Service Manual

TNC 407/415

10/00

Kundendienst/Service

HEIDENHAIN

* SERVICE MANUAL *
TNC 407 / 415

Changes/Developments
We are constantly working on technical improvements of our products.
For this reason, details described in this manual may differ slightly from your control. In this case, please order a revised service manual from us.

Issue 10/00

valid for the software versions	TNC 407	= 243 07 .,	version 07
	TNC 415	= 243 05 ., 259 91 .,	version 10
	TNC 407	= 243 02 .,	version 01
	TNC 415	= 259 96 ., 259 97 .,	version 01)

Contents Service Manual TNC 407/415

Table of Contents

1. How to use this Service Manual

The service manual TNC 407/415 can be used to diagnose, locate and eliminate errors on machine tools controlled by TNC.

In order to correctly judge the problems in an NC-controlled machine tool, fundamental knowledge of the machine tool and its drives, as well as their interaction with the control and the measuring systems is required. Incorrect behaviour of the machine tool can also result from improper use of the control, NC-programming errors and incorrect or not properly optimized machine parameter.

For further information in this respect please refer to the

.**Documentation of the Machine Tool Manufacturer**
.**Operating Manual** (HEIDENHAIN)
.**Technical Manual** (HEIDENHAIN).

The manual for the machine tool manufacturer is not enclosed with every control as is the operating manual. In general, it is only supplied to the machine tool manufacturer and is updated by HEIDENHAIN, Traunreut. Therefore, it is absolutely necessary to contact the machine tool manufacturer, if errors occur that are due to a machine parameter or to the interface of the control. Support will, however, also be provided by the service department of HEIDENHAIN, Traunreut. and HEIDENHAIN agencies. Telephone numbers, addresses and telex/fax numbers can be found on the back side of the cover page and on the back side of this service manual.

2. Minor Error Messages

The TNC 407/415 features a comprehensive integrated monitoring system to avoid input or operation errors, to locate errors and technical defects of the entire equipment (TNC, measuring system, machine tool, cables etc.). The monitoring system is a fixed component of the TNC hardware and software; it is always active when the control is switched on. If a technical defect or an operation error is detected, an error message in plain language is displayed on the screen.

To erase minor error messages, press CE.

Further error messages are described in the
- Operating Manual TNC 407/415
- Technical Manual
- Documentation by the machine tool manufacturer
- Operating Instructions FE 401 B.

ERROR MESSAGE	Section
AXIS DOUBLE PROGRAMMED	13.2
START POSITION INCORRECT	13.2
TOUCH POINT INACCESSIBLE	13.2
RANGE EXCEEDED	13.2
BAUD RATE NOT POSSIBLE	14.5
OPERATION PARAMETERS ERASED	2.1
CYCL-PARAMETER INCORRECT	13.2
FAULTY RANGE DATA	13.2
DATA MEDIUM MISSING	14.5
DATA MEDIUM EMPTY	14.5
DATA MEDIUM WRITE-PROTECTED	14.5
ROTATION NOT PERMITTED	13.2
PLANE WRONGLY DEFINED	13.2
LIMIT SWITCH <AXIS>	2.1
ERR: 001	14.5
ERR: 002	14.5
ERR: 003	14.5
ERR: 004	14.5
ERR: 010	14.5
ERR: 012	14.5
ERR: 013	14.5
ERR: 014	14.5
ERR: 100	14.5
ERR: 102	14.5
ERR: 103	14.5

ERROR MESSAGE	Section
ERR: 104	14.5
ERR: 105	14.5
ERR: 106	14.5
ERR: 107	14.5
ERR: 108	14.5
EMERGENCY STOP	17.3
EXT. IN-/OUTPUT NOT READY	14.5
WRONG OPERATING MODE	14.5
WRONG PROGRAM DATA	14.5
SCALING FACTOR NOT PERMITTED	13.2
ME: TAPE END	14.5
HANDWHEEL DEFECTIVE	12.3
HANDWHEEL ?	12.3
PLC PROGRAM NOT TRANSLATED	2.1
POSITIONING ERROR	2.1
PROGRAM INCOMPLETE	14.5
EXCHANGE BUFFERBATTERY	8.7
INTERFACE ALREADY ASSIGNED	14.5
MIRRORING NOT PERMITTED	13.2
RELAY EXT. DC VOLTAGE MISSING	17.3
POWER INTERRUPTED	2.1
EXCHANGE TOUCH PROBE BATTERY	13.2
STYLUS ALREADY IN CONTACT	13.2
PROBE SYSTEM NOT READY	13.2
TIME LIMIT EXCEEDED	13.2

2.1. Causes of Minor Error Messages

OPERATING PARAMETERS ERASED

With new and exchange controls, the machine parameters are always erased.
Software exchanged with different software versions.
- Defective buffer batteries, accumulator or capacitor
RAM error on the processor board

LIMIT SWITCH X+

"Manual" operating mode:
The preset **software limit switch** has been reached during traverse with the directional keys.
- "Automatic" operating mode:
The **calculated position** of the current block is **beyond the software limit switch range** or **beyond the additional limit** (set with MOD function >AXIS-LIMIT<). The positioning is not performed.

Machine Parameters for the Software Limit Switches

	X+	X-	Y+	Y-	Z+	Z-
Default setting	910.0	920.0	910.1	920.1	910.2	920.2
Activation via PLC	911.0	921.0	911.1	921.1	911.2	921.2
Activation via PLC	912.0	922.0	912.1	922.1	912.2	922.2

	IV+	IV-	V+	V-
Default setting	910.3	920.3	910.4	920.4
Activation via PLC	911.3	921.3	911.4	921.4
Activation via PLC	912.3	922.3	912.4	922.4

POWER INTERRUPTED

After a reset signal of the power supply (e.g. line voltage drops)
Important machine parameters may have been changed;
e.g. MP210, MP410.3, MP730, MP3240.1. MP7210. MP7310

POSITIONING ERROR

- The servo lag monitor set in the machine parameters MP1410 or MP1710 has responded.
(Check the run-in behaviour of the axis; readjust, if necessary)

PLC PROGRAM NOT TRANSLATED

- After editing, the PLC program must be compiled (translated) anew. Use the soft key >Compile< or switch off the control!

PLC: ERROR 00	Marker	2924	
to	to		set
PLC: ERROR 99	Marker	3023	

Instead of "PLC: ERROR 00 to 99" another dialog may be displayed with customized PLC programs
For further information, please contact your machine tool manufacturer.

3. Major Error Messages and their Causes

The integrated monitoring system distinguishes between minor and gross errors. Gross errors are characterized by a **blinking display (e.g.** malfunctions of the encoders, of the drives and data processing errors).
In the case of gross errors, the control opens the contact **Control Ready for Operation .**
This causes an emergency stop of the machine tool.

By switching off the main switch or by pressing END, the "emergency stop" state can be reset, provided that the error cause has been eliminated.

Display (blinking)	**Error Cause**
PROCESSOR CHECK ERROR XY	X = 0 CRC sum control data incorrect 1 CRC sum machine parameter incorrect 2 Check sum NC memory incorrect 3 Test plane incomplete / will not run 4 Crosstalk between data bits in the RAM 5 Crosstalk between addresses in the RAM 6 Stack overflow 7 CRC sum PLC program ASCII 8 CRC sum PLC program OP-code 9 CRC sum test-section A Software error B Wrong interrupt (differentiation with register V0) C Time slice overflow D Command stack overflow control loop E Wrong command main processor F Wrong display mode main processor G Wrong boot command H Verify error with boot command "Load" I Wrong supplementary command with boot command "Test" J Boot logon successful K EPROM-comparison CLP L Wrong command CLP processor M Operating voltage beyond tolerance range N No PLC texts in PLC chip 0 Axis 4 and/or 5 paraxial with export version P Inhibited software function activated (function Q TNC 415 without CLP or geometry CPU R PLC activates at least 2 commands from the Q-parameters (M2713) and zero shift (M2716). Y = CPU number 1 = main processor 2 = geometry processor 3 = CLP processor

If the error message "PROCESSOR CHECK ERROR XY" (XY = code; see above) comes up repeatedly, send the **complete logic unit** to HEIDENHAIN for repair. Please indicate the **error message and the code.**

Display (blinking)	Error Cause			
ERROR IN PLC-PROGRAM XX	XX = 1A	NC start		complement missing
	1B	Rapid traverse		
	1C	Directional key latch		
	ID	Feed enable		
	1E	PLC positioning	X [1]	
	IF	-"-	Y [1]	
	1G		Z [1]	
	1H	" -	4 [1]	
	II	Directional key	x+	
	1J		X-	_"-
	1K	-"-	Y+	
	IL	" -	Y-	
	1M	" -	z+	
	IN	-"-	Z-	
	10	" -	4+	
	1P		4-	
	IQ	More than one of the markers M2485 to M2487 (M03, M04. M05) are set simultaneously		
	2A	Jog increment pos.	X+	
	2B	" -	X-	
	2C		Y+	
	2D		Y-	_"-
	2E	-"-	z+	-"-
	2F	- "	Z-	_"-
	2G	-"-	4+	" -
	2H		4-	-"-
	2I	- "	5+	-"-
	2K	" -	5-	
	2L			" -
	2M	Directional key	5+	-"-
	2N		5-	
	2P	PLC positioning	5	
	50	Excessive nesting (too many modules nested inside one another)		
	51	STACK underflow (an attempt to acquire data from the STACK, although it was empty)		
	52	STACK overflow (an attempt to load too much data onto the STACK)		
	53	Time-out (the permissible program run-time has been exceeded by more than twice. Check the subprogram structure.)		
	54	CASE-arguments are larger than the number of entries in the table.		
	55	No access to error texts / dialog texts.		

Notes:

1) Only active with compatibility mode TNC 355

Display (blinking)	Error Cause
ERROR IN PLC-PROGRAM X	x= 7 Called label has not been defined
	8 No end-program condition found (the program does not contain an EM instruction, or it contains a JP instruction without a following LBL instruction)
	9 Program is too long (RAM-overflow) (insufficient memory for the program code which is to be generated)
	xx= 10 Assign with parenthesis (an =, S, SN, R, RN, or PS-instruction has been programmed, although arithmetic parentheses are open)
	11 Excessive nesting of parentheses (more than 16 parentheses are open)
	12 Jump within a gating sequence (unconditional jump has been programmed, although the gating sequence was not closed with an Assign.)
	13 "Close Parentheses" without "Open Parentheses" la "Close Parentheses" command was programmed, although no parentheses were open)
	14 Label within parentheses (a LBL instruction has been programmed, although parentheses are open)
	15 Label within a gating sequence (a LBL instruction has been programmed, although the previous gating was not closed with an Assign.)
	16 Jump within parentheses (a jump instruction has been programmed, although parentheses are open)
	17 Parentheses open at end of block (an EM instruction has been programmed, although parentheses are open)
	18 Label defined twice
	19 Word Assign missing (a Logic instruction has been programmed, although the previous Word-gating was not closed with an Assign)
	20 Logic Assign missing (a Word instruction has been programmed, although the previous Logic-gating was not closed with an Assign)
	21 Word accumulator not loaded (a Word Assign or gating has been programmed, although the Word accumulator does not contain a definite value)
	22 Logic accumulator not loaded (a Logic Assign has been programmed, although the Logic accumulator does not contain a definite value)

Display (blinking)	Error Cause
ERROR IN PLC-PROGRAM X (continued)	**23** Accumulators not loaded on "open parentheses" (an A[, AN[, O[, ON[or XON[command has been programmed, although neither the word nor the logic accumulator has been gated or loaded.) **24** Incorrect type of the parentheses result (a different type has been calculated in the parentheses from that which was defined in the "open parentheses" command, i.e. logic instead of word or vice versa.) **25** Conditional jump with incorrect logic accumulator (a conditional jump has been programmed, although the logic accumulator does not contain a definite value.) **26** Empty CASE-instruction **27** "END-CASE" missing

Notes:

Display (blinking)	Error Cause
GROSS POSITIONING ERROR <AXIS> YA	**Position (Servo Lag) Monitoring** Operation with feed precontrol: position monitoring range exceeded (range determined in MP 1420.x) Operation with servo lag: servo lag monitoring range exceeded (determined in MP 1720.x)
GROSS POSITIONING ERROR <AXIS> YB	**Monitoring of the Analog Voltage Limit** The nominal voltage calculated by the control has reached its limit of ± 10 V (only with feed precontrol).
GROSS POSITIONING ERROR <AXIS> YC	**Movement Monitoring** The voltage difference calculated by the control has reached the limit programmed in the machine parameter MP 1140.x.
GROSS POSITIONING ERROR <AXIS> YD	**Standstill Monitoring** The deviation from the nominal position of an axis in standstill has exceeded the value programmed in the machine parameter MP 1110.x.
GROSS POSITIONING ERROR <AXIS> YE	**Monitoring of the Offset Voltage** The offset voltage limit of 100 mV has been reached during an automatic offset adjustment with MP 1220. (see section 16.5)
	Y = CPU number 1 = main processor 2 = geometry processor 3 = CLP processor

Error Location

When the error message “GROSS POSITIONING ERROR” is displayed, the error may be located in any element of the closed loop.

e.g.

Error in control (e.g. CLP board)
Excessive offset voltage at the servo amplifier
Incorrect speed adjustment at the servo amplifier
Monitoring function of servo amplifier has responded
(e.g. monitoring of current intensity)
- Electrical defect at the servo amplifier
Mechanical error (bearing, spindle, guides)
Excessive mechanical forces on a drive

Display (blinking)	Error Cause
MEASURING SYSTEM <Axis> DEFECTIVE YA	A = Signal amplitude error
MEASURING SYSTEM <Axis> DEFECTIVE YB	**B** = Signal frequency error
MEASURING SYSTEM <Axis> DEFECTIVE YC	C = Error with distance-coded scale Y = CPU number 1 = main processor 2 = geometry processor 3 = CLP processor **Possible error causes:** Encoder not connected Cable damaged Glass scale contaminated or damaged - Scanning head defective Encoder monitoring system defective
WRONG REFERENCE POINT	Wrong reference mark spacing entered with distance-coded linear encoders (counting error caused by the measuring system or the LOGIC UNIT)
TNC OPERATING TEMP. EXCEEDED	Temoerature inside the LOGIC UNIT has exceeded + 70” C
EMERGENCY STOP DEFECTIVE YX	YX = 1(1. Emergency-stop test 1) 2. Emergency-stop test 1. 3. Emergency-stop test Error during the test routine for the output “Control Ready for Operation” (see section 17.4)
EMERGENCY STOP PLC	This error message is only generated if the marker 2815 is set without additional marker (M2924 M3023).
PLC: ERROR 00 [1)] to PLC: ERROR 99 [1)]	Marker 2924 to Marker 3023 and marker 2815 set

1) Instead of “PLC: ERROR 00 to 99” another dialog may be displayed with customized PLC programs. For further information, please contact your machine tool manufacturer.

Display (blinking)	**:rror Cause**
CHECK SUM ERROR YX	**-NC 407:** IA CRC-sum main processor EPROM CHIP 1/2 1B CRC-sum main processor EPROM CHIP 3/4 ID CRC-sum PLC chip IX Check sum calculation -NC 415A: YA CRC-sum main processor EPROM CHIP 1/2 YC CRC-sum main processor EPROM CHIP 3/4 YD CRC-sum PLC chip YE CRC-sum Gem chip CHIP 7 YR CRC-sum CLP boot chip IX Check sum calculation 'NC 415B, TNC 425: YA CRC-sum main processor EPROM CHIP 1/2 YB CRC-sum main processor EPROM CHIP 3/4 YC CRC-sum geometry processor EPROM CHIP 5/6 YD CRC-sum PLC chip YE CRC-sum Gem chip CHIP 7 YR CRC-sum CLP boot chip IX Check sum calculation Y = CPU number 1 = main processor 2 = geometry processor 3 = CLP processor

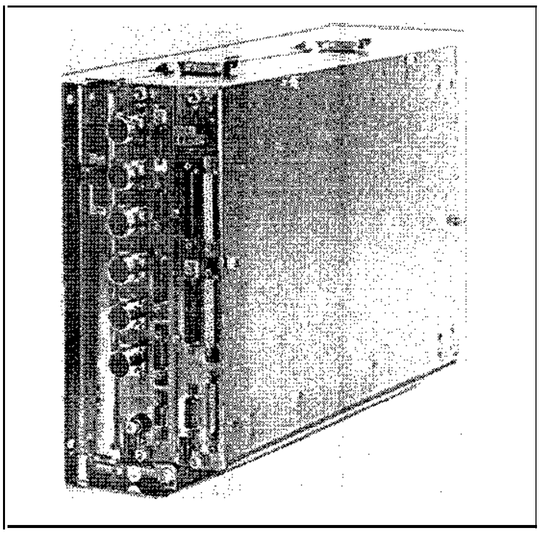
CRC = Cyclic Redundancy Check

If the error message "CHECK SUM ERROR YX" comes up repeatedly, send the **complete LOGIC UNIT** to HEIDENHAIN for repair. Please **indicate the check sum error.**

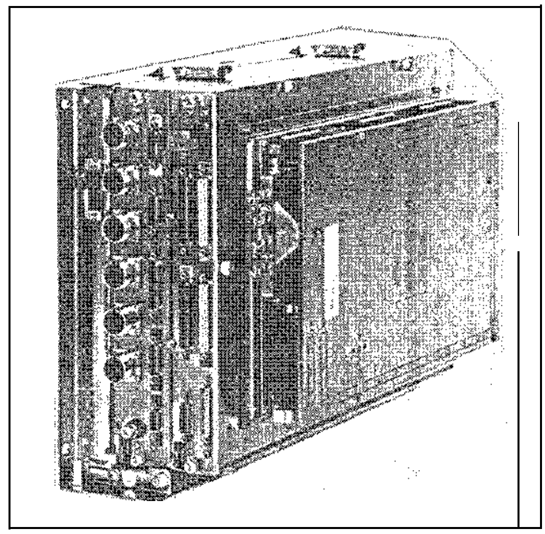
4. Logic Unit LE 407 / 415

4.1 Designation of the Logic Unit LE 407

Logic Unit LE 407 **without**
PLC I/O board (PL 400)

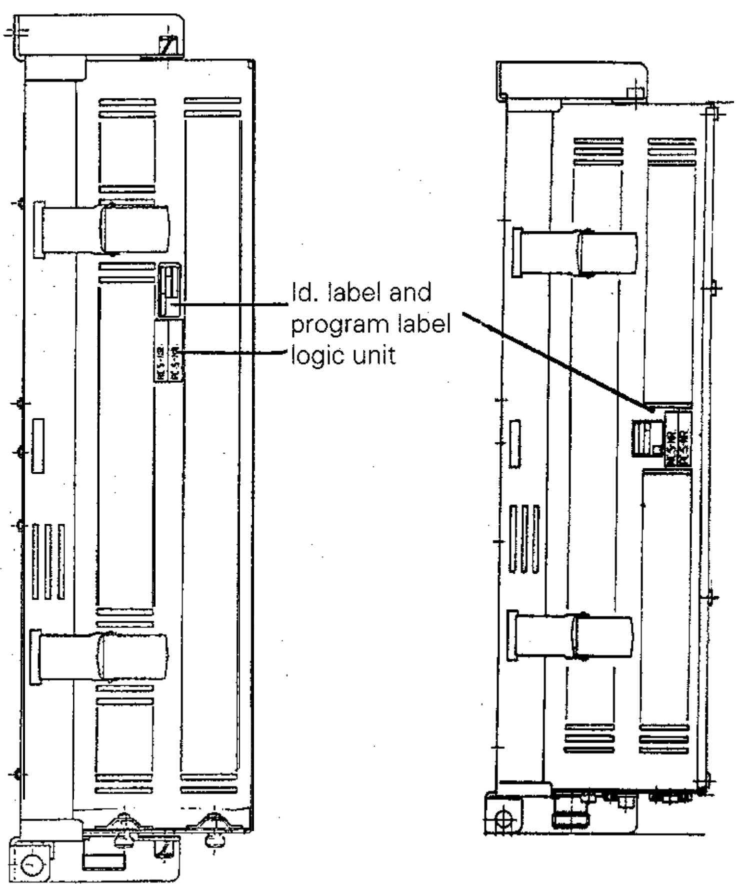


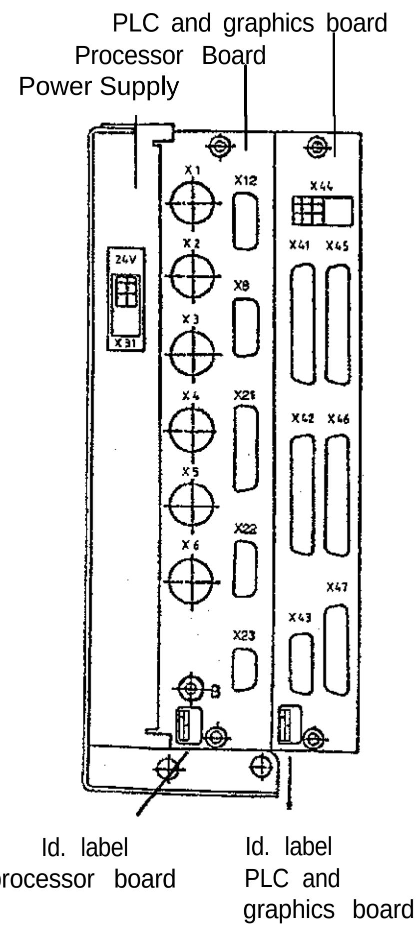
Option:
PLC I/O board (PL 400)



Old housing:

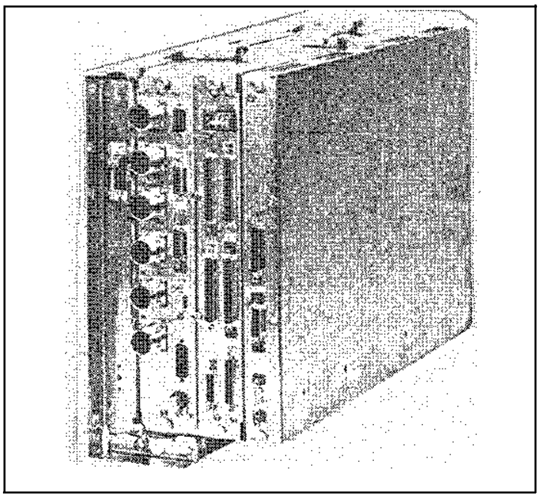
New housing:



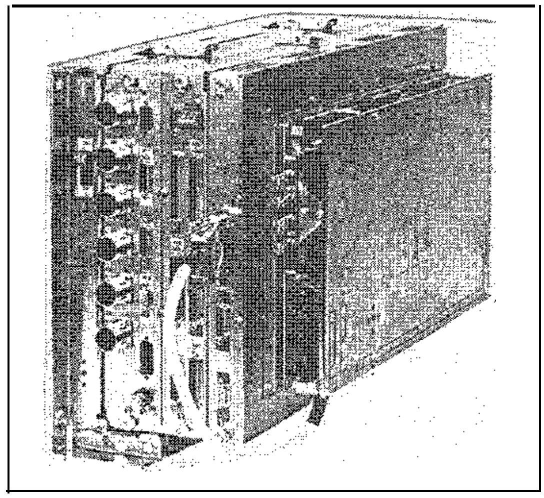


4.2. Designation of the Logic Unit LE 415

Logic Unit LE 415 **without**
PLC I/O board (PL 400)

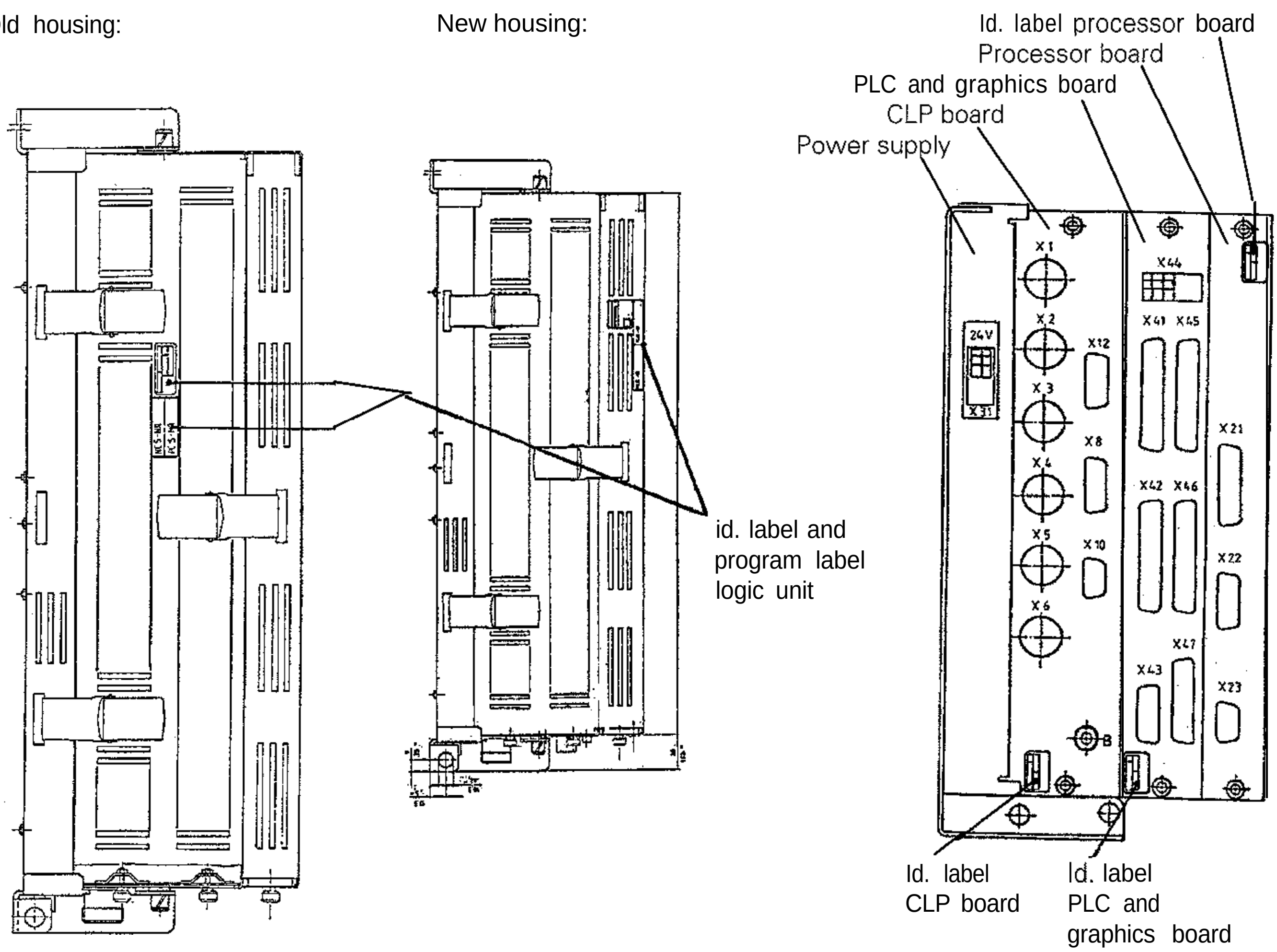


Option:
PLC I/O board (PL 400)



Old housing:

New housing:



4.3 Hardware Components of the Logic Unit

The logic unit consists of the following components:

- Power supply
- Processor board
- PLC board
- PLC I/O board PL 400 (optional)
- PLC analog board PA 110 (optional)

Following the components used in the different logic units are listed:

4.3.1 Components Overview TNC 407 / 415

Board Overview

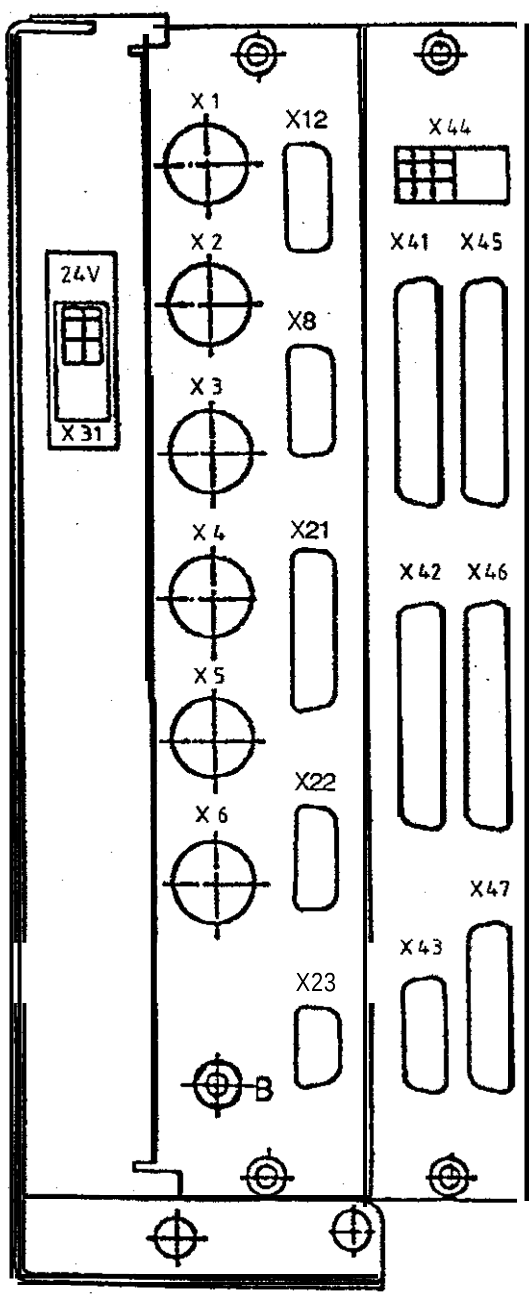
	LE 415/E 264 429 ..	LE 415/E 258 993 ..	LE 415/E 251 481	LE 407 A 264 430	LE 407 A 261 092	LE 407 A 255 444	LE 407 A 256 113
Processor Boards							
253 251 ..	X	X	X				
255 924 ..							X
256 235 ..						X	
261 073 ..					X		
265 219				X			
PLC Graphics Boards							
253 373			x				X
265 218	x	x		X	X	X	
CLP Boards							
253 248 ..		X	X				
265 218 ..	X						
Power Supply Boards							
236 484 08			X				X
236 484 09	X	X		X	X	X	
236 484 10	X	X	X	X	X	X	X
PL 400 (optional)							
252 **855**	X	X	X	X	X	X	X
PA 110 (optional)							
262 **651**	X	X	X				

5. Connector Designation and Pin Layout

5.1 Connectors on the Logic Units

5.1 .1 Connector Designation LE 407

Power Supply | Processor Board | PLC and Graphics Board



Processor Board
X1 = encoder 1 [~]
x2 = encoder 2 [~]
x3 = encoder 3 [~]
x4 = encoder 4 [~]
x5 = encoder 5 [⊓⊔]
X6 = encoder 6 [⊓⊔]
X8 = nominal value output 1, 2. 3. 4, 5. S
x12 = touch probe system
x21 = data interface RS 232C
x22 = data interface RS 422
X23 = serial handwheel interface

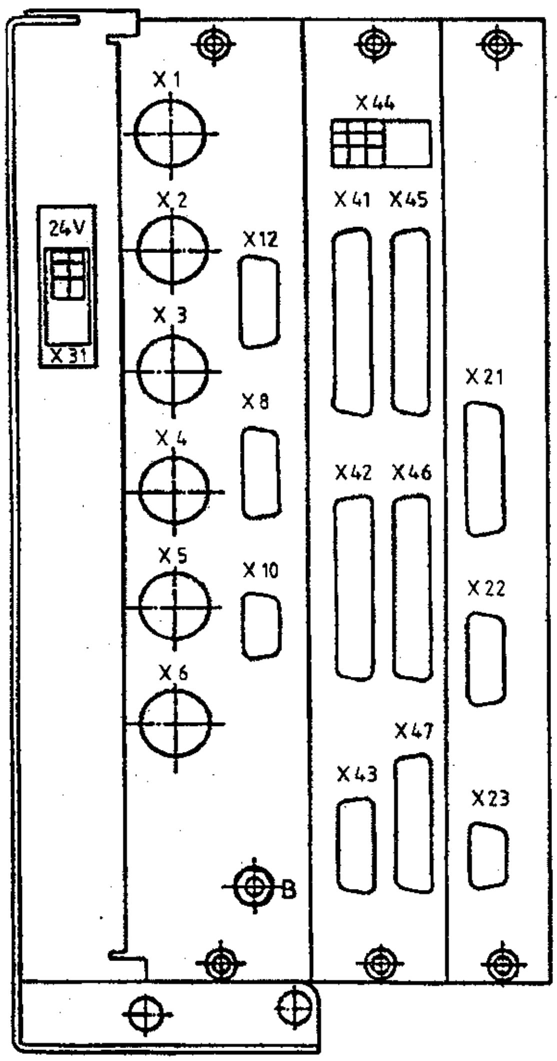
B = signal ground

PLC **and Graphics Board**
x41 = PLC output
X42 = PLC input
X43 = visual display unit (BC 110)
X44 = 24V supply for PLC
X45 = TNC operating panel (TE)
X46 = machine operating panel
X47 = PLC I/O board (PL) or
PLC analog board (PA)

Power **Supply**
X31 = 24V supply for **LE**

5.1.2 Connector Designation LE 415

Power Supply | CLP Board | Processor Board | PLC and Graphics Board



CLP Board
X1 = encoder 1 [~]
X2 = encoder 2 [~]
X3 = encoder 3 [~]
X4 = encoder 4 [~]
X5 = encoder 5 [⎍]
X6 = encoder 6 [⎍]
X8 = nominal value output 1, 2, 3, 4, 5. S
X10 = ref. pulse inhibit
X12 = touch probe system

B = signal ground

PLC and Graphics Board
X41 = PLC output
X42 = PLC input
X43 = visual display unit (BC 110)
X44 = 24V supply for PLC
X45 = TNC operating panel (TE)
X46 = machine operating panel
X47 = PLC I/O board (PL) or
PLC analog board (PA)

Processor Board
X21 = data interface RS 232C
X22 = data interface RS 422
X23 = serial handwheel interface

Power Supply
X31 = 24V supply for LE

5.1.3 Pin Layout: POWER SUPPLY TNC 407/415

X31 Power Supply
terminal block

Assignment	Pin No.
+ 24 V	1
0 V	2

5.1.4. Pin Layout: PROCESSOR BOARD TNC 407

X1, X2, X3, X4 Encoder Inputs 1, 2, 3, 4
Sinusoidal input
Flange socket with female insert (9-pin)

Signal Designation	Pin No.
0° +	1
0° -	2
90° +	5
90° -	6
RP+	7
RP -	8
+ 5V (U_P)	3
0V (U_N)	4
internal shield	9
external shield = housing	housing

X8 Nominal Value Outputs 1, 2, 3, 4, 5, S

Flange socket with female insert (15-pin)

Signal Designation	Pin No.
analog output 1	1
analog output 2	3
analog output 3	5
analog output 4	7
analog output 5	4
analog output S-axis	8
0V analog output 1	9
0V analog output 2	11
0V analog output 3	13
0V analog output 4	14
0V analog output 5	6
0V analog output S-axis	15
external shield = housing	housing
do not assign	2, 10, 12

X5, X6 Encoder Inputs 5, 6
Square-wave input
Flange socket with female insert (12-pin)

Signal Designation	Pin No.
Ua1	5
-Ua1	6
Ua2	8
-Ua2	1
Ua0	3
-Ua0	4
UaS	does not exist
-UaS	7
+ 5V (sensor line) *	2
+ 5V (U_P)	12
0V (sensor line) *	11
0V (U_N)	10
shield = housing	9 (via spring)

X12 Touch Probe System

Flange socket with female insert (7-pin)

Signal Designation	Pin No.
internal shield	1
ready for operation	3
start	4
+ 15V	5
+ 5V (U_P)	6
-battery warning	7
0V (U_N)	8
trigger signal	9
- trigger signal	10
do not assign	2
do not assign	11 to 15

* The sensor line is connected to the corresponding supply lines in the unit.

X21 Data Interface RS 232C

Flange socket with female insert (25-pin)

Signal Designation	Pin No.
shield	1
-RxD	2
-TxD	3
CTS	4
RTS	5
DTR	6
GND	7
DSR	20
external shield	housing
do not assign	8 to 19 21 to 25

X22 Data Interface RS 422

Flange socket with female insert (15-pin)

Signal Designation	Pin No.
shield	1
RxD	2
CTS	3
TxD	4
RTS	5
DSR	6
DTR	7
GND	8
-RxD	9
-CTS	10
-TxD	11
-RTS	12
-DSR	13
-DTR	14
do not assign	15

X23 Serial Handwheel Interface

Flange socket with female insert (9-pin, D-Sub)

Pin No.	Assignment HR 130/330	Assignment HR 332
1, 3, 5	n.c.	n.c.
4	+ 12V	+ 12V
2	0 V	0 V
6	DTR	DTR
9	n.c.	n.c.
8	RXD	RXD
7	do not assign	TXD
housing	external shield = housing	external shield = housing

5.1.5. Pin Layout: CLP BOARD TNC 415

XI, X2, X3, X4, X5 Encoder Inputs 1 to 5
see section 5.1.4 XI, X2, X3, X4

X6 **Encoder Input 6**
see section 5.1.4 X5, X6

X8 **Nominal Value Output 1, 2, 3, 4. 5. S**
see section 5.1.4 X8

XI2 **Touch Probe System**
see section 5.1.4 X12

X10 Ref. Pulse Inhibit *
Flange socket with female insert (15-pin)

Signal Designation	Pin 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
ref. pulse inhibit X6	7
0V (PLC)	9
do not assign	8

* no longer required

X21 Data Interface RS 232C
see section 5.1.4 X21

X22 Data Interface RS 422
see section 5.1.4 X22

X23 Handwheel HR 130/330
see section 5.1.4 X23

5.1.7 Pin Layout: PLC GRAPHICS BOARD TNC 407/415

X41 PLC Output
Flange socket with female insert (37-pin)

Pin No.	Assignment
1	00
2	01
3	02
4	03
5	04
6	05
7	06
8	07
9	08
10	09
11	010
12	011
13	012
14	013
15	014
16	015
17	016
18	017
19	018
20	019
21	020
22	021
23	022
24	023
25	024 4)
26	025 4)
27	026 4)
28	027 4)
29	028 4)
30	029 4)
31	030 4)
32	do not assign
33	0V (PLC) 1)
34	control ready for operation
35, 36, 37	24V can be switched off via EMERG.STOP (PLC) 2)
housing	external shield

X42 PLC Input
Flange socket with female insert (37-pin)

Pin No.	Assignment
1	I0
2	I1
3	I2
4	I3: acknowledgement for test "Control Ready for Operation"
5	I4
6	I5
7	I6
8	I7
9	I8
10	I9
11	I10
12	I11
13	I12
14	I13
15	I14
16	I15
17	I16
18	I17
19	I18
20	I19
21	I20
22	I21
23	I22
24	I23
25	I24
26	I25
27	I26
28	I27
29	I28
30	I29
31	I30
32	I31
33, 34	do not assign
35, 36, 37	0V (PLC) 2)
housing	external shield

1) Internal test potential for tests
2) External power supply for the outputs that can be switched off. Connect preferably via connector X44, pin 1.
3) External reference potential for the PLC supply. Connect preferably via X44, pin 3.
4) Cannot be switched off via EMERGENCY STOP.

X43 Visual Display Unit (BC 1 10)
Flange socket with female insert (15-pin)

Pin No.	Assignment
1, 8, 11	GND
2 to 6, 12, 13	do not assign
7	R
9	VSYNC
10	HSYNC
14	G
15	B

X 4 4 Power Supply for the PLC
Terminal block

Pin No.	Assignment
1	+ 24V can be switched off via EMERG.STOP
2	+ 24V cannot be switched off via EMERG.STOP
3	0V

X45 TNC Operating Panel (TE)
Flange socket with female insert (37-pin)

Pin No.	Assignment	
1	RL0	key matrix
2	RL1	
3	RL2	
4	RL3	
5	RL4	
6	RL5	
7	RL6	
8	RL7	
9	RL8	
10	RL9	
11	RL10	
12	RL11	
13	RL12	
14	RL13	
15	RL14	
16	RL15	
17	RL16	
18	RL17	
19	RL18	
20	SL0	
21	SL1	
22	SL2	
23	SL3	
24	SL4	
25	SL5	
26	SL6	
27	SL7	
28	RL19	
29	RL20	
30	do not assign	
31	RL21	key matrix
32	RL22	
33	RL23	
34	spindle override	
35	feed override (wiper)	
36	+ 5V override pot	
37	0V override pot	
housing	external shield	

X46 Machine Operating Panel

Flange socket with female insert (37-pin)

Pin No.	Assignment
1	I128
2	I129
3	I130
4	I131
5	I132
6	I133
7	I134
8	I135
9	I136
10	I137
11	I138
12	I139
13	I140
14	1141
15	1142
16	1143
17	1144
18	1145
19	1146
20	1147
21	1148
22	I149
23	I150
24	I151
25	I152
26	O0
27	O1
28	O2
29	O3
30	O4
31	O5
32	O6
33	O7
34	0V (PLC)[1]
35	0V (PLC)[1]
36	+ 24V (PLC)[2]
37	+ 24V (PLC)[2]

1) **PLC reference potential for the outputs 00 to 07**
2) PLC supply voltage routed via fuse for the inputs II 28 to II 52.

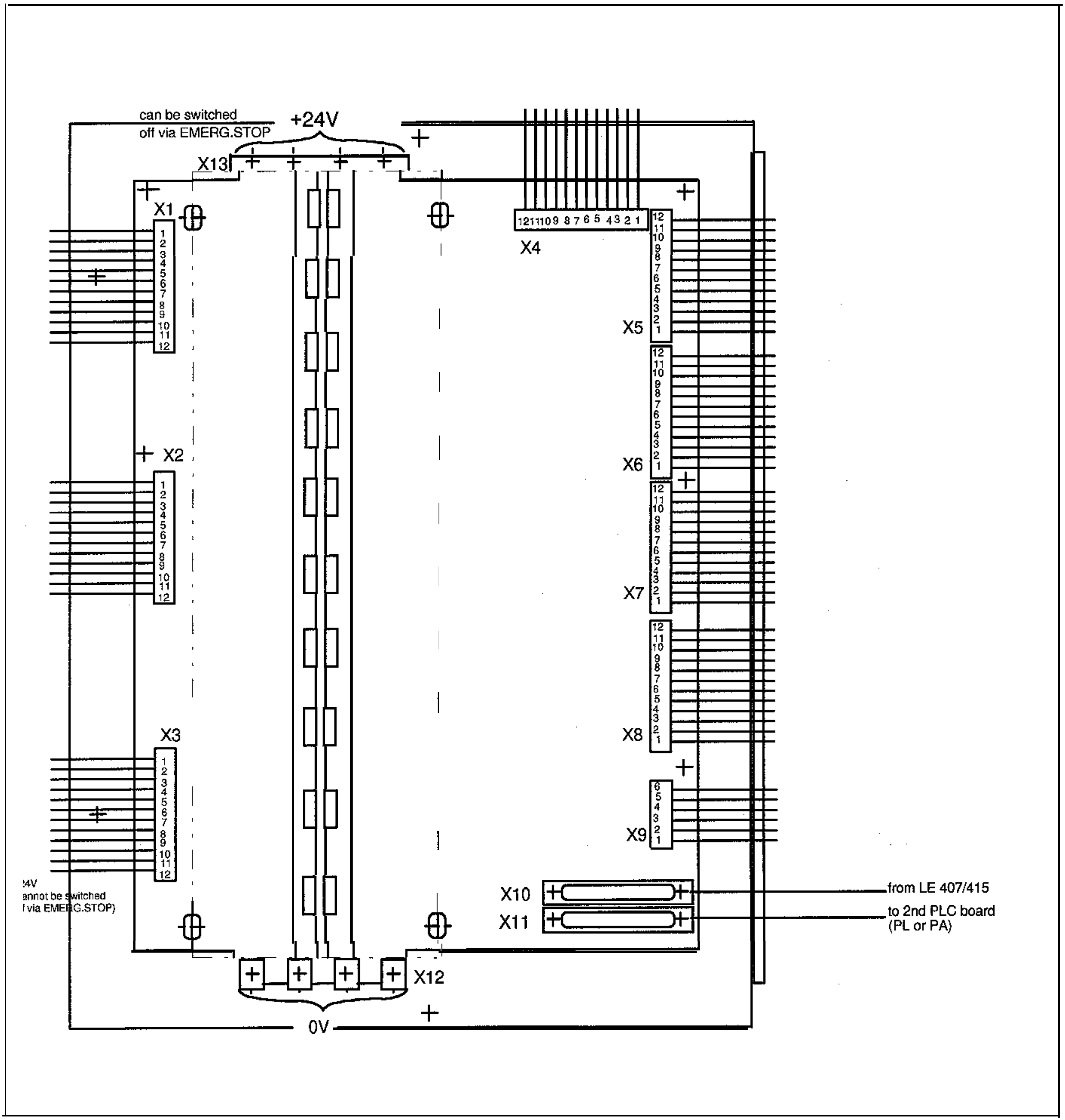
X47 PLC I/O Board (PL)

Flange socket with female insert (25-pin)

Pin No.	Assignment
1, 2, 3	0V
4	serial IN 2
5, 6, 17, 18	do not assign
7	-RESET
8	-WRITE EXTERN
9	WRITE EXTERN
10	-A5
11	-A3
12	-A1
13	shield
14, 15, 16	+ 12V
19	serial IN 1
20	EMERG.STOP
21	-serial out
22	serial out
23	-A4
24	-A2
25	-A0

5.2 Connectors on the PLC Boards

5.2.1 Connector Designation PLC I/O Board PL 400



5.2.2 Pin Layout of the 1st and 2nd PLC I/O Board PL 400

X1

Pin No.	Assignment 1st PL 400	2nd PL 400
1	O32	O64
2	O33	O65
3	O34	O66
4	O35	O67
5	O36	O68
6	O37	O69
7	O38	O70
8	O39	O71
9	O40	O72
10	O41	O73
11	O42	O74
12	do not	assign

X4

Pin No.	Assignment 1st PL 400	2nd PL 400
1	I126	I254
2	I74	I202
3	I73	I201
4	I72	I200
5	I71	I199
6	I70	I198
7	I69	I197
8	I68	I196
9	I67	I195
10	I66	I194
11	I65	I193
12	I64	I192

X2

Pin No.	Assignment 1st PL 400	2nd PL 400
1	O43	O75
2	O44	O76
3	O45	O77
4	O46	O78
5	O47	O79
6	O48	O80
7	O49	O81
8	O50	O82
9	O51	O83
10	O52	O84
11	O53	O85
12	do not	assign

X5

Pin No.	Assignment 1st PL 400	2nd PL 400
1	I86	I214
2	I85	I213
3	I84	I212
4	I83	I211
5	I82	I210
6	I81	I209
7	I80	I208
8	I79	I207
9	I78	I206
10	I77	I205
11	I76	I204
12	I75	I203

x3

Pin No.	Assignment 1st PL 400	2nd PL 400
1	O54	O86
2	O55	O87
3	O56	O88
4	O57	O89
5	O58	O90
6	O59	O91
7	O60	O92
8	O61	O93
9	O62	O94
10	Control Ready for Operation	
11	do not assign	
12	+24V cannot be switched off via EMERG.STOP*	

X6

Pin No.	Assignment 1st PL 400	2nd PL 400
1	I98	I226
2	I97	I225
3	I96	I224
4	I95	I223
5	I94	I222
6	I93	I221
7	I92	I220
8	I91	I219
9	I90	I218
10	I89	I217
11	I88	I216
12	I87	I215

* +24V must always be connected, even the outputs are not used.

X7

Pin No.	Assignment 1st PL 400	2nd PL 400
1	I110	I238
2	I109	I237
3	I108	I236
4	I107	I235
5	I106	I234
6	I105	I233
7	I104	I232
8	I103	I231
9	I102	I230
10	I101	I229
11	I100	I228
12	I99	I227

X10 Connection to LE or to 1st PL

Pin No.	Assignment
1, 2, 3	0V
4	serial IN 2
5, 6, 17, 18	do not assign
7	-RESET
8	-WRITE EXTERN
9	WRITE EXTERN
10	-A5
11	-A3
12	-A1
13	shield
14, 15	+12V
16	Board ID (PK)
19	serial IN 1
20	EMERG.STOP
21	-serial OUT
22	serial OUT
23	-A4
24	-A2
25	-A0

X 8

Pin No.	Assignment 1st PL 400	2nd PL 400
1	I122	I250
2	I121	I249
3	I120	I248
4	I119	I247
5	I118	I246
6	I117	I245
7	I116	I244
8	I115	I243
9	I114	I242
10	I113	I241
11	I112	I240
12	I111	I239

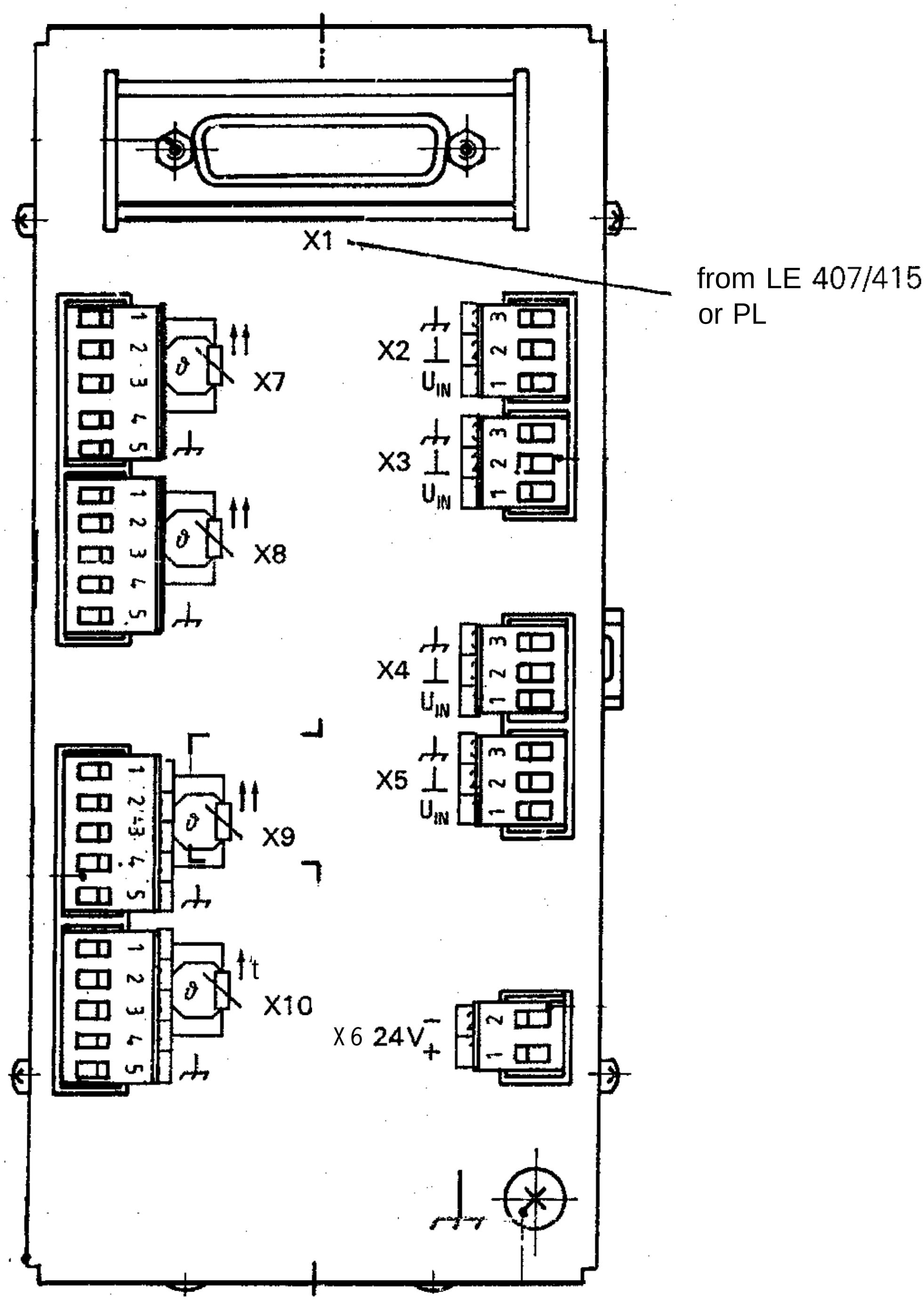
X11 Connection of the 2nd PL

Pin No.	Assignment
1, 2, 3	0V
4, 5, 6	do not assign
14 to 18	do not assign
7	-RESET
8	-WRITE EXTERN
9	WRITE EXTERN
10	-A5
11	-A3
12	-AI
13	shield
19	serial IN 2
20	EMERG.STOP
21	-serial OUT
22	serial OUT
23	-A4
24	-A2
25	-A0

X9

Pin No.	Assignment 1st PL 400	2nd PL 400
1	do not assign	
2	do not assign	
3	do not assign	
4	I125	I253
5	I124	I252
6	I123	I251

5.2.3 Connector Designation : PLC Analog Board PA 110



5.2.4 Pin Layout: PLC Analog Board PA 110

X1 Connection to LE or PL

Pin No.	Assignment
1, 2, 3	ov
4	serial IN 2
5, 6, 17, 18	do not assign
7	-RESET
8	-WRITE EXTERN
9	WRITE EXTERN
10	-A5
11	-A3
12	-A1
	shield
14.15	+ 12V
16	board identification
19	serial IN 1
20	EMERG.STOP
21	-serial OUT
22	serial OUT
23	-A4
24	-A2
25	-A0

X2, X3, X4, X5 Analog Inputs ± 10V

Pin No.	Assignment
1	power input (± 10V)
3	shield

X6 Power Supply

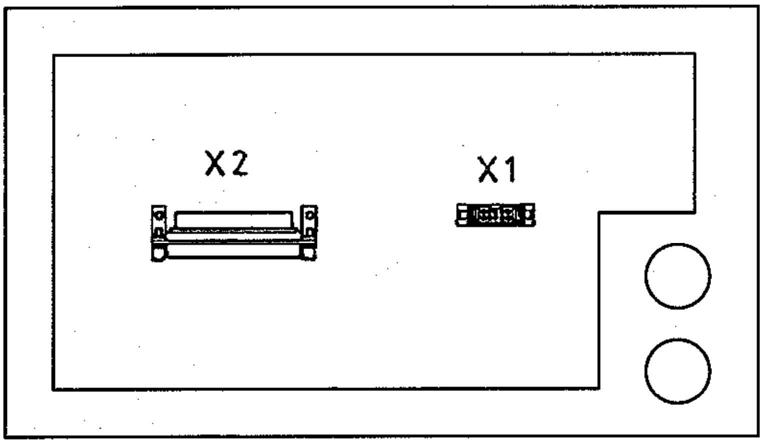
Pin No.	Assignment
1	+ 24V

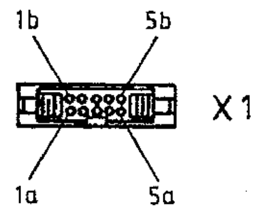
X7, X8, X9, X10 Inputs of the Pt 100 Thermistor

Pin No.	Assignment
1	I+ constant current for Pt 100
2	U+ measuring input
3	U- measuring input
4	I- constant current for Pt 100
5	shield

5.3 Connectors on the Keyboard Units

5.3.1 Connector Designation: TE 400





4820 E KD 6084

5.3.2 Pin Layout: TE 400

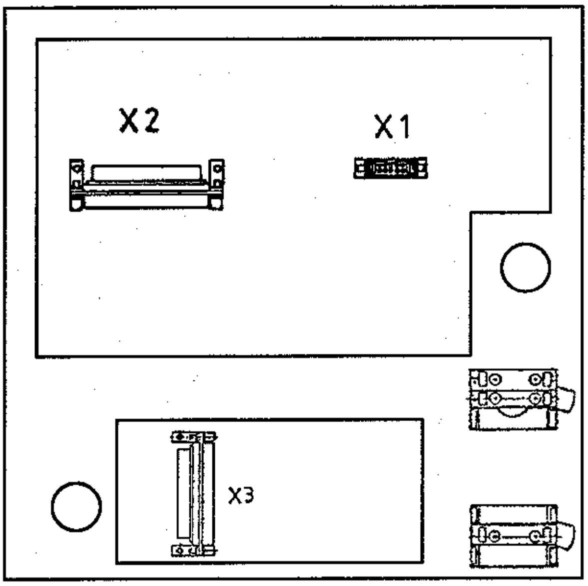
X1 Connection of the Soft Keys of the VDU (BC)
Flange socket with female insert (9-pin)

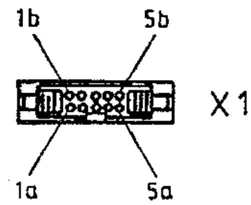
Pin No.	Assignment
1	SL0
2	SL1
3	SL2
4	SL3
5	do not assign
6	RL15
7	RL14
8	RL13
9	RL12

X2 Connection to the Logic Unit (LE)
Flange socket with female insert (37-pin)

Pin No.	Assignment
1	RL0
2	RL1
3	RL2
4	RL3
5	RL4
6	RL5
7	RL6
8	RL7
9	RL8
10	RL9
11	RL10
12	RL11
13	RL12
14	RL13
15	RL14
16	RL15
17	RL16
18	RL17
19	RL18
20	SL0
21	SL1
22	SL2
23	SL3
24	SL4
25	SL5
26	SL6
27	SL7
28	RL19
29	RL20
30	do not assign
31	RL21
32	RL22
33	RL23
34	spindle override (wiper)
35	feed override (wiper)
36	+ 5V
37	0V

5.3.3 Connector Designation: TE 410 (only customized version)





4820 E KD 6084

5.3.4 Pin Layout: TE 410

X1 Connection of the Soft Keys of the VDU (BC)
Flange socket with female insert (9-pin)

Pin No.	Assignment
1	SL0
2	SL1
3	SL2
4	SL3
5	do not assign
6	RL15
7	RL14
8	RL13
9	RL12

X2 Connection to the Logic Unit (LE)
Flange socket with female insert (37-pin)

Pin No.	Assignment
1	RL0
2	RL1
3	RL2
4	RL3
5	RL4
6	RL5
7	RL6
8	RL7
9	RL8
10	RL9
11	RL10
12	RL11
13	RL12
14	RL13
15	RL14
16	RL15
17	RL16
18	RL17
19	RL18
20	SL0
21	SL1
22	SL2
23	SL3
24	SL4
25	SL5
26	SL6
27	SL7
28	RL19
29	RL20
30	do not assign
31	RL21
32	RL22
33	RL23
34	spindle override (wiper)
35	feed override (wiper)
36	+ 5V
37	0V

X3 Connection to the Logic Unit (LE)

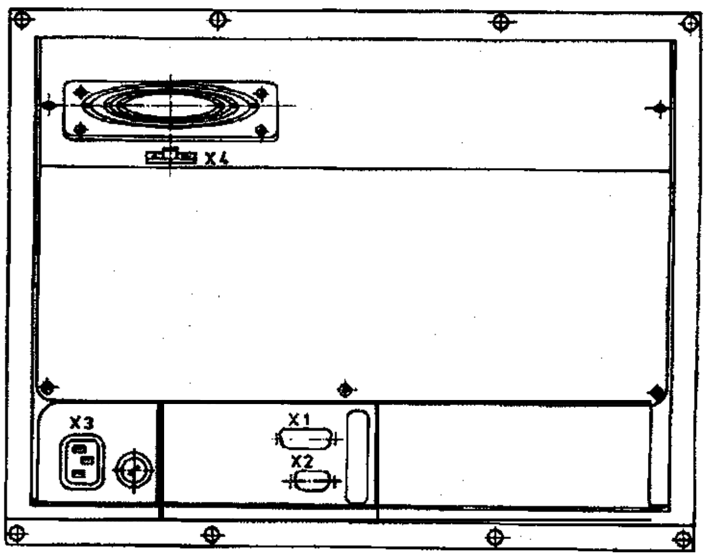
Flange socket with female insert (37-pin)

Pin No.	Assignment
1	I128 key non-functional
2	I129 coolant ON/OFF
3	I130 spindle OFF
4	I131 NC OFF
5	I132 NC ON
6	I133 directional key X- (X+)
7	I134 directional key Y- (Z-)
8	I135 directional key Z- (Y-)
9	I136 directional key Z+ (Y+)
10	I137 directional key Y+ (Z+)
11	I138 directional key X+ (X-)
12	I139 directional key VI+
13	I140 directional key VI-
14	I141 rapid traverse
15	I142 spindle ON
16	do not assign
17	do not assign
18	do not assign
19	I146 directional key V+
20	I147 directional key V-
21	I148 spindle scanning mode
22	do not assign
23	do not assign
24	do not assign
25	do not assign
26	do not assign
27	do not assign
28	do not assign
29	do not assign
30	do not assign
31	do not assign
32	do not assign
33	do not assign
34	do not assign
35	do not assign
36	+ 24V PLC
37	+ 24V PLC

( ) = version 02/04

5.4 Connectors on the Visual Display Units

5.4.1 Connector Designation: BC 110



5.4.2 Pin Layout: BC 110

X1 Connection to the Logic Unit
Flange socket with female insert (15-pin)

Pin No.	Signal
7	R analog
9	V SYNC
10	H SYNC
11	0 V
14	G analog
15	B analog

X3 Line Connection
Euro connector

X2 Connection of the Soft Keys to the Keyboard Unit
Flange socket with female insert (9-pin)

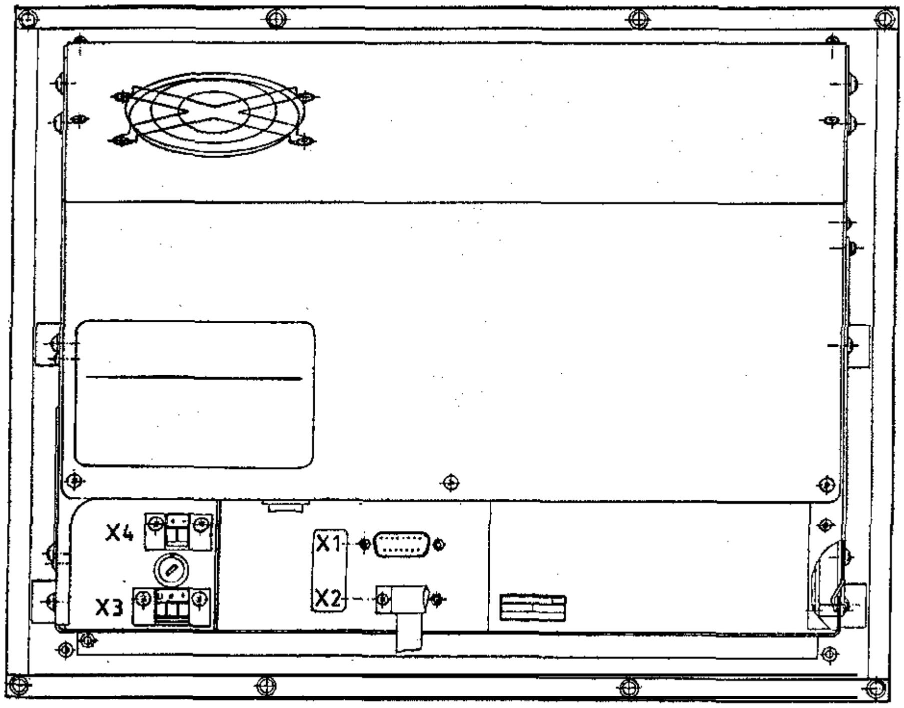
Pin No.	Signal
1	SL0
2	SL1
3	SL2
4	SL3
6	RL15
7	RL14
8	RL13
9	RL12

X4 DC Connection for Ventilator

Terminal block

Pin No.	Signal
1	+ 24v
2	o v

5.4.3 Connector Designation: BC 1 10 B



5.4.4 Pin Layout: BC 1 10 B

X I Connection to the Logic Unit
see section 5.4.2

X2 Connection of the Soft Keys to the Keyboard Unit
see section 5.4.2

X3 Line Connection
Terminal block (3-pin)
Assignment according to label

X4 **Voltage Output for External Units**
Terminal block (Z-pin)

Pin	Signal
+	6 V *
	0 V

* max. load 0.9 A

6. Board Description

LE 407

Processor Board

Interface:
Encoder inputs
3D Touch probe system
Data interface RS 232C
Data interface RS 422
Handwheel HR 130/330

Monitoring:
Encoder inputs
Axis positions
Program memory
Data processing
Emergency-Stop

Storage:
Operating program (NC software)
PLC programs
Machine parameters
Compensation value lists
NC programs (user programs)

LE 415

Processor Board

Interface:
Data interface RS 232C
Data interface RS 422
Handwheel HR 130/330

Monitoring:
Emergency-Stop

Storage:
Operating program (NC software)
PLC programs
Machine parameters
Compensation value tables
NC programs (user programs)

CLP Board

Interface:
Encoder inputs
Ref. pulse inhibit
3D Touch probe system

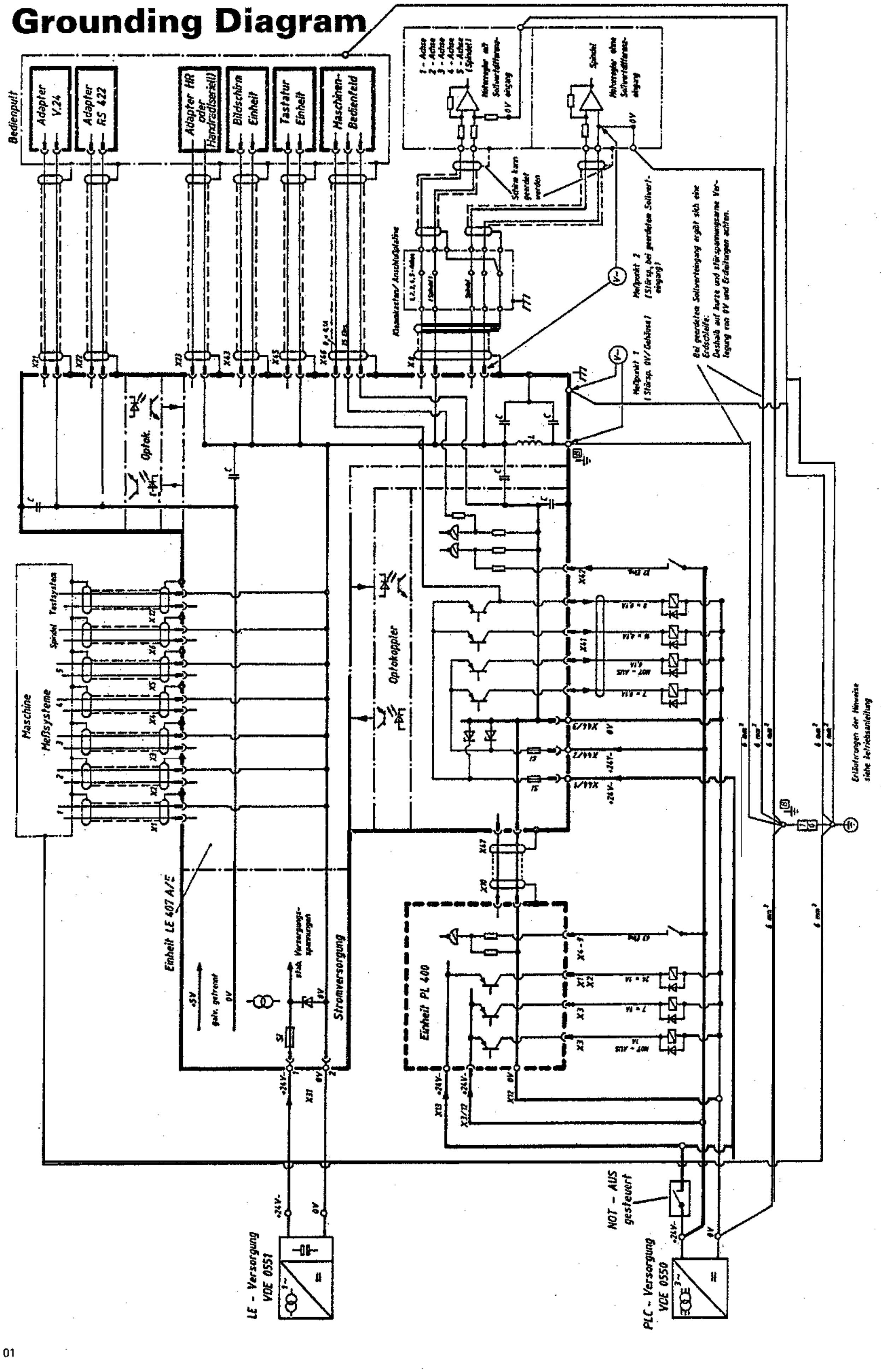
Monitoring:
Encoder inputs
Axis positions
Program memory
Data processing
Emergency-Stop

PLC Graphics Board:

Interface:
57 PLC inputs
31PLC outputs
VDU
Keyboard unit
Machine operating panel
PLC I/O board

Monitoring:
Temperature
Voltages
Buffer battery

7. Grounding Diagram



8. Power Supply

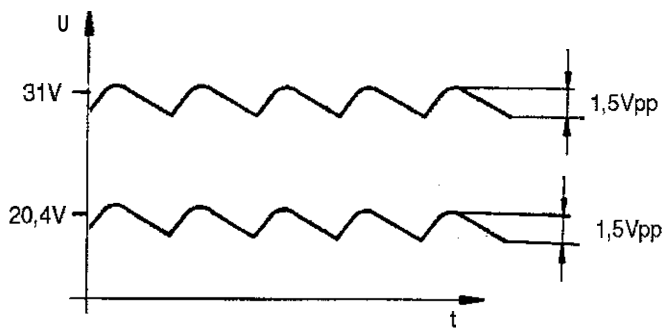
8.1 External Power Supply Requirements

The voltages must correspond to the following definitions:

Unit		Power Supply	Voltage Range DC Average Value	Max. Current Consumption	Power Consumption
LE	NC	24 V (VDE 0551)	**lower** limit 20.4 ⎓	LE 415: 1.5 A LE 407: 1.3 A	approx. 30 W
	PLC			1.8 A if half of the inputs/outputs are active simultaneously	approx. 6 W if approx. 1/3 of the inputs/ outputs are active simultaneously
PL 400		24 V (VDE 0550)	upper limit 31 V ⎓ *	21 A if half of the inputs/outputs are active simultaneously	approx. 25 W if approx. 1/3 of the inputs/ outputs are active simultaneously

* Voltages up to 36V ⎓ permissible with t < 100 ms.

8.1 .1 Power Supply

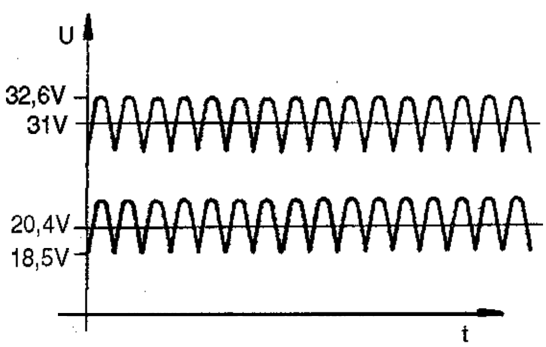


The NC-part of the LE must not be connected to the control voltage of the machine tool. It requires its own external power supply generated separately according to the German Standard VDE 0551:
24 V DC voltage with a permissible AC component (ripple voltage) of 1.5 Vpp (recommended filtering capacitor 10 000 µF / 40 V-).

8.1.2 PLC Power Supply

The PLC-part (PLC inputs and outputs) of the LE and the PL 400 is operated with a control voltage of 24V (of the machine tool), generated according to VDE 0550 (German Standard).

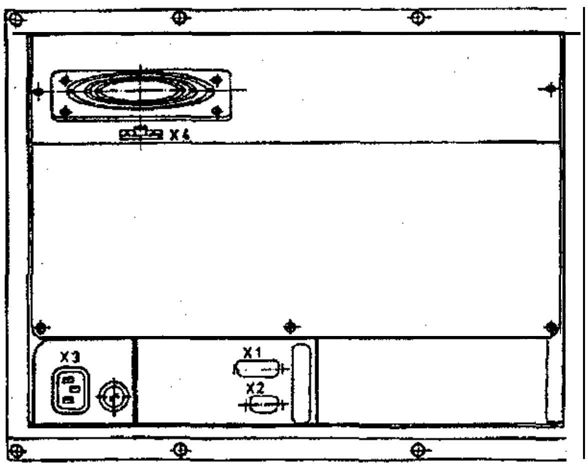
Superimposed AC voltage components arising from a non-controlled three-phase bridge connection with a ripple factor of 5% (see German Standard DIN 40110/10.75, section 1.2) are permissible. Thus, the highest absolute value for the upper voltage limit is 32.6V; the smallest absolute value for the lower voltage limit is 18.5V.



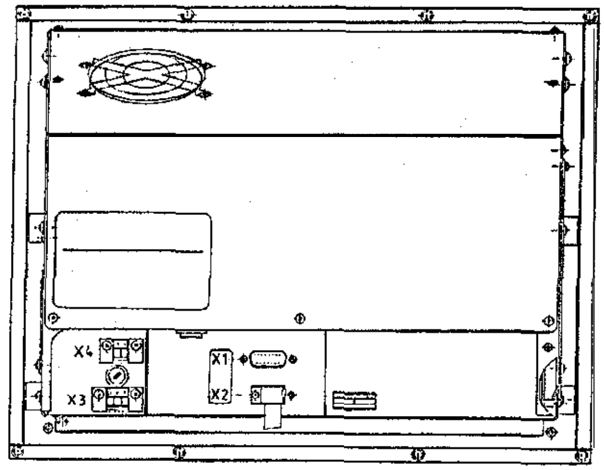
The 0 V line of the PLC power supply must be connected to the central signal ground of the machine tool (ground line 0 ≥ 6 mm²).

8.2 Power Supply of the Visual Display Units

Power Supply BC 110



Power Supply BC 110B



XI: Connection of the logic unit
X2: Connection of the keyboard unit (for soft keys)

X3: line connection

BC 110B		)		
110 V ~	220 V ~		220 V ~	
85 to 132 V ~	170 to 264 V ~	2 V ~	170 to 264 V ~	
T 2.0 A	T 2.0 A		F 3.15 A	
49 to 61 Hz		Hz		
Power consumption	60 W			60 W

X4: Connection of DC voltage
BC 110

Designation	Assignment
1	+ 24 V
2	0 V

X4: Voltage output for external units **
BC 110B

Designation	Assignment
+	6 V *
	0 V

* max. load 0.9 A
** auxiliary voltage for keyboard driver, if long cables are used

8.3 Power Supply of the NC Part

The power supply line for the NC is connected to the terminals of X31.

The different voltages for the LE are transformed from the voltage fed (+24V) in the POWER SUPPLY assembly. (see block diagram, sec. 8.3.1)

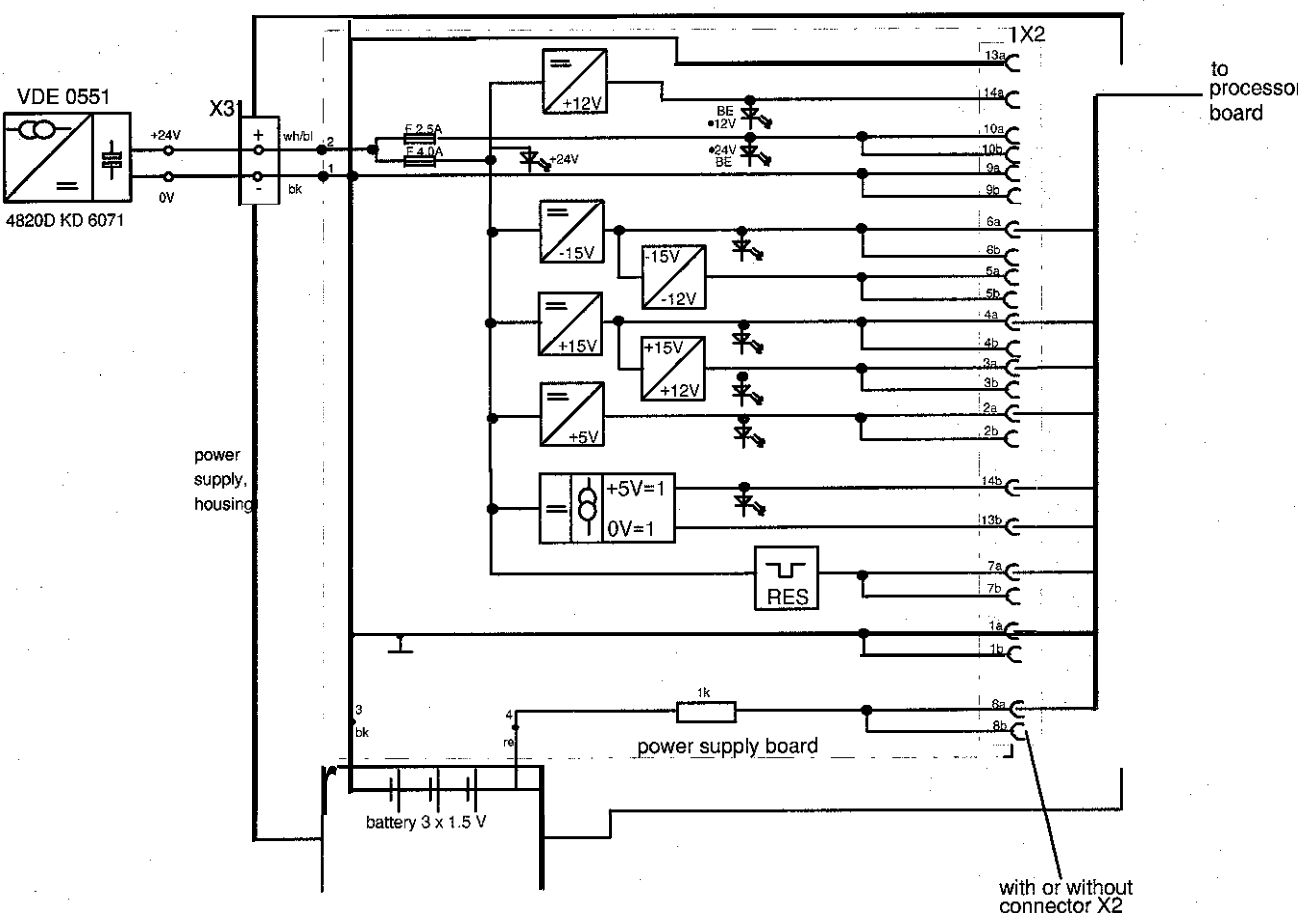
The input and output voltages are displayed by LEDs. The states of the individual voltages are only displayed approximately by the LEDs. The exact values must be measured, and the measured values must correspond to the following table:

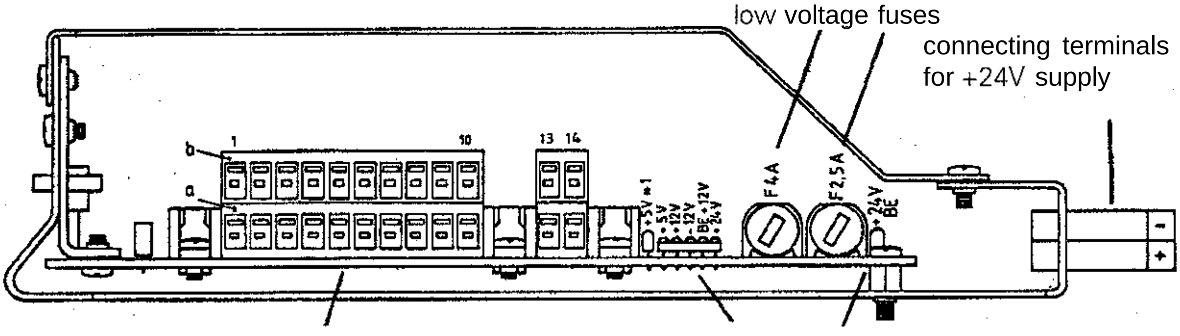
output	U_{NOM} [V]	U_{MIN} [V]	U_{MAX} [V]	I_{NOM} [V]
+ 5 V	+ 5.2	+ 5.18	+ 5.22	2.5
+ 12 V	+ 12	+ 11.4	+ 12.6	0.15
+ 15 V	+ 15	+ 14.4	+ 15.6	0.3
-15 v	-15	14.4	15.6	0.15
U_{BATT}	+ 4.5	+ 3.7		approx. 20 µA
+ 12 V BE [1)]	+ 12.3	+ 12	+ 12.6	1.5
+ 5 V * 1 [2)]	+ 5	+ 4.75	+ 5.25	0.3

1) + 12 V BE is not required for TNC 407/415
2) + 5 V * 1 is a potential-free voltage.

NOTE:
Always switch off the main switch before engaging or disengaging any connectors,
The power supply unit does not function during free run (basic load is required).

8.3.1 NC Power Supply for LE 407/415





With the current version the connector X2 is no longer required.
The strands are directly soldered to the power supply board.

8.4 Checking the Power Supply (Power Supply Unit)

Two low-voltage fuses are located on the power supply assembly. The fuse F 2.5A protects the output voltage of +24V BE [1], and the fuse F 4.0A protects the remaining voltages (see block diagram, section 8.3.1). If an error occurs in the power supply (all voltages are missing), first check the +24V at the supply line and then the low-voltage fuses.

By means of the test load unit, the power supply can be checked fast and easily. For this purpose the connectors to the power supply boards must be disconnected from the power supply and connected to the test load unit.

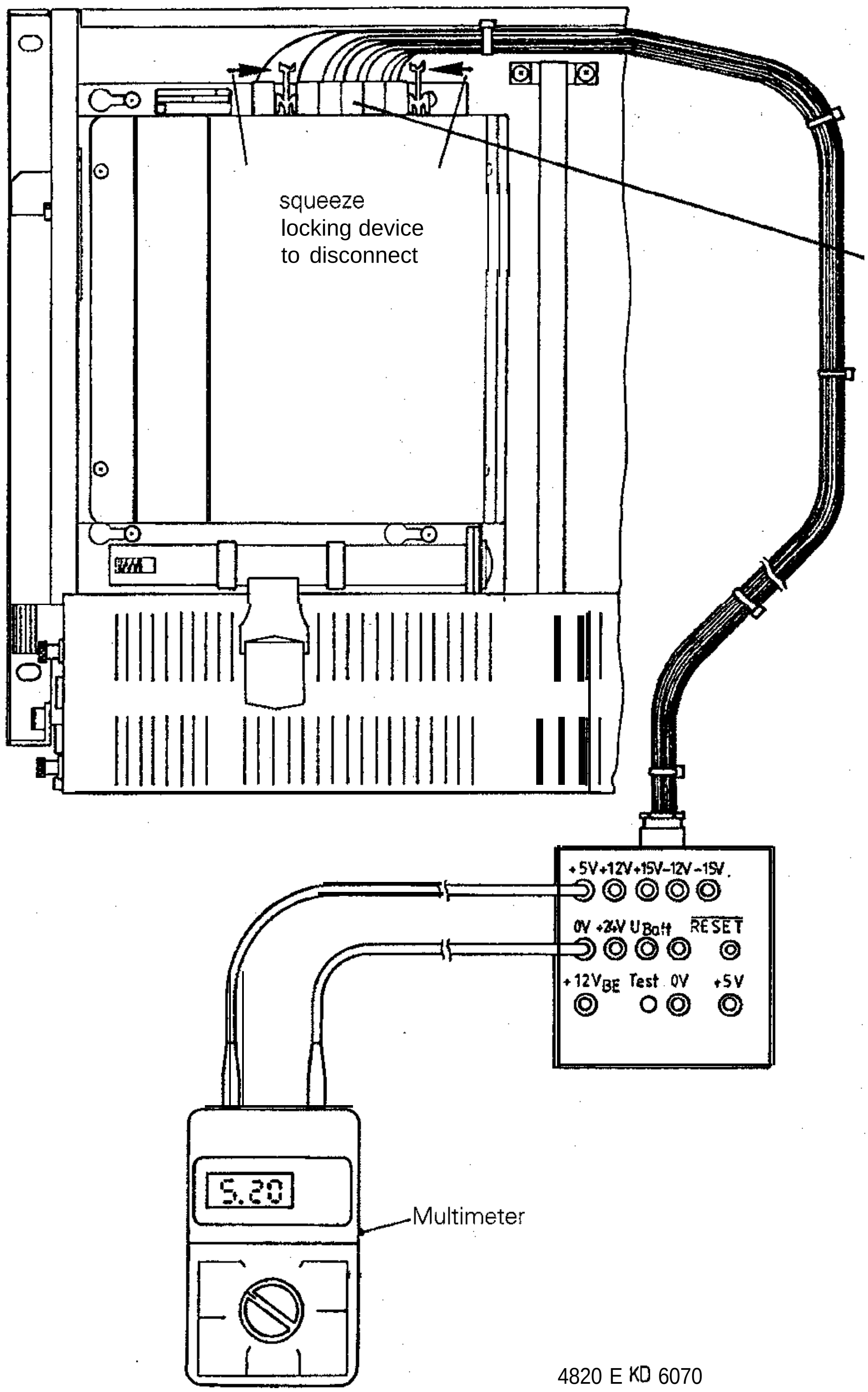
The different values can be measured at the sockets of the test load unit with a multimeter. The values and their tolerances can be seen from the table in section 8.3. If the measured values deviate distinctly from the values in the table, the power supply assembly is defective.

If no test load unit is available, the voltages can be measured at the measuring points on the processor board, the CLP board or the PLC graphics board. (Measuring points: see section 8.5)

1) The voltage of +24V BE is not required for the TNC 407/415, as the VDU has its own power supply,

NOTE:
Always switch off the main switch before engaging or disengaging any connectors
The power supply unit does not function during free-run (basic load is required).

8.4.1 Measurement Setup with the Test Load Unit

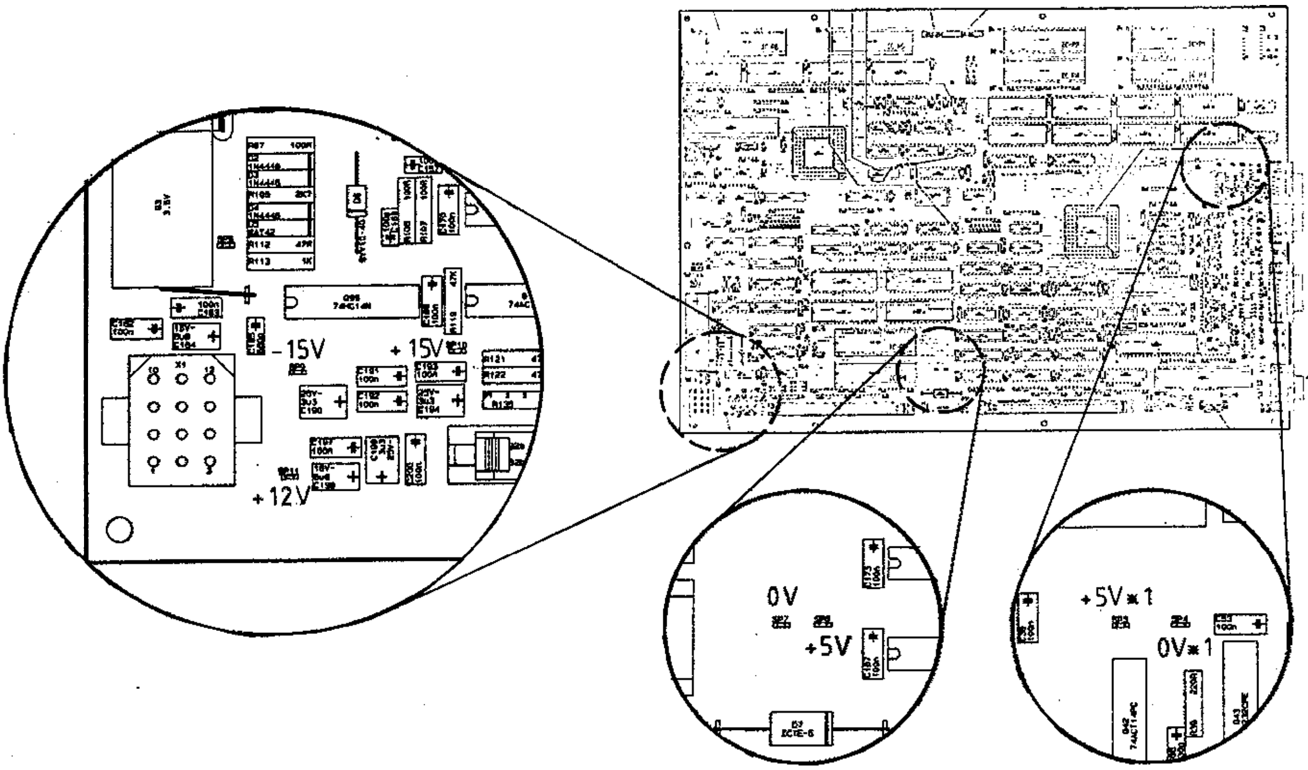


The connector on the power supply board is no longer required; the test load unit is being redesigned.

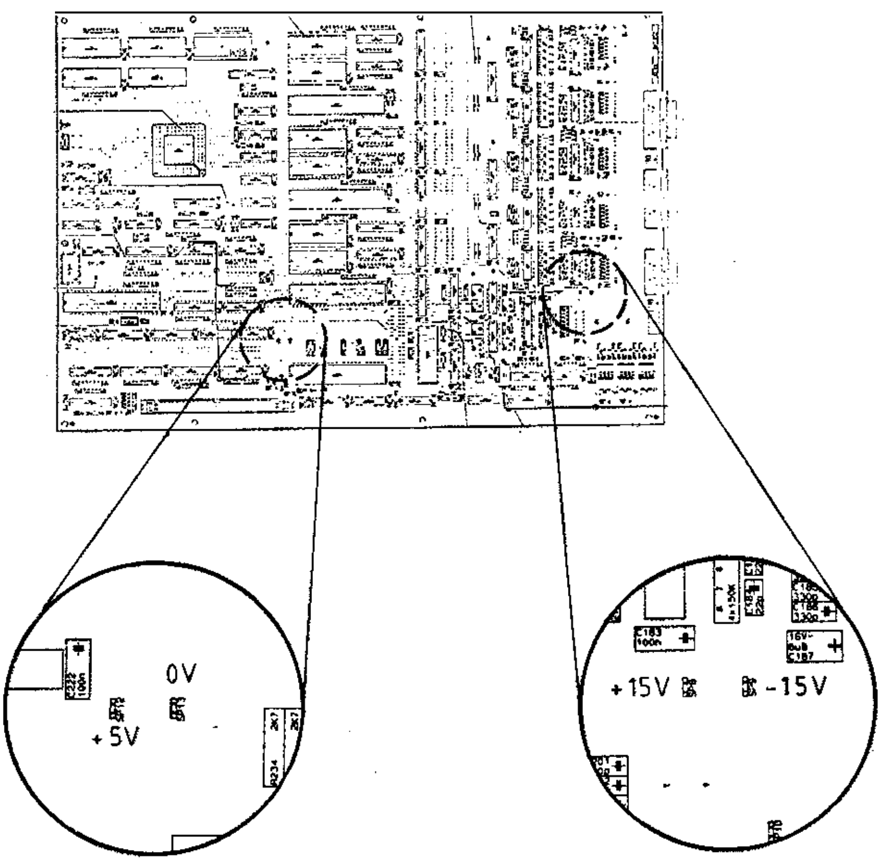
With the current version the connector X2 on the power supply board has been eliminated. The power supply can be tested as described in section 8.4, paragraph 4

8.5 Measuring Points on the Boards

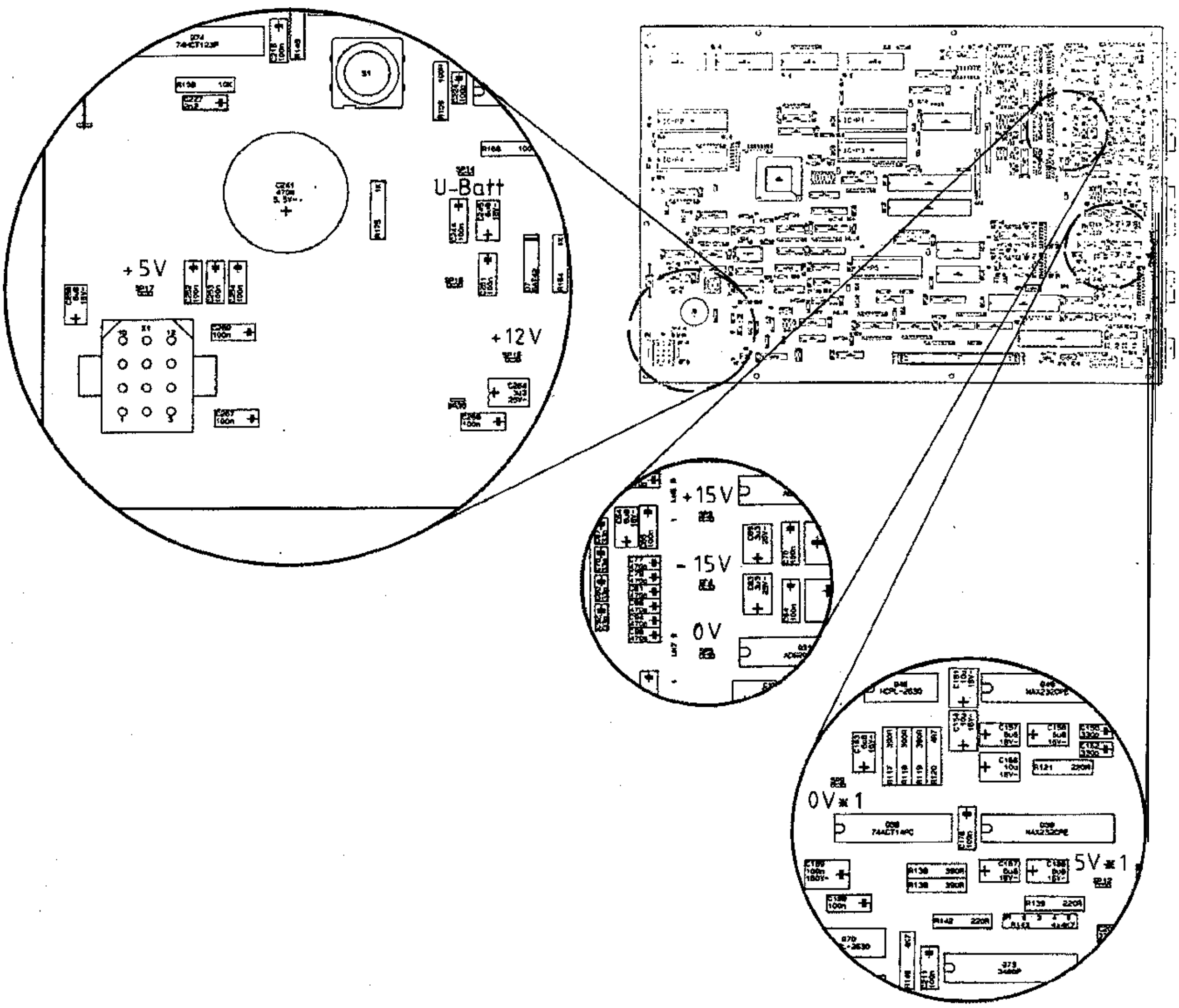
8.5.1 Processor Board TNC 415



8.5.2 CLP Board TNC 415



8.5.3 Processor Board TNC 407



8.6 Power Supply of the PLC-Part

The power supply line for the internal PLC is connected to the terminal block X44 (1= +24V can be switched off, 2 = +24V cannot be switched off, 3 = 0V). The OV line as well as the +24V (can be switched off) line may also be connected via connector X41 or X42 (see PLC Connection Schematic, section 8.6.2).

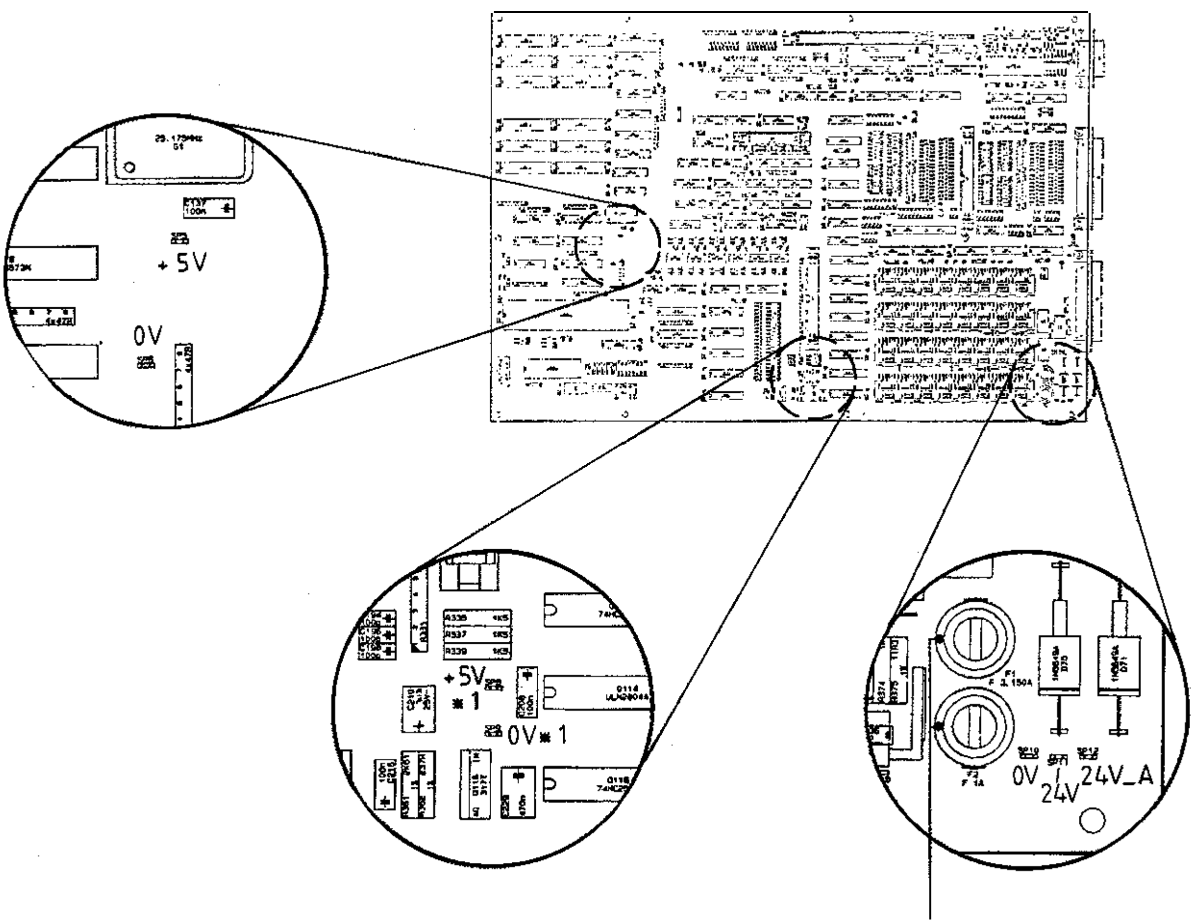
The PLC supply voltages are protected by means of low-voltage fuses on the PLC graphics board

24V can be switched off	low-voltage fuse F2.5 A
24V cannot be switched off	low-voltage fuse F 1 A

The power supply line for the PLC I/O board PL 400 is connected to the terminal blocks XI2 (0V), XI3 (+24V can be switched off) and the terminal strip X3/pin 12 (+24V cannot be switched off). See PLC Connection Schematic, section 8.6.2.

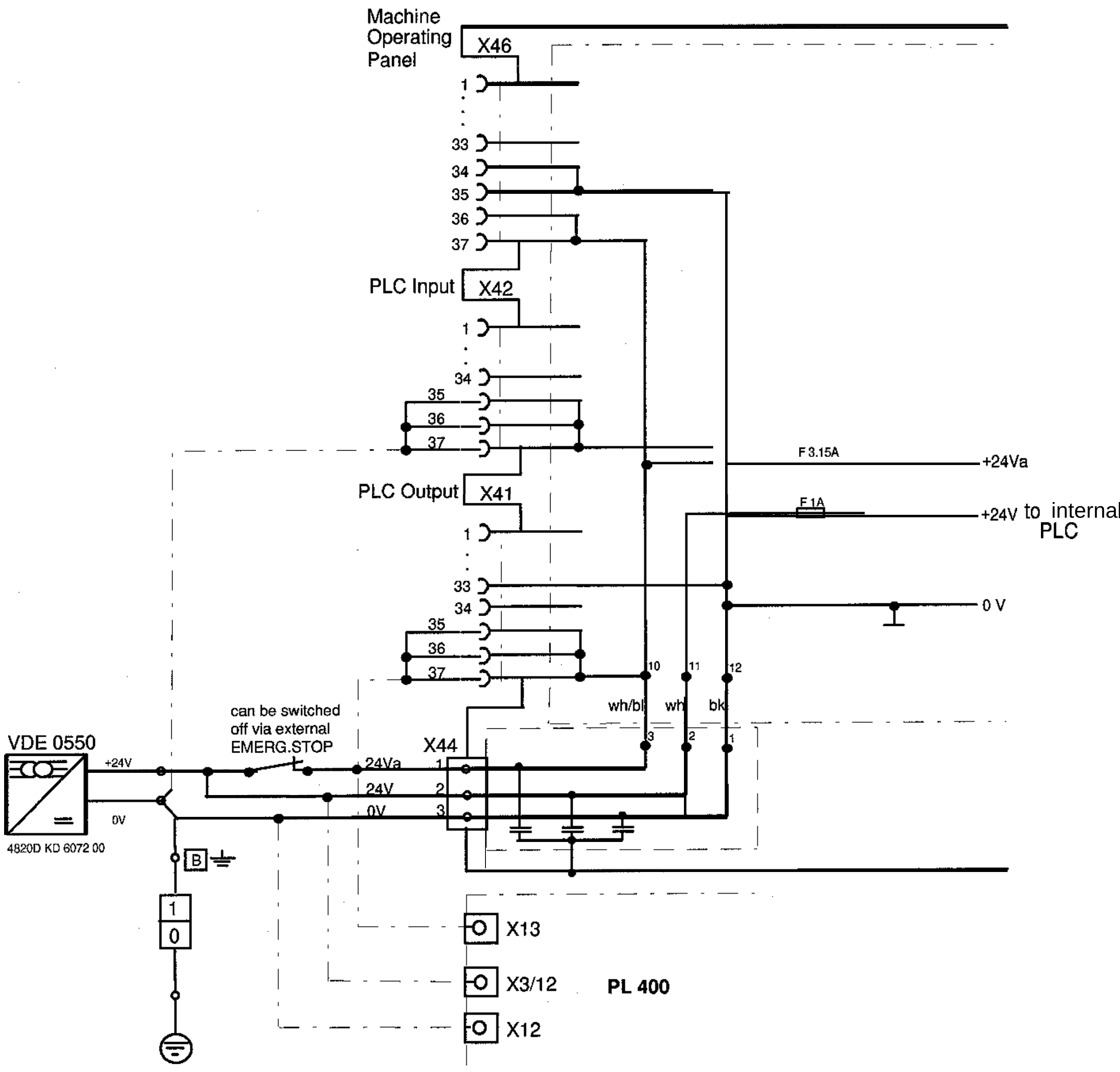
There is no fuse on the PLC I/O board (electronic power limiter)

8.5.1 Measuring Points on the PLC Graphics Board



low-voltage fuses

8.6.2 Connection Schematic of the PLC Power Supply



The PLC outputs 00 to 023 are supplied via X44/pin 1 (24V can be switched off) and can be reset by an external emergency stop.
The PLC outputs 024 to 030 are supplied via X44/pin 2 (24V cannot be switched off) and **cannot** be reset by an external emergency stop.
However, all PLC outputs can be reset by an internal emergency stop (e.g. GROSS POSITIONING ERROR <AXIS> XY).
(The voltage at X44/pin 2 must be connected, as it is used for the internal power supply of the PLC board and the graphics board.)

8.7 Buffer Battery

Exchange Buffer Battery

The buffer battery is the voltage source for the program memory, if the machine tool is switched off.

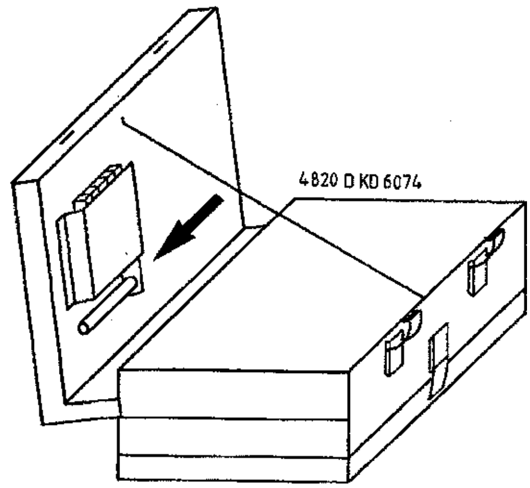
If the error message

EXCHANGE BUFFER BATTERY

appears, the batteries must be exchanged within one week.

The buffer batteries are located behind a screw fitting in the power supply of the LE 407/LE 415.
To exchange, open the LE by undoing both snaps

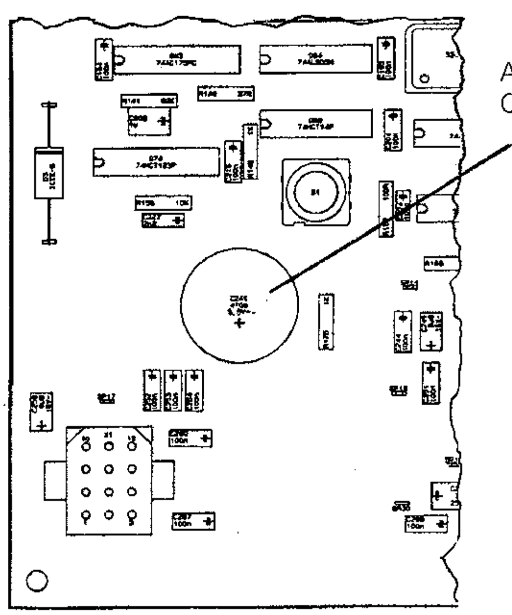
In order to protect the program memory of the TNC 407, a capacitor (located on the processor board) is used in addition to the batteries. Thus, the line voltage may be switched off during battery exchange, Without the batteries the capacitor is capable of maintaining the memory contents for about one day. The TNC contains an additional accumulator so that without the batteries the memory contents remains stored for approx. two weeks.



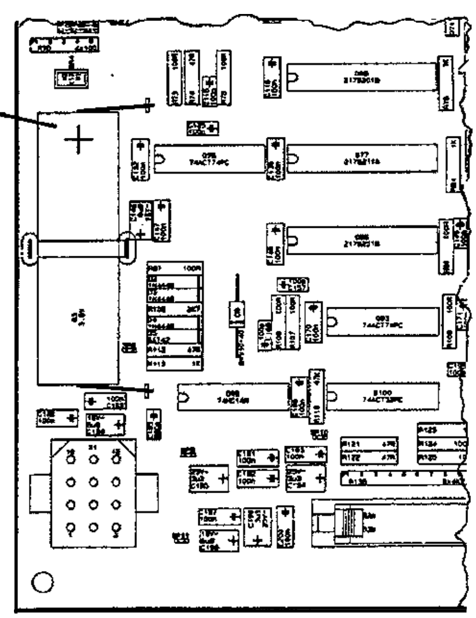
3 AA-size batteries,
leak-proof
IEC designation "LR6"

NOTE:
The capacitor and the accumulator are only being charged when the TNC is switched on (charging time of the accumulator: approx. 24 hi.

Processor Board TNC 407



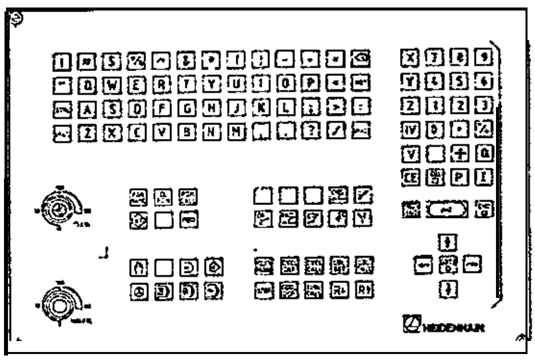
Processor Board TNC 415



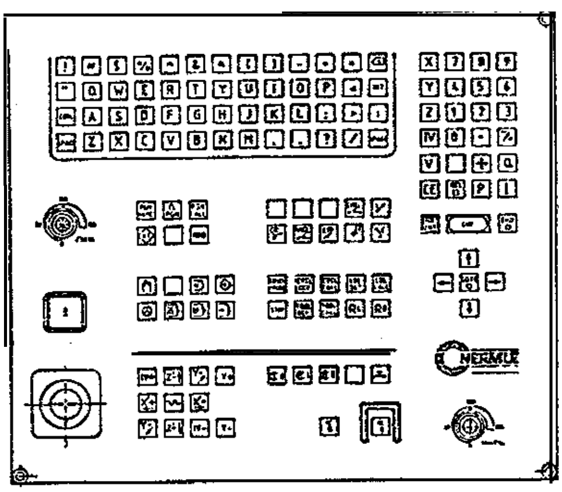
9. Keyboard Unit TE 400/4 10

9.1 Overview

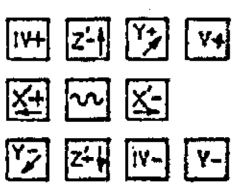
TE 400 — **Id.No. 250 517 01**



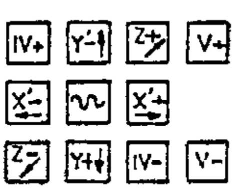
TE 410 (customized) — **Id.No. 258 645 . .**
(.. = version)



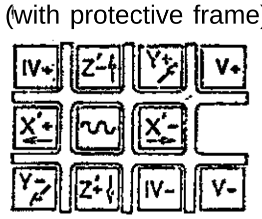
Version 01



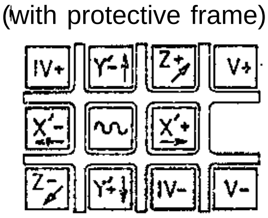
Version 03



Version 03
(with protective frame)



Version 04
(with protective frame)



9.2 Checking the Keyboard Unit

Example:
The key contacts can be measured with an ohmmeter at the flange socket X2 of the keyboard unit
The measuring adaptor can also be used, if available (see section 18.31.

If e.g. [!] is pressed at the TNC operating panel, < 100 mΩ can be measured between pin 17 and pin 20 of the flange socket X2 at the TNC operating panel with the measuring adaptor (connections 17 and 20).

9.2.1 TNC Operating Panel (Key Matrix)

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
!	17	20
#	17	21
$	18	20
%	18	21
^	19	20
&	19	21
*	28	20
(	28	21
)	29	20
−	29	21
+	31	20
=	31	21
⌫	32	20
"	17	22

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
Q	17	23
W	18	22
E	18	23
R	19	22
T	19	23
Y	28	22
U	28	23
I	29	22
O	29	23
P	31	22
<	31	23
RET	32	22
CTRL	17	24
A	17	25

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
S	18	24
D	18	25
F	19	24
G	19	25
H	28	24
J	28	25
K	29	24
L	29	25
;	31	24
>	31	25
:	32	24
SPACE	17	26
Z	17	27
X	18	26

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
C	18	27
V	19	26
B	19	27
N	28	26
M	28	27
,	29	26
.	29	27
?	31	26
/	31	27
SPACE	32	26
PGM NAME	8	24
CL PGM	7	24
PGM CALL	6	24
EXT	5	24
	6	22
MOD	2	27

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
	1	26
	2	20
	3	27
	5	26
	1	27
	2	26
	3	26
	4	26

	9	20
	9	21
	9	22
CHF	9	23
L	8	23
CR	7	23
RND	7	22
CT	8	22
CC	6	23
C	5	23

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
TOUCH PROBE	4	20
CYCL DEF	8	21
CYCL CALL	7	21
LBL SET	6	21
LBL CALL	5	21
STOP	5	22
TOOL DEF	8	20
TOOL CALL	7	20
R L -	6	20
R R +	5	20

X	4	24
7	3	24
8	2	24
9	1	24
Y	4	23
4	3	23
5	2	23
6	1	23

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
Z	4	23
1	3	22
2	2	22
3	1	22
IV	4	21
0	2	21
.	3	21
+/-	1	21

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
V	9	24
	9	25
	3	25
Q	3	20
CE	5	25
DEL	4	25
P	4	27
I	5	27

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
NO ENT	2	25
ENT	1	25
END	1	20

↑	8	25
←	6	25
GOTO	7	25
→	8	26
↓	6	26

Checking the Potentiometers of the TNC Operating Panel

If an ohmmeter is connected to the pins, the following resistances can be measured (use a measuring adaptor, if available):

Potentiometer	Flange Socket X2 of Keyboard Unit PIN	PIN	Measured Value Position 0	Position 150
Feed Override Pot	36	35	9.7 k	4.7 k
	37	35	4.7 k	9.7 k
Spindle Override Pot	36	34	9.7 k	4.7 k
	37	34	4.7 k	9.7 k

If a measuring adaptor is available, connect this adaptor between the logic unit and the keyboard unit.
Now the wiper voltages of the potentiometers can be measured at the above pins (values: approx. 0 to 4.95 V).

9.2.2 Machine Operating Panel

Key of Version 01/03	Key of Version 02/04	Flange Socket X2 of Keyboard Unit PIN	PIN
IV+	IV+	12	36, 37
Z-	Y-	8	36, 37
Y+	Z+	10	36, 37
V+	V+	19	36, 37
X+	X-	11	36, 37
		14	36, 37
X-	X+	6	36, 37
Y-	Z-	7	36, 37
Z+	Y+	9	36, 37
IV-	IV-	13	36, 37
V-	V-	20	36, 37

Key	Flange Socket X2 of Keyboard Unit PIN	PIN
O	3	36, 37
I	15	36, 37
T	21	36, 37
	1	36, 37
	2	36, 37
NC 0	4	36, 37
NC I	5	36, 37

9.2.3 Screen Soft Keys

Key	Flange Socket X1 of Keyboard Unit PIN	PIN
	8	1
	9	1
◁	6	2
SK1	7	2

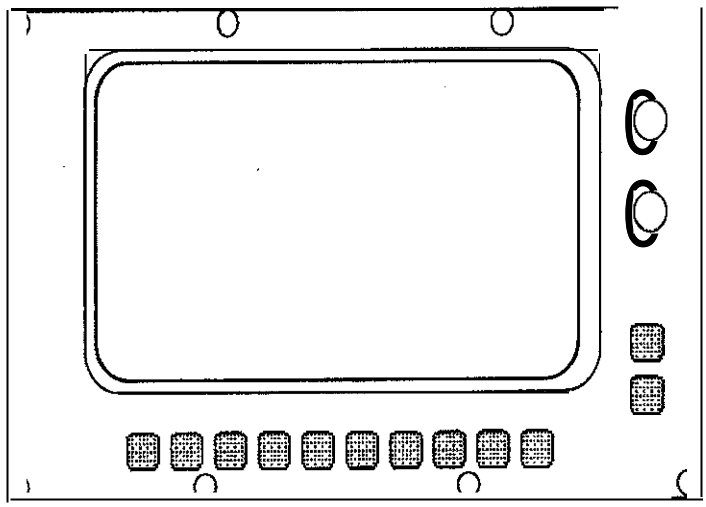
Key	Flange Socket X1 of Keyboard Unit PIN	PIN
SK2	8	2
SK3	9	2
SK4	6	3
SK5	7	3

Key	Flange Socket X1 of Keyboard Unit PIN	PIN
SK6	8	3
SK7	9	3
SK8	6	4
▷	7	4

10. Visual Display Unit BC 110/110B

10.1 Overview

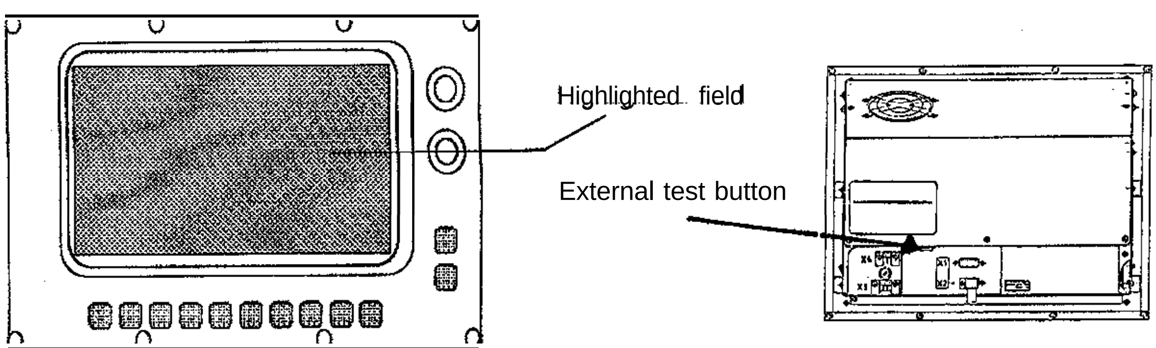
BC 110 Id. No. **254 740** 01 BC 110B Id.No. 260 520 01



10.2. Checking the Visual Display Unit

BC 110 B Id.No. 260 520 01

If the screen remains dark when the machine is switched on, first check the power supply (line voltage) of the VDU. If the voltage supply is functioning properly, a square highlighted field can be generated on the screen of the VDU (which must be switched on) by pressing the external test button on the back side of the unit.



If the VDU generates this highlighted field, the PLC graphics board in the logic unit is probably defective.
If however, the VDU remains dark after the test button was pressed, the VDU is defective and must be exchanged.

BC 1 10 B Id.No. 260 520 01

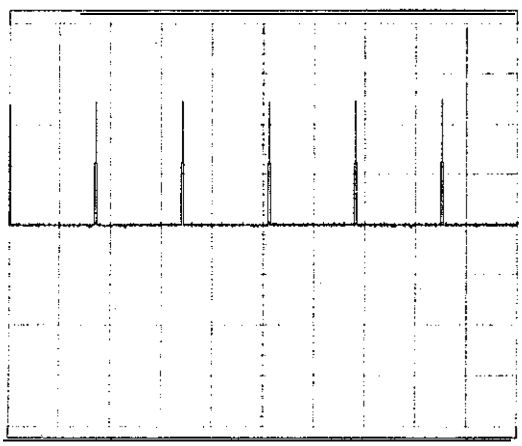
If the screen remains dark when the machine is switched on, first check the power supply (line voltage) of the VDU. The control signals of the VDU can only be checked by means of an oscilloscope.

The following diagrams were drawn while the VDU was connected. The colour signals R-analog, G-analog and B-analog may be shaped differently (depending on machine parameters and the current screen display).
Pin layout see sections 5.1.6 and 5.4.

Diagrams

V-SYNC pin 9

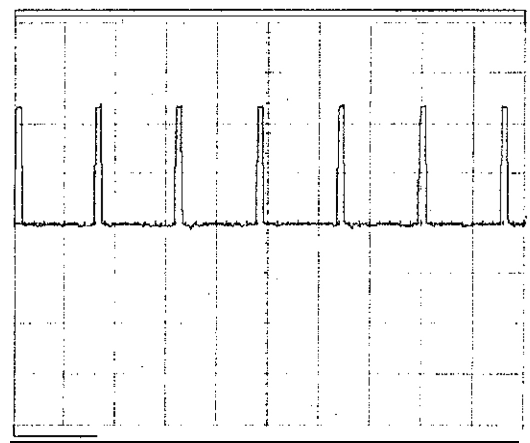
2V/DIV



10 ms/DIV

H-SYNC pin 10

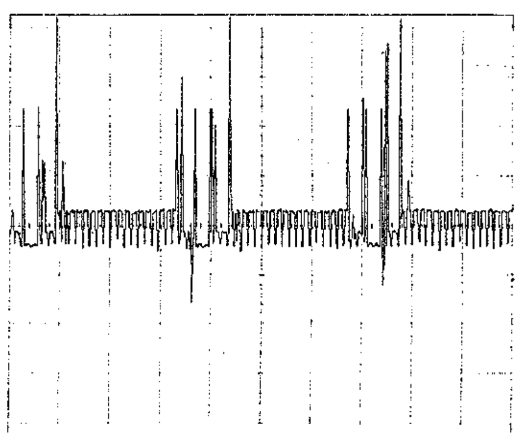
2V/DIV



20 µs/DIV

R-Analog pin 7"

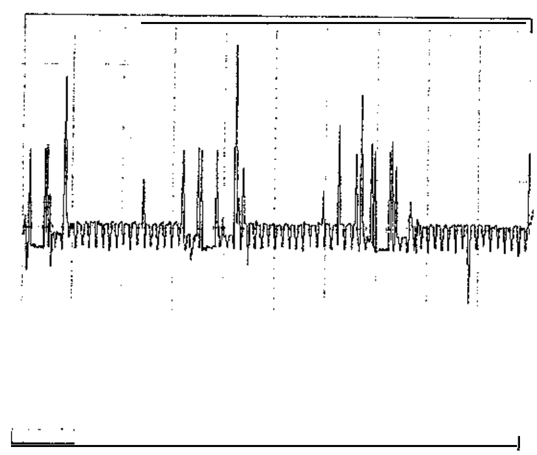
0.2V/DIV



5 ms/DIV

G-Analog pin 14*

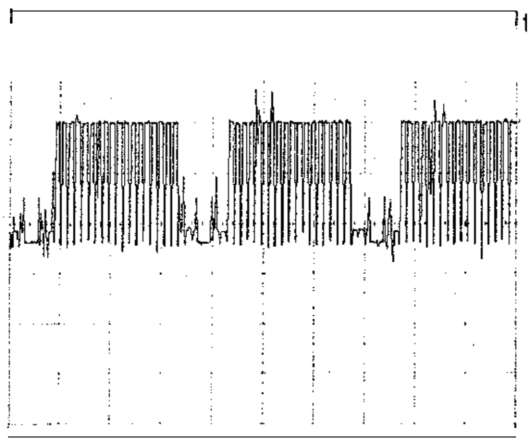
0.2V/DIV



5 ms/DIV

B-Analog pin 15*

0.2V/DIV



5 ms/DIV

* If the colour signals are measured directly at the output of the logic unit, the amplitudes are approx. twice as large.

11. Encoders

11.1 Error Messages

ENCODER <Axis> DEFECTIVE XY

Y = A: Signal amplitude too low
B: Frequency exceeded
C: Wrong reference mark spacing

x = CPU number 1 = Main processor
2 = Geometry processor
3 = CLP processor

11.2 Error Causes

Glass scale contaminated or defective
Scanning head contaminated or defective
Cable damaged
- Encoder input of the logic unit (LE) defective

11.3 Checking the Encoders

In order to determine whether the encoder or the encoder input of the logic unit is defective, the encoders can be switched at the logic unit For this purpose, the corresponding machine parameters must be altered as well.

Function		MP	Input Value
Allocation of the axes	X	110.0	0 = XI
to the encoder inputs	Y	110.1	1 = x2
	Z	110.2	2 = x3
	IV	110.3	3 = x4
	V	110.4	4 = x5
			5 = X6*

* X6 may only be used for a machine tool axis, if no spindle orientation is required.

Proceeding if an error message is displayed

e.g. **ENCODER X DEFECTIVE 3B**

- Switch off main switch.
Switch encoder X-axis with e.g. encoder Y-axis at the logic unit.
Switch on main switch.
If the error message POWER INTERRUPTED is generated, call the machine parameters with the code number 95148 and switch the entry values of the machine parameters 110.0 and 110.1.
Exit the machine parameters and switch on the machine as usual.

If the same error message POWER INTERRUPTED is generated again, the error is located in the encoder or in the extension cable. If the error message now says "Y" instead of "X", the encoder input of the logic unit is defective.

11.3.1 Electrical Check of Encoders

In order go give a precise statement on the electrical function of an encoder, it must be measured with a phase angle measuring unit (PWM), an oscilloscope and an impedance tester. (see operating instructions Encoder Diagnostic Kit)

If no phase angle measuring unit is available, the electrical state of the cable, the lamp and the photocells of an encoder can be checked with an ohmmeter. The following resistances must be measured at the connector of the encoder:

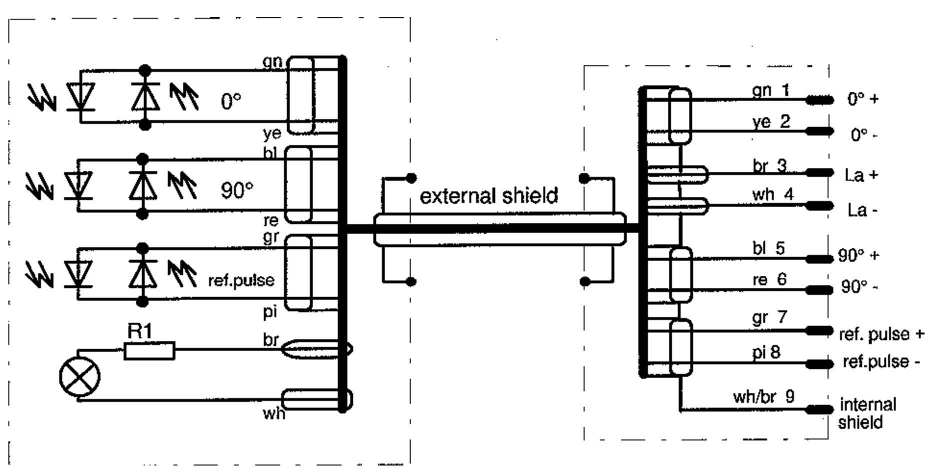
Encoder connector housing against machine housing (external shield)	$R < 1\,\Omega$
Encoder connector housing against pin 9 (internal shield against external shield)	$R = \infty$
- Encoder connector housing against pins 1 to 8 (external shield against signal lines)	$R = \infty$
Pin 9 against pins 1 to 8 (internal shield signal lines)	$R = \infty$

Pin 1 against pin 2	0”		
Pin 2 against pin 1	0”	(switch poles of ohmmeter)	
Pin 5 against pin 6	90”		
- Pin 6 against pin 5	90”	(switch poles of ohmmeter)	The measured values should
Pin 7 against pin 8	ref. pulse *		be approximately equal.
Pin 8 against pin 7	ref. pulse *	(switch poles of ohmmeter)	
- Pin 3 against pin 4 **	(approx. 5 - 30 Ω)		

*If encoders with selectable reference marks are used, different resistance values are measured (or no resistance), depending on the type of activation.

**The encoder check (pin 3 against pin 4) can only be carried out, if the encoder light unit is a lamp. With encoders with an amplifier section, the light unit cannot be checked at all. With encoders with infrared diodes a resistance in the conducting direction can be measured between pin 3 (+) and pin 4 (-).

Basic Circuit Diagram with Sinusoidal Signals

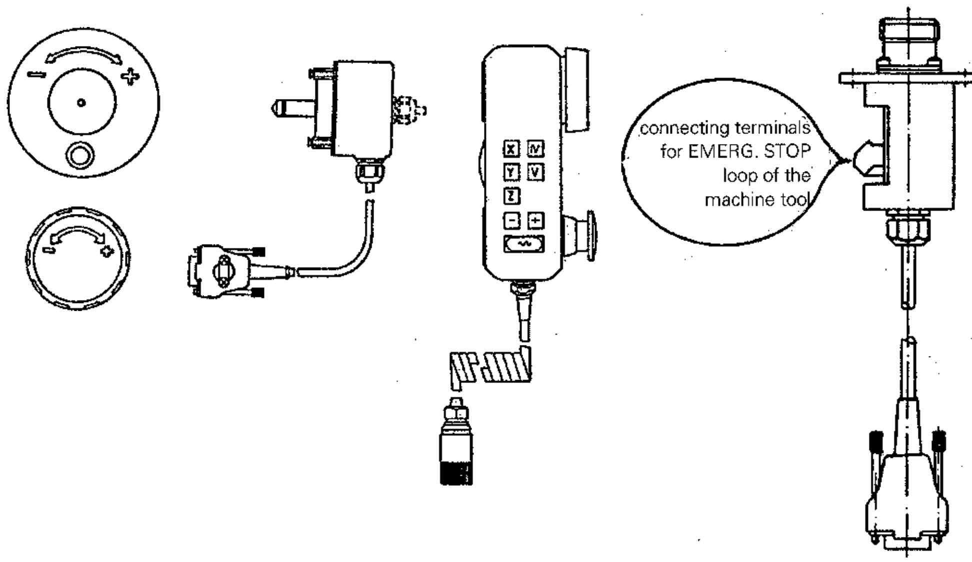


Encoders with square-wave output signals can only be tested with a phase angle measuring unit (PWM)

12. Handwheel HR 130/330

12.1 Overview

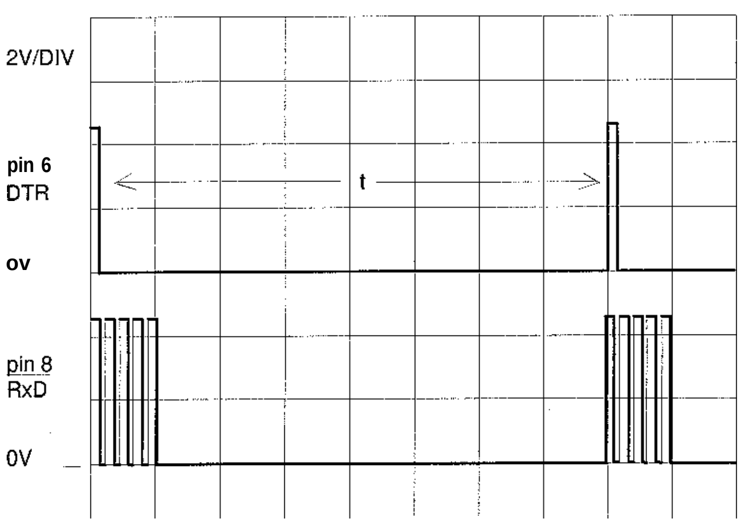
HR 130	Id.No. 254 040 –	HR 330		Cable Adaptor for HR 330
HR 130.001	Id.No. 249 371 –	Id.No. 251 534 –		Id.No. 249 889 –



PIN	Colour	Signal
1	blue	EM.
2	blue	STOP
3	green	-RXD
4	yellow	DTR
5	brown	+12V
6	white	0V

PIN	Colour	Signal
2	white	0V
4	brown	+12V
6	yellow	DTR
8	green	-RXD

12.2 Checking the Handwheel HR 130/330



t = 4 ms **(TNC 415)**
t = 12 ms **(TNC 407)**

The serial handwheels HR 130 and HR 330 can only be tested with an oscilloscope.
The controls signals (X23 /pin 6 = DTR.
pin 8 = RxD) must correspond to the diagram at the left.

The supply voltage for the handwheel is fed via the logic unit (X23 / pin 2 = OV, pin 4 = + 12V).

12.3 Error Messages

HANDWHEEL ?

Data transfer (cable) has been interrupted.

HANDWHEEL DEFECTIVE

The light unit in the electronic handwheel is not emitting enough light, with the result that the signals in the handwheel are too small. An error signal is sent over the serial interface of the handwheel.

HANDWHEEL NOT READY
X

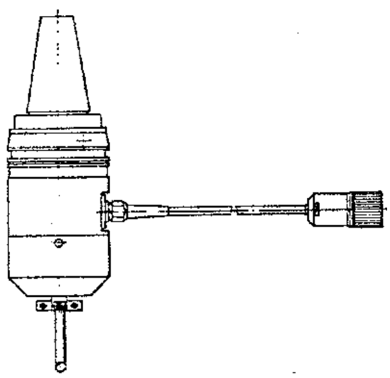
X = A: No manual handwheel connected
B: Identification code of the manual handwheel does not match MP7640
CY: Contamination, Y = axis identification (only for multi-axis handwheel)
D: Error during receipt of data
E: Incorrect BCC check sum received
F: Manual handwheel outputs “Wrong identification received”
G: Manual handwheel outputs ‘Incorrect BBC check sum received”
H: Manual handwheel outputs “Transmission error“
I: Manual handwheel outputs “Wrong number of initialising parameter received”
J: Manual handwheel outputs “Wrong value of initialising parameter received”

13. 3D Touch Probe Systems

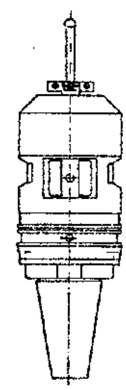
13.1 Overview

13.1.1 Touch Probe Systems with External APE

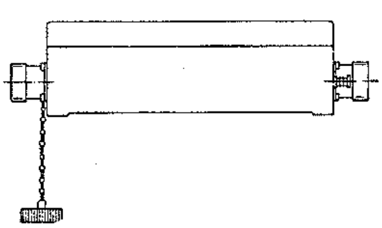
TS 111, Id. No. 237 400 --
with connecting cable



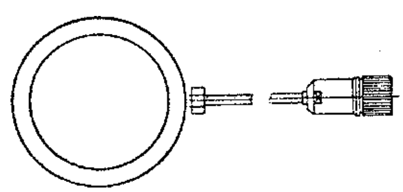
TS 511, Id. No. 237 402 --
with infra-red transmission



APE 110, Id.No. 230 465 -- for TS 111
APE 510, Id.No. 227 590 -- for TS 511
APE 511, Id.No. 237 586 -- for TS 511 and additional connection for a 2nd SE 510

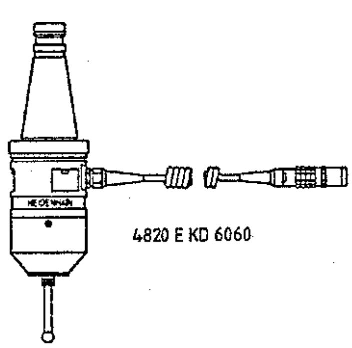


SE 510, Id.No. 230 473 --

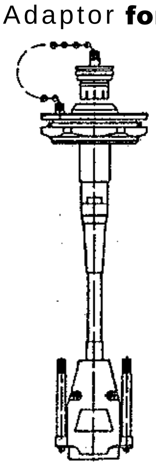


13.1.2 Touch Probe Systems with Integrated APE

TS **120,** Id.No. 243 614 --



Cable Adaptor **for TS 120,** Id.No. 244 891 --



13.2 Error Messages

TOUCH POINT INACCESSIBLE

After the start of a probing function, the scanning point was not reached within the measuring range defined in the machine parameter MP6130.

EXCHANGE TOUCH PROBE BATTERY

The battery voltage of the touch probe system with infrared transmission is below the minimum value.

STYLUS ALREADY IN CONTACT

- The stylus was already deflected when the probing function was started.

PROBE SYSTEM NOT READY

The infrared transmission between the "Touch Probe" and the "Transmitter/Receiver Unit" is faulty (e.g. caused by contamination) or interrupted. The two windows of the touch probe system must be oriented to the transmitter/receiver unit.
The battery is dead.

13.2.2 Error Messages during Digitizing of 3D-Contours

WRONG AXIS PROGRAMMED

The touch probe axis in the scanning cycle RANGE is not identical to the calibrated touch probe axis.

FAULTY RANGE DATA

- A MIN coordinate value in the scanning cycle RANGE is equal to or larger than the corresponding MAX coordinate value.
- One or more coordinates are beyond the limit switch range of the scanning cycle RANGE. A scanning cycle RANGE was already defined when the scanning cycles MEANDER or CONTOUR LINES were called.

MIRRORING NOT PERMITTED

ROTATION NOT PERMITTED

SCALING FACTOR NOT PERMITTED

Mirroring, rotation or scaling factor were active when the scanning cycles RANGE, MEANDER or CONTOUR LINES were called.

RANGE EXCEEDED

The range has been exceeded during scanning, i.e. a part of the 3D-contour is outside the range.

CYCL-PARAMETER INCORRECT

The programmed travel or the distance between lines or points is negative or larger than 56 535 mm (only possible via Q-parameter programming)

TOUCH POINT INACCESSIBLE

The stylus was deflected before the range was reached during approach.
- In the cycle CONTOUR LINES, the stylus was not deflected within the probing range.

STYLUS ALREADY IN CONTACT

The stylus is not at rest, although it is not touching the contour,

PLANE WRONGLY DEFINED

One of the coordinates of the starting point in the cycle CONTOUR LINES is identical with the touch probe axis.

START POSITION INCORRECT

- The starting point coordinate that is identical to the starting probe axis, is beyond the range

AXIS DOUBLE PROGRAMMED

The same axis has been programmed for both starting point coordinates in the cycle CONTOUR LINES.

TIME LIMIT EXCEEDED

In the scanning cycle CONTOUR LINES the first point of the scanned line was not reached within the programmed time limit.

14. Data Interfaces

14.1 Operating Modes

For data transfer the TNC 407/415 can be switched to the following 5 interface operating modes:

ME

For connection of the HEIDENHAIN Magnetic Tape Unit **ME 101/102 or** other peripheral units (e.g. printer); data transfer in standard data format; data format (7 data bits, 1 stop bit, even parity) and Baud rate (2400 bd) adapted to the ME.

FE2

For connection of the HEIDENHAIN Floppy Disk Unit **FE 401** or other peripheral units (e.g. personal computer with HEIDENHAIN data transfer software). Data are transferred with a special protocol (blockwise transfer) for data security. Data format 17 data bits, 1 stop bit, even parity) and the transfer protocol are adapted to the FE 401. In the interface mode FE 2 the file names must be noted down for output of machine parameters, compensation value lists and PLC-programs, as the directory of the external data medium cannot be displayed by the TNC and the file name is needed again for data input.

If the floppy disk unit FE 401 is used as an external data medium, no letters are permitted in program names.
When using the FE 401 the Baud rate at the control must be set to 9600

FE1

For connection of the HEIDENHAIN Floppy Disk Unit **FE 4018** (or **FE 401,** software version 230 626 03 and later) or other peripheral units. Data are transferred with a special protocol (blockwise transfer) for data security. Data format (7 data bits, 1 stop bit, even parity) and the transfer protocol are adapted to the FE 401/B. The disk directory is automatically displayed by the TNC (ESC sequence).
All characters are permitted for program names.
The Baud rate set at the TNC must always match that of the FE 410/B.
Possible Baud rates are 2400, 4800, 9600, 19 200 and 38 400.

EXT1

EXT2

To adapt the transfer of data to external units in standard data format and for blockwise transfer. The interfaces for data transfer are adapted via machine parameters.
Any Baud rate may be selected.

Peripheral units for the EXT operating mode are:
Tape punching units and punched tape readers
Printers or matrix printers for graphic printouts
Mass storage media or programming stations for “Blockwise Transfer”
Programming stations and personal computers for external programming

The Baud rate set at the TNC must always match that of the peripheral unit.
Possible Baud rates: 1 10 to 38 400.

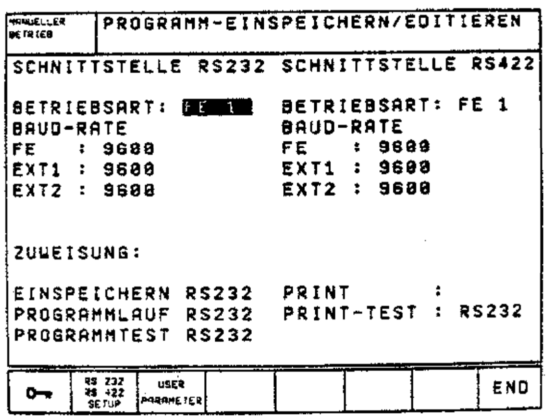
14.2 Interface Configuration and Allocation of the Operating Modes

In addition to the main operating modes the TNC features auxiliary modes or MOD-functions which permit additional displays and settings.

After pressing MOD in the operating modes EDIT PROGRAM and TEST RUN the following functions can be selected via soft key:

	RS 232 RS 422 SETUP	USER PARA- METER					END

The MOD function for the settings of the data interfaces is selected with the soft key RS 232 /R 422 SETUP and displayed on the screen:



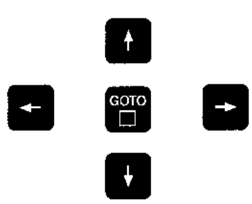
Note:
With the machine parameter MP5000 interfaces can be disabled. If the entry value is 0, no interface is disabled.

On the right half of the screen the interface RS 232C (V.24) is configured, on the left half the interface RS 422C (V.ll). On the left side (lower part of the screen) the operating modes PROGRAMMING AND EDITING, PROGRAM RUN/FULL SEQUENCE and TEST RUN can be allocated to either RS 232 or RS 422. (If the MOD function RS 232 /R 422 SETUP is called in the PLC editor or the machine parameter editor, the editor can be allocated to either RS 232 or RS 422.)

On the right side (lower part of the screen) the user can determine via PRINT and PRINT TEST whether outputs with FN 15 and digitized positions are to be output via one of the interfaces or into a file in the memory of the control:

RS 232 means: Data are output via the data interface RS 232.
RS 422 means: Data are output via the data interface RS 422.
- FILE means: Data are filed in the TNC.

With the arrow keys



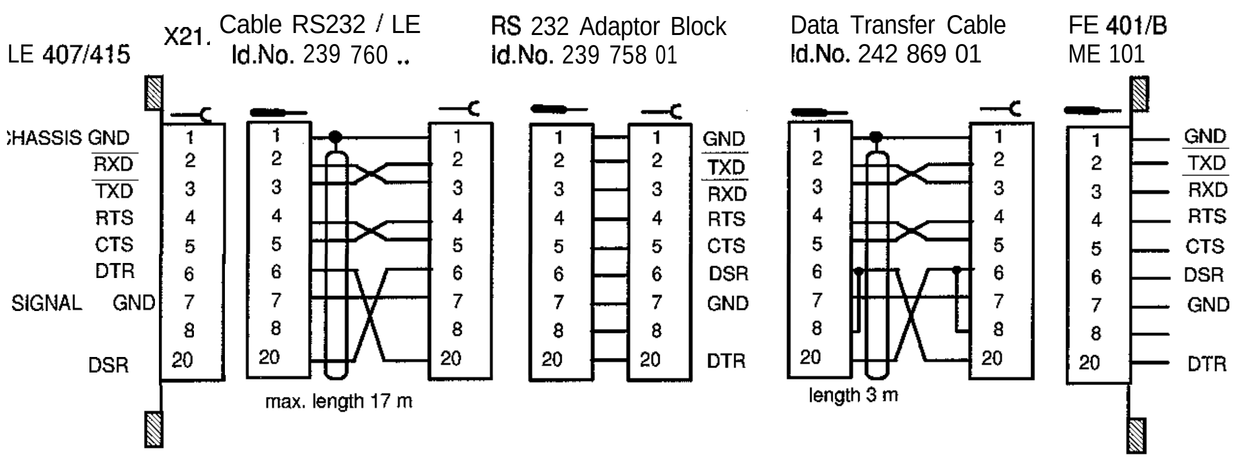
the desired settings

(operating mode, Baud rate and interface allocation) may be selected and set according to your requirements by pressing ENT

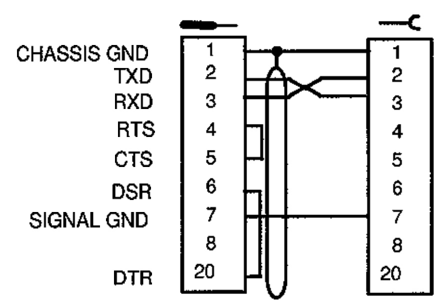
Exit the MOD function RS 232/RS 422 SETUP by pressing the soft key END

14.3 Connecting Cables and Adaptors for the RS 232C Interface

14.3.1 Wiring Diagram and Adaptor of the RS 232C Interface



In general simplified wiring of the data transfer cable is sufficient for the transfer via the RS 232C interface with DC1/DC3 protocol.



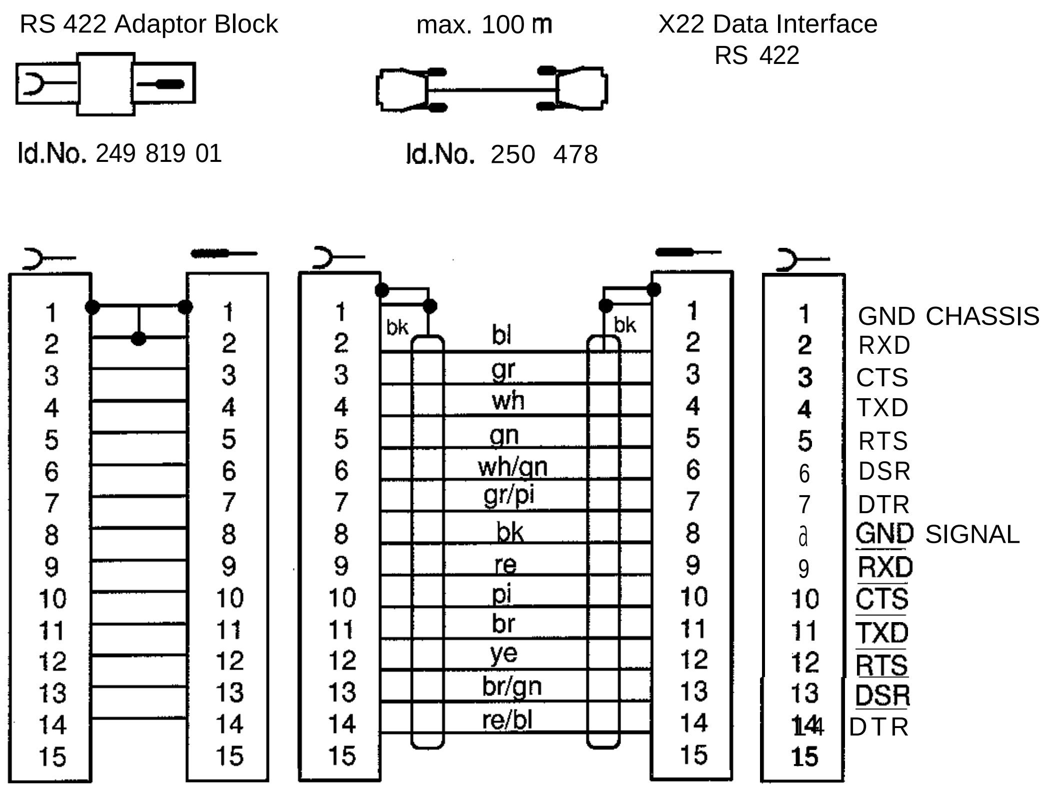
Signal Designations:

TXD Transmit Data
RXD Receive Data
RTS Request to Send
CTS Clear to Send
DSR Data Set Ready
DTR Terminal Ready

The data lines and the control lines of the cable between the LE 407/415 and the RS 232C adaptor block (Id.No. 239 760 ..) are transposed. The pin layout at the connector X21 of the LE 407/415 corresponds that of a data circuit terminating equipment (DCE). Due to the transposed data lines and control lines in the cable between the LE 407/415 and the RS 232C adaptor the allocation at the RS 232C adaptor corresponds to a data terminal equipment (DTE). Thus, the external units may be connected to the RS 232C adaptor via the standard HEIDENHAIN data transfer cable (Id.No. 242 869 01).

The RS 232C data interface has different pin assignments at the logic unit X21 and at the RS 232C adaptor block.

14.3.2 Wiring Diagram and Adaptor of the RS 422 Data Interface



Advantage of the RS 422 data interface:
If a Baud rate of **38 400** has been selected with the RS 422 interface, data transfer over a cable length of 1 km is possible.

☞ The pin assignment of the RS 422 is the same at the logic unit X22 and at the adaptor block RS 422

14.4 Machine Parameters for the Data Interfaces

The detailed functions of the machine parameters are explained in the TNC Manual for Machine Tool Manufacturers and in the information on the data interface RS232C/V.24.

In the operating modes **ME, FE1** and **FE2,** the interface parameters are fixed. In the operating modes **EXT1** and **EXT2,** the interface parameters may be determined via machine parameters

All machine parameters for the data interfaces are user parameters, i.e. they can be selected with the code number 123.

14.4.1 Machine Parameters for the Standard Interface (e.g. for ME 101, printer)

MP for EXT1	MP for EXT2	Entry Values	Function
5020.0	5020.1	168	7 data bits, transfer stop by DC3, parity bit (even parity), 1 stop bit
5030.0	5030.1	0	Standard data interface
5201 .0	5201 .1	3	Control character for end of program = ETX

The data format and the type of transfer stop must be set at the printer according to the values of MP5020.0 and MP5020.1.

14.4.2 Machine Parameters for Blockwise Transfer (e.g. for FE 401/B, personal computer with HEIDENHAIN data transfer software)

MP for EXT1	MP for EXT2	Entry Values	Function
5020.0	5020.1	168	7 data bits, transfer stop by DC3, parity bit (even parity), 1 stop bit
5030.0	5030.1	1 2)	Blockwise Transfer
5200.0	5201.1	2 2)	Control character for program start = STX
5201 .O	5201 .1	3 2)	Control character for end of program = ETX
5202.0	5202.1	72 2)	1. ASCII character for data input = H 1) (e.g. H = NC program in HEIDENHAIN plain language)
5203.0	5203.1	69 2)	2. ASCII character for data input = E
5204.0	5204.1	72 2)	1. ASCII character for data output = H 1) (e.g. H = NC program in HEIDENHAIN plain language)
5205.0	5205.1	65”	2. ASCII character for data output = A
5206.0	5206.1	1 2)	ASCII character for start of command block = SOH
5207.0	5207.1	23 2)	ASCII character for end of command block = ETB
5208.0	5208.1	6 2)	ASCII character for positive acknowledgement = ACK
5209.0	5209.1	212’	ASCII character for negative acknowledgement = NAK
5210.0	5210.1	4 2)	ASCII character for end of transfer = EOT

1) ASCII characters are only valid for the transfer of NC programs.
2) If these machine parameters are programmed with 0, the standard values apply.

14.5. Error Messages

14.5.1 Error Messages at the TNC in the ME-Mode

WRONG OPERATING MODE

- The wrong operating mode no operating mode was selected on the external data medium

WRONG PROGRAM DATA

Wrong program data have been detected during data transfer. The control attempted three times to read the data from the magnetic tape before interrupting the process.

DATA MEDIUM MISSING

No cassette has been inserted into the drive.

DATA MEDIUM EMPTY

No programs are stored on the data medium (cassette).

DATA MEDIUM WRITE-PROTECTED

The write-enable plug on the cassette is missing

PROGRAM INCOMPLETE

- Data transfer was interrupted before the program was transferred completely.

EXT. INPUT/OUTPUT NOT READY

The DSR-signal is missing at the TNC.
ME not connected
- Defective or wrong transfer cable
Wrong interface assignment

ME: TAPE END

The cassette is full. To continue data transfer, turn over or exchange the cassette.

14.5.2 Error Messages at the ME

In the ME the electronics is tested, and the external operating conditions are checked. If an error is detected, the lamps of the operating mode display start blinking. In the following table the error types are listed:

0 LED off ✱ LED blinking

<table>
<tr><th>Indicator Lamp</th><th>Error Message</th></tr>
<tr><td>○○○✱
0 0 0 0</td><td>Faulty data during transfer</td></tr>
<tr><td>○○✱○
0 0 0 0</td><td>No cassette inserted</td></tr>
<tr><td>○○✱✱
0 0 0 0</td><td>Write-enable plug in cassette missing</td></tr>
<tr><td>○✱○○
0 0 0 0</td><td>Wrong operating mode selected</td></tr>
<tr><td>○✱○✱
0 0 0 0</td><td>Data of magnetic tape faulty</td></tr>
<tr><td>○✱✱○
0 0 0 0</td><td>Magnetic tape blank</td></tr>
<tr><td>✱○○○
○○○○</td><td rowspan="6">Errors in ME electronics</td></tr>
<tr><td>✱○○✱
○○○○</td></tr>
<tr><td>✱○✱○
○○○○</td></tr>
<tr><td>✱○✱✱
○○○○</td></tr>
<tr><td>✱✱○○
○○○○</td></tr>
<tr><td>✱✱○✱
○○○○</td></tr>
<tr><td>✱✱✱✱
0 0 0 0</td><td>End of tape</td></tr>
<tr><td>○✱✱✱
0 0 0 0</td><td>Peripheral unit not connected</td></tr>
<tr><td>✱✱✱○
0 0 0 0</td><td>Data transfer between TNC and ME/peripheral unit was interrupted with DEL</td></tr>
</table>

By pressing STOP the error messages can be cleared.

14.5.3 Error Messages at the FE in the ME-Mode

In the ME-mode, errors are displayed by blinking indicator lamps (LEDs).

0 LED off ● LED on ✱ LED blinking

Indicator Lamp	Error Massage
○○○● ○✱○○	**Disk missing** or error in the ME electronics
○○○✱ ○✱○○	Disk cannot be formatted, as it is currently being used
✱○○● ✱○○○	Disk missing or not formatted
✱○○✱ ✱○○○	Disk cannot be copied, as a read/write process is active
● 0*@ 0 0 0 0	External unit not ready or not connected
✱○●● 0 0 0 0	Disk missing or not formatted
✱○○● ○○●○	Disk missing or not formatted or no program available
✱○●✱ 0 0 0 0	Program cannot be output, as a transfer is active via the TNC interface
✱○○✱ 0 0 . 0	Program cannot be output, as a transfer is active via the PRT interface
○○✱● ● 000	External unit not ready or not formatted
○○●● ✱○○○	Disk missing or not formatted
○○○● ✱○●○	Disk missing or not formatted
○○●✱ ✱○○○	Program cannot be output, as a transfer is active via the TNC interface
○○○✱ ✱○●○	Program cannot be output, as a transfer is active via the PRT interface
○●○● ○○✱○	External unit not ready or not connected
○✱○● ○○●○	Disk missing or error in the ME electronics
○✱○✱ ○○●○	Table of contents cannot be output, as a transfer is active via the PRT interface
○○○✱ ○○●○	No interface coupling possible, as a transfer is active via the TNC interface
○○●✱ 0 0 0 0	No interface coupling possible, as a transfer is active via the PRT interface
○○✱● 0 0 0 0	External unit not ready or not connected

By pressing STOP the error messages can be cleared.

14.5.4 Error Messages at the TNC in the FE-Mode

In this operating mode, the floppy disk unit outputs errors in the following format:

(SOH) ERR: (SP) (SP) (SP) [XXX] (ETB) (BCC)
XXX = error number

The following errors can be displayed on the screen:

Input/output errors:

ERR: 001 = wrong command code
ERR: 002 = illegal program name
ERR: 003 = faulty data transfer
ERR: 004 = program incomplete
ERR: 005 = receiving buffer overflow
ERR: 006 = function currently disabled
ERR: 007 = data-buffer overflow

Errors during program write or read:

ERR: 010 = program not on disk
ERR: 011 = program erase-protected
ERR: 012 = program is being written to
ERR: 013 = program directory is full
ERR: 014 = disk is full
ERR: 015 = text not found
ERR: 016 = program name already exists
ERR: 017 = disk access active
ERR: 018 = program currently being read

Disk / Drive / Controller Errors:

ERR: 100 = disk not initialized
ERR: 101 = sector number too large [1)]
ERR: **102** = drive not ready [2)]
ERR: 103 = disk is write-protected
ERR: 104 = faulty data on disk [1)]
ERR: 105 = sector cannot be found [1)]
ERR: 106 = check sum incorrect [1)]
ERR: 107 = disk controller defective [3)]
ERR: 108 = DMA defective [3)]
ERR: 109 = disk exchanged during program loading

1) These error messages indicate that the disk is defective; in most cases, they can only be eliminated by formatting the disk anew.

2) If this error message comes up while the disk is inserted, the drive is defective.

3) Hardware error

14.5.5 Error Messages during Data Transfer

TRANSFERRED VALUE ERRONEOUS X

x = A faulty character frame
B character overflow
C character frame or character overflow
D parity error
E character frame or parity error
F character overflow or parity error
G character frame or parity error
H receiving-buffer overflow
K, L } incorrect ESC sequence (only in ME-mode)

TRANSFERRED DATA INCORRECT X

x = A character frame faulty
D parity error
M control has received the character for "negative acknowledgement" (NAK) more than 3 times
N control has sent the character for "negative acknowledgement" (NAK) more than 3 times

BAUD RATE NOT POSSIBLE

If both data interfaces are activated simultaneously (RS 232 / RS 422), the baud rates of **both** interfaces must be the same.

INTERFACE ALREADY ASSIGNED

A data interface cannot be used for two operating modes **simultaneously (e.g.** DNC-mode and programming at the same time is not possible with one data interface).

EXT. IN-/OUTPUT NOT READY

DSR signal at the TNC missing
Defective or wrong transfer cable
Wrong interface assignment

PROGRAM INCOMPLETE

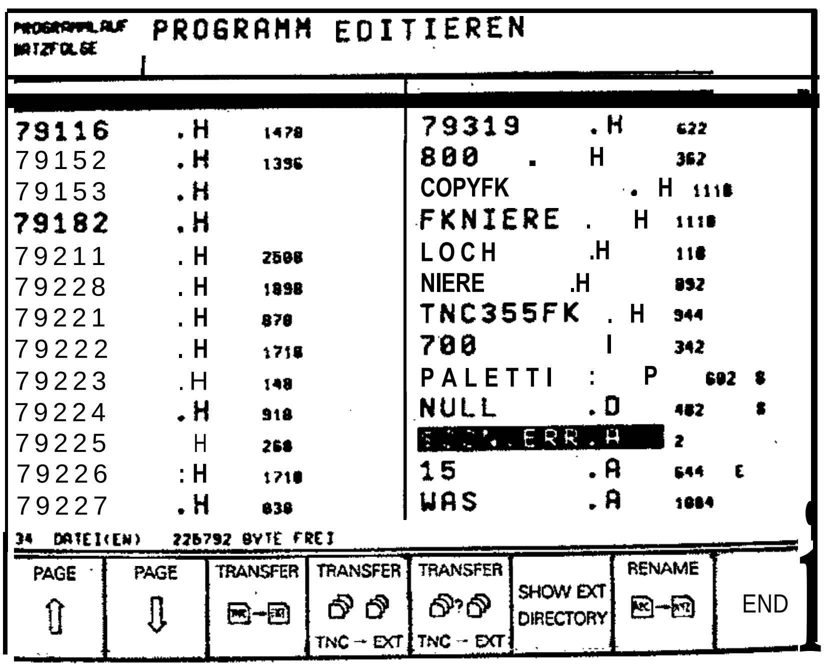
Data transfer was interrupted before the program was completely loaded

15. External Data Transfer

15.1 Data Transfer Menu

In the operating mode EDITING files can be read in and from the TNC. Press at the VDU to activate this operating mode.

To activate the data transfer menu, press in the operating mode EDITING.



The memory contents of the TNC is displayed on the left side of the screen, the memory contents of the external unit (if there is any) on the right side. (Only in the data interface mode FE1 is the memory contents of the external unit displayed automatically. With all other data interface modes the memory contents of the external unit can be loaded by means of a soft key.) The arrow keys of the TNC operating panel serve to select a program for data transfer,

The data transfer commands are displayed in the soft-key row.

Soft-key commands in the **FE1 mode:**

PAGE ⇧	PAGE ⇩	TRANSFER TNC → EXT	TRANSFER TNC → EXT	TRANSFER ? TNC → EXT	SHOW ALL	RENAME ABC → XYZ	END
Upwards page by page	Downwards page by page	Transfer sleeted program from to	Transfer all programs from ... to	Transfer programs from ... to ... after confirmation	Show all files	Rename selected program (only TNC)	Exit EXT function

Soft-key commands in the modes **FE2, ME, EXT1, EXT2:**

PAGE ⇧	PAGE ⇩	TRANSFER TNC → EXT	TRANSFER TNC → EXT	TRANSFER ? TNC → EXT	SHOW EXT DIRECTORY	RENAME ABC → XYZ	END
Upwards page by page	DOWwards page by page	Transfer selected program from to	Transfer all programs from to	Transfer programs from to after confirmation	Show directory of the external memory	Rename selected program (only TNC)	Exit EXT function

SHOW .H	SHOW .T	SHOW .I	SHOW .P	SHOW .D	SHOW .A		
Show all HEIDENHAIN programs	Show all tool tables	Show all ISO programs	Show all pallet tables	Show all datum tables	Show all text files		

Interrupting the Data Transfer

Once data transfer has been started, it can be interrupted by pressing END at the TNC.

If the data transfer is interrupted, the error message **PROGRAM INCOMPLETE** is generated.

15.2 Overview of All Files in RAM

File	File Extension	File Selection	
		Directly	via Code Number
NC programs HEIDENHAIN language	.H	x	
NC programs ISO	.I	x	
Tool files	.T	x	
Pallet tables	.P	x	
Datum tables	.D	x	
Text files	.A	x	
Machine parameters	.MP		x
Compensation value list	.KOR		x
PLC program	.PLC		x
Error messages 1. language	.ER1		x
Error messages English	.ERE		x
Dialogs 1. language	.DI1		x
Dialogs English	.DIE		x
Text files	.A		x

Additional information on the files and programs is provided by letters in the status field:

E: The file/program has been selected in the PROGRAMMING mode.
S: The file/program has been selected and activated in the TEST RUN mode.
M: The file/program has been selected and activated in either PROGRAM RUN/ FULL SEQUENCE or in PROGRAM RUN/SINGLE BLOCK.
P: The file/program is protected against erasing and editing.
IN: The file/program was programmed in Inch.
W: The file/program was not completely transferred to the external memory and thus is no longer available.

15.3 External Data Output

Preparations:

Connect the external data medium (ME, FE or other peripheral unit, e.g. personal computer with HEIDENHAIN data transfer software) to the TNC.
Prepare the external data medium for data transfer:

press STOP, and at the ME

press STOP at the FE.

Select the operating mode, the Baud rate and the interface assignment (see sections 14.1 and 14.2) at the TNC.

The ME (Magnetic Tape Unit) is not very suitable as an external data medium, as only one file can be stored on one side of a cassette.

15.3.1 Output of Files with the Extensions .H, .I, .T*, .D, .P, .A to an External Data Medium

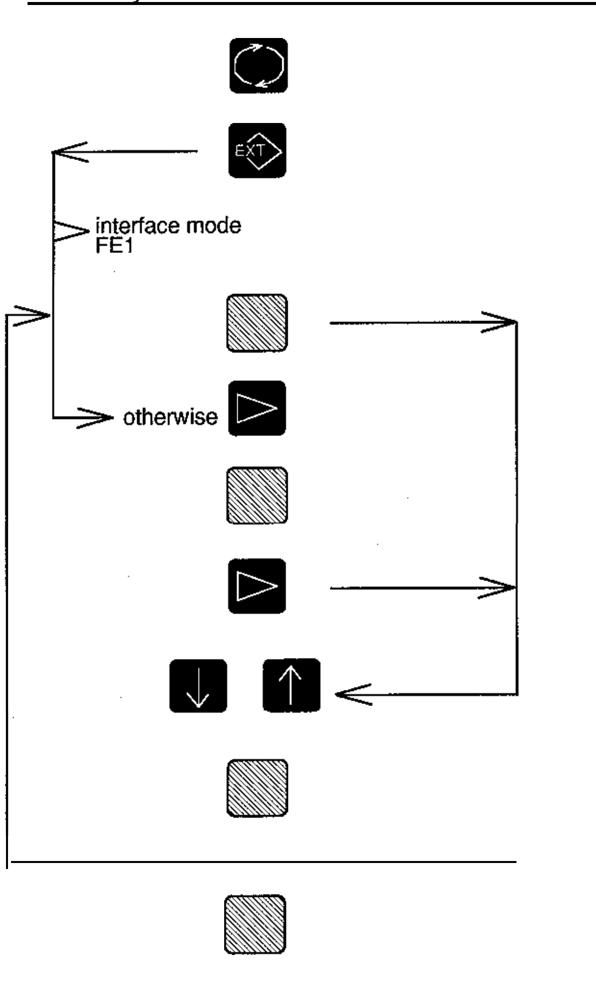
(Note down the file name of the ASCII file xxx.A in the interface mode FE2, as the TNC cannot display the directory of the external data medium.)

The TNC features several file types to facilitate searching and selecting files.

The different file types are distinguished by their names and their extensions.

The following six different file types can be selected via soft keys:

HEIDENHAIN plain language programs	<file name> .H
ISO programs	<file name> .I
Tool files	<file name> .T*
Datum tables	<file name> .D
Pallet tables	<file name> .P
Text files (ASCII files)	<file name> .A

ress Key	Function
	Switch TNC to operating mode EDITING (key on VDU) Activate data transfer menu Soft key >SHOW ALL< to display all file types Use arrow key at the VDU to switch the soft-key row to the file type display Soft key >SHOW.x< to select requested file type Use arrow key at the VDU to switch the soft-key row back to the data transfer menu If necessary: select file with arrow key Soft key >TRANSFER . ..< for data transfer Output of further files, if required Soft key >END< to end the data transfer menu TNC is in the operating mode EDITING

* The tool file TOOL.T is automatically generated by the TNC and selected for machining a workpiece. This file cannot be edited, read out or downloaded.

To output the file TOOL.T it needs to be copied into another tool table: it can be stored on the external data medium under the new file name

Copying TOOL.T to XXX.T

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
PGM NAME	Display of file names
interface mode FE1	
	Soft key >SHOW ALL< to display all file types
otherwise	Use arrow key at the VDU to switch the soft-key row to the file type display
	Soft key >SHOW .T< to select the tool tables
	Use arrow key at the VDU to switch back the soft-key row
	If necessary: select TOOL.T with arrow key
	Soft key >COPY ABC → XYZ<
... ENT	Enter the new name of the tool table and acknowledge with ENT
	Soft key >END< to switch the TNC to the operating mode EDITING

Output of the new file XXX.T: see section 15.3.1

15.3.2 Machine Parameter Output to an External Data Medium

(Note down the file name of the ASCII file xxx.A in the interface mode **FE2, as** the TNC cannot display the directory of the external data medium.)

Press Key	Function
(operating mode key)	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for input of code number
9 5 1 4 8 ENT	Enter code number, acknowledge with ENT
EXT	Activate data transfer menu
(soft key)	Soft key >TRANSFER TNC → EXT< to transfer data
(soft key)	Soft key >END< to end data transfer menu
END	TNC is in the operating mode EDITING

15.3.4 Output of the Compensation Value List for Multipoint Axis Error Compensation

(Note down the file name of the ASCII file xxx.A in the interface mode FE2, as the TNC cannot display the directory of the external data medium.)

Press Key	Function
(operating mode key)	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for input of code number
1 0 5 2 9 6 ENT	Enter code number, acknowledge with ENT
EXT	Activate data transfer menu
(soft key)	Soft key >TRANSFER TNC → EXT< to transfer data
(soft key)	Soft key >END< to end data transfer menu
END	TNC is in the operating mode EDITING

153.5 Output of PLC Program, Error Messages and Dialogs

The PLC comprises a file manager for all file types. The following file types are possible:

File Contents	File Extension EPROM Files	RAM Files
PLC Program	.PCE	.PLC
Error Messages, first language	.EE1*	.ER1*
Error Messages, English	.EEE*	.ERE*
Dialogs of OEM cycles, first language	.DE1*	.DI1*
Dialogs of OEM cycles, English	.DEE*	.DIE*
ASCII files		.A*

* Notes:
The error messages, dialogs and ASCII files are output as ASCII files with the file extension .A. For this reason, the files must have different names when they are to be read out so that they are not overwritten on the external data medium. (If necessary, rename files using the soft key >RENAME<.)

Note down file name and extension

During data input the file extension .A must be replaced with the original extension.

In general only the files in the RAM must be stored on an external data medium.
(Note down the file name of the ASCII file xxx.A in the interface mode **FE2. as** the TNC cannot display the directory of the external data medium.)

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for input of code number
8 0 7 6 6 7 ENT	Enter code number, acknowledge with ENT
EXT	Activate data transfer menu
interface mode FE1	
	Soft key >SHOW ALL< to display all file types
otherwise	Use arrow key at the VDU to switch the soft-key row to the desired extension
	Soft key >.XXX FILES< for desired extension
	Switch soft-key row back to data transfer menu
	If necessary: select desired file with arrow key
	If necessary: *rename* file with soft key >RENAME< (see 15.3.5)
	Soft key >TRANSFER< to transfer data
	Soft key >END< to end data transfer menu
END	TNC is in the operating mode EDITING

Several programs with the extension .PLC may be stored in the RAM.
The selected program is marked by an "S" in the status window. Note down the program name so that you can re-select it after the downloading process.

15.4 Downloading External Data

Preparations:

Connect the external data medium (ME, FE or other peripheral unit) to the TNC.
Prepare the external data medium for data transfer:

press STOP , and at the ME

press STOP at the FE

- Select the operating mode, the Baud rate and the interface assignment (see 14.1 and 14.2) at the TNC.

15.4.1 Downloading Files with the Extensions .H, .I, .T**, .D, .P, .A*

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
EXT	Activate data transfer menu
	Go to the directory of the external data medium
interface mode FE1	
	Soft key >SHOW ALL< to display all file types
otherwise	Use arrow key at the VDU to switch the soft-key row to the file type display
	Soft key >SHOW.x< to select requested file type
	Use arrow key at the VDU to switch the soft-key row back to the data transfer menu
	Soft key >SHOW ALL< or >SHOW EXT DIRECTORY< to display the directory of the ext. data medium at the TNC
	If necessary: select file with arrow key
	Soft key >TRANSFER...< for data transfer
	Download further files, if required
	Soft key >END< to end the data transfer menu
END	TNC is in the operating mode EDITING

(*)

* In the interface modes FEZ, EXT1 and EXT2 the name of the ASCII file must be entered manually, as it cannot be displayed by the TNC.

** The file TOOL.T always contains the tool table that is read by the TNC. TOOL.T cannot be edited, read out or downloaded. In the TNC several files xxx.T may be stored. The tool table (xxx.T) the TNC is supposed to read must be copied into TOOL.T. I.e. after downloading the files xxx.T, the current tool table still needs to be copied into TOOL.T (see section 15.3.1).

Copying the file xxx.T into TOOL.T

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
PGM NAME	Display of file names
interface mode FE1	
	Soft key >SHOW ALL< to display all file types
otherwise ▷	Press arrow key at the VDU to switch the soft-key row to the file type display
	Soft key >SHOW .T< to display the tool tables
▷	Press arrow key to switch back the soft-key row
↓ ↑	If necessary: select file xxx.T with arrow key
	Soft key >COPY ABC → XYZ<
T O O L ... ENT	Enter file name TOOL, acknowledge with ENT
	Soft key >END< to switch the TNC to the operating mode EDITING

15.4.2 Machine Parameter Input

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for parameter input
9 5 1 4 8 ENT	Enter code number. acknowledge with ENT
EXT	Activate data transfer menu
→	Press arrow key to enter the directory of the external data medium
interface mode FE1 ↓ ↑	If necessary: select desired MP file by pressing the arrow keys
otherwise ...	Enter name of MP file (ASCII or numerical keys)
	Soft key >TRANSFER TNC ←EXT< for data input
	Soft key >END< to end data transfer menu
END	TNC is in the operating mode EDITING

If the error message OPERATING PARAMETERS ERASED
is displayed, reenter the machine parameters as follows:

Press Key	**Function**
CE	Clear error message **OPERATING PARAMETERS ERASED**
EXT	Activate data transfer menu
interface mode FE1	
↓ ↑	If necessary: select desired machine parameter file by pressing the arrow keys
otherwise ...	Enter name of the **MP** file (ASCII or numerical keys)
	Soft key >TRANSFER TNC←EXT< to download data
	Soft key >END< to end data transfer menu
END	Exit machine parameter mode
CE	Clear error message OPERATING PARAMETERS ERASED

Note:
With new software versions, new machine parameters may be available. If these machine parameters are not comprised in the machine parameter list when downloading, they are set to the value 0. The correct input values for these machine parameters must be entered subsequently.

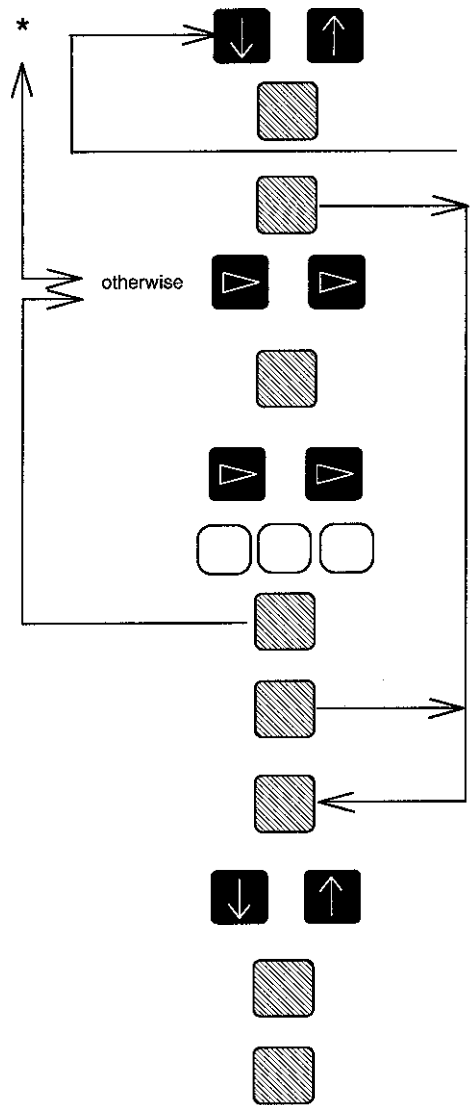
15.4.3 Machine Parameter Input for Multipoint Axis Error Compensation

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for code number input
1 0 5 2 9 6 ENT	Enter code number, acknowledge with ENT
EXT	Activate data transfer menu
→	Press arrow key to enter the directory of the external data medium
interface mode FE1	
↓ ↑	If necessary: select desired compensation value list by pressing the arrow keys
otherwise ...	Enter name of compensation value list (ASCII or numerical keys)
	Soft key >TRANSFER TNC ← EXT< for data input
	Soft key >END< to end data transfer menu
END	TNC is in the operating mode EDITING

15.4.4 Downloading the PLC Program: Error Messages and Dialogs

The error messages and the dialogs are read in as ASCII files. They need then to be reconverted into the original file types (see section 15.3.5)

Press Key	Function
	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for code number input
8 0 7 6 6 7 ENT	Enter code number, acknowledge with ENT
EXT	Activate data transfer menu
→	Press arrow key to enter the directory of the external data medium
interface mode FE1	
	Soft key >SHOW ALL< to display all files
↓ ↑	If necessary: select desired compensation value list by pressing the arrow keys
	Soft key >TRANSFER< to transfer data
	If necessary: download further files
PGM NAME	Convert original file extension list (only error messages and dialogs!)
	Soft key >SHOW ALL< to display all file types
	Soft key >MODIFY FUNCTIONS<
↓ ↑	Press arrow keys to select the file to be converted
	Soft key >CONVERT ABC → XYZ<
	Soft key >.xxx FILES< for original file type (file extension)
... ENT	Enter original file name, acknowledge with ENT
	Convert further files, if required.
CL PGM	Delete the ASCII files (.A) that were converted to the original file types
*	

Press Key	Function
	Press arrow key to select ASCII file to be deleted
	Soft key >DELETE< to delete ASCII file
	Delete further ASCII files, if required
	Soft key >END< to end data transfer menu
	Press arrow key at the VDU to switch the soft-key row to the requested file extension
	Soft key >.xxx FILES< to display requested file extension
	Press arrow key to switch back to data transfer menu
	Enter original file name (ASCII and numerical keys)
	Soft key >TRANSFER . ..< to transfer data
	Soft key >END< to end data transfer menu
	Soft key >COMPILE< to compile PLC program
	If required, press arrow key to select PLC program
	Soft key >SELECT< to select PLC program
	Soft key >END< to end the PLC editor and switch the TNC back to the operating mode EDITING

16. Analog Outputs

16.1 Specifications

6 outputs: 1, **2, 3, 4, 5,** and S

Load capacity: R_l mint 5 kΩ
C_l max ≤ 2 nF

Voltage range: Ua max = ± 10V ± 100 mV
Ua min = 0V ± 3 mV

Machine Parameters for the Analog Outputs

Analog Output	MP	Entry Value
X	120.0	0 = output 1
Y	120.1	1 = output 2
Z	120.2	2 = output 3
IV	120.3	3 = output 4
V	120.4	5 = output 5

	TNC 407	TNC 415
Resolution	14 bits = 16 384 steps	16 bits = 65 536 steps
Smallest step	$\frac{10V}{16384} = 0.610mV$	$\frac{10V}{65536} = 0.153mV$

16.2 Checking the Analog Outputs

Proportionally to the traversing speed, the control generates an analog voltage of **0V** (axis standstill) to **9V** (rapid traverse). The easiest way to determine this voltage is to connect the test adaptor directly to the logic unit or to the connecting terminals of the servo-amplifier and to measure with a multimeter.

If however, the axis does not move due to a defect, and you want to test whether the error is inside or outside the control, the following steps are recommended:

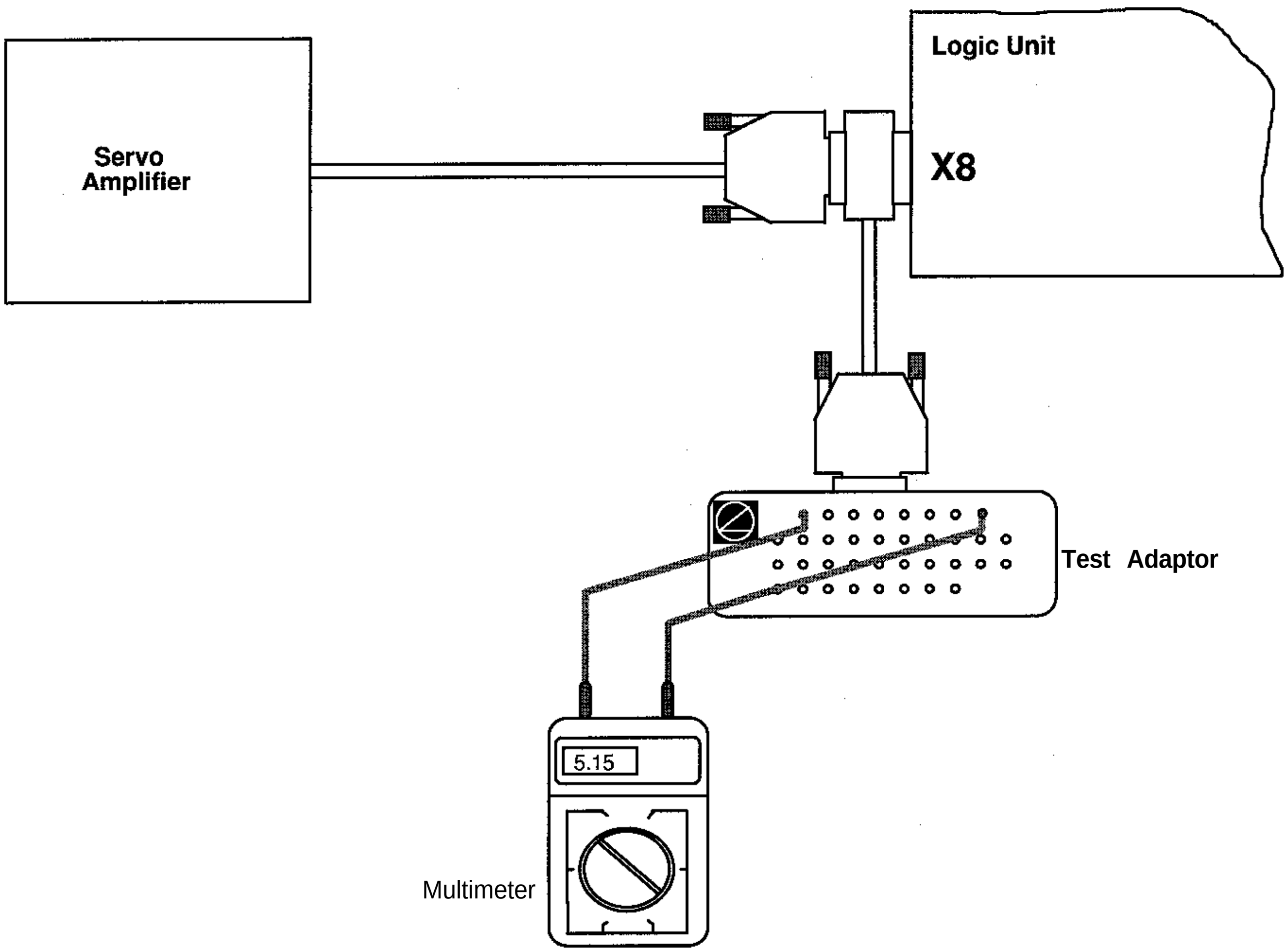
Switch off the main switch of the machine tool.
Connect the test adaptor to the connector X8 (nom. value output) of the LE and connect a multimeter to the test adaptor sockets for the defective axis If no test adaptor is available, connect a multimeter directly to the nominal value output of the servo-amplifier.
Switch on the main switch and the control voltage.
Switch the position display to LAG (servo lag) (see sec. 16.3).
Check or adjust the following machine parameters. (If you alter the machine parameters, note down the original values and enter them again after finishing the test.)

MP	**Entry Value**	**Function**	**Original Value**
1720	100 [mm]	Servo-lag monitoring EMERGENCY STOP	
1140	9.99 [V]	Movement monitoring	

Traverse the reference points that need to be traversed before those of the defective axis.
Turn the override potentiometer of the keyboard unit completely to the left and start reference point traverse for the defective axis.
Check the axis enable for the defective axis at the servo amplifier.
Check the screen display
* (control ready for operation) must be switched on, the "F" of the feed display must be lit normally (if the display is inverse, the feed enable is missing), and the symbol for “Axis not in the Position Loop” (e.g. → | ←) should not follow the position display.
- Turn the override potentiometer slowly to the right and turn it back left before the servo lag display reaches the limit of the position monitoring (MP1720).

When the override potentiometer is turned to the right, the control outputs an analog voltage which is increased proportionally to the servo lag up to 10V max. The control is operating correctly if a voltage of 10V ± 0.1V can be measured at the test adaptor with the multimeter. If no voltage can be measured, switch off the main switch, disconnect the nominal value line from the servo amplifier and test for short-circuit. If the nominal value line is in order, connect the connector X8 to the LE again (leave the nominal value line disconnected), switch on the main switch and repeat the measurement with reference mark traverse. If an analog voltage can be measured now, the control is operating correctly. If no voltage can be measured, the analog output of the LE is probably defective.

15.2.1 Checking the Analog Outputs: Measurement Setup



X8 Nominal Value Output 1, 2, 3, 4, 5, S
Flange socket with female insert (15-pin)

Pin No.	Signal Designation
1	analog output 1
3	analog output 2
5	analog output 3
7	analog output 4
4	analog output 5
8	analog output S-axis
9	0V analog output 1

Pin No.	Signal Designation
11	0V analog output 2
13	0V analog output 3
14	0V analog output 4
6	0V analog output 5
15	0V analog output S-axis
housing	external shield = housing
2, 10, 12	do not assign

16.3 Switching Over the Position Display

Press Key	Function
	Switch TNC to operating mode MACHINE
MOD	Prepare TNC to be switched over to position display
ENT	Press ENT to switch to desired position display (DIST, ACTL, REF. LAG, NOML)
	Press soft key >END< to switch the TNC to the operating mode EDITING

16.4 Feed Adjustment

Check/adjust the machine parameters. (Note down the original values before changing.)

MP	Entry Value	Function	Original Value
1390	0	Feed precontrol ON in the automatic operating modes	
7290	0	Display step = 1 µm	

Switch the position display to LAG (display of servo lag).

Enter the following test program:
e.g. 1 LBL 1
2 x 100 R0 F29999 M (select a larger traverse range if possible)
3 x 0 R F M
4 CALL LBL 1 REP 10

Run the test program in the operating mode PROGRAM RUN/FULL SEQUENCE.

Adjust the feed at the servo amplifier (tachometer) until the servo lag display is approx. zero for positioning in both directions.

Repeat adjustment for all axes.

Reset the machine parameters and the position display to the **original values.**

16.5 Offset Adjustment

16.5.1 Offset Adjustment with Code Number

The offset adiustment with code number only compensates the current offset. Subsequent offset modifications are not compensated.

Press Key	Function
	Switch TNC to operating mode EDITING
MOD	Prepare TNC for input of code number
7 5 3 6 8 ENT	Enter code number for offset adjustment and acknowledge with ENT

The offset values are displayed individually for each axis in converter increments
(TNC 407: 1 converter increment = 0.61 mV,
TNC 415: 1 converter increment = 0.153 mV)

→ ENT	The offset values are transferred to the offset memory and are compensated.
→ NO ENT	The offset memory is cleared and no compensation takes place.

16.52 Automatic Cyclic Offset Adjustment

In the machine parameter MP1220, the cycle time is determined [unit s] after which an offset is compensated by one converter increment. To switch off the automatic offset adjustment, enter the value 0 in the machine parameter MP1220.

NOTE:
If an offset voltage of 100 mV is reached with automatic offset adjustment, the control switches itself off, generating the error message "GROSS POSITIONING ERROR <Axis> <CPU Number> E".

16.5.3 Offset Adjustment at the Servo-Amplifier

Check/adjust the following machine parameters. (Note down the original values before changing.)

MP	Entry Value	Function	Original Value
1080.0 1080.1 1080.2 1080.3	Ø Ø Ø 0	Integral factor	
1220	0	Cycle time for automatic offset adjustment	
1390	0	Feed precontrol ON in the automatic operating modes	
1510.0 1510.1 1510.2 1510.3	> = 1 > = 1 > = 1 > = 1	KV factor for feed precontrol	
7290	0	Display step = 1 pm	

Switch position display to LAG (display of servo lag) (see sec. 16.3).

Clear the offset memory with the code number 75368 (see sec. 16.5.1).

Adjust the offset at the servo-amplifier until the values of the individual axes are zero or oscillate symmetrically about zero.

- Reset the machine parameter values and the position display to their original values.

17. PLC Inputs and Outputs

17.1 Specifications

17.1.1 PLC Inputs at the Logic Unit

I0 to I31 at X42
I128 to 1152 atX46

"0"-Signal	U_e = -20 V to 3.2 V I_e = 1 .O mA with U_e = 3.2 V
"I"-Signal	U_e = 13 v to 30.2 v I_e = 3.8 mA to 8.9 mA
Pin layout:	see section 5.1.7

17.12 PLC Outputs at the Logic Unit

00 to 07 at X46
00 to 030 and "Control Ready for Operation" at X41

"1"-Signal	U_{amin} = U_B - 3 V $I_{a\,NOM}$ = 0.1 A
Pin layout:	see section 5.1.7

17.1.3 PLC Inputs at the PL 400

I64 to 1126	at x4 to x9
"0"-Signal	U_e = -20 V to 4 V I_e = 1.6 mA with U_e = 4 V
"1"-Signal	U_e = 16.5 V to 30 V I_e = 6.2 mA to 12.6 mA

17.1.4 PLC Outputs at the PL 400

032 to 062 and "Control Ready for Operation" at X1 to X3

"I"-Signal	U_{amin} = U_B - 3 V $I_{a\,NOM}$ = 1.2 A
Pin layout:	see section 5.2.2

17.2 Checking the PLC Inputs and Outputs

Two test units are available to check the inputs and outputs of the PLC:

PLC Test Unit	for X41, X42 and X46
PL Test Adaptor	for the PL board

With the PLC Test Unit all inputs and outputs of a connector are displayed simultaneously and all voltages can be measured. If you use the PL Test Adaptor, only the inputs/outputs of one terminal strip of the PL board are displayed. In this case the voltages can be measured directly at the terminals.

17.2.1 PLC Inputs

Check the PLC inputs as follows:

Connect the test unit between LE and PLC or between LE and PL.
Set the TNC as follows:

Press key	Function
	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for code number input
8 0 7 6 6 7 ENT	Enter code number, acknowledge with ENT
	Soft key >TABLE< to display the tables
	Soft key >INPUT< to display the input table

Now the logic states of the inputs are displayed on the screen. The states of the screen display must correspond to those of the test unit. If there is a difference, measure the voltage level (see section 17.1) of this input at the test unit. If the input voltage is correct, the input board is probably defective (I0 to I31 and I128 to 1152 of PLC and graphics board, I64 to 11’26 of PLC I/O board).

	Soft key >END< to exit table display
	Soft key >END< to switch TNC back to operating mode EDITING

NOTE:
Always switch off the main switch before engaging or disengaging any connector.

17.2.2 PLC Outputs

Check the PLC outputs as follows:

Connect the test unit between LE and PLC or between LE and PL.
Set the TNC as follows:

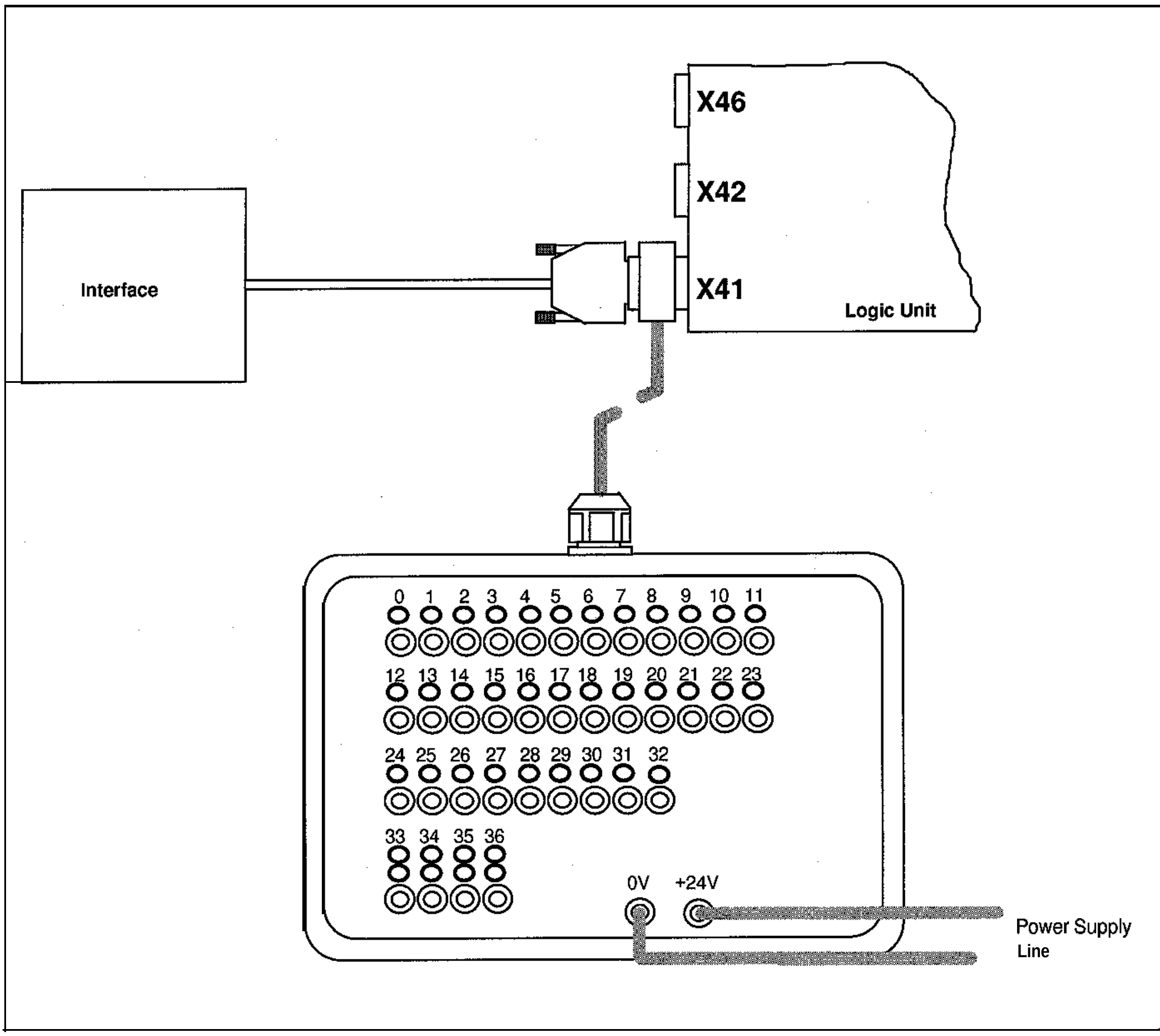
Press key	Function
(operating mode key)	Switch TNC to operating mode EDITING (key on VDU)
MOD	Prepare TNC for code number input
8 0 7 6 6 7 ENT	Enter code number, acknowledge with ENT
(soft key)	Soft key >TABLE< to display the tables
(soft key)	Soft key >OUTPUT< to display the output table

Now the logic states of the outputs are displayed on the screen. The states of the screen display must correspond to those of the test unit. If there is a difference, test the connecting cable for short circuit and measure the output current at interface (max. 100 mA for LE outputs, max. 1.2 A for PL outputs). If the output current is not exceeded and the connecting cable is in order, the output board is probably defective (00 to 030 of processor board, 032 to 062 of I/O board PL 400).

(soft key)	Soft key >END< to exit table display
(soft key)	Soft key >END< to switch TNC back to operating mode EDITING

NOTE:
Always switch off the main switch before engaging or disengaging any connector.

17.2.3 Measurement Setup for PLC Inputs and Outputs



17.3 Further Diagnosis Possibilities in the PLC Mode

The TRACE function provides the possibility of controlling the logic states of the markers, the inputs and outputs, of the timer and the counter. It also serves to check the contents of bytes. words and double words.

Call the TRACE function from the PLC main menu with the soft key TRACE.

An instruction list (AWL) of the compiled program (process program) is displayed. In addition, the contents of the operand and of the accumulator is displayed in HEX code or decimal code. All active commands of the instruction list are marked by *. Use the cursor keys or the GOT0 function to display the requested program part.

The following soft-key row is displayed:

SELECT M/I/O/T/C	LOGIC DIAGRAM	HEX ↓↑ DECIMAL	START DISPLAY	STOP DISPLAY	START TRACE	STOP TRACE	END

Explanation of the soft keys:

SELECT M/I/O/T/C	**see** section 17.3.2
LOGIC DIAGRAM	see section 17.3.2
HEX ↓↑ DECIMAL	Display of the operand contents (HEX15 or DECIMAL10)
START DISPLAY	Dynamic display of operands and accumulators stopped
STOP DISPLAY	Dynamic display of operands and accumulators
START TRACE	see section 17.3.2
STOP TRACE	see section 17.3.2
END	Exit to PLC main menu

17.3.2 Logic Diagram

Function:

The logic states of up to 16 operands (M, I, 0, T, C) can be displayed graphically on the screen at the same time. 1024 PLC scans can be traced.

Press Key	**Function**
	Soft key >SELECT M/I/O/T/C<

A table is displayed from which the desired operands can be selected. The control requests the positions of the table in a dialog. Wrong inputs can be cleared by pressing DEL. It is possible to enter a trigger condition for each operand. 512 states are traced before and after a trigger event. The following trigger conditions are possible:

"1" → trace if the operand is a logical "1"
(trigger on positive edge)

"0" → trace if the operand is a logical "0"
(trigger on negative edge)

NO ENT → no trigger
If no trigger condition is entered for any of the operands, the operand states are traced continuously and the last 1024 states are stored.

e.g.	Ø	I5	1	→ trigger on positive edge
	1	O6	2	→ trigger on negative edge
	2	M7		→ no trigger

	Soft key >START TRACE<
	Switch TNC to the operating mode MACHINE (key on VDU)

The trace function is started with START TRACE; END TRACE or a trigger event end the tracing

PCTR blinking:	trigger condition has not occurred yet
PCTR on:	trigger condition has occurred; write access to buffer memory
PCTR off:	buffer memory is full. logic diagram can be called.

	Switch to TRACE mode
	Soft key >LOGIC DIAGRAM< to call logic diagram

17.4 Output Control Ready for Operation and Acknowledgement for Test Control Ready for Operation

Important functions are monitored by the TNC 407/415 by way of a self-diagnosis system (electronic assemblies such as the micro-processor, the ROM, read/write memory, positioning systems, encoders etc.)

If an error is detected, a blinking error message is displayed in plain language in the dialog line. As soon as this error is displayed, the output “Control Ready for Operation” becomes inactive.

The output “Control Ready for Operation” is available via the connectors X41/X43 of the LE and on the terminal X3 /pin 10 of the I/O board PL 400. If the error cause has been eliminated, this state can be cancelled by switching off the main switch or pressing END.

The output “Control Ready for Operation” is to switch off the control voltage of +24V in the machine tool interface. Since this is an important safety function, the switch-off function of the output “Control Ready for Operation” is tested via the input “Acknowledgement Control Ready for Operation” every time the control is switched on.

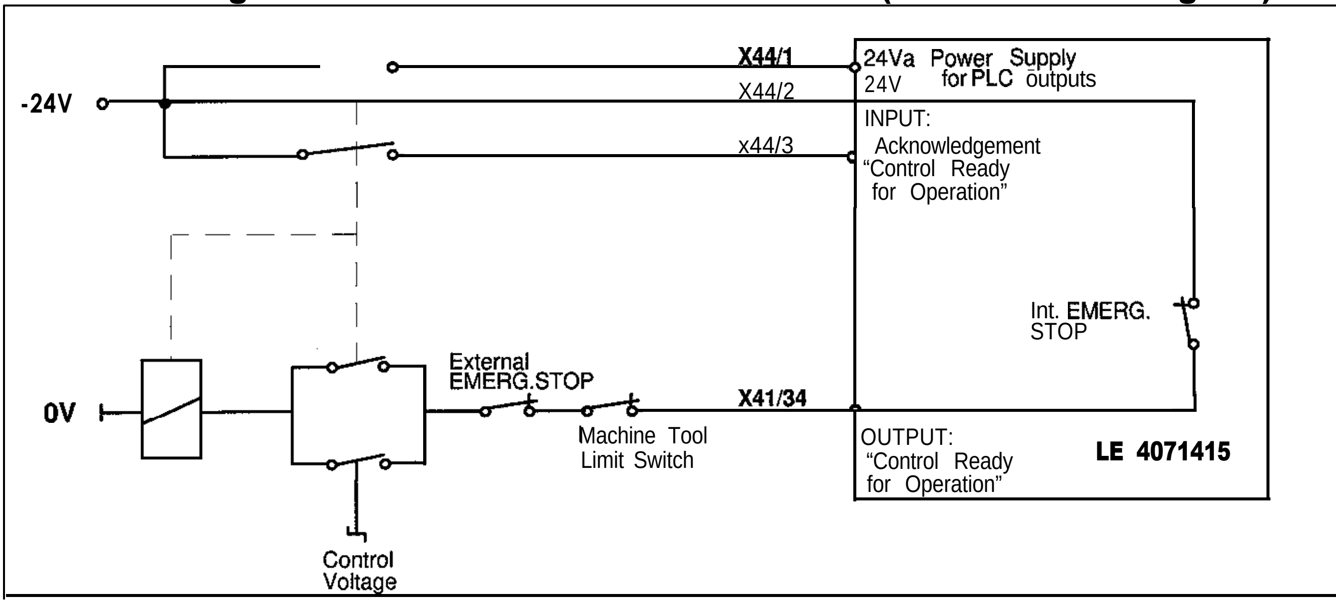
The TNC 407 features a monitoring function that is tested when the machine tool is switched on.
The TNC 415 comprises 3 monitoring systems (main processor, geometry processor and CLP processor) that are also tested when the machine tool is switched on.

If the +24V at the input “Acknowledgement Control Ready for Operation” are missing during the test routine when the control is switched on, the error message “RELAY EXT. DC VOLTAGE MISSING” is generated.
If however, the acknowledgement is switched off too late (or not switched off at all) after switch-off of the output, the blinking error message “EMERGENCY STOP DEFECTIVE” is displayed. This error message is also generated, if the power supply of the PLC part is missing (power supply of the PLC part: see section 8.6).

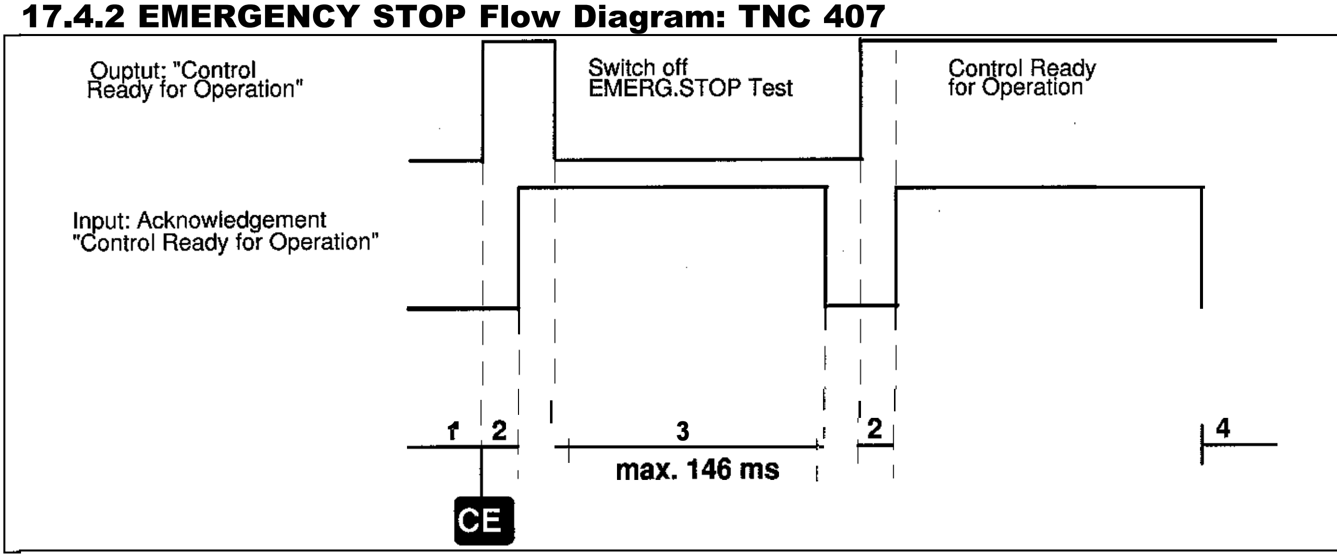
If the control detects an error during the switch-on test routine, a bridge can be inserted between the outputs “Control Ready for Operation” and “Acknowledge Control Ready for Operation” (disconnect the wires) in order to determine whether the defect is due to the control or to the interface. If the error is still present after inserting the bridge and with correct power supply of the PLC part, the defect is located in the logic unit.
If however, the error does not occur any longer after the bridge has been inserted, the interface is defective.

Note:
Do not forget to remove the bridge and to install the standard operating state after the test

17.4.1 Wiring of the EMERGENCY STOP Interface (Basic Circuit Diagram)

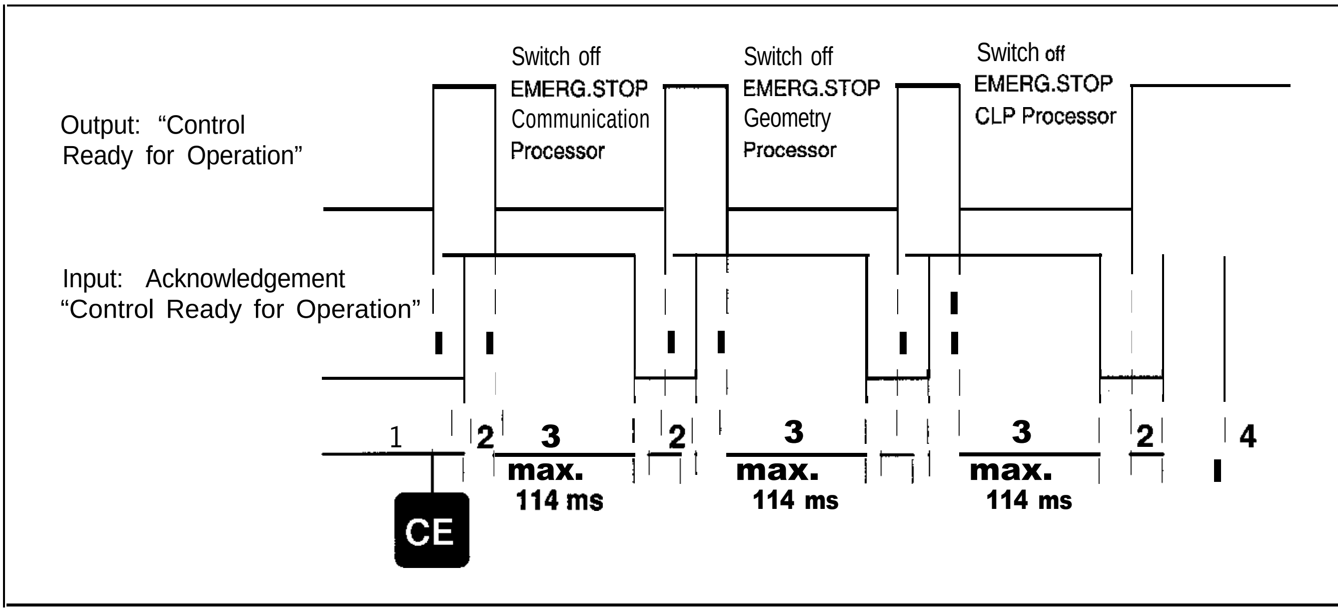


17.4.2 EMERGENCY STOP Flow Diagram: TNC 407



Time	Remarks	Error Message
1		POWER INTERRUPTED
2	Waiting for control voltage	RELAY EXT. DC VOLTAGE MISSING
3	After switching off the output "Control Ready for Operation", the "Acknowledgement Control Ready for Operation" must be switched off within 146 ms; otherwise a blinking error message is generated.	EMERGENCY STOP DEFECTIVE
4	If the acknowledgement is switched off during operation, the error message is displayed.	EMERGENCY STOP

17.4.3 Flow Diagram: TNC 415

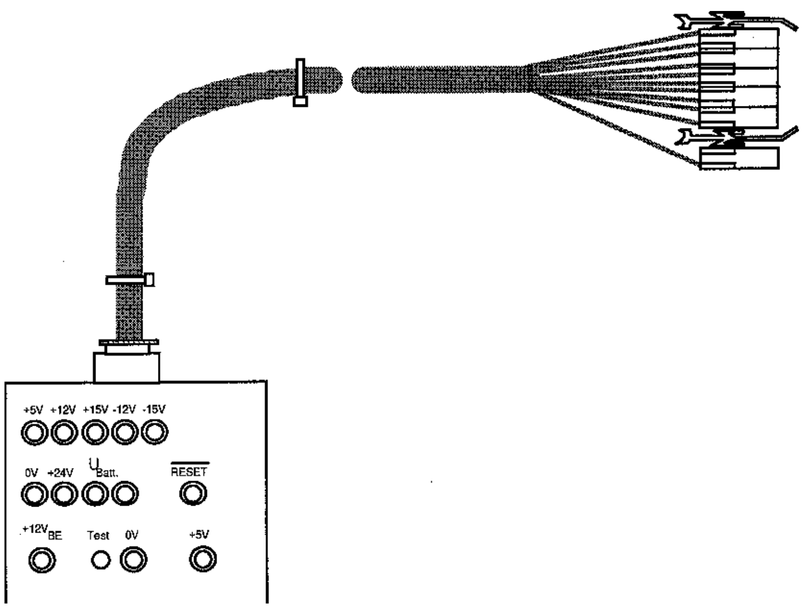


Time	Remarks	Error Message
1		POWER INTERRUPTED
2	Waiting for control voltage	RELAY EXT. DC VOLTAGE MISSING
3	After switching off the output "Control Ready for Operation", the "Acknowledgement Control Ready for Operation" must be switched off within 146 ms; otherwise a blinking error message is generated.	EMERGENCY STOP DEFECTIVE YX = 1(= Communication processor 1) = Geometry processor 1. = CLP processor
4	If the acknowledgement is switched off during operation, the error message is displayed.	EMERGENCY STOP

18. Test Units

18.1 Test Load Unit for the Power Supply Assembly

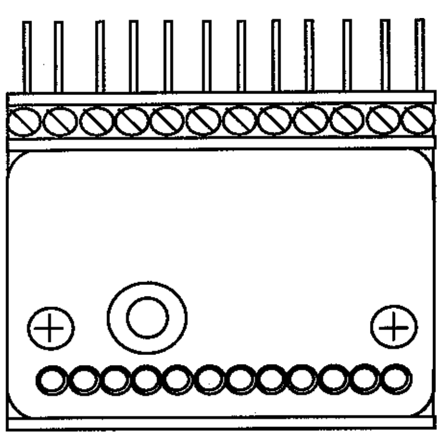
Used:
to test the power supply assembly



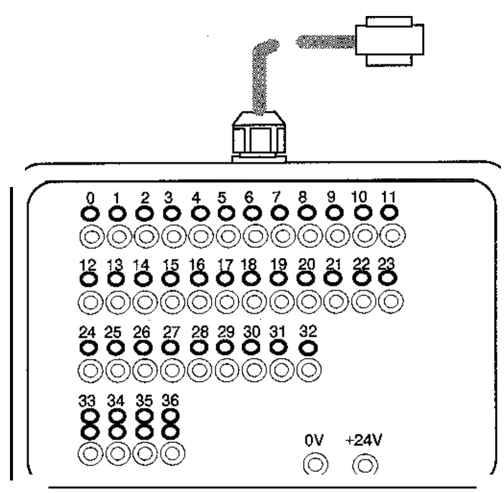
Connector no longer required
Test load unit is being redesigned

18.2 Test Unit for the PLC Inputs and Outputs

PL Test Unit, Id.No. 247 359 01
to test the PLC inputs and outputs at the PL

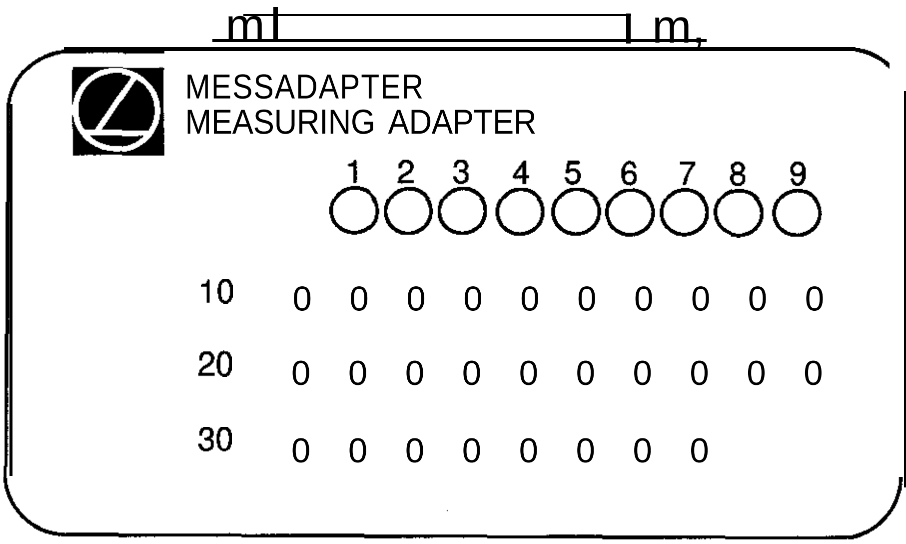


PLC Test Unit, Id.No. 247 361 01
to test the PLC inputs and outputs at the LE



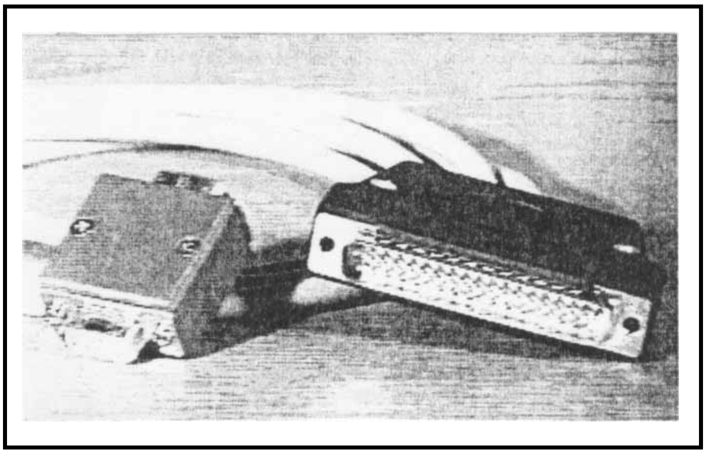
18.3 Measuring Adaptor - Id.No. 255 480 01

Used: to test the keyboard unit (see section 9.3)
as a universal test unit for D-sub connectors (9-pin to 37-pin)

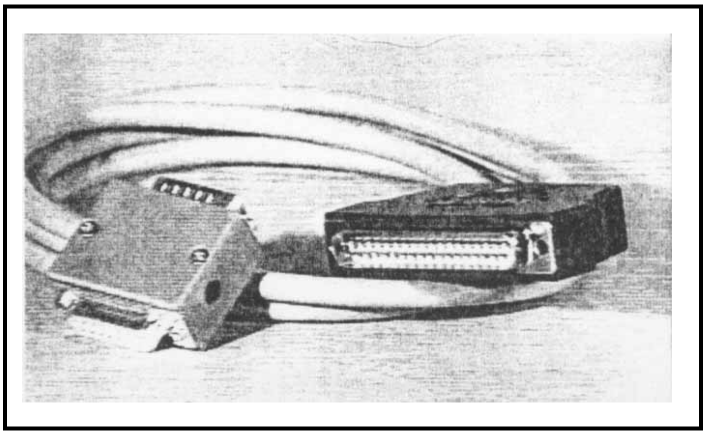


The measuring adaptor can be used to test the inputs and outputs of D-sub connectors (9-pin to 37-pin).
On the following page the adaptor cables required for each connector size are described.

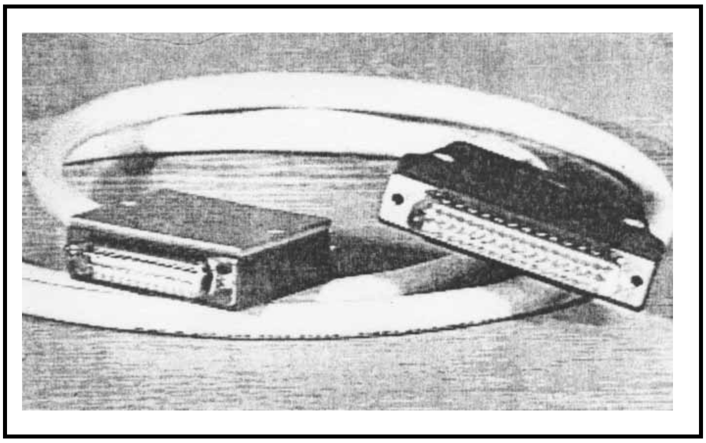
The measuring adaptor can also be used instead of the PLC test unit described on page 86 (without display)



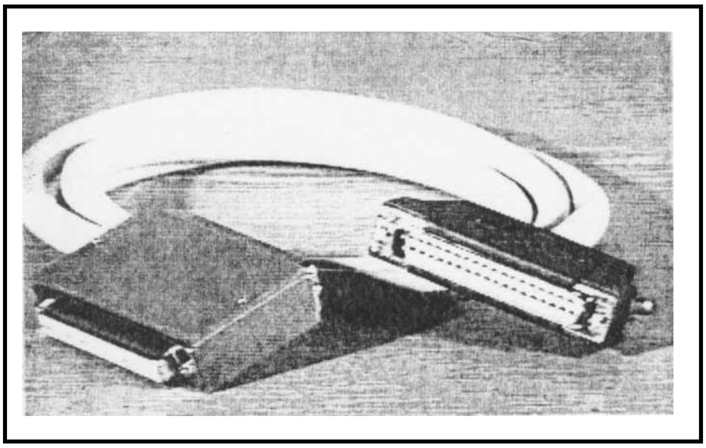
Adaptor Cable,9pin
Id.No. 255 481 01



Adaptor Cable, 15pin
Id.No. 255 482 01



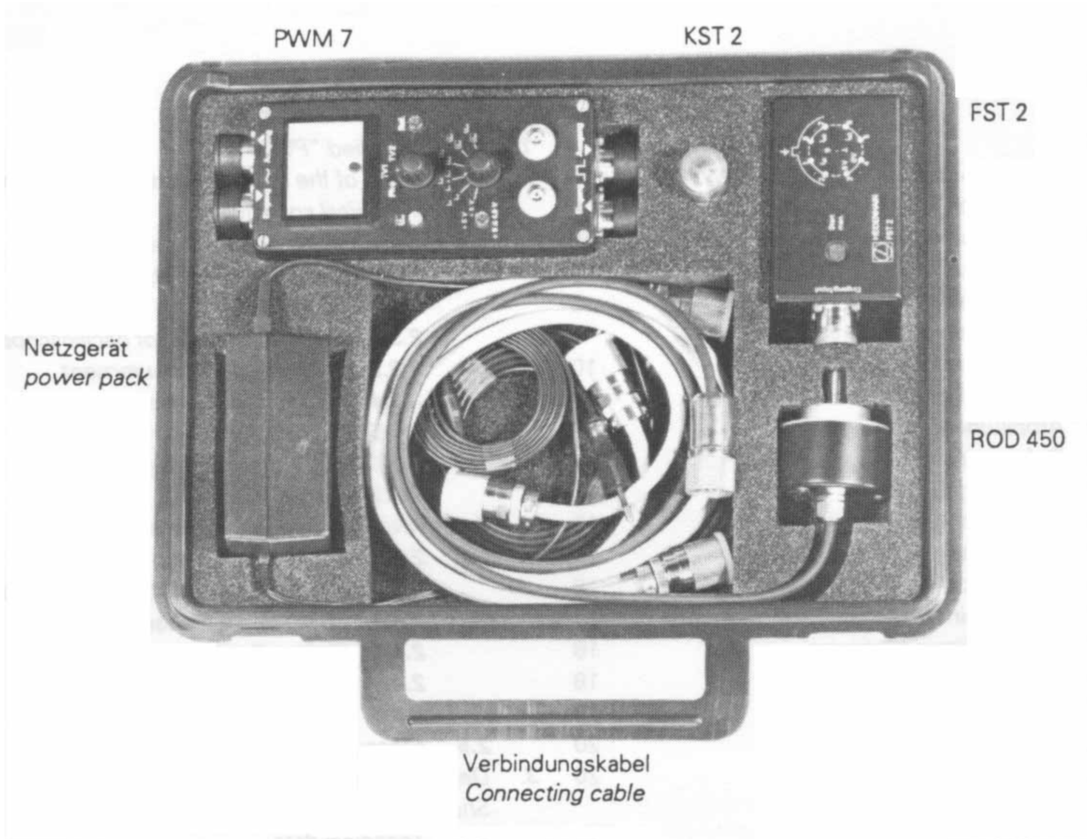
Adaptor Cable, 25pin
Id.No. 255 483 01



Adaptor Cable, 37pin
Id.No. 255 484 01

18.4 Encoder Diagnostic Set, Id.No. 254 599 02

Used:
- to test the electrical functions of an encoder
  (further information please see from the operating instructions of the Diagnostic Set)



19. Exchange Instructions

19.1 General Remarks

19.1.1 Equipment Required

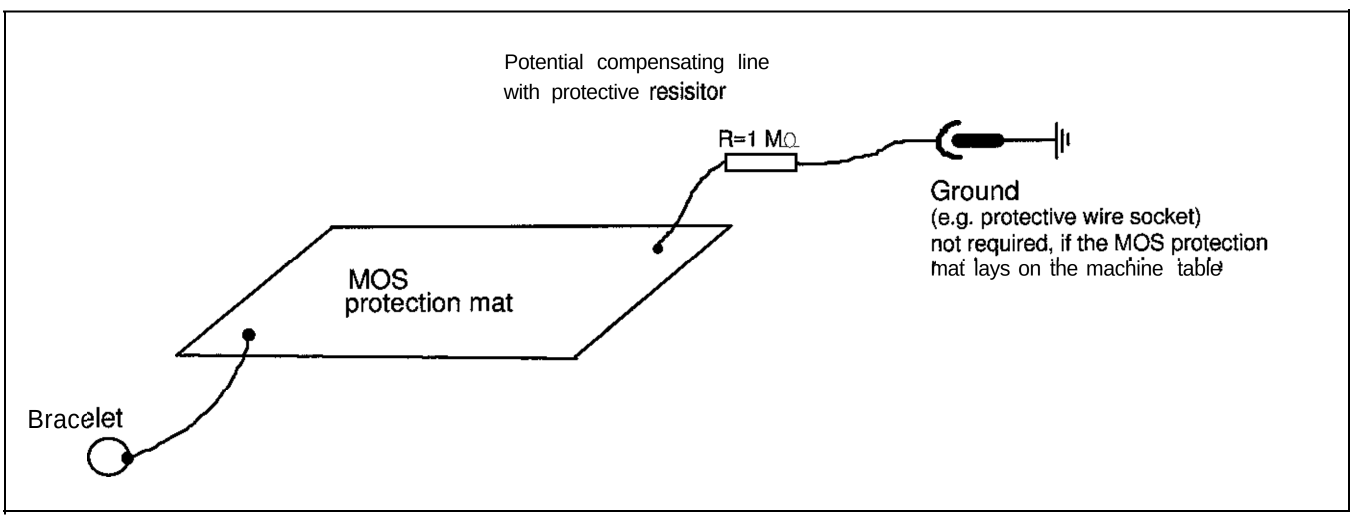
1 external data medium, e.g. FE 401/B or personal computer with connecting cable
1 tool set (screwdriver, socket wrench etc.)
1 MOS protection device (only required for exchanging boards or EPROMs)

19.12 MOS Protection

If the processor board, the PLC and graphics board, the CLP boards or EPROMs are to be exchanged, a MOS protection is definitely required, as otherwise MOS components on the boards or EPROMs may be destroyed.

Note:
Avoid any unprotected handling or contact of the boards or EPROMs with statically charged objects (packaging material, storage etc.).

MOS Protection



19.1.3 Software Compatibility

Exchange units (complete logic unit) are generally supplied with the latest software version. Exchange boards however, are always supplied without software and without software protection module.
For this reason, the EPROMs and the software enable module of the defective board must be inserted into the exchange board at site (see sec. 19.9). Before sending us exchange boards for repair, always remove the EPROMs and the software enable module.

19.1.4 Backing up RAM Data

Before the complete logic unit or the processor board is exchanged all files in the RAM must be backed up on at- external data medium.

The machine parameters and the part programs are always processed from the RAM and must be stored on an external data medium.

In the machine parameter MP7224 individual file types can be enabled:
e.g. tool tables, datum tables, pallet tables, ASCII files.
If all files or individual files are enabled, they need to be stored on an external data medium.

If the value of the machine parameter MP4010 is 1, the PLC program parts are processed from the RAM and must be backed up.

If the machine parameter MP730 is not 0, the multipoint axis error compensation is active for one or several axes. In this case, the compensation value list must be backed up as well.

Note:
For reasons of safety, the machine parameters, the compensation value list (if active) and the PLC program (if MP4010 = 1) should always be backed up on an external data medium. The procedure for data backup is described in section 15.3. Data backup is not required, if the data are already stored on an external data medium.

19.1.5 Determining Data for the Auxiliary Operating Modes:

If the processor board assembly or the complete logic unit are to be exchanged, or if a software exchange is to be carried out, the preset values and the current entry values of the auxiliary operating modes should be determined, so that they can be re-entered after the exchange.

Switch off and on the main switch of the machine tool

TNC Dialog Display	**Press Key**	**Remarks**
MEMORY TEST POWER INTERRUPTED	CE	
RELAY EXT. DC VOLTAGE MISSING		Switch on control voltage
MANUAL OPERATING MODE TRAVERSE REF. POINT .AXIS .AXIS .AXIS	MOD	**Do not yet traverse the reference points!**
POSITION DISPLAY (upper row) 0 0 0 0 0 ACTL REF LAG NOML DIST POSITION DISPLAY (lower row) 0 0 0 0 0 ACTL REF LAG NOML DIST The lower position display can be switched on with the soft key >STATUS ON< (only with split screen).		Note down the current setting for the position display the switch to ACTL by pressing ENT
CHANGE MM/INCH 0 0 MM INCH		Mark unit with a cross
PROGRAM ENTRY 0 0 HEIDENHAIN ISO		Mark type of program
LIMIT X- LIMIT X+ LIMIT Y- LIMIT Y+	Soft key >AXIS LIMIT<	Note down the limit values (Do not forget the algebraic sign!) If MP7490 = 1, three different limits may be active. In this case note down all 3 values.

TNC Dialog Display	Press Key	Remarks
LIMIT Z-		Note down the limit values (Do not forget the algebraic sign!)
LIMIT Z+		
LIMIT IV-		
LIMIT IV+		
LIMIT V-		
LIMIT V+	Soft key >END<	
ACTL X		Note down the preset values (Do not forget the algebraic sign!)
ACTL Y		
ACTL Z		
ACTL IV		(key on VDU)
ACTL V	MOD	
Software Number:		
NC	Soft key RS232/RS422 SETUP<	Note down the NC and PLC software numbers
PLC		
OPERATING MODE ME FE1 FEZ EXT1 EXT2 3 0 0 0 0		Mark the operating mode of the RS232 interface
BAUD RATE		
FE BAUD		Note down the Baud rates of the RS232 interface
EXT1 BAUD		
EXT2 BAUD		

TNC Dialog Display	Press Key	Remarks
OPERATING MODE ME FE1 FEZ EXT1 EXT2 0 0 0 0 0		Mark the operating mode of the RS422 interface
BAUD RATE FE [ ] BAUD EXT1 [ ] BAUD EXT2 [ ] BAUD		Note down the Baud rates of the RS422 interface
ALLOCATION PROGRAMMING 0 RS 323 0 RS422 TEST RUN 0 RS 3'23 0 RS422 PROGRAM RUN 0 RS 323 0 RS422	Soft key >END<	Mark the allocation of the interfaces to the operating modes

19.1.6 Labelling the Connecting Cables

If the connecting cables are labelled incompletely or not at all, they have to be marked such that the correct plug connections can be re-established after the exchange of the logic unit or of another assembly. (Pin layout: see section 5)

WARNING:
Switching the connecting cables may destroy the unit

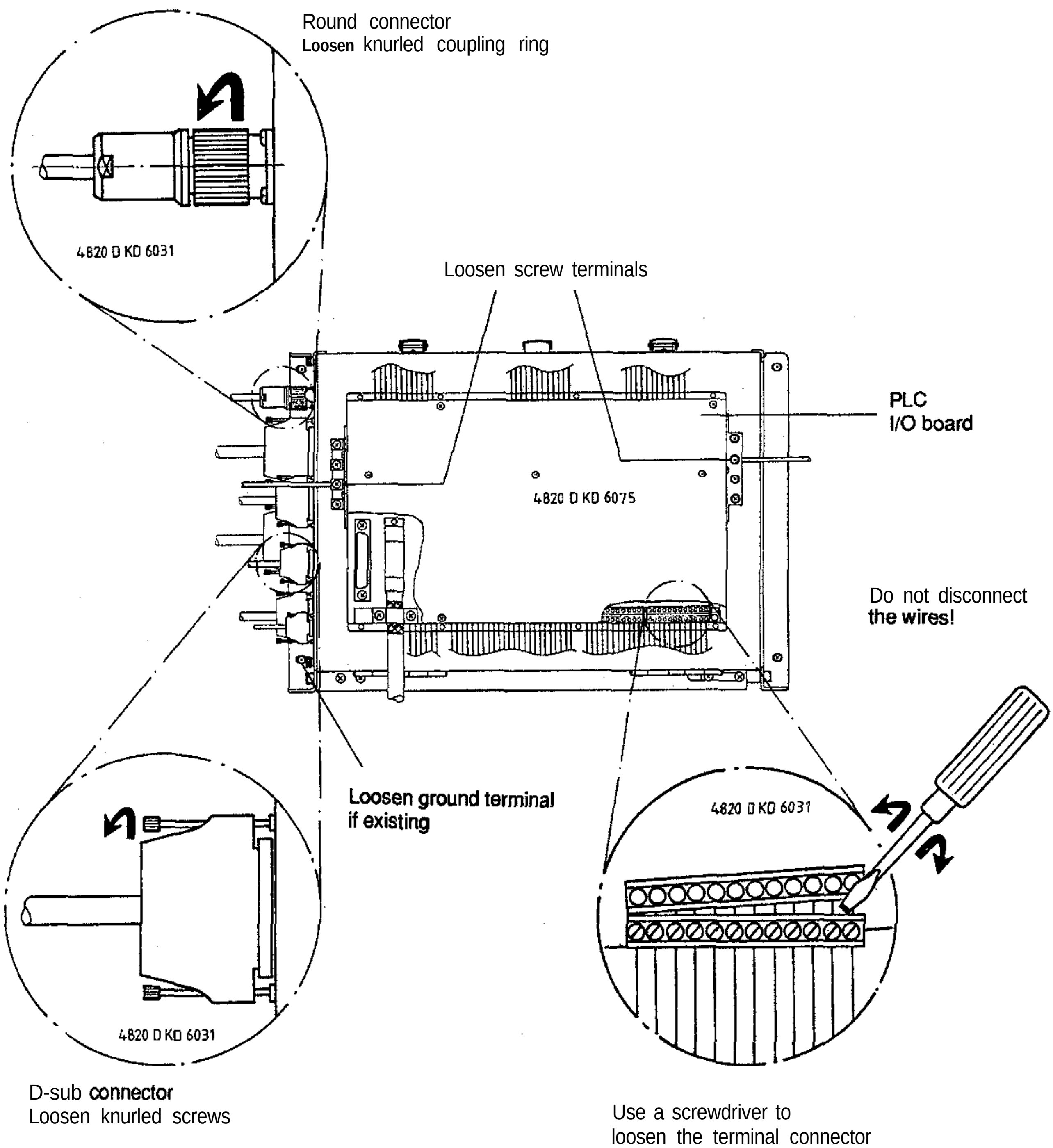
19.2 Exchanging the Logic Unit

192.1 Data Backup and Labelling of the Cables

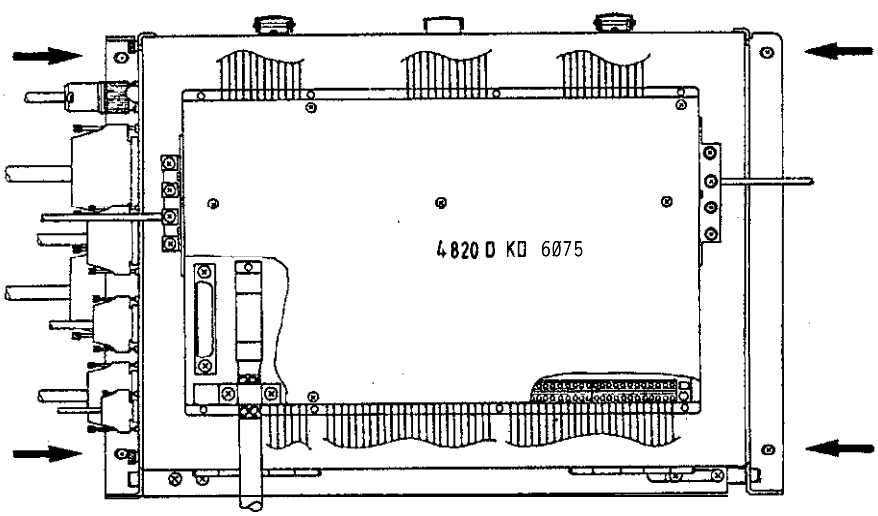
(see section 19.1)

19.2.2 Dismounting the Logic Unit

a) Switch off the main switch
b) Loosen all plug connectors and clamped joints at the logic unit
(pin layout: see section 5)



c) Loosen the 4 mounting screws on the logic unit



d) Remove the old logic unit and insert the new one.

19.23 Mounting of the Logic Unit

The logic unit is mounted in the reverse order that is was dismounted:
a) Insert the logic unit and secure it.
b) Engage connectors.

Observe that no connectors are switched!

c) Switch on the main switch.
d) Read in the machine tool data that have been backed up before the exchange (machine parameters, PLC program, NC programs and tables).
e) Enter preset values and supplementary operating modes from the table in section 19.1.5 **(before** ref. mark traverse).
f) Offset adjustment with code number (see section 16.5).

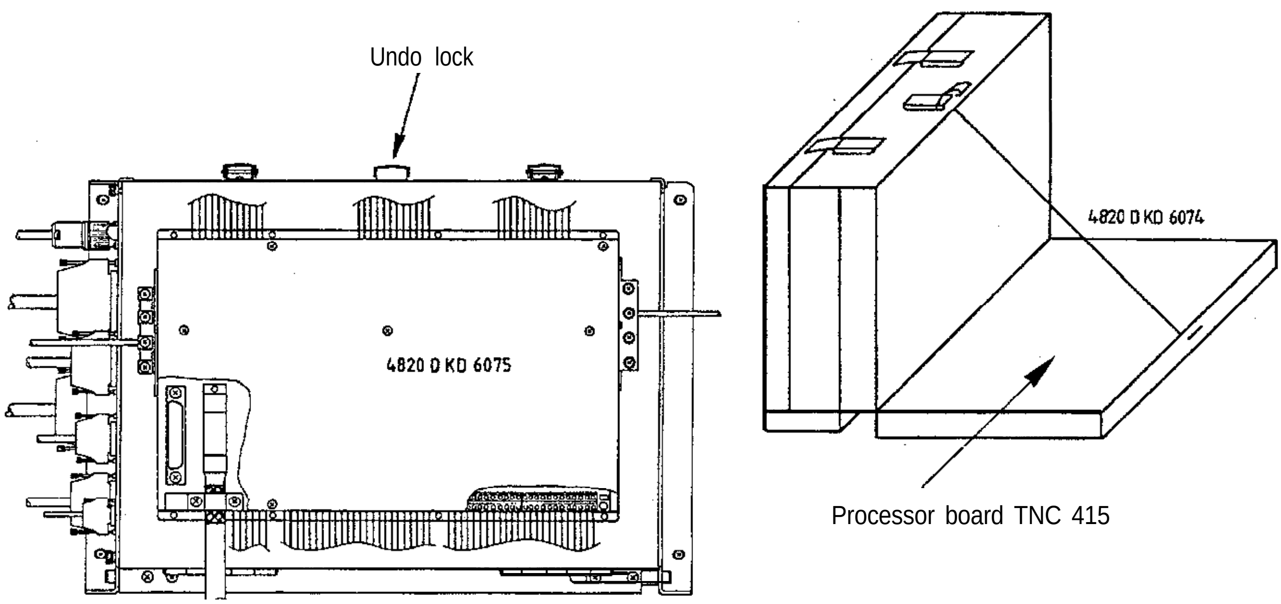
Exchange is now finished

19.3 Exchanging the TNC 415 Processor Board

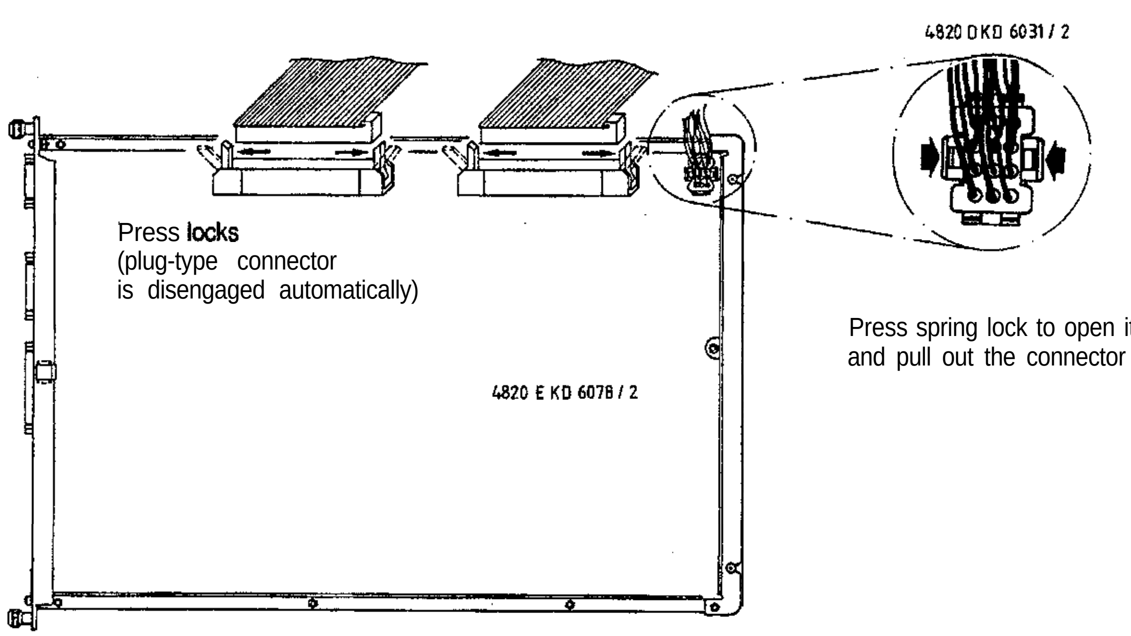
19.3.1 MOS-Protection, Software, Data Backup and Labelling of the Cables (see section 19. 1)

19.3.2 Dismounting the Processor Board

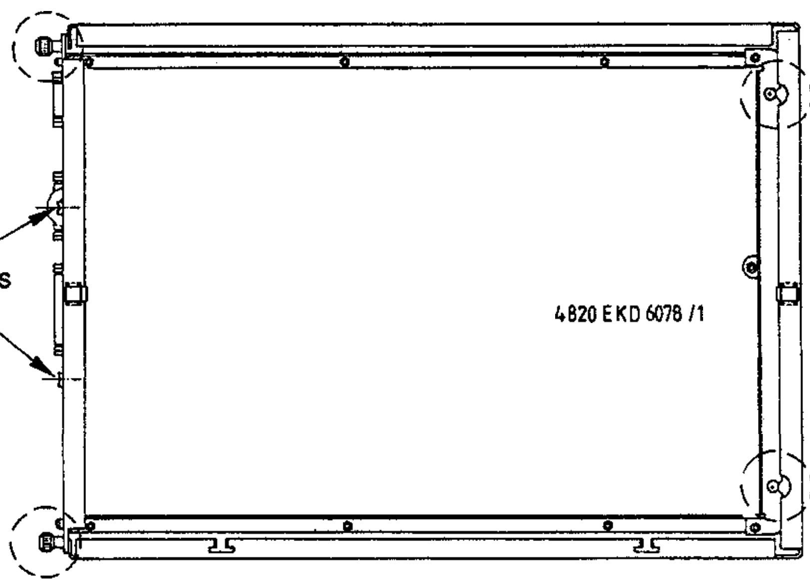
a) Switch off the main switch at the machine tool.
b) Loosen the connectors at the processor board (X21, X22, X231.
(Pin layout: see section 5)
c) Undo the lock and open the logic unit.



d) Disengage internal connectors



e) Loosen/remove the fixing screws



f) Lift out the processor board; exchange the **EPROMs,** if required (see section 19.9).
Insert the new board.

19.3.3 Mounting the Processor Board

The processor board is mounted in the reverse order that is was dismounted

a) Insert and secure the processor board.
b) Engage the connectors.

Observe that no connectors are switched!

c) **Close** the logic unit and close the lock.
d) Switch on the main switch.
e) Read in the machine tool data that have been backed up before the exchange (machine parameters, PLC program, NC programs and tables).
f) Enter preset values and supplementary operating modes from the tables in section 19.1.5 **(before** ref. mark traverse).
g) Offset adjustment with code number (see section 16.5).

Exchange is now finished

NOTE:
Send and store the boards only in the **original packaging** that protects them from acquiring static charge. Never use conventional plastics to wrap the boards in.

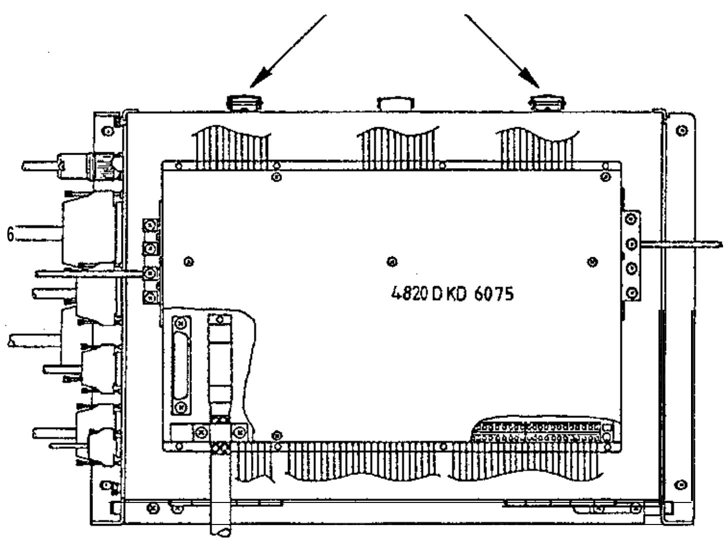
19.4 Exchanging the TNC 415 CLP Board

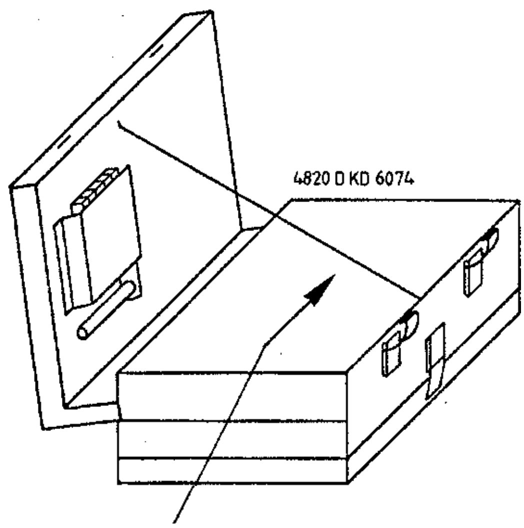
19.4.1 MOS-Protection, Software, Data Backup and Labelling of the Cables (see section 19.1)

19.4.2 Dismounting the CLP Board

a) Switch off the main switch at the machine tool.
b) Loosen the connectors at the CLP board (X1- X6, X8, X10, X12).
(Pin layout: see section 5.1
c) Undo the lock and open the logic unit

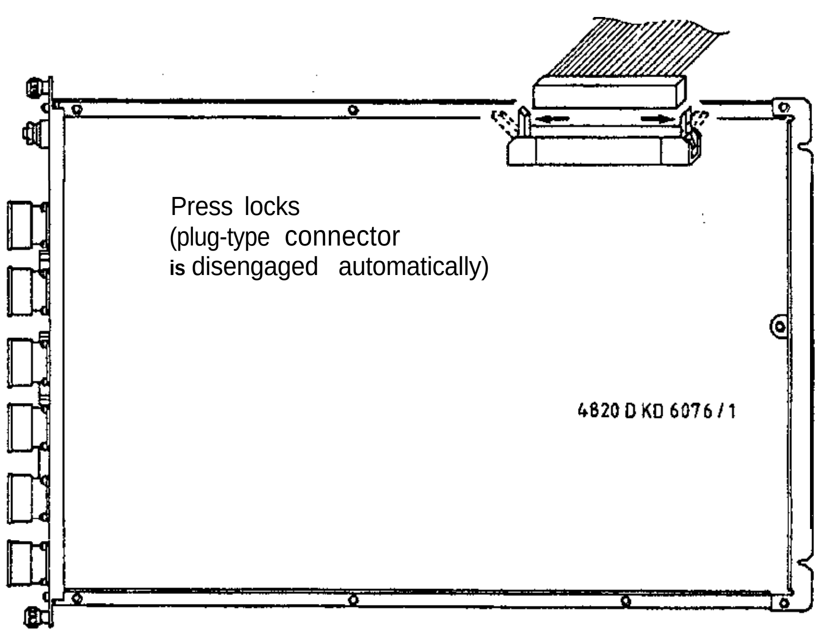
Undo lock



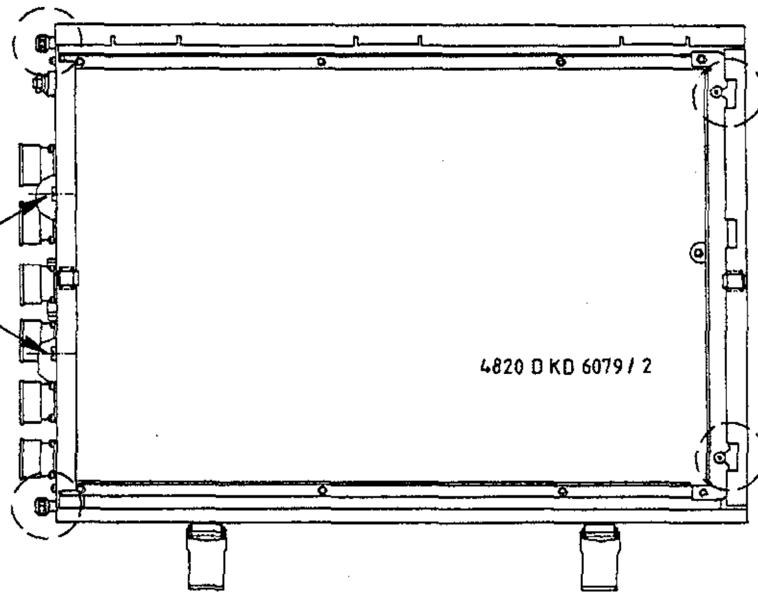


CLP board TNC 415

d) Disengage internal connectors



e) Loosen/remove the fixing screws



f) Lift out the CLP board: exchange the EPROMs, if required (see section 19.9).
Insert the new board.

19.4.3 Mounting the CLP Board

The CL'? board is mounted in the reverse order that is was dismounted.

a) Insert and secure the CLP board,
b) Engage the connectors.

Observe that no connectors are switched!

c) **Close** the logic unit and close the lock.
d) Switch on the main switch.
e) Offset adjustment with code number (see section 16.5)

Exchange is now finished

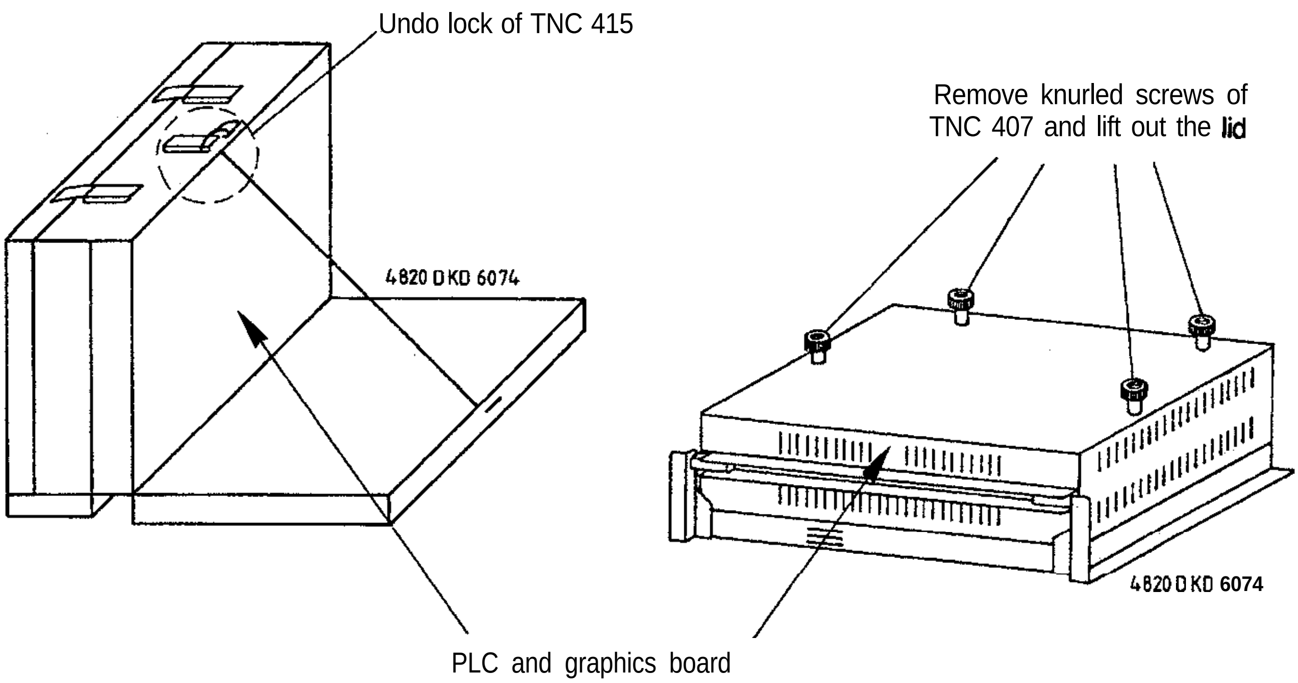
NOTE:
Send and store the boards only in the **original packaging** that protects them from acquiring static charge. Never use conventional plastics to wrap the boards in.

19.5 Exchanging the PLC and Graphics Board of TNC407/415

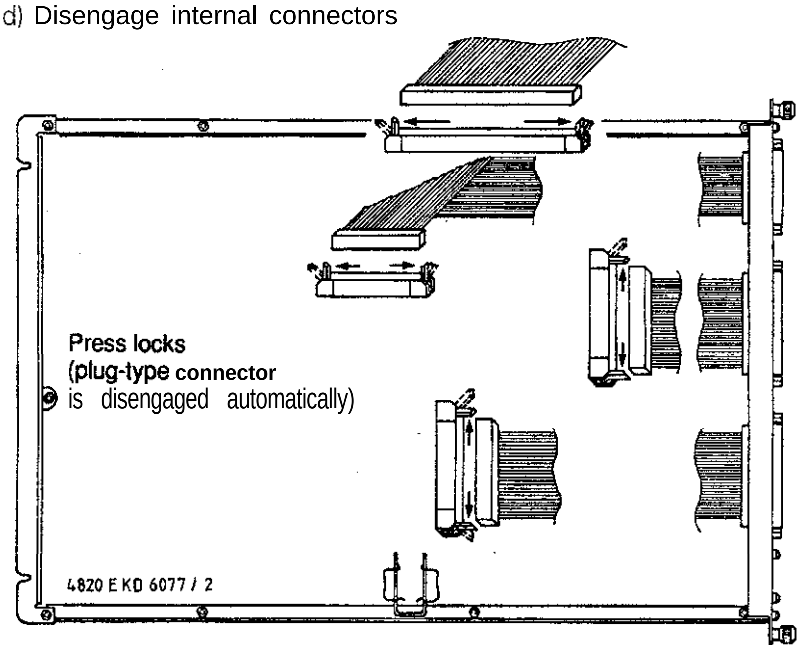
19.5.1 MOS-Protection and Labelling of the Cables
(see section 19.1)

19.5.2 Dismounting the PLC and Graphics Board

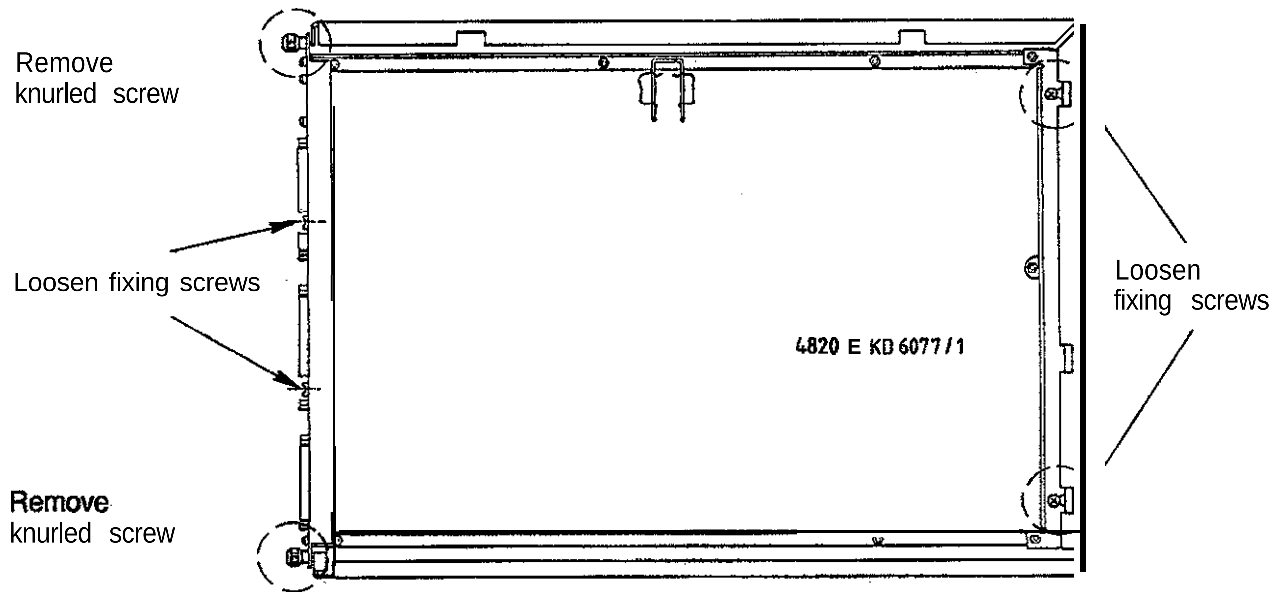
a) Switch off the main switch at the machine tool.
b) Loosen the connectors at the PLC and graphics board (X41 - X47)
(Pin layout: see section 5)
c) LE 407: Undo lock and open logic unit
LE 415: Remove knurled screws



d) Disengage internal connectors



e) Loosen/remove the fixing screws



f) Lift out the PLC and graphics board.
Insert the new board.

19.5.3 Mounting the PLC and Graphics Board

The PLC and graphics board is mounted in the reverse order that is was dismounted,

a) Insert and secure the CLP board.
b) Engage the connectors.

Observe that no connectors are switched!

c) **Close** the logic unit and close the lock.
d) Switch on the main switch.
e) Offset adjustment with code number (see section 16.5).

Exchange is now finished.

NOTE:
Send and store the boards only in the **original packaging** that protects them from acquiring static charge. Never use conventional plastics to wrap the boards in.

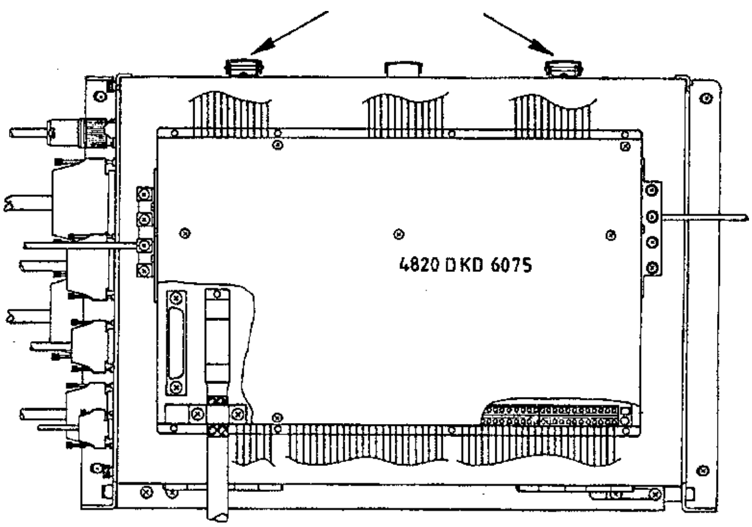
19.6 Exchanging the TNC 407 Processor Board

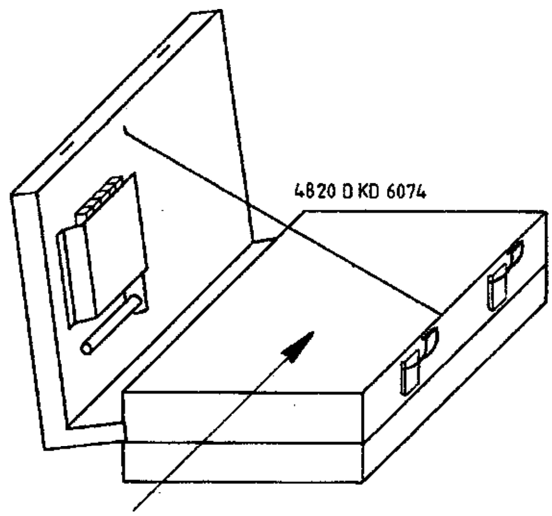
19.6.1 MO&Protection, Software, Data Backup and Labelling of the Cables

(see section 19.1)

19.6.2 Dismounting the Processor Board

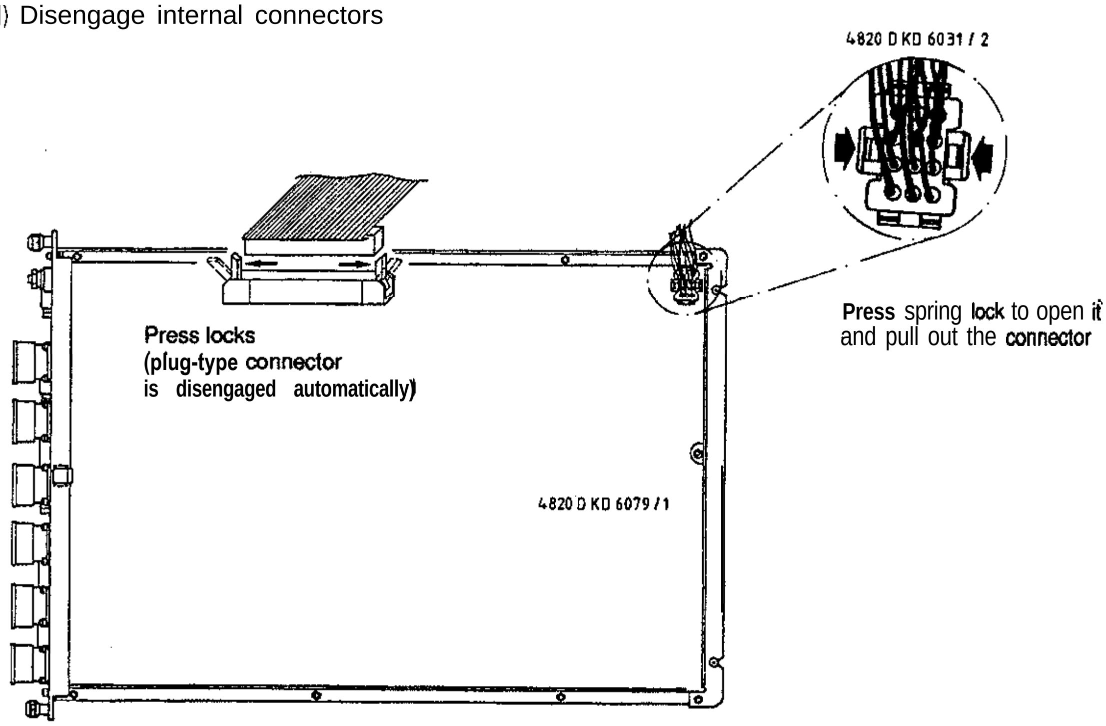
a) Switch off the main switch at the machine tool.
b) Loosen the connectors at the processor board (X1 to X6, X12 x21 to X23).
(Pin layout: see section 51
c) Undo the lock and open the logic unit.



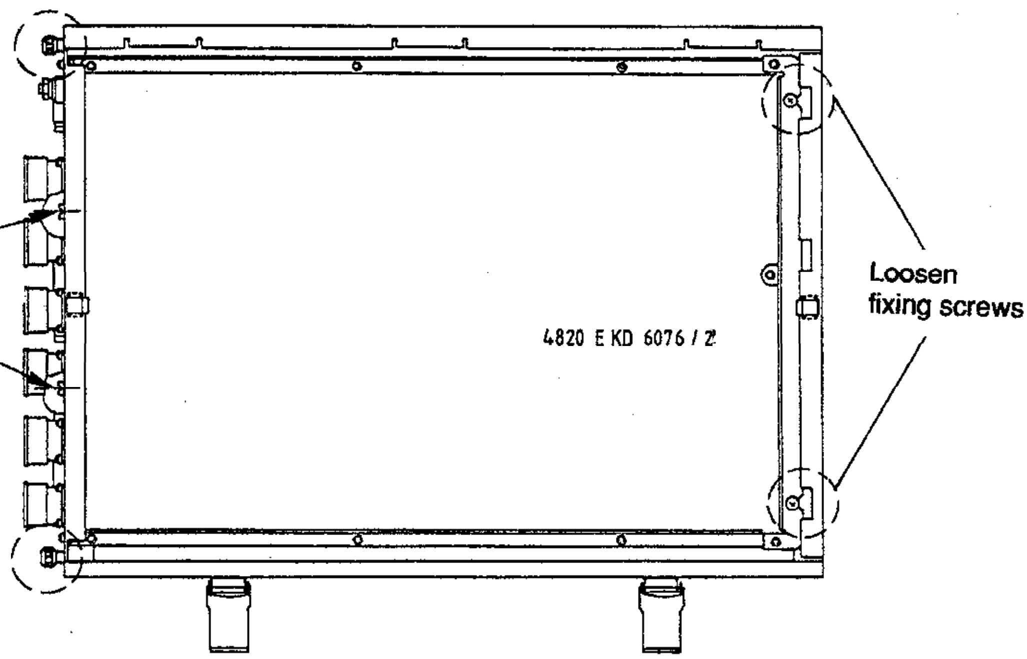


Processor board TNC 407

d) Disengage internal connectors



e) Loosen/remove the fixing screws



f) Lift out the processor board; exchange the EPROMs, if required (see section 19.9)
Insert the new board.

19.6.3 Mounting the Processor Board

The processor board is mounted in the reverse order that is was dismounted.

a) Insert and secure the processor board
b) Engage the connectors.

Observe that no connectors are switched!

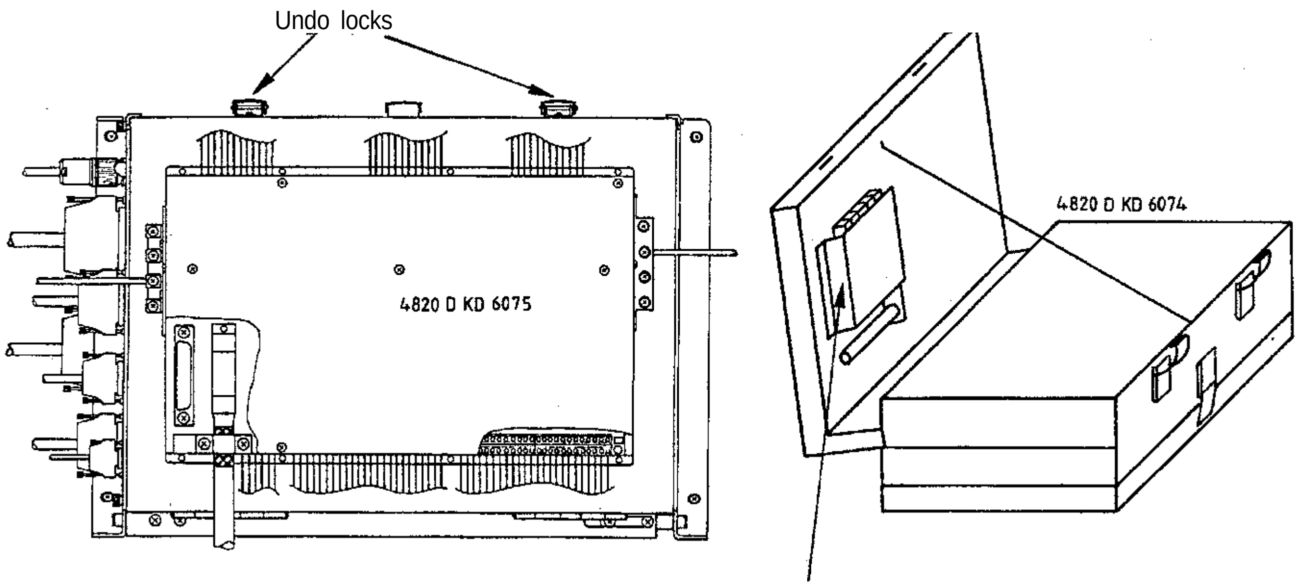
c) **Close** the logic unit and close the lock.
d) Switch on the main switch.
e) Read in the machine tool data that have been backed up before the exchange (machine parameters, PLC program, NC programs and tables).
f) Enter preset values and supplementary operating modes from the tables in section 19.1.5 **(before** ref. mark traverse).
g) Offset adjustment with code number (see section 16.5).

Exchange is now finished

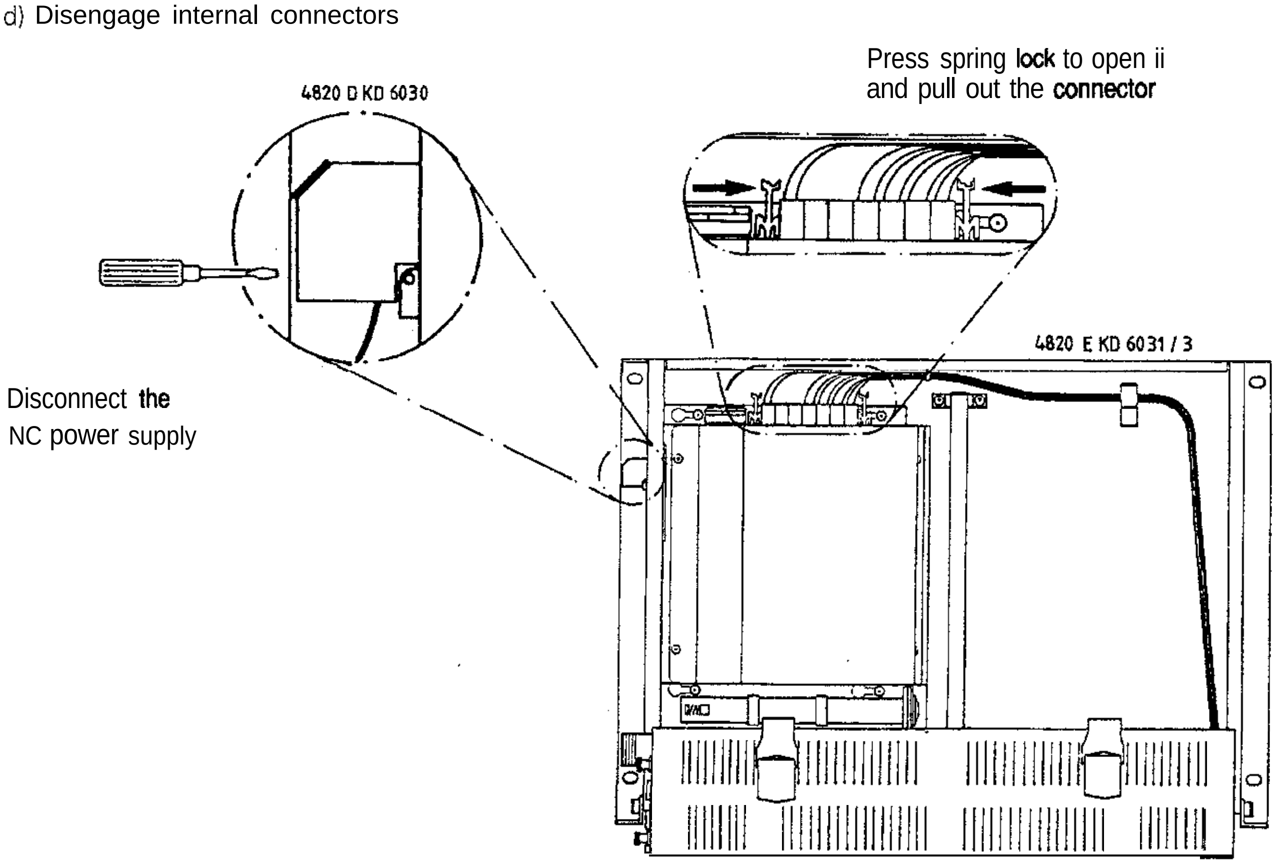
NOTE:
Send and store the boards only in the **original packaging** that protects them from acquiring static charge. Never use conventional plastics to wrap the boards in.

19.7 Exchanging the Power Supply Assembly of TNC 407/415

a) Switch off the main switch at the machine tool.
b) Undo the locks and open the logic unit.

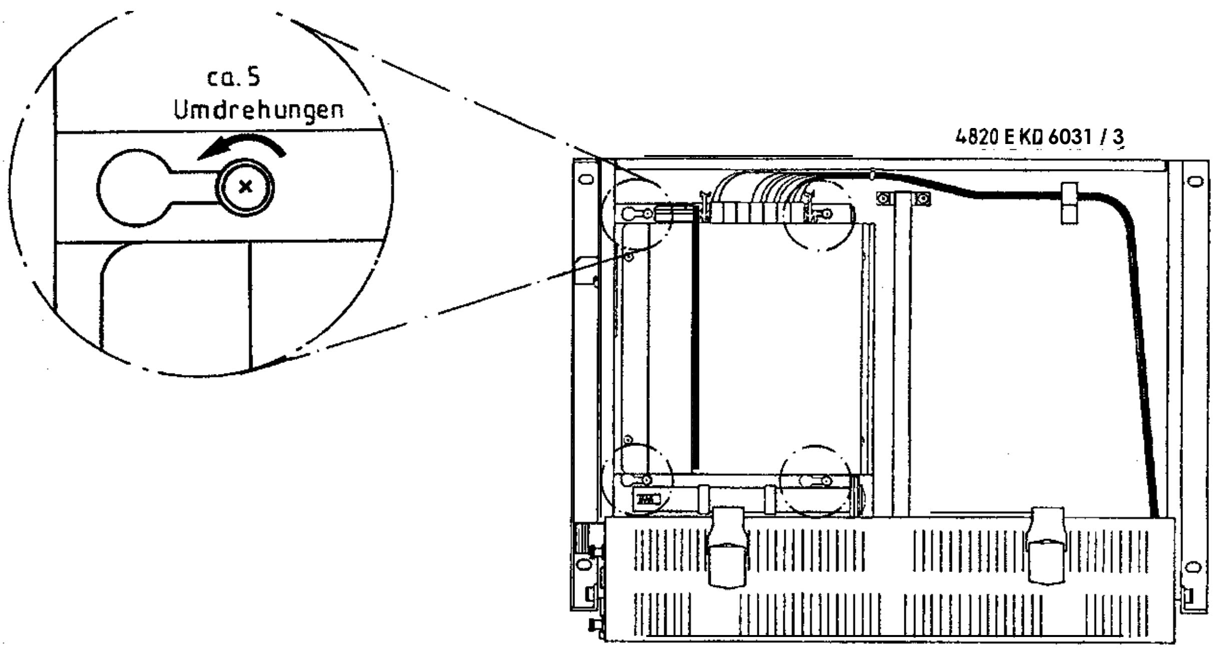


d) Disengage internal connectors



d) Loosen the mounting screws

Slide out the power supply unit to the right and insert the new power supply unit



e) Fasten the mounting screws, engage internal connectors

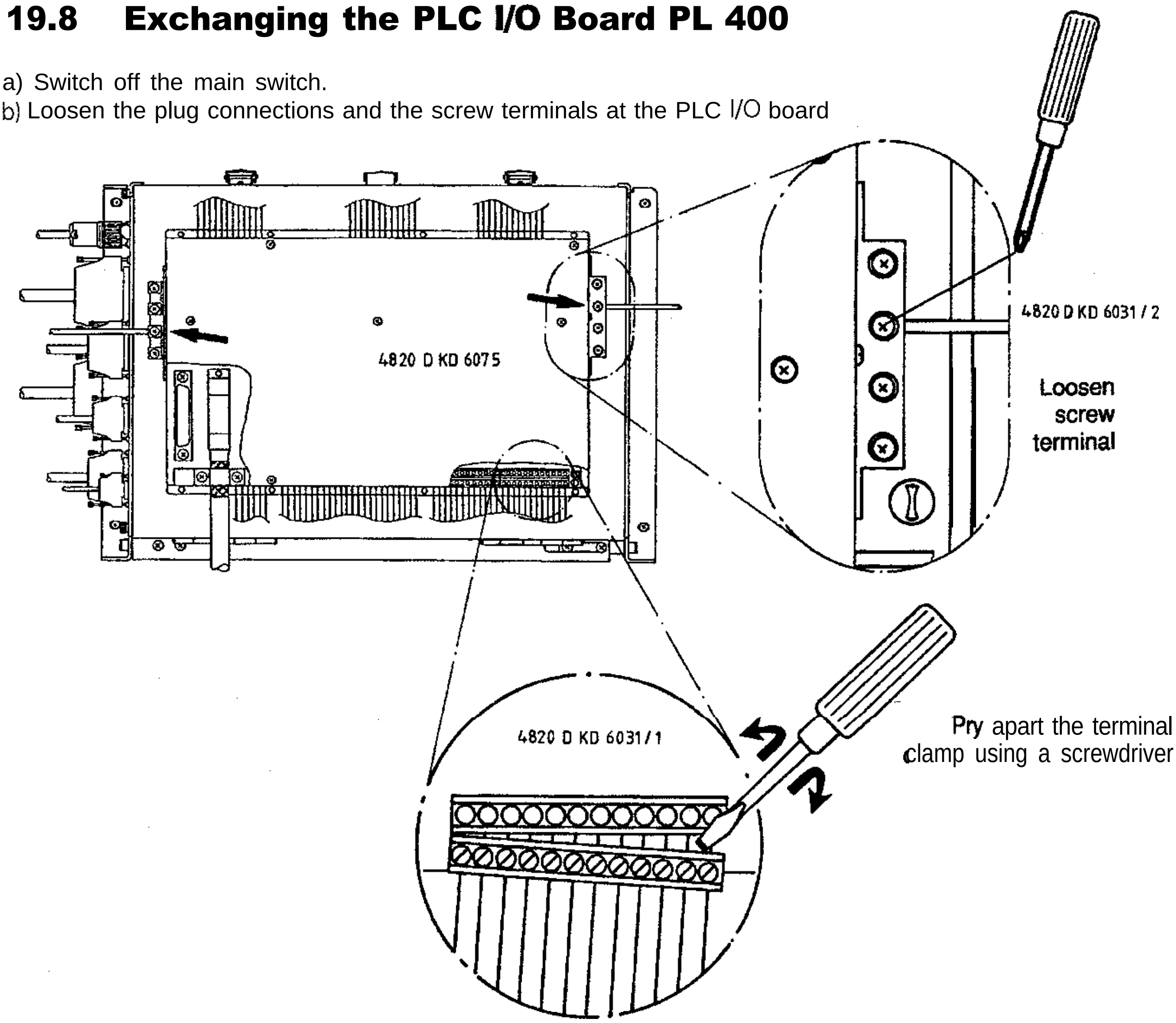
Observe that no connectors are switched!

f) Close the logic unit, switch on the main switch.

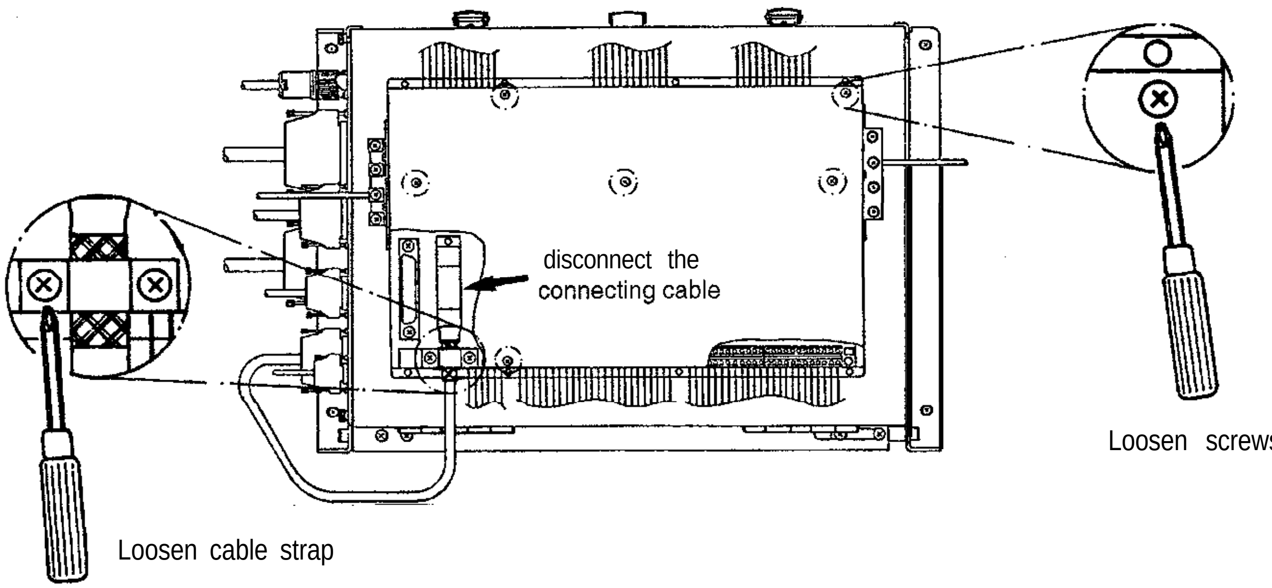
NOTE:
Send and store the boards only in the **original packaging** that protects them from acquiring static charge. Never use conventional plastics to wrap the boards in.

19.8 Exchanging the PLC I/O Board PL 400

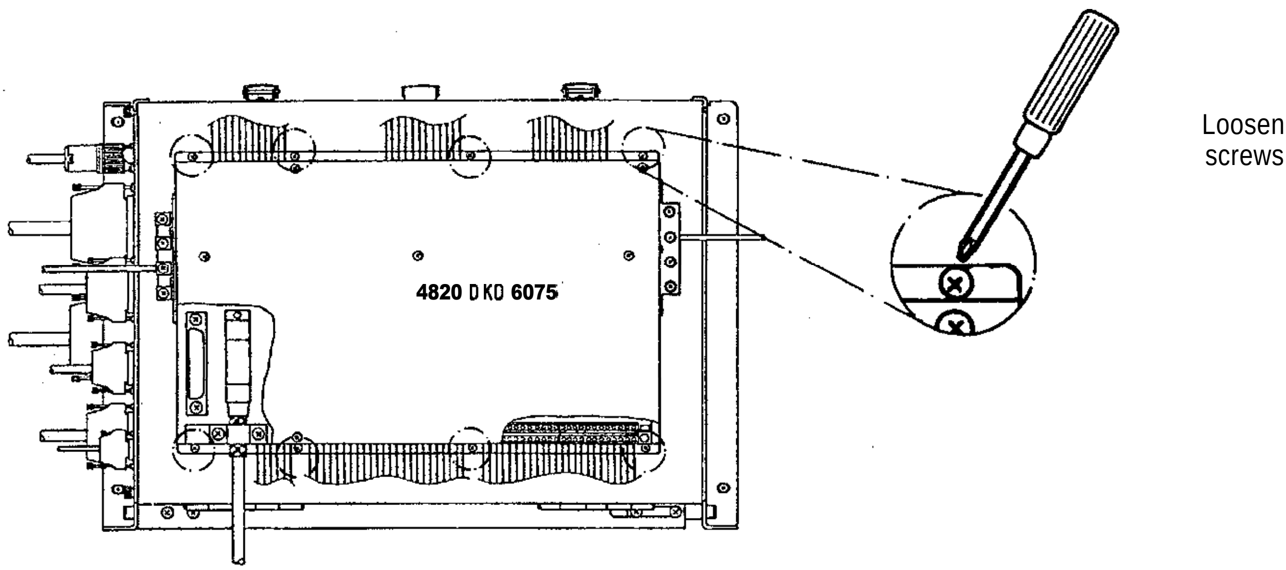
a) Switch off the main switch.
b) Loosen the plug connections and the screw terminals at the PLC I/O board



c) Loosen the screws from the cover of the PLC I/O board, remove cover and disconnect the connecting cable to the PLC board from the PLC I/O board.



d) Loosen the screws and remove the PLC I/O board



e) The new PLC I/O board is mounted in reverse order:
- Mount the PLC I/O board to the logic unit.
- Connect the PLC I/O board to the processor board.
  Engage the connectors.
- Switch on the main switch.

Exchange is now finished,

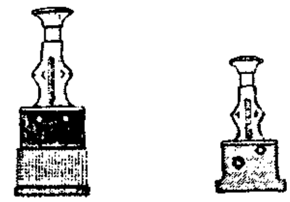
NOTE:
Send and store the boards only in the **original packaging** that protects them from acquiring static charge. Never use conventional plastics to wrap the boards in.

19.9 Exchanging EPROMs

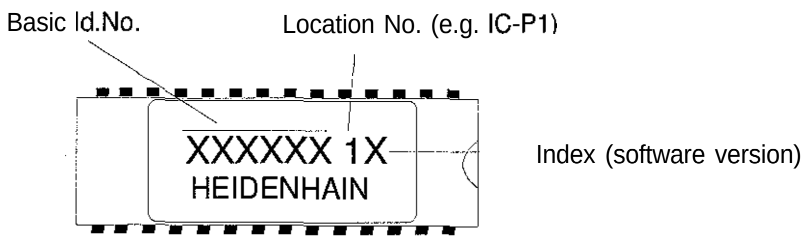
19.9.1 MOS Protection

For the exchange of EPROMs MOS-protection is indispensable, as otherwise the EPROMs could be destroyed by static charge. Moreover, all data should be backed up (see section 15.1).
Observe the mark on the EPROMs (do not turn them by 180”); be sure not to damage any components during the exchange. Use an appropriate tool.
After the software exchange, the logic unit must be marked with the new NC-software number (see section 14.1). The offset adjustment with code number should be performed as well (see section 16.5).

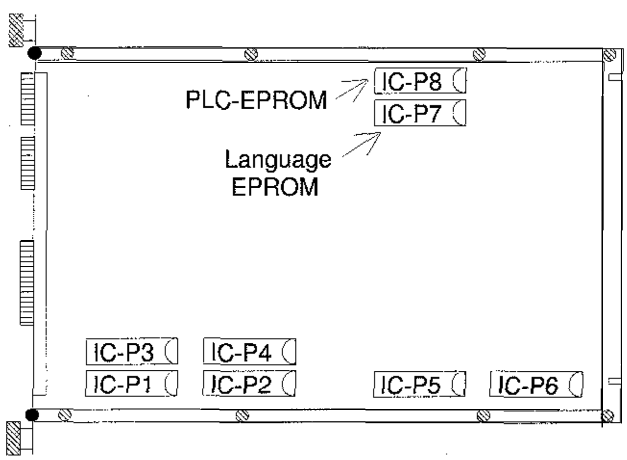
e.g. IC drawing punch and insertion tool



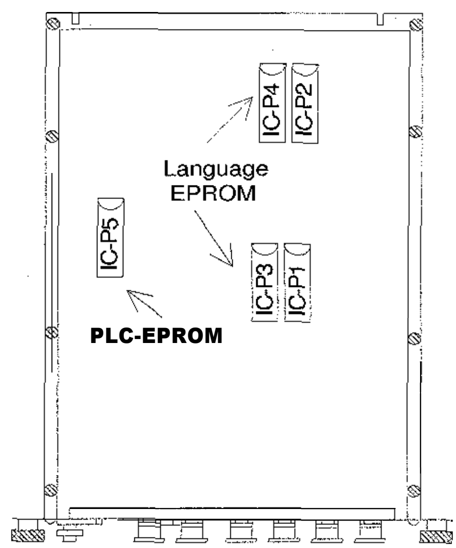
19.9.1 EPROM Designation



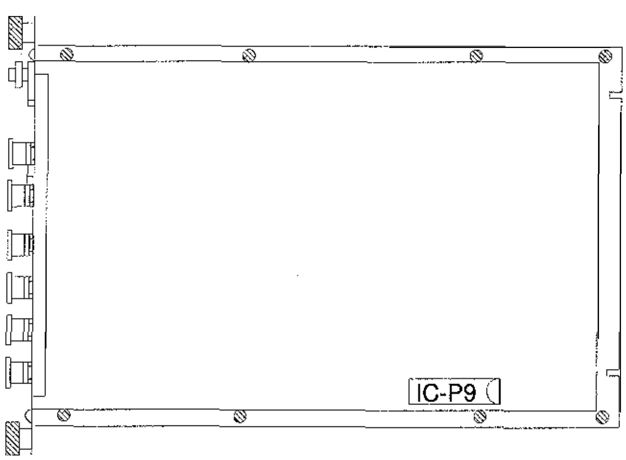
Processor Board TNC 415



Processor Board TNC 407



CLP Board TNC 415



20. Machine Parameters

The following list contains the machine parameters for all software versions. However, as some machine parameters are not valid for certain controls or have been introduced /eliminated with a certain software version, columns with symbols for differentiation have been added after the parameter numbers.

Explanation of the Symbols

◆ With this control, the machine parameter is valid for all software versions.

04 The machine parameter has been introduced with a certain software version (e.g. 04 means introduction with software version 04).

I04 The machine parameter has been eliminated starting with a certain software version (e.g. 04 means elimination as of software version 04). or it has been replaced by another parameter.

This machine parameter is not available on this control.

* The machine parameter is accessible via the code number 1'23.

Explanation of the Columns

407 AS	Old software 243 07.
415AS	Old software 243 05., 259 91.
407 NS	New software 243 02.
415 NS	New software 259 96.. 259 97.

Structure

The machine parameters are subdivided into groups.
Due to the structure of the parameter numbers, the list can be expanded easily.

0 999	Encoders and machine tool axes: allocation, evaluation, compensation
1000	Positioning
1400	Operation with feed precontrol
1700	Operation with servo lag
3000	Spindle control
4000	Integrated PLC
5000	Adaptation of the data interface
6000	Measurement with 3D-touch probe system
7100	Tapping
7200	Display and programming
7320	Colour allocation for colour screens
7330	User parameters
7400	Processing and program run
7600	Hardware

MACHINE PARAMETER LIST

(Excerpt from the Repair Handbook 1.0 TNC 4071415, section 10.2)

Code Numbers

123	MACHINE PARAMETER EDITING FOR END USERS (marked by *)
75368	OFFSET ADJUSTMENT
79513	DISPLAY OF VOLTAGE AND TEMPERATURE
86357	REMOVE EDIT/ERASE PROTECTION
95148	MP MODE
105296	COMPENSATION VALUE LIST
531210	RESETTING M 1000 TO M 2000 AND BYTES 0 - 127
620159	DOWNLOADING RUN-IN PROGRAM VIA INTERFACE
807667	PLC MODE
688379	INTERNAL OSCILLOSCOPE

Machine Parameters

The following list contains the machine parameters of all software versions.
Since, however, certain machine parameters are only valid for a certain software version or from a certain version on, the list contains columns with symbols for differentiation.

Explanation of the Symbols:

◆ = This machine parameter or entry value is valid for all software versions of this control model.
04 = This machine parameter has been introduced with a certain software version (e.g. 04 means that the MP has been introduced with the software version 04).
I04 = This machine parameter is inactive.
- = This machine parameter is not available with this control model.

Explanation of the Columns:

A = TNC 407 with NC software 243 07* -- (without digitizing)
B = TNC 415 with NC software 243 05* -- and 259 91* -- (without digitizing)
C = TNC 407 with NC software 243 02* -- (with digitizing)
D = TNC 415 with NC software 259 96* -- and 259 97* -- (with digitizing)
E = TNC 407 with NC software 243 03* --(equivalent to TNC 415B/425 software)
F = TNC 415 with NC software 280 58* -- (special software)
AE-6 = entry values for HEIDENHAIN test unit

User Parameters

By means of the MOD function "User Parameters" several machine parameters can be accessed easily (e.g. adaptation of the data interface). This user parameters accessible via MOD function are defined by the machine tool manufacturer through machine parameters.

Entry Values

Possible entry values are:

- The numbers 0 and 1 to select functions, signs, counting directions etc.
- Numerical values for feed rates, displacements etc.
- Decimal values that can be calculated by combining several functions (bit-coded).
- Bit patterns (marked by %), as of TNC407 with NC software 243 03* --
  e.g. MP 10: %00111
  i.e. X, Y, Z with encoder (1)
  IV, V without encoder (0)
- Hexadecimal values (marked by $), as of TNC407 with NC software 234 03* --
  e.g. MP 7353.0: $ 0F818A0

Structure

The machine parameters are subdivided into groups.
The machine parameter number are structured such that the list can be expanded easily.

0-999	Encoders and machine axes: allocation, evaluation, compensation
1000	Positioning
1400	Operation with feed forward control
1700	Operation with servo lag
3000	Spindle
4000	Integral PLC
5000	Adaptation of the data interface
6000	3D-touch probe (general parameters)
6210	Digitizing with 3D-touch probe
6500	Tool calibration with TT 110
7100	Tapping
7200	Display and Programming
7320	Colors, general display and FK graphics
7330	USER parameters
7350	Colors, general display and FK graphics
7400	Machining and program run
7600	Hardware

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Axes with encoder		10		◆	◆	◆	◆	◆	◆	0 = no encoder	
	X		0							+1 = X axis with encoder	% 11111
	Y		1							+2 = Y axis with encoder	(31)
	Z		2							+4 = Z axis with encoder	
	IV		3							+8 = IV. axis with encoder	
	V		4							+16 = V. axis with encoder	
Encoder monitoring		30		◆	◆	◆	◆	◆	◆	0 = no axis monitored	
Absolute position with distance-coded	X		0							+1 = X axis monitored	% 111111
reference marks	Y		1							+2 = Y axis monitored	(63)
	Z		2							+4 = Z axis monitored	
	IV		3							+8 = IV. axis monitored	
	V		4							+16 = V. axis monitored	
	S		5							+32 = S axis monitored	
Signal amplitude		31		◆	◆	◆	◆	◆	◆	0 = no axis monitored	
	X		0							+1 = X axis monitored	% 111111
	Y		1							+2 = Y axis monitored	(63)
	Z		2							+4 = Z axis monitored	
	IV		3							+8 = IV. axis monitored	
	V		4							+16 = V. axis monitored	
	S		5							+32 = S axis monitored	
Edge separation		32		◆	◆	◆	◆	◆	◆	0 = no axis monitored	
	X		0							+1 = X axis monitored	% 111111
	Y		1							+2 = Y axis monitored	(63)
	Z		2							+4 = Z axis monitored	
	IV		3							+8 = IV. axis monitored	
	V		4							+16 = V. axis monitored	
	S		5							+32 = S axis monitored	

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Screen display		40								0 = no display	
	X		0	◆	◆	◆	◆	◆	◆	+1 = X axis displayed	% 111111
	Y		1	◆	◆	◆	◆	◆	◆	+2 = Y axis displayed	(63)
	Z		2	◆	◆	◆	◆	◆	◆	+4 = Z axis displayed	
	IV		3	◆	◆	◆	◆	◆	◆	+8 = IV. axis displayed	
	V		4	◆	◆	◆	◆	◆	◆	+16 = V. axis displayed	
	S		5	-	-	-	-	-	-	+32 = position of controlled spindle (not with M03/M04)	
Controlled axes		50								0 = no axis controlled	
	X		0	◆	◆	◆	◆	◆	◆	+1 = X axis controlled	% 11111
	Y		1							+2 = Y axis controlled	(31)
	Z		2							+4 = Z axis controlled	
	IV		3							+8 = IV. axis controlled	
	V		4							+16 = V. axis controlled	
Auxiliary axes for the PLC		60		-	-	-	-	05	◆	0 = no auxiliary axis	
	X									+1 = X axis is auxiliary axis	% 00000
	Y									+2 = Y axis is auxiliary axis	(0)
	Z									+4 = Z axis is auxiliary axis	
	IV									+8 = IV. axis is auxiliary axis	
	V									+16 = V. axis is auxiliary axis	
Allocation of the encoder inputs to the machine axes										0 to 5	
	X	110.0		◆	◆	◆				0 = X1	0
	Y	110.1		◆	◆	◆				1 = X2	1
	Z	110.2		◆	◆	◆				2 = X3	2
	IV	110.3		◆	◆	◆				3 = X4	3
	V	110.4		◆	◆	◆				4 = X5	4
										5 = X6 [1]	

[1] X6 may only be used for a machine axes, if no regulated spindle (GS) is required.

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Allocation of the nominal value outputs to the machine axes	X	120.0		◆	◆	◆	◆	◆	◆	0 to 5 0 = output 1	0
	Y	120.1		◆	◆	◆	◆	◆	◆	1 = output 2	1
	Z	120.2		◆	◆	◆	◆	◆	◆	2 = output 3	2
	IV	120.3		◆	◆	◆	◆	◆	◆	3 = output 4	3
	V	120.4		◆	◆	◆	◆	◆	◆	4 = output 5	4
	S	120.5		◆	◆	◆	◆	◆	◆	5 = output S [1]	
Counting direction of the encoder signals		210		◆	◆	◆	◆	◆	◆	0 = positive	
	X		0							+1 = X axis negative	% 00000
	Y		1							+2 = Y axis negative	(0)
	Z		2							+4 = Z axis negative	
	IV		3							+8 = IV. axis negative	
	V		4							+16 = V. axis negative	
	S										
Signal period										0.1 to 1000 [µm]	
(Displacement per grating period.	X	330.0		◆	◆	◆	◆	◆	◆		20
Consider the screw pitch when using a	Y	330.1		◆	◆	◆	◆	◆	◆		20
rotary encoder)	Z	330.2		◆	◆	◆	◆	◆	◆		20
With square-wave input signals the	IV	330.3		◆	◆	◆	◆	◆	◆		20
displacement per square-wave period must	V	330.4		◆	◆	◆	◆	◆	◆		20
be indicated (consider external interpolation).	S										

[1] S-analogue may only be used for a machine axes, if no analogue output of the spindle speed is required.

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
EXE interpolation factor at encoder input										0, 1, 5	
	X	340.0		-	-	03	-	◆	◆	0 = no EXE	0
	Y	340.1		-	-	03	-	◆	◆	1 = 1-fold EXE	0
	Z	340.2		-	-	03	-	◆	◆	5 = 5-fold EXE	0
	IV	340.3		-	-	03	-	◆	◆		0
	V	340.4		-	-	03	-	◆	◆		0
Axis designation											
	VI	410.3		◆	◆	◆	◆	◆	◆	0 = A 1 = B 2 = C	4
	V	410.4		◆	◆	◆	◆	◆	◆	3 = U 4 = V 5 = W	5
Hirth coupling											
Activation	VI	420.3		◆	◆	◆	◆	◆	◆	0 = inactive	0
	V	420.4		◆	◆	◆	◆	◆	◆	1 = active	0
Defined steps											
	VI	430.3		◆	◆	◆	◆	◆	◆	0 to 30.0000 [°]	1
	V	430.4		◆	◆	◆	◆	◆	◆		1

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Axis compensations:											
Backlash compensation	X	710.0		◆	◆	◆	◆	◆	◆	-1.0000 to +1.0000 [mm]	0
	Y	710.1		◆	◆	◆	◆	◆	◆		0
	Z	710.2		◆	◆	◆	◆	◆	◆		0
	IV	710.3		◆	◆	◆	◆	◆	◆		0
	V	710.4		◆	◆	◆	◆	◆	◆		0
Compensation of reversal spikes with circular movements	X	711.0		-	-	◆	◆	◆	◆	0 to 1 [mm]	0
• magnitude of reversal spike	Y	711.1		-	-	◆	◆	◆	◆		0
	Z	711.2		-	-	◆	◆	◆	◆		0
	IV	711.3		-	-	◆	◆	◆	◆		0
	V	711.4		-	-	◆	◆	◆	◆		0
• feed rate to compensate the reversal spike	X	712.0		-	-	◆	◆	◆	◆	0 to 1 [mm per CLP cycle time]	0
	Y	712.1		-	-	◆	◆	◆	◆		0
	Z	712.2		-	-	◆	◆	◆	◆		0
	IV	712.3		-	-	◆	◆	◆	◆		0
	V	712.4		-	-	◆	◆	◆	◆		0
• magnitude of reversal spike (only effective with M05)	X	715.0		-	-	-	-	08	◆	0 to 1 [mm]	0
	Y	715.1		-	-	-	-	08	◆		0
	Z	715.2		-	-	-	-	08	◆		0
	IV	715.3		-	-	-	-	08	◆		0
	V	715.4		-	-	-	-	08	◆		0
• feed rate to compensate the reversal spike (only effective with M05)	X	716.0		-	-	-	-	08	◆	0 to 1 [mm per CLP cycle time]	0
	Y	716.1		-	-	-	-	08	◆		0
	Z	716.2		-	-	-	-	08	◆		0
	IV	716.3		-	-	-	-	08	◆		0
	V	716.4		-	-	-	-	08	◆		0

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Factor for multipoint axis error compensation	X	720.0		◆	◆	◆	◆	◆	◆	-1.0000 to +1.0000 [mm]	0
	Y	720.1		◆	◆	◆	◆	◆	◆		0
	Z	720.2		◆	◆	◆	◆	◆	◆		0
	IV	720.3		◆	◆	◆	◆	◆	◆		0
	V	720.4		◆	◆	◆	◆	◆	◆		0
Multipoint axis error compensation		730								0 = linear compensation active	
	X		0	◆	◆	◆	◆	◆	◆	+1 = X axis, multipoint compensation active	% 00000
	Y		1							+2 = Y axis, multipoint compensation active	(0)
	Z		2							+4 = Z axis, multipoint compensation active	
	IV		3							+8 = IV. axis, multipoint compensation active	
	V		4							+16 = V. axis, multipoint compensation active	
Display mode										0 to ± 99 999.9999 [mm] or [°]	
for rotary axes and PLC auxiliary axes	X	810.0		-	-	-	-	◆	◆	0 = display ± 99 999.9999	0
	Y	810.1		-	-	-	-	◆	◆	(software limit switch active)	0
	Z	810.2		-	-	-	-	◆	◆	≠ 0 modulo value for display	0
	IV	810.3		-	-	-	-	◆	◆	(software limit switch inactive)	0
	V	810.4		-	-	-	-	◆	◆		0

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Gantry axes										0 to 5	
Configuration	X	850.0		-	-	-	-	08	◆	0 = main axis	
	Y	850.1		-	-	-	-	08	◆	1 = coupled with X axis	0
	Z	850.2		-	-	-	-	08	◆	2 = coupled with Y axis	0
	IV	850.3		-	-	-	-	08	◆	3 = coupled with Z axis	0
	V	850.4		-	-	-	-	08	◆	4 = coupled with IV. axis	0
										5 = coupled with V. axis	0
Monitoring the parallel movement of the										0 to 100.0000 [mm]	
coupled axes	X	855.0		-	-	-	-	-	02	0 = monitoring inactive	0
	Y	855.1		-	-	-	-	-	02	≠ 0 maximum deviation of master	0
	Z	855.2		-	-	-	-	-	02	and slave axes	0
	IV	855.3		-	-	-	-	-	02		0
	V	855.4		-	-	-	-	-	02		0
Defining the relationship between the axes										0, 1	
	X	860.0		-	-	-	-	08	◆	0 = referenced to position after power-on	0
	Y	860.1		-	-	-	-	08	◆	1 = referenced to REF marks (machine datum)	0
	Z	860.2		-	-	-	-	08	◆		0
	IV	860.3		-	-	-	-	08	◆		0
	V	860.4		-	-	-	-	08	◆		0

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Software limit switch ranges										
Range 1	X+	910.0	◆	◆	◆	◆	◆	◆	linear axis:	+99 999.9999
Default setting after power-on:	Y+	910.1	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [mm]	"
	Z+	910.2	◆	◆	◆	◆	◆	◆		"
Activation via PLC:	IV+	910.3	◆	◆	◆	◆	◆	◆	rotary axis:	"
M2817 = 0, M2816 = 0	V+	910.4	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [°]	"
strobe marker M2824	X-	920.0	◆	◆	◆	◆	◆	◆		-99 999.9999
	Y-	920.1	◆	◆	◆	◆	◆	◆		"
	Z-	920.2	◆	◆	◆	◆	◆	◆		"
	IV-	920.3	◆	◆	◆	◆	◆	◆		"
	V-	920.4	◆	◆	◆	◆	◆	◆		"
Range 2										
	X+	911.0	◆	◆	◆	◆	◆	◆	linear axis:	+99 999.9999
Activation via PLC:	Y+	911.1	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [mm]	"
M2817 = 0, M2816 = 1	Z+	911.2	◆	◆	◆	◆	◆	◆		"
strobe marker M2824	IV+	911.3	◆	◆	◆	◆	◆	◆	rotary axis:	"
	V+	911.4	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [°]	"
	X-	921.0	◆	◆	◆	◆	◆	◆		-99 999.9999
	Y-	921.1	◆	◆	◆	◆	◆	◆		"
	Z-	921.2	◆	◆	◆	◆	◆	◆		"
	IV-	921.3	◆	◆	◆	◆	◆	◆		"
	V-	921.4	◆	◆	◆	◆	◆	◆		"
Range 3										
	X+	912.0	◆	◆	◆	◆	◆	◆	linear axis:	+99 999.9999
Activation via PLC:	Y+	912.1	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [mm]	"
M2817 = 1, M2816 = 1	Z+	912.2	◆	◆	◆	◆	◆	◆		"
strobe marker M2824	IV+	912.3	◆	◆	◆	◆	◆	◆	rotary axis:	"
	V+	912.4	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [°]	"
	X-	922.0	◆	◆	◆	◆	◆	◆		-99 999.9999
	Y-	922.1	◆	◆	◆	◆	◆	◆		"
	Z-	922.2	◆	◆	◆	◆	◆	◆		"
	IV-	922.3	◆	◆	◆	◆	◆	◆		"
	V-	922.4	◆	◆	◆	◆	◆	◆		"

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Datum for positioning blocks with M92	X	950.0	◆	◆	◆	◆	◆	◆	linear axis:	0
(referenced to the machine datum)	Y	950.1	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [mm]	0
	Z	950.2	◆	◆	◆	◆	◆	◆		0
	IV	950.3	◆	◆	◆	◆	◆	◆	rotary axis:	0
	V	950.4	◆	◆	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [°]	0
Target position for simulated tool change for TOOL CALL during block scan	X	951.0	-	-	09	09	08	◆	linear axis:	0
	Y	951.1	-	-	09	09	08	◆	-99 999.9999 to +99 999.9999 [mm]	0
	Z	951.2	-	-	09	09	08	◆		0
	IV	951.3	-	-	09	09	08	◆	rotary axis:	0
	V	951.4	-	-	09	09	08	◆	-99 999.9999 to +99 999.9999 [°]	0
Shifting the machine datum (referenced to the REF mark of the encoder)	X	960.0	-	-	◆	◆	◆	◆	linear axis:	0
	Y	960.1	-	-	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [mm]	0
	Z	960.2	-	-	◆	◆	◆	◆		0
	IV	960.3	-	-	◆	◆	◆	◆	rotary axis:	0
	V	960.4	-	-	◆	◆	◆	◆	-99 999.9999 to +99 999.9999 [°]	0

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Rapid traverse	X	1010.0		◆	◆	◆	◆	◆	◆	linear axis:	10000
	Y	1010.1		◆	◆	◆	◆	◆	◆	10 to 30 000 [mm/min]	10000
	Z	1010.2		◆	◆	◆	◆	◆	◆		10000
	IV	1010.3		◆	◆	◆	◆	◆	◆	rotary axis:	10000
	V	1010.4		◆	◆	◆	◆	◆	◆	10 to 30 000 [°/min]	10000
Manual feed											
	X	1020.0		◆	◆	◆	◆	◆	◆	linear axis:	10000
	Y	1020.1		◆	◆	◆	◆	◆	◆	10 to 30 000 [mm/min]	10000
	Z	1020.2		◆	◆	◆	◆	◆	◆		10000
	IV	1020.3		◆	◆	◆	◆	◆	◆	rotary axis:	10000
	V	1020.4		◆	◆	◆	◆	◆	◆	10 to 30 000 [°/min]	10000
Positioning window											
	X	1030.0		◆	◆	◆	◆	◆	◆	linear axis:	0.05
	Y	1030.1		◆	◆	◆	◆	◆	◆	0.0001 to 2.0000 [mm]	0.05
	Z	1030.2		◆	◆	◆	◆	◆	◆		0.05
	IV	1030.3		◆	◆	◆	◆	◆	◆	rotary axis:	0.05
	V	1030.4		◆	◆	◆	◆	◆	◆	0.0001 to 2.0000 [°]	0.05
Polarity of the nominal voltage with										0 = positive	
positive traverse direction	X	1040	0	◆	◆	◆	◆	◆	◆	+1 = X axis negative	% 00000
	Y		1							+2 = Y axis negative	
	Z		2							+4 = Z axis negative	
	IV		3							+8 = IV. axis negative	
	V		4							+16 = V. axis negative	
Analogue voltage for rapid traverse											
	X	1050.0		◆	◆	◆	◆	◆	◆	4.5 to 9 [V]	9
	Y	1050.1		◆	◆	◆	◆	◆	◆		9
	Z	1050.2		◆	◆	◆	◆	◆	◆		9
	IV	1050.3		◆	◆	◆	◆	◆	◆		9
	V	1050.4		◆	◆	◆	◆	◆	◆		9

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Acceleration X	1060.0	◆	◆	◆	◆	◆	◆	0.001 to 3.0 [m/s²]	1
Y	1060.1	◆	◆	◆	◆	◆	◆		1
Z	1060.2	◆	◆	◆	◆	◆	◆		1
IV	1060.3	◆	◆	◆	◆	◆	◆		1
V	1060.4	◆	◆	◆	◆	◆	◆		1
Radial acceleration	1070	◆	◆	◆	◆	◆	◆	0.0001 to 3.0 [m/s²]	1.5
Integral factor									
X	1080.0	◆	◆	◆	◆	◆	◆	0 to 65 535	0
Y	1080.1	◆	◆	◆	◆	◆	◆		0
Z	1080.2	◆	◆	◆	◆	◆	◆		0
IV	1080.3	◆	◆	◆	◆	◆	◆		0
V	1080.4	◆	◆	◆	◆	◆	◆		0
Standstill monitoring	1110	◆	◆					0.001 to 30 [mm]	0.1
X	1110.0	-	-	-	-	-	-	0.0001 to 30 [mm]	0.1
Y	1110.1	-	-	◆	◆	◆	◆		0.1
Z	1110.2	-	-	◆	◆	◆	◆		0.1
IV	1110.3	-	-	◆	◆	◆	◆		0.1
V	1110.4	-	-	◆	◆	◆	◆		0.1
Movement monitoring	1140	◆	◆						1
X	1140.0	-	-	-	-	-	-	0.03 to 10 [V]	1
Y	1140.1	-	-	◆	◆	◆	◆		1
Z	1140.2	-	-	◆	◆	◆	◆	**Note:**	1
IV	1140.3	-	-	◆	◆	◆	◆	entry value 10 → monitoring **inactive**	1
V	1140.4	-	-	◆	◆	◆	◆		1
Time out to switch off the residual nominal voltage when the error message "Positioning Error" is generated	1150	◆	◆	◆	◆	◆	◆	0 to 65 535 [s]	0
Automatic cyclic offset adjustment	1220	◆	◆	◆	◆	◆	◆	0 to 65 535 [s] 0 = no automatic adjustment	1

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Reference mark evaluation		1320		◆	◆	◆	◆	◆	◆	0 = positive	
Traverse direction for passing over the	X		0							+1 = X axis negative	% 00000
reference marks	Y		1							+2 = Y axis negative	(0)
	Z		2							+4 = Z axis negative	
	IV		3							+8 = IV. axis negative	
	V		4							+16 = V. axis negative	
Feed rate for passing over the reference											
marks	X	1330.0		◆	◆	◆	◆	◆	◆	linear axis:	10 000
	Y	1330.1		◆	◆	◆	◆	◆	◆	10 to 30 000 [mm/min]	10 000
	Z	1330.2		◆	◆	◆	◆	◆	◆		10 000
	IV	1330.3		◆	◆	◆	◆	◆	◆	rotary axis:	10 000
	V	1330.4		◆	◆	◆	◆	◆	◆	10 to 30 000 [°/min]	10 000
Feed rate for leaving the reference end											
position	X	1331.0		◆	◆	◆	◆	◆	◆	linear axis:	200
(only if MP1350 = 2)	Y	1331.1		◆	◆	◆	◆	◆	◆	10 to 500 [mm/min]	200
	Z	1331.2		◆	◆	◆	◆	◆	◆		200
	IV	1331.3		◆	◆	◆	◆	◆	◆	rotary axis:	200
	V	1331.4		◆	◆	◆	◆	◆	◆	10 to 500 [°/min]	200
Axis sequence for reference mark traverse										0 = no ref. mark traverse	
1. axis		1340.0		◆	◆	◆	◆	◆	◆	1 = X	1
2. axis		1340.1		◆	◆	◆	◆	◆	◆	2 = Y	2
3. axis		1340.2		◆	◆	◆	◆	◆	◆	3 = Z	3
4. axis		1340.3		◆	◆	◆	◆	◆	◆	4 = IV	4
5. axis		1340.4		◆	◆	◆	◆	◆	◆	5 = V	5
Selecting the functional procedure for										0 = position encoder with distance-coded	
passing over the reference marks	X	1350.0		◆	◆	◆	◆	◆	◆	reference marks (1. mode)	1
	Y	1350.1		◆	◆	◆	◆	◆	◆	1 = position encoder without distance-coded	1
	Z	1350.2		◆	◆	◆	◆	◆	◆	reference marks	1
	IV	1350.3		◆	◆	◆	◆	◆	◆	2 = special function (linear measurement	1
	V	1350.4		◆	◆	◆	◆	◆	◆	with rotary encoder)	1
										3 = position encoder with distance-coded	
										reference marks (2. mode)	

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Feed forward control or trailing mode in the operating modes "Positioning with MDI" "Program Run / Single Block" "Program Run / Full Sequence"		1390		◆	◆	◆	◆	◆	◆	0 = feed forward control 1 = trailing mode	0
Feed forward control in all operating modes	 X Y Z IV V	1391	 0 1 2 3 4	-	-	-	-	-	02	bit not set: control in the operating modes "Positioning with MDI", "Program Run / Single Block" and "Program Run / Full Sequence" according to MP1390 bit set: feed forward control in all operating modes	% 00000

Operation with Feed Forward Control

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Position monitoring during operation with feed forward control		1410		◆	◆					0.001 to 30 [mm]	
erasable (POSITIONING ERROR)	X	1410.0		-	-	-	-	-	-	0.0001 to 30 [mm]	3
	Y	1410.1		-	-	◆	◆	◆	◆		3
	Z	1410.2		-	-	◆	◆	◆	◆		3
	IV	1410.3		-	-	◆	◆	◆	◆		3
	V	1410.4		-	-	◆	◆	◆	◆		3
EMERGENCY STOP (GROSS POSITIONING ERROR)		1420		◆	◆					0.001 to 30 [mm]	
	X	1420.0		-	-	-	-	-	-	0.0001 to 30 [mm]	4
	Y	1420.1		-	-	◆	◆	◆	◆		4
	Z	1420.2		-	-	◆	◆	◆	◆		4
	IV	1420.3		-	-	◆	◆	◆	◆		4
	V	1420.4		-	-	◆	◆	◆	◆		4

Cams for "Reference End Position":

The reference marks can either be traversed manually using the axis direction keys or automatically with the start key. It is not necessary to enter a code number for the manual traverse as was the case with preceding TNC models. The traverse direction for automatic traverse of the reference marks is defined in MP1320. In order to reverse the traverse direction at the end of the traverse range, a cam for "reference end position" is required. The trigger signals "ref. end position" are assigned to free PLC inputs. By the PLC software these PLC inputs are connected to the PLC markers M2506 and M2556 to M25599. Depending on the entry value of MP1350 the TNC behaves differently.

Linear Encoder with Distance-Coded Reference Marks (MP 1350.X = 0), Mode 1

If the trigger signal "ref. end position" is set when starting reference mark traverse, the axis moves in the direction opposite to that set in the MP1320. If the trigger signal "ref. end position" is only set during automatic traverse, the TNC ignores this signal. Thus, there must be at least two reference marks within the range of the "reference end position". Ref. mark evaluation takes place either in the range of the "ref. end position" or else beyond this range. In case of an evaluation beyond the software limit switch range, the axis automatically moves to the software limit switch after evaluation.

Linear Encoder without Distance-Coded Reference Marks (MP 1350.X = 1)

The traverse direction is automatically reversed, if the axis traverses the cam for "ref. end position". If the axis is already in the range of the "reference end position" range when starting, it moves immediately in the opposite direction. For this reason the reference mark has to be outside the "ref. end position" range.

Special Operation: Linear Measurement with a Rotary Encoder (MP1350.X = 2)

The axis automatically moves to the cam for "reference end position" at the defined feed rate (MP1330). This axis is started again at a reduced feed rate (MP1331) in the opposite direction; the first reference mark is evaluated after the end of the "reference end position" range has been reached. Then the axis is stopped. If the axis is already in the "reference end position" range when starting, it moves immediately at the reduced feed rate (MP1331) in the direction opposite to that indicated in MP1320.

Linear Encoder with Distance-Coded Reference Marks (MP1350.X = 3), Mode 2

If the trigger signal "reference end position" is set during reference mark traverse, the axis moves opposite to the direction defined in MP1320. The signal "ref. end position" is not ignored by the NC. it is only set during automatic traverse. The traverse direction is reversed immediately. Thus, no reference marks are required in the "ref. end position" range.

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
1. block of Kv factors	X	1510.0	◆	◆	◆	◆	◆	◆	0.1 to 20	1
for operation with feed forward	Y	1510.1	◆	◆	◆	◆	◆	◆		1
control	Z	1510.2	◆	◆	◆	◆	◆	◆		1
	IV	1510.3	◆	◆	◆	◆	◆	◆		1
	V	1510.4	◆	◆	◆	◆	◆	◆		1
Stiction compensation	X	1511.0	-	-	-	-	◆	◆	0 to 16 777 215 [µs]	0
Duration of stiction compensation	Y	1511.1	-	-	-	-	◆	◆		0
(differential part)	Z	1511.2	-	-	-	-	◆	◆		0
	IV	1511.3	-	-	-	-	◆	◆		0
	V	1511.4	-	-	-	-	◆	◆		0
Limitation of stiction compensation	X	1512.0	-	-	-	-	◆	◆	0 to 16 777 215 [counting steps]	0
(differential part)	Y	1512.1	-	-	-	-	◆	◆		0
	Z	1512.2	-	-	-	-	◆	◆		0
	IV	1512.3	-	-	-	-	◆	◆		0
	V	1512.4	-	-	-	-	◆	◆		0
Feed rate for stiction compensation	X	1513.0	-	-	-	-	◆	◆	0 to 300 000 [mm/min]	0
(differential part)	Y	1513.1	-	-	-	-	◆	◆		0
	Z	1513.2	-	-	-	-	◆	◆		0
	IV	1513.3	-	-	-	-	◆	◆		0
	V	1513.4	-	-	-	-	◆	◆		0
2. block of Kv factors	X	1515.0	-	-	-	-	◆	◆	0.1 to 10	1
for operation with feed forward	Y	1515.1	-	-	-	-	◆	◆		1
control	Z	1515.2	-	-	-	-	◆	◆		1
M105: enable	IV	1515.3	-	-	-	-	◆	◆		1
M106: disable	V	1515.4	-	-	-	-	◆	◆		1
Approach speed and transient behaviour when accelerating		1520	◆	◆	◆	◆	-	-	0.1 to 10 [m/min]	1
Velocity below which the	X	1525.0	-	-	-	-	-	02	0.1 to 10.000 [mm/min]	0
positioning window is monitored	Y	1525.1	-	-	-	-	-	02		0
	Z	1525.2	-	-	-	-	-	02	recommended value: 0.5 mm/min	0
	IV	1525.3	-	-	-	-	-	02		0
	V	1525.4	-	-	-	-	-	02		0

Operation with Servo Lag

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Position monitoring during operation with servo lag		1710	◆	◆					0 to 100 [mm]	
cancellable (POSITIONING ERROR)	X	1710.0	-	-	-	-	-	-	0 to 300 [mm]	20
	Y	1710.1	-	-	◆	◆	◆	◆		20
	Z	1710.2	-	-	◆	◆	◆	◆		20
	IV	1710.3	-	-	◆	◆	◆	◆		20
	V	1710.4	-	-	◆	◆	◆	◆		20
EMERGENCY STOP (GROSS POSITIONING ERROR)		1720	◆	◆					0 to 100 [mm]	
	X	1720.0	-	-	-	-	-	-	0 to 300 [mm]	30
	Y	1720.1	-	-	◆	◆	◆	◆		30
	Z	1720.2	-	-	◆	◆	◆	◆		30
	IV	1720.3	-	-	◆	◆	◆	◆		30
	V	1720.4	-	-	◆	◆	◆	◆		30
1. block of Kv factors for the trailing mode	X	1810.0	◆	◆	◆	◆	◆	◆	0.1 to 10	1
	Y	1810.1	◆	◆	◆	◆	◆	◆		1
	Z	1810.2	◆	◆	◆	◆	◆	◆		1
	IV	1810.3	◆	◆	◆	◆	◆	◆		1
	V	1810.4	◆	◆	◆	◆	◆	◆		1
2. block of Kv factors for the trailing mode	X	1815.0	-	-	-	-	◆	◆	0.1 to 10	1
M105: enable	Y	1815.1	-	-	-	-	◆	◆		1
M106: disable	Z	1815.2	-	-	-	-	◆	◆		1
	IV	1815.3	-	-	-	-	◆	◆		1
	V	1815.4	-	-	-	-	◆	◆		1

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Multiplication factor Kv									
(not effective with M05)	1820	◆	◆					0.001 to 1.000	
X	1820.0	-	-	-	-	-	-		1
Y	1820.1	-	-	◆	◆	◆	◆		1
Z	1820.2	-	-	◆	◆	◆	◆		1
IV	1820.3	-	-	◆	◆	◆	◆		1
V	1820.4	-	-	◆	◆	◆	◆		1
Kink point									
	1830	◆	◆					0 to 100.000 [%]	
X	1830.0	-	-	-	-	-	-		100
Y	1830.1	-	-	◆	◆	◆	◆		100
Z	1830.2	-	-	◆	◆	◆	◆		100
IV	1830.3	-	-	◆	◆	◆	◆		100
V	1830.4	-	-	◆	◆	◆	◆		100

Spindle

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Output of the spindle speed	3010		◆	◆	◆	◆	◆	◆	0 = spindle speed not output	6
coded									1 = only if speed changes 2 = with every TOOL CALL	
analogue									3 = gear switching signal only if gear range changes 4 = gear switching signal with every TOOL CALL 5 = no gear switching signal	
regulated spindle for orientation									6 = gear switching signal only if gear range changes 7 = gear switching signal with every TOOL CALL 8 = no gear switching signal	
Output of an analogue voltage at the analogue output of the spindle (only if MP3010 < 3)	3011		- - - -	- - - -	- - - -	- - - -	◆ ◆ ◆ -	◆ ◆ ◆ ◆	0 = no function 1 = voltage is proportional to the current feed rate 2 = voltage defined via PLC (module 9130) 3 = voltage defined via M-function (M200 - M204)	0
Feed rate that corresponds to an analogue voltage of 10V (only if MP3011 = 1)	3012		-	-	-	-	◆	◆	0 to 300 000 [mm/min]	0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
LASER function with M202								10 to 300 000 [mm/min]	
Characteristic curve kink points	3013.0	-	-	-	-	-	◆		0
Speed	3013.1	-	-	-	-	-	◆		0
	3013.2	-	-	-	-	-	◆		0
	3013.3	-	-	-	-	-	◆		0
	3013.4	-	-	-	-	-	◆		0
	3013.5	-	-	-	-	-	◆		0
	3013.6	-	-	-	-	-	◆		0
	3013.7	-	-	-	-	-	◆		0
	3013.8	-	-	-	-	-	◆		0
	3013.9	-	-	-	-	-	◆		0
	3013.10	-	-	-	-	-	◆		0
	3013.11	-	-	-	-	-	◆		0
Characteristic curve kink points									
Voltage	3014.0	-	-	-	-	-	◆		0
	3014.1	-	-	-	-	-	◆		0
	3014.2	-	-	-	-	-	◆		0
	3014.3	-	-	-	-	-	◆		0
	3014.4	-	-	-	-	-	◆		0
	3014.5	-	-	-	-	-	◆		0
	3014.6	-	-	-	-	-	◆		0
	3014.7	-	-	-	-	-	◆		0
	3014.8	-	-	-	-	-	◆		0
	3014.9	-	-	-	-	-	◆		0
	3014.10	-	-	-	-	-	◆		0
	3014.11	-	-	-	-	-	◆		0
Limitation of speed code	3032	04	◆	◆	◆	◆	◆	0 to 99 999 00991 = no limitation	00991

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Axis standstill, if only a spindle speed is output during a TOOL CALL	3030	◆	◆	◆	◆	◆	◆	0 = axis standstill 1 = no axis standstill	0
Programming the spindle speed S = 0 (if MP3240.1 ≠ 0)	3120	◆	◆	◆	◆	◆	◆	0 → S = 0 permitted 1 → S = 0 not permitted	0
Polarity of S-analogue voltage	3130	◆	◆	◆	◆	◆	◆	0 = M03: positive voltage M04: negative voltage 1 = M03. negative voltage M04: positive voltage 2 = M03 / M04: positive voltage 3 = M03 / M04: negative voltage	0
Counting direction of the spindle encoder	3140	◆	◆	◆	◆	◆	◆	0 = positive 1 = negative	0
S-analogue voltage with nominal								0 to 9.999 [V]	
speed gear range 1	3210.0	◆	◆	◆	◆	◆	◆		9
gear range 2	3210.1	◆	◆	◆	◆	◆	◆		9
gear range 3	3210.2	◆	◆	◆	◆	◆	◆		9
gear range 4	3210.3	◆	◆	◆	◆	◆	◆		9
gear range 5	3210.4	◆	◆	◆	◆	◆	◆		9
gear range 6	3210.5	◆	◆	◆	◆	◆	◆		9
gear range 7	3210.6	◆	◆	◆	◆	◆	◆		9
gear range 8	3210.7	◆	◆	◆	◆	◆	◆		9
Controlled range for S-analogue output								0 to 9.999 [V]	
Max. S-analogue voltage that can be output	3240.0	◆	◆	-	-	-	-		
Min. S-analogue voltage that can be output	3240.1	-	-	◆	◆	◆	◆		0
Jog voltage for gear change (markers for direction of rotation: M2490 / M2491)	3240.2	◆	◆	◆	◆	◆	◆		0.1
Limit with S-override max.	3310.0	◆	◆	◆	◆	◆	◆	0 to 150 [%]	150
min.	3310.1	◆	◆	◆	◆	◆	◆		0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Ramp gradient of the spindle:								0 to 1.999 [V/ms]	
	3410	-	I03	-	-	-	-		
• Spindle ON/OFF, M03, M04, M05;	3410.0	◆	03	◆	◆	◆	◆		0.1
• Oriented spindle stop;	3410.1	◆	03	◆	◆	◆	◆		0.1
• "Tapping" cycle;	3410.2	08	11	◆	◆	◆	◆		0.1
• "Rigid Tapping" cycle	3410.3	-	-	◆	◆	◆	◆		0.1
Positioning window for the spindle	3420	◆	◆	◆	◆	◆	◆	0 to 65 535 [increments]	10
Spindle preset	3430	◆	◆	◆	◆	◆	◆	0 to 360 [°]	0
Kv factor for the spindle								0.1 to 10	
(per gear range) gear range 1	3440.0	◆	◆	◆	◆	◆	◆		1
gear range 2	3440.1	◆	◆	◆	◆	◆	◆		1
gear range 3	3440.2	◆	◆	◆	◆	◆	◆		1
gear range 4	3440.3	◆	◆	◆	◆	◆	◆		1
gear range 5	3440.4	◆	◆	◆	◆	◆	◆		1
gear range 6	3440.5	◆	◆	◆	◆	◆	◆		1
gear range 7	3440.6	◆	◆	◆	◆	◆	◆		1
gear range 8	3440.7	◆	◆	◆	◆	◆	◆		1

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Nominal spindle speed								0 to 99 999.999 [rpm]	
gear range 1	3510.0	◆	◆	◆	◆	◆	◆		1000
gear range 2	3510.1	◆	◆	◆	◆	◆	◆		2000
gear range 3	3510.2	◆	◆	◆	◆	◆	◆		3000
gear range 4	3510.3	◆	◆	◆	◆	◆	◆		4000
gear range 5	3510.4	◆	◆	◆	◆	◆	◆		5000
gear range 6	3510.5	◆	◆	◆	◆	◆	◆		6000
gear range 7	3510.6	◆	◆	◆	◆	◆	◆		7000
gear range 8	3510.7	◆	◆	◆	◆	◆	◆		8000
Maximum spindle speed								0 to 99 999 [rpm]	
gear range 1	3515.0	-	-	◆	◆	◆	◆		1200
gear range 2	3515.1	-	-	◆	◆	◆	◆		2400
gear range 3	3515.2	-	-	◆	◆	◆	◆		3600
gear range 4	3515.3	-	-	◆	◆	◆	◆		4800
gear range 5	3515.4	-	-	◆	◆	◆	◆		6000
gear range 6	3515.5	-	-	◆	◆	◆	◆		7200
gear range 7	3515.6	-	-	◆	◆	◆	◆		8400
gear range 8	3515.7	-	-	◆	◆	◆	◆		9600
Spindle speed if marker 2501 is set	3520.0	◆	◆	◆	◆	◆	◆	0 to 99 999.999 [rpm] direction of rotation always positive	200
Spindle speed for oriented spindle stop	3520.1	◆	◆	◆	◆	◆	◆	0 to 99 999.999 [rpm]	100

Integral PLC

Function		**MP No. Bit**	**A**	**B**	**C**	**D**	**E**	**F**	**Input**	**AE-6 Entry Value**
PLC program from RAM or EPROM		4010	◆	◆	◆	◆	◆	◆	+0 = EPROM +1 = RAM	0
Automatic lubrication	X	4060.0	◆	◆	◆	◆	◆	◆	0 to 65 535 [65 536 µm]	100
	Y	4060.1	◆	◆	◆	◆	◆	◆		200
	Z	4060.2	◆	◆	◆	◆	◆	◆		300
	IV	4060.3	◆	◆	◆	◆	◆	◆		400
	V	4060.4	◆	◆	◆	◆	◆	◆		0
Maximum change of the temperature compensation per PLC scan in the PLC words W576 - W584		4070	-	-	03	03	◆	◆	0.0001 to 0.0005 [mm]	0.0001

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
PLC:	**time for**								0 to 65 535 [PLC cycles]	
	T 0 - 29	4110.0	◆	◆	◆	◆	◆	◆		100
		4110.1	◆	◆	◆	◆	◆	◆		22
		4110.2	◆	◆	◆	◆	◆	◆		50
		4110.3	◆	◆	◆	◆	◆	◆		100
		4110.4	◆	◆	◆	◆	◆	◆		4
		4110.5	◆	◆	◆	◆	◆	◆		5
		4110.6	◆	◆	◆	◆	◆	◆		6
		4110.7	◆	◆	◆	◆	◆	◆		7
		4110.8	◆	◆	◆	◆	◆	◆		8
		4110.9	◆	◆	◆	◆	◆	◆		9
		4110.10	◆	◆	◆	◆	◆	◆		10
		4110.11	◆	◆	◆	◆	◆	◆		11
		4110.12	◆	◆	◆	◆	◆	◆		12
		4110.13	◆	◆	◆	◆	◆	◆		13
		4110.14	◆	◆	◆	◆	◆	◆		14
		4110.15	◆	◆	◆	◆	◆	◆		15
		4110.16	◆	◆	◆	◆	◆	◆		25
		4110.17	◆	◆	◆	◆	◆	◆		0
		4110.18	◆	◆	◆	◆	◆	◆		0
		4110.19	◆	◆	◆	◆	◆	◆		0
		4110.20	◆	◆	◆	◆	◆	◆		0
		4110.21	◆	◆	◆	◆	◆	◆		0
		4110.22	◆	◆	◆	◆	◆	◆		0
		4110.23	◆	◆	◆	◆	◆	◆		0
		4110.24	◆	◆	◆	◆	◆	◆		0
		4110.25	◆	◆	◆	◆	◆	◆		0
		4110.26	◆	◆	◆	◆	◆	◆		0
		4110.27	◆	◆	◆	◆	◆	◆		0
		4110.28	◆	◆	◆	◆	◆	◆		0
		4110.29	◆	◆	◆	◆	◆	◆		0

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
PLC:	**time for**									0 to 65 535 [PLC cycles]	
	T 30 - 47	4110.30		◆	◆	◆	◆	◆	◆		0
		4110.31		◆	◆	◆	◆	◆	◆		0
		4110.32		◆	◆	◆	◆	◆	◆		0
		4110.33		◆	◆	◆	◆	◆	◆		0
		4110.34		◆	◆	◆	◆	◆	◆		0
		4110.35		◆	◆	◆	◆	◆	◆		0
		4110.36		◆	◆	◆	◆	◆	◆		0
		4110.37		◆	◆	◆	◆	◆	◆		0
		4110.38		◆	◆	◆	◆	◆	◆		0
		4110.39		◆	◆	◆	◆	◆	◆		0
		4110.40		◆	◆	◆	◆	◆	◆		0
		4110.41		◆	◆	◆	◆	◆	◆		0
		4110.42		◆	◆	◆	◆	◆	◆		0
		4110.43		◆	◆	◆	◆	◆	◆		0
		4110.44		◆	◆	◆	◆	◆	◆		0
		4110.45		◆	◆	◆	◆	◆	◆		0
		4110.46		◆	◆	◆	◆	◆	◆		0
		4110.47		◆	◆	◆	◆	◆	◆		0
PLC:	**preset counter values**									0 to 65 535 [PLC cycles]	
	counters 0 - 10	4120.0		◆	◆	◆	◆	◆	◆		0
		4120.1		◆	◆	◆	◆	◆	◆		1
		4120.2		◆	◆	◆	◆	◆	◆		2
		4120.3		◆	◆	◆	◆	◆	◆		3
		4120.4		◆	◆	◆	◆	◆	◆		4
		4120.5		◆	◆	◆	◆	◆	◆		5
		4120.6		◆	◆	◆	◆	◆	◆		6
		4120.7		◆	◆	◆	◆	◆	◆		7
		4120.8		◆	◆	◆	◆	◆	◆		8
		4120.9		◆	◆	◆	◆	◆	◆		9
		4120.10		◆	◆	◆	◆	◆	◆		10

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
PLC: preset counter values								0 to 65 535 [PLC cycles]	
counters 11 - 31	4120.11	◆	◆	◆	◆	◆	◆		11
	4120.12	◆	◆	◆	◆	◆	◆		12
	4120.13	◆	◆	◆	◆	◆	◆		13
	4120.14	◆	◆	◆	◆	◆	◆		14
	4120.15	◆	◆	◆	◆	◆	◆		15
	4120.16	◆	◆	◆	◆	◆	◆		16
	4120.17	◆	◆	◆	◆	◆	◆		17
	4120.18	◆	◆	◆	◆	◆	◆		18
	4120.19	◆	◆	◆	◆	◆	◆		19
	4120.20	◆	◆	◆	◆	◆	◆		20
	4120.21	◆	◆	◆	◆	◆	◆		21
	4120.22	◆	◆	◆	◆	◆	◆		22
	4120.23	◆	◆	◆	◆	◆	◆		23
	4120.24	◆	◆	◆	◆	◆	◆		24
	4120.25	◆	◆	◆	◆	◆	◆		25
	4120.26	◆	◆	◆	◆	◆	◆		26
	4120.27	◆	◆	◆	◆	◆	◆		27
	4120.28	◆	◆	◆	◆	◆	◆		28
	4120.29	◆	◆	◆	◆	◆	◆		29
	4120.30	◆	◆	◆	◆	◆	◆		30
	4120.31	◆	◆	◆	◆	◆	◆		31
Fast PLC input Defining the fast input	4130	-	-	◆	◆	◆	◆	0 to 254	0
Defining the active level of the fast input	4131	-	-	◆	◆	◆	◆	0 = activation with LOW level 1 = activation with HIGH level	0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Setting a number								-99 999.9999 to +99 999.9999 [mm] or [°]	
D768	4210.0	◆	◆	◆	◆	◆	◆		+10
D772	4210.1	◆	◆	◆	◆	◆	◆		+1
D776	4210.2	◆	◆	◆	◆	◆	◆		+2
D780	4210.3	◆	◆	◆	◆	◆	◆		+3
D784	4210.4	◆	◆	◆	◆	◆	◆		+4
D788	4210.5	◆	◆	◆	◆	◆	◆		+5
D792	4210.6	◆	◆	◆	◆	◆	◆		+6
D796	4210.7	◆	◆	◆	◆	◆	◆		+7
D800	4210.8	◆	◆	◆	◆	◆	◆		+8
D804	4210.9	◆	◆	◆	◆	◆	◆		+9
D808	4210.10	◆	◆	◆	◆	◆	◆		+10
D812	4210.11	◆	◆	◆	◆	◆	◆		+11
D816	4210.12	◆	◆	◆	◆	◆	◆		+12
D820	4210.13	◆	◆	◆	◆	◆	◆		+13
D824	4210.14	◆	◆	◆	◆	◆	◆		+14
D828	4210.15	◆	◆	◆	◆	◆	◆		+15
D832	4210.16	◆	◆	◆	◆	◆	◆		+16
D836	4210.17	◆	◆	◆	◆	◆	◆		+17
D840	4210.18	◆	◆	◆	◆	◆	◆		+18
D844	4210.19	◆	◆	◆	◆	◆	◆		+19
D848	4210.20	◆	◆	◆	◆	◆	◆		+20
D852	4210.21	◆	◆	◆	◆	◆	◆		+21
D856	4210.22	◆	◆	◆	◆	◆	◆		+22
D860	4210.23	◆	◆	◆	◆	◆	◆		+23
D864	4210.24	◆	◆	◆	◆	◆	◆		+24
D868	4210.25	◆	◆	◆	◆	◆	◆		+25
D872	4210.26	◆	◆	◆	◆	◆	◆		+26
D876	4210.27	◆	◆	◆	◆	◆	◆		+27
D880	4210.28	◆	◆	◆	◆	◆	◆		+28
D884	4210.29	◆	◆	◆	◆	◆	◆		+29
D888	4210.30	◆	◆	◆	◆	◆	◆		+30
D892	4210.31	◆	◆	◆	◆	◆	◆		+31

Function			MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Setting a number											-99 999.9999 to +99 999.9999 [mm] or [°]	
		D896	4210.32		◆	◆	◆	◆	◆	◆		+0
		D900	4210.33		◆	◆	◆	◆	◆	◆		+0
		D904	4210.34		◆	◆	◆	◆	◆	◆		+0
		D908	4210.35		◆	◆	◆	◆	◆	◆		+0
		D912	4210.36		◆	◆	◆	◆	◆	◆		+0
		D916	4210.37		◆	◆	◆	◆	◆	◆		+0
		D920	4210.38		◆	◆	◆	◆	◆	◆		+0
		D924	4210.39		◆	◆	◆	◆	◆	◆		+0
		D928	4210.40		◆	◆	◆	◆	◆	◆		+0
		D932	4210.41		◆	◆	◆	◆	◆	◆		+0
		D936	4210.42		◆	◆	◆	◆	◆	◆		+0
		D940	4210.43		◆	◆	◆	◆	◆	◆		+0
		D944	4210.44		◆	◆	◆	◆	◆	◆		+0
		D948	4210.45		◆	◆	◆	◆	◆	◆		+0
		D952	4210.46		◆	◆	◆	◆	◆	◆		+0
		D956	4210.47		◆	◆	◆	◆	◆	◆		+0
Machine parameters with											10 to 30 000	
multiple functions	W960	X	4220.0		◆	◆	◆	◆	◆	◆	• setting a value in the PLC	1800
	W962	Y	4220.1		◆	◆	◆	◆	◆	◆	or	1800
	W964	Z	4220.2		◆	◆	◆	◆	◆	◆	• feed rate for reapproching the contour	1800
	W966	IV	4220.3		◆	◆	◆	◆	◆	◆	[mm/min] or [°/min]	1800
	W968	V	4220.4		◆	◆	◆	◆	◆	◆		1800
Setting a number			4230.0		-	-	06	06	◆	◆	-99 999.9999 to +99 999.9999 [mm]	0
(readable with module 9032)			...		...	...	...	...	...	...		...
			4230.31		-	-	06	06	◆	◆		0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
PLC: setting a number (readable with module 9032)	4231.0 ... 4231.31	- ... -	- ... -	06 ... 06	06 ... 06	◆ ... ◆	◆ ... ◆	-99 999.9999 to +99 999.9999 [mm]	0 ... 0
PLC: setting a number								-99 999.9999 to +99 999.9999 [mm]	
W976 (M2192 ... 2207	4310.0	◆	◆	◆	◆	◆	◆		20480
W978 (M2208 ... 2223	4310.1	◆	◆	◆	◆	◆	◆		0
W980 (M2224 ... 2239	4310.2	◆	◆	◆	◆	◆	◆		0
W982 (M3200 ... 3215	4310.3	◆	◆	◆	◆	◆	◆		0
W984 (M3216 ... 3231	4310.4	◆	◆	◆	◆	◆	◆		0
W986 (M3232 ... 3247	4310.5	◆	◆	◆	◆	◆	◆		0
W990 (M3248 ... 3263	4310.6	◆	◆	◆	◆	◆	◆		0
Adaptation of the data interface extension (X47)	4410	1)	1)	03	03	-	-	0 = no analogue inputs 1 = analogue inputs on 1. PL 2 = analogue inputs on 2. PL	
	4410	1)	1)	03	03	◆	◆		0
	Bit 0							+0 = no analogue inputs activated on 1. extension +1 = analogue inputs on 1. extension (PA 100 or analogue inputs activated on PL 410)	
	Bit 1							+0 = no analogue inputs activated on 2. extension +2 = analogue inputs on 2. extension (PA 100 or analogue inputs activated on PL 410)	

1) MP without function; therefore, do not enter 0.

Adaptation of the Data Interface

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Inhibiting a data interface	5000							0 = no interface inhibited 1 = RS-232 inhibited 2 = RS-422 inhibited	0
Control characters for "Blockwise Transfer" Character for beginning and end of program; the character of end of program is also valid for the standard data interface	5010.0*	I05	I08	-	-	-	-	0 to 32 382	515
ASCII character for data input	5010.1*	I05	I08	-	-	-	-	0 to 32 382	0
ASCII character for data output	5010.2*	I05	I08	-	-	-	-	0 to 32 382	0
ASCII character for beginning and end of command block	5010.3*	I05	I08	-	-	-	-	0 to 32 382	0
ASCII character for pos. and neg. acknowledgement	5010.4*	I05	I08	-	-	-	-	0 to 32 382	0
ASCII character for end of data transfer	5010.5*	I05	I08	-	-	-	-	0 to 32 382	0

* accessible via code number 123

Function	**MP No.**	**Bit**	**A**	**B**	**C**	**D**	**E**	**F**	**Input**	**AE-6 Entry Value**
Data format and transfer stop										
operating mode **EXT**			I05	I08	-	-	-	-	0 to 255	
operating mode **EXT1**	5020.0*		05	08	◆	◆	◆	◆		168
operating mode **EXT2**	5020.1*		05	08	◆	◆	◆	◆		168
operating mode **EXT3 (PLC)**	5020.2*		-	-	◆	◆	◆	◆		168
7 or 8 data bits		0							+0 = 7 data bits, bit 8 = parity +1 = 8 data bits, bit 8 = 0, bit 9 = parity	
Block check character		1							+0 = BCC may be any character +2 = control character not BCC	
Transfer stop by RTS		2							+0 = inactive +4 = active	
Transfer stop by DC3		3							+0 = inactive +8 = active	
Character parity even/odd		4							+0 = even +16 = odd	
Character parity on/off		5							+0 = off +32 = on	
Number of stop bits		6 7							+64 = bit 6 = 1 +128 = bit 7 = 1 bit 6 bit 7 0 1 = 1½ stop bits 1 0 = 2 stop bits 0 1 = 1 stop bit 1 1 = 1 stop bit	

* accessible via code number 123

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Operating mode for									
EXT	5030	I05	I08	-	-	-	-		
EXT1	5030.0*	05	08	◆	◆	◆	◆		1
EXT2	5030.1*	05	08	◆	◆	◆	◆	0 = standard data transfer	1
EXT3 (PLC)	5030.2*	-	-	◆	◆	◆	◆	1 = blockwise transfer	1
Transfer speed for PLC coupling (EXT3)	5040	-	-	◆	◆	◆	◆	0 to 9 0 = 110 Bd 5 = 2400 Bd 1 = 150 Bd 6 = 4800 Bd 2 = 300 Bd 7 = 9600 Bd 3 = 600 Bd 8 = 19200 Bd 4 = 1200 Bd 9 = 38400 Bd	7
Control characters for "Blockwise Transfer"									
ASCII character for beginning of program (STX)								0 to 127	
EXT1	5200.0*	05	08	◆	◆	◆	◆		0
EXT2	5200.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)	5200.2*	-	-	◆	◆	◆	◆		0
ASCII character for end of program								0 to 127	
EXT1 (ETX)	5201.0*	05	08	◆	◆	◆	◆		0
EXT2	5201.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)	5201.2*	-	-	◆	◆	◆	◆		0
ASCII character for file type (for data transfer)								0 to 127	
EXT1	5202.0*	05	08	◆	◆	◆	◆		0
EXT2	5202.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)	5202.2*	-	-	◆	◆	◆	◆		0
ASCII character for input code								0 to 127	
EXT1 (E)	5203.0*	05	08	◆	◆	◆	◆		0
EXT2	5203.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)	5203.2*	-	-	◆	◆	◆	◆		0

* accessible via code number 123

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
ASCII character for file type (for data output)									0 to 127	
EXT1		5204.0*	05	08	◆	◆	◆	◆		0
EXT2		5204.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5204.2*	-	-	◆	◆	◆	◆		0
ASCII character for output code									0 to 127	
EXT1	(A)	5205.0*	05	08	◆	◆	◆	◆		0
EXT2		5205.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5205.2*	-	-	◆	◆	◆	◆		0
ASCII character for beginning of command block									0 to 127	
EXT1	(SOH)	5206.0*	05	08	◆	◆	◆	◆		0
EXT2		5206.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5206.2*	-	-	◆	◆	◆	◆		0
ASCII character for end of command block									0 to 127	
EXT1	(ETB)	5207.0*	05	08	◆	◆	◆	◆		0
EXT2		5207.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5207.2*	-	-	◆	◆	◆	◆		0
ASCII character for positive acknowledgement									0 to 127	
EXT1	(ACK)	5208.0*	05	08	◆	◆	◆	◆		0
EXT2		5208.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5208.2*	-	-	◆	◆	◆	◆		0
ASCII character for negative acknowledgement									0 to 127	
EXT1	(NAK)	5209.0*	05	08	◆	◆	◆	◆		0
EXT2		5209.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5209.2*	-	-	◆	◆	◆	◆		0
ASCII character for end of transfer									0 to 127	
EXT1	(EOT)	5210.0*	05	08	◆	◆	◆	◆		0
EXT2		5210.1*	05	08	◆	◆	◆	◆		0
EXT3 (PLC)		5210.2*	-	-	◆	◆	◆	◆		0

* accessible via code number 123

3D-Touch Probe (General Parameters)

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Selection of touch trigger probe	6010*	◆	◆	◆	◆	◆	◆	0 = transmission via cable (TS 120) 1 = infrared transmission (TS 510)	0
Probing feed rate	6120*	◆	◆	◆	◆	◆	◆	10 to 3 000 [mm/min]	80
Maximum measuring range	6130*	◆	◆	04	04	◆	◆	0.001 to 99 999.9999 [mm]	1
Safety clearance over measuring point for automatic measurement	6140*	◆	◆	◆	◆	◆	◆	0.001 to 99 999.9999 [mm]	1
Rapid traverse for probe cycle	6150*	◆	◆	◆	◆	◆	◆	10 to 10 000 [mm/min]	2000
M-function for rotating the spindle by 180° to compensate the center misalignment of the stylus	6160*	-	-	-	-	◆	◆	-1 = oriented spindle stop via NC 0 = function inactive 1 to 88 = number of M-function for oriented spindle stop via PLC	0

* accessible via code number 123

Digitizing with 3D-Touch Probe

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Number of oscillations in normal direction	6210		-	-	◆	◆	◆	◆	0 to 65.535 [1/sec]	0
Lubrication of touch probe axis • displacement for lubrication at the end of a line	6220		-	-	-	-	-	◆	0.000 to 999.999 [mm]	0
• time intervals for lubrication	6221		-	-	-	-	-	◆	0 to 65 535 [min]	0
Feed rate in normal direction	6230		-	-	◆	◆	◆	◆	0 to 1 000 [mm/min]	0
Maximum deflection of the stylus	6240		-	-	◆	◆	◆	◆	0 to 10 [mm]	0
Output of M90 on NC blocks of digitized data	6260		-	-	◆	◆	◆	◆	0 = no output 1 = output	0
Rounding the decimal places (NC blocks)	6270		-	-	◆	◆	◆	◆	0 = output in 0.001 mm (1 µm) 1 = output in 0.01 mm (10 µm) 2 = output in 0.0001 mm (0.1 µm)	0

Tool Calibration with TT 110

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Tool calibration cycles	6500		-	-	-	-	-	◆	0 = cycles inhibited 1 = cycles enabled	0
Probing direction for tool calibration	6505		-	-	-	-	-	◆	0 = pos. probing direction in the angular reference axis (0° axis) 1 = pos. probing direction in the +90° axis 2 = neg. probing direction in the angular reference axis (0° axis) 3 = neg. probing direction in the +90° axis	0
Calculation of probing feed rate	6507		-	-	-	-	-	◆	0 = calculation of probing feed with constant tolerance 1 = calculation of probing feed with variable tolerance 2 = constant probing feed	0
Maximum permissible measuring error when calibrating with a rotating tool	6510		-	-	-	-	-	◆	0.002 to 0.999 [mm]	0.005
Probing feed rate when calibrating with a non-rotating tool	6520		-	-	-	-	-	◆	10 to 3 000 [mm/min]	10
Distance between lower edge of tool and upper edge of stylus for tool radius calibration	6530		-	-	-	-	-	◆	0.001 to 99.9999 [mm]	10
Diameter or edge length of the TT 110 stylus	6531		-	-	-	-	-	◆	0.001 to 99 999.9999 [mm]	10

Function	**MP No. Bit**	**A**	**B**	**C**	**D**	**E**	**F**	**Input**	**AE-6 Entry Value**
Safety zone around the stylus of TT 110 for prepositioning	6540	-	-	-	-	-	◆	0.001 to 99 999.9999 [mm]	10
Rapid traverse in the probing cycle	6550	-	-	-	-	-	◆	10 to 10 000 [m/min]	10
M-function for oriented spindle stop for measuring individual cutting edges	6560	-	-	-	-	-	◆	-1 = oriented spindle stop via NC 0 = function inactive 1 to 88 = number of M-function for oriented spindle stop via PLC	10
Maximum permissible surface cutting speed at the cutting edges of the tool	6570	-	-	-	-	-	◆	1.0000 to 120.0000 [m/min]	100
Center coordinates of the TT 110 stylus								- 99 999.9999 to + 99 999.9999 [mm]	
referenced to the machine datum X	6580.0	-	-	-	-	-	◆		0
Y	6580.1	-	-	-	-	-	◆		0
Z	6580.2	-	-	-	-	-	◆		0

Tapping

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Minimum feed override when tapping	7110.0	◆	◆	◆	◆	◆	◆	0 to 150 [%]	95
Maximum feed override when tapping	7110.1	◆	◆	◆	◆	◆	◆	0 to 150 [%]	105
Dwell time for change of direction of spindle rotation in a tapping cycle	7120.0	◆	◆	◆	◆	◆	◆	0 to 65.535 [s]	0
Spindle deceleration time in a tapping cycle (only effective with BCD output of the spindle speed)	7120.1	◆	◆	◆	◆	◆	◆	0 to 65.535 [s]	0
Spindle slow-down time after reaching the total hole depth	7120.2	◆	◆	◆	◆	◆	◆	0 to 65.535 [s]	0
Tapping without floating tap holder • run-in behaviour of the spindle	7130	-	-	◆	◆	◆	◆	0.001 to 10 [°/min]	0.5
• transient response of the spindle during acceleration	7140	-	-	◆	◆	◆	◆	0.01 to 0.999	0.15
Positioning window of the tool axis	7150	-	-	◆	◆	◆	◆	0.0001 to 2 [mm]	0.05
Spindle orientation at the beginning of cycle 17 "Rigid Tapping"	7160	-	-	-	-	08	◆	0 = spindle orientation is executed 1 = spindle orientation is not executed	1

Display and Programming

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
									0 = control	
Programming station	7210*		◆	◆	◆	◆	◆	◆	1 = programming station: PLC active	0
									2 = programming station: PLC inactive	
POWER INTERRUPTED	7212		-	-	-	-	◆	◆	0 = press [CE] to confirm the message	
									1 = message is confirmed automatically	1
Block-number increment size	7220*		08	08	◆	◆	◆	◆	0 to 250	
(for ISO programming)									0 = no generation	0
Maximum length of file names	7222*		-	-	-	-	◆	◆	0 = max. 8 characters	
when opening a file									1 = max. 12 characters	
									2 = max. 16 characters	
Disable file types	7224*		05	08	-	-	-	-	0 = no file type disabled	0
(for selection, table of contents and external data transfer)										
HEIDENHAIN programs (.H)		0	05	08	-	-	-	-	+ 1 = disabled	
ISO programs (.I)		1	05	08	-	-	-	-	+ 2= disabled	
Tool tables (.T)		2	05	08	-	-	-	-	+ 4= disabled	
Datum tables (.D)		3	05	08	-	-	-	-	+ 8= disabled	
Pallet tables (.P)		4	05	08	-	-	-	-	+ 16= disabled	
ASCII (text) files (.A)		5	05	08	-	-	-	-	+ 32= disabled	
Disable file types	7224.0*		-	-	◆	◆	◆	◆	0 = no file type disabled	% 00000000
(for selection, table of contents and external data transfer)										(0)
HEIDENHAIN programs (.H)		0	-	-	◆	◆	◆	◆	+ 1 = disabled	
ISO programs (.I)		1	-	-	◆	◆	◆	◆	+ 2= disabled	
Tool tables (.T)		2	-	-	◆	◆	◆	◆	+ 4= disabled	
Datum tables (.D)		3	-	-	◆	◆	◆	◆	+ 8= disabled	
Pallet tables (.P)		4	-	-	◆	◆	◆	◆	+ 16= disabled	
ASCII (text) files (.A)		5	-	-	◆	◆	◆	◆	+ 32= disabled	
PLC HELP files (.HLP)		6	-	-	-	-	08	◆	+ 64= disabled	
Measuring point tables (.PNT)		7	-	-	-	-	08	◆	+ 128= disabled	

* accessible via code number 123

Display and Programming

Function		MP No.	Bit	A	B	C	D	E	F	Input		AE-6 Entry Value
Protecting file types (for selection, table of contents and external data transfer)		7224.1*								0 =	no file type protected	% 00000000 (0)
HEIDENHAIN programs	(.H)		0	-	-	◆	◆	◆	◆	+ 1 =	protected	
ISO programs	(.I)		1	-	-	◆	◆	◆	◆	+ 2=	protected	
Tool tables	(.T)		2	-	-	◆	◆	◆	◆	+ 4=	protected	
Datum tables	(.D)		3	-	-	◆	◆	◆	◆	+ 8=	protected	
Pallet tables	(.P)		4	-	-	◆	◆	◆	◆	+ 16=	protected	
ASCII (text) files	(.A)		5	-	-	◆	◆	◆	◆	+ 32=	protected	
PLC HELP files	(.HLP)		6	-	-	-	-	08	◆	+ 64=	protected	
Measuring point tables	(.PNT)		7	-	-	-	-	08	◆	+ 128=	protected	
Preset size												
Pallet table	(.P)	7226.0*		05	08	◆	◆	◆	◆	0 to 255 =	number of reserved entries	10
Datum table	(.D)	7226.1*		05	08	◆	◆	◆	◆		(can be expanded via soft key)	10
Size of NC memory for DNC mode												
Minimum		7228.0		-	-	-	-	08	◆	1 to 1024 [kBytes]		1
Maximum		7228.1		-	-	-	-	08	◆	1 to 1024 [kBytes		10
Switching over the dialog language		7230*		◆	◆	◆	◆	◆	◆	0 = 1 =	first dialog language second dialog language (English)	0

* accessible via code number 123

Function	**MP No.**	**Bit**	**A**	**B**	**C**	**D**	**E**	**F**	**Input**	**AE-6 Entry Value**
Inhibiting program entry if PGM No. = No. of OEM cycle	7240*		◆	◆	◆	◆	◆	◆	0 = inhibited 1 = not inhibited	1
Inhibiting HEIDENHAIN cycles	7245.0		◆	◆	◆	◆	◆	◆	0 to 65 535	0
cycle 1		1							bit = 0 → cycle not inhibited	
cycle 2		2							bit = 1 → cycle inhibited	
cycle 3		3								
cycle 4		4								
cycle 5		5								
cycle 6		6								
cycle 7		7								
cycle 8		8								
cycle 9		9								
cycle 10		10								
cycle 11		11								
cycle 12		12								
cycle 13		13								
cycle 14		14								
cycle 15		15								
	7245.1		◆	◆	◆	◆	◆	◆	0 to 65 535	0
cycle 16		0							bit = 0 → cycle not inhibited	
cycle 17		1							bit = 1 → cycle inhibited	
cycle 18		2								
cycle 19		3								
cycle 20		4								
cycle 21		5								
cycle 22		6								
cycle 23		7								
cycle 24		8								
cycle 25		9								
cycle 26		10								
cycle 27		11								
cycle 28		12								
cycle 29		13								
cycle 30		14								
cycle 31		15								

Function	**MP No. Bit**	**A**	**B**	**C**	**D**	**E**	**F**	**Input**	**AE-6 Entry Value**
Disable paraxial positioning blocks with R+/R- compensation	7246	-	-	-	-	◆	◆	0 = enabled 1 = disabled	0
Difference between Q-parameter numbers for "DLG-DEF" block and "DLG-CALL" block in OEM cycle	7250	◆	◆	◆	◆	◆	◆	0 to 50 0 if "DLG-CALL" blocks only	0
Number of global Q-parameters that are transferred from an OEM cycle to the calling program	7251	◆	◆	◆	◆	◆	◆	0 to 100 40 = the Q-parameters Q60 to Q90 are global	0
Central tool table	7260*	◆	◆	◆	◆	◆	◆	0 to 254 0 = no central tool file entry value = number of tools	254
Number of tools with pocket number	7261*	◆	◆	◆	◆	◆	◆	0 to 254	254

* accessible via code number 123

Function		MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Selecting the elements in to tool file									0 = no display	0
(T file) that are displayed and output via									1 - 99 = position of the element in	
the interface									the tool table	
NAME	(tool name)	7266.0	-	-	-	-	◆	◆	smallest value = first position	1
L	(tool length)	7266.1	-	-	-	-	◆	◆	highest value = last position	2
R	(tool radius 1)	7266.2	-	-	-	-	◆	◆		3
R2	(tool radius 2)	7266.3	-	-	-	-	◆	◆		4
DL	(tool length allowance)	7266.4	-	-	-	-	◆	◆		5
DR	(oversize tool radius 1)	7266.5	-	-	-	-	◆	◆		6
DR2	(oversize tool radius 2)	7266.6	-	-	-	-	◆	◆		7
TL	(tool locked)	7266.7	-	-	-	-	◆	◆		8
RT	(replacement tool)	7266.8	-	-	-	-	◆	◆		9
TIME1	(max. tool life)	7266.9	-	-	-	-	◆	◆		10
TIME2	(max. tool life with TOOL CALL)	7266.10	-	-	-	-	◆	◆		11
CUR. TIME	(current tool life)	7266.11	-	-	-	-	◆	◆		12
DOC	(commentary on tool)	7266.12	-	-	-	-	◆	◆		13
CUT	(number of cutting edges)	7266.13	-	-	-	-	-	◆		14
LTOL	(tolerance for tool length)	7266.14	-	-	-	-	-	◆		15
RTOL	(tolerance for tool radius)	7266.15	-	-	-	-	-	◆		16
DIRECT	(cutting direction of tool)	7266.16	-	-	-	-	-	◆		17
PLC	(PLC status)	7266.17	-	-	-	-	-	02		18
TT: L-OFFS	(tool offset, length)	7266.18	-	-	-	-	-	04		19
TT: R-OFFS	(tool offset, radius)	7266.19	-	-	-	-	-	04		20
LBREAK	(breakage tolerance, tool length)	7266.20	-	-	-	-	-	04		21
RBREAK	(breakage tolerance, tool radius)	7266.21	-	-	-	-	-	04		22
Selecting the elements in the TOOL.P									0 = no display	
file (pocket table)									1 - 99 = pos. of the element in the tool table	
T	(tool number)	7266.0	-	-	-	-	◆	◆	smallest value = first position	1
ST	(special tool)	7266.1	-	-	-	-	◆	◆	highest value = last position	2
F	(fixed pocket)	7266.2	-	-	-	-	◆	◆		3
L	(locked pocket)	7266.3	-	-	-	-	◆	◆		4
PLC	(PLC status)	7266.4	-	-	-	-	◆	◆		5

* accessible via code number 123

Function		MP No.	Bit	A	B	C	D	E	F	Input		AE-6 Entry Value
Display of the current feed rate in the TOOL.P file before start in the manual operating modes		7270*		◆	◆	◆	◆	◆	◆	0 = 1 =	display of feed rate only when pressing an axis direction key (feed from MP1020.X individually for each axis) display of feed rate also before pressing an axis direction key (smallest value from MP1020.X for all axes)	0
Decimal sign		7280*		◆	◆	◆	◆	◆	◆	0 = 1 =	decimal comma decimal point	0
Tool length in ACTL/NOML display		7285*		-	-	◆	◆	◆	◆	0 = 1 =	ignored taken into account	0
Display step		7290		◆	◆	-	-	-	-	0 =	0.001 mm	1
										1 =	0.005 mm	
	X	7290.0*		-	-	◆	◆	-	-	0 =	0.001 mm	0
	Y	7290.1*		-	-	◆	◆	-	-	1 =	0.005 mm	0
	Z	7290.2*		-	-	◆	◆	-	-	2 =	0.0001 mm[1)]	0
	IV	7290.3*		-	-	◆	◆	-	-			0
	V	7290.4*		-	-	◆	◆	-	-			0
	X	7290.0*		-	-	-	-	◆	◆	0 =	0.1 mm / 0.1°	6
	Y	7290.1*		-	-	-	-	◆	◆	1 =	0.05 mm / 0.05°	6
	Z	7290.2*		-	-	-	-	◆	◆	2 =	0.01 mm / 0.01°	6
	IV	7290.3*		-	-	-	-	◆	◆	3 =	0.005 mm / 0.005°	6
	V	7290.4*		-	-	-	-	◆	◆	4 =	0.001 mm / 0.001°	6
										5 =	0.0005 mm / 0.0005°	
										6 =	0.0001 mm / 0.0001°	
Inhibiting datum setting		7295*		-	-	◆	◆	◆	◆	0 =	entry not inhibited	0
(axis keys and soft keys)	X		0							+1 =	X axis inhibited	
	Y		1							+2 =	Y axis inhibited	
	Z		2							+4 =	Z axis inhibited	
	IV		3							+8 =	IV. axis inhibited	
	V		4							+16 =	V. axis inhibited	
Datum setting via axis keys		7296		-	-	-	-	08	◆	0 = 1 =	datum setting via axis keys and soft key datum setting with soft key only	0

* accessible via code number 123
[1)] not with TNC 407

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Cancel status display and Q-parameters with M02, M30 and END PGM	7300*		I06	I09	-	-	-	-	0 = status display and Q-parameters are not cancelled 1 = status display and Q-parameters are cancelled	0
Cancel status display and Q-parameters	7300									
• cancel status display with M02, M30 and END PGM		0	06	09	◆	◆	-	-	+0 = status display is not cancelled +1 = status display is cancelled	
• cancel Q-parameters when program is selected		1	06	09	◆	◆	-	-	+0 = Q-parameters are cancelled +2 = Q-parameters are not cancelled	
Selective erasing of	7300		-	-	-	-	◆	◆	0 to 7	0
• status data (S)		0							end of program | program selection	
• TOOL data (T)		1							0 = S Q T | - - -	
• Q-parameter values (Q)		2							1 = - - - | - - -	
with M02, M30, END PGM									2 = S Q T | - Q -	
									3 = - Q - | - Q -	
									4 = S Q T | - - T	
									5 = - - T | - - T	
									6 = S Q T | - Q T	
									7 = - Q T | - Q T	
									- = data are erased	
Graphics display	7310*									0
• view in three planes		0	◆	◆	◆	◆	◆	◆	+0 = German standard +1 = American standard	
• rotating the coordinate system in the working plane		1	◆	◆	◆	◆	◆	◆	+0 = no rotation +2 = coordinate system rotated by +90°	
• BLK form after datum shift		2	-	-	-	-	◆	◆	+0 = BLK form is not shifted +4 = BLK form is shifted	
• show cursor position in "view in 3 planes"		3	-	-	-	-	◆	◆	+0 = cursor is not displayed +8 = cursor is displayed	

* accessible via code number 123

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Graphic simulation of a process without TOOL CALL and without infeed movement in the operating modes "Program Run" and "Test Run" **Tool radius**	7315*	-	-	-	-	◆	◆	0 to 99 999 [mm]	0
Tool penetration depth (from upper edge of blank)	7316*	-	-	-	-	◆	◆	0 to 99 999 [mm]	0
M-function to start the simulation	7317.0*	-	-	-	-	◆	◆	0 to 88	0
M-function to interrupt the simulation	7317.1*	-	-	-	-	◆	◆	0 to 88	0

* accessible via code number 123

Colours, General Display and FK-Graphics

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Background colour for soft keys, operating modes, dialog display, simulation, parallel graphics	7320.0		◆	◆	-	-	-	-	0 to 4095	0
Background of block display	7320.1		◆	◆	-	-	-	-	0 to 4095	538
Background of status factor	7320.2		◆	◆	-	-	-	-	0 to 4095	800
Background of FK-graphics	7320.3		◆	◆	-	-	-	-	0 to 4095	0
FK-graphics: resolved contour	7320.4		◆	◆	-	-	-	-	0 to 4095	4095
FK-graphics: subprograms	7320.5		◆	◆	-	-	-	-	0 to 4095	240
FK-graphics: alternative solutions	7320.6		◆	◆	-	-	-	-	0 to 4095	240
FK-graphics: non-resolved contour	7320.7		◆	◆	-	-	-	-	0 to 4095	3840
Window frames	7320.8		◆	◆	-	-	-	-	0 to 4095	3202
Operating mode display	7320.9		◆	◆	-	-	-	-	0 to 4095	3458
General block display	7320.10		◆	◆	-	-	-	-	0 to 4095	3731
Status display	7320.11		◆	◆	-	-	-	-	0 to 4095	4003
Axis display	7320.12		◆	◆	-	-	-	-	0 to 4095	4020
Display of current block	7320.13		◆	◆	-	-	-	-	0 to 4095	4055

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Dialog display, colour of soft key symbols	7320.14	◆	◆	-	-	-	-	0 to 4095	4074
Error messages	7320.15	◆	◆	-	-	-	-	0 to 4095	4095
Colours for "3D-View"								0 to 4095	
upper edges	7321.0	◆	◆	-	-	-	-		2254
front surface	7321.1	◆	◆	-	-	-	-		872
symbols	7321.2	◆	◆	-	-	-	-		4095
right edges	7321.3	◆	◆	-	-	-	-		1162
Colours for "View in 3 Planes"								0 to 4095	
horizontal projection	7322.0	◆	◆	-	-	-	-		2254
vertical and side view	7322.1	◆	◆	-	-	-	-		2254
symbols and coordinate system	7322.2	◆	◆	-	-	-	-		872
cursor	7322.3	◆	◆	-	-	-	-		300
Colours for the status window								0 to 4095	
status elements	7323.0	05	08	-	-	-	-		4095
recognition texts	7323.1	05	08	-	-	-	-		240
separating line	7323.2	05	08	-	-	-	-		3840
no function	7323.3	05	08	-	-	-	-		0

User Parameters

Function		MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
USER parameters											
										0 to 9999.99	
Determination of the user parameters	0	7330.0		◆	◆	◆	◆	◆	◆	number of desired machine parameter	0
	1	7330.1		◆	◆	◆	◆	◆	◆	NOTE: Always enter 2 decimal places:	0
	2	7330.2		◆	◆	◆	◆	◆	◆	i.e. 110.10 (not: 110.1)	0
	3	7330.3		◆	◆	◆	◆	◆	◆		0
	4	7330.4		◆	◆	◆	◆	◆	◆		0
	5	7330.5		◆	◆	◆	◆	◆	◆		0
	6	7330.6		◆	◆	◆	◆	◆	◆		0
	7	7330.7		◆	◆	◆	◆	◆	◆		0
	8	7330.8		◆	◆	◆	◆	◆	◆		0
	9	7330.9		◆	◆	◆	◆	◆	◆		0
	10	7330.10		◆	◆	◆	◆	◆	◆		0
	11	7330.11		◆	◆	◆	◆	◆	◆		0
	12	7330.12		◆	◆	◆	◆	◆	◆		0
	13	7330.13		◆	◆	◆	◆	◆	◆		0
	14	7330.14		◆	◆	◆	◆	◆	◆		0
	15	7330.15		◆	◆	◆	◆	◆	◆		0
Allocation of the dialogs to the user parameters	0	7340.0		◆	◆	◆	◆	◆	◆	0 to 4095	0
	1	7340.1		◆	◆	◆	◆	◆	◆	0 = first line of the respective file	0
	2	7340.2		◆	◆	◆	◆	◆	◆		0
	3	7340.3		◆	◆	◆	◆	◆	◆		0
	4	7340.4		◆	◆	◆	◆	◆	◆		0
	5	7340.5		◆	◆	◆	◆	◆	◆		0
	6	7340.6		◆	◆	◆	◆	◆	◆		0
	7	7340.7		◆	◆	◆	◆	◆	◆		0
	8	7340.8		◆	◆	◆	◆	◆	◆		0
	9	7340.9		◆	◆	◆	◆	◆	◆		0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
10	7340.10	◆	◆	◆	◆	◆	◆		0
11	7340.11	◆	◆	◆	◆	◆	◆		0
12	7340.12	◆	◆	◆	◆	◆	◆		0
13	7340.13	◆	◆	◆	◆	◆	◆		0
14	7340.14	◆	◆	◆	◆	◆	◆		0
15	7340.15	◆	◆	◆	◆	◆	◆		0

Colours for General Display and FK-Graphics

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Window frames	7350	-	-	◆	◆	◆	◆	$0000000 to $03F3F3F	$030200C
Error messages	7351	-	-	◆	◆	◆	◆	$0000000 to $03F3F3F	$03F3F3F
Operating mode "Machine"								$0000000 to $03F3F3F	
background	7352.0	-	-	◆	◆	◆	◆		$0000000
text of operating mode	7352.1	-	-	◆	◆	◆	◆		$0342008
dialogs	7352.2	-	-	◆	◆	◆	◆		$03F3828
Operating mode "Programming"								$0000000 to $03F3F3F	
background	7353.0	-	-	◆	◆	◆	◆		$0000000
text of operating mode	7353.1	-	-	◆	◆	◆	◆		$0342008
dialogs	7353.2	-	-	◆	◆	◆	◆		$03F3828

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Text display "Machine"								$0000000 to $03F3F3F	
background	7354.0	-	-	◆	◆	◆	◆		$0080400
general program text	7354.1	-	-	◆	◆	◆	◆		$038240C
current block	7354.2	-	-	◆	◆	◆	◆		$038341C
background of current window	7354.3	-	-	◆	◆	◆	I04		$00C0800
background of inactive window	7354.4	-	-	-	-	-	04		$0040800
Text display "Programming"								$0000000 to $03F3F3F	
background	7355.0	-	-	◆	◆	◆	◆		$0080400
general program text	7355.1	-	-	◆	◆	◆	◆		$038240C
current block	7355.2	-	-	◆	◆	◆	◆		$038341C
background of current window	7355.3	-	-	◆	◆	◆	I04		$00C0800
background of inactive window	7355.4	-	-	-	-	-	04		$0080400
Status and PLC window								$0000000 to $03F3F3F	
background	7355.0	-	-	◆	◆	◆	◆		$00C0800
axis positions in status display	7355.1	-	-	◆	◆	◆	◆		$03F2C18
status display (except axis pos.)	7355.2	-	-	◆	◆	◆	◆		$03F280C
Soft keys "Machine"								$0000000 to $03F3F3F	
background	7357.0	-	-	◆	◆	◆	◆		$0000000
symbols	7357.1	-	-	◆	◆	◆	◆		$03F3828
Soft keys "Programming"								$0000000 to $03F3F3F	
background	7358.0	-	-	◆	◆	◆	◆		$0000000
symbols	7358.1	-	-	◆	◆	◆	◆		$03F3828
Graphics: 3D view								$0000000 to $03F3F3F	
background	7360.0	-	-	◆	◆	◆	◆		$0000000
surface	7360.1	-	-	◆	◆	◆	◆		$0203038
front surface	7360.2	-	-	◆	◆	◆	◆		$00C1820
text fields in the graphics window	7360.3	-	-	◆	◆	◆	◆		$03F3F3F
lateral surface	7360.4	-	-	◆	◆	◆	◆		$0102028

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Graphics: View in 3 planes (and Oscilloscope)								$0000000 to $03F3F3F	
background	7361.0	-	-	◆	◆	◆	◆		$0000000
horizontal projection (grid)	7361.1	-	-	◆	◆	◆	◆		$0203038
vertical and horizontal view (non-selected channel)	7361.2	-	-	◆	◆	◆	◆		$0203038
coordinate system and texts in graphics display (cursor, data, detail)	7361.3	-	-	◆	◆	◆	◆		$03F3F3F
cursor (selected channel)	7361.4	-	-	◆	◆	◆	◆		$03F0000
Additional status display in graphics window								$0000000 to $03F3F3F	
background colour of status display	7362.0	-	-	◆	◆	-	-		
elements of status display	7362.1	-	-	◆	◆	-	-		
headlines of status display	7362.2	-	-	◆	◆	-	-		
separating lines	7362.3	-	-	◆	◆	-	-		
background of graphics window	7362.0	-	-	-	-	◆	◆	$0000000 to $03F3F3F	
background of status display	7362.1	-	-	-	-	◆	◆		$0080400
symbols in status display	7362.2	-	-	-	-	◆	◆		$00C0800
values in status display	7362.3	-	-	-	-	◆	◆		$038240C
									$03F2C18
FK graphics								$0000000 to $03F3F3F	
background colour	7363.0	-	-	◆	◆	◆	◆		$0000000
resolved contours	7363.1	-	-	◆	◆	◆	◆		$03F3F3F
subprograms and zoom frame	7363.2	-	-	◆	◆	◆	◆		$0003F00
alternative solutions	7363.3	-	-	◆	◆	◆	◆		$0003F00
non-resolved contours	7363.4	-	-	◆	◆	◆	◆		$03F0000

Machining and Program Run

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Cycle "Scaling Factor" active in 2 or 3 axes	7410*		◆	◆	◆	◆	◆	◆	0 = 3 axes 1 = in the operating plane	0
Tool data in TOUCH PROBE block	7411*		◆	◆	◆	◆	◆	◆	0 = the current tool data are overwritten with the calibrated touch probe data 1 = the current tool data are retained	0
Cycle for milling pockets with free-programmed contour	7420*		◆	◆	◆	◆	◆	◆	0 to 15	%0000 (0)
• slot-milling direction		0							0 = ccw for milling pockets cw for milling islands 1 = cw for milling pockets ccw for milling islands	
• sequence for clearing out and slot milling		1							0 = first slot-milling, then clear out pocket 2 = first clear out pocket, then slot-milling	
• merge programmed contours		2							0 = contours are only merged, if the tool center paths intersect 4 = contours are merged, if the programmed contours overlap	
• "clearing out" and "slot milling" to pocket depth or individually for each peck		3							0 = "clearing out" and "slot milling" in one operation over all pecks 8 = for each peck "slot milling" is run before "clearing out" (depending on bit 1)	

* accessible via code number 123

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Overlapping factor for pocket milling	7430*		◆	◆	◆	◆	◆	◆	0.1 to 1.414	1
Tolerance range for circle end point (linear contour)	7431*		-	-	◆	◆	◆	◆	0.0001 to 0.016 [mm]	0.01
Output of M-functions	7440*									%01011 (11)
Programmed stop with M06		0	◆	◆	◆	◆	◆	◆	+0 = program halt with M06 +1 = no program halt with M06	
Output of M98, modal cycle call		1	◆	◆	◆	◆	◆	◆	+0 = no cycle call, normal code transfer of M89 at beginning of block +2 = modal cycle call at end of block	
Axis standstill when an M-function is output **Exception:** axis standstill always occurs with M-functions that result in a programmed stop (e.g. M00, M02 ...) or with a STOP or a CYCL CALL block		2	◆	◆	◆	◆	◆	◆	+0 = program halt until acknowledgement of M-function +4 = no program halt, TNC does not wait for acknowledgement	
Select Kv factors with M105/M106		3	-	-	-	-	◆	◆	+0 = function not active +8 = function active	
Reduced feed rate in the tool axis with M103		4	-	-	-	-	◆	◆	+0 = function not active +16 = function active	
Position for tool exchange (from MP951.X) during block scan	7450		-	-	09	09	08	◆	0 = position ignored	%00000 (0)
X		0							+1 = position of X axis taken into account	
Y		1							+2 = position of Y axis taken into account	
Z		2							+4 = position of Z axis taken into account	
IV		3							+8 = position of IV. axis taken into account	
V		4							+16 = position of V. axis taken into account	
Constant feed rate in corners	7460*		◆	◆	◆	◆	◆	◆	0 to 179.9999 [°]	10
Display mode and software limit switches for rotary axis	7470*		◆	◆	◆	◆	◆	◆	0 = 0 to ± 359.999° (no software limit switch monitoring) 1 = 0 to ± 99 999.999°	0

* accessible via code number 123

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Datum in datum table	7475	-	-	-	-	◆	◆	0 = datum point is workpiece datum 1 = datum point is machine datum	0
Output of tool number or pocket number								0 to 6	
with TOOL CALL block	7480.0	◆	◆	◆	◆	◆	◆	0 = no output	2
		◆	◆	◆	◆	◆	◆	1 = output of tool number only when tool number changes (W262)	
		◆	◆	◆	◆	◆	◆	2 = output of tool number with every TOOL CALL (W262)	
		◆	◆	◆	◆	◆	◆	3 = output of pocket number (W262) and tool number (W264) only when tool number changes	
		-	-	05	04	◆	◆	4 = output of pocket number (W262) and tool number (W264) with every TOOL CALL	
		-	-	-	-	08	◆	5 = output of pocket number (W262) and tool number (W264); pocket table does not change.	
		-	-	-	-	08	◆	6 = output of pocket number (W264) with every TOOL CALL; pocket table does not change.	

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
with TOOL DEF blocks (only if MP7260 > 0)	7480.1	◆ ◆ ◆ ◆ -	◆ ◆ ◆ ◆ -	◆ ◆ ◆ ◆ 05	◆ ◆ ◆ ◆ 04	◆ ◆ ◆ ◆ ◆	◆ ◆ ◆ ◆ ◆	0 = no output 1 = output of tool number only when tool number changes (W262) 2 = output of tool number with every TOOL DEF (W262) 3 = output of pocket number (W262) and tool number (W264) only when tool number changes 4 = output of pocket number (W262) and tool number (W264) with every TOOL DEF	2
Number of traverse range limitations	7490	05 05 - -	08 08 - -	◆ ◆ - -	◆ ◆ - -	◆ ◆ 08 08	◆ ◆ ◆ ◆	0 = 1 range, 3 datum points 1 = 3 ranges, 3 datum points 2 = 1 range, 1 datum point 3 = 3 ranges, 1 datum point	0

* accessible via code number 123

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Description of the swivel head geometry										
1. Parameter block										
Selection of the transformed axis	7510									
		0	-	-	-	-	08	◆	0 to 63	0
		1							+1 = X-axis	
		2							+2 = Y-axis	
		3							+4 = Z-axis	
		4							+8 = A-axis	
		5							+16 = B-axis	
									+32 = C-axis	
Additional identifier for transformation	7511		-	-	-	-	08	◆		0
		0							0 = swivel head 1 = tilting table	
		1							0 = incremental dimensions (for swivel head) 1 = absolute dimensions, referenced to the machine datum (for tilting table)	
Dimensions for transformation	7512		-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999 0 = swivelling axis	0
2. Parameter block	7520		-	-	-	-	08	◆	0 to 63	0
	7521		-	-	-	-	08	◆	0 to 3	0
	7522		-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0
3. Parameter block	7530		-	-	-	-	08	◆	0 to 63	0
	7531		-	-	-	-	08	◆	0 to 3	0
	7532		-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0
4. Parameter block	7540		-	-	-	-	08	◆	0 to 63	0
	7541		-	-	-	-	08	◆	0 to 3	0
	7542		-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
5. Parameter block	7550	-	-	-	-	08	◆	0 to 63	0
	7551	-	-	-	-	08	◆	0 to 3	0
	7552	-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0
6. Parameter block	7560	-	-	-	-	08	◆	0 to 63	0
	7561	-	-	-	-	08	◆	0 to 3	0
	7562	-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0
7. Parameter block	7570	-	-	-	-	08	◆	0 to 63	0
	7571	-	-	-	-	08	◆	0 to 3	0
	7572	-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0
8. Parameter block	7580	-	-	-	-	08	◆	0 to 63	0
	7581	-	-	-	-	08	◆	0 to 3	0
	7582	-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0
9. Parameter block	7590	-	-	-	-	08	◆	0 to 63	0
	7591	-	-	-	-	08	◆	0 to 3	0
	7592	-	-	-	-	08	◆	- 99 999.9999 to + 99 999.9999	0

Hardware

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Feed rate and spindle override	7620									2
Feed rate override if the rapid traverse key is pressed in the operating mode "Program Run"		0	◆	◆	◆	◆	-	-	+0 = override inactive +1 = override active	
Override in 2% or 1% increments (if inactive, always 1%)		1	◆	◆	I04	I04	-	-	+0 = 2% steps +2 = 1% steps	
Feed rate override if the rapid traverse key and external direction keys are pressed in the "Manual" mode		2	◆	◆	◆	◆	-	-	+0 = override inactive +4 = override active	
Override in 0.01% increments with non-linear characteristic curve		3	-	-	02	02	-	-	+0 = override inactive +8 = 0.01% steps	
Feed rate and spindle override	7620		-	-	-	-	◆	◆		%1101
Feed rate override function if the rapid traverse key is pressed in the operating mode "Program Run"		0							+0 = feed override inactive +1 = feed override active	
Feed override function • in the MANUAL mode , if the rapid traverse key and external direction keys are pressed • in the HANDWHEEL mode if the rapid traverse key and the direction key on the handwheel are pressed.		2							+0 = feed override inactive +4 = feed override active	
Override, characteristic curve		3							+0 = feed and spindle override in 1% steps +8 = feed and spindle override in 0.01% steps and non-linear characteristic line	

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Configuration of the handwheel	7640*	◆	◆	I03	I03	-	-	0 = machine with electronic handwheel 1 = machine without electronic handwheel	0
Configuration of the handwheel		-	-	03	03	◆	◆	0 = no handwheel connected	0
	7640*	-	-	03	03	◆	◆	1 = HR 330 (all keys via NC) 1)	
		-	-	03	03	◆	◆	2 = HR 130, HR 330 (all keys via NC) 2)	
		-	-	-	-	◆	◆	3 = HR 330 rapid traverse key: PLC I 162 plus key: PLC I 160 minus key: PLC I 161	
		-	-	-	-	◆	◆	4 = HR 332; evaluation of keys and LEDs depends on MP7645.0	
		-	-	-	-	◆	◆	5 = HRA 110, multi-axis handwheel (3 x HR 150)	
		-	-	-	-	-	04	6 = HRA 410, evaluation of keys and LEDs depends on MP7645.0	
Entry of interpolation factor	7641	-	-	-	-	◆	◆	0 = at keyboard 1 = via PLC module 9036	0

* accessible via code number 123

1) axis switchover with handwheel
2) axis switchover with handwheel or keyboard
3) If the HR 410 does not receive any initializing parameters (MP 7645.x) it automatically switches to HR 332 mode (MP 7640 = 4).

Function	MP No.	Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Initalizing parameters for the handwheel Allocation of the 3rd handwheel via axis selector switch **(MP7640 = 5)**	7645.0	0	-	-	-	-	◆	◆	+0 = position 1 (left stop) → Z axis position 2 → IV. axis position 3 → V. axis +1 = position 1 → X axis position 2 → Y axis position 3 → Z axis position 4 → IV. axis position 5 → V. axis	0
		1							+2 = position 3 → Z axis position 4 → IV. axis position 5 → V. axis	
		2 - 7							reserved	
Evaluation of keys and LEDs on HR332 **(MP7640 = 4)** HR 410 in HR 332 mode **(MP 7640 = 4)**	7645.0		-	-	-	-	◆	◆	**HR 332** 0 = keys X, Y, Z, IV and their LEDs are evaluated by NC remaining keys: PLC I 164 to I 170 remaining LEDs: PLC O 100 to O 106 1 = keys: PLC I 160 to I 171 LEDs: PLC O 96 to O 107 **HR 410** 0 = keys X, Y, Z, IV and their LEDs are evaluated by NC remaining keys: PLC I 164 to I 171 remaining LEDs: PLC O 100 to O 107 1 = keys: PLC I 160 to I 171 LEDs: PLC O 96 to O 107	0
HR 410 in HR 410 mode **(MP 7640 = 6)**	7645.0		-	-	-	-	◆	◆	0 = keys X, Y, Z, IV, V, actl. value transfer and their LEDs are evaluated by NC remaining keys: PLC I 168 to I 175 remaining LEDs: PLC O 100 to O 111 1 = keys: PLC I 168 to I 175 LEDs: PLC O 96 to O 111	0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Allocation of the 3rd handwheel via machine parameter **(MP7640 = 5)**	7645.1	-	-	-	-	◆	◆	0 = simulation of the first position of the selector switch MP 7645.0 = 0 → Z axis MP 7645.0 = 1 → X axis +1 = X axis +2 = Y axis +4 = Z axis +8 = IV. axis +16 = V. axis	0
Select axis selection process **(MP7640 = 5)**	7645.2	-	-	-	-	◆	◆	0 = axis selection via axis selector switch according to MP 7645.0 1 = axis selection according to MP 7645.1	
reserved	7645.3 ... 7645.7	-	-	-	-	◆	◆	no function	0

Function	MP No. Bit	A	B	C	D	E	F	Input	AE-6 Entry Value
Handwheel, counting direction	7650	◆	◆	◆	◆	◆	◆	0 = positive counting direction 1 = negative counting direction	0
Hysteresis for electronic handwheel	7660	◆	◆	◆	◆	◆	◆	0 to 65 535 [increments]	10
Handwheel, minimum interpolation factor	7670	◆	◆	◆	◆	◆	I04	0 to 10	0
Handwheel interpolation factor								0 to 10	
slow (HR 130/3xx/410)	7670.0	-	-	-	-	-	04		0
medium (HR 410 only)	7670.1	-	-	-	-	-	04		0
fast (HR 410 only)	7670.2	-	-	-	-	-	04		0
HR 410: %-factor of manual feed								0 to 100 [%]	
slow (HR 410 only)	7671.0	-	-	-	-	-	04		50
medium (HR 410 only)	7671.1	-	-	-	-	-	04		75
fast (HR 410 only)	7671.2	-	-	-	-	-	04		100

Function	**MP No.**	**Bit**	**A**	**B**	**C**	**D**	**E**	**F**	**Input**	**AE-6 Entry Value**
Multifunctional parameters	7680									%0011111 (31)
• memory function for axis direction keys		0	◆	◆	◆	◆	◆	◆	0 = not stored +1 = stored	
• re-approaching the contour		1	◆	◆	◆	◆	◆	◆	0 = inactive +2 = active	
• block scan		2	06	09	◆	◆	◆	◆	0 = inactive +8 = active	
• block scan interrupted by STOP or M06		3	09	12	◆	◆	◆	◆	0 = interruption active +16 = interruption inactive	
• with block scan in a TAPPING cycle, the dwell time to reverse the direction of rotation is waited to end		4	19	12	◆	◆	◆	◆	0 = dwell time is waited to end +8 = dwell time is not waited to end	
• start of calculation with block scan		5	◆	◆	◆	◆	◆	◆	0 = start at cursor position +32 = start at beginning of program	
• tool length for blocks with surface normal vector		6	-	-	-	-	-	◆	0 = without DR2 from tool table +64 = with DR2 from tool table	
Memory test after power-on	7690		◆	◆	◆	◆	◆	◆	0 to 7	%11 (3)
RAM		0							+0 = test +1 = no test	
EPROM		1							+0 = test +2 = no test	