
RA1
RA0
D7
D6
D5
D4
a10
a6
c6
a5
c5
P113-
0v11

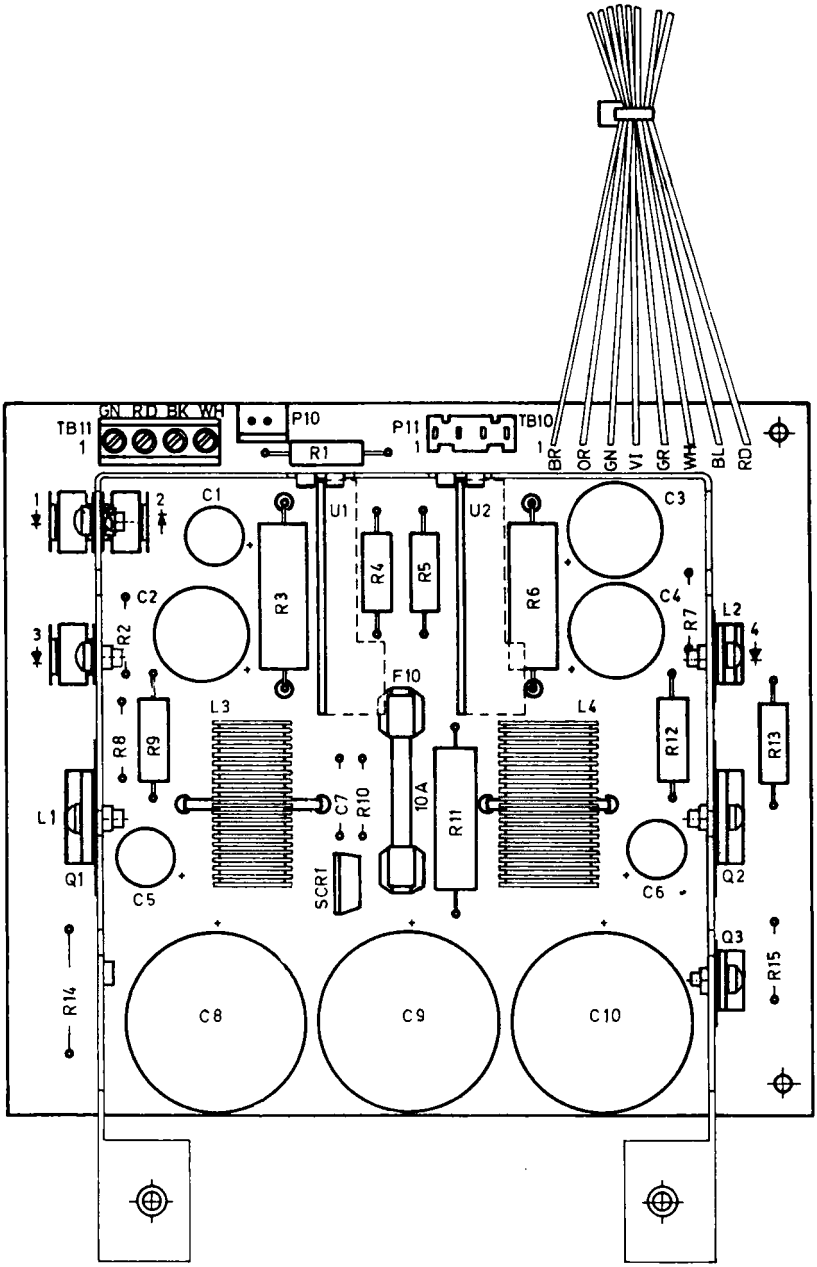
16-BIT PROCESSOR

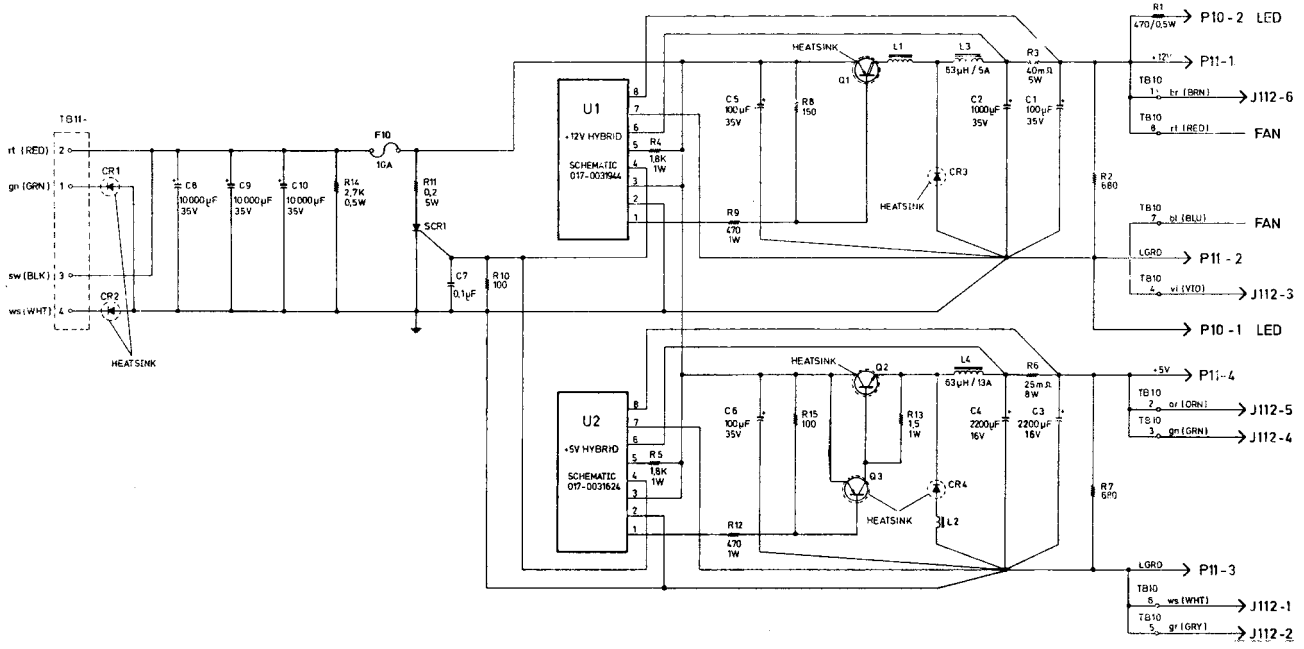



CLK16
READY16
RESET16
RESET 15
RES16
RDY16
CLK16/
READY16
RD/GT0
RD/GT1
HOLDA16
ALE
MEMR/
IOW/
IOR/
MEMW/
ALE/
RDY16
READYP
A19
9-19
D1 8088 CPU
B1 8087 NPX (Optional)
Q4 8284A
C2 74LS373
D2 74LS373
E2 2732
A2 8288
B3 74LS14
B3 74LS32
CR1
L1
D1 15MHZ
R2 510
R3 510
R4 510
R5 0
P107A
A17
A18
A19
A20
A21
A22
A23
A24
A25
A26
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C05
A05
A04
C04
C06
A07
C07
A08
C08
A09
C09

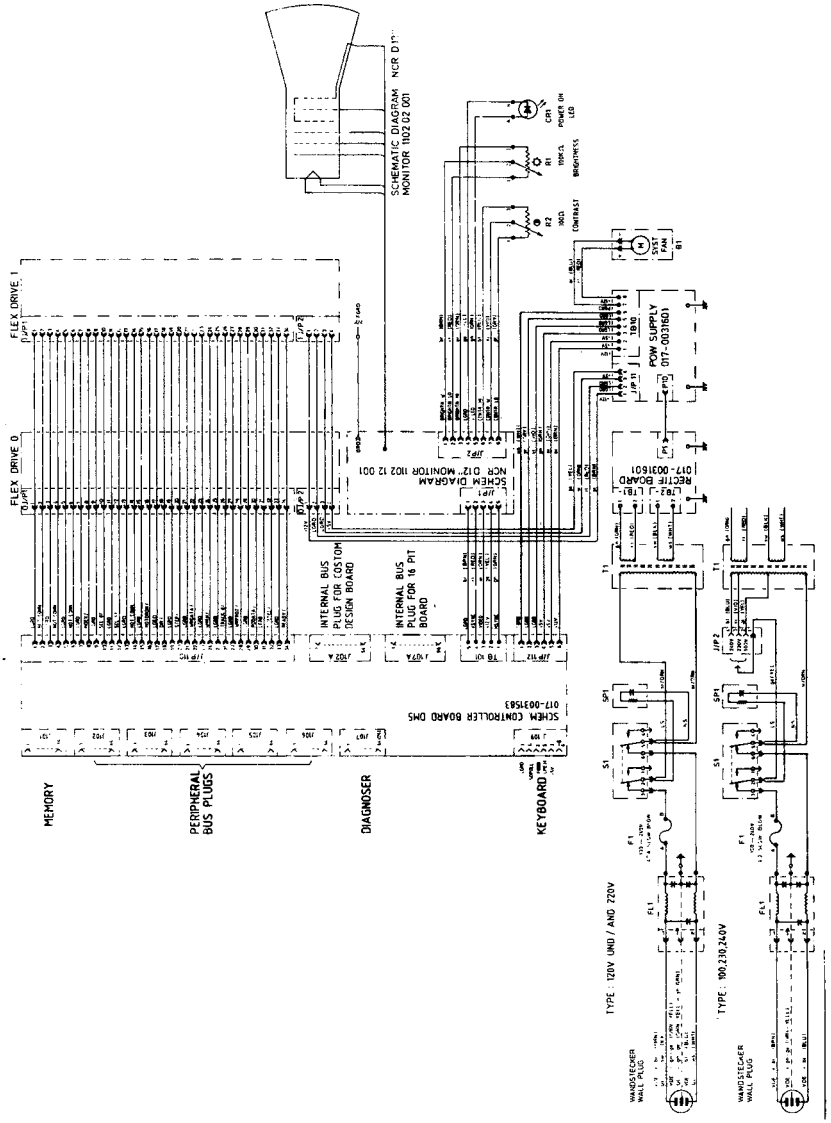

P107R
B11
B12
R03
STOMARO/
MBLOR
RESET/
PROCCH/
P107A
B17
RESET16
RD/
PU
CLK16/
RESET/
RD/GTO
R14
B13
B20
B15
STOMARO/
MBLOR16
MBLOR16/
RES16/
FW10CS/
C14
B14
A01
B01
C01
A16
B16
A32
B32
C32
CR1
33UF
CR2
0.1UF
CR11
0.1UF
R1
1K
R6
10K
D3 74LS32
D4 74LS08
F3 74LS00
F4 74LS86
B3 74LS14
B3 74LS04
B3 74LS32
C3 74LS125
C4 74LS74
B4 74LS74
E3 74LS74
E4 74LS74
F4 74LS08

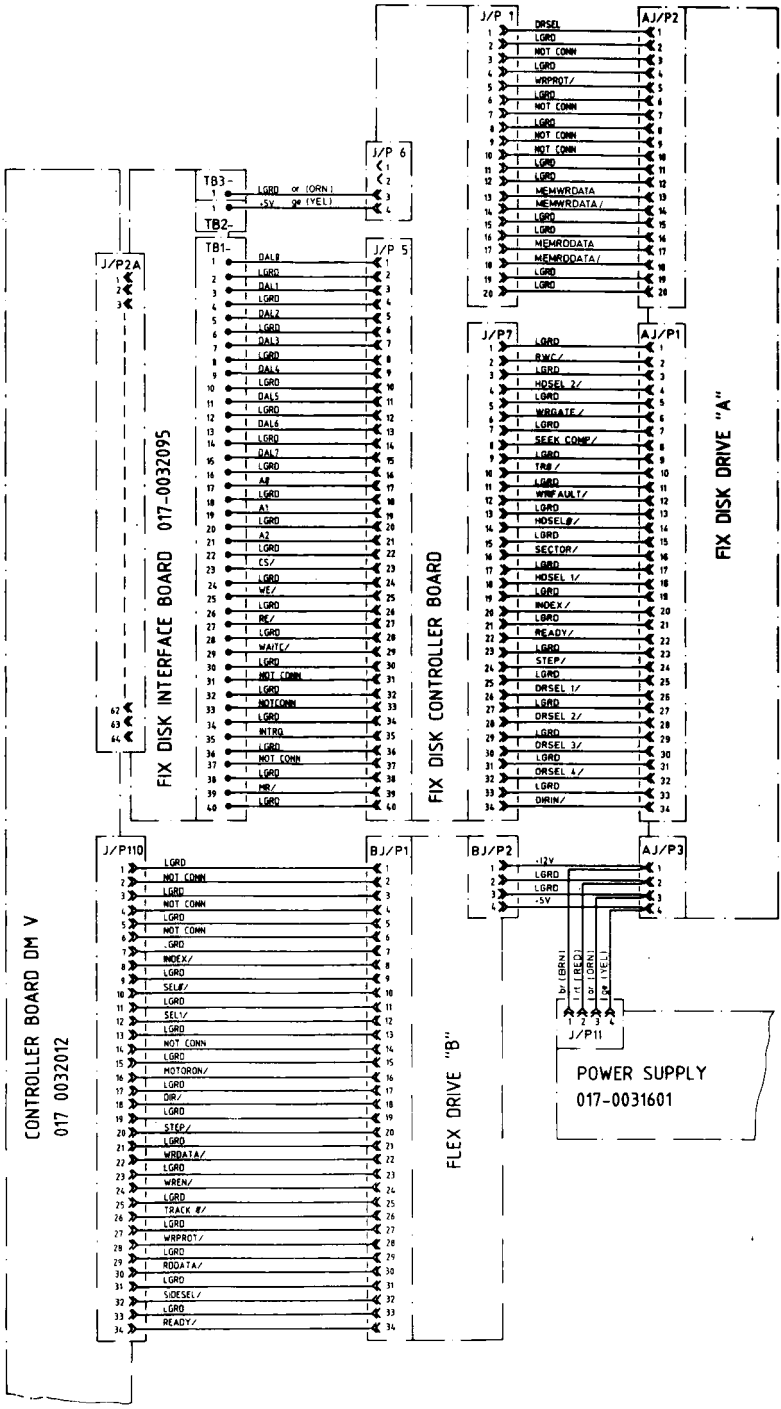
POWER SUPPLY



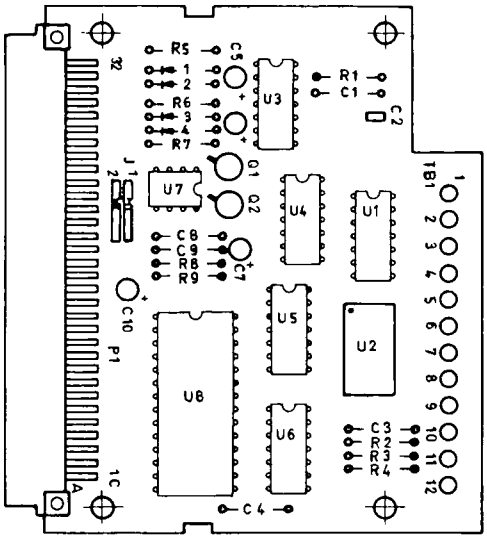

TB11-
rt (RED) 2
gn (GRN) 1
sw (BLK) 3
ws (WHT) 4
CR1
CR2
HEATSINK
C8 10000µF 35V
C9 10000µF 35V
C10 10000µF 35V
R14 2,7K 0,5W
F10 10A
R11 0,2 5W
SCR1
C7 0,1µF
R10 100
U1
+12V HYBRID
SCHEMATIC 017-0031944
R4 1,8K 1W
R9 470 1W
C5 100µF 35V
R8 150
HEATSINK
Q1
L1
L3 53µH / 5A
R3 40mΩ 5W
C2 1000µF 35V
C1 100µF 35V
CR3
HEATSINK
R2 680
R1 470/0,5W
P10-2 LED
+12V
P11-1
TB10 1 br (BRN) J112-6
TB10 8 rt (RED) FAN
TB10 7 bl (BLU) FAN
LGRD P11-2
TB10 4 vi (VIO) J112-3
P10-1 LED
U2
+5V HYBRID
SCHEMATIC 017-0031624
R5 1,8K 1W
R12 470 1W
C6 100µF 35V
R15 100
R13 15 1W
HEATSINK
Q2
Q3
L4 63µH / 13A
R6 25mΩ 8W
C4 2200µF 16V
C3 2200µF 16V
CR4
L2
R7 6R0
+5V
P11-4
TB10 2 or (ORN) J112-5
TB10 3 gn (GRN) J112-4
LGRD P11-3
TB10 6 ws (WHT) J112-1
TB10 5 gr (GRY) J112-2

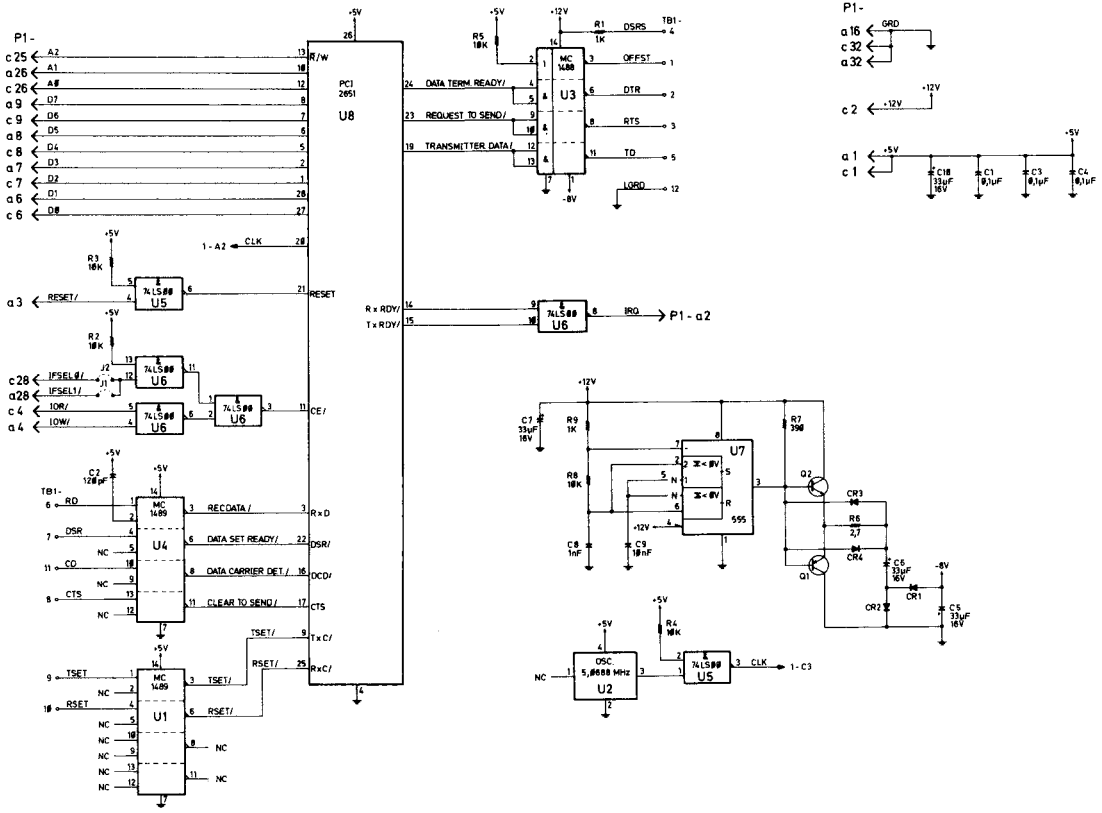
AC/DC WIRING


SCHEMATIC DIAGRAM MONITOR 1102 02 001
NCR D12
SCHEM DIAGRAM NCR D12 MONITOR 1102 12 001
FLEX DRIVE 1
FLEX DRIVE 0
INTERNAL BUS PLUG FOR CUSTOM DESIGN BOARD
INTERNAL BUS PLUG FOR 16 PIT BOARD
SCHEM CONTROLLER BOARD OMS 017-003583
POW SUPPLY 017-003160
RECTIF. BOARD 017-003160
MEMORY
PERIPHERAL BUS PLUGS
DIAGNOSER
KEYBOARD
TYPE: 120V UNIV / AND 220V
TYPE: 100,230,240V

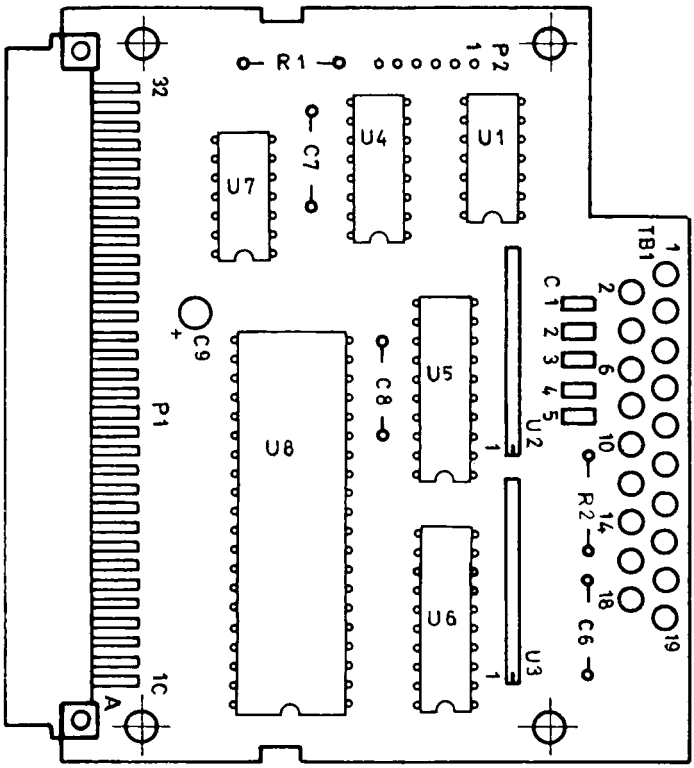

CONTROLLER BOARD DM V
017 0032012
FIX DISK INTERFACE BOARD 017-0032095
FIX DISK CONTROLLER BOARD
FIX DISK DRIVE "A"
FLEX DRIVE "B"
POWER SUPPLY
017-0031601
J/P 1
AJ/P2
J/P7
AJ/P1
J/P 6
J/P 5
TB3-
TB2-
TB1-
J/P2A
J/P110
BJ/P1
BJ/P2
AJ/P3
J/P11

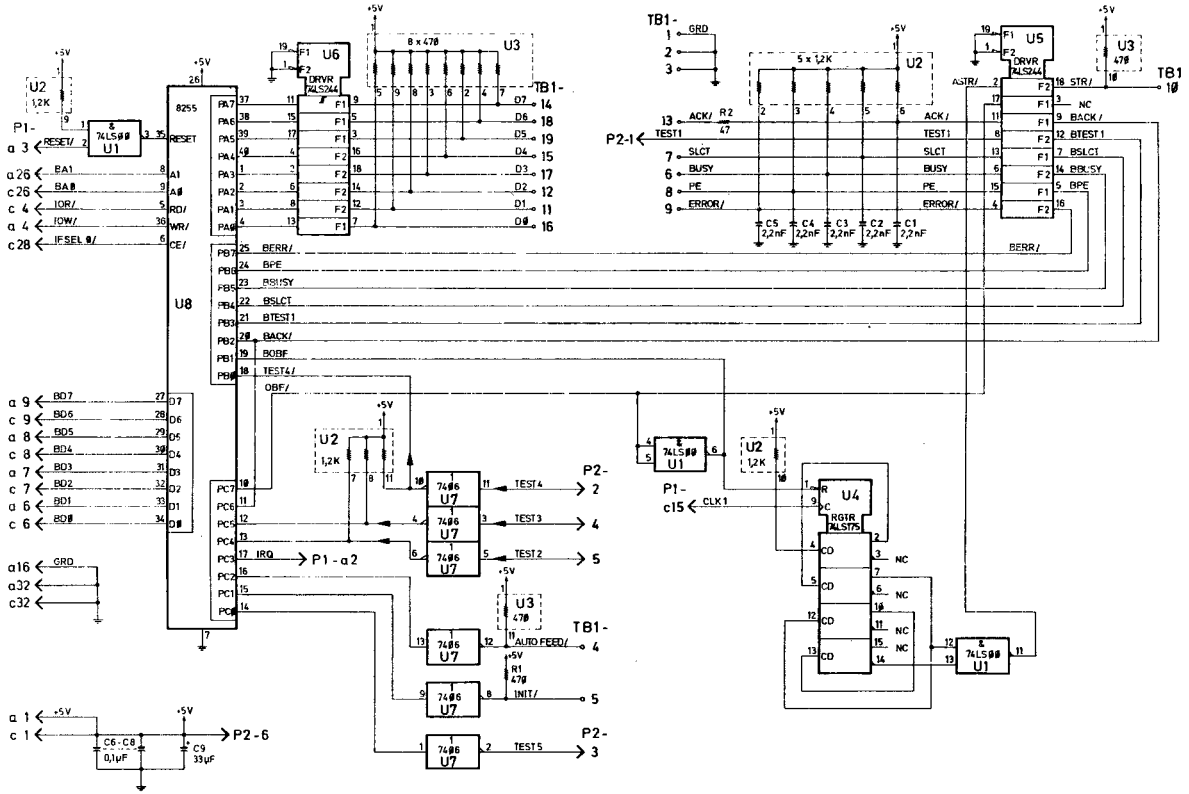
RS-232C ADAPTER



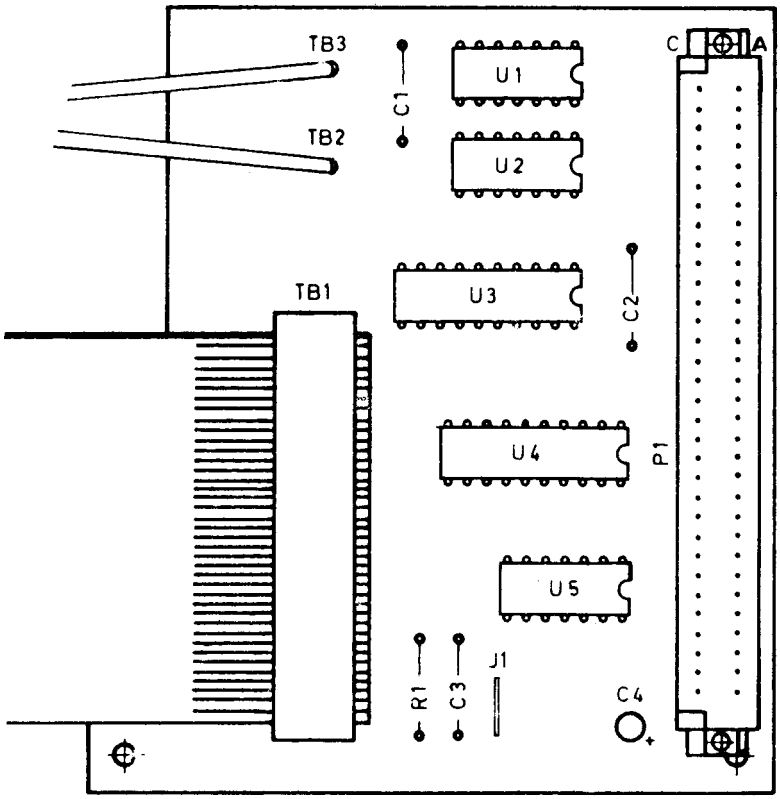

P1-
c 25 A2
a 26 A1
c 26 A0
a 9 D7
c 9 D6
a 8 D5
c 8 D4
a 7 D3
c 7 D2
a 6 D1
c 6 D0
R/W
PC1
2651
U8
1 - A2 CLK
RESET
a 3 RESET/
IFSEL0/
IFSEL1/
c 28
a 28
c 4 IOR/
a 4 IOW/
CE/
TB1-
6 RD
7 DSR
NC
11 CD
NC
8 CTS
NC
MC
1489
U4
RECDATA/
DATA SET READY/
DATA CARRIER DET./
CLEAR TO SEND/
R x D
DSR/
DCD/
CTS
TSET/
Tx C/
RSET/
Rx C/
9 TSET
NC
10 RSET
NC
NC
NC
NC
U1
NC
NC
+5V
+12V
-8V
R1 1K DSRS TB1- 4
R5 10K
MC
1488
U3
OFFST 1
DTR 2
RTS 3
TD 5
LORD 12
24 DATA TERM. READY/
23 REQUEST TO SEND/
19 TRANSMITTER DATA/
R3 10K
R2 10K
74LS00
U5
U6
R x RDY/
T x RDY/
IRQ
P1 - a2
C2 120pF
C7 33µF 16V
R9 1K
R8 10K
C8 1nF
C9 10nF
U7
555
R7 390
Q2
Q1
CR3
R6 2,7
CR4
CR1
CR2
C6 33µF 16V
C5 33µF 16V
OSC.
5,0688 MHz
U2
R4 10K
CLK
1 - C3
P1-
a 16 GRD
c 32
a 32
c 2
a 1
c 1
C18 33µF 16V
C1 0,1µF
C3 0,1µF
C4 0,1µF

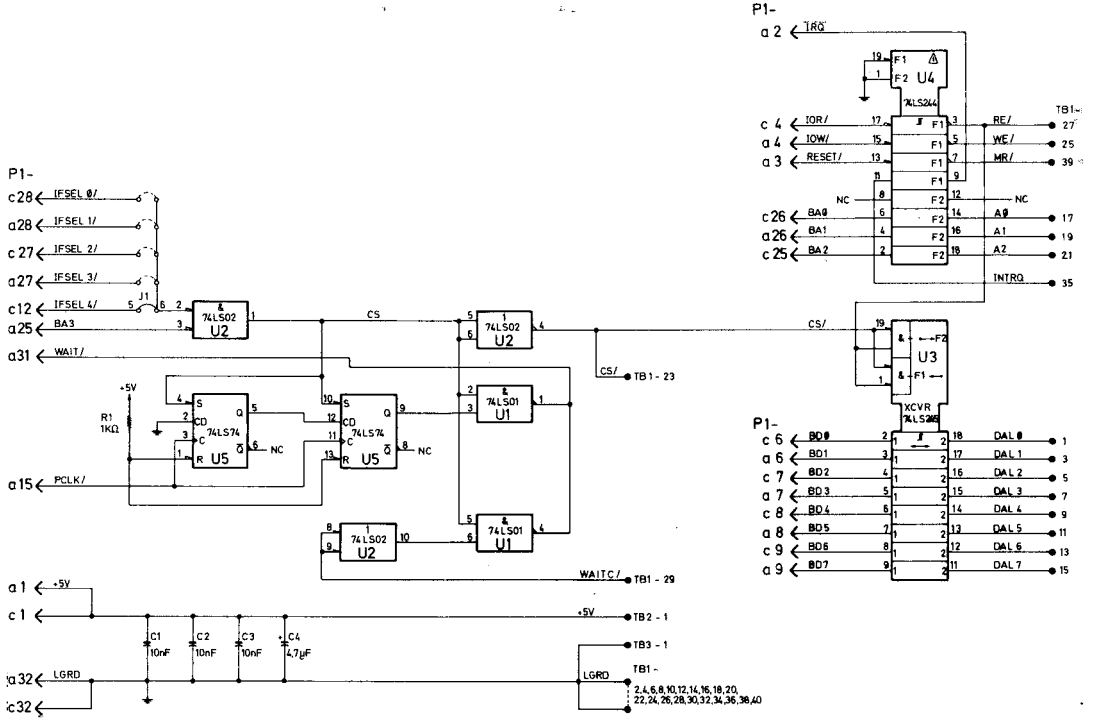
CENTRONICS ADAPTER



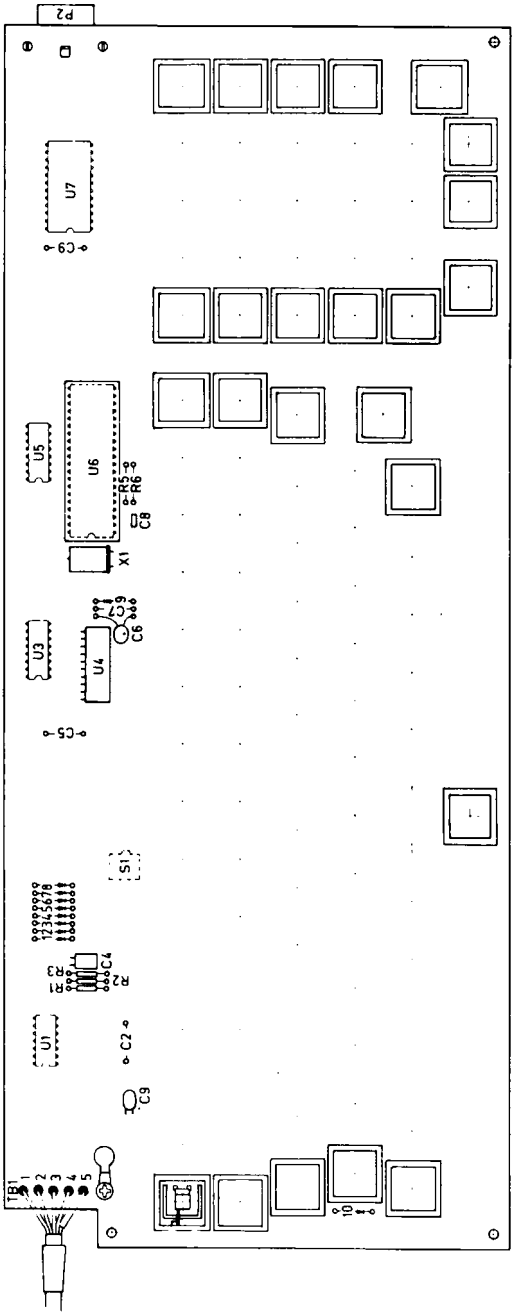

U8
8255
U1
74LS00
U2
1,2K
U3
8 x 470
U4
74LS75
U5
74LS244
U6
74LS244
U7
7406
5 x 1,2K
C1 2,2nF
C2 2,2nF
C3 2,2nF
C4 2,2nF
C5 2,2nF
C6 - C8 0,1µF
C9 33µF
R1 470
R2 47
+5V
GRD
RESET/
BA1
BA0
IOR/
IOW/
IFSEL 0/
BD7
BD6
BD5
BD4
BD3
BD2
BD1
BD0
IRQ
BERR/
BPE
BBUSY
BSLCT
BTEST1
BACK/
BOBF
TEST4/
OBF/
TEST4
TEST3
TEST2
TEST5
AUTO FEED/
INIT/
ACK/
TEST1
SLCT
BUSY
PE
ERROR/
CLK1
STR/
BACK/
BTEST1
BSLCT
BBUSY
BPE
NC
TB1-
P1-
P2-
P1 - a2
P2-6

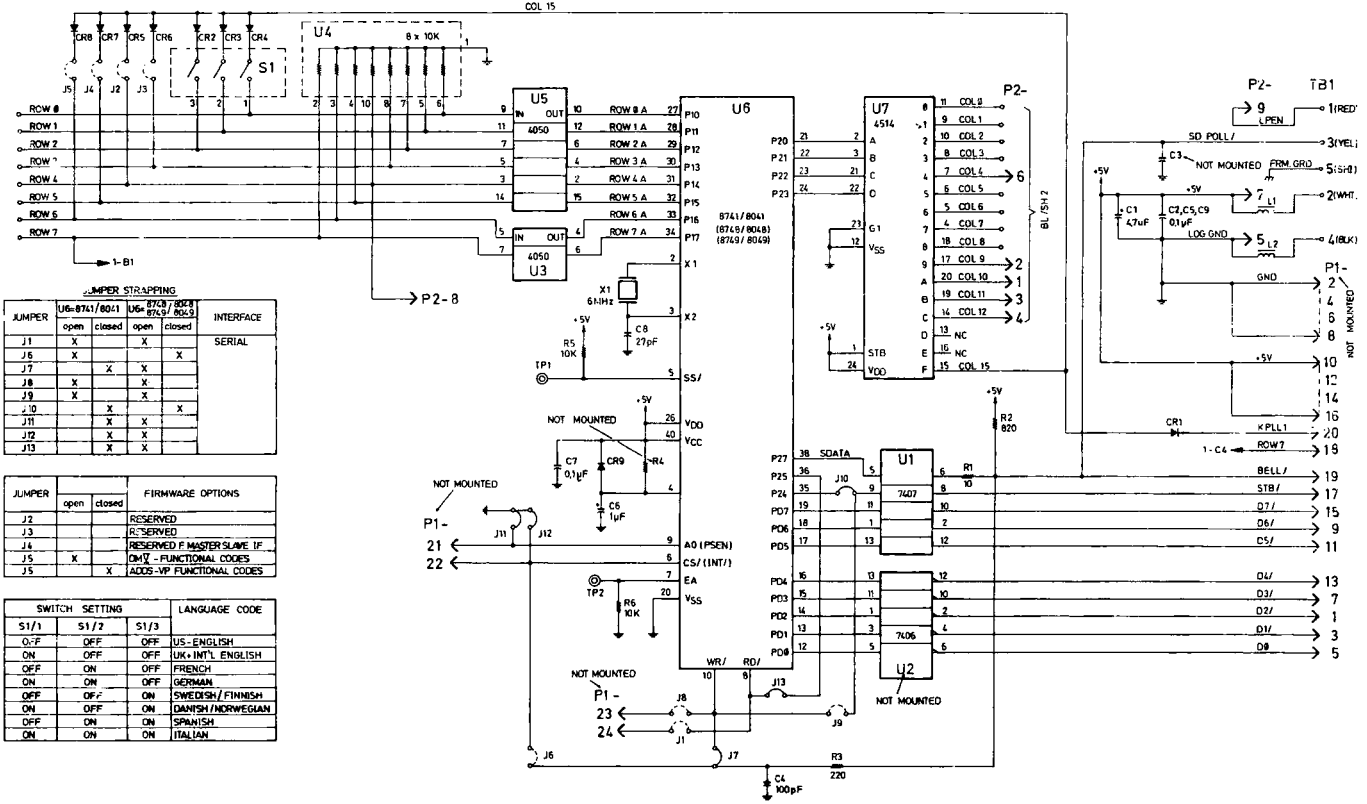
FIXED DISK INTERFACE




P1-
c28 IFSEL 0/
a28 IFSEL 1/
c27 IFSEL 2/
a27 IFSEL 3/
c12 IFSEL 4/
a25 BA3
a31 WAIT/
a15 PCLK/
J1
74LS02 U2
74LS74 U5
74LS01 U1
R1 1KΩ
+5V
CS
CS/
CS/ TB1 - 23
WAITC/ TB1 - 29
P1-
a 2 IRQ
c 4 IOR/
a 4 IOW/
a 3 RESET/
c26 BA0
a26 BA1
c25 BA2
74LS244 U4
XCVR 74LS245 U3
RE/ 27
WE/ 25
MR/ 39
INTRQ 35
A0 17
A1 19
A2 21
NC
P1-
c 6 BD0
a 6 BD1
c 7 BD2
a 7 BD3
c 8 BD4
a 8 BD5
c 9 BD6
a 9 BD7
DAL 0 1
DAL 1 3
DAL 2 5
DAL 3 7
DAL 4 9
DAL 5 11
DAL 6 13
DAL 7 15
a 1 +5V
c 1
C1 10nF
C2 10nF
C3 10nF
C4 4,7µF
TB2 - 1
TB3 - 1
a32 LGRD
c32
LGRD
TB1 - 2,4,6,8,10,12,14,16,18,20, 22,24,26,28,30,32,34,36,38,40

KEYBOARD


P2
U7
C9
U5
U6
R5
R6
C8
X1
C9
C6
U3
U4
C5
S1
R3
R2
C4
U1
C2
C9
TB1
1
2
3
4
5
10



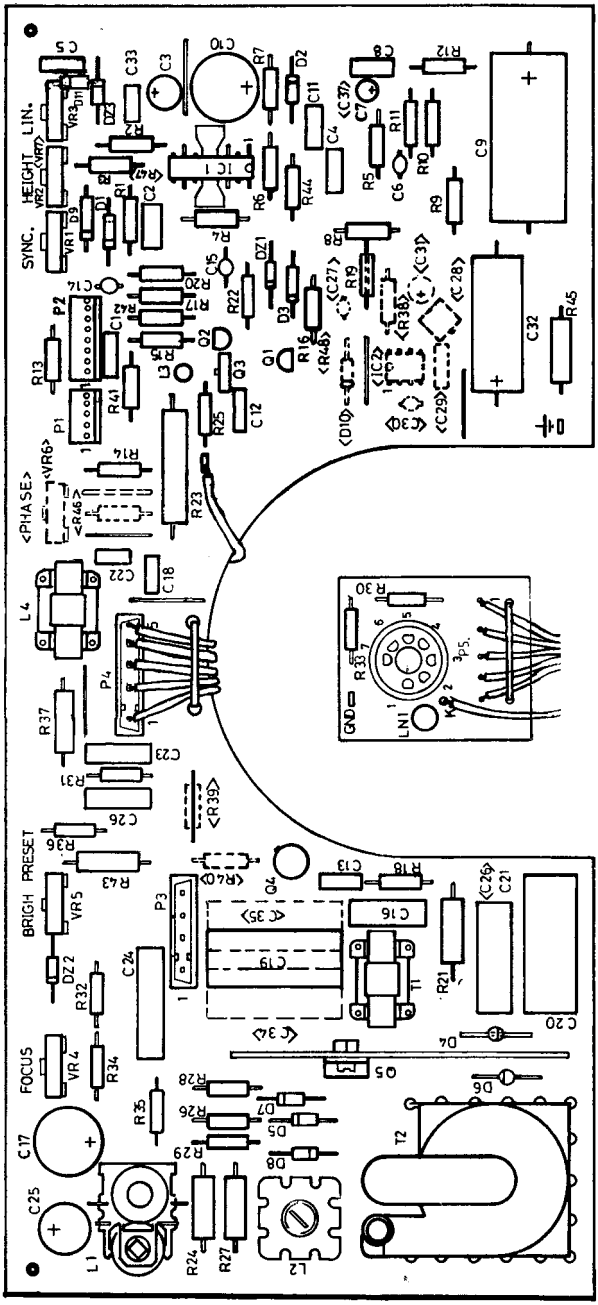
JUMPER STRAPPING

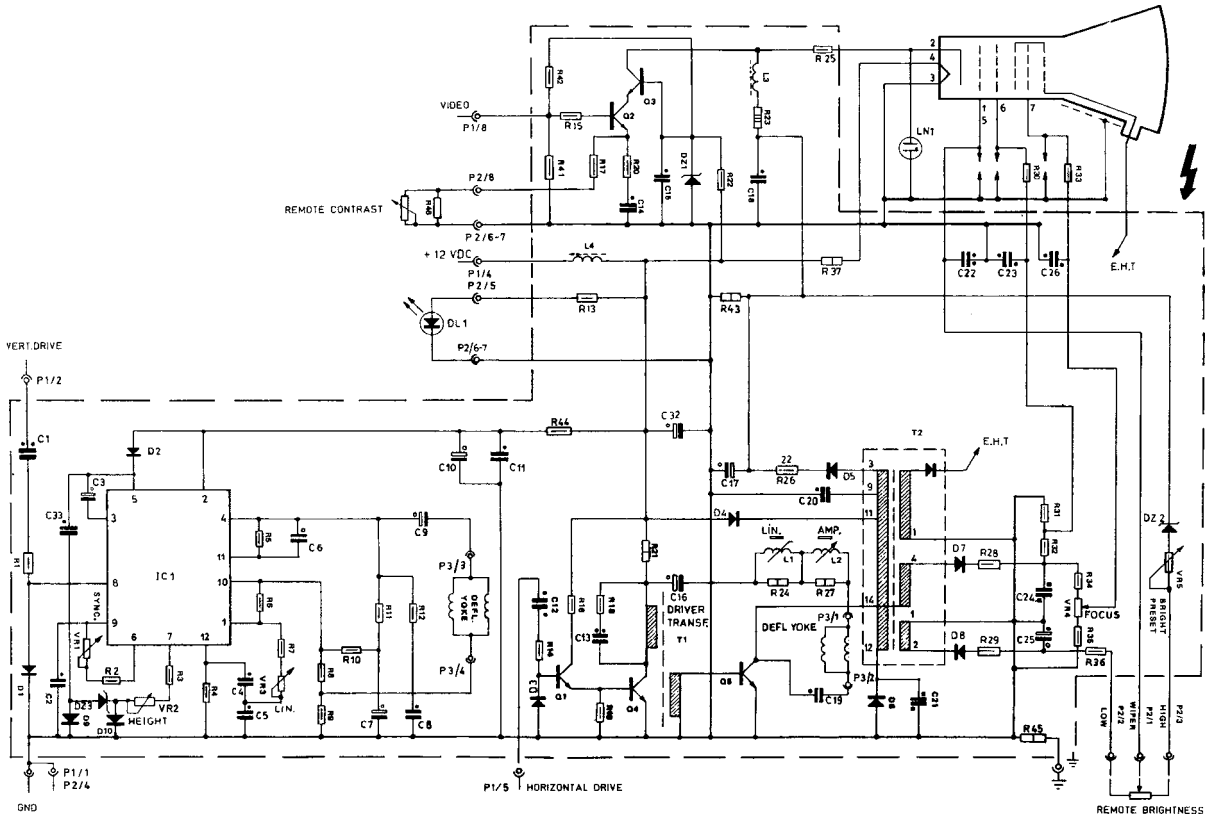
JUMPER	U6=8741/8041		U6=8748/8048/8749/8049		INTERFACE
	open	closed	open	closed	
J1	X		X		SERIAL
J6	X			X	
J7		X	X		
J8	X		X		
J9	X		X		
J10		X		X	
J11		X	X		
J12		X	X		
J13		X	X		

JUMPER	open	closed	FIRMWARE OPTIONS
J2			RESERVED
J3			RESERVED
J4			RESERVED F. MASTER/SLAVE I.F.
J5	X		OMIT - FUNCTIONAL CODES
J5		X	ADDS-VP FUNCTIONAL CODES

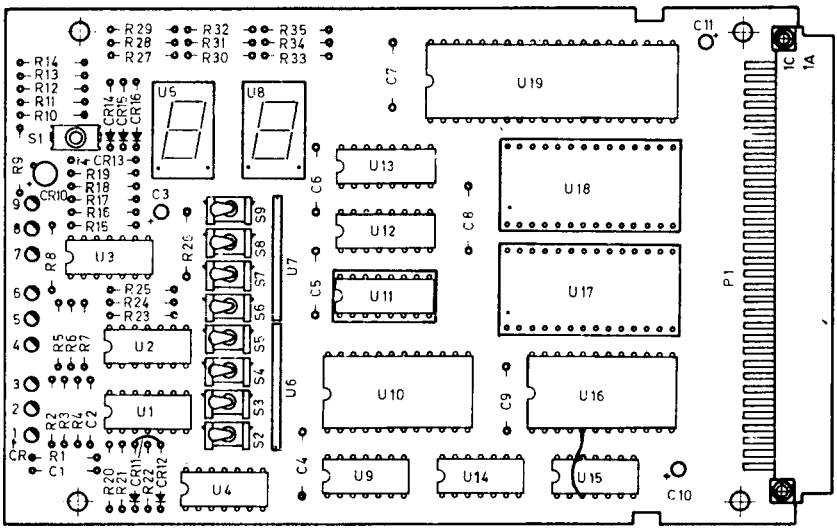
SWITCH SETTING			LANGUAGE CODE
S1/1	S1/2	S1/3	
OFF	OFF	OFF	US-ENGLISH
ON	OFF	OFF	UK+INT'L ENGLISH
OFF	ON	OFF	FRENCH
ON	ON	OFF	GERMAN
OFF	OFF	ON	SWEDISH/FINNISH
ON	OFF	ON	DANISH/NORWEGIAN
OFF	ON	ON	SPANISH
ON	ON	ON	ITALIAN

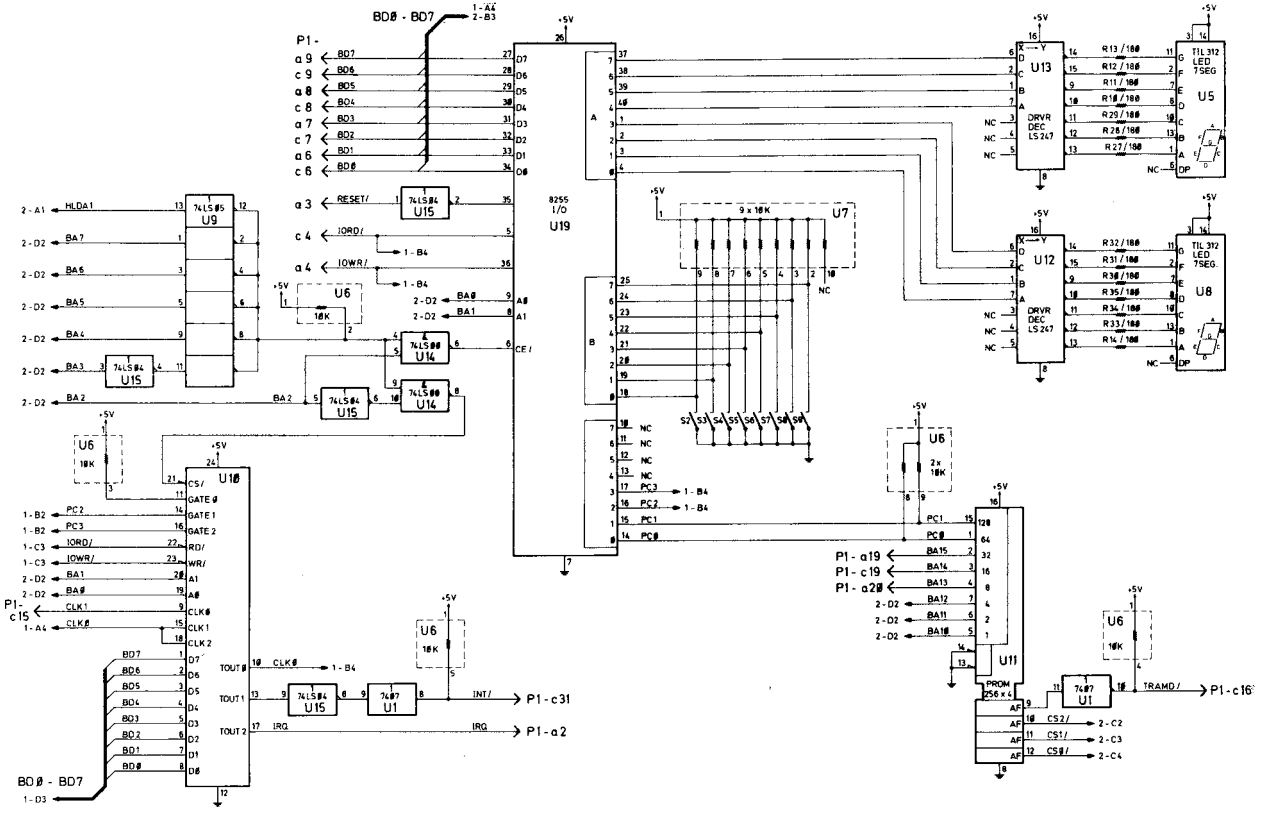
MONOCHROME CRT

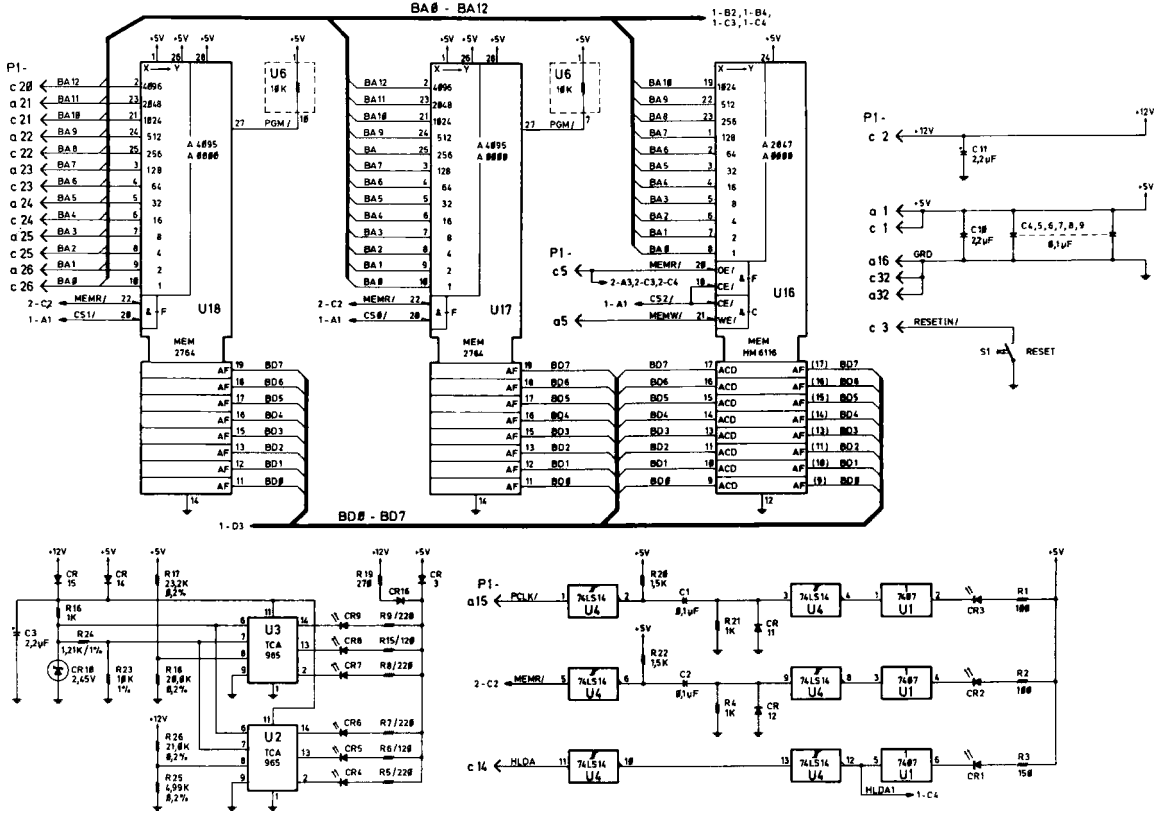



VIDEO
P1/8
REMOTE CONTRAST
P2/8
P2/6-7
+ 12 VDC
P1/4
P2/5
DL1
P2/6-7
VERT.DRIVE
P1/2
GND
P1/1
P2/4
P1/5
HORIZONTAL DRIVE
IC1
SYNC
HEIGHT
LIN.
DEFL. YOKE
P3/3
P3/4
DRIVER TRANSF.
T1
T2
LIN.
AMP.
DEFL YOKE
P3/1
P3/2
E.H.T
FOCUS
BRIGHT PRESET
LOW
WIPER
HIGH
P2/2
P2/1
P2/3
REMOTE BRIGHTNESS

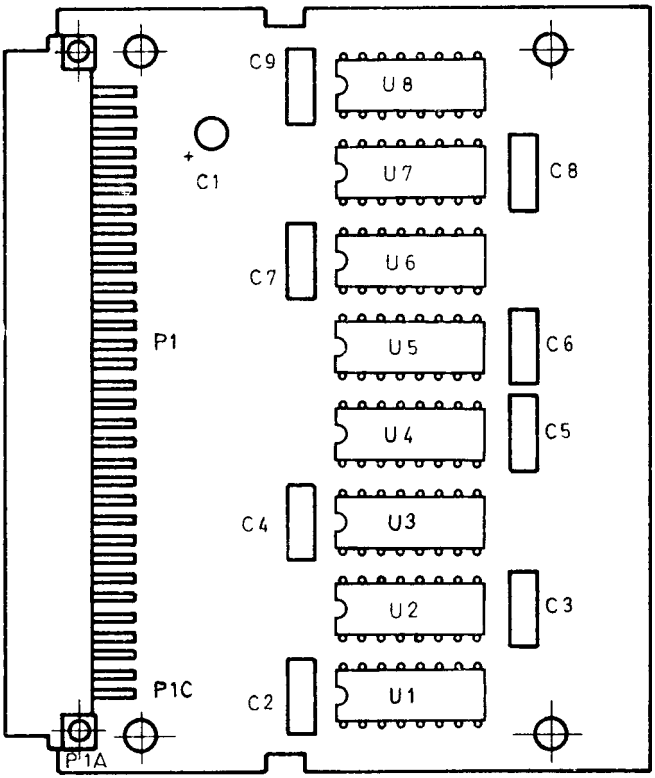
DIAGNOSTIC MODULE

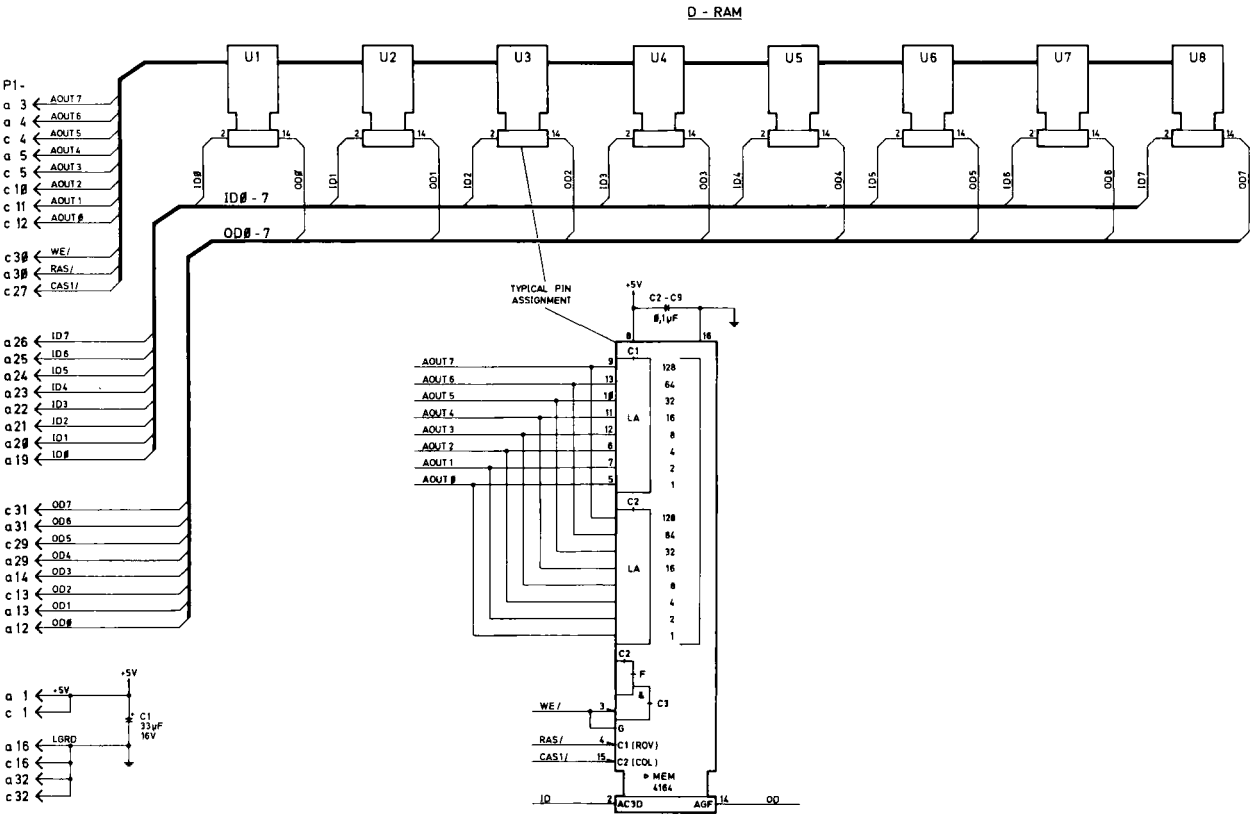



BDØ - BD7
1 - A4
2 - B3
P1 -
a 9
c 9
a 8
c 8
a 7
c 7
a 6
c 6
BD7
BD6
BD5
BD4
BD3
BD2
BD1
BDØ
+5V
8255
I/O
U19
U13
U12
DRVR
DEC
LS 247
TIL 312
LED
7SEG
U5
U8
R13 / 18Ø
R12 / 18Ø
R11 / 18Ø
R1Ø / 18Ø
R29 / 18Ø
R28 / 18Ø
R27 / 18Ø
R32 / 18Ø
R31 / 18Ø
R3Ø / 18Ø
R35 / 18Ø
R34 / 18Ø
R33 / 18Ø
R14 / 18Ø
U7
9 x 18K
S2
S3
S4
S5
S6
S7
S8
S9
U6
18K
2 x
18K
U9
U15
U14
74LSØ5
74LSØ4
74LSØ8
HLDA1
BA7
BA6
BA5
BA4
BA3
BA2
RESET/
IORD/
IOWR/
BAØ
BA1
CE1
U18
CS/
GATE Ø
GATE 1
GATE 2
RD/
WR/
A1
AØ
CLKØ
CLK1
CLK 2
D7
D6
D5
D4
D3
D2
D1
DØ
PC2
PC3
CLK1
CLKØ
TOUTØ
TOUT1
TOUT2
IRQ
INT/
U1
74ØØ
74Ø7
U11
PROM
256 x 4
AF
CS2/
CS1/
CSØ/
TRAMD/
PC1
PCØ
BA15
BA14
BA13
BA12
BA11
BA1Ø
NC
P1 - a19
P1 - c19
P1 - a2Ø
P1 - c15
P1 - c31
P1 - a2
P1 - c16
2 - C2
2 - C3
2 - C4
1 - B4
2 - D2
1 - A4
1 - B2
1 - C3
1 - D3

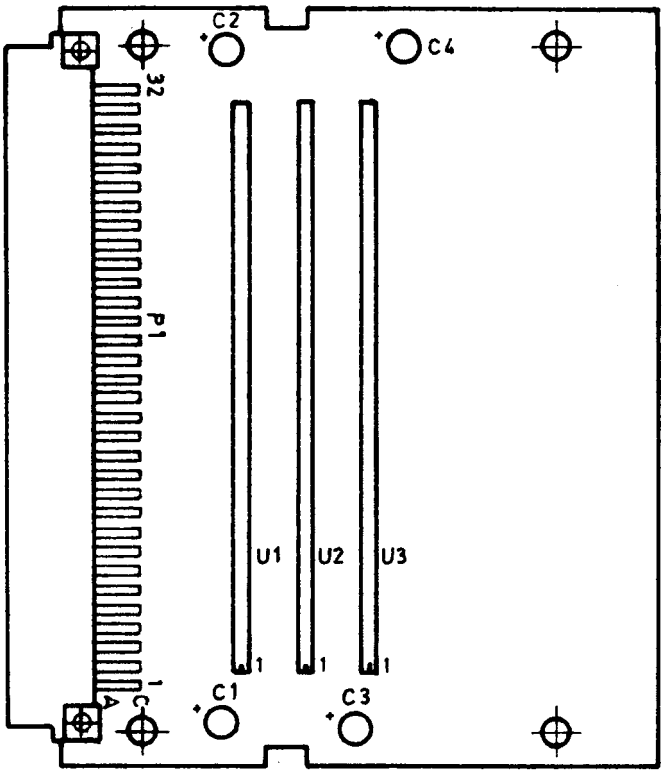

BA0 - BA12
1-B2,1-B4,
1-C3,1-C4
P1-
U18
U17
U16
U6
MEM
2764
MEM
MM 6116
BD0 - BD7
1-D3
U3
TCA
965
U2
TCA
965
74LS14
U4
7407
U1
PCLK/
MEMR/
HLDA
HLDA1
RESETIN/
RESET
S1
GRD

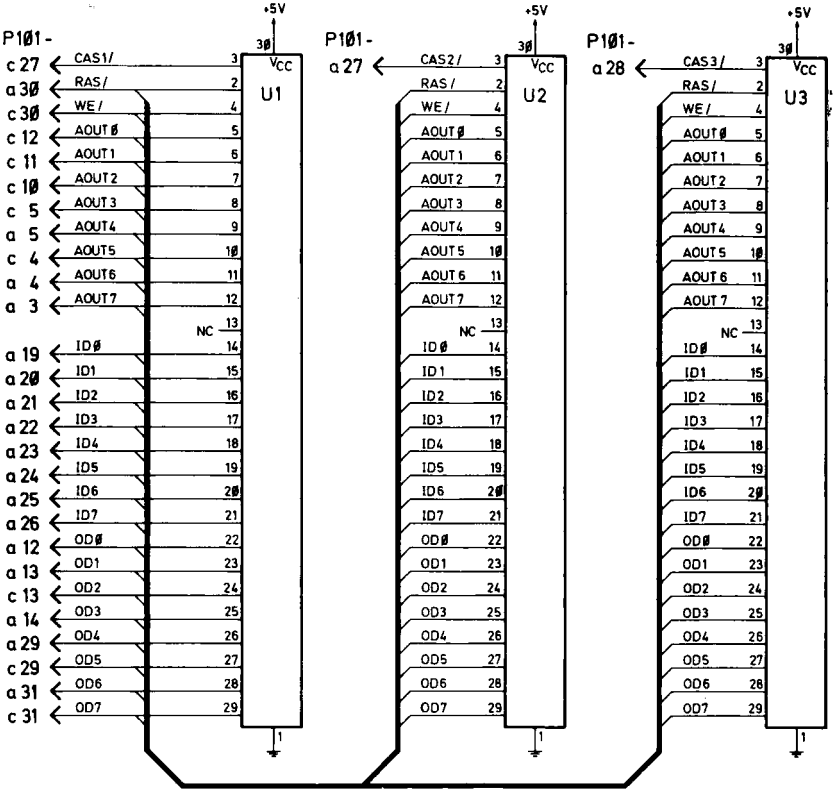
MEMORY EXTENSION 64K



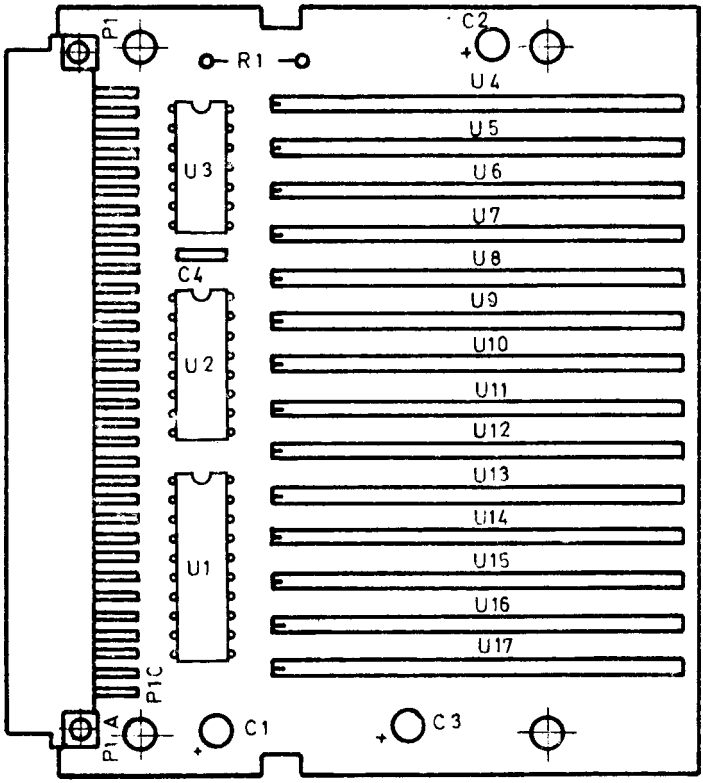

D - RAM
U1
U2
U3
U4
U5
U6
U7
U8
P1-
a 3 AOUT 7
a 4 AOUT 6
c 4 AOUT 5
a 5 AOUT 4
c 5 AOUT 3
c 10 AOUT 2
c 11 AOUT 1
c 12 AOUT 0
c 30 WE/
a 30 RAS/
c 27 CAS1/
a 26 ID 7
a 25 ID 6
a 24 ID 5
a 23 ID 4
a 22 ID 3
a 21 ID 2
a 20 ID 1
a 19 ID 0
c 31 OD 7
a 31 OD 6
c 29 OD 5
a 29 OD 4
a 14 OD 3
c 13 OD 2
a 13 OD 1
a 12 OD 0
ID0 - 7
OD0 - 7
TYPICAL PIN ASSIGNMENT
+5V
C2 - C9
0,1µF
C1
LA
128
64
32
16
8
4
2
1
C2
C3
F
WE/
RAS/
CAS1/
C1 (ROV)
C2 (COL)
MEM 4164
AC3D
AGF
a 1
c 1
a 16
c 16
a 32
c 32
LGRD
C1 33µF 16V

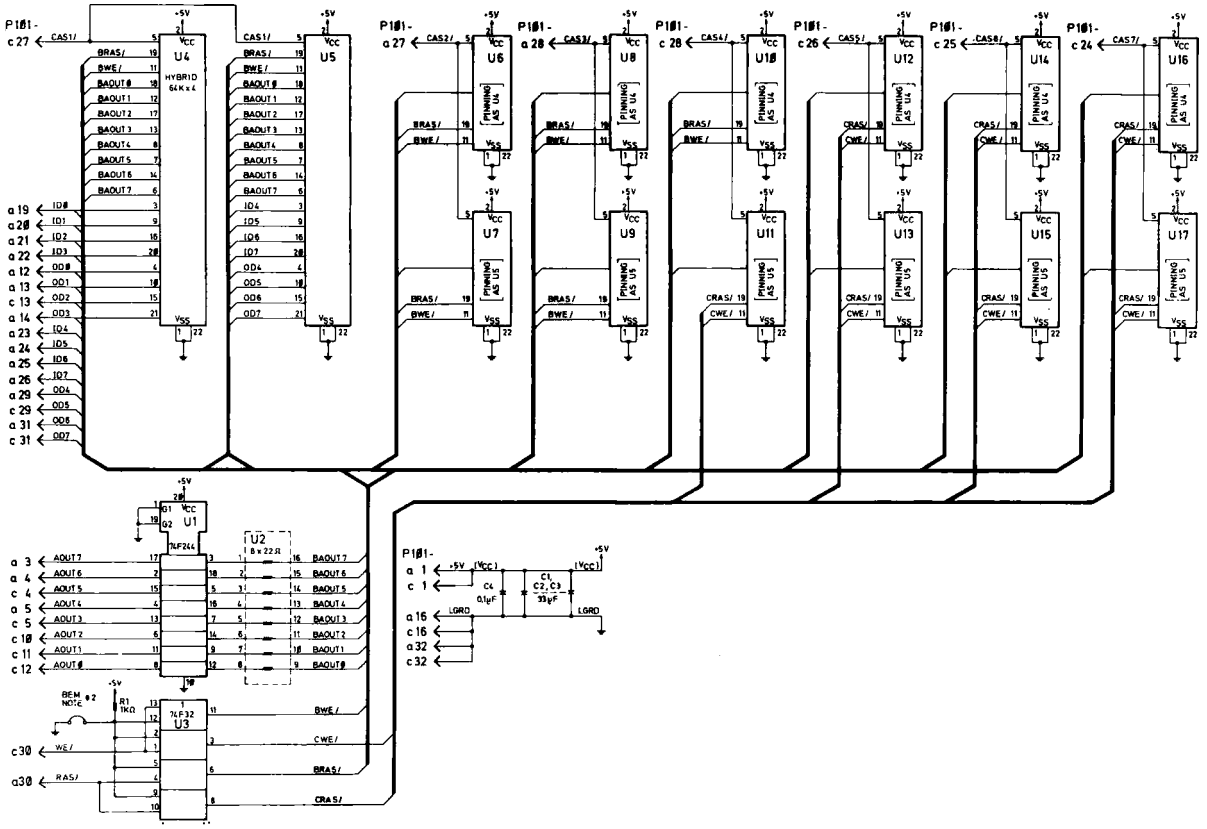
MEMORY EXTENSION 192K



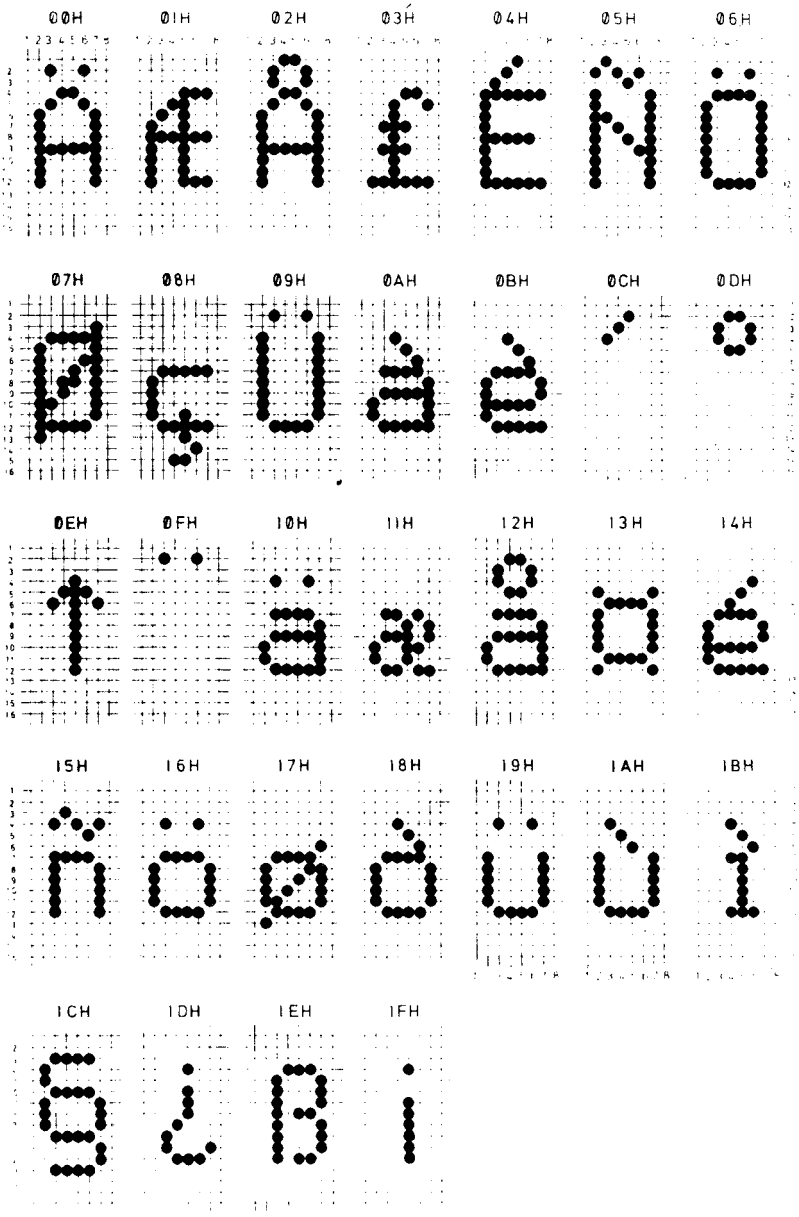

P1Ø1-
c 27
a 3Ø
c 3Ø
c 12
c 11
c 1Ø
c 5
a 5
c 4
a 4
a 3
a 19
a 2Ø
a 21
a 22
a 23
a 24
a 25
a 26
a 12
a 13
c 13
a 14
a 29
c 29
a 31
c 31
CAS1/
RAS/
WE/
AOUTØ
AOUT1
AOUT2
AOUT3
AOUT4
AOUT5
AOUT6
AOUT7
NC
IDØ
ID1
ID2
ID3
ID4
ID5
ID6
ID7
ODØ
OD1
OD2
OD3
OD4
OD5
OD6
OD7
+5V
3Ø
Vcc
U1
P1Ø1-
a 27
CAS2/
U2
P1Ø1-
a 28
CAS3/
U3
a 1
c 1
a 16
c 16
a 32
c 32
+5V (Vcc)
(Vcc)
C1, C2, C3, C4, C5, C6, C7
33µF
LGRD

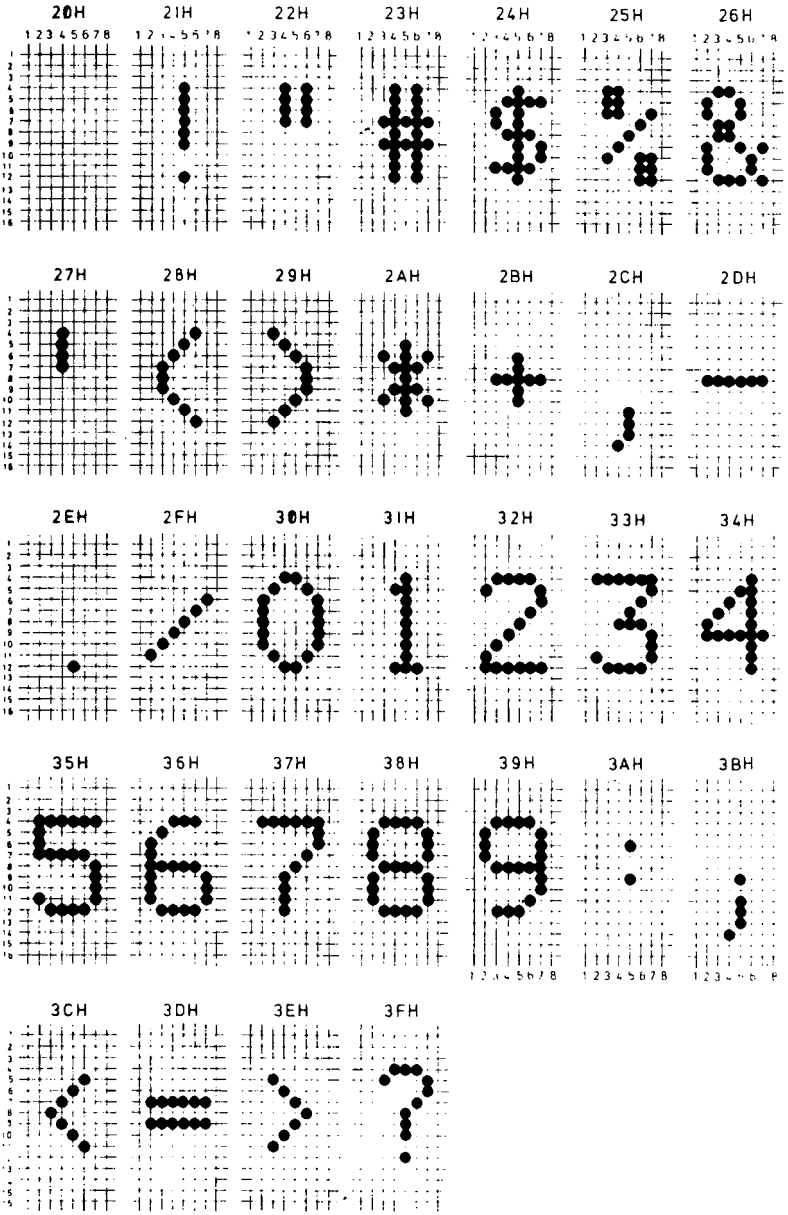
MEMORY EXTENSION 448K

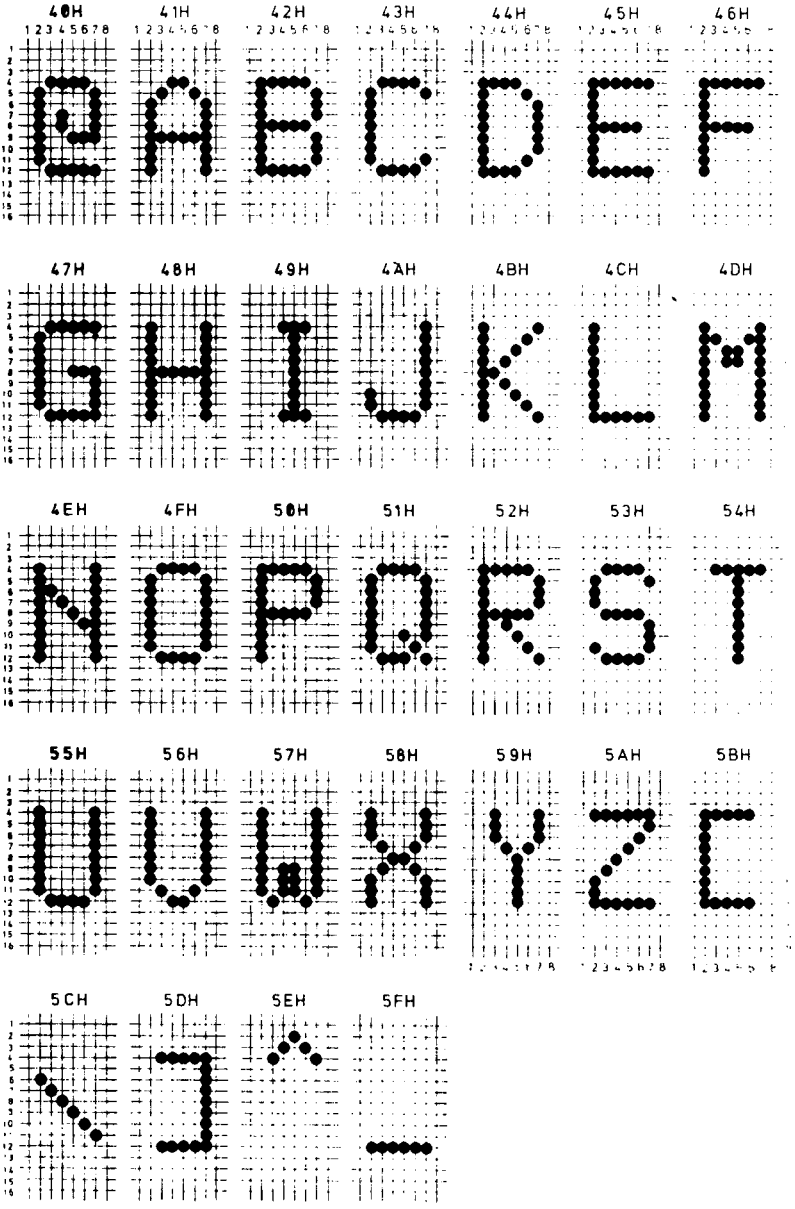


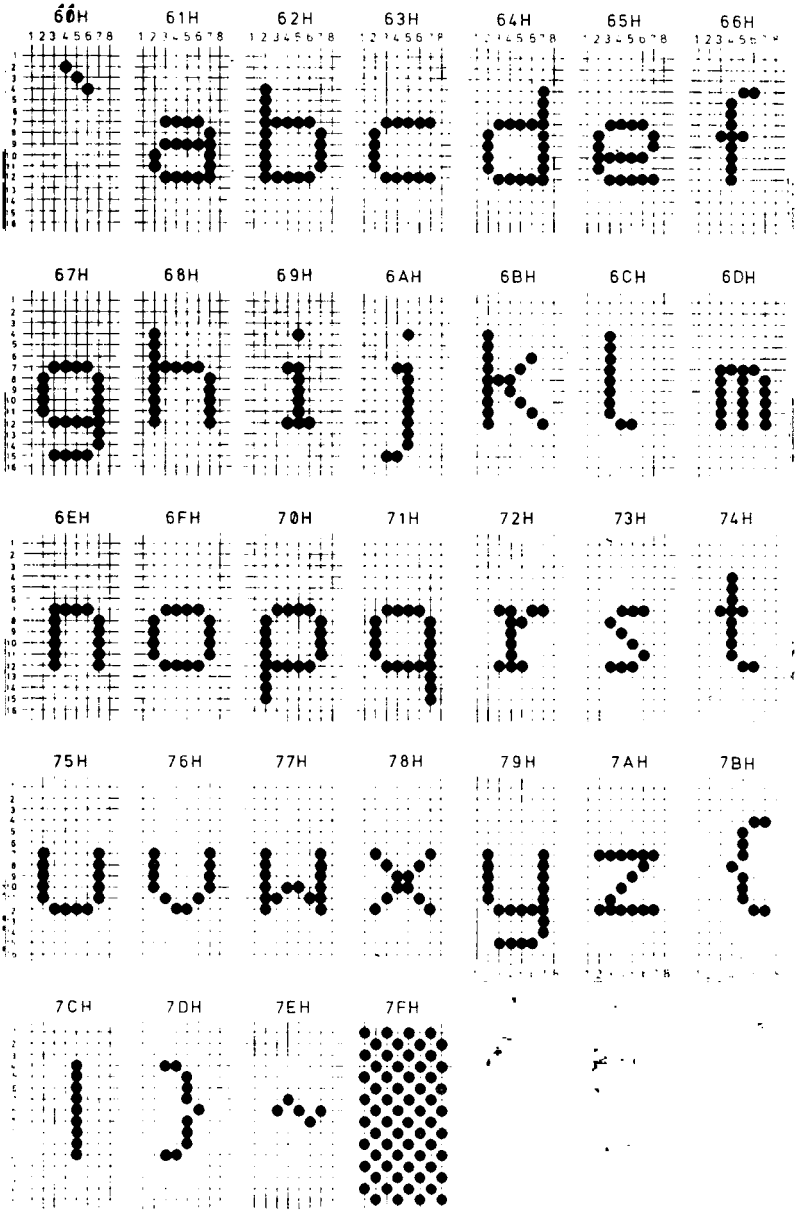

P1Ø1-
c 27
CAS1/
U4
HYBRID 64K x 4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
PINNING AS U4
PINNING AS U5
+5V
VCC
VSS
BRAS/
BWE/
CAS2/
CAS3/
CAS4/
CAS5/
CAS6/
CAS7/
CRAS/
CWE/
a 19
a 20
a 21
a 22
a 12
a 13
c 13
a 14
a 23
a 24
a 25
a 26
a 29
c 29
a 31
c 31
ID0
ID1
ID2
ID3
OD0
OD1
OD2
OD3
ID4
ID5
ID6
ID7
OD4
OD5
OD6
OD7
U1
74F244
U2
8 x 22R
U3
74F32
AOUT7
AOUT6
AOUT5
AOUT4
AOUT3
AOUT2
AOUT1
AOUT0
BAOUT7
BAOUT6
BAOUT5
BAOUT4
BAOUT3
BAOUT2
BAOUT1
BAOUT0
a 3
a 4
c 4
a 5
c 5
c 10
c 11
c 12
R1
1KΩ
REM NOTE 2
WE/
RAS/
c30
a30
P1Ø1-
a 1
c 1
a 16
c 16
a 32
c 32
C4
0,1µF
C1
C2, C3
33µF
LGRD

MATRIX CHARACTER SET




20H
21H
22H
23H
24H
25H
26H
27H
28H
29H
2AH
2BH
2CH
2DH
2EH
2FH
30H
31H
32H
33H
34H
35H
36H
37H
38H
39H
3AH
3BH
3CH
3DH
3EH
3FH


40H
41H
42H
43H
44H
45H
46H
47H
48H
49H
4AH
4BH
4CH
4DH
4EH
4FH
50H
51H
52H
53H
54H
55H
56H
57H
58H
59H
5AH
5BH
5CH
5DH
5EH
5FH


60H
61H
62H
63H
64H
65H
66H
67H
68H
69H
6AH
6BH
6CH
6DH
6EH
6FH
70H
71H
72H
73H
74H
75H
76H
77H
78H
79H
7AH
7BH
7CH
7DH
7EH
7FH

CHARACTER GENERATOR TABLE

Langu.grp.II Extension

	00	10	20	30	40	50	60	70	80	90
0	Ä	ä		0	@	P	`	p	Ã	ã
1	Æ	æ	!	1	A	Q	a	q	Õ	õ
2	Å	å	"	2	B	R	b	r	Ë	ë
3	£	¤	#	3	C	S	c	s	Ê	ê
4	¢	é	$	4	D	T	d	t	'N	'n
5	Ñ	ñ	%	5	E	U	e	u	Ç	±
6	Ö	ö	&	6	F	V	f	v	«	â
7	Ø	ø	'	7	G	W	g	w	»	ô
8	ç	ò	(	8	H	X	h	x	Đ	đ
9	Ü	ü	)	9	I	Y	i	y	Ć	ć
A	à	ù	*	:	J	Z	j	z	Č	č
B	è	ì	+	;	K	[	k	{	Š	š
C	´	§	,	<	L	\	l	|	Ž	ž
D	°	¿	-	=	M	]	m	}	²	û
E	↑	ß	.	>	N	∧	n	~	³	î
F	¨	ì	/	?	O	_	o	▒	½	ï

KEYBOARD OUTPUT ASSIGNMENTS

	00	10	20	30	40	50	60	70	80	90
0	NUL	DLE		0	@	P	`	p		
1	SOH	DC1	!	1	A	Q	a	q	↖	↖
2	STX	DC2	"	2	B	R	b	r	←	←
3	ETX	DC3	#	3	C	S	c	s	↓	↓
4	EOT	DC4	$	4	D	T	d	t	↑	↑
5	ENQ	NAK	%	5	E	U	e	u	→	→
6	ACK	SYN	&	6	F	V	f	v	CLR	CLR
7	BEL	ETB	'	7	G	W	g	w		
8	BS	CAN	(	8	H	X	h	x	NEW LINE	
9	HT	EM	)	9	I	Y	i	y		
A	LF	SUB	*	:	J	Z	j	z		
B	VT	ESC	+	;	K	[	k	{	⟷ BSp	
C	FF	FS	,	<	L	\	l	¦		
D	CR	GS	-	=	M	]	m	}		
E	SO	RS	.	>	N	^	n	~		
F	SI	US	/	?	O	_	o	DEL		



such marked fields are assigned to language dependent symbol extensions

MODE REGISTER 1 (MR1)

MR17	MR16	MR15	MR14	MR13 MR12	MR11	MR10
		Parity Type	Parity Control	Character Length	Mode and Baud Rate Factor	
ASYNCH: STOP BIT LENGTH 00 = Invalid 01 = 1 Stop bit 10 = 1 1/2 Stop bits 11 = 2 Stop bits		0 = Odd 1 = Even	0 = Disabled 1 = Enabled	00 = 5 Bits 01 = 6 Bits 10 = 7 Bits 11 = 8 Bits	00 = Synchronous 1X rate 01 = Asynchronous 1X rate 10 = Asynchronous 16X rate 11 = Asynchronous 64X rate	
SYNCH: NUMBER OF SYN CHAR 0 = Double syn 1 = Single syn	**SYNCH: TRANS-PARENCY CONTROL** 0 = Normal 1 = Transparent					
Note Baud rate factor in asynchronous applies only if external clock is selected. Factor is 16X if internal clock is selected.						

MODE REGISTER 2 (MR2)

MR27	MR26	MR25	MR24	MR23	MR22	MR21	MR20
		Transmitter Clock	Receiver Clock	Baud Rate Selection			
Always zero in NCR DMV		0 = External 1 = Internal	0 = External 1 = Internal	0000 = 50 Baud 0001 = 75 0010 = 110 0011 = 134.5 0100 = 150 0101 = 300 0110 = 600 0111 = 1200		1000 = 1800 Baud 1001 = 2000 1010 = 2400 1011 = 3600 1100 = 4800 1101 = 7200 1110 = 9600 1111 = 19,200	

COMMAND REGISTER (CR)

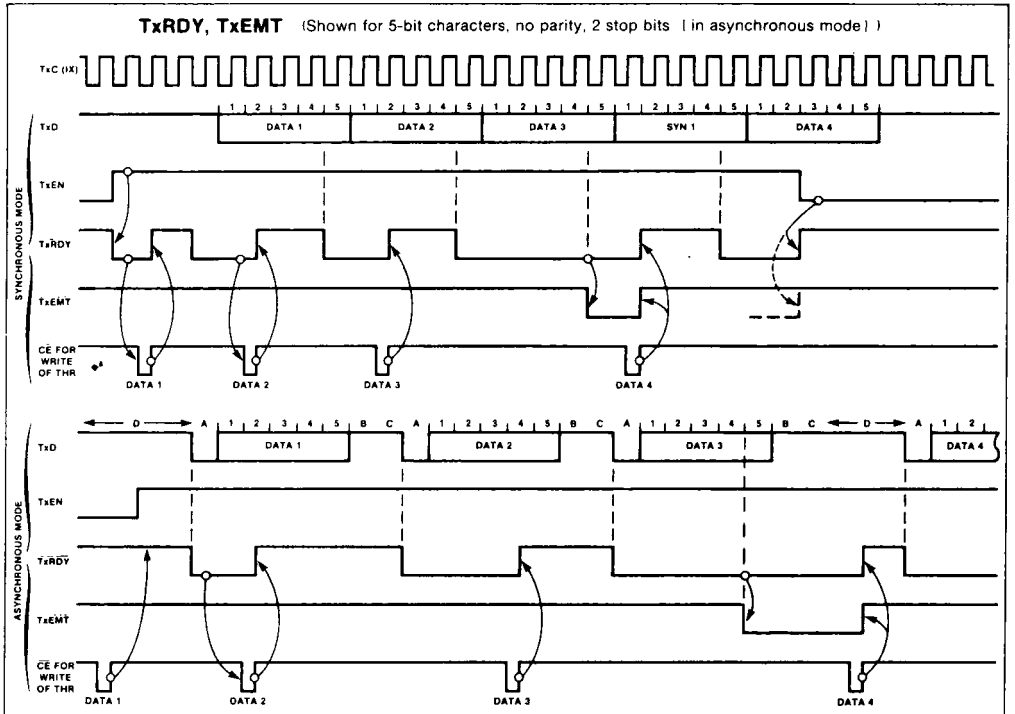
CR7 CR6	CR5	CR4	CR3	CR2	CR1	CR0
Operating Mode	**Request to Send**	**Reset Error**		**Receive Control (RxEN)**	**Data Terminal Ready**	**Transmit Control (TxEN)**
00 = Normal operation 01 = Asynch: atutomatic echo mode Synch: SYN and /or DLE stripping mode 10 = Local loop back 11 = Remote loop back	0 = Force $\overline{\text{RTS}}$ Output High 1 = Force $\overline{\text{RTS}}$ Output low	0 = Normal 1 = Reset error flag in status reg (FE, OE, PE/DLE detect)	**ASYNCH: FORCE BREAK** 0 = Normal 1 = Force break **SYNCH: SEND DLE** 0 = Normal 1 = Send DLE	0 = Disable 1 = Enable	0 = Force $\overline{\text{DTR}}$ Output High 1 = Force $\overline{\text{DTR}}$ Output low	0 = Disable 1 = Enable

STATUS REGISTER (SR)

SR7	SR6	SR5	SR4	SR3	SR2	SR1	SR0
Data Set Ready	**Data Carrier Detect**	**FE/SYN Detect**	**Overrun**	**PE/DLE Detect**	**TxEMT/DSCHG**	**RxRDY**	**TxRDY**
0 = $\overline{\text{DSR}}$ input is high 1 = $\overline{\text{DSR}}$ input is low	0 = $\overline{\text{DCD}}$ input is high 1 = $\overline{\text{DCD}}$ input is low	**ASYNCH:** 0 = Normal 1 = Framing error **SYNCH:** 0 = Normal 1 = SYN char detected	0 = Normal 1 = Overrun error	**ASYNCH:** 0 = Normal 1 = Parity error **SYNCH:** 0 = Normal 1 = Parity error or DLE char received	0 = Normal 1 = Change in $\overline{\text{DSR}}$ or $\overline{\text{DCD}}$, or transmit shift register is empty	0 = Receive holding reg empty 1 = Receive holding reg has data	0 = Transmit holding reg busy 1 = Transmit holding reg empty

TIMING DIAGRAMS

TxRDY, TxEMT (Shown for 5-bit characters, no parity, 2 stop bits [in asynchronous mode])



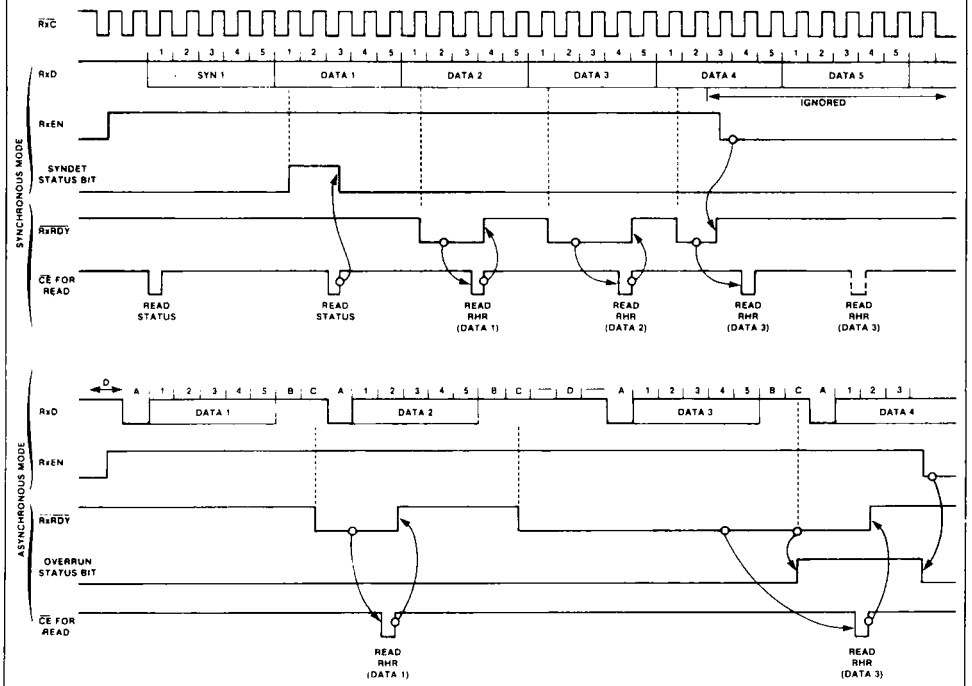
NOTES

A = Start bit
B = Stop bit 1
C = Stop bit 2
D = TxD marking condition

TxEMT goes low at the beginning of the last data bit, or, if parity is enabled, at the beginning of the parity bit.

TIMING DIAGRAMS (Cont'd)

RxRDY (Shown for 5-bit characters, no parity, 2 stop bits (in asynchronous mode).)



NOTES

A - Start bit
B - Stop bit 1
C - Stop bit 2
D - TxD marking condition

2651 REGISTER ADDRESSING

K212/K213	K211	$\overline{CE}$	A_1	A_0	$\overline{R/W} = A_2$	FUNCTION
–	–	1	X	X	X	Tri-state data bus
60H	70H	0	0	0	0	Read receive holding register
64H	74H	0	0	0	1	Write transmit holding register
61H	71H	0	0	1	0	Read status register
65H	75H	0	0	1	1	Write SYN1/SYN2/DLE registers
62H	72H	0	1	0	0	Read mode registers 1/2
66H	76H	0	1	0	1	Write mode registers 1/2
63H	73H	0	1	1	0	Read command register
67H	77H	0	1	1	1	Write command register

Use IN; OUT opcodes by Z80, 8088

For more information on the 2651 Programmable Communications Interface, see the manufacturers data sheets.

16-BIT FIRMWARE

```
LOC  OBJ              LINE     SOURCE

                        1 +1  $PL(68) XR SB DB EP NOGE
                        2
                        3
                        4     NAME BOOT_LOADER_LEVEL0
                        5
                        6
                        7     ;*********************************************************
                        8     ;*********************************************************
                        9     ;**                                                     **
                       10     ;**           DMS 16 BIT EXTENSION FIRMWARE             **
                       11     ;**                                                     **
                       12     ;**                                                     **
                       13     ;**                                                     **
                       14     ;**           VERSION:       1.0                       **
                       15     ;**                                                     **
                       16     ;**                                                     **
                       17     ;**                                                     **
                       18     ;**                                                     **
                       19     ;**                                                     **
                       20     ;**           COPYRIGHT NCR CORP. 1983                  **
                       21     ;**                                                     **
                       22     ;*********************************************************
                       23     ;*********************************************************
                       24
                       25
                       26
                       27
----                   28     DATA   SEGMENT WORD COMMON 'DATA'
                       29
  0800                 30            BUFFER  EQU    THIS WORD
0000                   31            M       LABEL  BYTE
                       32
                       33     ;
F800                   34            ORG    0F800H
                       35     ;
F800 ??                36     CURSX  DB     ?                    ;CURSOR - X - POSITION
F801 ??                37     CURSY  DB     ?                    ;CURSOR - Y - POSITION
                       38     ;
                       39
                       40     ; *** COMMAND MAIL BLOCK OF LANGUAGE AND IO BOARD ***
                       41     ;    ******************************************
                       42
FE01                   43            ORG    0FE01H
                       44
FE01 ??                45     SB8    DB     ?                    ;STATUS BLOCK FROM Z80
                       46
FE04                   47            ORG    0FE04H
                       48
FE04 ??                49     CB16   DB     ?                    ;COMMAND BLOCK TO 16 BIT
FE05 ??                50     SB16   DB     ?                    ;STATUS BLOCK RETURN OF 16 BIT
FE06 ??                51     MEM16  DB     ?                    ;AVAILABLE MEMORY SIZE
                       52
                       53
----                   54     DATA   ENDS
                       55
                       56
                       57
                       58     $      EJECT
```

```
LOC  OBJ                  LINE    SOURCE

                           59
                           60     PUBLIC          SWITCH,EXECUTE_SOFTWARE,SWITCH_TEST
                           61
                           62     EXTRN           MONITOR:NEAR,STARTS:NEAR,DISPL:NEAR
                           63     EXTRN           KEYINP:NEAR,L_13:NEAR,DISPLAY:NEAR
                           64
                           65
                           66
----                       67     BOOTER          SEGMENT WORD COMMON 'CODE'
                           68
                           69
                           70     ASSUME  DS:DATA,CS:BOOTER,SS:DATA,ES:DATA
                           71
                           72
                           73     %*DEFINE (JUMPER)(
                                  DW      MONITOR
                                  DW      STARTS
                                  )
                           74
                           75     ; *** "OUT" EQUATES ***
                           76     ; ***********************
                           77
  0010                     78     RAMSEL  EQU     10H                     ;RAMS SELECT
  0011                     79     ROMSEL  EQU     11H                     ;ROM SELECT
  00D0                     80     PROCCH  EQU     0D0H                    ;PROCESSOR CHANGE
                           81
                           82     ;*** ASCII EQUATES ***
                           83     ;***********************
                           84
  0088                     85     NEWL    EQU     88H                     ;NEW LINE COMMAND (CR+LF)
                           86
                           87
                           88     ;       *** JUMP TABLE ***
                           89     ;       ******************
                           90
0000 E90000          E     91     JMP     DISPLAY
                           92
                           93
                           94     ; *** COMMAND PHASE VERTEILER ***
                           95     ; ********************************
                           96
0003 B8----          R     97     BEGIN:  MOV     AX,DATA
0006 8ED0                  98             MOV     SS,AX
0008 8BE0                  99             MOV     SP,AX
000A 8ED8                 100             MOV     DS,AX
000C 8EC0                 101             MOV     ES,AX
000E EB0D                 102             JMP     SHORT LOOK_MAIL_BOX
                          103
                          104
  0010                    105     COMMAND EQU     THIS WORD
                          106             %JUMPER
0014 3900            E    110             DW      EXECUTE_SOFTWARE        ;PHASE 2
0016 4800            R    111             DW      LEVEL0                  ;PHASE 3
                          112
                          113
0018 E611                 114     SWITCH: OUT     ROMSEL,AL
001A E6D0                 115             OUT     PROCCH,AL               ;RETURN TO 8 BIT
001C 90                   116             NOP
                          117
001D                      118     LOOK_MAIL_BOX:
001D E610                 119             OUT     RAMSEL,AL               ;ALLWAYS RAM SELECTION
001F A004FE          R    120             MOV     AL,CB16
0022 250F00               121             AND     AX,0FH
```

BOOT_LOADER_LEVEL0

```
LOC  OBJ                  LINE    SOURCE

0025 3C04                  122             CMP     AL,04
0027 73EF                  123             JAE     SHORT SWITCH
0029 D1E0                  124             SHL     AX,1
002B 8BF0                  125             MOV     SI,AX
002D 2EFFA41000      R     126             JMP     COMMAND[SI]             ;JUMP TO COMMAND
                           127
0032                       128     SWITCH_TEST:
0032 C606050FE00     R     129             MOV     SB16,0                  ;00=GOOD STATUS
0037 EBDF                  130             JMP     SWITCH
                           131
0039                       132     EXECUTE_SOFTWARE:
0039 33C0                  133             XOR     AX,AX
003B 8ED8                  134             MOV     DS,AX
003D 8EC0                  135             MOV     ES,AX
003F 8ED0                  136             MOV     SS,AX
0041 8BE0                  137             MOV     SP,AX
                           138
0043 EA0000----      R     139             JMP     FAR PTR CPM86           ;JUMP IN TO CPM86 OPERATING SOFTWARE
                           140
                           141     $       EJECT
```

```
LOC  OBJ                  LINE    SOURCE

                          142
                          143
                          144
                          145
                          146     ;************************************************
                          147
                          148     ;               POWER UP POUTINE
                          149
                          150     ;************************************************
                          151
                          152
0048                      153     LEVEL0:
0048 33C0                 154             XOR     AX,AX                   ;SET AX AND START ADDRESS TO 0
004A 8EF0                 155             MOV     SI,AX
004C B90010               156             MOV     CX,1000H                ;ROM-TEST OVER 4K
004F 2EAC                 157     SUM1:   LODS    CS:M
0051 02E0                 158             ADD     AH,AL
0053 E2FA                 159             LOOP    SUM1
0055 80C400               160             ADD     AH,0
0058 7407                 161             JZ      SHORT RAMTST            ;ROM-TEST O.K.
                          162
005A                      163     LEVEL0_FAIL:
005A C60605FEFF     R     164             MOV     SB16,0FFH
005F EBB7                 165             JMP     SWITCH                  ;LEVEL 0 FAILED
                          166
                          167
                          168     ; *** RAM-TEST ***
                          169     ;     ********
                          170
0061                      171     RAMTST:
0061 C606001F817    R     172             MOV     CURSY,23
0066 C606000F800    R     173             MOV     CURSX,0
006B 8D1EEE001      R     174             LEA     BX,MESS1                ;MESSAGE MEMORY TEST OF BANK 0
006F E80000         E     175             CALL    DISPL
0072 8D1E1102       R     176             LEA     BX,MESS4
0076 E80000         E     177             CALL    DISPL
                          178
                          179
0079 B9AA0A               180             MOV     CX,2000H/3              ;WRITE A UNEVEN BYTE MUSTER IN MEMORY
007C 33FF                 181             XOR     DI,DI
007E                      182     RAMTST1A:
007E B8AA55               183             MOV     AX,55AAH
0081 AB                   184             STOSW
0082 B000                 185             MOV     AL,00
0084 AA                   186             STOSB
0085 E2F7                 187             LOOP    RAMTST1A
0087 B8AA55               188             MOV     AX,55AAH
008A AB                   189             STOSW
                          190
008B B9AA0A               191             MOV     CX,2000H/3
008E 33FF                 192             XOR     DI,DI
0090                      193     RAMTST1B:
0090 B8AA55               194             MOV     AX,55AAH
0093 AF                   195             SCASW
0094 7542                 196             JNZ     ERRORO
0096 B000                 197             MOV     AL,0
0098 AE                   198             SCASB
0099 753D                 199             JNZ     ERRORO
009B E2F3                 200             LOOP    RAMTST1B
009D B8AA55               201             MOV     AX,55AAH
00A0 AF                   202             SCASW
00A1 7535                 203             JNZ     ERRORO
                          204
```

BOOT_LOADER_LEVEL0

```
LOC  OBJ                  LINE    SOURCE

                          323
016B 86E0                 324             XCHG    AH,AL
016D FECF                 325             DEC     BH
016F 75EC                 326             JNZ     MEM_TEST
                          327
0171                      328     GOOD_BANK:
0171 FEC3                 329             INC     BL                      ;GOOD BANK INC BANK INDICATOR
0173 8BCD                 330             MOV     CX,BP
0175 E281                 331             LOOP    NEXT_BANK               ;ALL BANKS ?
0177 EB1B                 332             JMP     SHORT MEMORY_END
                          333
0179 33C0                 334     ERROR1: XOR     AX,AX
017B 8ED8                 335             MOV     DS,AX
017D 8EC0                 336             MOV     ES,AX                   ;SET SEGMENT TO ZERO
017F 53                   337             PUSH    BX
0180 C606D0F81E     R     338             MOV     CURSX,30
0185 8D1E0502       R     339             LEA     BX,MESS3                ;ERROR DETECTED WRITE FAILED TO SCREEN
0189 E80000         E     340             CALL    DISPL
018C E80000         E     341     ERR11:  CALL    KEYINP
018F 3C88                 342             CMP     AL,NEWL
0191 75F9                 343             JNZ     ERR11
0193 5B                   344             POP     BX
                          345
0194                      346     MEMORY_END:
0194 33C0                 347             XOR     AX,AX
0196 8ED8                 348             MOV     DS,AX
0198 8EC0                 349             MOV     ES,AX                   ;SET SEGMENT TO ZERO
019A C606D1F80A     R     350             MOV     CURSY,10
019F 881E06FE       R     351             MOV     MEM16,BL                ;SET COUNT OF MEM BANKS IN MEM16
01A3 C606D5FE00     R     352             MOV     SB16,0
01A8 E960FE               353             JMP     SWITCH                  ;JUMP TO 8 BIT
                          354
01AB                      355     BANK_DIS:
01AB 50                   356             PUSH    AX
01AC 33C0                 357             XOR     AX,AX
01AE 8ED8                 358             MOV     DS,AX
01B0 8EC0                 359             MOV     ES,AX                   ;SET SEGMENT TO ZERO BANK
01B2 B005                 360             MOV     AL,5
01B4 F6E3                 361             MUL     BL
01B6 53                   362             PUSH    BX
01B7 51                   363             PUSH    CX
01B8 50                   364             PUSH    AX
01B9 C606D1F817     R     365             MOV     CURSY,23                ;SET CURSOR FOR MESSAGES
01BE C606D0F800     R     366             MOV     CURSX,0
01C3 8D1EED01       R     367             LEA     BX,MESS1                ;WRITE MEMORY TEST ON SCREEN
01C7 E80000         E     368             CALL    DISPL
01CA 58                   369             POP     AX
                          370
01CB 8BD8                 371             MOV     BX,AX
01CD 8D061A02       R     372             LEA     AX,BANKS
01D1 03D8                 373             ADD     BX,AX
01D3 B509                 374             MOV     CH,9
01D5 E8D1DD         E     375             CALL    L_13+1                  ;WRITE THE TESTED BANK TO SCREEN
01D8 59                   376             POP     CX
01D9 5B                   377             POP     BX
01DA 58                   378             POP     AX
01DB 8EDA                 379             MOV     DS,DX
01DD 8EC2                 380             MOV     ES,DX
01DF C3                   381             RET
                          382
                          383
01ED 11                   384     MESS1   DB      17,'TEST MEMORY BANK '
01E1 54455354204D45
```

```
LOC  OBJ                  LINE     SOURCE

     4D4F5259204241
     4E4820
01F2 12                    385     MESS2   DB      18,'FATAL MEMORY ERROR'
01F3 4641544154C204D
     454D4F52592045
     52524F52
0205 0B                    386     MESS3   DB      11,'FAILED (CR)'
0206 4641494C454420
     28435229
0211 08                    387     MESS4   DB      8,'  0-64K'
0212 20202030203634
     4B
021A 2036344B203132        388     BANKS   DB      ' 64K-128K-192K-256K-320K-384K-448K-512K'
     384B203139324B
     2D3235364B2033
     32304B20333834
     4B2D3434384B2D
     35313248
                           389
                           390
                           391
----                       392     BOOTER          ENDS
                           393
                           394
----                       395     SOFTWARE        SEGMENT PARA PUBLIC 'CODE'
                           396
  0000                     397             CPM86   EQU     THIS FAR
                           398
----                       399     SOFTWARE        ENDS
                           400
                           401
                           402             END     BEGIN
```

BOOT LOADER LEVEL0

```
LOC  OBJ                  LINE    SOURCE

00A3 BA0010               205             MOV     DX,1000H
00A6 B8D201               206             MOV     AX,0102H
00A9                      207     RAMTST1:                        ;TEST WITH A ROTATING ONE
00A9 33FF                 208             XOR     DI,DI
00AB 8BCA                 209             MOV     CX,DX
00AD F3                   210             REP     STOSW
00AE AB
00AF 33FF                 211             XOR     DI,DI
00B1 8BCA                 212             MOV     CX,DX
00B3 F3                   213             REPZ    SCASW
00B4 AF
00B5 7521                 214             JNZ     ERRORO
00B7 D0C0                 215             ROL     AL,1
00B9 D0C4                 216             ROL     AH,1
00BB 73EC                 217             JNC     RAMTST1
                          218
00BD B702                 219             MOV     BH,2
00BF B855AA               220             MOV     AX,0AA55H
00C2                      221     RAMTST2:
00C2 8BCA                 222             MOV     CX,DX
00C4 33FF                 223             XOR     DI,DI
00C6 F3                   224             REP     STOSW                   ;STORE AA55
00C7 AB
                          225
00CB 33FF                 226             XOR     DI,DI
00CA 8BCA                 227             MOV     CX,DX
00CC F3                   228             REPZ    SCASW
00CD AF
                          229
00CE 7508                 230             JNZ     ERRORO
                          231
00D0 86E0                 232             XCHG    AH,AL
00D2 FECF                 233             DEC     BH
00D4 75EC                 234             JNZ     RAMTST2
00D6 EB0E                 235             JMP     SHORT MEM_BANK_TEST
                          236
                          237
00D8 C606D0F81E     R     238     ERRORO: MOV     CURSX,30                ;WRITE 'FATAL MEMMORY ERROR'
00DD 8D1EF201       R     239             LEA     BX,MESS2                ;AND STOP PROCESSING
00E1 E80000         E     240             CALL    DISPL
00E4 EBFE                 241             JMP     SHORT $
                          242
                          243
                          244     ;       MEMORY EXTENSION TEST
                          245     ;       =====================
                          246
                          247
00E6                      248     MEM_BANK_TEST:
00E6 B90300               249             MOV     CX,3                    ;SET BANK COUNTER TO MAX BANKS=256K (512K)
00E9 803ED1FE09     R     250             CMP     SB8,09                  ;VERSION NUMBER ) 10 ?
00EE 7203                 251             JB      UNDER
00F0 83C104               252             ADD     CX,4                    ;SET BANK COUNTER TILL 512K
00F3 BA0000               253     UNDER:  MOV     DX,0
00F6 B300                 254             MOV     BL,0                    ;SET BANK INDICATOR
                          255
00F8                      256     NEXT_BANK:
00F8 8BE9                 257             MOV     BP,CX                   ;SAVE BANK COUNTER
00FA 81C20010             258             ADD     DX,1000H                ;SET SEGMENT FOR NEXT BANK
00FE 8EDA                 259             MOV     DS,DX
0100 8EC2                 260             MOV     ES,DX
                          261
0102 B855AA               262             MOV     AX,0AA55H
0105 A30000         R     263             MOV     BUFFER,AX               ;TEST THE FIRST TWO BYTES OF A BANK
```

```
LOC  OBJ              LINE    SOURCE

0108 3B060000      R   264             CMP     AX,BUFFER               ;FOR A PRESENT BANK
010C 7403              265             JZ      L_200
010E E98300            266             JMP     MEMORY_END
0111 E89700            267     L_200:  CALL    BANK_DIS
                       268
0114 B95555            269             MOV     CX,0FFFFH/3             ;WRITE AN UNEVEN BYTE PATTERN IN MEMORY
0117 33FF              270             XOR     DI,DI
                       271
0119                   272     ADDTSTA:
0119 B8AA55            273             MOV     AX,55AAH
011C AB                274             STOSW
011D B000              275             MOV     AL,00
011F AA                276             STOSB
0120 E2F7              277             LOOP    ADDTSTA
0122 B055              278             MOV     AL,55H
0124 AA                279             STOSB
                       280
0125 B95555            281             MOV     CX,0FFFFH/3
0128 33FF              282             XOR     DI,DI
012A                   283     ADDTSTB:
012A B8AA55            284             MOV     AX,55AAH
012D AF                285             SCASW
012E 7549              286             JNZ     ERROR1
0130 B000              287             MOV     AL,0
0132 AE                288             SCASB
0133 7544              289             JNZ     ERROR1
0135 E2F3              290             LOOP    ADDTSTB
0137 B055              291             MOV     AL,55H
0139 AE                292             SCASB
013A 753D              293             JNZ     ERROR1
                       294
013C 33FF              295             XOR     DI,DI
013E BED080            296             MOV     SI,8000H                ;COUNTER OF A ENTIRE BANK 64 K
                       297
0141 B80201            298             MOV     AX,0102H
0144                   299     ROT_ONE:
0144 33FF              300             XOR     DI,DI
0146 8BCE              301             MOV     CX,SI
0148 F3                302             REP     STOSW
0149 AB
014A 33FF              303             XOR     DI,DI
014C 8BCE              304             MOV     CX,SI
014E F3                305             REPZ    SCASW
014F AF
0150 7527              306             JNZ     ERROR1
0152 D0C0              307             ROL     AL,1
0154 D0C4              308             ROL     AH,1
0156 73EC              309             JNC     ROT_ONE
                       310
0158 B702              311             MOV     BH,2                    ;COUNT OF BIT PATTERN
015A B855AA            312             MOV     AX,0AA55H
0150                   313     MEM_TEST:
0150 8BCE              314             MOV     CX,SI                   ;SET COUNTER FOR A ENTIRE BANK = 8000 WORDS
015F 33FF              315             XOR     DI,DI
0161 F3                316             REP     STOSW                   ;STORE AX INTO MEMORY
0162 AB
                       317
0163 33FF              318             XOR     DI,DI
0165 8BCE              319             MOV     CX,SI
0167 F3                320             REPZ    SCASW                   ;CHECK MEMORY WITH ACCU
0168 AF
                       321
0169 750E              322             JNZ     ERROR1
```

BOOT_LOADER_LEVEL0

XREF SYMBOL TABLE LISTING

```
NAME                TYPE    VALUE  ATTRIBUTES, XREFS

??SEG . . . . . SEGMENT         SIZE=0000H PARA PUBLIC
ADDTSTA . . . . . L NEAR   0119H  BOOTER  272# 277
ADDTSTB . . . . . L NEAR   012AH  BOOTER  283# 290
BANK_DIS. . . . . L NEAR   01A8H  BOOTER  267 355#
BANKS . . . . . V BYTE   021AH  BOOTER  372 388#
BEGIN . . . . . L NEAR   0003H  BOOTER  97# 402 402
BOOTER. . . . . SEGMENT         SIZE=0241H WORD  COMMON 'CODE'  67# 70 392
BUFFER. . . . . V WORD   0000H  DATA  30# 263 264
CB16. . . . . V BYTE   FE04H  DATA  49# 120
COMMAND . . . . . V WORD   0010H  BOOTER  105# 126
CPM86 . . . . . L FAR    0000H  SOFTWARE  139 397#
CURSX . . . . . V BYTE   F800H  DATA  36# 173 238 338 366
CURSY . . . . . V BYTE   F801H  DATA  37# 172 350 365
DATA. . . . . SEGMENT         SIZE=FE07H WORD  COMMON 'DATA'  28# 54 70 70 70 97
DISPL . . . . . L NEAR   0000H  EXTRN  62# 175 177 240 340 368
DISPLAY . . . . . L NEAR   0000H  EXTRN  63# 91
ERR11 . . . . . L NEAR   018CH  BOOTER  341# 343
ERROR0. . . . . L NEAR   00D8H  BOOTER  196 199 203 214 230 238#
ERROR1. . . . . L NEAR   0179H  BOOTER  286 289 293 306 322 334#
EXECUTE_SOFTWARE. L NEAR   0039H  BOOTER PUBLIC  60 110 132#
GOOD_BANK . . . . L NEAR   0171H  BOOTER  328#
KEYINP. . . . . L NEAR   0000H  EXTRN  63# 341
L_13. . . . . L NEAR   0000H  EXTRN  63# 375
L_200 . . . . . L NEAR   0111H  BOOTER  265 267#
LEVEL0. . . . . L NEAR   0048H  BOOTER  111 153#
LEVEL0_FAIL . . . L NEAR   005AH  BOOTER  163#
LOOK_MAIL_BOX . . L NEAR   001DH  BOOTER  102 118#
M . . . . . V BYTE   0000H  DATA  31# 157
MEM_BANK_TEST . . L NEAR   00E6H  BOOTER  235 248#
MEM_TEST. . . . . L NEAR   015DH  BOOTER  313# 326
MEM16 . . . . . V BYTE   FE06H  DATA  51# 351
MEMORY_END. . . . L NEAR   0194H  BOOTER  266 332 346#
MESS1 . . . . . V BYTE   01E0H  BOOTER  174 367 384#
MESS2 . . . . . V BYTE   01F2H  BOOTER  239 385#
MESS3 . . . . . V BYTE   0205H  BOOTER  339 386#
MESS4 . . . . . V BYTE   0211H  BOOTER  176 387#
MONITOR . . . . . L NEAR   0000H  EXTRN  62# 107
NEWL. . . . . NUMBER   0038H    85# 342
NEXT_BANK . . . . L NEAR   00F8H  BOOTER  256# 331
PROCCH. . . . . NUMBER   00D0H    80# 115
RAMSEL. . . . . NUMBER   0010H    78# 119
RAMTST. . . . . L NEAR   0061H  BOOTER  161 171#
RAMTST1 . . . . . L NEAR   00A9H  BOOTER  207# 217
RAMTST1A. . . . . L NEAR   007EH  BOOTER  182# 187
RAMTST1B. . . . . L NEAR   0090H  BOOTER  193# 200
RAMTST2 . . . . . L NEAR   00C2H  BOOTER  221# 234
ROMSEL. . . . . NUMBER   0011H    79# 114
ROT_ONE . . . . . L NEAR   0144H  BOOTER  299# 309
SB16. . . . . V BYTE   FE05H  DATA  50# 129 164 352
SB8 . . . . . V BYTE   FE01H  DATA  45# 250
SOFTWARE. . . . . SEGMENT       SIZE=0000H PARA PUBLIC 'CODE'  395# 399
STARTS. . . . . L NEAR   0000H  EXTRN  62# 108
SUM1. . . . . L NEAR   004FH  BOOTER  157# 159
SWITCH. . . . . L NEAR   0018H  BOOTER PUBLIC  60 114# 123 130 165 353
SWITCH_TEST . . . L NEAR   0032H  BOOTER PUBLIC  60 128#
UNDER . . . . . L NEAR   00F3H  BOOTER  251 253#

END OF SYMBOL TABLE LISTING
```

```
SERIES-III 8086/8087/8088 MACRO ASSEMBLER V1.1 ASSEMBLY OF MODULE BOOTER_IO_DRIVER
OBJECT MODULE PLACED IN :F1:DM16IO.OBJ
ASSEMBLER INVOKED BY:  A86.86 :F1:DM16IO.SRC


LOC  OBJ                  LINE     SOURCE

                            1 +1  $PAGELENGTH(68) XREF SYMBOLS DEBUG EP NOMR
                            2
                            3
                            4     NAME BOOTER_IO_DRIVER
                            5
                            6
                            7     ;*******************************************************
                            8     ;*******************************************************
                            9     ;**                                                   **
                            10    ;**            DM5 16 BIT EXTENSION FIRMWARE          **
                            11    ;**                                                   **
                            12    ;**             IDENTIFIER:     AMF-DM16FI 0101-00     **
                            13    ;**                                                   **
                            14    ;**             VERSION:        1.0                    **
                            15    ;**                                                   **
                            16    ;**             DATE:           24.02.83               **
                            17    ;**                                                   **
                            18    ;**             ORIG. PLANT:    NCR AUGSBURG           **
                            19    ;**                                                   **
                            20    ;**             COPYRIGHT NCR CORP. 1983               **
                            21    ;**                                                   **
                            22    ;*******************************************************
                            23    ;*******************************************************
                            24
                            25
                            26
                            27
----                        28    DATA    SEGMENT WORD COMMON 'DATA'
                            29
  0000                      30            BUFFER  EQU     THIS WORD
0000                        31            M       LABEL   BYTE
                            32
F800                        33            ORG     0F800H
                            34
F800 ??                     35    CURSX   DB      ?                       ;CURSOR - X - POSITION
F801 ??                     36    CURSY   DB      ?                       ;CURSOR - Y - POSITION
                            37
F830                        38            ORG     0F830H
                            39
F830 ??                     40    BUFSTA  DB      ?                       ;CRT-BUFFER START ADR.
                            41
F900                        42            ORG     0F900H
                            43
F900 ??                     44    CEADL   DB      ?                       ;LOW BYTE OF CURSOR
F901 ??                     45    CEADH   DB      ?                       ;HIGH BYTE OF CURSOR
F902 ??                     46    CDAD    DB      ?                       ;POS OF PIXEL
F903 ????                   47    SP1     DW      ?                       ;START OF PAGE 1
F905 ??                     48    LP11    DB      ?                       ;LENGTH OF PAGE 1 LOW
F906 ??                     49    LP12    DB      ?                       ;  "  "  "  1 HIGH
F907 ????                   50    SP2     DW      ?                       ;START OF PAGE 2
F909 ??                     51    LP21    DB      ?                       ;LENGTH OF PAGE 2 LOW
F90A ??                     52    LP22    DB      ?                       ;  "  "  "  2 HIGH
F90B ??                     53    INVFLG  DB      ?
                            54
----                        55    DATA    ENDS
                            56
                            57 +1 $ EJECT
```

BOOTER_IO_DRIVER

```
LOC  OBJ              LINE    SOURCE

                       58
                       59
                       60
                       61     PUBLIC          KEYINP,KYLOOK,MODCRT,SETCU,CALCHR,DISPL,L_13,DISPL1
                       62     PUBLIC          DISPLAY
                       63
----                   64     BOOTER          SEGMENT BYTE COMMON 'CODE'
                       65
                       66
                       67             ASSUME  DS:DATA,CS:BOOTER,SS:DATA,ES:DATA
                       68
0250                   69             ORG     250H
                       70
                       71
                       72     ; *** "OUT" EQUATES ***
                       73     ; ********************
                       74
 0010                  75     RAMSEL  EQU     10H                     ;RAMS SELECT
 0011                  76     ROMSEL  EQU     11H                     ;ROM SELECT
                       77
                       78
                       79
                       80     ;****************************************
                       81     ;
                       82     ;  DRIVER FOR KEYBOARD-CONTROLLER 8741
                       83     ;
                       84     ;****************************************
                       85
                       86
                       87     ; *** "IN/OUT" EQUATES ***
                       88     ;     ****************
                       89
 0040                  90     KEYDAT  EQU     40H                     ;READ KEYBOARD DATA
 0041                  91     KEYSTA  EQU     41H                     ;READ     "     STATUS
                       92
                       93
0250 E441              94     KEYINP: IN      AL,KEYSTA
0252 D0D8              95             RCR     AL,1
0254 73FA              96             JNC     KEYINP
0256 E440              97             IN      AL,KEYDAT               ;READ KEYBOARD-CHARACTER
0258 C3                98             RET
                       99
0259 E441             100     KYLOOK: IN      AL,KEYSTA
025B 2401             101             AND     AL,1
025D 7501             102             JNZ     SHORT L_1
025F C3               103             RET
0260 E440             104     L_1:    IN      AL,KEYDAT
0262 C3               105             RET
                      106
                      107
                      108     ;********************************
                      109     ;
                      110     ;         CRT-ROUTINES
                      111     ;
                      112     ;********************************
                      113
                      114
                      115
                      116
                      117     ; *** CONTROL CHARACTER EQUATES ***
                      118     ;     ************************
                      119
 0000                 120     NOMOV   EQU     00H                     ;NO CURSOR MOVE
```

```
LOC  OBJ              LINE    SOURCE

 002A                  121    PROMPT  EQU     2AH
 0020                  122    SPACE   EQU     20H
 0088                  123    NEWL    EQU     88H
 0001                  124    HOME    EQU     01H
 000C                  125    SCRER   EQU     0CH
 0088                  126    RUBOUT  EQU     8BH
                       127
                       128
                       129
                       130    ;************************************************
                       131    ;
                       132    ;               GDC-EQUATES
                       133    ;
                       134    ;************************************************
                       135
                       136
 0050                  137    CHARA   EQU     80                      ;80 CHARACTER/LINE
                       138
                       139
                       140    ;       *** GDC PORT EQUATES ***
                       141    ;          .***************
                       142
 00A1                  143    GDCCOM  EQU     0A1H                    ;WRITE COMMAND
 00A0                  144    GDCSTA  EQU     0A0H                    ;READ STATUS
 00A0                  145    GDCPAR  EQU     0A0H
                       146
                       147    ;       *** GDC STATUS EQUATES ***
                       148    ;           ******************
                       149
 0002                  150    FIFULL  EQU     02H                     ;FIFO IS FULL
                       151
                       152    ;       *** GDC COMMAND EQUATES ***
                       153    ;           ******************
                       154
 006B                  155    START   EQU     6BH                     ;START DISPLAY/END IDLE-MODE
 0049                  156    CURS    EQU     49H                     ;SPECIFY CURSOR-POSITION
 004A                  157    MASK_   EQU     4AH                     ;LOAD MASK-REGISTER
 004C                  158    FIGS    EQU     4CH                     ;SPECIFY FIGURE DRAWING-PARAMETER
 0070                  159    PRAM    EQU     70H                     ;LOAD PARAMETER-RAM
 0020                  160    WDAT    EQU     20H                     ;WRITE DATA INTO DISPLAY MEMORY
                       161                                            ;(COMMAND+TYPE+MODE)
 0000                  162    TYWORD  EQU     00H                     ;DATA TRANSFER BYTES
                       163                                            ;MODE OF RMW MEMORY CYCLE
 0000                  164    MOREPL  EQU     00H                     ;REPLACE WITH PATTERN
                       165
                       166
                       167
                       168
 3 55                  169    MODCRT: PUSH    BP
 4 56                  170            PUSH    SI
 5 57                  171            PUSH    DI
 6 53                  172            PUSH    BX
 7 51                  173            PUSH    CX
 8 52                  174            PUSH    DX
 9 9C                  175            PUSHF
 A 50                  176            PUSH    AX                      ;SAVE ASCII-CHARACTER
                       177
                       178    ; *** CHECK IF ANY CONTROL CHARACTER ***
                       179    ;    ******************************
                       180
 3 A8F0                181            TEST    AL,0F0H
 ) 7438                182            JZ      SHORT SETCHA
 : 3C00                183            CMP     AL,NOMOV
```

BOOTER_IO_DRIVER

```
LOC  OBJ              LINE    SOURCE

0271 7457              184            JE      GETRE                ;NO CURSOR MOVE
0273 3C0B              185            CMP     AL,NEWL
0275 740A              186            JE      SHORT CARRET         ;CARRIDGE RETURN
0277 3CD1              187            CMP     AL,HOME
0279 7420              188            JE      SHORT CHP            ;HOME POSITION
027B 3C0C              189            CMP     AL,SCRER
027D 7423              190            JE      SHORT SCERA          ;SCREEN ERASE
027F EB26              191            JMP     SHORT SETCHA         ;SET CHARACTER INTO CRT-BUFFER DEPENDING
                       192
0281 C606000F00    R   193    CARRET: MOV     CURSX,0
0286 A001F8        R   194            MOV     AL,CURSY
0289 FEC0              195            INC     AL
028B 3C19              196            CMP     AL,25
028D 7507              197            JNE     CAR1
028F 50                198            PUSH    AX
0290 E88700            199            CALL    SCROLM
0293 58                200            POP     AX
0294 FEC8              201            DEC     AL
0296 A201F8        R   202    CAR1:   MOV     CURSY,AL
0299 EB2F              203            JMP     SHORT GETRE
                       204
                       205    ;       *** CURSOR HOME POSITION ***
                       206    ;           ********************
                       207
029B 33C0              208    CHP:    XOR     AX,AX
029D A300F8        R   209            MOV     WORD PTR CURSX,AX
02A0 EB28              210            JMP     SHORT GETRE
                       211
                       212    ; *** SCREEN ERASE ***
                       213    ;
02A2 E88800            214    SCERA:  CALL    MCLSCR
02A5 EBF4              215            JMP     CHP
                       216
                       217    ; *** SET CHARACTER ***
                       218    ;
02A7 A100F8        R   219    SETCHA: MOV     AX,WORD PTR CURSX
02AA 3C50              220            CMP     AL,80                ;END OF LINE ?
02AC 7504              221            JNZ     SHORT CHA1
02AE 32C0              222            XOR     AL,AL
02B0 FEC4              223            INC     AH                   ;INCREMENT CURSY
02B2 80FC19            224    CHA1:   CMP     AH,25
02B5 7507              225            JNZ     SHORT CHA2           ;END OF SCREEN ?
02B7 50                226            PUSH    AX                   ;AH = Y POSITION
02B8 E88F00            227            CALL    SCROLM               ;AL = X POSITION
02BB 58                228            POP     AX
02BC FECC              229            DEC     AH
02BE 88C8              230    CHA2:   MOV     CX,AX                ;(CX = Y AND X POSITION
02C0 FEC0              231            INC     AL                   ;NEXT CURS POSTION
02C2 A300F8        R   232            MOV     WORD PTR CURSX,AX
02C5 58                233            POP     AX                   ;RESTORE ASCII CHARACTER
02C6 50                234            PUSH    AX
02C7 E80900            235            CALL    WRNCHR               ;(A) = ASCII CHARACTER
                       236                                         ;(B)=Y-POS,(C) = X-POS
02CA 58                237    GETRE:  POP     AX
02CB 9D                238            POPF
02CC 5A                239            POP     DX
02CD 59                240            POP     CX
02CE 5B                241            POP     BX
02CF 5F                242            POP     DI
02D0 5E                243            POP     SI
02D1 5D                244            POP     BP
02D2 C3                245            RET
                       246
```

```
LOC  OBJ                  LINE    SOURCE

                           247
                           248    ;*****************************************
                           249    ;
                           250    ;       G D C  DRIVER ROUTINES
                           251    ;
                           252    ;*****************************************
                           253
                           254
                           255    ;ENTRY: (AL) = ASCII CHARACTER
                           256    ;       (CH) = Y-POSITION
                           257    ;       (CL) = X-POSITION
                           258
0203 53                    259    WRMCHR: PUSH    BX
0204 52                    260            PUSH    DX
0205 51                    261            PUSH    CX
0206 50                    262            PUSH    AX
                           263
0207 E82C00                264            CALL    CALCHR                  ;CALCULATE CHARACTER-POS.
020A E8FC00                265            CALL    SETCU
020D E81300                266            CALL    SETCCA                  ;SEND CHARACTER
02E0 B020                  267            MOV     AL,WDAT+TYWORD+MOREPL
02E2 E82E01                268            CALL    OUTCMD
02E5 58                    269            POP     AX                      ;(A)=ASCII-CHARACTER
02E6 E83301                270            CALL    OUTPAR
02E9 A00BF9          R     271            MOV     AL,INVFLG               ;FETCH ATTRIBUT
02EC E82A01                272            CALL    OUTPAR
02EF 59                    273            POP     CX
02F0 5A                    274            POP     DX
02F1 5B                    275            POP     BX
02F2 C3                    276            RET
                           277
                           278
02F3 E8C400                279    SETCCA: CALL    SETMSK
02F6 B04C                  280            MOV     AL,FIGS
02F8 E81801                281            CALL    OUTCMD
02FB B002                  282            MOV     AL,2
02FD E81901                283            CALL    OUTPAR
0300 32C0                  284            XOR     AL,AL
0302 E81401                285            CALL    OUTPAR
0305 C3                    286            RET
                           287
0306                       288    CALCHR:
0306 F706603F9FFFF   R     289            TEST    SP1,0FFFFH
030C 750C                  290            JNZ     SHORT CALCH1
030E B050                  291            MOV     AL,80                   ;Y*80 + X = (CEADL)
0310 F6E5                  292            MUL     CH                      ;(CH)= Y-POS
0312 B500                  293    CALCH2: MOV     CH,0
0314 03C1                  294            ADD     AX,CX
0316 A300F9          R     295            MOV     WORD PTR CEADL,AX
0319 C3                    296            RET
                           297
031A                       298    CALCH1:                                 ;(CH)=Y-POS
031A B050                  299            MOV     AL,80
031C F6E5                  300            MUL     CH                      ;Y * 80
031E 030603F9        R     301            ADD     AX,SP1                  ;(SP1) + (Y*80)=AX
0322 BA0007                302            MOV     DX,25*80
0325 3BC2                  303            CMP     AX,DX
0327 72E9                  304            JB      CALCH2
0329 2BC2                  305            SUB     AX,DX
032B EBE5                  306            JMP     CALCH2
                           307
                           308
                           309
```

BOOTER_IO_DRIVER

```
LOC  OBJ                LINE    SOURCE

                        310     ;       **** CLEAR SCREEN ****
                        311     ;            ************
                        312
                        313
0320 E86F00             314     MCLSCR: CALL    SETCR                   ;SET CURSOR IN HOME-POS.
0330 E80700             315             CALL    CLRL                    ;CLEAR SCREEN
0333 E85800             316             CALL    INIT1A
0336 E88800             317             CALL    SCROL1                  ;SET PARTITION
0339 C3                 318             RET
                        319
                        320
033A B020               321     CLRL:   MOV     AL,VDAT+TYWORD+MOREPL
033C E80400             322             CALL    OUTCMD
033F B020               323             MOV     AL,' '                  ;SPACE-WRITE
0341 E80500             324             CALL    OUTPAR
0344 32C0               325             XOR     AL,AL
0346 E80000             326             CALL    OUTPAR                  ;CLEAR ATTRIB.
0349 C3                 327             RET
                        328
                        329
                        330
                        331     ;       **** SCROLL SCREEN ****
                        332     ;            *************
                        333
                        334
034A 8B1E03F9       R   335     SCROLM: MOV     BX,SP1
034E 891E00F9       R   336             MOV     WORD PTR CEADL,BX
0352 E88400             337             CALL    SETCU                   ;SET CURSOR
0355 E86200             338             CALL    SETMSK                  ;SET WORD-TRANSFER
                        339
0358 B04C               340             MOV     AL,FIGS                 ;SET LENGTH (80-CHAR)
035A E88600             341             CALL    OUTCMD  ;FOR DELETE 1 LINE
035D B002               342             MOV     AL,2
035F E88700             343             CALL    OUTPAR
0362 B04F               344             MOV     AL,80-1
0364 E88200             345             CALL    OUTPAR
0367 32C0               346             XOR     AL,AL
0369 E8AD00             347             CALL    OUTPAR
                        348
036C E8C8FF             349             CALL    CLRL                    ;CLEAR LAST LINE
036F 8B1E00F9       R   350             MOV     BX,WORD PTR CEADL       ;SET CURSOR
0373 E86300             351             CALL    SETCU
                        352
0376 830603F950     R   353             ADD     SP1,80                  ;POINTER + 80-CHAR.
                        354
037B A006F9         R   355             MOV     AL,LP12
037E FEC8               356             DEC     AL                      ;LENGTH1 - 1
0380 7503               357             JNZ     SHORT L_31
0382 E87D90             358             JMP     INI10
0385                    359     L_31:
0385 A206F9         R   360             MOV     LP12,AL
                        361
0388 FE060AF9       R   362             INC     LP22                    ;LENGTH2 + 1
038C EB63               363             JMP     SHORT SCROL1
                        364
                        365
                        366
                        367
                        368
038E 33C0               369     INIT1A: XOR     AX,AX
0390 A303F9         R   370             MOV     SP1,AX
0393 A307F9         R   371             MOV     SP2,AX
0396 A20AF9         R   372             MOV     LP22,AL
```

```
LOC  OBJ              LINE    SOURCE

0399 C606F919    R     373            MOV     LP12,25
039E C3                374            RET
                       375
039F E82600            376    SETCR:  CALL    CUHOM1                  ;WHOLE GRAPHIC HOME
03A2 E81500            377            CALL    SETMSK
03A5 B04C              378            MOV     AL,FIGS                 ;SET DIRECTION AND NUMBER AND WORDS
03A7 E86900            379            CALL    OUTCMD
03AA B002              380            MOV     AL,2                    ;DIR = 2
03AC E86A00            381            CALL    OUTPAR
03AF B0FF              382            MOV     AL,0FFH                 ;LENGTH 16K WORD
03B1 E86500            383            CALL    OUTPAR
03B4 B03F              384            MOV     AL,3FH                  ;HIGH BYTE
03B6 E86000            385            CALL    OUTPAR
03B9 C3                386            RET
                       387
03BA B04A              388    SETMSK: MOV     AL,MASK_                ;SET MASK TO STORED VALUES
03BC E85400            389            CALL    OUTCMD
03BF B0FF              390            MOV     AL,0FFH                 ;LOAD LOW BYTE
03C1 E85500            391            CALL    OUTPAR
03C4 E85200            392            CALL    OUTPAR
03C7 C3                393            RET
                       394
03C8 B049              395    CUHOM1: MOV     AL,CURS
03CA E84600            396            CALL    OUTCMD  ;CURSOR HOME
03CD 32C0              397            XOR     AL,AL
03CF E84700            398            CALL    OUTPAR
03D2 E84400            399            CALL    OUTPAR
03D5 E84100            400            CALL    OUTPAR
03D8 C3                401            RET
                       402
03D9 B049              403    SETCU:  MOV     AL,CURS
03DB E83500            404            CALL    OUTCMD                  ;SET CURSOR
03DE A000F9      R     405            MOV     AL,CEADL                ;LOW BYTE OF CURSOR
03E1 E83500            406            CALL    OUTPAR
03E4 A001F9      R     407            MOV     AL,CEADH                ;HIGH BYTE OF CURSOR
03E7 E82F00            408            CALL    OUTPAR
03EA A002F9      R     409            MOV     AL,CDAD                 ;POSITION OF PIXEL
03ED E82900            410            CALL    OUTPAR
03F0 C3                411            RET
                       412
03F1 B070              413    SCROL1: MOV     AL,PRAM+0
03F3 E81D00            414            CALL    OUTCMD                  ;SET START AND LENGTH OF
03F6 B90800            415            MOV     CX,8                    ;PAGE 1 AND PAGE 2
03F9 8D1E03F9    R     416            LEA     BX,SP1
03FD E82A00            417            CALL    SEMPAR
0400 C3                418            RET
                       419
0401 33C0              420    INI10:  XOR     AX,AX
0403 A303F9      R     421            MOV     SP1,AX
0406 A307F9      R     422            MOV     SP2,AX                  ;START OF PAGE 1 = 0
0409 A20AF9      R     423            MOV     LP22,AL                 ;LENGTH OF PAGE 2 = 0
040C C606F919    R     424            MOV     LP12,25                 ;LENGTH OF PAGE 1 = 25
0411 EBDE              425            JMP     SCROL1
                       426
                       427
                       428    ;       *** SUBROUTINES OF GDC ***
                       429    ;           ******************
                       430
0413 E80900            431    OUTCMD: CALL    FIFRDY                  ;PUT A COMMAND IN FIFO
0416 E6A1              432            OUT     GDCCOM,AL
0418 C3                433            RET
                       434
0419 E80300            435    OUTPAR: CALL    FIFRDY                  ;PUT A PARAMETER TO FIFO
```

BOOTER_IO_DRIVER

```
LOC  OBJ              LINE    SOURCE

041C E6A0              436            OUT     GDCPAR,AL
041E C3                437            RET
                       438
041F 9C                439    FIFRDY: PUSHF
0420 50                440            PUSH    AX
0421 E4A0              441    FIFO10: IN      AL,GDCSTA               ;READ GDC-STATUS
0423 2402              442            AND     AL,FIFULL
0425 75FA              443            JNZ     FIFO10                  ;JUMP IF FIFO FULL
0427 58                444            POP     AX
0428 9D                445            POPF
0429 C3                446            RET
                       447
                       448
042A                   449    SENPAR:
042A 8A07              450            MOV     AL,[BX]                 ;LOAD PARAMETER
042C E8EAFF            451            CALL    OUTPAR                  ;OUTPUT PARAMETER
042F 43                452            INC     BX
0430 E2F8              453            LOOP    SENPAR                  ;LOOP UNTIL END OF PARAMETER-LIST
0432 C3                454            RET
                       455
                       456
                       457    ;*********************************************************
                       458    ;
                       459    ;                 SUBROUTINES
                       460    ;
                       461    ;*********************************************************
                       462
                       463
                       464    ;     *** DISPLAY ROUTINE ***
                       465    ;         ***************
                       466
0433 2E8A2F            467    DISPL:  MOV     CH,CS:[BX]
0436 43                468    L_13:   INC     BX
0437 2E8A07            469            MOV     AL,CS:[BX]
043A E826FE            470            CALL    MODCRT
043D FECD              471            DEC     CH
043F 75F5              472            JNZ     L_13
0441 43                473            INC     BX
0442 C3                474            RET
                       475
0443 8A07              476    DISPL1: MOV     AL,[BX]
0445 E818FE            477            CALL    MODCRT
0448 43                478            INC     BX
0449 E2F8              479            LOOP    DISPL1
044B C3                480            RET
                       481
044C                   482    DISPLAY PROC FAR
                       483
044C 8A0F              484            MOV     CL,[BX]
044E 32ED              485            XOR     CH,CH
0450 43                486    DISP_N: INC     BX
0451 8A07              487            MOV     AL,[BX]
0453 E80DFE            488            CALL    MODCRT
0456 E2F8              489            LOOP    DISP_N
0458 CB                490            RET
                       491
                       492    DISPLAY ENDP
                       493
```

XREF SYMBOL TABLE LISTING
---- ------ ----- -------

```
NAME     TYPE     VALUE  ATTRIBUTES, XREFS

??SEG .  SEGMENT         SIZE=0800H PARA PUBLIC
BOOTER.  SEGMENT         SIZE=0459H BYTE  COMMON 'CODE'  64# 67 494
BUFFER.  V WORD   0000H  DATA  30#
BUFSTA.  V BYTE   F830H  DATA  40#
CALCH1.  L NEAR   031AH  BOOTER  290 298#
CALCH2.  L NEAR   0312H  BOOTER  293# 304 306
CALCHR.  L NEAR   0306H  BOOTER PUBLIC  61 264 288#
CAR1. .  L NEAR   0296H  BOOTER  197 202#
CARRET.  L NEAR   0281H  BOOTER  186 193#
CDAD. .  V BYTE   F902H  DATA  46# 409
CEADH .  V BYTE   F901H  DATA  45# 407
CEADL .  V BYTE   F900H  DATA  44# 295 336 350 405
CHA1. .  L NEAR   02B2H  BOOTER  221 224#
CHA2. .  L NEAR   02BEH  BOOTER  225 230#
CHARA .  NUMBER   005DH    137#
CHP . .  L NEAR   029BH  BOOTER  188 208# 215
CLRL. .  L NEAR   033AH  BOOTER  315 321# 349
CUHOM1.  L NEAR   03C8H  BOOTER  376 395#
CURS. .  NUMBER   0049H    156# 395 403
CURSX .  V BYTE   F800H  DATA  35# 193 209 219 232
CURSY .  V BYTE   F801H  DATA  36# 194 202
DATA. .  SEGMENT         SIZE=F90CH WORD  COMMON 'DATA'  28# 55 67 67 67
DISP_M.  L NEAR   0450H  BOOTER  486# 489
DISPL .  L NEAR   0433H  BOOTER PUBLIC  61 467#
DISPL1.  L NEAR   0443H  BOOTER PUBLIC  61 476# 479
DISPLAY  L FAR    044CH  BOOTER PUBLIC  62 482# 492
FIFO1O.  L NEAR   0421H  BOOTER  441# 443
FIFRDY.  L NEAR   041FH  BOOTER  431 435 439#
FIFULL.  NUMBER   0002H    150# 442
FIGS. .  NUMBER   004CH    158# 280 340 378
GDCCOM.  NUMBER   00A1H    143# 432
GDCPAR.  NUMBER   00A0H    145# 436
GDCSTA.  NUMBER   00A0H    144# 441
GETRE .  L NEAR   02CAH  BOOTER  184 203 210 237#
HOME. .  NUMBER   0001H    124# 187
INI1O .  L NEAR   04D1H  BOOTER  358 420#
INIT1A.  L NEAR   038EH  BOOTER  316 369#
INVFLG.  V BYTE   F9CBH  DATA  53# 271
KEYDAT.  NUMBER   0040H    90# 97 104
KEYIMP.  L NEAR   0250H  BOOTER PUBLIC  61 94# 96
KEYSTA.  NUMBER   0041H    91# 94 100
KYLOOK.  L NEAR   0259H  BOOTER PUBLIC  61 100#
L_1 , .  L NEAR   0260H  BOOTER  102 104#
L_13. .  L NEAR   0436H  BOOTER PUBLIC  61 468# 472
L_31. .  L NEAR   0385H  BOOTER  357 359#
LP11. .  V BYTE   F905H  DATA  48#
LP12. .  V BYTE   F906H  DATA  49# 355 360 373 424
LP21. .  V BYTE   F909H  DATA  51#
LP22. .  V BYTE   F90AH  DATA  52# 362 372 423
M . . .  V BYTE   0000H  DATA  31#
MASK_ .  NUMBER   004AH    157# 388
MCL5CR.  L NEAR   032DH  BOOTER  214 314#
MODCRT.  L NEAR   0263H  BOOTER PUBLIC  61 169# 470 477 488
MOREPL.  NUMBER   0000H    164# 267 321
NEWL. .  NUMBER   0088H    123# 185
NOMOV .  NUMBER   0000H    120# 183
OUTCMD.  L NEAR   0413H  BOOTER  268 281 322 341 379 389 396 404 414 431#
OUTPAR.  L NEAR   0419H  BOOTER  270 272 283 285 324 326 343 345 347 381 383 385 391 392 398 399 400 406 408 410 435#
```

BOOTER_IO_DRIVER

```
NAME     TYPE     VALUE  ATTRIBUTES, XREFS

PRAM. .  NUMBER   0070H    159# 413
PROMPT.  NUMBER   002AH    121#
RAMSEL.  NUMBER   0010H    75#
ROMSEL.  NUMBER   0011H    76#
RUBOUT.  NUMBER   0088H    126#
SCERA .  L NEAR   02A2H  BOOTER  190 214#
SCRER .  NUMBER   000CH    125# 189
SCROL1.  L NEAR   03F1H  BOOTER  317 363 413# 425
SCROLM.  L NEAR   034AH  BOOTER  199 227 335#
SEMPAR.  L NEAR   042AH  BOOTER  417 449# 453
SETCCA.  L NEAR   02F3H  BOOTER  266 279#
SETCHA.  L NEAR   02A7H  BOOTER  182 191 219#
SETCR .  L NEAR   0399H  BOOTER  314 376#
SETCU .  L NEAR   0309H  BOOTER PUBLIC  61 265 337 351 483#
SETMSK.  L NEAR   03BAH  BOOTER  279 338 377 388#
SP1 . .  V WORD   F903H  DATA  47# 289 301 335 353 370 416 421
SP2 . .  V WORD   F907H  DATA  50# 371 422
SPACE .  NUMBER   0020H    122#
START .  NUMBER   0868H    155#
TYWORD.  NUMBER   0000H    162# 267 321
WDAT. .  NUMBER   0020H    160# 267 321
WRMCHR.  L NEAR   02D3H  BOOTER  235 259#

END OF SYMBOL TABLE LISTING
```

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Thank You

NCR

NCR DECISION MATE V SYSTEM TECHNICAL MANUAL

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	Clarity	Accuracy	Organi-zation	Complete-ness	Usability
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Good (Could Use Minor Improvements)					
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Technical Publications Department
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Federal Republic of Germany

NCR DECISION MATE V

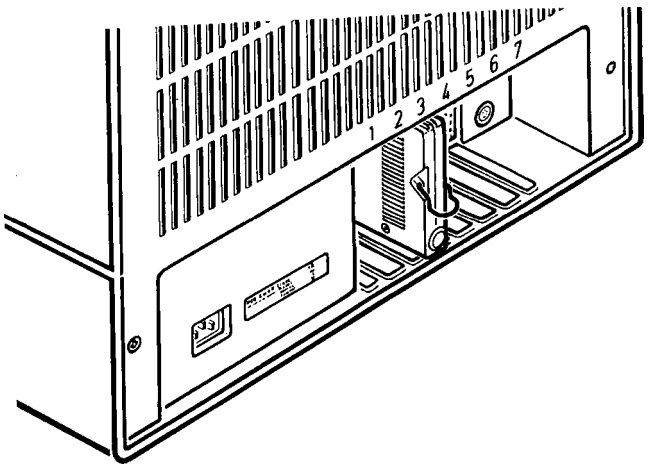
LEERADAPTER
(K214-V001)

Das beiliegende Blatt erklärt Ihnen, wie Sie diese Leistungserweiterung an Ihren NCR DECISION MATE V anschließen können. Bitte ordnen Sie diese Beschreibung in Ihre Bedienungsanleitung für den NCR DECISION MATE V ein.

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LEERADAPTER
(K214-V001)

Dieser Adapter enthält eine leere Platine und Stifte fü
alle Anschlußmöglichkeiten einer beliebigen Steckfassung a
der Rückseite Ihres NCR DECISION MATE V.



KIT INSTALLATION

for

BLANK INTERFACE

(K214-V001)

The attached pages provide information for installing thi
kit into an NCR DECISION MATE V. These pages should be file
in your NCR DECISION MATE V User Information Manual.

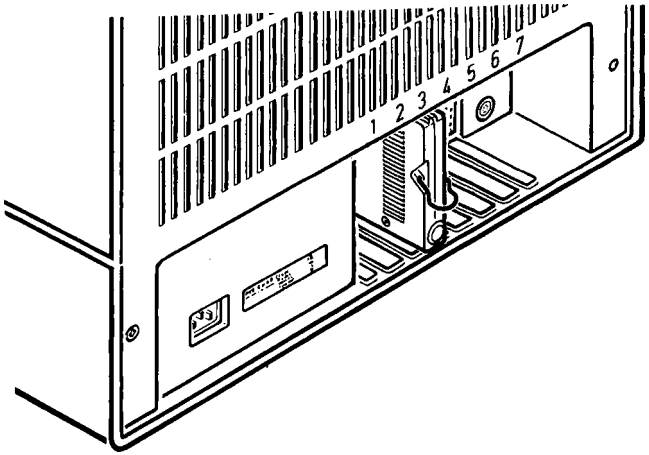
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KIT INSTALLATION

BLANK INTERFACE
(K 214-V001)

1. The interface provided by this kit may be put into a vacant slot at the rear of the NCR DECISION MATE V (slots 2 to 6 may be used).
2. Check with the supplier of the interface for any further installation procedures.



NCR DECISION MATE V

IEEE-488 ADAPTER (K804-V001)

Die beiliegenden Seiten zeigen Ihnen, wie Sie diese Leistungserweiterung an Ihren NCR DECISION MATE V anschließen können. Bitte ordnen Sie diese Beschreibung in Ihre Bedienungsanleitung für den NCR DECISION MATE V ein.

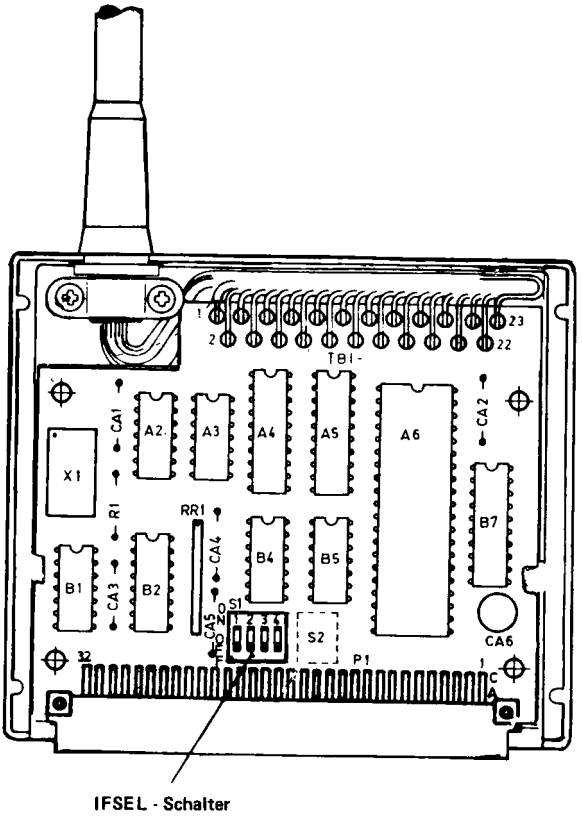
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IEEE-488 ADAPTER
(K804-V001)

Dieser Adapter erlaubt den Anschluß von Peripheriegeräten die einen IEEE-488 Bus verwenden. Der IEEE-488 Bus muß de Norm "IEEE-488 Standard Digital Interface for Programmabl Instrumentation ANSI/IEEE Std 488-1978, 488A-1980" genügen.

1. Die Standardvoreinstellung für die IFSEL-Schalter ist 2B Falls Ihr System diese Einstellung erwartet, können Sie bei 3. weiterlesen.
2. Um die Einstellung der IFSEL-Schalter zu verändern müssen Sie die vier Gehäuseschrauben lösen und die Gehäusehälfte abnehmen. Stellen Sie anhand de nachstehenden Tabelle die Schalter auf den von Ihne gewünschten Wert ein.

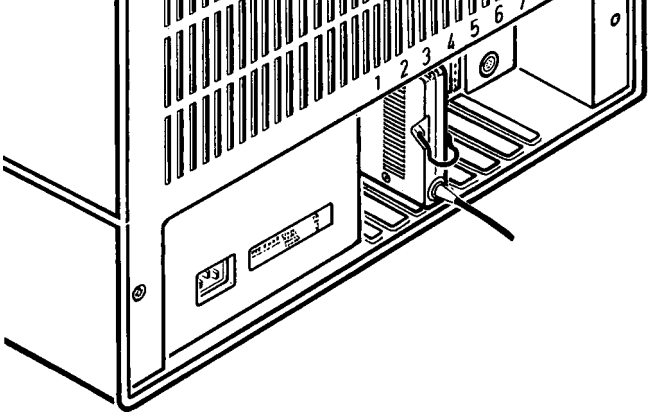


IFSEL - Schalter

IFSEL	SCHALTER 4 2 1 A	PORT-ADRESSE
0A	o o o ●	60H - 67H
0B	o o o o	68H - 6FH
1A	o o ● ●	70H - 77H
1B	o o ● o	78H - 7FH
2A	o ● o ●	30H - 37H
2B	o ● o o	38H - 3FH
3A	o ● ● ●	B0H - B7H
3B	o ● ● o	B8H - BFH
4A	● o o ●	C0H - C7H
4B	● o o o	C8H - CFH
o = offen ● = geschlossen		

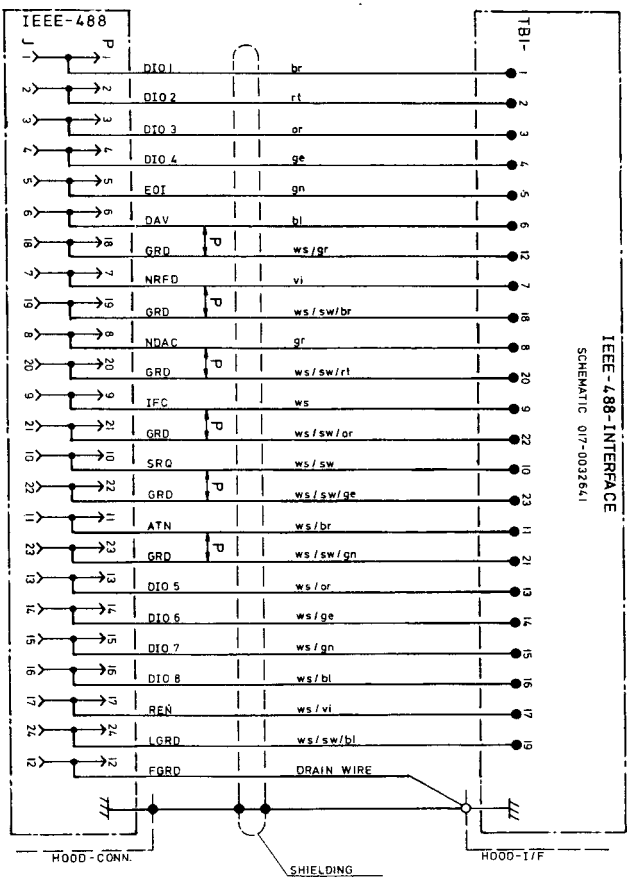
Für die Einstellung der Schalter ist der Aufkleber in der Gehäusehälfte maßgeblich. Der Aufdruck auf den Schaltern ist nicht gültig.

3. Bauen Sie den Adapter wieder zusammen und schließen Sie ihn an einen der Steckplätze **2 bis 6** Ihres NCR DECISION MATE V an.



4. Schließen Sie den Stecker am Kabelende an das IEEE-48 kompatible Gerät an. Falls Sie hierzu zusätzliche Kabe verwenden, sollten Sie darauf achten, daß diese der Nor entsprechen.
5. Prüfen Sie anhand der Dokumentation Ihres Peripheriege rätes, ob ggf. weitere Anpassungen erforderlich sin (Talker/Listener Adresse).
6. Anhand der Beschreibung Ihrer IEEE-488-Software-Unter stützung können Sie deren Anpassung vornehmen.

Nachstehend finden Sie den Schaltplan des IEEE-488 Kabel und eine Übersicht der verwendeten Signale.



Die Übertragungsleitungen vom IEEE-488 Bus sind in drei Gruppen aufgeteilt:

- Datenbus, 8 Übertragungsleitungen
- Datenübertragungs-Steuer-Bus, 3 Übertragungsleitungen
- Allgemeiner Schnittstellen-Steuer-Bus, 5 Übertragungsleitungen

Datenbus	
DIO1 - DIO8	Die DIO-Leitungen übertragen Daten in paralleler-Bit und serieller-Byte Weise (synchronisiert). Grundsätzlich sind beide Übertragungsrichtungen (E/A) möglich.
Datenübertragungs-Steuer-Bus	
DAV	"Data Valid" zeigt das Vorhandensein und die Gültigkeit der an den DIO Leitungen anstehenden Information an.
NRFD	"Not Ready For Data" zeigt den Status der Datenempfangsbereitschaft angeschlossener Geräte an.
NDAC	"Not Data Accepted" zeigt den Status des Datenempfangs angeschlossener Geräte an.
Die Leitungen DAV, NRFD und NDAC arbeiten in einem verschränkten Drei-Draht-Quittungsbetrieb, um jedes Datenbyte zu übertragen.	

IEEE-488 Bus Signale

Allgemeiner Schnittstellen-Steuer-Bus	
ATN	"Attention" wird von einem "Controller" benutzt, um zu beschreiben, wie die Signale an den DIO Leitungen zu interpretieren sind und welche Geräte angesprochen sind.
IFC	"Interface Clear" wird von einem "Controller" benutzt, um das gesamte Schnittstellensystem (einige Teile hiervon befinden sich in den angeschlossenen Geräten) in einen definierten Ruhezustand zu versetzen.
SRQ	"Service Request" wird von einem Gerät verwendet, um den "Controller" auf sich aufmerksam zu machen und eine Unterbrechung der laufenden Ereignisfolge zu verlangen.
REN	"Remote Enable" wird von einem "Controller" in Verbindung mit anderen Nachrichten verwendet, um zwischen zwei alternativen Datenquellen zur Geräteprogrammierung zu wählen.
EOI	"End Or Identify" wird von einem "Talker" verwendet, um das Ende einer vielfachen Byte-Übertragungsfolge anzuzeigen, oder um in Verbindung mit ATN eine Aufruffolge durchzuführen.

IEEE-488 Bus Signale (Fortsetzung)

KIT INSTALLATION

for

IEEE-488 ADAPTER
(K804-V001)

The attached pages provide information for installing this kit into an NCR DECISION MATE V. These pages should be filed in your NCR DECISION MATE V User Information Manual.

FEDERAL COMMUNICATIONS COMMISSION (FC)
RADIO FREQUENCY INTERFERENCE STATEMET

WARNING

This equipment generates, uses, and can radiate radio frequency energy and it not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Information to User

This equipment must be installed and used in strict accordance with the manufacturer's instructions. However, there is no guarantee that interference to radio communications will not occur in a particular commercial installation. If this equipment does cause interference, which can be determined by turning the equipment off and on, the user is encouraged to consult an NCR service representative immediately.

The NCR Corporation (NCR) is not responsible for any radio or television interference caused by unauthorized modification of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by NCR. The correction of interferences caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

This equipment is designed for use in a commercial environment, not in a residential area. It fully complies with the relevant FCC regulations; when connected to any Class B equipment then the total product is reclassified accordingly.

It is the policy of NCR Corporation to improve products as new technology, components, software, and firmware become available. NCR Corporation, therefore, reserves the right to change specifications without prior notice.

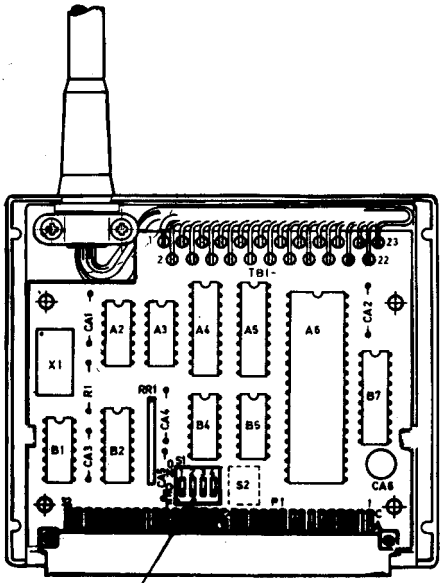
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KIT INSTALLATION

IEEE-488 ADAPTER
(K804-V001)

This kit is designed for use with peripheral devices using the IEEE-488 bus, according to the IEEE-488 Standard Digital Interface for Programmable Instrumentation ANSI/IEEE Std 488-1978, 488A-1980.

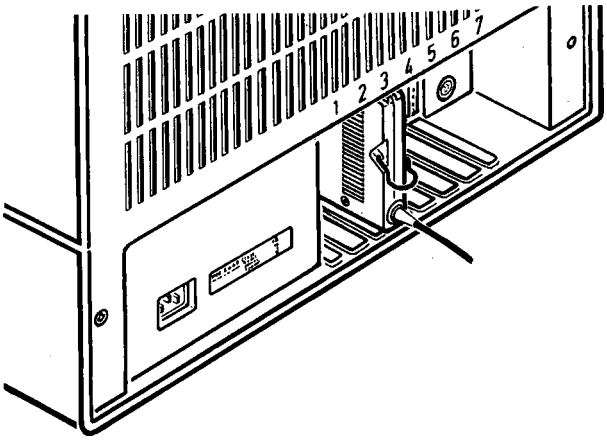
1. The standard setting (default value) for the IFSEL switches is 2B. If your system is using this standard setting, continue at Step 3.
2. To change the IFSEL switch setting, remove the four screws and cover from the adapter. Set the IFSEL switches to the desired configuration; the position of the switch and the possible settings are shown in the following figures.



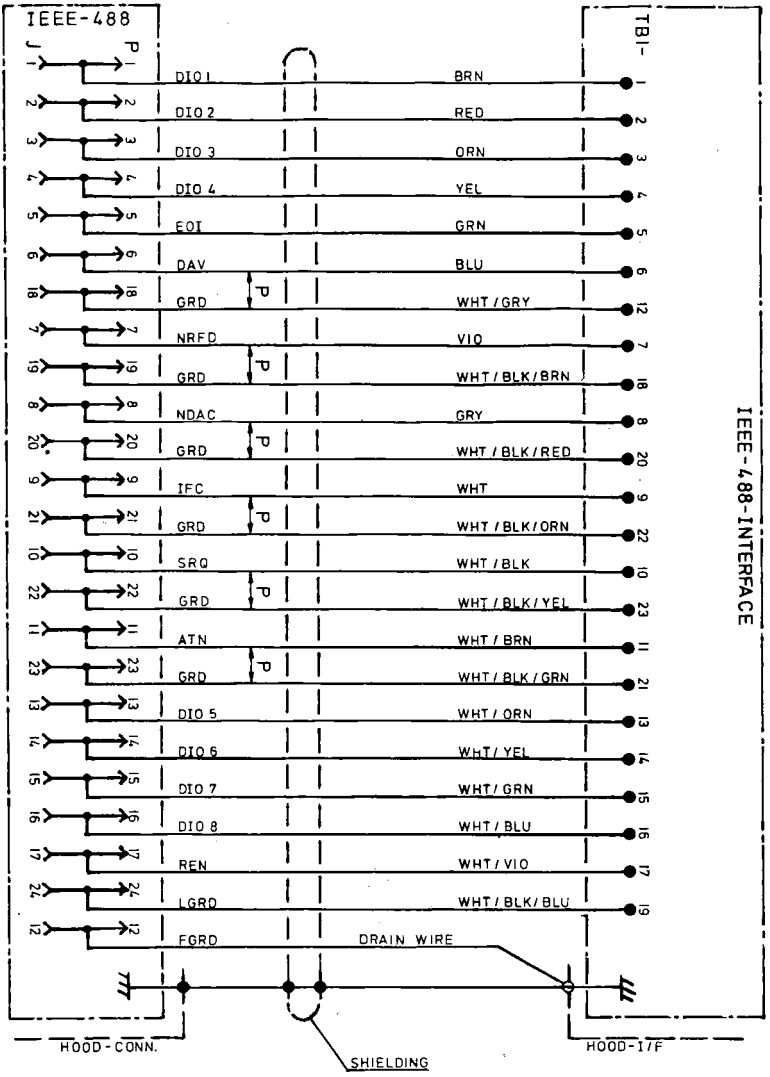
IFSEL	Switch 4 2 1 A	Port Addresses
0A	O O O ●	60-67 Hex
0B	O O O O	68-6F Hex
1A	O O ● ●	70-77 Hex
1B	O O ● O	78-7F Hex
2A	O ● O ●	30-37 Hex
2B	O ● O O	38-3F Hex
3A	O ● ● ●	B0-B7 Hex
3B	O ● ● O	B8-BF Hex
4A	● O O ●	C0-C7 Hex
4B	● O O O	C8-CF Hex
O = Open		● = Closed

Follow instructions inside adapter cover: ignore any markings on switch assembly

3. Install the IEEE-488 adapter into a vacant slot at the rear of the NCR DECISION MATE V (slots 2 to 6 may be used)



4. Connect the plug to the IEEE-488 compatible device; if you are using additional cables be sure that they match the IEEE-488 standards.
5. Check the device documentation for any strapping or switch setting requirements (Talker/Listener address).
6. Refer to the CONFIG description in your IEEE-488 Software Support Package for software installation procedures.


IEEE-488
J
P
DIO 1
DIO 2
DIO 3
DIO 4
EOI
DAV
GRD
NRFD
GRD
NDAC
GRD
IFC
GRD
SRQ
GRD
ATN
GRD
DIO 5
DIO 6
DIO 7
DIO 8
REN
LGRD
FGRD
BRN
RED
ORN
YEL
GRN
BLU
WHT / GRY
VIO
WHT / BLK / BRN
GRY
WHT / BLK / RED
WHT
WHT / BLK / ORN
WHT / BLK
WHT / BLK / YEL
WHT / BRN
WHT / BLK / GRN
WHT / ORN
WHT / YEL
WHT / GRN
WHT / BLU
WHT / VIO
WHT / BLK / BLU
DRAIN WIRE
TB1-
IEEE-488-INTERFACE
HOOD - CONN.
SHIELDING
HOOD - I/F

IEEE Cable

The bus is organized into three sets of signal lines:

- Data bus, 8 signal lines
- Data byte transfer control bus, 3 signal lines
- General interface management bus, 5 signal lines

Data Bus	
DIO1 - DIO8	Data Input Output message bytes are carried on the DIO signal lines in a bit- parallel byte serial form, synchronously, and generally in a bidirectional manner.
Data Byte Transfer Control Bus	
DAV	Data Valid is used to indicate the availability and validity of information on the DIO signal lines.
NRFD	Not Ready For Data is used to indicate the condition of readyness of devices to accept data.
NDAC	Not Data Accepted is used to indicate the condition of acceptance of data by devices.
The DAV NRFD and NDAC signal lines operate in a three wire (interlocked) handshake process to transfer each data byte across the interface.	
General Interface Management Bus	
ATN	Attention is used by a controller to specify how data on the DIO signal lines is to be interpreted and which devices must respond to the data.
IFC	Interface Clear is used by a controller to place the interface system (portions of which are contained in all interconnected devices) in a known quiescent state.
SRQ	Service Request is used by a device to indicate the need for attention, and to request an interruption of the current sequence of events.
REN	Remote Enable is used by a controller in conjunction with other messages to select between two alternate sources of device programming data.
EOI	End Or Identify is used by the talker to indicate the end of a multiple byte transfer sequence or, in conjunction with ATN to execute a polling sequence.

IEEE - 488 Bus Signals

NCR DECISION MATE V

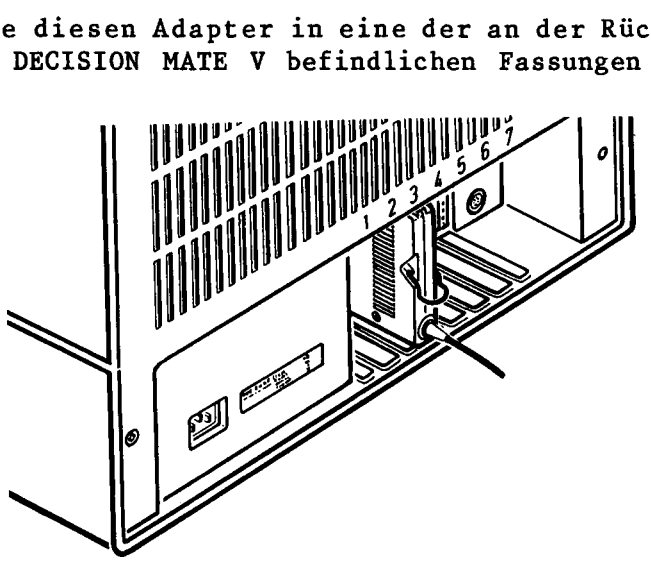
CENTRONICS-ADAPTER
(K210-V001)

Die beiliegenden Seiten zeigen Ihnen, wie Sie diese Lei stungserweiterung an Ihren NCR DECISION MATE V anschließe können. Bitte ordnen Sie diese Beschreibung in Ihre Bedie nungsanleitung für den NCR DECISION MATE V ein.

NCR ist ständig bemüht, die Produkte im Zuge der Entwicklung von Technologie, Bauteilen, Soft- und Firmware dem neuesten Stand anzupassen. NCR behält sich deshalb das Recht vor, Spezifikationen ohne vorherige Ankündigung zu ändern.
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CENTRONICS-ADAPTER
(K210-V001)

1. Setzen Sie diesen Adapter in eine der an der Rückseite Ihres NCR DECISION MATE V befindlichen Fassungen (2...6) ein.

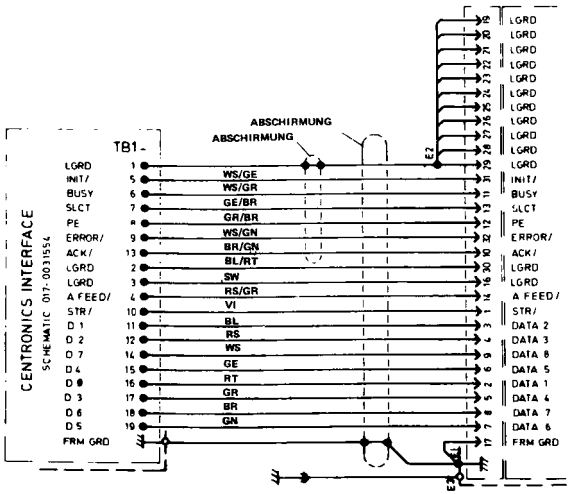


2. Schließen Sie den am Kabelende vorhandenen Stecker an einen Centronics-kompatiblen Drucker an.
3. Das zu Ihrem Drucker gehörende Handbuch beschreibt die Handhabung von Druckpapier und Farbband.
4. Schließen Sie den Drucker an die erforderliche Netzspannung an.

WICHTIG: Der gleichzeitige Betrieb dieses Adapters mit dem Adapter K212 oder K213 ist nicht möglich.

Umseitig finden Sie eine Übersicht der im Rahmen des Übertragungsprotokolls benutzten Leitungen.

STROBE/	Taktfrequenz zur Druckersynchronisierung. Mindesttaktzeit 1 µsec. Empfang erfolgt während Signal-"low".
ACKNLG/	Signal (2.5 bis 10 µsec) zur Datenempfangsbestätigung. Empfang neuer Daten vor Rücksetzung dieses Signals unmöglich.
BUSY	Datenannahme nicht möglich aus einem der folgenden Gründe : - während des Datenempfangs (je nach Drucker) - während des Druckvorgangs - im Off-Line-Zustand - beim Vorliegen eines Fehlerzustandes - während des Zeilenvorschubs
DATA 1-8	Parallele Datenübertragung ("High" = log 1; "Low" = log 0)
PE	"High" zeigt das Papierende an.
SLCT	Signal zeigt Wahlzustand des Druckers an (je nach Drucker)
AUTO FEED/	Automatischer Zeilenvorschub (nicht bei allen Druckern).
INIT/	Computersignal zur Druckerrückstellung (je nach Drucker).
ERROR/	Fehlerzustand des Druckers (z.B. Papierende, Off-Line, o.ä).
TEST 1-4	Eventuell vorhandene Prüfleitungen.



KIT INSTALLATION

for

CENTRONICS ADAPTER
(K210-V001)

The attached pages provide information for installing thi kit into an NCR DECISION MATE V. These pages should be file in your NCR DECISION MATE V User Information Manual.

FEDERAL COMMUNICATIONS COMMISSION (FCC)
RADIO FREQUENCY INTERFERENCE STATEMENT

WARNING

This equipment has been certified to comply with the limits for a Class B computing device, pursuan to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals printers, etc.) certified to comply with the Class B limits may be attached to this computer. Operatio with non-certified peripherals is likely to result in interference to radio and TV reception.

Information to User

This equipment generates and uses radio frequency energy and if not installed and used properly that is, in strict accordance with the manufacturer's instructions, may cause interference to radi and television reception. It has been type tested and found to comply with the limits for a Class computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, whic are designed to provide reasonable protection against such interference in a residential installatio However, there is no guarantee that interference will not occur in a particular installation. If thi equipment does cause interference to radio or television reception, which can be determined b turning the equipment off and on, the user is encouraged to try to correct the interference by one o more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that computer and receiver are on different branc circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician fo additional suggestions. The user may find the following booklet prepared by the Federa Communications Commission helpful: "How to Identify and Resolve Radio-TV Interferenc Problems". This booklet is available from the U.S. Government Printing Office, Washington, D 20402, Stock No. 004-000-00345-4.

The NCR Corporation (NCR) is not responsible for any radio or television interference caused b unauthorized modifications of this equipment or the substitution or attachment of connecting cable and equipment other than those specified by NCR. The correction of interferences caused by suc unauthorized modification, substitution or attachment will be the responsibility of the user.

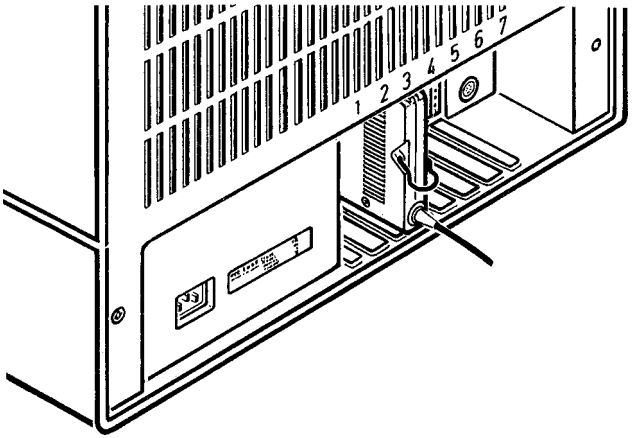
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KIT INSTALLATION

CENTRONICS ADAPTER
(K210-V001)

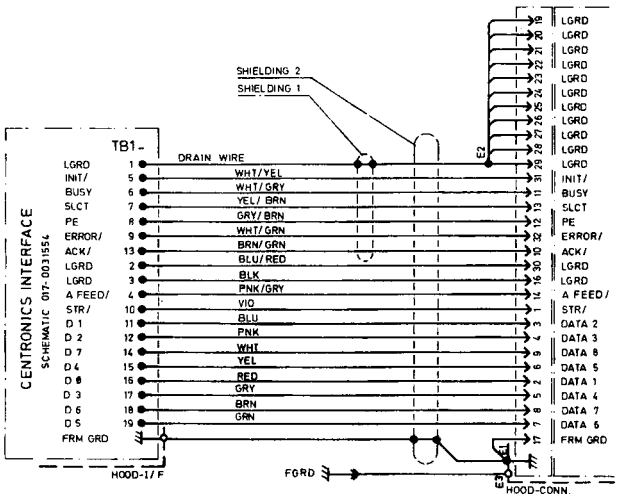
1. Install this kit into a vacant slot at the rear of th NCR DECISION MATE V (slots 2 to 6 may be used).
2. Connect the plug to the Centronics compatible printer.



3. Check the printer documentation for ribbon installatio and paper loading.

NOTE: When this kit is installed, then kits K212 an K213 cannot be installed at the same time.

STROBE/	Pulse is used to clock read data in. The pulse width must be more than 1 µsec at receiving printer. Read in of data is performed at the "low" level of this signal.
ACKNLG/	Indicates that data has been received by the printer. New data cannot be received before ACKNLG is reset. Pulse width 2.5 µsec to 10 µsec.
BUSY	When "HIGH" the printer indicates that it cannot receive data. The signal becomes "HIGH" in the following cases: - During data entry (depending on printer) - During printing operation - In off-line state - During printer error status - During line feed
DATA 1-8	Signals represent information of parallel data "HIGH" = log 1; "LOW" = log 0.
PE	"HIGH" signal indicates that the printer is out of paper.
SLCT	(Input) Printer is in selected mode (option).
AUTO FEED/	(Output) Auto line feed (option).
INIT/	(Output) Printer reset (option).
ERROR/	(Input) Indicates printer error (option) for example at paper end, off-line, safety switch open, failure status.
TEST 1-4	Optional loop test inputs.



NCR DECISION MATE V

16-Bit Microprocessor
with
Programmable Interrupt Controller (PIC) and
Memory Retention Facility
(K235 V001)

FEDERAL COMMUNICATIONS COMMISSION (FCC)
RADIO FREQUENCY INTERFERENCE STATEMENT

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Information to User

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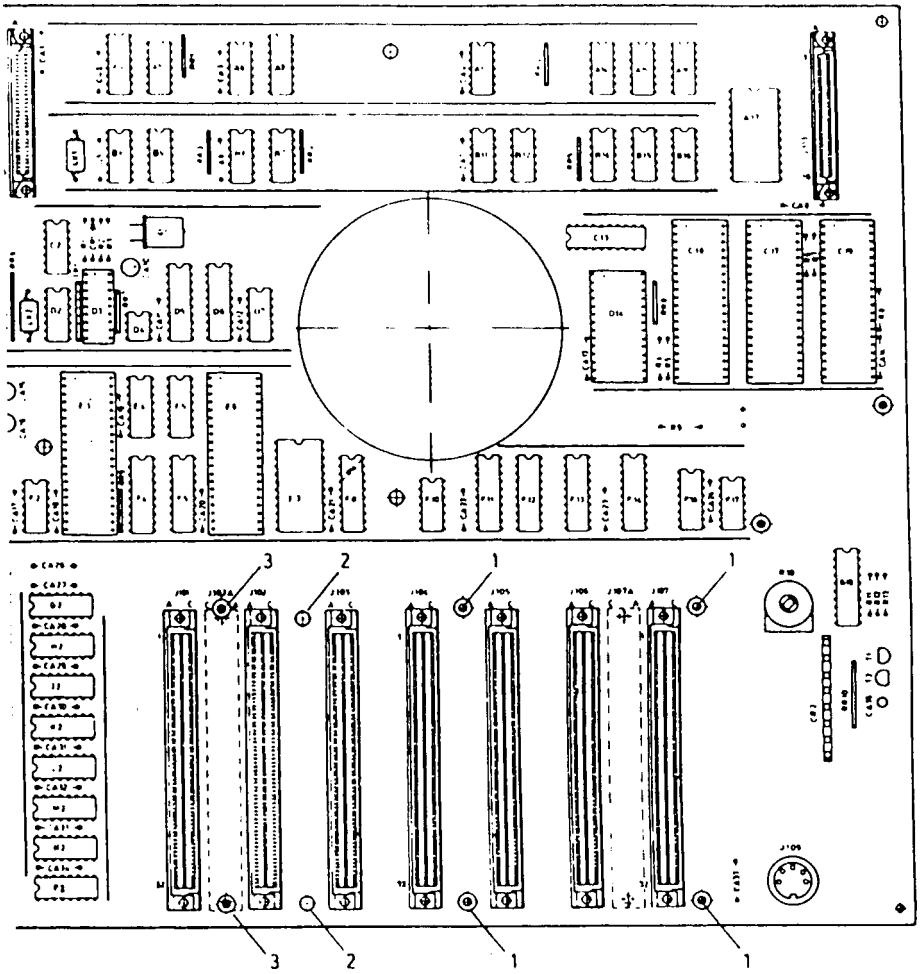


Figure 2: Controller PCB

- Screw
- Additional screws (see text)

2 -- Pre-drilled hole

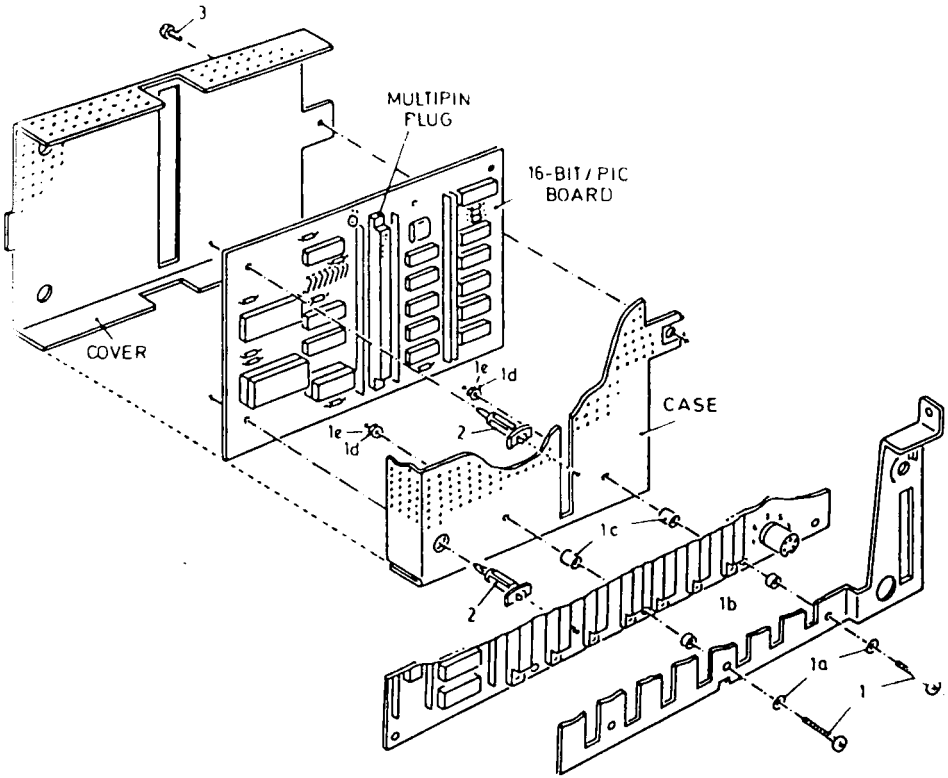


Figure 3: K235 V001 Assembly

1 -- Screw 3x16
1a -- Washer
1b -- Spacer washer
1c -- PVC spacer
1d -- Washer
1e -- Nut

2 -- PVC stand-off clip
3 -- Screw 2.9x6.5

NCR DECISION MATE V

16-Bit Microprocessor
with
Programmable Interrupt Controller (PIC) and
Memory Retention Facility
(K235 V001)

This Kit can be installed in your NCR DECISION MATE V, provided that it is capable of executing the System Restart by means of the CONTROL-F20 key combination (refer to the User Information for the NCR DECISION MATE V).

CAUTION: Installation of this Kit requires knowledge of and experience in handling semiconductor components and other computer hardware. It should therefore be installed by a qualified engineer. The following installation procedures should be carried out only by such a person.

The 16-bit/PIC board contains two wire jumper switches (S1, S2). These must be set to the positions indicated in Figure 1, before installation of the Kit.

Installation of the 16-bit/PIC board on a multilayer board which already contains a 16-bit processor board:

1. Remove the multilayer controller printed circuit board from the computer. This procedure is described in the Service Manual for the NCR DECISION MATE V.

2. Refer to Figure 3 in this description and remove the screw marked 3. Remove the metal cover.

Doc: 017-0033472

4. Refer to Figure 3. Using the longer screws (1) and the additional PVC spacers (1c) provided with the Kit, assemble the metal case onto the controller PCB.

5. Insert the 16-bit/PIC board into the multipin socket which is now protruding into the metal case. Press the multipin plug firmly into the socket. Press the 16-bit/PIC board downwards over the noses of the PVC stand-off clips.

6. Close the case with the metal cover provided and secure it by means of the screw (3) provided with the Kit.

7. Re-install the controller PCB and carry out a complete diagnostic check of the NCR DECISION MATE V.

3. Squeeze the noses of the two stand-off clips (2) to overcome their latching mechanism and pull the 16 bit PCB fractionally away from the controller PCB at these two corners. Then grip the edges of the 16-bit PCB at a position adjacent to the multipin plug and pull it away from the controller PCB.

4 Install the 16-bit/PIC board in place of the 16-bit PCB which you have just removed.

5. Re-install the controller PCB and carry out a complete diagnostic check of the NCR DECISION MATE V.

Installation of the 16-bit/PIC board on a multilayer controller board which has not previously contained a 16-bit PCB:

1. Remove the multilayer controller printed circuit board from the computer. This procedure is described in the Service Manual for the NCR DECISION MATE V.

2. Refer to Figure 2 which shows the multilayer controller PCB from the component side. Remove the four screws marked 1 in this Figure.

   If the 96-pin socket J107A (supplied with the Kit) is not already present, additionally remove the screws marked 3. Then remove the metal plate containing the adapter retention clips, taking care not to misplace the spacer washers. Then solder the socket into place, so that the cut-out corners of the socket are on the right-hand side when viewing the solder side of the controller board with the socket in a bottom left position. Replace the metal plate with screws 3 and their spacer washers.

3. Insert the bases of the two PVC stand-off clips into the pre-drilled holes (2) from the solder side of the controller PCB.

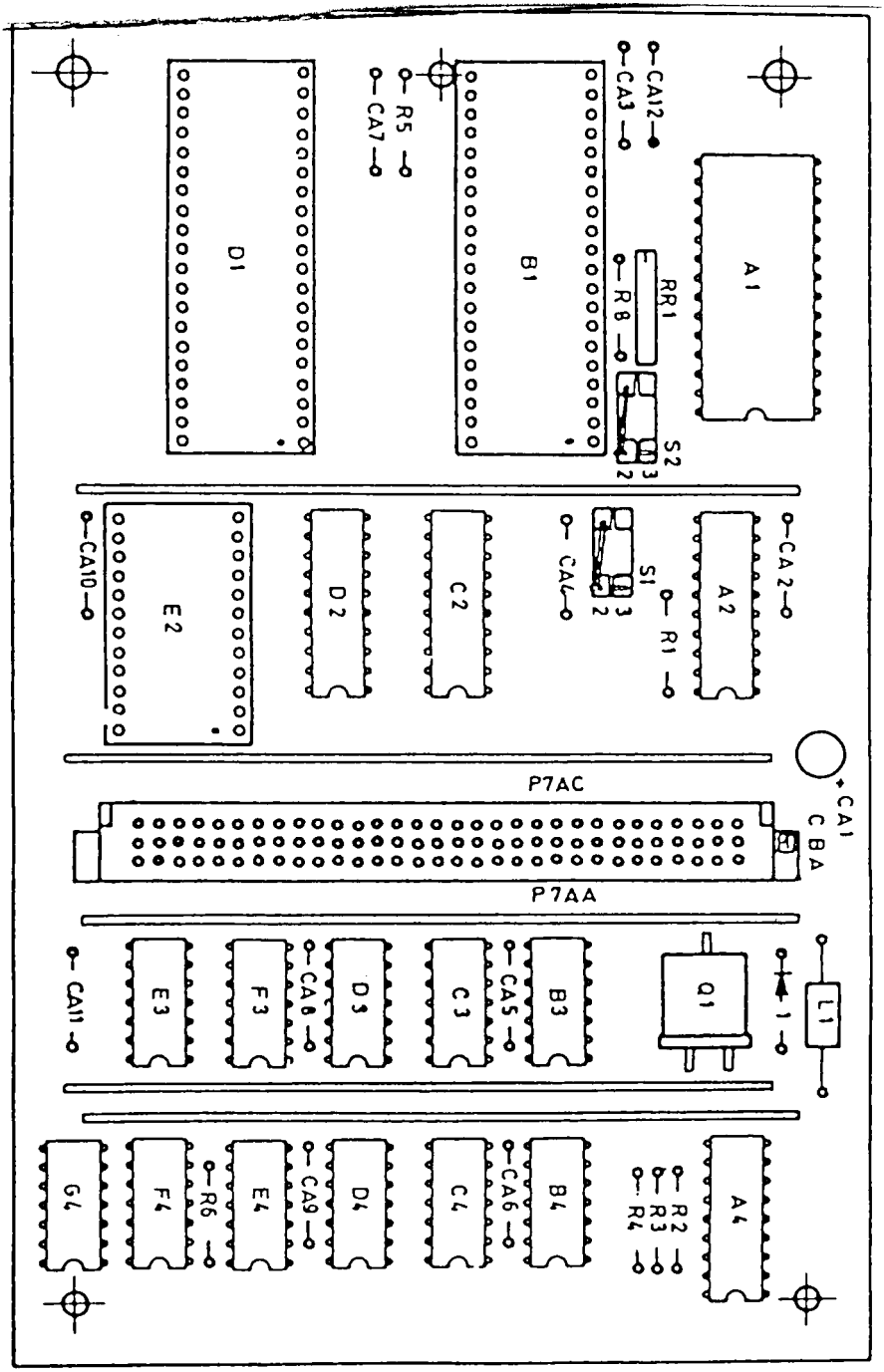


Figure 1: K235 V001 Component Layout

NCR DECISION MATE V

16-Bit Mikroprozessor
mit
Programmierbarem Interrupt Controller (PIC) und
Speicherschnelltester (K235 V001)
(Memory Retention Facility)

Doc: 017-0033155

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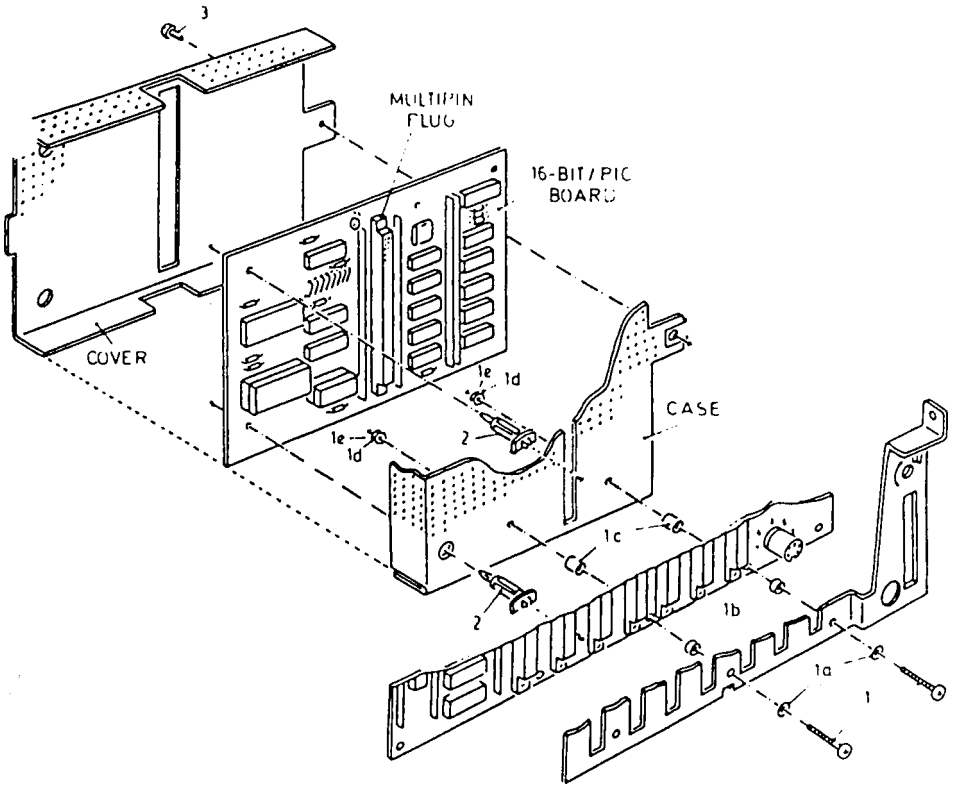


Bild 3: K235 V001 Einbau

1	Schraube 3x16	2	PVC-Abstandhalter
1a	Unterlegscheibe	3	Schraube 2,9x6,5
1b	Abstandsringe		
1c	PVC-Unterlegscheibe		
1d	Unterlegscheibe		
1e	Mutter		

NCR DECISION MATE V

16-Bit Mikroprozessor
mit
Programmierbarem Interrupt Controller (PIC) und
Speicherschnelltester (K235 V001)

Diese Leistungserweiterung kann in Ihren NCR DECISION MATE V nur eingebaut werden, wenn Sie den Systemneustart mit CONTROL-F20 Tastenkombination durchführen können (siehe Bedienungsanleitung für NCR DECISION MATE V).
VORSICHT: Für den Einbau dieser Erweiterung brauchen Sie Kenntnisse und Erfahrung im Umgang mit Halbleiter-Bauelementen und anderer Computerhardware. Überlassen Sie den Einbau einem qualifizierten Techniker.

Die 16-Bit/PIC-Platine enthält zwei Drahtbrücken (S1, S2). Vor dem Einbau der Leistungserweiterung müssen diese in den im Bild 1 gezeigten Stellungen stecken.

Einbau der 16-Bit/PIC-Platine auf eine Hauptplatine, auf der schon eine 16-Bit Prozessor-Platine montiert ist:

1. Entfernen Sie die Haupt- mit aufgesteckter Grafik-Platine aus dem Computer. Dieser Vorgang ist im Service Manual für den NCR DECISION MATE V beschrieben.

2. Halten Sie sich an das Bild 3 in dieser Beschreibung und entfernen Sie die Schraube 3. Nehmen Sie das Metallgehäuse ab.

3. Ziehen Sie die 16-Bit Platine von den zwei Abstandshaltern (2) und der mehrpoligen Buchse von der Haupt-Platine ab.

4. Ersetzen Sie die 16-Bit Platine durch die 16-Bit/PIC Platine.

5. Bauen Sie die Haupt- mit aufgesteckter Grafik-Platine wieder ein und machen Sie einen vollständigen Diagnose-Check des NCR DECISION MATE V.

Doc: 017-0033155

Einbau der 16-Bit/PIC Platine auf eine Haupt-Platine, auf die vorher keine 16-bit Platine montiert war:

1. Entfernen Sie die Haupt- mit aufgesteckter Grafik-Platine aus dem Computer. Dieser Vorgang ist im Service Manual für den NCR DECISION MATE V beschrieben.

2. Halten Sie sich an das Bild 2. Es zeigt die Haupt-Platine von der bestückten Seite. Entfernen Sie die vier Schrauben 1.
   Wenn die 96-polige Buchse J107A (wird mit der Leistungserweiterung geliefert) nicht schon montiert ist, entfernen Sie zusätzlich die Schrauben 3. Dann entfernen Sie die Metallplatte mit den Adapterhaltern. Achten Sie auf den richtigen Sitz der Unterlegscheiben. Dann löten Sie die Buchse so an, daß die ausgeschnittenen Ecken der Buchse auf der rechten Seite sind; betrachten Sie die Lötseite der Haupt-Platine mit der Buchse unten links. Montieren Sie die Metallplatte mit Schrauben 3 und ihren Unterlegscheiben.

3. Stecken Sie die Füße der zwei PVC-Abstandhalter in die vorgebohrten Löcher von der Lötseite der Haupt-Platine aus.

4. Betrachten Sie Bild 3. Mit den längeren Schrauben (1) und den zusätzlichen PVC-Unterlegscheiben (1c) (wird mit der Leistungserweiterung geliefert) befestigen Sie das Metallgehäuse auf der Haupt-Platine.

5. Stecken Sie die 16-Bit/PIC-Platine in die mehrpolige Buchse, die jetzt in das Metallgehäuse ragt. Drücken Sie die Steckerleiste fest in die Buchse.
   Drücken Sie die 16-BIT/PIC Platine auf die Spitzen der PVC-Abstandhalter.

6. Schließen Sie das Gehäuse mit dem mitgelieferten Metalldeckel und sichern Sie es mit der Schraube 3.

7. Bauen Sie die Haupt- mit aufgesteckter Grafik-Platine wieder ein und machen Sie einen kompletten Diagnose-Check des NCR DECISION MATE V.

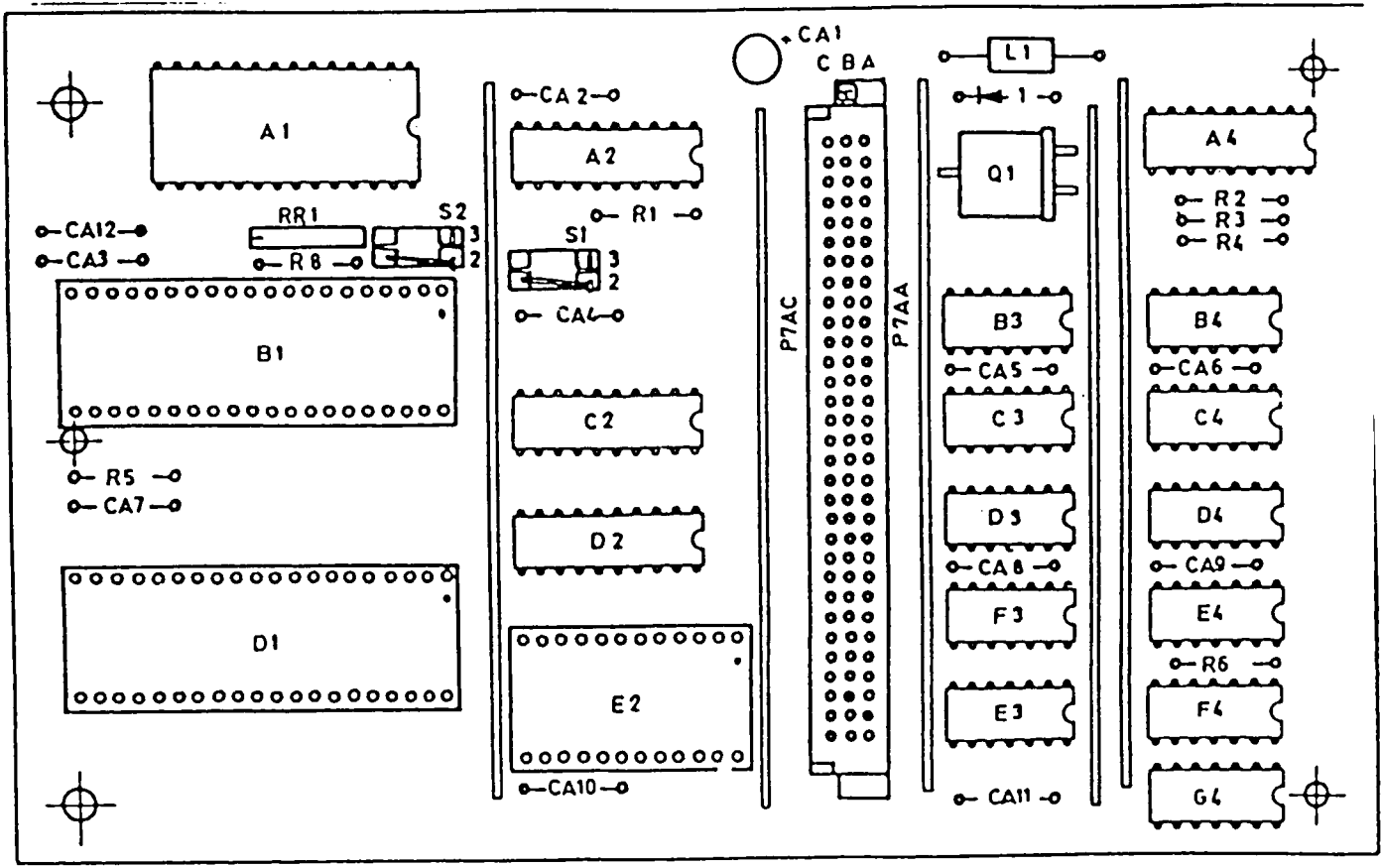


Bild 1: K235 V001 Bestückung

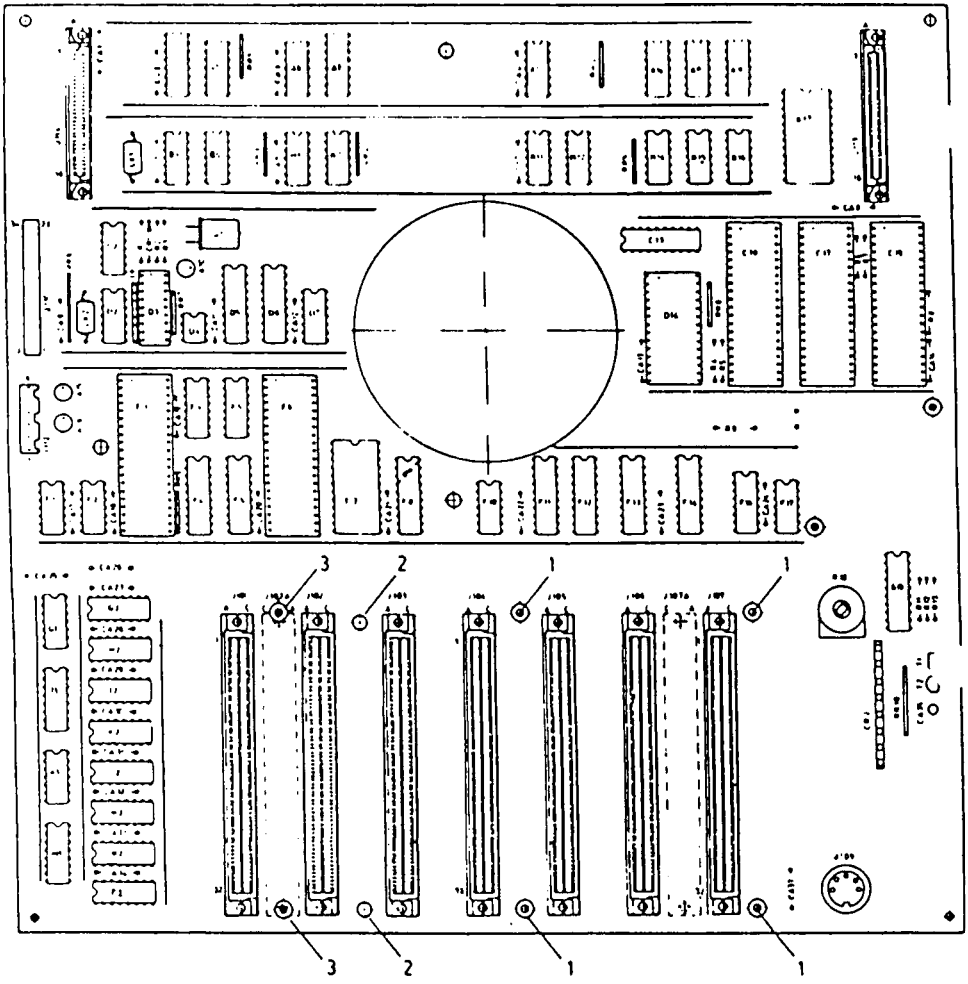


Bild 2: Haupt-Platine

1 Schraube
2 vorgebohrte Löcher
3 zusätzliche Schrauben (siehe Text)

KIT INSTALLATION

for

EXTERNAL 16-BIT PROCESSOR UPGRADE
(K 231)

The attached pages provide information for installing this kit into an NCR DECISION MATE V. These pages should be filed in your NCR DECISION MATE V User Information Manual.

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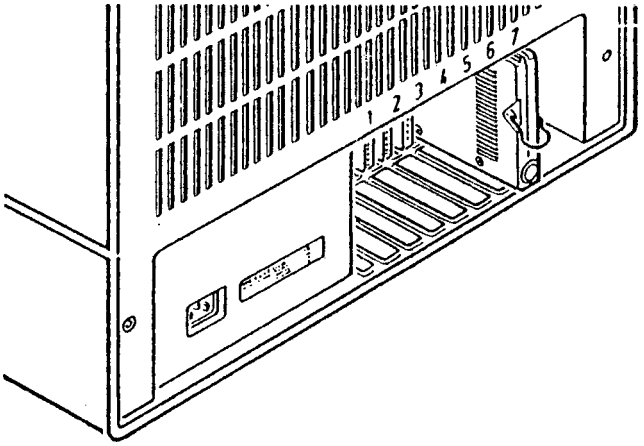
KIT INSTALLATION

EXTERNAL 16-BIT PROCESSOR UPGRADE (K 231)

1. Install this kit into slot 7 at the rear of the NCR DECISION MATE V.

   NOTE: No other position may be used for this kit.

Your system is now ready for the use of either 8-bit or 16-bit software.



NCR DECISION MATE V

MAUS-ADAPTER
(K806)

Die beiliegenden Seiten zeigen Ihnen, wie Sie diese Leistungserweiterung an Ihren NCR DECISION MATE V anschließen können. Bitte ordnen Sie diese Beschreibung in Ihre Bedienungsanleitung für den NCR DECISION MATE V ein.

MAUS-ADAPTER
(K806)

INHALT

INBETRIEBNAHME

EINLEITUNG.....
IFSEL- UND MAUS-AUSWAHL.....

SOFTWARE

EINLEITUNG.....
BENUTZUNG DER PORT-ADRESSEN.....
FUNKTIONSPRÜFUNG.....
DAS STATUS-BYTE.....
BEFEHLE UND IHRE PARAMETER.....
INTERRUPT-BEHANDLUNG.....

INBETRIEBNAHME

EINLEITUNG

Mit Hilfe einer "Maus" lassen sich Handbewegungen auf einem Schreibtisch oder einer ähnlichen Fläche in Bildschirmgrafik umsetzen. Sie können folgende Mäuse in Verbindung mit dem Maus-Adapter benutzen:

- Hawley Mouse MARK II
- Alps Encoder-Mouse
- Mouse Systems Quad Mouse
- Depraz Souris P4
- Logitech LM-P-5
- Logitech P4

Die Verständigung zwischen einem Adapter und Ihrem NCR DECISION MATE V erfolgt über einen von insgesamt 10 Datenübertragungskanälen. Jeder Datenübertragungskanal (oder IFSEL: engl. InterFace SELect) verfügt über 8 Portadressen. Der Maus-Adapter kann grundsätzlich jede beliebige der 10 IFSEL-Nummern benutzen. Die für diesen Adapter vorhandene p-System-Software betrachtet die IFSEL-Nummer 2A (Portadressen 30H...37H) als Standardwert. Diese IFSEL-Nummer ist bereits bei der Lieferung des Maus-Adapters eingestellt. Die zur IFSEL-Auswahl gehörenden Schalter befinden sich innerhalb des Gehäuses.

Ebenfalls innerhalb des Gehäuses sind Schalter für die Auswahl der von Ihnen benutzten Maus vorhanden. Diese Schalter sind für den Betrieb der folgenden Mäuse werksseitig eingestellt:

- Hawley Mouse Mark II
- Alps Encoder-Mouse
- Mouse Systems Quad Mouse

Vorausgesetzt, daß Sie eine dieser Mäuse mit der Standardeinstellung der IFSEL-Nummer betreiben wollen, ist ein

Öffnen des Gehäuses des Maus-Adapters nicht erforderlich. In diesem Fall können Sie ohne weiteres den Adapter in eine der Steckfassungen 2...6 an der Rückseite Ihres NCR DECISION MATE V einsetzen (siehe Abb. 1.1). Anschließend sollten Sie den zweiten Teil dieser Anleitung ("Software") bezüglich der für den Betrieb einer Maus benötigten Software lesen.

Wenn Sie eine Depraz- oder eine Logitech-Maus benutzen, oder im Fall, daß Sie von einer vom Standardwert (2A) abweichenden IFSEL-Nummer Gebrauch machen möchten, sollten Sie gemäß der im folgenden Abschnitt enthaltenen Beschreibung verfahren.

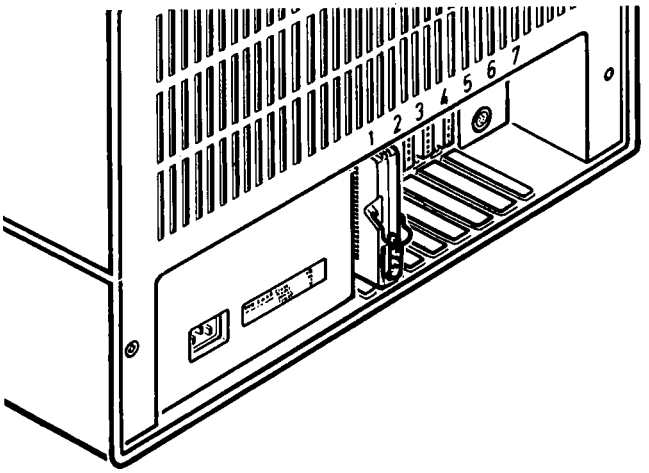
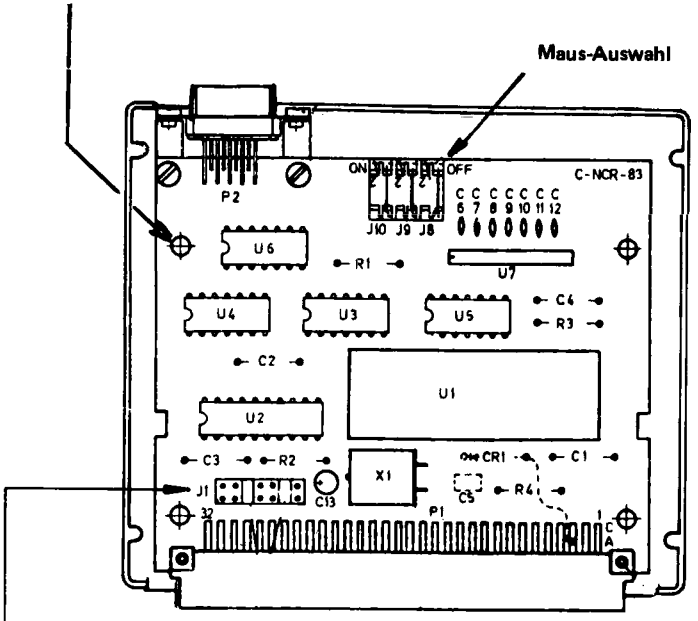


Abbildung 1.1: Der Maus-Adapter

IFSEL- UND MAUS-AUSWAHL

Die nachstehend beschriebenen Arbeitsschritte sind nur dann erforderlich, wenn Sie die IFSEL-Nummer ändern oder eine der folgenden Mäuse benutzen möchten:

WICHTIG:
Ein Federring befindet sich zwischen der mit den Leiterbahnen belegten Fläche der Platine und dem Gehäuse.



IFSEL 0A:	J1	J6
IFSEL 0B:	J1	J7
IFSEL 1A:	J2	J6
IFSEL 1B:	J2	J7
IFSEL 2A:	J3	J6
IFSEL 2B:	J3	J7
IFSEL 3A:	J4	J6
IFSEL 3B:	J4	J7
IFSEL 4A:	J5	J6
IFSEL 4B:	J5	J7

Abbildung 1.2: IFSEL- und Maus-Auswahl

- Depraz Souris P4
- Logitech LM-P-5
- Logitech P4

1. Entfernen Sie den am Gehäuse befestigten Drahtgriff und die vier Schrauben. Das Gehäuse sollten Sie noch nicht öffnen.
2. Halten Sie die zwei Teile des Gehäuses zusammen, und legen Sie den Adapter auf einen Schreibtisch o.ä., so daß die Schraublöcher nach unten zeigen. Entfernen Sie den oberen Teil des Gehäuses.
3. Auf der Platine des Maus-Adapters sind drei Schaltbrücken mit J10, J9, J8 gekennzeichnet (siehe auch Abbildung 1.2). Die Standardeinstellung 2A hat zur Folge, daß jede dieser drei Schaltbrücken in der OFF-Stellung ist. Wenn Sie eine Depraz- oder eine Logitech-Maus benutzen, müssen Sie alle drei Schalter in die ON-Stellung bringen. Hierzu ist jeder Draht aus seinem Haken zu lösen und in den jeweils unmittelbar links befindlichen Haken einzusetzen.
4. Die Aufschrift J1 auf der Platine (siehe auch Abbildung 1.2) zeigt Ihnen, wo die Schalter für die IFSEL-Auswahl zu finden sind. Die Einstellung einer IFSEL-Nummer erfordert eine Neubelegung der zwei Steckverbindungen auf den paarweise angeordneten Stiften (siehe Abb. 1.2). Die zwei am weitesten links befindlichen Stifte bilden die Schaltbrücke J1, die zwei am weitesten rechts befindlichen Stifte bilden die Schaltbrücke J7. Die zwei Steckverbindungen befinden sich auf den Schaltbrücken J3 bzw. J6, solange die IFSEL-Nummer 2A eingestellt ist.
5. Schrauben Sie das Gehäuse anhand der vier Schrauben zusammen; bringen Sie den Drahtgriff wieder an.

Abbildung 1.3 enthält eine Aufstellung der IFSEL-Nummern mit den jeweils verfügbaren Portadressen.

IFSEL-NR	PORT-ADRESSEN
0A	60-67
0B	68-6F
1A	70-77
1B	78-7F
2A	30-37
2B	38-3F
3A	B0-B7
3B	B8-BF
4A	C0-C7
4B	C8-CF

Abbildung 1.3: IFSEL/Portadressen

SOFTWARE

EINLEITUNG

Der Maus-Adapter beinhaltet einen eigenen Mikroprozessor sowie eigene Firmware. Dies hat zur Folge, daß die zusätzliche Belastung des Prozessors des NCR DECISION MATE V durch den Betrieb des Maus-Adapters sehr gering ist. Der Maus-Adapter ist in der Lage, bis zu 4000 Positionen der angeschlossenen Maus in einer Sekunde an den Computer zu senden. Ihr Programm kann einen Bereich definieren, innerhalb dessen die Maus sich bewegen muß. (Sämtliche Positionen und Bereiche werden als X/Y-Koordinaten angegeben.) Der Maus-Adapter kann nicht nur die Position der Maus sondern auch den Zustand von bis zu drei an der Maus befindlichen Schaltern vermitteln. Ein Status-Byte gibt Aufschluß darüber, ob die internen ROM- und RAM-Speicher des Adapters einwandfrei funktionieren, ob der Adapter bereit ist, Befehle oder Daten zu senden oder zu empfangen, und ob das Interrupt-Signal gesetzt wurde.

Der Maus-Adapter bietet zwei Verfahrensweisen, auf die Ihr Programm die Bewegung der Maus und die Betätigung eines Schalters an der Maus verfolgen kann: Es kann in bestimmten Zeitabständen diese Daten von dem Maus-Adapter lesen. Die zweite Methode besteht darin, auf ein Interruptsignal zu warten, und erst dann die Positions- und Schalterdaten zu lesen. Sofern Sie von der Interrupt-Leitung des Computers Gebrauch machen wollen, sind in der Regel zusätzliche Interrupt-Controller-Schaltungen erforderlich. Wenn Sie aber Ihren NCR DECISION MATE V als 8-Bit-System benutzen, können Sie aufgrund bestimmer Eigenschaften des Z80A-Mikroprozssors Interrupt-Behandlung auch ohne solche Schaltungen verwirklichen (siehe hierzu den Abschnitt "Interrupt-Behandlung").

Die von NCR erhältliche p-System-Software beinhaltet eine Anzahl von BASIC-, FORTRAN- und Pascal-Programme für den Betrieb des Maus-Adapters. Eine Beschreibung dieser Programme in englischer Sprache liegt dieser Anleitung bei.

Sie können den Maus-Adapter selbstverständlich auch mit de Betriebssystemen CP/M und MS-DOS benutzen. Dieser Tei ("Software") beschreibt die Anweisungen für die Programmie rung des Maus-Adapters. Die besten Ergebnisse lassen sic mit Programmen in Assemblersprache erzielen.

BENUTZUNG DER PORT-ADRESSEN

Der Maus-Adapter verwendet die erste und die zweite der zu gewählten IFSEL-Nummer gehörenden Port-Adressen. Vorausge setzt, daß Sie die Standard-IFSEL-Nummer nicht geände haben, sind die benutzten Port-Adressen 30H (Port 1) und 31 (Port 2). Die Ein- und Ausgabe über die Port-Adressen er folgt gemäß folgender Einteilung:

IN Port 1 - Das Programm liest Daten vom Maus-Adapter.
OUT Port 1 - Der Maus-Adapter empfängt Daten von Ihre Programm.
IN Port 2 - Das Program liest das Status-Byte des Maus Adapters.
OUT Port 2 - Das Programm sendet Befehle an den Maus Adapter.

FUNKTIONSPRÜFUNG

Wenn Sie Ihren NCR DECISION MATE V bei eingesetztem Maus Adapter einschalten, setzt das Reset-Signal des Computer auch den Maus-Adapter in seinen Anfangszustand zurück. De Prozessor des Maus-Adapters liest dann Anweisungen im eige nen ROM: Zunächst wird geprüft, ob ROM und RAM de Maus-Adapters einwandfrei funktionieren. Dann initialisier der Maus-Adapter seine I/O-Ports.

Sollte ein Fehlerzustand im ROM oder im RAM vorliegen, wir ein entsprechendes Bit im Status-Byte gesetzt. Der folgend Abschnitt erläutert die Bedeutung der einzelnen Bits de Status-Bytes und zeigt Ihnen, wie Ihr Programm dieses Byt lesen kann.

DAS STATUS-BYTE

Ihr Programm kann das Status-Byte mit einer IN-Anweisung an Port 2 (31H bei IFSEL 2A) lesen. Abbildung 2.1 zeigt die Bedeutung der einzelnen Bits dieses Bytes.

Bit:	7	6	5	4	3	2	1	0
	X	INT	RAM	ROM	X	X	IBF	OBF

Abbildung 2.1: Das Status-Byte

X Dieses Bit wird nicht benutzt.

INT Sobald der Maus-Adapter ein Interruptsignal ausgibt, wird dieses Bit gesetzt (logisch 1). Es bleibt in diesem Zustand, während die Interruptleitung aktiviert ist (active "low").

ROM Ein Fehlerzustand im ROM des Maus-Adapters führt dazu, daß dieses Bit gesetzt wird. Sonst ist es zurückgesetzt.

RAM Ein Fehlerzustand im RAM des Maus-Adapters führt dazu, daß dieses Bit gesetzt wird. Sonst ist es zurückgesetzt.

IBF Input Buffer Full: Solange dieses Bit gesetzt ist, kann der Maus-Adapter weder Befehle noch Daten von Ihrem Programm empfangen. Vor der Ausgabe von Befehlen oder Daten an den Maus-Adapter sollte ein Programm den Zustand dieses Bits abfragen und die Ausgabe erst dann ausführen, wenn das Bit zurückgesetzt ist.

OBF Sobald dieses Bit gesetzt wird, kann Ihr Programm ein Datenbyte über Port 1 des Maus-Adapters lesen. Das Programm sollte keinen Lesevorgang versuchen, während dieses Bit zurückgesetzt ist.

BEFEHLE UND IHRE PARAMETER

Dieser Abschnitt befaßt sich mit den vom Maus-Adapter anerkannten Befehlen. Einige dieser Befehle leiten die Übertragung einer Reihe von Parametern (Daten) ein.

WICHTIG: Nachdem ein zum Senden oder zum Empfangen von Parametern gehörender Befehl gesendet worden ist, müssen alle zu diesem Befehl gehörenden Parameter ausgegeben bzw. gelesen werden. Ihr Programm sollte die Übertragung der Parameterliste nicht vorzeitig abbrechen, indem es z.B. einen neuen Befehl an den Maus-Adapter sendet.

Alle Befehle an den Maus-Adapter sind über Port 2 auszugeben; Parameter werden über Port 1 sowohl gesendet als auch empfangen.

Die folgenden Werte werden beim Einschalten Ihres NCR DECISION MATE V mit Maus-Adapter automatisch eingestellt. Sie verlieren ihre Gültigkeit, erst wenn sie von Ihrem Programm bzw. einer Bewegung der Maus aufgehoben werden.

XMAX: Der höchste Wert, den die Maus in der X- (horizontalen) Richtung erreichen kann: 640
YMAX: Der höchste Wert, den die Maus in der Y- (vertikalen) Richtung erreichen kann: 400
XMIN: Der niedrigste Wert, den die Maus in der X-Richtung erreichen kann: 0
YMIN: Der niedrigste Wert, den die Maus in der Y-Richtung erreichen kann: 0
X- und Y-Koordinaten der gegenwärtigen Maus-Position: 0
Alle Interruptsignale sind außer Kraft.

Nachstehend finden Sie eine Beschreibung jedes Befehls und der etwa dazugehörigen Parameter. Für jeden Befehl ist der hexadezimale Wert angegeben, der über Port 2 an den Maus-Adapter zu senden ist. Negative (Minus-) Werte werden immer als Zweierkomplement dargestellt.

00 Die absolute Position der Maus wird gelesen

Die Reihenfolge der zu lesenden Parameter:

X-Koordinate, niederwertiges Byte
X-Koordinate, höherwertiges Byte
Y-Koordinate, niederwertiges Byte
Y-Koordinate, höherwertiges Byte
Schalter-Status-Byte (s. Ende dieses Abschnitts)

Die absolute Position bezieht sich auf die Änderung der Position der Maus (ggf. innerhalb des definierten Bewegungsbereichs) seit dem letzten Setzen der Anfangsposition. (Diese Anfangsposition wird beim Einschalten auf X=0, Y=0 gesetzt. Sie kann ebenfalls anhand des Befehls 04 gesetzt werden.)

01 Das aufgrund einer Bewegung der Maus erzeugte Interruptsignal wird anerkannt
Keine Parameter.
Dieser Befehl hat gleichzeitig zur Folge, daß das Interruptsignal für die Mausschalter außer Kraft gesetzt wird.

02 Interruptsignale werden nicht erkannt
Keine Parameter.

03 Das Signal an der Interruptleitung und das INT-Bit im Status-Byte werden zurückgesetzt
Keine Parameter.

04 Die logische Position der Maus wird gesetzt
Die Reihenfolge der Parameter, die an den Maus-Adapter zu senden sind:

X-Koordinate, niederwertiges Byte
X-Koordinate, höherwertiges Byte
Y-Koordinate, niederwertiges Byte
Y-Koordinate, höherwertiges Byte

Wenn diese Position sich außerhalb des für die Bewegung der Maus definierten Bereichs liegt (s. Befehle 05 und 0A), findet die Definition dieses Bereichs keine Anwendung.

05 Der Höchstwert, den die Maus in der X- bzw. Y-Richtung erreichen kann, wird gesetzt
Die Reihenfolge der Parameter, die an den Maus-Adapter zu senden sind:

XMAX, niederwertiges Byte
XMAX, höherwertiges Byte

YMAX, niederwertiges Byte
YMAX, höherwertiges Byte

Das Verhältnis der mit der Maus zurückgelegten Entfernung zum Wert, der für diese Entfernung vom Maus-Adapter gesendet wird, ist für die verschiedenen Mäuse unterschiedlich. Die beim Einschalten automatisch eingestellten Werte (XMAX = 640, YMAX = 400) entsprechen einer angenehmen Reichweite bei der Benutzung einer Maus auf einem Schreibtisch.

06 Das aufgrund der Betätigung eines Maus-Schalters erzeugte Interruptsignal wird anerkannt
Keine Parameter.
Dieser Befehl hat gleichzeitig zur Folge, daß das bei einer Bewegung der Maus erzeugte Interruptsignal außer Kraft gesetzt wird.

07 Die Interruptsignale sowohl für die Betätigung eines Schalters als auch für eine Bewegung der Maus werden erkannt
Keine Parameter.

08 Der ROM des Maus-Adapters wird überprüft
Keine Parameter.
Diese Überprüfung erfolgt auch beim Einschalten.

09 Die relative Position der Maus wird gelesen
Parameter: Siehe 00.
Die relative Position der Maus bezieht sich auf den Positionsunterschied zwischen der gegenwärtigen Position und der zuletzt gelesenen Position.

0A Der Niedrigstwert, den die Maus in der X- bzw. Y-Richtung erreichen kann
Die Reihenfolge der Parameter, die an den Maus-Adapter zu senden sind:

XMIN, niederwertiges Byte
XMIN, höherwertiges Byte
YMIN, niederwertiges Byte
YMIN, höherwertiges Byte

WICHTIG: Absolute und relative Position der Maus werden in denselben Registern des Maus-Adapters gespeichert. Infolgedessen ist bei der Benutzung beider Positionsformate in einem Programm Vorsicht geboten. Im Fall, daß sowohl die absolute als auch die relative Position der Maus in Ihrem Programm benötigt wird, empfiehlt es sich, die absolute Position als X/Y-Koordinaten in Programmvariablen festzuhalten. Sie können mit Hilfe des Befehls 04 diese Werte in die Positionsregister wieder zurückschreiben.

Der Maus-Adapter berücksichtigt die am Gehäuse der Maus vorhandenen Schalter. Der am weitesten links befindliche Schalter wird als S1, der am weitesten rechts befindiche Schalter als S2 bezeichnet. Ein etwa in der Mitte vorhandener Schalter wird als S3 bezeichnet. Jedem Schalter ist ein Bit im Schalter-Status-Byte (Befehl 00) zugeordnet:

S1 - Bit 0
S2 - Bit 1
S3 - Bit 2

(Die verbleibenden fünf Bits dieses Bytes werden nicht benutzt.) Das Bit ist gesetzt, während der entsprechende Schalter sich in gedrückter Stellung befindet.

INTERRUPT-BEHANDLUNG

Dieser Abschnitt befaßt sich mit den Interruptsignalen, die von dem Maus-Adapter ausgegeben werden. Vorausgesetzt, daß die Interruptsignale nicht außer Kraft sind, wird ein solches Signal bei jeder Bewegung der Maus bzw. bei jedem Öffnen und jedem Schließen der Kontakte eines Schalters.

WICHTIG: Die Benutzung der Interrupt-Leistungen des Maus-Adapters (über die Abfrage des INT-Bits des Status-Bytes hinaus) setzt Erfahrung im Umgang mit Halbleiter-Bauteilen voraus. Wichtige Informationen über die Hardware Ihres NCR DECISION MATE V finden Sie im Band "Hardware" des von NCR herausgegebenen System Technical Manual.

Wenn Sie Ihren NCR DECISION MATE V als 16-Bit-System benutzen, sind für die Behandlung von Interruptsignalen zusätzliche Interrupt-Controller unerläßlich.

Bestimmte Eigenschaften des Z80A-Mikroprozessors ermöglichen in einem 8-Bit-System eine Interrupt-Behandlung ohne Interrupt-Controller: Beim Interrupt-Modus 1 (IM 1 / Opcode: ED 56) wird beim Erzeugen eines Signals auf der Interruptleitung die Programmsteuerung an die hexadezimale Adresse 38 übergeben. Das Betriebssystem CP/M-80 enthält an dieser Adresse einen Sprungbefehl (JP) an das zu Testzwecken eingesetzte DDT-Programm. Vorausgesetzt, daß DDT für Ihre Anwendung nicht benötigt wird, können Sie einen Sprungbefehl an dieser Adresse ablegen. Dieser könnte dann auf Ihr eigenes Interrupt-Behandlungsprogramm verweisen.

C H A P T E R 8

M O U S E

(This is the description of the Mouse unit of the p-System™. Please insert it in the manual UCSD p-System, Programming, chapter 8)

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Introduction

The following is a description of the procedures you can use with the p-System™ to work with your mouse.

The software you need for using the Mouse interface and working with the Mouse in the p-System™ is contained in the MOUSE.CODE file. If you have a Runtime System MOUSE.CODE is incorporated in your SYSTEM.LIBRARY. If you have a Plus System, you have to insert this code in your SYSTEM.LIBRARY, in any of slots Ø through 15. Chapter 6 utility 'LIBRARY' in the 'UCSD p-System, Programming' Manual describes how this is done.

The interface part of the Mouse unit affords access to the following procedures:

GMOUS: gives the status of the Mouse switches and Mouse position. This procedure supplies the absolute position (x and y coordinates) of the Mouse and the status of the switch(es) (up to 3). Use all three switch variables, even if your Mouse has only one or two switches.

X,Y: absolute x and y coordinates

SW1,SW2,SW3: status of the Mouse switches (1 = pressed, 0 = not pressed or not existent)

SETPOS: sets the logical position of the Mouse.

X,Y: New x and y coordinates for the Mouse position.

Note: Use this option to set a new position for the Mouse. If you require no direct correlation between the physical position of the Mouse and its program position, you can reset

the logical Mouse position by means of SETPOS.

SETMAX: sets maximum values for the Mouse position. Sets the maximum x and y values the Mouse can attain (default: x=640, y=400).

XMAX,YMAX: are maximum values for the x and y coordinates

For SETPOS note that the initial Mouse position is x=0, y=0. The Mouse can move within the area delimitated by x=0, y=0 and the values set in SETMAX.

Pascal Procedures

To use the Mouse procedures in a Pascal program, declare
USES MOUSE;

The first lines of the respective procedures have the following forms:

GMOUS

```
PROCEDURE GMOUS
   (VAR SW3, SW2, SW1, Y, X: INTEGER)
```

SETPOS

```
PROCEDURE SETPOS (X,Y: INTEGER)
```

SETMAX

PROCEDURE SETMAX (XMAX,YMAX: INTEGER)

Example

Here is an example for the use of the Mouse procedures in Pascal.

In the first part of the main program, the maximum Mouse position is set by means of the X and Y coordinates; and the present Mouse position is set to zero. In the second part of the main program, the variables are collected and displayed on the screen. SW1, SW2, and SW3 designate the switches on the Mouse (here the HAWLEY MARK II Mouse) which can be on or off. X is the Mouse position on the X coordinate, Y the Mouse position on the Y coordinate.

```
{ EXAMPLE MOUSE PROGRAM PASCAL }

 PROGRAM MOUSETP;

   USES MOUSE;

   VAR SW1,SW2,SW3,X,Y,X0,Y0,XM,YM:INTEGER; C:CHAR;

   PROCEDURE FIN(VAR C:CHAR);
{ PROMPT FOR FINISH }
     BEGIN
       GOTOXY(0,18);
       WRITE('    DO YOU WANT TO FINISH?   Y/N ');
       READLN(C);
     END;

   BEGIN
{ CLEAR SCREEN, CURSOR INVISIBLE }
     WRITELN(CHR(27),'@0',CHR(27),CHR(69));

     WRITELN('    ******   M O U S E  EXAMPLE  P A S C A L   ******')
     GOTOXY(0,16);
     WRITELN('    TO STOP PRESS SWITCH 1 ');
```

```
{ SET MAXIMUM }
     XM:=10000;
     YM:=10000;
     SETMAX(XM,YM);

{ SET START POSITION }
     X0:=0;
     Y0:=0;
     SETPOS(X0,Y0);

     C:='N';

{ LOOP MOUSE ACTIONS }
     REPEAT
       GMOUS(SW3,SW2,SW1,Y,X);
       GOTOXY(0,4);
       WRITELN('    X=',X:6,'     Y=',Y:6);
       GOTOXY(0,6);
       WRITELN('    SWITCH 1:',SW1,'  SWITCH 3:',SW3,'  SWITCH 2:',SW2);
       GOTOXY(0,18);

{ SET OR CLEAR PROMPT FOR FINISH DEPENDING ON SW1 }


       IF SW1=1 THEN FIN(C)
                ELSE WRITE(CHR(27),'L');

     UNTIL C in ['y','Y'];

{ CURSOR VISIBLE }
     WRITE(CHR(27),'@1')
   END.
```

Fortran Procedures
To use the Mouse procedures in a Fortran program, declare

```
$USES MOUSE
```

The subroutine and parameter definition can be found below:

GMOUS

```
SUBROUTINE GMOUS(SW3,SW2,SW1,Y,X)
   INTEGER SW1, SW2, SW3, Y, X
```

SETPOS

```
SUBROUTINE SETPOS (X,Y)
   INTEGER X,Y
```

SETMAX

```
SUBROUTINE SETMAX (XMAX,YMAX)
   INTEGER XMAX,YMAX
```

Example

Here is an example for the use of the Mouse procedures i
FORTRAN.

In the line starting with 1, the maximum Mouse position i
set by means of the X and Y coordinates. In the lin
starting with 2, the present Mouse position is set to zero
In the line starting with 1Ø, SW1, SW2, and SW3 designat
the switches on the Mouse (here the HAWLEY MARK I
Mouse), which can be on or off. X is the Mouse positio

on the X coordinate; y the Mouse position on the Y coordinate.

Then the program collects the values and displays them on the screen.

```
C
C       MOUSE EXAMPLE PROGRAM FOR FORTRAN
C
$USES MOUSE

        PROGRAM MOUSTF

        INTEGER SW1,SW2,SW3,X,Y,X0,Y0,XM,YM
        CHARACTER C

C       CLEAR SCREEN, CURSOR INVISIBLE
        WRITE(*,'(AAAA)') CHAR(27),'@0',CHAR(27),'E'

        WRITE(*,200)
200     FORMAT(4X,'******   M O U S E  EXAMPLE  F O R T R A N   ******')
C       SCREEN POSITION LINE 16 COLUMN 0
        WRITE(*,'(AA\)') CHAR(27),'Y0 '
        WRITE(*,'(A)') '    TO STOP PRESS SWITCH 1 '

C       SET MOUSE MAX VAL
        XM=10000
        YM=10000
1       CALL SETMAX(XM,YM)

C       SET MOUSE POSITION
        X=0
        Y=0
2       CALL SETPOS(X,Y)

        C='N'
```

```
C       LOOP MOUSE ACTIONS
        DO 1000 I=0,0,0
10      CALL GMOUS(SW3,SW2,SW1,Y,X)
        WRITE(*,'(AA\)') CHAR(27),'Y$ '
C       SCREEN POSITION LINE 4, COLUMN 0
        WRITE(*,300) X,Y
300     FORMAT ('     X=',I6,'      Y=',I6//)
        WRITE(*,100) SW1,SW3,SW2
100     FORMAT('     SWITCH1:',I1,'    SWITCH3:',I1,'    SWITCH2:',I1)
C       SCREEN POSITION LINE 18, COLUMN 0
        WRITE(*,'(AA\)') CHAR(27),'Y2 '

C       SET OR RESET PROMPT FOR FINISH DEPENDING ON SW1
        IF (SW1 .EQ. 1) THEN
        CALL FIN(C)
        ELSE
        WRITE(*,'(AA\)') CHAR(27),'L'
        ENDIF

        IF ((C .EQ. 'Y') .OR. (C .EQ. 'y')) THEN
        I=1
        ENDIF
1000    CONTINUE

C       CURSOR VISIBLE
        WRITE(*,'(AA)') CHAR(27),'@1'
        END

        SUBROUTINE FIN (C)
C       PROMPT FOR FINISH
        CHARACTER C
        WRITE(*,'(A\)') '     DO YOU WANT TO FINISH?   Y/N '
        READ(*,'(A1)') C
        RETURN
        END
```

BASIC Interface

To use the Mouse procedures in a BASIC program, declare

```
USES MOUSE
```

The subroutine and parameter definition can be found below:

GMOUS

```
SUB GMOUS(SW3,SW2,SW1,Y,X)
   INTEGER SW1, SW2, SW3, Y, X
```

SETPOS

```
SUB SETPOS (X,Y)
   INTEGER X,Y
```

SETMAX

```
SUB SETMAX (XMAX,YMAX)
   INTEGER XMAX,YMAX
```

Example

Here is an example for the use of the Mouse procedures
BASIC.

In the line starting with 1Ø, the maximum Mouse position
set by means of the X and Y coordinates. In the li
starting with 2Ø, the present Mouse position is set to zer
In the line of the main program starting with 1ØØ, th
variables are collected and displayed on the screen.

SW1, SW2, and SW3 designate the switches on the Mous (here the HAWLEY MARK II Mouse), which can be on o off. X is the Mouse position on the X coordinate; y th Mouse position on the Y coordinate.

```
        REM
        REM   MOUSE TEST PROGRAM  B A S I C
        REM

        USES MOUSE

        INTEGER SW1,SW2,SW3,X,Y,X0,Y0,XM,YM
        DIM C$*1

        SUB FIN (C$)
        REM PROMPT FOR FINISH
        INPUT AT (19,1)"    DO YOU WANT TO FINISH?   Y/N ":C$
        SUBEND

        REM CLEAR SCREEN, CURSOR INVISIBLE
        DISPLAY ERASE ALL:CHR$(27);"@0"

        DISPLAY AT (2,1): "    ******   M O U S E  EXAMPLE  B A S I C   ******
        DISPLAY AT (17,1):"    TO STOP PRESS SWITCH 1 "

        REM  SET MOUSE MAX VAL
        XM=10000
        YM=10000
10      CALL SETMAX(XM,YM)

        REM   SET MOUSE POSITION
        X0=0
        Y0=0
20      CALL SETPOS(X0,Y0)

        C$="N"

        REM LOOP MOUSE ACTION
        FOR I=0 TO 0 STEP 0
100     CALL GMOUS(SW3,SW2,SW1,Y,X)
        DISPLAY AT(5,1) USING "    X=######    Y=######":X,Y
        DISPLAY AT(7,1):"    SWITCH 1:";SW1;"  SWITCH 3:";SW3;"  SWITCH 2:";SW

        REM    SET OR CLEAR PROMPT FOR FINISH DEPENDING ON SW1
        IF SW1=1 THEN CALL FIN(C$) ELSE DISPLAY AT (19,1):CHR$(27);"L";

        IF C$="Y" OR C$="y" THEN I=1
        NEXT I

1000    REM CURSOR VISIBLE
        DISPLAY AT (1,1):CHR$(27);"@1"
        END
```

KIT INSTALLATION

for

MOUSE INTERFACE
(K806)

The attached pages provide information for installing this kit into an NCR DECISION MATE V. These pages should be filed in your NCR DECISION MATE V User Information Manual.

FEDERAL COMMUNICATIONS COMMISSION (FCC)
RADIO FREQUENCY INTERFERENCE STATEMENT

WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Information to User

This equipment must be installed and used in strict accordance with the manufacturer's instructions. However, there is no guarantee that interference to radio communications will not occur in a particular commercial installation. If this equipment does cause interference, which can be determined by turning the equipment off and on, the user is encouraged to consult an NCR service representative immediately.

The NCR Corporation (NCR) is not responsible for any radio or television interference caused by unauthorized modification of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by NCR. The correction of interferences caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

This equipment is designed for use in a commercial environment, not in a residential area. It fully complies with the relevant FCC regulations; when connected to any Class B equipment then the total product is reclassified accordingly.

It is the policy of NCR Corporation to improve products as new technology, components, software, and firmware become available. NCR Corporation, therefore, reserves the right to change specifications without prior notice.

All features, functions, and operations described herein may not be marketed by NCR in all parts of the world. In some instances, photographs are of equipment prototypes. Therefore, before using this document, consult your NCR representative or NCR office for information that is applicable and current.

KIT INSTALLATION

MOUSE INTERFACE
(K806)

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INSTALLATION

INTRODUCTION

A mouse is a hand-held device which facilitates movement on a screen display in response to movement of the hand on a level surface such as a desk-top. The Mouse Interface for your NCR DECISION MATE V provides the means of using the following "mice":

- Hawley Mouse MARK II
- Alps Encoder-Mouse
- Mouse Systems Quad Mouse
- Depraz Souris P4
- Logitech LM-P-5
- Logitech P4

The Mouse Interface, like other adapters which can be installed in your NCR DECISION MATE V, makes use of an IFSEL (InterFace SELect) number in order to communicate with the computer. There is a total of 10 IFSELs available, each governing 8 I/O ports. The p-System software available for the Mouse Interface uses the IFSEL 2A (ports 30H to 37H) as a default setting. This is the IFSEL number already set when you receive the Mouse Interface.

The Mouse Interface is factory set to operate with the following mice:

- Hawley Mouse MARK II
- Alps Encoder-Mouse
- Mouse Systems Quad Mouse

If you are using one of these mice, and provided that you do not wish to change the default IFSEL number (2A), there is no need to open the Mouse Interface. In this case, you can insert the adapter into a vacant slot 2...6 at the rear of your NCR DECISION MATE V (see Figure 1.1). Then refer to Part 2 of this document for information about software support for the Mouse Interface.

If you are using a Depraz or Logitech mouse, or if you system requires the use of a different IFSEL number, yo should proceed in accordance with the following section.

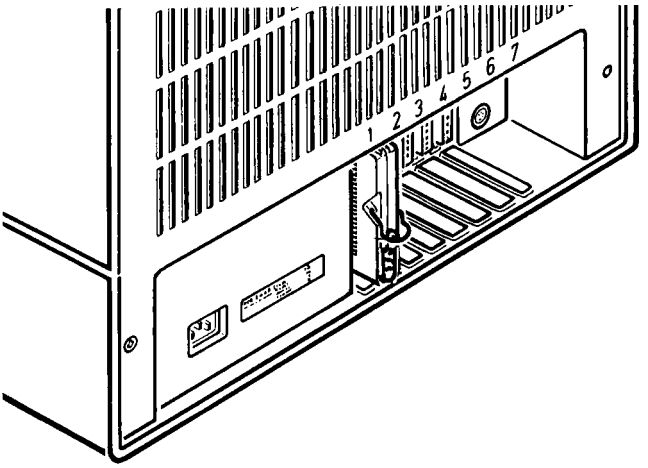


Figure 1.1 Mouse Interface

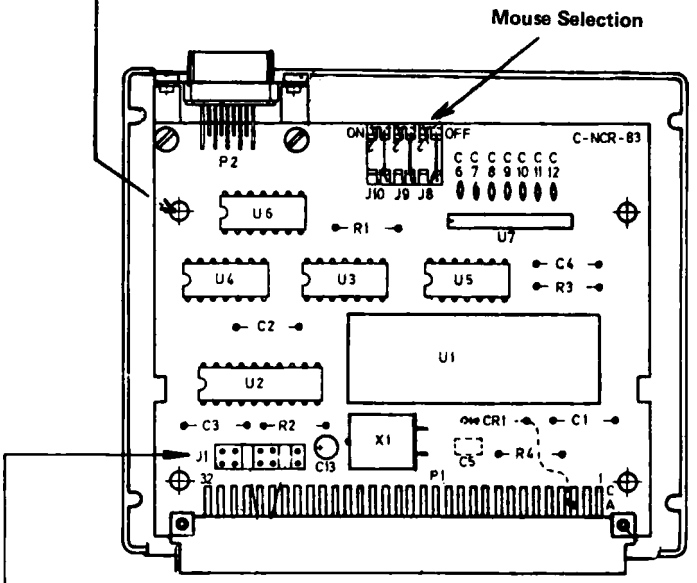
INTERFACE AND MOUSE SELECTION

The following procedures are necessary only if you wish t change the IFSEL number or use one of the following mice:

- Depraz Souris P4
- Logitech LM-P-5
- Logitech P4

1. Remove the wire handle and the four screws of the Mous Interface. Do not yet open the housing.
2. Holding the two halves of the housing together, turn th interface upside down and place it on a level surface. Now lift off the upper half of the housing, so that th

CAUTION:
Do not lose the spring washer situated between the solder side of the printed circuit board and the housing



IFSEL 0A:	J1	J6
IFSEL 0B:	J1	J7
IFSEL 1A:	J2	J6
IFSEL 1B:	J2	J7
IFSEL 2A:	J3	J6
IFSEL 2B:	J3	J7
IFSEL 3A:	J4	J6
IFSEL 3B:	J4	J7
IFSEL 4A:	J5	J6
IFSEL 4B:	J5	J7

Figure 1.2 Interface and Mouse Selection

component side (not the solder side) of the component board is showing.

3. Refer to Figure 1.2. The factory setting of the wire jumpers J10, J9, and J8 as shown in this Figure is all OFF. If you are using one of the three mice named above, these jumpers must be all ON. To set a jumper to the ON position, unhook the wire from its retaining clip and hook it under the retaining clip immmediately to the left.
4. A small panel holding 7 pairs of connector pins is situated immediately behind the multipin connector plug at the position marked J1 on the component board. If you wish to change the IFSEL number, you must place the two bridge connectors over the appropriate pins. In Figure 1.2, the leftmost pair of pins is J1, the rightmost J7. These connectors are factory set to IFSEL 2A. The table included in Figure 1.2 states which two pairs of pins have to be bridged for each IFSEL number.
5. Re-assemble the Mouse Interface.

Figure 1.3 shows the group of port addresses belonging to each IFSEL number.

IFSEL	PORTS
0A	60-67
0B	68-6F
1A	70-77
1B	78-7F
2A	30-37
2B	38-3F
3A	B0-B7
3B	B8-BF
4A	C0-C7
4B	C8-CF

Figure 1.3 IFSEL Port Assignments

SOFTWARE

INTRODUCTION

The Mouse Interface has its own microprocessor and firmware. This offloads the microprocessor of your NCR DECISION MATE V to a great extent. The Mouse Interface is capable of transmitting the position of the mouse up to 4000 times a second. It is possible to define a range of movement in terms of Cartesian co-ordinates. In addition to the position of the mouse, the status of up to three switches is included in the transmission protocol to the computer. A status byte provides information about function integrity checks and whether the Mouse Interface is ready to accept or transmit commands and data. In addition, the status byte records whether an interrupt has been issued.

There are two methods of checking mouse position and switch status. The first is simply to poll the Mouse Interface for the appropriate information. The second method is to make use of interrupts issued by the interface. Normally, this requires additional hardware in the form of interrupt controller circuitry. However, if you are using your NCR DECISION MATE V as an 8-bit system, it is possible to utilize certain characteristics of the Z80A microprocessor in order to create a limited interrupt handling facility. This is described in the section "Interrupts".

p-System software provides support, consisting of a number of BASIC, FORTRAN, and Pascal routines, for the Mouse Interface. A description of these routines is included at the end of this document. This description is ready for inserting as Chapter 8 of the p-System Plus, Volume 2, Programming Manual.

The Mouse Interface can, of course, be used with the CP/M and MS-DOS operating systems. This Part of the document is intended for programmers who wish to write their own Mouse Interface driver routines. The most effective results are to be achieved by programs in assembly language.

USE OF PORTS

The Mouse Interface uses the first two addresses of the eight available under an IFSEL number. If the IFSEL number is 2A (the default setting), then these two ports are 30H (Port 1) and 31H (Port 2). The significance of these ports is as follows:

IN Port 1	-	Read data from Mouse Interface.
OUT Port 1	-	Write data to Mouse Interface.
IN Port 2	-	Read the Mouse Interface status byte.
OUT Port 2	-	Write commands to the Mouse Interface.

POWER-UP CHECK

When you switch on the computer with the Mouse Interface inserted, the signal which resets the whole system also initiates the local processor in the Mouse Interface to execute instructions read from its own read-only memory (ROM). These instructions include an integrity check of both the ROM itself and the read/write memory (RAM) on the Mouse Interface component board. The I/O ports are then initialized.

Should the Mouse Interface register a fault in ROM or RAM, the appropriate bit of the status byte is set. Otherwise these two bits are set to zero. The following section includes information about how to read and evaluate the status byte.

THE STATUS BYTE

Your program can read the status byte by means of an IN instruction to Port 2 of the two ports used by the Mouse Interface. Figure 2.1 shows the significance of the individual bits within this byte.

Bit:	7	6	5	4	3	2	1	0
	X	INT	RAM	ROM	X	X	IBF	OBF

Figure 2.1 The status byte

X Indicates that this bit is unused.

INT When this bit is set, the Mouse Interface has issued an interrupt and the interrupt line is still active (low).

ROM If this bit is set, there is a fault in the ROM of the Mouse Interface.

RAM If this bit is set, there is a fault in the RAM of the Mouse Interface.

IBF Input Buffer Full: when this bit is set, the Mouse Interface is busy. Your program should wait until this bit is reset before transmitting commands or data to the Mouse Interface.

OBF Output Buffer Full: when this bit is set, one byte of data is available for reading by the processor of your NCR DECISION MATE V. Your program should not attempt to read data while this bit is zero.

COMMANDS AND PARAMETERS

This section consists of a summary of the commands recognized by the microprocessor of the Mouse Interface. A number of these commands require subsequent parameters, either to be transmitted to or read from the Mouse Interface.

NOTE: After issuing a command entailing parameters, it is important to complete all parameters formally detailed for that command. Therefore, do not terminate prematurely the parameter sequence of a command by transmitting a further command.

Remember that all commands are transmitted to the Mouse Interface via Port 2, parameters (data) via Port 1. Parameters are read from the Mouse Interface via Port 1.

The following default values are automatically set by the Mouse Interface upon switching on. They remain in force until changed by your program, or, in the case of the current mouse position, by movement of the mouse itself.

XMAX: maximum range in the X (horizontal) direction	640
YMAX: maximum range in the Y (vertical) direction	400
XMIN: minimum range in the X direction	0
YMIN: minimum range in the Y direction	0
X and Y coordinates of the current mouse position, both	0

All interrupts disabled.

The summary of commands and parameters follows. The hexadecimal value for the OUT instruction via Port 2 two is given for each command, together with a description of its purpose and any ensuing parameters. Negative values are represented as two's complement.

00 Read absolute position of mouse
Sequence of parameters subsequently read:

X co-ordinate, low byte
X co-ordinate, high byte
Y co-ordinate, low byte
Y co-ordinate, high byte
Switch status byte (see below)

The absolute position refers to movement of the mouse (within the delimited range) since the starting position of the mouse was last set (initially set at switching on to 0,0; can be subsequently set by command 04).

01 Enable interrupt issued when mouse is moved
No parameters.
At the same time, this command disables the switch interrupt.

02 Disable all interrupts
No parameters.

03 Reset the interrupt line and INT bit (status byte)
No parameters.

04 Set logical mouse position
Sequence of parameters transmitted to the interface:

X co-ordinate, low byte
X co-ordinate, high byte
Y co-ordinate, low byte
Y co-ordinate, high byte

If the position thus set is outside the delimited range (see commands 05 and 0A), that range does not apply.

05 Set maximum X and Y values the mouse can attain.
Sequence of parameters transmitted to the interface:

XMAX, low byte
XMAX, high byte
YMAX, low byte
YMAX, high byte

The relation between the X/Y co-ordinates computed by the Mouse Interface and the actual distance covered by the mouse varies according to the type of mouse being used. The default settings (XMAX = 640, YMAX = 400) correspond to practicable ranges for using a mouse on a desk top.

06 Enable switch interrupt
No parameters.
At the same time, this command disables the mouse movement interrupt.

07 Enable both the mouse movement and the switch interrupt.
No parameters.

08 Perform a ROM check
No parameters.
This is the same check as is performed at switching on.

09 Read the relative position of the mouse
Parameters as for command 00.
The relative position of the mouse refers to movement in the X and Y directions since the mouse position was last

read. (The absolute position refers to movement from the starting position.)

0A Set the minimum X and Y values the mouse can attain
Sequence of parameters to be transmitted to the Mouse Interface:

XMIN, low byte
XMIN, high byte
YMIN, low byte
YMIN, high byte

NOTE: Absolute and relative position are stored in the same set of internal registers. This means that a program cannot read both the absolute and the relative mouse position. If this facility is required, you should consider storing a position required for later reference in an area in your program. You can then write this position back to the Real-Time-Clock (Command 04) at an appropriate point in your program.

The Mouse Interface can handle up to three switches on the mouse. The leftmost switch is designated S1, the rightmost S2, and the centre switch, if present on the mouse, S3. The switch status byte (command 00) uses bit 0 to record the status of S1; bit 1 is used for S2, and bit 2 for S3. In each case, the bit is set when the appropriate switch is in the depressed condition, otherwise the bit is zero. The five most significant bits of the switch status byte are unused.

INTERRUPTS

This section is intended for specialist applications of the Mouse Interface, for which the use of interrupts is required. Assuming that both interrupts are enabled, the Mouse Interface issues an interrupt whenever the mouse is moved, and whenever any one of the switches changes state (ON to OFF, or OFF to ON).

CAUTION: The setting up of interrupt facilities beyon that of software sampling of the interrupt bit in th status byte requires knowledge of and experience i dealing with semiconductor components and circuitry. I addition, you should consult the Hardware volume of th System Technical Manual for the NCR DECISION MATE V.

If you are using the 16-bit version of the processor for th NCR DECISION MATE V, you will require interrupt controlle circuitry, in addition to access to the interrupt line o the computer bus system.

The 8-bit processor (Z80A) has a characteristic which offer a limited interrupt handling facility with a minimum o hardware overhead, namely the Interrupt Mode 1. When thi interrupt mode is set (Instruction: IM 1 / Opcode: ED 56) the setting of an interrupt (interrupt line goes low) force the transfer of program control to the hexadecimal addres 38. The CP/M-80 operating system contains at this address a unconditional jump to the DDT utility. This address is use when a breakpoint is encountered during the testing of program. If use of the DDT is not required, it is possibl to write a different jump instruction to address 38H. Thi jump instruction can pass program control to your ow interrupt service routine.

CHAPTER 8

MOUSE

(This is the description of the Mouse unit of the p-System™. Please insert it in the manual UCSD p-System, Programming, chapter 8)

p-System™ is a trademark of Softech Microsystems, Inc., and is used pursued to a license granted by Softech Microsystems, Inc.

Introduction

The following is a description of the procedures you can use with the p-System™ to work with your mouse.

The software you need for using the Mouse interface and working with the Mouse in the p-System™ is contained in the MOUSE.CODE file. If you have a Runtime System MOUSE.CODE is incorporated in your SYSTEM.LIBRARY. If you have a Plus System, you have to insert this code in your SYSTEM.LIBRARY, in any of slots 0 through 15. Chapter 6, utility 'LIBRARY' in the 'UCSD p-System, Programming' Manual describes how this is done.

The interface part of the Mouse unit affords access to the following procedures:

GMOUS: gives the status of the Mouse switches and Mouse position. This procedure supplies the absolute position (x and y coordinates) of the Mouse and the status of the switch(es) (up to 3). Use all three switch variables, even if your Mouse has only one or two switches.

X,Y: absolute x and y coordinates

SW1,SW2,SW3: status of the Mouse switches (1 = pressed, 0 = not pressed or not existent)

SETPOS: sets the logical position of the Mouse.

X,Y: New x and y coordinates for the Mouse position.

Note: Use this option to set a new position for the Mouse. If you require no direct correlation between the physical position of the Mouse and its program position, you can reset

the logical Mouse position by means of SETPOS.

SETMAX: sets maximum values for the Mouse position. Sets the maximum x and y values the Mouse can attain (default: x=640, y=400).

XMAX,YMAX: are maximum values for the x and y coordinates

For SETPOS note that the initial Mouse position is x=0, y=0. The Mouse can move within the area delimitated by x=0, y=0 and the values set in SETMAX.

Pascal Procedures

To use the Mouse procedures in a Pascal program, declare
USES MOUSE;

The first lines of the respective procedures have the following forms:

GMOUS

```
PROCEDURE GMOUS
   (VAR SW3, SW2, SW1, Y, X: INTEGER)
```

SETPOS

```
PROCEDURE SETPOS (X,Y: INTEGER)
```

SETMAX

PROCEDURE SETMAX (XMAX,YMAX: INTEGER)

Example

Here is an example for the use of the Mouse procedures in Pascal.

In the first part of the main program, the maximum Mouse position is set by means of the X and Y coordinates; and the present Mouse position is set to zero. In the second part of the main program, the variables are collected and displayed on the screen. SW1, SW2, and SW3 designate the switches on the Mouse (here the HAWLEY MARK II Mouse), which can be on or off. X is the Mouse position on the X coordinate, Y the Mouse position on the Y coordinate.

```
{ EXAMPLE MOUSE PROGRAM PASCAL }

 PROGRAM MOUSETP;

   USES MOUSE;

   VAR SW1,SW2,SW3,X,Y,X0,Y0,XM,YM:INTEGER; C:CHAR;

   PROCEDURE FIN(VAR C:CHAR);
{ PROMPT FOR FINISH }
     BEGIN
       GOTOXY(0,18);
       WRITE('    DO YOU WANT TO FINISH?   Y/N ');
       READLN(C);
     END;

   BEGIN
{ CLEAR SCREEN, CURSOR INVISIBLE }
     WRITELN(CHR(27),'@0',CHR(27),CHR(69));

     WRITELN('    ******   M O U S E  EXAMPLE  P A S C A L   ******');
     GOTOXY(0,16);
     WRITELN('    TO STOP PRESS SWITCH 1 ');
```

```
{ SET MAXIMUM }
     XM:=10000;
     YM:=10000;
     SETMAX(XM,YM);

{ SET START POSITION }
     X0:=0;
     Y0:=0;
     SETPOS(X0,Y0);

     C:='N';

{ LOOP MOUSE ACTIONS }
     REPEAT
       GMOUS(SW3,SW2,SW1,Y,X);
       GOTOXY(0,4);
       WRITELN('    X=',X:6,'     Y=',Y:6);
       GOTOXY(0,6);
       WRITELN('    SWITCH 1:',SW1,'  SWITCH 3:',SW3,'  SWITCH 2:',SW2);
       GOTOXY(0,18);

{ SET OR CLEAR PROMPT FOR FINISH DEPENDING ON SW1 }


       IF SW1=1 THEN FIN(C)
                ELSE WRITE(CHR(27),'L');

     UNTIL C in ['y','Y'];

{ CURSOR VISIBLE }
     WRITE(CHR(27),'@1')
   END.
```

Fortran Procedures
To use the Mouse procedures in a Fortran program, declare

```
$USES MOUSE
```

The subroutine and parameter definition can be found below:

GMOUS

```
SUBROUTINE GMOUS(SW3,SW2,SW1,Y,X)
   INTEGER SW1, SW2, SW3, Y, X
```

SETPOS

```
SUBROUTINE SETPOS (X,Y)
   INTEGER X,Y
```

SETMAX

```
SUBROUTINE SETMAX (XMAX,YMAX)
   INTEGER XMAX,YMAX
```

Example

Here is an example for the use of the Mouse procedures in FORTRAN.

In the line starting with 1, the maximum Mouse position is set by means of the X and Y coordinates. In the line starting with 2, the present Mouse position is set to zero. In the line starting with 10, SW1, SW2, and SW3 designate the switches on the Mouse (here the HAWLEY MARK II Mouse), which can be on or off. X is the Mouse position

on the X coordinate; y the Mouse position on the Y coordinate.

Then the program collects the values and displays them on the screen.

```
C
C       MOUSE EXAMPLE PROGRAM FOR FORTRAN
C
$USES MOUSE

        PROGRAM MOUSTF

        INTEGER SW1,SW2,SW3,X,Y,X0,Y0,XM,YM
        CHARACTER C

C       CLEAR SCREEN, CURSOR INVISIBLE
        WRITE(*,'(AAAA)') CHAR(27),'@0',CHAR(27),'E'

        WRITE(*,200)
200     FORMAT(4X,'******   M O U S E  EXAMPLE  F O R T R A N   ******')
C       SCREEN POSITION LINE 16 COLUMN 0
        WRITE(*,'(AA\)') CHAR(27),'Y0 '
        WRITE(*,'(A)') '    TO STOP PRESS SWITCH 1 '

C       SET MOUSE MAX VAL
        XM=10000
        YM=10000
1       CALL SETMAX(XM,YM)

C       SET MOUSE POSITION
        X=0
        Y=0
2       CALL SETPOS(X,Y)

        C='N'
```

```
C       LOOP MOUSE ACTIONS
        DO 1000 I=0,0,0
10      CALL GMOUS(SW3,SW2,SW1,Y,X)
        WRITE(*,'(AA\)') CHAR(27),'Y$ '
C       SCREEN POSITION LINE 4, COLUMN 0
        WRITE(*,300) X,Y
300     FORMAT ('    X=',I6,'     Y=',I6//)
        WRITE(*,100) SW1,SW3,SW2
100     FORMAT('    SWITCH1:',I1,'   SWITCH3:',I1,'   SWITCH2:',I1)
C       SCREEN POSITION LINE 18, COLUMN 0
        WRITE(*,'(AA\)') CHAR(27),'Y2 '

C       SET OR RESET PROMPT FOR FINISH DEPENDING ON SW1
        IF (SW1 .EQ. 1) THEN
        CALL FIN(C)
        ELSE
        WRITE(*,'(AA\)') CHAR(27),'L'
        ENDIF

        IF ((C .EQ. 'Y') .OR. (C .EQ. 'y')) THEN
        I=1
        ENDIF
1000    CONTINUE

C       CURSOR VISIBLE
        WRITE(*,'(AA)') CHAR(27),'@1'
        END

        SUBROUTINE FIN (C)
C       PROMPT FOR FINISH
        CHARACTER C
        WRITE(*,'(A\)') '    DO YOU WANT TO FINISH?   Y/N '
        READ(*,'(A1)') C
        RETURN
        END
```

BASIC Interface

To use the Mouse procedures in a BASIC program, declare

```
USES MOUSE
```

The subroutine and parameter definition can be found below:

GMOUS

```
SUB GMOUS(SW3,SW2,SW1,Y,X)
   INTEGER SW1, SW2, SW3, Y, X
```

SETPOS

```
SUB SETPOS (X,Y)
   INTEGER X,Y
```

SETMAX

```
SUB SETMAX (XMAX,YMAX)
   INTEGER XMAX,YMAX
```

Example

Here is an example for the use of the Mouse procedures in BASIC.

In the line starting with 10, the maximum Mouse position is set by means of the X and Y coordinates. In the line starting with 20, the present Mouse position is set to zero. In the line of the main program starting with 100, the variables are collected and displayed on the screen.

SW1, SW2, and SW3 designate the switches on the Mous (here the HAWLEY MARK II Mouse), which can be on o off. X is the Mouse position on the X coordinate; y th Mouse position on the Y coordinate.

```
        REM
        REM   MOUSE TEST PROGRAM  B A S I C
        REM

        USES MOUSE

        INTEGER SW1,SW2,SW3,X,Y,X0,Y0,XM,YM
        DIM C$*1

        SUB FIN (C$)
        REM PROMPT FOR FINISH
        INPUT AT (19,1)"    DO YOU WANT TO FINISH?   Y/N ":C$
        SUBEND

        REM CLEAR SCREEN, CURSOR INVISIBLE
        DISPLAY ERASE ALL:CHR$(27);"@0"

        DISPLAY AT (2,1): "    ******   M O U S E  EXAMPLE  B A S I C   *****
        DISPLAY AT (17,1):"    TO STOP PRESS SWITCH 1 "

        REM  SET MOUSE MAX VAL
        XM=10000
        YM=10000
10      CALL SETMAX(XM,YM)

        REM   SET MOUSE POSITION
        X0=0
        Y0=0
20      CALL SETPOS(X0,Y0)

        C$="N"

        REM LOOP MOUSE ACTION
        FOR I=0 TO 0 STEP 0
100     CALL GMOUS(SW3,SW2,SW1,Y,X)
        DISPLAY AT(5,1) USING "    X=######    Y=######":X,Y
        DISPLAY AT(7,1):"    SWITCH 1:";SW1;"  SWITCH 3:";SW3;"  SWITCH 2:";S

        REM    SET OR CLEAR PROMPT FOR FINISH DEPENDING ON SW1
        IF SW1=1 THEN CALL FIN(C$) ELSE DISPLAY AT (19,1):CHR$(27);"L";

        IF C$="Y" OR C$="y" THEN I=1
        NEXT I

1000    REM CURSOR VISIBLE
        DISPLAY AT (1,1):CHR$(27);"@1"
        END
```

KIT INSTALLATION

for

MEMORY EXPANSION
(K202-V001)

The attached pages provide information for installing this kit into an NCR DECISION MATE V. These pages should be filed in your NCR DECISION MATE V User Information Manual.

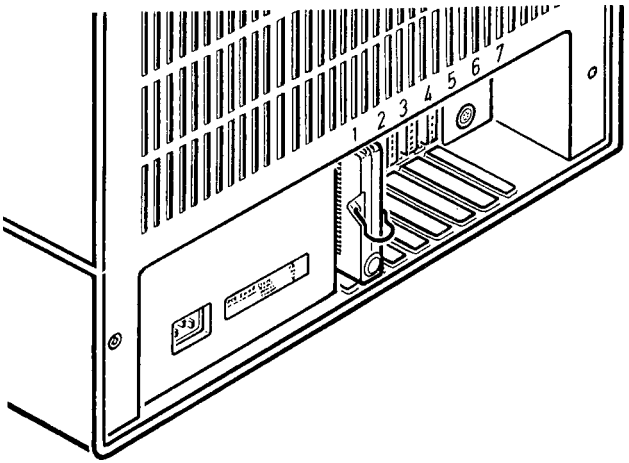
KIT INSTALLATION

MEMORY EXPANSION
(K202-V001)

1. Install this kit into slot 1 at the rear of the NCR DECISION MATE V.

   NOTE: No other slot position may be used for this kit.

You have now increased the memory capacity of your system to 256 Kilobytes.



IMPORTANT INFORMATION
FOR MS-DOS USERS WITH 256KB MEMORY

Do not use the /HIGH switch when linking a program with MS-LINK on systems with 256 KB memory. (The switch can never be used with PASCAL and FORTRAN programs, regardless of memory size.) While MS-LINK performs successfully, the computer "goes down" when MS-DOS attempts to load the .EXE program into memory.

If using interpretive BASIC, you can store a subroutine in high memory, but you should only use this technique if you are familiar with debugger:

1. Debug subroutine
2. Move subroutine to higher memory
3. Record register values (segment address of subroutine)
4. Load BASIC
5. Load BASIC program
6. Change DEF SEG to refer to subroutine
7. Save subroutine (BSAVE)

Finally, use the following sequence in programs that compute the size of the user area. This sequence ensures a successful program load.

1. Load the application program.
2. Save segment address of program (in CS).
3. Issue the System Call, "Modify allocated memory block":
   - move CS to ES
   - move length of program to BX
   - move 4AH to AH
   - INT 21H

4. Issue the System Call "Allocate memory":
   - move FFFFH to BX
   - move 48H to AH
   - INT 21H

5. Multiply the contents of BX by 16 to determine the size of the user area.

(For detailed information see the MS-DOS Programmer's Manual, "System Calls" chapter.)

NCR DECISION MATE V

SPEICHERERWEITERUNG
(K202-V001)

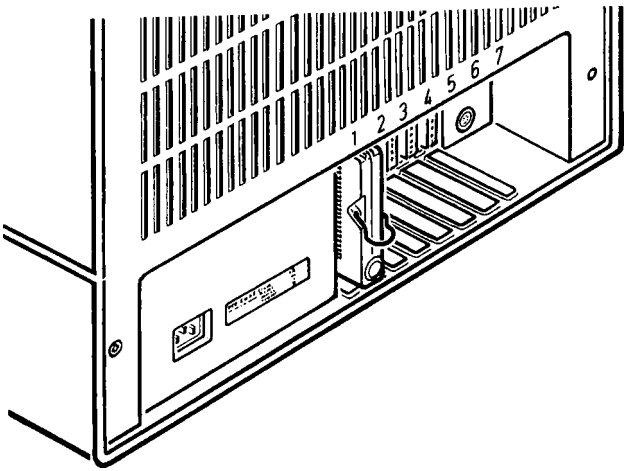
Die beiliegende Seite erklärt Ihnen, wie Sie diese Lei
stungserweiterung an Ihren NCR DECISION MATE V anschließe
können. Bitte ordnen Sie diese Beschreibung in Ihre Bedie
nungsanleitung für den NCR DECISION MATE V ein.

NCR ist ständig bemüht, die Produkte im Zuge der Entwicklung von Technologie, Bauteilen, Soft- und Firmware dem neuesten Stand anzupassen. NCR behält sich deshalb das Recht vor, Spezifikationen ohne vorherige Ankündigung zu ändern.
Nicht alle hier beschriebenen Leistungen werden von NCR in allen Teilen der Welt vertrieben. Nähere Informationen bezüglich eventueller Einschränkungen oder Erweiterungen sowie den aktuellen Stand erfahren Sie von Ihrem Händler oder der nächstgelegenen NCR-Geschäftsstelle.

SPEICHERERWEITERUNG
(K202-V001)

Setzen Sie dieses Erweiterungsmodul in die dafür vorgesehen
Steckfassung **1** an der Rückseite Ihres NCR DECISION MATE
ein.

Beachten Sie bitte, daß diese Erweiterung in keine ander
Steckfassung gesteckt werden darf.



Sie haben damit die Speicherkapazität Ihres NCR DECISION
MATE V auf 256 Kilobyte erweitert.

WICHTIGER HINWEIS
FÜR DIE BENUTZUNG VON MS-DOS MIT 256KB-SPEICHER

Wenn Ihr System einen 256 KB-Speicher beinhaltet, sollten Sie bei Verwendung des MS-LINK-Dienstprogramms die /HIGH-Option nicht benutzen. (Diese Option kann ohnehin mit PASCAL- und FORTRAN-Programmen unabhängig von der verfügbaren Speichergröße nicht benutzt werden.) Der MS-LINK-Vorgang wird wie üblich durchgeführt. Sobald MS-DOS aber versucht, das maschinenausführbare .EXE-Programm in den Speicher zu laden, ist ein Neubetätigen des Netzschalters am Computer erforderlich.

Es ist möglich, ein Unterprogramm, das vom BASIC-Interpreter übersetzt werden soll, in den oberen Bereich des Speichers zu laden. Dies ist aber nur dann zu empfehlen, wenn Sie bereits mit der Funktionsweise der Programm-Testhilfe (debugger) vertraut sind:

1. Vergewissern Sie sich, daß Ihr Unterprogramm keine Fehler enthält.
2. Übertragen Sie das Unterprogramm in den oberen Speicherbereich.
3. Notieren Sie die neue Segmentadresse entsprechend der neuen Anfangsadresse des Unterprogramms.
4. Laden Sie den BASIC-Interpreter.
5. Laden Sie das BASIC-Programm.
6. Ändern Sie die DEF SEG-Instruktion, damit sie auf die neue Anfangsadresse zeigt.
7. Übertragen Sie das Unterprogramm auf Platte (BSAVE).

Die nachstehende Erläuterung sollten Sie lesen, wenn Sie Programme einsetzen wollen, die die Größe des Benutzerbereichs berechnen. Die folgenden Anweisungen sorgen dafür, daß das Programm einwandfrei geladen wird.

1. Laden Sie das Anwender-Programm.
2. Kopieren Sie den Inhalt von CS (Segmentadresse des Programms) in eine Speicherstelle (2 Byte), wo er nicht versehentlich gelöscht werden kann.
3. Rufen Sie die System-Funktion "Modify allocated memory block" auf, indem Sie folgende Anweisungen ausführen:
   - Übertragen Sie den Inhalt von CS in ES
   - Laden Sie BX mit der Länge des Programms

- Laden Sie das AH-Register mit 4AH
- INT 21H

4. Rufen Sie die System-Funktion "Allocate memory" auf, indem Sie folgende Anweisungen ausführen:
   - Laden Sie BX mit FFFFH
   - Laden Sie das AH-Register mit 48H
   - INT 21H

5. Multiplizieren Sie den Inhalt von BX mit 16, um die Größe des Benutzerbereichs zu berechnen.

(Das Kapitel "System Calls" im MS-DOS "Programmer's Manual" enthält eine ausführliche Beschreibung der hier benutzten System-Funktionen.

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