SIEMENS

PU 670 C
Programming Unit

Manual

Order No. 6ES5 998-0BK21
Release 3

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Siemens Aktiengesellschaft

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6ES5 670-0CB21

Instructions

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PU 670 C

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1 Technical description

1.1 Application

The 670 visual display programming unit is designed for programming and commissioning all SIMATIC S5 programmable controllers, and can be used for the direct input of functions using graphic representation methods. Sophisticated test functions allow it to be used as a computer aided commissioning unit. The following characteristics are significant in reducing time and costs during the design, programming, testing, and commissioning of programmable controller systems: direct input of a graphically represented program, program lucidity due to clear documentation, filing of reusable programs and program sections, powerful test and commissioning functions, portable, thus allowing it to be set-up as a table top or upright unit at any location.

1.2 Construction

The metal housing with laterally located handles has a polyurethane frame with visual display unit, the brilliance and contrast controls, two mini-floppy disk drives, a plug location for EPROM modules, and a keyboard and other control elements at the front. An equipment plug for attaching all connecting cables is located on the rear of the unit. A carrying case, with castors and handles, provides protection during transport.

1.3 Principle of operation

1.3.1 Introduction

The block circuit diagram of the PU 670 is illustrated in Fig 1. The principal of operation of the unit is to be subsequently described with the aid of this block circuit diagram.

Programming unit control is located on several plug-in printed circuit boards, and can thus be easily maintained. The 8085 microprocessor provides the central control functions. This microprocessor undertakes the processing of all programming unit functions in conjunction with the associated high integrated modules. A 60K byte dynamic RAM memory is available as operating memory. The complete programming unit software, having a scope of approximately 160k bytes, is stored on diskettes, and is subdivided into segments. Depending on the function to be executed, then the corresponding section is automatically loaded into the operating memory.

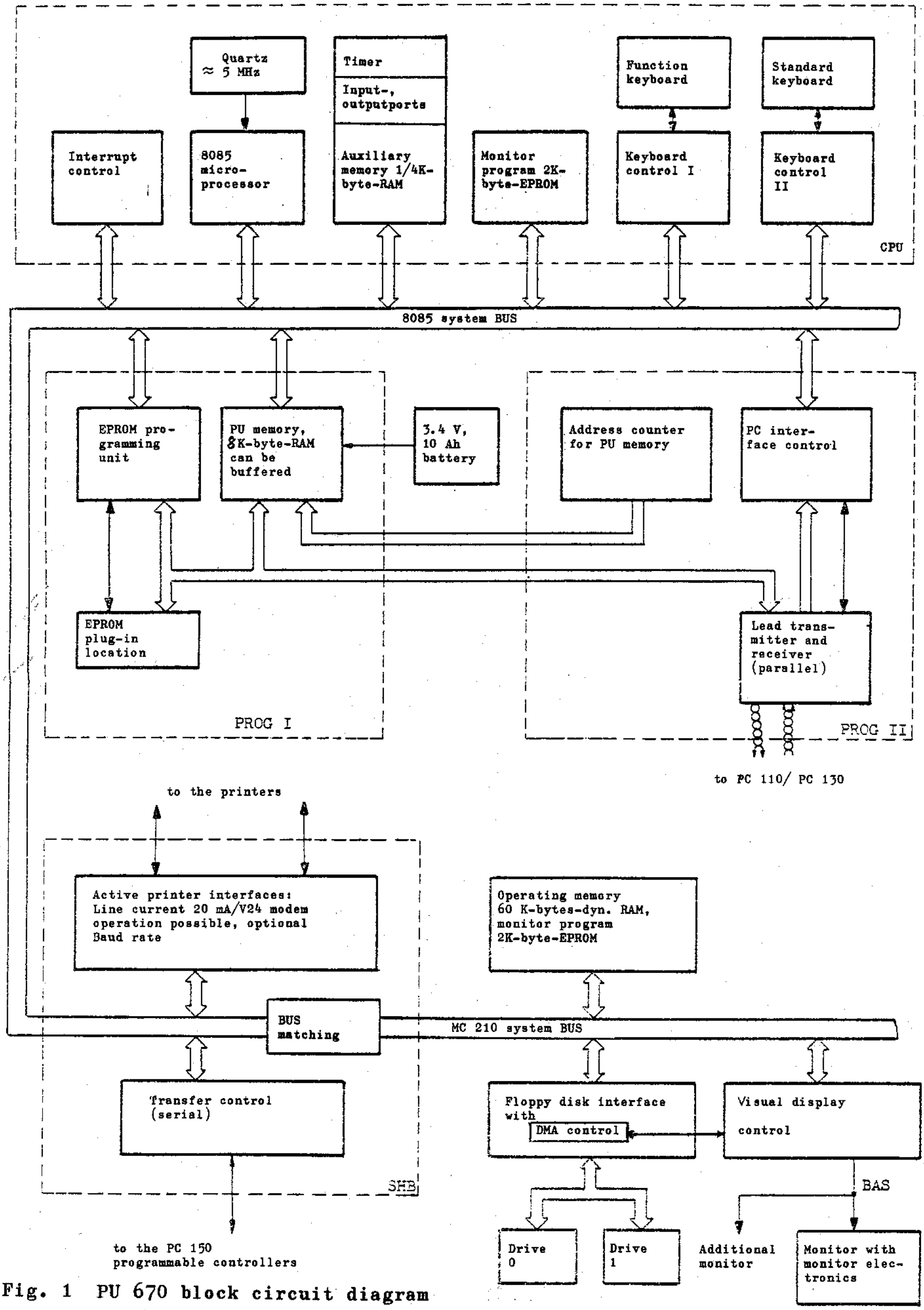


Fig. 1 PU 670 block circuit diagram

1.3.2 Description of the individual printed circuit boards

CPU

All central functions of the programming units are executed on this printed circuit board. The quartz controlled 8085 microprocessor executes the system start, and prepares all high integrated modules after switch-on. It receives its instructions from the internal monitor program, which is deposited in the 2K-byte EPROM on the CPU, and in the 2K-byte EPROM, on the operating memory. Further, the keyboard and the interrupt control are also processed on this printed circuit board. The micro-processor can control the system, and scan certain conditions via input and output ports. The internal sequences are supplemented by a programmable timer, and an auxiliary RAM memory of 1/4K-bytes.

PROG I/PU-memory

The PU-memory, which is able to be buffered, is located on PROG I. The complete program of a programmable controller, or a module is deposited in this memory. If required, this program can be transferred to a EPROM module via the EPROM slot. These modules can be used as program memory as well as data carrier by the programmable controllers.

PROG II

The parallel interfaces, including the corresponding special signals to the PC 110/130 programmable controllers are controlled and monitored here. In this case, the synchronization of the address counter for the PU-memory to the programmable controller is realized.

A large percentage of the address decoding is located here for space reasons. The address decoding provides mainly the control signals for the PROG I and PROG II printed circuit boards.

SHB

A TTY interface (20 mA line current, full duplex), as well as a V24 interface, which is suitable for modem operation, are available for connecting printers. The transfer rates can be selected between 110 Baud up to 9600 Baud, using wire jumpers in a plug housing. The connection to the PC 150 programmable controller is established via a serial 20 mA line current interface.

A bus matching for this system is executed at the slot for this printed circuit board, so that the following printed circuit board can be operated with a MC 210 bus structure.

Floppy interface using two mini-floppy disk double-head drives

Two diskettes with a total capacity of 2 x 160K-bytes can be inserted in the programming unit. A drive is continuously occupied by a system diskette, on which the total software for a programming type (CSF, SL, LD) is available. The diskette in the second drive can be used for storing the user program, making it insensitive to voltage failures, or as data carrier.

A floppy disk controller in conjunction with a DMA controller (direct memory access), undertakes the data transfer to the diskettes. The DMA controller occasionally receives the control via the system bus on request.

Visual display unit control and monitor

Rows after rows, from the image repeat memory (a component of the operating memory) are written into the CRT controller via DMA cycles. The CRT controller then generates the necessary BAS signal for the monitor.

1.3.3 Interrupt structure

The interrupt structure of the programming unit is illustrated in Fig 2. This interrupt structure consists of an interrupt control, and direct inputs of the microprogram. TRAP is the highest priority input, which is activated by a NEW START key operated switch, or by a mains failure. The other interrupt inputs are masked by instructions, so that a subroutine jump is first made possible after a precise enabling signal.

The interrupt control can accept several requests, execute a pre-selection, and transfer to the microprocessor, which then executes a certain subroutine jump, depending on the request.

1.4 Printer interfaces

The plug connections to the units are established on the backside of the PU 670. Printers having a 20 mA line current, and V24 interface can be connected.

Order No., refer to section 2.3, terminals for connecting cable.

The transfer rate can be adjusted by inserting corresponding jumpers in the plug housing of the printer cable on the programming unit side. The assignment of these plug connections is described in 3.2.5.

Transfer rate selection

Pins		Baud rate
17,4,3	- 2	9600
4,3	- 2	300
17,3	- 2	4800
3	- 2	1200
17,4	- 2	2400
4	- 2	600
17	- 2	110

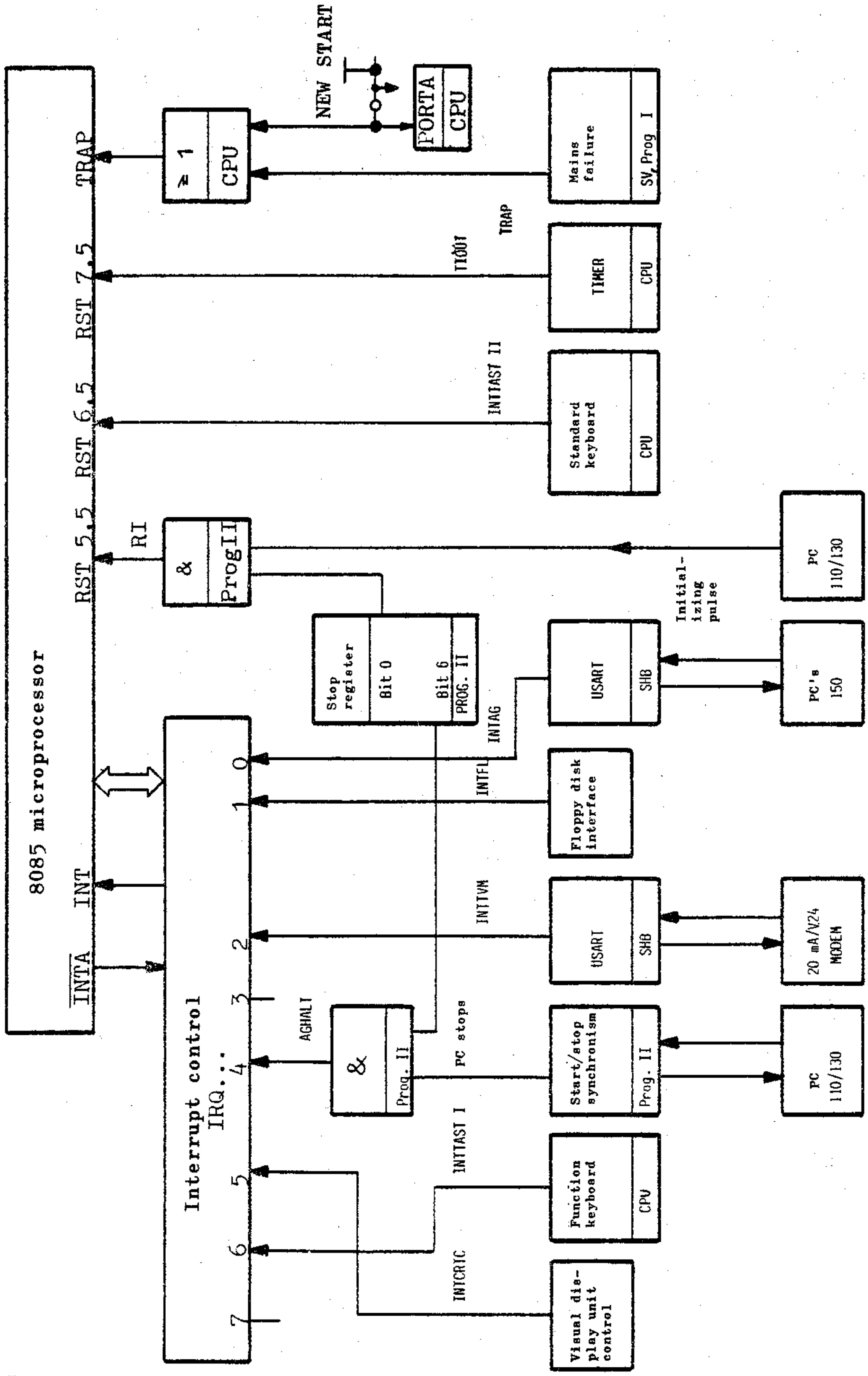
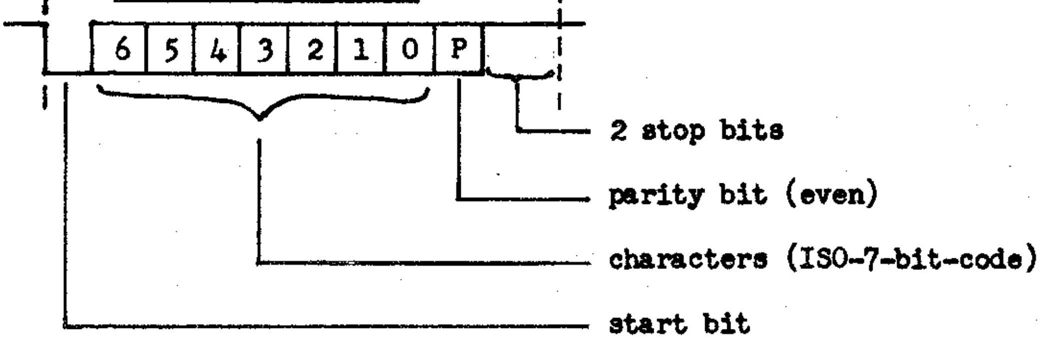


Fig. 2 Interrupt structure

PU 670 C

The PU 670 transmits the signals CR and LF as control characters for the printer. This is subsequently followed by a transmission of 4 empty characters. The print-out comprises 80 characters per line, and 73 lines per sheet. In order that this sheet control correctly functions, the printer paper must be adjusted so that the start of the paper is in position, after the programming unit has been switched-on or after a new start (fold = 1 line above the printer position).

Transmission format



Preferred length code and Order No. supplement

Length	Order No. supplement
0.60 m	6ES5 7**-0AGC0
0.80 m	-0AI00
1.00 m	-0BB00
1.20 m	-0BB20
1.60 m	-0BB60
2.00 m	-0BC00
2.50 m	-0BC50
3.20 m	-0BD20
4.00 m	-0BE00
5.00 m	-0BF00
6.30 m	-0BG30
8.00 m	-0BI00
10.00 m	-0CB00

1. <u>Teletype</u> (Siemens designation 3913)

   - Transmission rate: 110 Baud
   - Control character handling: CR, LF; waiting time 400 ms
   - Cable connector: 6ES5-735-0...0

2. <u>PT 80 with 20 mA interface</u>

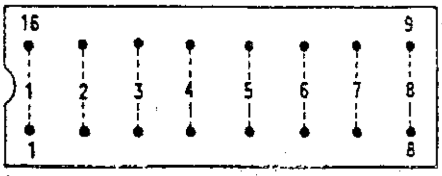
   - Technical data: 60 characters/s
   - Control character handling: CR, LF
   - Cable connector: 6ES5-736-0...0

   Usually only one character is necessary for control of a device function, but two characters for carriage return (generally CR, LF). In extreme cases, e.g. high transmission rate of 600 Bd or continuous printing of very short lines, the printer requires more time to transport the paper or carriage than is available through the receipt of characters. In order to bridge the time in such cases, an additional fill character, preferably a "NUL", must be inserted behind the corresponding control characters.

   The following table shows the number of fill characters required according to the transmission rate

<table>
<tr><td rowspan="2">Control character to be followed by fill character</td><td colspan="5">Number of fill characters necessary at a transmission rate of:</td></tr>
<tr><td colspan="2">600 Bd</td><td>300 Bd</td><td>200 Bd</td><td>≦ 150 Bd</td></tr>
<tr><td rowspan="3">CR or
CR LF</td><td colspan="2">Printers with a max. line length</td><td rowspan="2">If only up to 3 cpl are repeatedly printed
2</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>80 Ch.</td><td>132 Ch.</td></tr>
<tr><td>20</td><td>32</td><td>If only up to 6 cpl are repeatedly printed
1</td></tr>
<tr><td>LF</td><td colspan="2">6</td><td>If only LF and up to 3 print characters are repeatedly input
2</td><td>If only LF and 1 character are repeatedly input
1</td><td></td></tr>
</table>

- Jumper arrangement:



Position of the jumpers on the jumper base

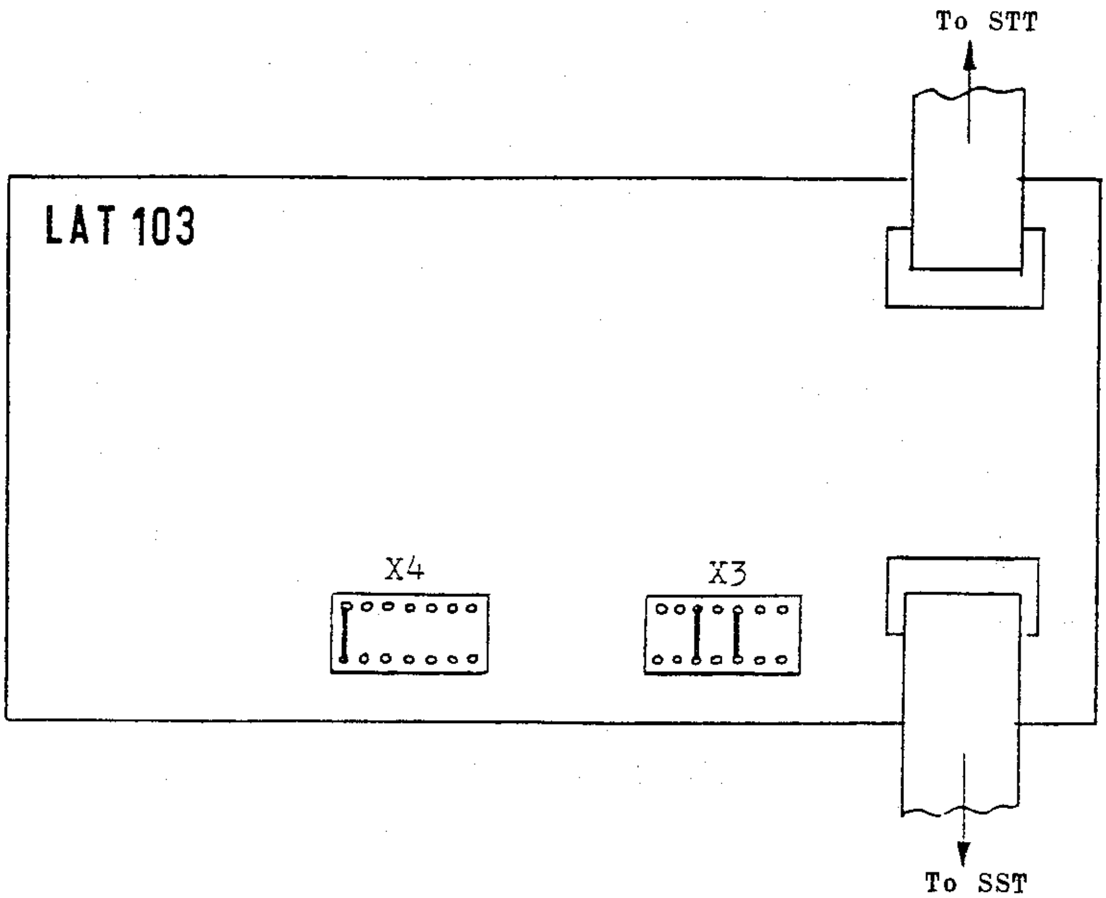
a) Basic electronics (= large module in bottom of unit after swinging up the printer mechanism)

(only with KSR: X13 ⟶ 1,6,7)
RO: X14 ⟶ 1,6,7
X15 ⟶ 5,7,8
X16 ⟶ No jumper

In addition: W4, W11, W12

b) Control unit STT 103: X6 ⟶ 1,2,5,7

c) Lead interface unit LAT 103: X3 ⟶ 3,5
X4 ⟶ 1



3. PT 80 with V.24 interface (Siemens designation 3917)

- Technical data: 60 characters/s
- Control character handling: as with 20 mA interface
- Cable connector: 6ES5-737-0...0
- Jumper arrangement: as with 20 mA interface without LAT 103

PG 670	Signal	PT 80, V.24
2	GND	7
11	TXD	3
5	RXD	2
24/25	Screen	1
4] 600 Bd	0V	
2]	K6	

4. TALLY printer 220 (Siemens designation 3915)

- Technical data: 132 characters/line
  200 lines/min
  9600 Baud
- Control character handling: CR, LF; "BUSY" feedback
- Cable connector (not a GWK product)

PG 670	Signal	3915
2	GDN	7
11	TXD	3
5	RXD	2
7	DSR/BUSY	25
24/25	Screen	1
17	K5	14
4	K6	7
3	K7	
2	0V	

Ord.No. C74451-Z1073-U1

5. Printer UD-3 (Siemens designation 3918)

- Technical data: Forward and reverse printing
  250/200 characters/s
  Line feed ca. 100 ms
  Noise level: 60 dB (A)
- Control character } As for Tally
- Cable connector } As for Tally
- Ord.No.:

3918 printer with 9x7 dot matrix

Needle print mechanism 250 characters/s	U2503-B231
Interface V.24/20 mA	U25037-B9
Single tractor	U25031-B2
Character generator (9x7): International	U25035-B1
German	U25035-B2

1.5 Technical data

Power supply (primary clocked)

mains supply voltage	110V, 220 / +10%, -15%
mains frequency range	48 to 63 Hz
switching frequency	approx. 40 KHz
mains fuse	2A/220V, 4A/110V
current consumption	approx. 0.6A at 220 V
protection classification	I
degree of protection	IP 50 for operation IP 63 when enclosed in carrying case
internal d.c. voltage	5V/7 to 8 A 25.5 V programming voltage +12V monitor, drives, electronics -12V electronics mains failure monitoring
cooling	forced cooled with filter element
safety specifications	VDE 0160

Buffer battery

voltage	3.4 V
capacity	10 Ah, after 30 min automatic switch-off
buffer current	up to 5 mA
storage	10 years
construction	lithium elements

UV erase unit

max. erase time	30 min
capacity	1 EPROM memory module
timer	mechanical timer with automatic switch-off
life of the UV source	3000 operating hours, after which the intensity is reduced by 50%

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Memory types

RAM memory	8K-bytes static RAM, 30 min buffer time 60K-bytes dynamic RAM, operating memory two extension memories, each 64K-bytes dyn. RAM
mini floppy disk	two drives, each 160K-bytes

Environmental conditions

storage temperature	-40 to +60°C
operating temperature	10 to 40°C
relative humidity	20-80%, without dew
acclimatization phase	switch-on unit, with inserted diskette, and wait 10 min.
packaging	ES 902, series 2 and flat signal ribbon cable connections
integrated circuit technology	TTL (MSI, LSI) and semi-conductor memories, 8085 processor
weight	approx. 28 kg without carrying case approx. 41 kg with carrying case
dimensions (W x D x H in mm)	carrying case: 536 x 325 x 817 unit: 488 x 655 x 290

Serial interfaces

transfer rate in Baud:	110, 300, 600, 1200, 2400, 4800, 9600
Baud rate selection:	in the cable plug for PU 670

TTY - interfaces for printer and programmable controllers:
current sources in PU 670
permissible distance to the printer is 10 m (preferred length 3 m)
permissible distance to the programmable controller 100 m (1000 m)
(preferred length 5 m)

V24 - interface for printer and MODEM:
voltage source in the PU 670, permissible distance to the peripherals
30 m (preferred length 3 m)

permissible printer: refer to section 2.3

Parallel interface

the connection to the PC 110 and PU 130 is established via a 50-pole plug connector (max. length 3 m)

Supplementary monitor

permissible distance 100 m (preferred length 10 m)

Interface module 6ES5 511-5AA11, 12, 13

power supply voltage	5V
current consumption	1.6 to 2A
permissible temperature range	0 to 50°C
transmission type	20 mA line current (passive)
transfer rate	9600 Baud standard, adjustable via software

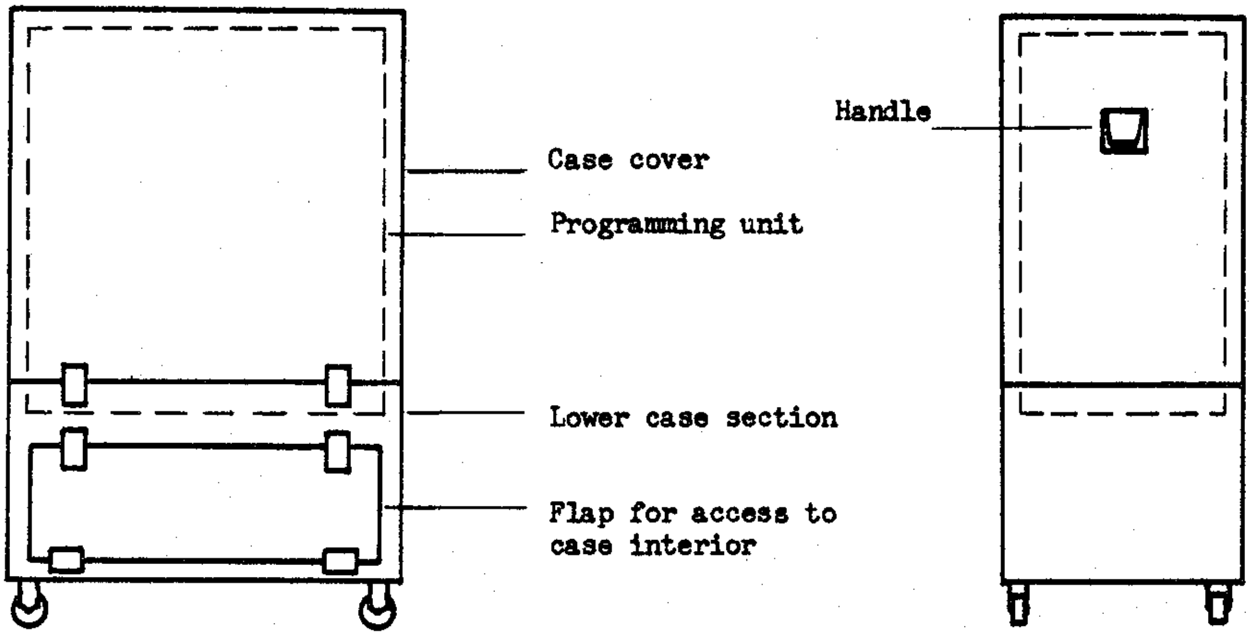
Interface module 6ES5 501-5AA11

power supply voltage	5V
current consumption	approx. 0.7A
permissible temperature range	0 to 50°C
transmission type	parallel

2 Setting-up and operation

2.1 Setting-up

The 670 programming unit is supplied in a multi-function case.

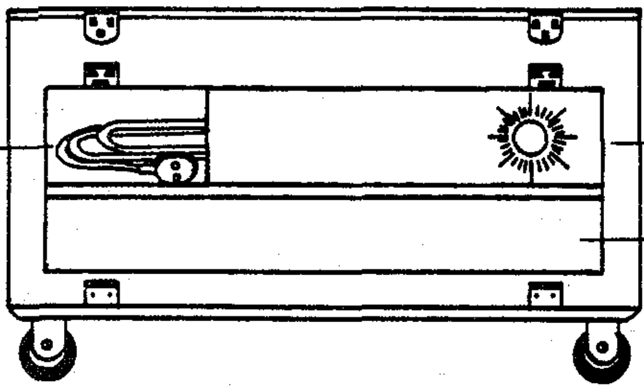


The case comprises two sections:

- a lower case section with four castors and
- a cover, which can be located on the lower case section.

When the case is closed, the lower case section and case cover are connected by four latches, which provide a dust-tight and splash-proof seal. The programming unit is located on the lower case section with its rear panel vertical, and is covered and protected by the case cover.

The lower case section interior is accessible by opening the flap on the broad side of the lower case section.



The following can be accommodated in the compartmented interior:

- an EPROM erasing facility (belongs to the scope of supply)
- connecting cable (e.g. for printer)
- interface modules for programmable controllers
- other accessories

The multi-function case enables the following modes of operation to be used:

- the programming unit can be operated without additional setting-up aids (e.g. table, chair), e.g. when commissioning programmable controllers; in this case, refer to the following section "Setting-up the programming unit as an upright unit".

- the programming unit can be operated on a table, independent of the case, e.g. in design departments; in this case refer to the following section "Setting-up the programming unit as a desk-top unit."

Checking and selecting the permissible mains voltage

The programming unit can be operated from the 110 V and 220 V mains supplies. The unit is adjusted for 220 V when supplied. The subsequent procedure should be followed to select the required mains voltage:

1. remove the mains cable;

2. slide the cover for the mains fuse to the left-hand side;

3. the permissible mains voltage is indicated under the fuse holder;

4. in order to select another mains voltage, the fibre board is removed using a pair of pliers after the mains fuse has been removed (turn down the ejector to the left-hand side).
   The selected voltage value is printed on the left-hand side of the small panel, in the direction of insertion.

Direction of insertion

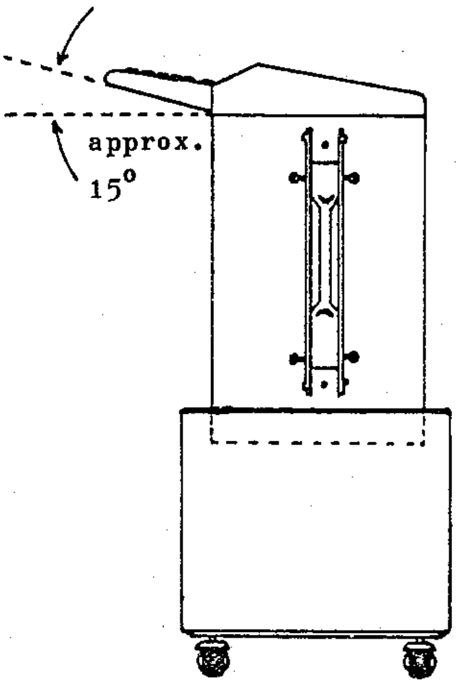
Setting-up to operate as an upright unit

The subsequent description assumes that the previous section "Description" has been carefully studied. The setting-up procedure is carried out as follows:

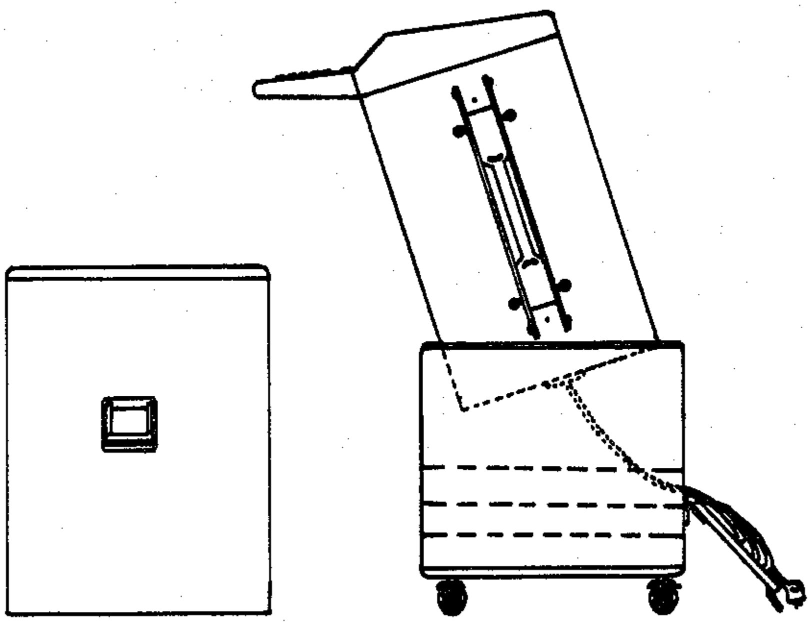
1. Position the closed case so that it is lying flat on the four castors on the lower case section, and the broad side of the lower case section (without flap)is pointing towards the operator.

2. Open the four quick-release latches, and raise the case cover vertically until it can easily be removed. The case cover can be used as a seat for the operator or as a stand.

3. Lift the programming unit keyboard off from the protector and insert the cable into the keyboard, so that the locking lever snaps into place. Insert the keyboard into the programming unit front frame, as far as the stop. Remove the loosely fitted protector from the front frame.



4. Tilt the programming unit in the direction of the operator until it locks into position (a fixture in the lower case section enables an inclination of 15° to be obtained).



Open the flap on the lower case section and pull out the mains cable.

5. The programming unit can now be switched on.

Note:

In order that the programming unit can be easily operated when used in the upright position, all cables which are required by the user should be always connected to the programming unit. All the connections are located on the rear side of the programming unit, and are accessible after the programming unit has been lifted from the lower section. The cables can be accommodated in the cable recess of the case lower section, and are therefore immediately accessible when required. It is recommended that the cables be suitably labelled, e.g. on the plug, for rapid identification.

Setting-up to operate as a desk-top unit

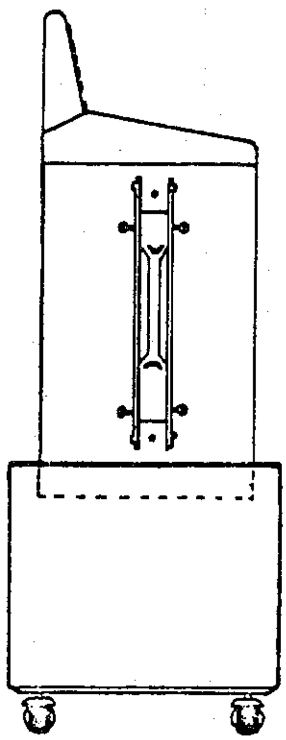
The subsequent description assumes that the previous section "Description" has been carefully studied. The setting-up procedure is carried out as follows:

1. Position the closed case so that it is located correctly on the four casters on the lower case section, and the broad side of the lower case section (without flap) is directed towards the operater.

2. Open the four quick-release latches, and raise the case cover vertically until it can be easily be removed.

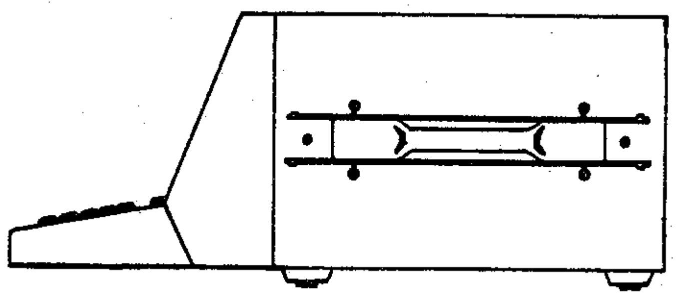
3. Lift the programming unit keyboard off the protector, and remove the protector from the front frame (e.g. place it on the case cover). Insert the connection cable into the keyboard so that the catches snap into place.

4. Insert the keyboard into the front frame as far as the stop, and so that the underside of the keyboard forms a line with the programming unit housing (there are two insertion possibilities, depending whether the programming unit is to be used as an upright unit or desk-top unit).

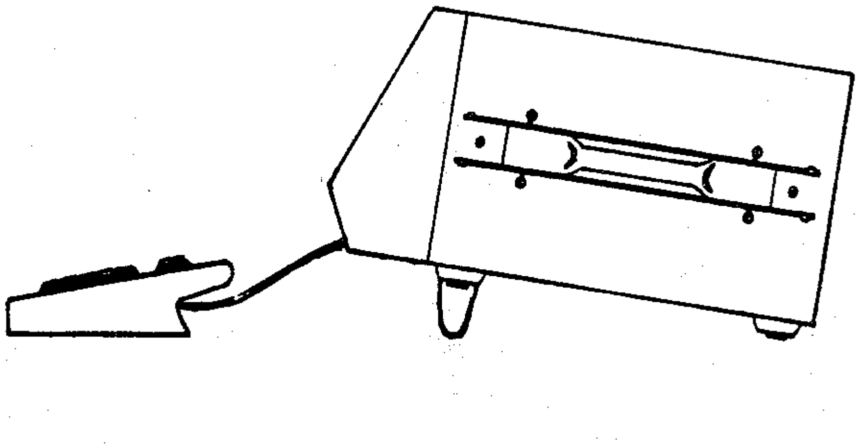


5. Raise the programming unit out of the lower case section using the two side handles (weight: approx. 20 kg), and, if required, place it on the lower case section. Detach the connection cable to the EPROM erasing facility.

6. Place the programming unit on a level surface, e.g. a tabletop. If required, the keyboard can be set up separately from the programming unit (within a radius of approx. 40 cm).



Two brackets located under the front frame can be swung out in order to raise the front of the programming unit.



7. The programming unit can now be switched on.

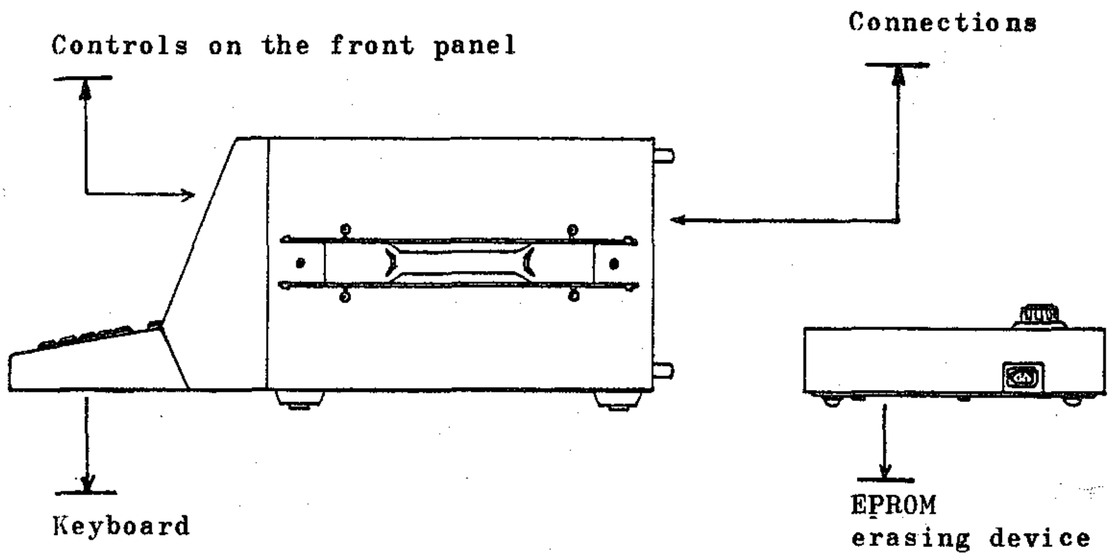
2.2 Operating control elements

Description

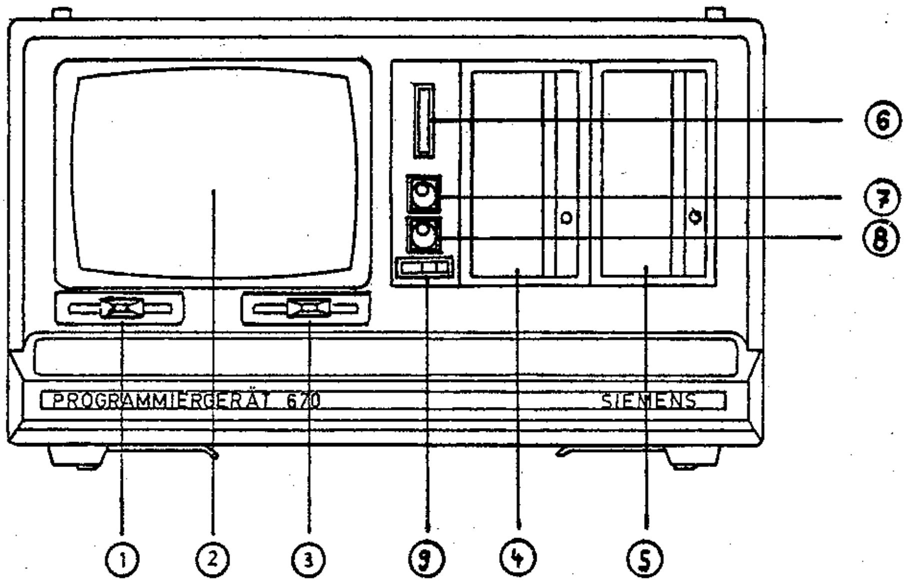
When the programming unit is used as a desk-top unit (refer to "Setting up as desk-top unit"), all controls and programming unit connections, described in the following sections are directly accessible.

If the programming unit is being used as an upright unit (refer to "Setting up as an upright unit"), all the connections for the connecting cable, as described in the following section, are not directly accessible. Thus, when the programming unit is to be mainly used as an upright unit, it is recommended that all required connecting cables be permanently inserted and accessibly stowed in the cable recess of the multi-function case.

The following sections are subdivided as follows:



Controls on the front panel



1 Intensity control

The image intensity can be continuously regulated. A dark background, where the text can still easily be read, is recommended.

2 Visual display unit

23 cm diagonal screen. 1920 characters can be represented at one time (24 rows each having 80 characters).

3 Contrast control

The image contrast can be continuously regulated.

4 Mini floppy disk drive (drive 0)

Drive 0 is a double drive, and is intended to accept the mini floppy disk (diskette) on which the 670 system program is stored. The drive must be opened to insert or remove the mini floppy disks (slide the flap towards the left-hand side).

The diskettes are inserted in such a way that the radial opening in the disk cover points in the direction of the programming unit, and the disk cover fold points towards the right-hand side.
A signal lamp is illuminated when the drive is active (data transfer).
Do not close drives without diskette or card.

5 **Mini floppy disk drive (drive 1)**

Drive 1 is a double head drive, and is intended for accepting mini floppy disks (diskette) on which the STEP 5 programs are deposited.
The drive must be opened to insert or remove the diskettes (slide the flap towards the left-hand side).
The diskettes are inserted in such a way that the radial opening in the disk cover points in the direction of the programming unit, and the disk cover fold points towards the right-hand side.
A signal lamp is illuminated when the drive is active (data transfer)

6 **EPROM module receptacle**

The receptacle is intended for accepting EPROM modules, such as are used by the SIMATIC S5 programmable controllers as program memory, e.g. for EPROM programming.

7 **Key-operated switch for "new start"**

The system program monitor is called up by rotating the key in a clockwise direction as far as the stop, and then immediately releasing it. The register contents of the microprocessor appear on the visual display unit. A * appears on the screen if the key is rotated to the stop and is left in this position for longer than 1 s, and then immediately released. The 670 system program can then be re-loaded.

(8) <u>"Input inhibit" key-operated switch</u>

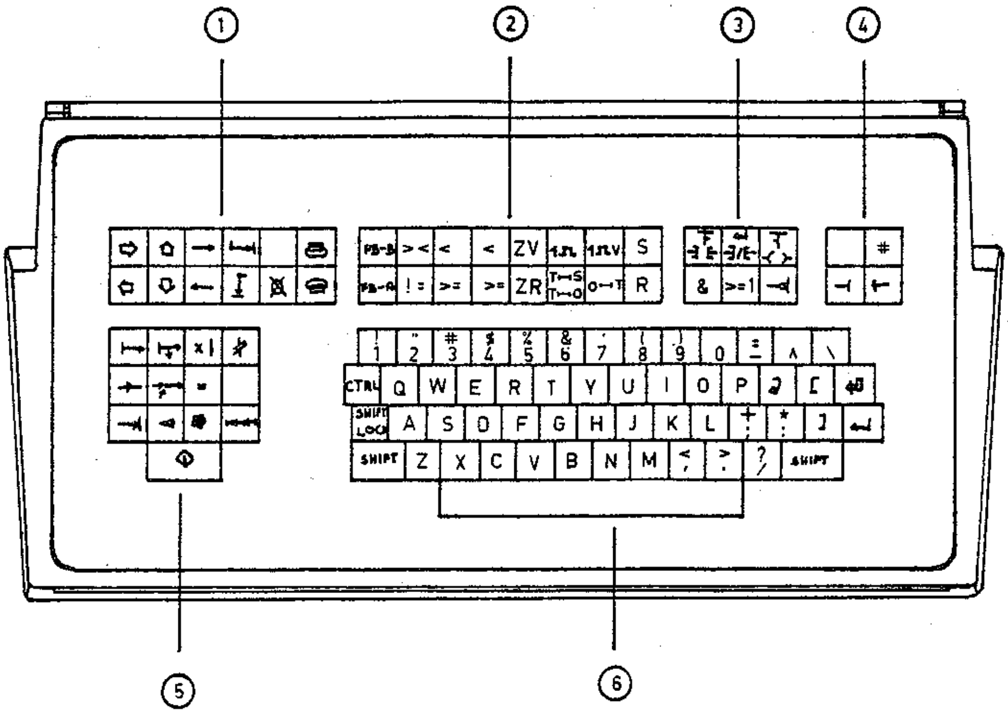
The switch can be actuated as far as the stop by rotating the inserted key in a clockwise or anti-clockwise direction. For anti-clockwise rotation ("Input inhibit off") all programming unit functions are enabled. For clockwise rotation ("Input inhibit on"), only the functions for "Output on visual display unit and printer" can be executed. The key can be removed when in the centre position. The previous selection, i.e. either "Input inhibit on", or "Input inhibit off" is retained.

(9) <u>Mains switch</u>

I Position: mains voltage switched on;
0 Position: mains voltage switched off.

Keyboard

The keyboard is functionally divided into pads. In the case of keys with double inscriptions, the upper inscription is valid if the key is actuated simultaneously with the SHIFT key, otherwise the lower inscription is always valid.



(1) Keys for "Position cursor", "Image correction","Image roll mode"

Format-dependent right cursor movement AWL (SL), KOP (CSF), FUP (LD)

Format-dependent left cursor movement AWL (SL), KOP (CSF), FUP (LD)

 Format-dependent upward cursor movement (SL, CSF, LD)

 Format-dependent downward cursor movement (SL, CSF, LD)

 Shift cursor one character to the right

 Shift cursor one character to the left

 Format-dependent (SL, CSF, LD) - horizontal expansion from cursor position (image correction)

 Format-dependent (SL, CSF, LD) - vertical expansion (image correction)

 Format-dependent (SL, CSF, LD) - deletion at cursor position (image correction)

 Linewise upwards image shift

 Linewise downwards image shift

2 <u>Keys for inputting complex functions for graphic programming (CSF, LD)</u>

For graphic programming, complex functions, such as comparison, counting, timer and memory functions, as well as function modules, are entered in the visual display unit via this keypad. The complete function is immediately displayed on the screen in box form with all inputs and outputs to be initialized when the key is actuated. The inputs and outputs are initialized by the operator, using the alphanumeric keyboard 6 .

FB-B	Conditional call-up of function modules
FB-A	Unconditional call-up of function modules
><	Call-up of the comparison function "Not equal to" and setting the comparator input "ZI"
!=	Call-up of the comparison function "Equal to" and setting the comparator input "ZI"
<=	Call-up of the comparison function "Equal to or less than" and setting the comparator input "ZI"
>=	Call-up of the comparison function "Equal to or greater than" and setting the comparator input "ZI"
<	Call-up of the comparison function "Less than" and setting the comparator input "ZI"
>	Call-up of the comparison function "Greater than" and setting the comparison input "ZI"
ZV	Call-up of a complete up/down counter and setting the counter input "ZW" (count up)
ZR	Call-up of a complete up/down counter and setting the counter input "ZR" (count down)
1⎍	Call-up of the timer "Pulse" and setting the timer start input
T⊢S T⊢0	Call-up of the timer "Switch-on delay" and setting the timer start input

T⊢S / T⊢0 * — Call-up of the timer "Latching switch-on delay" and setting the timer start input

1ΠV — Call-up of timer "Extended pulse", and setting the timer start input

0⊢T — Call-up of the timer "Switch-off delay", and setting the timer start input

S — Call-up of a complete RS flip-flop, and setting the set input "S"

R — Call-up of a complete RS flip-flop, and setting the reset input "R"

③ <u>Keys for inputting binary logic functions for graphic programming KOP (CSF), FUP (LD)</u>

The upper row of the keypad is used for inputting binary logic functions for ladder diagram programming, and the lower row for inputting binary logic functions for control system flowchart programming.

 NO contact

 * Start of a parallel branch

 NC contact

 * Marker for designating the termination of a parallel branch

 Relay/contactor

 * Termination of parallel branches

* Simultaneously actuate the "SHIFT" key! jen!

&	Call-up of an AND function
>=1	Call-up of an OR function
	Negated input of a function

④ Keys for inputting line segments

	Establish connection to a function element
	Terminate function element
#	Connector

⑤ Keys for selecting programming unit functions

	Output
	Transfer
	Input
	Signal flow, output signal status
	Control
	Processing check
×	Delete
=	Compare
	Special functions

Terminate or interrupt the programming unit function. This is not necessary when *COMMAND* is located on the bottom left corner of the screen.

Repeat

Execute the selected function

(6) Alphanumeric keyboard (standard keyboard)

The alphanumeric keyboard is mainly used for the following purposes:

- More detailed specification of the programming unit functions specified under (5),
- input of STEP 5 programs in the statement list representation
- servicing graphically represented functions with operands

The character inscribed on the key is written on the screen at the position indicated by the cursor when the key is actuated.
Exception:

Character switchover (not required for STEP 5 programming)

Locking key (is illuminated when actuated). The SHIFT key is permanently selected when the SHIFT LOCK key is actuated. Is not required for STEP 5 programming.

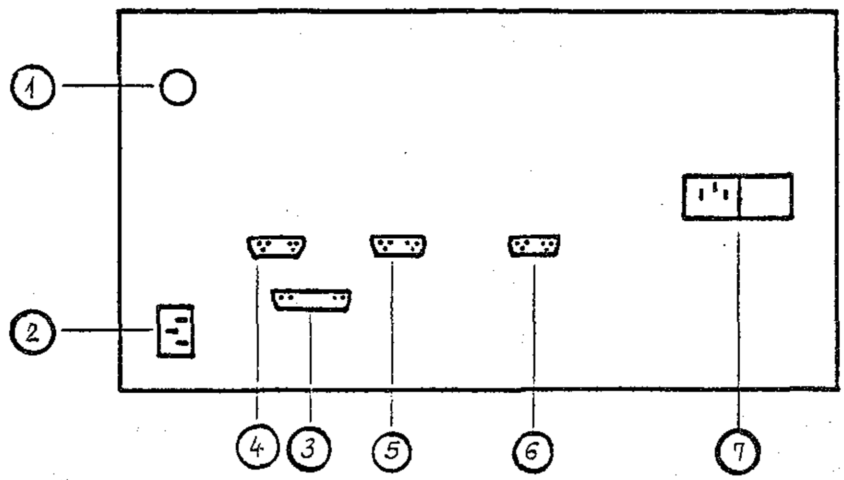
The upper inscription is valid for double inscription keys if the SHIFT key is simultaneously actuated with a key.

Termination and translation of program sections

Termination of a partial input

2.3 Cable connections

All cable connections are located on the rear side of the programming unit. The main cable (7) and the connecting cable to the EPROM erasing facility (2) are included in the PU 670 scope of supply.



(1) **Connection for supplementary monitor**

A monitor can be connected using the coaxial cable 6ES5 738-0...0 (max. length 100 m) if a supplementary, e.g. larger, visual display unit is necessary. The monitor must be able to process composite video signals (1 V peak-peak, positive), conforming the CCIR Standard.

(2) **Connection for EPROM erasing unit**

The EPROM erasing unit is connected here. This connection provides a constant 220 V a.c. voltage when the power switch is in position I, irrespective of the mains voltage (110 V a.c. or 220 V a.c.) to which the programming unit is connected.

(3) **Connection for programmable controllers with parallel coupling to programming units (PC 110A/PC 130 A)**

Programmable controllers, on which only EPROMs are permissible as program memories for STEP 5 programs can be connected here for commissioning and test purposes. The connected programmable controllers then use the battery-backed PU memory (RAM, 4K statements) as program memory. The programmable controllers are connected to the programming unit using the 6ES5 734-0...0 connecting cable (max. length 3 m).

(4) Connection for printer unit with line-current interface (Teletype, 20 mA)

This connection is available for the PT 80 printer unit with line-current interface. The printers are listed in the process computer catalogue (edition published in 1981) PR 23, section "Standard peripherals" under the designation 3914 and 3917, and have the following Order Nos:

Order No. 2)	Short description
L22751-A80-B295	PT 80, RO 1) /80 characters per line/matrix printer / 600 baud
L22751-A80-B294	PT 80, RO 1) /80 characters per line/ink printer / 600 baud
L22751-A80-B292	PT 80, RO 1) /132 characters per line/matrix printer / 600 baud
L22751-A80-B293	PT 80, RO 1) /132 characters per line/ink printer / 600 baud
L22751-A80-C256	PT 80, KSR 1) /80 characters per line/matrix printer / 600 baud

The PT 80 is connected to the 670 programming unit via the 6ES5 736-0...0 connecting cable (max. length 10 m).

1) RO = without keyboard; KSR = with keyboard
2) The Order Nos. specified are for reference only. For the actual numbers as well as where to order please refer to the PR 21 Process Computer catalogue.

(5) Connection for printer with V.24/V.28 interface (RS 232 c-compatible)

The connection is intended for the PT 80 with V.24 interface. The printer units are listed in the PR 21 and PR 23 process computer catalogues, section "Standard peripherals" with the designations 3914 and 3917, and have the following Order Nos:

Order No. [2]	Short description
L22751-A80-B290	PT 80, RO [1] /80 characters per line/matrix printer / 600 baud
L22751-A80-B289	PT 80, RO[1] /132 characters per line/matrix printer / 600 baud
L22751-A80-C207	PT 80, KSR[1] /80 characters per line/matrix printer / 600 baud

The PT 80 is connected to the PU 670 using the 6ES5 737-0...0 connecting cable (max. length 30 m).

(6) Connection for programmable controllers with serial coupling to programming units (PC 150 A/150 S)

The programmable controllers are connected to the programming unit via the 6ES5 731-0...0 connecting cable (max. length 100 m, greater lengths up to 1000 m on request).

(7) 110 V/220 V mains connection

The programming unit can be set to operate on the 110 V a.c. or 220 V a.c. mains.

---

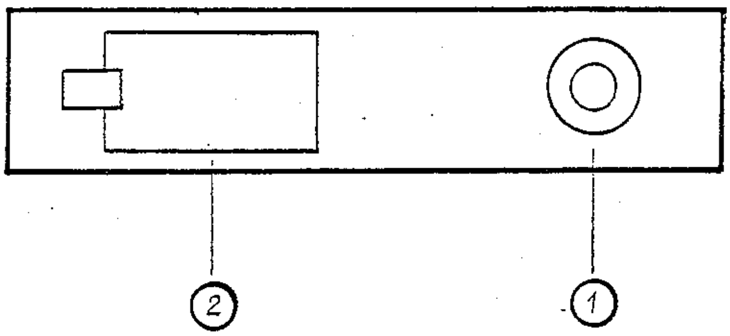
1) RO = without keyboard; KSR = with keyboard

2) The Order Nos. specified are for reference only. For the actual numbers as well as where to order please refer to the PR 21 and PR PR 23 process computer catalogues.

EPROM erase unit

The EPROM erase unit is operational when it is connected to a 220 V a.c. power supply. The "EPROM erase unit" connection located at the rear of the programming unit provides this 220 V a.c. voltage when the programming unit mains is in the I position.

When supplied, the EPROM erase unit is located in the lower case section, and is connected to the "EPROM erase unit" connection of the programming unit via a cable. When required the EPROM erase unit can be removed, and can be used with the programming unit desk-top operation (refer to "Setting up").



1 Timer

The UV lamp in the EPROM erase unit is switched on, and the erasing period adjusted (max. 30 min.) by rotating the timer clockwise.

2 EPROM module receptacle

The receptacle flap is automatically opened to receive an EPROM module by sliding back the catch.

3. Maintenance

3.1 General checking and maintenance

The numbers in parentheses refer to the parts shown in the illustrations. The re-assembly is the same but in the reversed sequence.

3.1.1 Opening the PU 670

a) Preparations

- position the programming unit on a level working surface (refer to section 2.1 setting-up)
- remove all connections from the back side

b) Removing the unit back panel (18)

- remove the four screws (8)
- remove the rear unit panel (18)

c) Removing the upper cover (1)

- remove the four screws (6), located on both unit sides, above the carrying handles
- remove the four screws on the upper side of the unit, together with the two sleeves under the front screws
- remove the cover (1) by raising it

d) Removing the lower cover (2)

- position the programming unit upside down on the working surface
- remove the four screws (6) on both sides of the unit above the carrying handles
- after removing the four screws (7), remove the feet (14) and brackets (13)
- remove the cover (2) by lifting it upwards

e) Removing the keyboard (4)

- position the programming unit on a working surface
- extend the keyboard from the unit
- remove the signal ribbon cable (29) from the keyboard by opening the interlocking lever on the side

f) **Removing the front frame (3)**

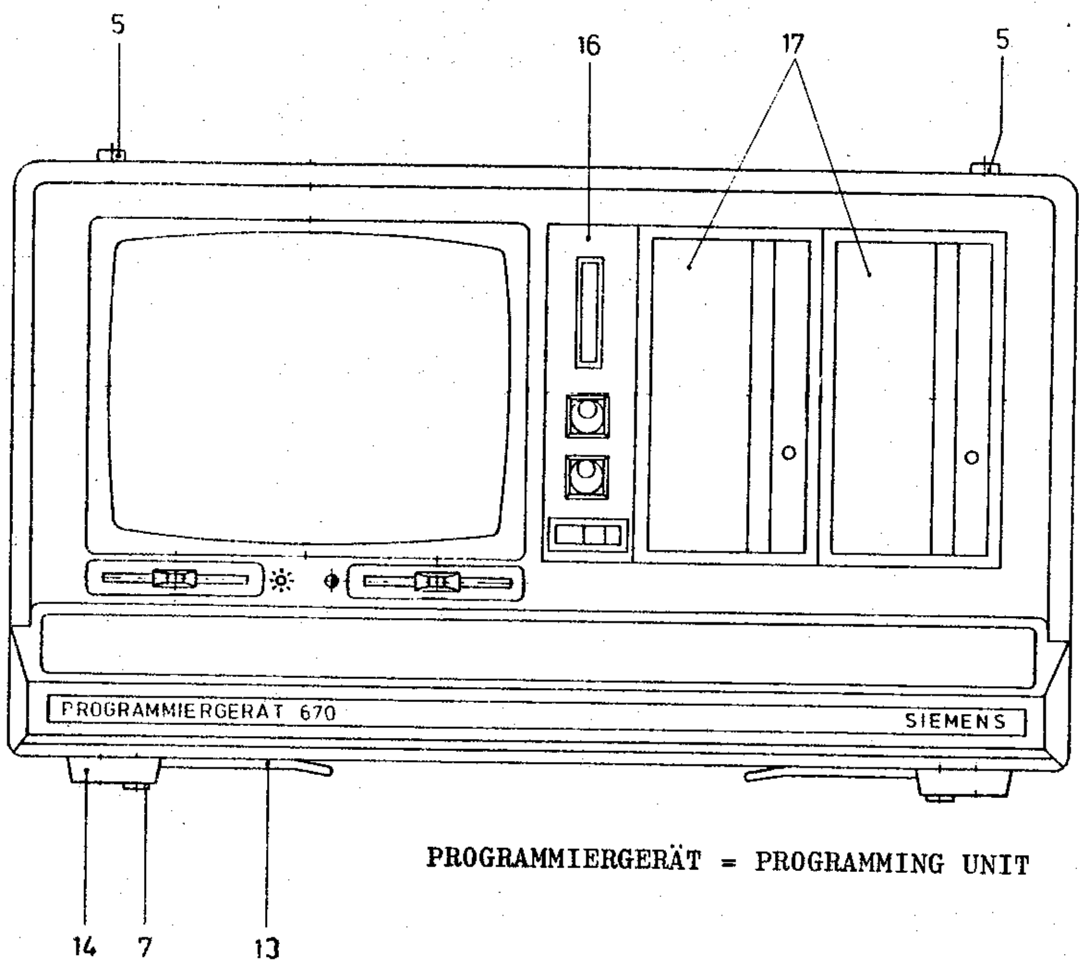
- open the programming unit according to point a) to e)
- release the holding bracket (34) for the printed circuit boards and lift out of the way
- remove the two screws (11) from the printed circuit board SHB (24) and remove the printed circuit board
- remove the left-hand side plug connector (plug 3) from the Prog I printed circuit board, and expose the cable (plug connection/EPROM)
- remove the signal ribbon cable from the floppy interface (27) by opening the interlocking lever on the side (the notch on the signal ribbon cable is on the upper side).
- stand-up the programming unit on the left-hand side
- screw off the cable connection to the key actuated switches from terminal 1 (refer to BUS wiring) and cut cable binders

  disposition: Terminal 1/1 = black
  Terminal 1/2 = white
  Terminal 1/3 = red
  screw connection = black
- remove two screws (9) from the visual display unit electronics (19) and swing-out the printed circuit board
- remove the plug connections to the visual display unit electronics: power supply, composite video signal and slide switches, high voltage, cathode ray tube socket, earthing belt for the cathode ray tube, deflection unit
- release and remove the retaining strip (30) for the keyboard cable
- cut off the cable bindings for the main supply lead from the mains switch below the cathode ray tube
- place the programming unit on the lower side, and remove the M4 screws at the corners of the unit behind the front frame, take out the front frame simultaneously feeding and easing out the cable connections towards the front, and lay on the working surface (watch out for the cathode ray tube neck)

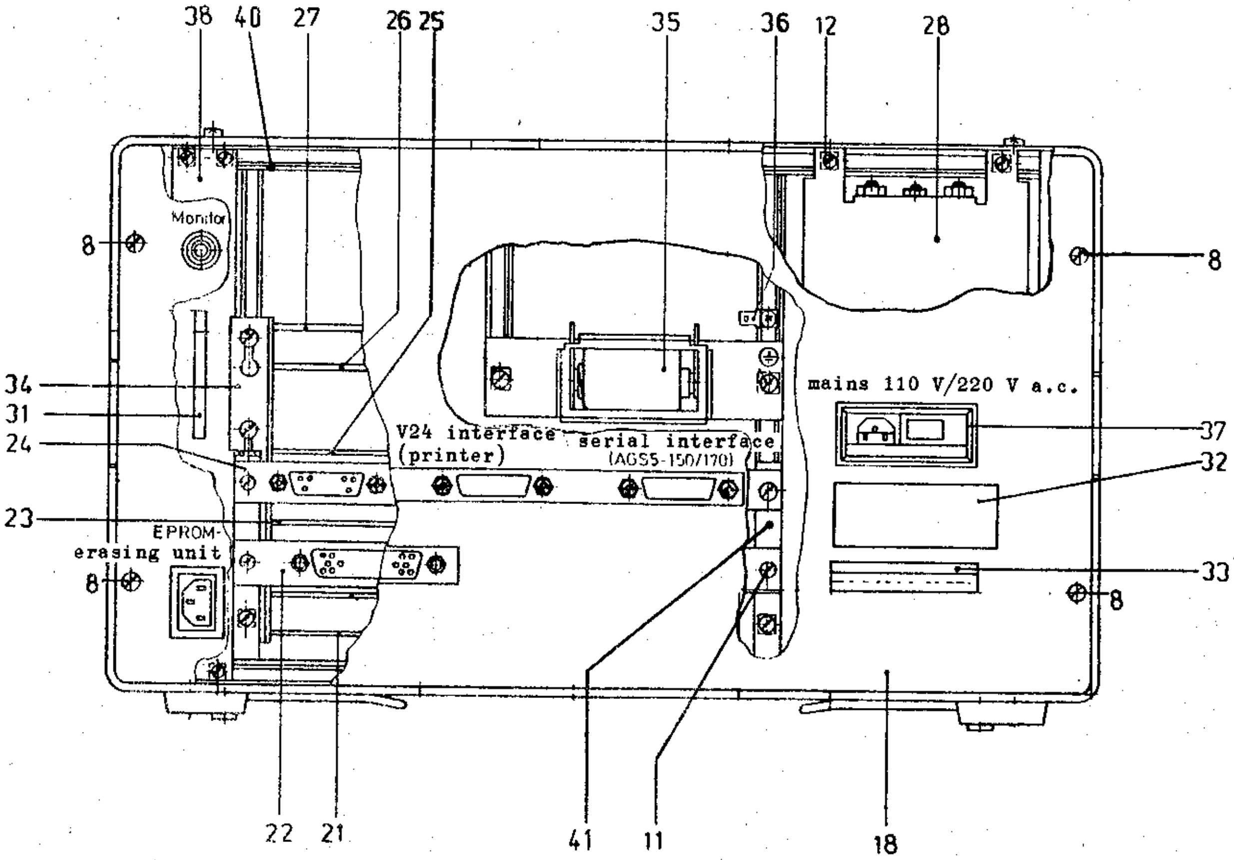
g) Removing the front panel (16)

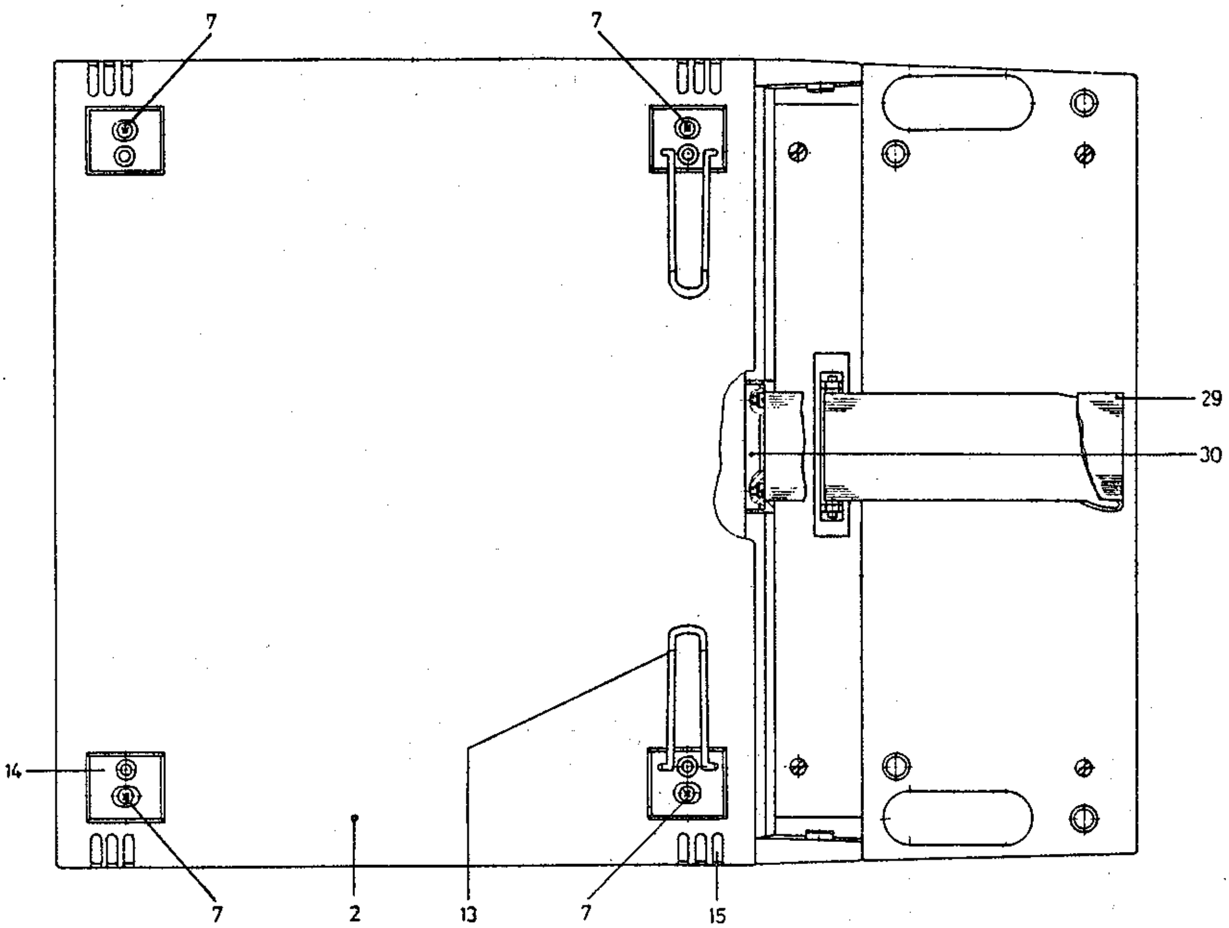
- remove the front panel (3) according to point f)
- loosen the front panel by removing the six retaining screws, and take out towards the front

When re-assembling the unit, the correct positioning of the distance sleeves and the screen connection for the cable to the key actuated switches should be observed.

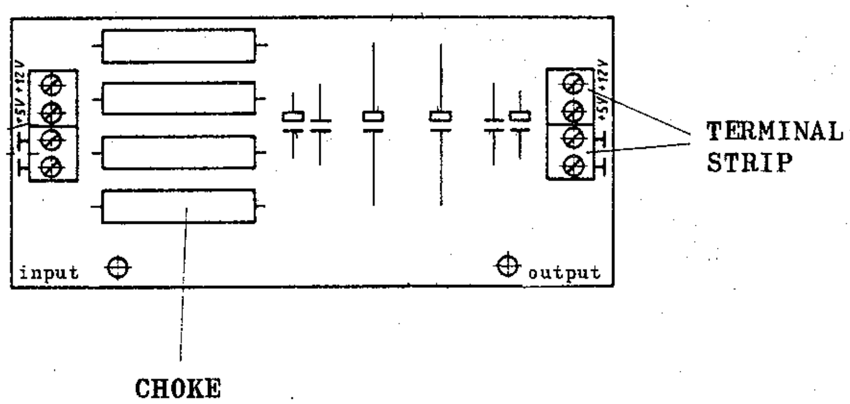


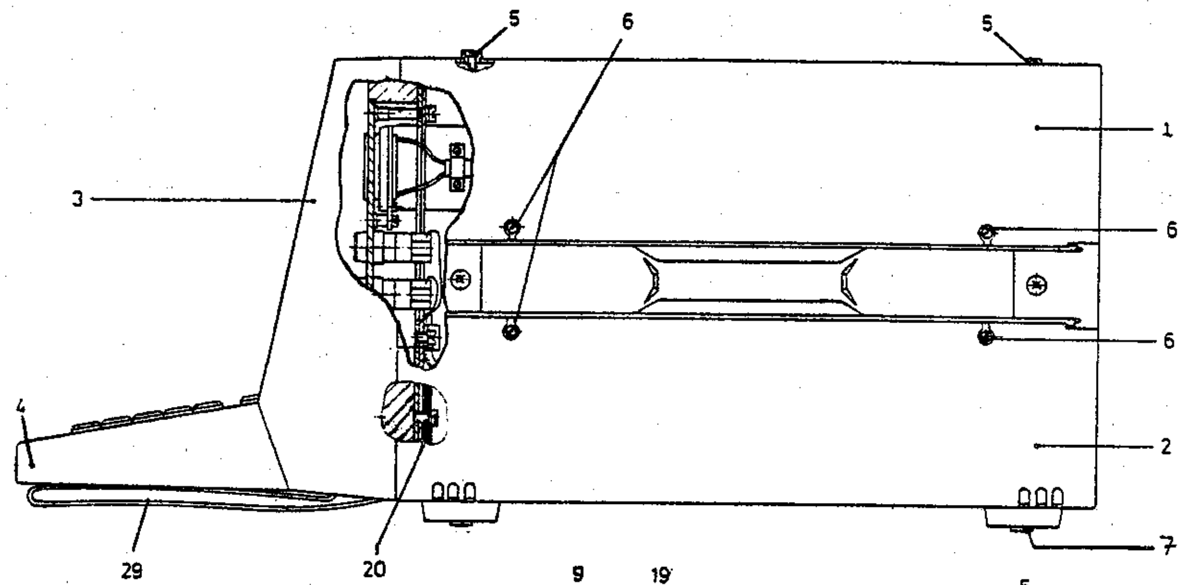
PROGRAMMIERGERÄT = PROGRAMMING UNIT

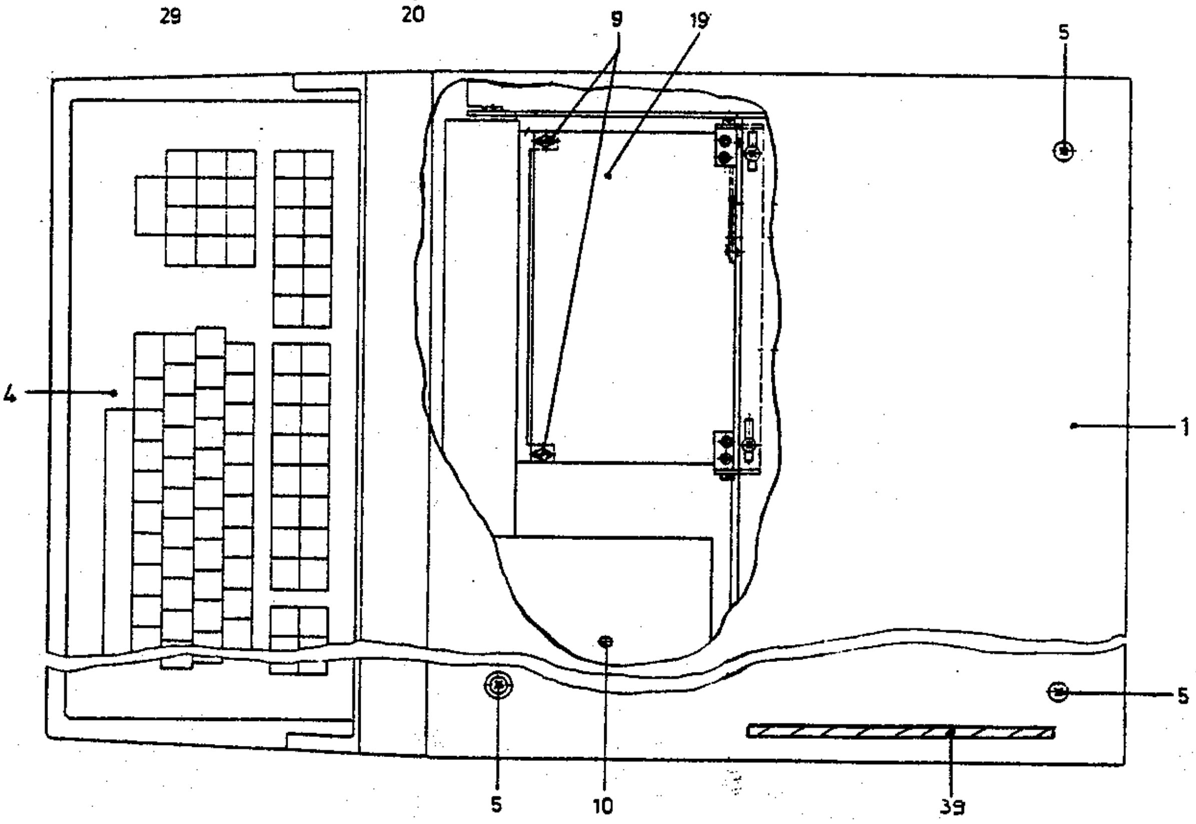




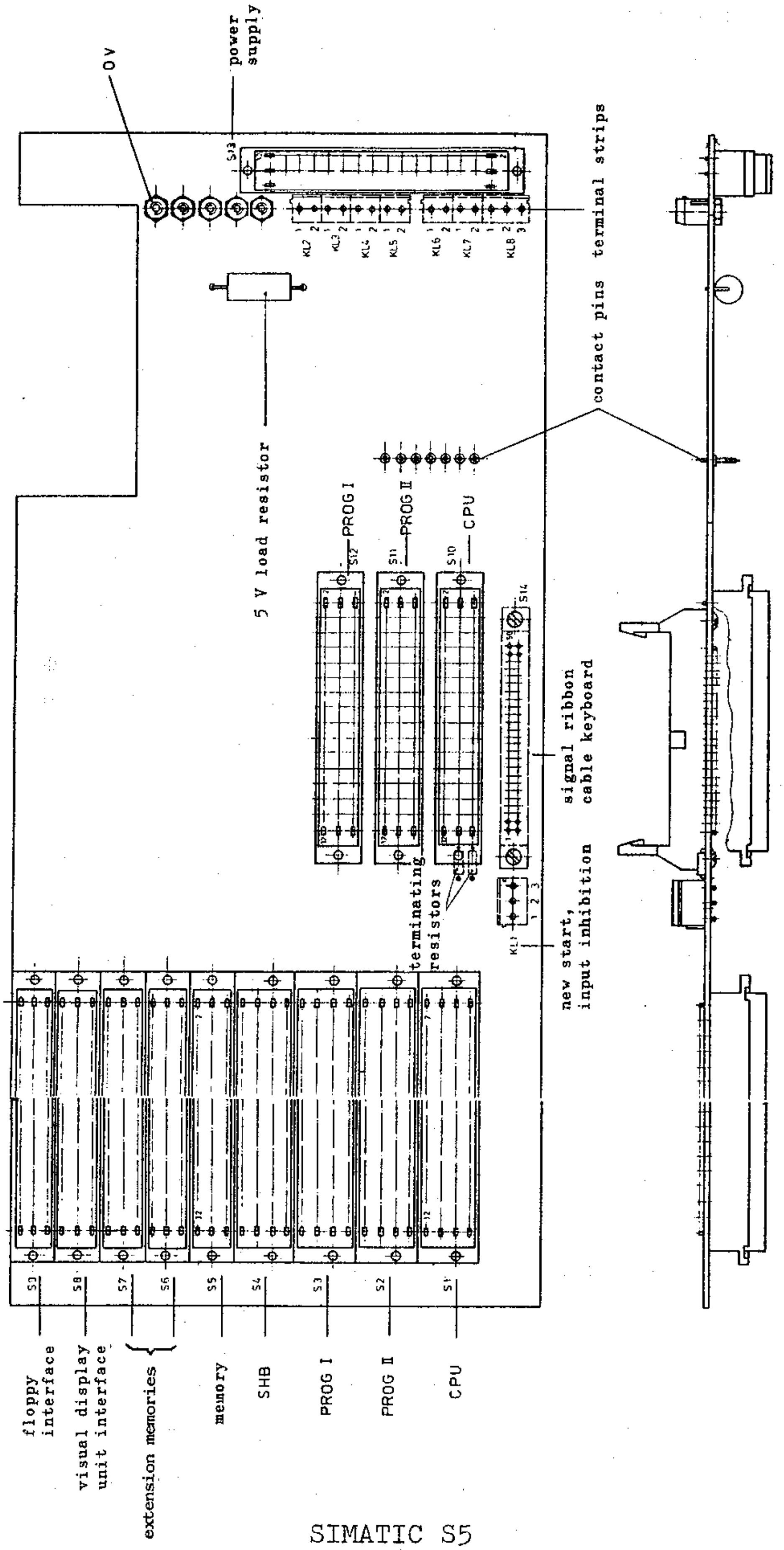
NOISE FILTER (2)




5
6
5
1
3
6
6
4
2
7
29
20


9
19
5
4
1
5
5
10
39

BUS WIRING


0 V
power supply
S13
terminal strips
KL2
KL3
KL4
KL5
KL6
KL7
KL8
contact pins
5 V load resistor
PROG I
PROG II
CPU
S12
S11
S10
S14
signal ribbon cable keyboard
terminating resistors
new start, input inhibition
KL1
S9
S8
S7
S6
S5
S4
S3
S2
S1
floppy interface
visual display unit interface
extension memories
memory
SHB
PROG I
PROG II
CPU

1	upper cover
2	lower cover
3	front frame
4	keyboard
5,6,7	phillips screws
8,9,10,11,12	various screws
13	stand bracket
14	feet
15	ventilation slits
16	front panel
17	double head drive unit
18	unit back panel
19	visual display unit electronics
20	noise filter for drive unit
21	CPU printed circuit board
22	PROG II printed circuit board
23	PROG I printed circuit board
24	SHB printed circuit board
25	memory printed circuit board
26	visual display unit control printed circuit board
27	floppy interface printed circuit board
28	power supply
29	keyboard signal ribbon cable
30	retaining strip for keyboard cable
31	housing
32	unit series plate
33	type plate
34	retaining bracket/printed circuit boards
35	battery
36	protective conductor to power supply unit
37	mains power supply module with voltage adjustment
38	holding rail
39	dust filter
40	cover plate/printed circuit board frames
41	retaining strap for the printed circuit boards

3.1.2 Changing the dust filter

- Place the unit on its left-hand side.
- Unscrew the locking device of the filter cover.
- Remove the filter cover.
- Pull out the dust filter by its strap and exchange it.
- Remount the dust filter in the reverse sequence.

3.1.3 Changing the battery

The battery must be replaced when the error display 207 appears.

- open-up the programming unit as described under points a) and b)
- remove the battery (28) from the holder, and insert the new battery, ensuring that the polarity is correct.

3.1.4 Checking the power supply

At least one printed circuit board must be inserted as base load when checking the power supply (28).

- open-up the programming unit as described under points a) and d)
- locate the unit on its right-hand side
- connect the negative pole of a volt meter with the programming unit housing
- connect the units to the mains supply;
  the mains voltage is available at the terminals 6 to 8
- switch-on the programming unit
- test the voltages

  terminal 2/1 = 5V, ± 5 %
  terminal 3/2 = 12V, ± 5 % (wired to the drives via the noise filter (2))
  terminal 4/1 = 12V, ± 5 %
  terminal 4/2 = 35V to 40V
  terminal 5/1 = -12 V, ± 5 %
  terminal 5/2 = approx 6 V (as soon as the mains voltage falls below Urms = 180 V, then the voltage falls to below 1 V)

Remove the mains supply plug before re-assembling.

3.2 Servicing

3.2.1 UV erase unit

The radiation intensity of the UV light source is only 50% of its original value after 3000 operating hours.

a) Opening-up the UV erase unit

- pull-out the power plug
- detach the cap (2) from the knob
- unscrew the knob (3) and remove it
- remove the phillips screws (1) at the front and rear
- take off the cover (4) by lifting it upwards

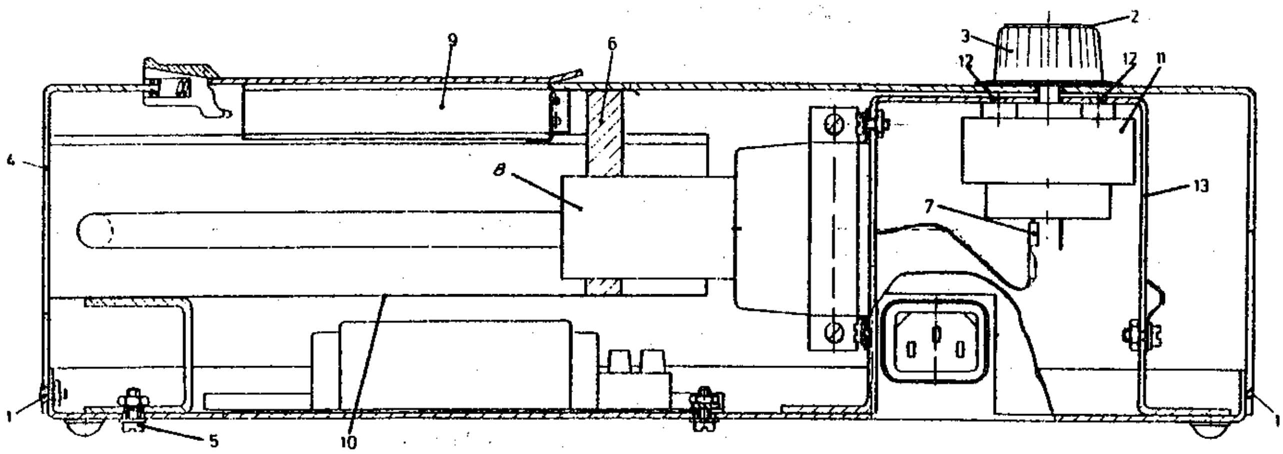
b) Replacing the time switch

- detach the plug connector for the power supply (7) from pins 1-1 of the time-switch
- loosen the screws (12) on the bracket (13)
- remove the time-switch (11)

c) Replacing the UV light source

- remove the fixing screws(5) for the reflector
- remove the reflector (10) together with the rubber seal (6) over the UV light source
- screw out the UV light source (8)

The re-assembly is executed in the opposite order. It should be ensured that the cover is first placed over the reflector in order to avoid any damage.

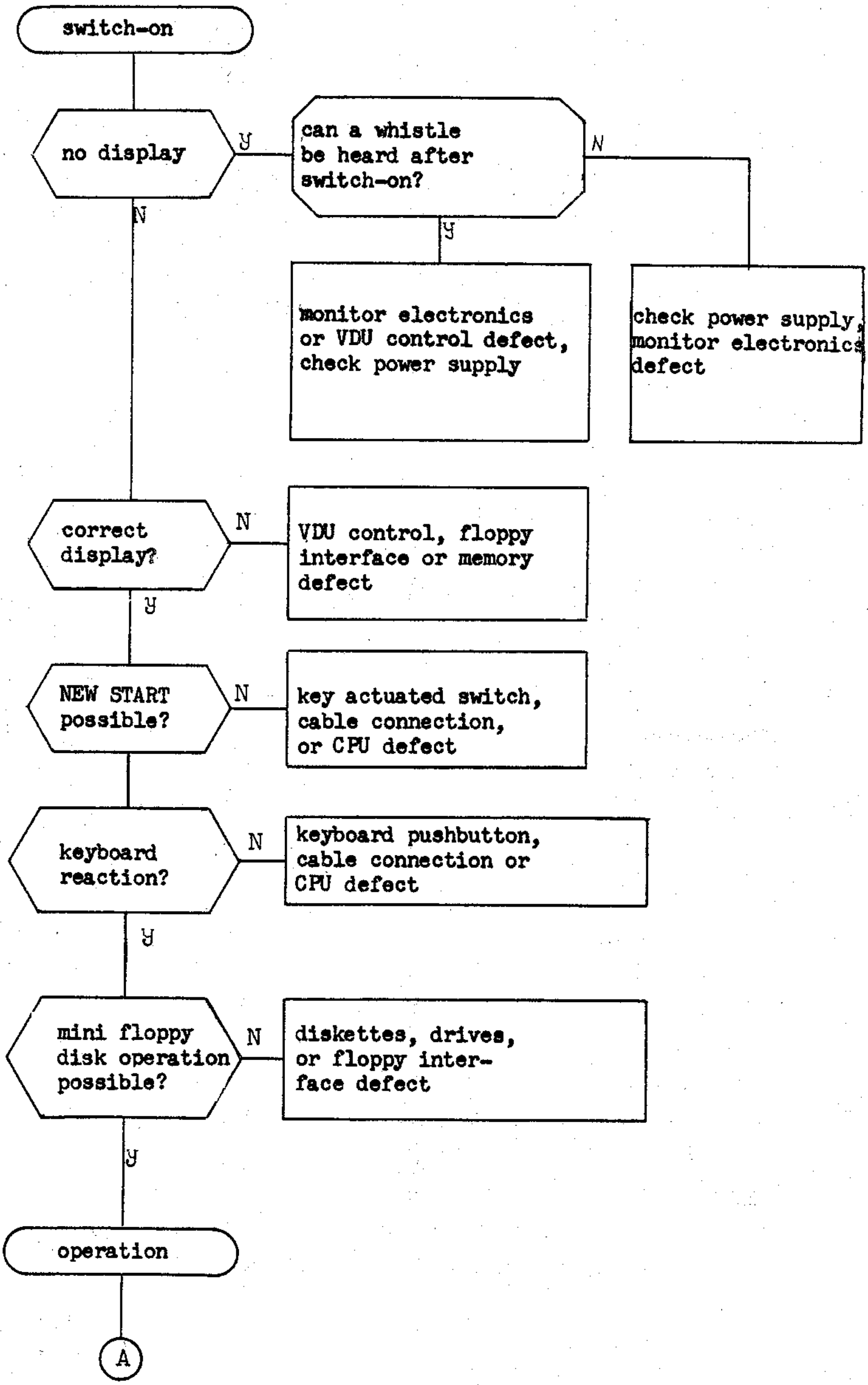


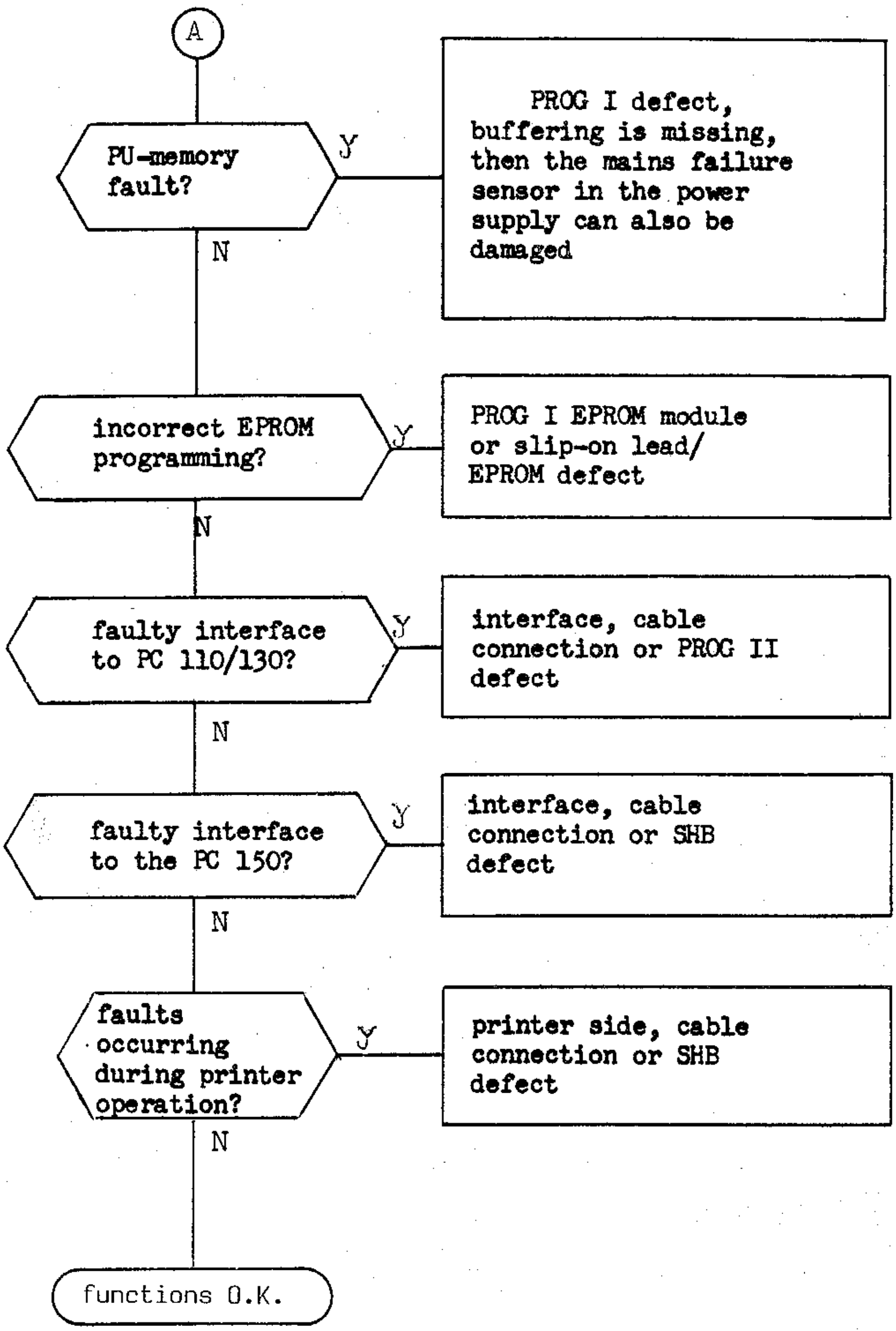
1 phillips screws
2 cap for knob
3 knob
4 cover
5 fixing screws for reflector
6 rubber seal
7 plug connector for the power supply
8 UV light source
9 plug-in location for memory module/EPROM
10 reflector
11 time-switch
12 fixing screws for the time-switch
13 bracket

3.2.2 Error functions and troubleshooting

The following troubleshooting instructions provides information for fault recognition, and for replacing printed circuit boards. Precise troubleshooting instructions is not possible due to the diverse signal paths.
The error table (cf User Instructions) should be studied if a defined error indication appears on the visual display unit.
A differentiation should be made between hard, dynamic, and thermal faults, for errors occuring operation. For errors having thermal reasons, it should be checked as to whether the ambient temperature is permissible, and that the fan is functioning correctly.

Troubleshooting instructions

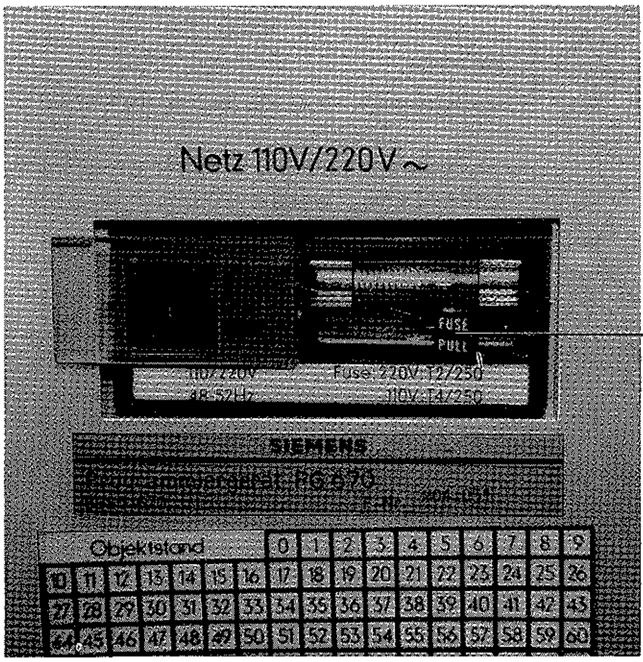



A
PU-memory fault?
Y
N
PROG I defect, buffering is missing, then the mains failure sensor in the power supply can also be damaged
incorrect EPROM programming?
Y
N
PROG I EPROM module or slip-on lead/ EPROM defect
faulty interface to PC 110/130?
Y
N
interface, cable connection or PROG II defect
faulty interface to the PC 150?
Y
N
interface, cable connection or SHB defect
faults occurring during printer operation?
Y
N
printer side, cable connection or SHB defect
functions O.K.

3.2.3 Replacing defect components

a) Mains fuse

- detach the power cable
- slide the perspex cover in front of the line fuse to the left
- put the ejector lever over to the left
- take out the line fuse and replace it with a new one



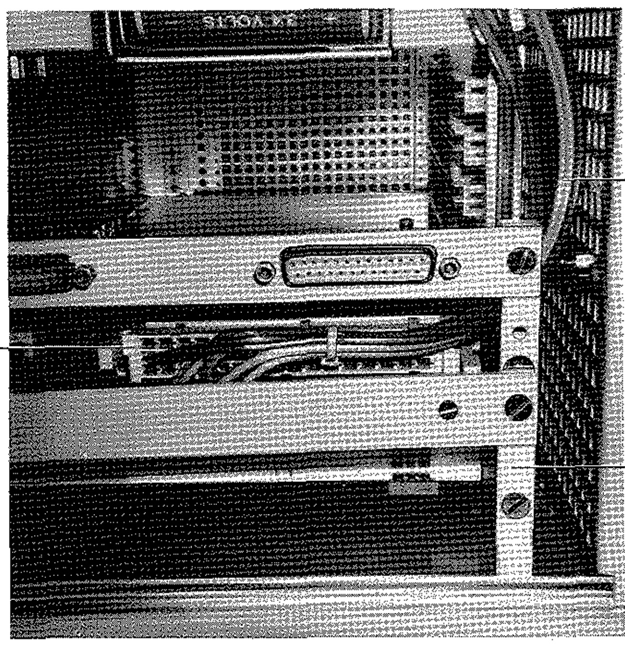
Netz	Mains supply
Programmiergerät PG 670	Programming unit PU 670
Objektstand	Unit series

b) <u>Printed circuit boards</u>

- the programming unit should be opened as described under point 3.1.1 a) and 3.1.1 b), in order to replace the printed circuit board, and the power supply, except the monitor electronics; the re-assembly is realised in the reverse sequence
- loosen retaining bracket (34) and shift upwards
- when required, remove screws (11) or the Prog II printed circuit board (22), and SHB (24).

<u>Special cases</u>

PROG I P.C.B. (23): In order to replace the PROG I P.C.B., the PROG II P.C.B. and the SHB must be first removed. The printed circuit board can be withdrawn from the programming unit after the front plug has been removed. When inserting the PROG I P.C.B. it should be ensured that the front plug cable connections are routed behind the retaining bar of the SHB.

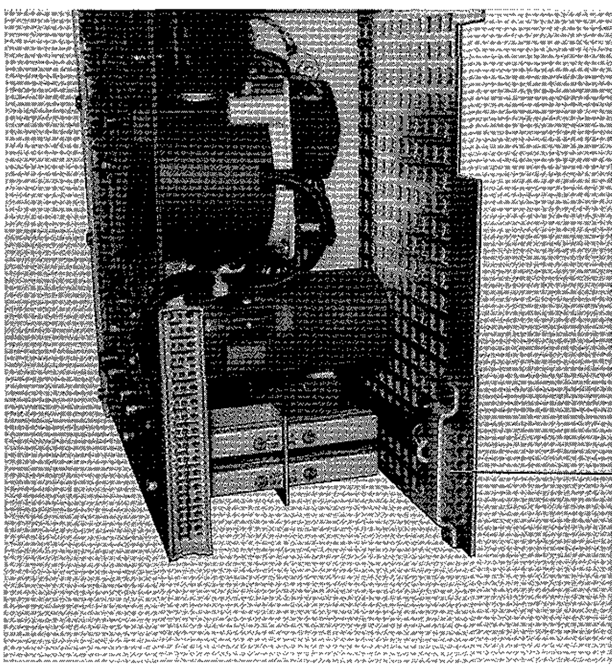


Floppy disk interface (27):

The signal ribbon cable can be removed from the front plug by opening the interlocking lever on the side. It should be inserted into the floppy disk interface, with the notch at the top.

Power supply unit (28):

Remove protective conductor from the connector (36). Remove the four countersunk screws (12), and withdraw the power supply from the holder. When re-assembling the unit, it must be ensured that the seven left-hand side contacts of the power supply unit are correctly inserted onto the BUS wiring pins.



7 pin contacts

Monitor electronics (19):

- open-up programming units as described under points 3.1.1 a) and 3.1.1 c). Remove the cable connections to the monitor electronics as described under point f).
- remove the retaining screws at the hinging point of the monitor electronics, and replace the printed circuit board
- carry-out a new calibration as described under point 3.2.3 m).

c) Double-head drives

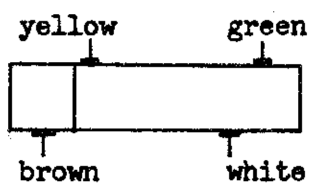
- open-up programming unit as described under poing 3.1.1 a) to 3.1.1 d)
- withdraw the signal ribbon cable from the drive, towards the back (cable end is allocated to the LW1)
- remove the two screws (10) on the upper and lower side of the relevent drive
- carefully withdraw the drive towards the front (together with the attached power supply cable)
- disconnect power supply cable
  (when plugging in the power supply cable ensure that the individual contact pins are correctly positioned)

Note the jumper allocation for LWO and LW1.

d) Mains switch

- open-up programming unit as described under point 3.1.1 a) and 3.1.1 d), and stand it up on its left-hand side
- press the mains supply switch from behind out of the front panel (16)
- remove the cable connections from the mains switch

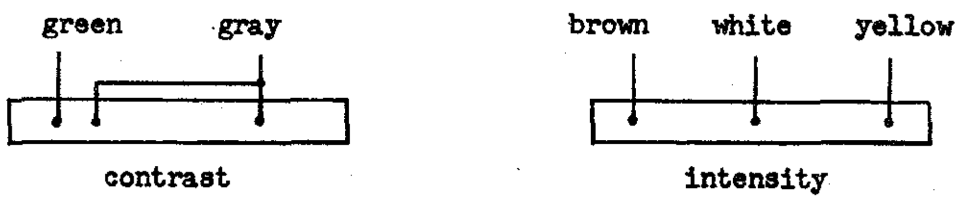
Mains switch lead assignments(as seen from the front)



e) Slide controls

- open-up the programming unit as described under points 3.1.1 a), and 3.1.1 d), and stand it up on its left-hand side.
- withdraw the operating knob of the shift control towards the front
- remove the soldered cable connections on the corresponding shift control

Lead assignments of the shift control (as seen from the rear)



- in each case remove two retaining screws
- displace the shift control laterally and withdraw from behind.

f) Fan

- open-up the programming unit as described under points 3.1.1 a), to 3.1.1 d)
- remove the dust filter as described under point 3.1.2
- remove the four countersunk screws, which are visible after the dust filter has been removed
- remove the soldered connections from the fan module power supply to the auxiliary transformer, located under the drives
  pin 2 = brown
  pin 5 = black
- cut the cable bindings in order to have access to the leads
- loosen the unit side panel on the fan module side by unscrewing the four screws
- place the unit on its lower side, screw off the upper cover panel (40), and shift sideways
- withdraw the fan module from above
- replace the defect fan.

g) Cathode-ray tube

- open-up the programming unit as described under point 3.1.1 a) to 3.1.1 f), and discharge the cathode-ray tube using a cable
- remove the earthing band from the cathode-ray tube
- remove the deflection unit from the cathode-ray tube, without altering the position of the magnets
- remove the nuts on the four corner retaining elements
- carefully replace cathode-ray tube
- carry out a new alignment with the monitor electronis

h) Anti-reflex frame

-open-up the programming unit as described under points 3.1.1 a), to 3.1.1 f),
-remove the cathode-ray tube as described under point 3.2.3 g)
-replace anti-reflex frame

i) Key-operated switch

- open-up programming unit as described under point 3.1.1 a) to 3.1.1 f)
- remove cable soldered connections at the corresponding key operated switch

Lead assignment of the key operated switch:

NEW START	1 = black
	2 = red
INPUT INHIBIT	1 = black
	2 = white

- remove the front panel as described under point 3.1.1 g)
- loosen and screw off the retaining ring using suitable tools
- remove the key operated switch from the front.

j) EPROM plug-on lead

- open-up programming unit as described under points 3.1.1 a), to 3.1.1 g)
- screw-off the plug-on lead on the front panel
- remove the retaining clip
- screw-off the retaining bracket from the plug-on lead plug connector
- withdraw the plug-on lead out of the programming unit from the front

k) Keyboard plug-on lead

- open-up programming unit as described under point 3.1.1 a), 3.1.1 d), and 3.1.1 e), and stand it up on its left-hand side
- screw-off the retaining strip/keyboard cable
- remove the signal ribbon cable from F14 on the BUS wiring, by opening the interlocking lever on the side, and withdraw from the programming unit from the front.

l) Keyboard buttons

- remove the keyboard as described under 3.1.1 e)
- open the keyboard housing by removing the six lower screws
- replace the faulty pushbuttons/switches.

m) **Re-calibration of the monitor electronics/cathode-ray tube**

Required measuring instruments:

multi-meter (0-30 V)

signal generator (1V_{pp}-composite video signal on a 75 Ohm grid raster)

Setting-up:

- check the 12 V power supply voltage for the monitor electronics (IC V36 must be removed for this purpose)
- connect the signal generator to the visual display unit control system using the coaxial cable (do not use the monitor output on the rear panel as the input)
- increase the contrast controller setting by approximately one third
- shift the intensity control until the image is visible.

Cathode-ray tube replacement

- after replacing the cathode-ray tube, axially fix the deflection unit, and check using the grid raster
- if required, correct the geometrical setting using the grid raster
- focus with R42 for optimal image sharpness between the center of the image and the edge of the image
- generate a ladder diagram on the visual display unit
- if required, adjust the image position using the positioning magnet disks on the shift system.

Monitor electronics

- generate a ladder diagram on the visual display unit
- adjust the image width using coil L4
- adjust the image height using R24
  (image size approx. 160 mm x 110 mm)
- generate the grid raster on the visual display unit
- adjust the horizontal linearity with coil L3
- adjust the vertical linearity with R27
- focus for optimal image sharpness between the center and edge of the image using R42
- generate a ladder diagram on the visual display unit
- adjust the image position using the positioning magnet disks on the shift system.

3.2.4 Jumper assignments

The following jumpers must be inserted:

CPU Jumper (Ju.) 4
EPROM 2716
32/1-16
/3-14
/4-13
/6-11

PROG I
52/2-15, 3-14   64/2-15, 4-13, 7-10

SHB Ju. 1, Ju. 2, Ju. 3, Ju. 4, Ju. 5,
13/2-15
/5-12
/8-9

Basic memory module	2/3-14	28/2-15	33/3-14	Ju. 5
(-L556)	/5-12	/3-14	/5-12	
	/6-11	/4-13	/6-11	
	20/2-15		/7-10	
	/4 -13		/8-9	

Extension memory module 1	2/3-14	28/2-15
	20/4-13	/3-14
		/4-13

Extension memory module 2	2/1-16	28/2-15
	/3-14	/3-14
	20/4-13	/4-13

The following jumpers must be inserted in all memory modules:

26/1-16	Ju. 2,	Ju. 8,	Ju. 14
/2-15			
/3-14	Ju. a-a		
/4-13	c-c		
/5-12			
/7-10			
/8-9	f-f		
	g-g		

Visual display unit control

X 2/1-16	X 3/1-16
/2-15	/3-14
/3-14	/5-12
/4-13	/7-10
/5-12	
/6-11	
/7-10	

Floppy interface

21/1-16 IO/W
8-9 INTA

22/2-15
4-13 floppy on channel 0, CRT on channel 2 of DMA
7-10

23/1-16 from FC00 (63 K)
2-15

Ju. B-M, B-E

Double-head drives

Drive 0: no resistor array on location 1E
Ju. HS, Ju. DS1, Ju. DL

Drive 1: resistor array on location 1E
Ju. HS, Ju. DS2, Ju. DL

Keyboard 2-15
3-14
6-14
7-10

Interface 6ES5 511-5AA11
44/1-16 Ju. 1, 2, 5, 6, 9, 10
/2-15
/3-14
/4-13

3.2.5 Connector pin assignment

CPU

S1

	z	b	d	f
2	ADB 1	ADB 0	ADB 2	OV
4	ADB 5	ADB 4	ADB 6	ADB 3
6	ADB 9	ADB 8	ADB 10	ADB 7
8	ADB 13	ADB 12	ADB 14	ADB 11
10	$\overline{\text{WR}}$	OV	OV	ADB 15
12	DB 0	OV	DB 1	$\overline{\text{RD}}$
14	DB 4	DB 3	DB 5	DB 2
16	OV	DB 7	$\overline{\text{CPKLA}}$	DB 6
18	DBR	DBA 1	$\overline{\text{AZ}}$/CPU	DBA 0
20	LOR	STATUS	RISY	AZS5
22	$\overline{\text{PGON}}$	BE	OV	POK
24	RDY	RI	OV	TRAP
26	HOLDA	OV	HOLD	WRT
28	INTAL	INTAG	INTTVM	OV
30	INTCRTC	AGHALT	OV	IRQ3
32	OV	5V	5V	CLOCK

S2

	z	b	d
2	NEUST	C II	$\overline{\text{RE 10}}$
4	$\overline{\text{RL 15}}$	$\overline{\text{RL 14}}$	$\overline{\text{RE 12}}$
6	OV	$\overline{\text{EINGSP}}$	$\overline{\text{RL 17}}$
8	$\overline{\text{RL 13}}$	$\overline{\text{RL 12}}$	$\overline{\text{RL 16}}$
10	$\overline{\text{RL 11}}$	$\overline{\text{RL 10}}$	S I
12	C I	LOR	STATUS
14	$\overline{\text{RE 13}}$	$\overline{\text{RE 11}}$	$\overline{\text{RE 14}}$
16	$\overline{\text{RE 17}}$	$\overline{\text{RE 16}}$	$\overline{\text{RE 15}}$
18		OV	S II
20			
22	$\overline{\text{RL 04}}$	$\overline{\text{RL 05}}$	RL 03
24	$\overline{\text{RL 02}}$	$\overline{\text{RL 00}}$	$\overline{\text{RL 01}}$
26	$\overline{\text{RE 04}}$	$\overline{\text{RE 06}}$	$\overline{\text{RE 05}}$
28	$\overline{\text{RE 01}}$	$\overline{\text{RE 02}}$	$\overline{\text{RE 03}}$
30		$\overline{\text{RE 00}}$	$\overline{\text{630}}$/670
32	$\overline{\text{RL 06}}$	$\overline{\text{RE 07}}$	$\overline{\text{RL 07}}$

Keyboard

1	OV	2	$\overline{\mathrm{RL\ 17}}$
3	$\overline{\mathrm{RL\ 16}}$	4	$\overline{\mathrm{RL\ 15}}$
5	$\overline{\mathrm{RL\ 14}}$	6	$\overline{\mathrm{RL\ 13}}$
7	$\overline{\mathrm{RL\ 12}}$	8	$\overline{\mathrm{RL\ 11}}$
9	$\overline{\mathrm{RL\ 10}}$	10	OV
11	SI	12	CI
13	OV	14	$\overline{\mathrm{RE\ 10}}$
15	$\overline{\mathrm{RE\ 11}}$	16	$\overline{\mathrm{RE\ 12}}$
17	$\overline{\mathrm{RE\ 13}}$	18	$\overline{\mathrm{RE\ 14}}$
19	$\overline{\mathrm{RE\ 15}}$	20	$\overline{\mathrm{RE\ 16}}$
21	$\overline{\mathrm{RE\ 17}}$	22	OV
23	SII	24	CII
25	OV	26	$\overline{\mathrm{RL\ 07}}$
27	$\overline{\mathrm{RL\ 06}}$	28	$\overline{\mathrm{RL\ 05}}$
29	$\overline{\mathrm{RL\ 04}}$	30	$\overline{\mathrm{RL\ 03}}$
31	$\overline{\mathrm{RL\ 02}}$	32	$\overline{\mathrm{RL\ 01}}$
33	$\overline{\mathrm{RL\ 00}}$	34	OV
35	$\overline{\mathrm{RE\ 07}}$	36	$\overline{\mathrm{RE\ 06}}$
37	$\overline{\mathrm{RE\ 05}}$	38	$\overline{\mathrm{RE\ 04}}$
39	$\overline{\mathrm{RE\ 03}}$	40	$\overline{\mathrm{RE\ 02}}$
41	$\overline{\mathrm{RE\ 01}}$	42	$\overline{\mathrm{RE\ 00}}$
43	OV	44	OV
45	OV	46	OV
47	5V	48	5V
49	**Screen**	50	**Screen**

Prog II

S1

	z	b	d	f
2	ADB 1	ADB 0	ADB 2	OV
4	ADB 5	ADB 4	ADB 6	ADB 3
6	ADB 9	ADB 8	ADB 10	ADB 7
8	ADB 13	ADB 12	ADB 14	ADB 11
10	WR	OV	OV	ADB 15
12	DBO	OV	DB 1	RD
14	DB 4	DB 3	DB 5	DB 2
16	OV		CPKLA	
18	DBR	DBA 1		DBAO
20	VKE	STATUS	RISY	AZS5
22	PGON		OV	
24		RI	OV	
26		OV		WRT
28				OV
30		AGHALT	OV	
32	OV	5V	5V	

S2

	z	b	d
2	WR FE85	AZ7	AZ6
4	OV	OV	PEG EPR
6	AZ1	AZ0	AZ2
8	AZ5	AZ4	AZ3
10	AZ9	AZ8	AZ11
12	WR FE83	OV	AZ10
14	WRT FE8A	OV	OV
16	Dxxx	OV	-
18	RDFE88	OV	RD FE89
20	RD FE8C	OV	OV
22	ADRZW	OV	OV
24	-	OV	-
26	RB5	RB6	RB3
28	RB1	RB2	RB4
30	OV	OV	RBO
32	RD FE8D	RB7	OV

PROG II

S3

1	DBA1-
2	-
3	DBA1+
4	RISY -
5	RISY +
6	BE -
7	BE +
8	SDB3 -
9	SDB3 +
10	SDBO -
11	SDBO +
12	SDB5 -
13	SDB5 +
14	$\overline{\text{TPGAS}}$ -
15	$\overline{\text{TPGAS}}$ +
16	DBAO -
17	DBAO +

18	VKE -
19	VKE +
20	TA -
21	TA +
22	MAO -
23	MAO +
24	SDB1 -
25	SDB1 +
26	SDB6 -
27	SDB6 +
28	$\overline{\text{PGON}}$ -
29	$\overline{\text{PGON}}$ +
30	$\overline{\text{RDYPG}}$ -
31	$\overline{\text{RDYPG}}$ +
32	DBR -
33	DBR +

34	-
35	STATUS -
36	STATUS +
37	MA 1-
38	MA 1+
39	T1 -
40	T1 +
41	SDB2-
42	SDB2+
43	SDB7-
44	SDB7+
45	SDB4-
46	SDB4+
47	$\overline{\text{CPKLA}}$ -
48	$\overline{\text{CPKLA}}$ +
49	OV
50	OV

Prog I

S1

	z	b	d	f
2	ADB 1	ADB 0	ADB 2	OV
4	ADB 5	ADB 4	ADB 6	ADB 3
6	ADB 9	ADB 8	ADB 10	ADB 7
8	ADB 13	ADB 12	ADB 14	ADB 11
10	$\overline{\text{WR}}$	OV	OV	ADB 15
12	DB0	OV	DB1	$\overline{\text{RD}}$
14	DB4	DB3	DB5	DB2
16	OV	DB7		DB6
18			$\overline{\text{AZ}}$/CPU	
20				
22			OV	POK
24			OV	TRAP
26		OV		WRT
28				OV
30			OV	
32	OV	5V	5V	

S2

	z	b	d
2	$\overline{\text{WR FE85}}$	AZ7	AZ6
4	OV	OV	PEG EPR
6	AZ1	AZ0	AZ2
8	AZ5	AZ4	AZ3
10	AZ9	AZ8	AZ11
12	$\overline{\text{WR FE83}}$	OV	AZ10
14	$\overline{\text{WR FE8A}}$	OV	OV
16	$\overline{\text{Dxxx}}$	OV	-
18	$\overline{\text{RD FE88}}$	OV	$\overline{\text{RD FE89}}$
20	$\overline{\text{RD FE8C}}$	OV	ØV
22	ADRZW	OV	OV
24		OV	
26	RB5	RB6	RB3
28	RB1	RB2	RB4
30	OV	OV	RB0
32	$\overline{\text{RD FE8D}}$	RB7	OV

PROG-I

S3

	z	b	d
2	5 V	OV	OV
4	SADB 2	SADB 0	SADB 1
6	SADB 5	SADB 3	SADB 4
8	SADB 8	SADB 6	SADB 7
10	SADB 11	SADB 9	SADB10
12	PGM 3	PGM 1	PGM 2
14	SDBL 1	PGM 4	SDBL 0
16	SDBL 4	SDBL 2	SDBL 3
18	SDBL 7	SDBL 5	SDBL 6
20	SDBR 2	SDBR 0	SDBR 1
22	SDBR 5	SDBR 3	SDBR 4
24	K1	SDBR 6	SDBR 7
26	K2	$\overline{CS1}$	$\overline{CS3}$
28	K3	$\overline{CS2}$	$\overline{CS4}$
30	K4	OV	PSW
32	K5	VPr.	OV

S4

	z	b	d
2			
4			
6			
8			
10			
12			
14			
16			
18			
20	OV BAT	U BAT	
22			
24			
26		$\overline{NAU}$	
28	HQ	open	
30			
32	oV-BUS	35V ung.	

SHB

S1

	z	b	d	f
2	5V	0V	-12V	
4	TAKT	PESP	$\overline{\text{HOLD}}$	
6	$\overline{\text{CPKL}}$	ADB 0	ADB 12	
8	$\overline{\text{MEMR}}$	ADB 1	ADB 13	
10	$\overline{\text{MEMW}}$	ADB 2	ADB 14	
12	$\overline{\text{RDY}}$	ADB 3	ADB 15	
14	DB0	ADB 4	$\overline{\text{INTFL}}$	
16	DB1	ADB 5		
18	DB2	ADB 6	INTCRTC	$\overline{\text{AZ}}$/CPU
20	DB3	ADB 7	RDY	
22	DB4	ADB 8	INTCRTC	
24	DB5	ADB 9	HOLDA	$\overline{\text{FGCRTC}}$
26	DB6	ADB10	HOLD	WRT
28	DB7	ADB11	INTFL	INTAG
30	INTTVM	$\overline{\text{HOLDA}}$		MEMSEL
32	0V	0V	12V	

SHB

S3

1			14	
2	0V		15	
3	k4		16	
4	k3		17	k2
5			18	
6	RxD		19	
7			20	+20mA/R
8	$\overline{\text{RxD}}$		21	-20mA/R
9			22	+20mA/T
10	TxD		23	-20mA/T
11			24	screen
12	$\overline{\text{TxD}}$		25	screen
13				

S4

1			14	
2	0V		15	
3	k7		16	
4	k6		17	k5
5	RxD		18	
6			19	
7	$\overline{\text{DSR}}$		20	
8			21	$\overline{\text{DTR}}$
9	$\overline{\text{CTS}}$		22	
10			23	special
11	TxD		24	
12			25	
13	$\overline{\text{RTS}}$			

S5 (AG 150)

1			14	
2	0V		15	
3	k10		16	
4	k9		17	k8
5			18	
6	RxD		19	
7			20	+20mA/R
8	$\overline{\text{RxD}}$		21	-20mA/R
9			22	+20mA/T
10	TxD		23	-20mA/T
11			24	screen
12	$\overline{\text{TxD}}$		25	screen
13				

3	4	17	Cannon-St.
k4	k3	k2	Baud rate
k7	k6	k5	
k10	k9	k8	
0	0	0	9 600
0	0	1	300
0	1	0	4 800
0	1	1	1 200
1	0	0	2 400
1	0	1	600
1	1	0	110
1	1	1	no clock

'0' : connection with pin 2

'1' : no connection

Visual display unit control

S1

	z	b	d
2	5 V	0V	
4		PESP	
6		ADB0	
8			
10	$\overline{\text{MEMW}}$		
12	$\overline{\text{RDY}}$	ADB3	
14	DB0	ADB4	
16	DB1	ADB5	
18	DB2	ADB6	INTCRTC
20	DB3	ADB7	
22	DB4	ADB8	
24	DB5	ADB9	
26	DB6	ADB10	$\overline{\text{IOW}}$
28	DB7	ADB11	$\overline{\text{FG CRTC}}$
30	DRQ		$\overline{\text{DACK}}$
32		0 V	

Memory module

S1

	z	b	d
2	5V	0V	
4			
6		ADB0	ADB12
8	$\overline{\text{MEMR}}$	ADB1	ADB13
10	$\overline{\text{MEMW}}$	ADB2	ADB14
12	$\overline{\text{RDY}}$	ADB3	ADB15
14	DB0	ADB4	
16	DB1	ADB5	
18	DB2	ADB6	
20	DB3	ADB7	SAP 0
22	DB4	ADB8	SAP 1
24	DB5	ADB9	SAP 2
26	DB6	ADB10	SAP 3
28	DB7	ADB11	$\overline{\text{DS}}$
30			MEMSEL
32		0V	12V

Floppy interface

S1	z	b	d
2	5V	OV	
4	TAKT	PESP	$\overline{\text{HOLD}}$
6	$\overline{\text{CPKL}}$	ADB0	ADB12
8	$\overline{\text{MEMR}}$	ADB1	ADB13
10	$\overline{\text{MEMW}}$	ADB2	ADB14
12	$\overline{\text{RDY}}$	ADB3	ADB15
14	DB0	ADB4	
16	DB1	ADB5	
18	DB2	ADB6	
20	DB3	ADB7	
22	DB4	ADB8	
24	DB5	ADB9	
26	DB6	ADB10	$\overline{\text{IOW}}$
28	DB7	ADB11	
30	DRQ	$\overline{\text{HOLDA}}$	$\overline{\text{DACK}}$
32		OV	

34-pole front plug

S3

1	OV	2	$\overline{\text{HEAD LOAD}}$
3	OV	4	
5	OV	6	$\overline{\text{READY 0}}$
7	OV	8	$\overline{\text{INDEX}}$
9	OV	10	$\overline{\text{SEL0}}$
11	OV	12	$\overline{\text{SEL1}}$
13	OV	14	
15	OV	16	$\overline{\text{MOTON}}$
17	OV	18	$\overline{\text{DIR}}$
19	OV	20	$\overline{\text{STEP}}$
21	OV	22	$\overline{\text{WR DATA}}$
23	OV	24	$\overline{\text{WR GATE}}$
25	OV	26	TRACK 0
27	OV	28	WR PROTEKT
29	OV	30	USEP DATA
31	OV	32	SIDE 1
33	OV	34	

Power supply

	z	b	d
2	screen	screen	
4			
6	220 V	220 V	
8	M/110 V	M/110 V	
10	220 V	220 V	
12			
14			
16	$\overline{NAU}$		
18	-12V	35 V ung.	
20	+12V	+12V Fl.	
22	+ 5V F	+ 5V	
24	+ 5V	+ 5V	
26	+ 5V	+ 5V	
28	0V F	0V	
30	0V	0V	
32	0V	0V	

Pin contacts

7.	M/110 V	
6.	Ter. 6/2	mains switch
5.	Ter. 7/2	
4.	Ter. 8/1	auxiliary transformer
3.	Ter. 8/2	
2.	free	
1.	free	

Plug assignment for memory module/EPROM

	c	b	a
1	ØV *	ØV *	5V
2	SADBØ	SADB1	SADB2
3	SADB3	SADB4	SADB5
4	SADB6	SADB7	SADB8
5	SADB9	SADB1Ø	SADB11
6	PGM1	PGM2	PGM3
7	PGM4	SDBLØ	SDBL1
8	SDBL2	SDBL3	SDBL4
9	SDBL5	SDBL6	SDBL7
10	SDBRØ	SDBR1	SDBR2
11	SDBR3	SDBR4	SDBR5
12	SDBR6	SDBR7	K1
13	CS1	CS3	K2
14	CS2	CS4	K3
15	V_{Pr}	PSW	K4
16	V_{Pr}	ØV	K5

* = screen

Plug connector 4 from the 6ES5 501-5AA11 interface to PU

1	-
2	-
3	-
4	DBAØ+
5	DBAØ-
6	$\overline{\text{TPGAS}}$+
7	$\overline{\text{TPGAS}}$-
8	SDB5+
9	SDB5-
10	SDBØ+
11	SDBØ-
12	SDB3+
13	SDB3-
14	BE+
15	BE-
16	RISY+
17	RISY-

18	DBR+
19	DBR-
20	$\overline{\text{RDYPG}}$+
21	$\overline{\text{RDYPG}}$-
22	$\overline{\text{PGON}}$+
23	$\overline{\text{PGON}}$-
24	SDB6+
25	SDB6-
26	SDB1+
27	SDB1-
28	MAØ+
29	MAØ-
30	TA+
31	TA-
32	VKE+
33	VKE-

34	-
35	ØV
36	ØV
37	$\overline{\text{CPKLA}}$+
38	$\overline{\text{CPKLA}}$-
39	SDB4+
40	SDB4-
41	SDB7+
42	SDB7-
43	SDB2+
44	SDB2-
45	T1 +
46	T1 -
47	MA1+
48	MA1-
49	STATUS+
50	STATUS-

Plug connector 4 from the 6ES5511-5AA11,12 interface to the PU 670

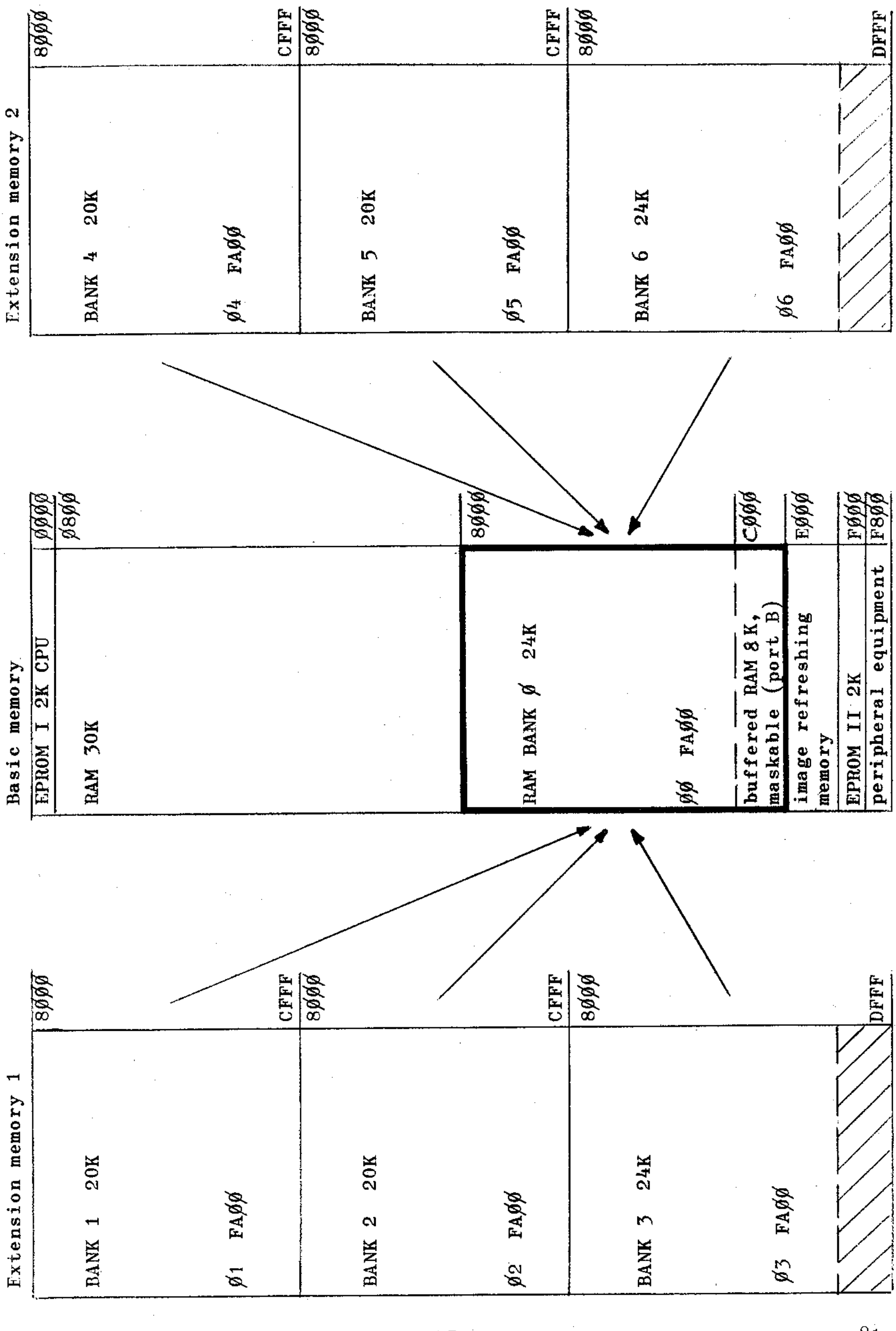
1	
2	
3	
4	
5	OV
6	OV
7	OV
8	OV
9	OV
10	
11	
12	
13	

14	
15	
16	
17	
18	$\overline{\text{TxD}}$
19	TxD
20	$\overline{\text{RxD}}$
21	RxD
22	
23	
24	
25	

3.2.6 Address space allocations

Area	Addresses	Allocation		
0 - 2 K	0000 - 07FF	Program memory (2716), monitor I		
2 - 32K	0800 - 7FFF	Operating memory		
32 -56K	8000 - DFFF	RAM bank Ø		Dial via bank address register (FA 00)
32 -52K	8000 - CFFF	RAM bank 1	Extension memory	
32 -52K	8000 - CFFF	RAM bank 2		
32 -56K	8000 - DFFF	RAM bank 3		
32 -52K	8000 - CFFF	RAM bank 4		
32 -52K	8000 - CFFF	RAM bank 5		
32 -56K	8000 - DFFF	RAM bank 6		
48 -56K	C000 - DFFF	PU REM (buffered, PROG I), can be masked		
56 -60K	E000 - EFFF	Image refresh memory		
60 -62K	F000 - F7FF	Program memory (2716), monitor II, on basic memory		
62K	F800 - F8FF	1/4 K bytes RAM		Port module 8155
	F900	Command		
	F901	Port A		
	F902	Port B		
	F903	Port C		
	F904	Timer-reg. low		
	F905	Timer-reg. high		
	FA00	Interface control register WR		
	FB	Identification port RD		

Area	Addresses	Allocation	
63 K	FC00 - FCOS	8257 DMA control module	
	FC10	Status register	8271 floppy
	FC11	Parameter	control module
	FC80	Parameter	8275 CRT
	FC81	Command	module
	FE00	Date	Keyboard I, 8279 I
	FE01	Command	(functions)
	FE02	Date	Keyboard II, 8279 II
	FE03	Command	(standard)
	FE04	Date	USART (CPU)
	FE05	Command	8251
	FE06	Command, status	8259 interrupt
	FE07	Command, status	control module
	FE80	Stop register	$\overline{WR}$
	FE81	Surch address register, low	$\overline{WR}$
	FE82	Surch address register, high	$\overline{WR}$
	FE83	Control word register	$\overline{WR}$
	FE84	Reset address counter	$\overline{WR}$
	FE85	Increment address counter	$\overline{WR}$
	FE86	Load address counter high	$\overline{WR}$
	FE87	Load address counter low	$\overline{WR}$
	FE88	EPROM plug-in module test	$\overline{RD}$
	FE89	EPROM level test (0.5/2.2 V)	$\overline{RD}$
	FE8A	Read S5 data bus	$\overline{RD}$
	FE8A	Load interface register	$\overline{WR}$
	FE8B	Address test	$\overline{RD}$
	FE8C	EPROM runtime test (500 ns)	$\overline{RD}$
	FE8D	Reset POK flip-flop	$\overline{RD}$
	FF00	Date	USART (PC 150)
	FF01	Command	8251
	FF02	Date	USART (TTY/V24/MODEM)
	FF03	Command	8251


Extension memory 2
8ØØØ
BANK 4 20K
Ø4 FAØØ
CFFF
8ØØØ
BANK 5 20K
Ø5 FAØØ
CFFF
8ØØØ
BANK 6 24K
Ø6 FAØØ
DFFF
Basic memory
ØØØØ
EPROM I 2K CPU
Ø8ØØ
RAM 30K
8ØØØ
RAM BANK Ø 24K
ØØ FAØØ
CØØØ
buffered RAM 8 K,
maskable (port B)
EØØØ
image refreshing
memory
FØØØ
EPROM II 2K
F8ØØ
peripheral equipment
Extension memory 1
8ØØØ
BANK 1 20K
Ø1 FAØØ
CFFF
8ØØØ
BANK 2 20K
Ø2 FAØØ
CFFF
8ØØØ
BANK 3 24K
Ø3 FAØØ
DFFF

Item	Description	Order no.		Spare parts group *)	Quantity per product	Contained in or valid as of object status	
1	Carrying case	C79165-F1239-K2		N	1		
2	CPU	C79458-L417-A31		R	1		
3	PROG II	C79458-L426-A1		R	1		
4	PROG I	C79458-L425-A1		R	1		
5	SHB	C79458-L299-A2		R	1		
6	Memory module	C79458-L556-A1		R	1		
7	Memory module	C79458-L556-A31		R	1		Extension memory
8	Software package	6ES5 800-0AA11		N	1		Order from GWK
9	Diskette, empty	6ES5 820-0AA11		N	10		order from GWK
10	Visual display unit control	C79458-L288-A11		R	1		
11	Floppy interface module	6AB5 101-0AB70		R	1		
12	Power supply	C79451-A3095-B3		R	1		
13	Double-head drive	L22742-A2005-N001		R	2		
14	Monitor electronics	C72145-A54-B2		R	1		
15	23 cm monitor CRT	W79045-A2010		N	1		
16	Interface module	6ES5 501-5AA11		R	1		
17	Interface module	6ES5 511-5AA12		R	1		
18	Complete keyboard	C79451-A3095-B19		R	1		
19							
20	2-pole off-switch	C72315-Z111-D12		N	1		
21	Fuse insert (220 V)	W79054-L4011-T200		N	1		

Place of delivery:
E MA-ED

*) R: can be repaired
N: cannot be repaired

Datum 2/82
Bearb Motel
Gepr
Norm

List fo spare parts

Siemens AG
GWK QPS 2

Zust.	Mitteilung	Datum	Name
1	NK	8.2.82	M

Sh. 1
2 Sh.

S 6057 20 000 10.74 137

Item	Description	Order no.		Spare parts group *)	Quantity per product	Contained in or valid as of object status	
22	Fuse insert (110 V)	W79054-L4011-T400		N	1		
23	Key actuated switch	W79050-E7501-A911		N	1		
24	Key actuated button	W79050-E7503-A911		N	1		
25	Fan	W74247-L8750-A2		N	2		
26	Dust filter	W79087-Z9		N	1		
27	Lithium battery	W79084-U1001-B12		N	1		
28	Keyboard pushbuttons	3.1300.001		N	104	Order from RAFI	
29	Keyboard switches	3.1300.121		N	1	- " -	
30	Anti-reflex frame	C79451-A3095-B59		N	1		
31	EPROM connector lead	C79451-A3095-B65		N	1		
32	Keyboard connector lead	C79451-A3095-B67		N	1		
33	Erase unit connector lead	W79079-N2003-A3		N	1		2 m
34	Mains cable	W79079-N2001-A3		N	1		2 m
35	PT 80 connector lead	6ES5 736-0BD20		N	1		3,2 m
36	PT80, V24 connector lead	6ES5 737-0BD20		N	1		3,2 m
37	PC150 connector lead	6ES5 731-0...0		N	1		max. 100m
38	PC110/130 connect. lead	6ES5 734-0BD20		N	1		3,2 m
39	Second monitor connector lead	6ES5 738-0...0		N	1		max. 100m

Place of delivery:
E MA-ED

*) R: can be repaired
N: cannot be repaired

Datum	2/82
Bearb	Meid
Gepr	
Norm	

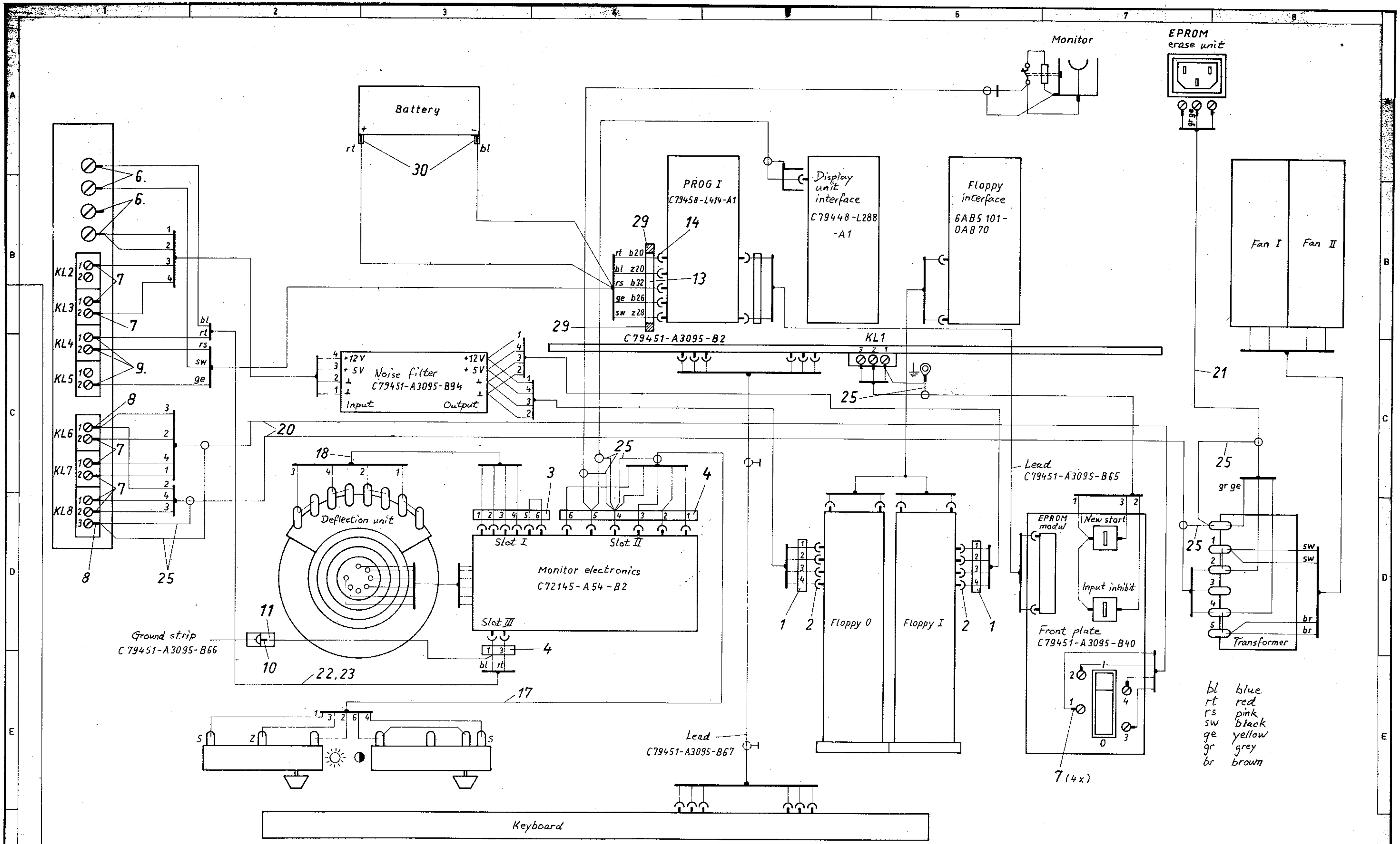
List of spare parts

Siemens AG
GWK QPS 2

Sh. 2
2 Sh.

Zust.	Mitteilung	Datum	Name
1	NK	8.2.82	M

S 605 1000 10.74 137



-A1...A3
231

Zust.	Mitteilung	Datum	Name
4	79AN0094	15.01.81	
3	79 AM 1509	20.8.80	Jac.
2	79 AL 1189	10.12.79	Jac.
1	79AL 125	20.8.79	
51	——	16.7.79	Jac.

Datum 16.7.79
Bearb. Jac.
Gepr.
Norm.
GWK TEK2ITEP1

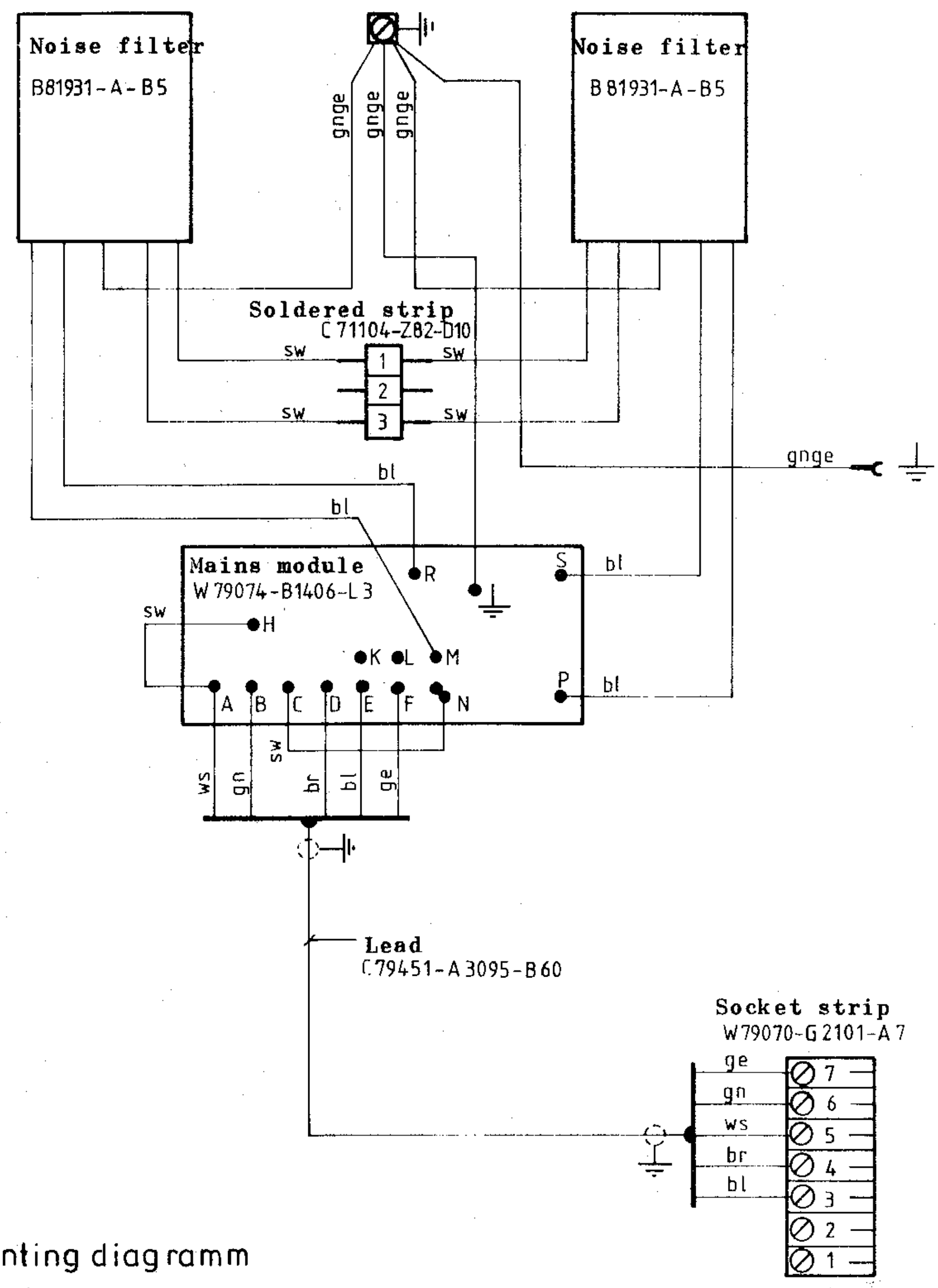
Maßstab

Siemens AG

Bauschaltplan PG 670
Circuit diagram
Schéma éléctrique

C79451-A3095-A1...A3-*-82

Blatt



bl blue
br brown
ge yellow
gn green
sw black
ws white

Mounting diagramm
Plan de montage

Ausgabe X 2 3 4 5 6 7 8 9 10

231			Maßstab
			Datum 21.5.79
			Bearb. Sieg
			Gepr. Kaffun
			Norm.
			GWK TEK1/TEP1
2	79AL1401	13.09.79	Yi
1	NK 79NL125/II	12.6.79	Jae.
S1	—	21.05.79	Yi
Zust.	Mitteilung	Datum	Name

Siemens AG

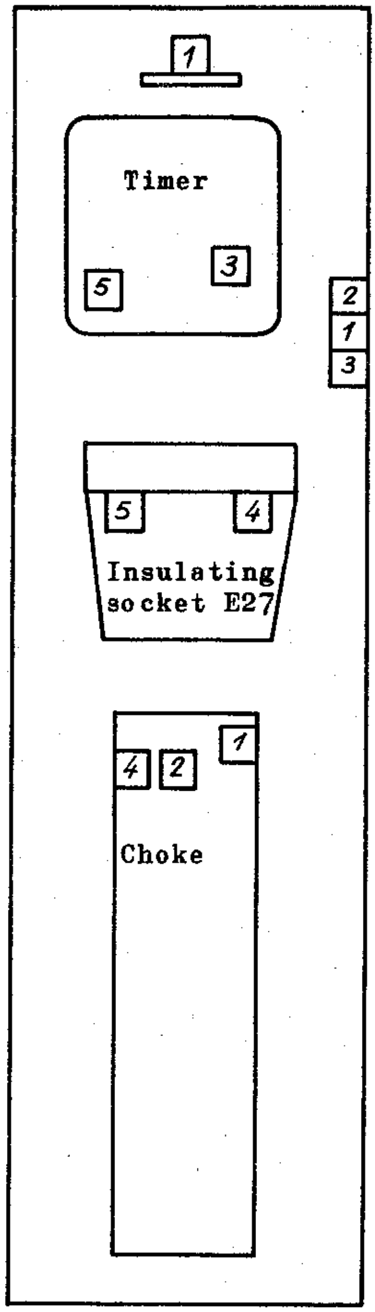
Bauschaltplan

C79451-A3095-B38-*-82

Blatt

Bl.

S 6047 50000 179 974



Switch cords

Wire no.	1	NYAF	0,75	yellow/brown
	2	"	"	blue
	3	"	"	brown
	4	"	"	blue
	5	"	"	brown

The connections of wire-nos. 2 - 5 are spouted

Mounting diagramm: UV erase unit

Plan de montage: unité d'effacement UV

Ausgabe	X	2	3	4	5	6	7	8	9	10

A 11 / 231

Maßstab ——

Datum	1.06.78
Bearb.	Dr. Klein
Gepr.	[illegible]
Norm.	
GWK TEK 1	

Bauschaltplan
UV-Löscheinheit

Siemens AG

C79451-A3071-A11-*-82

Blatt

Bl.

Zust	Mitteilung	Datum	Name
1	79NK344	15.06.78	Kl
51	------	1/06/78	Kl

SIEMENS

SIMATIC® S5

Video monitor control for the 670 programming unit

C79458-L288-A11

Instructions

Order No. C79000-B8576-C201-2

1 Technical description

1.1 Application

The video monitor control for the 670 programming unit (PU 670) is an interface module for generating a video signal. Using this video monitor control it is possible to display 128 different characters, deposited in a PROM memory, and 3 symbols on a black and white monitor with composite video signal input.

The characters can be generated with normal intensity, fifty percent intensity, inverse, flashing or underlined in the format 24 lines x 80 characters. The characters are represented in a 5 x 7 point matrix in the 7 x 10 field format.

1.2 Construction

The video monitor control is accommodated on an printed circuit board 100 mm x 160 mm. This printed circuit board is not functional by itself. The following units are necessary for operation:

- image refresh memory (RAM),
- DMA controller (DMA = direct memory access) for coordinating and processing the DMA transfer between the image repeat memory and the video monitor control and
- address selection unit for selecting the parameter address of the CRT controller (CRT = cathode ray tube).

1.3 Mode of operation

The image refresh memory has a maximum capacity of 2034 bytes and is located in the microcomputer main memory. The image refresh memory address can be selected as required. The memory area from $E000_H$ to $EFFF_H$ is reserved in the PU 670 for this purpose.

The partial channels 2 and 3 of a 8257 DMA controller is used for the data transfer between the image refresh memory and the video monitor control (CRT controller). This module is located in the PU 670, on the interface module of the mini floppy disk drive unit. A block of 16 addresses, starting at address $FC00_H$, is occupied for supplying the parameters of the DMA controller. The address selection of the CRT controller (signal $\overline{\text{FG CRTC}}$) is realized in the PU 670, on the SHB module. The CRT controller must be supplied once with a start parameter.

A 8257 CRT controller is used for image generation. The CRT controller places a DMA control request (signal DRQ) to the DMA controller. A maximum of 96 bytes (characters) are subsequently read from the image memory. A maximum of 80 representable characters are included in the 96 characters, which can be written into one of the two character buffers in the CRT controller.

The remaining characters (max. 16) are control characters (e. g. flashing) and are immediately processed by the CRT controller. Bit 7 has an H level signal for graphic symbols and control characters and a L signal level for representable characters. While one line (= contents of a character buffer) is being represented, the second character buffer is respecified in the CRT controller.

The CRT controller selects the corresponding character in the character generator (PROM) using 7 bits from the character buffer. The controller selects the display line within a character line (refer ro Fig. 2) with 4 additional bits (sub-address). The addresses are represented in the hexidecimal code.

The contents of the memory location in the PROM, which has been selected as described, is written into a shift register and is then outputted in a serial fashion from this register. The outputted dot pattern is supplemented with other information (e.g. inverse, fifty percent intensity) and is outputted onto a monitor as a composite video signal.

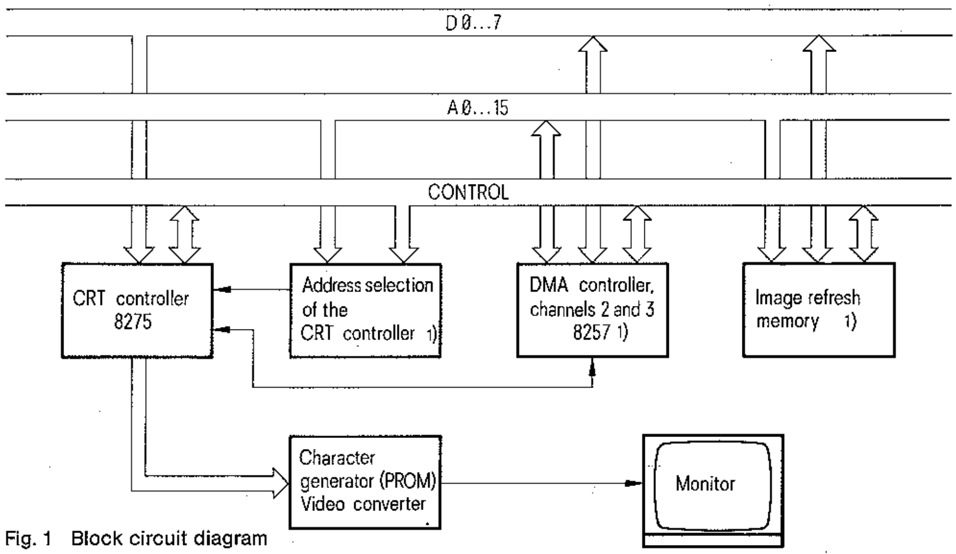


Fig. 1 Block circuit diagram

1) This component is not located on the module -L288-A1.

PROM location address	BS address	Sub-address	PROM contents Q7 Q6 Q5 Q4 Q3 Q2 Q1
410	41	0	0 0 0 0 0 0 0
411	41	1	0 0 0 1 0 0 0
412	41	2	0 0 1 0 1 0 0
413	41	3	0 1 0 0 0 1 0
414	41	4	0 1 0 0 0 1 0
415	41	5	0 1 1 1 1 1 0
416	41	6	0 1 0 0 0 1 0
417	41	7	0 1 0 0 0 1 0
410	41	8	0 0 0 0 0 0 0 [1]
411	41	9	0 0 0 0 0 0 0 [1]
412	41	A	0 0 0 0 0 0 0 [1]

Fig. 2 Bit format in the character generator for the character A = 41_H of the US ASCII table in the 5 x 7 format (7 x 11 character field)

[1] In this range the PROM is not enabled by bit 3 of the sub-address. Cursor, underlining and symbols are directly generated in this range by the CRT controller.

2 Setting-up and operation

2.1 Setting-up

Interface to microcomputer

The interface to the microcomputer has been selected, so that its function and plug assignment correspond to the MC-210 standard interface. The leads PL 1 to PL 4 are occupied by the video monitor control. Thus, the interface module can only be inserted in the provided location. The PROM is not available at the location V28 and the resistor R3 is missing, for the -A1 version.

Interface to monitor

The monitor connection is established using a coaxial plug, located on the front panel of the interface module. A 75-Ω video cable should be used.

2.2 Commissioning

Adjusting the composite video signal

Generally speaking, an adjustment is not required during the commissioning phase. In order to adjust the composite video signal, the composite video output should be terminated with 75 Ω (e.g. by connecting a monitor). An oscilloscope should be connected to pin X107. The potentiometer R11 should be rotated clockwise to its end stop.

Complete signal

Specify the monitor using the keyboard with characters in the normal representation type. The composite video signal is adjusted to $U_{PP} = 1$ V ± 10% using the potentiometer R15.

Fifty percent intensity representation

Specify the monitor using the keyboard (control characters) with characters in the fifty percent intensity representation mode. The composite video signal is adjusted to $U_{PP} = 0.7$ V ± 10% using the potentiometer R11.

Jumper assignment

All jumpers are fixed and selected as follows:

Location X2	Jumper inserted	Without jumper
1–16	x	
2–15	x	
3–14	x	
4–13	x	
5–12	x	
6–11	x	
7–10	x	
8– 9		x

Location X3	Jumper inserted	Without jumpers
1–16	x	
2–15		x
3–14	x	
4–13		x
5–12	x	
6–11		x
7–10		x
8– 9		x

SIEMENS AKTIENGESELLSCHAFT

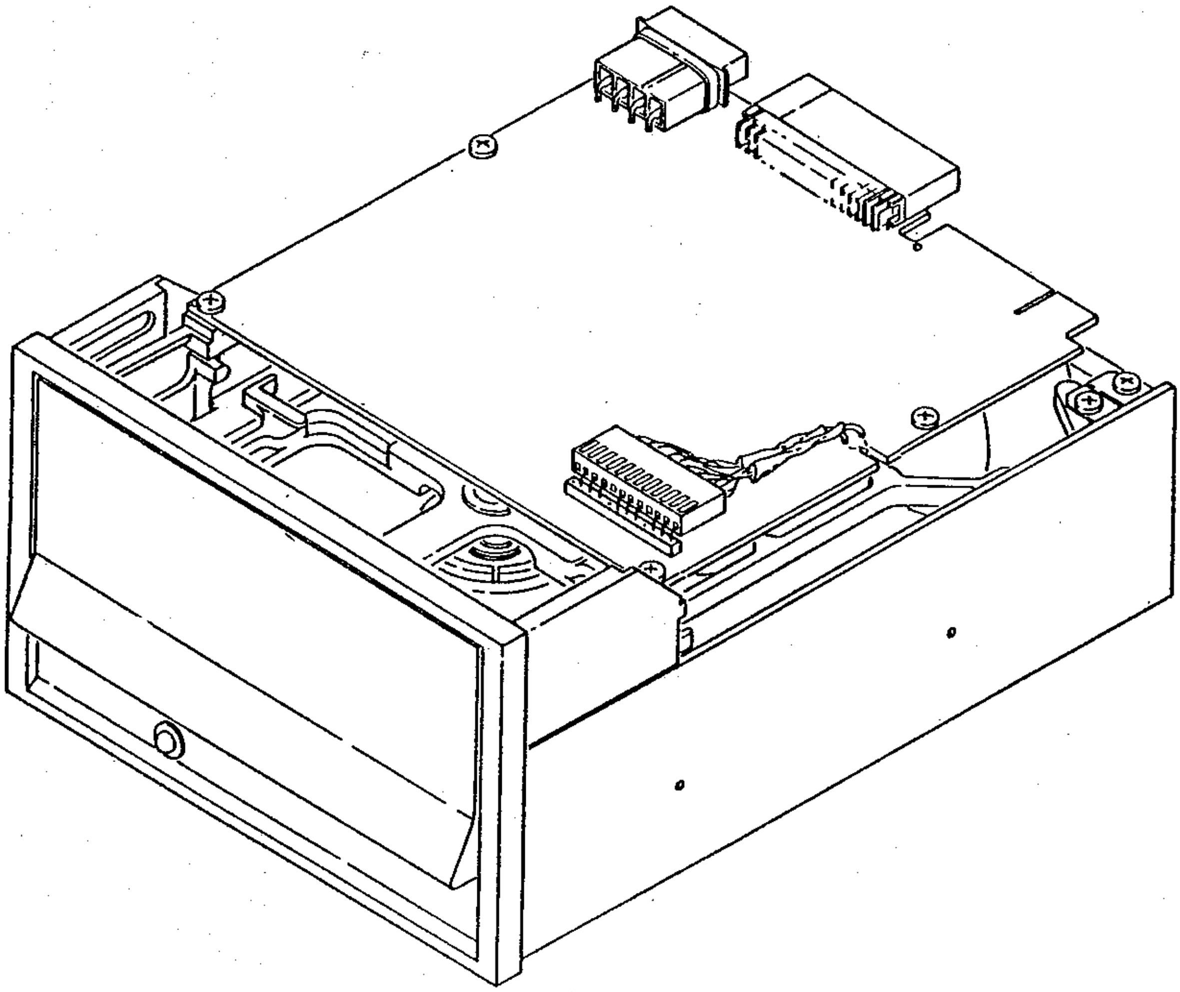
Order No.: C79000-B8576-C201-2
Order from: Gerätewerk Karlsruhe
Printed in the Federal Republic of Germany
AG 1282 0.5 SK 2 En

SIEMENS

Mini Disk Drive FDD 200-5
L22742-A2005-N001

Instructions

Order No. C79000-B8776-C146-1



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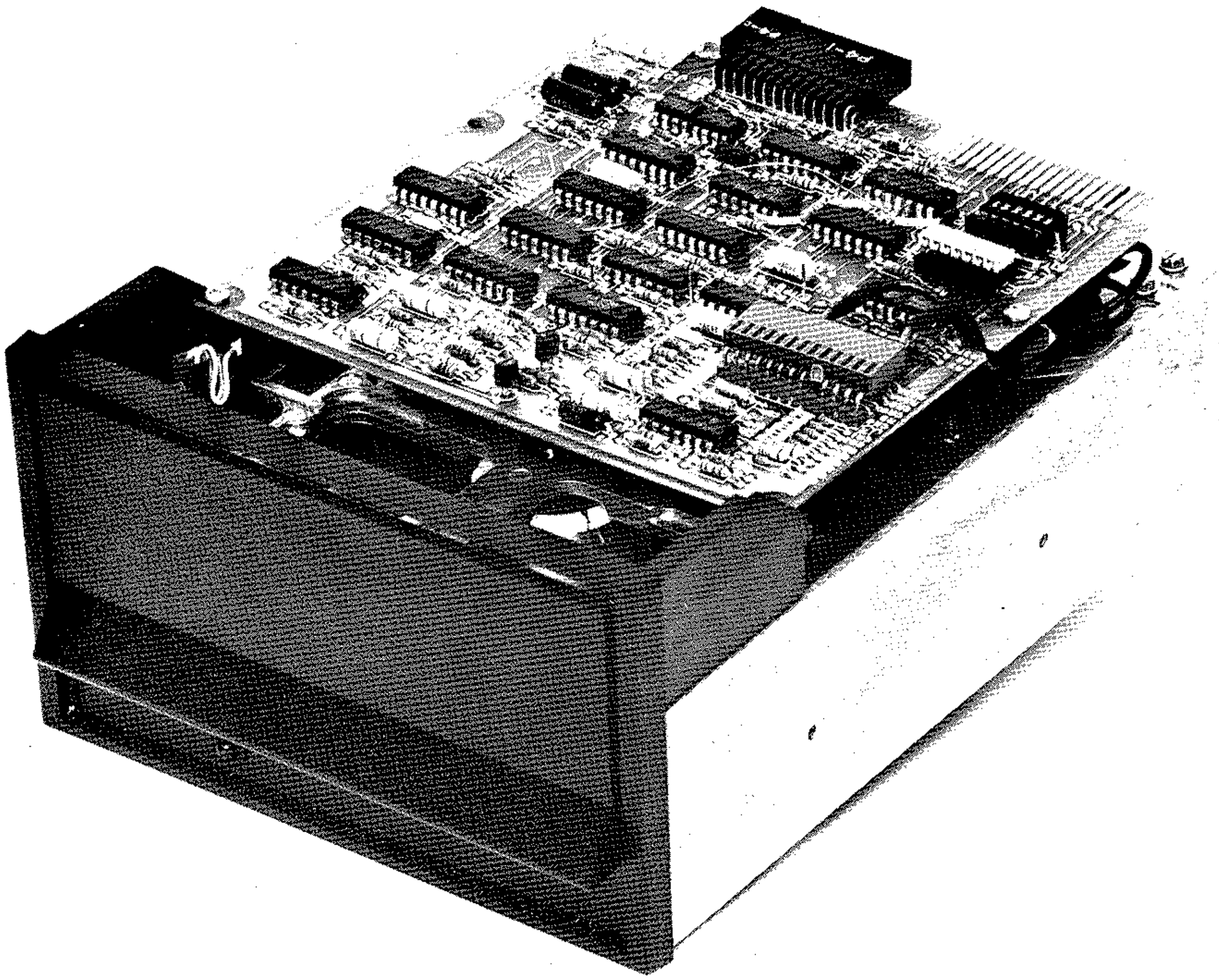


Model FDD200-5 Dual-Head Flexible Disk Drive

SECTION 1

GENERAL DESCRIPTION

1.1 SCOPE

This manual describes interfacing, operation, and maintenance of the Model FDD200-5 Dual-Head Flexible Disk Drive, and is divided into the following five sections:

- Section 1 – General Description
- Section 2 – Installation and Interfacing
- Section 3 – Operation Procedures
- Section 4 – Theory of Operation
- Section 5 – Maintenance

In this manual, it is assumed the user has a practical understanding of floppy disk controllers; e.g., the FDC200-5 Controller, and of TTL and MOS LSI logic.

NOTE

> The Company also offers a line of intelligent microfloppy controllers. Model FDC100-5 is a single-density, single-head controller for use with the Model FDD100-5 Disk Drive, or its equivalent. Model FDC200-5 is a double-density, dual-head controller for use with the Model FDD200-5 Disk Drive or its equivalent.

1.2 INTRODUCTION

The Model FDD200-5 Disk Drive is a high-speed, random access device which stores data on and retrieves data from an oxide-coated, two-sided mylar diskette that is 5.125 inches (13.0175 cm) in diameter. It provides a highly reliable and compact solution to problems of low-cost data storage. The Model FDD200-5 Disk Drive contains electronics for Read, Write, Control, Step, and Direction functions, and for Status indications. The signal interface is a printed wiring board (PWB) edge connector with a pin arrangement that is compatible with standard ANSI X3T9.2 configuration; the PWB also has a standard DC power connector. The Model FDD200-5 Disk Drive has an unformatted data storage capacity of 125K bytes on 40 tracks per diskette side. To obtain compatibility with other disk drives that have less capacity, only the first 35 tracks are normally used. The first 35 tracks provide an unformatted data storage capacity of 109.4K bytes. Since both sides of the diskette can be used for storage and retrieval of data, the unformatted data storage capacity for both diskette sides is 250K bytes (80 tracks) or 218.8K bytes (70 tracks). Formatting the disk drive is a function of the host system.

1.2.1 DOUBLE DENSITY

By using MFM, M^2FM or GCR double-density encoding techniques, unformatted data storage capacity can be increased to 500K bytes (80 tracks) or 437.6K bytes (70 tracks) on a single two-sided diskette.

1.2.2 DAISY CHAIN CAPABILITY

Up to four Model FDD200-5 Disk Drives can be daisy chained on a single bus. When all expanded capacity features of the disk drives are employed, a total unformatted data storage capacity of two megabytes can be provided by the system.

1.2.3 APPLICATIONS

Options that can be selected and installed by the customer are available to broaden applications. The Model FDD200-5 Disk Drive can be used in the following applications:

A. Microcomputer program/load storage.
B. Power typing systems.
C. Microprocessor systems.
D. Word processing systems.
E. Desk-top calculators and portable computers.
F. Text editing systems.
G. Smart terminals.

The Model FDD200-5 Disk Drive is also equipped with an interface that allows upward expansion of the units within the system and future system enhancements with the larger floppy disk drives. AC power requirements have been eliminated through the use of a DC servo-controlled spindle-drive motor.

1.2.4 HEAD CHARACTERISTICS

The dual read/write heads are of the single-gap type with trailing tunnel-erase structures to ensure interchange capability by enhancing off-track reading capability. The written track is 0.013 inch (0.03302 cm) wide, and the 40 tracks are centered at 1/48-inch (0.053-cm) intervals. The head carriage is positioned by a lead screw that is driven by a stepper motor.

1.3 FEATURES

The Model FDD200-5 Disk Drive includes the following features:

A. Small size - compactness and light weight.
B. High Data Integrity - soft error rate not greater than one in 10^9 bits.
C. Low Cost - competitive with cassette drives.
D. Compatible Media - industry-standard media and format ensures interchangeability.
E. Gentle Media Handling - field-proven patented positive operator interlock extends media life, and does not allow clutch to engage diskette unless diskette package is correctly positioned in disk drive.
F. Ceramic/Ferrite Heads - high reliability and long life.
G. Daisy-Chain Capability - up to four disk drives may be interconnected on a single bus.
H. Simplified Power Requirements - uses only +5 or 12 Volts DC power.
I. Molded Construction - for rugged consistency and quality.
J. Write Protection - optical Write inhibit protects data file.
K. High-Speed Head Positioner - provides track-to-track access time of 25 milliseconds.
L. Industry Standard Tracks - allows use of up to 40 tracks and matches industry standards for the first 35 tracks.
M. Double-Density Recording - disk drive electronics and head are designed for use with MFM, M^2FM or GCR double-density encoding techniques which enable up to 250K bytes of unformatted data to be stores on each side of a diskette.

1.4 SPECIFICATIONS

Specifications for the Model FDD200-5 Disk Drive are listed in Table 1-1. Unformatted data capacity specifications are listed in Table 1-2.

Table 1-1. Model FDD200-5 Disk Drive Specification

GENERAL		
Parameter	Characteristics	
	35 Tracks	40 Tracks
Track Density:	48 TPI	48 TPI
Rotational Speed:	300 ± 3 rpm	300 ± 3 rpm
Data Transfer Rate:	125K bits/sec	125K bits/sec
Access Time –		
Track-to-Track:	25 msec	25 msec
Average Random Access Time:	298 msec	340 msec
Settle Time:	15 msec	15 msec
Average Latency:	100 msec	100 msec
Recording Density (FM):	2728 BPI (inner track)	2938 BPI (inner track)
Data Flux Density:	5457 fci (inner track)	5876 fci (inner track)
Head Load Time:	50 msec	50 msec
Power-Up Delay:	1 sec	1 sec

PHYSICAL	
Parameter	Characteristics
Height:	3.25 ± 0.02 inches (in.) (8.255 ± 0.0508 cm) 3.38 ± 0.02 in. (8.582 ± 0.0508 cm) over front bezel
Width:	5.75 ± 0.02 in. (14.605 ± 0.0508 cm)
Length:	8.00 in. (20.32 cm) max.
Net Weight:	3.5 pounds (1.5876 kg)
Shipping Weight:	4.5 pounds (2.0412 kg)
Media Requirements –	
Type 820 (or equivalent):	Soft-Sector Format
Type 821 (or equivalent):	10 Physical Sectors
Type 822 (or equivalent):	16 Physical Sectors
Power:	+12VDC ± 5%, 1.8A max., 0.80A typ., 100 mV p-p max. ripple +5VDC ± 5%, 0.7A max., 0.4A typ., 50mV p-p max. ripple
Typical Power Dissipation:	12W operating 7W standby

Table 1-1. Model FDD200-5 Disk Drive Specifications (continued)

ENVIRONMENTAL	
Parameter	**Characteristics**
Temperature Range –	
Operating:	4 to 46°C (40 to 115°F)
Shipping or Storage:	-40 to 60°C (-40 to 140°F)
Wet Bulb (maximum):	36.3°C (78°F)
Relative Humidity Range –	
Operating:	20 to 80%, noncondensing
Shipping or Storage:	5 to 95%, noncondensing
RELIABILITY	
Parameter	**Characteristics**
Mean Time Between Failure (MTBF):	8500 hours (assume 25% power-on cycle for spindle-drive motor)
Mean Time To Repair (MTTR):	0.5-hour
Media Life (with approved media):	Not less than 3 x 10^6 passes per track
Design Life:	5 years

Table 1-2. Unformatted Data Capacity Specifications

Capacity	Single Density (FM)		Double Density (MFM, M^2FM)	
	Single Side	Double Side	Single Side	Double Side
Track:	3.13K bytes	3.13K bytes	6.26K bytes	6.26K bytes
Diskette (35 Tracks):	109.4K bytes	218.8K bytes	218.8K bytes	437.6K bytes
(40 Tracks):	125.0K bytes	250.0K bytes	250.0K bytes	500.0K bytes

SECTION 2

INSTALLATION AND INTERFACE

2.1 UNPACKING AND INSPECTION

During unpacking and inspection, use the following procedure:

A. Remove contents of shipping container and inspect for in-transit damage. If damage is evident, notify carrier and manufacturer. Specify nature and extent of damage.

B. Verify that contents of shipping container agree with shipping list. Notify a Company representative if anything is missing.

C. Verify that model designation and serial number agree with those on shipping invoice.

D. Inspect assemblies for loose hardware and connectors; if necessary, tighten hardware.

2.2 INSTALLATION

The Model FDD200-5 Disk Drive may be mounted in one of the following positions:

A. Horizontally, with PWB facing up as shown in Figure 2-1.

B. Vertically, on either the right or left side, with the door opening to one side or the other side.

C. Vertically, with the door opening upward.

D. Any combination of A, B, and/or C.

Figure 2-2 shows outline and mounting dimensions.

2.3 INTERFACE

Communication between the Model FDD200-5 Disk Drive and the controller is established through an I/O cable. Power to the Model FDD200-5 Disk Drive is applied through a separate cable. Input interface signal lines are terminated by a resistor network that offers an impedance of 132 Ohms. For ideal signal transmission, the input/output (I/O) cable should have a characteristic impedance of 132 Ohms. Maximum cable length between the controller and the last disk drive should be not greater than 10 feet (3.048 m).

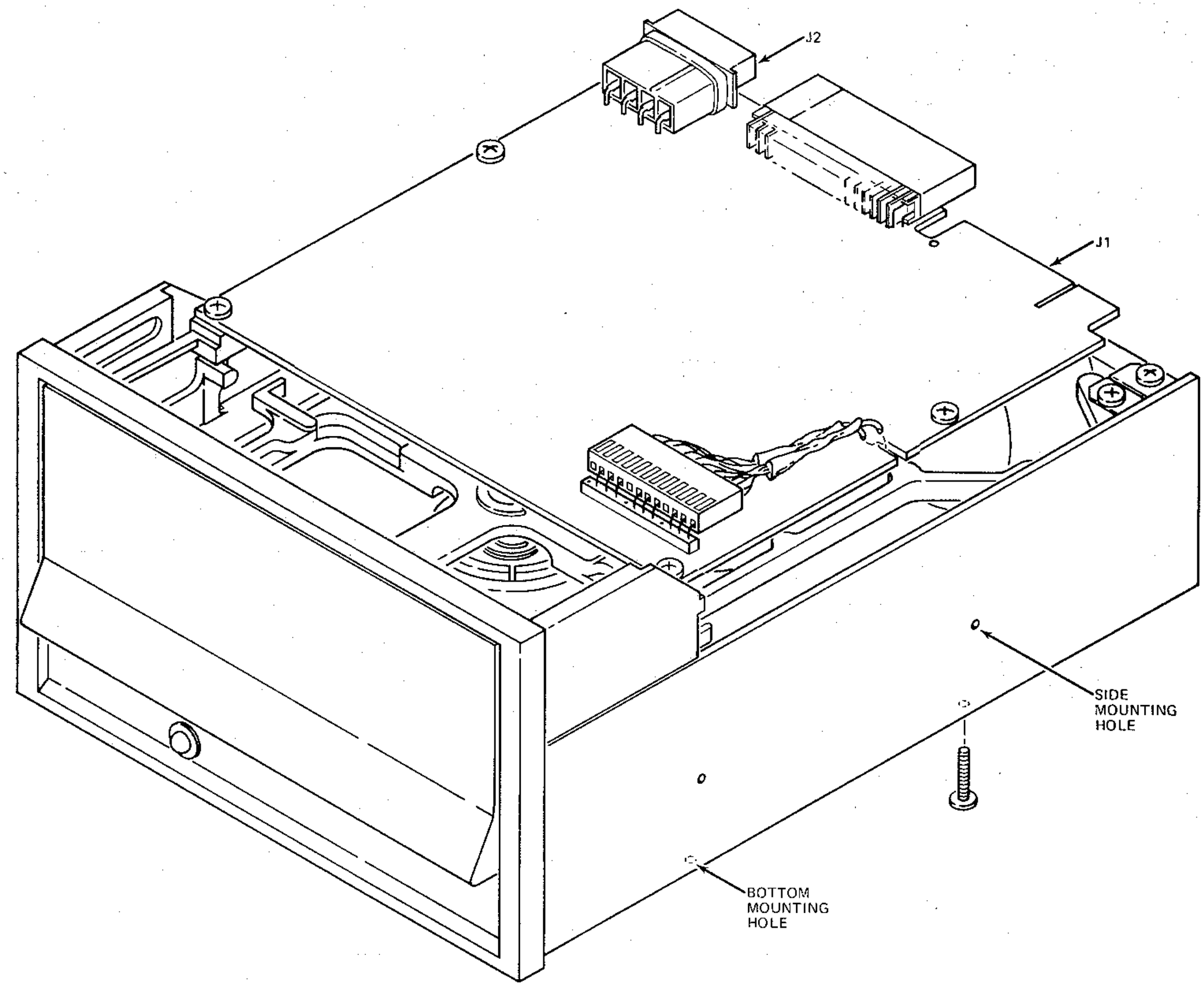
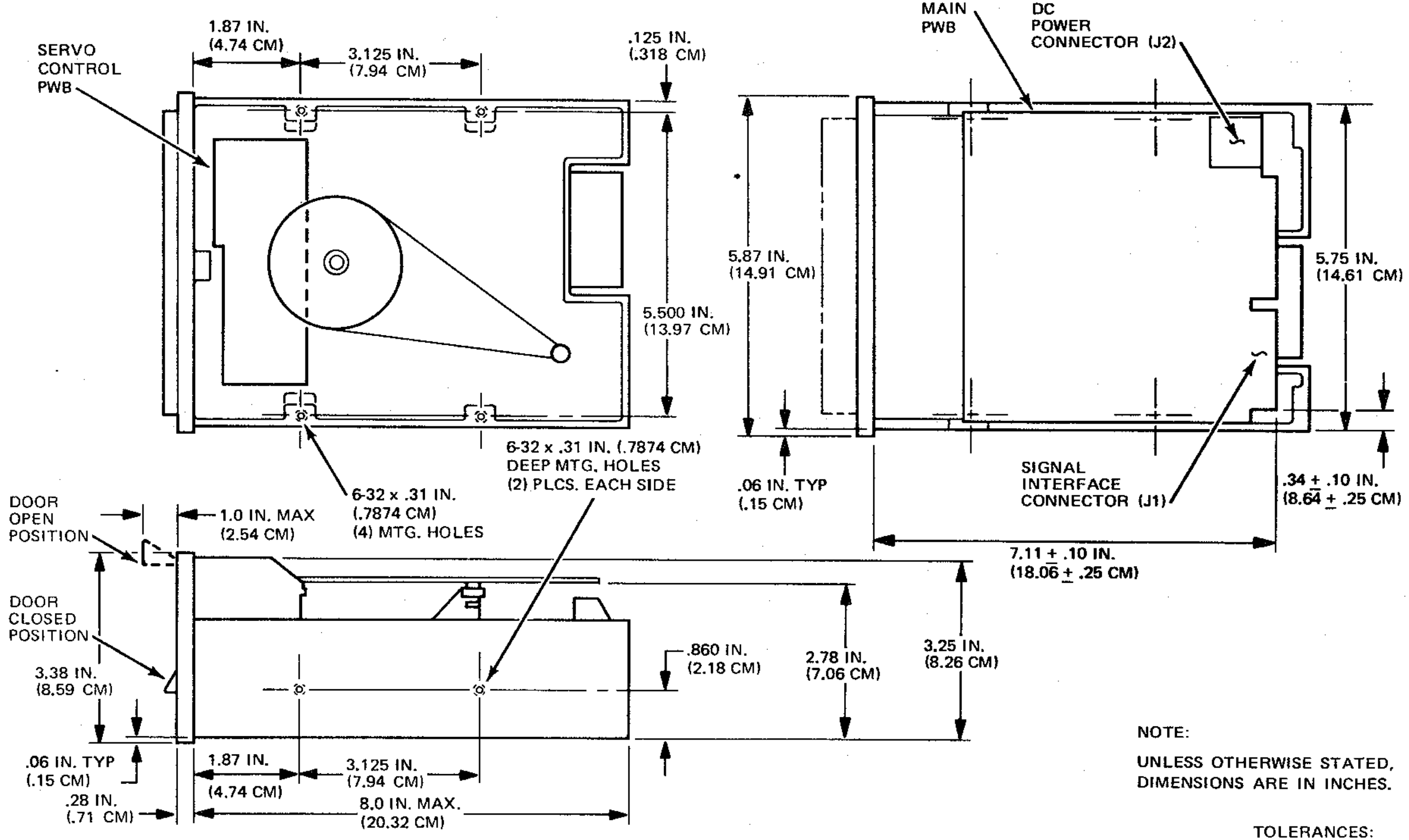


Figure 2-1. Model FDD200-5 Disk Drive, Isometric View



NOTE:

UNLESS OTHERWISE STATED, DIMENSIONS ARE IN INCHES.

TOLERANCES:
.XXX ± 0.010
.XX ± 0.020

Figure 2-2. Outline and Mounting Dimensions

2.3.1 SYSTEM CONFIGURATION

The Model FDD200-5 Disk Drive can be connected in either a star or daisy-chain configuration as shown in Figure 2-3.

In the star configuration, each disk drive requires a termination network; in the daisy-chain configuration, only the last disk drive in the daisy chain requires a termination network. Either system configuration can interface with up to four Model FDD200-5 Disk Drives.

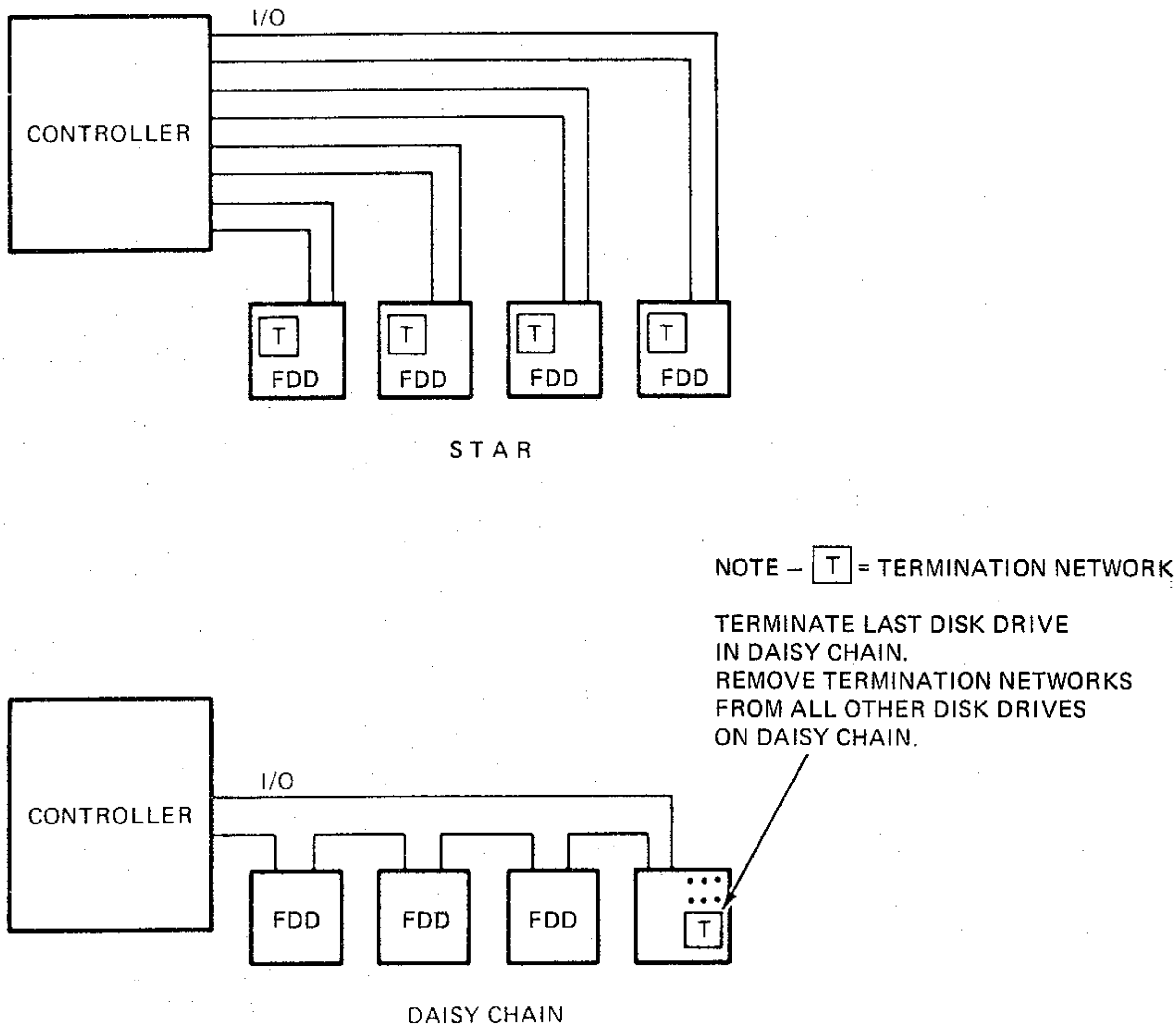


Figure 2-3. Model FDD200-5 Disk Drive System Configurations

2.3.2 ELECTRICAL CONNECTORS

The interface between the Model FDD200-5 Disk Drive and the controller consists of two connectors, J1 and J2. J1 provides the primary signal interface, and J2 provides DC power. There is also a frame-ground "Fast-On" terminal.

2.3.2.1 Primary Signal Interface Connector. This interface is through connector J1 which is a 34-pin card-edge connector on the PWB. Figure 2-4 shows the configuration of this connector. The pins are numbered 1 through 34 with the even numbered pins on the component side and the odd numbered pins on the solder side. Pins 33 and 34 are on the end of J1 nearest the spindle motor. A key slot is provided between pins 3/4 and 5/6 for optional connector keying. Pins 1/2 and 33/34 are labeled. Pin assignments for the interface signals are shown in Figure 2-5. The recommended mating connectors for J1 are listed in Table 2-1.

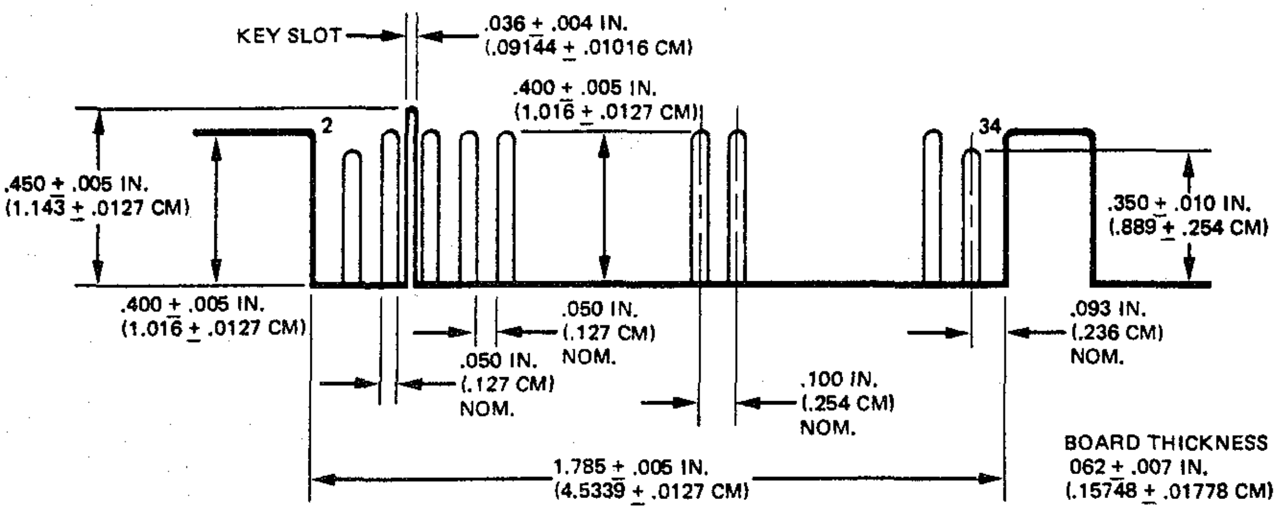


Figure 2-4. J1 Connector Configuration

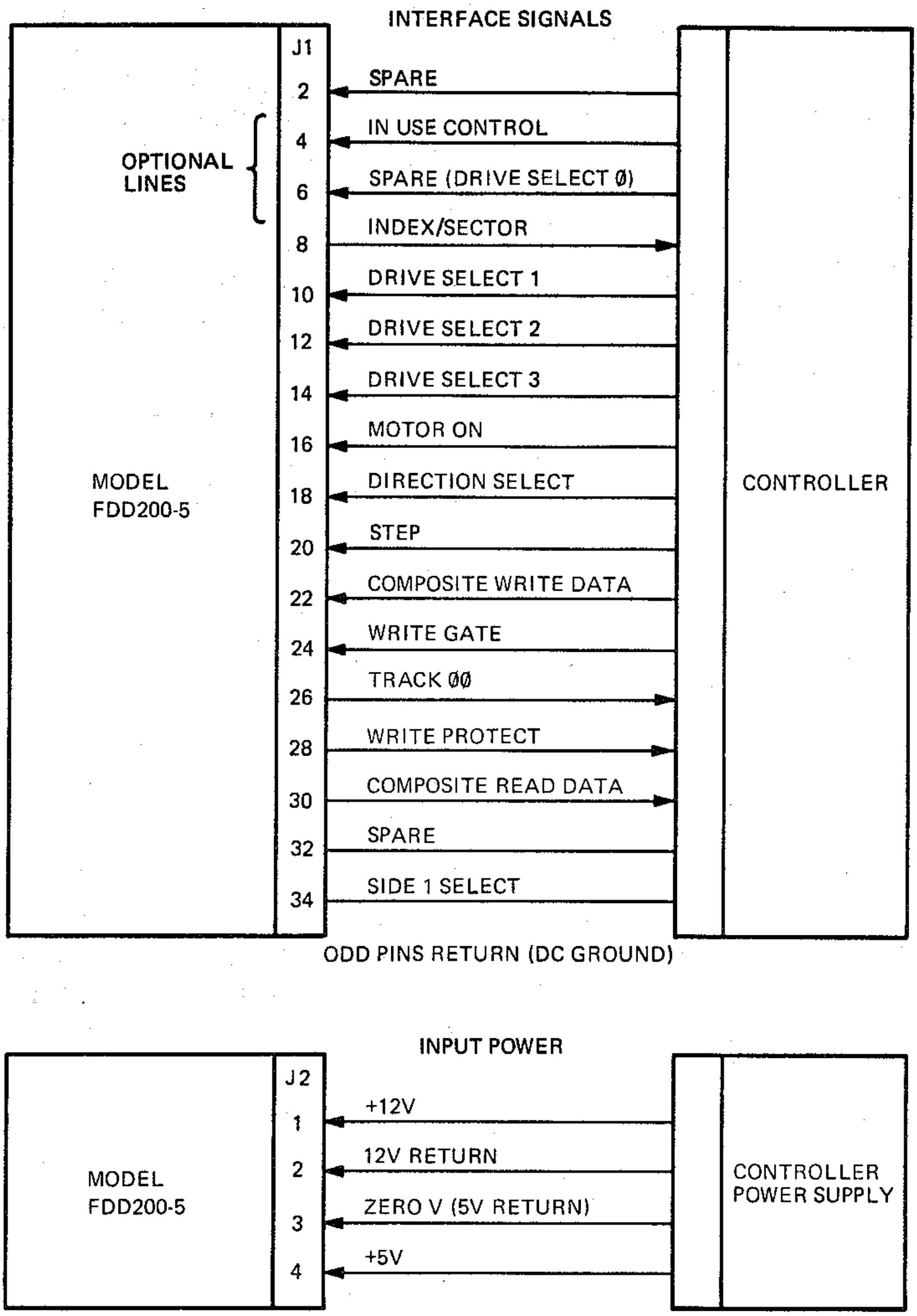
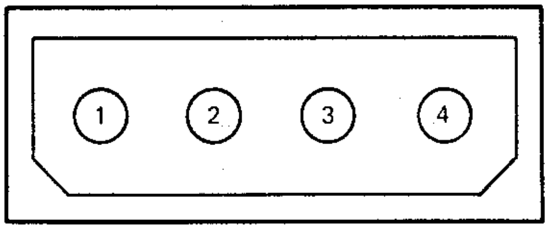


Figure 2-5. Interface Signals and Input Power

Table 2-1. Recommended Mating Connectors for Primary Signal Interface

Type of Cable	Manufacturer	Connector P/N	Contact P/N
Twisted pair, no. 26 AWG (crimp or solder)	AMP	583717-5	1-583616-1
Flat cable	3M "ScotchFlex"	3463-0001	Not applicable

2.3.2.2 Power Connector. The DC power connector (J2) is mounted opposite J1 on the component side of the PWB. Power connector J2 is a 4-pin AMP P/N 1-480426-0. The recommended mating connector P2 is AMP P/N 1-480424-0 which uses AMP pins P/N 60619-1. The recommended wire size is no. 18 AWG. Figure 2-6 shows the pin-numbering sequence of J2. The 5V and 12V power returns are tied together and connected to the chassis at the disk drive.



J2 CONNECTOR

Figure 2-6. J2 Connector Outline

2.3.2.3 Frame Ground. The Model FDD200-5 Disk Drive must be grounded to the controller to ensure proper operation and low-noise susceptibility. The AC ground or neutral wire should be connected to the disk drive frame. A Fast-On tab is provided on the disk drive. The tab is an E.T.C. P/N 3431, and the mating connector is AMP P/N 60972-1. Means for providing only AC coupling between the frame and logic grounds is available on the main PWB; however, use of this feature may increase disk drive noise susceptibility. The modification is made by removing resistor R59 (1M) from the main PWB.

2.3.3 TRANSMITTER CHARACTERISTICS

The Model FDD200-5 Disk Drive uses an SN7438 IC or equivalent to transmit all control and data signals. This IC can sink 48 milliamperes at a low level of 0.4 volt. Output signals are to be terminated by a 132-Ohm resistor network at the controller interface.

2.3.4 RECEIVER CHARACTERISTICS

The Model FDD200-5 Disk Drive uses an SN7414 IC or equivalent to receive all transmitted signals from the controller. The input of each receiver is terminated by a resistor network.

2.3.5 TERMINATOR

The resistor network that is used to terminate all input signals is inserted in or removed from a socket on the PWB. Network impedance is 132 Ohms provided by a 220-Ohm resistor to +5V together with a 330-Ohm resistor to DC ground as shown in Figure 2.7. Each Model FDD200-5 Disk Drive is shipped with a terminator installed.

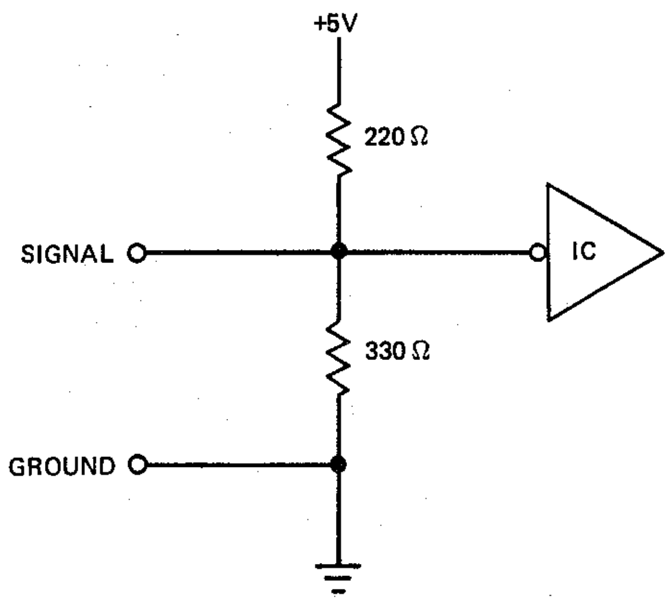


Figure 2-7. Termination Configuration

2.4 INTERFACE SIGNALS

A timing diagram of the interface signals is shown in Figure 2-8. Interface signals are carried by input control lines, output lines, and data lines.

2.4.1 INPUT CONTROL LINES

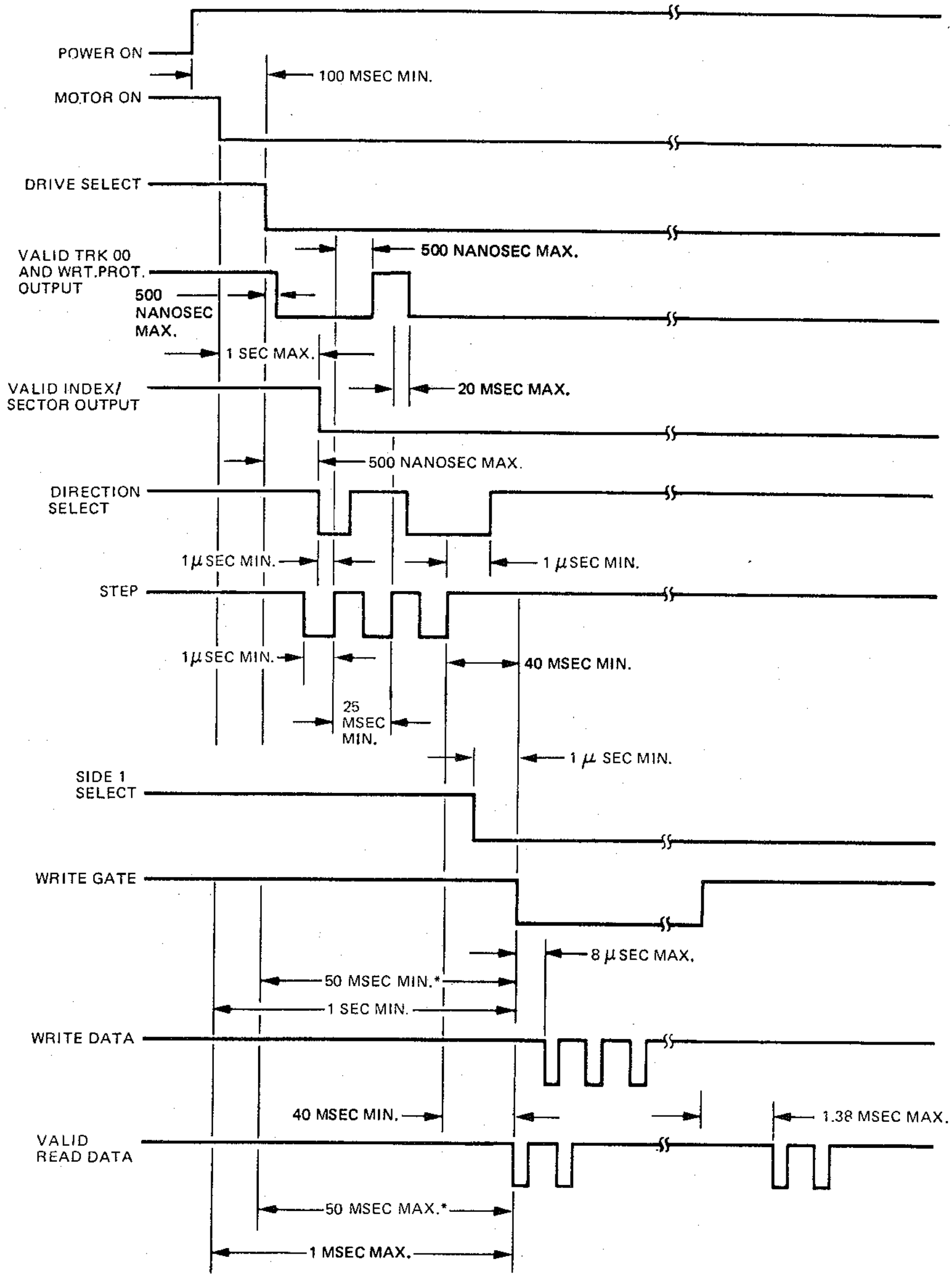
Input control signals are carried by ten lines; two of which are optional.

2.4.1.1 Drive Select Lines. There are four Drive Select lines: DS1, DS2, and DS3 are standard, and DS0 is optional. A low (true) level on any one of these lines allows the controller to communicate with the disk drive assigned to that line. During all communication with the disk drive, the line must remain true because all transmitters and receivers are gated with a corresponding Drive Select line; therefore, they can be activated only by the corresponding Drive Select command from the controller. In a multiple-drive system, the user must alter the program shunt module to allow the multiplexing of the I/O lines. An optional interface line may be assigned to the DS0 line.

2.4.1.2 Motor On (J1-16). This feature is provided for the user to directly control (via the interface) the DC spindle motor. A low level at the interface turns the spindle motor on. The spindle takes one second after this line is activated to come up to speed. A one second delay should occur after Motor On and before any reading or writing is attempted. If such feature is not desirable, the spindle motor can be kept on by permanently grounding the Motor On line; however, use of this feature is recommended to reduce average power consumption and increase overall life of the disk drive. If the Motor On signal is used, and if the Head Load with Motor On option is selected, the program shunt module may require changing.

2.4.1.3 Direction Select (J1-18). This line controls the direction of travel of the read/write heads. A low level on this line causes the head to move toward the center of the spindle only when a Step pulse occurs. The Direction Select signal should be stable from 1.0 microsecond before to 1.0 microsecond after the trailing edge of Step.

2.4.1.4 Step (J1-20). A low pulse on this line, together with Direction Select, initiates a single track move of the heads. Head movement begins on the trailing edge of this pulse. Minimum pulse width should be not less than 1.0 microsecond and the maximum pulse repetition rate should be one pulse every 25 milliseconds.



*IF HEAD LOAD WITH SELECT. IF HEAD IS ALREADY LOADED 500 NANOSECONDS.

Figure 2-8. Interface Timing Diagram

2.4.1.5 Write Gate (J1-24). A low level on this line enables Composite Write Data to be written on the diskette. A high (false) level on this line enables the stepper motor logic and the Composite Read Data line so that Read data may be read from the diskette.

2.4.1.6 In Use Control (J1-4). This is an optional input line that may be used to externally control the indicator on the front panel. This signal line is not gated with any Drive Select line. A low level on this line causes the IN USE indicator lamp on the front panel to illuminate.

2.4.1.7 Side One Select (J1-32). The signal level on this line selects which side of the two-sided diskette will be written on or read from. A high level selects side zero (lower head). A low level selects side one (upper head). A switch delay time of one microsecond must be used when switching from one side to the other.

2.4.2 OUTPUT LINES

Output signals from disk drive to controller are carried by three lines: Track ØØ, Index/Sector, and Write Protect.

2.4.2.1 Track ØØ (J1-26). A low level on this line informs the controller that the position of the read/write head is at track ØØ. Subsequent Step pulses are ignored by the disk drive.

2.4.2.2 Index/Sector (J1-8). For soft sector operation that uses single-hole media, this line transmits a reference Index pulse once every diskette rotation to indicate the beginning of a track. For hard sector operation that uses multi-hole media, this line transmits the Index pulse and all Sector pulses where Sector pulses indicate the beginning of a sector. Pulse widths for both Index and Sector is 4+1.5 milliseconds. Figure 2-9 shows the Index/Sector timing.

2.4.2.3 Write Protect (J1-28). A photosensor assembly senses the presence or absence of a notch in the diskette. If a notch is not detected, a low signal is transmitted to the controller to indicate that a Read-only diskette has been inserted into the Model FDD200-5 Disk Drive. This condition also inhibits writing data on the diskette.

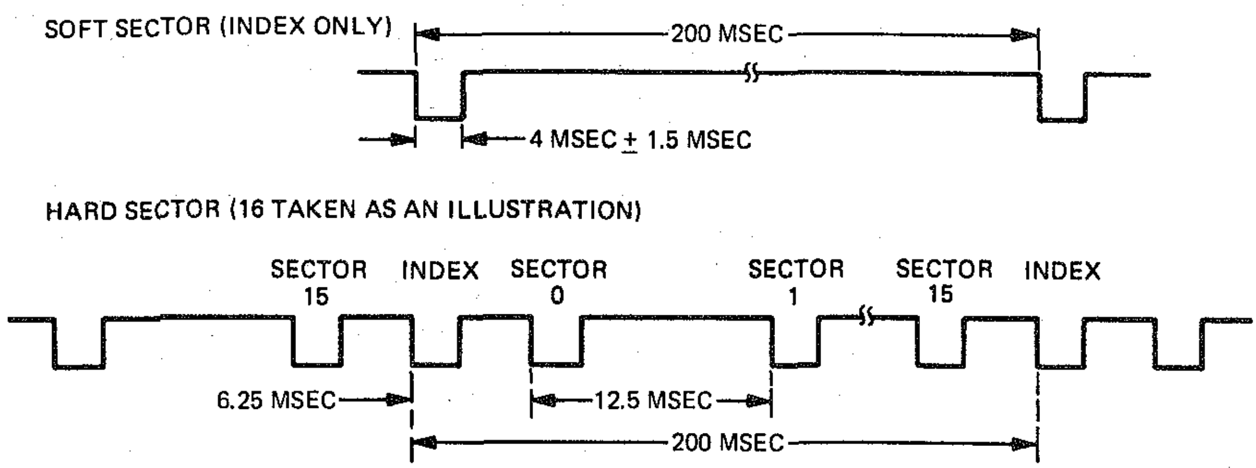


Figure 2-9. Index/Sector Timing

2.4.3 DATA LINES

Data lines are provided for transfer of composite Write or Read data.

2.4.3.1 Composite Write Data (J1-22). The controller uses this line to transmit the data to be written on the diskette of the selected disk drive. Each transition from a logical one level to a logical zero level causes the current through the read/write head to be reversed, thereby writing a data bit. This line is enabled by Write Gate being in a low logical state. Write timing is shown in Figure 2-10. The pulse width of clock and data bits should be between 250 nanoseconds (minimum) and 2.1 microseconds (maximum). At 125 kHz, the clock interval is 8 microseconds and the clock-to-data or data-to-clock interval is 4 microseconds. The write clock frequency should be held within ± 0.5 percent.

2.4.3.2 Composite Read Data (J1-30). Read data from the selected disc drive are output to the host system in the same format as Write data are input from the host system. Each flux reversal sensed on the diskette results in a transition to a low level on this line for a duration of 1 ± 0.25 microsecond. Read timing is shown in Figure 2-11.

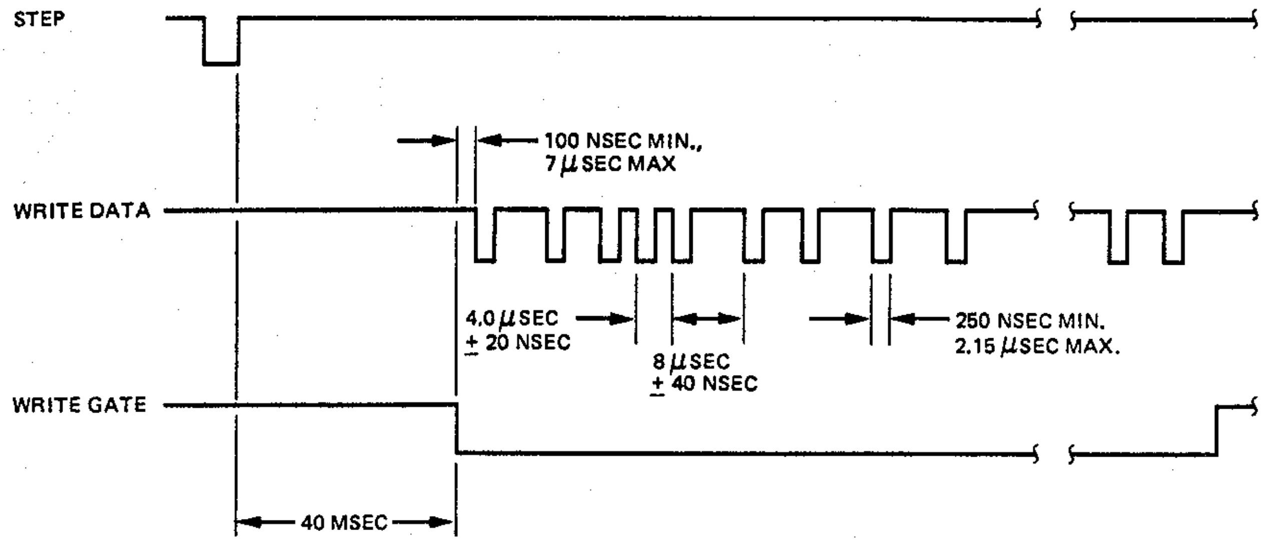
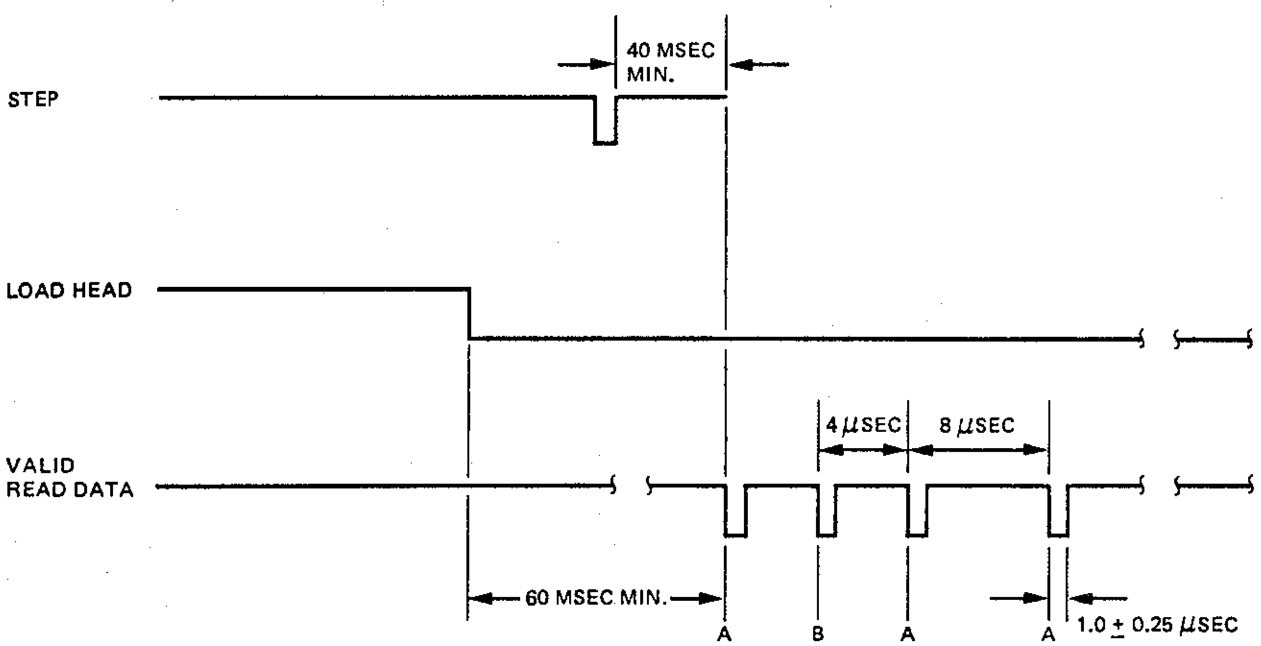


Figure 2-10. Write Timing



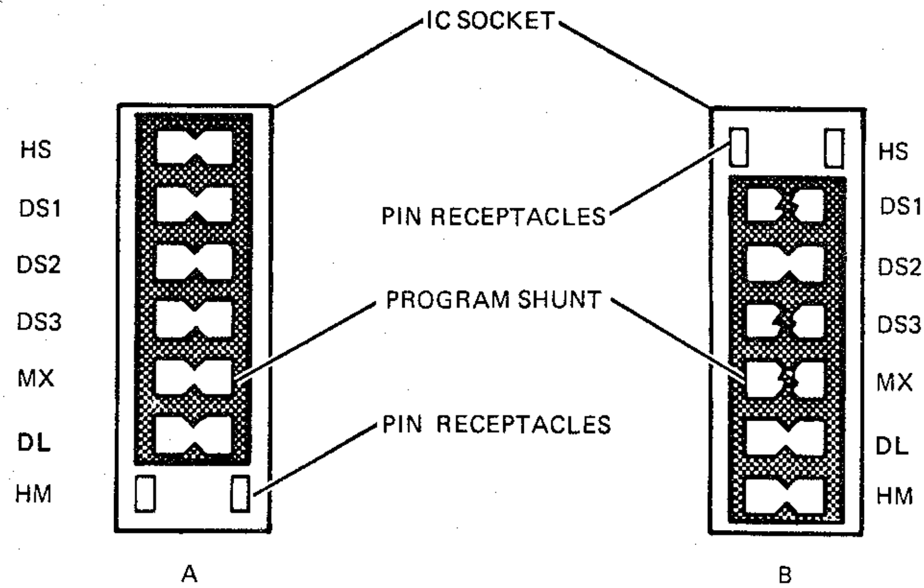
A – LEADING EDGE OF BIT MAY BE ± 800 NSEC FROM ITS NOMINAL POSITION

B – LEADING EDGE OF BIT MAY BE ± 400 NSEC FROM ITS NOMINAL POSITION

Figure 2-11. Read Timing

2.5 PROGRAM SHUNT MODULE

Figure 2-12 shows the program shunt module with the program shunt installed. The module is an IC socket located on the PWB near connector J1. The IC socket has seven sets of pin receptacles, while the program shunt has six sets of pins. One set of pin receptacles at either end of the IC socket is always unused.



- SINGLE DRIVE CONFIGURATION
- HEAD LOAD WITH DRIVE SELECT

- MULTIPLE DRIVE CONFIGURATION
- HEAD LOAD WITH MOTOR ON
- DRIVE NUMBER 2 PROGRAMMED

HS – HEAD SELECT – HEAD IS LOADED BY DRIVE SELECT SIGNAL
DS1 – DRIVE SELECT 1 – SELECT SIGNAL FOR DRIVE ONE.
DS2 – DRIVE SELECT 2 – SELECT SIGNAL FOR DRIVE TWO.
DS3 – DRIVE SELECT 3 – SELECT SIGNAL FOR DRIVE THREE.
MX – MULTIPLEX – MUST BE CUT FOR MULTIPLE DRIVE CONFIGURATION.
HM – HEAD MOTOR – HEAD IS LOADED BY MOTOR ON SIGNAL.

Figure 2-12. Program Shunt Module

2.5.1 HS – HEAD SELECT OPTION

The Head Select option causes the head of the disk drive to load when the Drive Select signal is received. The program shunt is installed so that the HS position is short circuited (see Figure 2-12A). The HS position can be used in either single-drive or multiple-drive configuration.

2.5.2 HM – HEAD MOTOR OPTION

The Head Motor option causes the head of the disk drive to load when the Motor On signal is received. The program shunt is installed so that the HM position is short circuited (see Figure 2-12B). The HM position can be used in either single-drive or multiple-drive configuration.

2.5.3 SINGLE-DRIVE CONFIGURATION

With a single-drive configuration, the program shunt need not be altered in any way except to select either the HS or HM positions. Any Drive Select signal will activate the Select light and load the head if HS is programmed.

2.5.4 MULTIPLE-DRIVE CONFIGURATION

With a multiple-drive system, the MX (Multiplex) position and two of the three DS (Drive Select) positions must be cut (see Figure 2-12B). The shunt positions can be cut by using AMP special tool, P/N 435705, or the appropriate leg of the program shunt can be bent away from the socket to provide the necessary open-circuit condition.

2.6 OPTIONS

The Model FDD200-5 Disk Drive can be modified by the customer to operate by other than the standard methods described in subsection 2.5. The modifications can be made by connecting optional pads or cutting jumpers, or by using the optional interface lines at connector pins 2, 4, 6 and 34, or by altering the program shunt module. Available options are listed and described in Table 2-2.

Table 2-2. Options

Options	Modification
Drive Select Ø (DSO)	Adds DSO input line to spare interface line so that system can accommodate up to four disk drives. Add jumper between pads E and G. If spare at J1-6 is designated as DSO, cut of etch between pads E and F is also required.
Side Select One with DS1, DS2, or DS3 Line	This option will work only with single drive configuration, and the MUX line must remain short circuited. Cut etch between pads A and B; then add jumper from pad A to pad J (DS1), K (DS2), or L (DS3).
Write Protect to Interface Only	This option indicates to the interface that a Write Protected or Non-Write Protected diskette is installed in the disk drive; it does not inhibit writing. Cut etch between pads C and D.
Write Inhibit Controlled by Interface Line	Cut etch between pads C and D, then add jumper from pad C to pad associated with selected spare interface line.
Independent Head Load (Pin J1-6)	Add jumper between pads E and R. Modify program shunt module to select neither HM nor HS
Independent Head Load Gated with Select	Cut etch between pads T and U; then add jumper between pads U and R. Modify program shunt module to select either HM nor HS.
Motor On with Select	Cut etch between pads M and N; then add jumper between pads G and P.
Indicator Lamp with Motor On	Cut etch between pads G and H; then add jumper between pads H and P.
Indicator Lamp with Interface Only	Cut etch between pads G and H; then add jumper from pad H to pad associated with selected spare interface line.
Indicator Lamp with Busy	Cut etch between pads G and H; then add jumper between pads H and S.
Select Disk Drive without Loading Head	Place program shunt module in HM position. (Load head only with Motor On signal.)

Note

Upon implementing any optional modification, verify that associated interface line is properly terminated.

SECTION 3

OPERATION PROCEDURES

3.1 INTRODUCTION

There are no front panel controls on the Model FDD200-5 Disk Drive. A single, front-panel indicator lamp lights when the disk drive is selected. All power and control functions are handled through the interface. Operating procedures consist primarily of loading and unloading the diskette. Adjustments and corrective maintenance procedures are covered in Section 5.

3.2 DISKETTE

The diskette recording medium is contained in a sealed envelope that measures 5.25 inches (13.335 cm) square. The diskette recording medium is 5.125 inches (13.0175 cm) in diameter and is made of mylar coated with magnetic oxide on both sides. The diskette has 40 circular tracks that are spaced 0.02083-inch (0.529082 mm) apart.

– CAUTION –

Ensure that all media used is 40 track (long slot) media. Usage of 35 track or short slot media will damage the head/carriage assembly when attempting to seek tracks 36 thru 39.

3.3 DISKETTE HANDLING

Protection of the diskette requires the same careful handling specified for computer magnetic tapes. Use the following handling procedure:

A. Return the diskette to its storage envelope whenever it is removed from the disk drive.
B. Keep diskettes away from magnetic fields and ferromagnetic materials.
C. Replace storage envelopes when they become worn, cracked, or distorted.
D. Do not write on the plastic jacket with a lead pencil or ballpoint pen; use a felt-tip pen.
E. Do not touch or try to clean the diskette surface. Abrasions may cause loss of data.
F. Do not expose diskette to heat or sunlight. Exposure to temperatures that exceed 51.6°C (125°F) may cause diskette to be damaged beyond useability.

3.4 LOADING THE DISKETTE

To load the diskette, open the door on the front panel of the Model FDD200-5 Disk Drive, insert the diskette (label up) and close the door. A door interlock mechanism prevents the door from closing if the diskette is not properly loaded. The door may be closed without a diskette being loaded.

3.5 WRITE PROTECT FEATURE

The diskette is protected from being written on when a Write Protect tab is used. Figure 3-1 shows an unprotected (Read and Write) and a Write-protected (Read-only) diskette. A photoelectric sensor detects the presence or absence of a notch in the side of the diskette. When the open notch is sensed, writing is allowed. When the notch is not sensed (covered with a tab), writing is inhibited, and a status signal informs the controller that a Write Protect condition exists. Optional modification of the disk drive electronics may cause the Write Protect signal to go only to the interface, and writing will not be inhibited (see Table 2-2).

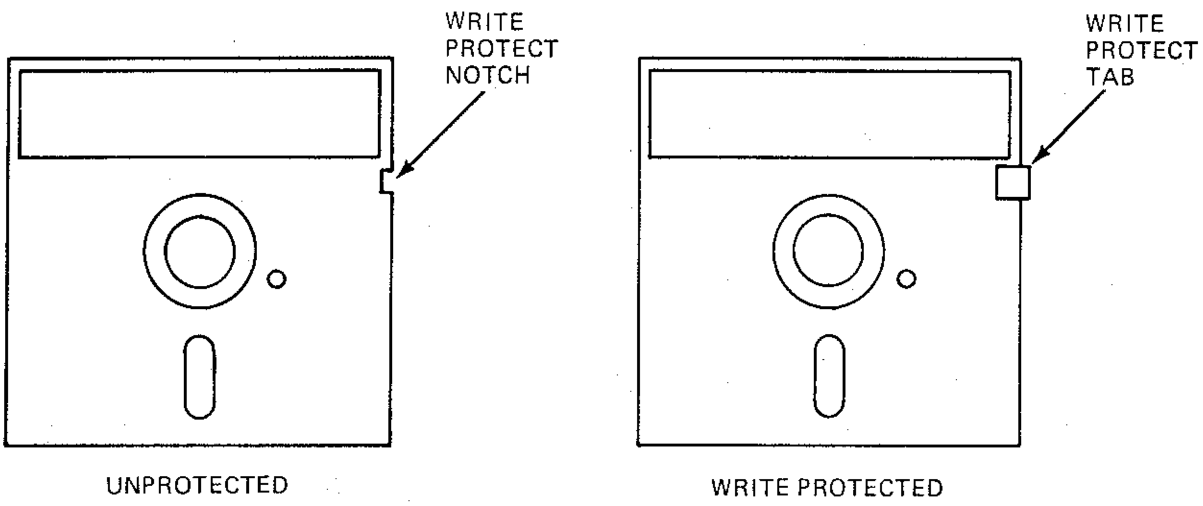


Figure 3-1. Write Protect Feature

SECTION 4

THEORY OF OPERATION

4.1 FUNCTIONAL DESCRIPTION

Figure 4-1 is a functional block diagram that shows overall operation of the Model FDD200-5 Disk Drive. The disk drive has one main PWB which contains Read, Write, and Control logic, and a small PWB which contains the speed-control for the spindle drive motor.

4.1.1 DRIVE SELECT

Disk drive selection occurs when the Drive Select line that corresponds to a particular disk drive is active. Only the disk drive in which this line is active will respond to input lines. Under normal operation, the Drive Select line will load the read/write (R/W) head, enable the input lines, and activate the output lines. Optional modes of operation are available to the user.

4.1.2 POWER-UP MODE

The two DC power sources can be applied to the disk drive in any sequence; however, once power has been applied, a 1-second delay must be allowed before any Read or Write operation is attempted. This delay is for stabilization of the diskette rotational speed and must be allowed anytime the Motor On line is activated. When DC power is applied, a Power On Reset (POR) pulse automatically resets the electronics and inhibits inadvertent writing or erasing on the diskette. Therefore, the disk drive is ready for operation after application of DC power and one second after activation of Motor On; also, the initial position of the R/W head with respect to data tracks is indeterminate immediately after application of DC power. To ensure proper positioning of the R/W heads before any Read or Write operation, a Step Out operation for each disk drive should be performed until the Track ØØ status signal becomes active.

4.1.3 HEAD LOAD SIGNAL LINE (OPTION)

The Head Load signal is applied through control logic to the Head Load solenoid. The solenoid allows the diskette envelope with its rotating media to be pushed against the R/W head so that

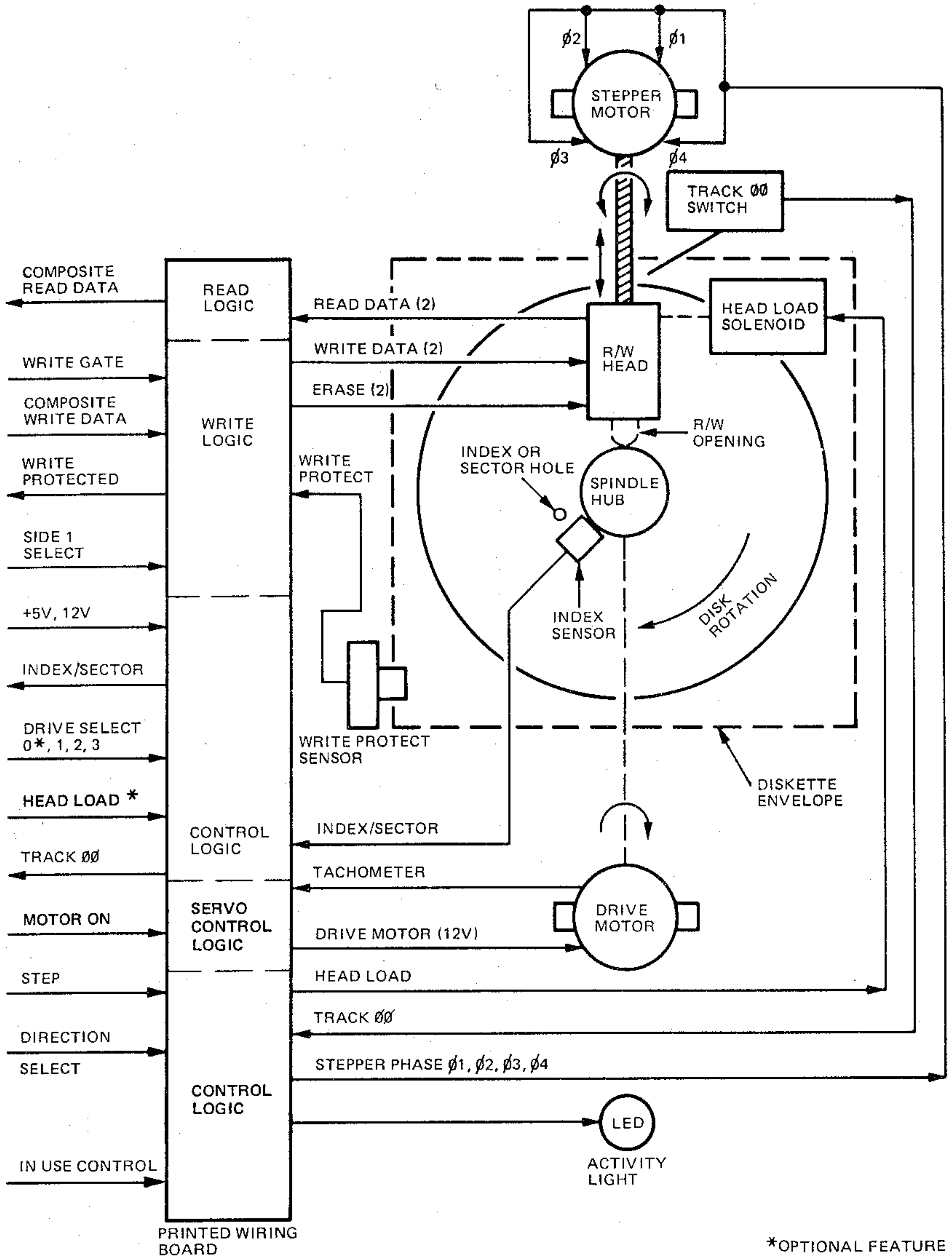


Figure 4-1. Model FDD200-5 Disk Drive, Block Diagram

contact is made through the slot in the envelope. The Head Load signal line is optional. Without the use of this option, the heads are loaded when either the Drive Select or Motor On signals are activated.

4.1.4 SEEK MODE

The Read/Write head carriage is mounted on a threaded shaft connected to the stepper motor. As the stepper motor turns in one direction, the heads are stepped outward toward the edge of the diskette. When the motor turns in the other direction, the heads are stepped inward toward the spindle hub. This allows access to any track on the diskette. Direction Select from the interface or controller determines the direction of rotation of the stepper motor, while the number of Step pulses determines the amount of stepper-motor rotation. The control logic translates these input pulses into a sequential pattern of phase currents to the stepper motor. Each pulse on the Step line causes the R/W head to move one track in or out, depending on the state of the Direction Select line. Multiple-track accessing is accomplished by repeated pulsing of the Step line until the desired track has been reached. Seeking cannot occur while a Write operation is in progress.

4.1.5 READ/WRITE HEADS

The Model FDD200-5 Disk Drive uses a unique two-sided head assembly that is mounted on the head carriage. The lower head is fixed with respect to the carriage and diskette surface, and the upper and lower head surface. Both heads use ferrite cores that are mounted in ceramic slider assemblies and the face of each head has a flat profile. The heads also use a trailing tunnel-erase structure.

4.1.6 SENSORS AND SWITCHES

The index sensor is a light-sensitive device which is activated whenever an index or sector hole passes it in rotation. The sensor output is a pulse which is fed back to the interface as the Index/Sector signal. The Track ØØ signal is generated when the R/W head carriage trips a microswitch as it reaches Track ØØ on the diskette. The Track ØØ signal is then transmitted back to the interface. The Write Protect sensor detects the presence or absence of a notch in the diskette envelope. If a tab is covering the notch (to indicate a Read-only diskette), a Write Protect signal is sent back to the interface. The Write Protect signal also disables the Write logic so that writing on the diskette is not possible (see option table 2-2 for exceptions).

4.1.7 WRITE MODE

A Write operation records data on the selected side of the diskette in the form of flux reversals. To Write data on the diskette, certain timing relationships must be ensured. These relationships are required to avoid erasure of data due to hardware failure, unstabilized head position, or head in transit condition (see Figure 2-8). The Write circuitry is enabled by activating the Write Gate interface line.

4.1.8 ERASE MODE

The Erase circuitry is also enabled by activating the Write Gate interface line and the erase currents are applied to the R/W head erase coils when writing data. The erase poles erase an area just to each side of a track. This ensures off-track reading ability and provides capability to read during worst-case data recovery conditions.

4.1.9 READ MODE

A Read operation retrieves previously recorded data from the selected side of the diskette. This is accomplished by the winding in the read head sensing flux reversals on the diskette. The Read mode is entered on a selected disk drive by deactivating the Write Gate line. Certain timing relationships are required to ensure stabilization of the R/W head position (see Figure 2-8).

4.1.10 POWER-DOWN MODE

When the +5V supply drops to an unsafe level during DC power-down, all Write and Erase circuitry is deactivated to prevent inadvertent writing or erasing on the diskette.

4.1.11 SPINDLE DRIVE MOTOR

The spindle drive motor is a DC motor with an integral tachometer. It is activated by a separate Motor On interface line. This motor requires approximately one second to attain stabilized speed. The Motor On signal turns on a current driver that applies current to the motor windings. The phase of the tachometer output voltage is compared with the phase of a reference oscillator. Any phase error is converted to a voltage that is added to a constant voltage. The sum is applied to the motor drive circuit which increases or decreases the motor speed, as required, to keep the tachometer phase-locked with the reference oscillator (see paragraphs 5.8.1 - 5.8.2).

4.2 POSITIONING CHARACTERISTICS

Head positioning is governed by five timing characteristics:

A. Time for a single-track step is 25 milliseconds. This is the time required to move the R/W head between any two adjacent tracks.

B. Step settle time is 15 milliseconds. This is the time required for the head assembly to cease oscillating after the head has achieved nominal track location following a move.

C. Random access time (T) is 298 milliseconds (35 tracks) or 340 milliseconds (40 tracks). This time is determined from the following equation:

$$T = \frac{(\text{No. of tracks} - 1)\ (\text{Step time})}{3} + \text{Settle time}$$

D. The time to move the R/W head 39 tracks is 975 milliseconds. It is defined as the time required to move the R/W head from track ØØ to track 39, or from track 39 to track ØØ.

E. Head load time is 50 milliseconds. This is the time required for the head load arm to contact the diskette and settle down before a Read or Write operation begins.

4.3 DATA FORMAT

To perform data transfer, the operating system must be able to locate specific data areas on the diskette. Two such format schemes exist; both involve detecting and establishing a reference point on the diskette to organize data on a track and further divide this track into smaller segments called sectors. Such a subdivision can be achieved by either head or soft sector formats. All disk drive tolerances have been taken into account in developing the formats.

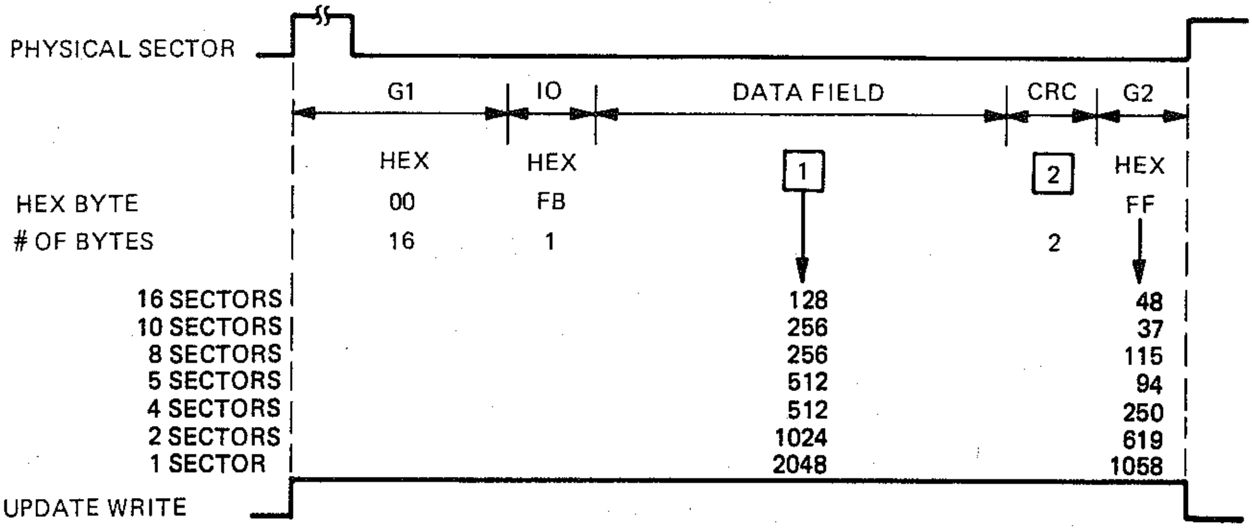
4.3.1 HARD SECTOR FORMAT

The controller will typically record 10 or 16 sectors (records) per track due to the availability of hard-sectored diskettes in these configurations. Each track is started by an Index pulse, and each sector is started by a Sector pulse which is present on connector pin J1-8. Figure 4-2 shows a hard-sectored format. The number of sectors is determined by the number of sector holes in the diskette.

4.3.2 SOFT SECTOR FORMAT

The controller may record one long record or several small records in this type of format. The Index pulse starts each track, and a unique record identifier precedes each record. Figure 4-3 shows a soft-sectored format.

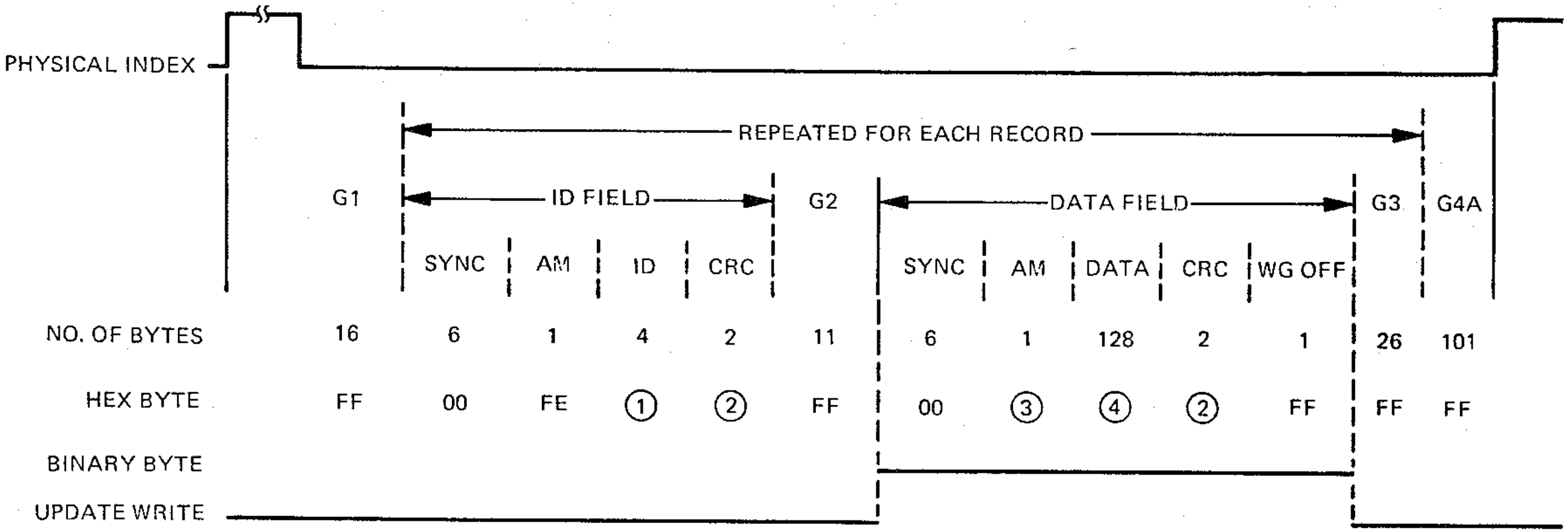
SECTOR SEPARATION DONE BY THE USING SYSTEM
FM RECOMMENDED FORMAT (SINGLE DENSITY)



1 -USER DATA

2 GENERATED BY CRC GENERATOR (IBM OR EQUIV)

Figure 4-2. Hard-Sectored Format for Single Density



1 – TRACK ADDRESS, ZEROES; SECTOR ADDRESS, ZEROES.

2 – GENERATED BY CRC GENERATOR (IBM OR EQUIVALENT).

3 – FB FOR DATA FIELD, OR F8 FOR DELETED DATA FIELD.

4 – USER DATA.

Figure 4-3. Soft-Sectored Format (128 bytes/sector, 16 sectors)

SECTION 5

MAINTENANCE

5.1 RELIABILITY

To establish mean time between failures, mean time to repair, and service life, operation time must be greater than 10,000 hours, and field performance data from all field sites must be used in the calculation.

5.1.1 MEAN TIME BETWEEN FAILURES (MTBF)

MTBF is derived from the following expression:

$$\text{MTBF} = \frac{\text{Operating Hours}}{\text{Number of Failures}}$$

Operating hours means power-on hours minus any maintenance times. The MTBF design goal for the Model FDD200-5 Disk Drive is 8500 hours.

5.1.2 MEAN TIME TO REPAIR (MTTR)

This is defined as the average time for an adequately trained service engineer to diagnose and correct problems on-site. MTTR for the Model FDD200-5 Disk Drive is 30 minutes and does not include travel time or time when the disk drive is not released to the service engineer.

5.1.3 SERVICE LIFE

The Model FDD200-5 Disk Drive is designed and constructed for a minimum useful life of five years.

5.2 DIAGNOSTIC TECHNIQUES

Incorrect operating procedures, faulty programming, damaged diskettes, and soft errors caused by airborne contaminants, random electrical noise, and other external causes, can produce errors that may be falsely attributed to disk-drive failure or maladjustment. Unless visual inspection of the disk drive discloses an obvious misalignment or broken part, attempt to repeat the fault with the original diskette; then attempt to duplicate the fault on a second diskette.

5.3 ERROR RATES

Errors may occur in Write, Read, or Seek operations. The error rate for each of these operations is defined in the following paragraphs.

5.3.1 WRITE ERROR RATE

For successful writing of a record, the Write operation should always be followed by a Write Check or Read operation during the next diskette rotation. Not more than five such Write and verification attempts is recommended. If a record cannot be successfully written within five attempts, that sector or track must be labeled defective and an alternate sector or track must be assigned. If more than two defective tracks are encountered, the diskette should be replaced.

5.3.2 READ ERROR RATE

If a Read error occurs, up to ten attempts should be made to recover data. Repositioning the head on the desired track is recommended if the error persists. The Read recoverable error rate is not greater than 1 in 10^9 bits transferred. The Read unrecoverable error rate is not greater than 1 in 10^{12} bits transferred.

5.3.3 SEEK ERROR RATE

Unless the stepping rate is exceeded, seek errors will rarely occur. Recalibration of track location can be achieved by initiating Step commands until track ØØ is sensed. The Seek error rate is not greater than 1 in 10^6 seeks.

5.4 ERROR DETECTION AND CORRECTION

Detection and correction of Write and Read errors is described in the following paragraphs.

5.4.1 WRITE ERRORS

If an error occurs during a Write operation, it will be detected on the next diskette rotation by doing a Read operation commonly called a "Write Check." To correct the error, another Write and Write Check operation must be done. If the Write operation is not successful after five attempts, error correction should be attempted on another track. If the error persists, the diskette should be considered defective and be discarded or re-initialized.

5.4.2 READ ERRORS

Most errors that occur will be "soft" errors; that is, by performing an error recovery procedure, the data will be recovered.

Soft errors are usually caused by any of three conditions:

A. Airborne contaminants that pass between the R/W head and the diskette surface. These contaminants will generally be removed by the cartridge self-cleaning wiper.

B. Random electrical noise which usually lasts for a few microseconds.

C. Small defects in the written data and/or track, not detected during the Write operation and which may cause a soft error during a Read operation.

5.4.2.1 Soft Error Recovery Procedure. To recover soft errors, the following procedure is recommended:

A. Reread the track five times or until such time as the data are recovered.

B. If data are not recovered after performing step A, access the head to the adjacent track in the same direction previously moved, then return to the desired track and repeat step A.

C. If data are not recovered, the error is not recoverable.

5.5 ALIGNMENT DISKETTE

The Alignment Disk P/N 620446-001 (Dysan P/N 224/2), is available from Dysan Corp., Santa Clara, California. This special disk is used to perform the following alignments and adjustments.

A. R/W head radial adjustment using track 16 on sides zero and one.

B. Index photo detector alignment using track 01 on both sides and track 34 on side zero.

C. Head azimuth check on both sides using track 10.

D. Identification of track zero. Read track ØØ on side zero with a 125KHz Signal (2F). This test is used to determine if the head is positioned over track ØØ when the track ØØ output interface is at a low (true) level.

E. Identification of track 34 and head resolution check. Read track 34 on side zero with 125KHz and 62.5 KHz signal (2F and 1F). Head resolution is % $= \frac{2F}{1F} \times 100$.

CAUTION

USE CARE TO PRESERVE PRERECORDED ALIGNMENT TRACKS. THE WRITE PROTECT TAB SHOULD ALWAYS BE INSTALLED ON THE ALIGNMENT DISKETTE TO PREVENT ACCIDENTAL WRITING ON ITS SURFACE.

5.6 REMOVAL AND REINSTALLATION PROCEDURES

For assembly and component locations, refer to the Illustrated Parts Breakdown in Appendix D. All item numbers refer to the Illustrated Parts Breakdown, Figure D-1 (overall view).

5.6.1 FRONT BEZEL

To remove and reinstall the front bezel, use the following procedure:

A. Close door.

B. Using a screwdriver, carefully bend the two tabs located on the top sides of the bezel (item 26) inward and push forward off the tabs on the diskette guides (items 9 and 14).

C. Open door.

D. Carefully push two plastic studs on lower portion of front bezel forward through two retainers (item 75) from bottom of disk drive.

E. To reinstall, open door and push the two plastic studs into the two retainers. Close door and push upper portion of bezel onto the tabs on the diskette guides. The ends of the diskette guides must be fully seated in the bezel for the tabs to lock into the notch on the bezel tabs.

5.6.2 DRIVE MOTOR ASSEMBLY

To remove and reinstall the drive motor assembly, use the following procedure:

A. Remove drive belt (item 25) (remove from large pulley first).

B. Disconnect connector P6-2 from servo control PWB (item 3). Cut wire ties to free drive motor wires.

C. Remove head cable connector, four screws (item 84) which attach PWB and fold back main PWB (about 120°).

D. Remove drive motor mounting screws and washers (items 68, 69 & 70).

E. Remove drive motor and carefully route wires through holes in disk drive main frame.

F. Reinstall by reversing steps A–E and replace wire ties.

G. Adjust motor speed (see paragraphs 5.8.1 & 5.8.2).

5.6.3 STEPPER MOTOR AND LEAD SCREW

To remove and reinstall the stepper motor and lead screw, use the following procedure:

A. Remove head cable connector and main harness connectors.

B. Remove four screws (item 84) which attach PWB and remove PWB.

C. Remove two screws, washers and motor clamps (items 64, 65 and 66) that attach stepper motor.

D. Remove E-ring (item 61) and washer (item 62) from front end of lead screw.

E. Remove stepper motor out through back by gently turning lead screw in a counterclockwise (CCW) direction, as viewed from back of motor, to disengage head/carriage assembly.

F. Reinstall by reversing steps A–E. When replacing antibacklash nut and spring (item 51) it must be positioned with 0.010–0.030 inch (0.0254–0.0762 cm) clearance between antibacklash nut and carriage (figure 5-3).

G. Adjust head radial alignment (see paragraph 5.8.6).

5.6.4 HEAD AND CARRIAGE ASSEMBLY

To remove and reinstall the head and carriage assembly, use the following procedure:

A. Close door and remove motor cover plate (item 54) by carefully peeling it off from the motor body.

B. Loosen screws (item 79). Move guide shaft (item 49) towards the front of the drive to free head cable from underneath the guide shaft.

C. Remove E-ring (item 61) and washer (item 62) from the front end of the lead screw. Remove lead screw from carriage by gently turning the lead screw while pulling out. It may be necessary to hold the carriage while removing lead screw.

D. Move carriage up and away from guide rod and gently remove the read/write head assembly. Place a piece of paper in between two heads if the head assembly is not defective and intended to be reused.

E. To reinstall, reverse above procedure. Be careful to ensure that there is enough slack in the head cable to allow carriage to go to track ØØ and the cables are routed properly.

F. Align head to correct track position by using alignment disk. Head assembly will be approximate in alignment if stepper motor body is not removed.

G. Readjust track ØØ/39 stop if necessary (see paragraph 5.8.4).

H. Replace motor cover plate (item 54), if damaged use new part.

5.6.5 SPINDLE HUB AND PULLEY ASSEMBLY

This assembly requires dial indicators and surface plate, so they are not recommended for field replacement.

5.6.6 CARRIER FRAME ASSEMBLY

Removal of this assembly is not normally recommended. Removal will be only required if LED is burned out or carrier is bent. Under those conditions, the entire carrier assembly should be replaced. To remove and reinstall, or replace the carrier assembly, use the following procedure:

A. Remove head cable connector and main harness connectors.

B. Remove four screws (item 84) which attach PWB and remove PWB.

C. Remove harness connector from LED. Cut wire ties on carrier frame and fold wires back off carrier frame.

D. Remove head and carriage assembly per paragraph 5.6.4. CAUTION: Serious damage will occur to the head assembly if the head is not removed prior to carrier removal.

E. Remove two screws (item 79) that attach leaf hinges (item 45) to main frame.

F. Open door and carefully slide the carrier assembly out of the grooves in the disk guides, towards the rear end of the unit. To reinstall, reverse the procedure and slide the assembly into the grooves. Lightly tighten leaf hinge mounting screws.

G. Close door and position clutch assembly on carrier frame in center of drive hub (item 16). Tighten leaf hinge mounting screws. Check that door does not bind in bezel by opening and closing door. If binding occurs, loosen leaf hinge mounting screws and reposition carrier frame until it operates freely.

H. Install head carriage assembly per paragraph 5.6.4. Replace all ties and connectors.

I. Check and readjust index timing (see paragraph 5.8.5).

5.6.7 WRITE PROTECT SENSORS AND DISKETTE GUIDE ASSEMBLIES

The Write Protect sensors are integral to the diskette guide assemblies. They are electro-optical devices and normally do not require replacement. To remove and reinstall or replace either diskette guide assembly, use the following procedure:

A. Remove head cable connector and main harness connectors.

B. Remove four screws (item 84) which attach PWB and remove PWB.

C. Note orientation of optical device connectors, top and bottom, and remove them.

D. Remove front bezel (see paragraph 5.6.1).

E. Remove carrier frame assembly (see paragraph 5.6.6) and head assembly (see paragraph 5.6.4).

F. Remove two screws (item 74) which attach diskette guide (item 9 or 14) and remove diskette guide.

G. Reinstall by reversing steps A–E. Use alignment tool, P/N 650160-T11S to position diskette guide when attaching it to main frame. Make sure disk protect arms are functioning properly.

5.6.8 INDEX SENSOR ASSEMBLY

To remove and reinstall index sensor assembly, use the following procedure:

A. Remove head cable connector, four screws (item 84) which attach PWB and fold back main PWB (about 120°).

B. Note orientation of connector on index sensor assembly and remove it.

C. From bottom of disk drive, remove screw and washer (items 84 and 78) that attach sensor block (item 37) to main frame. Remove sensor block from top of disk drive.

D. To remove photo transistor (item 43) from sensor block, carefully remove bonding agent from around photo transistor susing an x-acto knife or similar tool.

E. To replace photo transistor, insert into sensor block with flat on photo transistor flange seated into "D" hole and bond in place using a high strength, flexible adhesive. Carefully bend leads over (about 90°).

F. Reinstall index sensor assembly by reversing steps A–C. Ensure that mounting surface is smooth and sensor block is seated into main frame.

G. Adjust and set index timing (see paragraph 5.8.5).

5.6.9 INDEX LED

To remove and reinstall the index LED, use the following procedure:

A. Remove head cable connector, four screws (item 84) which attach PWB and fold back main PWB (about 120°).

B. Remove connector from LED on carrier frame (item 15).

C. Carefully remove bonding agent from around LED using an x-acto knife or similar tool. Use caution not to bend or distort carrier frame or leaf springs that attach carrier to the main frame.

D. Insert new LED carrier frame with flat on LED flange seated into "D" hole and bond in place using a high strength, flexible adhesive. Carefully bend lead over 90° toward outside of disk drive.

E. Adjust and set index timing (see paragraph 5.8.5).

5.6.10 TRACK ØØ SWITCH

To remove and reinstall the track ØØ switch, use the following procedure:

A. Remove connector from micro switch (item 32).

B. Remove two screws and washers (items 76, 72 & 77) and remove switch.

C. Reinstall by reversing steps A & B. Adjust per paragraph 5.8.3.

5.6.11 SERVO CONTROL PWB

To remove and reinstall the servo control PWB, use the following procedure:

A. Remove connectors P6-1 and P6-2.

B. Remove two screws (item 82) that attach PWB to main frame and life out PWB.

C. Reinstall by reversing steps A & B.

D. Check motor speed and adjust if necessary (see paragraphs 5.8.1 & 5.8.2).

5.6.12 SOLENOID ASSEMBLY

To remove and reinstall the solenoid assembly, use the following procedure.

A. Remove head cable connector and main harness connectors.

B. Remove four screws (item 84) which attach PWB and remove PWB.

C. Remove head and carriage assembly (see paragraph 5.6.4).

D. Remove carrier assembly (see paragraph 5.6.6).

E. Note color coding of wires and unsolder from terminals on solenoid body (item 36).

F. Remove screw and washers (items 80, 70 & 69) that attach solenoid assembly from bottom of disk drive and lift out entire assembly from top of disk drive.

G. Reinstall by reversing steps A–F. Ensure that tab on solenoid frame is seated in hole in main frame.

H. Check and adjust head load bail (see paragraph 5.8.7).

5.6.13 CLUTCH ASSEMBLY

All item numbers refer to the illustrated Parts Breakdown, Figure D-2 (clutch assembly) To remove and reinstall the clutch assembly, use the following procedure:

A. Remove head cable connector.

B. Remove four screws (item 84) which attach PWB and carefully fold back PWB (about 120°).

C. With door closed, remove E-ring (item 8) from clutch shaft (item 2) on carrier (item 1).

D. Open door and carefully remove entire clutch assembly, with clutch spring (item 9) from disk drive.

E. Carefully place new clutch assembly, with clutch spring onto the spindle hub or disk drive.

F. Slowly close door to compress clutch spring and allow clutch shaft to protrude through hole in carrier.

G. Reinstall E-ring onto clutch shaft. No adjustment required.

5.7 HEAD AMPLITUDE CHECK

The head amplitude check is valid only when reading pre-written data. The diskette used for this check should show no evidence of wear or damage on either side. Use the following procedure:

A. Install known good diskette.

B. Start motor.

C. Select disk drive and step to track 34.

D. Sync oscilloscope external on TP5 (+Index). Set oscilloscope to measure differential signal between TP1 and TP2. Ground probes.

E. Set volts-per-division to 50 millivolts and timebase to 20 milliseconds per division.

F. Write entire track with all one's.

G. Measure read-back head amplitude. Average minimum read-back head amplitude should be 200 millivolts peak-to-peak.

H. Check motor speed (see paragraph 5.8.1 - 5.8.2).

I. If output from disk drive PWB looks inappropriate, change disk drive PWB and recheck.

J. If steps H-I check out but average minimum read-back head amplitude remains low, the head and carriage assembly must be replaced.

5.8 ADJUSTMENT PROCEDURES

This subsection provides seven adjustment procedures that may be necessary after replacement of an assembly or component in the disk drive. Test point locations are shown in Figure 5-1.

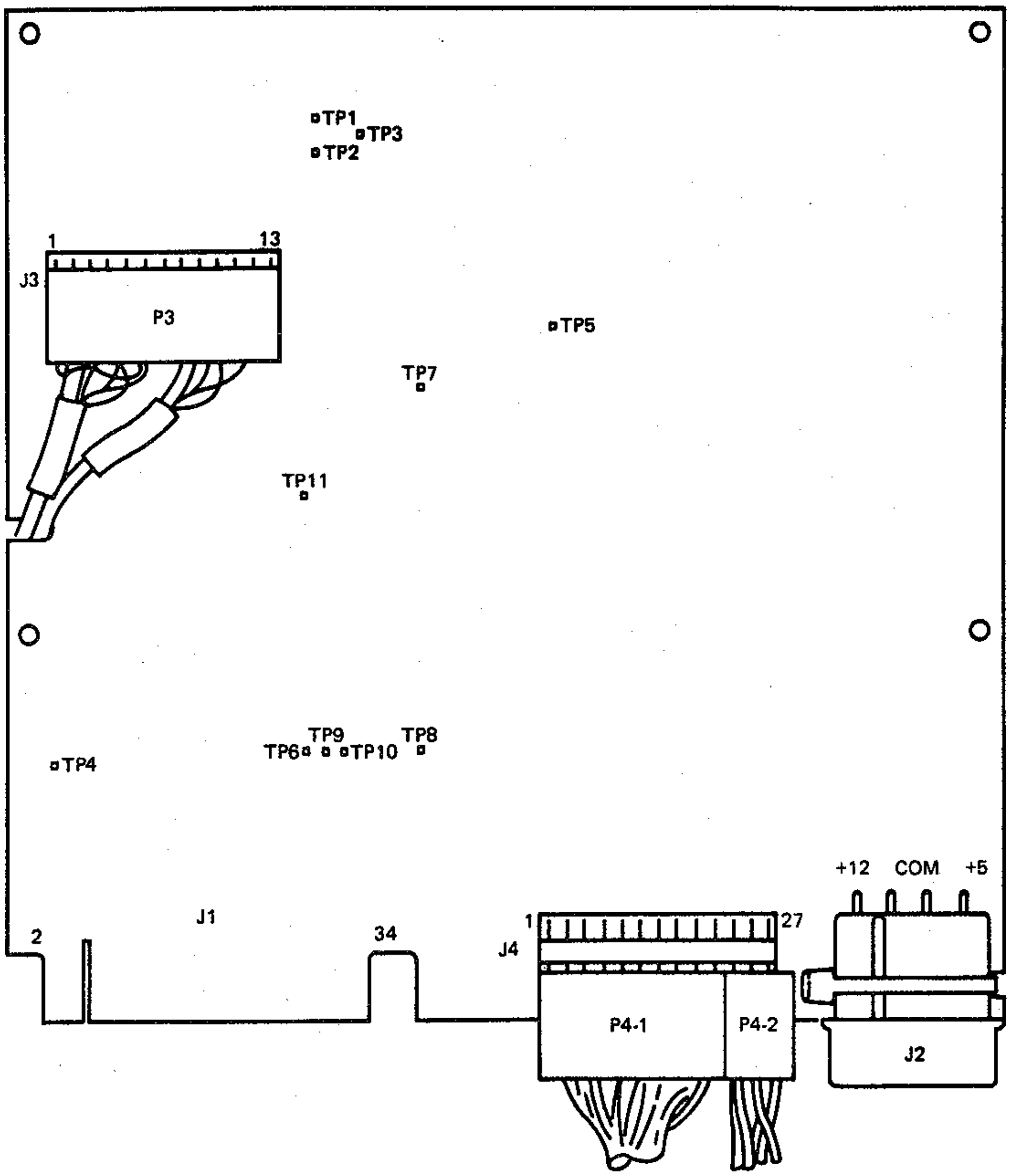


Figure 5-1. Test Point Locations

5.8.1 MOTOR SPEED ADJUSTMENT WITHOUT FREQUENCY COUNTER

This adjustment procedure can be used only where there is fluorescent lighting:

A. Insert a diskette, energize disk drive, and start motor. Step head to track 16 and keep head loaded.

B. Adjust potentiometer R7, on Servo Control PWB until dark lines on spindle pulley appear motionless. For 60 Hz power, use outside ring of lines. For 50 Hz power, use inside ring.

C. A one percent speed variation is exhibited by the strobe lines rotating 90° in five seconds.

5.8.2 MOTOR SPEED ADJUSTMENT WITH FREQUENCY COUNTER

This adjustment procedure can be used anywhere a frequency counter is available:

A. Install a soft-sector scratch diskette.

B. Start motor, load head, and step to track 16.

C. Connect frequency counter to TP5 (+Index) on disk drive PWB.

D. Adjust potentiometer R7, on Servo Control PWB, for 200 ± 1 milliseconds.

5.8.3 TRACK ØØ SWITCH ADJUSTMENT

To adjust the track ØØ switch position, see Figure 5-2 and use the following procedure:

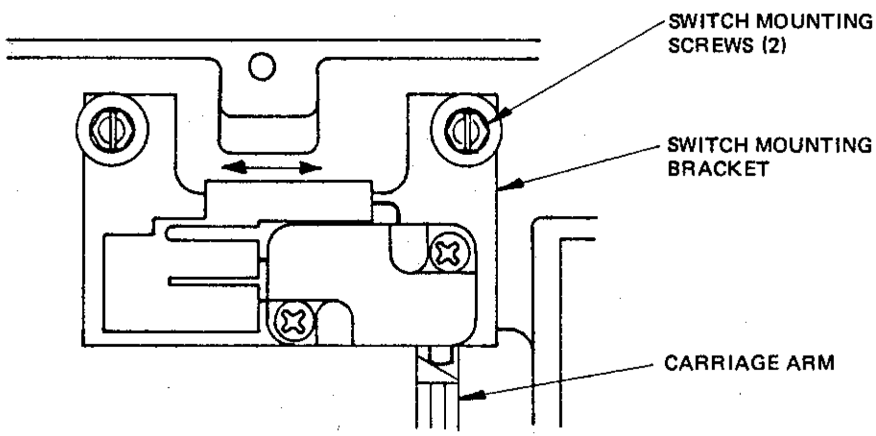


Figure 5-2. Track ØØ Switch Adjustment

A. Power up disk drive and insert an Alignment Diskette.

B. Step to track ØØ. This should energize Phase A of stepper motor. Loosen track ØØ switch mounting bracket.

C. Adjust track ØØ switch position, by moving its mounting bracket, in direction as shown by arrow, until switch is just activated.

D. Observe a high signal at TP8 with oscilloscope. Step to track Ø1. Signal level at TP8 should switch from high to low. If transition from high to low does not occur, readjust track ØØ switch position.

E. Step to track ØØ. Signal level at TP8 should switch from low to high.

F. Readjust track ØØ switch position to transfer both open and closed states between track ØØ and track Ø1, then secure mounting bracket of track ØØ switch.

5.8.4 TRACK ØØ/39 STOP ADJUSTMENT

To adjust track ØØ/39 stop, see Figure 5-3 and use the following procedure:

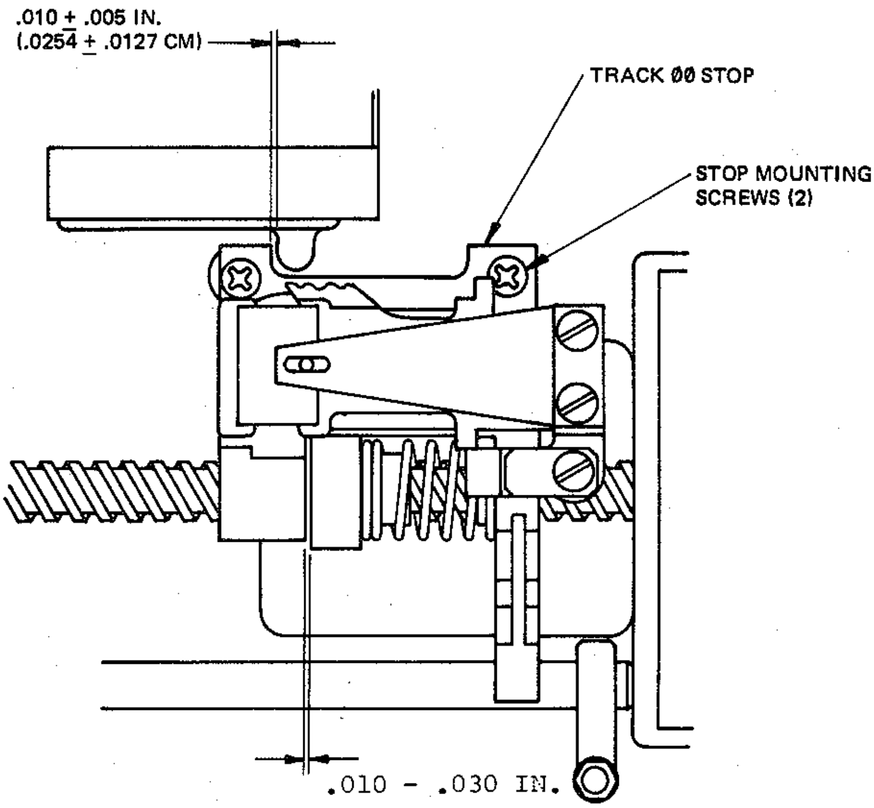


Figure 5-3. Track ØØ/39 Stop Adjustment

A. Unplug head cables and remove PWB from disk drive. Leave interface and PWB connectors installed.

B. Step disk drive to track ØØ.

C. Adjust track ØØ stop until distance between track ØØ stop and post on main frame is 0.010 ± 0.005 inch (0.254 ± 0.127 mm). This task can be simplified by using a .010" thick mylar or other plastic strip between the stop and post and pushing the stop against the plastic strip. Remove plastic strip after tightening screws.

D. Step to track 39 and verify clearance exists between track ØØ/39 stop and post on main frame.

E. Reinstall disk drive PWB and plug in head cables.

5.8.5 INDEX/SECTOR TIMING ADJUSTMENT

To adjust index/sector timing, see Figure 5-4 and use the following procedure:

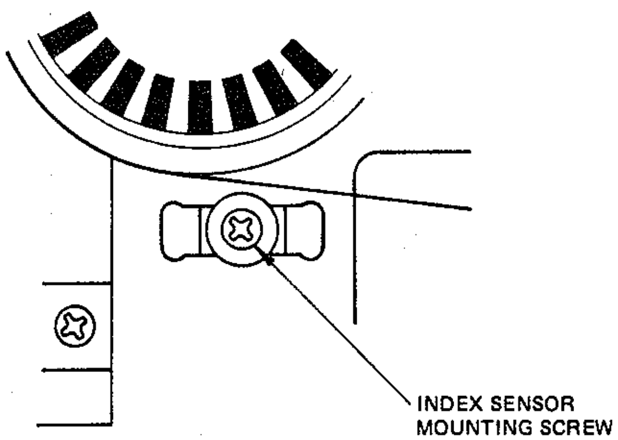


Figure 5-4. Index/Sector Timing Adjustment

A. Insert an Alignment Diskette.

B. Start motor and select disk drive.

C. Sync oscilloscope with external positive probe on TP5 to monitor +Index signal, then set oscilloscope to 50 microseconds/division.

D. Connect probe to TP1 and TP2 and ground probes.
On oscilloscope, set inputs to AC and set vertical deflection to 500 millivolts/division.

E. Step to track .Ø1.

F. Observe timing between start of sweep and first data pulse. This should be 200 ± 100 microseconds. If timing is not within tolerance, continue with adjustment.

G. Loosen mounting screw in Index Sensor block until assembly is just able to be moved. This is located on bottom of disk drive.

H. Observe timing and adjust Index Sensor position until timing is 200 ± 50 microseconds. Verify that detector assembly is against registration surface.

I. Open and close door; then recheck timing. Repeat several times.

J. Tighten mounting screw slowly. Do not overtighten.

K. Recheck timing to ensure that Index Sensor block did not move when mounting screw was retightened.

5.8.6 RADIAL ALIGNMENT OF HEAD

To radially align the head, use the following procedure:

A. Start motor and select disk drive.

B. Insert an Alignment Disk. Alignment Disk should be at the same environmental condition as drive for at least one hour before alignment.

C. Sync oscilloscope external positive with probe on TP5 and set time base on oscilloscope to 20 milliseconds/division. This provides a display of one diskette rotation.

D. Set oscilloscope to measure differential signal between TP1 and TP2. Ground probes, set inputs to AC, and set vertical deflection to 100 millivolts/division.

E. Step to track ØØ. Insure that the following conditions both exist:
1. Phase A of stepper driver logic is active, 2. TP1 & 2 indicate a 2F data pattern on the diskette. This will insure that the proper stepper motor phase is active with the correct track number.

F. Step disk drive to track 16.

G. Loosen two mounting screws that hold stepper motor to main frame.

H. Rotate stepper motor to move head radially in and out and observe cat eye pattern on oscilloscope until the lobes are within 80% of each other. Then carefully lock down two previously loosened stepper motor mounting screws.

I. Check adjustment by stepping off several tracks in both directions from track 16 and return to track 16. If necessary, readjust by repeating steps G and H until cat-eye pattern is within 80% of each other.

J. After radial alignment of head is completed, track ØØ switch and track ØØ/39 stop position must be checked and adjusted if required (see paragraph 5.8.3 & 5.8.4).

5.8.7 HEAD-LOAD BAIL ADJUSTMENT

To adjust the head-load bail, see Figure 5-5 and use the following procedure:

A. Select disk drive and load head to energize head-load solenoid.

B. Adjust two screws that hold diskette load arm and arm adjustment bracket to head-load solenoid until 0.18 ± 0.010 inch (0.4572 ± 0.254 cm) clearance is obtained between lower side of head-load bail and platen on main frame casting. Verify that head-load bail lifts upper head 0.030 ± 0.010 inch (0.0762 ± 0.0254 cm) off of lower head when solenoid is not energized and clears the arm by 0.020 – 0.050 inch (0.0508 – 0.1270 cm) when solenoid is energized.

C. If bail cannot be adjusted, head load solenoid stroke must be adjusted (see paragraph 5.8.8).

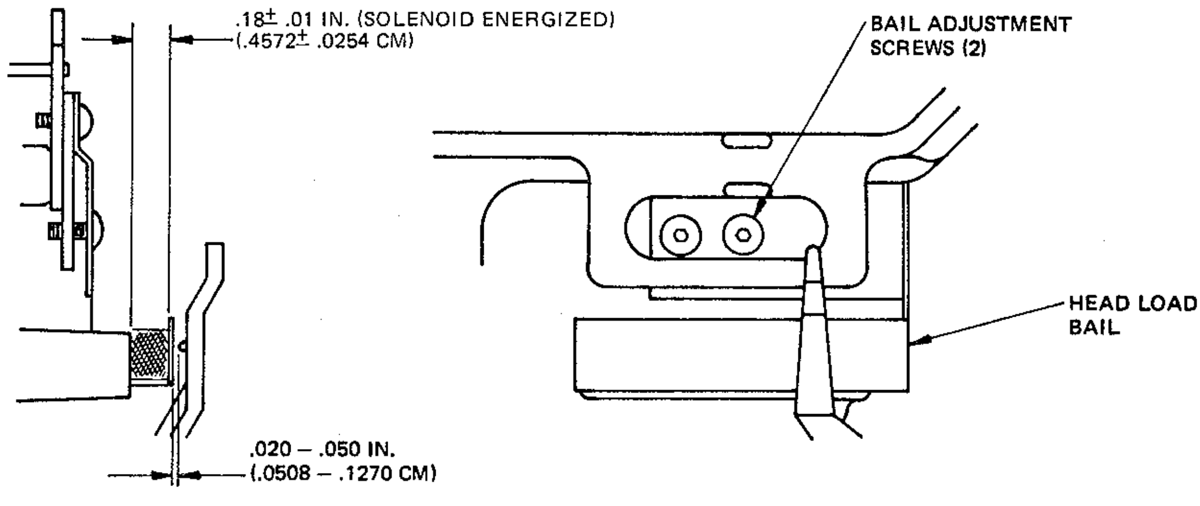


Figure 5-5. Head-Load Bail Adjustment

5.8.8 HEAD LOAD SOLENOID ADJUSTMENT

To adjust the head load solenoid, see Figure 5-6 and use the following procedure:

A. Unload head load solenoid and open door to lift head/carriage assembly arm off head load bail.

B. Using a small screw driver or similar tool, reach through access hole on bottom of disk drive and bend tab on solenoid frame in to increase travel or out to decrease travel. Adjust to .080–.090 inch travel measured at center of head load bail (0.95 inch from solenoid center).

C. Adjust head load bail (see paragraph 5.8.7).

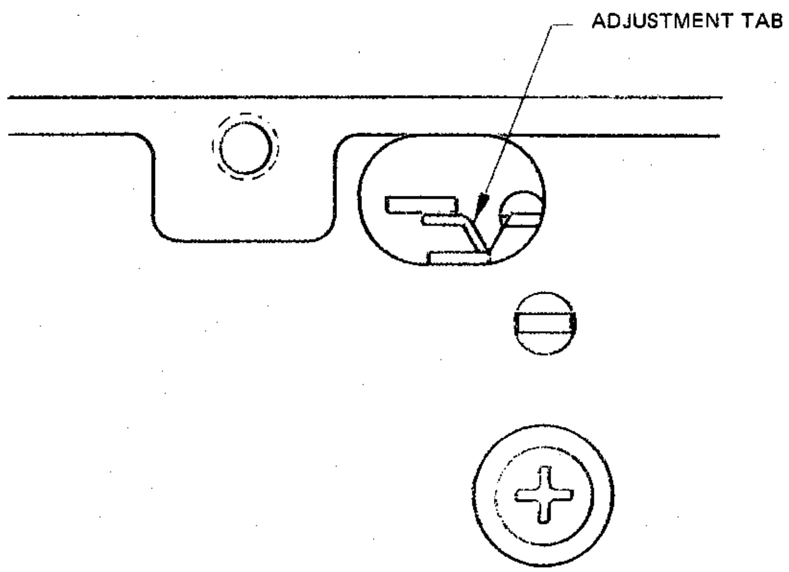


Figure 5-6 Head-Load Solenoid Adjustment

5.8.9 CLEANING THE HEADS

A. Open both drives.

B. Switch on programming unit.

C. Insert the cleaning diskette with the green layer to the right in drive 0 and close the door.

D. Press button T. Drive 0 is activated.

E. Carry out a new start after 3 s by using the key switch (red LED extinguishes).

F. Open drive 0.

G. Insert the cleaning diskette with the green layer to the left in drive 0 and close the door.

H. Press button T.

I. Carry out a new start after 3 s.

The cleaning procedure for drive 1 is carried out in the same manner by pressing the button S.

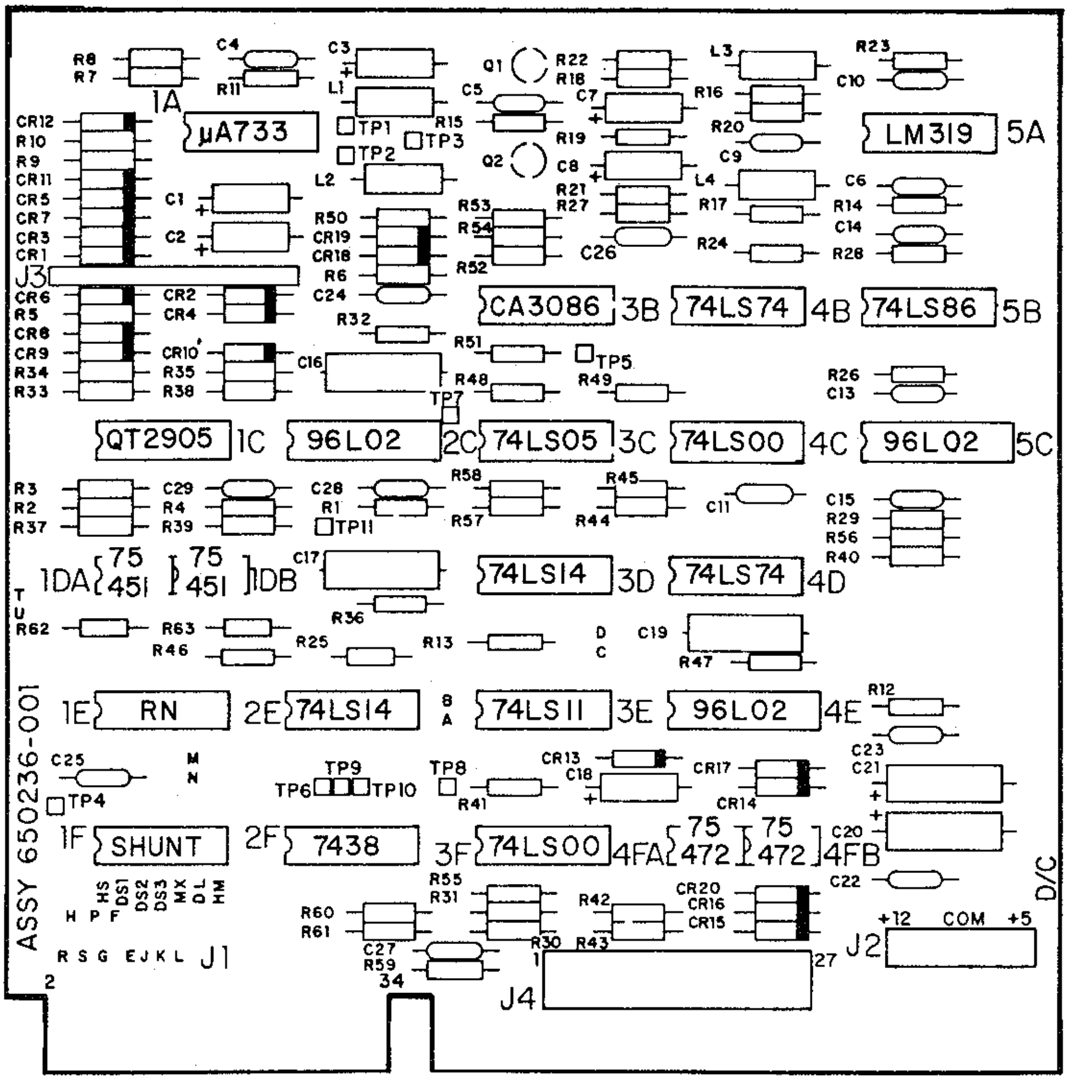
Clean the heads at intervals of 6 months.

SECTION 6

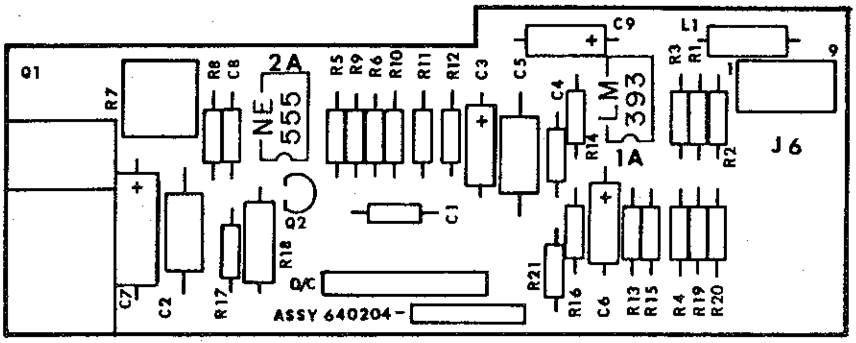
MODEL FDD200-5 DISK DRIVE

ASSEMBLY DRAWINGS

Title	Dwg No.	Page
Assembly, PWB, Main	650236-100	B-3
Assembly, PWB, Servo Control	640204-100	B-4



Assembly, PWB, Main

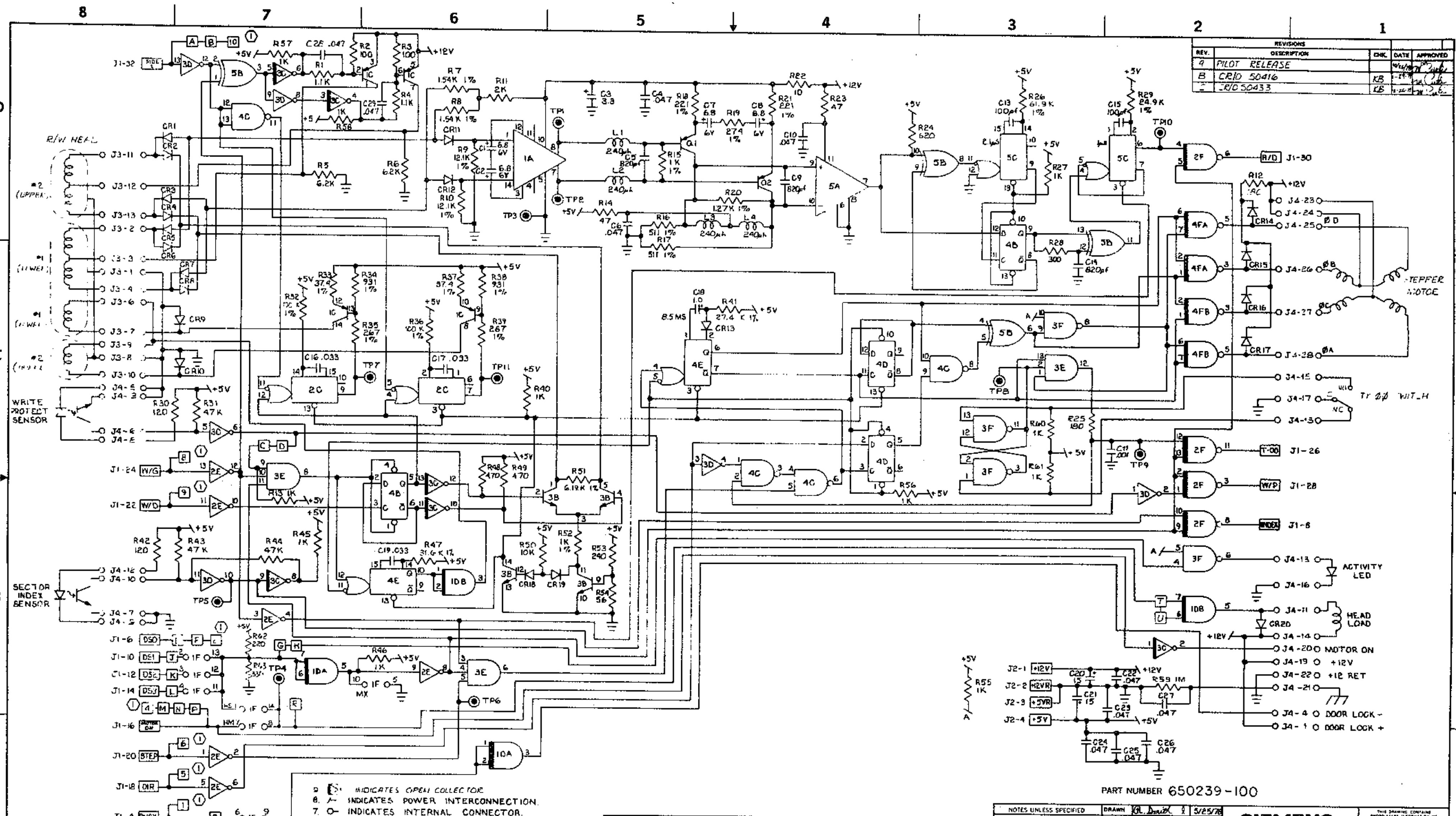


Assembly, PWB, Servo Control

SECTION 7

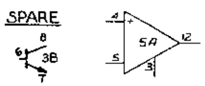
LOGIC SCHEMATICS

Title	Dwg No.	Page
Schematic Diagram, Model FDD200-5 Disk Drive	650239-100	C-3
Schematic Diagram, Motor Control	630322-100	C-5



PART NUMBER 650239-100

SPARE



9. INDICATES OPEN COLLECTOR
8. INDICATES POWER INTERCONNECTION.
7. INDICATES INTERNAL CONNECTOR.
6. INDICATES INTERFACE CONNECTOR.
5. INDICATES JUMPER OPTION PADS.
4. ALL CAPACITORS ARE IN MICROFARADS.
3. ALL RESISTORS ARE IN OHMS, 1/4W 5%.
2. TIMING VALUES INDICATED ARE NOMINAL.
1. TYPICAL TERMINATION WHEN PART NUMBER 618417-001 IS INSTALLED IN LOCATION 1E

NOTES: UNLESS OTHERWISE SPECIFIED

I.C. DESIGNATIONS

LOCATION	TYPE	LOCATION	TYPE
1A	UA733	3C	74LS05
5A	LM319	4C, 3F	74LS00
3B	CA3086	1DA, 1DB	75451
4B, 4D	74LS74	3D, 2E	74LS14
5B	74LS86	3E	74LS11
1C	QT2905	2F	7438
2C, 5C, 4E	96L02	4FA, 4FB	75452

REFERENCE DESIGNATIONS

LAST USED	NOT USED
R63	
C29	C12
L4	
CR20	
Q2	

NOTES UNLESS SPECIFIED
1. TOLERANCES .XX ± .XXX ± ANGULAR
2. BREAK ALL SHARP EDGES APPROX .010
3. MACH SURFACES
4. ALL DIMS IN INCHES
5. DIMENSIONS APPLY AFTER FINISH AND HEAT TREAT

DRAWN 5/25/78
CHECK
APPR.
MATERIAL
FINISH
MODEL No. 282
NEXT ASSY

SIEMENS CORPORATION

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SCHEMATIC DIAGRAM
MODEL 282

SIZE D 650239-100 REV. C

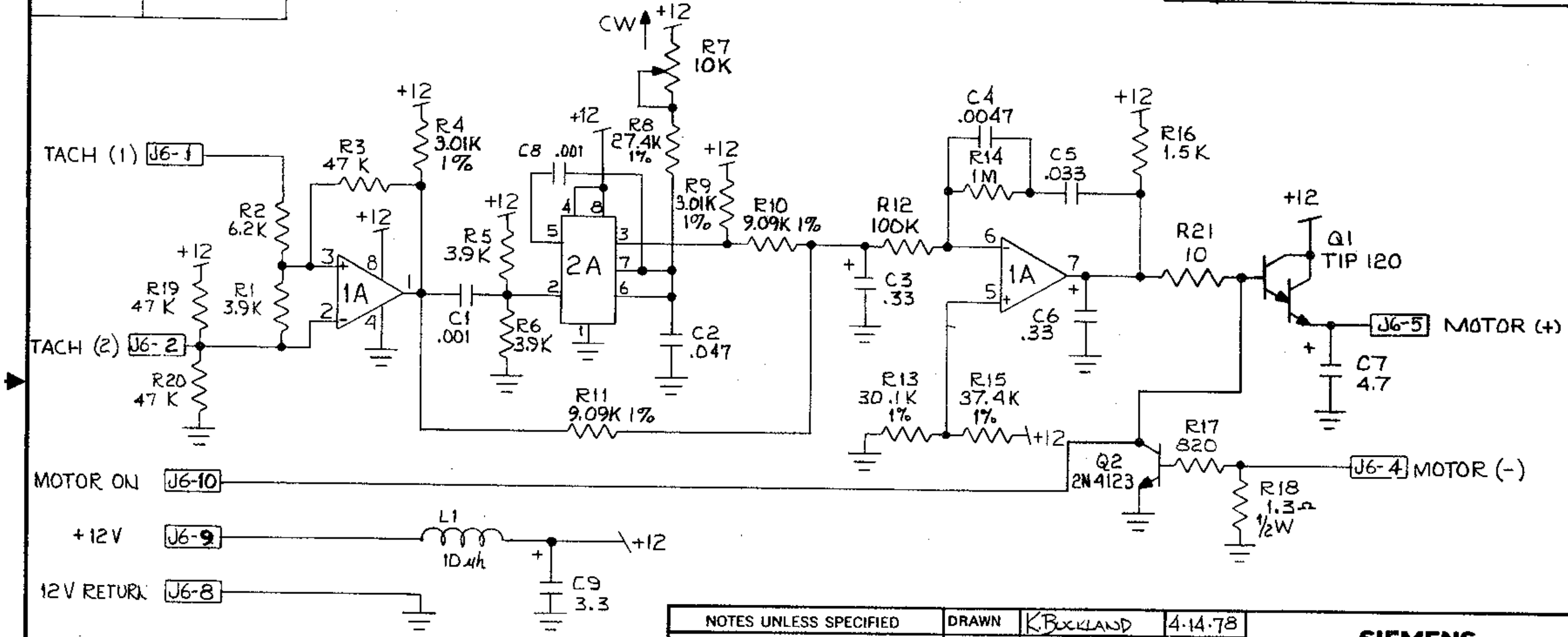
CODE IDENT 52465

DO NOT SCALE THIS DRAWING

REF. DESIGNATIONS	
LAST USED	NOT USED
R21	
C9	
L1	
Q2	

I C DESIGNATIONS	
LOCATION	TYPE
1A	LM393
2A	NE555

REVISIONS				
REV.	DESCRIPTION	CHK.	DATE	APPROVED
A	PILOT RELEASE		11-16-78	[illegible]
A	MFG. RELEASE		3-16-79	[illegible]
B	CR/O 50462		5/23/79	[illegible]
C	CR/O 50474		7/5/79	[illegible]



3. R21 IS NOT REQUIRED WITH PCB'S, REVS A AND B.
2. ALL CAPACITORS IN MICROFARADS
1. ALL RESISTORS IN OHMS, 1/4 W, 5%.

NOTES: UNLESS OTHERWISE SPECIFIED

NOTES UNLESS SPECIFIED

1. TOLERANCES .XX± .XXX± ANGULAR ±
2. BREAK ALL SHARP EDGES APPROX. .010
3. MACH. SURFACES ✓
4. ALL DIMS IN INCHES.
5. DIMENSIONS APPLY AFTER FINISH AND HEAT TREAT

DRAWN	K. BUCKLAND	4.14.78
CHECK		
APPR.		
MATERIAL		
FINISH		
MODEL No.	FDD 100-5B/200 5N	
NEXT ASSY		

SIEMENS CORPORATION

SCHEMATIC DIAGRAM
MOTOR DRIVE PWB

CODE	FD 108	QTY. REQ'D.	
SCALE	SIZE B	630322-100	C
DO NOT SCALE THIS DRAWING	WEIGHT	SHEET 1 OF 1	

FORM 392 (10/75)

SIEMENS

Floppy Disk Interface Module
for the 210 Microcomputer System
6AB5 101-0A*70 and 6AB5 102-0AA70

Instructions | **Ord. No. C79000-B8776-C175-2**

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1 Application

A floppy disk unit, consisting of up to two dual-head or two single-head drives and one parameterable interface module, is used as peripheral store unit of the 210 microcomputer system (MCS 210) (for a limitation, see note in section 3.2).

2 Design

The interface module performs the following functions:

- Conversion of the parallel data arriving from the MC 210 bus to serial bit sequences for output on the FD-LW, and vice versa.
- Take-over and execution of the instructions which are admissible for the controller.
- Processing of the data (separation of data and pulse, pulse generation).
- Check or generation of the data safeguard information.
- Signaling of device states and execution peculiarities.
- Formating, control reading.

In addition, the interface module, which is made up of LSI circuits, can make available a DMA subchannel for another interface module which in turn does not contain any DMA module.

The interface module, consisting of a p.c. board having the dimensions 100 x 160 mm or 233.4 x 160 mm, is designed for connection of both mini-floppy disk drives (MFD-LW) and drives of the floppy disk unit 3943 of the Siemens 300 systems (termed standard drives or standard LW in the text). The connection is established directly at the MC 210 bus, the location being wired with additional private lines. The interface module is connected to the MC 210 bus via base plugs whereas the connection to the drives is established via front plugs (Fig. 1).

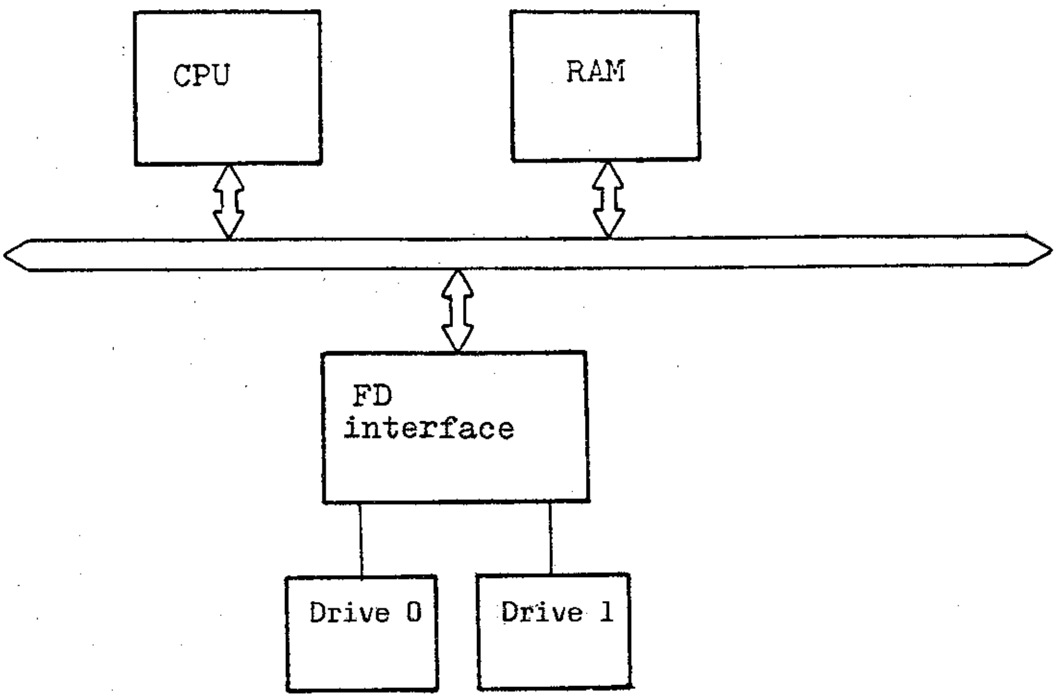


Fig. 1 Interface module in the MC 210 system

Up to two MFD-LW in single-head or dual-head design or up to two standard drives can be connected to one interface module. MFD drives and standard drives cannot be mixed at one interface module.

The interface module is available in three versions which differ in the front plugs for the cable connector or in the subassembly format.

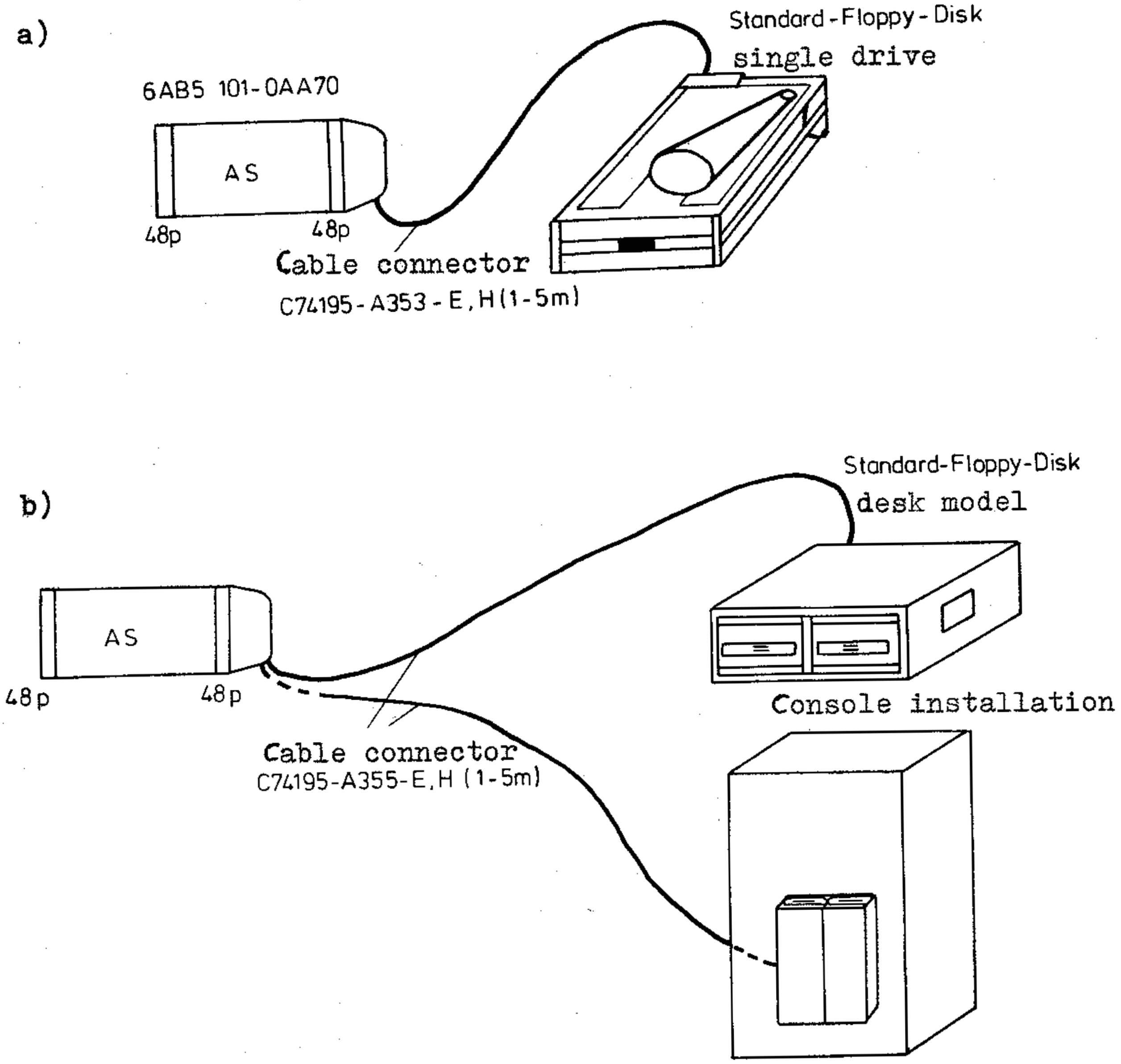
Note on operation with standard drives:

Because of the IBM format the exchange of data carriers with the 3943 floppy disk unit is only possible if the 3943 floppy disk unit contains the central module C71458-A6431-A12 (ES 902) or
C71458-A6431-A3 (SIVAREP®B).

Model 1 (6AB5 101-0AA70)

- Single-height p.c. board, ES 902, 100 mm x 160 mm
- 1 base plug for connection to MC 210E bus
- 48-pole ES 902 front plug for connection of
  - (a) one single standard drive
  - (b) up to two standard drives via floppy disk distributor
  - (c) up to two mini-floppy disk drives via separate distributor

(Fig. 2)



c)

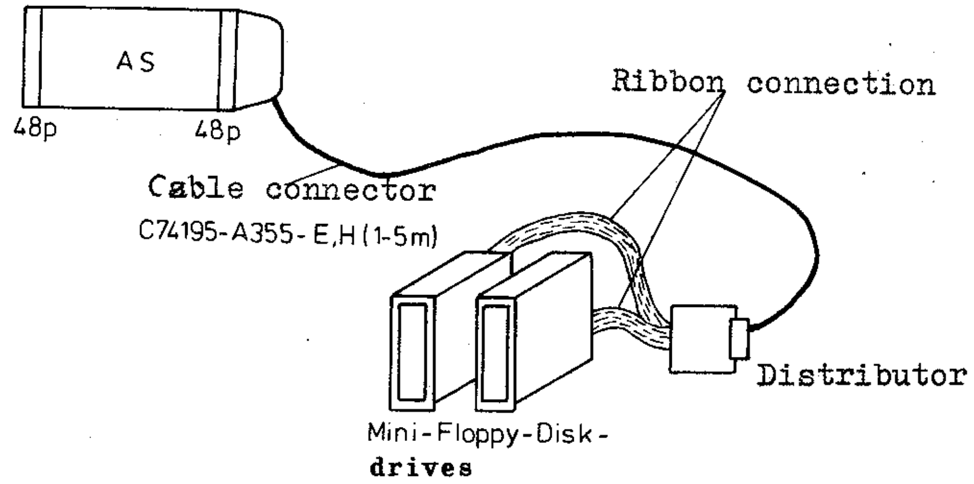


Fig. 2 Model 1 of the interface module

Model 2 (ord. no. 6AB5 101-0AB70)

- Single-height p.c. board (ES 902).
- 1 base plug for connection to MC 210E system bus.
- 34-pole ribbon plug as front plug.
- Connection of MFD drives in daisy-chain operation (single-head or dual-head drive).

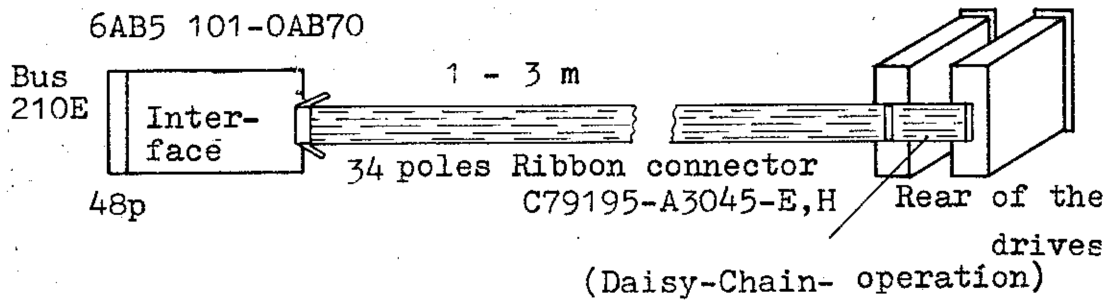


Fig.3 Model 2 of the interface modul

Model 3 (6AB5 102-0AA70)

- Dual-height p.c. board 233.4 mm x 160 mm.
- Two 48-pole base plugs for connection to MC 210D bus.
- Marshalling of the DMA signals by solder straps on base plug 1 or 2.
- One 48-pole ES902 front plug for connection of standard drives (Fig. 2, a, b) and one 34-pole front plug for connection of MFD-LW (Fig. 3).

6AB5 102-0AA70

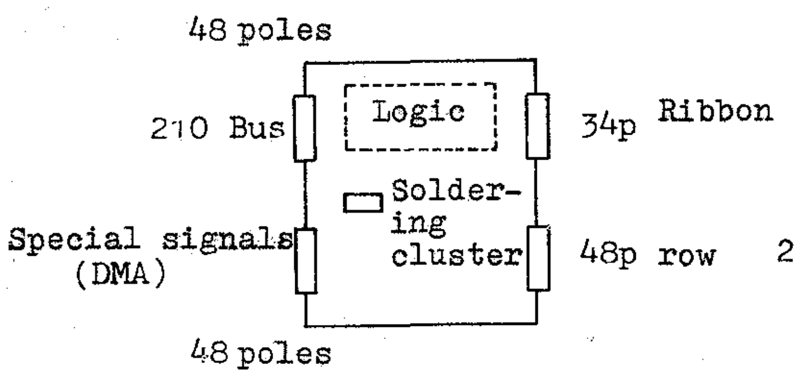


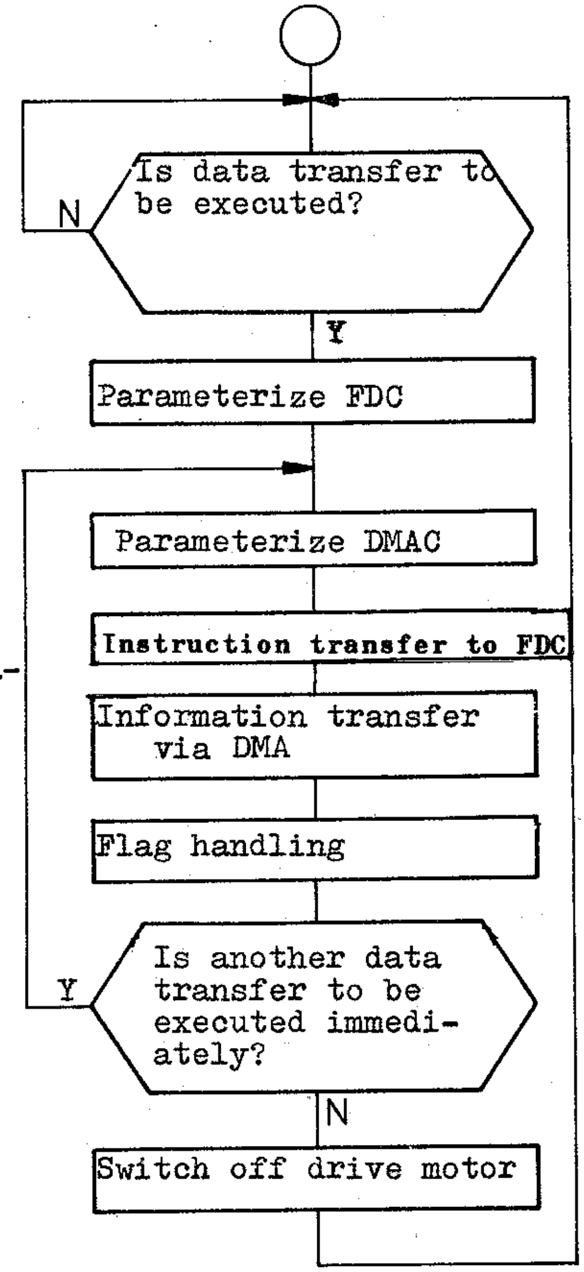
Fig. 4 Model 3 of the interface module

The signals $\overline{\text{HOLD}}$, $\overline{\text{BUSEN}}$, $\overline{\text{HLDA}}$ and $\overline{\text{SHLDA}}$ are marshalled to the base plug 1 or 2 via the link cluster (slot 72) (see chapter 6.3 for link allocation).

3 Mode of operation

3.1 Information transfer

Execution of an information transfer is composed of the parametering, transmission and termination phases:



In order to prepare the data transfer, the necessary parameters and instructions must be fed to the highly integrated FD and DMA components (FDC 8271 and DMAC 8257) under program control.
After instruction transfer to the FDC by the CPU, the phase of information exchange with direct store access (DMA communication) begins . This phase is terminated when flags are prepared for the CPU; the message from the interface module is sent via an interrupt.

Information transfer is handled by the mapped memory process. In order to reduce the address recognition input, the address range 60 K to 64 K only is used for the floppy disk interface.

3.2 Interface signals (Figs. 5 and 6)

$\overline{\text{BUSEN}}$ Output signal to the driver stage of the CPU to switch off the data and address buses as well as the control lines MEMW, MEMR, I/OR and I/OW.

DRQ (DRQ0 - DRQ3) Request signal to the DMAC to execute DMA communication; it is made by the FDC or another interface module without a DMAC of its own.

$\overline{\text{DACK}}/\overline{\text{SHLDA}}$ Acknowledgment signal to DRQ; at the system interface for chaining several interface modules for DMA communication.

HOLD Request signal to the CPU for direct memory access

HLDA Acknowledgment signal to HOLD from the CPU to the DMAC

IRA - IRF Interrupt bus from the FDC; permits marshalling to one of 7 IR inputs of the CPU. If there is a subchannel, marshalling of IRF and IRG is forbidden.

PESP CPU signal, formed from the four adress bits with with the highest valency for addressing the interface module.

The FD interface module cannot be connected to an MC210E with 48-pole base plug. The signals $\overline{\text{BUSEN}}$, HOLD and HLDA are only brought out via the 64-pole base plug of the MC 210E or via the base plug 2 in the MC 210D.

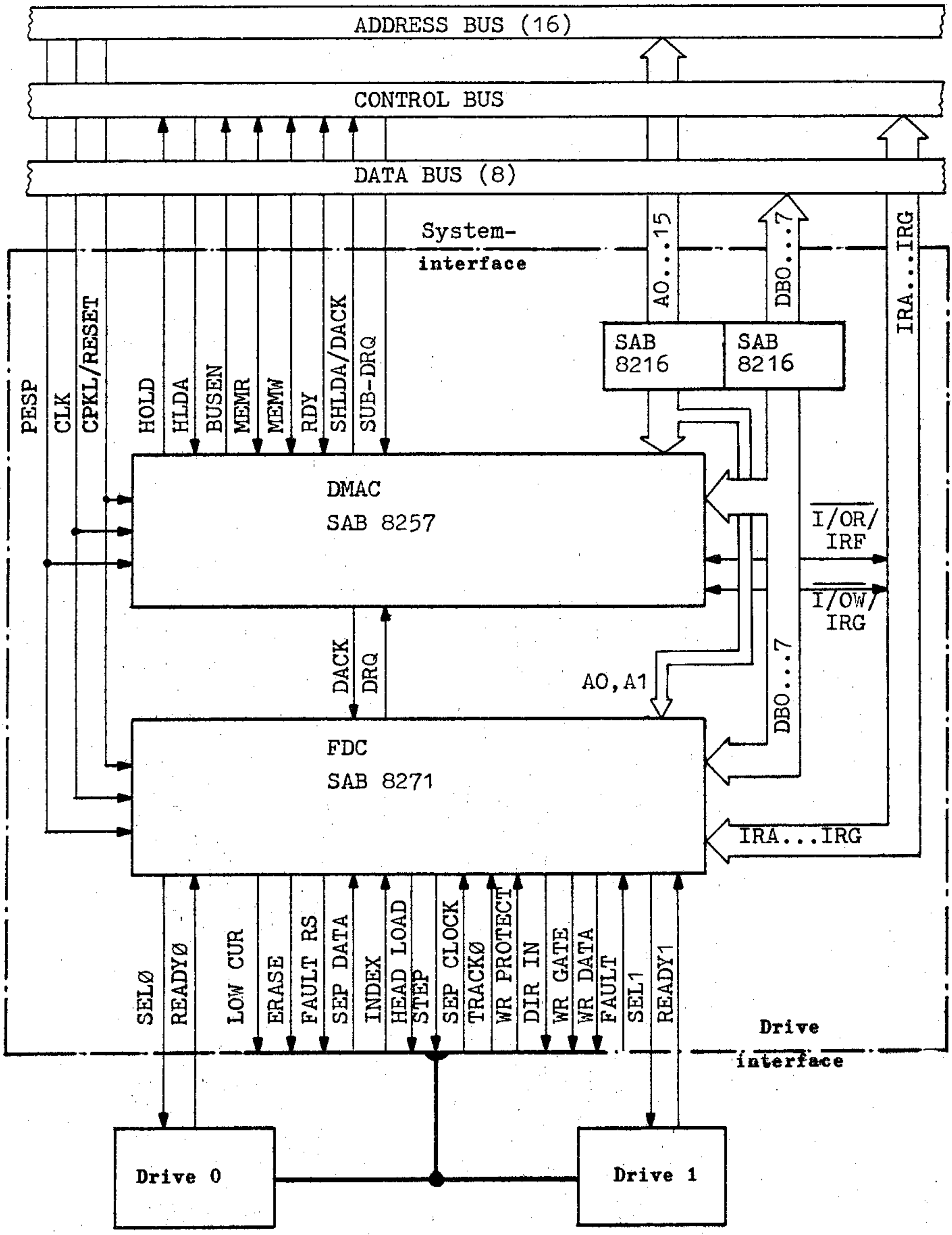


Fig. 5 Interface signals for standard drives

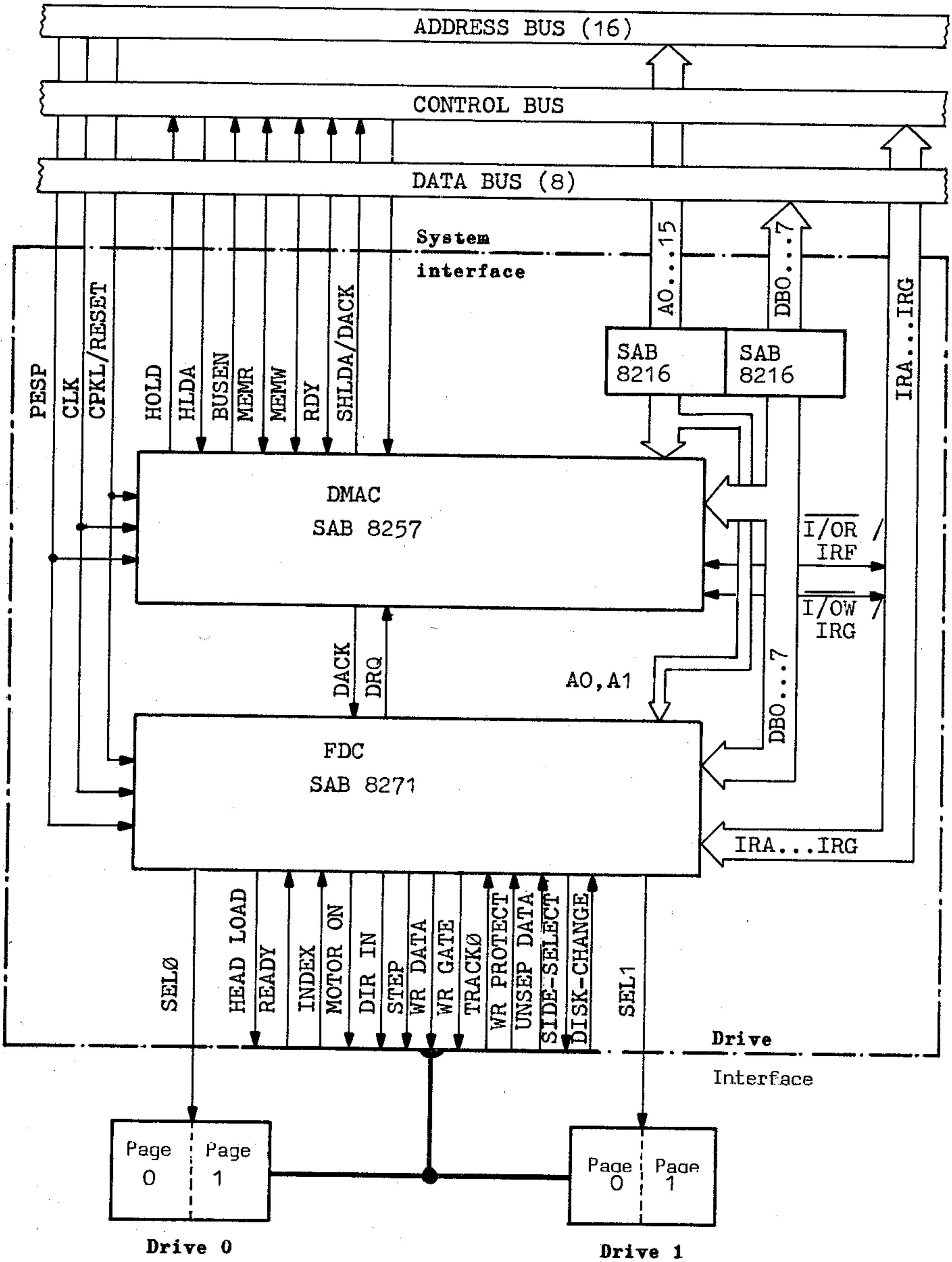


Fig. 6 Interface signals for MFD drives

3.3 Operating modes (cf. section 5.2)

In the MCS 210 the FD interface module can be operated in three modes as regards DMA operation:

Mode 1

FD interface module as sole DMA participant in the MCS 210. The DMA component is marshalled so that the DMA subchannel 2 is used for monitoring data transfer.

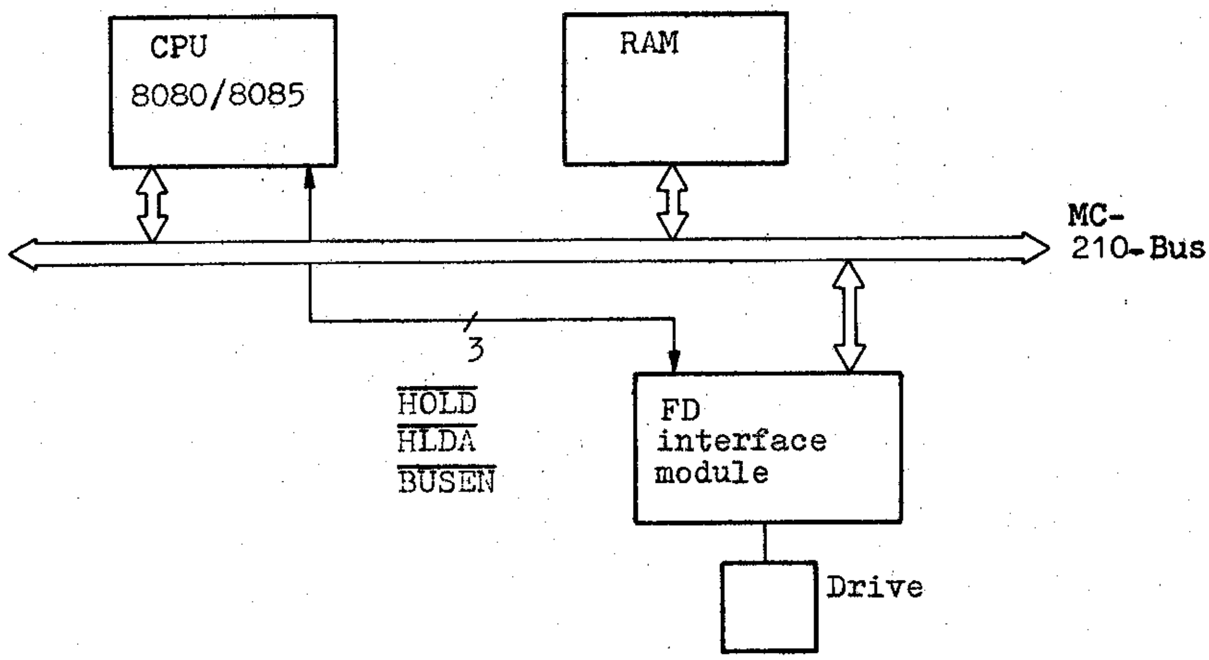


Fig. 7 Interface module in mode 1

Mode 2

The FD interface module supplies the DMA subchannel

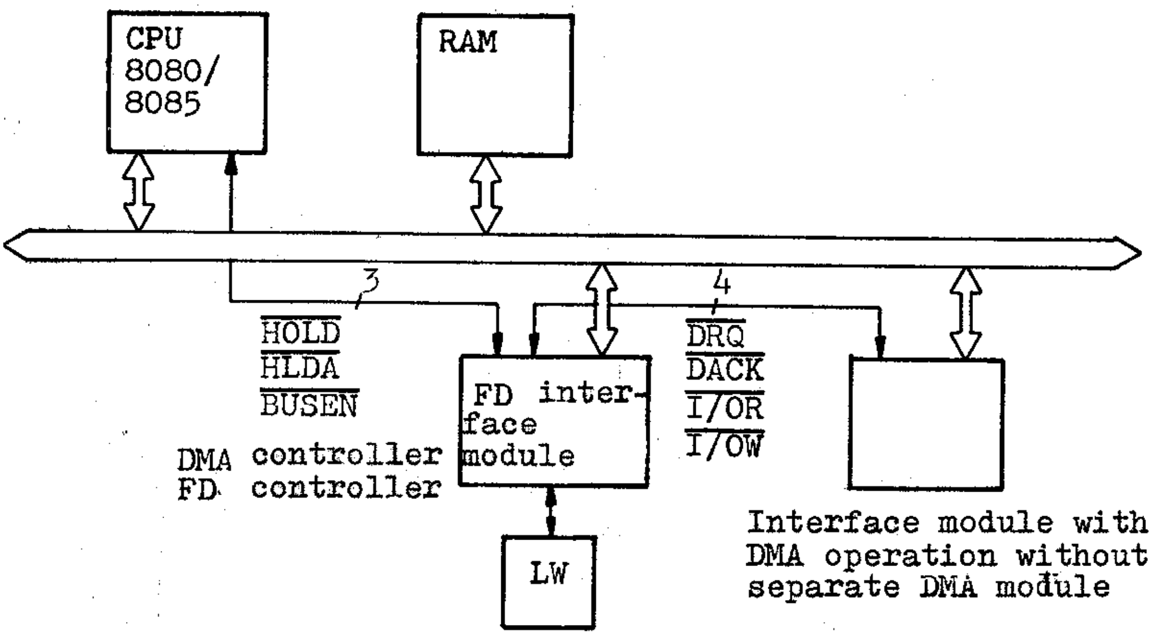


Fig. 8 Interface module in mode 2

The FD interface module is the sole DMA participant in the MC system, but makes available a DMA subchannel via private lines for another interface module which operates with DMA but does not contain any DMA module.
Depending on the transfer direction, i.e., from the subchannel interface module (sub-AS) to the store or from the store to the sub-AS, the private lines I/OR or I/OW must be wired.
The lines IRF or IRG are used to this end and are then no longer available as interrupt channels in this mode. They must be masked in the MC 210.

Two alternatives of channel allocation of the DMA module can be selected via link settings:

- FD interface module at channel 2 of the DMAC, DMA subchannel at DMAC channel 1,
  or
- FD interface module at channel 0 of the DMAC, DMA subchannel at DMAC channel 2.

Mode 3

Several DMA interface modules via chain priority schedule

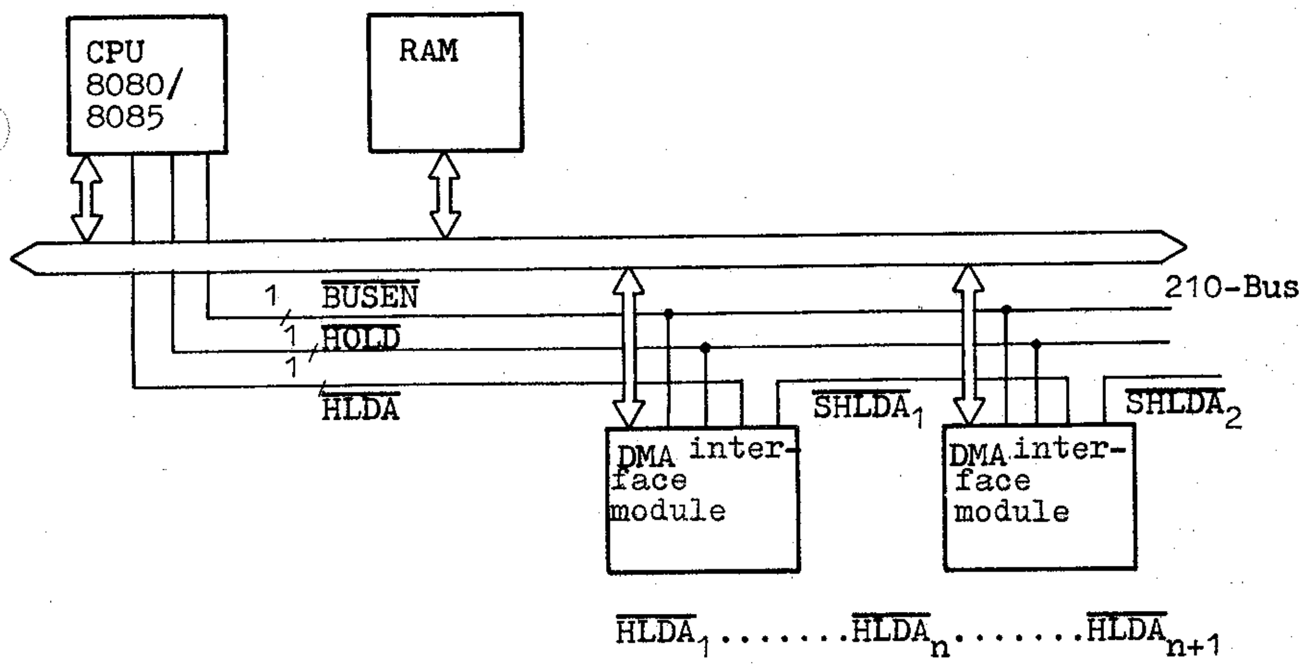


Fig. 9 Interface module in mode 3

There are several interface modules in the system which each contain a separate DMA module (separate DMA organization).

The priority distribution results from the location allocation along the DMA enable line $\overline{HLDA}$ or $\overline{SHLDA}$.
The interface module which is closest to the MC 210 with regard to the $\overline{HLDA}$ signal has the highest priority.

3.4 <u>Address evaluation</u>

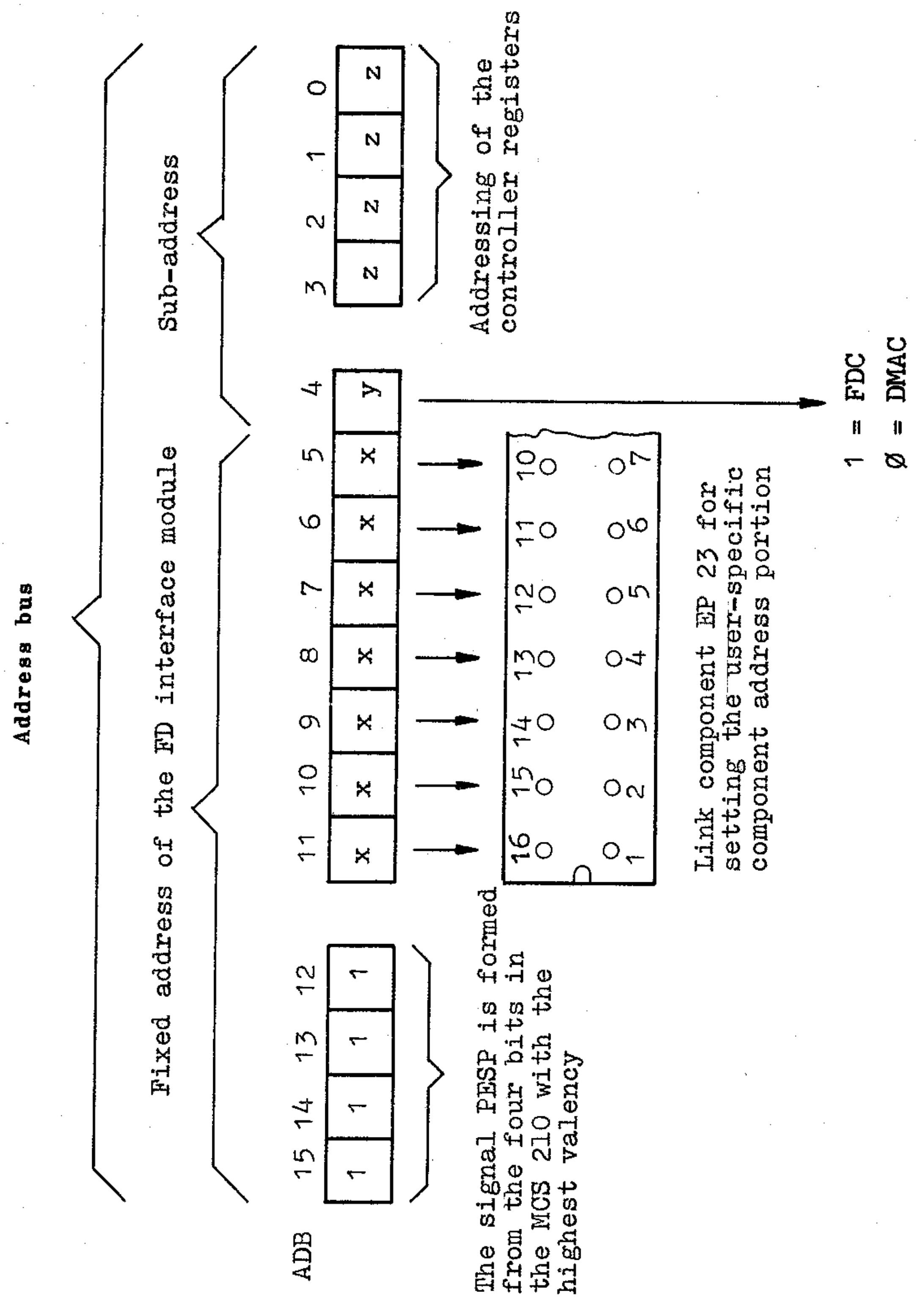


Fig. 10 Structure of the address bus ADB

4 Technical data

Interface module	Standard drive	MFD drive
Structure	1 p.c. board	1 p.c. board
	(ES 902 modular system) single or double height	
Ordering numbers		
Single-height p.c. board	6AB5 101-0AA70	6AB5 101-0AB70
Dual-height p.c. board	6AB5 102-0AA70	6AB5 102-0AA70
Supply voltage	+ 5 V ± 5 %	+ 5 V ± 5 %
Power consumption	1 A	1 A
Ambient temperature in operation	0 to 50 °C	0 to 50 °C
Circuit technique	TTL, MOS	TTL, MOS
Cable length	up to 5 m to the most distant drive	up to 3 m to the most distant drive for order no. 6AB5 101-0AB70 or 6AB5 102-0AA70 up to 5 m to the most distant drive for order no. 6AB5 101-0AA70

5 Operation

5.1 Starting-up

Presettings in the hardware must be done before commissioning the FD interface module in order to match the module to the respective application. In addition to setting the links, private lines must be wired in the MC 210 bus to suit the specific needs of the user (see tables 1 and 2 as well as the plug allocation diagrams).

The model 3 of the FD interface module with the most important components, in particular the location of the links and link components, is shown in Fig. 11.

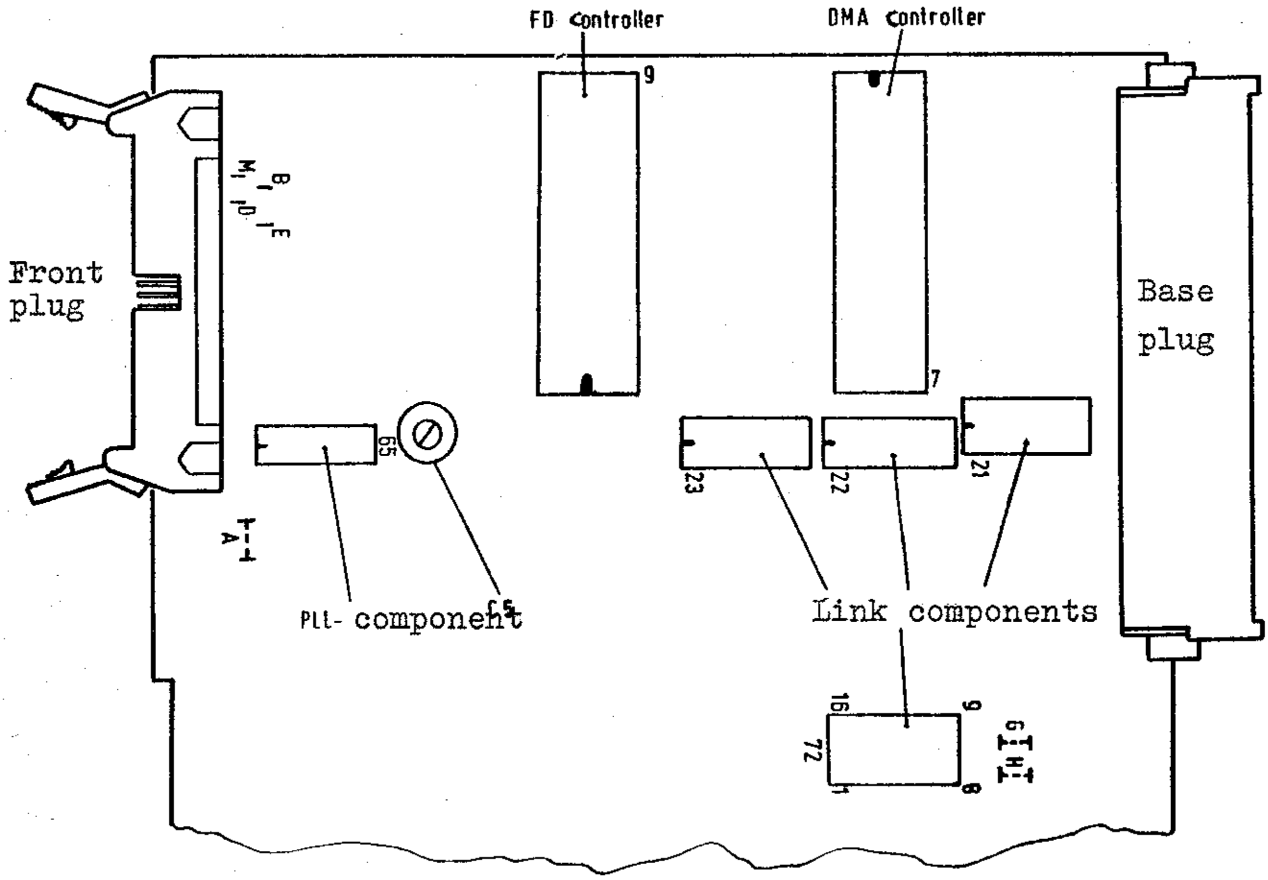


Fig. 11 Location of the link components and links

The links G and H as well as the link component EP 72 are dispensed with in the models 1 and 2.

5.2 Link allocation

	Private lines	Link modules Slot 22	Slot 21
MODUS 1	$\overline{HOLD}_{CPU}$ - $\overline{HOLD}_{FD}$ $\overline{HLDA}_{CPU}$ - $\overline{HLDA}_{FD}$ $\overline{BUSEN}_{CPU}$ - $\overline{BUSEN}_{FD}$ d30, z30 must be free	1 - 16 6 - 11 all other free	
MODUS 2	$\overline{HOLD}_{CPU}$ - $\overline{HOLD}_{FD}$ $\overline{HLDA}_{CPU}$ - $\overline{HLDA}_{FD}$ $\overline{BUSEN}_{CPU}$ - $\overline{BUSEN}_{FD}$ $\overline{DRQ}_{FD}$ - $\overline{DRQ}_{SUB-AS}$ (z30) $\overline{DACK}_{FD}$ - $\overline{DACK}_{SUB-AS}$ (d30) 1) $\overline{I/ORD}_{FD}$ - $\overline{I/ORD}_{SUB-AS}$(d24) 2) I/OWD_{FD} - I/OWD_{SUB-AS}(d26)	a) 1 - 16 5 - 12 6 - 11 8 - 9 all other free b) 2 - 15 4 - 13 7 - 10 8 - 9 all other free	1-16 link placed 2-15 3-14 must not be inserted
MODUS 3	$\overline{HOLD}_{CPU}$ - $\overline{HOLD}_{AS1}$ - $\overline{HOLD}_{AS2}$ - ... - $\overline{HOLD}_{ASn}$ $\overline{BUSEN}_{CPU}$ - $\overline{BUSEN}_{AS1}$ - $\overline{BUSEN}_{AS2}$ - ... - $\overline{BUSEN}_{ASn}$ $\overline{HLDA}_{CPU}$ - $\overline{HLDA}_{AS1}$ $\overline{SHLDA}_{AS1}$ - $\overline{HLDA}_{AS2}$ $\overline{SHLDA}_{AS2}$ - $\overline{HLDA}_{AS3}$ ⋮ ⋮ $\overline{SHLDA}_{ASn-1}$ - $\overline{HLDA}_{ASn}$	**Standard allocation** 1 - 16 3 - 14 6 - 11 all other free	

1) Line required if DMA data transfer from interface module to store is required
2) Line required if DMA data transfer from store to interface module is required

Table 1 Wiring and link allocation for various DMA modes (cf. section 313 for description of the modes).

Links	x inserted - not inserted	
A	x	Standard drives connected
A	-	MFD drives connected
B - E	x	MFD-LW in daisy-chain operation
B - E	-	Standard drive; READY 0 and 1 separated
B - M	x	READY signals are not evaluated (always active)
B - M	x	READY signals depend on the drive states
D - M	x	SEL signals independent of HEAD LOAD
D - M	-	SEL signals only active with HEAD LOAD

Table 2 Link allocation for selecting the type of drive

Examples for MFD-LW:

Type of drive	Links to be inserted				
	A	B-E	B-M	D-M	
SIEMENS FDD 200-5	-	x	x	-	
BASF 6106/6108	-	x	x	-	depending on
BASF 6106/6108	-	x	-	x	software

Links	x inserted - not inserted	
G H	x -	FD interface module makes available DMA subchannel; pin 1z30: input signal DRQ of the subchannel
G	-	Pin 1z30: output signal EANK for recognition of multiple addressing. Allocation illegal in mode 2!

Link component EP 21 *)	8 - 9	FD interrupt on IRA	
	7 - 10	FD interrupt on IRB	
	6 - 11	FD interrupt on IRC	
	5 - 12	FD interrupt on IRD	
	4 - 13	FD interrupt on IRE	
	3 - 14	FD interrupt on IRF	Cannot be used in
	2 - 15	FD interrupt on IRG	mode 2 (cf. table 1)
Link component EP 23	Marshalling as per section 3.4		

Table 3 Link allocation for selecting the interrupt and the operating mode

*) One link only may be inserted. In the case of FD interface modules (except 6AB5 102-0AA70) with output status ≤ 3, one link must be inserted on EP 21 (any location). In the case of FD interface modules with an output status greater than 3, interrupt marshalling is required only when necessary.

6 Maintenance

6.1 Interface for standard drives

Allocation of the 48-pole front plug and meaning of the signals

	z	b	d
2	0 V	0 V	Screen
4	$\overline{\text{SEL0}}$	$\overline{\text{SEL1}}$	Screen
6	0 V	0 V	0 V
8	-	-	$\overline{\text{DIR IN}}$
10	0 V	0 V	0 V
12	$\overline{\text{LOW CUR}}$	$\overline{\text{HEAD LOAD}}$	$\overline{\text{WR GATE}}$
14	0 V	0 V	0 V
16	$\overline{\text{ERASE}}$	$\overline{\text{STEP}}$	$\overline{\text{WR DATA}}$
18	0 V	0 V	0 V
20	$\overline{\text{FAULT RS}}$	$\overline{\text{SEP CLOCK}}$	$\overline{\text{SIDE SELECT}}$
22	0 V	0 V	0 V
24	$\overline{\text{SEP DATA}}$	$\overline{\text{READY 1}}$	$\overline{\text{READY 2}}$
26	0 V	0 V	0 V
28	-	$\overline{\text{TRACK 0}}$	-
30	0 V	0 V	0 V
32	$\overline{\text{INDEX}}$	$\overline{\text{WR PROTECT}}$	$\overline{\text{FAULT}}$

$\overline{\text{SEL0}}$	= Ø	Drive 0 selected
$\overline{\text{SEL1}}$	= Ø	Drive 1 selected
$\overline{\text{DIR IN}}$	= Ø	Positioning direction inward
	= 1	Positioning direction outward
$\overline{\text{LOW CUR}}$	= Ø	Lower writing current as of track no. $\geqq$ 43
$\overline{\text{HEAD LOAD}}$	= Ø	Write/read head applied
$\overline{\text{WR GATE}}$	= Ø	Write current enabled
$\overline{\text{ERASE}}$	= Ø	Erase tunnel
$\overline{\text{STEP}}$		Pulse for the step motor
$\overline{\text{WR DATA}}$		Write data pulses
$\overline{\text{FAULT RS}}$	= Ø	Reset fault message
$\overline{\text{SEP CLOCK}}$		Separate clock pulses
$\overline{\text{SIDE SELECT}}$	= Ø	Side 1 selected
	= 1	Side 0 selected

SEP DATA	Separate data pulses
READY 1 = Ø	LW 1 operational without prior selection
READY 0 = Ø	LW 0 operational without prior selection
TRACK 0 = Ø	Write/read head is on track 0
INDEX = Ø	Pulse for track start
WR PROTECT = Ø	Inserted floppy disk is protected from being written on
FAULT = Ø	Fault message from drive
Screen	Screening of electric faults

6.2 Interface for mini-floppy disk drives

Allocation of the 34-pole plug strip and meaning of the signals

0 V	Signal	Name	Meaning	
1	2	HEAD LOAD	= Ø	Write/read head is applied
3	4	-		
5	6	READY	= Ø	Drive operational after prior selection only
7	8	INDEX	= Ø	Pulse for track start
9	10	SEL0	= Ø	Drive 0 selected
11	12	SEL1	= Ø	Drive 1 selected
13	14	-		
15	16	MOTOR ON	= Ø	Motor switched on
17	18	DIR IN	= Ø	Positioning direction inward
19	20	STEP	= Ø	Pulse for the step motor
21	22	WR DATA	= Ø	Write data pulses
23	24	WR GATE	= Ø	Write current is enabled
25	26	TRACK 0	= Ø	Write/read head is on track 0
27	28	WR PROTECT	= Ø	Inserted floppy disk is protected from being written on
29	30	UNSEP DATA	= Ø	Unseparated data pulses
31	32	SIDE SELECT	= Ø = 1	Side 1 selected Side 0 selected
33	34	DISK CHANGE	= Ø	Change of floppy disk

The drives are selected via the stub lines SELECT 0 and 1, and the corresponding inputs and outputs are switched to the bus. All other lines represent bus lines.

6.3 Interface for MC 210 bus

Models 1 and 2, single-height p.c. board (base plug)

	d	b	z
2	-	0 V	+ 5 V
4	$\overline{\text{HOLD}}$ (PL0)	PESP	Ø2 TTL
6	ADB12	ADB0	$\overline{\text{CPKL}}$
8	ADB13	ADB1	$\overline{\text{MEMR}}$
10	ADB14	ADB2	$\overline{\text{MEMW}}$
12	ADB15	ADB3	$\overline{\text{RDY}}$
14	$\overline{\text{IRA}}$	ADB4	DB0
16	$\overline{\text{IRB}}$	ADB5	DB1
18	$\overline{\text{IRC}}$	ADB6	DB2
20	$\overline{\text{IRD}}$	ADB7	DB3
22	$\overline{\text{IRE}}$	ADB8	DB4
24	$\overline{\text{IRF}}$ or $\overline{\text{I/ORD}}$ *	ADB9	DB5
26	$\overline{\text{IRG}}$ or $\overline{\text{I/OWD}}$ *	ADB10	DB6
28	$\overline{\text{BUSEN}}$ (PL1)	ADB11	DB7
30	$\overline{\text{SHLDA}}$ or $\overline{\text{DACK}}$* (PL2)	$\overline{\text{HLDA}}$ (PL3)	DRQ * (PL4)
32	-	0 V	-

MC-210-Bus

+ private lines (PL)

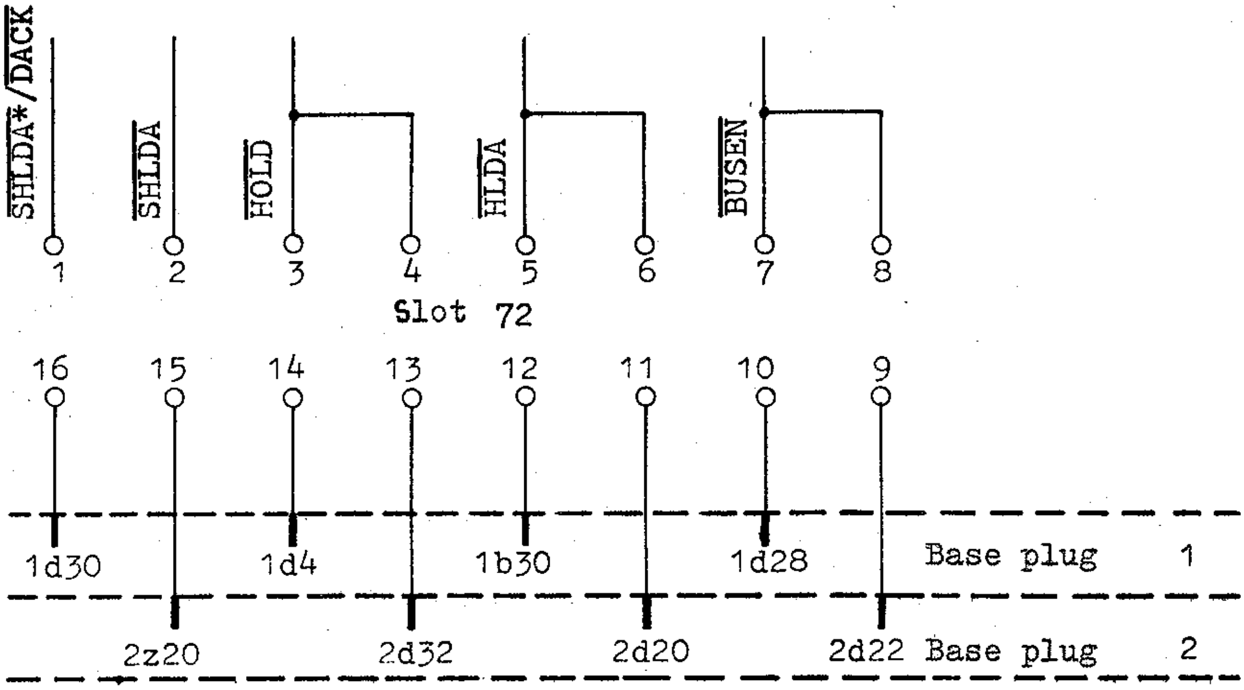
*) $\overline{\text{I/ORD}}$, $\overline{\text{I/OWD}}$, DRQ and $\overline{\text{DACK}}$ in case of connection of a DMA participant (subchannel) without separate DMA controller.

Model 3, dual-height p.c. board (base plugs 1 and 2)

	d	b	z
2	-	0 V	+ 5 V
4	PLØ	PESP	$\overline{\text{Ø2}}$ TTL
6	ADB12	ADB0	$\overline{\text{CPKL}}$
8	ADB13	ADB1	$\overline{\text{MEMR}}$
10	ADB14	ADB2	$\overline{\text{MEMW}}$
12	ADB15	ADB3	$\overline{\text{RDY}}$
14	$\overline{\text{IRA}}$	ADB4	DB0
16	$\overline{\text{IRB}}$	ADB5	DB1
18	$\overline{\text{IRC}}$	ADB6	DB2
20	$\overline{\text{IRD}}$	ADB7	DB3
22	$\overline{\text{IRE}}$	ADB8	DB4
24	$\overline{\text{IRF}}$ or $\overline{\text{I/ORD}}$	ADB9	DB5
26	$\overline{\text{IRG}}$ or $\overline{\text{I/OWD}}$	ADB10	DB6
28	PL1	ADB11	DB7
30	$\overline{\text{DACK}}$ (PL2)	PL3	$\overline{\text{DRQ}}$ (PL4)
32	-	0 V	- base plug 1

	d	b	z
2		0 V	+ 5 V
4			
6			
8			
10			
12			
14			
16			
18			
20	$\overline{\text{HLDA}}$		$\overline{\text{SHLDA}}$
22	$\overline{\text{BUSEN}}$		
24			
26			
28			
30			
32	$\overline{\text{HOLD}}$		base plug 2

Marshalling of the signals $\overline{\text{HOLD}}$, $\overline{\text{HLDA}}$, $\overline{\text{BUSEN}}$ and $\overline{\text{SHLDA}}$ (SHLDA*) on base plug 1 or 2:



Model 3	Link component EP 72 Mode 1	Mode 2	Mode 3
Marshalling on base plug 1	3-14 5-12 7-10	1-16 3-14 5-12 7-10	2-15 3-14 5-12 7-10
Marshalling on base plug 2	4-13 6-11 8- 9	1-16 4-13 6-11 8- 9	2-15 4-13 6-11 8- 9

6.4 System interfaces

System interface 210E with a 64-pole base plug

	f	d	b	z
2	WAIT	-5 V	0 V	+5 V
4	SYNC	PL0: $\overline{\text{RESIN}}$	PESP	$\overline{\emptyset}$ 2 TTL
6	$\overline{\text{RESIN}}$	ADB 12	ADB 0	$\overline{\text{CPKL}}$
8	-	ADB 13	ADB 1	$\overline{\text{MEMR}}$
10	INTE	ADB 14	ADB 2	$\overline{\text{MEMW}}$
12	$\overline{\text{IOR}}$	ADB 15	ADB 3	$\overline{\text{RDY}}$
14	$\overline{\text{FEHLER}}$	$\overline{\text{IRA}}$	ADB 4	DB 0
16	$\overline{\text{IOW}}$	$\overline{\text{IRB}}$	ADB 5	DB 1
18	$\overline{\text{INTA}}$	$\overline{\text{IRC}}$	ADB 6	DB 2
20	$\overline{\text{HLDA}}$	$\overline{\text{IRD}}$	ADB 7	DB 3
22	BUSEN	$\overline{\text{IRE}}$	ADB 8	DB 4
24	$\overline{\text{IRH}}$	$\overline{\text{IRF}}$	ADB 9	DB 5
26	$\overline{\text{INT}}$	$\overline{\text{IRG}}$	ADB 10	DB 6
28	$\overline{\text{STSTB}}$	PL1	ADB 11	DB 7
30	$\overline{\text{EZT}}$	PL2: $\overline{\text{RSF}}$	PL3	PL4: $\overline{\text{EANK}}$
32	$\overline{\text{HOLD}}$	+12 V	0 V	+15 V

System interface 210D with two 48-pole base plugs

	d	b	z
2	-5 V	0 V	+5 V
4	PL0: UBAT	PESP	$\overline{\emptyset}$ 2 TTL
6	ADB 12	ADB 0	$\overline{\text{CPKL}}$
8	ADB 13	ADB 1	$\overline{\text{MEMR}}$
10	ADB 14	ADB 2	$\overline{\text{MEMW}}$
12	ADB 15	ADB 3	$\overline{\text{RDY}}$
14	$\overline{\text{IRA}}$	ADB 4	DB 0
16	$\overline{\text{IRB}}$	ADB 5	DB 1
18	$\overline{\text{IRC}}$	ADB 6	DB 2
20	$\overline{\text{IRD}}$	ADB 7	DB 3
22	$\overline{\text{IRE}}$	ADB 8	DB 4
24	$\overline{\text{IRF}}$	ADB 9	DB 5
26	$\overline{\text{IRG}}$	ADB 10	DB 6
28	PL1: $\overline{\text{DS}}$	ADB 11	DB 7
30	PL2:	PL3 MEMSEL	PL4: $\overline{\text{EANK}}$
32	+12 V	0 V	+15 V

Base plug 1

	d	b	z
2	WAIT		
4	SYNC		
6	$\overline{\text{RESIN}}$		
8			
10	INTE		
12	$\overline{\text{IOR}}$	$\overline{\text{RSF}}$	
14	$\overline{\text{FEHLER}}$		
16	$\overline{\text{IOW}}$	ZF 2	
18	$\overline{\text{INTA}}$	ZF 1	
20	$\overline{\text{HLDA}}$	$\overline{\text{IRK}}$	
22	BUSEN	$\overline{\text{IRL}}$	
24	IRH	TS	
26	$\overline{\text{INT}}$	ZT 1	
28	$\overline{\text{STSTB}}$	$\overline{\text{IRI}}$	
30	$\overline{\text{EZT}}$	ZT 2	
32	$\overline{\text{HOLD}}$	0 V	

Base plug 2

6.5 Note on maintenance

The trimmer C5 should not be changed!
The PLL circuit is set optimally to its freely oscillating nominal frequency during the final check at GWK, using C5.

When the PLL circuit (NE 564, EP 65) is replaced, readjustment is necessary:

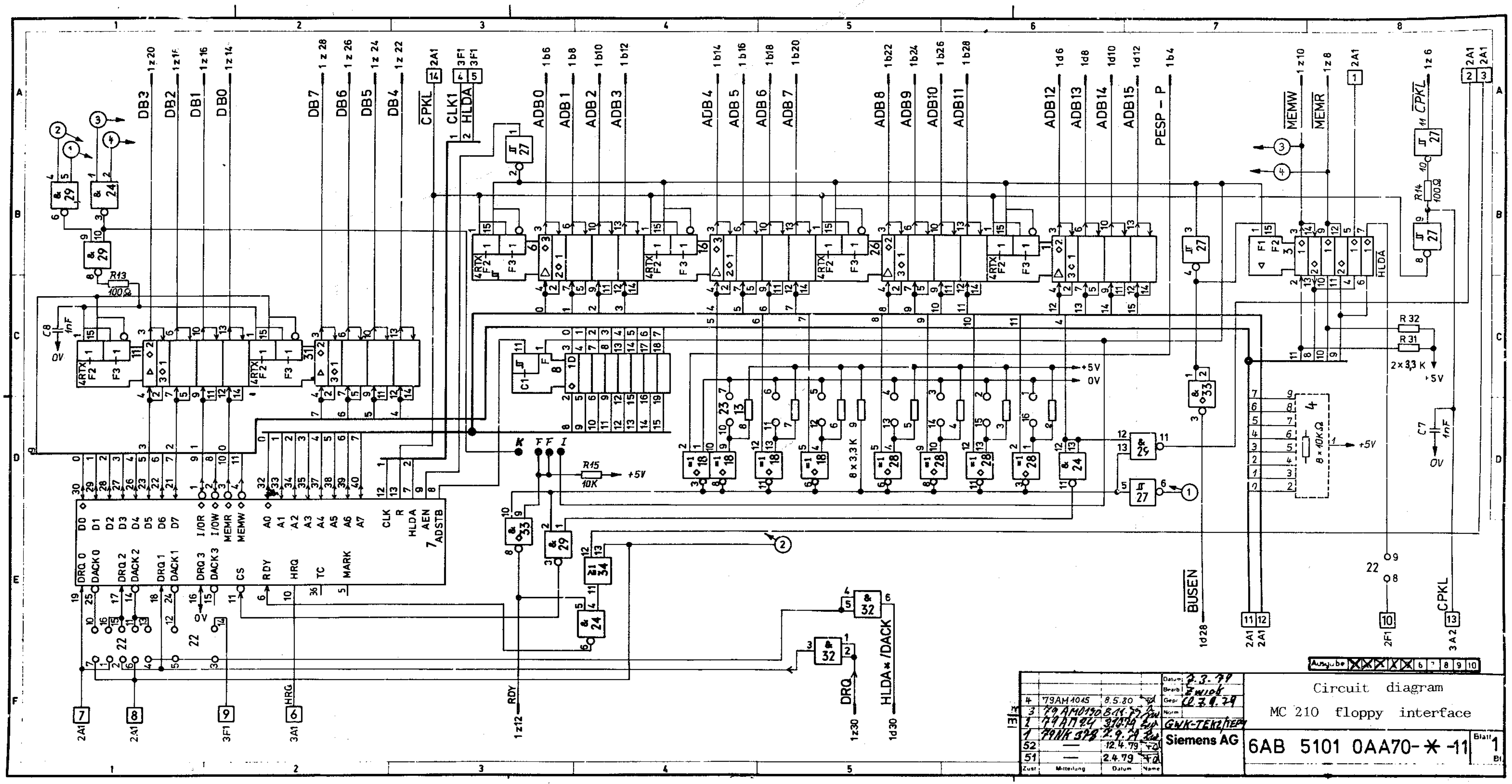
- Shortcircuit EP 65/2 against ground

- Measurement at EP 9/26 by means of a frequency meter
  Link A inserted: 250 kHz ± 100 Hz or
  Link A open: 125 kHz ± 50 Hz

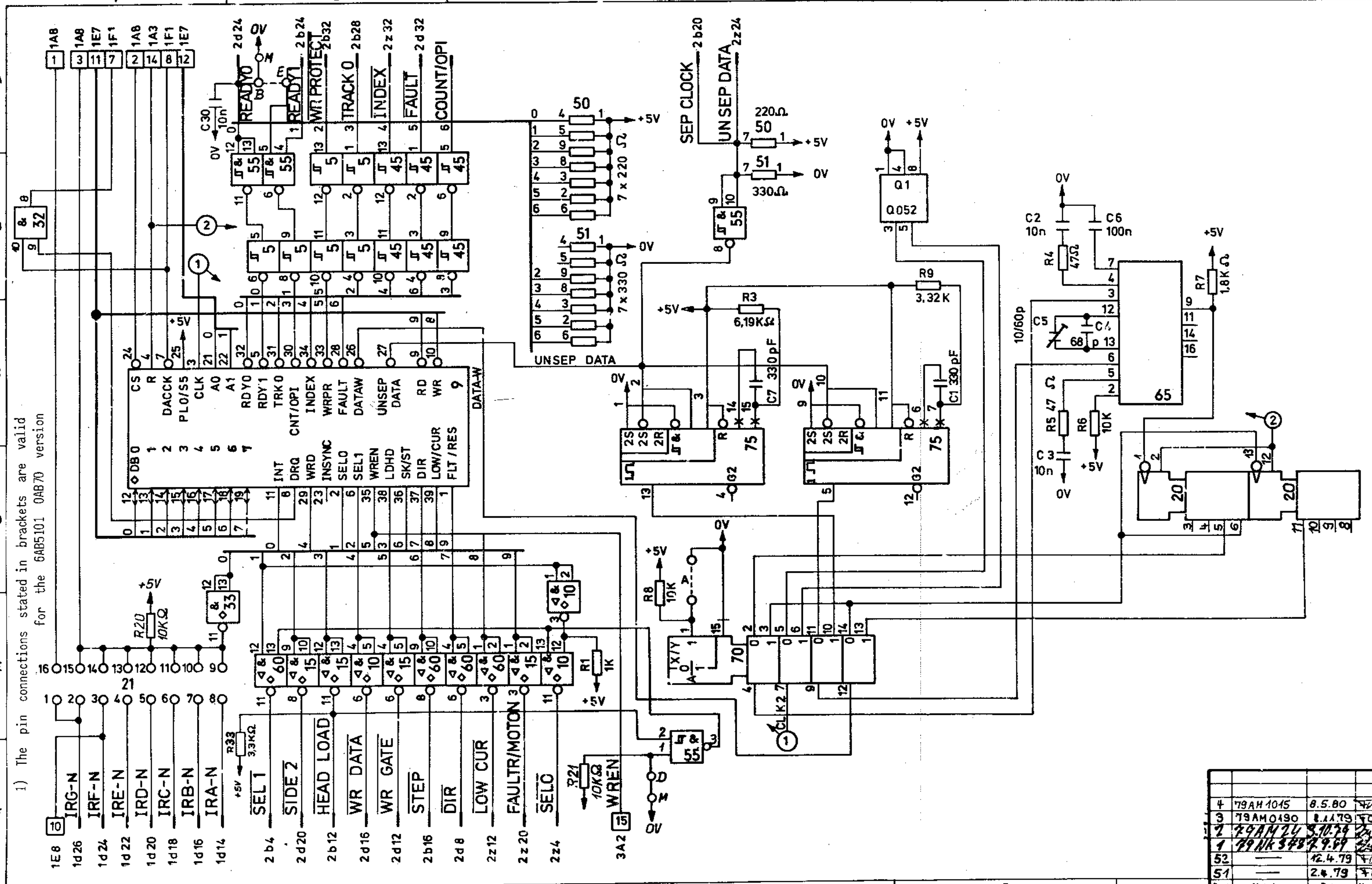
- Adjustment at trimmer C5.

6.6 Circuit diagrams

Model	Drawing no.
1 6AB5 101-0AA70	6AB5 101-0AA70-*-11, sheets 1 - 3
2 6AB5 101-0AB70	
3 6AB5 102-0AA70	C79458-L467-X1-*-11, sheets 1 - 3



Circuit diagram
MC 210 floppy interface
Siemens AG
6AB 5101 0AA70-✱-11
GWK-TEKZ
DB3
DB2
DB1
DB0
DB7
DB6
DB5
DB4
CPKL
CLK1
HLDA
ADB0
ADB1
ADB2
ADB3
ADB4
ADB5
ADB6
ADB7
ADB8
ADB9
ADB10
ADB11
ADB12
ADB13
ADB14
ADB15
PESP - P
MEMW
MEMR
BUSEN
HRQ
RDY
DRQ
HLDA✱/DACK
R13 100Ω
R14 100Ω
R15 10K
R 32
R 31
2×3,3 K
8×3,3 K
8×10KΩ
C7 1nF
C8 1nF
+5V
0V



1) The pin connections stated in brackets are valid for the 6AB5101 0AB70 version

Front plug occupation :

	ES902	34 pol	50 pol
SEL 0	z 4	10	26
SEL 1	b 4	12	28
—	d 4		
—	z 8		
—	b 8		
DIR	d 8	18	34
LOW CUR	z 12	—	8
HEAD LOAD	b 12	2	18
WR GATE	d 12	24	40
ERASE	z 16	—	6
STEP	b 16	20	36
WP. DATA	d 16	22	38
FAULTR/MOTON	z 20	16	32 (SEL 3)
SEP CLOCK	b 20	—	
SIDE 1	d 20	32	14 u. 48
UNSEP/SEP DATA	z 24	30	46
READY 1	b 24	—	—
READY 0	d 24	6	22
—	z 28	—	—
TRACK 0	b 28	26	42
—	d 28	—	—
INDEX/SEKTOR	z 32	8	20/24
WR PROTECT	b 32	28	44
FAULT	d 32	—	—
DUAL SIDE	—	—	10
DISK. CHANGE	—	34	12 u. 50
IN USE/LED	—	—	16

Zust	Mitteilung	Datum	Name
4	79AH1015	8.5.80	[illegible]
3	79AM0190	8.11.79	[illegible]
2	79AM24	3.10.79	[illegible]
1	79NK348	7.9.79	[illegible]
52	—	12.4.79	[illegible]
51	—	2.4.79	[illegible]

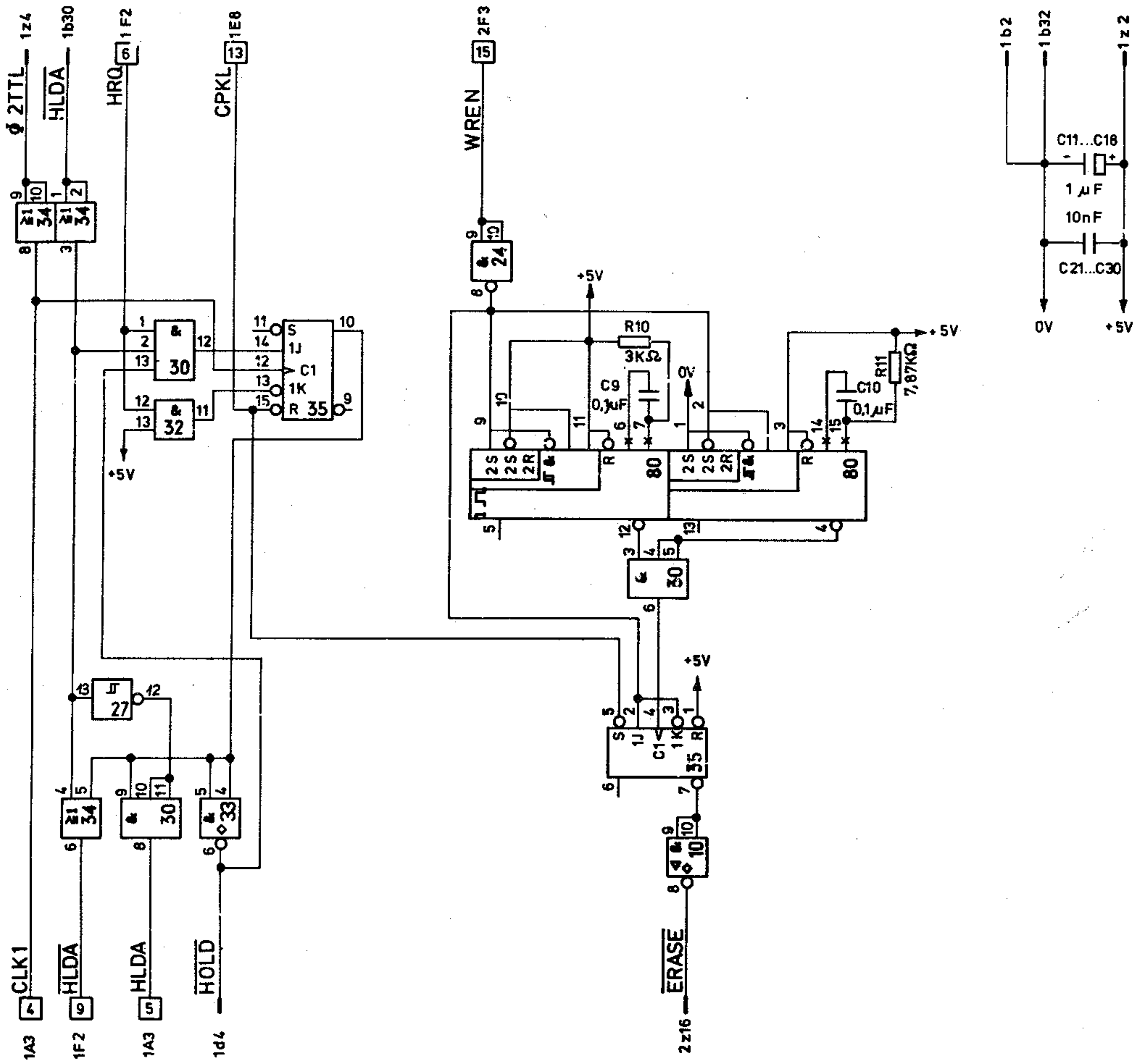
Datum 7.3.79
Bearb Zwick
Gepr 07.9.79
Norm
GWK/EKZ/TEP1

Siemens AG

Circuit diagram
MC 210 floppy interface

6AB-5101-0AA70-✱-11

Blatt 2
Bl



Location no.	Component	Conn. 0V	Conn. +5V
29, 24	SN 74 LS 500	7	14
30	SN 74 LS 11	7	14
5, 45, 27	SN 74 LS 14	7	14
33	SN 74 LS 26	7	14
34	SN 74 LS 32	7	14
10, 15, 60	SN 74 38	7	14
20	SN 74 393	7	14
35	SN 74 LS 109	7	16
18, 28	SN 74 LS 136	7	14
70	SN 74 LS 157	8	16
8	SN 74 LS 373	10	20
1, 6, 11, 16, 26, 31	SAB 8216	6	16
7	SAB 8257	20	31
9	SAB 8271	20	40
3	SN 74 367	8	16
75, 80	SN 74 LS 221	8	16
55	SN 74 LS 132	7	14
65	NE 564		
32	SN 74 LS 08	7	14

Jumper assignment:

A	without	mini drive
	with	standard drive
B	without	ready 0 and 1 separated
	with	daisy chained
21 (1-16)	with	$\overline{\text{I/OWD}}$ connected with $\overline{\text{IRG}}$
21 (2-15)	"	FDC interrupt strapped to $\overline{\text{IRG}}$
21 (3-14)	"	" $\overline{\text{IRF}}$
21 (4-13)	"	" $\overline{\text{IRE}}$
21 (5-12)	"	" $\overline{\text{IRD}}$
21 (6-11)	"	" $\overline{\text{IRC}}$
21 (7-10)	"	" $\overline{\text{IRB}}$
21 (8-9)	"	" $\overline{\text{IRA}}$

22 (1-16)
22 (2-15)
22 (3-14)
22 (4-13)
22 (5-12)
22 (6-11)
22 (7-10)
22 (8-9)

$\left.\right\}$ Standard assignment:
FDC to DMA channel 2
chained priority
inserted: 1-16
3-14, 6-11
$\overline{\text{I/ORD}}$ connected to $\overline{\text{IRF}}$

23 (1-16) with
23 (2-15) "
23 (3-14) "
23 (4-13) "
23 (5-12) "
23 (6-11) "
23 (7-10) "
23 (8-9) "

Address setting:
ADB 11 = 1
ADB 10 = 1
ADB 9 = 1
ADB 8 = 1
ADB 7 = 1
ADB 6 = 1
ADB 5 = 1

Zust	Mitteilung	Datum	Name
3	79AM1015	8.5.80	Fd
2	79AM24	3.10.79	[illegible]
1	79N378	7.9.79	[illegible]
53	—	7.9.79	Fd
52	—	12.4.79	Fd
51	—	2.4.79	Fd

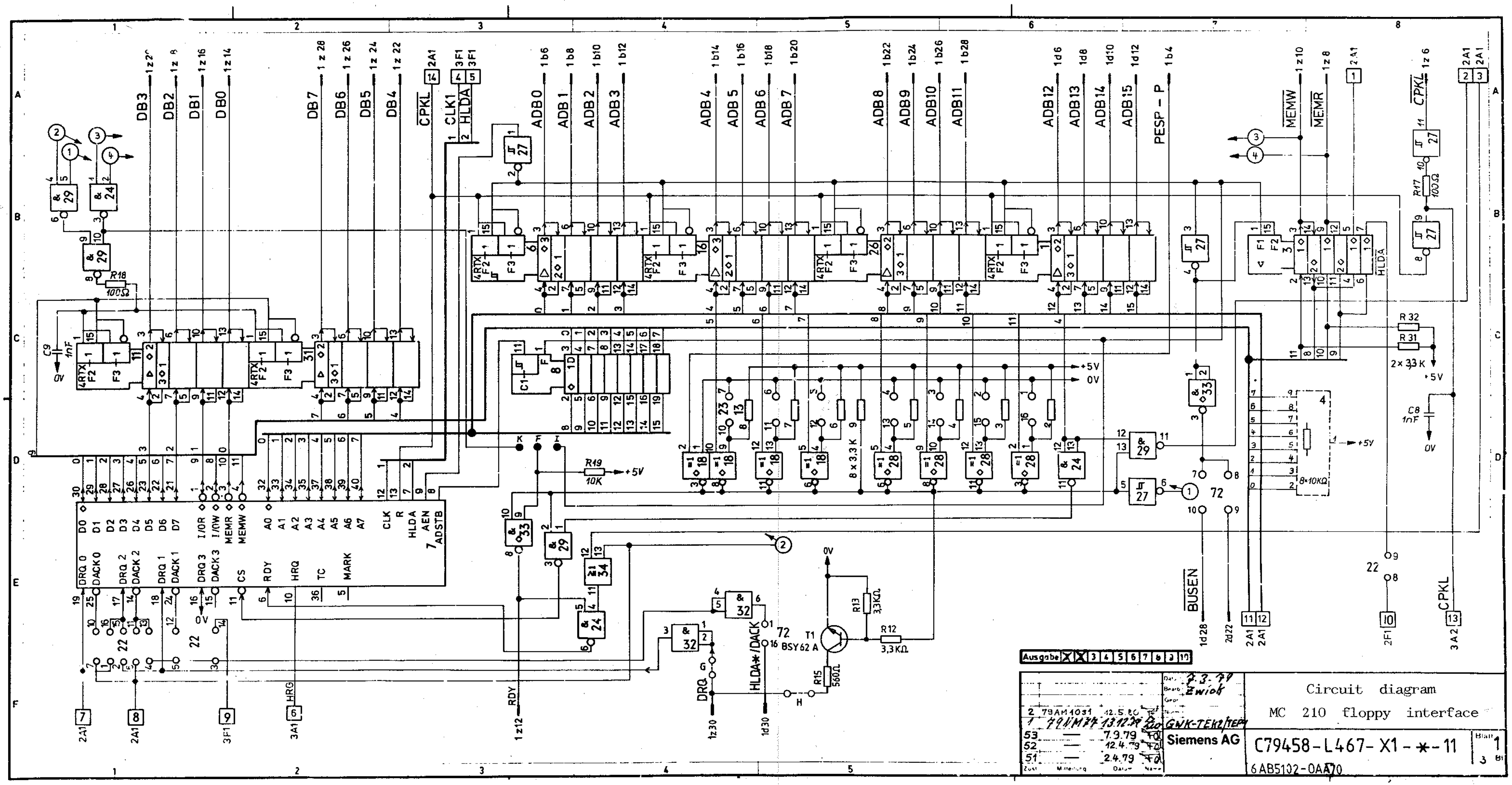
Datum 7.3.79
Bearb Zwick
Gepr [illegible] 7.9.79
Norm
GWK-TEKZ/TEP1

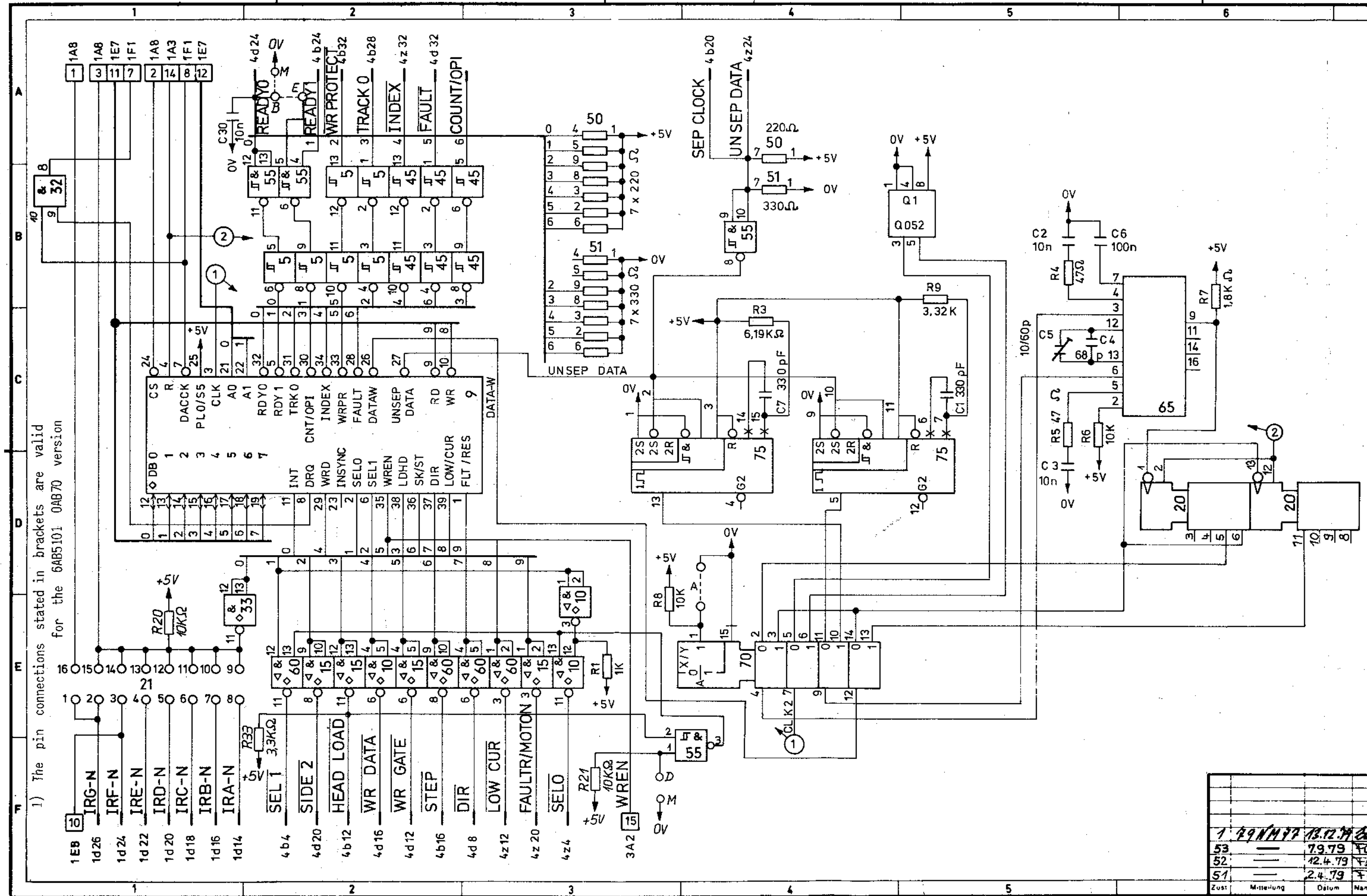
Maßstab

Circuit diagram
MC 210 floppy interface

Siemens AG

6AB-5101-0AA70-✱-11 Blatt 3


Circuit diagram
MC 210 floppy interface
Siemens AG
C79458-L467-X1-*-11
6AB5102-0AA70
Ausgabe 1 2 3 4 5 6 7 8 9 10
7.3.79
Zwiok
GWK-TEK2/TEP4
79AM4031 12.5.80
79NM77 13.12.79
7.3.79
12.4.79
2.4.79
R18 100Ω
R17 100Ω
R19 10K
R32
R31
2×3,3K
R13 3,3KΩ
R12 3,3KΩ
R15 560Ω
T1 BSY62 A
C9 1nF
C8 10nF
8×3,3 K
8×10KΩ
+5V
0V
BUSEN
CPKL
HLDA
HLDA*/DACK
DRQ
HRQ
RDY
MEMW
MEMR
ADSTB
AEN
CLK1
PESP-P



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SEL 1	b 4	12	28
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—	z 8		
—	b 8		
DIR	d 8	18	34
LOW CUR	z 12	—	8
HEAD LOAD	b 12	2	18
WR GATE	d 12	24	40
ERASE	z 16	—	6
STEP	b 16	20	36
WR DATA	d 16	22	38
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SEP CLOCK	b 20	—	
SIDE 1	d 20	32	14 u. 48
UNSEP/SEP DATA	z 24	30	46
READY 1	b 24	—	—
READY 0	d 24	6	22
—	z 28	—	—
TRACK 0	b 28	26	42
—	d 28	—	—
INDEX/SEKTOR	z 32	8	20/24
WR PROTECT	b 32	28	44
FAULT	d 32	—	—
DUAL SIDE	—	—	10
DISK. CHANGE	—	34	12 u. 50
IN USE/LED	—	—	16

Zust	Mitteilung	Datum	Name
1	79NM77	13.12.79	Zw
53	—	7.9.79	Fd
52	—	12.4.79	Fd
51	—	2.4.79	Fd

Datum 7.3.79
Bearb Zwick
Gepr
Norm
GWK TEK2/TEP1

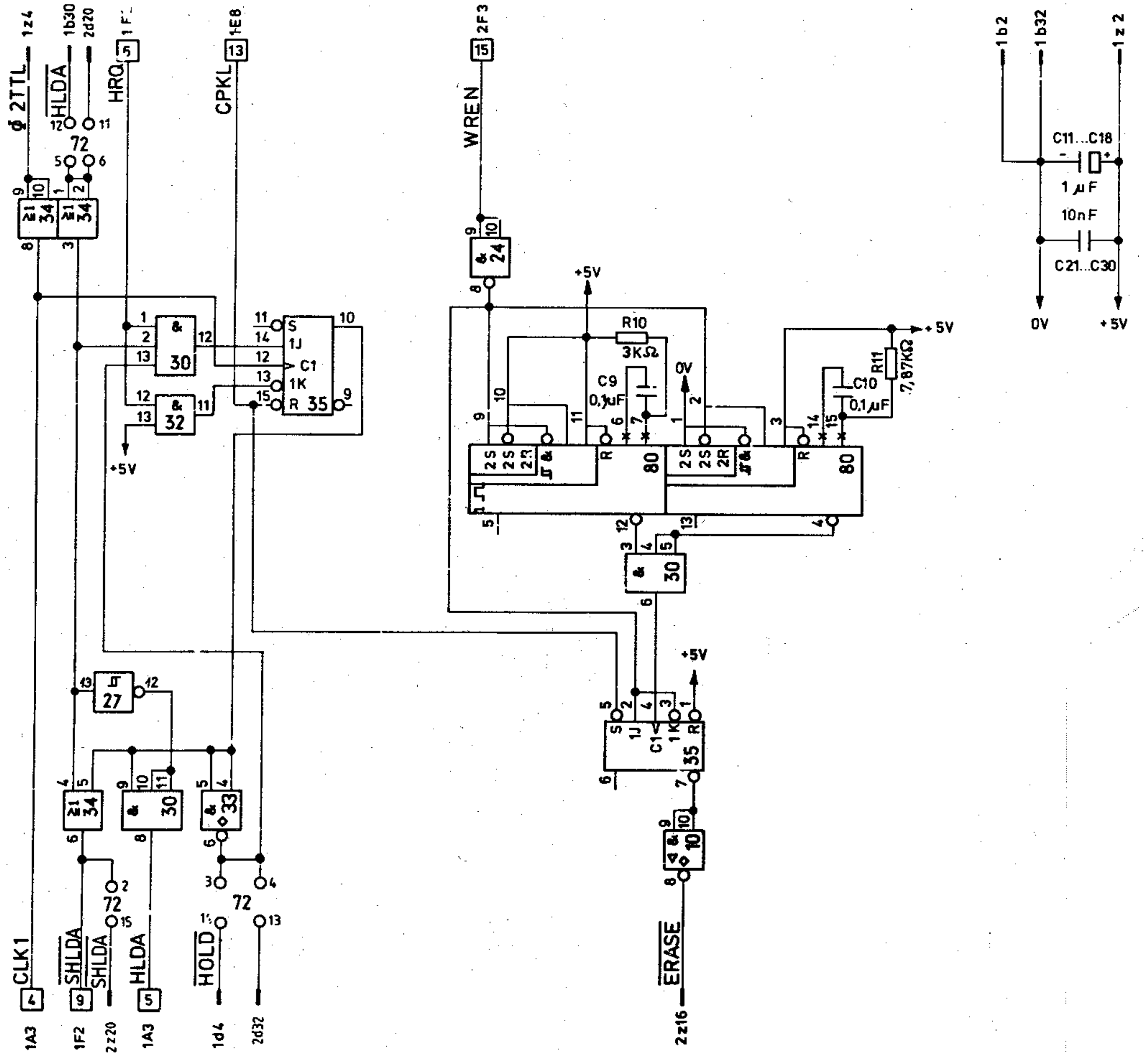
Siemens AG

Circuit diagram
MC 210 floppy interface

C79458-L467-X1-*-11

Blatt 2

6AB5102-0AA70



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5, 45, 27	SN 74 LS 14	7	14
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34	SN 74 LS 32	7	14
10, 15, 60	SN 74 38	7	14
20	SN 74 393	7	14
35	SN 74 LS 109	7	16
18, 28	SN 74 LS 136	7	14
70	SN 74 LS 157	8	16
8	SN 74 LS 373	10	20
1, 6, 11, 16, 26, 31	SAB 8216	8	16
7	SAB 8257	20	31
9	SAB 8271	20	40
3	SN 74 367	8	16
75, 80	SN 74 LS 221	8	16
55	SN 74 LS 132	7	14
65	NE 564		
32	SN 74 LS 08	7	14

Jumper assignment:

A without — mini drive
with — standard drive

B without — ready 0 and 1 separated
with — daisy chained

24 (1-16) with — $\overline{\text{I/OWD}}$ connected with $\overline{\text{IRG}}$
24 (2-15) " — FDC interrupt strapped to $\overline{IRG}$
24 (3-14) " — " $\overline{IRF}$
24 (4-13) " — " $\overline{IRE}$
24 (5-12) " — " $\overline{IRD}$
24 (6-11) " — " $\overline{IRC}$
24 (7-10) " — " $\overline{IRB}$
24 (8-9) " — " $\overline{IRA}$

22 (1-16)
22 (2-15)
22 (3-14)
22 (4-13)
22 (5-12)
22 (6-11)
22 (7-10)
22 (8-9)

Standard assignment:
FDC to DMA channel 2
chained priority
inserted: 1-16
3-14, 6-11
$\overline{\text{I/ORD}}$ connected to $\overline{\text{IRF}}$

23 (1-16) with
23 (2-15) "
23 (3-14) "
23 (4-13) "
23 (5-12) "
23 (6-11) "
23 (7-10) "
23 (8-9) "

Address setting:
ADB 11 = 1
ADB 10 = 1
ADB 9 = 1
ADB 8 = 1
ADB 7 = 1
ADB 6 = 1
ADB 5 = 1

Zust.	Mitteilung	Datum	Name
2	79AH1031	12.5.80	
1	79AM77	13.12.79	
53	—	7.9.79	
52	—	12.4.79	
51	—	2.4.79	

Datum 7.3.79
Bearb. Zwick
GWK-TEKZ/TEP

Siemens AG

Maßstab

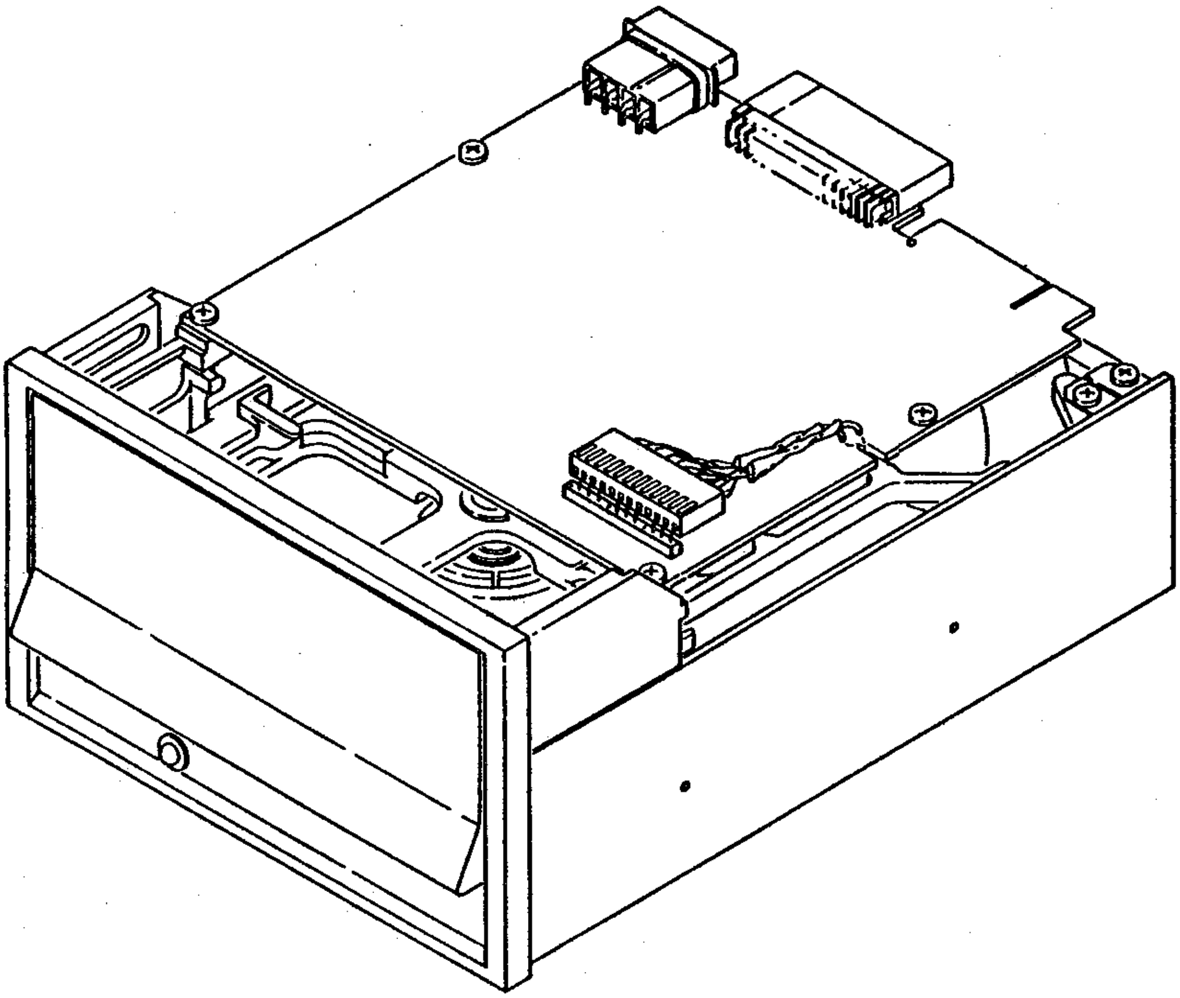
Circuit diagram
MC 210 floppy interface

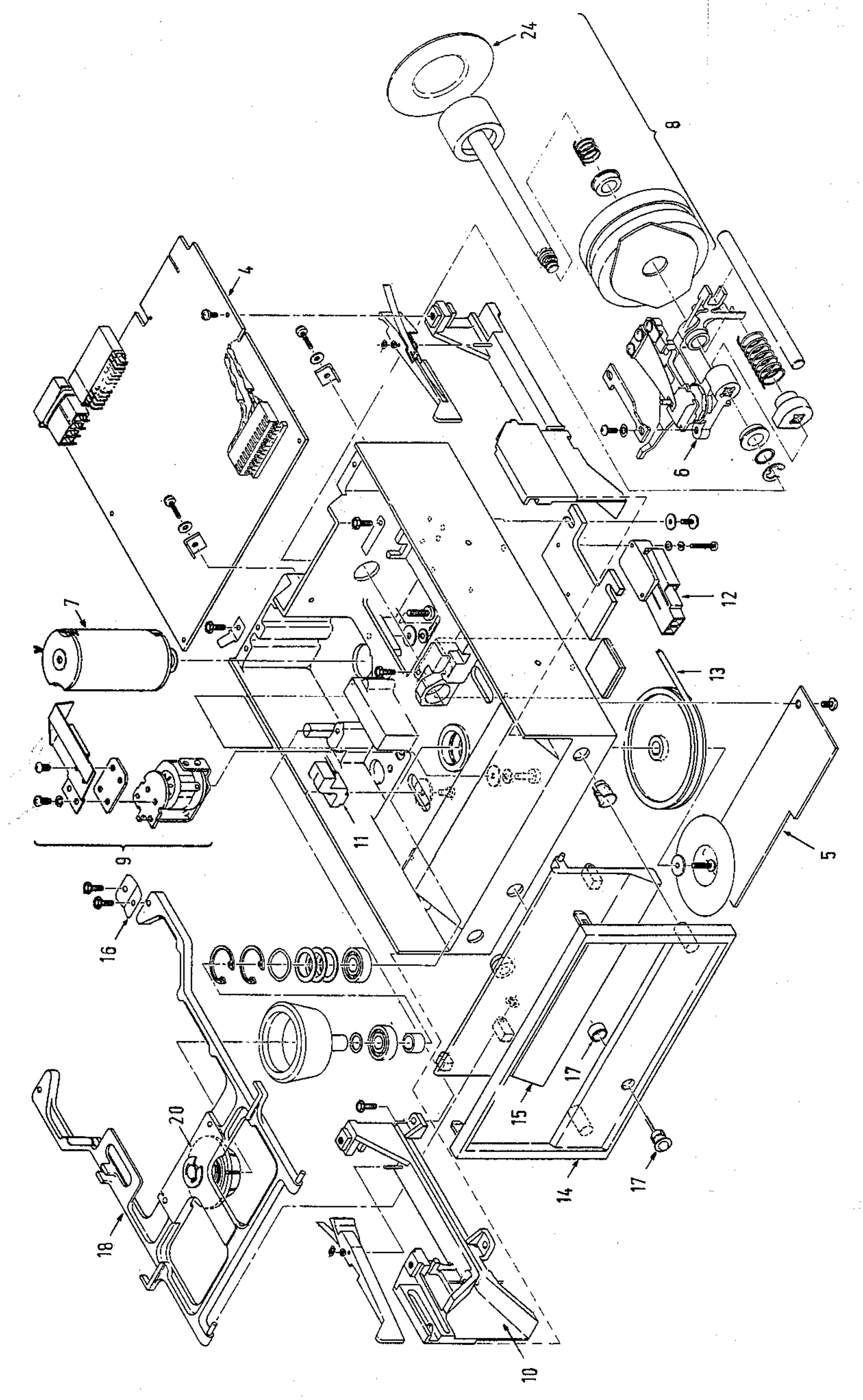
C79458-L467-X1-*-11
Blatt 3
6AB5102-0AA70

SIEMENS

Mini Disk Drive
L22742-A2005-N001

Spare Parts List — Order No. C79000-E8776-C24-3




24
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18
10

Item	Designation	Order no.	No. per product	Repair-able	Contained in or valid from object status	Place of delivery
1	Mini disk drive	L22742-A2005-N001	1	yes		GWK AZ
2	Diskette 1)	6ES5 820-0AA11	1	no		GWK AZ
3	Adjustment diskette	C74451-Z1069-U121	1	no		E MA ED
4	Main assembly PWB	S22742-L020-A001	1	yes	1	2)
5	Servo assembly PWB	S22742-L001-A001	1	no	1	2)
6	Carriage assembly	C22256-A106-B013	1	no	1	2)
7	Drive motor assembly	C22256-A106-B007	1	no	1	2)
8	Stepper motor assembly	C22256-A106-B014	1	no	1	2)
9	Solenoid assembly	S22742-B106-B092	1	no	1	2)
10	Disk-guide assembly	S22742-D106-D011	1	no	1	2)
11	Index sensor assembly	C22256-A106-B006	1	no	1	2)
12	Micro-switch	V22747-S131-D001	1	no	1	2)
13	Drive belt	C22256-A106-C026	1	no	1	2)
14	Front bezel	C22256-A106-C078	1	no	1	2)
15	Door	C22256-A106-C013	1	no	1	2)
16	Leaf hinge	C22256-A106-C003	2	no	1	2)
17	LED	V22747-V200-A015	1	no	1	2)
18	Carrier assembly	S22742-B106-B3	1	no	1	2)
19	Programmable shunt	V22747-E103-A006	1	no	1, 4	2)
20	Clutch assembly	C22256-A106-B024	1	no	1	2)
22	Set of mounting parts	L22967-V2038-A2	10	no		2)
23	Terminator network	V22747-R953-A002	1	no	1, 4	2)
24	Motor cover plate	C22256-A106-C072	1	no	1	2)
25	Cleaning diskette	C74451-Z1069-U103	1	no		E MA ED

1) Minimum order quantity: 10 off

2) To be ordered from ZN Frankfurt
Rebstückerstr. 59
6000 Frankfurt