11. Display

D I S P L A Y   T A 2 2

General Description

The Display can be connected to every TA 22 machine.
The Display consists of one I/O card with microprocessor
INTEL 8085 of its own and a screen controller.
The designation of the I/O card is SBAP 01. The microprocessor treats
the I/O card as intelligent. The control of the screen sequences is
carried out through a microprogramme of its own whose are maintained
in 3 PROM chips with 2 K bytes capacity each.
The basic machine has no access on this chip.
A Display is connected with a screen circulating memory of its own
to the I/O card.
Like further intelligent I/O cards (DFÜ and Floppy) the I/O card has
a so-called device head micro on whose contents the main processor
and the processor of the I/O card can have access. This micro is in
charge of the status interrogation of the I/O card.
The system TA 22 with Display is restrictedly compatible, this means:
if a Display is connected, the error message on the Display is carried
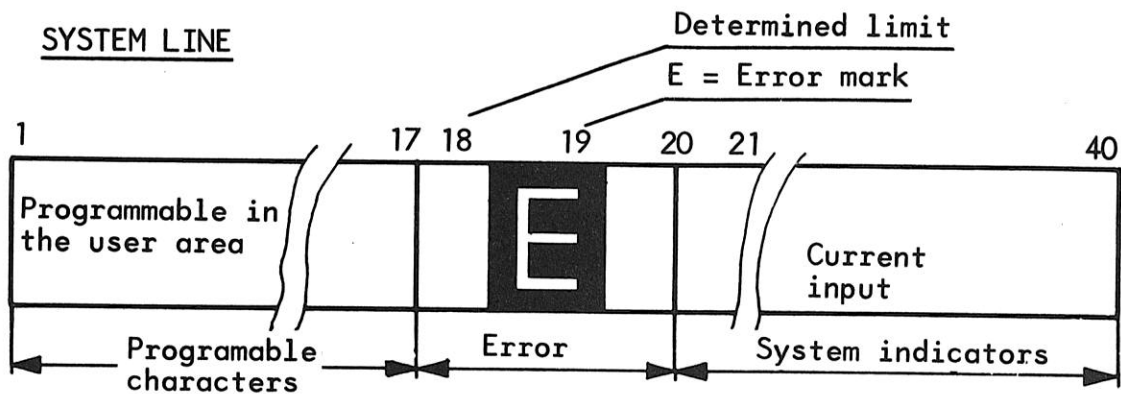out in the system line.
If the Display is missing the error will be printed out.
Exception: In case of DFÜ the error is basically printed out.
The operation with the Display facilitates the processing of data
considerably, as at any time the current input can be displayed.

Display TA 22 Data:

Screen diagonal : 5 Inch

Display capacity : 480 Charcters

Number of lines : 12 (including one programmable system line)

System line : Subdivided into system and programme indications

Number of characters/line : 40

Character size : Height 4,00 mm
Width 2,10 mm

Set of characters : 128 Characters
(Capitals/small letters, digits, special characters and symbols)

Cursor : Blinking character
(for spacing blinking rectangle)

Cursor functions : Any programmable and can be controlled with start keys.

Display : Yellow

Dereflection : Yes

Brightness : Can be manually adjusted

Screen frequency : 50 Hz

Installation : Left on the desk, in any position (dependent upon cable)

SYSTEM LINE

Determined limit

E = Error mark

```
 1                       17 18    19    20 21                        40
┌──────────────────────┬──────┬──────┬──────┬──────────────────────┐
│ Programmable in      │      │      │      │                      │
│ the user area        │      │  E   │      │  Current             │
│                      │      │      │      │  input               │
└──────────────────────┴──────┴──────┴──────┴──────────────────────┘
   Programable              Error           System indicators
   characters
```

System line:	12th line assigned on the screen
Number of characters:	40 17 Characters of them are programmable 3 Characters error siganling 20 Characters system indicators
Error mark E signals:	– Operation error – Internal error – Programming error (parallel with the error lamp)
System indication:	– Data input (rolling) – Operating keys can also be indicated

SET OF CHARACTERS:

For the transmission from screen memory BS or from the user area in
the main memory BSA or submemory BSB, one proceeds that always umpacked
representation is available in BS or user memory, if a Display command
is available. On the Display all representations are represented in
the ISO - 7 bit code 2.0 - 7.15 alphabet 8.0 for ◇ and 8.1 for o/oo.
All further characters are interpreted as '?' on the Display.

TRANSMISSION FROM THE KEYBOARD IN THE MAIN MEMORY AND ITS REPRESENTA-
TION IN THE SYSTEM LINE

All values in the ISO 7 bit code are invariably taken over (2.0 - 7.15).
The selection keys A - F are represented with [A] - [F] .
The start keys ⍺1 and ⍺2 are represented with [1] and [2]

The correction key C is represented in inverse shape for special
marking, which means dark C on light ground.
The Repeat key has its function as before, however, not represented.
The same is valid for the Shift key. The 00 key is subdivided into
2 points = 0.
Numeric characters as 0 - 9 are converted into the corresponding
ISO 7 bit code.
The minus sign is converted into the minus ISO 7 bit code.
The backspace key is converted into the ISO 7 bit code and is
represented as ——≫ .

COMMUNICATION AREA

Byte

|			
1.	Initial address for screen memory (any in the user area)		
2.		Initial address	
3.	1st Line on the screen	$1 \leq n \leq 11$	
4.	Last line on the screen	$1 \leq n \leq 11$	
5.	1st Character in the line	$1 \leq n \leq 40$	
6.	Last character in the line	$1 \leq n \leq 40$	
7.	Line of the cursor	$1 \quad n \quad 11$	
8.	Position of the cursor in the line	$1 \leq n \leq 40$	
9.	Cursor ⟶	key B for 1, no key for 0	
10.	Cursor ⟵	key A for 1, no key for 0	
11.	Cursor ↑	key C for 1, no key for 0	
12.	Cursor ↓	key D for 1, no key for 0	
13.	Cursor Home,	key E for 1, no key for 0	
14.	Screen Clear,	key F for 1, no key for 0	

Cursor = Blinking character.

The image memory can be smaller for the screen (image memory) or 480 characters. The first line to be created on the screen can be 10 lines (on the screen) (3rd byte). It is also possible to create only 20 characters (e.g. 1).

The contents of the image memory address (Bytes 1 and 2) are transferred to the defined screen position through bytes 3 and 5.

SYSTEM LINE:

(12th Line on Line Display)

subdivided into

1   17 18 19 20 21   40
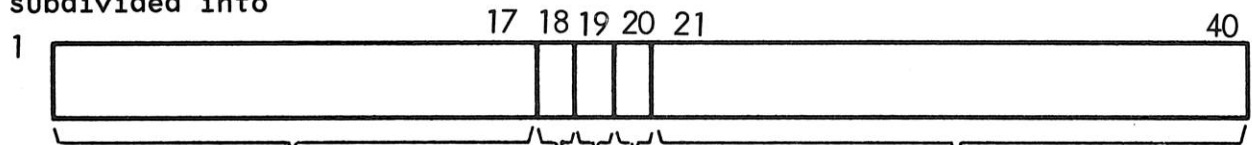
1st - 17th Character

a) For programming
   Indication corresponding to the
   programming

b) If not programmed, no indication, except
   error

18th Character

Transverse line

19th Character

E for error, as error lamp F
Clear with C key

20th Character

Transverse line

21th - 40 th Character

Numeric or alpha numeric indication
corresponding to FIFO, independently whether
programmed or not

automatically from system sequence as in FIFO,
in case of overflow running from left to
right.

If the FIFO of the basic machine is full and
the values were not picket through commands,
the values already keyed in the system line
remain on the Display, ie. always the lower
most 20 characters of the FIFO are
illustrated.

SET OF COMMANDS

OPEN

1	- 6	Command code 48
7	- 8	Device number g
9		Indirect addressing ia
10	- 16	Communication area vr (data memory)

With the command OPEN the Display is opened with the addressed device number g. The command OPEN sets the values to zero indicated for the position of the cursor in the communication area.

No values are illustrated on the screen but only blanks. The 18th and 20th character are illustrated only as a star.

In OPEN also the user area of the basic machine and the specifications are checked in the communication area.

As prerequisite for the processing of further Display commands (exception command (LOSE) OPEN marker will be set.

Independent of OPEN the system line is illustrated only so far no commands are needed.

Error possibilities

GA	Wrong OP code
GJ	User area exceeded
DC	Communication area wrongly assigned.

<u>BBS</u>   (Bring image memory)

1 - 6   Command code 52
7 - 8   Device number g
9 - 16   Free

With the command BBS the image memory is illustrated on the screen
according to the specifications defined in the communication area.

<u>Error possibilities:</u>

GA   Wrong OP code
DO   No OPEN programmed

<u>DIS</u>   (Illustrate on screen)

1 - 6	Error code 50
7 - 8	Device number g
9	Indirect addressing ia
10 - 16	Line on the screen 1 n 12 (or vr for ia = 1)
17	Indirect addressing ia
18 - 24	Position specification in the line (for all further lines)
25	Indirect addressing ia
26 - 32	Length specification L457 - (Line number - 1) x 40 - progr. pos. - Position x remaining line number (or vr for ia = 1)
33	Indirect addressing ia
34	Data/programme memory r
35 - 48	Byte address b (beginning of the field to be illustrated in the user memory)

The command DIS is used in order to indicate values from programme in
the system line in the column 1st - 18th character.

With the command DIS the field programmed in the length indicated is
illustrated on the screen in the line indicated starting from the
programmed position. The rest of the screen is preserved.

The image memory and the communication area are not affected by this.

The area system 18th - 40 character is a protected area.

<u>Error possibilites:</u>

GA	Wrong OP code
GJ	User area exceeded/CA wrongly assigned
DM	Line specification/length specification or position too big or image memory exceeded.
DO	No OPEN programmed

<u>PUT</u>   (Input on screen)

1 - 6	Command code 51
7 - 8	Device number g
9	Indirect addressing ia
10 - 17	Number of the characters (capacity) CP
18	Indirect addressing ia
19	Data/programme memory r
20 - 32	Byte address b

With the command PUT the data in the length indicated are input through the keyboard (ten keyboard or alpha keyboard), filed in the screen memory starting from the byte address indicated in the ISO 7 bit code in ascending address sequence and indicated on the screen.

The data are written starting from the byte address indicated.

The byte address must he within the image memory defined in the CA. With the help of the image beginning indicated in the CA the byte address specifies a position which is transferred as current cursor position in the CA. If the byte address lies beyond the image memory, an error is registered. If the byte address indicated is 0, the text is written starting from the position (position or cursor) defined in CA.

The contents of the screen (BWS) and of the image memory (BS) is overwritten with the characters indicated on the keyboard, whereas the cursor is shifted to the right side by one position for every new character.

If the line end or the last character of the line is reached, the cursor jumps to the beginning of the next line.

If the last line of the image area is reached, however not yet programmed input capacity, the command is terminated and marker 2 is set. Too many characters input are cleared from the FIFO. The input must always be terminated with an alpha start key also in case of fault. If the input is terminated with alpha start key 1, marker 1 is set and if the input is terminated with alpha start key 2, no marker is set.

With the command PUT the markers 1, 2 and 3 will automatically be cleared at first.

If the input is terminated with alpha start key 1 or 2 before reaching the programmed capacity, the remainder, is maintained on the screen (BWS) or in the image memory (BS) (is not filled with blanks).

Before actuating an alpha start key the entire input can be cleared with the C key. The command is repeated, i.e. the cursor is reset in the initial position and the characters already input is replaced. So far start keys for the cursor movement were determined in the communication area, the cursor can be moved upon actuating the corresponding keys, however, only within the area programmed in the command PUT. If the cursor strikes the limits, the keys have no longer effect. The current capacity always corresponds to the highest position; which was ever reached.

This value is also filed in auxiliary cell 1. If the keys Cursor Home or Screen Clear (in the CA) are allowed and depressed, the function is carried out and marker 3 is set.

The image memory (BS) is preserved. The current cursor position is entered in the CA upon terminating the command.

Additionally the data input in the system line from left to right are written, sequence as in the FIFO, rolling in case of everflow.

The length or capacity programmed in the command is for the number of the characters to be illustrated.

Error possibilities:

GA	Wrong OP code
GJ	User area exceeded
DM	Capacity too big or byte address beyond image memory
DO	No OPEN programmed

SEC   (Set cursor)

1 - 6   Command code 54
7 - 8   Device number g
9   Indirect addressing ia
10 - 16   Line on screen
17   Indirect addressing ia
18 - 24   Position in the line
25 - 32   Free (for magnifier, blinking, bright, dark etc.)

With the command SEC the cursor is positioned on the screen
according to the programming.
The corresponding position is entered in the communication area CA
and the entire line is currently illustrated on the image memory BS.

Error possibilities:

GA   Wrong OP code
DM   Line specification or position beyond image memory
DO   No OPEN programmed

DEL | Delete

1 - 6	Command code 57
7 - 8	Device number g
9	Indirect addressing ia
10 - 16	Line on screen
17	Indirect addressing ia
18 - 24	Position in the line (and all further lines)
25	Indirect addressing ia
26	Length specification

With the command DEL the field in the length indicated is deleted on the screen (BWS), in the programmed line starting from the programmed position.

The command DEL is programmed in order to clear a previously programmed DIS or parts of the DIS. The image memory (BS) is not changed.

The image is accordingly supplemented (corresponds to BSA) or the previous state is maintained again on the screen.

Error possibilities:

GA	Wrong OP code
GJ	User area exceeded
DM	Line specification, position of the length specification too big
DO	No OPEN programmed

CLOSE

1 - 6	Error code 56
7 - 8	Device number g
9 - 16	Free

With the Command CLOSE the Display quits with the device number g
and the image is cleared (BWS, BSA and BSB are cleared).
The image memory (BS) is preserved.
Internally the OPEN marker is reset.
Several CLOSE and CLOSE without OPEN are admissible.

Error possibilities:

GA   Wrong OP code

WID

1 - 6	Command code 53
7 - 8	Device number g
9 - 16	Free

With the command WAIT the command sequence (of the basic machine) is stopped so long till the device is addressed with the device g.

Error possibilities:

GA	Wrong OP code
DO	No OPEN programmed

BCZ   Bring cursor line

1 - 6   Command code 55
7 - 8   Device number g
9   Indirect addressing ia
10 - 16   Line on screen (or vr for ia = 1)

With the command BCZ the cursor line is currently ullustrated on the
programmed line on the screen (BWS) from the image memory BS.

Error possibilities:

GA   Wrong OP code
DM   Line specification beyond image memory
DO   No OPEN programmed

DISPLAY TA 22

Processing Levels

Background Level

- Interrogate CPRQ
- F2 Error indication
- Coupling on HP for CPRQ and
- Take over command code

Status: CPRDY

Main Level

Command Execution

- OPEN
- DIF
- BBS
- SEC
- BCZ
- DEL
- DIS
- PUT
- WAIT
- CLOSE

Status: CPRDY

Interrupt Level

TRAP – Clear FiFo
5.5 – Characters from keyboard
7.5 – Shift display field
6.5 – FiFo read from GM

Status: INT
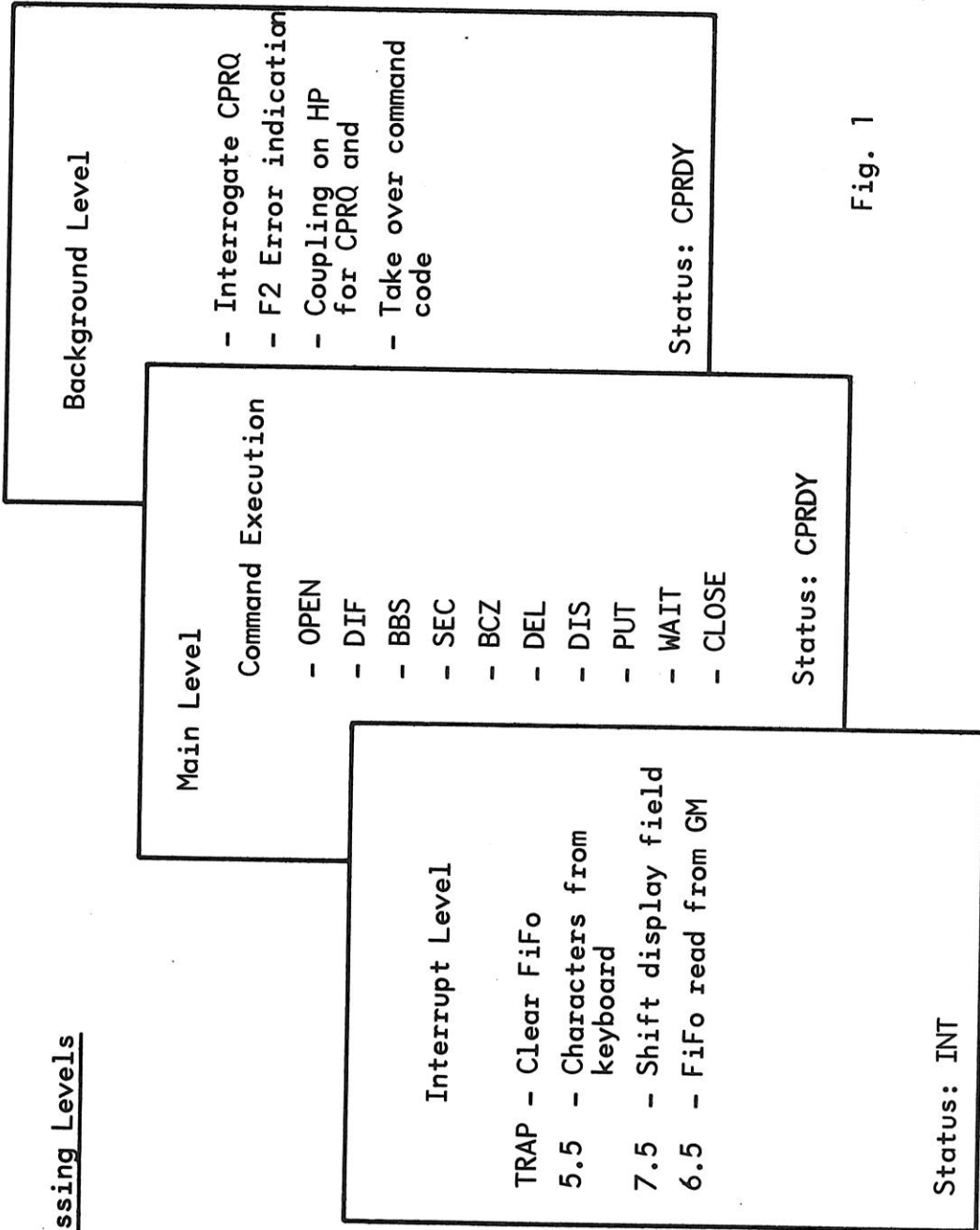
Fig. 1

ADDITION TO THE COMMANDS

MAK, WAK, ACP, ACS, ASL

Every keyboard input is illustrated on the screen (BWS) in the system line (line 12) in the field 21th - 40th character from left to right, sequence as in FIFO, rolling in case of overflow.

Special Fifo synchronous to basic machine Fifo.

Display TA 22

Definitions:

Simultaneous operation	:	The printer runs simultaneously to the programme sequence.
Cursor Home	:	Cursor goes into home position
Screen clear	:	Clear screen
BWS	:	Image repeat memory (screen)
BS	:	Image memory (central unit)
BSA	:	Main memory (I/O card)
BSB	:	Submemory (I/O card)
SZ	:	System line
BBS	:	Bring image memory
SEC	:	Set cursor
BCZ	:	Bring cursor line
DEL	:	Delete
DIS	:	Display on the screen
CPRDY?	:	Is I/O card SBAP 01 ready?
CPRQ	:	Is interrogation from GM whether I/O card ready?
ANW	:	Priority request for Interrupt on main processor

FUNCTION DESCRIPTION FOR DISPLAY TA 22

One interrogates in the switch routine whether the device head
micro (BAG 63) is available. If this is the case the Display commands
can be processed (see command list).
One can file with the command OPEN Display in the communication area,
where the image memory is located. The image memory is located in the
user area of the basic machine and needs max. 440 bytes.
The memory BSA (image main memory) and the BSB (image submemory) and
the BSB (image submemory) and the micro for processing of all Display
commands are located on the I/O card SPAP 01.
The information or data coming from the keyboard not only go into the
basic machine but at the same time in the FIFO of the I/O card.
On the I/O card the commands are precessed with the micro chips
BAZ 45-46-47, as follows: The commands MAK, WAK, ACP, ACS and ASL
are illustrated in the system line 21 up to 40 characters (BSA).
In case of overlauf the characters are taken over in the BSB.
With the commands BBS, SEC and BCZ data are taken over from BS into
the BSA. With the command DIS data are taken over from BS into BSB.

The contents of BSA and BSB are transferred with the commands BBS,
SEC, BCZ, DEL and DIS to the BWS of the Display through the Display
coupler.

In order to guarantee a perfect sequence of all units the individual
interrupt inquiry priorities are set. The I/O card of the Display
has the slightest priority in this sequence, this means, the interrupt
is treated as a last one by the basic machine in case of an interrupt
inquiry of the I/O card SBAP 01.

The highest priority has the I/O card of the Floppy unit.

The I/O card SBAP 01 works on three various processing levels:

1. The Interrupt level (state: INT)
   The CPU works on 4 various Interrupt levels.
   If the Interrupt TRAP comes into existence the FIFO is cleared.
   With Interrupt RST 5.5 characters are read from the keyboard, for
   RST 6.5 characters are read from the FIFO of the basic machine
   and for RST 7.5 the display field is shifted.

2. The main level (state: CPRDY)
   The execution of the commands is carried out on the main level
   (see command list).

3. The background level (state: CPRDY)
   On the background level

        a) CPRQ is interrogated
        b) F2 error indication
        c) Coupling on the main processor for CPRQ
        d) Command code takeover

The coupling of the I/O card on the basic machine is effected on the
programmable interface chip (8255) and the bus coupler.

I/O Card for Display TA 22
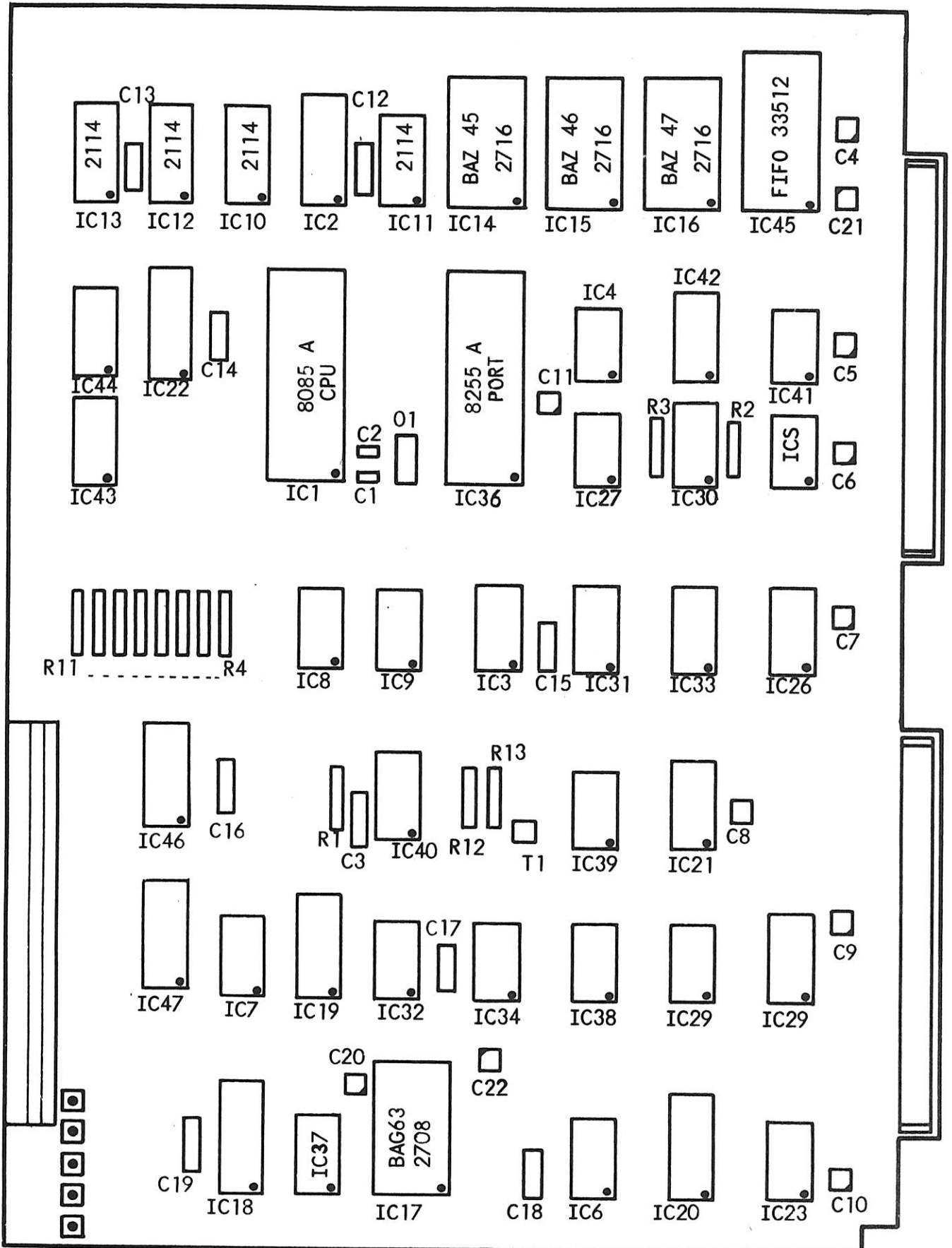
Display TA 22

Connection conditions

The following conditions must be fulfilled upon connecting a
Display (BJ00).

1. <u>Corr. micro:</u>   starting from BAZ 94 / 01
                                   BAZ 95 / 01

2. <u>Motherboard:</u>   BAA 03

3. <u>Logic board:</u>   BAB 02 starting from Pos. P
                  BAB 04 starting from Pos. C
                  BAB 06

4. <u>FDE I/O Card:</u>   BAH 02

5. <u>FDE-Micro:</u>   starting from BAZ 30 / 02
                                   BAZ 31 / 05
                                   BAZ 32 / 04
                                   BAZ 33 / 04
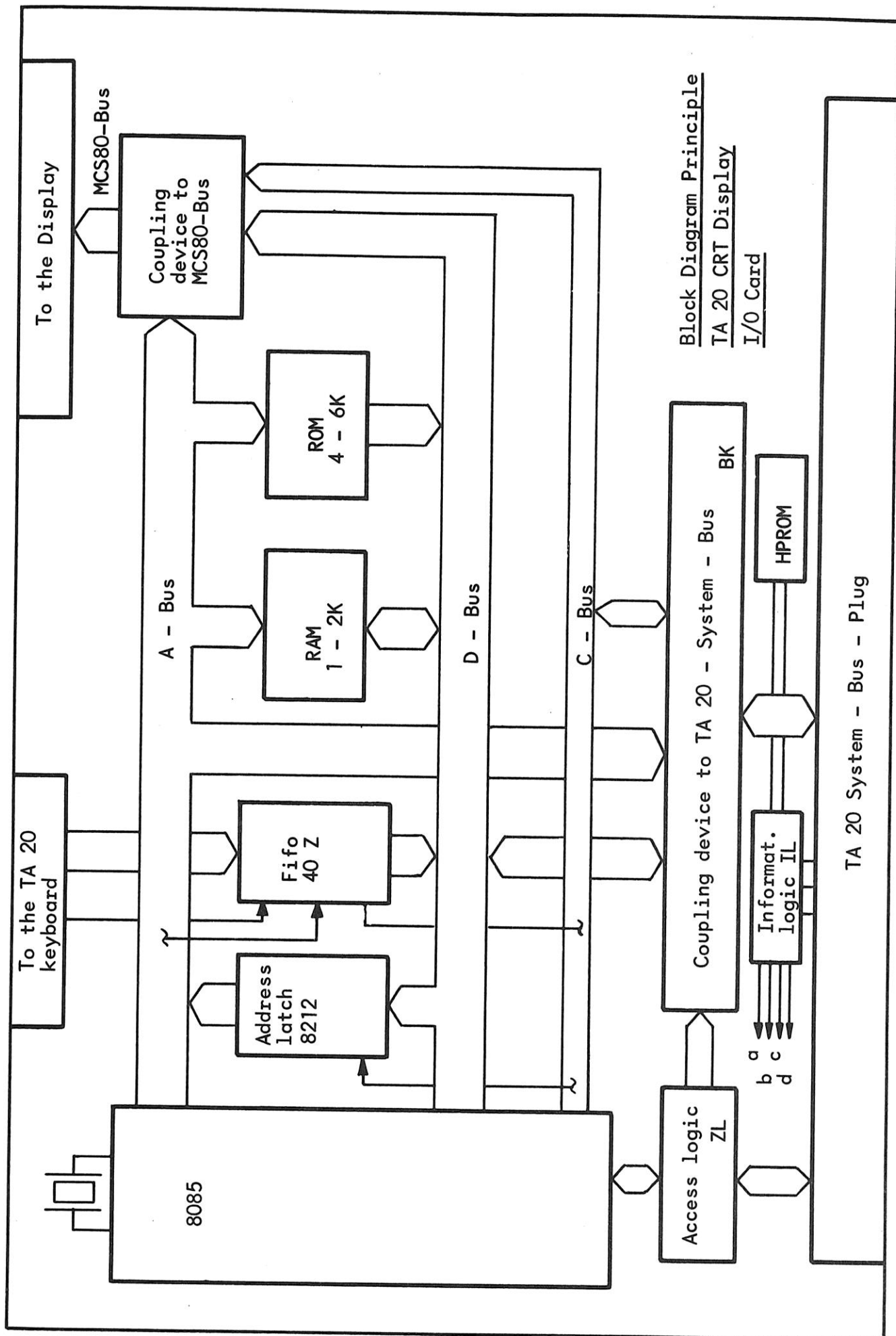
Block Diagram Principle

TA 20 CRT Display

I/O Card

Drucker 4
Printer 4
Imprimante 4

BDC 02

Geräetkabel BDG 01
Device cable BDG 01
Cable d'appareil BDG 01

Schlüsselschalter
Key switch
Contacteur de clef

Schlüsselschalter - Kabel BMG 03
Key switch cable BMG 03
Cable de contacteur de clef BMG 03

BDJ 01

Cable secteur

Entstörglied BMF 02
Interference suppressor BMF 02
Dispositif antiparasite BMF 02

Zur Verteilerplatte
To distribution board
A la plaque de distribution
BVB Ø1

Rahmen FDE
Chassis FDE
Chassis FDE

Display

AHA

Gerätekabel BAF 41
Device cable BAF 41
Cable d'appareil BAF 41

Geräetkabel BCD 02

Tastatur / Keyboard / Clavier

PET 4

Flachbandkabel
Flat cable
Cable plat

BAB 06

BAC 06

BAH 02

BAN 02

BAP 01

BAP 01 muß immer auf den
letzten Platz gesteckt werden.
(Wegen Zugentlastung)

BAP 01 must always be plugged
into the last slot.
(for cable retaining)

BAP 01 il faut toujours plonger
dans la place demière

Auf / On / Sur BAB 06

Gerätekabel BHA 02
Device cable BHA 02
Cable d'appareil BHA 02

PET 4

BCD 02
Device cable BCD
Cable d'appareil BCD

DFÜ
DFÜ
DFÜ

BKA 01

Gerätekabel
Device cable
Cable d'appareil

MODEM
(Schnittstelle
Interface
Interface
V24 / 28)

BAA 03

BAK 01

BDJ 01

Verteiler
Distributor
Distributeur

BAL 02

Netzkabel BDJ 01

Power cable

Netzkabel BDJ 01
Power cable BDJ 01
Cable secteur BDJ 01

BAM 01
Akku

Wird beim Betrieb ohne AEA in den
Verteiler BAJ 02 gesteckt.

On operation without AEA-plug
into BAJ 02 Distributor.

A L'opèration sans AEA-connecter
à Distributeur BAJ 02.

BML 01 AEA - Schaltgerät
AEA - Control unit
AEA - Dispositif de contrôle

Rahmen FDE
Chassis FDE
Chassis FDE

BMJ 01

Von Netzteil BVC Ø1
From power supply BVC Ø1
De l'Alimentation BVC Ø1

Netzkabel / Power cable / Cable secteur

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BLOCK DIAGRAM FOR DISPLAY I/O CARD SBAPO1

From the TA22 keyboard

Characters from keyboard

RST 5.5

CPU 8085

ALE

TRAP RST 7.5 RST 6.5

Clear FIFO

Shift display field

Read FIFO

from basic machine

Address latch

STB

SI

FIFO 40 characters

Strobe logic

RAM 2 KB

ROM 6 KB

Address bus

Daten – Bus

Control – Bus

Display coupler (CRT)

To Display

Decoder Logik

PPI (8255)
Programmable interface chip

IN   OUT

Bus – Coupler (BK)

Link
CPRDY

HPF2

FIFOGL

HLDA HOLD HPRDY

ANW

HRQ

Access logic (ZL)

HLDA HOLD HPRDY

Main processor data bus

Main processor ROM (HP–ROM) BAG 63 ((2708))

Decoder HP–ROM

Information logic (IL)

IOR IOW

Main processor – Control bus

Main processor – Address bus

TA 22 System-Bus

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