

\* SERVICE MANUAL \*

**TNC 351/355**

**Subject to Change/Further Developments**

DR. JOHANNES HEIDENHAIN is constantly working on technically improving its units. It is therefore possible that details of your Control may differ slightly from those described herein. If that is the case please order a suitably revised issue of the Service Manual.

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**1. How to use the TNC 351/355 Service Manual**

The TNC 351/355 Service Manual can be used for fault diagnosis, fault localisation and elimination of a TNC-controlled machine tool.

In order to determine the fault condition on an NC-machine, a fundamental knowledge of the machine and the servo amplifiers is necessary, as well as a knowledge of their interaction with the Control and measuring system. In addition, improper use of the Control, such as incorrect NC-programming or incorrect selection of machine parameters can lead to the occurrence of fault conditions. Further information in this respect can be found in the:

- .Machine Documentation of the Manufacturer
- .Service Manual
- .Handbook for the Machine Manufacturer

The handbook for the machine manufacturer is not enclosed with every control as the service manual.

It is generally only supplied to the machine manufacturer and is submitted to a "change service" by HEIDENHAIN, Traunreut. It is therefore absolutely necessary to consult the machine manufacturer in the case of errors concerning the machine parameters or the interface of the control. Support can also be obtained by the HEIDENHAIN service, Traunreut or by HEIDENHAIN agencies.

Telephone numbers or addresses and telex/telefax connections can be found on the inner side of the cover page and on the rear side of the service manual.



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## 2. Error Messages

The TNC 351/355 contains a comprehensive, integrated supervision system to avoid input or operating errors, to localize and diagnose faults of technical defects of the whole plant (TNC, measuring system, machine, cabling etc.).

The supervision system is a fix component of the TNC-hardware and software and is always operative when the control is switched on. The recognition of a technical defect or an operating error is displayed in plain language on the screen.

Insignificant error messages can be erased with the **[CE]**-key.

The error messages listed are described more precisely in the following instructions:

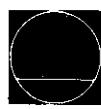
- Service Manual, section:

- TNC 355 Operating Manual

- Handbook for the machine manufacturer, resp.  
machine documentation of the manufacturer

- FE 401 Operating Instructions

|                                  | BA<br>FE | HM/<br>MD | OM | SI   |
|----------------------------------|----------|-----------|----|------|
| ADDRESS LETTER ALREADY ASSIGNED  |          |           | x  |      |
| SELECTED BLOCK NOT ADDRESSED     |          |           | x  |      |
| TOUCH POINT INACCESSIBLE         |          |           | x  | 10.2 |
| ARITHMETICAL ERROR               |          |           | x  |      |
| PATH OFFSET WRONGLY ENDED        |          |           |    |      |
| PATH OFFSET WRONGLY STARTED      |          |           | x  |      |
| OPERATION PARAMETERS ERASED      |          | x         |    | 2.1  |
| CC-BLOCK MISSING                 |          |           | x  |      |
| CYCL INCOMPLETE                  |          |           | x  |      |
| DATA MEDIUM MISSING              |          |           |    | 11.6 |
| DATA MEDIUM EMPTY                |          |           |    | 11.6 |
| DATA MEDIUM WRITE-PROTECTED      |          |           |    | 11.6 |
| PROGRAM INCOMPLETE               |          |           |    | 11.6 |
| BLK FORM DEFINITION INCORRECT    |          |           | x  |      |
| AXIS DOUBLE PROGRAMMED           |          |           | x  |      |
| PLANE WRONGLY DEFINED            |          |           | x  |      |
| FURTHER PROGRAM ENTRY IMPOSSIBLE |          |           | x  |      |
| ENTRY VALUE INCORRECT            |          |           | x  |      |
| LIMIT SWITCH X+                  |          | x         |    | 2.1  |
| LIMIT SWITCH X-                  |          | x         |    | 2.1  |
| LIMIT SWITCH Y+                  |          | x         |    | 2.1  |
| LIMIT SWITCH Y-                  |          | x         |    | 2.1  |
| LIMIT SWITCH Z+                  |          | x         |    | 2.1  |
| LIMIT SWITCH Z-                  |          | x         |    | 2.1  |
| LIMIT SWITCH AXIS IV +           |          | x         |    | 2.1  |
| LIMIT SWITCH AXIS IV -           |          | x         |    | 2.1  |
| LIMIT SWITCH AXIS V +            |          | x         |    | 2.1  |
| LIMIT SWITCH AXIS V -            |          | x         |    | 2.1  |



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|                               | BA<br>FE | HM/<br>MD | OM | SI   |
|-------------------------------|----------|-----------|----|------|
| ERR: 001                      | X        |           |    | 11.6 |
| ERR: 002                      | X        |           |    | 11.6 |
| ERR: 003                      | X        |           |    | 11.6 |
| ERR: 004                      | X        |           |    | 11.6 |
| ERR: 010                      | X        |           |    | 11.6 |
| ERR: 011                      | X        |           |    | 11.6 |
| ERR: 012                      | X        |           |    | 11.6 |
| ERR: 013                      | X        |           |    | 11.6 |
| ERR: 014                      | X        |           |    | 11.6 |
| ERR: 100                      | X        |           |    | 11.6 |
| ERR: 102                      | X        |           |    | 11.6 |
| ERR: 103                      | X        |           |    | 11.6 |
| ERR: 104                      | X        |           |    | 11.6 |
| ERR: 105                      | X        |           |    | 11.6 |
| ERR: 106                      | X        |           |    | 11.6 |
| ERR: 107                      | X        |           |    | 11.6 |
| ERR: 108                      | X        |           |    | 11.6 |
| EXT. IN-/OUTPUT NOT READY     |          |           |    | 11.6 |
| EMERGENCY-STOP                |          | X         |    | 14.3 |
| WRONG AXIS PROGRAMMED         |          |           | X  |      |
| WRONG OPERATING MODE          |          |           |    | 11.6 |
| WRONG RPM                     |          | X         |    |      |
| WRONG POCKET NR.              |          |           | X  |      |
| CHAMFER NOT PERMITTED         |          |           | X  |      |
| WRONG PROGRAM DATA            |          |           | X  | 11.6 |
| PROTECTED PGM                 |          |           | X  |      |
| G-CODE GROUP ALREADY ASSIGNED |          |           | X  |      |
| NO EDITING OF RUNNING PROGRAM |          |           | X  |      |
| CONTOUR PROGRAMMING ERROR     |          |           | X  |      |
| CONTOUR CANNOT BE PROCESSED   |          |           | X  |      |
| CONTOUR TOO COMPLEX           |          |           | X  |      |
| CIRCLE END POS. INCORRECT     |          |           | X  |      |
| CIRCLE CENTRE UNDEFINED       |          |           | X  |      |
| SHORT CURRENT INTERRUPTION    |          |           |    | 2.1  |
| LABEL NUMBER ALLOCATED        |          |           | X  |      |
| LABEL NUMBER NOT ALLOCATED    |          |           | X  |      |
| MACHINE PARAMETER INCOMPLETE  |          |           |    | 12.2 |
| N-CODE MISSING                |          |           | X  |      |
| ILLEGAL NC-BLOCK              |          |           | X  |      |
| SLOT WIDTH TOO LARGE          |          |           | X  |      |
| PGM-SECTION CANNOT BE SHOWN   |          |           | X  |      |
| PGM XXXXXXXX MISSING          |          |           | X  |      |
| POCKET Ø UNDEFINED            |          |           | X  |      |
| PLC: ERROR 0                  |          | X         |    |      |
| .                             |          | .         |    |      |
| .                             |          | .         |    |      |
| PLC: ERROR 99                 |          | X         |    |      |
| POSITIONING ERROR             |          | X         |    | 2.1  |
| PROGRAM NUMBER ALLOCATED      |          |           | X  |      |
| PROGRAM NUMBER UNAVAILABLE    |          |           | X  |      |
| PROGRAM MEMORY EXCEEDED       |          |           | X  |      |

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|                                | BA<br>FE | HM/<br>MD | OM | SI   |
|--------------------------------|----------|-----------|----|------|
| EXCHANGE BUFFER BATTERY        |          |           | X  | 5.5  |
| RADIUS COMP. UNDEFINED         |          |           | X  |      |
| ROUNDING-OFF UNDEFINED         |          |           | X  |      |
| ROUNDING-OFF NOT PERMITTED     |          |           | X  |      |
| ROUNDING RADIUS TOO LARGE      |          |           | X  |      |
| BLOCK FORMAT INCORRECT         |          |           | X  |      |
| BLOCK NUMBER ALREADY ALLOCATED |          |           | X  |      |
| BLOCK TOO LONG                 |          |           | X  |      |
| SPINDLE ROTATES MISSING        |          |           | X  |      |
| JUMP TO LABEL Ø NOT PERMITTED  |          |           | X  |      |
| RELAY TOT. DC VOLTAGE MISSING  |          | X         |    | 14.3 |
| POWER INTERRUPTED              |          | X         |    | 14.3 |
| SEARCH ADDRESS MISSING         |          |           | X  |      |
| KEY NON FUNCTIONAL             |          | X         |    |      |
| EXCHANGE TOUCH PROBE BATTERY   |          |           | X  | 10.2 |
| STYLUS ALREADY IN CONTACT      |          |           | X  | 10.2 |
| PROBE SYSTEM NOT READY         |          |           | X  | 10.2 |
| TOOL CALL MISSING              |          |           | X  |      |
| TOOL DEF MISSING               |          |           | X  |      |
| TOOL DEF Ø NOT PERMITTED       |          |           | X  |      |
| ILLEGAL G-CODE                 |          |           | X  |      |
| PROGRAM-START UNDEFINED        |          |           | X  |      |
| WRONG SIGN PROGRAMMED          |          |           | X  |      |
| MIRROR IMAGE ON TOOL AXIS      |          |           | X  |      |
| TOOL NUMBER ALLOCATED          |          |           | X  |      |
| TOOL RADIUS TOO LARGE          |          |           | X  |      |
| ANGLE REFERENCE MISSING        |          |           | X  |      |
| EXCESSIVE SUBPROGRAMMING       |          |           | X  |      |
| TOO MANY USER PARAMETER        |          | X         |    |      |
| EXCESSIVE SUBCONTOURS          |          |           | X  |      |
| TWO TOOL DEF XXX WITH PGM CALL |          |           | X  |      |
| 3D-INTERPOLATION NOT PERMITTED |          |           | X  |      |

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**2.1 Possible Causes for Error Messages**

**OPERATING PARAMETERS ERASED**

- The machine parameters are principally erased with new units and exchange units.
- Software exchange with different software updates
- Buffer batteries and rechargeable NiCd batteries defective
- RAM-error on PROCESSOR Board

**LIMIT SWITCH X+**

(e.g.)

- "Manual" operating mode  
When traversing with directional keys the adjusted software limit switch or the additional limitation in the auxiliary operating modes was reached.
- "Automatic" operating mode  
The positioning path calculated with the current block lies out of the software limit switch or out of the additional limitation. The positioning is not carried out.

Machine parameters for software limit switches

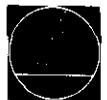
|       |       |       |       |       |       |       |       |        |        |
|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| MP 44 | MP 45 | MP 46 | MP 47 | MP 48 | MP 49 | MP 50 | MP 51 | MP 325 | MP 326 |
| X+    | X-    | Y+    | Y-    | Z+    | Z-    | IV+   | IV-   | V+     | V-     |

**SHORT CURRENT INTERRUPTION**

- Short collapse of supply to TNC (approx. 120 - 150 ms)
- Important machine parameters were changed; e.g. MP 12, MP 20, MP 60, MP 72, MP 90, MP 170, MP 184, MP 217, MP 236 etc.

**POSITIONING ERROR**

- The position supervision entered in machine parameter 56 or 175 is effective (control approach behaviour of axis, optimize again, if required).



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### 3. Fault Messages and their Causes

The integrated supervision system differentiates between insignificant and significant errors. Significant errors are displayed with a **flashing display** (e.g. erroneous functions of linear transducers, drives and errors in data processing).

The control opens the contact "Control ready" in the case of significant errors. This results in a **EMERGENCY-STOP** of the machine.

The state "EMERGENCY-STOP" can only be eliminated again by switching off the main switch provided that the error cause was eliminated before.

| Flashing display       |   | Possible fault cause             |
|------------------------|---|----------------------------------|
| FAULTY DATA PROCESSING | 0 | PROCESSOR Board                  |
| "                      | 1 | " "                              |
| "                      | 2 | " "                              |
| "                      | 3 | " "                              |
| "                      | 4 | " "                              |
| "                      | A | " "                              |
| "                      | B | CLP PROCESSOR Board              |
| "                      | C | " "                              |
| "                      | D | " "                              |
| "                      | E | PROCESSOR or CLP PROCESSOR Board |
| "                      | F | " " " "                          |
| "                      | G | CLP PROCESSOR Board              |
| "                      | H | PROCESSOR Board                  |
| "                      | I | " "                              |
| "                      | K | " "                              |
| "                      | L | Machine Parameter *              |

\* Enable (selection) of a function via machine parameters which are not integrated in the software.

If the error message "FAULTY DATA PROCESSING" (= identification letter, see above!) occurs repeatedly return the compl. LOGIC UNIT to HEIDENHAIN for repair. Indicate also the error message and the identification letter.

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| Flashing display                  | Fault cause  |
|-----------------------------------|--|
| <b>ERROR IN PLC-PROGRAM .....</b> | Fault with non-erasable marker<br>(see also PLC-Description)                     |
| " " " A                           | Start Key<br>or incremental positioning X+                                       |
| " " " B                           | Rapid Traverse Key<br>or incremental positioning X-                              |
| " " " C                           | Direction Latch Key<br>or incremental positioning Y+                             |
| " " " D                           | Feed Release<br>or incremental positioning Y-                                    |
| " " " E                           | Start PLC Positioning X-axis<br>or incremental positioning Z+                    |
| " " " F                           | Start PLC Positioning Y-axis<br>or incremental positioning Z-                    |
| " " " G                           | Start PLC Positioning Z-axis<br>or incremental positioning IV+                   |
| " " " H                           | Start PLC Positioning IV-axis<br>or incremental positioning IV-                  |
| " " " I                           | Directional key X+<br>or incremental positioning V+                              |
| " " " J                           | Directional key X-<br>or incremental positioning V-                              |
| " " " K                           | Directional key Y+<br>or start-PLC-positioning axis V                            |
| " " " L                           | Directional key Y-   |
| " " " M                           | Directional key Z+<br>or directional key V+                                      |
| " " " N                           | Directional key Z-<br>or directional key V-                                      |
| " " " O                           | Directional key IV+<br>or supplementary axis to be changed<br>to M2590 and M2591 |
| " " " P                           | Directional Key IV-<br>or Start PLC Positioning S-axis                           |
| " " " Q                           | Non-defined macro called up via PLC markers                                      |

Possible location of fault:

PLC Program, PROCESSOR Board, PL 300 (PLC POWER I/O Board Assembly), external  
keys, switch or wiring

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| Flashing display          | Fault cause   |
|---------------------------|---|
| GROSS POSITIONING ERROR A | <p><b>Position (trailing error) supervision</b></p> <ul style="list-style-type: none"> <li>- Speed precontrol operation: Exceeding position supervision determined by machine parameter 57.</li> <li>- Trailing error operation: Exceeding trailing error supervision determined by machine parameter 174.</li> </ul>   |
| GROSS POSITIONING ERROR B | <p><b>Supervision of analog voltage limit</b></p> <ul style="list-style-type: none"> <li>- The nominal value of the voltage calculated by the control reached the <math>\pm 10</math> volt limit (only with speed precontrol).</li> </ul>   |
| GROSS POSITIONING ERROR C | <p><b>Movement supervision</b></p> <ul style="list-style-type: none"> <li>- The voltage difference calculated by the control reached the limit programmed in machine parameter 234.</li> </ul>  |
| GROSS POSITIONING ERROR D | <p><b>Standstill supervision</b></p> <ul style="list-style-type: none"> <li>- The position deviation from the nominal position of an axis at standstill is greater than programmed in machine parameter 169.</li> <li>- When positioning beyond the target point programmed the value of the nominal position is greater than programmed in machine parameter 169.</li> </ul> |
| GROSS POSITIONING ERROR E | <p><b>Supervision of offset voltage</b></p> <ul style="list-style-type: none"> <li>- The offset voltage limit of 100 mV was reached with an automatic offset adjustment by machine parameter 252.</li> </ul>  |

Possible location of error with the error message "GROSS POSITIONING ERROR A/B/C/D/E": With "Gross Positioning Error" the error can be due to any component of the closed loop.

- e.g.:
- control error (e.g. CLP PROCESSOR Board)
  - excessive offset voltage at servo amplifier
  - wrong speed adjustment at servo amplifier
  - supervision of servo amplifier is effective (e.g. current supervision)
  - electrical defect of servo amplifier
  - motor defective, tacho, measuring system or cabling
  - mechanical defect (bearing, spindle or guidance error)
  - excessive mechanical forces on drive



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Flashing display

Fault cause

TRANSDUCER X DEFECTIVE A

|   |    |   |   |
|---|----|---|---|
| " | Y  | " | A |
| " | Z  | " | A |
| " | IV | " | A |
| " | V  | " | A |

Fault code: A = signal amplitude fault  
B = signal frequency fault  
- Measuring system not connected  
- Cable damaged  
- Glass scale dirty or damaged  
- Scanning head damaged  
- Measuring system supervision defective  
(CLP PROCESSOR Board)

TRANSDUCER X DEFECTIVE B

|   |    |   |   |
|---|----|---|---|
| " | Y  | " | B |
| " | Z  | " | B |
| " | IV | " | B |
| " | V  | " | B |

Supervision of measuring systems, see section 8.3

WRONG REFERENCE POINT

Wrong distance of reference mark with transducers having distance-coded reference marks (counting error caused by measuring system or LOGIC Unit).

TNC OPERATING TEMP. EXCEEDED

Temperature in the inner side of the LOGIC Unit greater than +65°C.

EMERGENCY STOP DEFECTIVE

- Fault with the supervision routine for the output "Control Ready" when switching on machine (see section 14.3).

EMERGENCY STOP PLC

The error message only appears if marker 2815 is set without additional markers (M2924 - M3023).

PLC: ERROR 00

1)

Marker 2924

PLC: ERROR 99

1)

Marker 3023

to and marker 2815 was set

1) Instead of PLC: ERROR 00 ... 99, also another dialog may appear with a customized PLC-program. Detailed information can be obtained from the machine manufacturer.

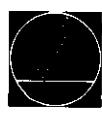


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| Flashing display            | Fault cause                               | Possible fault location |
|-----------------------------|---|-------------------------|
|                             | X X Ø Ø CRC-checksum *                    |                         |
|                             | └ location of fault<br>└ correct checksum |                         |
| <b>CHECK-SUM ERROR XX00</b> | CRC-checksum error with EPROM 3           | PROCESSOR Board         |
| " " XX10                    | " " 4                                     | " "                     |
| " " XX20                    | " " 5                                     | " "                     |
| " " XX30                    | " " 6                                     | " "                     |
| " " XX31                    | " " 6                                     | " "                     |
| " " XX40                    | " " 2                                     | CLP PROCESSOR Board     |
| " " XX42                    | " " 2                                     | " "                     |
| " " XX41                    | " RAM                                     | " "                     |
| " " XX43                    | "   | " "                     |
| " " XXE9                    | "   | PROCESSOR Board         |
| " " XXEA                    | "   | " "                     |

\* CRC = Cyclic Redundancy Check (cyclic block check when data is transmitted)

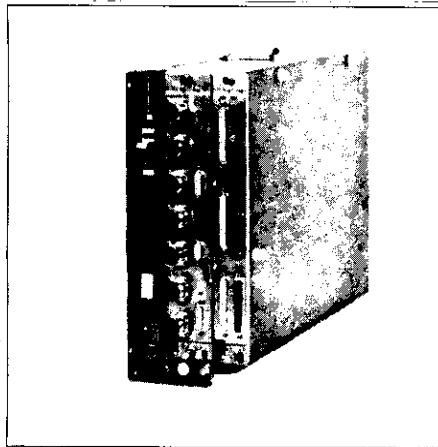
If the error message "CHECKSUM ERROR XXXX" occurs repeatedly return the compl. LOGIC UNIT for repair and indicate the checksum error.



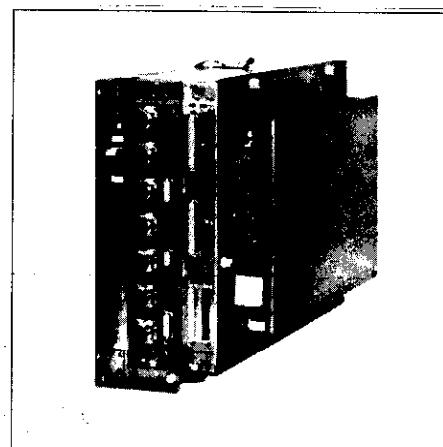
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## 4. LOGIC Unit LE 351/355

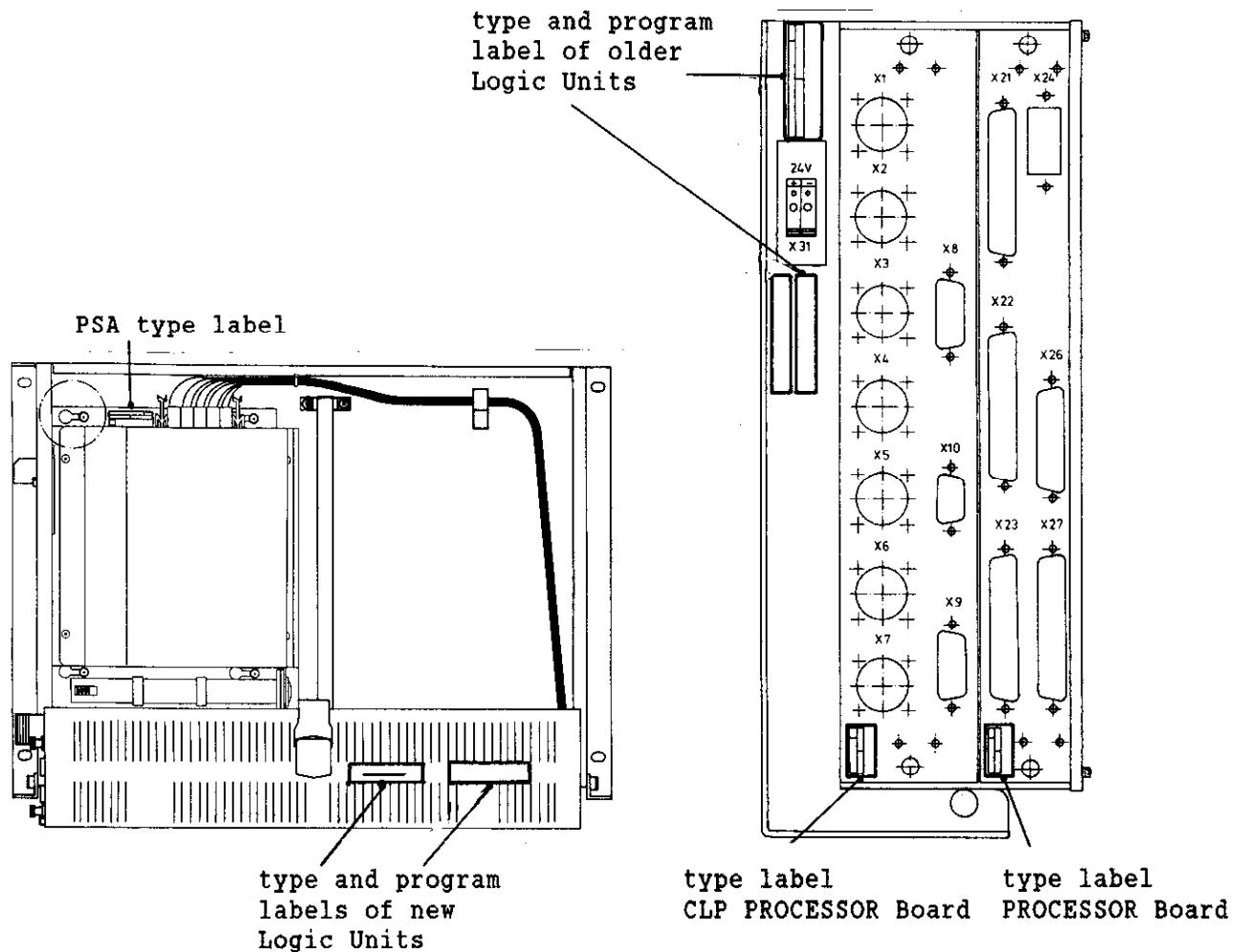
Logic Unit without  
PLC Power I/O Board Assembly (PL 300)



Logic Board with PLC Power  
I/O Board Assembly (PL 300)



### 4.1 Designation of the LOGIC Unit





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**4.2 Hardware components of the LOGIC UNIT**

The LOGIC UNIT consists of the following assemblies:

- POWER SUPPLY ASSEMBLY
- PLC PROCESSOR Board
- PROCESSOR Board
- PL 300 (= PLC-Power Supply Board, only with Q/W/S/Y-Version)

The following tables show the inserted assemblies for the various LOGIC UNITS.

**4.2.1 TNC 355 Assembly Overview, new Hardware Version  
(connecting sockets marked with colours)**

| Logic Unit<br>Assembly | TNC 355 (IV) + S         |                          | TNC 355 (V) + S          |                          |                            |                            |
|------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|----------------------------|
|                        | LE 355 B/F<br>254 581 .. | LE 355 Q/W<br>254 582 .. | LE 355 C/G<br>254 819 .. | LE 355 S/Y<br>254 820 .. | LE 355 CR/GR<br>249 516 .. | LE 355 SR/YR<br>249 517 .. |

PROCESSOR BOARD

|            |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|
| 249 652 .. | x | x | x | x | x | x |
|------------|---|---|---|---|---|---|

CLP PROCESSOR BOARD

|            |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|
| 249 663 .. |   |   | x | x |   |   |
| 249 820 .. |   |   |   |   | x | x |
| 249 823 .. | x | x |   |   |   |   |

POWER SUPPLY ASSEMBLY

|            |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|
| 236 484 07 | x | x | x | x | x | x |
|------------|---|---|---|---|---|---|

PL 300

|            |  |   |  |   |  |   |
|------------|--|---|--|---|--|---|
| 237 659 .. |  | x |  | x |  | x |
|------------|--|---|--|---|--|---|



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**4.2.2 TNC 351/355 Assembly Overview,  
old Hardware Version**

| Logic Unit | TNC 351                  | CNC 332                 | TNC 355 (IV) + S         |                          | TNC 355 (V)              |                          | TNC 355 (V) + S          |                          |
|------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Assemblies | LE 351 B/F<br>243 992 .. | LE 355 /E<br>236 482 .. | LE 355 B/F<br>237 660 .. | LE 355 Q/W<br>238 324 .. | LE 355 B/F<br>242 408 .. | LE 355 Q/W<br>242 407 .. | LE 355 C/G<br>246 813 .. | LE 355 S/Y<br>248 055 .. |

PROCESSOR BOARD

|            |   |   |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|---|---|
| 235 635 .. |   | x |   |   |   |   |   |   |
| 237 930 .. | x |   | x | x | x | x | x | x |

CLP PROCESSOR BOARD

|            |   |   |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|---|---|
| 235 769 .. |   | x |   |   |   |   |   |   |
| 238 289 .. |   |   | x | x |   |   |   |   |
| 239 863 .. |   |   |   |   | x | x |   |   |
| 242 878 .. | x |   |   |   |   |   |   |   |
| 245 922 .. |   |   |   |   |   |   | x | x |

POWER SUPPLY ASSEMBLY

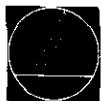
|            |   |   |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|---|---|
| 236 484 02 |   | x | x | x | x | x |   |   |
| " 04       | x |   |   |   |   |   |   |   |
| " 07       |   | * | * | * |   |   | x | x |

PL 300

|            |  |  |  |   |  |  |   |  |   |
|------------|--|--|--|---|--|--|---|--|---|
| 237 659 .. |  |  |  | x |  |  | x |  | x |
|------------|--|--|--|---|--|--|---|--|---|

x = from first delivery

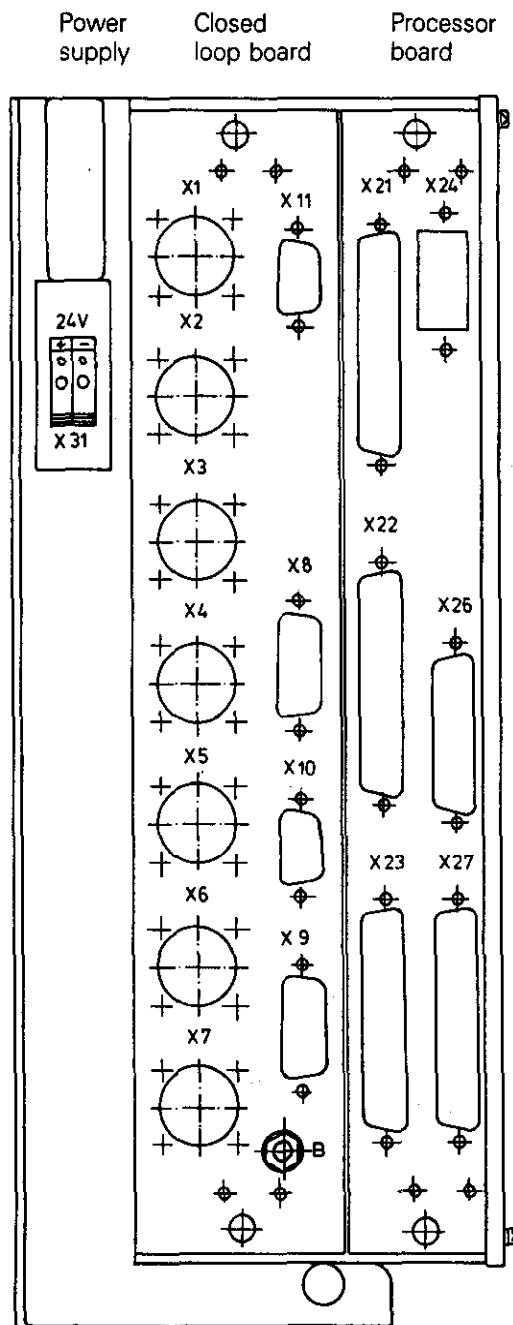
\* = from production code K7 (7/89)



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**4.3 LE 351/355 connector layout**

**4.3.1 Connector layout of LE 351/355 B/F/Q/W LOGIC UNITS**



**Closed loop:**

X1 = Encoder 1

X2 = Encoder 2

X3 = Encoder 3

X4 = Encoder 4

X5 = Encoder 5

X6 = Electronic handwheel HR 150/HR 250

X7 = Touch probe system

X8 = Nominal value output for X, Y, Z, IV, S (V)

Red

X9 = Visual display unit BE 412B

Blue

X10 = Reference pulse inhibitor

Yellow

X11 = Test I/O 1)

Red

S = Signal ground

**Processor:**

X21 = PLC-output

Red

X22 = PLC-input

Yellow

X23 = Keyboard unit TE 355

Blue

X24 = Power supply 24 V- for PLC

Red

X26 = Data interface RS-232-C/V.24

Red

X27 = Machine operating panel

Green

**Power supply:**

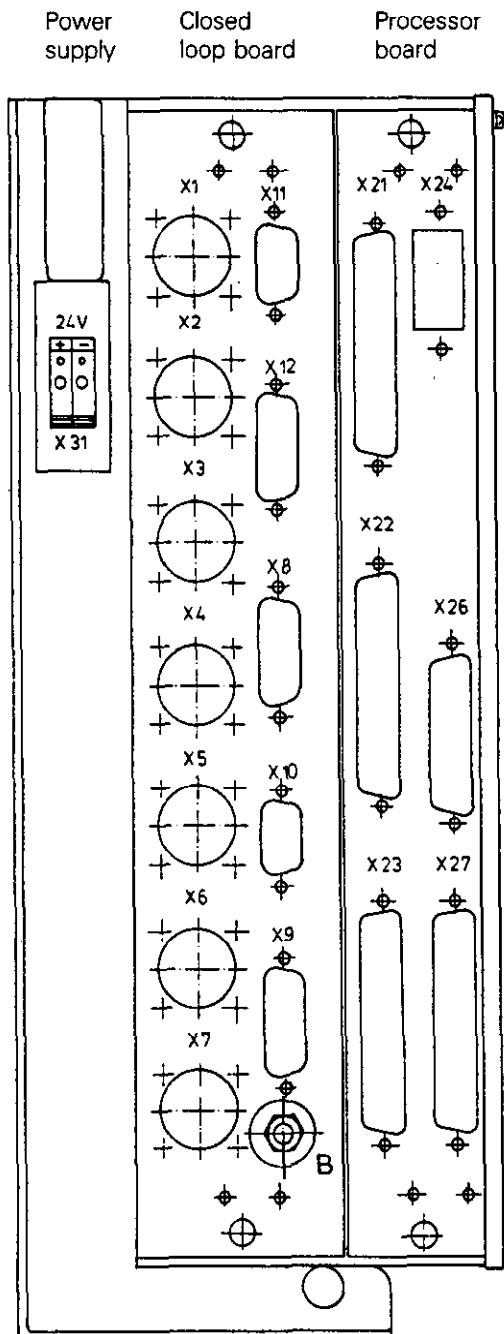
X31 = Power supply 24 V- for LE

<sup>1)</sup> only with Logic Units from 9/89



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4.3.2 Connector layout of LE 355 C/G/S/Y LOGIC UNITS



**Closed loop:**

X1 = Encoder 1  
X2 = Encoder 2  
X3 = Encoder 3  
X4 = Encoder 4  
X5 = Encoder 5  
X6 = Encoder S

} Standard allocation  
(switchover via machine  
parameters 253 ... 257)

X7 = Electronic handwheel HR 150/HR 250

X8 = Nominal value output for X, Y, Z, IV, V, S Red

X9 = Visual display unit BE 412B Blue

X10 = Reference pulse inhibitor Yellow

X11 = Handwheel with axis selection keys 1) Red

X12 = Touch probe system TS 120 (TS 111/511) Yellow

B = Operational ground

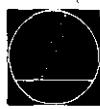
**Processor:**

X21 = PLC-output Red  
X22 = PLC-input Yellow  
X23 = Keyboard unit TE 355 Blue  
X24 = Power supply 24 V- for PLC  
X26 = Data interface RS-232-C/V.24 Red  
X27 = Machine operating panel Green

**Power supply:**

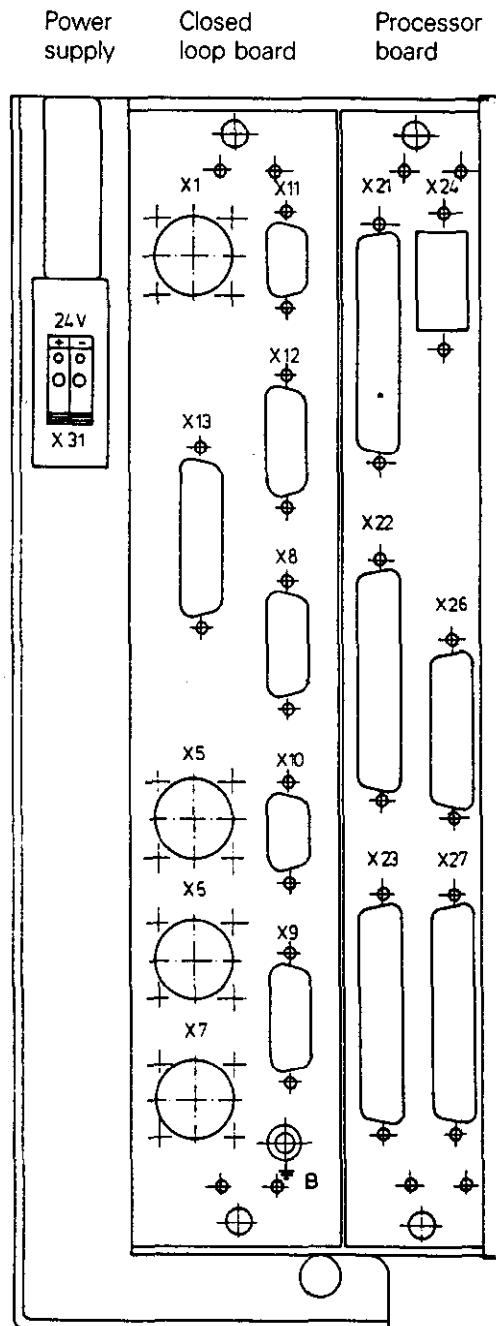
X31 = Power supply 24 V- for LE

<sup>1)</sup> only with Logic Units from 9/89



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4.3.3 Connector layout of LE 355.R LOGIC UNITS



**Closed loop:**

|   | Color code |
|---|------------|
| X1 = Encoder 1                                  |            |
| X13 = Encoder 2, 3, 4                           | Blue       |
| X5 = Encoder 5                                  |            |
| X6 = Encoder S                                  |            |
| X7 = Electronic handwheel HR 150/HR 250         |            |
| X8 = Nominal value output for X, Y, Z, IV, V, S | Red        |
| X9 = Visual display unit BE 412B                | Blue       |
| X10 = Reference pulse inhibitor                 | Yellow     |
| X11 = Handwheel with axis selection keys        | Red        |
| X12 = Touch probe system TS 120 (TS 111/511)    | Yellow     |
| B = Operational ground                          |            |

**Processor:**

|                                    |        |
|------------------------------------|--------|
| X21 = PLC-output                   | Red    |
| X22 = PLC-input                    | Yellow |
| X23 = TNC-keyboard unit TE 355     | Blue   |
| X24 = Power supply 24 V- for PLC   |        |
| X26 = Data interface RS-232-C/V.24 | Red    |
| X27 = Machine operating panel      | Green  |

**Power supply:**

X31 = Power supply 24 V- for LE



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4.3.4 Connector layout of the TNC 351/355 B/F/Q/W CLP PROCESSOR Board

X1,X2,X3,X4 encoder input 1, 2, 3, 4  
Sine signal input  
Flanged socket with 9-pin female insert

| Signal designation               | Connection no. |
|----------------------------------|----------------|
| 0°+                              | 1              |
| 0°-                              | 2              |
| 90°+                             | 5              |
| 90°-                             | 6              |
| RI+                              | 7              |
| RI-                              | 8              |
| +5 V (U <sub>p</sub> )           | 3              |
| 0 V (U <sub>N</sub> )            | 4              |
| Inner shield                     | 9              |
| Outer shield = connector housing |                |

X5 encoder input 5  
Square-wave signal input

Flanged socket with 12-pin female insert

| Signal designation           | Connection no. |
|------------------------------|----------------|
| U <sub>a</sub> 1             | 5              |
| U <sub>a</sub> 1             | 6              |
| U <sub>a</sub> 2             | 8              |
| U <sub>a</sub> 2             | 1              |
| U <sub>a</sub> 0             | 3              |
| U <sub>a</sub> 0             | 4              |
| U <sub>a</sub> S not present | -              |
| U <sub>a</sub> S             | 7              |
| +5 V (sensor line)*          | 2              |
| +5 V (U <sub>p</sub> )       | 12             |
| 0 V (sensor line)*           | 11             |
| 0 V (U <sub>N</sub> )        | 10             |
| Shield = housing             | 9 (via spring) |

\* The sensor line is connected in the unit with the pertinent supply line.

X6 Electronic Handwheel HR 150/250

| Signal designation               | Connection no.    |
|----------------------------------|-------------------|
| 0°+                              | 1                 |
| 0°-                              | 2                 |
| 90°+                             | 5                 |
| 90°-                             | 6                 |
| +5 V (U <sub>p</sub> )           | 3                 |
| 0 V (U <sub>N</sub> )            | 4                 |
| Inner shield (0 volt)            | 9                 |
| Outer shield = connector housing | 7,8 do not assign |

X7 Touch Probe System

Flanged socket with 7-pin flanged socket

| Signal designation             | Connection no.    |
|--------------------------------|-------------------|
| U <sub>N</sub>                 | 1                 |
| U <sub>p</sub>                 | 2                 |
| Start                          | 3                 |
| Trigger signal                 | 4                 |
| Standby signal                 | 5                 |
| Battery warning                | 6                 |
| Inner shield (U <sub>N</sub> ) | 7                 |
| Outer shield                   | connector housing |

X8 nominal value output for X,Y,Z,IV,V\*,S

Flanged socket with 15-pin female insert

| Signal designation               | Anschluß-Nr.                 |
|----------------------------------|------------------------------|
| Analog output of X-axis          | 1                            |
| Analog output of Y-axis          | 3                            |
| Analog output of Z-axis          | 5                            |
| Analog out. of IVth-axis         | 7                            |
| Analog output of Vth-axis        | 4 *                          |
| Analog output of S-axis          | 8                            |
| 0V X-axis                        | 9                            |
| 0V Y-axis                        | 11                           |
| 0V Z-axis                        | 13                           |
| 0V IVth-axis                     | 14                           |
| 0V Vth-axis                      | 6 *                          |
| 0V S-axis                        | 15                           |
| Outer shield = connector housing | 2,4,6,10,12<br>do not assign |

\* only with 5-axes controls

X9 BE 412 Visual Display Unit

Flanged socket with 15-pin female insert

| Signal designation               | Anschluß-Nr.                  |
|----------------------------------|-------------------------------|
| 0 V                              | 1,8,11                        |
| V SYNC                           | 9                             |
| H SYNC                           | 10                            |
| BRIGHT/DARK                      | 12                            |
| VIDEO                            | 13                            |
| Outer shield = connector housing | 3 to 6,14,15<br>do not assign |

X10 reference pulse inhibit

Flanged socket with 9-pin female insert

| Signal designation    | Connection no. |
|-----------------------|----------------|
| Shield                | 1              |
| Ref. pulse inhibit X1 | 2              |
| Ref. pulse inhibit X2 | 3              |
| Ref. pulse inhibit X3 | 4              |
| Ref. pulse inhibit X4 | 5              |
| Ref. pulse inhibit X5 | 6              |
| +24 V (PLC)*          | 8              |
| 0 V (PLC)             | 9              |

7 do not assign

\* only with LE 351, id.no. 243 992 ...  
LE 355, id.no. 237 660..., 238 324...  
242 407 ..., 242 408 ..



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4.3.5 Connector layouts for LE 355 C/G/S/Y/.R CLP PROCESSOR BOARD

X1, X2, X3, X4 encoder input 1, 2, 3, 4

see page 16 X1, X2, X3, X4

X5, X6 encoder input 5, 6  
square-wave input

see page 16 X5

X7 HR 150/250 Electronic Handwheel

see page 16 X6

X8 nominal value output for X, Y, Z, IV, V, S

see page 16 X8

X9 BE 412 Visual Display Unit

see page 16 X9

X10 reference pulse inhibit

see page 16 X10

X11 Handwheel with axis switch-over keys

Flanged socket with 9-pin female/male insert

| Signal designation | Connection no. |
|--------------------|----------------|
| 0V                 | 2              |
| +5V                | 3              |
| +12V               | 4              |
| -15V               | 5              |
| DTR                | 6              |
| RxD                | 7              |
| Do not assign      | 1, 8, 9        |

X12 TS120 Touch Probe System (TS 111/TS 511  
only via cable adapter)

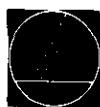
Flanged socket with 15-pin female/male insert

| Signal designation           | Connection no. |
|------------------------------|----------------|
| 0V-shield                    | 1              |
| Standby signal               | 3              |
| Start                        | 4              |
| +15V                         | 5              |
| +15V (Up)                    | 6              |
| Battery warning              | 7              |
| 0V (UN)                      | 8              |
| Trigger signal               | 9              |
| Trigger signal <sup>2)</sup> | 10             |
| Do not assign                | 2, 11 to 15    |

X13 encoder 2, 3, 4 with square-wave signal  
input

Flanged socket with 25-pin female insert

| Signal designation | Connection no. |
|--------------------|----------------|
| Ua1                | 1              |
| Ua2                | 2              |
| Uae                | 3              |
| Uas                | 4              |
| Ua1                | 14             |
| Ua2                | 15             |
| Uae                | 16             |
| 0V                 | 17             |
| Ua1                | 5              |
| Ua2                | 6              |
| Uae                | 7              |
| Uas                | 8              |
| Ua1                | 18             |
| Ua2                | 19             |
| Uae                | 20             |
| 0V                 | 21             |
| Ua1                | 9              |
| Ua2                | 10             |
| Uae                | 11             |
| Uas                | 12             |
| Ua1                | 22             |
| Ua2                | 23             |
| Uae                | 24             |
| 0V                 | 25             |
| Do not assign      | 13             |
| Outer shield       | housing        |



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**4.3.6 Connector layout of PROCESSOR BOARD**

**X21 PLC-output**

Flange socket, female (37-pole)

| Contact No. | Allocation  |
|-------------|---|
| 1           | A0 <sup>3)</sup>  |
| 2           | A1 <sup>3)</sup>  |
| 3           | A2 <sup>3)</sup>  |
| 4           | A3 <sup>3)</sup>  |
| 5           | A4 <sup>3)</sup>  |
| 6           | A5 <sup>3)</sup>  |
| 7           | A6 <sup>3)</sup>  |
| 8           | A7 <sup>3)</sup>  |
| 9           | A8  |
| 10          | A9  |
| 11          | A10   |
| 12          | A11   |
| 13          | A12   |
| 14          | A13   |
| 15          | A14   |
| 16          | A15   |
| 17          | A16   |
| 18          | A17   |
| 19          | A18   |
| 20          | A19   |
| 21          | A20   |
| 22          | A21   |
| 23          | A22   |
| 24          | A23   |
| 25          | A24 <sup>2)</sup>   |
| 26          | A25 <sup>2)</sup>   |
| 27          | A26 <sup>2)</sup>   |
| 28          | A27 <sup>2)</sup>   |
| 29          | A28 <sup>2)</sup>   |
| 30          | A29 <sup>2)</sup>   |
| 31          | A30 <sup>2)</sup>   |
| 32, 33      | do not assign   |
| 34          | Control operational   |
| 35, 36, 37  | 24 V via external EMERGENCY STOP<br>disconnectible (PLC <sup>1)</sup> ) |
| Housing     | External screen   |

<sup>1)</sup> If required, the supply voltage for the disconnectible outputs can be assigned to connector X24, pin 1.

<sup>2)</sup> not disconnectible via external EMERGENCY STOP  
A0 ... A23 are disconnectible via external EMERGENCY STOP

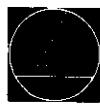
<sup>3)</sup> A0 ... A7 duplicated on X27, Machine operating panel

**X22 PLC-input**

Flange socket, female (37-pole)

| Contact No. | Allocation   |
|-------------|--|
| 1           | E0   |
| 2           | E1   |
| 3           | E2   |
| 4           | E3 Feedback signal for test<br>"Control operational" |
| 5           | E4   |
| 6           | E5   |
| 7           | E6   |
| 8           | E7   |
| 9           | E8   |
| 10          | E9   |
| 11          | E10  |
| 12          | E11  |
| 13          | E12  |
| 14          | E13  |
| 15          | E14  |
| 16          | E15  |
| 17          | E16  |
| 18          | E17  |
| 19          | E18  |
| 20          | E19  |
| 21          | E20  |
| 22          | E21  |
| 23          | E22  |
| 24          | E23  |
| 25          | E24  |
| 26          | E25  |
| 27          | E26  |
| 28          | E27  |
| 29          | E28  |
| 30          | E29  |
| 31          | E30  |
| 32          | E31  |
| 33, 34      | do not assign  |
| 35, 36, 37  | 0 V (PLC) <sup>1)</sup>                              |
| Housing     | External screen                                      |

<sup>1)</sup> If required, the 0 V-connection can be assigned to connector X24, pin 3.



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**X23 KEYBOARD Unit TE 351/355**

Flanged socket connector (37-pin)

| Pin no. | Assignment  |
|---------|---|
| 1       | RL0   |
| 2       | RL1   |
| 3       | RL2   |
| 4       | RL3   |
| 5       | RL4   |
| 6       | RL5   |
| 7       | RL6   |
| 8       | RL7   |
| 9       | E128  |
| 10      | E129  |
| 11      | E130  |
| 12      | E131  |
| 13      | E132  |
| 14      | E133  |
| 15      | E134  |
| 16      | E135  |
| 17      | E136  |
| 18      | E137  |
| 19      | E138  |
| 20      | OUT0  |
| 21      | OUT1  |
| 22      | OUT2  |
| 23      | OUT3  |
| 24      | OUT4  |
| 25      | OUT5  |
| 26      | OUT6  |
| 27      | OUT7  |
| 28      | E139  |
| 29      | E140  |
| 30      | +15V (supply for keys on Machine Operating Panel) |
| 31      | E141  |
| 32      | E142  |
| 33      | E143  |
| 34      | Spindle Override (wiper)                          |
| 35      | Feed Override (wiper)                             |
| 36      | +12V Override Potentiometer                       |
| 37      | 0V Override Potentiometer                         |
| housing | outer shield                                      |

PLC-inputs E128...E140 from Machine Operating Panel

**X24 PLC Supply**

Terminal block

| Terminal no. | Assignment   |
|--------------|--|
| 1            | +24V disconnectable via external EMERGENCY-STOP <sup>1</sup> |
| 2            | +24V not disconnectable                                      |
| 3            | 0V <sup>2</sup> )  |

<sup>1)</sup> The supply can be optionally assigned to connector X21, pin 35, 36, 37.

<sup>2)</sup> 0V can be optionally assigned to connector X22, pin 35, 36, 37.

**X26 Data Interface RS-232-C**

Flanged socket, connector (25-pin)

| Pin no.  | Assignment    |
|----------|---------------|
| 1        | shield        |
| 2        | RxD           |
| 3        | TxD           |
| 4        | CTS           |
| 5        | RTS           |
| 6        | DTR           |
| 7        | GND           |
| 8 to 19  | do not assign |
| 20       | DSR           |
| 21 to 25 | do not assign |
| housing  | outer shield  |

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**X27 Machine Operating Panel**

Flanged socket, connector (37-pin)

This connection is used when the assigned inputs on the TE 355 are insufficient.

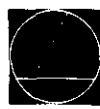
| Pin no. | Assignment  |
|---------|-------------|
| 1       | E128        |
| 2       | E129        |
| 3       | E130        |
| 4       | E131        |
| 5       | E132        |
| 6       | E133        |
| 7       | E134        |
| 8       | E135        |
| 9       | E136        |
| 10      | E137        |
| 11      | E138        |
| 12      | E139        |
| 13      | E140        |
| 14      | E141        |
| 15      | E142        |
| 16      | E143        |
| 17      | E144        |
| 18      | E145        |
| 19      | E146        |
| 20      | E147        |
| 21      | E148        |
| 22      | E149        |
| 23      | E150        |
| 24      | E151        |
| 25      | E152        |
| 26      | A0          |
| 27      | A1          |
| 28      | A2          |
| 29      | A3          |
| 30      | A4          |
| 31      | A5          |
| 32      | A6          |
| 33      | A7          |
| 34      | 0 V (PLC)   |
| 35      | 0 V (PLC)   |
| 36      | +24 V (PLC) |
| 37      | +24 V (PLC) |

PLC outputs A# ... A7 to  
Machine Operating Panel

**X31 Logic Supply (LE)**

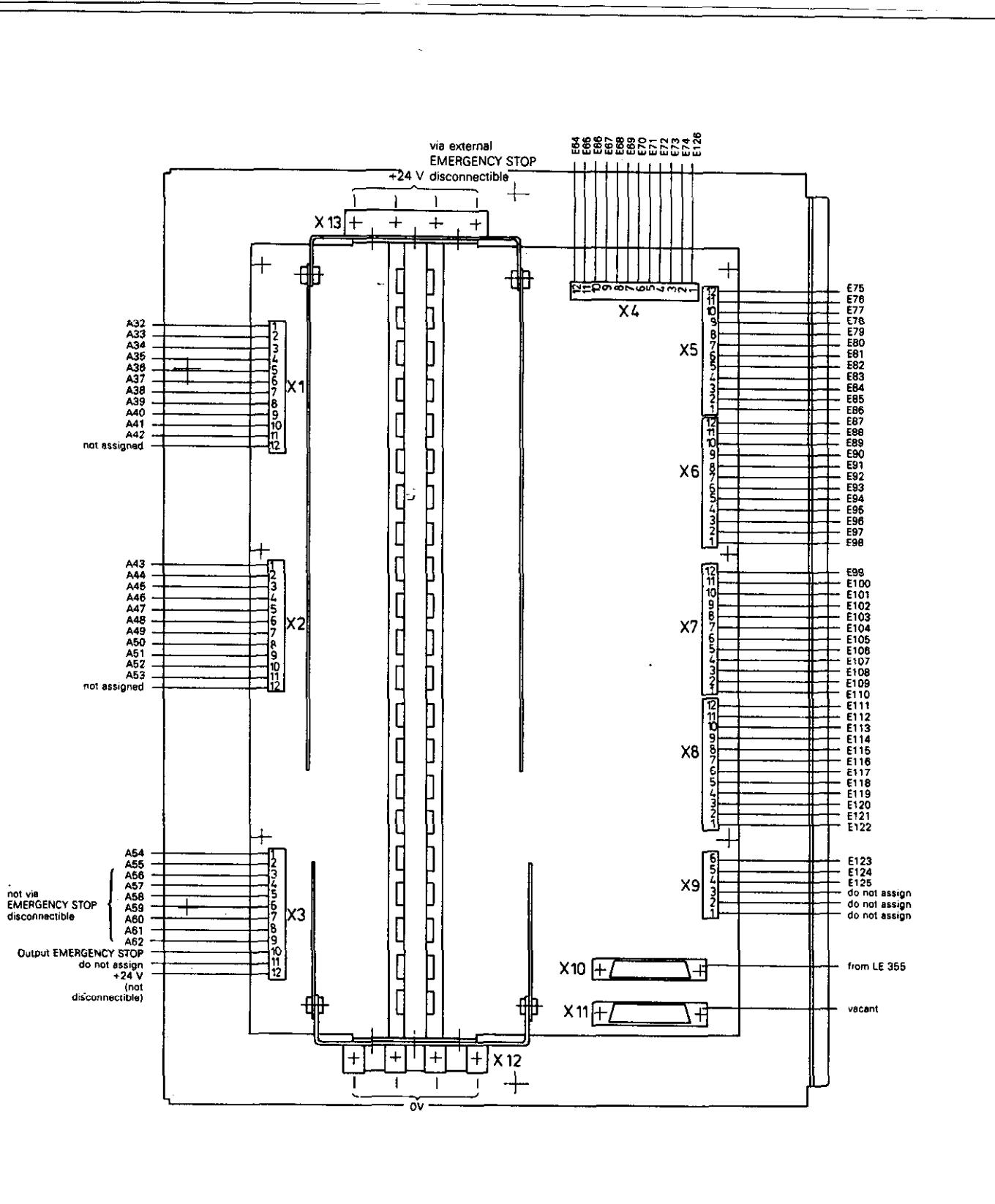
| Pin no. | Assignment |
|---------|------------|
| -       | 0 V        |
| -       | +24 V      |

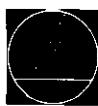
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4.3.7 Connector Layout of the PLC POWER I/O Board Assembly PL 300





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#### 4.3.8 Connector Layouts of the TE 351/355 KEYBOARD Unit

##### X1 For connection of the machine operating panel

Flange socket, female (25-pole)

| Contact No.      | Allocation  |
|------------------|---|
| 1                | E140  |
| 2                | E139  |
| 3                | E138  |
| 4                | E137  |
| 5                | E136  |
| 6                | E135  |
| 7                | E134  |
| 8                | E133  |
| 9                | E132  |
| 10               | E131  |
| 11               | E130  |
| 12               | E129  |
| 13               | E128  |
| 14 <sup>1)</sup> | 0 V (override potentiometer)                          |
| 15 <sup>1)</sup> | +12 V (override potentiometer)                        |
| 16 <sup>1)</sup> | Feed rate override potentiometer (wiper)              |
| 17 <sup>1)</sup> | Spindle override potentiometer (wiper)                |
| 18 to 21         | do not assign   |
| 22               | +15 V (Supply for buttons of machine operating panel) |
| 23               | E143  |
| 24               | E142  |
| 25               | E141  |

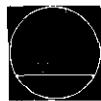
<sup>1)</sup> Caution!

Do not assign if the potentiometer on the TE is to be used.

##### X2 For connection of the logic unit LE 355

Flange socket, male (37-pole)

| Contact No. | Allocation  |
|-------------|---|
| 1           | RL0   |
| 2           | RL1   |
| 3           | RL2   |
| 4           | RL3   |
| 5           | RL4   |
| 6           | RL5   |
| 7           | RL6   |
| 8           | RL7   |
| 9           | E128  |
| 10          | E129  |
| 11          | E130  |
| 12          | E131  |
| 13          | E132  |
| 14          | E133  |
| 15          | E134  |
| 16          | E135  |
| 17          | E136  |
| 18          | E137  |
| 19          | E138  |
| 20          | OUT0  |
| 21          | OUT1  |
| 22          | OUT2  |
| 23          | OUT3  |
| 24          | OUT4  |
| 25          | OUT5  |
| 26          | OUT6  |
| 27          | OUT7  |
| 28          | E139  |
| 29          | E140  |
| 30          | +15 V (Supply for buttons of machine operating panel) |
| 31          | E141  |
| 32          | E142  |
| 33          | E143  |
| 34          | Spindle override (wiper)                              |
| 35          | Feed rate override (wiper)                            |
| 36          | +12 V Override potentiometer                          |
| 37          | 0 V Override potentiometer                            |



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#### **4.4 PROCESSOR Board**

##### **4.4.1 Interface**

- 57 PLC-inputs
- 32 PLC-outputs
- Keyboard Unit
- Machine Operating Panel
- V. 24-interface

##### **4.4.2 Supervision**

- Program memory
- Data Processing
- PLC-program
- Acknowledgement Emergency-stop

##### **4.4.3 Storage**

- NC-Programs
- PLC-Program
- Machine parameters
- List of compensation values
- Operating program

#### **4.5 CLP PROCESSOR Board**

##### **4.5.1 Interface**

- Encoder inputs
- Reference pulse inhibit
- Electronic Handwheel
- 3D-Touch Probe
- Analog outputs
- Display

##### **4.5.2 Supervision**

- Measuring systems
- Temperature
- Buffer battery
- Data processing
- Program memory
- Axis positions (closed loop)

##### **4.5.3 Storage**

- Operating program



**HEIDENHAIN**  
DR. JOHANNES HEIDENHAIN GmbH  
D-8225 Traunreut · Tel. (08669) 31-0

SERVICE MANUAL TNC 351/355  
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Notes

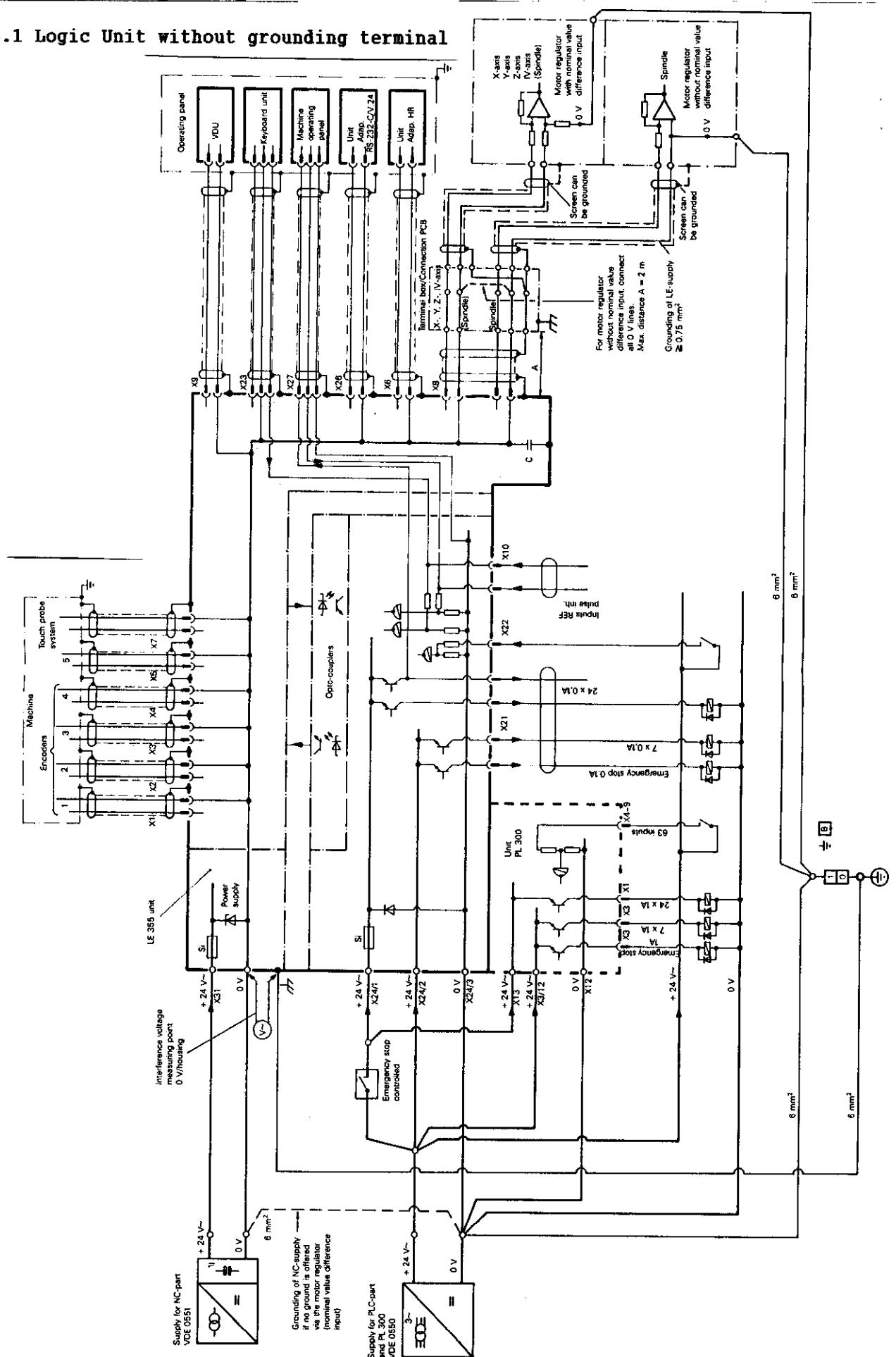
A large grid of squares for notes, with a vertical margin line on the left side.



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## 4.6 Grounding Diagram

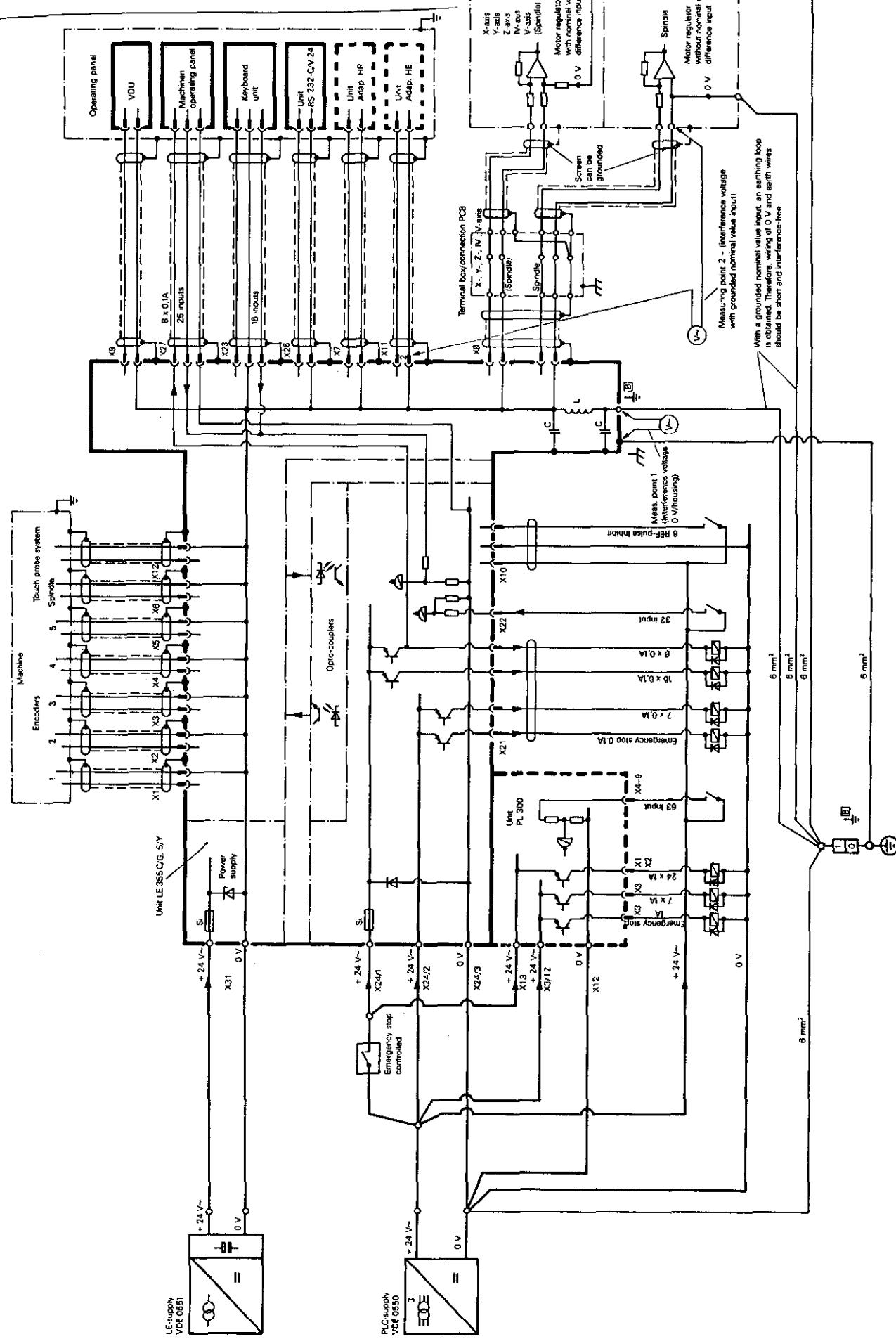
### 4.6.1 Logic Unit without grounding terminal





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4.6.2 Logic Unit with grounding terminal



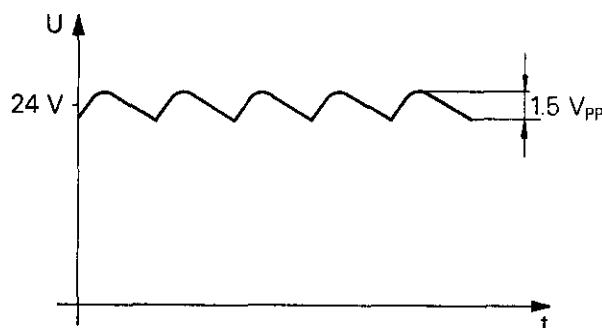


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## 5. External Supply

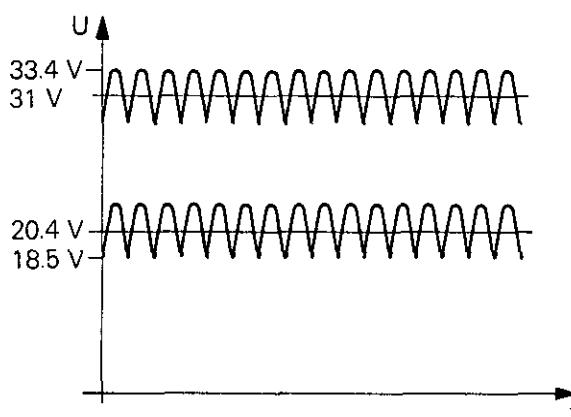
### 5.1 Requirements of the Ext. Supply

The LE 355 must not be supplied by the machine control voltage! The LE 355 needs its own, external, separately generated supply voltage to VDE 0551. 24 V DC-voltage with a permissible oscillated AC-component of  $1.5 \text{ V}_{\text{PP}}$  (recommended filter capacitor  $10000 \mu\text{F}/40 \text{ V}-$ ).



The **PLC-part** (PLC-inputs and outputs of the LE 355 and PL 300) is operated on the **24 V control voltage of the machine** which is generated according to VDE 0550.

Superimposed oscillated AC components which derive from an uncontrolled three-phase non-filtered bridge circuit with a ripple factor (see DIN 40110/10.75, Section 1.2) of 5% are permitted. This results in a maximum absolute value of 33.4 V for the upper voltage limit and a minimum absolute value of 18.5 V for the lower limit.



The **0 V-lines** of the two power sources must be **connected together ( $\varnothing \geq 6 \text{ mm}^2$ )** and to the **central operating ground of the machine** ( $\vartriangleq \text{B}$ ) via an earth ground ( $\varnothing \geq 6 \text{ mm}^2$ ).

The voltages must comply with the definitions given below:

| Unit   | Supply voltage            | Voltage range<br>Average DC voltage   | Max. current consumption   | Power consumption  |
|--------|---------------------------|---------------------------------------|--|--|
| LE 355 | NC<br>24 V<br>(VDE 0551)  | Lower limit<br>20.4 V ...             | 1.5 A  | approx. 30 W   |
|        | PLC<br>24 V<br>(VDE 0550) |                                       | 1.8 A<br>if half of the inputs and outputs are driven simultaneously | approx. 6 W<br>if approx. 1/3 of the inputs and outputs are driven simultaneously  |
| PL 300 | 24 V<br>(VDE 0550)        | Upper limit<br>31 V ... <sup>1)</sup> | 21 A<br>if half of the inputs and outputs are driven simultaneously  | approx. 25 W<br>if approx. 1/3 of the inputs and outputs are driven simultaneously |

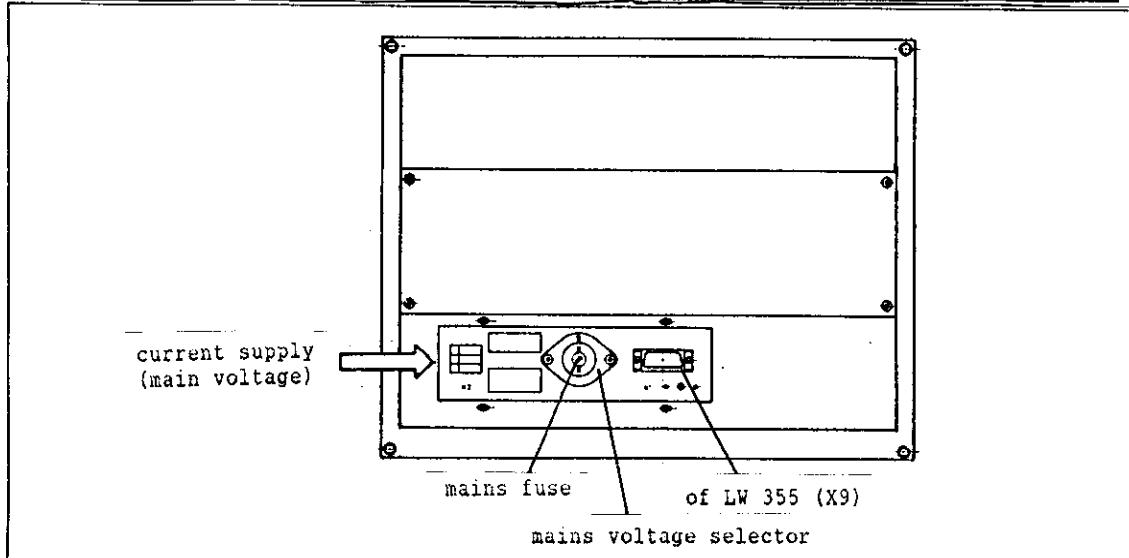
<sup>1)</sup> Voltage increases up to 36 V ... for  $t < 100 \text{ ms}$  are permissible.

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The BE 412(B) Display is supplied with mains voltage (ac voltage). With the mains voltage selector two voltage ranges can be adjusted in the BE 412B and six in the BE 412. Please check whether the mains voltage selector is correctly set and whether the correct mains fuse is used.

**BE 412**

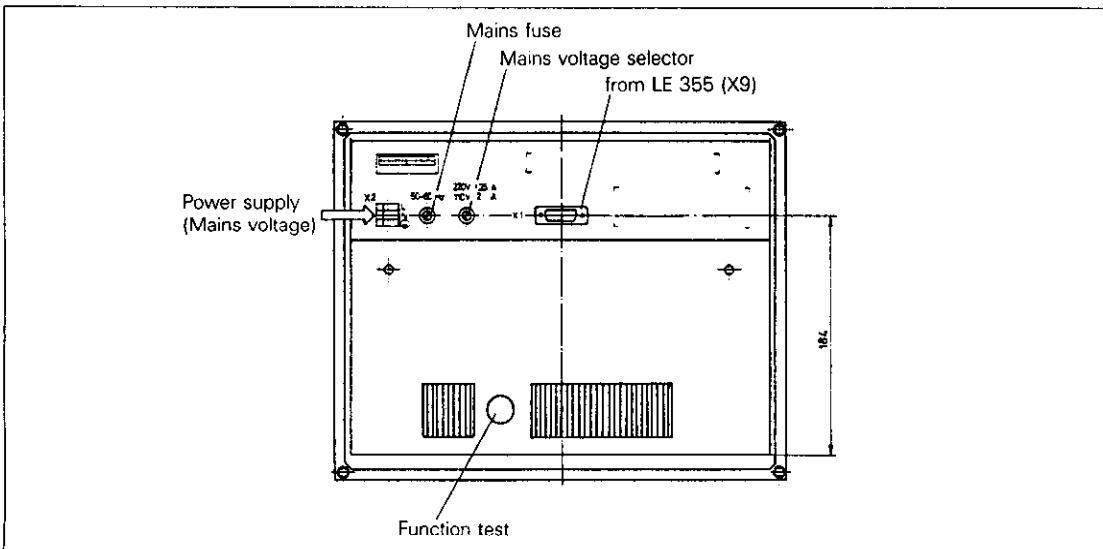
| Voltage supply  | Voltage range  | Frequency range | Power consumption | Mains fuse |
|-----------------|----------------|-----------------|-------------------|------------|
| 100/120/140 V ~ | -15 % ... +10% | 48 ... 62 Hz    | approx. 40 W      | T 0.630 A  |
| 200/220/240 V ~ |                |                 |                   | T 0.315 A  |



In case of 110 V supply voltage the mains voltage selector must be adjusted to 120 V.

**BE 412B**

| Supply voltage | Voltage range   | Frequency range | Power consumption | Mains fuse |
|----------------|-----------------|-----------------|-------------------|------------|
| 110 V~         | 85 V~ - 132 V~  | 48 ... 62 Hz    | approx. 40 W      | M 2 A      |
| 220 V~         | 170 V~ - 264 V~ |                 |                   | M 1.25 A   |





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**5.2 Supply for the NC-Part**

The supply for the NC-part is connected to the X31 terminals.

The various voltages for the LE are converted in the "POWER SUPPLY Board Assembly" from the +24V- supplied (see Block Diagrams, page 27 and 28).

The on/off-condition of the output voltages are displayed by LEDs. The level of the individual voltages can only coarsely be displayed by LEDs. To make a precise statement about the single voltages they must be measured for accuracy and correspond to the following table:

| Output            | U <sub>ONOML</sub> [V] | U <sub>MIN</sub> [V] | U <sub>MAX</sub> [V] | I <sub>ONOML</sub> [A] |
|-------------------|------------------------|----------------------|----------------------|------------------------|
| + 5 V             | + 5.15                 | + 5.05               | + 5.25               | 2.5                    |
| + 12 V            | + 12                   | + 11.4               | + 12.6               | 0.15                   |
| - 12 V            | - 12                   | - 11.4               | - 12.6               | 0.08                   |
| + 15 V            | + 15                   | + 14.2               | + 15.8               | 0.3                    |
| - 15 V            | - 15                   | - 14.2               | - 15.8               | 0.07                   |
| U <sub>BATT</sub> | + 4.5                  | + 3.7                | -                    | - 50 µA                |
| + 24 V BE         | + 24                   | + 20.4               | + 31                 | -                      |
| + 12 V BE 1)      | + 12                   | + 11.5               | + 12.5               | 1.3                    |
| + 5V * 1)         | + 5                    | + 4.75               | + 5.25               | 0.3                    |

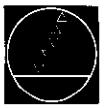
The red LED for the RESET signal illuminates briefly when switching the control on/off.

(only applies for TNC 355; the TNC 351 does not have a RESET LED)

RESET TNC 351 U<sub>L MAX</sub> = 0.4 V U<sub>H MIN</sub> = 3.9 V t<sub>L</sub> = 100-300ms

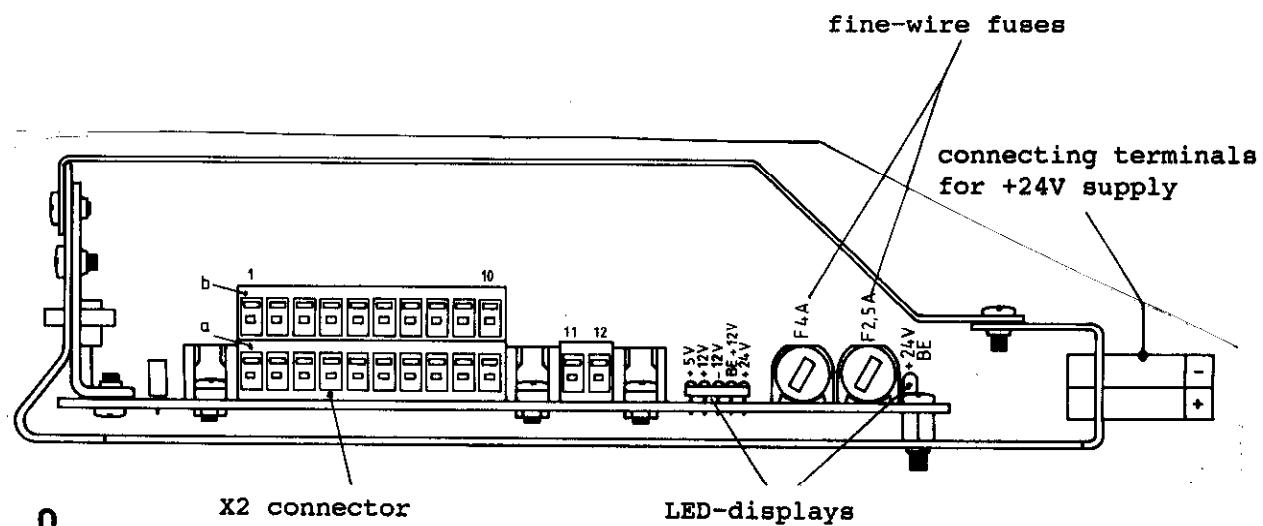
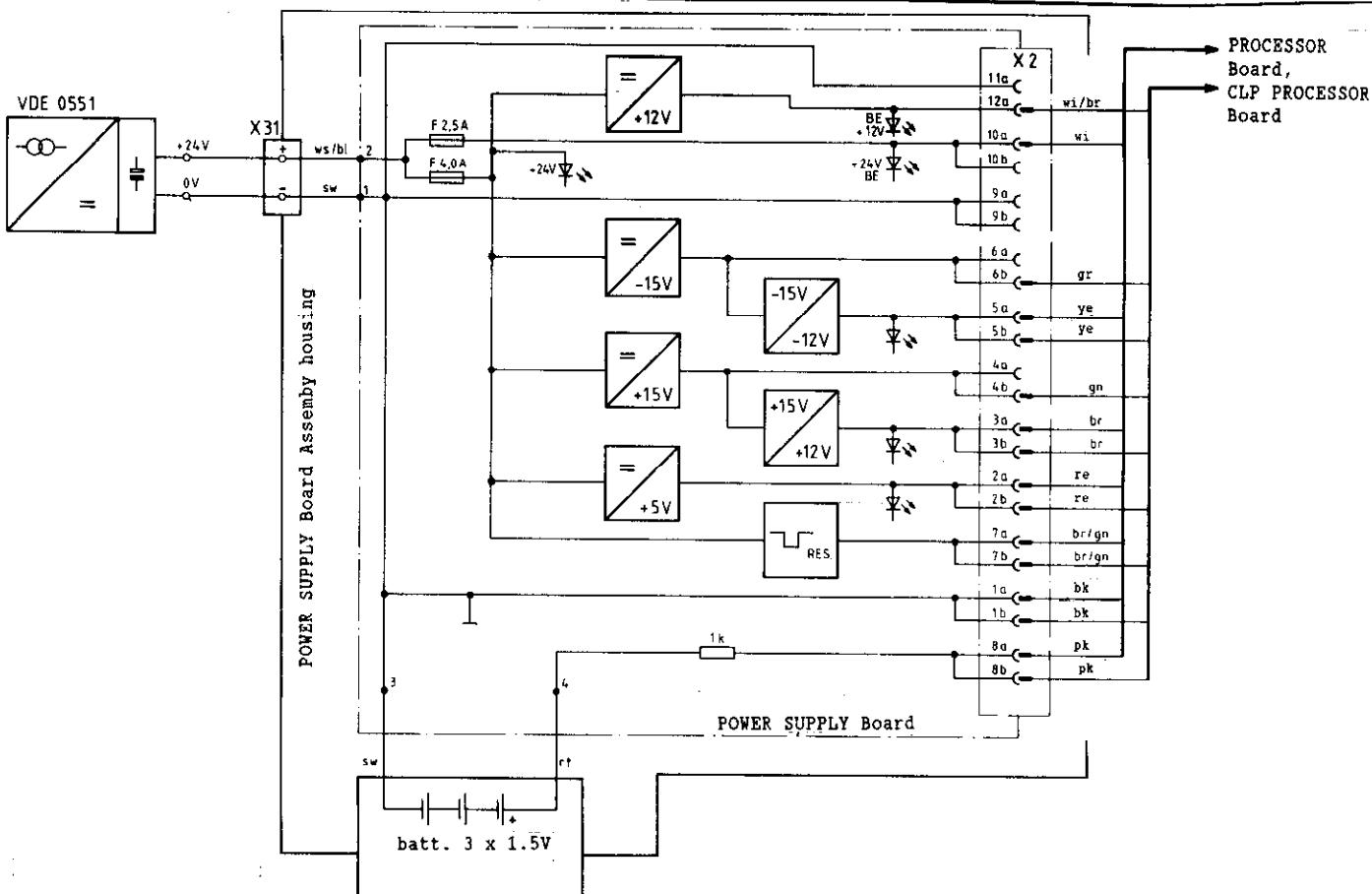
RESET TNC 355 U<sub>L MAX</sub> = 0.4 V U<sub>H MIN</sub> = 3.0 V t<sub>L</sub> = 100-300ms

1) + 12 V BE (for BE 212) and +5V\* (potential-free) only with the power supply, id.no. 236 484 04 for TNC 351.

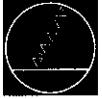


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5.2.1 LE 351 NC POWER SUPPLY Board Assembly



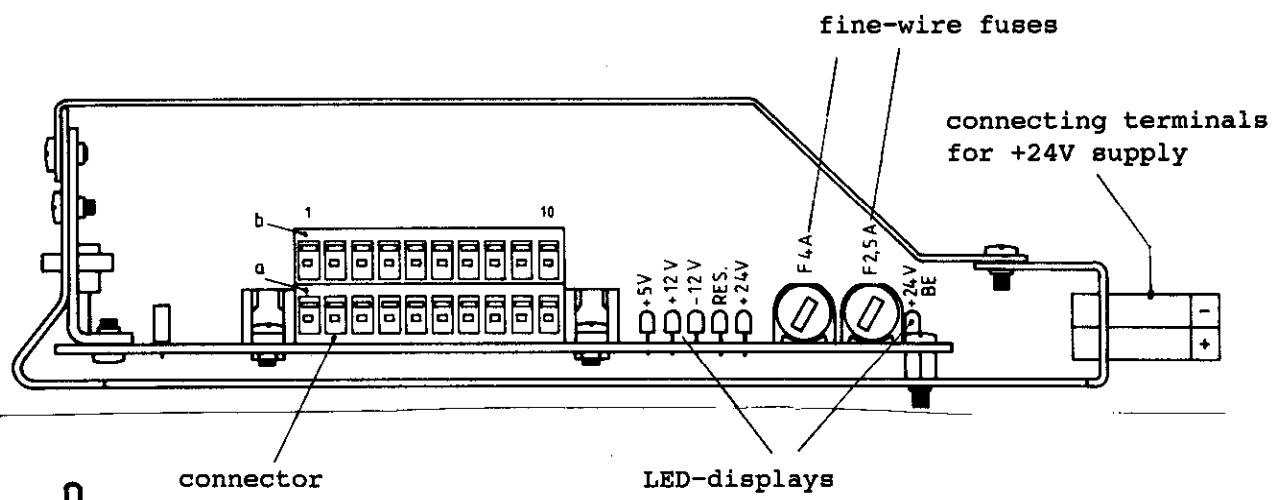
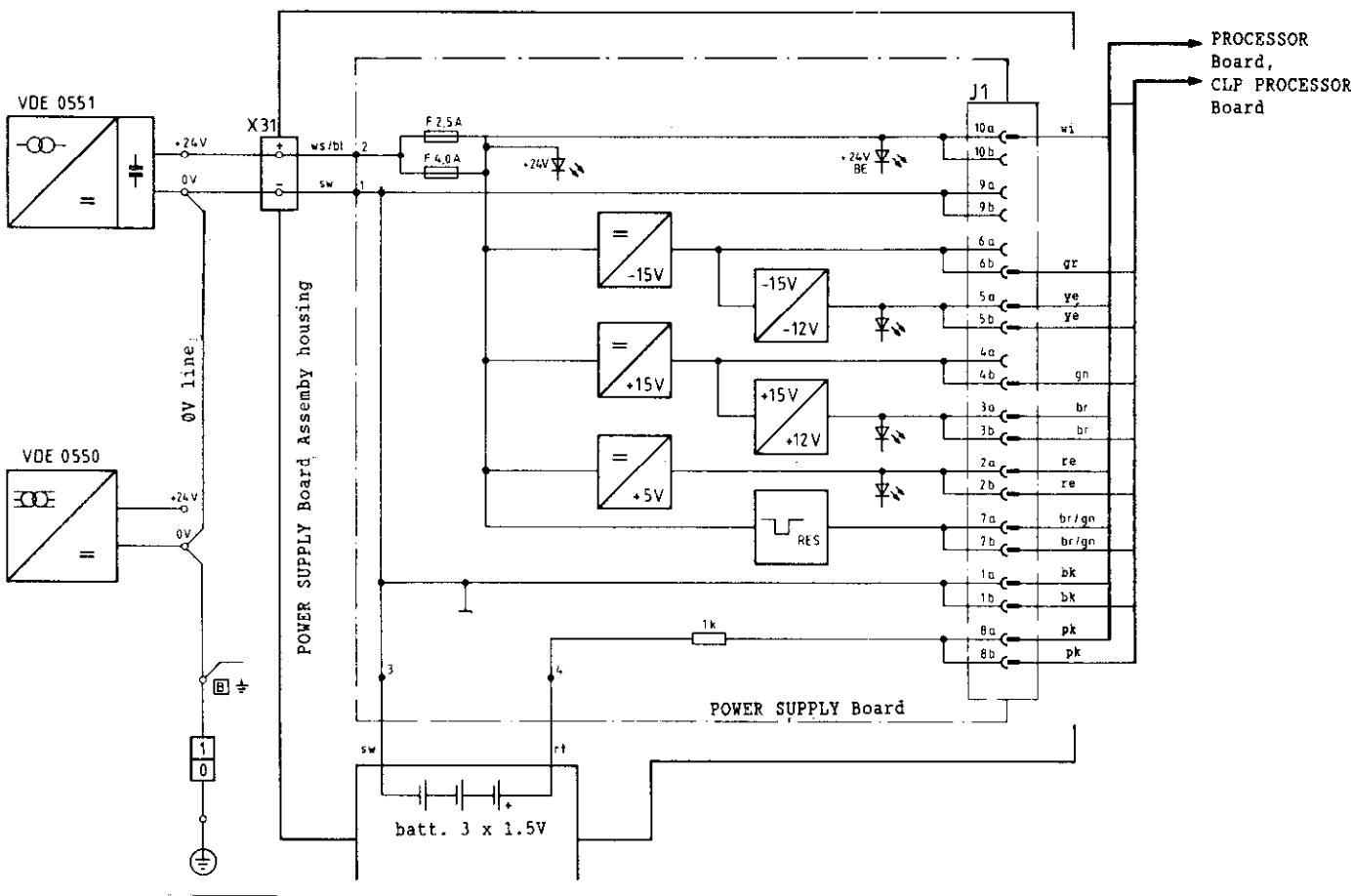
The connector doesn't exist with new versions due to direct soldering of the insulated wires onto the power supply board.



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**5.2.2 LE 355 NC POWER SUPPLY Board Assembly**

Fig. 4 PLC Adapter (Id. No. 224 873 ZY)



The connector doesn't exist with new versions due to direct soldering of the insulated wires onto the power supply board.

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**5.3 Testing the POWER SUPPLY Board Assembly**

The POWER SUPPLY Board Assembly is protected by two fine-wire fuses. The +24V BE output voltage is protected by a F 2.5A fuse, all other output voltages by F 4.0A (see Block Diagram, pages 27 and 28). If a fault is detected (all voltages are missing) check if the LE 24V supply is present, then the two fuses.

Safe and fast testing of the POWER SUPPLY Board Assembly is possible by means of the PSA LOAD UNIT. The plug connection to the boards at the POWER SUPPLY Board Assembly has to be disconnected and the PSA LOAD UNIT has to be connected in its place.

Various voltages can be measured with a voltmeter at the sockets of the PSA LOAD UNIT. The measured values and tolerances can be compared with the values in the table, page 26. If the values of the measurements do not coincide with the values of the table the POWER SUPPLY Board Assembly is defective.

If no PSA LOAD UNIT is available the voltages may also be measured at the test points on the PROCESSOR Board or on the CLP PROCESSOR Board (for location of test points, see section 5.3.2).



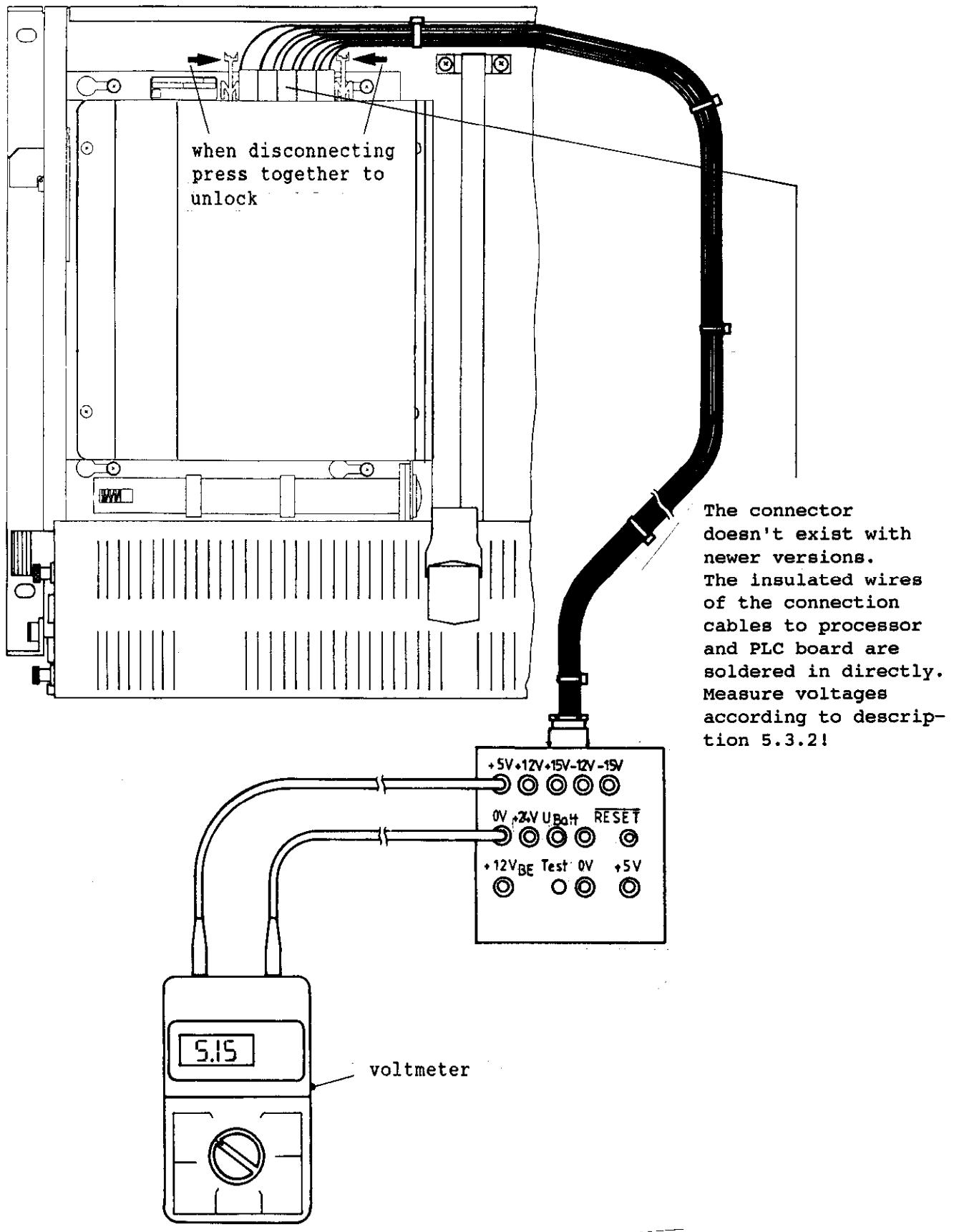
**A T T E N T I O N**

When connecting (disconnecting, always switch off mains switch first!



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5.3.1 Measuring Circuit with PSA LOAD UNIT

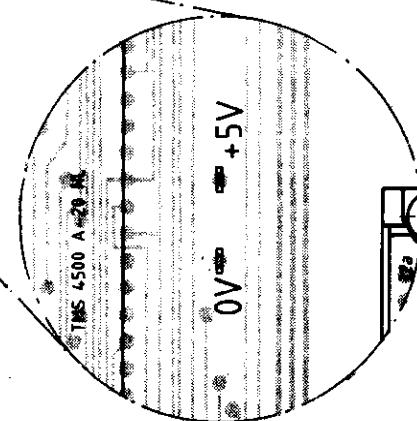
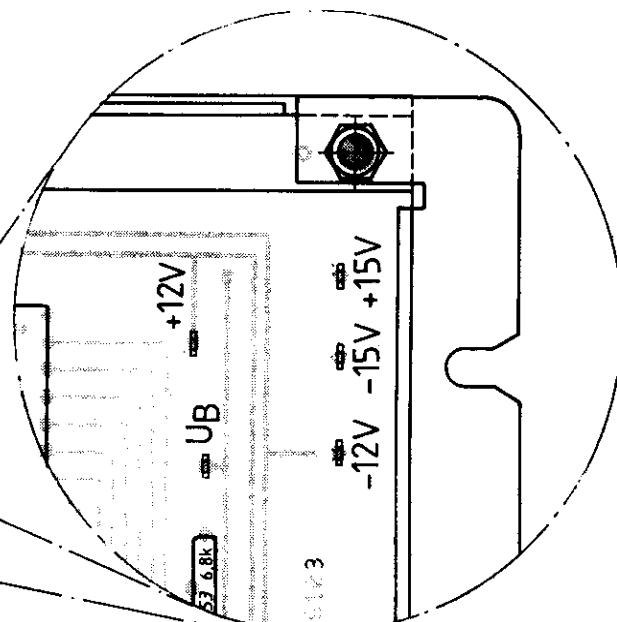
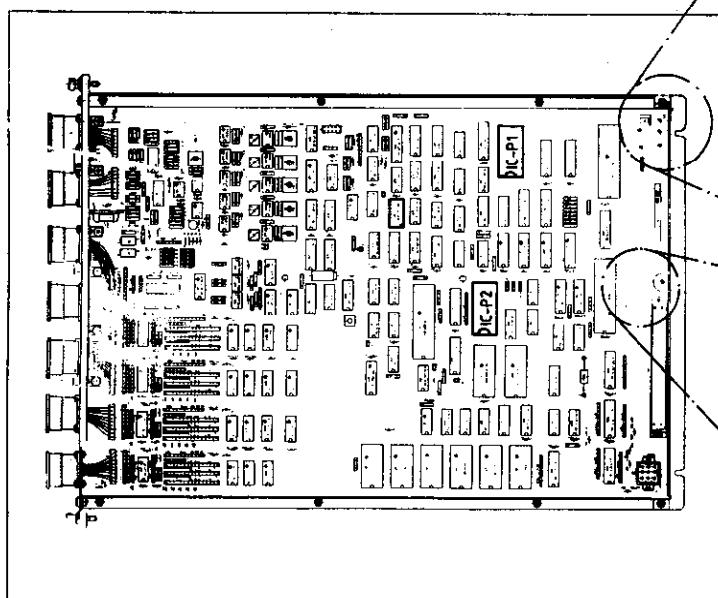




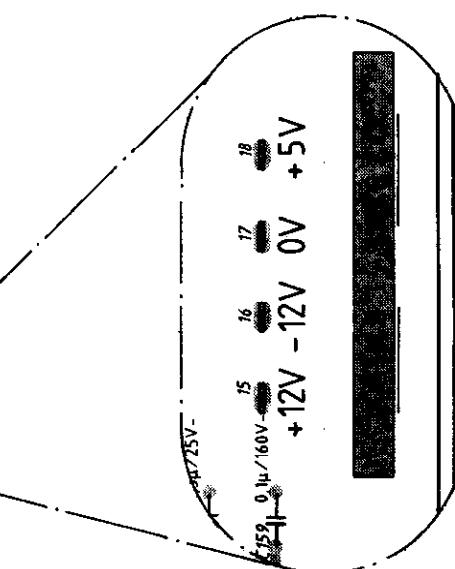
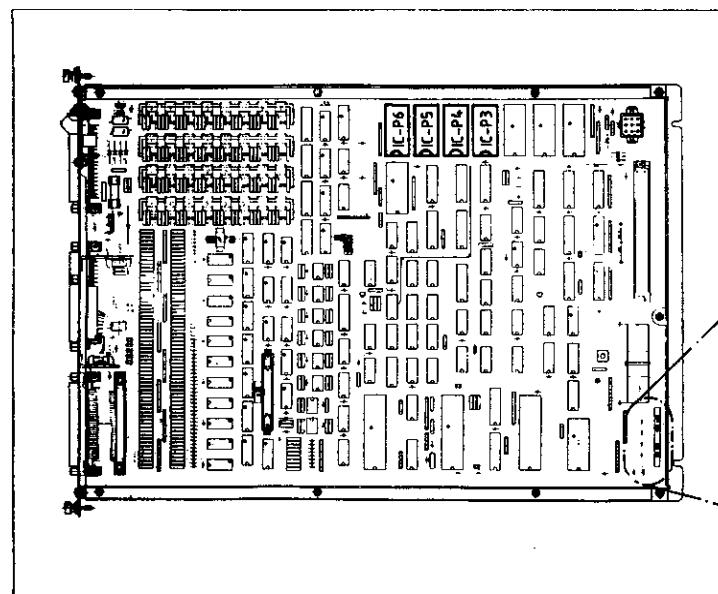
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5.3.2 Test Points on the Boards

CLP PROCESSOR Board



PROCESSOR Board



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5.4 Supply for the PLC-Part

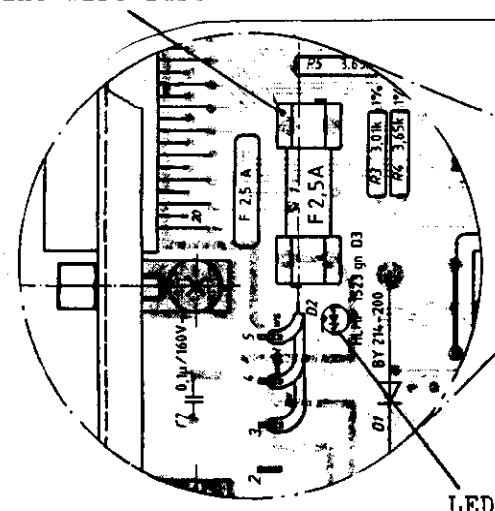
The terminal supply of the internal PLC-part is normally connected to the X 24 terminal (1 = +24V disconnectable, 2 = +24V not disconnectable 3 = 0V). The 0-volt line as well as the +24V disconnectable can optionally be connected via connector X 21 or X 22 (see PLC-Connection Diagram, page 33).

The supply for the PLC POWER Board Assembly PL 300 (only with Q/W/S/Y-versions) is connected to the X 12 terminal (0V), X 13 (+24V disconnectable) and the connector blocks X 3/12 (+24V not disconnectable). See PLC-Connection Diagram, page 33.

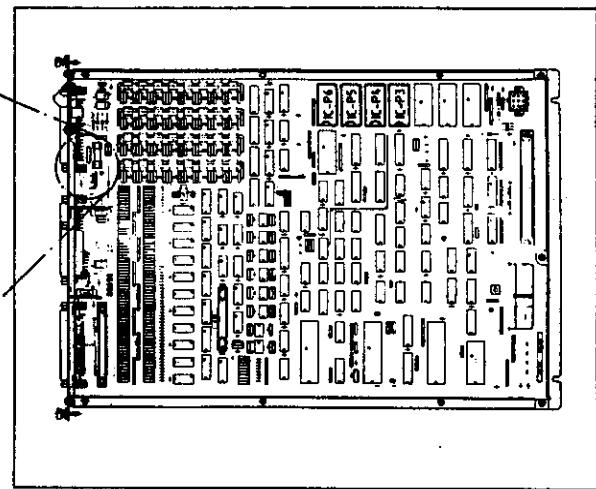
There are no fuses on the PLC POWER I/O Board Assembly (electronic current limitation).

The +24V which can be switched off are protected on all PROCESSOR boards with a F 2.5A fine-wire fuse and indicated with a green LED. The +24V which cannot be switched off are only protected with a F 1A fine-wire fuse on the PROCESSOR Board, id.no. 249 652 ..

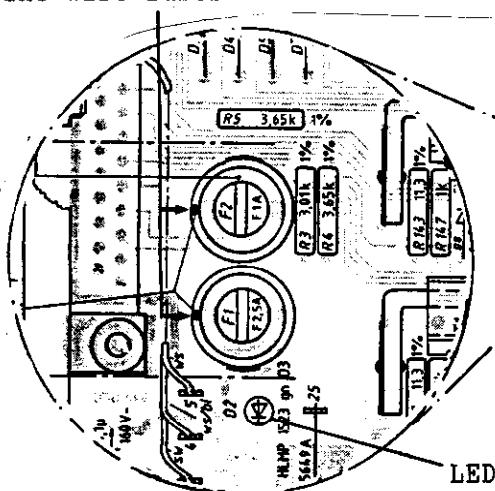
fine-wire fuse



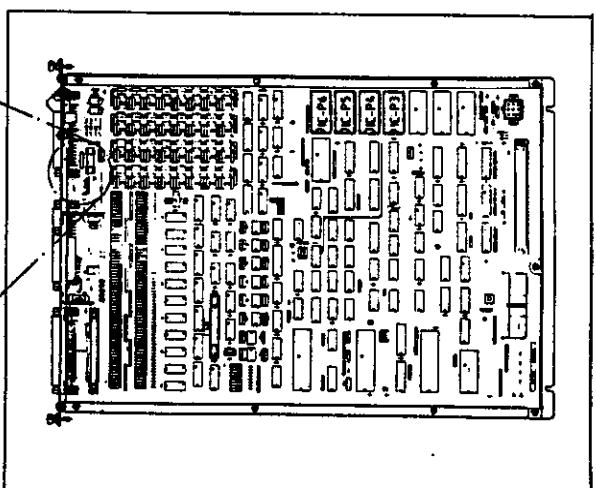
PROCESSOR Board, id.no. 237 930 ..

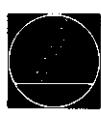


fine-wire fuses



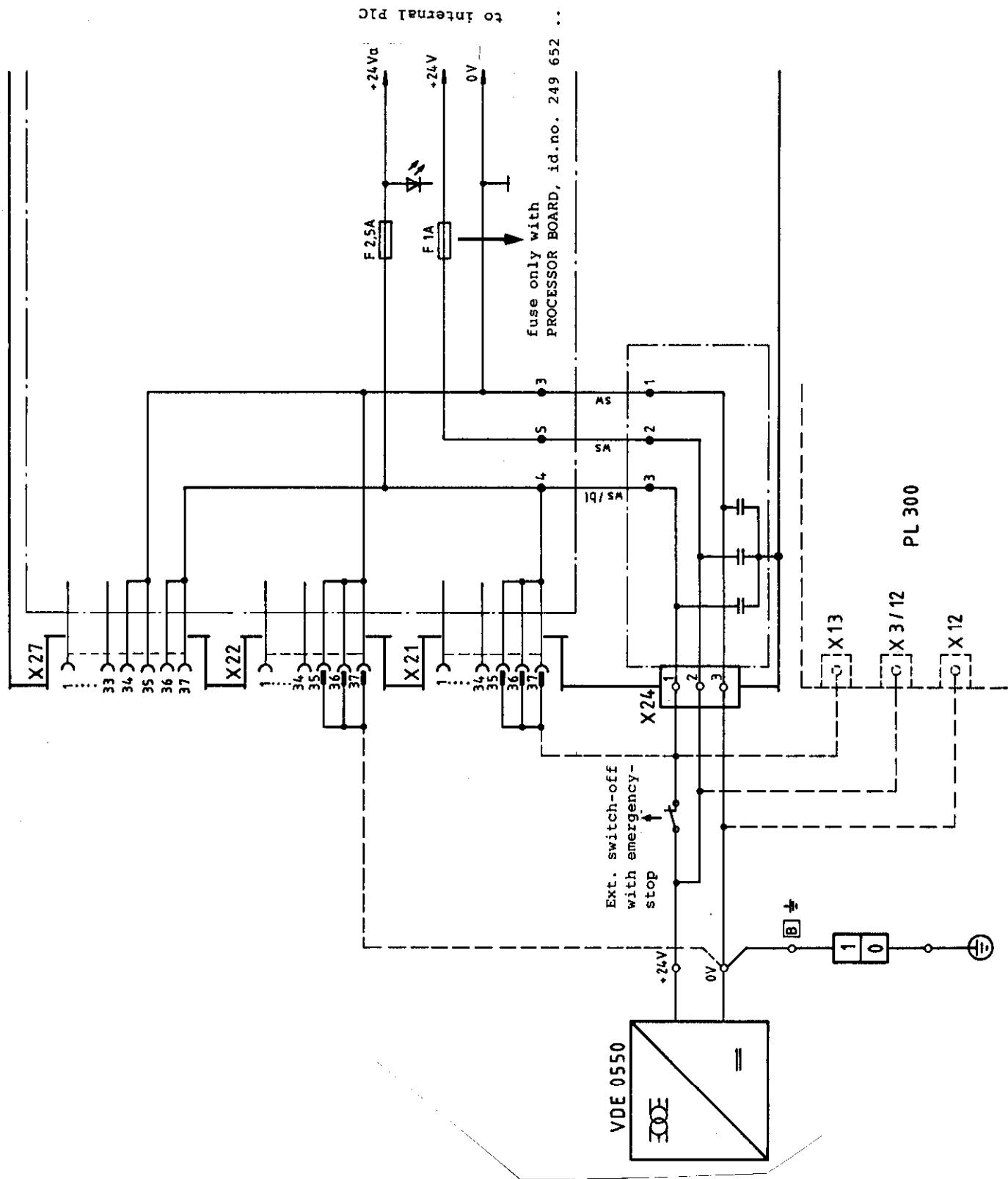
PROCESSOR Board, id.no. 249 652 ..





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5.4.1 Connection Diagram for the PLC Supply





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## 5.5 Buffer Batteries

### Change Buffer Battery

The buffer battery is the voltage source for the program memory with switched-off machine.

If the message

**EXCHANGE BUFFER BATTERY**

appears the batteries have to be exchanged within one week.

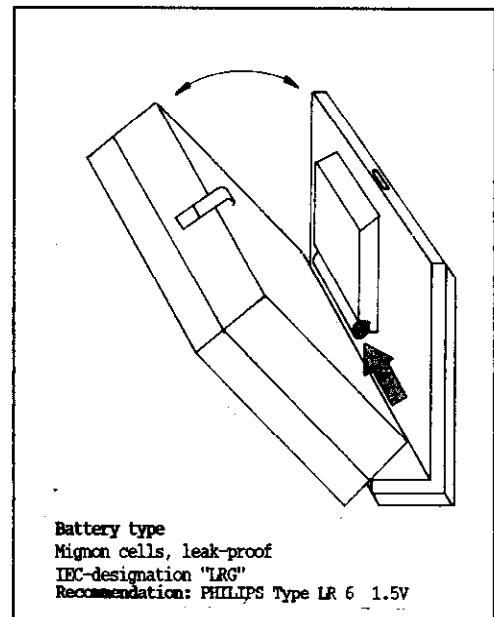
The buffer batteries are located behind a PG screwed connection in the POWER SUPPLY Board Assembly of the LE 351/355.

Apart from the batteries additional rechargeable NiCd batteries on the PROCESSOR Board were used to backup the program memory of TNC 351 and TNC355.

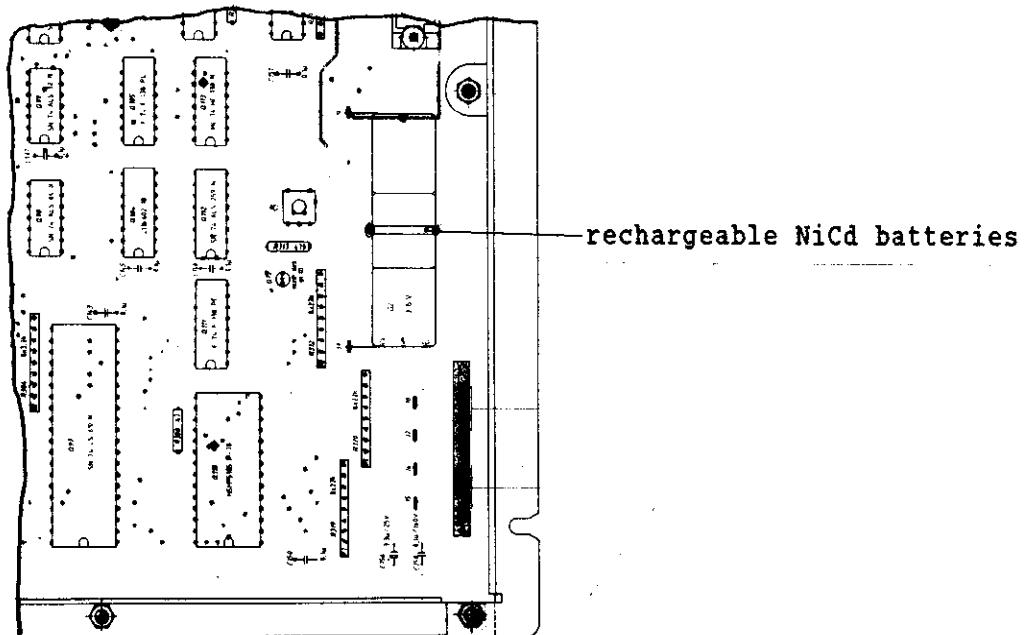
The mains voltage can be switched off to exchange the batteries. The rechargeable batteries store the contents without batteries for approx. 2 weeks.



The rechargeable NiCd batteries are only charged if the TNC is switched on.



PROCESSOR Board



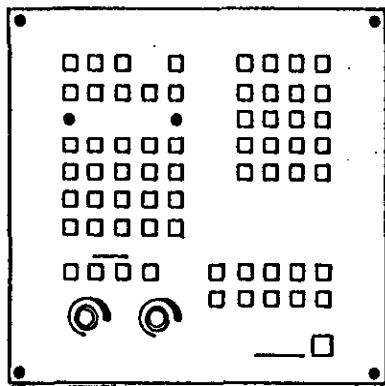
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## 6. TE 351/355 KEYBOARD UNIT

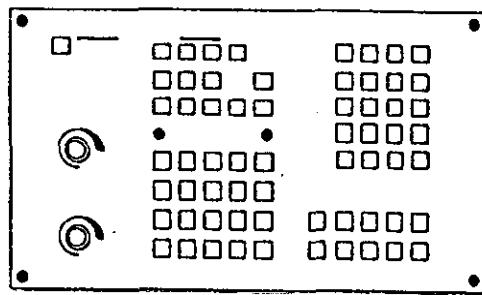
### 6.1 Overview

TE 351 A Id.no. 243 995 02 1) 4)  
TE 355 " 237 661 01 2) 4)  
TE 355 A " " 02 4)  
TE 355 C " " 03 5)  
TE 355 Id.no. 255 015 01 2) 3) 4)  
TE 355 A " " 02 3) 4)  
TE 355 C " " 03 3) 5)

TE 355 B Id.no. 241 964 01 4)  
TE 355 D " " 02 5)  
TE 355 B Id.no. 255 016 01 3) 4)  
TE 355 D " " 02 3) 5)



high version



wide version

1) without graphic keys

2) without connector X 1 (connection to Machine Operating Panel)

3) with ground connection

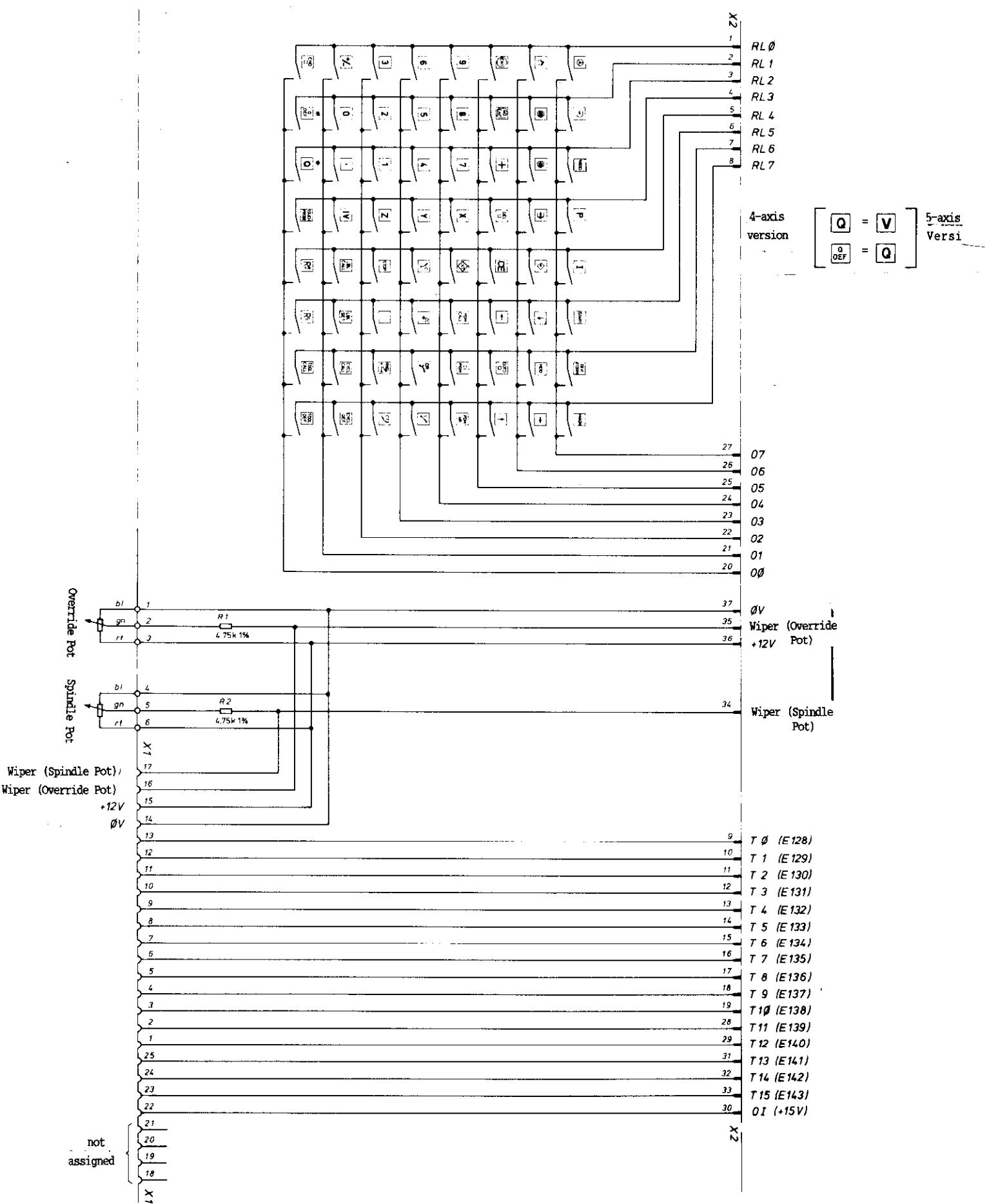
4) IV-axes-version

5) V-axes-version



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**6.2 Circuit Diagram of the KEYBOARD Unit**



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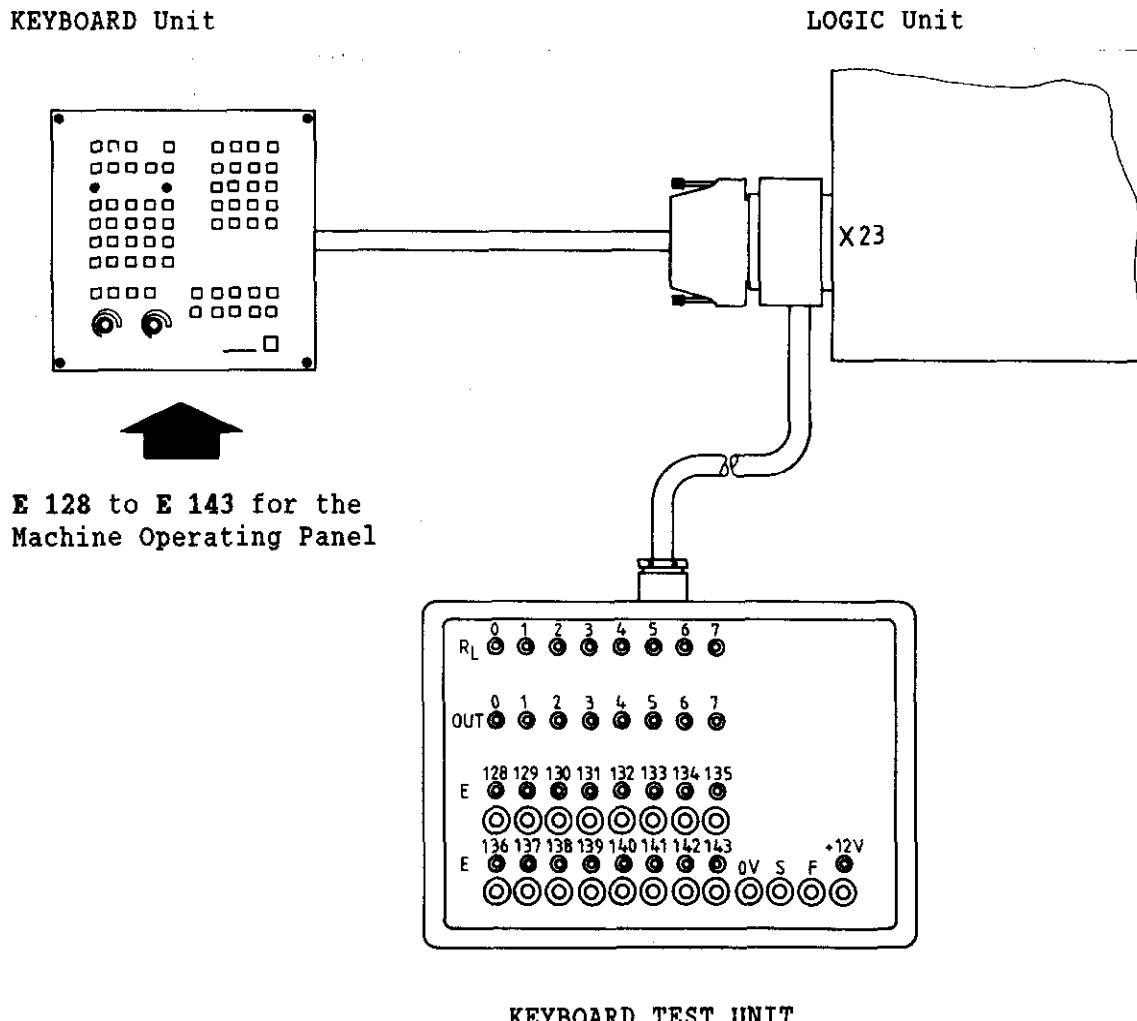
6.3 Testing the KEYBOARD Unit

Safe and fast testing of the KEYBOARD Unit is possible by means of a KEYBOARD TEST UNIT. The KEYBOARD TEST UNIT is connected to the X 23 connection of the LE.

On the KEYBOARD TEST Unit the **key code**, the input states of the inputs E 128 to E 143 and +12V are displayed. In addition, the voltages for the inputs E 128 to E 143 as well as the wiper voltage for the **override or spindle potentiometer** (approx 0 - 11.5V) can be measured.

With switched-on LE and pressing a key the respective LEDs RL and Out illuminate. The **key code** can be compared to the tables, pages 38 to 40.

If no KEYBOARD TEST UNIT is available the contacts of the keys can also be measured with an ohmmeter at the connector.

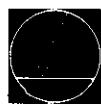
6.3.1 KEYBOARD TEST UNIT Connection




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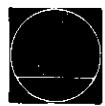
## 6.4 Key Matrix

| X2 Pin   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| Key      | RL0 | RL1 | RL2 | RL3 | RL4 | RL5 | RL6 | RL7 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
| PGM NR   |     |     |     |     |     |     |     | ⊕   |    |    |    |    |    | ⊕  |    |    |
| CL PGM   |     |     |     |     |     |     | ⊕   |     |    |    |    |    |    | ⊕  |    |    |
| PGM CALL |     |     |     |     | ⊕   |     |     |     |    |    |    |    | ⊕  |    |    |    |
| CR       |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |
| L        |     |     |     |     |     |     |     | ⊕   |    |    |    | ⊕  |    |    |    |    |
|          |     |     |     |     |     |     | ⊕   |     |    |    |    | ⊕  |    |    |    |    |
| RND      |     |     |     |     |     |     | ⊕   |     |    |    | ⊕  |    |    |    |    |    |
| CT       |     |     |     |     |     |     |     | ⊕   |    |    | ⊕  |    |    |    |    |    |
| CC       |     |     |     |     |     | ⊕   |     |     |    |    |    | ⊕  |    |    |    |    |
| YC       |     |     |     |     | ⊕   |     |     |     |    |    |    | ⊕  |    |    |    |    |



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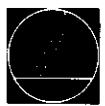
| X2 Pin         | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| Key            | RL0 | RL1 | RL2 | RL3 | RL4 | RL5 | RL6 | RL7 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
| EXT            |     |     |     |     | ⊕   |     |     |     |    |    |    |    |    | ⊕  |    |    |
| TOUCH PROBE    |     |     |     |     | ⊕   |     |     |     |    | ⊕  |    |    |    |    |    |    |
| DEL □          |     |     |     |     | ⊕   |     |     |     |    |    |    |    |    | ⊕  |    |    |
| +              |     |     | ⊕   |     |     |     |     |     |    |    |    |    |    | ⊕  |    |    |
|                | ⊕   |     |     |     |     |     |     |     |    |    |    |    |    | ⊕  |    |    |
| GOTO □         |     |     |     |     |     |     | ⊕   |     |    |    |    |    |    | ⊕  |    |    |
| ↓              |     |     |     |     |     | ⊕   |     |     |    |    |    |    |    |    |    | ⊕  |
| ↑              |     |     |     |     |     |     |     | ⊕   |    |    |    |    |    | ⊕  |    |    |
| ←              |     |     |     |     |     | ⊕   |     |     |    |    |    |    |    | ⊕  |    |    |
| → .            |     |     |     |     |     |     |     | ⊕   |    |    |    |    |    |    | ⊕  |    |
| STOP           |     |     |     | ⊕   |     |     |     |     |    |    |    | ⊕  |    |    |    |    |
| CYCL DEF       |     |     |     |     |     |     |     | ⊕   |    |    |    | ⊕  |    |    |    |    |
| CYCL CALL      |     |     |     |     |     |     | ⊕   |     |    |    |    | ⊕  |    |    |    |    |
| LBL SET        |     |     |     |     |     | ⊕   |     |     |    |    | ⊕  |    |    |    |    |    |
| LBL CALL       |     |     |     |     | ⊕   |     |     |     |    |    | ⊕  |    |    |    |    |    |
| NO ENT         |     | ⊕   |     |     |     |     |     |     |    |    |    |    |    |    | ⊕  |    |
| TOOL DEF       |     |     |     |     |     |     |     |     | ⊕  | ⊕  | ⊕  |    |    |    |    |    |
| TOOL CALL      |     |     |     |     |     |     |     | ⊕   |    | ⊕  |    |    |    |    |    |    |
| R <sup>L</sup> |     |     |     |     |     | ⊕   |     |     |    | ⊕  |    |    |    |    |    |    |
| R <sup>R</sup> |     |     |     |     | ⊕   |     |     |     |    | ⊕  |    |    |    |    |    |    |



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| X2 Pin | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|
| Key    | RL0 | RL1 | RL2 | RL3 | RL4 | RL5 | RL6 | RL7 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
| X      |     |     |     | ⊕   |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 7      |     |     | ⊕   |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 8      |     | ⊕   |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 9      | ⊕   |     |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| Y      |     |     |     | ⊕   |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 4      |     |     | ⊕   |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 5      |     | ⊕   |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 6      | ⊕   |     |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| Z      |     |     |     | ⊕   |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 1      |     |     | ⊕   |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 2      |     | ⊕   |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 3      | ⊕   |     |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| IV     |     |     |     | ⊕   |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| 0      |     | ⊕   |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| .      |     |     | ⊕   |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| ±%     | ⊕   |     |     |     |     |     |     |     |    |    |    |    | ⊕  |    |    |    |
| CE     |     |     |     |     | ⊕   |     |     |     |    |    |    |    |    | ⊕  |    |    |
| *V Q   |     |     | ⊕   |     |     |     |     |     |    | ⊕  |    |    |    |    |    |    |
| *Q DEF |     | ⊕   |     |     |     |     |     |     |    | ⊕  |    |    |    |    |    |    |
| END    | ⊕   |     |     |     |     |     |     |     |    | ⊕  |    |    |    |    |    |    |

\* Key assignment for 5-axis-version



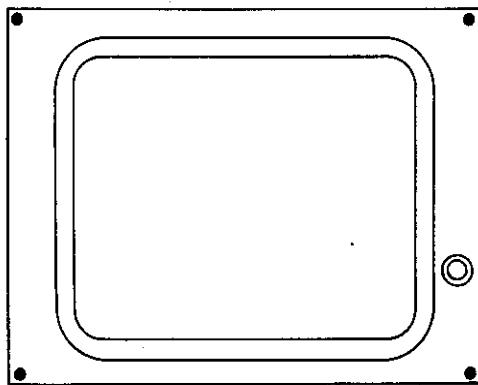
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## 7. DISPLAY Unit BE 212/412

### 7.1 DISPLAY Unit for TNC 351

BE 212 Id.no. 242 370 01

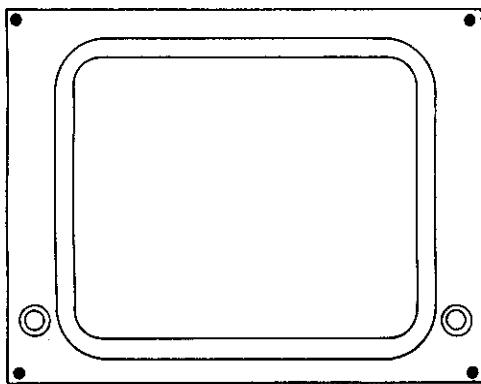


### 7.2 DISPLAY Units for TNC 355

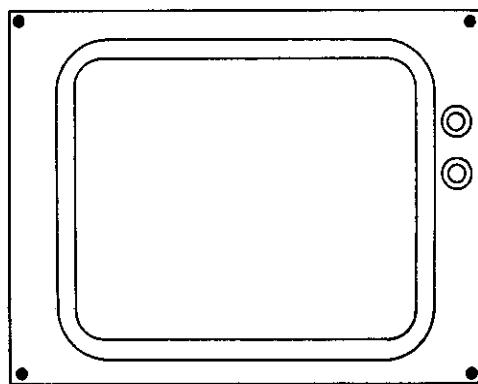
BE 412 Id.no. 237 657 01

BE 412 B Id.no. 241 845 01

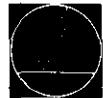
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discontinued type



current type



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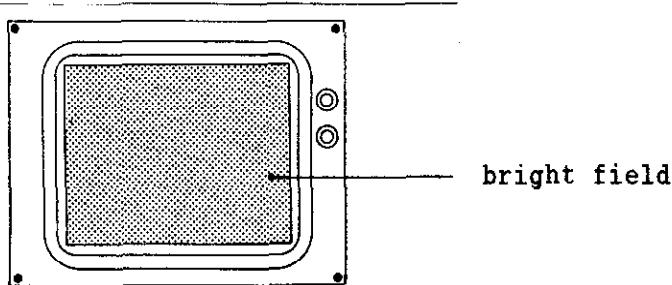
**7.3 Testing the DISPLAY Unit**

**BE 412**

If the machine is switched on and the DISPLAY Unit remains dark check the mains fuse (mains fuse integrated with voltage selector at rear of DISPLAY Unit) and replace, if necessary.

If the fuse is in order you can check with the TNC 355 whether the fault is on the DISPLAY Unit or on the LE by disconnecting the plug-and-socket connection.

With disconnected plug and switched-on display a bright, rectangular field has to be displayed.



If the screen displays this field the CLP PROCESSOR Board in the LOGIC Unit might be defective.

If, however, the display remains dark with plug disconnected the display is defective and has to be exchanged.

**BE 212**

This test cannot be carried out with the TNC 351 since the DISPLAY Unit of this control does not have its own mains supply.

The voltage is supplied by the LOGIC Unit and can be checked with a voltmeter at connector X9 (pin 1, 8 and 11  $0V$ , pin 2 and 4  $+12V$ ).

The control signals for the TNC 351 and the TNC 355 Display Unit can only be checked with an oscilloscope and must correspond to the following diagrams. With diagrams for VIDEO and BRIGHT/DARK, deviations may occur in the time base in the figures shown.

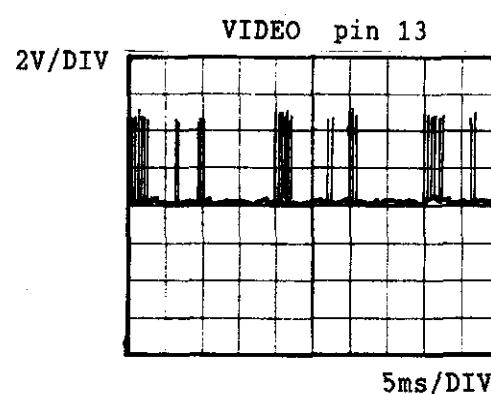
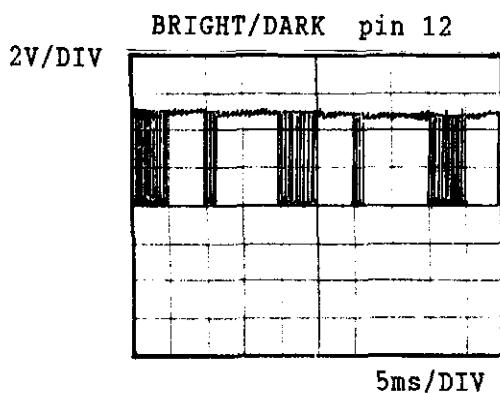
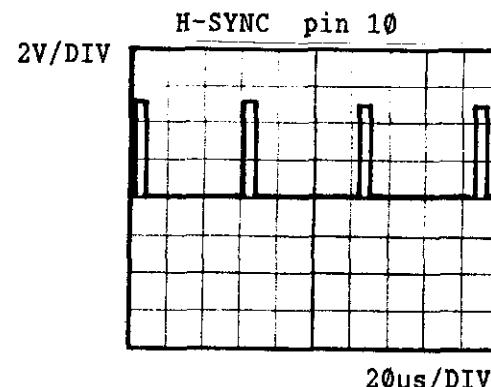
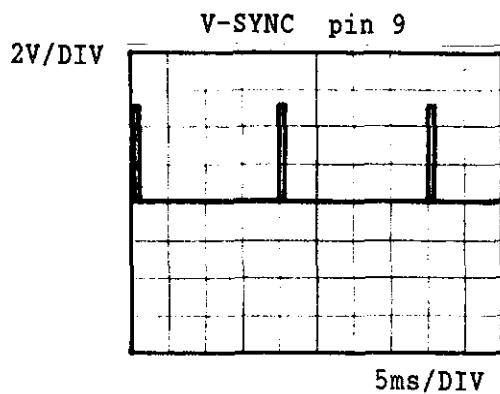
As to connector layout, see section 4.3.4.



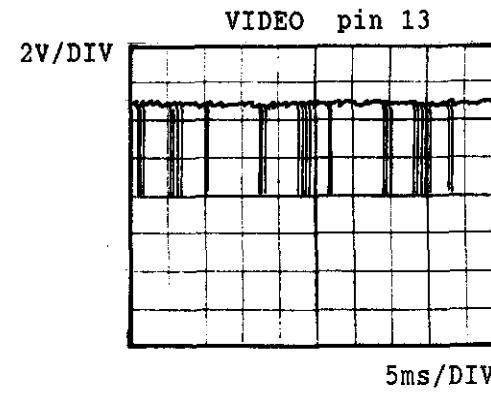
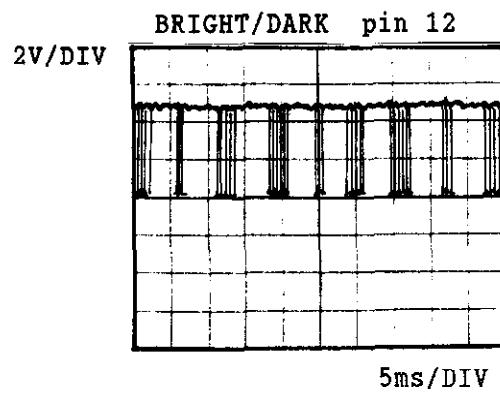
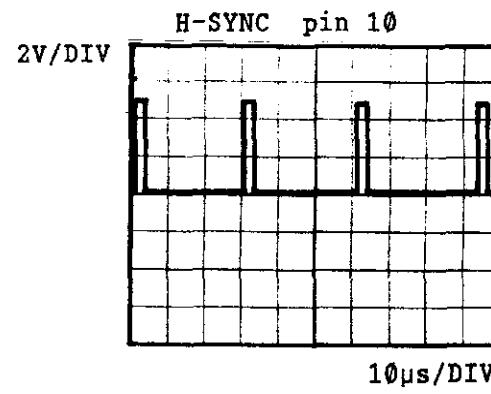
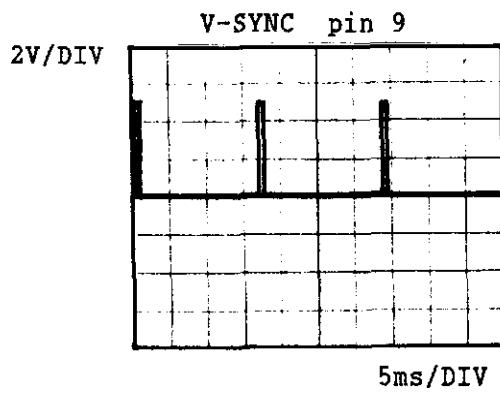
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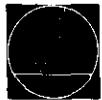
**7.3.1 Timing Diagrams LE 351 with BE 212**

X 9 Connector Timing Diagrams



**7.3.2 Timing diagrams LE 355 with BE 412**





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## 8 . Measuring Systems

### 8.1 Error Messages

TRANSDUCER X DEFECT A = signal amplitude fault

TRANSDUCER X DEFECT B = signal frequency fault

### 8.2 Possible Fault Cause

- Glass scale dirty or damaged
- Scanning head damaged or defective
- Cable damaged
- Encoder input in the LOGIC Unit (LE) defective

### 8.3 Testing the Measuring Systems

Encoders can be interchanged with each other at the LOGIC Unit (X1...X5 refer to section 4.3.1 LOGIC Unit Connections) which allows you to determine whether the encoders or the encoder inputs of the LOGIC Unit is defective. In conjunction with the above procedure the respective machine parameters have to be changed when interchanging encoders at the LOGIC Unit (LE).

| Function                              | MP | Input value  |
|---------------------------------------|----|--|
| Axis allocation to the encoder inputs | X  | 253  |
|                                       | Y  | 254  |
|                                       | Z  | 255  |
|                                       | IV | 256  |
|                                       | V  | 257  |
|                                       |    | 0 ≈ standard allocation<br>1 ≈ encoder input X1<br>2 ≈ encoder input X2<br>3 ≈ encoder input X3<br>4 ≈ encoder input X4<br>5 ≈ encoder input X5<br>6 ≈ encoder input X6 (only with V-axes-version) |

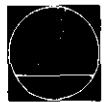
Procedure with an error message

e.g. "ENCODER X DEFECTIVE B"

- Switch off main switch
- Exchange X-axis of encoder, e.g. with the Y-axis at the LOGIC Unit
- Switch on main switch
- Call machine parameters with the error message "POWER INTERRUPTED" with key number 95148 and exchange the input values from machine parameter 253 and 254. If the input value for the machine parameters is 0 the machine parameter 253 has to be programmed with 2 and 254 with 1.
- Enter machine parameters and switch on machine as usual.

If the same error message "ENCODER X DEFECTIVE" appears the error is due to the encoders or the extension cable. If the error message changed from "X" to "Y", however, the encoder input of the LOGIC Unit is defective.

If the reference pulse inhibit (connector X10) is used and if positioning should occur with exchanged encoders also the reference pulse inhibit for the respective axes must be exchanged.



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### 8.3.1 Electrically Checking the Scanning Head of the Measuring System

To determine if the measuring system is at fault the following test equipment is used:

- phase angle measuring unit (PWM) with/without oscilloscope
- high-resistance short circuit tester

If no phase angle measuring unit is available an ohmmeter can be used to electrically test the state of the cable, the lamp and the photoelements of a measuring system by taking the following measurements at the connector of the measuring system:

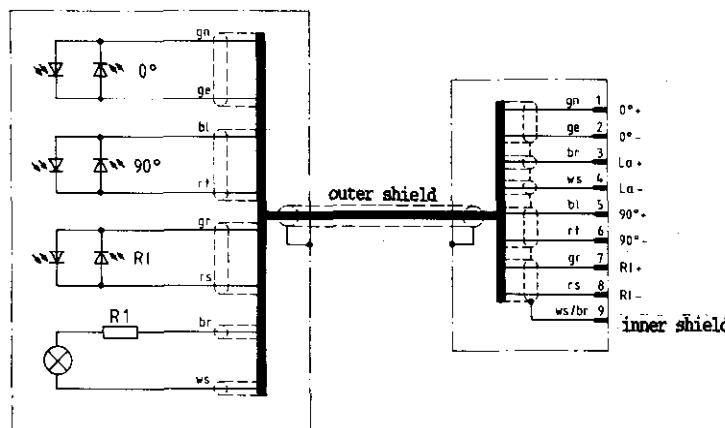
- Connector housing of measuring system with machine housing  $\leq 1 \Omega$  (outer shielding)
- Connector housing of measuring system with pin 9 (inner screen - outer screen)  $R = \infty$
- Connector housing of measuring system with pin 1 to 8 (outer screen - signal lines)  $R = \infty$
- Pin 9 with pin 1 to pin 8 (inner screen - signal lines)  $R = \infty$
  
- Pin 1 with pin 2  $0^\circ$
- Pin 2 with pin 1  $0^\circ$  (change poles of ohmmeter)
- Pin 5 with pin 6  $90^\circ$
- Pin 6 with pin 5  $90^\circ$  (change poles of ohmmeter)
- Pin 7 with pin 8  $RI_1$
- Pin 8 with pin 7  $RI_1$  (change poles of ohmmeter)

The measured values should be approximately the same.

- Pin 3 with pin 4  $La$  (approx.  $5 - 30 \Omega$ )

1) With measuring systems having an adjustable reference mark different values or no resistances are measured depending on the type of activation.

Diagram of measuring system with sine-wave output signals



Measuring systems with square-wave output signals can only be tested with a phase angle measuring unit (PWM).

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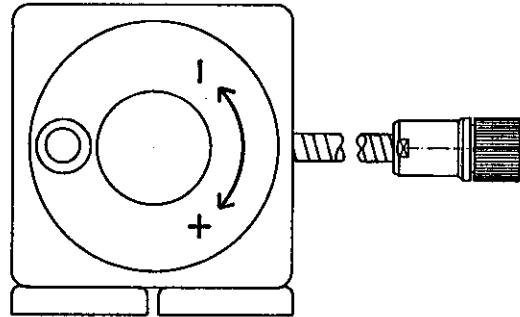
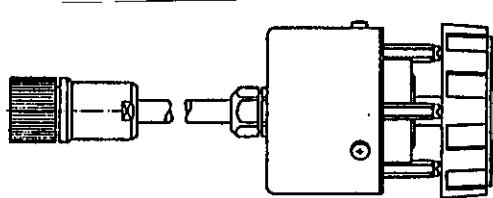
**9. Handwheel**

**9.1 Overview**

**9.1.1 Handwheels with sine signal**

**HR 150** Id.no. 217 978 --

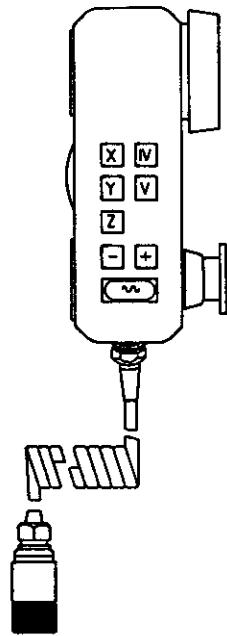
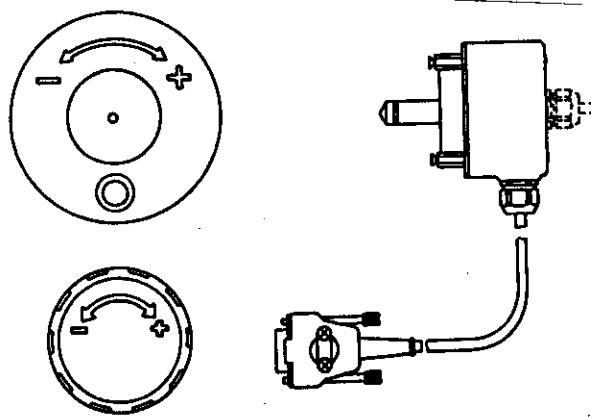
**HR 250** Id.no. 217 977 --

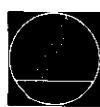


**9.1.2 Serial Handwheels**

**HR 130** Id.no. 254 040 --  
**HR 130.001** Id.no. 249 371 --

**HR 330** Id.no. 251 534 --





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## 9.2 Checking the Handwheel

### 9.2.1 Handwheel with sine input

The HR 150, resp. the HR 250 Handwheel can be electrically checked as an encoder, but without reference pulse, however.

### 9.2.2 Serial Handwheel

The serial HR 130, resp. the HR 330 Handwheel can only be checked with an oscilloscope. The control signals (X11 pin 6 = DTR, pin 8 = RxD) must correspond to the following diagram.

The Handwheel is supplied by the Logic Unit (X11 pin 2 = 0V, pin 4 = +12V).

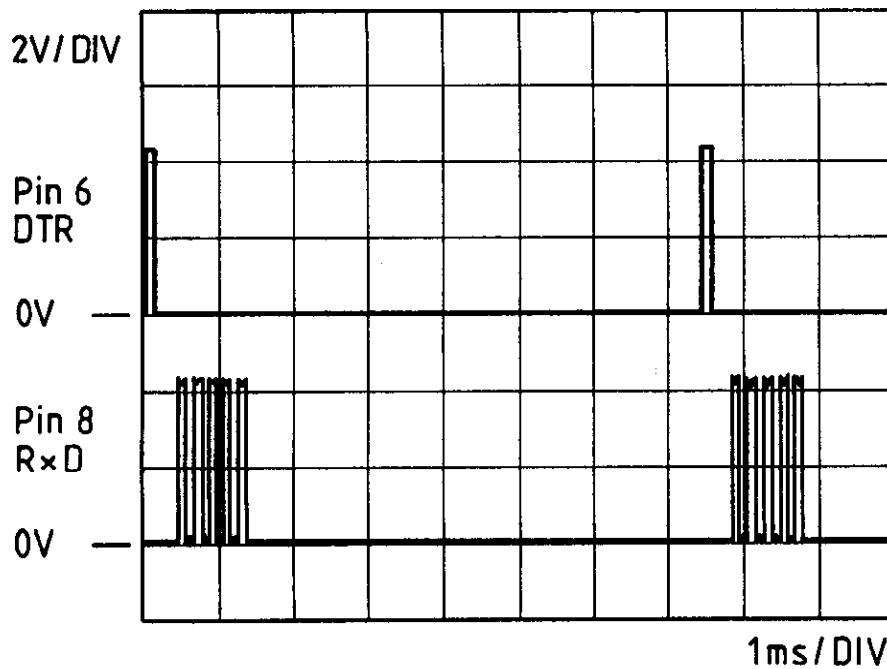


Diagram measured at the X11 Logic Unit.



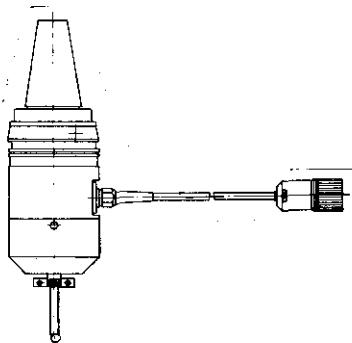
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## 10. 3D-Touch Probe

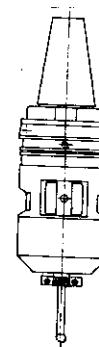
### 10.1 Overview

#### 10.1.1 Touch Probe with an external Interface Electronics (APE)

**TS 111** Id.no. 237 400 --  
with cable connection



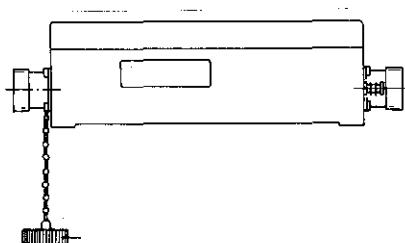
**TS 511** Id.no. 237 402 --  
with infrared transmission



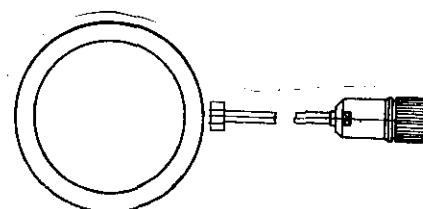
**APE 110** Id.no. 230 465 -- for TS 111

**APE 510** Id.no. 237 590 -- for TS 511

**APE 511** Id.no. 237 586 -- for TS 511 and  
additional connection for a  
second SE 510)

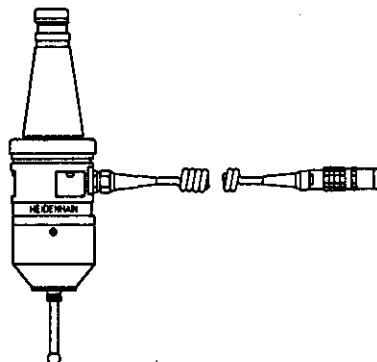


**SE 510** Id.no. 230 473 --



#### 10.1.2 Touch Probe with integrated Interface Electronics (APE)

**TS 120** Id.no. 243 614 --



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**10.2 Error Messages**

1. **TOUCH POINT INACCESSIBLE**

After starting a probe the probing point was not reached within the measuring path determined in machine parameter 216.

2. **EXCHANGE TOUCH PROBE BATTERY**

The battery voltage of the touch probe with infrared transmission remains below admissible level.

3. **STYLUS ALREADY IN CONTACT**

When starting a probe function, the stylus is already deflected.

4. **PROBE SYSTEM NOT READY**

The infrared transmission path between the "Touch Probe" and the "Transmit-Receive Unit" is obstructed (e.g. coolant film on probe windows) or is interrupted completely. The touch probe side with two windows has to be adjusted in the direction of transmit-receive unit.

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**11. RS-232-C/V.24 - Interface****11.1 Operating Modes ME-FE-EXT**

The TNC 355 can be switched to 3 operating modes for data transmission as follows:

- ME** - To connect the **ME 101/ME 102** HEIDENHAIN Magnetic Tape Unit or other peripheral units. The data format (7 data bits, 1 stop bit, parity (even parity) and the baud rate (2400) are adapted to the **ME**.
- FE** - To connect the **FE 401** HEIDENHAIN Floppy Disk Unit or other peripheral units. The data is transmitted with a special protocol (blockwise transfer) in order to backup data. The data format (7 data bits, 1 stop bit, parity (even parity), the baud rate (9600) and the transmission protocol is adapted to the **FE**.
- EXT** - To adapt data transmission in the standard data format and for blockwise transfer on external peripheral units. The interface for data transmission is adapted via the machine parameters, the baud rate is optional.

Peripheral units for the operating mode **EXT**:

Paper tape punch or paper tape reader  
Printer or matrix printer for graphic printout  
Mass storage or programming stations for "Blockwise Transfer"  
Programming stations and PCs' for external programming

**11.1.1 Changing Operating Modes ME-FE-EXT**

Select auxiliary operating mode "MOD" with the **[MOD]**-key.  
Press the **[MOD]**-key or **[MOD]** several times until the **RS-232-C/V.24-INTERFACE** with the **ME-**, **FE-** or **EXT**-display appears.

Press the **[ENT]**-key until the required operating mode is displayed. Acknowledge the auxiliary operating mode with the **[DEL]**-key subsequently.

With graphic printout the operating mode **EXT** is automatically selected which is independent of the **ME** or **FE**-mode.

**11.2 Selecting the Baud-Rate**

Select auxiliary operating mode "MOD" with the **[MOD]**-key.  
Press the **[MOD]**-key or **[MOD]** several times until **BAUD-RATE** is displayed.

Input new value for **BAUD-RATE**, if required (possible values: 110, 150, 300, 600, 1200, 4800, 9600, Baud) and enter with the **[ENT]**-key.  
Acknowledge the auxiliary operating mode with the **[DEL]** key subsequently.

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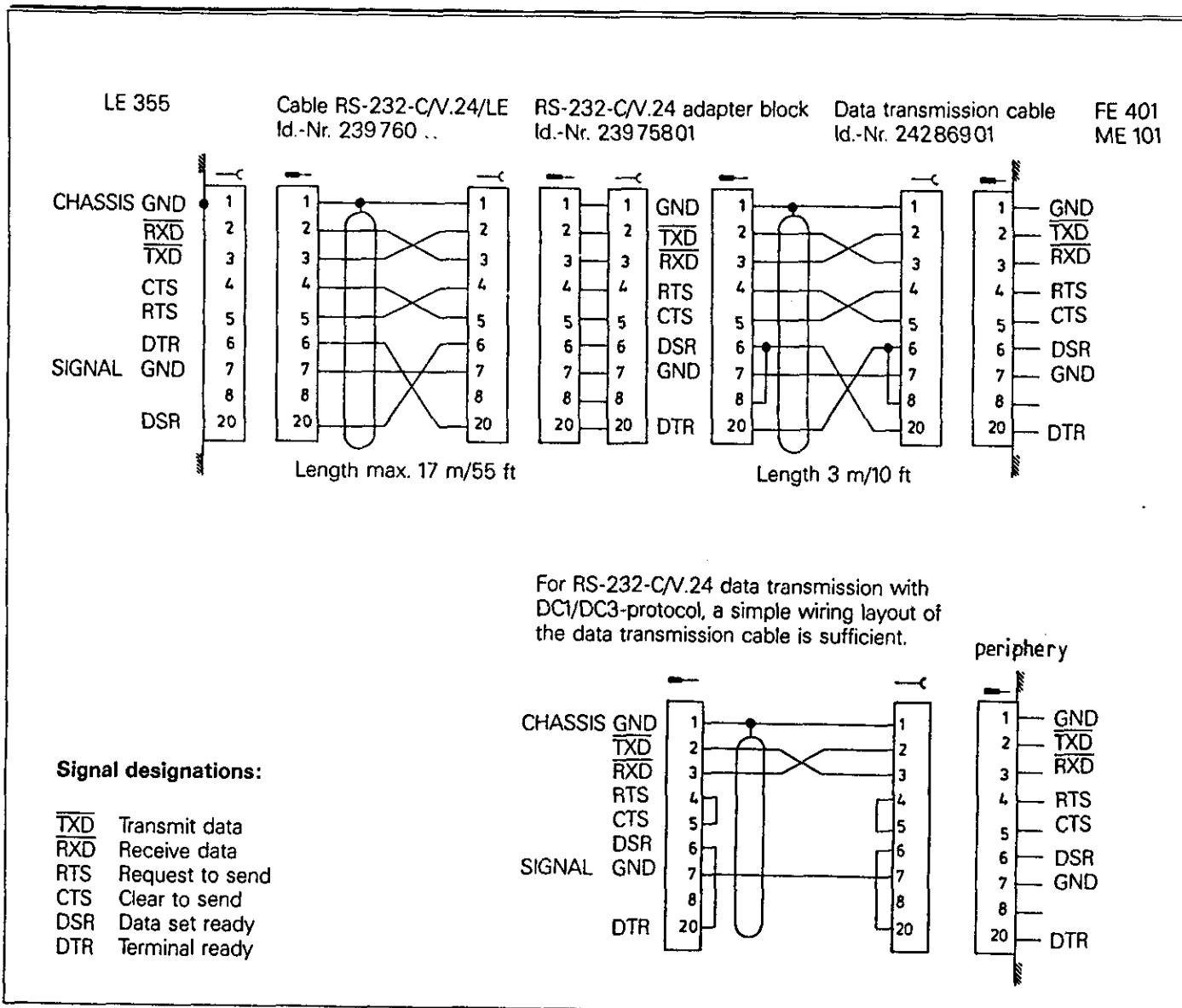
\* with special HEIDENHAIN software



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**11.3 Connection Cable and Adapter for RS-232-C/V.24-Interface**

Wiring diagram of the RS-232-C/V.24-Interface



The data lines and control lines of the cable between LE 351/355 and the RS-232-C/V.24-adapter block (id.no. 239 760 ..) are crossed. At connector X26 of the LE 351/355 the layout is carried out according to a DTU (Data Transmission Unit). Owing to the crossed data and control lines of the cable between LE 351/355 and RS-232-C/V.24-adapter the layout of the RS-232-C/V.24-adapter corresponds to the DTE (Data Terminal Equipment). Thus the external units can be connected to the standard data transmission cable (id.no. 242 869 01) of HEIDENHAIN.



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**11.4 Machine Parameters for the RS-232-C/V.24-Interface**

A precise description of the single machine parameters can be taken from the TNC Handbook for Machine Manufacturers, resp. from the information regarding the RS-232-C/V.24-data interface.

**11.4.1 Machine Parameters for "Standard interface"**

| MP  | Input values | Function   |
|-----|--------------|--|
| 71  | 3            | sign for prgr. end = ETX   |
| 92  | Bit 0 0      | decimal point  |
| 222 | 168          | 7 data bits, transmission stop by DC3,<br>parity bit (even parity), 1 stop bit |
| 223 | 0            | standard interface   |

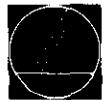
**11.4.2 Machine Parameters for "Blockwise transfer"**

| MP  | Input values | Function   |
|-----|--------------|--|
| 71  | 515          | sign for prgr. end = ETX<br>sign for prgr. beginning = STX                     |
| 218 | 17736        | H and E  |
| 219 | 16712        | H and A  |
| 220 | 279          | ETB and SOH  |
| 221 | 5382         | ACK and NAK  |
| 222 | 168          | 7 data bits, transmission stop by DC3,<br>parity bit (even parity), 1 stop bit |
| 223 | 1            | Blockwise transfer   |
| 224 | 4            | EOT  |

**11.4.3 Machine Parameters for Graphic Printout**

| MP  | LQ500 | LX800 | E P S O N<br>LX85 | FX100 | FX800 | BROTHER<br>1509 | HP<br>Thinkjet | MANNESMANN<br>Tally |
|-----|-------|-------|-------------------|-------|-------|-----------------|----------------|---------------------|
| 226 | 795   | 795   | 1819              | 1819  | 1819  | 1051            | 795            | 1819                |
| 227 | 16648 | 13078 | 17217             | 17217 | 17224 | 12301           | 16648          | 17224               |
| 228 | 0     | 0     | 6963              | 6963  | 6963  | 2560            | 0              | 6963                |
| 229 | 0     | 0     | 6154              | 7424  | 5624  | 0               | 0              | 5642                |
| 230 | 1546  | 1546  | 1546              | 1290  | 1546  | 1546            | 1546           | 1546                |
| 231 | 3355  | 6954  | 6954              | 6987  | 6954  | 3355            | 3355           | 6987                |
| 232 | 19200 | 13312 | 1024              | 2     | 1024  | 19200           | 19200          | 1280                |
| 233 | 512   | 512   | 512               | 0     | 512   | 512             | 512            | 512                 |

When printing graphics the control automatically switches the operating mode to EXT and the data format to 8 data bits.



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**11.5 Connection Cable for Printers**

Simple wiring proved to be the right one for most printers (see page 50).

**11.6 Error Messages**

**11.6.1 Displayed Error Messages in the ME-Operating Mode**

**WRONG OPERATING MODE**

No or wrong operating mode on external data storage unit.

**WRONG PROGRAM DATA**

During data transmission defective program data were found. Reading was repeated three times by the magnetic tape and aborted subsequently.

**DATA MEDIUM MISSING**

No disk inserted in drive.

**DATA MEDIUM EMPTY**

On the data carrier (diskette) no programs are stored.

**DATA MEDIUM WRITE-PROTECTED**

Write-enable pin of cassette is missing.

**PROGRAM INCOMPLETE**

Data transmission was aborted before the program was completely transmitted.

**EXT. IN-/OUTPUT NOT READY**

DSR-signal of TNC is missing.  
- ME not connected.  
- defective transmission cable.

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### 11.6.2 Displayed Error Messages of the TNC in the FE-Operating Mode

In this operating mode errors are output by the Floppy Disk Unit in the following form:

ERR: (SP) (SP) XXX (CR) (XXX = error number)

The following errors can be displayed on the screen:

ERR: **001** Wrong instruction code (e.g. wrong machine parameters for control character)

ERR: **002** Illegal program name (monitor operation)

ERR: **003** Faulty data transmission

ERR: **004** Incomplete program on diskette

ERR: **010** Program not on diskette

ERR: **011** Program is protected against erasure

ERR: **012** Program is being stored

ERR: **013** Diskette directory is full

ERR: **014** Diskette is full

ERR: **100** Diskette not formatted

ERR: **102** Drive not ready

ERR: **103** Diskette is write-protected

ERR: **104** Faulty data on diskette

ERR: **105** Section cannot be found (e.g. unformatted diskette is to be described)

ERR: **106**

ERR: **107** Electronic error in the FE

ERR: **108**



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### 11.6.3 Error Messages at the ME

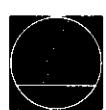
The ME-electronics as well as the external operating conditions are tested. Detected errors are displayed as flashing codes by the operating mode indicating lamps. Error descriptions can be found in the following table:

LED - off

LED - flashing

| Indicating lamps | Error message   |
|------------------|---|
|                  | Faulty data during transmission   |
|                  | Cassette is not inserted  |
|                  | Write-protection pin in cassette is missing   |
|                  | Wrong operating mode selected   |
|                  | Data from magnetic tape defective   |
|                  | Magnetic tape blank   |
|                  |   |
|                  |   |
|                  |   |
|                  | Electronic fault in ME  |
|                  |   |
|                  |   |
|                  |   |
|                  | Tape end  |
|                  | Peripheral unit is not connected  |
|                  | Data transfer between TNC and ME (or peripheral unit) interrupted by pressing the  -key |

By pressing the -key the error messages can be erased.



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**11.6.4 Error Messages at the FE in the ME-mode**

In the ME-mode errors are displayed as flashing codes by the operating modes indicating lamps.



LED - off



LED - on



LED - flashing

| Indicating lamps   | Error messages  |
|--------------------|---|
| ○ ○ ○ ●<br>○ ● ○ ○ | Diskette is missing or electronic error   |
| ○ ○ ○ ●<br>○ ● ○ ○ | Diskette cannot be formatted since diskette is accessed   |
| ● ○ ○ ●<br>● ○ ○ ○ | Diskette is missing or not formatted  |
| ● ○ ○ ●<br>● ○ ○ ○ | Diskette cannot be copied since writing and reading is active                                     |
| ● ○ ● ●<br>○ ○ ○ ○ | External unit not ready or not connected  |
| ● ○ ● ●<br>○ ○ ○ ○ | Diskette is missing or not formatted  |
| ● ○ ○ ●<br>○ ○ ● ○ | Diskette is missing or not formatted or no program available                                      |
| ● ○ ● ●<br>○ ○ ○ ○ | Program cannot be output since a transmission is active via a TNC-interface                       |
| ● ○ ○ ●<br>○ ○ ● ○ | Program cannot be output since a transmission is active via a PRT-interface                       |
| ○ ○ ● ●<br>● ○ ○ ○ | External unit not ready or not connected  |
| ○ ○ ● ●<br>● ○ ○ ○ | Diskette is missing or not formatted  |
| ○ ○ ○ ●<br>● ○ ● ○ | Diskette is missing or not formatted  |
| ○ ○ ● ●<br>● ○ ○ ○ | Program cannot be stored since a transmission is active via a TNC-interface                       |
| ○ ○ ○ ●<br>● ○ ● ○ | Program cannot be stored since a transmission is active via a PRT-interface                       |
| ○ ● ○ ●<br>○ ○ ● ○ | External unit not ready or not connected  |
| ○ ● ○ ●<br>○ ○ ● ○ | Diskette is missing or electronic error   |
| ○ ● ○ ○<br>○ ○ ● ○ | Directory cannot be output since a transmission is active via a PRT-interface                     |
| ○ ○ ○ ●<br>○ ○ ● ○ | A coupling of the interfaces is not possible since a transmission is active via the TNC-interface |
| ○ ○ ● ●<br>○ ○ ○ ○ | A coupling of the interfaces is not possible since a transmission is active via the PRT-interface |
| ○ ○ ● ●<br>○ ○ ○ ○ | External unit not ready or not connected  |

By pressing the **STOP**-key the error messages can be erased.



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## 12. External Data I/O

### 12.1 External Data Output

- Connect external data storage unit (**ME**, **FE** or **EXT**) to the TNC.
- Prepare external data storage unit for data transmission:  
with the **ME** by pressing the **STOP**, **TNC** and the **-B**-keys.  
with the **FE** by pressing the **STOP**-key.
- Select operating mode of the interface (**ME**, **FE** or **EXT**) at the TNC  
(see section 11.1.1). Also select baud rate with the operating mode **EXT**.  
(see section 11.2).

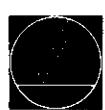
#### 12.1.1 Output of Machine Parameters to the ME

| Dialog display  | Press key   |
|---|---|
| MANUAL OPERATION  | <b>MOD</b>  |
| VACANT BLOCKS = XXXX                                      | <b>↑</b>  |
| CODE NUMBER =   | <b>9</b> <b>5</b> <b>1</b> <b>4</b> <b>8</b> <b>ENT</b> |
| MACHINE PARAMETER PROGRAMMING<br>MACHINE PARAMETER MP Ø ? | <b>EXT</b>  |
| EXTERNAL DATA INPUT ?                                     | <b>NO ENT</b>   |
| EXTERNAL DATA OUTPUT                                      |   |
| MANUAL OPERATION  |   |

#### 12.1.2 Output of Machine Parameters to the FE

| Dialog display  | Press key   |
|---|---|
| MANUAL OPERATION  | <b>MOD</b>  |
| VACANT BLOCKS = XXXX                                      | <b>↑</b>  |
| CODE NUMBER =   | <b>9</b> <b>5</b> <b>1</b> <b>4</b> <b>8</b> <b>ENT</b> |
| MACHINE PARAMETER PROGRAMMING<br>MACHINE PARAMETER MP Ø ? | <b>EXT</b>  |
| EXTERNAL DATA INPUT ?                                     | <b>NO ENT</b>   |
| PROGRAM NUMBER =  |   |
| EXTERNAL DATA OUTPUT                                      |   |
| MANUAL OPERATION  |   |

Input program number requested under which the machine parameters are to be output and acknowledge with the **ENT**-key.



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12.1.3 Output of the PLC-Program to the ME

Dialog display

Press key

MANUAL OPERATION

MOD

VACANT BLOCKS = XXXX

↑

CODE NUMEBR =

9 5 1 0 2 6 ENT

TABELLE E/A/Z/T/M

↶

PC-EDITIER-FUNKTION

( EXIT )<sup>1)</sup> ( GOTO □ 2 0 4 8 ENT EXIT )<sup>2)</sup>

EXTERN EIN/AUS ? ENT/NO-ENT

[NO ENT]

AUSGABE ASC/BIN ? ENT/NO-ENT

[ENT]

AUSGABE AB PGM-ZEILE = 0

( ENT )<sup>1)</sup> ( 2 0 4 8 ENT )<sup>2)</sup>

AUSGABE BIS PGM-ZEILE = 0

( 2 0 4 7 ENT )<sup>1)</sup> ( 3 0 7 1 ENT )<sup>2)</sup>

EXTERNAL DATA OUTPUT

[NO ENT]

QUERVERWEIS-LISTE ?

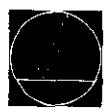
[END □]

PC-EDITIER-FUNKTION

MANUAL OPERATION

1) with output of 1st and 2nd kByte

2) with output of 3rd kByte



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**12.1.4 Output of the PLC-Program to the FE**

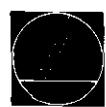
| Dialog display               | Press key   |  |
|------------------------------|---|--|
| MANUAL OPERATION             |   |  |
| VACANT BLOCKS = XXXX         |   |  |
| CODE NUMBER =                |   |  |
| TABELLE E/A/Z/T/M            |   |  |
| PC-EDITIER-FUNKTION          | 1,   2,   |  |
| EXTERN EIN/AUS ? ENT/NO-ENT  |   |  |
| AUSGABE ASC/BIN ? ENT/NO-ENT |   |  |
| AUSGABE AB PGM-ZEILE = 0     | 1,  2,  |  |
| AUSGABE BIS PGM-ZEILE = 0    | 1,  2,  |  |
| PROGRAM NUMBER =             | Input program number requested under which the PLC-program is to be output and enter with the -key. |  |
| EXTERNAL DATA OUTPUT         |   |  |
| PC-EDITIER-FUNKTION          |   |  |
| MANUAL OPERATION             |   |  |

<sup>1)</sup> with output of 1st and 2nd kByte

<sup>2)</sup> with output of 3rd kByte

**12.1.5 Output of all NC-Programs to the ME or the FE**

| Dialog display   | Press key |
|--|-----------|
| MANUAL OPERATION                                       |           |
| PROGRAMMING AND EDITING                                |           |
| PROGRAMMING AND EDITING<br>SELECTION = ENT/END = NOENT |           |
| READ-IN SELECTED PROGRAM                               |           |
| READ-OUT SELECTED PROGRAM                              |           |
| READ-OUT ALL PROGRAMS                                  |           |
| EXTERNAL DATA OUTPUT                                   |           |
| PROGRAMMING AND EDITING                                |           |



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**12.1.6 Output of the compensation value list to the ME**

Dialog display

Press key

MANUAL OPERATION

MOD

VACANT BLOCKS = XXXX

↑

CODE NUMBER =

1    0    5    2    9    6     ENT

COMPENSATION VALUE LIST  
DEFECTIVE AXIS ?

EXIT

EXTERNAL DATA INPUT ?

NO  
 ENT

EXTERNAL DATA OUTPUT

END

COMPENSATION VALUE LIST

MANUAL OPERATION

**12.1.7 Output of the correction list to the FE**

Dialog display

Press key

MANUAL OPERATION

MOD

VACANT BLOCKS = XXXX

↑

CODE NUMBER =

1    0    5    2    9    6     ENT

COMPENSATION VALUE LIST  
DEFECTIVE AXIS ?

EXIT

EXTERNAL DATA INPUT ?

NO  
 ENT

PROGRAM NUMBER =

Enter the requested program number  
under which the compensation value  
list is to be output and acknow-  
ledge with the key  ENT.

EXTERNAL DATA OUTPUT

END

COMPENSATION VALUE LIST

MANUAL OPERATION



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**12.2 External Data Input**

- Connect external data storage unit (**ME**, **FE** or **EXT**) to the TNC.
- Prepare external data storage unit for the data transmission:
  - with the **ME** by pressing the **STOP**, **TNC** and the **-8**-keys.
  - with the **FE** by pressing the **STOP**-key.
- Adjust operating mode of the interface (**ME**, **FE** or **EXT**) at the TNC.  
(see section 11.1.1). Also select baud rate with the operating mode **EXT**.  
(see section 11.2).

**12.2.1 Machine parameter input from the ME with erased memory**

| Dialog display  | Press key  |
|---|------------|
| OPERATING PARAMETERS ERASED                               | <b>CE</b>  |
| PLC: PROGRAM MEMORY ERASED                                | <b>CE</b>  |
| MACHINE PARAMETER PROGRAMMING<br>MACHINE PARAMETER MP Ø ? | <b>EXT</b> |
| EXTERNAL DATA INPUT                                       |            |
| *   |            |

**12.2.2 Machine parameter input from the FE with erased memory**

| Dialog display  | Press key  |
|---|--|
| OPERATING PARAMETERS ERASED                               | <b>CE</b>  |
| PLC: PROGRAM MEMORY ERASED                                | <b>CE</b>  |
| MACHINE PARAMETER PROGRAMMING<br>MACHINE PARAMETER MP Ø ? | <b>EXT</b>   |
| PROGRAM NUMBER =  | Input program number under which the machine parameters are stored and transfer with the <b>ENT</b> -key |
| EXTERNAL DATA INPUT                                       |  |
| *   |  |

\* After reading in the machine parameters "POWER INTERRUPTION" usually appears in the dialog display; if, however, the error message "MACHINE PARAMETERS INCOMPLETE" appears, fewer machine parameters are stored on the external data storage unit than required by the TNC. In this case the remaining machine parameters have to be entered manually.

These machine parameters can be obtained by the machine manufacturer.

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12.2.3 Input of Machine Parameters from the ME with not-erased Memory  
(the machine parameters in the memory are overwritten)

## Dialog display

MANUAL OPERATION

VACANT BLOCKS = XXXX

CODE NUMBER =

MACHINE PARAMETER PROGRAMMING  
MACHINE PARAMETER MP Ø ?

EXTERNAL DATA INPUT ?

EXTERNAL DATA INPUT

\*

## Press key



12.2.4 Input of Machine Parameters from the FE with non-erased Memory  
(the machine parameters in the memory are overwritten)

## Dialog display

MANUAL OPERATION

VACANT BLOCKS = XXXX

CODE NUMBER =

MACHINE PARAMETER PROGRAMMING  
MACHINE PARAMETER MP Ø ?

EXTERNAL DATA INPUT ?

PROGRAM NUMBER =

EXTERNAL DATA INPUT

\*

## Press key



Input program number under which  
the machine parameters are stored  
and transfer with the -key

\* After reading in the machine parameters "MANUAL OPERATION" usually appears in the dialog display; if, however, the error message "MACHINE PARAMETERS INCOMPLETE" appears fewer machine parameters are stored on the external data storage unit than required by the TNC. In this case the remaining machine parameters have to be entered manually.

These machine parameters can be interrogated by the machine manufacturer.



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12.2.5 Input of the PLC-Program from the ME

Dialog display

MANUAL OPERATION

VACANT BLOCKS = XXXX

CODE NUMBER =

TABELLE E/A/Z/T/M

PC-EDITIER-FUNKTION

EXTERN EIN/AUS ? ENT/NO-ENT

EINGABE AB PGM-ZEILE = 0

EXTERNAL DATA INPUT

PC-EDITIER-FUNKTION

MANUAL OPERATION

Press key

MOD

↑

↓

()<sup>1)</sup>

(GOTO 2 0 4 8 ENT )<sup>2)</sup>

(ENT)

()<sup>1)</sup>

(2 0 4 8 ENT)<sup>2)</sup>

END

12.2.6 Input of the PLC-Program from the FE

Dialog display

MANUAL OPERATION

VACANT BLOCKS = XXXX

CODE NUMBER =

TABELLE E/A/Z/T/M

PC-EDITIER-FUNKTION

EXTERN EIN/AUS ? ENT/NO-ENT

EINGABE AB PGM-ZEILE = 0

PROGRAM NUMBER =

EXTERNAL DATA INPUT

PC-EDITIER-FUNKTION

MANUAL OPERATION

1) with input of 1st and 2nd kByte

2) with input of 3rd kByte

Press key

MOD

↑

↓

()<sup>1)</sup>

(GOTO 2 0 4 8 ENT )<sup>2)</sup>

(ENT)

()<sup>1)</sup>

(2 0 4 8 ENT)<sup>2)</sup>

Input program number under which  
the PLC-program is stored and  
transfer with the -key

END

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**12.2.7 Input of NC-Programs from the ME or FE**

Dialog display

Press key

MANUAL OPERATION



PROGRAMMING AND EDITING



PROGRAMMING AND EDITING  
SELECTION = ENT/END = NOENT



READ-IN SELECTED PROGRAM



READ-IN PROGRAM OFFERED



READ-IN ALL PROGRAMS

EXTERNAL DATA INPUT

PROGRAMMING AND EDITING



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**12.2.8 Input of compensation value list from the ME**

Dialog display

MANUAL OPERATION

VACANT BLOCKS = XXXX

CODE NUMBER =

COMPENSATION VALUE LIST  
DEFECTIVE AXIS ?

EXTERNAL DATA INPUT ?

EXTERNAL DATA INPUT ?

COMPENSATION VALUE LIST

MANUAL OPERATION

Press key

MOD

↑

1 0 5 2 9 6 ENT

EXT

ENT

END

**12.2.9 Input of the compensation value list from the FE**

Dialog display

MANUAL OPERATION

VACANT BLOCKS = XXXX

CODE NUMBER =

COMPENSATION VALUE LIST  
DEFECTIVE AXIS ?

EXTERNAL DATA INPUT ?

PROGRAM NUMBER =

EXTERNAL DATA INPUT

COMPENSATION VALUE LIST

MANUAL OPERATION

Press key

MOD

↑

1 0 5 2 9 6 ENT

EXT

ENT

enter the program number  
under which the compensation  
value list is stored and ack-  
nowledge with the ENT-key.

END



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## 13. Analog Outputs

### 13.1 Technical Data

5 or 6 outputs X, Y, Z, IV, V and S      Loading capacity:  $R_L \text{ min} = 5 \text{ k}\Omega$   
 $C_L \text{ max} = 5 \text{ nF}$

$U_a \text{ max} = \pm 10 \text{ V} \pm 0.25 \text{ V}$   
 $U_a \text{ min} = 0 \text{ V} \pm 1 \text{ mV}$

Resolution 12 Bit  $\approx 4095$  steps

$$\text{Smallest step} = \frac{U_a \text{ max}}{4095 \text{ steps}} = \frac{10 \text{ V}}{4095} = 2.44 \text{ mV}$$

### 13.2 Measuring the Analog Output Voltages

Proportional to the traversing speed the control outputs an analog voltage of 0V (axis standstill) to 9V (rapid traverse). This voltage can simply be measured with the ANALOG OUTPUT TEST ADAPTER directly at the LOGIC Unit or at the connecting terminals of the servo amplifier with a voltmeter.

If, however, no axis movement takes place due to a defect and if it is to be checked whether the error is due to the control or to an external unit proceed as follows:

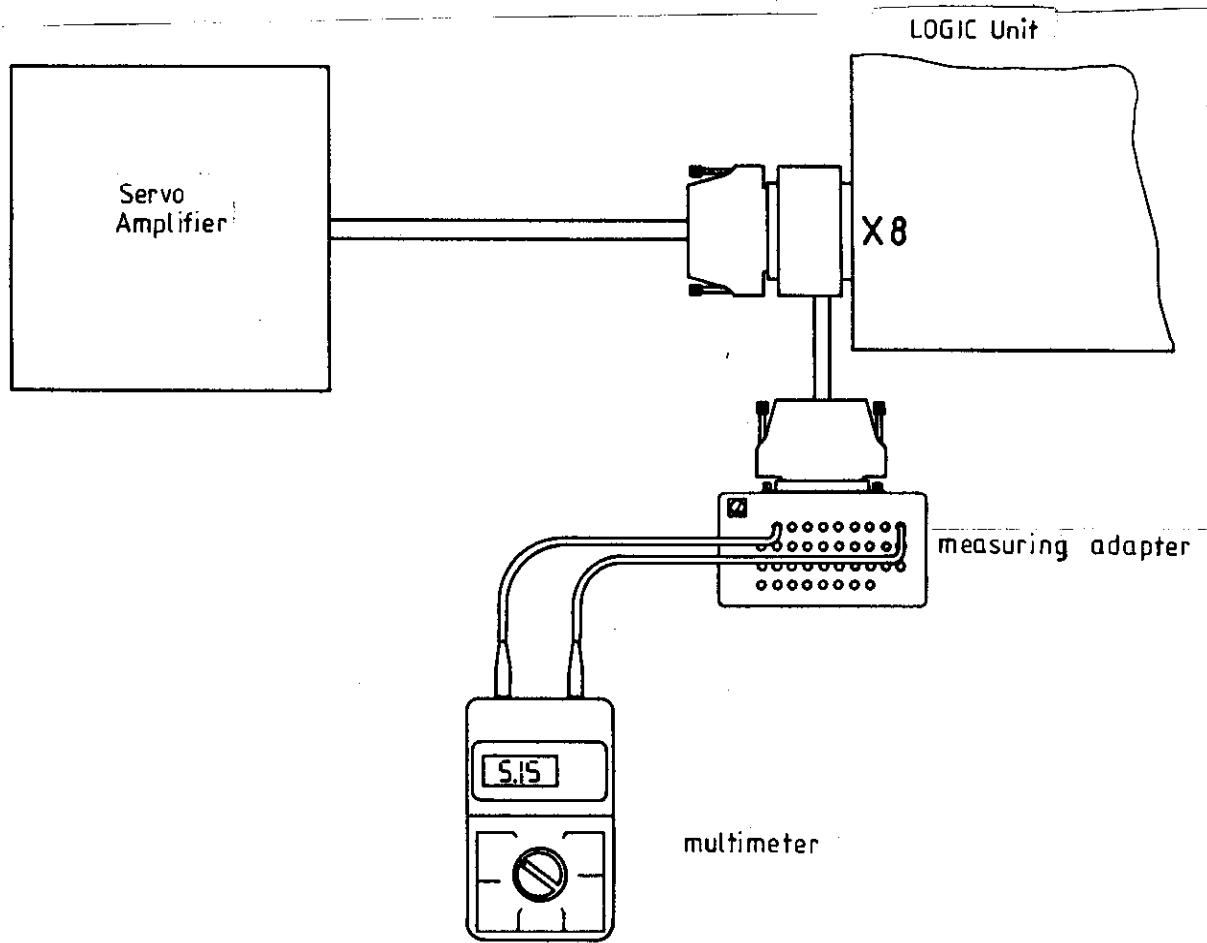
- Switch off mains switch at machine.
- Connect ANALOG OUTPUT TEST ADAPTER to connector X8 (nominal value output) of the LE and connect voltmeter at the ANALOG OUTPUT TEST ADAPTER to the sockets of the defective axis. If no ANALOG OUTPUT TEST ADAPTER is available then connect voltmeter directly to the nominal value input of the servo amplifier.
- Switch on main switch and control voltage.
- Switch position display to LAG (trailing error).
- Check or adjust the following machine parameters (note original input values when changing machine parameters and input them after checking).

| MP  | Input value | Function                                  |
|-----|-------------|---|
| 174 | 100 (mm)    | Trailing error supervision EMERGENCY-STOP |
| 234 | 9.99 (V)    | Movement supervision                      |

- Sequentially traverse over those reference marks that have to be traversed over before that of the defective axis.
- Turn back completely override potentiometer of the KEYBOARD Unit and start reference mark approach for the defective axis.
- Check axis release for defective axis at servo amplifier.
- Check display  
(Control in operation) has to be on, F has to illuminate as usual with the feed display (not inverse F) and with the position display no point must illuminate after the axis designation (e.g. X.).
- Turn override potentiometer to the right and turn back again before the trailing error display reaches the position supervision limit (MP 174).

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The control outputs an analog voltage when turning the override potentiometer to the right and increases this voltage proportionally to the trailing error up to maximally 10V. If a voltage of  $10V \pm 0.25V$  is measured with a voltmeter at the ANALOG OUTPUT TEST ADAPTER the control is in order. If, however, no voltage is measured then switch off mains switch, unplug connector X8 of the LE, remove the wire to the nominal value line at servo drive and check for short circuit. If the nominal value line is in order reconnect connector X8 to the LE (leave nominal value line at servo amplifier unconnected), switch on mains switch and repeat measurement by approaching the reference mark. If an analog voltage is measured the control is in order. If, however, no voltage is measured the analog output of the LE is probably defective.

**13.2.1 Set-up for Measuring the Analog Outputs**



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**13.3 Changing Positional Display Mode**

Select auxiliary operating mode "MOD" with the **[MOD]**-key.

Press the **[↓]** or the **[MOD]**-key several times until the POSITION DISPLAY appears.

Press the **[ENT]**-key, if necessary, until the requested display (ACTL, REF, LAG, NOML or DIST) appears.

Acknowledge the auxiliary operating mode with the **[DEL]**-key subsequently.

**13.4 Speed Adjustment**

Check and/or optimize machine parameters (note original input values when changing the machine parameters).

| MP | Input value | Function            |
|----|-------------|---------------------|
| 60 | 0           | Speed precontrol on |
| 65 | 0           | Display step = 1µm  |

- Change positional display mode to LAG (trailing error display).

- Input the following test program.

e.g.      1LBL1  
              2X100 R0 F29999 M         (Select bigger traverse range if possible)  
              3X0 R F M  
              4CALLLBL1REP10

- Processing of test program in the operating mode "Program Run Full Sequence".

- Adjust speed at servo amplifier (tacho) such until the trailing error display possibly displays zero in both directions during positioning.

- Repeat adjustment for all axes.

- Bring machine parameters and positional display to original state again.

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### 13.5 Offset Adjustment

#### 13.5.1 Offset Adjustment with Key Number

- Select auxiliary operating mode "MOD" with the **MOD**-key and select key number with the **↑**-key.
- Input key number 75368 and transfer with the **ENT**-key.  
The converter steps (2.44mV) are now displayed for the offset on the display. If the **ENT**-key is now pressed the offset values are transferred into the offset memory and compensated. If instead of the **ENT**-key the **[NO ENT]**-key is pressed the offset memory is erased and the compensation is eliminated.
- Acknowledge the auxiliary operating mode with the **DEL**-key.

#### 13.5.2 Automatic Cyclic Offset Adjustment

In machine parameter 252 the cycle time (20 ms units) is determined according to an existing offset which is compensated by one converter step (2.44mV). If the automatic offset adjustment is to be switched off the machine parameter 252 has to be programmed with zero.

##### ATTENTION !



If with the automatic offset adjustment an offset voltage of 100 mV is reached the control switches off with the error message "GROSS POSITIONING ERROR E".

#### 13.5.3 Offset Adjustment at the Servo Amplifier

- Check or adjust the following machine parameters (note the original values when changing machine parameters).

| MP                  | Input value | Function                                   |
|---------------------|-------------|--|
| 28, 29, 30, 31      | 0           | Integral factor                            |
| 32, 33, 34, 35, 332 | > 0.5       | Differential factor                        |
| 60                  | 0           | Speed precontrol on                        |
| 65                  | 0           | Display step = 1 µm                        |
| 252                 | 0           | Cycle time for automatic offset adjustment |

- Switch position display to LAG (trailing error display).
- Erase offset memory with key number 75368 (see section 13.5.1).
- Select operating mode **④** or **⑤** or **⑥**.
- Adjust offset at servo amplifier until the individual axes display zero or oscillate symmetrically around zero.
- Bring machine parameters and position display to original state again.



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## 14 . PLC-I/O

### 14.1 Technical Data

#### 14.1.1 PLC-Inputs of the LE

**E0** up to E31 to X22  
**E128** up to E143 to X23 and X27  
**E144** up to E152 to X27

"0"     $U_e = -20 \text{ V}$  up to 3.2 V  
       $I_e = 1.5 \text{ mA}$  with  $U_e = 3.2 \text{ V}$   
"1"     $U_e = 13 \text{ V}$  up to 30.2 V  
       $I_e = 3.7 \text{ mA}$  up to 9.1 mA

#### 14.1.2 PLC-Outputs of the LE

**A0** up to A7 to X21 and X27  
**A8** up to A30 and "control ready" to X21

"1"     $U_a \text{ min} = U_B - 3 \text{ V}$   
       $I_a \text{ NOM} = 0.1 \text{ A}$

Connector layout, see section 4.3.3

#### 14.1.3 PLC-inputs of the PL 300

**E64** up to E126 to X4 up to X9

"0"     $U_e = -20 \text{ V}$  up to 4 V  
       $I_e = 1.6 \text{ mA}$  with  $U_e = 4 \text{ V}$   
"1"     $U_e = 16.5 \text{ V}$  up to 30 V  
       $I_e = 6.2 \text{ mA}$  up to 12.6 mA

#### 14.1.4 PLC-outputs to the PL 300

**A32** up to A62 and "control ready" to X1 up to X3

"1"     $U_a \text{ min} = U_B - 3 \text{ V}$   
       $I_a \text{ NOM} = 1.2 \text{ A}$

Connector layout, see section 4.3.4



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### **14.2 Checking the PLC-I/O**

3 test units are available for checking the PLC-inputs and outputs:

|                    |                  |
|--------------------|------------------|
| PLC TEST UNIT      | X21, X22 and X27 |
| KEYBOARD TEST UNIT | for X23          |
| PL TEST ADAPTER    | for PL Board     |

All inputs or outputs of a connector are simultaneously displayed with the PLC TEST UNIT and the KEYBOARD Unit and their voltages can be measured. Only the inputs or outputs of one connector block of the PLC POWER I/O Board Assembly (PL 300) can be displayed at one time using the PL TEST ADAPTER. Taking measurements directly at the terminals is possible.

#### **14.2.1 PLC-Inputs**

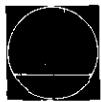
The inputs can be controlled as follows:

- Connect TEST Unit to the LE or to the PLC POWER I/O Board Assembly PL 300.
- Select auxiliary operating mode "MOD" with the -key and select key number with the -key.
- Input code number 951026, input with the -key and look at the table (at the BE) of the inputs with the -key subsequently.  
The logical states of the inputs are now displayed on the screen. The states displayed on the screen and on the test unit have to coincide. If there is a difference then measure the voltage level (as to the values, see Techn. Data) for this input at the TEST UNIT. If the input voltage is in order the respective input board is probably defective (E0 to E31 and E128 to E152 PROCESSOR Board, E64 to E126 PLC POWER I/O Board Assembly PL 300).
- Acknowledge the auxiliary operating mode with the  and -keys.

#### **ATTENTION !**



When connecting/disconnecting always  
switch off mains switch first!



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#### 14.2.2 PLC-Outputs

The outputs can be checked as follows:

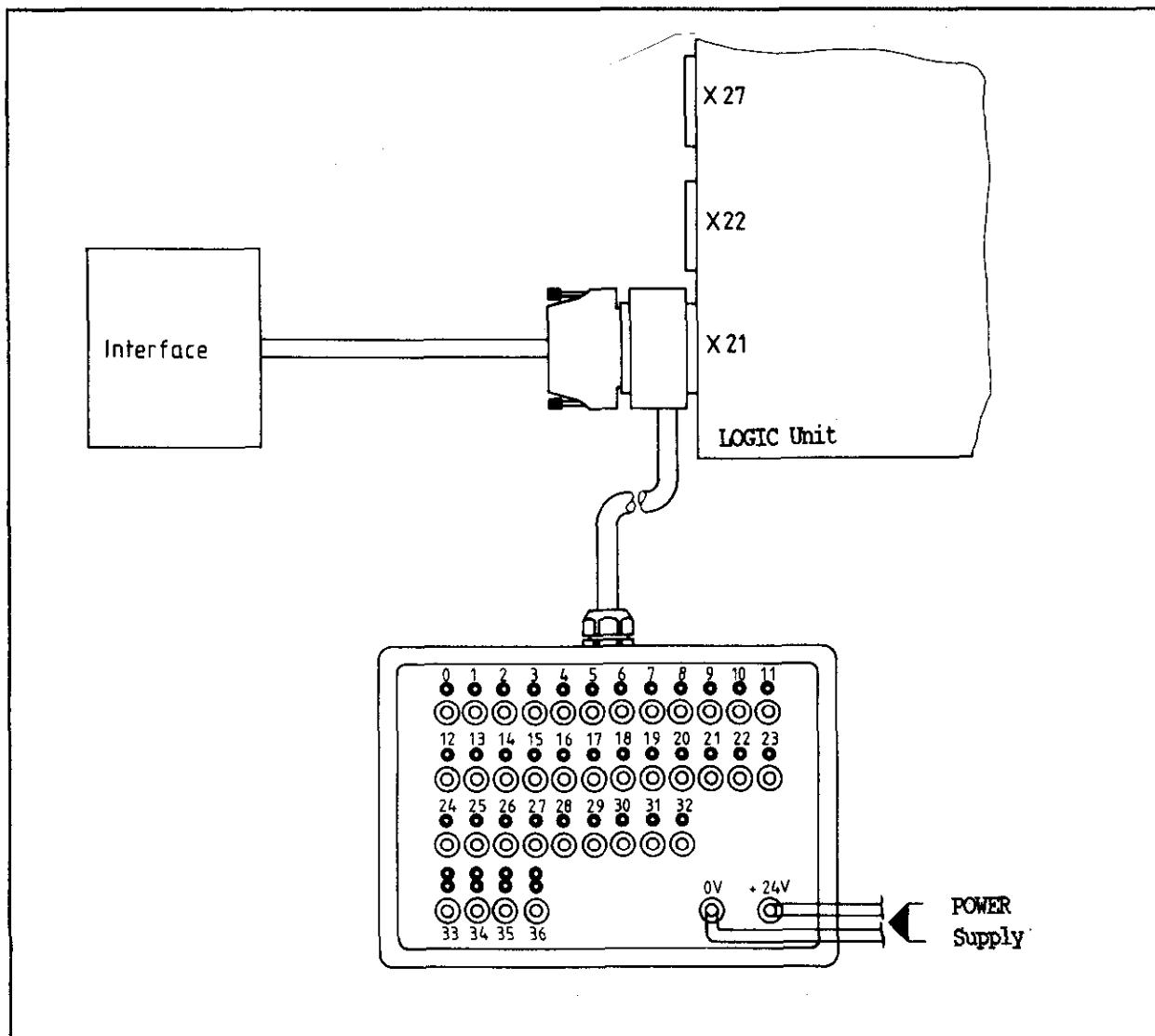
- Connect PLC I/O TEST UNIT between the LE and the interface or the PL 300 Interface.
- Select auxiliary operating mode "MOD" with the **[MOD]**-key and select key number with the **[↑]**-key.
- Input key number "951026", enter with the **[ENT]**-key and call the table (at the BE) for outputs with the **[RND]**-key subsequently.  
The logical states for the outputs are now displayed on the screen. The states displayed on the screen and on the test unit must coincide. If there is a difference then check the connecting cable for short circuit and measure output current for this output at the interface (max. 100mA for the LE or 1.2A for the PL-outputs). If the output current is not exceeded and the connecting cable is also in order the output board is probably defective (A0 to A30 PROCESSOR Board, A32 to A62 PLC POWER I/O Board Assembly PL 300)
- Acknowledge the auxiliary operating mode with the **[DEL]** and the **[END]**-keys.

#### ATTENTION !



When connecting/disconnecting  
always switch off mains switch first!

#### 14.2.3 Set-up for testing the PLC I/O



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**14.3 Output "Control Ready" and acknowledgement  
for the test "Control ready"**

Important functions are supervised with self-diagnosis by the TNC 351/355 control (electronic assemblies as microprocessors, read-only memory, read-write memory, positioning systems, encoders, etc.)

If an error is determined when checking a flashing error message appears in plain dialog in the dialog display.

The output "control ready" is opened when outputting this error message. This state can be cancelled by switching the main switch off if the error cause has been eliminated before.

The output "Control ready" must switch off the 24 volt control voltage in the machine interface. Since this function is a very important safety feature the switch-off function of the output "Control Ready" is checked each time the machine is switched on via the input "Acknowledgement control ready".

The control has two supervision devices (CLP PROCESSOR Board and PROCESSOR Board). Both boards are checked one after another when switching the machine on.

If the +24V are missing at the input "Acknowledgement control Ready" during the switch-on test routine the error message "CONTROL VOLTAGE FOR RELAY MISSING" appears. If, however, the acknowledgement is switched off too late or not at all after switching the output off the flashing error message "EMERGENCY-STOP DEFECTIVE" appears. Also if the supply is missing for the PLC-part a flashing error message "EMERGENCY-STOP DEFECTIVE" appears (Supply for the PLC-Part, see section 5.4).

If an error is determined by the control during the switch-on test routine it can be determined by inserting a bridge between the output "Control ready" and the input "Acknowledgement control ready" (separate connected wires) whether the defect is due to the control or to the interface. If after inserting the bridge and correct power supply for the PLC-part the error is still present the defect is due to the LOGIC Unit. If, however, after inserting the bridge the error no longer appears the defect can be found at the interface.



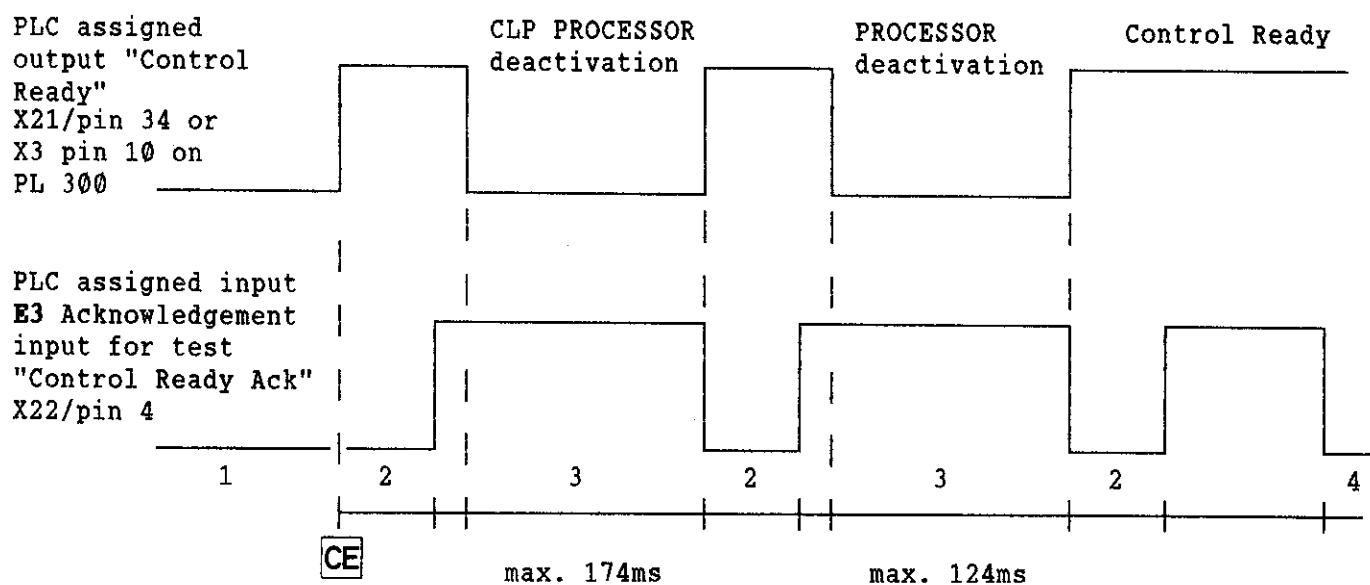
**ATTENTION**

After the check it is absolutely necessary to remove the bridge and to regenerate the operating state.



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14.3.1 Switch on Test Routine Timing Diagram



| Time | Remarks   | Fault message                        |
|------|---|--------------------------------------|
| 1    |   | CURRENT INTERRUPTION                 |
| 2    | Wait for control voltage  | CONTROL VOLTAGE FOR RELAY IS MISSING |
| 3    | After switching the output "Control Ready" off, the acknowledgement "control ready" must be switched off within 174 ms, resp. 124 ms; if not, the flashing error message appears. | EMERGENCY-STOP DEFECTIVE             |
| 4    | If during the operation the acknowledgement is switched off .... appears.   | EXTERNAL EMERGENCY-STOP              |

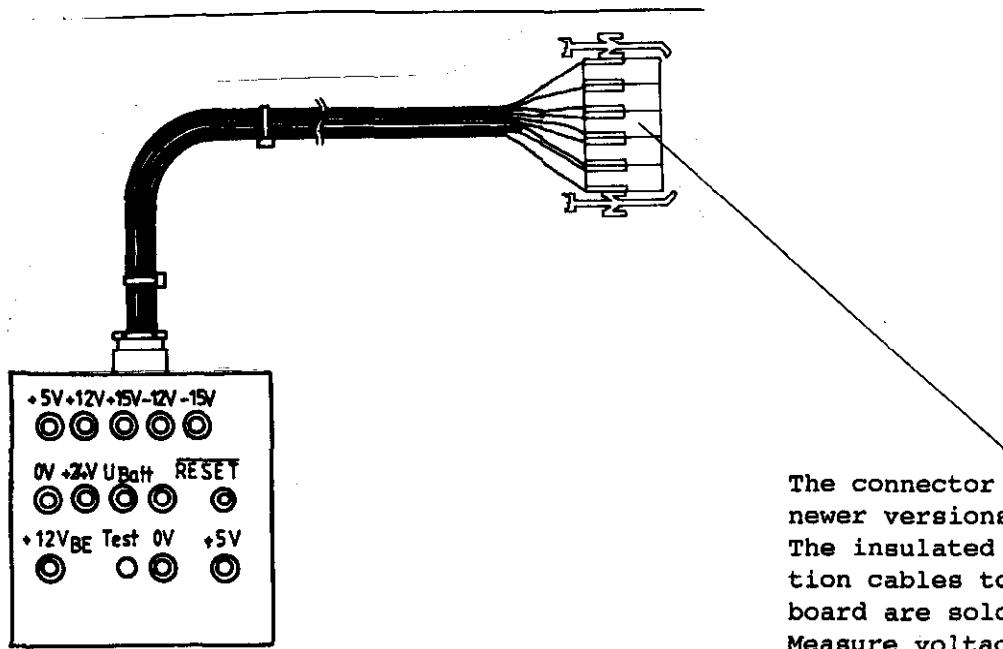


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## 15. Test Equipment

### 15.1 Test Unit for the POWER SUPPLY Board Assembly

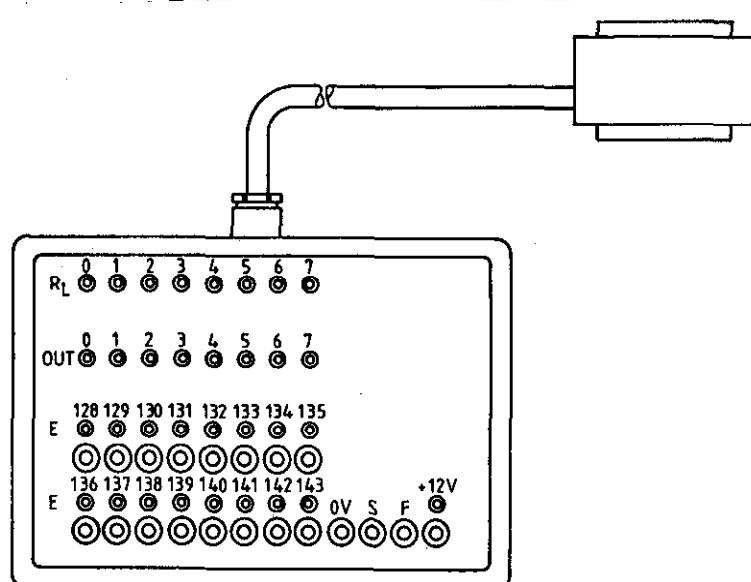
PSA LOAD UNIT Id.no. 247 358 01



The connector doesn't exist with newer versions.  
The insulated wires of the connection cables to processor and PLC board are soldered in directly.  
Measure voltages according to description 5.3.2!

### 15.2 Test Unit for the Keyboard Unit

KEYBOARD TEST UNIT, Id.no. 247 360 01

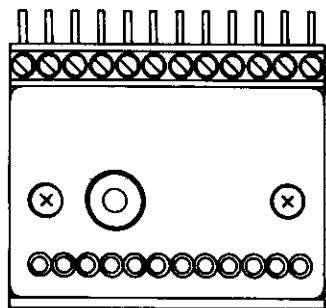




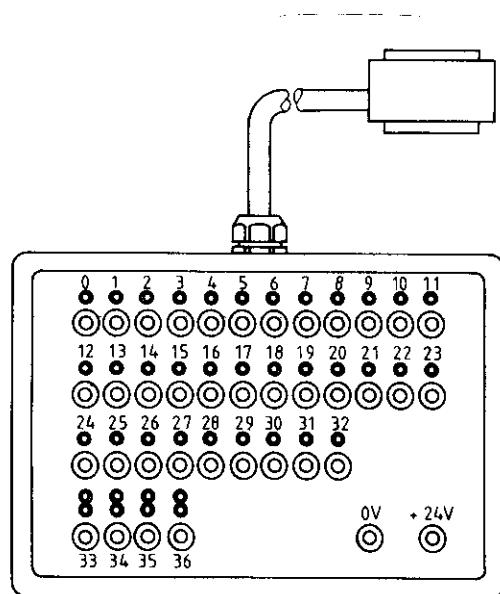
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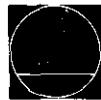
### **15.3 Test Aids for the PLC-I/O**

PL TEST ADAPTER Id.no. 247 359 01



PLC TEST UNIT Id.no. 247 361 01

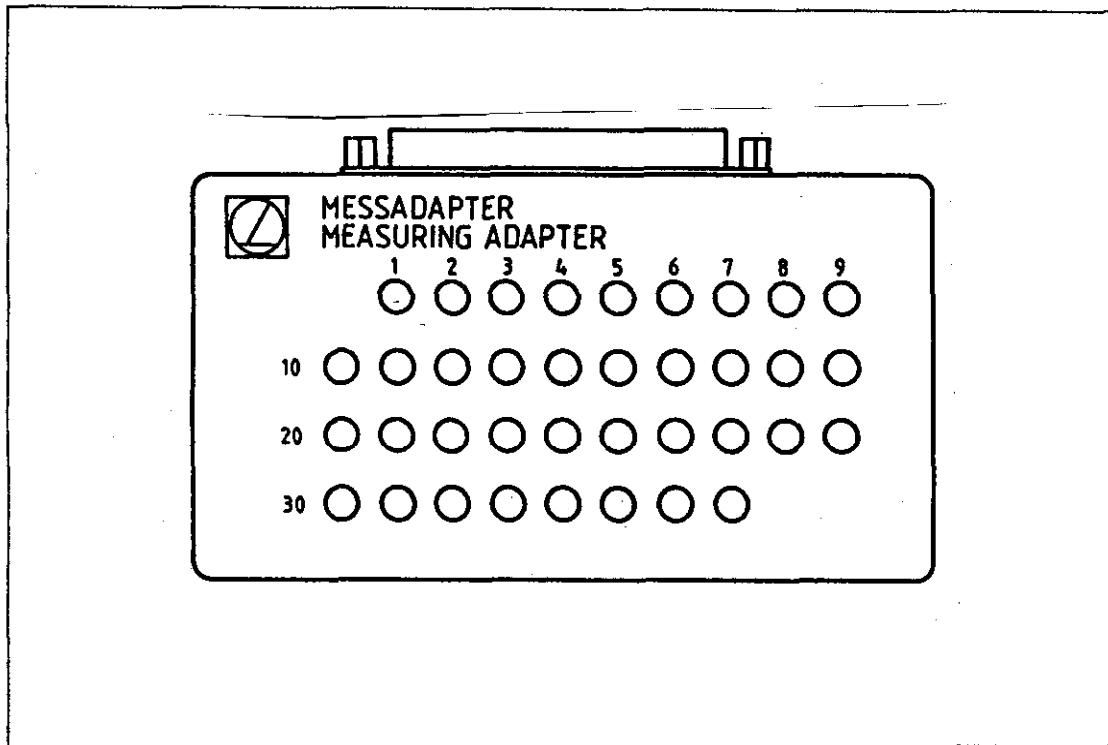




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**15.4 Universal Test Unit for 15-37-pin Sub-D connector**

Measuring adapter, id.no. 255 480 01

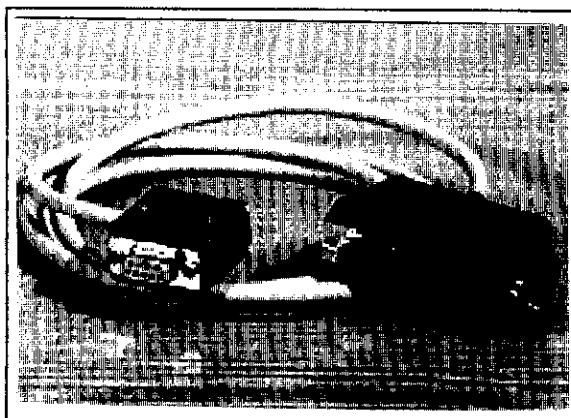


The measuring adapter is used to check the inputs and outputs of 15-37 pin Sub-D plug connections. A cable adapter described on the following page is required for each connector size.

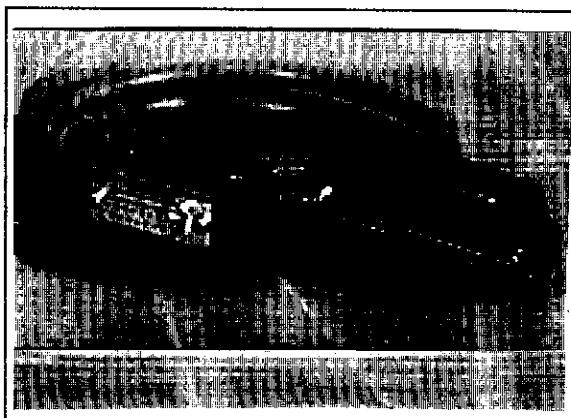
The measuring adapter can also be inserted instead of the PLC- and the KEYBOARD test units (without display, however) previously described.



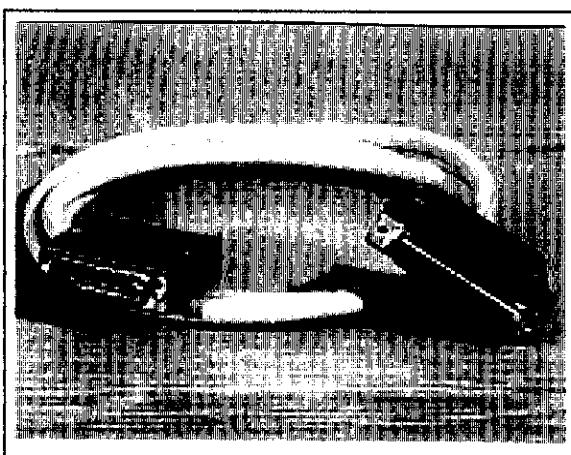
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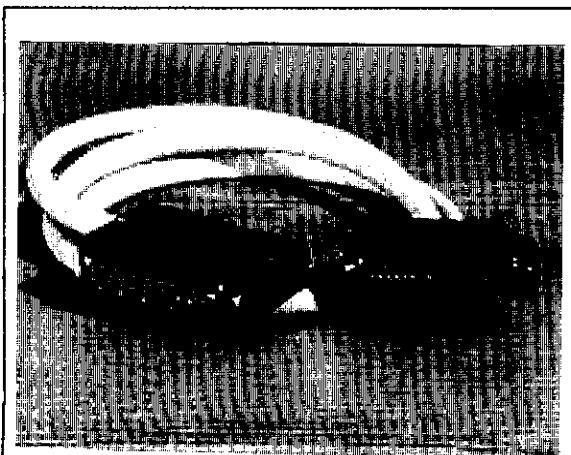
9-pin cable adapter, id.no. 255 481 01



15-pin cable adapter, id.no. 255 482 01



25-pin cable adapter, id.no. 255 483 01



37-pin cable adapter, id.no. 255 484 01

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## **16. EXCHANGE INFORMATION**

### **16.1 General**

#### **16.1.1 Auxiliaries required**

- 1 external data storage unit, e.g. ME 101/102 or FE 401 with connecting cable
- 1 tool set (screwdriver, socket wrench etc.)
- 1 MOS-protection mat (only required when exchanging a board or the EPROMs).

#### **16.1.2 MOS-Protection**

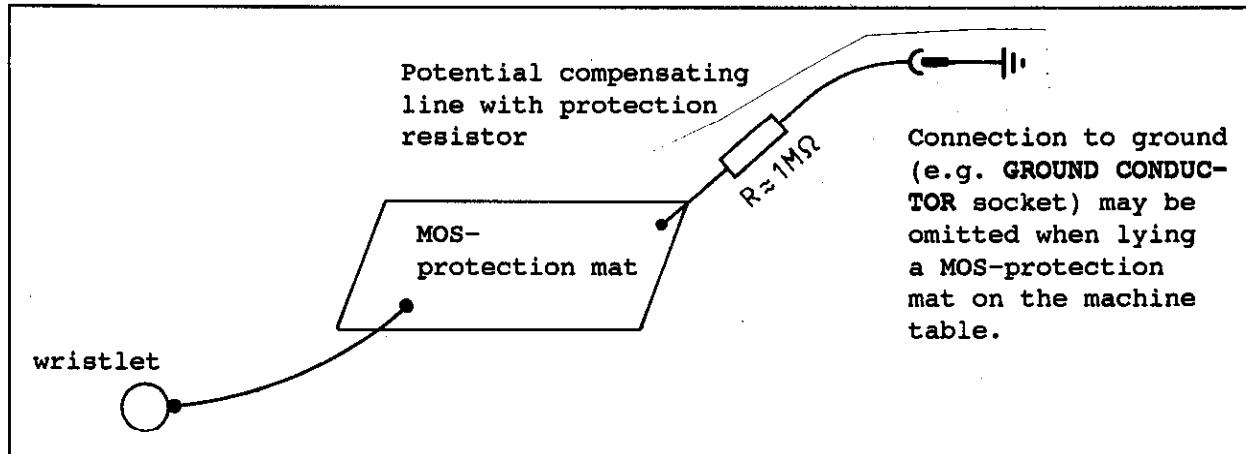
When exchanging the PROCESSOR or the CLP PROCESSOR Boards and/or the EPROMs it is absolutely necessary that a MOS-protection mat is used since the MOS-components on the board or the EPROMs may be damaged by electrostatic discharge.

**Attention:**



Any contact with the boards or the EPROMs with an electrostatically charged object (packing, storage, place of deposit) or careless handling must be avoided.

**MOS-Protection Mat:**



#### **16.1.3 Compatibility of Software**

Exchange units (compl. Logic Units) are equipped on principle with the latest software.

Exchange boards are delivered without software and without software release modul.

Therefore EPROMs and software release modul have to be removed from the defective board and inserted to the exchange board. (see section 16.7)

Please always send exchange boards back for repair without EPROMs and without software release modul.

When exchanging the boards it is convenient to exchange both boards (PROCESSOR and CLP PROCESSOR).

Thus an EPROM exchange is avoided and it is guaranteed that the software of your control is updated.



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#### 16.1.4 Backup of Machine Parameters and User Programs

Before exchanging the complete LOGIC Unit or the PROCESSOR Board, the machine parameters, the user programs and perhaps also the "PLC-program" and the "Compensation value list" have to be saved on an external data carrier.

If machine parameter 77 is unequal 1 PLC program parts are processed from the RAM and must be saved as well.

The following table shows which program parts are processed from RAM in dependence of machine parameter 77:

| Machine parameter | Input value | PLC-program from RAM   |
|-------------------|-------------|------------------------|
| 77                | 0           | 1st and 2nd kByte      |
|                   | 1           | -----                  |
|                   | 2           | 1st, 2nd and 3rd kByte |
|                   | 3           | 3rd kByte              |

If the non-linear axis error compensation for one or for several axes is activated the "compensation value list" must also be saved.

The following table shows the activation of the non-linear axis error compensation in dependence of machine parameter 20 to 23 and 330:

| Machine parameter | Input value            | non-linear axis error compensation active in |
|-------------------|------------------------|--|
| 20                | (4 to 7) or (12 to 15) | X-axis                                       |
| 21                | " " "                  | Y-axis                                       |
| 22                | " " "                  | Z-axis                                       |
| 23                | " " "                  | IVth-axis                                    |
| 330               | " " "                  | Vth-axis                                     |

The procedure for data backup is described in section 12.1. The programs do not have to be backed up if they are already present on an external data carrier.

Note:

The machine parameters, the compensation value list (if active) and the PLC-program (MP 77 unequal 1) should be principally backed up on an external data carrier due to reasons of safety.



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**16.1.5 Data determination for Supplementary Operating Modes:**

If the PROCESSOR Board or the complete LOGIC Unit is to be exchanged the pre-set values and the input values should be determined for supplementary operating modes to bring them to the previous state after the exchange.

Switch the main switch on and off again.

| Dialog display                                       | Press keys                    | Remarks  |
|--|-------------------------------|--|
| MEMORY TEST  | -                             |  |
| POWER INTERRUPTED                                    | [CE]                          |  |
| RELAY EXT. DC VOLTAGE MISSING                        |                               | Switch on control voltage.   |
| MANUAL OPERATION                                     | [MOD]                         |  |
| PASS OVER X-REFERENCE MARK                           |                               |  |
| PASS OVER Y-REFERENCE MARK                           |                               |  |
| PASS OVER Z-REFERENCE MARK                           |                               |  |
| PASS OVER REFERENCE MARK AXIS 4                      |                               | <u>Do not yet approach reference marks!</u>  |
| VACANT BLOCKS  | [↓]                           |  |
| CHANGE MM/INCH                                       | [↓]                           |  |
| POSITION DATA<br>0 0 0 0 0<br>ACTL REF LAG NOML DIST |                               | Note position data (0) adjusted and then switch over to ACTL with the [ENT] key.             |
| VZ   |                               |  |
| ACTL X   | [ ] . [ ] [ ] [ ] [ ] [ ] [ ] | Note preset values.<br>(Do not forget sign!)   |
| ACTL Y   | [ ] . [ ] [ ] [ ] [ ] [ ] [ ] |  |
| ACTL Z   | [ ] . [ ] [ ] [ ] [ ] [ ] [ ] |  |
| ACTL IV.   | [ ] . [ ] [ ] [ ] [ ] [ ] [ ] | [↓]  |
| ACTL V.  | [ ] . [ ] [ ] [ ] [ ] [ ] [ ] | [↓]  |
| POS.-DATA DISPLAY LARGE/SMALL                        | [ ] [ ] [ ] [ ]               | [↓]  |
| BAUD-RATE =  | [ ] [ ] [ ] [ ]               | Note baud-rate.<br>[↓]   |
| RS-232-C-INTERFACE = ME 0<br>FE 0<br>EXT 0           | [ ] [ ] [ ] [ ]               | Note interface (0) adjusted and then switch over to ME, FE or EXT with the [ENT] key.<br>[↓] |

\* only Vth-axis control.



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| TNC dialog display      | Press key  | Remarks  |   |
|-------------------------|--|--|---|
| VZ                      |  |  |   |
| LIMIT X+ =              | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       | Note limit values.<br>(Do not forget sign!) |
| LIMIT X- =              | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT Y+ =              | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT Y- =              | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT Z+ =              | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT Z- =              | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT IV+ =             | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT IV- =             | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT V+ * =            | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| LIMIT V- * =            | <input type="text"/> . <input type="text"/>                    | <input type="button" value="↓"/>                                       |   |
| NC: SOFTWARE<br>NUMBER  | <input type="text"/> | <input type="button" value="↓"/>                                       |   |
| PLC: SOFTWARE<br>NUMBER | <input type="text"/> | <input type="button" value="↓"/><br><input type="button" value="DEL"/> |   |

\* only with V-axes control

#### 16.1.6 Labelling of Connection Cables:

If the connection cables are incompletely or not at all labelled, they must be labelled in order to generate the right plug connection after exchanging the LOGIC UNIT or another assembly.  
Connector layout, see section 4.3



A T T E N T I O N !

Incorrect connection may cause damage to  
the unit.



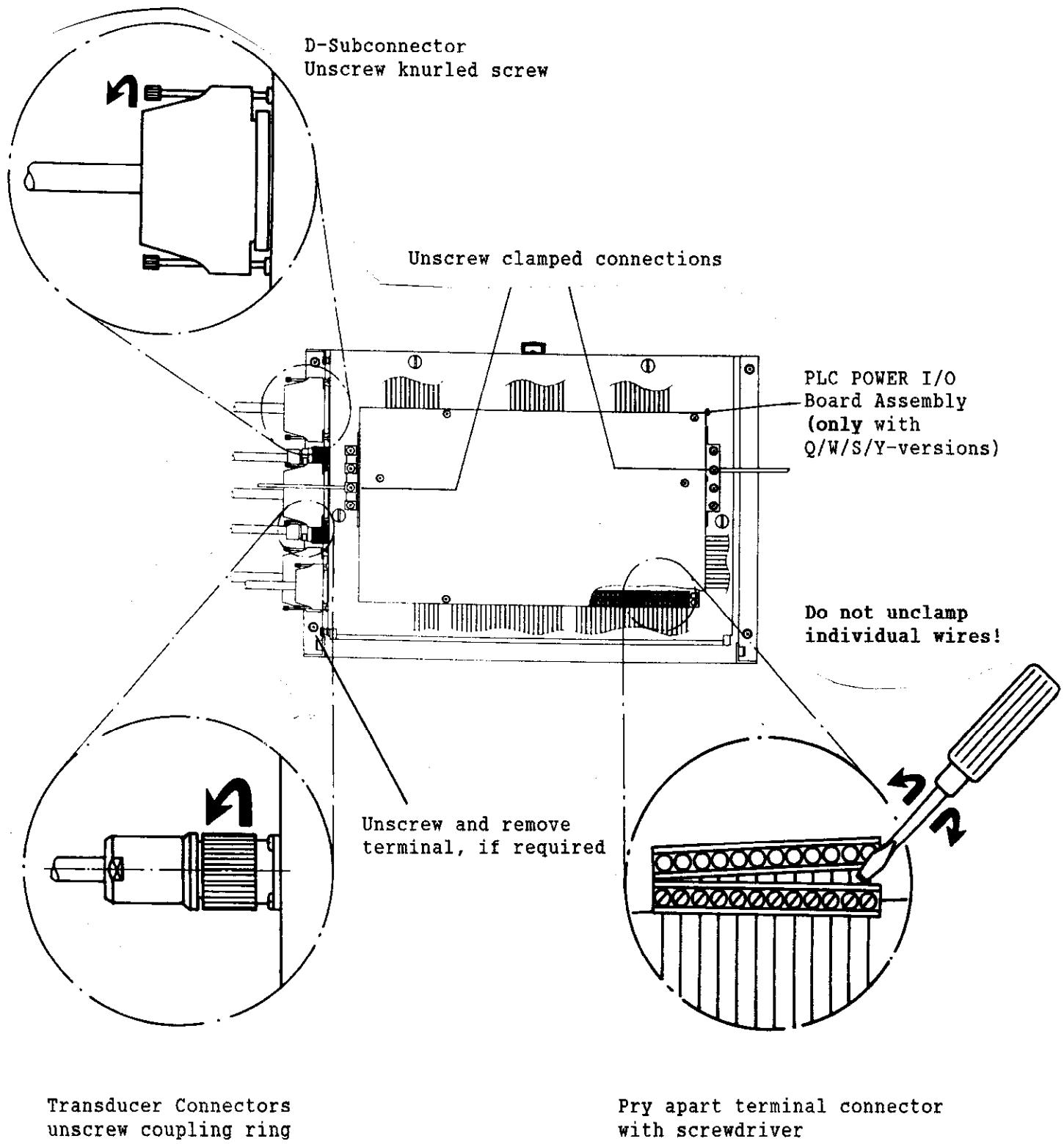
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**16.2. Exchange Procedure for the LOGIC Unit**

**16.2.1 Backup and Cable Labelling**  
(see section 1.4 to 1.6)

**16.2.2 Demounting the LOGIC Unit**

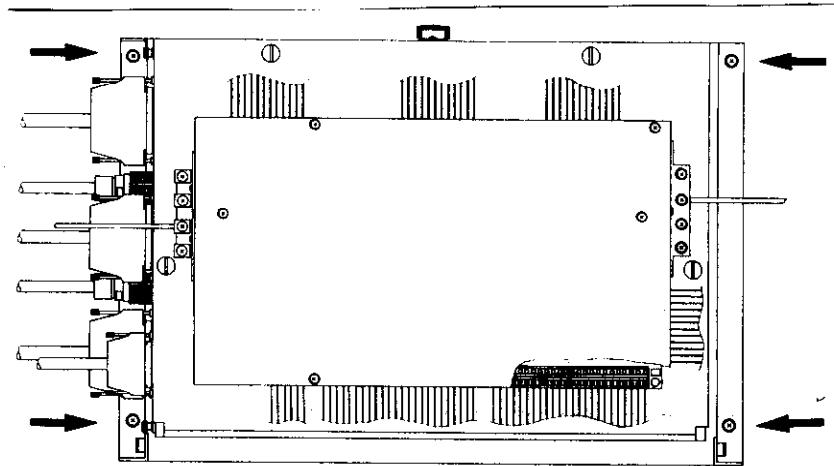
- Switch off mains switch.
- Unscrew and disconnect all plug and terminal connections of the LOGIC Unit.





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- c) Unscrew the 4 mounting screws for the LOGIC Unit.



- d) Take out the LOGIC Unit and replace with an exchange unit.

#### 16.2.2 Mounting the LOGIC Unit

The procedure for mounting the replacement LOGIC Unit is opposite to that of removal.

- a) Mount and secure LOGIC Unit.
- b) Reconnect plug, terminal and clamp connections.

**Please pay attention that no connections are interchanged!**

- c) Switch on mains switch.
- d) Read machine parameters in again (machine parameter, PLC-program and compensation value list) which were saved before the exchange.
- e) Enter preset values and supplementary operating modes from the previous table (before approaching the reference marks).
- f) Read in user program.

Exchange completed.



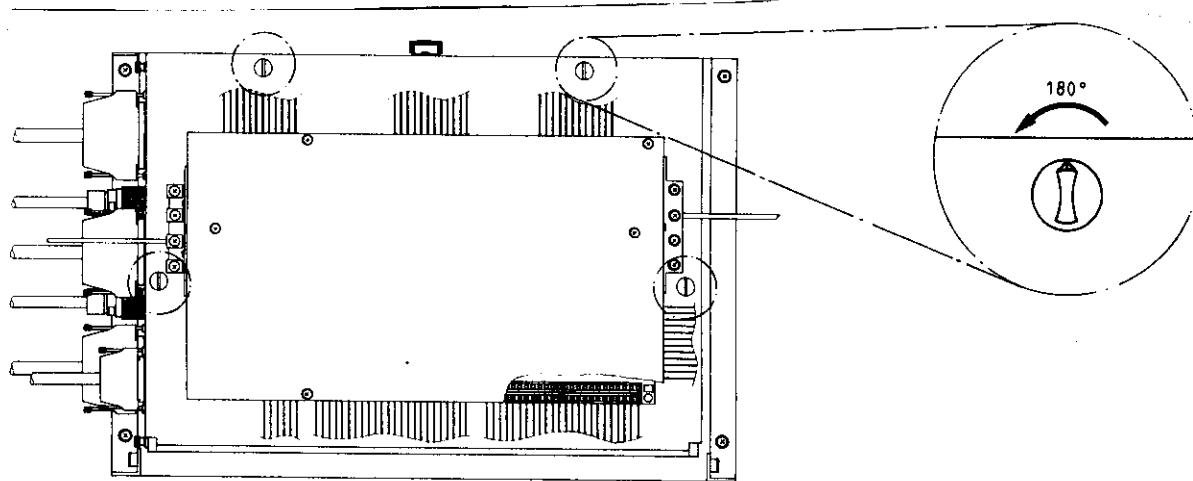
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**16.3. Exchange Procedure for the PROCESSOR Board**

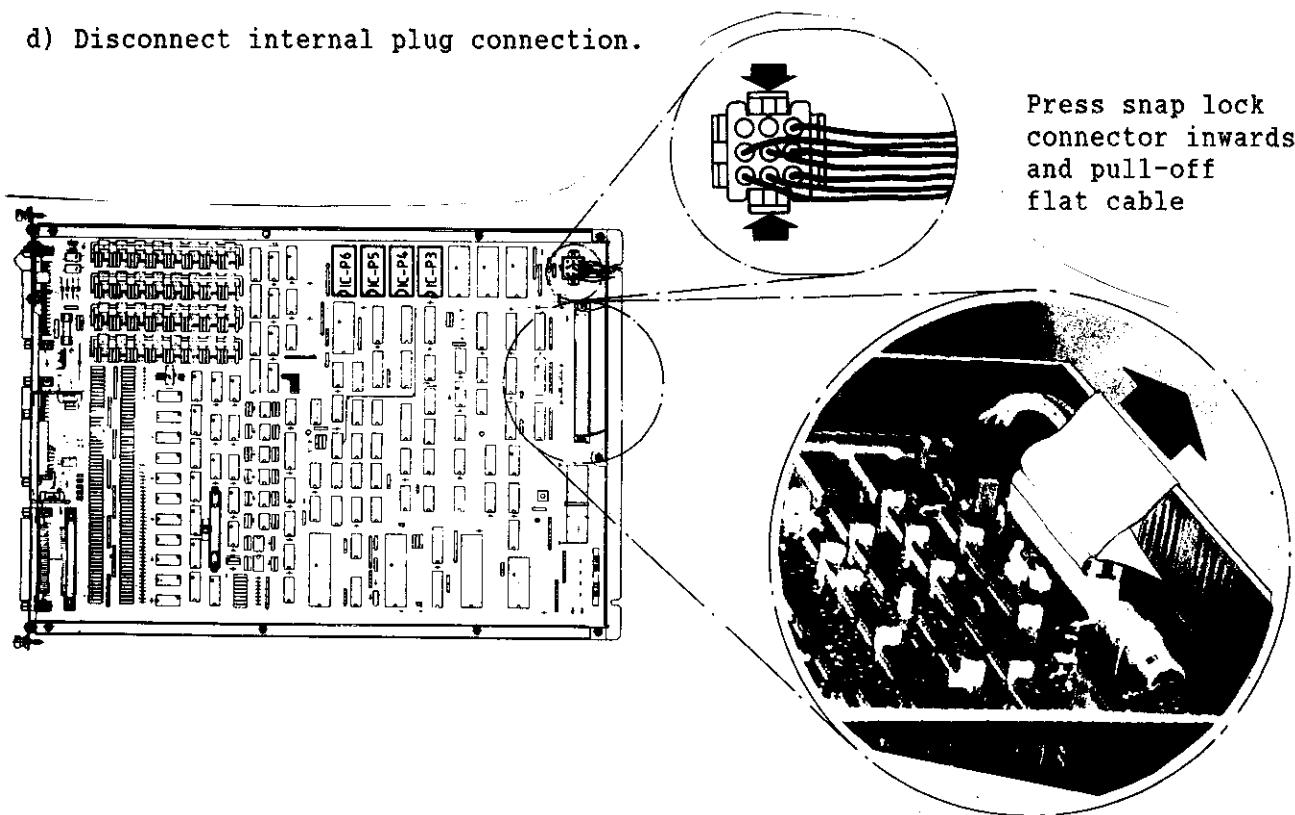
**16.3.1 MOS-Protection Mat, Software, Backup and  
Cable Labelling (see section 16.1.2 to 16. 1.6)**

**16.3.2 Removal of PROCESSOR Board**

- a) Switch off mains switch of the machine.
- b) Unscrew and disconnect all plugged connections and the terminal connection at the PROCESSOR Board (X21, X22, X23, X24, X26 and X27).  
As to connector layout, see section 4.3
- c) Loosen the 4 turn-lock fasteners and remove cover of LOGIC Unit.

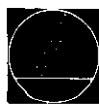


- d) Disconnect internal plug connection.



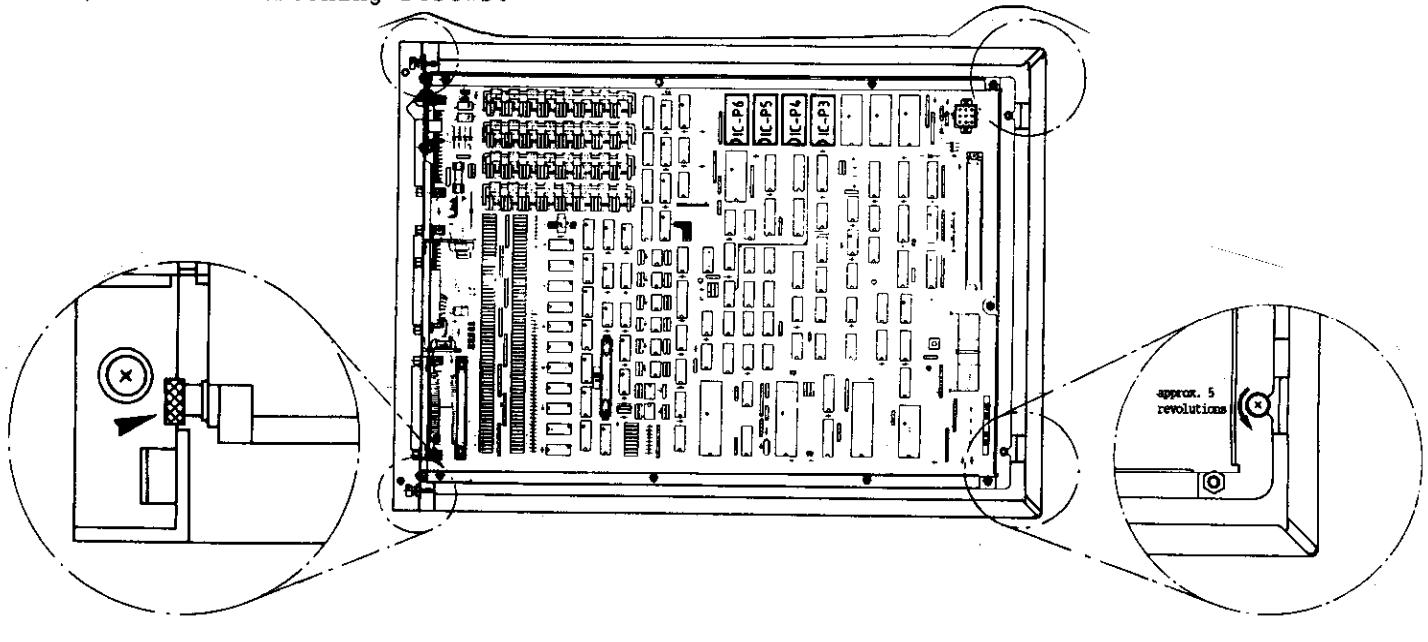
Press snap lock  
connector inwards  
and pull-off  
flat cable

Pull-off flat cable  
connector by pulling  
strap



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- e) Unscrew fastening screws.



Loosen knurled screws

Loosen fastening screws

- f) Take out PROCESSOR Board from the frame, exchange EPROMs, if necessary, (see section 1.3), insert new board.

#### 16.3.3 Insertion of PROCESSOR Board

The procedure for inserting the replacement PROCESSOR Board is opposite to that of removal.

- Push in and secure PROCESSOR Board.
- Reconnect plug and terminal connections.

**Please pay attention that no connections are interchanged!**

- Refit LOGIC Unit cover.
- Switch on mains switch.
- Read machine parameters in again (machine parameters, PLC-program and compensation value list) which were saved before the exchange.
- Enter preset values and supplementary operating modes from the previous table (before approaching the reference marks).
- Read in user program.

Exchange completed.

#### **A T T E N T I O N**



Send or store the boards **only** in the original package which protects the boards against electrostatic discharge!

Never use ordinary plastic bags for packaging!



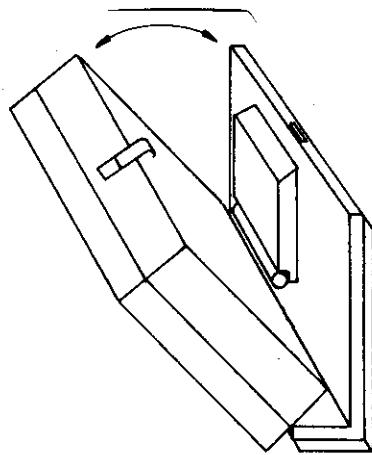
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**16.4. Exchange Procedure for  
the CLP Processor Board**

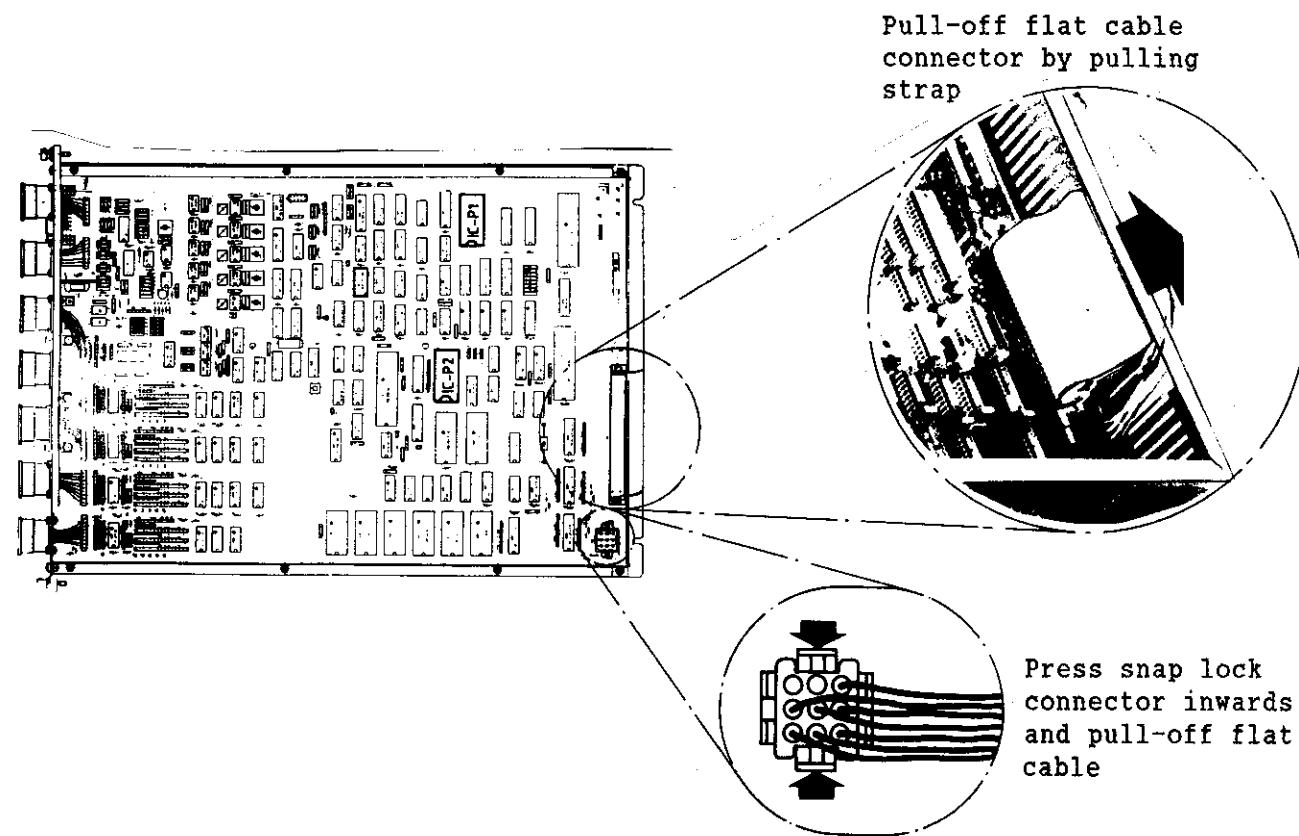
**16.4.1 MOS-protection set, Software, Backup and  
Cable Labelling (see section 1.2 to 1.6)**

**16.4.2 Removal of CLP PROCESSOR Board**

- a) Switch off mains switch of the machine.
- b) Unscrew and disconnect plug connections at the CLP PROCESSOR Board (X1 - X13) (connector layout, refer to section 4.3)
- c) Open LOGIC Unit



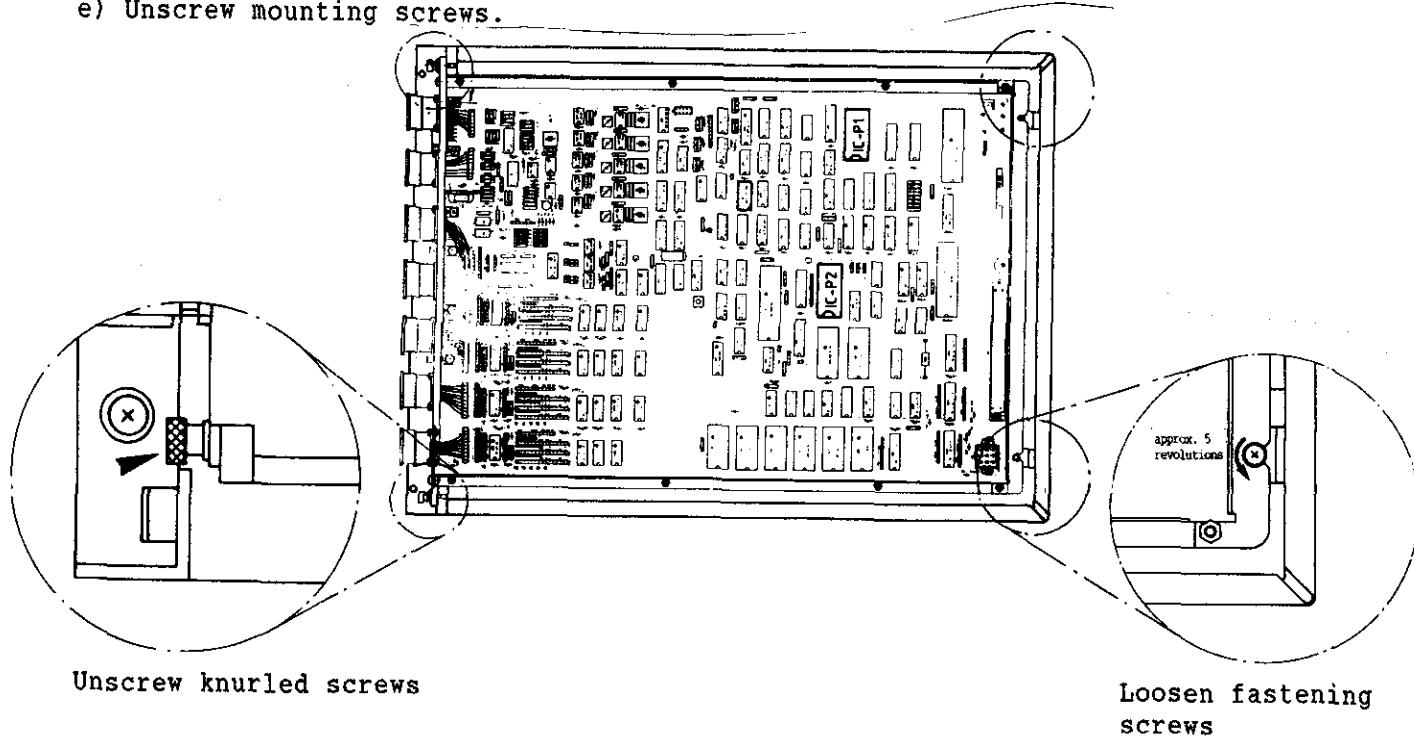
- d) Disconnect internal plug connections.





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- e) Unscrew mounting screws.



Unscrew knurled screws

Loosen fastening screws

- f) Take out CLP PROCESSOR Board from the frame, exchange EPROMs, if necessary, (see section 1.3), insert new board.

#### 16.4.3 Insertion of CLP PROCESSOR Board

The procedure for inserting the replacement CLP PROCESSOR Board is opposite to that of removal.

- Insert and secure CLP PROCESSOR Board.
- Reconnect plug connection.

**Please pay attention that no connections are interchanged!**

- Close LOGIC Unit.
- Switch on mains switch.

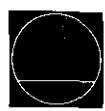
Exchange completed.



#### ATTENTION

Send or store the boards **only** in the original package which protects the boards against electrostatic discharge!

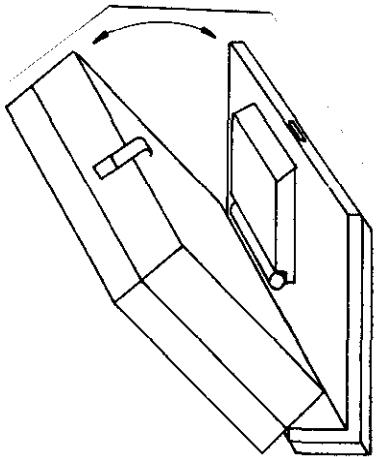
Do never use ordinary plastic material for packaging!



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**16.5. Procedure for the  
POWER SUPPLY Board Assembly**

- a) Switch off mains switch of the machine.
- b) Open LOGIC Unit

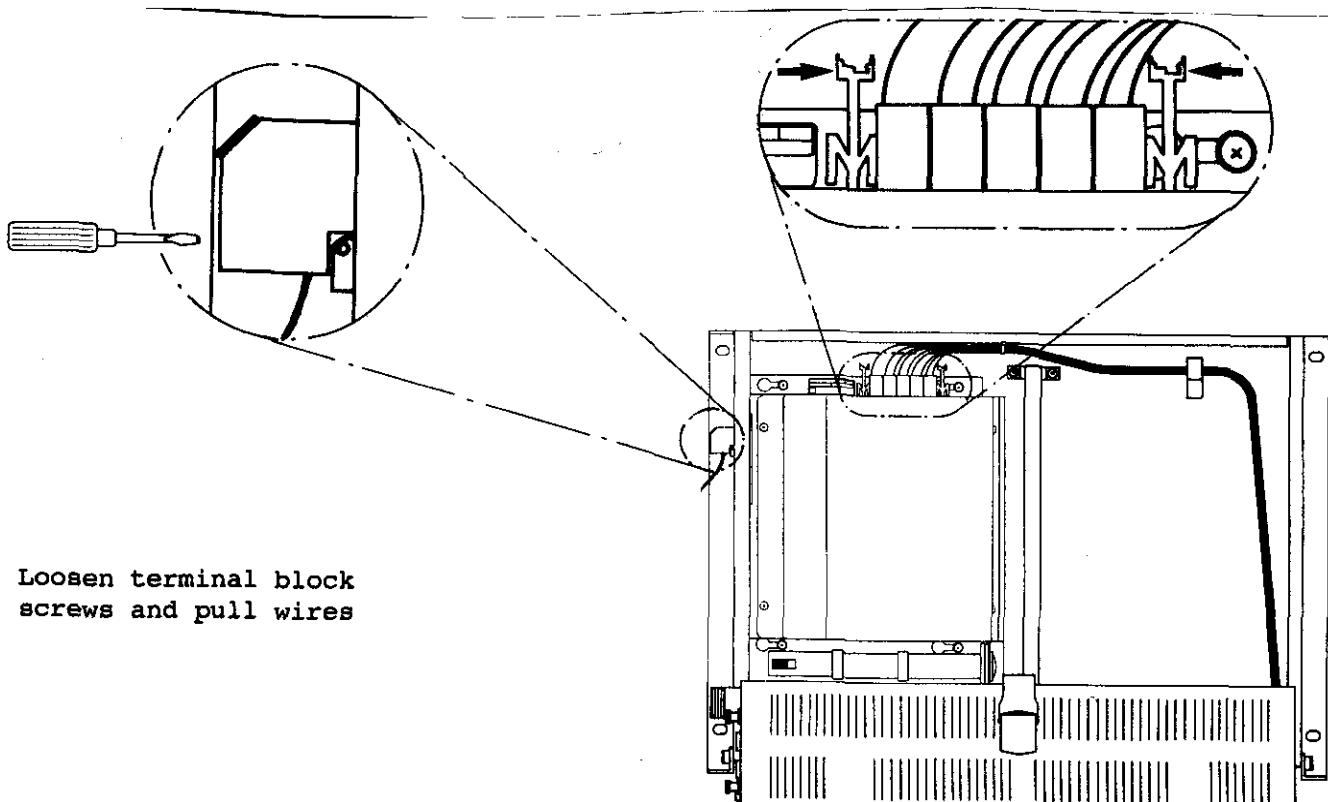


- c) Disconnect terminal and multiplug connector.

Press strap lock connector  
inwards and pull-off plug X2.



With versions having no  
connector X2 the plug on  
the CLP processor board  
has to be disconnected.  
(see section 16.4.2)

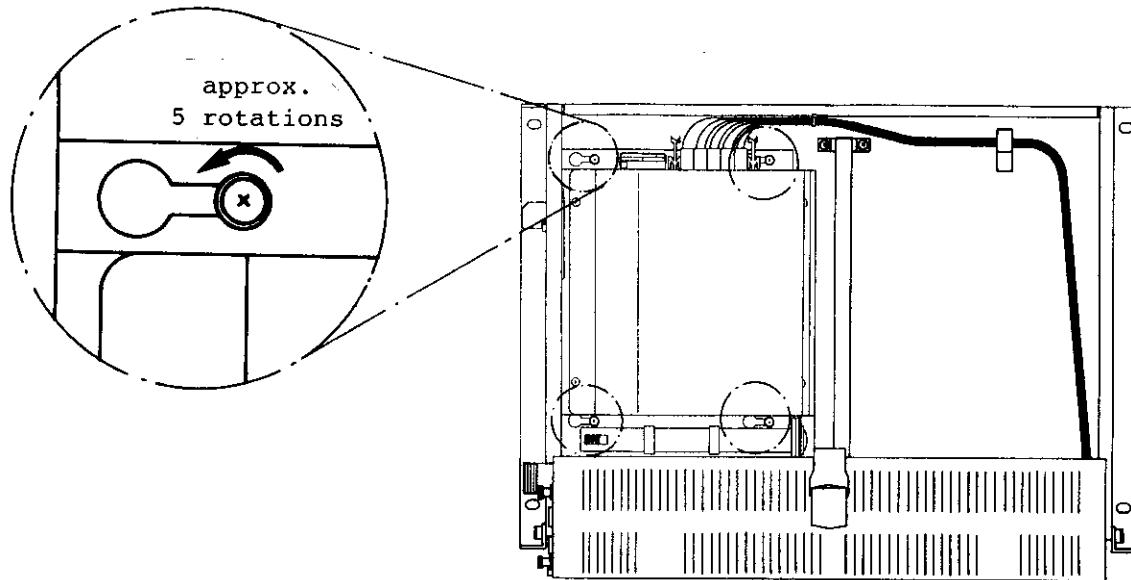


Loosen terminal block  
screws and pull wires

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- d) Loosen fastening screws.

Take out POWER SUPPLY Board Assembly and insert replacement.



- e) Tighten fastening screws, reconnect terminal and multiplug connection.

**Please pay attention that no connections are interchanged!**

- f) Close LOGIC Unit, switch on mains switch.

Exchange completed.



**A T T E N T I O N**

Send or store the boards **only** in the original package which protects the boards against electrostatic discharge!

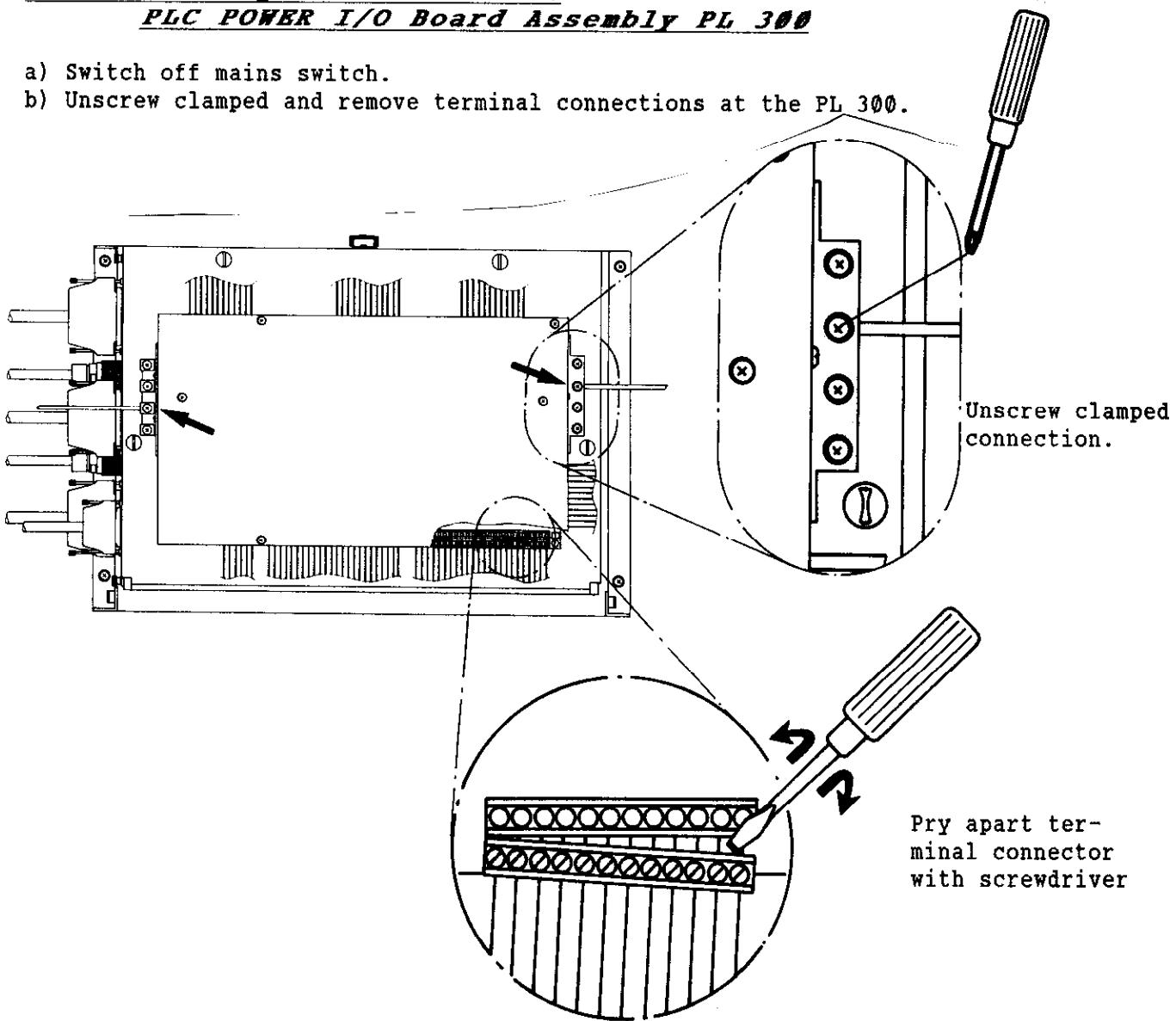
Never use ordinary plastic bags for packaging!



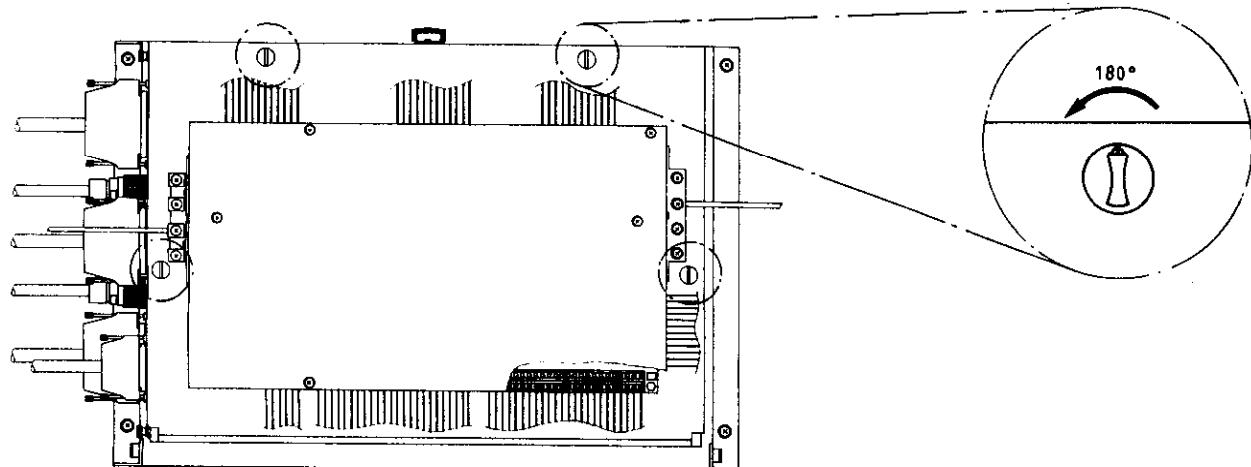
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**16.6. Exchange Procedure for**  
**PLC POWER I/O Board Assembly PL 300**

- a) Switch off mains switch.
- b) Unscrew clamped and remove terminal connections at the PL 300.

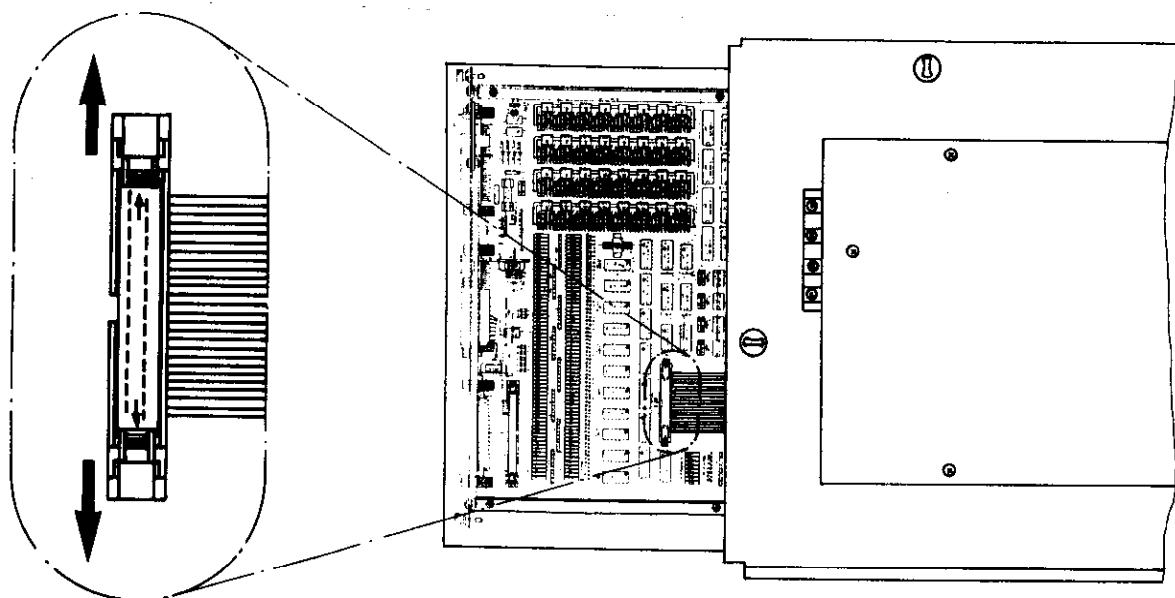


- c) Loosen the 4 turn-lock fasteners and remove cover of LOGIC Unit.



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- d) Disconnect flat cable connection on the PROCESSOR Board.



Press apart snap lock and  
pull-off flat cable

- e) The procedure for mounting the replacement PL 300 is opposite to that of removal.  
- Reconnect PL 300 to PROCESSOR Board.  
- Mount PL 300 onto the LOGIC Unit.  
- Reconnect terminal and clamp connections.  
- Switch on mains switch.

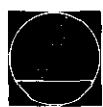
Exchange completed.



A T T E N T I O N

Send or store the boards only in the original package which  
protects the boards against electrostatic discharge!

Never use ordinary plastic bags for packaging!



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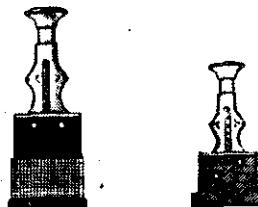
### **16.7. Exchange Procedure for the EPROMs**

#### **16.7.1 MOS-protection**

When exchanging the EPROMs it is absolutely necessary to use a MOS-protection mat. Otherwise they may be damaged by electrostatic discharge.

We recommend using an IC extraction/insertion tool to prevent damage to the board, IC socket or EPROM. Note the position no. and the package index of the EPROM for correct insertion.

e.g. IC extraction/insertion tool



#### **16.7.2 Labelling of EPROMs**

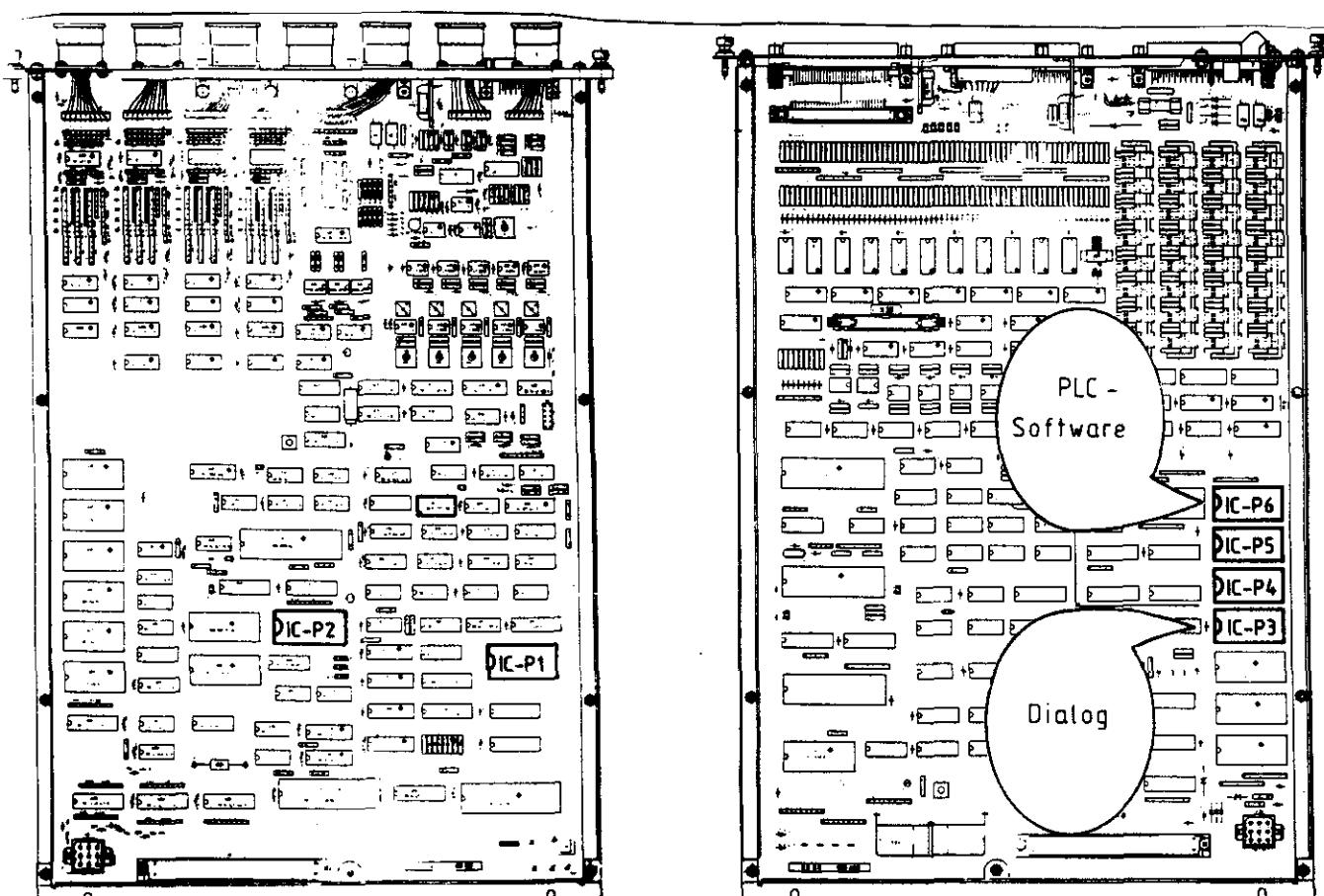
basic software id. no.

position no. (e.g. IC-P1)



software index (software update)

package index (must point in same direction as other ICs on board)



CLP PROCESSOR Board

PROCESSOR Board



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## 17. Machine parameters

The machine parameters are listed for all software versions as follows:  
Since certain machine parameters are only applied for a certain software, resp.  
are active from a certain software version, columns with symbols after the  
parameter numbers are introduced for differentiation.

Meaning:

Column:

4 = standard software PGM-no. 237 300 .. to 237 339 .. for IV-axes-controls  
5 = standard software PGM-no. 237 340 .. to 237 359 .. for V-axes-controls  
4\* = special software PGM-no. 243 100 .. to 243 139 .. for IV-axes-controls  
5\* = special software PGM-no. 243 140 .. to 243 159 .. for V-axes-controls

Symbols

- ♦ = the machine parameter is active with all software versions.
- 04 = the machine parameter is active from a certain software version (e.g. 04 means from software version 04).
- Ø = the machine parameter of this software has no function and must be programmed with Ø.
- = the machine parameter is not present in this software.

| Function  | Parameter no. | 4  | 5 | 4* | 5* | Input range   |
|---|---------------|----|---|----|----|---|
| Rapid course  | X             | Ø  | ♦ | ♦  | ♦  | 80...29998 [mm/min]                                   |
|   | Y             | 1  | ♦ | ♦  | ♦  | angular axis:   |
|   | Z             | 2  | ♦ | ♦  | ♦  | 80...29998 [°/min]                                    |
|   | IV            | 3  | ♦ | ♦  | ♦  |   |
| Manual feed   | X             | 4  | ♦ | ♦  | ♦  |   |
|   | Y             | 5  | ♦ | ♦  | ♦  |   |
|   | Z             | 6  | ♦ | ♦  | ♦  |   |
|   | IV            | 7  | ♦ | ♦  | ♦  |   |
| Speed when approaching the reference marks              | X             | 8  | ♦ | ♦  | ♦  |   |
|   | Y             | 9  | ♦ | ♦  | ♦  |   |
|   | Z             | 10 | ♦ | ♦  | ♦  |   |
|   | IV            | 11 | ♦ | ♦  | ♦  |   |
| Signal evaluation, input                                | X1            | 12 | ♦ | ♦  | ♦  | 1 = 4-fold  |
|   | X2            | 13 | ♦ | ♦  | ♦  | (max. traverse speed 30 [m/min])                      |
|   | X3            | 14 | ♦ | ♦  | ♦  | 2 = 2-fold  |
|   | X4            | 15 | ♦ | ♦  | ♦  | (max. traverse speed 15 [m/min])                      |
| Traverse direction when approaching the reference marks | X             | 16 | ♦ | ♦  | ♦  | Ø = plus direction                                    |
|   | Y             | 17 | ♦ | ♦  | ♦  | 1 = minus direction                                   |
|   | Z             | 18 | ♦ | ♦  | ♦  | (if parameters no. 20 to 27 are programmed correctly) |
|   | IV            | 19 | ♦ | ♦  | ♦  |   |



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| Function   | Parameter no.                 | 4  | 5  | 4* | 5* | Input range   |
|--|-------------------------------|----|----|----|----|---|
| Machine parameter with multiple function                 | X 20<br>Y 21<br>Z 22<br>IV 23 |    |    |    |    |   |
| Counting direction                                       | bit                           | 0  | ♦  | ♦  | ♦  | + 0 = positive counting direction<br>+ 1 = negative counting direction  |
| Release for reference pulse inhibit                      | 1                             | ♦  | ♦  | ♦  | ♦  | + 0 = reference pulse inhibit inactive<br>+ 2 = reference pulse inhibit active  |
| Release for non-linear axis error compensation           | 2                             | 09 | 04 | ♦  | ♦  | + 0 = inactive<br>+ 4 = compensation active   |
| Output of the smallest possible voltage steps of 2.44 mV | 3                             | 09 | 04 | ♦  | ♦  | + 0 = 2.44 mV output if the nominal value calculated is equal/exceeds 1.22 mV.<br>+ 8 = 2.44 mV output if the nominal value calculated exceeds 0. |
| Polarity of the nominal value voltage                    | X 24<br>Y 25<br>Z 26<br>IV 27 | ♦  | ♦  | ♦  | ♦  | 0 = positive with positive traverse direction<br>1 = negative with positive traverse direction  |
| Integral factor  | X 28<br>Y 29<br>Z 30<br>IV 31 | ♦  | ♦  | ♦  | ♦  | 0...65535   |
| Differential factor                                      | X 32<br>Y 33<br>Z 34<br>IV 35 | ♦  | ♦  | ♦  | ♦  | 0...65536   |
| Backlash compensation                                    | X 36<br>Y 37<br>Z 38<br>IV 39 | ♦  | ♦  | ♦  | ♦  | - 1.000 ... + 1.000 [mm]<br>angular axis - 1.000 ... + 1.000 [°]  |
| Compensation factor for linear compensation              | X 40<br>Y 41<br>Z 42<br>IV 43 | ♦  | ♦  | ♦  | ♦  | - 1.000 ... + 1.000 [mm/m]  |



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| Function   | Parameter no.  | 4  | 5  | 4* | 5* | Input range  |
|--|--|----|----|----|----|--|
| Software limit switch ranges   | X+   | 44 | ♦  | ♦  | ♦  | - 30000.000 ... + 30000.000 [mm]   |
|  | X-   | 45 | ♦  | ♦  | ♦  |  |
|  | Y+   | 46 | ♦  | ♦  | ♦  |  |
|  | Y-   | 47 | ♦  | ♦  | ♦  |  |
|  | Z+   | 48 | ♦  | ♦  | ♦  |  |
|  | Z-   | 49 | ♦  | ♦  | ♦  |  |
|  | IV+  | 50 | ♦  | ♦  | ♦  | angular axis:  |
|  | IV-  | 51 | ♦  | ♦  | ♦  | - 30000.000 ... + 30000.000 [°]  |
|  | Analog voltage with rapid course, X-axis<br>X, Y, Z, IVth-axis<br>X-axis | 52 | ♦  | ♦  | -  | -  |
|  |  | 06 | 03 | ♦  | ♦  | + 4.5 ... + 9 [V]  |
| Approach speed   | 53   | ♦  | ♦  | ♦  | ♦  | 0.1 ... 10 [m/min]   |
| Acceleration<br>X, Y, Z, IVth-axis<br>X-axis   | 54   | ♦  | -  | -  | -  | 0.001 ... 3.0 [m/s²]   |
|  | 05   | ♦  | ♦  | ♦  | ♦  |  |
| Radial acceleration  | 55   | ♦  | ♦  | ♦  | ♦  | 0.001 ... 3.0 [m/s²]   |
| Position supervision in operation<br>with speed precontrol<br>erasable<br>Emergency-stop | 56   | ♦  | ♦  | ♦  | ♦  | 0.001 ... 30 [mm]  |
|  | 57   | ♦  | ♦  | ♦  | ♦  |  |
| Positioning window X, Y, Z   | 58   | ♦  | ♦  | ♦  | ♦  | 0.001 ... 2.000 [mm]   |
|  | -  | -  | 03 | 03 |    | 0.001 ... 65.535 [mm]  |
| Axis sequence when approaching<br>the reference marks                                    | 59   | ♦  | ♦  | ♦  | ♦  | 0 = X Y Z IV      12 = Z X Y IV<br>1 = X Y IV Z      13 = Z X IV Y<br>2 = X Z Y IV      14 = Z Y X IV<br>3 = X Z IV Y      15 = Z Y IV X<br>4 = X IV Y Z      16 = Z IV X Y<br>5 = X IV Z Y      17 = Z IV Y X   |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    | 6 = Y X Z IV      18 = IV X Y Z<br>7 = Y X IV Z      19 = IV X Z Y<br>8 = Y Z X IV      20 = IV Y X Z<br>9 = Y Z IV X      21 = IV Y Z X<br>10 = Y IV X Z      22 = IV Z X Y<br>11 = Y IV Z X      23 = IV Z Y X |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    |  |
|  |  |    |    |    |    |  |
| Speed precontrol   | 60   | ♦  | ♦  | ♦  | ♦  | 0 = on      1 = off  |
| Output of tool numbers or<br>allocation numbers  | 61   | ♦  | ♦  | ♦  | ♦  | 0 = no output<br>1 = output of tool number only<br>if the tool number changes.<br>2 = output of the tool number<br>with each tool call.<br>3 = output of allocation no. (if MP 225 >= 1)                         |
| Output of spindle speed  | 62   | ♦  | ♦  | ♦  | ♦  | 0 = no output of spindle speeds  |



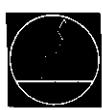
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| Function   | Parameter no. | 4 | 5 | 4* | 5* | Input range  |
|--|---------------|---|---|----|----|--|
| Coded output of spindle speed  |               |   |   |    |    | 1 = code output only if the speed changes.<br>2 = code output with each tool call.   |
| Analog output of spindle speed   | 62            | ◆ | ◆ | ◆  | ◆  | 3 = gear switching signal only if the speed changes.<br>4 = gear switching signal with every tool call<br>5 = without gear switching signal  |
| Rpm code limitation  | 63            | ◆ | ◆ | ◆  | ◆  | 01991 = no limitation  |
| Transient behaviour during acceleration  | 64            | ◆ | ◆ | ◆  | ◆  | 0.01 - 0.999   |
| Display step   | 65            | ◆ | ◆ | ◆  | ◆  | 0 = 1 µm      1 = 5 µm   |
| without function for the time being  | 66            | 0 | 0 | 0  | 0  | enter 0  |
| Dwell time of rotating direction reverse<br>Working spindle for cycle<br>"Tapping" | 67            | ◆ | ◆ | ◆  | ◆  | 0 ... 65.535 [s]   |
| Memory function for directional keys   | 68            | ◆ | ◆ | ◆  | ◆  | 0 = off      1 = on  |
| Reference mark approach  | 69            | ◆ | ◆ | ◆  | ◆  | 0 = after approaching the reference marks the axes automatically approach the software limit switches.<br>1 = after approaching the reference marks the axes automatically return to the reference marks.<br>2 = special procedure for the approach of the reference marks |
| Nominal value voltage for spindle drive<br>when gear is changed                    | 70            | ◆ | ◆ | ◆  | ◆  | 0 ... 9.999 [V]  |
| Sign for end and beginning of program  | 71            | ◆ | ◆ | ◆  | ◆  | 0 ... 65535  |
| Selection of the axes inhibited<br>for the control                                 | 72<br>bit     |   |   |    |    |  |
| X-axis   | 0             | ◆ | ◆ | ◆  | ◆  | + 0 = not inhibited<br>+ 1 = inhibited   |
| Y-axis   | 1             | ◆ | ◆ | ◆  | ◆  | + 0 = not inhibited<br>+ 2 = inhibited   |
| Z-axis   | 2             | ◆ | ◆ | ◆  | ◆  | + 0 = not inhibited<br>+ 4 = inhibited   |
| IVth-axis  | 3             | ◆ | ◆ | ◆  | ◆  | + 0 = not inhibited<br>+ 8 = inhibited   |
| Vth-axis   | 4             | - | ◆ | -  | ◆  | + 0 = not inhibited<br>+ 16 = inhibited  |



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| Function   | Parameter no. | 4 | 5 | 4* | 5* | Input range   |
|--|---------------|---|---|----|----|---|
| Parameters with multiple function  | 73            |   |   |    |    | 0 ... 65.535 [s]  |
| MP 92 Bit 12 = 0<br>BCD-output of the spindle speed:<br>Preswitch-off time of the spindle for cycle "Tapping"  |               | ♦ | ♦ | ♦  | ♦  |   |
| MP 92 Bit 12 = 1<br>Analog output of the spindle speed:<br>spindle tracking time after reaching the drilling depth with cycle "Tapping"  |               | - | - | 02 | 02 |   |
| Feed and spindle override  | 74<br>bit     |   |   |    |    |   |
| Feed override, if the rapid traverse key is pressed in the auto. operating modes   | 0             | ♦ | ♦ | ♦  | ♦  | + 0 = override not active<br>+ 1 = override active  |
| Continuous feed override or 2%-stages feed override  | 1             | ♦ | ♦ | ♦  | ♦  | + 0 = 2%-stages<br>+ 2 = continuous   |
| Feed override, if the rapid traverse key and the external directional keys are pressed in the operating mode "Manual"  | 2             | ♦ | ♦ | ♦  | ♦  | + 0 = override not active<br>+ 4 = override active  |
| Continuous spindle override or 2%-stages spindle override  | 3             | ♦ | ♦ | ♦  | ♦  | + 0 = 2%-stages<br>+ 8 = continuous   |
| Reference signal evaluation for inhibited axes   | 75            | ♦ | ♦ | ♦  | ♦  | 0 = reference signal evaluation without display "Reference mark approach"<br>1 = reference signal evaluation with display "Reference mark approach"<br>2 = no reference signal evaluation |
| Position data and encoder supervision  | 76<br>bit     |   |   |    |    |   |
| Position data and encoder supervision for inhibited axes   | 0             | ♦ | ♦ | ♦  | ♦  | + 0 = inactive<br>+ 1 = active  |
| The supervision of the encoder inputs for each axis can be separately switched off with bit 2 up to bit 5. This is applied for inhibited axes and for non-inhibited axes. The position data remains active if bit 0 = 1. | 1             | ♦ | ♦ | ♦  | ♦  | encoder input X<br>+ 0 = with supervision<br>+ 2 = no supervision   |
|  | 2             | ♦ | ♦ | ♦  | ♦  | encoder input Y<br>+ 0 = with supervision<br>+ 4 = no supervision   |
|  | 3             | ♦ | ♦ | ♦  | ♦  | encoder input Z<br>+ 0 = with supervision<br>+ 8 = no supervision   |



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| Function   | Parameter no. | 4  | 5 | 4* | 5* | Input range  |
|--|---------------|----|---|----|----|--|
|  | 4             | ◆  | ◆ | ◆  | ◆  | encoder input IV<br>+ 0 = with supervision<br>+ 16 = no supervision                                |
|  | 5             | ◆  | ◆ | ◆  | ◆  | encoder input V<br>+ 0 = with supervision<br>+ 32 = no supervision                                 |
|  | 6             | -  | ◆ | -  | ◆  | encoder input VI<br>+ 0 = with supervision<br>+ 64 = no supervision                                |
| PLC-Program from RAM or from EPROM                       | 77 bit        |    |   |    |    |  |
|  | 0             | ◆  | ◆ | ◆  | ◆  | + 0 = 1st a. 2nd K-commands from RAM<br>+ 1 = 1st a. 2nd K-commands from EPROM                     |
|  | 1             | 05 | ◆ | ◆  | ◆  | + 0 = 3rd K-commands from EPROM<br>+ 2 = 3rd K-commands from RAM                                   |
| S-analog output  | 0             | 78 | ◆ | ◆  | ◆  | ◆  |
| Speed range  | 1             | 79 | ◆ | ◆  | ◆  |  |
| Gear stages  | 2             | 80 | ◆ | ◆  | ◆  |  |
|  | 3             | 81 | ◆ | ◆  | ◆  |  |
| Speed range of gear stages                               | 4             | 82 | ◆ | ◆  | ◆  | ◆  |
| or   | 5             | 83 | ◆ | ◆  | ◆  |  |
| limit speed with supervision                             | 6             | 84 | ◆ | ◆  | ◆  |  |
|  | 7             | 85 | ◆ | ◆  | ◆  |  |
| S-analog voltage with S-override to 100%                 | 86            | ◆  | ◆ | ◆  | ◆  | 0 ... 9.999 [V]  |
| S-analog voltage with S-override and max. output voltage | 87            | ◆  | ◆ | ◆  | ◆  | 0 ... 9.999 [V]  |
| Limitation of S-override                                 |               |    |   |    |    | 0 ... 150 [%]  |
| Maximum  | 88            | ◆  | ◆ | ◆  | ◆  |  |
| Minimum  | 89            | ◆  | ◆ | ◆  | ◆  |  |
| Axis designation for the IVth-axis                       | 90            | ◆  | ◆ | ◆  | ◆  | 0 = A                    3 = U<br>1 = B                    4 = V<br>2 = C                    5 = W |
| Constant contouring speed at corners                     | 91            | ◆  | ◆ | ◆  | ◆  | 0 ... 179.999 [°]  |
| Parameters with multiple function                        | 92 bit        | ◆  | ◆ | ◆  | ◆  |  |
| Decimal characters                                       | 0             | ◆  | ◆ | ◆  | ◆  | + 0 = decimal comma<br>+ 1 = decimal point   |
| Dialog   | 1             | ◆  | ◆ | ◆  | ◆  | + 0 = first dialog<br>+ 2 = second dialog (English)  |



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| Function  | Parameter<br>no. | 4  | 5  | 4* | 5* | Input range  |
|---|------------------|----|----|----|----|--|
| Memory test during switch-on<br>(RAM)   | 2                | ♦  | ♦  | ♦  | ♦  | + 0 = memory test carried out<br>+ 4 = no memory test  |
| Checksum test during switch-on<br>(RAM + EPROM)   | 3                | ♦  | ♦  | ♦  | ♦  | + 0 = checksum test carried out<br>+ 8 = no checksum test  |
| Change from program run block sequence<br>to program run single block when pro-<br>cessing continuous contours  | 4                | ♦  | ♦  | ♦  | ♦  | + 0 = the precalculated contour is<br>finished (up to 14 blocks)<br>+ 16 = Interruption in current block   |
| Counting mode if the IVth-axis works<br>as a position data for an angular<br>axis   | 5                | ♦  | ♦  | ♦  | ♦  | + 0 = IVth axis counts 0...29999,99 [°]<br>+ 32 = IVth-axis counts 0...359.999 [°]->   |
| Activation of functions for the<br>Hirth-toothing for the IVth-axis   | 6                | 07 | 04 | ♦  | ♦  | + 0 = no Hirth-toothing<br>+ 64 = Hirth-toothing active  |
| Activation of functions for the<br>Hirth-toothing for the Vth-axis  | 7                | 0  | 04 | ♦  | ♦  | + 0 = no Hirth-toothing<br>+ 128 = Hirth-toothing active   |
| <b>Note:</b>  |                  |    |    |    |    |  |
| With active Hirth-toothing MP 65 only<br>determines the display step for the<br>X, Y and Z-axes, MP 260 is applied for<br>the IVth-axis and MP 342 for the<br>Vth-axis. |                  |    |    |    |    |  |
| Actual/nominal value transfer after<br>external EMERGENCY-STOP  | 8                | 10 | 04 | ♦  | ♦  | + 0 = acknowledgement<br>+ 256 = no acknowledgement  |
| Distribution of the central tool memory<br>in tools with and without allocation<br>numbers  | 9                | 0  | 0  | ♦  | ♦  | + 0 = no subdivision<br>+ 512 = subdivision (MP 209) = number of<br>tools with allocation numbers<br>(MP 225) - (MP 209) = number of<br>tools without allocation numbers                                       |
| Manual insertion of tools without<br>allocation numbers   | 10               | 0  | 0  | ♦  | ♦  | + 0 = no tool call without allocation<br>numbers possible (that means error<br>message "Wrong allocation number")<br>+ 1024= tool call without allocation<br>numbers possible (that means no<br>error message) |
| Automatic acknowledgement of the error<br>message "Current interrupted"   | 11               | 0  | 0  | ♦  | ♦  | + 0 = error message "Current interrupted"<br>must be acknowledged manually<br>+ 2048= error message "Current interrupted"<br>is automatically acknowledged after<br>approx. 3 seconds                          |
| Ramp for the spindle speed<br>when tapping  | 12               | 0  | 0  | ♦  | ♦  | + 0 = spindle ramp is determined<br>via the tool axis<br>+ 4096= spindle ramp is determined via<br>MP 168/MP 316, resp. MP 317/MP 318<br>(dependent on marker M2816)   |



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| Function   | Parameter no.  | 4 | 5 | 4* | 5* | Input range  |
|--|--|---|---|----|----|--|
| Editing inhibit for manufacturer cycles  | 13   | 0 | 0 | ♦  | ♦  | + 0 = the editing of the manufacturer cycle is inhibited if the program number of the manufacturer cycle is already filed in the EPROM.<br>+ 8192= no editing inhibit, that means the program number of an existing manufacturer cycle is assigned to a new program. |
| "GOTO-function" with blockwise transfer and simultaneous processing                                    | 14   | 0 | 0 | 02 | 02 | + 0 = GOTO-function not possible<br>+ 16384 = GOTO-function possible   |
| Actual/nominal value display with/ without tool length correction when setting datums in the tool axis | 15   | 0 | 0 | 03 | 03 | + 0 = display without tool length correction<br>+ 32768 = display with tool length correction  |
| Overlapping factor with pocket milling   | 93   | ♦ | ♦ | ♦  | ♦  | 0.1 ... 1.414  |
| PLC: counter preset value for counters 0 - 15  | 94<br>95<br>96<br>97<br>98<br>99<br>100<br>101<br>102<br>103<br>104<br>105<br>106<br>107<br>108<br>109       | ♦ | ♦ | ♦  | ♦  | 0 ... 65535  |
| PLC: time of timer for timers 0 - 15   | 110<br>111<br>112<br>113<br>114<br>115<br>116<br>117<br>118<br>119<br>120<br>121<br>122<br>123<br>124<br>125 | ♦ | ♦ | ♦  | ♦  | 0 ... 65535 (in units of 20 ms)  |



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| Function   | Parameter no. | 4   | 5 | 4* | 5* | Input range  |
|--|---------------|-----|---|----|----|--|
| PLC: 31 positioning values for PLC-Positioning   | 126           | ♦   | ♦ | ♦  | ♦  | - 30000.000 ... + 30000.000 [mm]   |
|  | 127           | ♦   | ♦ | ♦  | ♦  |  |
|  | 128           | ♦   | ♦ | ♦  | ♦  |  |
|  | 129           | ♦   | ♦ | ♦  | ♦  |  |
|  | 130           | ♦   | ♦ | ♦  | ♦  |  |
|  | 131           | ♦   | ♦ | ♦  | ♦  |  |
|  | 132           | ♦   | ♦ | ♦  | ♦  |  |
|  | 133           | ♦   | ♦ | ♦  | ♦  |  |
|  | 134           | ♦   | ♦ | ♦  | ♦  |  |
|  | 135           | ♦   | ♦ | ♦  | ♦  |  |
|  | 136           | ♦   | ♦ | ♦  | ♦  |  |
|  | 137           | ♦   | ♦ | ♦  | ♦  |  |
|  | 138           | ♦   | ♦ | ♦  | ♦  |  |
|  | 139           | ♦   | ♦ | ♦  | ♦  |  |
|  | 140           | ♦   | ♦ | ♦  | ♦  |  |
|  | 141           | ♦   | ♦ | ♦  | ♦  |  |
|  | 142           | ♦   | ♦ | ♦  | ♦  |  |
|  | 143           | ♦   | ♦ | ♦  | ♦  |  |
|  | 144           | ♦   | ♦ | ♦  | ♦  |  |
|  | 145           | ♦   | ♦ | ♦  | ♦  |  |
|  | 146           | ♦   | ♦ | ♦  | ♦  |  |
|  | 147           | ♦   | ♦ | ♦  | ♦  |  |
|  | 148           | ♦   | ♦ | ♦  | ♦  |  |
|  | 149           | ♦   | ♦ | ♦  | ♦  |  |
|  | 150           | ♦   | ♦ | ♦  | ♦  |  |
|  | 151           | ♦   | ♦ | ♦  | ♦  |  |
|  | 152           | ♦   | ♦ | ♦  | ♦  |  |
|  | 153           | ♦   | ♦ | ♦  | ♦  |  |
|  | 154           | ♦   | ♦ | ♦  | ♦  |  |
|  | 155           | ♦   | ♦ | ♦  | ♦  |  |
|  | 156           | ♦   | ♦ | ♦  | ♦  |  |
| Activation of the next tool number, programmable with TOOL CALL .../.. or with the following allocation number, programmable with TOOL DEF | 157           | ♦   | ♦ | ♦  | ♦  | 0 = no output of next tool number<br>1 = output of next tool number only if tool number is changed (TOOL CALL .../..)<br>2 = output of next tool number with each tool call (TOOL CALL .../..)<br>3 = output of next tool allocation number, programmable with TOOL DEF (if MP 325 >= 1) |
| Setting of a binary number with 16 markers (marker 2192 to 2207)   | 158           | ♦   | ♦ | ♦  | ♦  | 0 ... 65535  |
| Automatic lubrication after programmed traverse path in  | X             | 159 | ♦ | ♦  | ♦  | 0 ... 65535 (in units of 65536 µm)   |
|  | Y             | 160 | ♦ | ♦  | ♦  |  |
|  | Z             | 161 | ♦ | ♦  | ♦  |  |
|  | IV            | 162 | ♦ | ♦  | ♦  |  |



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| Function  | Parameter no.                     | 4 | 5 | 4* | 5* | Input range  |
|---|-----------------------------------|---|---|----|----|--|
| Feed speed<br>for parameter no. 126<br>to no. 156   | X 163<br>Y 164<br>Z 165<br>IV 166 | ♦ | ♦ | ♦  | ♦  | 80 ... 29998 [mm/min]  |
| Actual feed display before the start<br>in the <b>manual operating modes</b><br>(same feed in all axes, that means<br>smallest programmable feed, that means<br>from parameters 4 to 7 and 322) | 167                               | ♦ | ♦ | ♦  | ♦  | 0 = no display<br>1 = display  |
| Ramp gradient for S-analog voltage  | 168                               | ♦ | ♦ | ♦  | ♦  | 0 ... 1.999 [V/ms]   |
| Standstill supervision  | 169                               | ♦ | ♦ | ♦  | ♦  | 0.001 ... 30 [mm]  |
| Programming station   | 170                               | ♦ | ♦ | ♦  | ♦  | 0 = control<br>1 = programming station: PLC active<br>2 = programming station: PLC inactive<br>3 = analog outputs for plotter operation  |
| Selection of the Handwheel and<br>the probe system  | 171 bit                           | 0 | 0 | 0  | ♦  | + 0 HR 150/250<br>+ 1 HR 130/330   |
|   |                                   | 1 | ♦ | ♦  | ♦  | + 0 = TS 511<br>+ 2 = TS 111/120   |
| Polarity of S-analog voltage  | 172                               | ♦ | ♦ | ♦  | ♦  | 0 = M03: positive voltage<br>M04: negative voltage<br>1 = M03: negative voltage<br>M04: positive voltage<br>2 = M03 and M04: positive voltage<br>3 = M03 and M04: negative voltage |
| Status display erasure and<br>Q-parameters with M02, M30 and<br>program end   | 173                               | ♦ | ♦ | ♦  | ♦  | 0 = status display is not erased<br>1 = status display is erased   |
| Position supervision in<br>trailing distance operation<br>Emergency-Stop<br>Erasable  | 174<br>175                        | ♦ | ♦ | ♦  | ♦  | 0 ... 100 [mm]   |
| Multiplication factor for the Kv-factor   | 176                               | ♦ | ♦ | ♦  | ♦  | 0.001 ... 1.000  |
| Kv-factor for the trailing<br>operation   | X 177<br>Y 178<br>Z 179<br>IV 180 | ♦ | ♦ | ♦  | ♦  | 0.100 ... 10.000   |
| Characteristic kink   | 181                               | ♦ | ♦ | ♦  | ♦  | 0 ... 100.000 [%]  |
| Minimum for feed override when<br>tapping   | 182                               | ♦ | ♦ | ♦  | ♦  | 0 ... 150 [%]  |
| Maximum for feed override when<br>tapping   | 183                               | ♦ | ♦ | ♦  | ♦  | 0 ... 150 [%]  |



Kundendienst

| Function   | Parameter no. | 4 | 5 | 4* | 5* | Input range   |
|--|---------------|---|---|----|----|---|
| Minimum voltage for S-analog output  | 184           | ♦ | ♦ | ♦  | ♦  | 0 ... 9.999 [V]   |
| Waiting time to switch-off the residual nominal value voltage when the error message "Positioning error" appears | 185           | ♦ | ♦ | ♦  | ♦  | 0 ... 65.535 [s]  |
| Datums for positioning blocks with M92:  |               |   |   |    |    |   |
| X  | 186           | ♦ | ♦ | ♦  | ♦  | - 30000.000 ... + 30000.000 [mm]                        |
| Y  | 187           | ♦ | ♦ | ♦  | ♦  | resp.   |
| Z  | 188           | ♦ | ♦ | ♦  | ♦  | - 30000.000 ... + 30000.000 [°]                         |
| IV   | 189           | ♦ | ♦ | ♦  | ♦  |   |
| Programming of speed S=0 permitted (voltage value of MP 184 can be very low)                                     | 190           | ♦ | ♦ | ♦  | ♦  | 0 = S=0 permitted<br>1 = S=0 not permitted              |
| Display of current spindle speed before the spindle start  | 191           | ♦ | ♦ | ♦  | ♦  | 0 = off<br>1 = on                                       |
| Positioning window for the IVth-axis   | 192           | ♦ | ♦ | ♦  | ♦  | 0.001 ... 2.000 [mm or °]<br>0.001 ... 65.535 [mm or °] |
| PLC: time of timers for timer 16-31  | 193           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535 (in units of 20 ms)                         |
|  | 194           | ♦ | ♦ | ♦  | ♦  |   |
|  | 195           | ♦ | ♦ | ♦  | ♦  |   |
|  | 196           | ♦ | ♦ | ♦  | ♦  |   |
|  | 197           | ♦ | ♦ | ♦  | ♦  |   |
|  | 198           | ♦ | ♦ | ♦  | ♦  |   |
|  | 199           | ♦ | ♦ | ♦  | ♦  |   |
|  | 200           | ♦ | ♦ | ♦  | ♦  |   |
|  | 201           | ♦ | ♦ | ♦  | ♦  |   |
|  | 202           | ♦ | ♦ | ♦  | ♦  |   |
|  | 203           | ♦ | ♦ | ♦  | ♦  |   |
|  | 204           | ♦ | ♦ | ♦  | ♦  |   |
|  | 205           | ♦ | ♦ | ♦  | ♦  |   |
|  | 206           | ♦ | ♦ | ♦  | ♦  |   |
|  | 207           | ♦ | ♦ | ♦  | ♦  |   |
|  | 208           | ♦ | ♦ | ♦  | ♦  |   |
| Function dependent on M92, bit 9   | 209           |   |   |    |    |   |
| -----  |               |   |   |    |    |   |
| MP92 bit 9 = 0: activation of PLC macro commands   |               | ♦ | ♦ | ♦  | ♦  |   |
| -----  |               |   |   |    |    |   |
| M92 Bit 9 = 1: number of tools with allocation number  |               | - | - | ♦  | ♦  | 0 ... 99 tools  |
| Activation of PLC-macro commands (Setting of markers 3200 ... 3263)  | 210           | ♦ | ♦ | ♦  | ♦  | 0 ... 9999  |
|  | 211           | ♦ | ♦ | ♦  | ♦  |   |
|  | 212           | ♦ | ♦ | ♦  | ♦  |   |
| Cycle "Scaling" is active on 2 axes or on 3 axes   | 213           | ♦ | ♦ | ♦  | ♦  | 0 = 3 axes (spacial)<br>1 = 2 axes (operating plane)    |



Kundendienst

| Function  | Parameter no. | 4 | 5 | 4* | 5* | Input range   |
|---|---------------|---|---|----|----|---|
| Output of M- and S-function   | 214           |   |   |    |    |   |
| Programmed stop with M06  |               | ♦ | ♦ | ♦  | ♦  | + 0 = programmed stop with M06<br>+ 1 = no programmed stop with M06   |
| Output of M89   | 1             | ♦ | ♦ | ♦  | ♦  | + 0 = normal output at beginning of block<br>+ 2 = modal cycle call at end of block   |
| Axis standstill if only one new spindle speed is output with a TOOL CALL  | 2             | ♦ | ♦ | ♦  | ♦  | + 0 = axis standstill<br>+ 4 = no axis standstill   |
| Axis stands still when M-function is output<br><b>Exceptions:</b> axis stands still with M-functions which result in a programmed stop (as M00, M02 ...) or if a STOP or a CYCL-CALL block occurs | 3             | ♦ | ♦ | ♦  | ♦  | + 0 = axis standstill<br>+ 8 = no axis standstill   |
| Reserved  | 4             | 0 | 0 | 0  | 0  | + 0   |
| Axis stands still if a tool number, a tool axis or a spindle speed was programmed with a TOOL CALL  | 5             | 0 | 0 | ♦  | ♦  | + 0 = axis standstill<br>+ 32 = no axis standstill  |
| Nominal/actual value acknowledgement during M/S/T-strobe if marker 2552 ff was set  | 6             | 0 | 0 | ♦  | ♦  | + 0 = during M/S/T-strobe the actual value is acknowledged as nominal value<br>+ 64 = during M/S/T-strobe the actual value is not acknowledged as nominal value |
| Probe system: feed for probing  | 215           | ♦ | ♦ | ♦  | ♦  | 80 ... 3000 [mm/min]  |
| Probe system: measuring path  | 216           | ♦ | ♦ | ♦  | ♦  | 0 ... 19999.999 [mm]  |
| Switch-over from HEIDENHAIN dialog programming to DIN/ISO-programming   | 217           | ♦ | ♦ | ♦  | ♦  | 0 = HEIDENHAIN-dialog<br>1 = DIN/ISO  |
| "Blockwise transfer"<br>ASCII-character for data input  | 218           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535   |
| "Blockwise transfer"<br>ASCII-character for data output   | 219           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535   |
| "Blockwise transfer"<br>ASCII-character for the beginning the end of the command block  | 220           | ♦ | ♦ | ♦  | ♦  | 0 ... 12079   |
| "Blockwise transfer"<br>ASCII-character for pos. acknowledgement, resp. negative acknowledgement  | 221           | ♦ | ♦ | ♦  | ♦  | 0 ... 12079   |



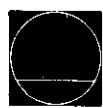
Kundendienst

| Function  | Parameter no. | 4   | 5 | 4* | 5* | Input range   |
|---|---------------|-----|---|----|----|---|
| Data format and transmission stop for V.24-data interface   | 222           | bit |   |    |    |   |
| 7 or 8 data bit   |               | 0   | ♦ | ♦  | ♦  | + 0 = 7 data bit (ASCII-code with 8th bit = parity)<br>+ 1 = 8 data bit (ASCII-code with 8th bit 0, 9th bit = parity)                   |
| Block-check character   | 1             | ♦   | ♦ | ♦  | ♦  | + 0 = any BCC-character (also control sign)<br>+ 2 = BCC-character, no control sign   |
| Transmission stop by RTS  | 2             | ♦   | ♦ | ♦  | ♦  | + 0 = inactive<br>+ 4 = active  |
| Transmission stop by DC3  | 3             | ♦   | ♦ | ♦  | ♦  | + 0 = inactive<br>+ 8 = active  |
| Even or odd character parity  | 4             | ♦   | ♦ | ♦  | ♦  | + 0 = even<br>+ 16 = odd  |
| Requested character parity  | 5             | ♦   | ♦ | ♦  | ♦  | + 0 = not required<br>+ 32 = required   |
| Number of stop bits   | 6/7           | ♦   | ♦ | ♦  | ♦  | 7   6<br><br>0 0 1½ stop bits<br>0 1 2 stop bits<br>1 0 1 stop bit<br>1 1 1 stop bit<br><br>Setting bit 6: + 64<br>Setting bit 7: + 128 |
| Operating mode V.24-data interface  | 223           | ♦   | ♦ | ♦  | ♦  | 0 = "standard data interface"<br>1 = "blockwise transfer"   |
| "Blockwise transfer"<br>ASCII-character for end of data transmission                                | 224           | ♦   | ♦ | ♦  | ♦  | 0 ... 12079   |
| Central tool memory   | 225           | ♦   | ♦ | ♦  | ♦  | 0 = no central tool memory<br>1 ... 99 = central tool memory<br>input value = number of tool stations                                   |
| Graphic printout<br>Number of control characters to set the printer interface + 1 control character | 226           | ♦   | ♦ | ♦  | ♦  | 0 ... 65535   |
| Graphic printout<br>2 control characters to set the printer interface                               | 227           | ♦   | ♦ | ♦  | ♦  | 0 ... 65535   |
|   | 228           | ♦   | ♦ | ♦  | ♦  |   |
|   | 229           | ♦   | ♦ | ♦  | ♦  |   |



Kundendienst

| Function  | Parameter no. | 4 | 5 | 4* | 5* | Input range  |
|---|---------------|---|---|----|----|--|
| Graphic printout<br>Number of control characters before each printer line + 1 control character | 230           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535  |
| Graphic printout<br>2 control characters before each printer line                               | 231<br>232    | ♦ | ♦ | ♦  | ♦  | 0 ... 65535  |
| Movement supervision  | 234           | ♦ | ♦ | ♦  | ♦  | 0.03 ... 10 [V]  |
| Touch probe system: safety distance via measuring point for autom. measurement                  | 235           | ♦ | ♦ | ♦  | ♦  | 0 ... 19999.999 [mm]   |
| Graphics  | 236 bit       |   |   |    |    |  |
| Switch-over to "View in three planes"   | 0             | ♦ | ♦ | ♦  | ♦  | + 0 = German standard<br>+ 1 = American standard   |
| Turning the coordinate system by 90° in the working plane                                       | 1             | ♦ | ♦ | ♦  | ♦  | + 0 = no rotation<br>+ 2 = coordinate system turned  |
| Activation of the S-axis for spindle orientation  | 237           | ♦ | ♦ | ♦  | ♦  | 0 = axis inactive<br>1 = axis is used to orientate the main spindle, without position data<br>2 = as input value 1, with position data, however (displayed instead of the IVth-, resp. the Vth-axis) |
| Kv-factor for S-axis (spindle)  | 238           | ♦ | ♦ | ♦  | ♦  | 0.100 ... 10.0000  |
| Counting direction and handwheel input inhibit for axis of spindle orientation                  | 239 bit       |   |   |    |    |  |
| Counting direction  | 0             | ♦ | ♦ | ♦  | ♦  | + 0 = positive counting direction<br>+ 1 = negative counting direction   |
| Not assigned  | 1             | - | - | 0  | 0  |  |
| Not assigned  | 2             | - | - | 0  | 0  |  |
| Not assigned  | 3             | - | - | 0  | 0  |  |
| Encoder input X5 as Handwheel input for the X-axis  | 4             | - | - | ♦  | ♦  | + 0 = encoder input X5 corresponds to the standard input<br>+ 16 = encoder input X5 corresponds to the Handwheel input for the X-axis  |
| Positioning value to the reference value for the S-axis (spindle)                               | 240           | ♦ | ♦ | ♦  | ♦  | 0 ... 360.000  |



Kundendienst

| Function   | Parameter no. | 4 | 5 | 4* | 5* | Input range   |
|--|---------------|---|---|----|----|---|
| Cycles to mill pockets of any contour                            | 241           |   |   |    |    |   |
|  | bit           |   |   |    |    |   |
| Cycle "Reaming": milling direction to premill contour            | 0             | ♦ | ♦ | ♦  | ♦  | + 0 = counterclockwise premilling of the contour with pockets,<br>clockwise premilling with islands<br>+ 1 = clockwise premilling of the contour with pockets, counterclockwise premilling with islands |
| Cycle "Reaming": sequence for reaming and premilling             | 1             | ♦ | ♦ | ♦  | ♦  | + 0 = mill a channel round the contour first, ream the pocket subsequently<br>+ 2 = ream the pocket first, mill a channel round the contour subsequently  |
| Combining corrected or uncorrected contours                      | 2             | ♦ | ♦ | ♦  | ♦  | + 0 = combining corrected contours<br>+ 4 = combining uncorrected contours  |
| Reference mark distance for distance-coded encoders              | 242           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535   |
| X  |               |   |   |    |    | 0 = no distance-coded reference marks   |
| Y  | 243           | ♦ | ♦ | ♦  | ♦  | 1000 = linear encoder with 20 µm grating  |
| Z  | 244           | ♦ | ♦ | ♦  | ♦  | pitch or angular encoder with 36 reference marks and 18000 lines  |
| IV   | 245           | ♦ | ♦ | ♦  | ♦  |   |
| Positioning window for S-axis (spindle)                          | 246           | ♦ | ♦ | ♦  | ♦  | 1 ... 65535 [incrementals]  |
| Hysteresis for Electronical Handwheel                            | 247           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535 [incrementals]  |
| Spindle speed for spindle orientation                            | 248           | ♦ | ♦ | ♦  | ♦  | 0 ... 99999.999 [rpm]   |
| Setting a binary number with 16 markers (marker 2208 to 2223)    | 249           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535   |
| Setting a binary number with 16 markers (marker 2224 to 2239)    | 250           | ♦ | ♦ | ♦  | ♦  | 0 ... 65535   |
| Touch probe: rapid traverse for probing                          | 251           | ♦ | ♦ | ♦  | ♦  | 80 ... 29998 [mm/min]   |
| Automatic, cyclic offset adjustment                              | 252           | ♦ | ♦ | ♦  | ♦  | 1 ... 65535 [in unist of 20 ms]<br>0 = no automatic adjustment  |
| Allocation of the axes to the encoder inputs                     | 253           | ♦ | ♦ | ♦  | ♦  | 0 = standard allocation   |
| X  | 254           | ♦ | ♦ | ♦  | ♦  | 1 = encoder input X1  |
| Y  | 255           | ♦ | ♦ | ♦  | ♦  | 2 = encoder input X2  |
| Z  | 256           | ♦ | ♦ | ♦  | ♦  | 3 = encoder input X3  |
| IV   | 257           | 0 | ♦ | 0  | ♦  | 4 = encoder input X4  |
| V  |               |   |   |    |    | 5 = encoder input X5  |
|  |               |   |   |    |    | 6 = encoder input X6  |
| Analog output of the speed for the spindle if marker 2501 is set | 258           | ♦ | ♦ | ♦  | ♦  | 0 ... 99999.999 [rpm]<br>the rotating direction is always positive  |



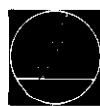
## Kundendienst

| Function  | Parameter no. | 4  | 5  | 4* | 5* | Input range  |
|---|---------------|----|----|----|----|--|
| Change-over dialogs for manufacturer cycles: difference between dialog numbers of the second (English) and the first dialog | 259           | ♦  | ♦  | ♦  | ♦  | 0 ... 50   |
| Prescribed step for the IVth-axis if the Hirth-toothing is activated via MP 92  | 260           | 08 | 04 | ♦  | ♦  | 0 ... 9.999 [°]<br>Input value 0 is treated as 0.001.                |
| Displacement for the IVth-axis if the Hirth-toothing is activated via MP 92   | 261           | 08 | 04 | ♦  | ♦  | - 30000.000 ... + 30000.000 [°]                                      |
| Number of global Q-parameters which are transferred from a manufacturer cycle to the calling program                        | 262           | 05 | ♦  | ♦  | ♦  | 0 ... 50<br>When entering 40 the Q-parameters Q60 ... Q99 are global |
| Difference between Q-parameter numbers for "DLG-DEF"-block and "DLG-CALL"-block in the user cycle                           | 263           | ♦  | ♦  | ♦  | ♦  | 0 ... 50<br>0 if "DLG-CALL"-blocks only                              |
| PLC: time of timers for timers 32 - 47  | 264           | 05 | ♦  | ♦  | ♦  | 0 ... 65535  |
|   | 265           | 05 | ♦  | ♦  | ♦  | (in units of 20 ms)  |
|   | 266           | 05 | ♦  | ♦  | ♦  |  |
|   | 267           | 05 | ♦  | ♦  | ♦  |  |
|   | 268           | 05 | ♦  | ♦  | ♦  |  |
|   | 269           | 05 | ♦  | ♦  | ♦  |  |
|   | 270           | 05 | ♦  | ♦  | ♦  |  |
|   | 271           | 05 | ♦  | ♦  | ♦  |  |
|   | 272           | 05 | ♦  | ♦  | ♦  |  |
|   | 273           | 05 | ♦  | ♦  | ♦  |  |
|   | 274           | 05 | ♦  | ♦  | ♦  |  |
|   | 275           | 05 | ♦  | ♦  | ♦  |  |
|   | 276           | 05 | ♦  | ♦  | ♦  |  |
|   | 277           | 05 | ♦  | ♦  | ♦  |  |
|   | 278           | 05 | ♦  | ♦  | ♦  |  |
|   | 279           | 05 | ♦  | ♦  | ♦  |  |
| PLC: counter preset value for counters 16 - 31  | 280           | 05 | ♦  | ♦  | ♦  | 0 ... 65535  |
|   | 281           | 05 | ♦  | ♦  | ♦  |  |
|   | 282           | 05 | ♦  | ♦  | ♦  |  |
|   | 283           | 05 | ♦  | ♦  | ♦  |  |
|   | 284           | 05 | ♦  | ♦  | ♦  |  |
|   | 285           | 05 | ♦  | ♦  | ♦  |  |
|   | 286           | 05 | ♦  | ♦  | ♦  |  |
|   | 287           | 05 | ♦  | ♦  | ♦  |  |
|   | 288           | 05 | ♦  | ♦  | ♦  |  |
|   | 289           | 05 | ♦  | ♦  | ♦  |  |
|   | 290           | 05 | ♦  | ♦  | ♦  |  |
|   | 291           | 05 | ♦  | ♦  | ♦  |  |
|   | 292           | 05 | ♦  | ♦  | ♦  |  |
|   | 293           | 05 | ♦  | ♦  | ♦  |  |
|   | 294           | 05 | ♦  | ♦  | ♦  |  |
|   | 295           | 05 | ♦  | ♦  | ♦  |  |



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| Function  | Parameter no. | 4  | 5  | 4* | 5* | Input range  |
|---|---------------|----|----|----|----|--|
| Limitation of the feed override in % if marker 2509 is set  | 296           | 05 | ◆  | ◆  | ◆  | 0 ... 150 [%]  |
| Acceleration<br><br>The acceleration for the X-axis is determined by MP 54.                         | Y 297         | 05 | ◆  | ◆  | ◆  | 0.001 ... 3.0 [m/s <sup>2</sup> ]  |
|   | Z 298         | 05 | ◆  | ◆  | ◆  |  |
|   | IV 299        | 05 | ◆  | ◆  | ◆  |  |
| Analog voltage with rapid traverse<br><br>The analog voltage for the X-axis is determined by MP 52. | Y 300         | 08 | 03 | ◆  | ◆  | + 4.5 ... + 9 [V]  |
|   | Z 301         | 08 | 03 | ◆  | ◆  |  |
|   | IV 302        | 08 | 03 | ◆  | ◆  |  |
| Input values for the datum shift, activated via markers 2816, 2817, 2819<br><br>1. datum shift      | X 303         | 08 | 04 | ◆  | ◆  | - 30000.000 ... + 30000.000 [mm]   |
|   | X 304         | 08 | 04 | ◆  | ◆  |  |
|   | X 305         | 08 | 04 | ◆  | ◆  |  |
| 1. datum shift  | Y 306         | 08 | 04 | ◆  | ◆  | - 30000.000 ... + 30000.000 [mm]   |
|   | Y 307         | 08 | 04 | ◆  | ◆  |  |
|   | Y 308         | 08 | 04 | ◆  | ◆  |  |
| 1. datum shift  | Z 309         | 08 | 04 | ◆  | ◆  | - 30000.000 ... + 30000.000 [mm]   |
|   | Z 310         | 08 | 04 | ◆  | ◆  |  |
|   | Z 311         | 08 | 04 | ◆  | ◆  |  |
| 1. datum shift  | IV 312        | 08 | 04 | ◆  | ◆  | - 30000.000 ... + 30000.000 [mm]   |
|   | IV 313        | 08 | 04 | ◆  | ◆  | resp.  |
|   | IV 314        | 08 | 04 | ◆  | ◆  | - 30000.000 ... 30000.000 [°]  |
| %-factor for the analog spindle voltage if marker 2822 is set                                       | 315           | 08 | 04 | ◆  | ◆  | 0 ... 150 [%]  |
| Ramp gradient - S-analog voltage to stop the spindle  | 316           | 09 | 04 | ◆  | ◆  | 0 ... 1.999 [V/ms]<br>0 = acceleration and braking from MP 168   |
| Ramp gradient for the S-analog voltage if M 2816 is set   |               |    |    |    |    |  |
| Acceleration  | 317           | 09 | 04 | ◆  | ◆  | 0 ... 1.999 [V/ms]   |
| Braking   | 318           | 09 | 04 | ◆  | ◆  | 0 ... 1.999 [V/ms]   |
| M 90 modal  | 319           | 0  | 0  | ◆  | ◆  | 0 = M 90 not modal<br>1 ... 89 (except for 2, 3, 4, 5, 6, 8, 9, 13, 14, 30)= M-function which is active as M 90, but not modal |



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| Function   | Parameter no. | 4   | 5  | 4* | 5* | Input range  |
|--|---------------|-----|----|----|----|--|
| Axis designation for the Vth-axis  | 320           | -   | ♦  | 0  | ♦  | 0 = A      3 = U<br>1 = B      4 = V<br>2 = C      5 = W   |
| Rapid traverse for the Vth-axis  | 321           | -   | ♦  | 0  | ♦  | 80 ... 29998 [mm/min]<br>angular axis:<br>80 ... 29998 [°/min]   |
| Manual feed for the Vth-axis   | 322           | -   | ♦  | 0  | ♦  | 80 ... 29998 [mm/min]<br>angular axis:<br>80 ... 29998 [°/min]   |
| Speed when approaching the reference marks                               | 323           | -   | ♦  | 0  | ♦  | 80 ... 29998 [°/min]   |
| Feed for PLC-positioning of Vth-axis                                     | 324           | -   | ♦  | 0  | ♦  |  |
| Software limit switch ranges   | V +           | 325 | -  | ♦  | 0  | - 30000.000 ... + 30000.000 [mm]<br>angular axis:<br>- 30000.000 ... + 30000.000 [°]   |
|  | V -           | 326 | -  | ♦  | 0  |  |
| Signal evaluation, input X5  | 327           | -   | ♦  | 0  | ♦  | 1 = 4-fold<br>2 = 2-fold<br>(max. traverse speed limited by the EXE-input frequency)   |
| Reference mark distance for distance-coded encoders Axis V               | 328           | -   | ♦  | 0  | ♦  | 0 ... 65535<br>0 = no distance-coded reference marks<br>1000 = linear encoders with 20µm grating pitch or angular encoder with 36 reference marks and 1800 lines |
| Traverse direction when approaching the reference marks                  | 329           | -   | ♦  | 0  | ♦  | 0 = plus direction<br>1 = minus direction<br>(if machine parameters 330 and 331 are correctly programmed)  |
| Machine parameters with multiple function                                | 330           | bit |    |    |    |  |
| Counting direction for the Vth-axis                                      | 0             | -   | ♦  | 0  | ♦  | + 0 = positive counting direction<br>+ 1 = negative counting direction   |
| Reference pulse inhibit for the Vth-axis                                 | 1             | -   | ♦  | 0  | ♦  | + 0 = inactive<br>+ 2 = active   |
| Release for non-linear axis error compensation for the Vth-axis          | 2             | -   | 04 | 0  | ♦  | + 0 = inactive<br>+ 4 = compensation active  |
| Output of the smallest possible voltage step of 2.44 mV for the Vth-axis | 3             | -   | 04 | 0  | ♦  | + 0 = 2.44 mV output if the nominal value calculated is equal or exceeds 1.22 mV.<br>+ 8 = 2.44 mV output if the nominal value calculated exceeds 0.             |



Kundendienst

| Function  | Parameter no. | 4 | 5  | 4* | 5* | Input range  |
|---|---------------|---|----|----|----|--|
| Polarity of the nominal value voltage   | 331           | - | ◆  | 0  | ◆  | 0 = positive with positive traverse direction<br>1 = negative with positive traverse direction |
| Differential factor for the speed precontrol  | 332           | - | ◆  | 0  | ◆  | 0 ... 65.535   |
| Rv-factor for the trailing operation V  | 333           | - | ◆  | 0  | ◆  | 0.100 ... 10.000   |
| Datum setting via axis key V  | 334           | - | ◆  | 0  | ◆  | 0 = inactive, datum is acknowledged from MP 337<br>1 = active                                  |
| Acceleration for the Vth-axis   | 335           | - | ◆  | 0  | ◆  | 0.001 ... 3.0 [m/s <sup>2</sup> ]  |
| Positioning window for the Vth-axis   | 336           | - | ◆  | 0  | ◆  | 0.001 ... 2.000 [mm or °]<br>- 03 0.001 ... 65.535 [mm or °]                                   |
| Datum for the Vth-axis  | 337           | - | ◆  | 0  | ◆  | - 30000.000 ... + 30000.000 [mm]   |
| Analog voltage with rapid traverse, axis V  | 338           | - | 03 | 0  | ◆  | + 4.5 ... + 9 [V]  |
| Input values for the datum shift of the Vth-axis, activated via marker 2816, 2817, 2819 |               |   |    |    |    | - 30000.000 ... + 30000.000 [mm]<br>resp.<br>- 30000.000 ... + 30000.000 [°]                   |
| 1. datum shift V  | 339           | - | 04 | 0  | ◆  |  |
| 2. datum shift V  | 340           | - | 04 | 0  | ◆  |  |
| 3. datum shift V  | 341           | - | 04 | 0  | ◆  |  |
| Prescribed step for the Vth-axis if the Hirth-toothring is activated via MP 92          | 342           | - | 04 | 0  | ◆  | 0 ... 9.999 [°]<br>input value 0 is treated as 0.001   |
| Displacement for the Vth-axis if the Hirth-toothring is activated via MP 92             | 343           | - | 04 | 0  | ◆  | - 30000.000 ... + 30000.000 [°]  |
| Compensation factor for linear compensation of the Vth-axis                             | 344           | - | 04 | 0  | ◆  | - 1.000 ... + 1.000 [mm/m]   |



Kundendienst

| Function   | Parameter no.  | 4 | 5 | 4* | 5* | Input range  |
|--|--|---|---|----|----|--|
| 2nd group: software limit switch ranges for the 5th-axis; selectable via markers M2816/M2817             | 5+ 345<br>5- 346   | - | - | 0  | ◆  | linear axis:<br>- 30000.000 ... + 30000.000 mm<br>rotational axis:<br>- 30000.000 ... + 30000.000°   |
| 3rd group: software limit switch ranges for the 5th-axis, selectable via marker M2816/M2817              | 5+ 347<br>5- 348   | - | - | 0  | ◆  | linear axis:<br>- 30000.000 ... + 30000.000 mm<br>rotational axis:<br>- 30000.000 ... + 30000.000°   |
| Datum for positioning blocks with M 92   | axis 5 349   | - | - | 0  | 02 | - 30000.000 ... + 30000.000 [mm]<br>resp.<br>- 30000.000 ... + 30000.000 [°]                         |
| Reserved   | 350<br>351<br>352<br>353<br>354<br>355<br>356<br>357<br>358<br>359                         | - | - | 0  | 0  |  |
| Minimum spindle speed  | 360  | - | - | ◆  | ◆  | 0 ... 99999.999 rpm  |
| Spindle speed, %-deviation of nominal value output   | 361  | - | - | ◆  | ◆  | 0 ... 99 %   |
| 2nd spindle speed for spindle orientation; active if the MP317/MP318 ramps were selected via marker 2823 | 362  | - | - | ◆  | ◆  | 0 ... 99999.999 rpm  |
| 2nd group: software limit switch ranges; selectable via markers M2816/M2817                              | X+ 363<br>X- 364<br><br>Y+ 365<br>Y- 366<br><br>Z+ 367<br>Z- 368<br><br>IV+ 369<br>IV- 370 | - | - | ◆  | ◆  | linear axis:<br>- 30000.000 ... + 30000.000 mm<br><br>rotational axis:<br>- 30000.000 ... 30000.000° |



Kundendienst

| Function  | Parameter no. | 4   | 5 | 4* | 5* | Input range:   |
|---|---------------|-----|---|----|----|--|
| 3rd group: software limit switch X+ ranges; selectable via M2816/M2817 markers                  | 371           | -   | - | ◆  | ◆  | linear axis:<br>- 30000.000 ... + 30000.000 mm   |
|   | 372           | -   | - | ◆  | ◆  |  |
|   | Y+            | 373 | - | -  | ◆  | rotational axis:<br>- 30000.000 ... + 30000.000°   |
|   | Y-            | 374 | - | -  | ◆  |  |
|   | Z+            | 375 | - | -  | ◆  | 375  |
|   | Z-            | 376 | - | -  | ◆  |  |
|   | IV+           | 377 | - | -  | ◆  | 377  |
|   | IV-           | 378 | - | -  | ◆  |  |
| Non-volatile storage of Q-parameters (8 parameters)   | 379           | -   | - | ◆  | ◆  | 0 = no non-volatile storage of Q-parameters<br>1 ... 92 = number of the first Q-parameter out of eight (non-volatile storage)  |
| Multiple definition of tools in the control tool memory   | 380           | -   | - | ◆  | ◆  | 0 = no multiple definition per tools<br>1 = 2 various definitions per tool<br>2 = 3 various definitions per tool<br>3 = 4 various definitions per tool<br>4 = 5 various definitions per tool<br>5 = 6 various definitions per tool |
| Size of NC-buffer memory with "Blockwise transfer" with simultaneous processing                 | 381           | -   | - | 02 | 02 | 0 = reload continuous blocks<br>1 ... 3000 = minimum number of NC-blocks in the block memory. After remaining below this limit data are reloaded via the interface.  |
| Overlap voltage for positive analog voltage of the spindle (only active if analog voltage > 0)  | 382           | -   | - | 02 | 02 | - 9.999 ... + 9.999 [V]  |
| Overlap voltage for negative analog voltage for the spindle (only active if analog voltage < 0) | 383           | -   | - | 02 | 02 | - 9.999 ... + 9.999 [V]  |