HEIDENHAIN

Technical Information

TNC 370 D

NC Software 286 02x xx

April 1999

Contents

1 Specifications

Axes		3 or 4 and spindle S; All axes can be defined as NC or PLC axes
Program memory		128 KB (64 NC programs with a total of approx. 6000 blocks)
Input resolution and display step		1 µm for linear axes 0.001 degrees for rotary axes
Interpolation		
	Linear interpolation	3 of 4 axes
	Circular interpolation	2 of 4 axes
	Helix	Superimposition of circular arcs and straight lines
	Tapping without floating tap holder[1)]	Yes
Block processing time[2)]		6 ms
Axis control		Velocity feedforward control; Operation with servo lag
	Position control resolution	**Fehler!**
	Cycle time path interpolation	6 ms
Error compensation		• Linear axis error • Multipoint axis error • Backlash • Reversal spikes during circular motion • Thermal expansion • Offset
Data interface		RS–232–C/ V.24, max. 115 200 baud

1) This function must be implemented by the machine manufacturer.
2) 3-D straight lines without radius compensation

Integral PLC

PLC memory	Approx. 8 000 commands				
PLC cycle time	24 ms				
	LE	**LE + PL 410 B**		**LE + 2 PL 410 B**	
		Analog input PT 100		**Analog input PT 100**	
		without	**with**	**without**	**with**
PLC inputs 24 Vdc	56	119	119	183	183
PLC outputs 24 Vdc	31	62	62	93	93
Analog inputs ± 10 V	3 (option)	–	7	–	11
Inputs for PT100 thermistors	2 (option)	–	6	–	10
"Control-is-ready" signal output	1	2		3	
"Control-is-ready" signal input	1	1		1	

Power supply for logic	400 Vac ± 10 %
Power supply for PLC	24 Vdc
Weight	6 kg

User Functions

Program input	In HEIDENHAIN conversational programming and according to ISO	
Position data	Nominal positions in Cartesian or polar coordinates, dimensional data absolute or incremental, display and input in mm or inches	
Subprogramming	Program section repeat, subprograms, program calls	
Parallel operation	Creation of a program while another program is being run	
Fixed cycles	• Peck drilling, tapping, slot milling, rectangular and circular pockets, contour pockets • OEM cycles	
Coordinate transformation	• Shift, rotation, mirror, scaling (axis-specific)	
Q parameters for programming using variables	• Mathematical functions =, +,–, ∗, /, sin α, cos α, angle α from sin α and cos α, $\sqrt{}$,a, $\sqrt{}$,$a^2 + b^2$, tan α, arc sin, arc cos, arc tan, a^n, e^n, ln, log, absolute value of a number, the constant π, negation, truncation before or after decimal point • Logical comparisons (=, ≠, <, >) • Parentheses	
Tools	Compensation	Tool radius in the working plane and tool length
	Management	Tool table for max. 256 tools with flexible pocket coding, tool-life monitoring and sister tool organization
FK free contour programming	FK free contour programming in HEIDENHAIN plain language with graphic support for non NC-dimensioned workpieces	
Return to contour/ Mid-program startup	Possible	
Position capture	Actual positions are transferred directly to the NC programs	
Datum tables	Tables with 256 datums	
Pattern	Tables with 256 datums	
Test graphics Display modes	Graphic simulation of machining process • Plan view • view in three planes • 3-D view • Detail enlargement	

2 Components

LE 370 D logic unit **Id. Nr. 337 526-xx**	LE in M design for analog axis control with integrated power supply
BF 370 B visual display unit **Id. Nr. 288 708-04**	Visual display unit with flat-panel display (monochrome, 192 mm x 120 mm)
TE 370 keyboard unit **Id. Nr. 288 713-01**	Keyboard unit with integrated handwheel and machine operating keys

Accessories

PLC input/output unit PL 410 B **Id. Nr. 263 371 12**	64 inputs 24 Vdc 31 outputs 24 Vdc
PLC input/output unit PL 410 B **Id. Nr. 263 371-02**	64 inputs 24 Vdc 31 outputs 24 Vdc 4 analog inputs ± 10 V 4 inputs for PT100 thermistors
PLC input/output unit PL 405 B **Id. Nr. 263 371 21**	32 inputs 24 Vdc 15 outputs 24 Vdc
TS 220 touch probe **Id. Nr. 293 488-xx**	Triggering touch probe, transmission via cable
TS 220/LE adapter cable Id. Nr. 274 543-xx	Adapter cable for connecting the touch probe to the logic unit
TS 630 touch probe **Id. Nr. 293 714-xx**	Triggering touch probe, infrared transmission, omnidirectional transmission
EA 550 receiver unit Id. Nr. 262 904-01	Receiver unit for trigger signals
EA 550/LE adapter cable Id. Nr. 310 197-xx	Adapter cable for connecting the EA 550 receiver unit to the logic unit
TT 130 touch probe **Id.-Nr. 296 537-xx**	Triggering touch probe, transmission via cable, for tool measurement
TS 130/LE adapter cable Id. Nr. 335 332-xx	Adapter cable for connecting the touch probe to the logic unit

HR 410 handwheel **Id. Nr. 296 469-xx**	Portable electronic handwheel
Connecting cable to handwheel Id. Nr. 312 879-01	Spiral cable 3m
Adapter cable HR 410/LE Id. Nr. 296 466-xx	Adapter cable for connecting the spiral cable, emergency stop and permissive keys
HR 130 handwheel **Id. Nr. 254 040-05**	Integral handwheel

3 Mounting and Electrical Installation

3.1 Electrical Noise Immunity

Location for Use
This device corresponds to Class A according to EN 55022 and is intended primarily for operation in industrially zoned areas.

Remember that the vulnerability of electronic equipment to noise increases with faster signal processing and higher sensitivity. Protect your equipment by observing the following rules and recommendations.

Noise voltages are mainly produced and transmitted by capacitive and inductive coupling. Electrical noise can be picked up by the inputs and outputs to the equipment, and the cabling.

Likely sources of interference are:
- Strong magnetic fields from transformers and electric motors
- Relays, contactors and solenoid valves
- High-frequency equipment, pulse equipment and stray magnetic fields from switch-mode power supplies
- Mains leads and leads to the above equipment

Electrical interference can be avoided by:

- A minimum distance of 20 cm between the logic unit (and its leads) and interfering equipment.
- A minimum distance of 10 cm between the logic unit (and its leads) and cables carrying interference signals. (Where signal cables and cables that carry interference signals are laid together in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.)
- Shielding according to IEC 742 EN 50 178
- **Potential compensating lines — $\varnothing \geq 6$ mm²/10 mm² (see Grounding Plan)**
- **Use of original HEIDENHAIN cables, connectors and couplings.**

3.2 Heat Generation and Cooling

Please note that the reliability of electronic equipment is greatly reduced by continuous operation at high temperatures. Be sure to make the necessary arrangements to keep within the permissible ambient temperature range.

Permissible ambient temperature in operation: **0 °C to 45 °C (32 to 113 °F)**

The following means may be employed to ensure adequate heat removal:

- Provide sufficient space for air circulation.
- Build in a fan to circulate the air inside the control cabinet. The fan must reinforce the natural convection. It must be mounted so that the warm air is extracted from the logic unit and no pre-warmed air is blown into the unit. The warmed air should flow over surfaces that have good thermal conductivity to the external surroundings (for example sheet metal).
- For a closed steel housing without assisted cooling, the figure for heat conduction is 3 Watt/m² of surface per °C air temperature difference between inside and outside.
- Use of a heat exchanger with separate internal and external circulation.
- Cool by blowing external air through the control cabinet to replace the internal air. In this case the fan must be mounted so that the warm air is extracted from the control cabinet and only filtered air can be drawn in. HEIDENHAIN advises against this method of cooling, since the function and reliability of electronic assemblies are adversely affected by contaminated air (fine dust, vapors, etc.). Besides these disadvantages, a filter that is not adequately serviced leads to a loss in cooling efficiency. Regular servicing is therefore vital.

3.3 Humidity

Permissible humidity: < 75% in continuous operation,
< 95% for not more than 30 days p.a. (randomly distributed).

In tropical areas it is recommended that the TNC not be switched off, so that condensation is avoided on the circuit boards. The heat generation prevents condensation and has no further disadvantages.

3.4 Mechanical Vibration

Permissible vibration: $< 0.5\ m/s^2$

3.5 Degree of Protection

Visual display unit when mounted	Protection class IP54
Keyboard unit when mounted	Protection class IP54
HR 410 handwheel	Protection class IP54

IP54 = Protection against dust and splashwater

3.6 Mounting Position

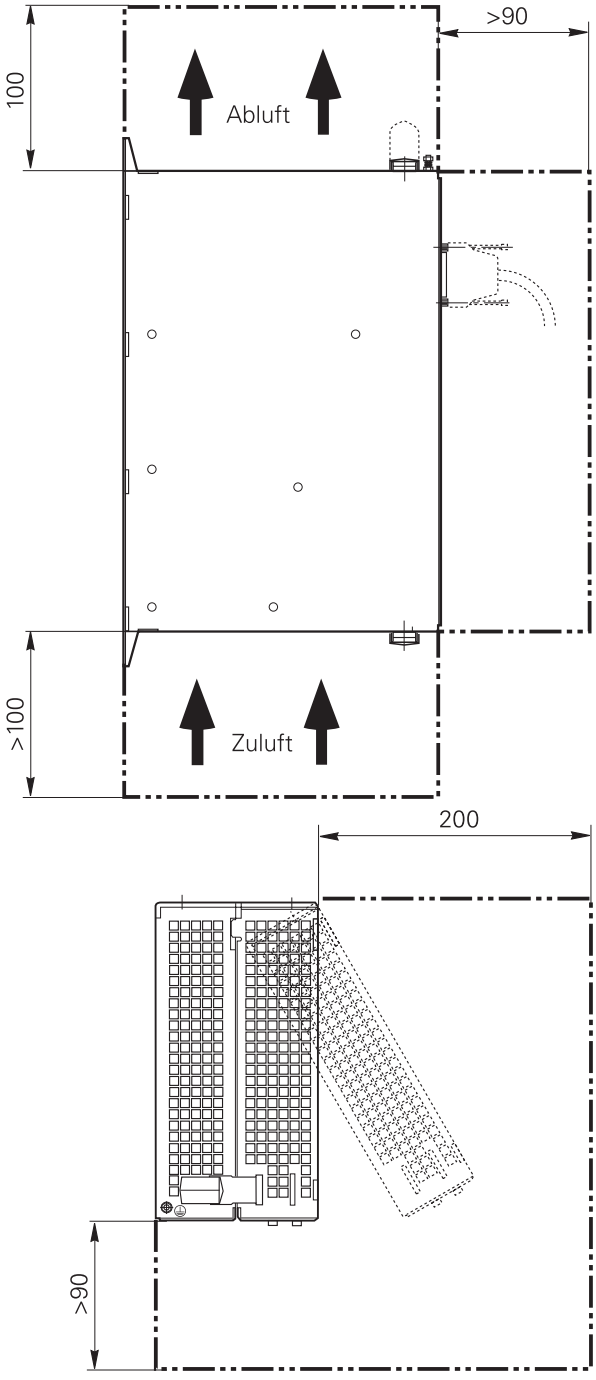
Note the following fundamental points on mounting:

- Mechanical accessibility
- Permissible environmental conditions
- Electrical noise immunity
- The electrical regulations that are in force in your country

Visual Display Unit BF 370 B

The required clearance for air circulation is shown in the dimension drawing in the Appendix!

Mounting Position of LE 370 D



Free space for air circulation!

Leave space for servicing

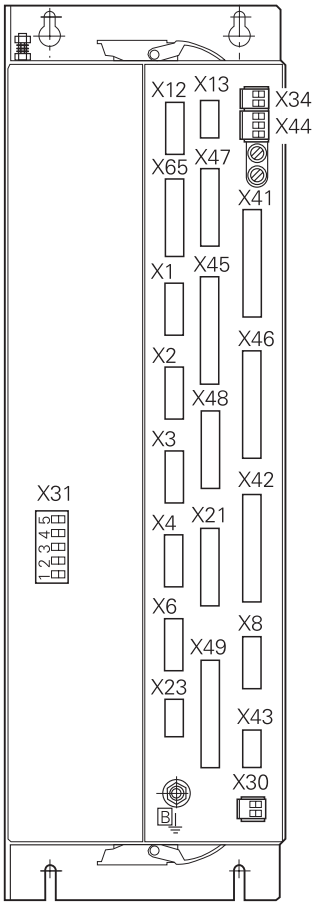
Free space for air circulation and servicing

Leave space for servicing.

Connecting cables must be laid in a way that allows the LE to be opened!

3.7 Connection Overview

3.7.1 LE 370 D



X1 to X4	Position encoder
X6	Encoder for spindle position
X8	Nominal value output
X12	Triggering touch probe for workpiece measurement
X13	Triggering touch probe for tool measurement
X21	RS-232-C/V24 data interface
X23	Handwheel input
X30	Reference signal for spindle
X41	PLC output
X42	PLC input
X44	PLC power supply
X43	Flat-panel display BF 370 B
X45	TNC keyboard
X46	Machine operating panel
X47	PLC expansion PL410B/PL405B
X48	PLC analog input
X31	NC power supply
B	Signal ground
⏚	Protective ground (YL/GN)

3.7.2 Power Supply

X31 NC Power Supply

Terminal X31	Assignment	
PE	Protective ground (YL/GN)	
U_1	L1	330 Vac to 450 Vac; 50 to 60 Hz
U_2	L2	
$-U_Z$	Do not use	
$+U_Z$	Do not use	

Danger to internal components!
Do not engage or disengage any connections while the unit is under power.

X44 PLC Power Supply

Terminal	Assignment	Fuse
1	+ 24 Vdc can be switched off via EMERGENCY STOP	F 3,15 A
2	+ 24 Vdc cannot be switched off via EMERGENCY STOP	F 2 A
3	0 V	

HEIDENHAIN recommends that you operate the PLC of the LE (and the PL 410B/PL 405B) with a 24 V control voltage that is generated as per VDE 0551. The control voltage must be smoothed with approx. 150µF / A (at 15 A, this corresponds to a smoothing capacity of 2250 µF), where a minimum capacity of 1000µF (63V) is to be ensured.

The 0 V line of the PLC power voltage must be connected by a grounding line (∅≥ 6 mm^2) with the central signal ground of the machine.

Supply voltage	**Voltage range, mean dc voltage**	**Max. current consumption** (when half of the outputs are on simultaneously)	**Current consumption** (when half of the outputs are on simultaneously)
24 Vdc EN 61 131-2: 1994; VDE 0411 Part 500	Lower limit 19,2 V ⎓ Upper limit 30 V ⎓	**LE 370 D:** 2 A	**LE 370 D:** 48 W

Besides the voltage tolerance, a dc component with a peak value of 5% of the rated voltage is permissible. The absolute limits lie at 30 V/19.2 V.

Danger to internal components!
Use only original replacement fuses.

3.7.3 Measuring System Inputs

HEIDENHAIN TNC contouring controls are designed for use with incremental linear and angular encoders as measuring systems.
However, HEIDENHAIN recommends using encoders with distance-coded reference marks because they significantly reduce the traverse distance required to establish the absolute position.

Maximum current load per encoder input: 200 mA

Use only original HEIDENHAIN encoder cables, connectors and couplings. For maximum cable lengths see "Cable Overview."

Encoder for Position with 1 V_{SS}

Maximum input frequency: 350 kHz (via MP 115.1 switchable to 50 kHz)

X1, X2, X3, X4 and X6 (Spindle) Encoder (1 V_{PP}) (via MP 115.0 switchable to 11µA)

Logic unit		Encoder cable	
D-sub terminal (male) 15-pin	**Assignment**	**D-sub connector (female) 15-pin**	
1	+ 5 V (U_P)	1	Brown/Green
2	0 V (U_N)	2	White/Green
3	A+	3	Brown
4	A–	4	Green
5	0 V	5	
6	B+	6	Gray
7	B–	7	Pink
8	0 V	8	
9	+ 5 V	9	Blue
10	R+	10	Red
11	0 V	11	White
12	R–	12	Black
13	0 V	13	
14	*Do not use*	14	Violet
15	*Do not use*	15	
Housing	External shield	Housing	External shield

For the spindle position, HEIDENHAIN recommends the ROD 486 with 1024 or 2048 lines.
The **1 V_{PP}** signals are interpolated by a factor of 1024.

3.7.4 Reference Signal for the Spindle

Usually, the reference mark of the spindle encoder is evaluated as a reference signal for the spindle. In special cases, a 24 V signal on terminal X30 can be evaluated as a reference signal for the spindle or as a reference signal release (see chapter "Spindle"). For reliable evaluation, the signal must last for at least 3 milliseconds.

X30 Spindle Reference Signal

Terminal	Assignment
1	+24 V input
2	0 V

3.7.5 Supply voltage for Control-is-Ready Signal

The power supply for the control-is-ready signal is taken from the 24 V power supply of the PLC.

X34 power supply for control-is-ready signal

Connecting terminal	Assignment
1	+24 V PLC
2	0 V

3.7.6 Analog Nominal Value Output

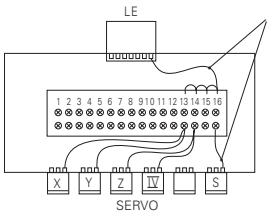
Maximum loading of the analog outputs: 2 mA
Maximum capacitance: 2 nF

X8 Nominal Value Output

Logic unit		Connecting Cable	
D-sub terminal (female) 15-pin	**Assignment**	**D-sub connector (male) 15-pin**	**Color**
1	Nominal value output 1	1	BN
2	Analog input	2	BN/GN
3	Nominal value output 2	3	YL
4	*Do not use*	4	RD/BL
5	Nominal value output 3	5	PK
6	*Do not use*	6	GY/PK
7	Nominal value output 4	7	RD
8	Nominal value output 5	8	VI
9	0V Nominal value output 1	9	WH
10	0V Analog input	10	WH/GY
11	0V Nominal value output 2	11	GN
12	*Do not use*	12	
13	0V Nominal value output 3	13	GY
14	0V Nominal value output 4	14	BL
15	0V Nominal value output 5	15	BK
Housing	External shield	Housing	External shield

- The connecting cables to the nominal value outputs must not have more than one intermediate terminal.
- If it is necessary to branch to physically separate servo inputs, the connection must be made in a grounded terminal box. Suitable terminal boxes are available from HEIDENHAIN (Id. Nr. 251 249 01).
- The chassis of the terminal box must be electrically connected with frame of the machine.
- The 0 V connection of the nominal-value-difference inputs must be connected with signal ground. Required cross section ≥ Ø 6 mm².
- Use only original HEIDENHAIN connecting cables and connecting elements.

The following wiring plan is suggested for shielding in the terminal box :



Insulated against housing

Leads are provided with en sleeves.

Cable screens are led onto 0.14 mm² insulated strands via crimp eyelets.

Insulated against housing

Leads are provided with end sleeves

Cable shields are led onto 0.14 mm² insulated wires via crimp eyelets.

Connection terminal	**Assignment**	
1	Nominal value output	X axis
2	Nominal value output 0 V	X axis
3	Nominal value output	Y axis
4	Nominal value output 0 V	Y axis
5	Nominal value output	Z axis
6	Nominal value output 0 V	Z axis
7	Nominal value output	IV axis
8	Nominal value output 0 V	IV axis
9	*Not used*	
10	*Not used*	
11	Nominal value output	S axis
12	Nominal value output 0 V	S axis
13	Shield connection	
14	Shield connection	
15	Shield connection	
16	Shield connection	

3.7.7 Switching Inputs 24 Vdc for the PLC

Voltage ranges:	**Logic unit**	**PL 410 B/PL 405 B**
"1" signal: U_i	13 V to 30.2 V	
"0" signal: U_i	–20 V to 3.2 V	

Current ranges:

"1" signal: I_i	3.8 mA to 8.9 mA	2.5 mA to 6 mA
"0" signal: I_i when U_i = 3.2 V	1.0 mA	0.65 mA

Address	**No. of inputs**	**Device**
I0 to I31	31 + control-is-ready signal	Logic unit X42 (PLC input)
I128 to I152	25	Logic unit X46 (machine operating panel)
I64 to I127	64	First PLC input/output board PL 410 B
I92 to I255	64	Second PLC input/output board PL 410 B
I64 to I95	32	PL 405 B

X42 PLC Input at the LE

Logic unit		Con. cable Id.-Nr 244 005 .. / Id. Nr. 263 954 ..	
D-sub connector (female) 37-pin	**Assignment**	**D-sub connector (male) 37-pin**	
1	D-sub connection (female) 37-pin	1	Gray/Red
2	I1	2	Brown/Black
3	I2	3	White/Black
4	I3 acknowledge "control-is-ready"; main processor	4	Green/Black
5	I4	5	Brown/Red
6	I5	6	White/Red
7	I6	7	White/Green
8	I7	8	Red/Blue
9	I8	9	Yellow/Red
10	I9	10	Gray/Pink
11	I10	11	Black
12	I11	12	Pink/Brown
13	I12	13	Yellow/Blue
14	I13	14	Green/Blue
15	I14	15	Yellow
16	I15	16	Red
17	I16	17	Gray
18	I17	18	Blue
19	I18	19	Pink
20	I19	20	White/Gray
21	I20	21	Yellow/Gray
22	I21	22	Green/Red
23	I22	23	White/Pink
24	I23	24	Gray/Green
25	I24	25	Yellow/Brown
26	I25	26	Gray/Brown
27	I26	27	Yellow/Black
28	I27	28	White/Yellow
29	I28	29	Gray/Blue
30	I29	30	Pink/Blue
31	I30	31	Pink/Red
32	I31	32	Brown/Blue
33	I32 (do not use)	33	Pink/Green
34	Do not use	34	Brown
35	0 V (PLC) Test output; *Do not use*	35	Yellow/Pink
36	0 V (PLC) Test output; *Do not use*	36	Violet
37	0 V (PLC) Test output; *Do not use*	37	White
Housing	External shield	Housing	External shield

PLC Input at the PL 410 B/PL 405 B

X3

Connection terminal	Assignment	
	1st PL 410 B PL 405 B	2nd PL 410 B
1	I64	I192
2	I65	I193
3	I66	I194
4	I67	I195
5	I68	I196
6	I69	I197
7	I70	I198
8	I71	I199
9	I72	I200
10	I73	I201
11	I74	I202
12	I75	I203
13	I76	I204
14	I77	I205
15	I78	I206
16	I79	I207

X4

Connection terminal	Assignment	
	1st PL 410 B PL 405 B	2nd PL 410 B
1	I80	I208
2	I81	I209
3	I82	I210
4	I83	I211
5	I84	I212
6	I85	I213
7	I86	I214
8	I87	I215
9	I88	I216
10	I89	I217
11	I90	I218
12	I91	I219
13	I92	I220
14	I93	I221
15	I94	I222
16	I95	I223

X5

Connection terminal	Assignment	
	1st PL 410 B	2nd PL 410 B
1	I96	I224
2	I97	I225
3	I98	I226
4	I99	I227
5	I100	I228
6	I101	I229
7	I102	I230
8	I103	I231
9	I104	I232
10	I105	I233
11	I106	I234
12	I107	I235
13	I108	I236
14	I109	I237
15	I110	I238
16	I111	I239

X6

Connection terminal	Assignment	
	1st PL 410 B	2nd PL 410 B
1	I112	I240
2	I113	I241
3	I114	I242
4	I115	I243
5	I116	I244
6	I117	I245
7	I118	I246
8	I119	I247
9	I120	I248
10	I121	I249
11	I122	I250
12	I123	I251
13	I124	I252
14	I125	I253
15	I126	I254
16	I127	I255

3.7.8 Switching Outputs 24 Vdc for the PLC

Transistor outputs with current limiting

	Logic unit	PL 410 B/PL 405 B
Min. output voltage for "1" signal	3 V below supply voltage	
Nominal operating current per output	0.125 A with simultaneity factor of 0.5	1.2 A with simultaneity factor of 0.5; 2 A with max. current consumption of 20 A

- Permissible load: resistive load; inductive load only with quenching diode parallel to the inductance.
- No more than one output may be shorted on the logic unit at any time. Short circuit of **one** output does not cause an overload.
- No more than half the PLC outputs may be driven at the same time (simultaneity factor 0.5).

Address	No. of outputs	Device
O0 to O30	31	Logic unit X41 (PLC output)
O0 to O7		Logic unit X46 (machine operating panel)
O32 to O62	31	First PL 410 B
O64 to O94	31	Second PL 410 B
O48 to O62	15	PL 405 B

X44 Power Supply for the outputs of the LE

Terminal	Assignment	PLC outputs
1	+24 Vdc can be switched off via EMERGENCY STOP	O0 to O23
2	+24 Vdc cannot be switched off via EMERGENCY STOP	O24 to O30
3	0V	

Power Supply for the outputs on the PL 410 B/ PL 405 B

Terminal	Assignment	1st PL 410 B Pl 405 B	2nd PL 410 B
X9	0 V		
X10	+24 Vdc power supply for logic and for control-is-ready signal		
X11	+24 Vdc power supply for outputs	O32 to O39	O64 to O71
X12	+24 Vdc power supply for outputs	O40 to O47	O72 to O79
X13	+24 Vdc power supply for outputs	O48 to O55	O80 to O87
X14	+24 Vdc power supply for outputs	O56 to O62	O88 to O94

For connecting the PL 410 B to the LE, see section 3.9.14.

X41 PLC Outputs on the LE

Logic unit		Connecting cable Id. Nr 244 005 .. / Id. Nr. 263 954 ..	
D-sub terminal (female) 37-pin	**Assignment**	**D-sub connector (male) 37-pin**	
1	O0	1	Gray/Red
2	O1	2	Brown/Black
3	O2	3	White/Black
4	O3	4	Green/Black
5	O4	5	Brown/Red
6	O5	6	White/Red
7	O6	7	White/Green
8	O7	8	Red/Blue
9	O8	9	Yellow/Red
10	O9	10	Gray/Pink
11	O10	11	Black
12	O11	12	Pink/Brown
13	O12	13	Yellow/Blue
14	O13	14	Green/Blue
15	O14	15	Yellow
16	O15	16	Red
17	O16	17	Gray
18	O17	18	Blue
19	O18	19	Pink
20	O19	20	White/Gray
21	O20	21	Yellow/Gray
22	O21	22	Green/Red
23	O22	23	White/Pink
24	O23	24	Gray/Green
25	O24	25	Yellow/Brown
26	O25	26	Gray/Brown
27	O26	27	Yellow/Black
28	O27	28	White/Yellow
29	O28	29	Gray/Blue
30	O29	30	Pink/Blue
31	O30	31	Pink/Red
32	*Do not use*	32	Brown/Blue
33	*Do not use*	33	Pink/Green
34	Control-is-ready signal	34	Brown
35	24 V (PLC) test output; *Do not use*	35	Yellow/Pink
36	24 V (PLC) test output; *Do not use*	36	Violet
37	24 V (PLC) test output; *Do not use*	37	White
Housing	External shield	Housing	External shield

PLC Outputs on the PL 410 B/PL405 B

X7

Connection terminal	Assignment	
	1st PL 410 B	2nd PL 410 B
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	O43	O75
13	O44	O76
14	O45	O77
15	O46	O78
16	O47	O79

X8

Connection terminal	Assignment	
	1st PL 410 B PL 405 B	2nd PL 410 B
1	O48	O80
2	O49	O81
3	O50	O82
4	O51	O83
5	O52	O84
6	O53	O85
7	O54	O86
8	O55	O87
9	O56	O88
10	O57	O89
11	O58	O90
12	O59	O91
13	O60	O92
14	O61	O93
15	O62	O94
16	Control-is-ready signal	

3.7.9 Machine Operating Panel

Logic unit		Connecting cable Id. Nr. 263 954 ..			TE 370	
D-sub terminal (female) 37-pin	**Assignment**	**D-sub connector (male) 37-pin**		**D-sub connector (female) 37-pin**	**X3 D-sub connector (female) 37-pin**	**Key**
1	I128	1	Gray/Red	1	1	Coolant ON
2	I129	2	Brown/Black	2	2	Coolant OFF
3	I130	3	White/Black	3	3	Spindle OFF
4	I131	4	Green/Black	4	4	NC STOP
5	I132	5	Brown/Red	5	5	NC START
6	I133	6	White/Red	6	6	X-
7	I134	7	White/Green	7	7	Y-
8	I135	8	Red/Blue	8	8	Z-
9	I136	9	Yellow/Red	9	9	Z+
10	I137	10	Gray/Pink	10	10	Y+
11	I138	11	Black	11	11	X+
12	I139	12	Pink/Brown	12	12	4+
13	I140	13	Yellow/Blue	13	13	4-
14	I141	14	Green/Blue	14	14	Rapid traverse
15	I142	15	Yellow	15	15	Spindle ON
16	I143	16	Red	16	16	-
17	I144	17	Gray	17	17	-
18	I145	18	Blue	18	18	-
19	I146	19	Pink	19	19	-
20	I147	20	White/Gray	20	20	KEY F5
21	I148	21	Yellow/Gray	21	21	KEY F1
22	I149	22	Green/Red	22	22	KEY F2
23	I150	23	White/Pink	23	23	KEY F3
24	I151	24	Gray/Green	24	24	KEY F4
25	I152	25	Yellow/Brown	25	25	-
26	O0	26	Gray/Brown	26	26	
27	O1	27	Yellow/Black	27	27	
28	O2	28	White/Yellow	28	28	
29	O3	29	Gray/Blue	29	29	
30	O4	30	Pink/Blue	30	30	
31	O5	31	Pink/Red	31	31	
32	O6	32	Brown/Blue	32	32	
33	O7	33	Pink/Green	33	33	
34	0 V (PLC)	34	Brown	34	34	
35	0 V (PLC)	35	Yellow/Pink	35	35	
36	+24 V (PLC)	36	Violet	36	36	
37	+24 V (PLC)	37	White	37	37	
Housing	External shield	Housing	External shield	Housing	Housing	

3.7.10 TNC Keyboard

The TNC keyboard is connected by cable with the logic unit, and by flat cable with the soft keys of the visual display unit. The flat cable is included with the visual display unit.

X1 on the TNC Keyboard for Connecting the Soft Keys of the Visual Display Unit

Connecting element (male) 9-pin	Assignment
1	SL0
2	SL1
3	SL2
4	SL3
5	*Do not use*
6	RL15
7	RL14
8	RL13
9	RL12

X45 TNC Keyboard (TE 370)

Logic unit		Connecting cable Id. Nr. 263 954 ..			TE 420
D-sub terminal (female) 37-pin	**Assignment**	**D-sub connector (male) 37-pin**		**D-sub connector (female) 37-pin**	**X2 D-sub terminal (male) 37-pin**
1	RL0	1	Gray/Red	1	1
2	RL1	2	Brown/Black	2	2
3	RL2	3	White/Black	3	3
4	RL3	4	Green/Black	4	4
5	RL4	5	Brown/Red	5	5
6	RL5	6	White/Red	6	6
7	RL6	7	White/Green	7	7
8	RL7	8	Red/Blue	8	8
9	RL8	9	Yellow/Red	9	9
10	RL9	10	Gray/Pink	10	10
11	RL10	11	Black	11	11
12	RL11	12	Pink/Brown	12	12
13	RL12	13	Yellow/Blue	13	13
14	RL13	14	Green/Blue	14	14
15	RL14	15	Yellow	15	15
16	RL15	16	Red	16	16
17	RL16	17	Gray	17	17
18	RL17	18	Blue	18	18
19	RL18	19	Pink	19	19
20	SL0	20	White/Gray	20	20
21	SL1	21	Yellow/Gray	21	21
22	SL2	22	Green/Red	22	22
23	SL3	23	White/Pink	23	23
24	SL4	24	Gray/Green	24	24
25	SL5	25	Yellow/Brown	25	25
26	SL6	26	Gray/Brown	26	26
27	SL7	27	Yellow/Black	27	27
28	RL19	28	White/Yellow	28	28
29	RL20	29	Gray/Blue	29	29
30	*Not used*	30	Pink/Blue	30	30
31	RL21	31	Pink/Red	31	31
32	RL22	32	Brown/Blue	32	32
33	RL23	33	Pink/Green	33	33
34	Spindle override (wiper)	34	Brown	34	34
35	Feed rate override (wiper)	35	Yellow/Pink	35	35
36	+5 V override potentiometer	36	Violet	36	36
37	0 V override potentiometer	37	White	37	37

Housing	External shield	Housing	External shield	Housing	Housing

3.7.11 Visual Display Unit

X43 Visual Display Unit (BF 370 B)

Logic Unit Id. Nr. xxx xxx 3x		Connecting Cable VB Id.-Nr. 311 535 .. VL Id.-Nr. 311 536 ..			BF 370 B
D-sub terminal (female) 15-pin 3-row	**Assignment**	**D-sub connector (male) 15-pin 3-row**		**D-sub connector (female) 15-pin 3-row**	**X2 D-sub terminal (male) 15-pin 3-row**
1	-	1		1	1
2	-	2		2	2
3	Do not use	3		3	3
4	-	4		4	4
5	Do not use	5		5	5
6	Do not use	6		6	6
7	video	7	red	7	7
8	-	8		8	8
9	VSYNC	9	Yellow	9	9
10	-	10	Pink	10	10
11	0V signal	11	Black	11	11
12	-	12		12	12
13	-	13		13	13
14	HSYNC	14	green	14	14
15	clock	15	blue	15	15
Housing	External shield	Housing	External shield	Housing	Housing

The interface complies with the recommendations in IEC 742 EN 50 178 for separation from line power.

3.7.12 PLC input/output unit PL 410 B/ PL 405 B

Up to two PL 410 B and one PL 405 B can be connected to the LE 370 D.

X47 PL 410 B/PL 405 B input/output unit on the LE

Logic unit		Connecting cable Id. Nr. 289 111 ..			1st PL 410 B	
X47 D-sub terminal (male) 25-pin	**Assignment**	**D-sub connector (female) 25-pin**		**D-sub connector (male) 25-pin**	**X1 D-sub terminal (female) 25-pin**	**Assignment**
1	0 V	1	Brown, Yellow, Pink, Red, Violet	1	1	0 V
2	0 V	2	Red/Blue, Brown/Green, Yellow/Brown, Gray/Brown, Pink/Brown	2	2	0 V
3	0 V	3	Brown/Blue, Brown/Red, Brown /Black, Yellow/Gray, Yellow/Pink	3	3	0 V
4	*Do not use*	4	Gray/Green	4	4	Serial IN 2
5	Address 6	5	White/Green	5	5	Address 6
6	INTERRUPT	6	Pink/Green	6	6	INTERRUPT
7	RESET	7	Green/Blue	7	7	RESET
8	WRITE EXTERNAL	8	White/Blue	8	8	WRITE EXTERNAL
9	WRITE EXTERNAL	9	White/Red	9	9	WRITE EXTERNAL
10	Address 5	10	Gray/Pink	10	10	Address 5
11	Address 3	11	Blue	11	11	Address 3
12	Address 1	12	Green	12	12	Address 1
13	*Do not use*	13		13	13	*Do not use*
14	PCB identifier 4	14	Yellow/Blue, Pink/Blue, Yellow/Black	14	14	+ 12 V
15	PCB identifier 3	15	Yellow/Red, Gray/Red, Pink/Red	15	15	+ 12 V
16	*Do not use*	16	Gray/Blue	16	16	PCB identifier 2
17	*Do not use*	17	Green/Black	17	17	PCB identifier 1
18	Address 7	18	White/Yellow	18	18	Address 7
19	Serial IN 1	19	White/Black	19	19	Serial IN 1
20	EMERGENCY STOP	20	Green/Red	20	20	EMERGENCY STOP
21	Serial OUT	21	White/Gray	21	21	Serial OUT
22	Serial OUT	22	White/Pink	22	22	Serial OUT
23	Address 4	23	Black	23	23	Address 4
24	Address 2	24	Gray	24	24	Address 2
25	Address 0	25	White	25	25	Address 0
Housing	External shield	Housing	External shield	Housing	Housing	External shield

3.7.13 Touch Trigger Probes

Any of the following touch trigger probes for **workpiece measurement** can be connected.

TS 220 Touch trigger probe with cable connection: for digitizing, workpiece setup and workpiece measurement during machining

TS 630 Touch trigger probe with infrared transmission: for workpiece setup and workpiece measurement during machining

X12 Touch Probe Input for Workpiece Measurement

Logic unit	
D-sub terminal (female) 15-pin	**Assignment**
1	0 V
3	Ready
4	Start
5	+15 V ± 10% (maximum 100mA)
6	+ 5 V ± 5% (maximum 100mA)
7	Battery warning
8	0 V (U_N)
9	Trigger signal
10	Trigger signal [1]
2, 11 to 15	*Do not use*
Housing	External shield

1) Stylus at rest means logic level High

Adapter cable Id. Nr.274 543			TS120 Id. Nr. 265 348 .. TS220 Id. Nr. 293 488 ..	
D-sub connector (male) 15-pin		**Coupling on mounting base 6-pin**	**Quick disconnect 6-pin**	
3	Pink	4	4	Gray
5	Gray			
6	Brown/Green	2	2	Brown
7	Gray	3	3	Gray
8	White/Green	1	1	White
9	Green	5	5	Green
10	Yellow	6	6	Yellow
Housing	External shield	Housing	Housing	External shield

Connecting cable Id. Nr. 310 197 ..			EA Id. Nr. 262 904 01		TS 630
D-sub connector (male) 15-pin		**Connector (female) 7-pin**	**Coupling on mounting base 7-pin**		**Id. Nr. 293 714 ..**
1	White/Brown internal shield	7	7	Internal shield	
3	Gray	5	5	Gray	
4	Yellow	3	3		
5	Brown	2	2	Brown	
7	Blue	6	6	Blue	
8	White	1	1	White	
10	Green	4	4	Green	
Housing	External shield	Housing	Housing	External shield	

TT 130 Triggering Touch Probe for Workpiece Measurement

X13 Touch Probe Input for Workpiece Measurement

Logic unit	
D-sub terminal (female) 9-pin	**Assignment**
1	Ready
2	0 V (U_N)
4	+15 V ± 5% (U_P)
7	+5 V ± 5% (U_P)
8	Trigger signal
9	$\overline{\text{Trigger signal}}$ [1]
3, 5, 6	*Do not use*
Housing	External shield

1 Stylus at rest means logic level High

Adapter cable Id. Nr. 335 332 ..			TT 130 Id. Nr. 296 537 06	
D-sub connector (male) 9-pin		**Coupling on mounting base (female) 6-pin**	**Connector (male) 6-pin**	
1	Pink	6	6	
2	White/Green	1	1	White
4	Gray	5	5	
7	Brown/Green	2	2	Brown
8	Green	3	3	Green
9	Yellow	4	4	Yellow
Housing	External shield	Housing	Housing	External shield

3.7.14 RS-232-C/V.24 Data Interface

- Maximum cable length 20 meters
- To connect a peripheral device you must install an adapter cable either in the switching cabinet or on the operating panel. See also the "Dimensions" section in the Appendix.
- For information on interface cables, see "Cable Overview."

Logic unit		**Connecting cable Id. Nr. 239 760 ..**			**Adapter block Id. Nr. 239 758 01**		**Connecting cable Id. Nr. 274 545 01**		
D-sub terminal (female) 25-pin	**Assignment**	**D-sub connector (male) 25-pin**		**D-sub connector (female) 25-pin**	**D-sub terminal (male) 25-pin**	**D-sub terminal (female) 25-pin**	**D-sub connector (male) 25-pin**		**D-sub connector (female) 25-pin**
1	GND	1	WH/BN External shield	1	1	1	1	WH/BN External shield	1
2	RxD	2	Green	3	3	3	3	Yellow	2
3	TxD	3	Yellow	2	2	2	2	Green	3
4	CTS	4	Gray	5	5	5	5	Pink	4
5	RTS	5	Pink	4	4	4	4	Gray	5
6	DTR	6	Blue	20	20	20	20	Brown	6
7	Signal GND	7	Red	7	7	7	7	Red	7
20	DSR	20	Brown	6	6	6	6	Blue	20
8 to 19, 21 to 25	*Do not use*			8	8	8	8		8
Housing	External shield	Housing	External shield	Housing	Housing	Housing	Housing	External shield	Housing

The interface complies with the recommendations in IEC 742 EN 50 178 for separation from line power.

3.7.15 Handwheel Input

Any of the following handwheels can be used with the LE 370 D:

One HR 410 portable handwheel
One HR 130 panel-mounted handwheel or
One HRA 110 handwheel adapter for connecting three HR 150 panel-mounted handwheels

X23 Handwheel Input

D-sub terminal (female) 9-pin	Assignment
2	0 V
4	+12 V ± 0.6 V (Uv)
6	DTR
7	TxD
8	RxD
9	DSR
1, 3, 5	*Not used*
Housing	External shield

The interface complies with the recommendations in IEC 742 EN 50 178 for separation from line power.

HR 410 Portable Handwheel

The HR 410 is a portable electronic handwheel with:

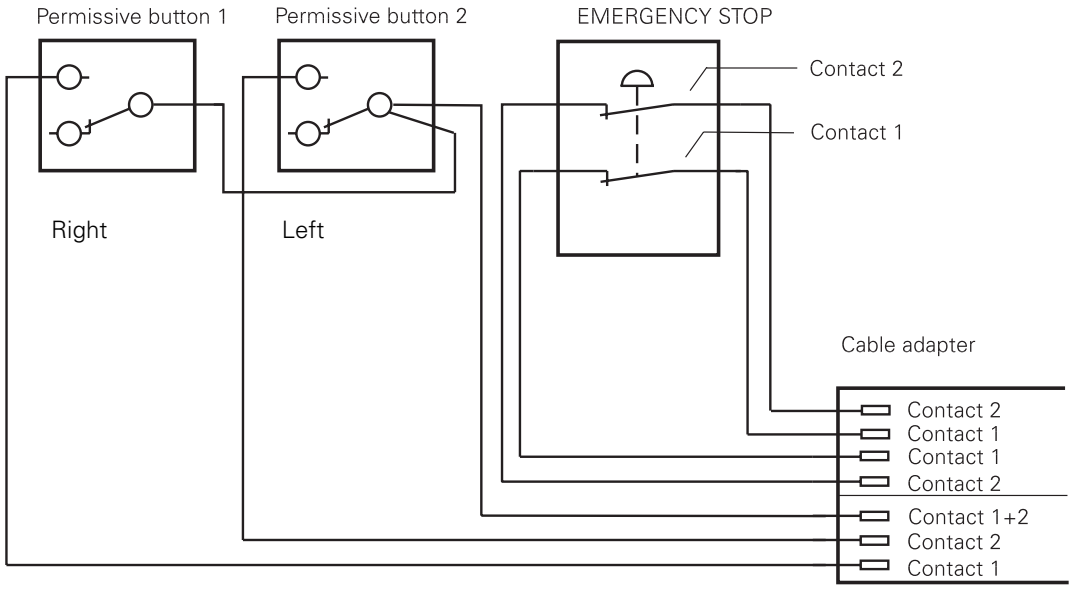
- Five axis-selection keys
- Two traverse direction keys
- Three keys with predefined traverse speeds (slow, medium, fast)
- Actual-position-capture key
- Three keys for machine functions to be determined by the machine tool builder
- Two permissive keys
- EMERGENCY STOP button
- Holding magnets

Dummy plug for EMERGENCY STOP circuit (option) Id. Nr. 271 958 03
Connecting cable (spiral cable) Id. Nr. 312 879 01
Connecting cable (normal cable) Id. Nr. 296 467 ..
Connecting cable (with metal armor) Id. Nr. 296 687 ..

Extension cable Id. Nr. 281 429..			**Adapter cable Id. Nr. 296 466..**			**Connecting cable Id. Nr. 296 467 05**			**HR 410 Id. Nr. 296 469 01**	
D-sub connector (male) 9-pin		**D-sub connector (female) 9-pin**	**D-sub connector (male) 9-pin**		**Coupling on mounting base (female) 18-pin**	**Connector (male) 18-pin**		**Connector (female) 18-pin**	**Connector (male) 18-pin**	
Housing	Shield	Housing	Housing	Shield	Housing	Housing	Shield	Housing	Housing	Shield
2	White	2	2	White	E	E	White	E	E	
4	Brown	4	4	Brown	D	D	Brown	D	D	
6	Yellow	6	6	Yellow	B	B	Yellow	B	B	
7	Gray	7	7	Gray	A	A	Gray	A	A	
8	Green	8	8	Green	C	C	Green	C	C	
					6	6	WH/BK	6	6	
					7	7	YL/BK	7	7	
					5	5	WH/RD	5	5	
					4	4	WH/BL	4	4	
					2	2	WH/GN	2	2	
					3	3	WH/YL	3	3	
					1	1	WH/BN	1	1	
				WH/BN	3	Contact 1 + 2				
				WH/YL	2	Contact 2 (left)	Permissive button			
				WH/GN	1	Contact 1 (right)				
				WH/BL	1	Contact 1				
				WH/RD	2	Contact 1	EMERGENCY STOP			
				YL/BK	3	Contact 2				
				WH/BK	4	Contact 2				

The adapter includes plug-in terminal strips for the contacts of the EMERGENCY STOP button and permissive button (maximum load 1.2 A, 24 V).

Internal wiring of contacts to permissive buttons and EMERGENCY STOP button of the HR 410:



The plug-in terminal strips are included in delivery with the adapter cable. If you have an immediate need for these terminal strips before the adapter cable, they can be ordered separately:
Plug-in terminal strip, 3-pin Id. Nr. 266 364 06
Plug-in terminal strip, 4-pin Id. Nr. 266 364 12

HR 130 Panel-Mounted Handwheel

The HR 130 is the panel-mount version of the HR 330 without axis keys, rapid traverse keys, etc. It is connected to the logic unit directly or by extension cable.

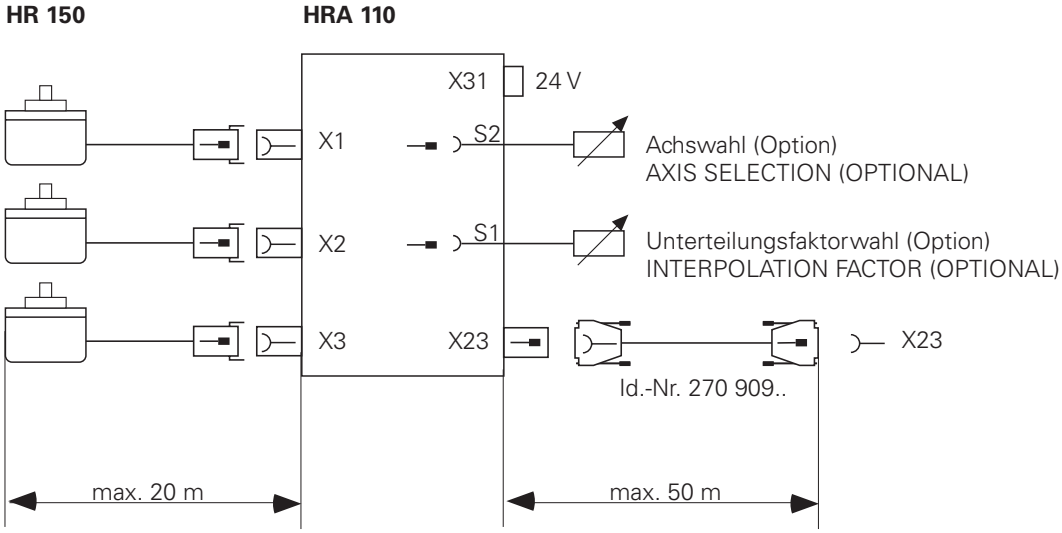
The HR 130 is available in various versions (standard cable length 1 meter):
- Small knob, axial cable outlet: Id. Nr. 254 040 01
- Small knob, radial cable outlet: Id. Nr. 254 040 02
- Large knob, axial cable outlet: Id. Nr. 254 040 03
- Large knob, radial cable outlet: Id. Nr. 254 040 04
- Ergonomic knob, radial cable outlet: Id. Nr. 254 040 05

(See also the "Dimensions" section in the Appendix)

Extension cable Id. Nr. 281 429 ..			**HR 130 Id. Nr. 254 040 ..**	
D-sub connector (male) 9-pin		**D-sub connector (female) 9-pin**	**D-sub connector (male) 9-pin**	
Housing	Shield	Housing	Housing	Shield
2	White	2	2	White
4	Brown	4	4	Brown
6	Yellow	6	6	Yellow
8	Green	8	8	Green
7	Gray	7		

HRA 110 Handwheel Adapter

The HRA 110 handwheel adapter enables you to connect two or three HR 150 panel-mounted handwheels to the TNC. The first and second handwheels are permanently assigned to the X and Y axes. The third handwheel can be assigned to the X, Y, Z or IVth axis, either by a step switch (option) or with MP7645 (see "Machine Integration").



An additional step switch (option) provides such functions as the selection of the handwheel interpolation factors. You must evaluate the current setting of the step switch in the PLC and then activate the corresponding interpolation factor with Module 9036.

X1, X2, X3 Handwheel Inputs for HR 150

HRA 110	
Terminal (female) 9-pin	**Assignment**
1	I_1+
2	I_1–
5	I_2+
6	I_2–
7	I_0+
8	I_0–
3	+ 5 V
4	0 V
9	Internal shield
Housing	External shield

X23 Connection to Logic Unit

HRA 110	
D-sub terminal (male) 9-pin	**Assignment**
1	RTS
2	0 V
3	CTS
4	+12V + 0.6 V (Uv)
5	*Do not use*
6	DSR
7	RxD,
8	TxD,
9	DTR
Housing	External shield

X31 Power Supply

HRA 110	
Terminal	**Assignment**
1	+ 24 Vdc
2	0 V

Power supply: 24 Vdc VDE 0160, basic insulation
Max. current consumption: 200 mA

3.7.16 Analog Inputs

The logic unit and the PL 410 B input/output board can be supplied with analog inputs (± 10 V) and inputs for connecting Pt 100 thermistors .

	Analog inputs (± 10 V)	**Inputs for Pt 100 thermistors**
LE 370 D	3 on connector X48	2 on connector X48
PL 410 B (Id. Nr. 263 217 02)	4	4

The current values of these inputs are interrogated with Module 9003.

Analog inputs:

Voltage range	–10 V to +10 V
Input resistance	> 250 kΩ
Resolution	100 mV
Internal value range	–100 to +100

Inputs for Pt 100 thermistors:

Constant current	5 mA
Temperature range	0° C to 100° C
Resolution	0.5° C
Internal value range	0 to 200

X48 Analog Input (PLC) at the LE

D-sub terminal (female) 25-pin	Assignment
1	I_1+ Constant current for Pt 100
2	I_1– Constant current for Pt 100
3	U_1+ Measuring input for Pt 100
4	U_1– Measuring input for Pt 100
5	I_2+ Constant current for Pt 100
6	I_2– Constant current for Pt 100
7	U_2+ Measuring input for Pt 100
8	U_2– Measuring input for Pt 100
9	*Do not use*
10	*Do not use*
11	*Do not use*
12	*Do not use*
13	*Do not use*
14	Analog input 1 –10 V to +10 V
15	Analog input 1 0 V (reference potential)
16	Analog input 2 –10 V to +10 V
17	Analog input 2 0 V (reference potential)
18	Analog input 3 –10 V to +10 V
19	Analog input 3 0 V (reference potential)
20 to 25	*Do not use*
Housing	External shield

The correct polarity of analog inputs is essential.

X15, X16, X17, X18 Analog inputs on the PL 410 B

Terminal	Assignment
1	–10 V to +10 V
2	0 V (reference potential)
3	Shield

X23 Power supply at the analog inputs

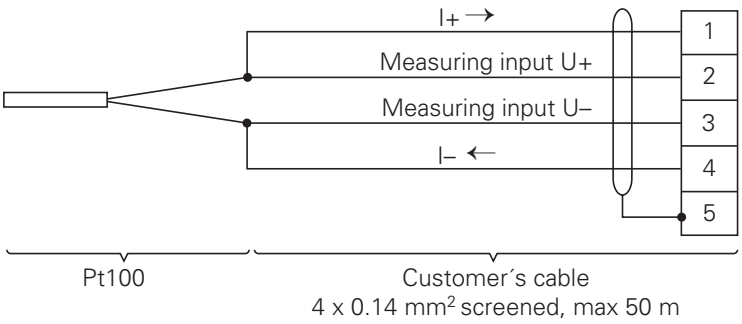
Terminal	Assignment
1	+24 Vdc (IEC 742 EN 50 178, 5.88 low-voltage electrical separation)
2	0 V

X19,X20,X21,X22 Connection for Pt 100 on the PL 410 B

Terminal	Assignment
1	I + Constant current for Pt 100
2	U + Measuring input for Pt 100
3	U – Measuring input for Pt 100
4	I – Constant current for Pt 100
5	Shield

Connection to the analog inputs
Connecting cable 2 x 0.14 mm^2 shielded, max. 50 m.

Connection to the inputs for Pt 100 thermistors
The connection to the Pt 100 thermistors must be arranged as a four-wire circuit.
e.g. PL 410 B X19:



3.8 Visual Display Unit BF 370 B

The BF 370 B visual display unit consists of a flat-panel display, soft keys and numeric keypad (see dimension drawing).

The following connections are available on the BF 370 B:

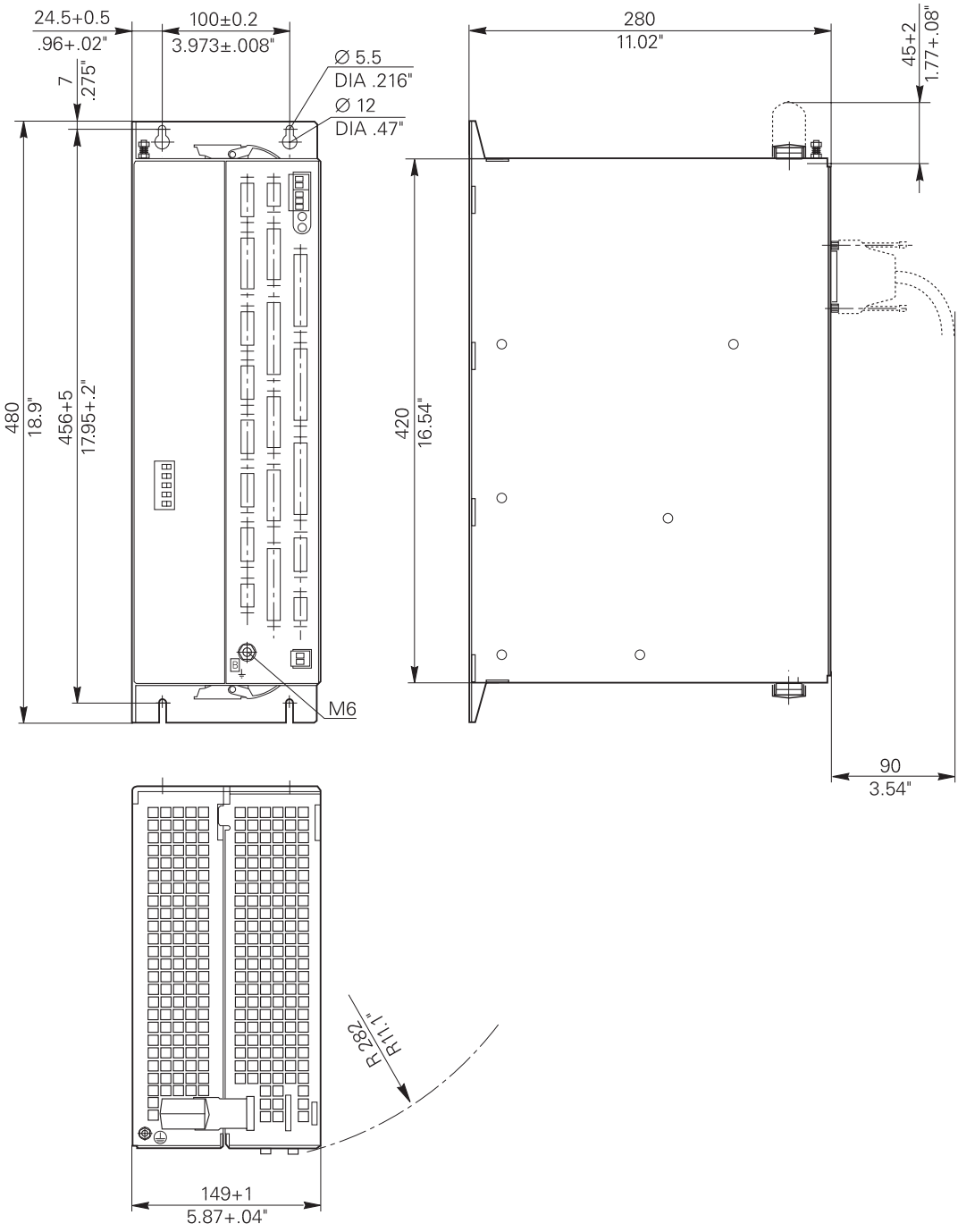
Connector on BFT 110	Function	Connector on LE 310 M
X1	Operating voltage for screen 24 Vdc (PLC)	-
X2	Screen	X43 (see Chapter 1.10.9)

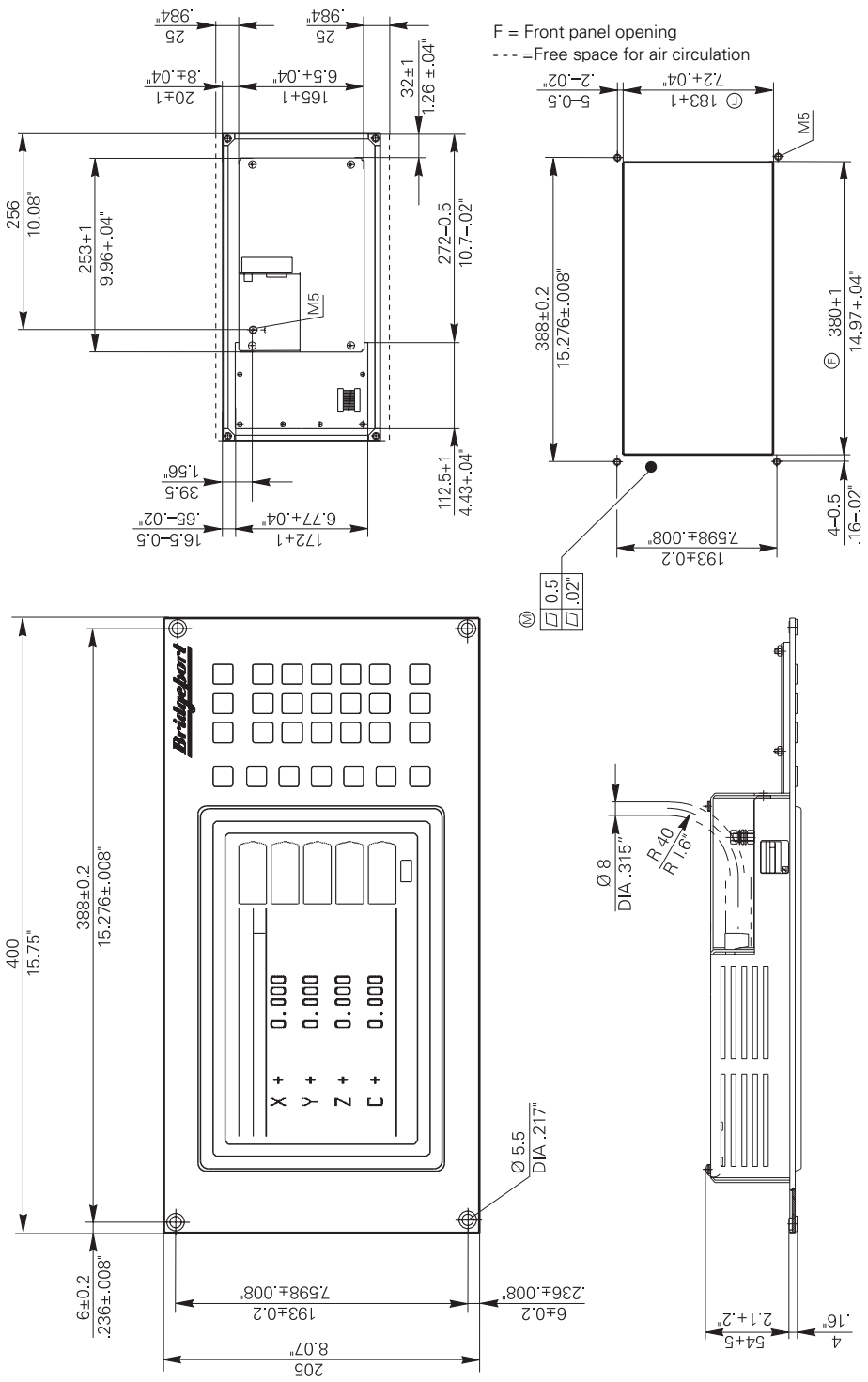
X2 supply voltage for screen

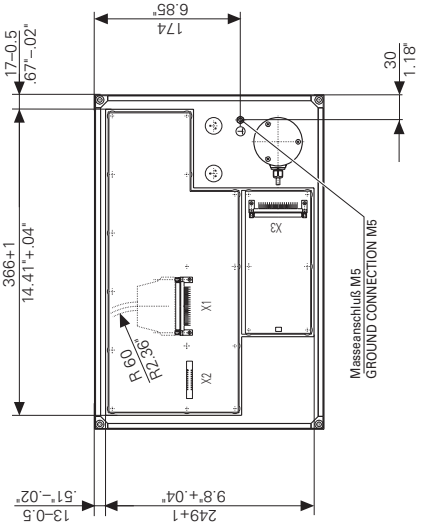
Connecting terminal	Assignment
1	+ 24 V (power consumption 15 W; supply voltage with basic insulation as per EN 50 178
2	0V

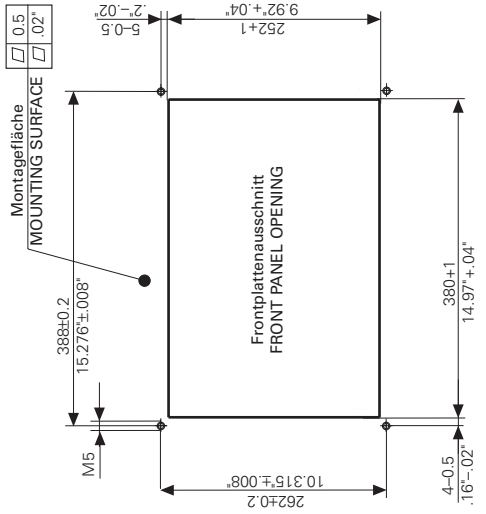
3.9 Mounting Dimensions

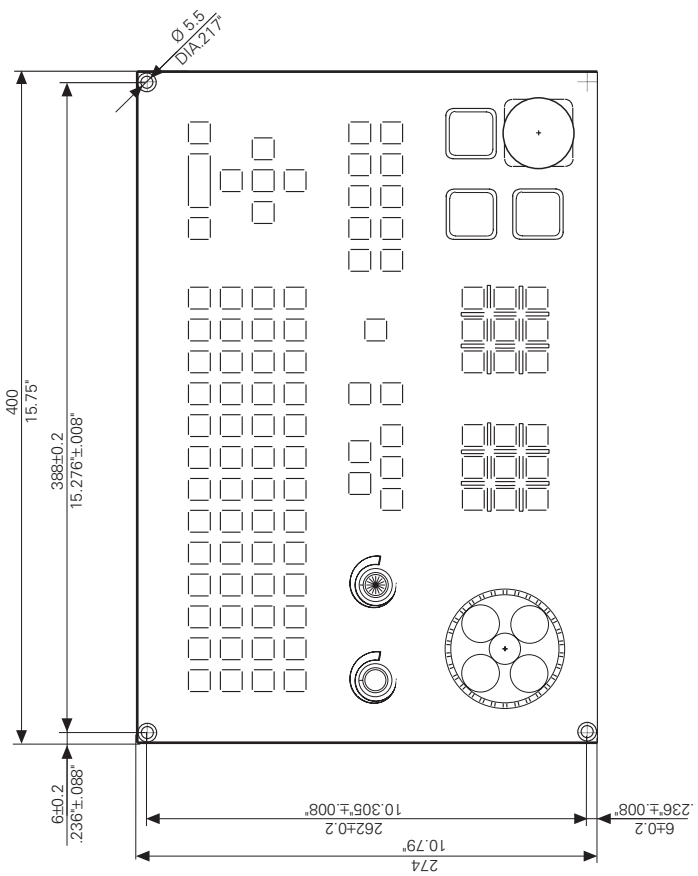
LE 370 D

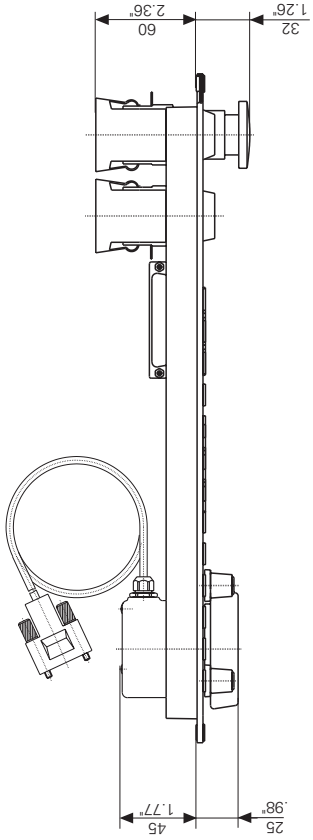



F = Front panel opening
- - - =Free space for air circulation
Bridgeport
X + 0.000
Y + 0.000
Z + 0.000
C + 0.000
M5
Ø 5.5
DIA .217"
Ø 8
DIA .315"
R 40
R 16"

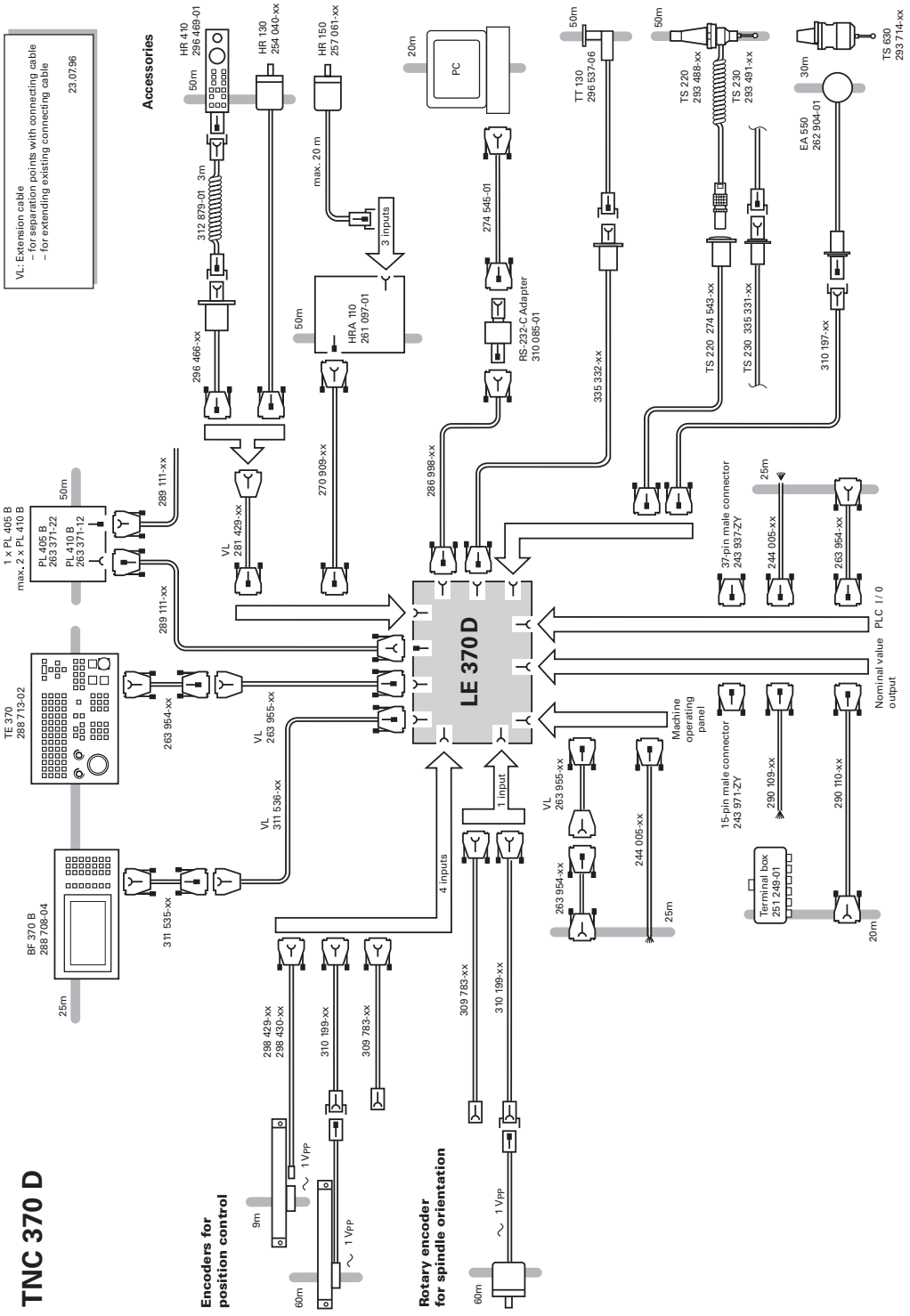

6.85"
174
17–0.5
.67"–.02"
30
1.18"
366+1
14.41"+.04"
X3
X1
X2
R 60
R2.36
Masseanschluß M5
GROUND CONNECTION M5
13–0.5
.51"–.02"
9.8"+.04"
249+1


0.5
.02"
5–0.5
.2"–.02"
9.92"+.04"
252+1
Montagefläche
MOUNTING SURFACE
Frontplattenausschnitt
FRONT PANEL OPENING
388±0.2
15.276"±.008"
380+1
14.97"+.04"
M5
10.315"±.008"
262±0.2
4–0.5
.16"–.02"

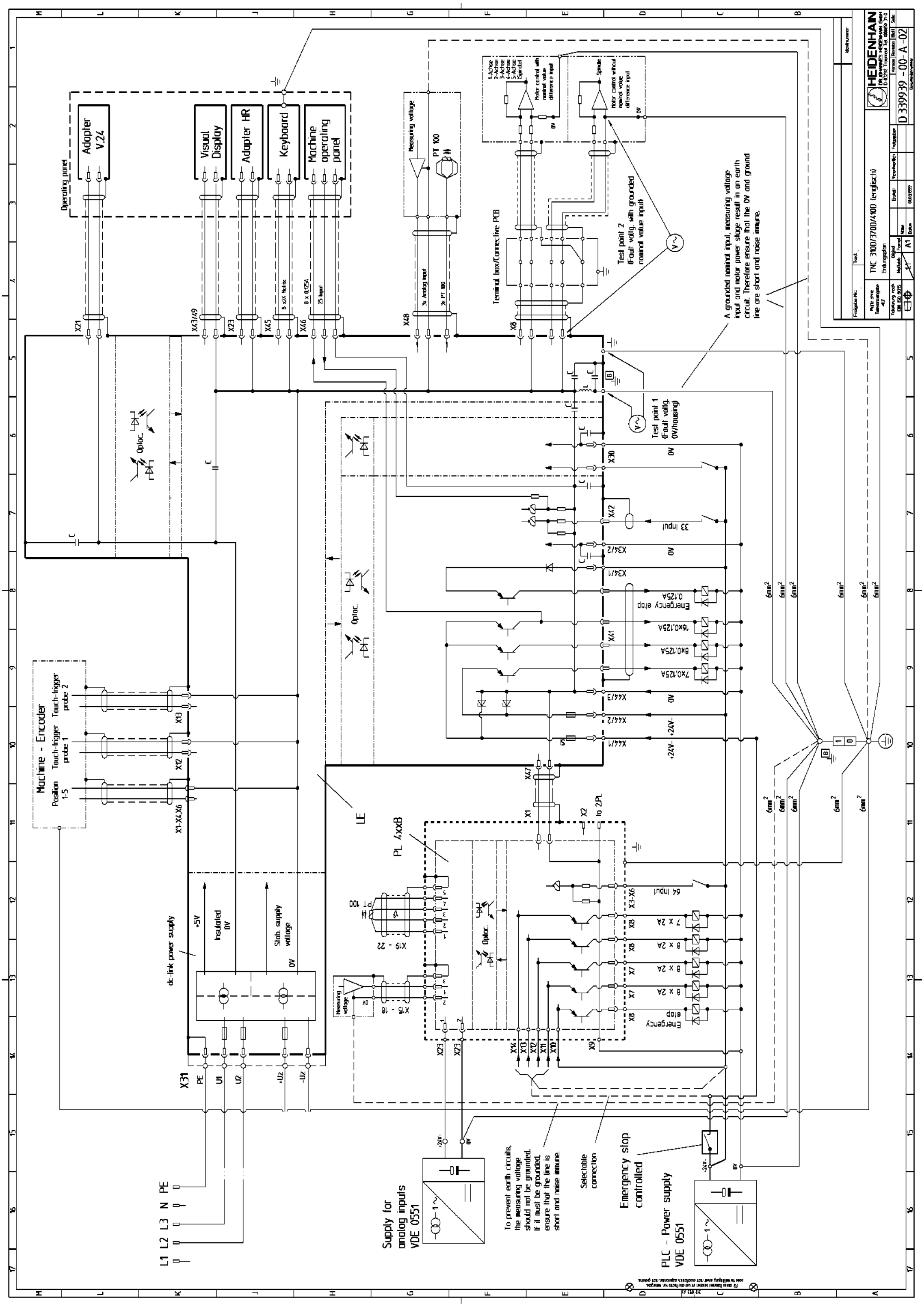

Ø 5.5
DIA.217"
400
15.75"
388±0.2
15.276"±.008"
6±0.2
.236"±.088"
10.305"±.008"
262±0.2
10.79"
274
6±0.2
.236"±.008"


60
2.36"
32
1.26"
45
1.77"
25
.98"

3.10 Cable overview



3.11 Grounding plan


Operating panel
Adapter V.24
Visual Display
Adapter HR
Keyboard
Machine operating panel
Measuring voltage
PT 100
Terminal box/Connective PCB
Test point 2 (Fault voltg. with grounded nominal value input)
Test point 1 (Fault voltg. 0V/housing)
A grounded nominal input, measuring voltage input and motor power stage result in an earth circuit. Therefore ensure that the 0V and ground line are short and noise immune.
Machine - Encoder
Position 1-5
Touch-trigger probe 1
Touch-trigger probe 2
Optoc.
Emergency stop
dc-link power supply
LE
PL 4xxB
X31
L1 L2 L3 N PE
Supply for analog inputs VDE 0551
To prevent earth circuits, the measuring voltage should not be grounded. If it must be grounded, ensure that the line is short and noise immune.
Selectable connection
Emergency stop controlled
PLC - Power supply VDE 0551
HEIDENHAIN
D 339939 -00-A-02

4 Machine Parameters

4.1 What Is a Machine Parameter?

A contouring control must have access to specific data (e.g., traverse distances, acceleration) before it can execute its programmed instructions. You define these data in so-called machine parameters.

In addition, machine parameters can be used to activated certain functions, which are possible with HEIDENHAIN contouring controls, but are required only on certain types of machines (e.g. automatic tool changing). The list of machine parameters is not numbered in sequence but is divided into groups according to function.

Machine parameter	Functional Group
10 to 999	Encoders and Machines
1000 to 1399	Positioning
1400 to 1699	Operation with Velocity Feedforward
1700 to 1999	Operation with Servo Lag
2000 to 2999	Integrated Closed-Loop Speed and Current Control
3000 to 3999	Spindle
4000 to 4999	Integral PLC
5000 to 5999	Data Interface
6000 to 6199	3-D Touch Probe
6200 to 6299	Digitizing with Triggering Touch Probe
6500 to 6599	Tool Measurement with Touch Trigger Probe
7100 to 7199	Tapping
7200 to 7349	Display and Operation
7350 to 7399	Colors
7400 to 7599	Machining and Program Run
7600 to 7699	Hardware

If there is more than one input value for a single function (e.g., a separate input for each axis), the parameter number is provided with indices that are permanently assigned to the corresponding axes: Index zero is always axis X, index one is always axis Y, etc.

Example:
MP1010.0-3 Rapid traverse
MP1010.0 Rapid traverse for axis X
MP1010.1 Rapid traverse for axis Y
MP1010.2 Rapid traverse for axis Z
MP1010.3 Rapid traverse for axis 4

Other machine parameters function as on/off switches for specific functions. These machine parameters are bit-coded. Each bit is assigned to either an axis or a function.

4.2 Input and Output of Machine Parameters

If the machine parameters have not yet been entered in a HEIDENHAIN contouring control (e.g., during commissioning), the TNC presents the list of machine parameters after the memory test. Now you must enter the values either by hand on the keyboard or through the data interface.

4.2.1 Input Format

A number is entered for each machine parameter. This value can be, for example, the acceleration in mm/s^2 of an individual axis, or the analog voltage in volts. You can add a written comment to your entry by placing a semicolon ";" behind the numerical entry, followed by your comment. The input values can be entered in decimal, binary (%) or hexadecimal ($) format.

There are machine parameters with which individual functions are activated bit-coded. Binary entry (%) is recommended for these machine parameters. The hexadecimal format ($) may be advisable for other machine parameters.

4.2.2 Activating the Machine Parameter Settings

After you have entered the values for the machine, exit the machine parameter list by pressing the END key. Missing or incorrect entries result in error messages from the control that prompt you to correct your entry. The following errors are displayed:

Input error	Meaning
0	No MP number found
1	Invalid MP number
2	No separator ";" found
3	Entry value incorrect
4	MP doubly defined
6	MP can not be stored

If the control does not recognize any errors, it automatically exits the machine parameter editor and is ready for operation. If during commissioning you do not make any entries in the parameter list (MP NAME), the TNC will generate a standard machine parameter list when you press the END key and leave the machine parameter editor. In this list the TNC is defined as a programming station with the HEIDENHAIN standard colors. All other machine parameters assume the minimum value.

You can keep several machine parameter lists and load the desired list into the TNC when needed. The desired list can be selected in the machine parameter editor by pressing the PGM MGT key and the SELECT soft key. The parameter list that is active when you exit the machine parameter editor goes into effect.

4.2.3 Changing the Input Values

After you have created a machine parameter list, it can be changed either through the machine parameter editor or directly through the PLC.

The list of machine parameters included the following indicators showing how the value can be changed and how the TNC reacts after the change:

- CN The MP is also accessible through the code number 123
- PLC The MP can be changed through the PLC
- RUN The MP can also be changed while a program is running.
- RESET Changing the MP results in a reset
- REF The axis must be moved over the reference mark again.

Manual input

Call the machine parameter editor through the MOD function "code number":

- Code number **95148**
  This code number give you access to the complete list of machine parameters.
- Code number **415263** all commissioning functions are activated , access to MP-editor via soft key MP-EDIT
- Code number **123**
  This code number gives you access to only some of the machine parameters. These are the machine parameters that the user is authorized to change (see User's Manual). In the following list, the machine parameters that can be changed through the code number 123 are indicated by „CN123.„

To exit the machine parameter editor, press END.

Users parameters

With the **USER PARAMETER** MOD function you can easily access certain machine parameters without having to first enter a code number. In MP7330.x you can define up to 16 machine parameters, and in MP7340.x you define the associated dialog to be shown when the **USER PARAMETER** soft key is pressed. See also the chapter „Display and Operation.„

Changing the input values through the PLC

The PLC can also change the machine parameters. You can use the following modules for this purpose:

- Overwrite machine parameters (Module 9031)
- Read machine parameters (Module 9032)
- Select machine parameter file (Module 9033)
- Load machine parameter partial file (Module 9034)

In the list below, the machine parameters that you can change with modules 9031 or 9034 are indicated with „PLC„:

Overwrite Machine Parameter (Module 9031)

With Module 9031 you can overwrite the value of the given machine parameter with a new value. The input value must be a natural number including all possible decimal places.

Example: MP910.0 = 100.12 [mm]
Decimal places: 1001200 (4 decimal places)

It is always the value in the process memory that is overwritten, the value in the editable machine parameter list does not change. This means that the old value is valid again after editing and exiting from the machine parameter list.

Zero must be given as the index for non-indexed machine parameters. If a RESET MP is overwritten, an error code is sent.

Once the NC program has started the module operates only during the output of M/S/T/Q strobes. The reply of the strobe must not occur until the end of the Submit-Job!

Depending on the type of machine parameter, the NC is re-initialized.

Call only from a Submit job:

PS B/W/D/K <MP number>
PS B/W/D/K <MP index>
PS B/W/D <MP value>
CM 9031
PL B/W/D <Error code>

- 0: No error
- 1: MP does not exist/not modifiable/not modifiable once the program has started
- 2: MP value out of range
- 3: Error when saving (fatal error), contains RESET parameter
- 4: Call was not from a Submit job
- 5: Call during running program without strobe

Read Machine Parameter (Module 9032)

With Module 9032 you can read the value of a machine parameter. The value is transferred as a natural number including all possible decimal places.

It is always the value from the editable machine parameter list that is read, not any value in the process memory modified by PLC Module 9031. Zero must be given as the index for non-indexed machine parameters.

Call only from a Submit job:

PS B/W/D/K <MP number>
PS B/W/D/K <MP index>
CM 9032
PL B/W/D <MP value> / <Error code>

- 1: MP number does not exist
- 2: No separator „:„
- 3: MP value out of range
- 4: MP not in file
- 5: No MP file found
- 6: Call was not from a Submit job

Select Machine Parameter File (Module 9033)

With Module 9033 you select an editable machine parameter file. The module does not cause a system reset, but it does reinitialize the NC. The file name is specified in an empty string, since at the time a new editable machine parameter file is being handled. Once the NC program has started the module operates only during the output of M/S/T/Q strobes.

Call only from a Submit job:

PS B/W/D/K <String number> 0 to 3
CM 9033 Note: Program execution ends here if a new file is selected.
PL B/W/D <Error code>

- 0: No error, file was already selected
- 1: The specified string does not conform to the above conventions.
- 2: File found not
- 3: File is faulty
- 4: Incorrect string was transferred (out of range 0 to 3)
- 5: The module was not called from a Submit job.
- 6: The module was called after the NC program started without a strobe marker being active.

Loading a Machine Parameter Partial File (Module 9034)

With Module 9034 you load the contents of the given machine parameter file into the main memory. All parameters not contained in this file remained unchanged. The new MP file to be selected is checked; no faulty files are loaded. The MP file is not loaded if it contains parameters that require a system reset. The file name is transferred in a string that must contain the complete file name. Additional characters (including blank characters) are not allowed. If a RESET MP is overwritten, an error code is sent. If the PLC program is created externally, ensure that lower-case letters are not used for the file name. Once the NC program has started the module only operates during the output of M/S/T/Q strobes.

Call only from a Submit job:

PS B/W/D/K <String number > 0 to 3
CM 9034
PL B/W/D <Error code>

- 0: No error
- 1: String does not have a valid file name, or the name (including path) is too long
- 2: File found not
- 3: File is faulty / File contains reset parameters
- 4: Incorrect string number was transferred (out of range 0 to 3)
- 5: The module was not called from a Submit job.
- 6: The module was called after the NC program started without a strobe marker being active.

4.3 List of Machine Parameters

4.3.1 Encoders and Machine

Machine parameter	Function and input	Change via	Reaction
MP10	Active axes Input: %00xxxx Bit 0 to 3 0 = not active Axis X to 4 1 = active Bits 4 and 5 reserved, enter 0	PLC	Reset
MP20.0	Checking the absolute position of the distance-coded reference marks Input: %00xxxx Bit 0 to 3 0 = not active Axis 1 to 4 1 = active Bits 4 and 5 reserved, enter 0	PLC	
MP20.1	Checking the amplitude of the encoder signals Input: %00xxxx Bit 0 to 3 0 = not active Axis 1 to 4 1 = active Bits 4 and 5 reserved, enter 0	PLC	
MP20.2	Checking the edge separation of the encoder signals Input: %00xxxx Bit 0 to 3 0 = not active Axis 1to 4 1 = active Bits 4 and 5 reserved, enter 0	PLC	
MP21.0	Checking the absolute position of the distance-coded reference marks on the encoder for the spindle position Input: %x Bit 0 0 = not active Spindle 1 = active	PLC	
MP21.1	Checking the amplitude of the signals on the encoder for the spindle position Input: %x Bit 0 0 = not active Spindle 1 = active	PLC	
MP21.2	Checking the edge separation of the encoder signals for the spindle position Input: %x Bit 0 0 = not active Spindle 1 = active	PLC	
MP40	Display on screen Input: %00xxxx Bit 0 to 3 0 = not active Axis X to 4 1 = active Bits 4 and 5 reserved, enter 0		Reset

Machine parameter	Function and input	Change via	Reaction
MP60	PLC-auxiliary axis Input: %xxxx Bit 0 to 3 0 = not active Axis X to 4 1 = active		Reset
MP110.0-3	Assignment of the position measuring system inputs for the axes Input: 0 to 6 0 = no position measuring system 1 = position measuring system input X1 2 = position measuring system input X2 3 = position measuring system input X3 4 = position measuring system input X4 6 = position measuring system input X6		Reset
MP111	Assignment of the position measuring system input for the spindle Input: 0 to 6 0 = no position measuring system 1 = position measuring system input X1 2 = position measuring system input X2 3 = position measuring system input X3 4 = position measuring system input X4 6 = position measuring system input X6		Reset
MP112.0-3	Assignment of the rpm measuring system inputs for the axes Input: 15 to 19 0 = no rpm measuring system input (analog axis) 15 = rpm measuring system input X15 16 = rpm measuring system input X16 17 = rpm measuring system input X17 18 = rpm measuring system input X18 19 = rpm measuring system input X19		Reset
MP113	Assignment of the rpm measuring system inputs for the spindle Input: 15 to 19 0 = no rpm measuring system input (analog axis) 15 = rpm measuring system input X15 16 = rpm measuring system input X16 17 = rpm measuring system input X17 18 = rpm measuring system input X18 19 = rpm measuring system input X19		Reset

Machine parameter	Function and input	Change via	Reaction
MP115.0	Position encoder inputs $1V_{PP}$ or 11µA Input: %xxxxx 0 = $1V_{PP}$ 1 = 11µA		Reset
MP115.1	Reserved Input: %00000		
MP115.2	Input frequency of position encoders Input: %xxxxx 0 = 50kHz for $1V_{PP}$; 50kHz for 11µA 1 = 350kHz for $1V_{PP}$; 150kHz for 11µA		Reset
MP120.0-3	Assignment of the nominal value output for the axes Input: 0 = no controlled axis 1 = analog nominal value to X8/1 2 = analog nominal value to X8/2 3 = analog nominal value to X8/3 4 = analog nominal value to X8/4 5 = analog nominal value to X8/5		Reset
MP121	Assignment of the nominal value output for the spindle Input: 0 = no controlled spindle 1 = analog nominal value to X8/1 2 = analog nominal value to X8/2 3 = analog nominal value to X8/3 4 = analog nominal value to X8/4 5 = analog nominal value to X8/5		Reset
MP210	Count direction of the measuring system signals of the position measuring system Input: %00xxxx Bit 0 to 3 0 = not active Axis X to 4 1 = active Bits 4 and 5 reserved, enter 0		
MP331.0-3	Distance per number of signal periods out of MP332 Input: 0.001 to 99 999.999 [mm or °]		
MP332.0-3	Number of signal periods in the distance from MP331 Input: 1 to 16 777 215		
MP334.0-3	Distance between reference marks for encoders with distance-coded reference marks Input: 0 to 65535 [grating periods] 0=1000 grating periods (standard setting)		

Machine parameter	Function and input	Change via	Reaction
MP410.3	Axis identification for axis 4 Input: 0 = A 1 = B 2 = C 3 = U 4 = V 5 = W		
MP420.3	Activation of Hirth coupling for 4th axis Input: 0 or 1 (the MP can be read by the PLC, currently it has no other function in the NC) 0 = Hirth coupling not active 1 = Hirth coupling active		
MP430.3	Prescribed jog increment for Hirth coupling (the MP can be read by the PLC, currently it has no other function in the NC) Input: 0.000 to 30.000[°]		
MP710.0-3	Backlash compensation Input: –1.000 to +1.000 [mm] or [°]	PLC	
MP711.0-3	Height of reversal spikes during rotation Input: 0 –1.000 to +1.000 [mm]	PLC RUN	
MP712.0-3	Compensation value per CLP cycle time Input: 0.000 to +1.000 [mm]	PLC RUN	
MP720.0-3	Linear axis-error compensation Input: –1.0000 to +1.0000 [mm/m]	PLC	
MP 730	Selection of linear or non-linear axis-error compensation Input: %xxxx 0 = linear axis-error compensation 1 = non-linear axis-error compensation Bit 0 to 3 0 = non-active Axis X to 4 1 = active		Reset
MP810.0-3	Display mode for rotary axes and PLC auxiliary axes Input: 0.000 to 99 999.999[°] 0 = display ±99 999.999; Software limit switch active ≠ 0 = modulo value for display; Software limit switch inactive	PLC	
MP910.0-3	Positive software limit switch for traverse range 1; default setting after power-on; activation via PLC M4575 = 0, M4574 = 0 Input: –30 000.000 to +30 000.000 [mm] or [°] (Input values are referenced to the machine datum)	PLC	

Machine parameter	Function and input	Change via	Reaction
MP911.0-3	Positive software limit switch for traverse range 2; Activation via PLC M4575 = 0, M4574 = 1 Input: –30 000.000 to +30 000.000 [mm] or [°] (Input values are referenced to the machine datum)	PLC	
MP912.0-3	Positive software limit switch for traverse range 3; Activation via PLC: M4575 = 1, M4574 = 0 Input: –30 000.000 to +30 000.000 [mm] or [°] (input values referenced to machine datum)	PLC	
MP920.0-3	Negative software limit switch for traverse range 1; Default setting after power-on; activation via PLC M4575 = 0, M4574 = 0 Input: –30 000.000 to +30 000.000 [mm] or [°] (input values referenced to the machine datum)	PLC	
MP921.0-3	Negative software limit switch for traverse range 2; Activation via PLC M4575 = 0, M4574 = 1 Input: –30 000.000 to +30 000.000 [mm] or [°] (Input values referenced to the machine datum)	PLC	
MP922.0-3	Negative software limit switch for traverse range 3; Activation via PLC: M4575 = 1, M4574 = 0 Input: –30 000.000 to +30000.000 [mm] or [°] (Input values referenced to the machine datum)	PLC	
MP950.0-3	Datum for positioning blocks with M92 Input: –30 000.000 to +30 000.000 [mm] or [°] Values referenced to the machine datum	PLC RUN	
MP960.0-3	Machine datum Input: –30 000.000 to +30 000.000 [mm] or [°] Values referenced to scale reference point		Reset

4.4 Positioning

Machine parameter	Function and input	Change via	Reaction
MP1010.0-3	Rapid traverse Input: 80 to 300 000 [mm/min]	PLC	
MP1020.0-3	Manual feed rate Input: 80 to 300 000 [mm/min]	PLC	
MP1030.0-3	Positioning window Input: 0. 001 to 2.000 [mm]	PLC	
MP1040	Polarity of the nominal value voltage for the positive traverse direction Input: %xxxx Bit 0 to 3 0 = not active Axis X to 4 1 = active		Reset
MP1050.0-3	Analog voltage for rapid traverse Input: 1.000 to 9.000 [V]	PLC	
MP1060.0-3	Acceleration Input: 0.001 to 20.000 [m/s^2]	PLC	
MP1070.0	Radial acceleration Input: 0.001 to 20.000 [m/s^2]	PLC RUN	
MP1070.1	Acceleration at contour transition elements Input: 0.001 to 20.000 [m/s^2]	PLC RUN	
MP1080.0-3	Integral factor Input: 0 to 65 535	PLC RUN	
MP1090	Jerk limiting on the contour Input: 0 to 1000 [m/s^3] 0 = no jerk limiting (MP 1520 active) 1 to 1000 jerk limiting		
MP1097.0-3	Axis-specific jerk limit (active only with M112 and MP7415.1 bit 2) Input: 1 to 1000 [m/s^3] Recommended input value 10 to 50		
MP1099	Filter order for nominal position value filter Input: 0 to 7 0 = no filter 1 to 7 filter order Recommended input value 1 to 3		
MP1110.0-3	Standstill monitoring Input: 0.001 to 30.000 [mm]	PLC	
MP1140.0-3	Movement monitor on Input: 0.030 to 10.000 [V]	PLC RUN	

Machine parameter	Function and input	Change via	Reaction
MP1150	Delay time for erasing the nominal velocity value after an erasable error message **Positioning error <Axis> #** Input: 0.000 to 65.535 [s] Recommended: 0	PLC RUN	
MP1220	Automatic cyclic offset adjustment Input: 0 to 65 536 [s] 0 = no automatic adjustment	PLC RUN	
MP1320	Direction for traversing the reference marks Input: %xxxx Bit 0 to 3 0 = not active Axis X to 4 1 = active		Reset
MP1330.0-3	Velocity when traversing the reference marks Input: 80 to 300 000 [mm/min]	PLC RUN	
MP1331.0-3	Velocity when leaving the reference end position (only with MP1350=2) Input: 80 to 500 [mm/min]	PLC RUN	
MP1340.0-3	Axis sequence when traversing the reference marks Input: 0 = No evaluation of the reference mark 1 = Axis X 2 = Axis Y 3 = Axis Z 4 = Axis 4		Reset
MP1350.0-3	Functional sequence when traversing the reference marks Input: 0 = linear encoder with distance-coded reference marks (old routine) 1 = linear encoder with one reference mark 2 = special run (linear measurement via ROD) 3 = linear encoder with distance-coded reference marks (new routine)		Reset

4.5 Operation with Velocity Feedforward

Machine parameter	Function and input	Change via	Reaction
MP1390	Velocity feedforward control in the "Positioning with MDI,„ "Program run, single block" and "Program run, full sequence„ operating modes Input:0 or 1 0 = velocity feedforward control 1 = control with servo lag		Reset
MP1391	Velocity feedforward control in the "Manual" and "Handwheel" operating modes Input: %xxxx 0 = control with servo lag 1 = velocity feedforward control Bit 0 to 3 0 = not active Axis X to 4 1 = active		Reset
MP1410.0-3	Position monitoring for velocity feedforward control (erasable) Input: 0.001 to 30.000 [mm]	PLC	
MP1420.0-3	Position monitoring for operation with velocity feedforward control (EMERGENCY STOP) Input: 0.001 to 30.000 [mm]	PLC	
MP1510.0-3	k_v factor for velocity feedforward Input: 0.100 to 10.000 [**Fehler!**]	PLC RUN	
MP1511.0-3	Factor for stiction compensation Input: 0 to 16 777 215	PLC RUN	
MP1512.0-3	Limit to amount of stiction compensation Input: 0 to 16 777 215 [counting steps]	PLC RUN	
MP1513.0-3	Feed rate limit for stiction compensation Input: 0 to 300 000 [**Fehler!**]	PLC RUN	
MP1520	Transient response Input: 0.100 to 10.000	PLC	

4.6 Operation with Servo Lag

Machine parameter	Function and input	Change via	Reaction
MP1710.0-3	Position monitoring for control with servo lag (erasable) Input: 0.000 to 1 000.000 [mm] Recommended: 1.2 • servo lag	PLC	
MP1720.0-3	Position monitoring for control with servo lag (EMERGENCY STOP) Input: 0.000 to 1 000.000 [mm] Recommended: 1.4 • servo lag	PLC	
MP1810.0-3	k_v factor for control with servo lag Input: 0.100 to 10.000 [**Fehler!**]	PLC	
MP1820.0-3	Multiplication factor for the k_V factor Input: 0.001 to 1.000	PLC	
MP1830.0-3	Characteristic kink Input: 0.000 to 100.000 [%]	PLC	

4.7 Main Spindle

Machine parameter	Function and input	Change via	Reaction
MP3010	Output of rotational speed, gear range Input: 0 = no output of spindle speed 1 = coded output of spindle speed, only if the speed changes 2 = coded output of spindle speed on each TOOL CALL 3 = analog output of spindle speed, but gear change signal only if the speed changes 4 = analog output of spindle speed, but gear change signal on each TOOL CALL 5 = analog output of spindle speed, but no gear change signal 6 = same as input value 3 but with controlled spindle for orientation 7 = same as input value 4 but with controlled spindle for orientation 8 = same as input value 5 but with controlled spindle for orientation		Reset
MP3020	Speed range for S code output Input: 0 to 99 999 (with analog output of the spindle speed, enter 1991 here)	PLC	

Machine parameter	Function and input	Change via	Reaction
MP3030	Axis stops with TOOL CALL Input: 0 = Axis stops with TOOL CALL 1 = Axis does not stop with TOOL CALL	PLC	
MP3120	Permissibility of zero speed value Input: 0:S = 0 permitted 1:S = 0 not permitted	PLC	
MP3130	Polarity of the nominal speed command signal for the spindle Input: 0 = M03 positive; M04 negative 1 = M03 negative; M04 positive 2 = M03 and M04 positive 3 = M03 and M04 negative		Reset
MP3140	Counting direction of spindle speed encoder signals Input: 0 = positive count direction with M03 1 = negative count direction with M03		Reset
MP3142	Line count of the position encoder on the spindle Input: 100 to 9 999 [lines]	PLC RUN	
MP3143	Mounting configuration of spindle position encoder Input: 0 to 2 0 = position encoder directly on the spindle 1 = position encoder via transmission (transmission ratios in MP3450.x and MP3451.x). X30 Pin 1 = reference pulse 2 = position encoder via transmission (transmission ratios in MP3450.x and MP3451.x). X30 Pin 1 = reference pulse release 3 = same as 1, but second reference pulse is evaluated first With the input values 1 and 2, the reference traverse must be activated via Module 9220	PLC RUN	
MP3210.0-7	Nominal value voltage at rated speed Input: 0.000 to 20.000 [V]	PLC RUN	

Machine parameter	Function and input	Change via
MP3240.1	Minimum nominal value voltage Input: 0 to 9.999 [V]	
MP3240.2	Jog voltage for gear changing (M4009/M4010) Input: 0 to 9.999 [V]	
MP3310 MP3310.0 MP3310.1	Limits for spindle override Input: 0 to 150 [%] Upper limit Lower limit	
MP3411 MP3411.0-7	Ramp gradient of the spindle at M03 and M04 Input: 0.000 to 1.999 [V/ms] Gear range: 1 to 8	PLC RUN
MP3412 MP3412.0 MP3412.1 MP3410.2 MP3410.3	Multiplier for MP3411.x Input: 0.000 to 1.999 For M05 For spindle orientation For tapping For rigid tapping	PLC RUN
MP3415 MP3415.0 MP3415.1 MP3415.2 MP3415.3	Transient response of the spindle (functions like MP1520) Input: 0 to 1000 [ms] for M03, M04 and M05 for spindle orientation for tapping for rigid tapping	PLC RUN
MP3420	Positioning window for the spindle Input: 0 to 360.000 [°]	PLC RUN
MP3430	Deviation of the reference mark from the desired position (spindle preset) Input: 0 to 360.000 [°]	PLC RUN

Machine parameter	Function and input	Change via	Reaction
MP3440 MP3440.0-7	k_v factor for spindle orientation Input: 0.1 to 10 [**Fehler!**] Gear range 1 to 8	PLC RUN	
MP3450 MP3450.0-7	Number of revolutions of the spindle position encoder Input: 0 to 255 0 = no transmission Gear range 1 to 8	PLC RUN	
MP3451 MP3451.0-7	Number of revolutions of the spindle Input: 0 to 255 0 = no transmission Gear range 1 to 8	PLC RUN	
MP3510 MP3510.0-7	Rated speed for gear ranges Input: 0 to 99 999.999 [rpm] Gear range 1 to 8	PLC	
MP3515 MP3515.7	Maximum spindle speed Input: 0 to 99 999.999 [rpm] Gear range 1 to 8	PLC	
MP3520.0	Spindle speed activated by marker M4011 Input: 0 to 99 999.999 [rpm]	PLC RUN	
MP3520.1	Spindle speed for oriented spindle stop Input: 0 to 99 999.999 [rpm]	PLC RUN	

4.8 Integrated PLC

Machine parameter	Function and input	Change via	Reaction
MP4010	PLC program out of EPROM or RAM Input: 0 or 1 0 = EPROM 1 = RAM		Reset
MP4020	PLC compatibility Input: %xxxxxxx Bit 0 0 = non-compatible (marker range 4xxx) 1 = compatible (marker range 2xxx) Bit 1 to 5 reserved Bit 6 1 = PLC positions in the format 1/10000 mm; oriented spindle stop triggered by module 9171 or by marker M4130/D592 in the format 1/10000°		Reset
MP4060.0-3	Path-dependent lubrication Input: 0 to 99 999.9999 [mm]	PLC RUN	
MP4070	Compensation per PLC cycle for lag-tracking error compensation Input: 0.001 to 0.005 [mm]	PLC RUN	
MP4110.0-47	Time for Timer T0 to T47 Input: 0 to 65 535 [PLC cycles]	PLC RUN	
MP4120.0-31	Preset value for counter C0 to C31 Input: 0 to 65 535 [PLC cycles]	PLC RUN	
MP4130 MP4130.0 MP4130.1 MP4130.2 MP4130.3 MP4130.4 MP4130.5	Number the fast PLC inputs Input: 0 to 255 [No. of the PLC input] Fast PLC input for suppressing the monitoring functions No function Fast PLC input sets M4590 (signal duration > 6 ms) Fast PLC input sets M4591 (signal duration > 6 ms) Fast PLC input sets M4592 (signal duration > 6 ms) Fast PLC input sets M4593 (signal duration > 6 ms)		

Machine parameter	Function and input	Change via	Reaction
MP4131	Criterion for activating the fast PLC input from MP4130 Input: 0 = Activation at Low level 1 = Activation at High level		
MP4131.0	Fast PLC input for switching off the monitoring functions		
MP4131.1	No function		
MP4131.2	Fast PLC input for sets M4590 (signal duration > 6 ms)		
MP4131.3	Fast PLC input sets M4591 (signal duration > 6 ms)		
MP4131.4	Fast PLC input sets M4592 (signal duration > 6 ms)		
MP4131.5	Fast PLC input sets M4593 (signal duration > 6 ms)		
MP4210.0-47	Setting a number in the PLC (D768 to D956) Input: –30 000.000 to +30 000.000 [mm]		
MP4220.0-3	Setting a number in the PLC (Word range W960 to W968) Input: 0 to 65 535		
MP4230.0-31	Setting a number in the PLC (Module 9032) Input: –99 999.999 to +99 999.999		
MP4231.0-31	Setting a number in the PLC (Module 9032) Input: –99 999.999 to +99 999.999		
MP4310.0-6	Setting a number in the PLC (W976 to W988) Input: 0 to 65 535 $0000 to $FFFF		

4.9 Adaptation of the Data Interfaces

Machine parameter	Function and input	Change via	Reaction
MP5020.0-2	Data format EXT1 to EXT3 Input: %xxxxxxxxx Bit 0 0 = 7 data bits 1 = 8 data bits Bit 1 0 = BCC any 1 = BCC not control character Bit 2 Transmission stop through RTS 0 = not active 1 = active Bit 3 Transmission stop through DC3 0 = not active 1 = active Bit 4 0 = even parity 1 = odd parity Bit 5 0 = parity not required 1 = parity required Bit 6/7 Stop bits Bit 6 Bit 7 1½ stop bits 0 0 2 stop bits 1 0 1 stop bit 0/1 1/1 Bit 8 0= RTS always active 1= RTS only active when data transfer is started Bit 9 0= EOT sent after EXT 1= EOT **not** sent after EXT	CN PLC RUN	
MP5030.0-2	MP5030.0 Operating mode EXT1 MP5030.1 Operating mode EXT2 MP5030.2 Operating mode EXT3 (PLC) Input: 0 = "standard data transfer" 1 = "blockwise transfer"	CN PLC RUN	
MP5040	Data transfer rate in operating mode EXT3 (data transfer via PLC) Input: 0 = 110 baud 6 = 4800 baud 1 = 150 baud 7 = 9600 baud 2 = 300 baud 8 = 19 200 baud 3 = 600 baud 9 = 38 400 baud 4 = 1200 baud 10 = 57 600 baud 5 = 2400 baud 11 = 115 200 baud	PLC RUN	

4.10 3-D Touch Probe

Machine parameter	Function and input	Change via	Reaction
MP6010	Selection of the touch probe Input: 0 = Touch probe 220 1 = Touch probe 630	CN PLC	
MP6120	Probe feed rate (triggering touch probe) Input: 10 to 3000 [mm/min]	CN PLC RUN	
MP6130	Maximum measuring range Input: 0.001 to 30 000.000 [mm]	CN PLC RUN	
MP6140	Setup clearance above measuring point Input: 0.001 to 30 000.000 [mm]	CN PLC RUN	
MP6150	Rapid traverse in probing cycle (triggering touch probe) Input: 80 to 30 000 [mm/min]	CN PLC RUN	
MP6160	M function for 180° turn of the spindle Input: –1 to 88 –1 = Spindle orientation directly through NC 0 = Function inactive 1 to 88 = Number of the M function for spindle orientation through the PLC	CN PLC RUN	
MP6210	Number of the oscillations in normal direction per second Input: 0 to 65.535 [1/s]	CN PLC RUN	
MP6230	Feed rate in normal direction Input: 0 to 1000 [mm/min]	CN PLC RUN	
MP6240	Maximum stylus deflection Input: 0 to 10.000 [mm]	CN PLC RUN	
MP6260	Output of M90 for NC blocks with digitized data Input: 0 = no output of M90 1 = output of M90 in each NC block	CN PLC RUN	
MP6270	Rounding decimal places Input: 0 = output in 0.001-mm steps (1 µm) 1 = output in 0.01-mm steps (10 µm)	CN PLC RUN	

4.11 Tool Measurement with TT 130

Machine parameter	Function and input	Change via	Reaction
MP6500	Tool measurement with TT 130 Input: %xxxx Bit 0: 0 = Cycles for tool measurement disabled 1 = Cycles for tool measurement not disabled Bit 1: 0 = Tool radius measurement permitted; tool length measurement with rotating spindle 1 = Tool radius measurement and individual tooth measurement disabled Bit 2: 0 = Tool length measurement with stationary spindle (bit 1 = 1) 1 = Tool length measurement with rotating spindle. The tool length is then calibrated with the spindle rotating only if a tool radius offset (TT:R-OFFS) is entered in the tool table. Bit 3: 0 = Tool measurement with oriented spindle stop 1 = Tool measurement without oriented spindle stop. Individual-tooth measurement is not possible. Tool radius measurement might be incorrect.	PLC	
MP6505	Probing direction for tool measurement Input: 0 to 3 0 = Positive probing direction in the angle reference axis (0° axis) 1 = Positive probing direction in the +90°-axis 2 = Negative probing direction in the angle reference axis (0° axis) 3 = Negative probing direction in the +90°-axis	CN PLC	
MP6507	Calculation of the probing feed rate Input: 0 to 3 0 = Calculation of the probing feed rate with constant tolerance 1 = Calculation of the probing feed rate with variable tolerance 2 = Constant probing feed rate 3 = Constant probing speed	CN PLC	

Machine parameter	Function and input	Change via	Reaction
MP6510	Max. permissible measuring error for tool measurement with rotating tool Input: 0.002 to 0.999 [mm]	CN PLC	
MP6520	Probing feed rate for tool measurement with non-rotating tool Input: 10 to 3 000 [mm/min]	CN PLC RUN	
MP6530	Distance from tool lower edge to probe contract upper edge for tool radius measurement Input: 0.001 to 30.000.000 [mm]	CN PLC	
MP6531	Diameter or edge length of the TT 120 probe contact Input: 0.001 to 99 999.9999 [mm]	PLC	
MP6540.0	Safety zone around the probe contact TT 120 for pre-positioning in linear measurement Input: 0.001 to 30 000.000 [mm]	CN PLC	
MP6540.1	Safety zone around the probe contact TT 120 for pre-positioning in radius measurement Input: 0.001 to 30 000.000 [mm]	CN PLC	
MP6550	Rapid traverse in probing cycle for TT 120 Input: 10 to 20 000 [mm/min]	CN PLC RUN	
MP6560	M function for spindle orientation with single-tooth calibration Input: –1 to 88 –1 = spindle orientation directly via NC 0 = function inactive 1 to 88 = Number of the M function for spindle orientation via PLC	CN PLC RUN	
MP6570	Max. permissible surface cutting speed at the tool edge Input: 1.000 to 120.000 [m/min]	CN PLC	
MP6580 MP6580.0-2	Coordinates of the TT 120 probe center referenced to the machine datum Input: –30 000.000 to +30 000.000 [mm] Axes 1 to 3	CN PLC	

4.12 Tapping

Machine parameter	Function and input	Change via	Reaction
MP7110.0	Minimum for feed-rate override during tapping Input: 0 to 150 [%]	PLC RUN	
MP7110.1	Maximum for feed-rate override during tapping Input: 0 to 150 [%]	PLC RUN	
MP7120.0	Dwell time for reversal of spindle rotation direction Input: 0 to 65.535 [s]	PLC RUN	
MP7120.1	Advanced switching time of the spindle for tapping with coded output of the spindle speed Input: 0 to 65.535 [s]	PLC RUN	
MP7120.2	Spindle slow-down time after reaching the total hole depth Input: 0 to 65.535 [s]	PLC RUN	
MP7130	Approach behavior of the spindle for rigid tapping Input: 0.01 to 10.000 [°/min]	PLC	
MP7150	Positioning window of the tool axis for rigid tapping Input: 0.001 to 2.000 [mm]	PLC	
MP7160	Spindle orientation with Cycle 17 Input: 0= spindle orientation before execution of Cycle 17 1= no spindle orientation before execution of Cycle 17	CN PLC RUN	

4.13 Display and Operation

Machine parameter	Function and input	Change via	Reaction
MP7210	Programming station Input: 0 = controlling and programming 1 = programming station "PLC active" 2 = programming station "PLC not active"	CN	Reset
MP7212	**POWER INTERRUPTED** message Input: 0 = **POWER INTERRUPTED** message must be acknowledged with the CE key 1 = **POWER INTERRUPTED** message does not appear	CN PLC RUN	
MP7220	Block number increment for ISO programs Input: 0 to 250	CN PLC RUN	
MP7224	Lock file types Input: %xxxxxxxx Bit 0 HEIDENHAIN programs Bit 1 ISO programs Bit 2 Tool tables Bit 3 Datum tables Bit 8 Point tables 0 = do not lock 1 = lock	CN PLC RUN	
MP7230	Switching the dialog language Input: 0 or 1 1 = local language 2 = English	CN PLC RUN	
MP7237	Reset NC operating times with code number 857 282 Input: %xxx Bit 0: reset "CONTROL ON " Bit 1: reset "PROGRAM RUN" Bit 2: reset "SPINDLE ON"	PLC RUN	
MP7251	Amount of global Q parameters Input: 0 to 40	PLC RUN	

Machine parameter	Function and input	Change via	Reaction
MP7260	Number of the tools in the tool table Input: 0 to 254	CN	
MP7261	Number of pockets in the tool magazine Input: 0 to 254	CN	
MP7266	Elements of the tool table Input: 0 = no display 1 to 99 = position in the tool table	CN	
MP7266.0	Tool name (NAME)		
MP7266.1	Tool length (L)		
MP7266.2	Tool radius (R)		
MP7266.3	*Free*		
MP7266.4	Oversize for tool length (DL)		
MP7266.5	Oversize for tool radius (DR)		
MP7266.6	*Free*		
MP7266.7	Tool locked? (TL)		
MP7266.8	Replacement tool (RT)		
MP7266.9	TIME 1		
MP7266.10	TIME 2		
MP7266.11	CURRENT TIME		
MP7266.12	Comment about the tool (DOC)		
MP7266.13	Number of tool teeth (CUT)		
MP7266.14	Wear tolerance for tool length (LTOL)		
MP7266.15	Wear tolerance for tool radius (RTOL)		
MP7266.16	Cutting direction of the tool (DIRECT)		
MP7266.17	PLC status (PLC)		
MP7266.18	Tool offset for length (TT: L-OFFS)		
MP7266.19	Tool offset for radius (TT: R-OFFS)		
MP7266.20	Breakage tolerance for tool length (LBREAK)		
MP7266.21	Breakage tolerance for tool radius (RBREAK)		
MP7267	Elements of the pocket table Input: 0 = no display 1 to 99 = position in the pocket table	CN	
MP7267.0	Tool number (T)		
MP7267.1	Special tool (ST)		
MP7267.2	Fixed pocket (F)		
MP7267.3	Locked pocket (L)		
MP7267.4	PLC status (PLC)		

Machine parameter	Function and input	Change via	Reaction
MP7270	Feed-rate display in the "Manual operation" and "Electronic handwheel" modes Input: %xx Bit 0 = 0 display of the axis feed rate only when an axis-direction button is pressed (axis-specific feed from MP1020.x) Bit 0 =1 display of the axis feed-rate even before operating an axis-direction button (smallest value from MP1020.x for all axes) Bit 1 =1 interruption when NC stop during manual mode	CN PLC RUN	
MP7274	Display current gear range Input: 0 or 1 0 = no display 1 = display	CN PLC RUN	
MP7280	Decimal sign Input: 0 = decimal comma 1 = decimal point	CN PLC RUN	
MP7285	Offset tool length in the position display of the tool axis Input: 0 = tool length is not offset 1 = tool length is offset	CN PLC RUN	
MP7290.0-3	Position display step Input: 0 = 0.1 mm or 0.1° 1 = 0.05 mm or 0.05° 2 = 0.01 mm or 0.01° 3 = 0.005 mm or 0.005° 4 = 0.001 mm or 0.001°	CN	
MP7295	Inhibit datum set on axis-specific basis Input: %00xxxx 0 = do not inhibit datum set 1 = inhibit datum set Bits 4 and 5 reserved, enter 0 (no DATUM SET soft key, if datum set inhibited for all axes)		

Machine parameter	Function and input	Change via	Reaction
MP7296	Setting the datum via axis keys or soft key Input: 0 or 1 0 = datum can be set via both axis keys and soft key; switch handwheel symbol using axis keys 1 = datum can only be set via soft key; switch to current axis for +/– direction traverse using axis keys	CN PLC RUN	
MP7300	Clear the status display and the Q parameters Input: %xxx 0 = Cancel the status display, Q parameters and tool data when a program is selected 1 = Cancel the status display, Q parameters and tool data with M02, M30, END PGM and when a program is selected 2 = Cancel the status display and tool data when a program is selected 3 = Cancel the status display and tool data with M02, M30, END PGM, and when a program is selected 4 = Cancel the status display and Q parameters when a program is selected 5 = Cancel the status display and Q parameters when a program is selected and with M02, M30, END PGM 6 = Cancel the status display when a program is selected 7 = Cancel the status display when a program is selected and with M02, M30, END PGM	CN PLC RUN	
MP7310	Graphic display mode Input: %xxxxxxxx Bit 0: Display mode in three planes 0 = projection preferred in Germany 1 = projection preferred in America Bit 1: Rotating the coordinate system in the working plane by +90° 0 = no rotation 1 = coordinate system rotated by +90° Bit 2, 3 Reserved Bit 4: Simulation graphics for machining cycles 0 = Only the last infeed plane is represented (default) 1 = All machining steps are represented Bit 5-7 Reserved	CN	

Machine parameter	Function and input	Change via	Reaction
MP7311	Drawing mode for editing graphics Input: %xxxxxxxx Bit 0 : 0/1 = do not indicate/indicate infeed points Bit 1 : 0/1 = do not draw/draw pocket meanders Bit 2 : 0/1 = do not draw/draw compensated contours Bit 3-7 *Reserved*	CN	
MP7330.0-15	Definition of parameters as user parameters Input: 0 to 9999.99 (no. of the desired machine parameters)	PLC RUN	
MP7340.0-15	Dialogs for user parameters Input: 0 to 199 (line number in the PLC dialog file)	PLC RUN	

4.14 Machining and Program Run

Machine parameter	Function and input	Change via	Reaction
MP7410	Scaling factor cycle in two or three axes Input: 0 = Scaling factor cycle effective in all three primary axes 1 = Scaling factor cycle effective only in the working plane	CN PLC RUN	
MP7411	Tool data in touch probe block Input: 0 = With the touch probe block the current tool data are overwritten with the calibrated data of the probe system. 1 = The current tool data are retained even with a touch probe block.	CN PLC RUN	
MP7415.0	Type of transition element with M112 Input: %000000xx (recommended input value %00000011) 0 = insert circular arc 1 = insert cubic spline 2 = insert 5^{th} degree polynomial 3 = insert 7^{th} degree polynomial Bits 2 to 7 *Reserved*		

Machine parameter	Function and input	Change via	Reaction
MP7415.1	Smooth contour transition Input: %0000000x 0: = Do not smooth contour transition 1: = Smooth contour transition Bit 1 r*eserved* Bit 2 1= jerk limit active Bit 3 1 = short contour elements (< 16 µm) are combined to form one contour element Bits 4 to 7 *reserved*		
MP7420.0	Cycles for milling pockets with combined contours Input: %xxxx Bit 0 Milling direction in channel milling 0 = pockets counterclockwise, islands clockwise 1 = pockets clockwise, islands counterclockwise Bit 1 Sequence for clearing and channel-milling 0 = first mill the channel, then clear the pocket 1 = first clear the pocket, then mill the channel Bit 2 Merging of listed contours 0 = contours are combined only if the tool center paths intersect 1 = contours are combined if the programmed contours intersect	CN PLC RUN	
	Bit 3 Clearing and channel-milling to pocket depth or for each pecking depth 0 = each process uninterrupted to pocket depth 1 = first channel milling, then clearing for each pecking depth before proceeding to the next depth. Bit 4: Position after machining the cycle 0 = tool moves to same position as before cycle was called 1 = tool moves only to the last programmed position Bits 5–7 *Reserved*	CN PLC RUN	

Machine parameter	Function and input	Change via	Reaction
MP7420.1	Cycles for milling combined contour pockets Input: %xxxxxxxx Bit 0 = 0 Rough out of the separate contour areas with individual tool infeeds Bit 0 = 1 Rough out of the separate contour areas without withdrawing the tool Bits 1–7 *Reserved*		
MP7430	Overlap factor for pocket milling Input: 0.1 to 1.414	CN PLC RUN	
MP7440	Output of M functions Input: %xxxxx Bit 0: program stop with M06 0 = program stop with M06 1 = no program stop with M06 Bit 1 Modal cycle call M89 0 = normal code transfer of M89 at beginning of block 1 = modal cycle call M89 at end of block Bit 2 Program stop with M functions 0 = program stop until acknowledgment of M function 1 = no program stop (do not wait for acknowledgment) Bit 3 no function Bit 4 Reduced feed rate in the tool axis with M103 0 = Function not effective 1 = Function effective Bit 5 Marker axis in position is set between two NC sets during waiting period 0 = Function not effective 1 = Function effective	CN PLC RUN	
MP7460	Constant contouring speed at corners Input: 0.000 to 179.999 [°]	CN PLC RUN	
MP7470	Maximum feed rate at 100% override Input: 0 to 300 000 [mm/min] 0 = no limit	CN PLC RUN	
MP7475	Reference point for datum table Input: 0 or 1 0 = reference point is workpiece datum 1 = reference point is machine datum	CN PLC RUN	

Machine parameter	Function and input	Change via	Reaction
MP7480.0	Output of tool or pocket number with TOOL CALL block Input: 0 = No output 1 = Tool number output only when tool number changes (W264) 2 = Tool number output with every TOOL CALL block (W264) 3 = Output of pocket number (W264) and tool number only when tool number changes 4 = Output of pocket number (W264) and tool number with every TOOL CALL block 5 = Output of pocket number (W264) and tool number only when tool number changes. Fixed tool pocket coding 6 = Output of pocket number (W262) and tool number (W264) with every TOOL CALL block. (Fixed tool pocket coding).	PLC RUN	
MP7480.1	Output of tool or pocket number with TOOL DEF block Input: 0 = No output 1 = Tool number output only when tool number changes 2 = Tool number output with every TOOL DEF block 3 = Output of pocket number and tool number only when tool number changes 4 = Output of pocket number and tool number with every TOOL DEF block	PLC RUN	
MP7490	Number of datums in traverse range Input: 1 or 3 1 = 3 traverse ranges, 3 datums 3 = 3 traverse ranges, 1 datum		

4.15 Hardware

Machine parameter	Function and input	Change via	Reaction
MP7620	Feed-rate override and spindle override Input: %xxxx Bit 0: Feed rate override if the rapid traverse key is pressed in the "program run" operating mode 0 = override not in effect 1 = override in effect Bit 1: no function Bit 2: Feed rate override if the rapid traverse key and the machine direction button are pressed in the "manual" operating mode 0 = override not in effect 1 = override in effect Bit 3: Feed-rate override and spindle override in 1% steps or according to a nonlinear curve 0 = 1% steps 1 = Nonlinear curve	PLC RUN	
MP7640	Handwheel Input: 0 = no handwheel 1 = reserved 2 = HR 130 3 = reserved 4 = reserved 5 = up to three HR 150 via HRA 110 6 = HR 410 7 = reserved 8 = reserved 9 = reserved 10 = reserved	CN	
MP7641	Entry of interpolation factor Input: %xxxxx Bit 0 = 0 Interpolation factor via TNC keyboard 1 Interpolation factor via PLC module 9036 Bit 1 = 1 Handwheel active in Programming and Editing mode Bit 2 = 1 Interpolation factor via keyboard and module Bit 3 = 1 Handwheel input active in every operating mode Bit 4 = 1 Handwheel active during return to the contour	CN PLC RUN	

Machine parameter	Function and input	Change via	Reaction
MP7645.0 MP7645.1-7	Initializing parameters for handwheel HR410 Input: 0 to 255 ($00 to $FF) 0 = evaluation of the keys via NC 1 = evaluation of the keys via PLC Reserved	CN PLC RUN	R
MP7650	Counting direction for handwheel Input: 0 = negative counting direction 1 = positive counting direction	PLC RUN	
MP7660	Threshold sensitivity for electronic handwheel Input: 0 to 65 535 [increments]	PLC RUN	
MP7670 MP7670.0 MP7670.1 MP7670.2	Interpolation factor for handwheel Input: 0 to 10 Interpolation factor for low speed (only for HR410) Interpolation factor for medium speed (only HR 410) Interpolation factor for high speed (only HR 410)	PLC RUN	
MP7671 MP7671.0 MP7671.1 MP7671.2	Manual feed rate in handwheel mode with HR410 Input: 0 to 1000 [% of MP1020] Low speed Medium speed High speed	PLC RUN	
MP7680	Multiple function Input: %xxxxxxxxxxxxxxxx Bit 0: = 1 Memory function for axis direction keys active Bit 1: = 1 Returning to the contour active Bit 2: = 1 Mid-program startup active Bit 3 to bit 10 reserved Bit 11: = 1 PLC functions are carried out during mid-program setup; PLC ON/OFF is not displayed in the mid-program startup window Bit12 to bit15 reserved	PLC RUN	
MP7690	MEMORY TEST during power-on Input: %xxx Bit 0: Test the RAM Bit 1: Test the EPROM 0 = MEMORY TEST during power-on 1 = no MEMORY TEST during power-on		

5 List of Markers and Words

5.1 List of Markers

Marker		S	R
	Spindle		
M4000	Spindle in position	NC	NC
M4001	Nominal speed command signal of the spindle not in the ramp	NC	NC
M4002	Nominal speed command signal of the spindle = zero	NC	NC
M4003	Nominal speed output analog or digital	NC	NC
M4004	Illegal rotational speed	NC	NC
M4005	Status display and nominal speed value output for M03	PLC	PLC
M4006	Status display and nominal speed value output for M04	PLC	PLC
M4007	Status display for M05 and spindle stop	PLC	PLC
M4008	Disable speed output for spindle	PLC	PLC
M4009	Spindle rotation counterclockwise (for gear change)	PLC	PLC
M4010	Spindle rotation clockwise (for gear change)	PLC	PLC
M4011	Activate rotational speed MP3520.0 and direction of rotation from M4013	PLC	PLC
M4012	Open the spindle control loop	PLC	PLC
M4013	Direction for spindle orientation 0 = M03 1 = M04	PLC	PLC
M4014	Reverse the direction of spindle rotation	PLC	PLC
M4015	Renewed evaluation of the spindle reference mark	PLC	NC
M4016	Cycle 13 is executed	NC	PLC
M4017	Controlled spindle in motion	NC	NC
M4018	Reference mark for spindle not yet traversed	NC	NC
	Thread Cutting		
M4030	Cycle 2 or Cycle 17 active	NC	NC
M4031	Cycle 17 or Cycle 18 active	NC	NC
	Coolant Status		
M4040	Status display M07, M08, M09 highlighted	PLC	PLC
M4041	Status display M07, M08, M09 and MK	PLC	PLC
M4042	Status display M07, M08, M09 and MK	PLC	PLC
	Touch Probe		
M4050	Touch probe not ready (ready signal is missing)	NC	NC
M4051	Stylus deflected before start of probing cycle	NC	NC
M4052	Stylus deflected (probing process not executed)	NC	PLC
M4053	Probing sequence ended or interrupted	NC	NC

Marker		S	R
M4054	Battery voltage too low (battery warning at touch probe connection); evaluated only during the probing process	NC	NC
M4055	Enabling the probing process	NC	PLC
M4056	NC stop in all operating modes if stylus is deflected	PLC	PLC
M4060	Cycle for tool measurement started	NC	NC
M4061	0 = tool measurement 1 = tool inspection	NC	NC
M4062	0 = wear tolerance not exceeded 1 = wear tolerance exceeded	NC	NC
M4063	0 = breakage tolerance not exceeded 1 = breakage tolerance exceeded	NC	NC
	Strobe Signals from the NC to the PLC		
M4070	Strobe signal for gear code	NC	NC
M4071	Strobe signal for S code	NC	NC
M4072	Strobe signal for M function	NC	NC
M4073	Strobe signal T code (P code) with TOOL CALL	NC	NC
M4074	Strobe signal T code (P code) with TOOL DEF	NC	NC
M4075	Transfer with FN19 active	NC	NC
	Acknowledgment of NC Strobe Signals		
M4090	Acknowledgment "gear change completed"	PLC	PLC
M4091	Acknowledgment of S code	PLC	PLC
M4092	Acknowledgment of M code	PLC	PLC
M4093	Acknowledgment of T code (P code) with TOOL CALL	PLC	PLC
M4094	Acknowledgment of T code (P code) with TOOL DEF	PLC	PLC
M4095	Acknowledgment of transfer with FN19	PLC	PLC
	Strobe Signals from the PLC to the NC		
M4120	PLC positioning axis X active	PLC	NC; PLC
M4121	PLC positioning axis Y active	PLC	NC; PLC
M4122	PLC positioning axis Z active	PLC	NC; PLC
M4123	PLC positioning axis 4 active	PLC	NC; PLC
M4130	Activation of PLC positioning for spindle orientation	PLC	NC
M4131	Activation of transfer of the value from D528 to the Q parameter defined in W516	PLC	NC
M4132	Activate datum shift from D528 to D544	PLC	NC
M4134	Activation of a gear range and speed through the PLC	PLC	NC
M4135	Activation of the selected traverse range (M2816/M2817)	PLC	NC

Marker		S	R
	NC Operating Modes and Status		
M4150	Operating mode: Manual operation	NC	NC
M4151	Operating mode: Electronic handwheel	NC	NC
M4152	Operating mode: Positioning with manual data input	NC	NC
M4153	Operating mode: Program run, single block	NC	NC
M4154	Operating mode: Program run, full sequence	NC	NC
M4155	Operating mode: Traversing the reference marks	NC	NC
M4156	MANUAL OPERATION soft key was pressed	NC	NC
M4157	Returning to the contour active	NC	NC
M4158	Mid-program startup active	NC	NC
M4170	END PGM, M02 or M30 was executed	NC	NC
M4171	First PLC scan after end of EMERGENCY STOP test	NC	NC
M4172	First PLC scan after power on	NC	NC
M4173	First PLC scan after interruption of the PLC program	NC	NC
M4174	First PLC scan after editing the MPs (MP edit was exited and the MPs were altered)	NC	NC
M4175	Program interruption (control-in-operation symbol flashes)	NC	NC
M4176	Control is in operation (control-in-operation symbol is on or is blinking)	NC	NC
M4177	Erasable error message is displayed	NC	NC
M4178	Error message **EMERGENCY STOP** is displayed	NC	NC
M4180	Rapid traverse programmed (FMAX)	NC	NC
	Arithmetic or Module Error in the PLC		
M4200	Overflow during multiplication	NC	PLC
M4201	Division by 0	NC	PLC
M4202	MODULO incorrectly executed	NC	PLC
M4203	Is set or reset during module calls	NC	NC PLC
M4204	Reserved for errors, that the PLC programmer wants to intercept	NC	NC
	Markers That Can Be Changed by Machine Parameter		
M4300 to M4347	Markers that can be changed by MP4310.0, MP4310.1 and MP 4310.2	NC	NC
M4348 to M4411	Values from MP4310.3 to MP4310.6		

Marker		S	R
	Tool Change		
M4520	Another T code (P code) follows with TOOL CALL	NC	NC
M4521	Tool no. zero programmed	NC	NC
M4522	Tool programmed with pocket number	NC	NC
M4523	Tool programmed without pocket number	NC	NC
M4524	Call special tool (TOOL CALL)	NC	NC
M4526	Axis X is tool axis	NC	NC
M4527	Axis Y is tool axis	NC	NC
M4528	Axis Z is tool axis	NC	NC
M4529	Axis 4 is tool axis	NC	NC
M4538	Geometry of the tool from W264	PLC	NC
M4539	T highlighted in status display	PLC	PLC
M4540	Sequence for tool change from special tool to normal tool	PLC	PLC
M4541	Special tool to original pocket despite variable pocket coding	PLC	PLC
M4542	Do not update pocket number in pocket table	PLC	PLC
M4543	Tool life expired (TIME1 in the tool table)	NC	NC; PLC
M4544	Open tool holder	PLC	NC
M4545	Status of tool holder	NC	NC
	Additional Keys		
M4560	NC stop ("0" corresponds to stop)	PLC	PLC
M4561	Rapid traverse	PLC	PLC
M4562	Memory function for axis direction keys	PLC	PLC
M4563	Feed rate release for all axes	PLC	PLC
M4564	NC start (edge evaluation)	PLC	PLC
	General Functions		
M4570	Unit of measure for transfer with FN19 0 = mm; 1 = inch	NC	NC
M4571	Enabling of decoded M-code transfer in markers M1900 to M1999	PLC	PLC
M4572	Enabling of incremental jog positioning	PLC	PLC
M4573	Disabling of transfer (after acknowledging the M/S/T/Q strobe the following NC blocks are executed)	PLC	PLC
M4574	Selecting the traverse range	PLC	PLC
M4575	Selecting the traverse range	PLC	PLC
M4576	Suppression of handwheel pulses	PLC	PLC
M4577	Disabled key was pressed	NC	PLC

Marker		S	R
M4578	Activate axis direction keys before crossing the reference points	NC	NC
M4579	Enable incremental jog positioning via NC	NC	NC
M4580	Suppress EMERGENCY STOP, open all position control loops, NC stop	PLC	PLC
M4581	Open all position control loops, NC stop	PLC	PLC
M4583	Display PLC error messages flashing	PLC	PLC
M4584	Disable multi-dimensional axis movements	PLC	PLC
M4585	Disable "Program Run, Full Sequence " mode	PLC	PLC
M4590	Triggering signal of the PLC input defined in MP4130.2	NC	PLC
M4591	Triggering signal of the PLC input defined in MP4130.3	NC	PLC
M4592	Triggering signal of the PLC input defined in MP4130.4	NC	PLC
M4593	Triggering signal of the PLC input defined in MP4130.5	NC	PLC
M4800 to M4899	Markers for error messages	PLC	NC; PLC

5.2 List of Words

Word	Function
W256	G code for S analog
W258	S code
W260	Code for M function
W262	Tool pocket number / Tool number
W264	Tool number
W270	Help-file line number –1 = no help file selected –2 = no valid numerical value 0 to 9999 = line number
W272	Operating mode 1 = Manual operation 2 = Electronic handwheel 3 = Positioning with manual data input 4 = Program run, single block 5 = Program run, full sequence 7 = Traversing the reference point
W274	Code of the activated key
D276	Code of the code number last entered via MOD
D280	First numerical value from FN19
D284	Second numerical value from FN19
W302	PLC soft-key number of the activated PLC soft key

Word	Function
W320	Nominal rotational speed (only with controlled spindle)
W322	Actual rotational speed (only with controlled spindle)
D356	Programmed rotational speed
D360	Programmed feed rate (NC → PLC)
D388	Current feed rate
W392	Analog voltage on connector X8
W480	Voltage input 0 on the LE
W482	Voltage input 1 on the LE
W484	Voltage input 2 on the LE
W486	Temperature input 0 on the LE
W488	Temperature input 1 on the LE
W492	Percentage factor for spindle override (NC → PLC)
W494	Percentage factor for feed-rate override (NC → PLC)
W516	Number of the Q parameter to be overwritten (Q100 to Q107 = 0 to 7)
W522	Switch off the monitoring functions if the PLC input from MP4130 is activated
D528	Value to be transferred to the Q parameters Datum shift for X axis Position axis X [1/10 000 mm]
D532	Datum shift for Y axis Position of axis Y
D536	Datum shift for Z axis Position of axis Z
D540	Datum shift for IV axis Position of axis 4
W560	Feed rate in axis X [mm/min]
W562	Feed rate in axis Y
W564	Feed rate in axis Z
W566	Feed rate in axis 4
W576 W578 W580 W582	Lag-tracking error compensation (compensation speed from MP4070) Input range: + 32 767 to – 32 768 [1/10 000mm] Axis X Axis Y Axis Z Axis 4

Word	Function
D592	Nominal position for oriented spindle stop
D596	Max. feed rate from PLC
D604	Max. spindle speed from the PLC
D756	Preset speed from the PLC; programmed speed
W764	% factor for spindle override (PLC → NC)
W766	% factor for feed-rate override (PLC → NC)
D768 to D956	Input values from MP4210.0 to MP4210.47
W960 to W968	Input values from MP4220.0 to MP4220.4
W976 to W988	Input values from MP4310.0 to MP4310.6
W1008	S code for minimum speed
W1010	Rotational speed increment for S code
W1022	Error status of the last called module
W1024	Axis releases, bit-coded (5/4/Z/Y/X)
W1026	Axes in position, bit-coded (5/4/Z/Y/X)
W1028	Axes in motion, bit-coded (5/4/Z/Y/X)
W1030	Traverse direction, bit-coded (5/4/Z/Y/X) 0 = positive; 1 = negative
W1032	Reference marks not yet traversed, bit-coded (4/Z/Y/X)
W1034	Positive software limit switch was traversed, bit-coded (4/Z/Y/X)
W1036	Negative software limit switch was traversed, bit-coded (4/Z/Y/X)
W1038	Preparing to open the position control loop, bit-coded (4/Z/Y/X)
W1040	Opening the control loop, bit-coded (4/Z/Y/X)
W1042	No monitoring, bit-coded (4/Z/Y/X)
W1044	Actual position capture, bit-coded (4/Z/Y/X)
W1046	Manual traversing with + direction button, bit-coded (4/Z/Y/X)
W1048	Manual traversing with – direction button, bit-coded (4/Z/Y/X)
W1050	Incremental jog positioning +, bit-coded (4/Z/Y/X)
W1052	Incremental jog positioning –, bit-coded (4/Z/Y/X)
W1054	Reference end position, bit-coded (4/Z/Y/X)
W1056	Lubrication pulse. Value from MP4060.x exceeded, bit-coded (4/Z/Y/X)
W1058	Reset the accumulated distance for lubrication, bit-coded (4/Z/Y/X)
W1060	Axis-specific feed rate enable (4/Z/Y/X)
W1062	Axis-specific inhibiting of handwheel pulses

6 List of Modules

Module	Function
9000	Copy marker block
9001	Copy word block
9002	Read inputs of a PL
9003	Read analog input of a PL
9004	Read edges of PLC inputs
9005	Update outputs of a PL 410
9010	Read indexed byte
9011	Read indexed word
9012	Read indexed double word
9019	Interrogate no. bytes in processing stack
9020	Write indexed byte
9021	Write indexed word
9022	Write indexed double word
9031	Write machine parameter
9032	Read machine parameters from MP list
9033	Select a machine parameter file
9034	Load an incomplete machine parameter file
9035	Read status information
9036	Write status information
9040	Read coordinate values (format 1/1000 mm)
9042	Read spindle coordinates
9050	Number conversion binary ASCII
9051	Number conversion binary-ASCII formatted
9052	Number conversion ASCII-binary
9053	Conversion binary-ASCII/hexadecimal
9054	Conversion ASCII/Hexadecimal-binary
9070	Copy a number from a string
9071	Determine string length
9080	Delete PLC window
9081	Interrogate status of PLC window
9082	Display string
9083	Display bar chart
9085	Display PLC error message
9086	Delete PLC error message
9087	Interrogate status of PLC error message

Module	Function
9093	Read from .T/.D/.TCH tables
9094	Write in .T/.D/.TCH tables
9100	Assign RS-232-C interface
9101	Release RS-232-C interface
9102	Read interface status
9103	Send string via RS-232-C
9104	Receive string from RS-232-C
9105	Transmit binary data via RS-232-C
9106	Receive binary data from RS-232-C
9107	Read binary data from reception buffer
9120	Start a PLC axis
9121	Stop a PLC axis
9122	Interrogate status of PLC axis
9123	Traverse the reference point of a PLC axis
9124	Set override value for PLC axis
9145	Actual and nominal value transfer in every operating mode
9155	Open axis position control loop
9156	Close axis position control loop
9171	Oriented spindle stop
9180	Key simulation
9181	Disable individual NC keys
9182	Re-enable NC keys
9183	Disable groups of NC keys
9184	Re-enable groups of NC keys
9186	Execute soft-key function
9187	Interrogate the status of the soft-key function
9200	Create/delete PLC soft-key row
9201	Create/delete PLC soft key
9220	Cross over reference points
9221	Start PLC positioning
9222	Interrogate status of PLC positioning