Start-Up 01/2002 Edition

sinumerik

SINUMERIK 802S

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SINUMERIK 802S

Start–Up

Valid for

Control	*Software Version*
SINUMERIK 802S	as from 3

01.2002 Edition

SINUMERIK® Documentation

Printing history

Brief details of this edition and previous editions are listed below.

IThe status of each edition is shown by the code in the "Remarks"column.

Status code in the "Remarks" column:

A . . . . . New documentation.
B . . . . . Unrevised reprint with new Order No.
C . . . . . Revised edition with new status.
If actual changes have been made on the page since the last edition, this is indicated by a new edition coding in the header on the page.

Edition	Order–No.	Remark
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01.02	6FC5597-2AA00-0BP2	**C**

This Manual is included on the documentation on CD-ROM **(DOCONCD)**

Edition	Order–No.	Remark
11.02	6FC5298-6CA00-0BP3	**C**

This publication was produced with Interleaf V 7

Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

We have checked that the contents of this document correspond to the hardware and software described. Nonetheless, differences might exist and therefore we cannot guarantee that they are completely identical. The information contained in this document is, however, reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

Subject to change without prior notice.

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Safety notices

This Manual contains notices intended to ensure your personal safety and to avoid material damage. The notices are highlighted by a warning triangle and, depending on the degree of hazard, represented as shown below:

Danger

indicates that loss of life, severe personal injury or substantial material damage **will** result if the appropriate precautions are not taken.

Warning

indicates that loss of life, severe personal injury or substantial material damage **may** result if the appropriate precautions are not taken.

Caution

indicates that minor personal injury or material damage may result if the appropriate precautions are not taken.

Caution

without a warning triangle means that a material damage **can** occur if the appropriate precautions are not taken.

Attention

means that an undesirede event or status **can** occur if the appropriate note is not observed.

Note

is used to draw your special attention to an important information on the product, the handling of the product or the corresponding part of the documentation.

Qualified personnel

Start–up and operation of a device may only be carried out by **qualified personnel**. Qualified personnel as referred to in the safety notices provided in this Manual are persons who are authorized to start up, ground and tag devices, systems and circuits according to the relevant safety standards.

Usage as per intended purpose

Please observe the following:

Warning

The device may only be used for the cases of application, as intended by the Catalog, and only in conjunction with third–party devices and components recommended or approved by Siemens.

The proper and safe operation of the product requires transport, storage and installation according to the relevant instructions and qualified operation and maintenance at the prescribed intervals.

Table of Contents

notice

SINUMERIK 802S Control System

1

1.1 Components of the SINUMERIK 802S

What is SINUMERIK?

The SINUMERIK 802S is a microprocessor–controlled numerical control system for simple machine tools with stepper motor drives (”S” = stepper).

Hardware components

It consists of the following hardware components:

- ENC: Control component for a maximum of 3 stepper motor axes and an analog interface for a main spindle drive (ENC = Economical Numerical Control)
- OP020: NC operator panel with graphics display and keyboard
- MCP: machine control panel
- DI/O16: 16 binary inputs/outputs each extendable to max. 64 by using 4 modules

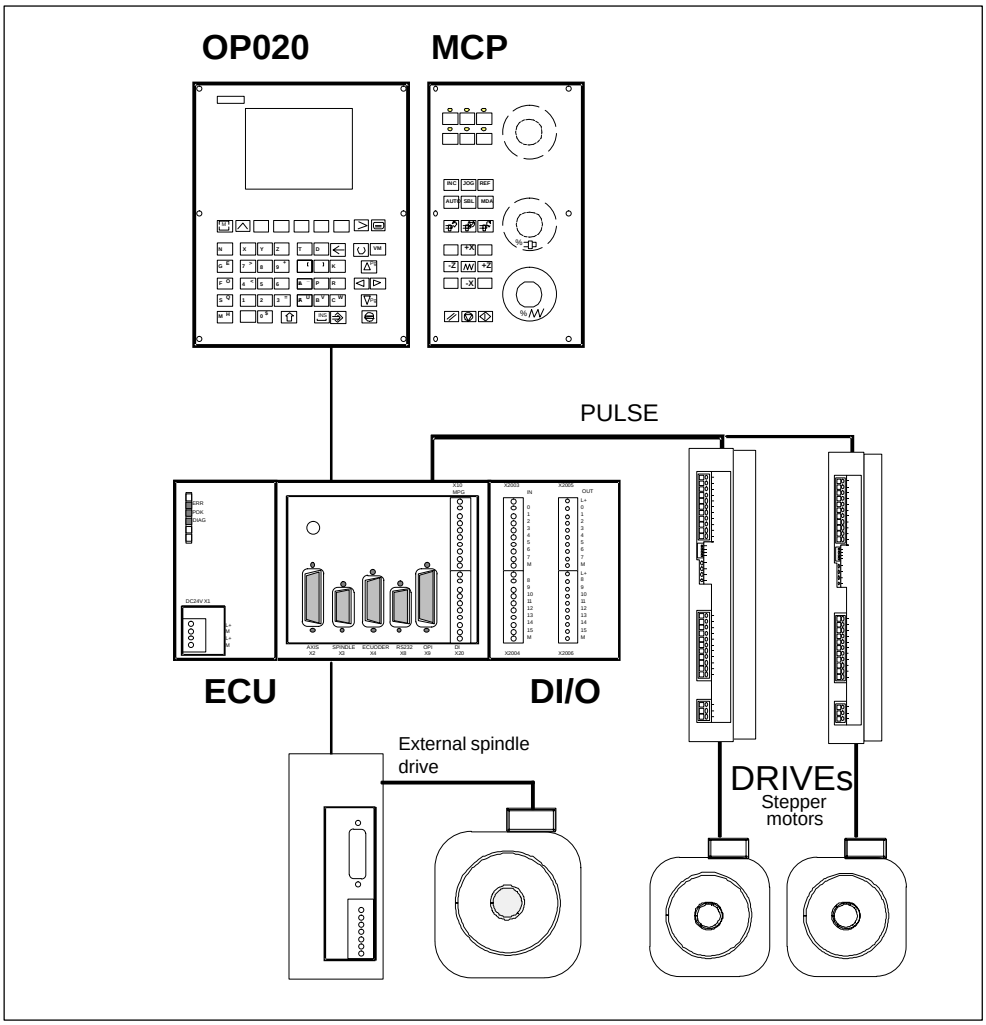


Fig. 1-1 SINUMERIK 802S hardware components (turning variant)

Software components

The SINUMERIK 802S comprises the following software components, which can be ordered:

- System software on the permanent FLASH memory of the ENC
  - Boot software,
    loads the remaining system software from the permanent memory into the user memory (DRAM) and starts the system.
  - MMC software (Man Machine Communication),
    implements all operating functions
  - NCK software (NC Kernel)
    implements all NC functions. This software controls an NC channel with a maximum of 3 movement axes and a spindle.
  - PLC software (Programmable Logic Control),
    executes the Integrated PLC user program cyclically.
  - Integrated PLC user program
    intended to adjust the SINUMERIK 802S to the machine functions (see also Description of Functions “Integrated User Program for SINUMERIK 802S”).
- Toolbox
  - WinPCIN transfer program for a PC/PG (programming device) to transfer user data and programs
  - Text manager
  - Cycle kit for loading into the control system using WinPCIN
  - User program library
  - Technological machine data files
  - Programming tool
- Update diskettes
  - Update program with operator prompting system
  - 802S system software, packed, for loading and programming the SINUMERIK 802S via an update program.

User data

User data are:

- Machine data
- Setting data
- Tool data
- R parameters
- Zero offsets
- Compensation data
- Part programs
- Standard cycles

Data saving Modified user data are saved for at least 50 h after power off or power failure. After then, they might get lost.

Warning

To avoid data loss, the operator must carry out data saving (see Section 4.1.4).

1.2 Technical data

Connected load

Table 1-1 Connected load

Parameter	Min.	Typ.	Max.	Unit	
Supply voltage	20.4		28.8	V	
Ripple			3.6	Vss	
Current consumption from 24 V		1		A	*
Power dissipation of ENC		15		W	
Power dissipation of OP020		7		W	
Power dissipation of MCP		-			
Power dissipation of DI/O16		7		W	**
Start–up current			2.6	A	

* Basic configuration of ENC, OP020, MCP and DI/O16, all outputs open, current consumption for any further DI/O16 connected will increase by 0.05 A each.

** at nominal load

Weight

Table 1-2 Weight

Component	Weight [g]
ENC component	900 g
DI/O16 component	350 g
OP020 component	1,800 g
MCP component	1,200 g

Dimensions

Table 1-3 Component dimensions

Component	Dimensions HxWxD [mm]
ENC component	125 x 200 x 118
DI/O component	125 x 80 x 118
OP020 component	300 x 250 x 50
MCP component	300 x 170 x 50

Environmental operating conditions

Table 1-4 Environmental operating conditions

Parameter	
Temperature range	0...55 °C
Permissible relative humidity	5...95 % without condensation
Air pressure	700...1,060 hPa

The operating conditions comply with IEC 1131-2.
Installation in a housing (e.g. cubicle) is absolutely necessary for operation.

Transport and storage conditions

Table 1-5 Transport and storage conditions

Parameter	
Temperature range	Transport: -40...70 °C Storage: –20 ... 55 °C
Permissible relative air humidity	5...95 % without condensation
Air pressure	700...1,060 hPa
Transport height	-1,000...3,000 m
Free fall in transport package	≤ 1,200 mm

Protective quality and degree of protection

Class of protection I to IEC 536.

No PE terminal required.

Foreign matter and water protection to IEC 529.

- for ENC and DI/O16: IP 20
- for OP020 and MCP: IP 54 front
  IP 00 rear

Installing the Control System

2

2.1 Installing and removing the SINUMERIK 802S

Warning

Before performing any installation work, always first make sure that the system is disconnected from the mains!

The modules contain electrostatically sensitive devices.
It must be ensured that persons without ESD protection never touch printed circuit boards or components when handling operator and machine control panels.

Approach

Prior to installation, the machine control panel can be provided with a spindle override switch and an emergency stop button. If these are not required, the openings must be covered with the supplied self–adhesive covers.

1. Mount the spindle override switch.
2. Install the operator panel and the machine control panel.
3. Connect the panel using ribbon cable.
4. Install the DIN rail.
5. Connect the ENC and DI/O components.

Note

If you want to connect several DI/O16 components, it may be necessary to remove the right–hand connector from the housing.

6. Slide the components onto the DIN rail, tilt it down and screw it tight.

Removing the control system

The control components are removed as described above in the reverse order.

Warning

Before removing the control components, always first make sure that the system is disconnected from the mains!

Mounting dimensions

The dimensions shown below are important for installing the control components:

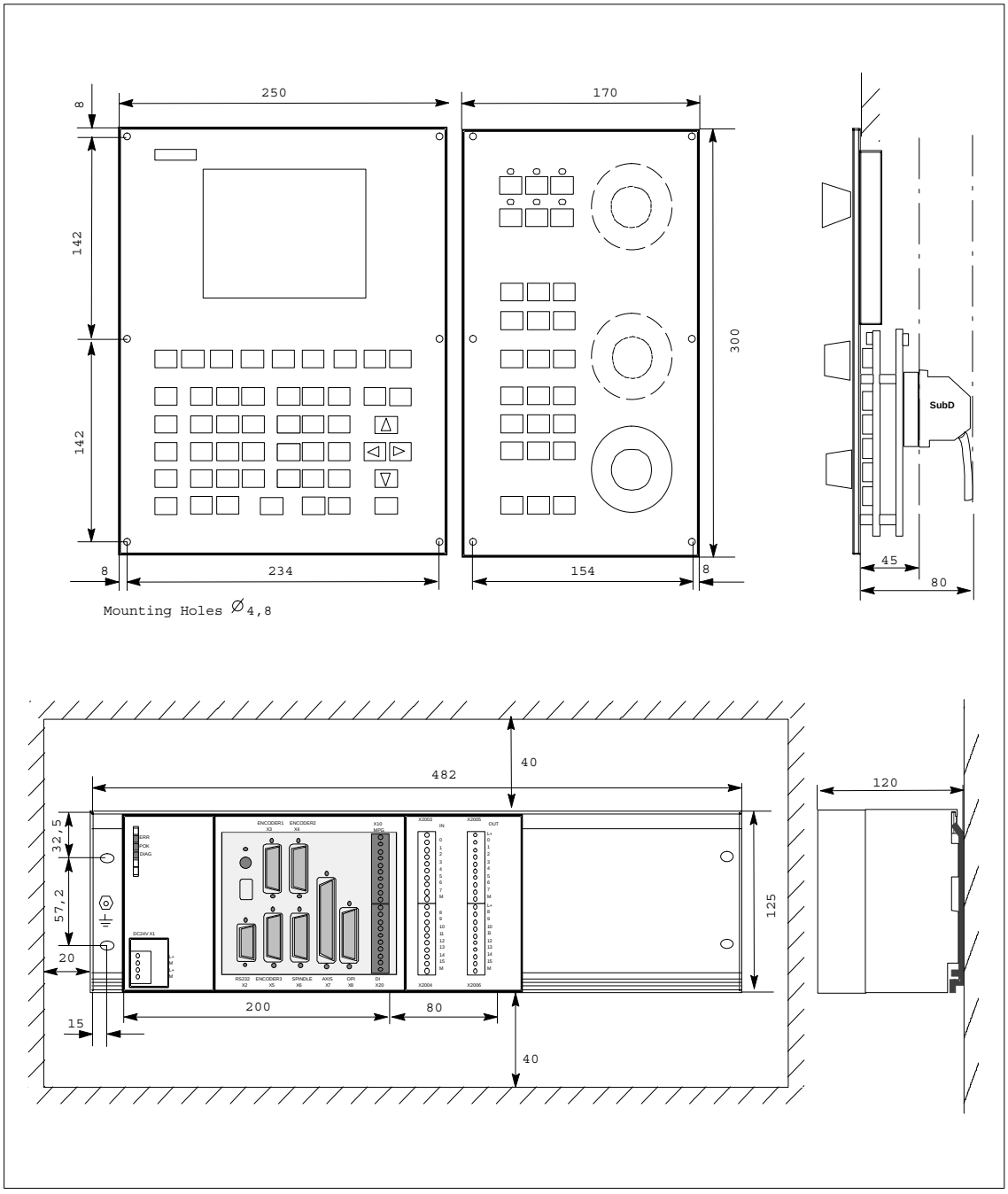


Fig. 2-1 Mounting dimensions for SINUMERIK 802S

2.2 Interfaces and cables

Position of the interfaces and front panel elements

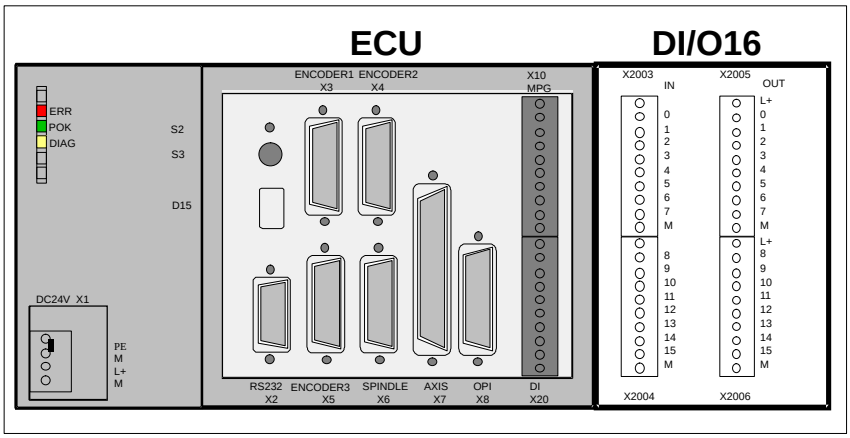


Fig. 2-2 User interfaces

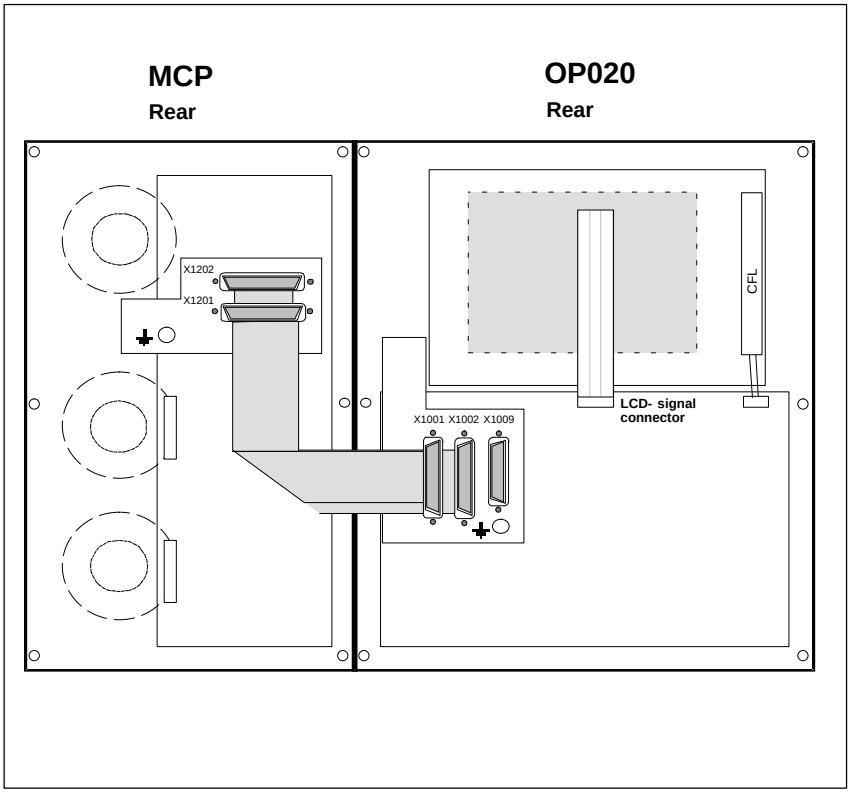


Fig. 2-3 Rear of machine control panel and operator panel

Interfaces

- **X1 power supply terminals (DC24V)**

  4–pin screw–terminal block for connecting the 24 V load power supply

- **X2 RS232 interface (AXIS)**

  25–pin sub–D plug connector for connecting ther power sections for max. 4 stepper motor drives

- **X3 spindle interface (SPINDLE)**

  9–pin D–Sub connector fr connecting a spindle drive with analog interface

- **X4 measuring system interfaces (ENCD)**

  15–pin D–Sub female connector for connecting a position encoder (incremental, RS422)

- **X8 RS232 drive interface (V24)**

  9–pin D–Sub connector

- **X9 operator terminal interface (OPI)**

  25–pin D–Sub female connector for connecting the operator terminal

- **X10 handwheel interface (MPG)**

  10–pin front connector for connecting the handwheels

- **X20 BEROs (DI)**

  10–pin front connector for connecting fast inputs including BEROs and for wiring the NC READY relay

DI/O

- **X2003 and X2004**

  10–pin front connector for connecting digital inputs

- **X2005 and X2006**

  10–pin front connector for connecting digital outputs

LEDs

3 LEDs for fault and status displays

Operating elements

Start–up switch **S1**

Connecting cables

The components are wired up as shown in the Connection Diagram 2-4. For the cables required, please refer to the diagram below.

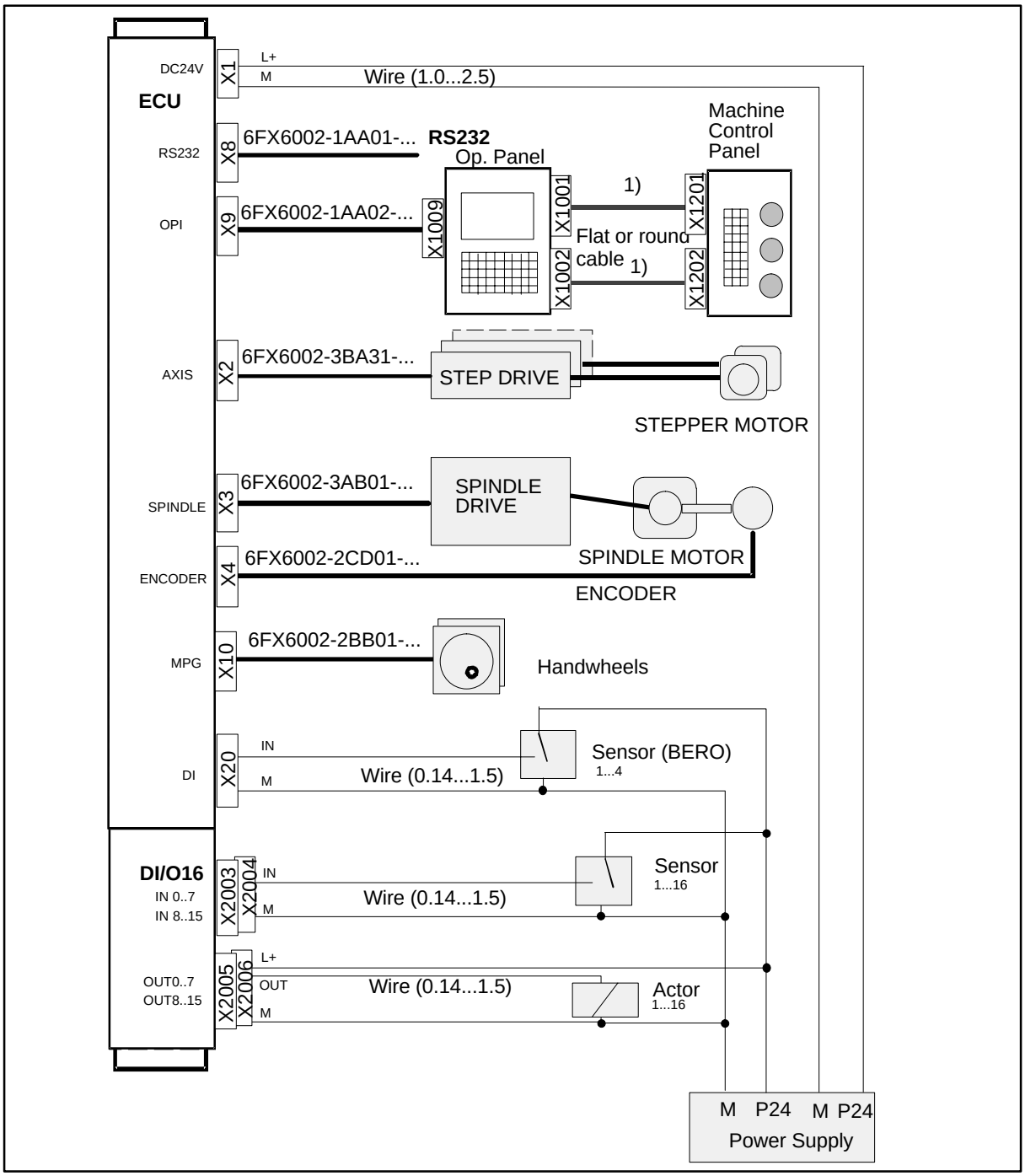


Fig. 2-4 SINUMERIK 802S Connection Diagram

1) Ribbon cable (included in scope of supply)

2.3 Connecting the individual components

Connecting the components

Note

Use only shielded cable and make sure that the shield is connected to the metal or metal plated connector casing on the control side. For the purpose of isolating the analog setpoint signal from low–frequency interference, we recommend not to ground the shield on the drive side.

The preassembled cable offered as accessories provides optimum protection against interference.

General procedure:

Proceed as follows to connect the individual components:

1. Connect the cables to the components as shown in Fig. 2-4.
2. Fix the sub–D connector in place using the knurled screws.

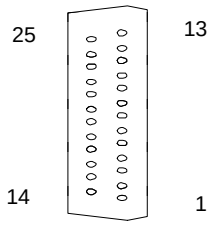
2.3.1 Connecting the operator panel

Connector pin assignment on the ENC side

Operator panel interface

Connector designation:	**X8** OP020
Connector type:	25–pin sub–D plug connector

Table 2-1 Pin assignment of connector X9

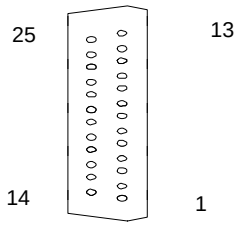
X8						
Pin	Signal	Type	Pin	Signal	Type	
1			14	P24_OP	VO	
2	M_OP	VO	15	OPD0_N	O	
3	OPD0	O	16	OPD1_N	O	
4	OPD1	O	17	OPD2_N	O	
5	OPD2	O	18	OPD3_N	O	
6	OPD3	O	19	OPCP1_N	O	
7	OPCP1	O	20	OPCP2_N	O	
8	OPCP2	O	21	OPS_N	O	
9	OPS	O	22	ENRXD_N	I	
10	ENRXD	I	23	ENTXD_N	O	
11	ENTXD	O	24	ENRTS_N	O	
12	ENRTS	O	25	P24_OP	VO	
13	M_OP	VO				

Connector pin assignment on the OP side

Operator panel interface

Connector designation: **X1009**
OP020
Connector type: 25–pin sub–D plug connector

Table 2-2 Pin assignment of connector X1009

X1009						
Pin	Signal	Type	Pin	Signal	Type	
1			14	P24_OP	VI	
2	M_OP	VI	15	OPD0_N	I	
3	OPD0	I	16	OPD1_N	I	
4	OPD1	I	17	OPD2_N	I	
5	OPD2	I	18	OPD3_N	I	
6	OPD3	I	19	OPCP1_N	I	
7	OPCP1	I	20	OPCP2_N	I	
8	OPCP2	I	21	OPS_N	I	
9	OPS	I	22	OPTXD_N	O	
10	OPTXD	O	23	OPRXD_N	I	
11	OPRXD	I	24	OPCTS_N	I	
12	OPCTS	I	25	P24_OP	VI	
13	M_OP	VI				

Signal names

OPD[0...3]	LCD Data 0...3
OPCP1	LCD Latch
OPS	LCD Frame
OPCP2	LCD Clock
OPRXD	OP Receive Data
OPTXD	OP Transmit Data
OPCTS	OP Clear to Send
ENRXD	ECU Receive Data
ENTXD	ECU Transmit Data
ENRTS	ECU Request to Send
P24_OP	DC24V
M_OP	Ground

Signal level

RS422 / LVDS

Signal type

VO	Voltage output
VI	Voltage input
O	Output
I	Input

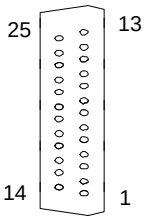
2.3.2 Connecting the feed drives

Connector pin assignment on the ENC side

Feed drive interface

Connector designation: **X2**
AXIS 1-4
Connector type: 50–pin sub–D plug connector

Table 2-3 Pin assignment of connector X1009

X1009						
Pin	Signal	Type	Pin	Signal	Type	
1			14	P24_OP	VI	
2	M_OP	VI	15	OPD0_N	I	
3	OPD0	I	16	OPD1_N	I	
4	OPD1	I	17	OPD2_N	I	
5	OPD2	I	18	OPD3_N	I	
6	OPD3	I	19	OPCP1_N	I	
7	OPCP1	I	20	OPCP2_N	I	
8	OPCP2	I	21	OPS_N	I	
9	OPS	I	22	OPTXD_N	O	
10	OPTXD	O	23	OPRXD_N	I	
11	OPRXD	I	24	OPCTS_N	I	
12	OPCTS	I	25	P24_OP	VI	
13	M_OP	VI				

Signal names

PULS[1...4], PULS[1...4]_N	Clock pulse, true and negated
DIR[1...4], DIR[1...4]_N	Direction signal, true and negated
EN[1...4], EN[1...4]_N	Servo enable, true and negated
M	Ground

Signal level

RS422

Signal type

O	Signal output

Axis assignment

1	X axis
2	Y axis
3	Z axis
4	(reserved)

Signals

One clock, direction and enable signal each is output per axis both as a true and a negated signal.

- **PULS (CLOCK)**

  The clock pulses control the motor. With each rising pulse edge, the motor carries out a single step.

  Thus, the angle of rotation, i.e. the distance to be traversed, is determined by the number of output pulses.

  The rotational speed, i.e. the traversing speed, is determined by the pulse frequency.

- **DIR (DIRECTION)**

  The direction of rotation of the motor is determined by the signal level.

  Signal ON: ”CCW rotation”
  Signal OFF: ”CW rotation”

- **EN (ENABLE)**

  This signal is activated by the control system when the cyclic control mode is initiated.

  Signal ON: Secondary power control enabled
  Signal OFF: Motor dead
  No readiness

Signal parameters

All signals for stepper drives are output to the RS422 standard via differential signal cable drivers.

All outputs are eletcronically protected against short–circuit and thermal overload.

Table 2-4 Electrical parameters of the signal outputs for stepper drives

Parameter		Min.	Max.	Unit	at
Differential output voltage	V_{OD}	2		V	R_L = 100 Ω
Output voltage ”high”	V_{OH}	3.7		V	I_O = -20 mA
		4.5		V	I_O = -100 µA
Output voltage ”low”	V_{OL}		1	V	I_O = 20 mA
Load resistance	R_L	55		Ω	
Output current	I_O		±60	mA	
Pulse frequency	f_P		250	kHz	

Cable length: max. 50 m
(with asymmetric transfer 10 m)

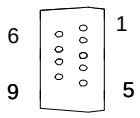
2.3.3 Connecting the spindle drive (X3)

Pin assignment of the connector on the ENC side

Spindle drive interface

Connector designation: **X3**
SPINDLE
Connector type: 9–pin D-Sub plug connector

Table 2-5 Belegung des Steckers X3

X3						
Pin	Signal	Type	Pin	Signal	Type	
1	SW	VO	6	BS	VO	
2			7			
3			8			
4			9	RF.1	K	
5	RF.2	K				

for analog drives:

SW Setpoint
BS Reference potential for setpoint (analog ground)
RF.1, RF.2 Servo enable contact

Signal type

VO Voltage output
K Switching contact

Drives with analog interface

Signals:

One voltage and one enable signal is provided.

- **SW (SETPOINT)**

  Analog voltage signal in the range of ± 10 V to output a speed setpoint

- **BS (REFERENCE SIGNAL)**

  Reference potential (analog ground) for the setpoint signal, internally connected to the logics ground

- **RF (SERVO ENABLE)**

  Relay contact pair used to switch the enable signal for the power section, e.g. a SIMODRIVE unit. This signal is used by the ENC when the cyclic control mode is started.

Signal parameters

The setpoint is output as an analog differential signal.

Table 2-6 Electrical parameters of the spindle setpoint signal

Parameter	Min.	Max.	Unit
Voltage range	-10.5	10.5	V
Output current	-3	3	mA

Relay contact

Table 2-7 Electrical parameters of the relay contacts

Parameter	Max.	Unit
Switching voltage	50	V
Switching current	1	A
Switching power	30	VA

Cable length: max. 35 m

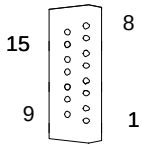
2.3.4 Connecting the spindle measuring system (X4)

Pin assignment of the connector on the ENC side

Measuring system interface (incremental encoder)

Connector designation: **X4**
ENCD
Connector type: 15–pin D-Sub female connector

Table 2-8 Pin assignment of the X4 female connector

X4						
Pin	Signal	Type	Pin	Signal	Type	
1			9	M	VO	
2			10	N	I	
3			11	N_N	I	
4	P5_MS	VO	12	B_N	I	
5		VO	13	B	I	
6	P5_MS	VO	14	A_N	I	
7	M	VO	15	A	I	
8						

Signal names

A, A_N	Track A (true and negated)
B, B_N	Track B (true and negated)
N, N_N	Zero mark (true and negated)
P5_MS	+5.2 V supply
M	Supply ground

Signal level

RS422

Signal type

VO	Voltage output (supply)
I	5V input (5V signal)

Encoder types which can be connected

Incremental 5 V encoders can be connected directly.

Characteristics

The encoders must meet the following requirements:

Transmission method:	Differential transmission with 5 V square–wave signals
Output signals:	Track A as true and negated signal (U_{a1}, $\overline{U_{a1}}$) Track B as true and negated signal (U_{a2}, $\overline{U_{a2}}$) Zero signal N as true and negated signal (U_{a0}, $\overline{U_{a0}}$)
Max. output frequency:	1.5 MHz
Phase offset between tracks A and B:	90° ± 30°
Current consumption:	max. 300 mA

Cable lengths

The maximum cable length depends on the specification of the encoder supply and on the transmission frequency. When using preassembled cables from SIEMENS, the following values may not be exceeded to ensure interference–free operation:

Table 2-9 Maximum cable length with respect to the encoder supply

Supply Voltage	Tolerance	Current Consumption	Max. Cable Length
5 V DC	4.75 V...5.25 V	≤ 300 mA	25 m
5 V DC	4.75 V...5.25 V	≤ 220 mA	35 m

Table 2-10 Maximum cable lengths with respect to the transmission frequency

Encoder Type	Frequency	Max. Cable Length
Incremental	1 MHz	10 m
	500 kHz	35 m

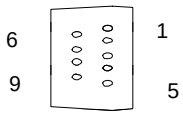
2.3.5 Configuration of the RS232 interface connection (X8)

Pin assignment of the connector on the ENC side

RS232 interface

Connector designation: **X8**
RS232
Connector type: 9–pin sub–D plug connector

Table 2-11 Pin assignment of connector X8

X8						
Pin	Name	Type	Pin	Name	Type	
1			6	DSR	I	
2	RxD	I	7	RTS	O	
3	TxD	O	8	CTS	I	
4	DTR	O	9			
5	M	VO				

Signal description:

RxD	Receive data
TxD	Send data
RTS	Request to send
CTS	Send enable
DTR	Standby output
DSR	Standby input
M	Ground

Signal level

RS232 (± 12 V)

Signal type

I	Input
O	Output
VO	Voltage output

Cable for WinPCIN

Table 2-12 Cable for WinPCIN: Pin assignment of the Sub–D connector

9–Pin	Name	25–Pin
1	Shield	1
2	RxD	2
3	TxD	3
4	DTR	6
5	M	7
6	DSR	20
7	RTS	5

Table 2-12 Cable for WinPCIN: Pin assignment of the Sub–D connector

8	CTS	4
9		

2.3.6 Connecting handwheels (X10)

Pin assignment of the connector on the ENC side

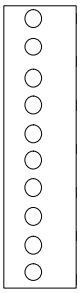
Handwheel interface

Connector designation: **X10**
MPG

Connector type: 10–pin mini-Combicon plug connector

Table 2-13 Pin assignment of connector X10

X10		
Pin	Name	Type
1	A1	I
2	A1_N	I
3	B1	I
4	B1_N	I
5	P5_MS	VO
6	M5_MS	VO
7	A2	I
8	A2_N	I
9	B2	I
10	B2_N	I



Signal names

A1, A1_N	Track A, true and negated (handwheel 1)
B1, B1_N	Track B, true and negated (handwheel 1)
A2, A2_N	Track A, true and negated (handwheel 2)
B2, B2_N	Track B, true and negated (handwheel 2)
P5_MS	5.2 V supply voltage for handwheels
M	Supply ground

Signal level

RS422

Signal type

VO	Voltage output
I	Input (5 V signal)

Handwheels

Two electronic handwheels can be connected which must meet the following requirements:

Transmission method:	5 V square–wave (TTL level or RS422)
Signals:	Track A as true and negated signal (U_{a1}, $\overline{U_{a1}}$) Track B as true and negated signal (U_{a2}, $\overline{U_{a2}}$)
Max. output frequency:	500 kHz
Phase offset between tracks A and B:	90° ± 30°
Supply:	5 V, max. 250 mA

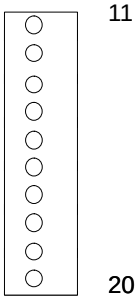
2.3.7 Connecting NCREADY (X20)

Pin assignment of the connector on the ENC side

BERO input interface

Connector designation:	**X20** **DI**
Connector type:	10–pin plug connector

Table 2-14 Pin assignment of connector X20

X20			
Pin	Name	Type	
11	NCRDY_1	K	
12	NCRDY_2	K	
13	reserved	DI	
14	reserved	DI	
15	reserved	DI	
16	reserved	DI	
17	reserved	DI	
18	reserved	DI	
19	reserved	VI	
20	reserved	VI	

Signal names

NCRDY_1...2	NC Ready (NCREADY contacts 1...2)
BERO1...BERO4	BERO input for axes 1 ... 4

L–	Reference potential for digital inputs

Signal type

VI	Voltage input
DI	Input (24 V signal)
K	Switching contact

4 BERO inputs

These inputs are 24 V-P switching. Either switches or non–contact sensors, such as inductive sensors (BEROs), can be connected.

When using the BERO as a reference point switch, the following fixed assignment will apply:
BERO1 - X axis
BERO3 - Z axis

Table 2-15 Electrical parameters of the digital inputs

Parameter	Value	Unit	Remark
“1” signal, voltage range	11...30	V	
“1” signal, current consumption	6...15	mA	
“0” signal, voltage range	-3...5	V	or input open
Signal delay 0 → 1	15	µs	
Signal delay 1 → 0	150	µs	

NC-READY output

Readiness in the form of a relay contact (NO); must be integrated into the EMERGENCY STOP circuit.

Table 2-16 Electrical parameters of the NCREADY relay contact

Parameter	Max.	Unit
DC switching voltage	50	V
Switching current	1	A
Switching power	30	VA

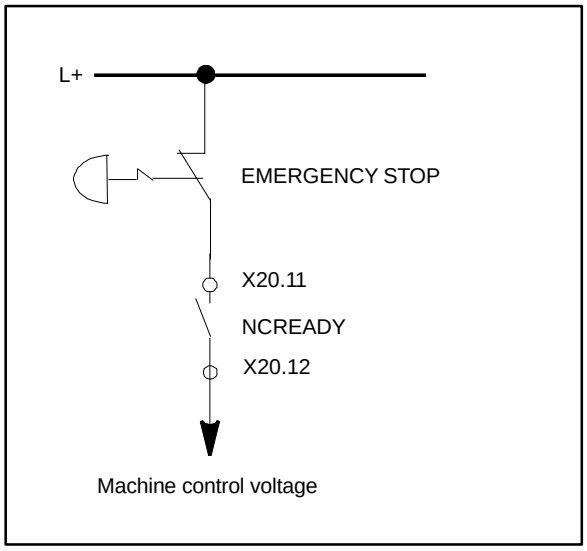


Fig. 2-5

The NCREADY contact will switch off the control voltage in case of danger.

2.3.8 Connecting the digital inputs and outputs (X2003 ... X2006)

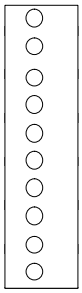
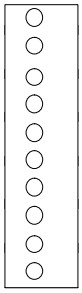
Connector pin assignment

Interface for the digital inputs

Connector designation: **X2003, X2004**
IN

Connector type: 10–pin plug connector

Table 2-17 Connector pin assignment

X2003			
Pin	Name	Type	
1			
2	DI0	I	
3	DI1	I	
4	DI2	I	
5	DI3	I	
6	DI4	I	
7	DI5	I	
8	DI6	I	
9	DI7	I	
10	M24	V	
X2004			
Pin	Name	Type	
1			
2	DI8	I	
3	DI9	I	
4	DI10	I	
5	DI11	I	
6	DI12	I	
7	DI13	I	
8	DI14	I	
9	DI15	I	
10	M24	V	

Signal names

DI0...15 24 V digital inputs

Signal type

V Voltage input
I Input (24 V signal)

Table 2-18 Electrical parameters of the digital inputs

Parameter	Value	Unit	Note
“1” signal, voltage range	15...30	V	
“1” signal, current consumption	2...15	mA	
“0” signal, voltage range	-3...5	V	or input open
Signal delay 0 → 1	0.5...3	ms	
Signal delay 1 → 0	0.5...3	ms	

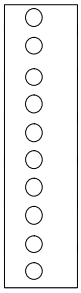
Connector pin assignment

Interface for digital outputs

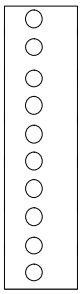
Connector designation: **X2005, X2006**
OUT
Connector type: 10–pin plug connector

Table 2-19 Connector pin assignment

X2005		
Pin	Name	Type
1	1P24	V
2	DO0	O
3	DO1	O
4	DO2	O
5	DO3	O
6	DO4	O
7	DO5	O
8	DO6	O
9	DO7	O
10	1M24	V



X2006		
Pin	Name	Type
1	2P24	V
2	DO8	O
3	DO9	O
4	DO10	O
5	DO11	O
6	DO12	O
7	DO13	O
8	DO14	O
9	DO15	O
10	2M24	V



Signal names

DO0...15 Digital outputs 24V/0.5A

Signal type

V Voltage input
O Output (24 V signal)

Table 2-20 Electrical parameters of the digital outputs

Parameter	Value	Unit	Note
“1” signal, nominal voltage Voltage drop	24 max. 3	V V	
“1” signal, output current	0.5	A	Simultaneity factor 0.5 per 16 outputs
“0” signal, leakage current	max. 2	mA	

Connecting sensors and actuators

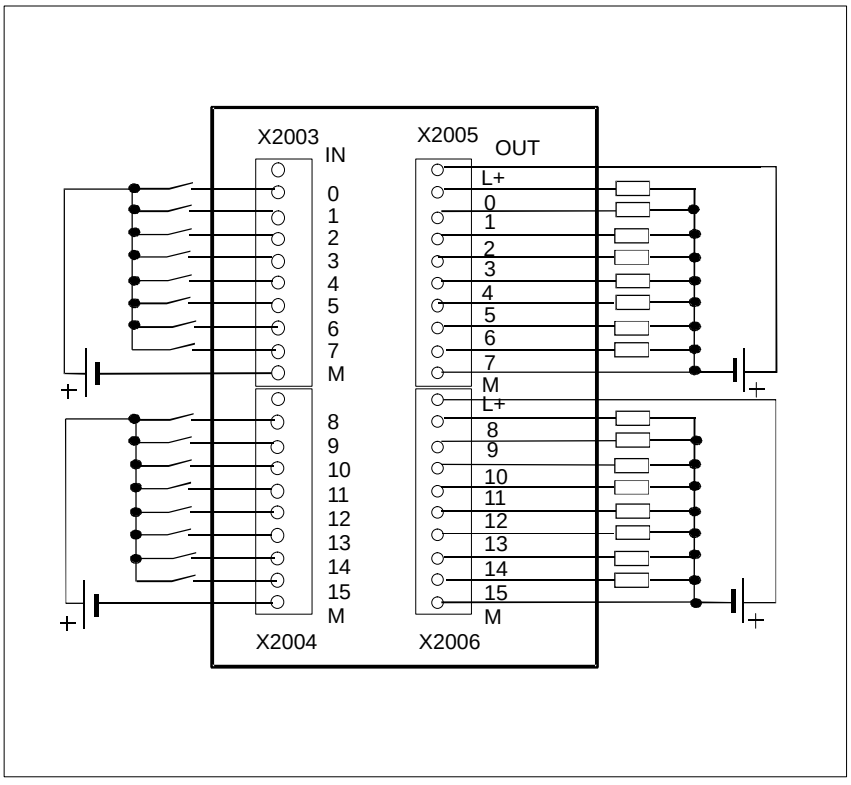


Fig. 2-6 Connecting the digital inputs and outputs

2.4 ENC and operator panel power supply (X1)

Screw–type terminal block

The 24 V DC load power supply unit required for supplying ENC and operator terminal is connected to screw–type terminal block X1.

Characteristics of the load power supply

The 24 V DC voltage must be generated as a functional extra–low voltage with safe electrical isolation (to IEC 204-1, Section 6.4, PELV).

Table 2-21 Electrical parameters of the load power supply

Parameter	Min.	Max.	Units	Conditions
Voltage range mean value	20.4	28.8	V	
Ripple		3.6	Vss	
Non–periodic overvoltage		35	V	500 ms cont. 50 s recovery
Rated current consumption		1	A	
Starting current		2.6	A	

Pin connector assignment on the ENC side

Table 2-22 Pin connector assignment of screw–type terminal block X1

Terminal		
1	PE	PE
2	M	Ground
3	L+	DC 24 V
4	M	Ground

The contacts 2/4 are connected internally in the device.

Operator panel

The operator panel does not possess a separate power supply connection. It is powered from the ENC via the signal cables.

2.5 Grounding

Ground connections

The following ground connections must be implemented:

- Busbar for ENC, DI/O
- OP020 operator panel
- Machine control panel (MCP)

The ground connections for the MCP/OP020 must take into account installation in the machine or a panel.

In the case of cubicle installation, the grounding points must be connected to the grounding bar (see Fig. 2-7).

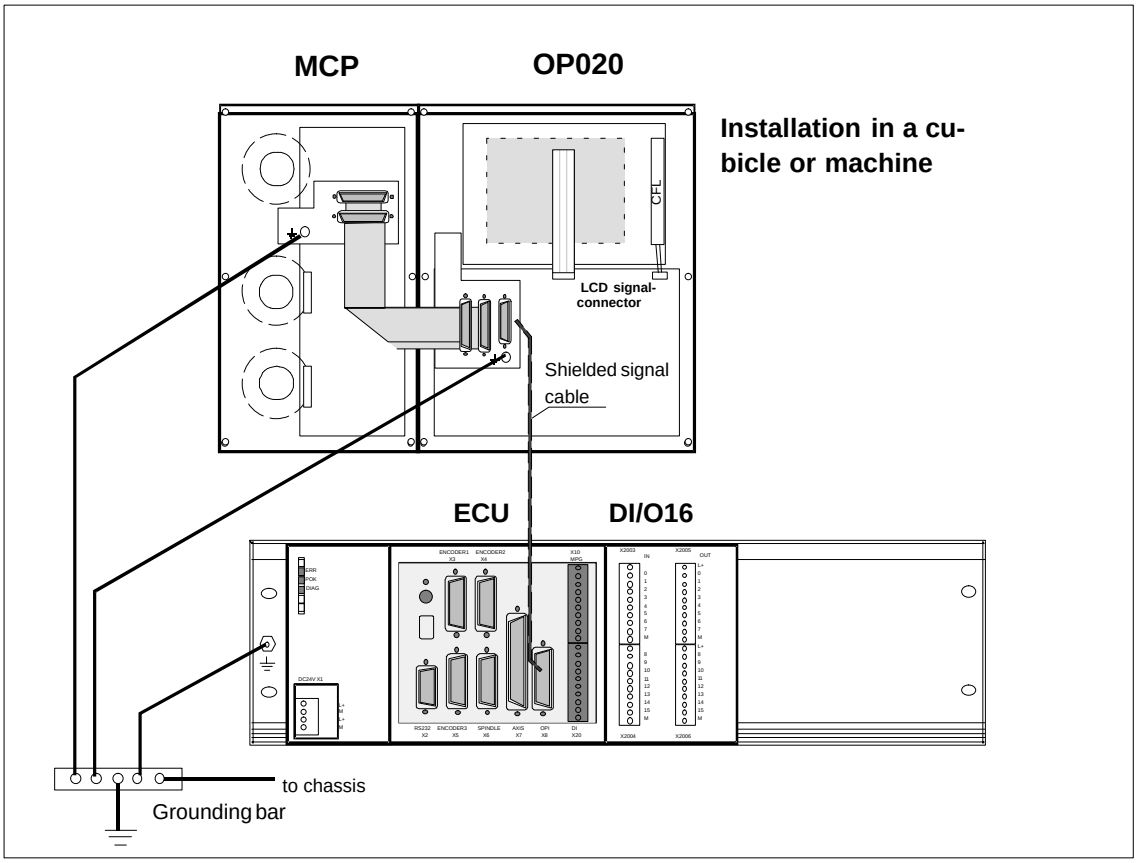


Fig. 2-7 Grounding diagram for MCP/OP020 installation in a cubicle or machine

Panel installation requires that the ground connections on the MCP and OP020 are connected together and to the panel frame. The panel frame is grounded centrally (see Fig. 2-8).

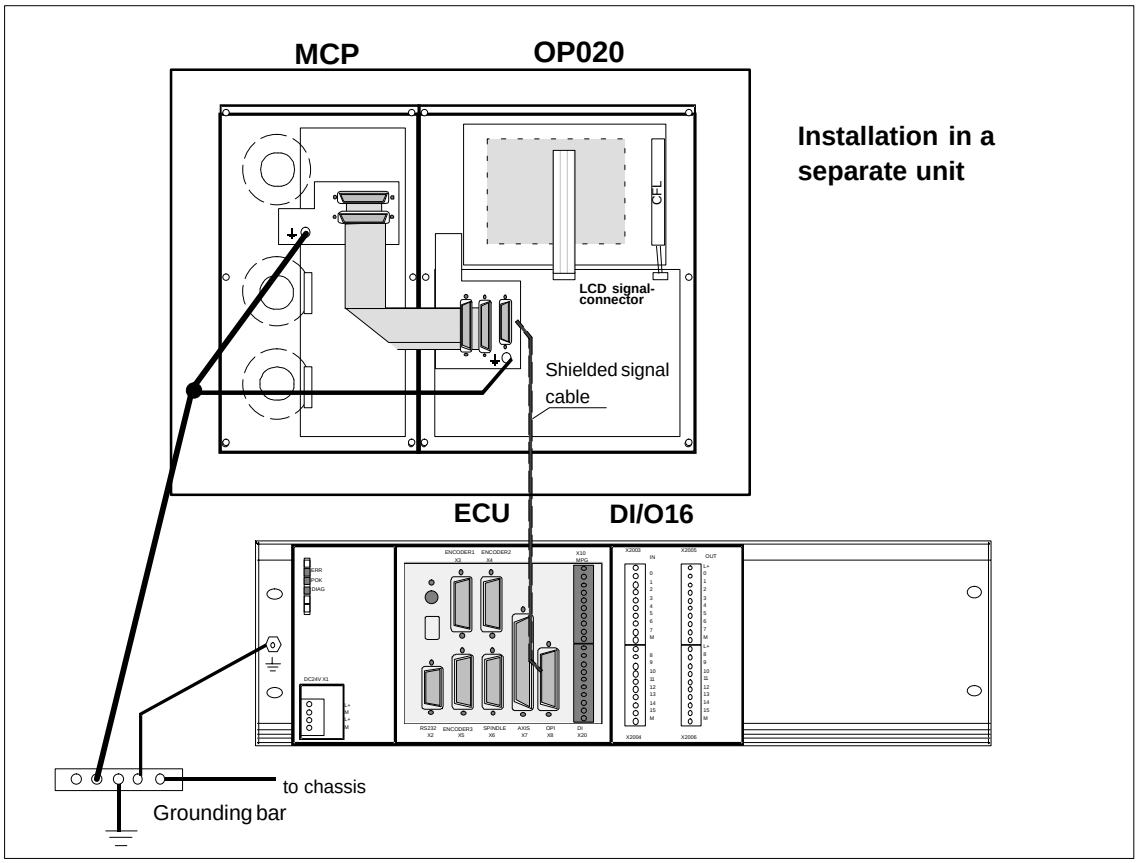


Fig. 2-8 Grounding diagram for MCP/OP020 installation in a panel

2.6 LEDs and operating elements on the ENC unit

Error and status LEDs

There are three LEDs on the front panel of the ENC unit.

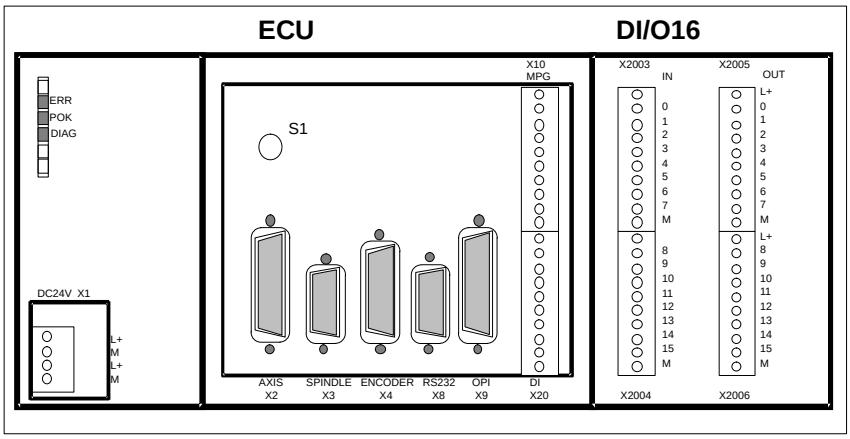


Fig. 2-9 User interfaces

ERR (red)

Group error

This LED indicates an error condition of the ENC.

POK (green)

Power OK

The power supply is ready.

DIAG (yellow)

Diagnostics

This LED indicates various diagnosis states. Under normal operating conditions, this LED flashes 1:1.

Start–up switch (S1)

This rotary switch is intended to assist start–up.

Position 0: Normal operation
Positions 1-4: Start–up

cf. also Section 4.2, Table 4-2

Installing the STEPDRIVE C Drives

3

3.1 Installing and removing the STEPDRIVE C drive modules

Warning

Before installing the STEPDRIVE C drive modules, first always make sure that the equipment is disconnected from the mains.

Installation

To install the drive modules, proceed as follows (see Fig. 3-1):

1. Screw in the upper fastening screws M5 with washer and lock washer.
2. Hang the module into the clips of the upper fastening bracket.
3. Screw in the lower fastening screws and tighten all screws.

Note

The modules should be installed such that a clearance of at least 10 cm is left above, below and between the modules (dimension “a”).

The drive modules, however, can be mounted directly side by side (a> 10 mm) provided they are ventilated with an air stream greater than / equal to 1 m/s.

Do not install devices which are strongly heated during operation beneath the drive modules!

Removal

The drive modules are removed in the reverse order.

Warning

When removing the drive modules, always first make sure that the system is disconnected from the mains!

Mounting dimensions

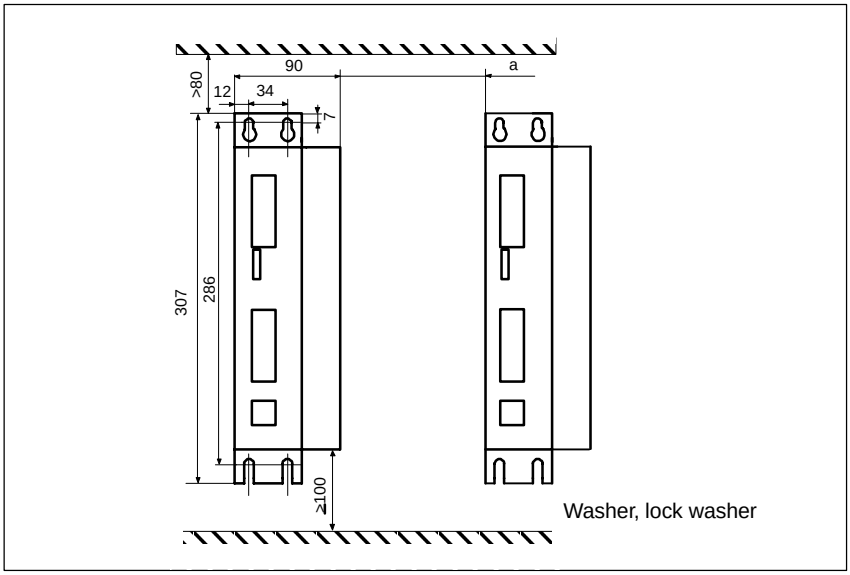


Fig. 3-1 Mounting dimensions

3.2 Cabling

Cable overview

Connect the STEPDRIVE C drive modules, the BYG stepper motors and the SINUMERIK 802S control system as shown in Fig. 3-2:

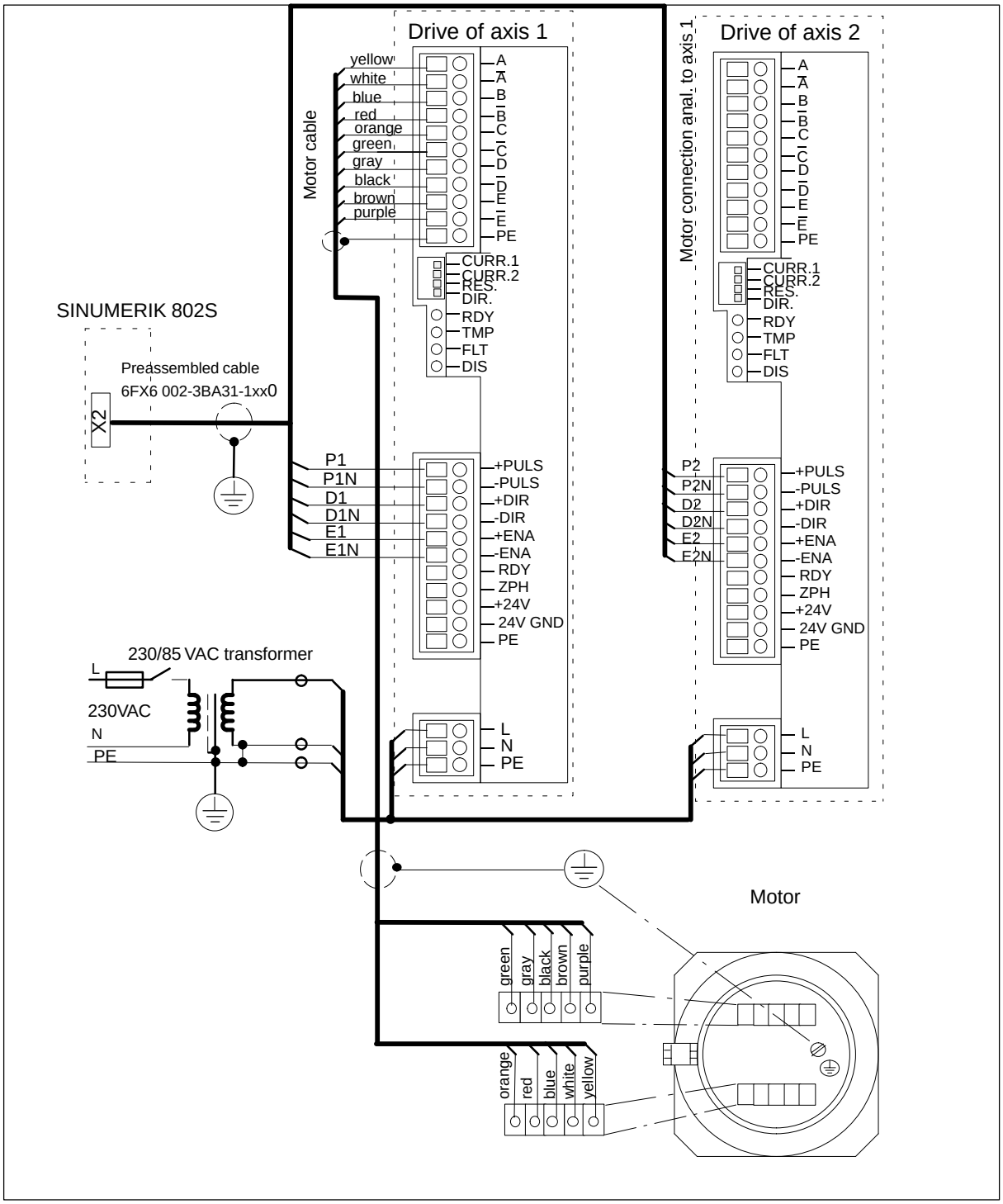


Fig. 3-2 Cable overview

Warning

Prior to performing connection work, always first make sure that the supply voltage is switched off.

With the supply voltage switched off, hazardous voltages are present at the mains and motor connections. Under no circumstances may these connection be touched in the ON condition; otherwise, loss of life or severe personal injury could be the consequence.

Mains connection

- The device must be connected via an external fuse.

  Fuse: K6A for 1 axis

  K10A for max. 2 axes

- If the transformer possesses a shielded winding, this should be connected with low inductivity to PE.
- Ground the transformer on the secondary side.

Connecting the motor–end cables

- To connect the cables, remove the terminal box cover (3 screws).
- Use the cable with the order no. 6FX6 002-5AA51-.....
- On the drive end, connect the cable shield to the housing such that an electrical connection is provided via the appropriate strain relief clamp and clamp the braided shield to PE.
- On the motor side, braid the shield, provided it with a cable shoe and clamp it to the grounding screw.

Pulse interface

- To connect the drive pulse interface to the SINUMERIK 802S, use the preassembled cable, order no.6FX6 002-3BA31-1xx0.
- On the drive side, connect the cable shield to the housing such that an electrical connection is provided via the appropriate strain relief clamp.

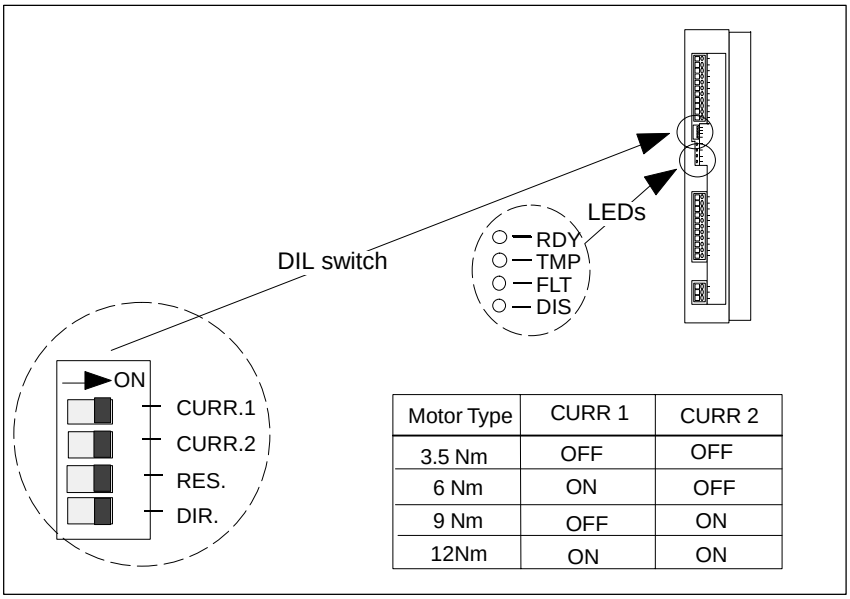
24V signal interface

- To evaluate the 24 V high-side signals “Zero Phase” (ZPM) and/or “Drive ready” (RDY) in the CNC, then connect a 24 V voltage (PELV) to the **+24 V** and **24 V GND** terminals.

3.3 Starting up the drive modules

Prerequisite

- Proper connection of the cables as shown in Fig. 3-2.
- Setting of the current in accordance with the motor type using the DIL switch



Motor Type	CURR 1	CURR 2
3.5 Nm	OFF	OFF
6 Nm	ON	OFF
9 Nm	OFF	ON
12Nm	ON	ON

Fig. 3-3 DIL switch and LEDs

Warning

If the current is set too large for the motor, the motor can be damaged due to overtemperature.

Start–up sequence

1. Connect the mains voltage and – if necessary – also the 24 V supply voltage.
2. Check the **DIS LED**.
3. Activate the ENABLE signal via the control system (power–up the control system).

   The yellow **DIS LED** goes out and the green **RDY LED** is lit. The drive is ready, the motor is powered.

   If the PULSE signal is provided by the control system with pulses, then motor will rotate in the direction of rotation specified by the DIR signal.

Note

The **DIR** switch can be used to adapt the direction of rotation to the mechanics of the machine. Never actuate the switch when the drive is powered!

3.4 Error messages and error elimination

LED			Meaning	Remedy
Name	**Color**			
RDY	green	the only LED that is lit	Drive ready	If the motor does not rotate, it can have the following causes: – No pulses are output by the control system. – Pulse frequency too high (motor is “out of step”) – Motor load too large or sluggish
DIS	yellow	the only LED that is lit	Drive ready; motor not powered	Activate ENABLE signal via CNC
FLT	red	is lit	There is one of the following errors: – Overvoltage or undervoltage – Short–circuit between the motor phases – Short–circuit between motor phase and ground	Measure 85 V operating voltage Check cable connections
TMP	red	is lit	Overtemperature in the drive	Drive defective; replace
all		No LED is lit	No operating voltage	Check cable connections

Start-Up

4

4.1 General

Start-up requirements

- The following is required:
  - User's Guide: "Operation and Programming, SINUMERIK 802S"
  - **PC/PG** (programming device) only for data saving and series start-up
  - **Toolbox** on CD. The CD is either supplied with the control system or can be ordered separately.

    Contents: see also p. 1–11
- The mechanical and electrical installation of the equipment must be completed.

Note

Installation notes are to be found in Chapter LEERER MERKER.

- The control system with its components has powered up without errors.

Start-up sequence

The SINUMERIK 802S can be strated up as follows:

1. Check whether the ENC has powered up.
2. PLC start–up
3. Technology setting
4. Set general machine data.
5. Set axis/machine-specific machine data.
   - Match encoder with spindle
   - Match setpoint with spindle
6. Dry run for axes and spindle(s)
7. Drive optimization
8. Complete start–up, data saving

4.1.1 Access levels

Protection levels

The SINUMERIK 802S provides a protection level concept for enabling data areas. The protection levels range from 0 to 7 whereby **0** is the highest and **7** the lowest level.

The control system comes with default passwords for protection levels 2 and 3. If necessary these passwords can be changed by the appropriate authorized person.

Table 4-1 Protection level concept

Protection Level	Disabled via	Data Area
0		Siemens, reserved
1		Siemens, reserved
2	Password: EVENING (default)	Machine manufacturer
3	Password: CUSTOMER (default)	Authorized operator, setter
4	No password or user IS from PLC → NCK	Authorized operator, setter
5	User IS from PLC → NCK	
6	User IS from PLC → NCK	
7	User IS from PLC → NCK	

Protection levels 2 ... 3

The protection levels 2 and 3 require a password. The passwords can be changed after activation. For example, if the passwords are no longer known, the control system must be reinitialized (booting in Start-Up Switch position 1). This will reset all passwords to the default settings for this software version.

If the password is deleted, protection level 4 is applicable.

The password remains set until it is reset using the **Delete password** softkey; **POWER ON** will not reset the password.

Protection levels 4 ... 7

Protection level 4 is automatically set when no password is entered. If required, the protection levels 4 ... 7 can be set from the user program via the user interface.

See Section 6.1.1 “Display Machine Data”.

Note

How to set the access levels is described in the User’s Guide “Operation and Programming”.

4.1.2 Structure of machine data (MD) and setting data (SD)

Number and name

Machine data (MD) and setting data (SD) are differed either by numbers or names. Both the number and the name are displayed on the screen.
Parameters:

- Activation
- Protection level
- Unit
- Standard value
- Range of values

Activation

The activation levels are listed according to their priority. Any data changes come into effect after:

- POWER ON (po) switching on/off the SINUMERIK 802S
- NEW_CONF (cf)
  - **Activate MD** softkey on the operator panel
  - **RESET** key on machine control panel (MCP)
  - Modifications at the block limits are possible while the program is running.
- RESET (re) **RESET** key on the machine control panel (MCP) or M2/m30 at the end of the program
- IMMEDIATELY (im) after entering a value

Protection level

To display machine data, protection level 4 (or higher) must be activated.

Start-up or machine data input generally requires protection level 2 or higher (password ”EVENING”).

Unit/unit system

Depending on the MD SCALING_SYSTEM_IS_METRIC, the physical units of the MD are set as follows:

MD10240 = 1	MD10240 = 0
mm	in
mm/min	in/min
m/s^2	in/s^2
m/s^3	in/s^3
mm/rev	in/rev

If no physical units are applicable to the MD, the field contains a ”-”.

Note
The default setting of the machine data is MD10240 SCALING_SYSTEM IS METRIC = 1 (metric).
With the INCH scaling system MD10240=0, MD203=4 (display unit after the decimal).

Default data

This is the default value for the machine or setting data.

Range of values (minimum and maximum values)

... specifies the input limits. If no range of values is specified, then the input limits are defined by the data type, and the field is marked with "***".

4.1.3 Handling machine data

Handling methods

- Display
- Input via keys and V24 interface
- Making backup copies and reading in/reading out data via the V24 interface

  These back–up copies contain

  – machine data
  – line check sums and
  – machine data numbers.

Aborting when loading MD

If incorrect machine data files are read into the control system, an alarm is output.

At the end of reading, an alarm with the number of errors is displayed.

4.1.4 Data saving

Saving data internally

The data in the memory backed up for a limited period can be saved internally in the permanent memory of the control system.

An internal data backup should be carried out if the control system has been switched off for more than 50 hours (at least 10 min/day with controller ON).

It is recommended to carry out internal data saving whenever important data changes have been made.

Note

During the internal data backup, a memory copy of the memory backed up for a limited time is made and stored in the permanent memory. Selective data backup (e.g. only the machine data and not the part programs) is not possible.

Saving data internally:

Use the **ETC key** to extend the menu in the **Diagnosis/Start-up** menu and press the **Save data** softkey.

Loading data from an internal data backup:

Boot the control system using the start-up switch, position 3

If the data in the backed-up memory area are lost, on **POWER ON** the data saved in the permanent memory area are automatically reloaded into the memory.

Note

The note ”4062 Data backup copy has been loaded“ appears.

Saving data externally

In addition to the internal data backup, the user data of the control system can and must also be saved internally.

External data saving requires a PC/PG (programming device) with V24 interface and the **WinPCIN** tool (included in the tool box).

External data saving should be performed whenever substantial changes in the data have been made, as well as always at the end of start-up.

External data backup variants:

1. The data record is read out completely, creating the **series start–up file.** This is intended for series start–up or to restore the control system status after replacing hardware components or after data loss.
2. Files are read in or read out by areas. The following user data can be selected as individual files:

   Data

   – Machine data
   – Setting data
   – Tool data
   – R parameters
   – Zero offset
   – Compensation data (LEC)

   Part programs

   Standard cycles

Saving data externally:

Use the **Services/Data outp.** menu to transfer the following user data as individual files to an external PC via the V24 interface.

Loading data from an external data backup into the control system:

Press the **Start data inp.** softkey in the **Services** menu.

4.2 Turning on and booting the control system

Approach

- Inspect the system visually for:
  - proper mechanical installation with tight electrical connections
  - supply voltages
  - connections for shielding and grounding.
- Turn on the control system.

Note

Providing memory and start-up switch **S1** are set correctly (see Fig.LEERER MERKER), the control system boots.

Start-up switch S1 (hardware)

The ENC is provided with a start-up switch to assist start-up of the control system. This switch can be actuated using a screw driver.

Table 4-2 Start-up switch settings

Position	Meaning
0	Normal power–up
1	Power–up with default machine data (user data determined by the software version)
2	System software update
3	Power–up with saved data
4	PLC stop
5	Reserve
6	Assigned
7	Assigned

The switch position comes into effect with next power–up and is displayed on the screen when the control system powers up.

Start-up switch(software)

In addition to the hardware start-up switch, the following functions can also be carried out in the **Diagnosis/Start-up/Start-up switch** menu:

- Normal power–up (Start-up switch position 0)
- Power–up with default machine data (Start-up switch position 1)
- Power–up with saved data (Start-up switch position 3)

These power–up functions have a higher priority than the hardware start–up switch.

Booting the control system

When the control system is turned on for the first time, an initial state of the control system is established automatically. All memory areas are initialized and are loaded with previously stored default data.

The PLC area of retentive bit memories is explicitly erased.

The control system changes to the **JOG/Ref.point approach** mode and the yellow **LED DIAG** flashes (see Fig. LEERER MERKER).

This initial state is the precondition for error-free start-up of the control system.

When the control system is already turned on, start-up is also possible in the **Diagnosis** menu (see User Manual).

Normal booting (Start–up switch position 0)

	Result
User data exist, no boot error	Control system changes to **JOG/Ref.point approach** mode, yellow **LED DIAG** (see Fig. 4-1) flashes.
Data in user memory faulty	Backed-up user data are loaded from the permanent memory into the user memory (as in start-up switch position 3). If no valid user data are in the permanent memory, the default data are loaded (as in start-up switch position 1). Any deviations from normal booting are displayed on the screen.

Booting with delault machine data (Start–up switch position 1)

Result
The user memory area not loaded with default data is erased, and the default machine data are loaded from the permanent memory into the user memory.

Booting with saved data (Start–up switch position 3)

Result
The user data backed-up on the permanent memory are loaded into the user memory.

Contrast control

See User's Guide "Operation and Programming"

4.2.1 Boot messages

Displays on the screen

When the control system is booting, test patterns or boot information are displayed on the screen as progress displays.

After the control system has booted without errors, it changes to the **JOG/Ref.point approach** mode, and the yellow **DIAG** LED (see Fig. 4-1) flashes.

Boot errors

Boot errors are displayed either on the screen or via the LED (see Fig. 4-1 in the following).

The **ERR** flashes, and the **DIAG** LED does not flash.

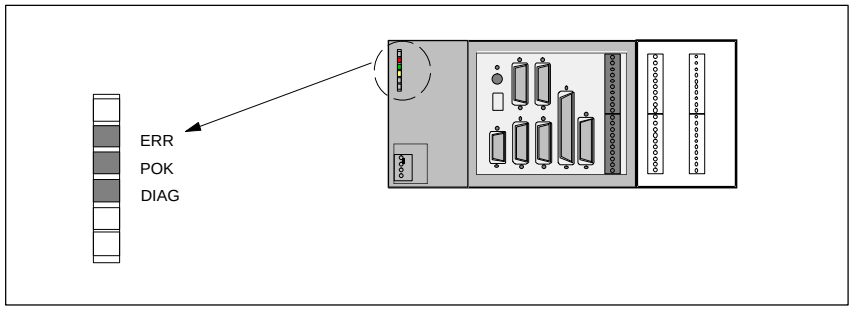


Fig. 4-1 LED

Table 4-3 Boot errors

Error Message	Remedial Action
ERROR EXCEPTION	1. Check the connections of the plugged or connected modules (PLC D/IO modules). 2. Switch off the control system and back on again (POWER ON). 3. Carry out a software update. 4. Replace the hardware components. 5. Inform the hotline if necessary.
ERROR DRAM	
ERROR BOOT	
ERROR NO BOOT2	
ERROR NO SYSTEM	
ERROR LOAD NC NO SYSTEM-LOADER	
ERROR LOAD NC CHECKSUM-ERROR	
ERROR LOAD NC DECOMPRESS-ERROR	
ERROR LOAD NC INTERNAL-ERROR 1	

4.3 Starting up the PLC

General

The PLC is a store–programmable logic controller for simple machines. It has no hardware of its own and is used as a software PLC in the SINUMERIK 802S control system.

The task of the PLC is to control machine–related functional sequences.

The PLC executes the user program cyclically. A PLC cycle is always executed in the same sequence of order.

- Update process image (inputs, outputs, user interface, timers)
- Process communication requests (Operator Panel, PLC 802 Programming Tool)
- Execute user program
- Evaluate alarms
- Output process image (outputs, user interface)

The PLC executes the user program cyclically, starting from the first up to the final operation. Access from user program is only carried out via the process image and not directly to the hardware inputs or outputs. The hardware inputs and outputs are updated by the PLC at the beginning and at the end of program execution. The signals are thus stable over a PLC cycle.

The user program can be created by means of the PLC 802 Programming Tool using the programming language S7–200 in conjunction with ladder diagrams (LAD). A ladder diagram is a graphical programming language to represent electrical circuit diagrams.

This Documentation describes the program structure and the instruction set of the PLC in detail.

4.3.1 Commissioning of the PLC

The SINUMERIK 802S comes to the user with a simulation program included.

The SAMPLE user program is stored in the permanent memory. This sample program and the documentation are included in the SINUMERIK 802SC Toolbox component “PLC802SC Library”.

The simulation program is intended for the first function test of the control system after assembling the control.

Internal simulation program

The simulation program is integral part of the 802S system software. The simulation program allows operation of the control system without digital input and output modules. The user program processes all firmly defined keys and the default setting of the axis keyboard (default).

Axes and spindle are switched to simulation mode. No real axis movement is carried out. The Axis/Spindle Disable user signal is set for each axis. For this reason, the movements of the axes and of the spindle are simulated virtually. The user can use this program to test the interrelation of the components Operator Panel / Machine Control Panel / ENC.

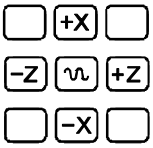
Approach

- Set MD20700 to zero.
- Use the **Diagnosis/StartUp switch/PLC** softkey to select Simulation**.**
  You can check the current setting via **Diagnosis/Service display/Version/PLC application.**
- Select the desired key and check your setting by pressing the key.

Supported keys

- Mode selection

- Axis keys



- NC keys

Note

- The **Increment** key is only active in the **JOG** mode. The toggle function can be used to set increments in the range between 1 and 1,000. Check the response by pressing the axis direction keys.
- **Reference Point** is not supported.

Standard user program

The control system comes with the SAMPLE user program for simple turning machines, which is stored in the permanent memory.

4.3.2 Start–up modes of the PLC

The PLC can activate its start–up modes from two places.

Table 4-4 Start–up modes

Start–Up Switch	Operator Panel Start Up Menu	PLC Program Selection	Program Status	Retentive Data (Backed–Up)	MD for the PLC in the User Interface
	NCK start–up *				
Normal power–up **Position 0**	Normal power–up	User program	Run	Unchanged	Accept active PLC MD
Power–up with default values **Position 1**	Power–up with default values	User program	Run	Deleted	Standard PLC MD
Power–up with saved data **Position 3**	Power–up with saved data	User program	Run	Saved data	Saved PLC MD
PLC Stop after POWER ON **Position 4**		Unchanged	Stop	Unchanged	Accept active PLC MD
	PLC start up **				
	Restart	User program	Run	Unchanged	Accept active PLC MD
	Restart and debug mode	User program	Stop	Unchanged	Accept active PLC MD
	Restart with simulation	Simulation program	Run	Unchanged	Accept active PLC MD
	Overall reset	User program	Run	Deleted	Accept active PLC MD
	Overall reset and debug mode	User program	Stop	Deleted	Accept active PLC MD

* Diagnosis/Start up / Start up switch / NCK softkey ** Diagnosis/Start up / Start up switch / PLC softkey

The start–up switch PLC Stop can be activated either during operation or power–up.

The debug mode (see “Operation and Programming”, Chapter 7) causes the PLC to remain in PLC Stop after the control system has powered up. All power–up modes that have been set either via softkeys or via hardware start–up switches will only come into effect after the next power–up of the control system. The hardware start–up switch “PLC STOP” (position 4) is active immediately. The priority of the power–up modes activated via the softkeys on the operator panel is higher than that of the hardware start–up switches.

Example:

- Hardware start–up switch position 3
- Restart from operator panel

=> Restart is active from next power–up of the control system

The Run mode activates the cyclic mode.

In the Stop mode, the following actions are initiated:

- All hardware outputs are disabled.
- The NC Ready relay is inactive.
- No cyclic operation (active user program is not executed)
- Process image is no longer updated (”frozen”)
- Emergency Stop active

The user can also use the PLC 802 Programming Tool to start the Stop or Run modes.

A corrected or new project can only be loaded into the control system in the Stop mode. The user program comes only into effect with next power–up or when the Run mode is active.

4.3.3 PLC alarms

The control system displays a maximum of 8 PLC alarms (system alarms or user alarms).

The PLC manages the alarm information per PLC cycle. It stores or deletes the alarms in the alarm list according to their occurrence. The first alarm in the list is generally the alarm last occurred.

If more than 8 alarms occur, the first seven alarms occured are displayed, and the last one with the highest cancel priority is displayed.

Alarm response and cancel criterion

Furthermore, the PLC manages the alarm responses. The alarm responses are always active, irrespective of the number of active alarms. Depending on the type of the alarm response, the PLC triggers an appropriate response.

Each alarm requires a cancel criterion to be defined. The PLC uses the SELF– CLEARING criterion as default criterion.

Cancel criteria are:

- POWERONCLEAR: The alarm is canceled by switching off/switching on the control system.
- CANCELCLEAR: The alarm is canceled by pressing the Cancel key or the Reset key (analogously to NCK alarms).
- SELF–CLEARING: The alarm is cleared because the cause resulting in the alarm has been eliminated or does not exist any longer.

Desired alarm responses are defined for each alarm in the PLC. By default, the PLC uses the SHOWALARM response (bit0 – bit5 = 0).

Possible alarm responses are:

- PLC Stop : The user program is no longer executed, the NC Ready relay drops out, and the hardware outputs are disabled (OUTDS).
- EMERGENCY STOP: The PLC provides the EMERGENCY STOP signal to the NCK in the user interface after the user program has been executed.
- Feed disable: The PLC provides the Feed Disable signal to the NCK in the user interface after the user program has been executed.
- Read–in disable: The NCK provides the Read–in Disable signal to the NCK in the user interface after the user program has been executed.
- NC Start inhibited: The PLC provides the NC Start Inhibited signal to the NCK after the user program has been executed.
- SHOWALARM : This alarm has no alarm response (bit0 – bit5 =0).

Priority of cancel conditions

The cancel conditions have the following priority:

- POWER ON CLEAR – system alarms (highest priority)
- CANCEL CLEAR – system alarms
- SELF–CLEARING – system alarms
- POWER–ON CLEAR – user alarms
- CANCEL CLEAR – user alarms
- SELF–CLEARING – user alarm (lowest priority)

System alarms see

see Diagnostics Guide

User alarms

The user interface “1600xxxx” provides the user with two sub–ranges for setting a user alarm.

- Sub–range 0: 4 x 8 bits to set user alarms (0 –> 1 edge)
  Byte 0 : Bit0 => 1st user alarm ‘’ 700000 ‘’
  Byte 3 : Bit7 => 32nd user alarm ‘’ 700031 ’’
- Sub–range 1: User alarm variables

The respective bit (sub–range 0) with a 0/1 edge change will activate a new user alarm. Sub–range 1 is intended for additional user information.

Sub–range 2 can be used to analyze the active alarm responses.

Sub–range 1 can only be read or written as a double word. Sub–range 2 can only be read.

You can delete self–clearing alarms by resetting the respective bit in the variable range ‘’1600xxxx” in sub–range 0 (1 –> 0 edge).

The remaining user alarms are cleared by the PLC after detecting the respective cancel condition. If the alarm is still present, the alarm occurs again.

User alarm activation

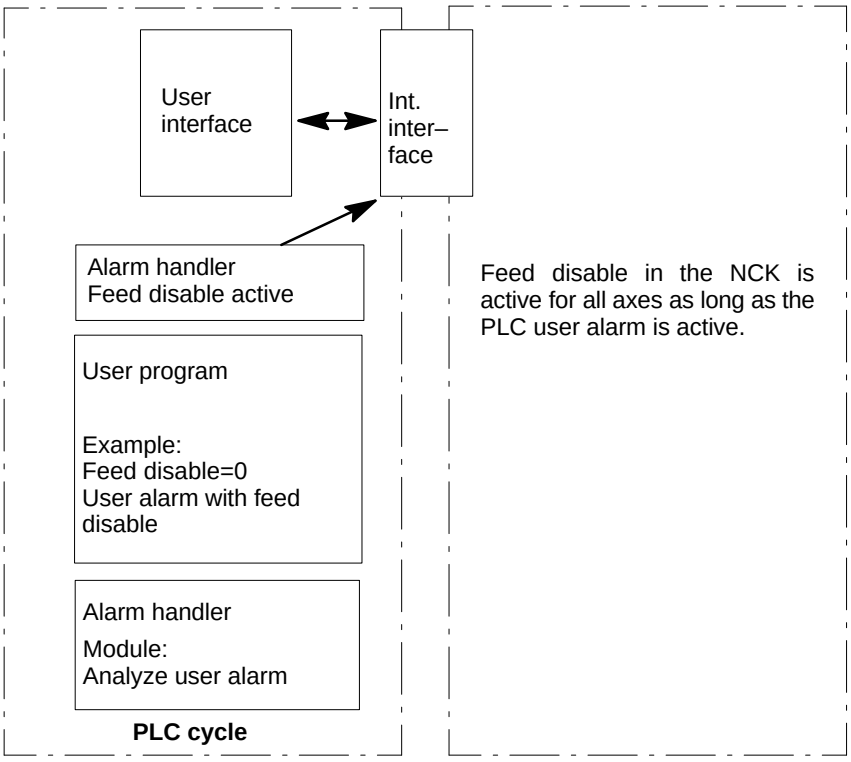


Fig. 4-2 User alarm with Feed Disable alarm response

Configuring user alarms

Each alarm is assigned a configuration byte. The user alarms can be configured by the user in machine data **14516_MN_USER_DATA_PLC_ALARM**.

Default setting MD 14516: 0 => SHOW ALARM/SELF–CLEARING user alarm

Configuration byte structure:

- Bit0 – bit5 : Alarm responses
- Bit6 – bit7 : Cancel criterion

Alarm responses:		Bit0 – bit 5 = 0: Showalarm (default)
	Bit0 = 1:	NC Start inhibited
	Bit1 = 1:	Read–in disable
	Bit2 = 1:	Feed disable for all axes
	Bit3 = 1:	EMERGENCY STOP
	Bit4 = 1:	PLC Stop
	Bit5 =	Reserved
Cancel criteria:	Bit6 + bit7 = 0:	SELF–CLEARING alarm (default)
	Bit6 = 1 :	CANCELCLEAR alarm
	Bit7 = 1 :	POWERONCLEAR alarm

Alarm texts

The user has two possibilities to define his own alarms.

- using the **Edit PLC txt** softkey (**cf. “Operation, Programming”, Chapter 7)**
- using the Toolbox 802SC Text Manager

  The procedure is described in the Toolbox readme file.

  Alarm texts are structured as follows:

  Alarm number Flag 1 Flag2 Text

Note

The text must be put in inverted commas (‘’ ‘’)! Adhere to the given text structure.

Table 4-5 Example

Alarm Number	Flag 1	Flag 2	Text
700000	0	0	“User alarm 1”

700000 0 0 “” // 1st user alarm, text is assigned by the user

700001 0 0 “” // 2nd user alarm, text is assigned by the user

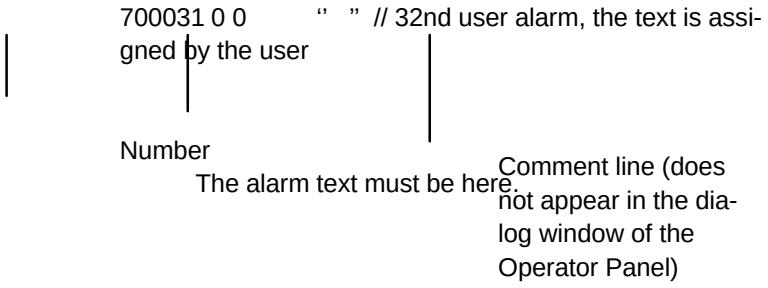
700002 0 0 “” // 3rd user alarm, text is assigned by the user

700003 0 0 “” // 4th user alarm, text is assigned by the user

700004 0 0 “” // 5th user alarm, text is assigned by the user

700005 0 0 “” // 6th user alarm, text is assigned by the user

...


700031 0 0 '' '' // 32nd user alarm, the text is assigned by the user
Number
The alarm text must be here.
Comment line (does not appear in the dialog window of the Operator Panel)

If no user alarm text is assigned by the user, the operator panel will display only the alarm number.

The % character in the alarm text is the code for the additional variable. The variable type is the representation type of the variable.

The following variable types are possible:

- %D ... Integer decimal number
- % I ... Integer decimal number
- %U ... Unsigned decimal number
- %O ... Integer octal number
- %X ... Integer hexadecimal number
- %B ... Binary representation of 32–bit value
- % F... 4 byte floating point number

User alarm text examples

- 700000 ‘’ ‘’ // Only user alarm number
- 700001 ‘’ Hardware limit switch X + axis
- 700002 ‘’ %D ‘’ // Only variable as an integer decimal number
- 700003 ‘’ Alarm number with fixed alarm text and variable %X ‘’
- 700004 ‘’ %U Alarm number with variable and fixed alarm text ‘’
- 700005 ‘’Rotation monitoring of axis active : %U’’

  Operator panel display : 700005 Rotation monitoring of axis active : 1

  or 700005 Rotation monitoring of axis active : 3

4.3.4 Machine control panel (MCP) layout

The machine control panel in the standard version has been configured for simple turning machines (2 axes and one spindle).

The user can use the keys 1 – 6 and the associated LEDs (the same applies to keys 1 ... 6) for his own purposes.

The keys 16–24 should be used as axis keys (see sample program SAMPLE). The programmer can assign the axis keys depending on his particular machine type.

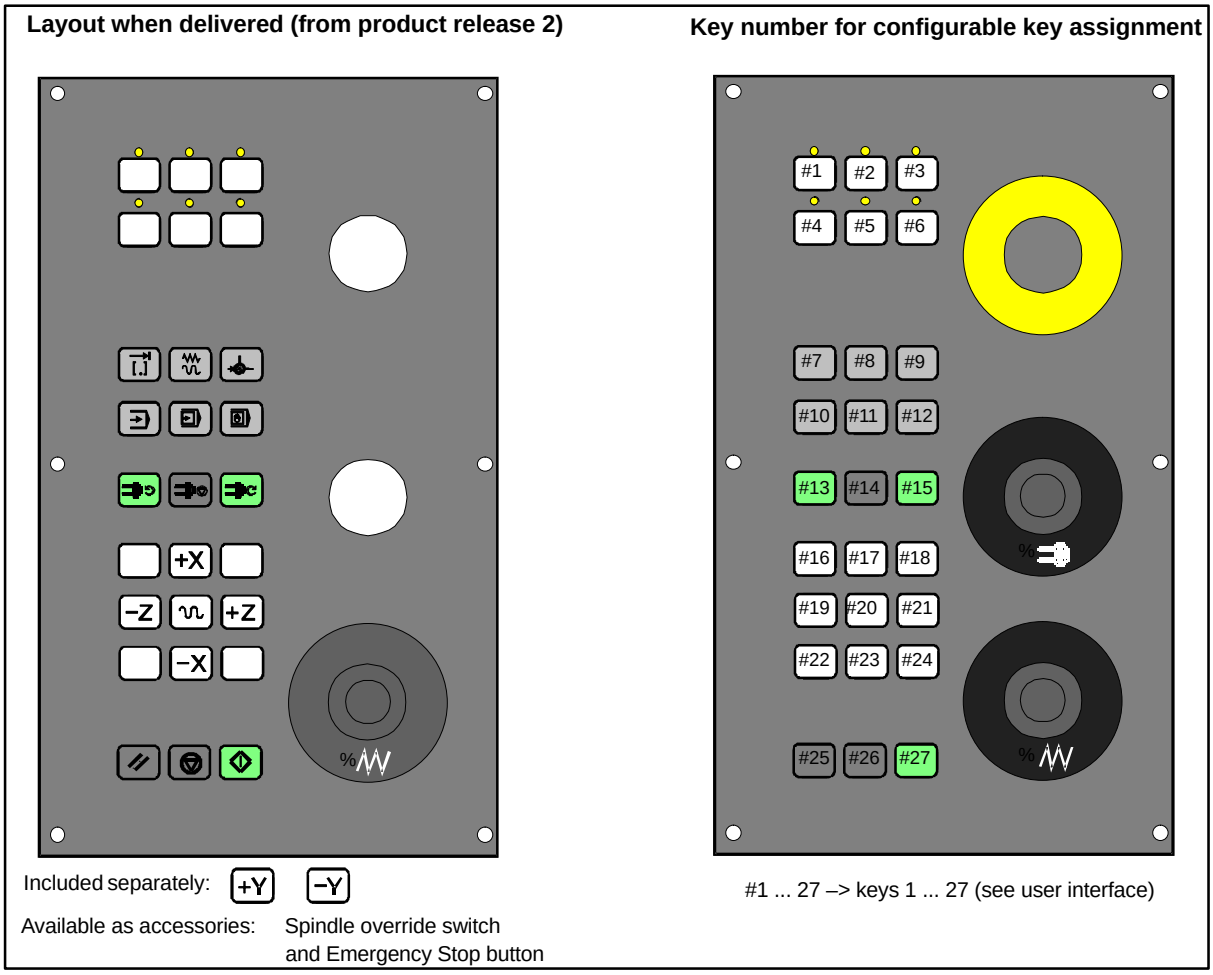


Fig. 4-3 Layout of the machine control panel

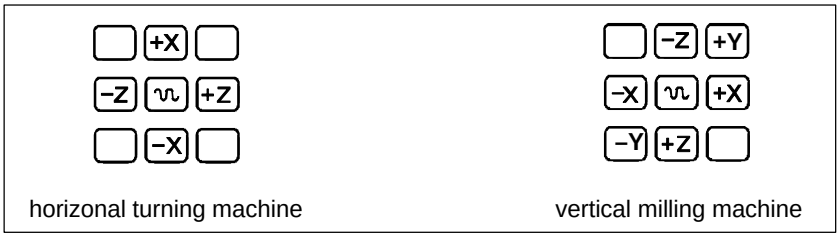


Fig. 4-4 Examples for the assignment of the axis keyboard

4.3.5 PLC programming

The PLC user program is created using the PLC 802 Programming Tool.

The Documentation “S7–200 Automation System, System Manual“ describes how this tool is operated for S7–200. The PLC 802 Programming Tool is to be understood as a subset of this Documentation.

Compared with the S7–200 MicroWin basic system, please note the following:

- The PLC 802 Programming Tool is delievered in the English language version.
- The user program can only be programmed using ladder diagram.
- Only a subset of the S7–200 programming language is supported.
- The compilation of the user program is carried out either offline on a programming device (PG)PC or semi–automatically when downloading into the control system.
- The project can be loaded into the control system (download).
- It is also possible to load the project from the control system (upload).
- Direct data addressing is not possible; therefore, no programming errors will rsult during the operation.
- The data/process information must be managed by the user in accordance with the particular type.

  Example:

Information 1	T value	DWord memory size	(32–bit)
Information 2	Override	Byte memory size	(8–bit)

User data		
Byte 0	DWord	(Information 1)
Byte 4	Byte	(Information 2)

  The user is not allowed to access both of these data at the same time; otherwise, the relevant data access rules must be observed.

- Furthermore, the data direction in the memory model (alignment) and the data type must be observed for all data.

  Example:

Flag bit	MB0.1,MB3.5
Flag byte	MB0,MB1,MB2
Flag word	MW0,MW2,MW4
	MW3, MW5 ... are not permissible
Flag double–word	MD0,MD4,MD8
	MD1,MD2,MD3, MD5 ... are not permissible

Table 4-6 PLC data types permitted in the control system

Data Type	Size	Address Alignment	Range for Logic Operations	Range for Arithmetical Operations
BOOL	1 bit	1	0, 1	–
BYTE	1 byte	1	00 ... FF	0 ... +255
WORD	2 bytes	2	0000 ... FFFF	–32 768 ... + 32 767
DWORD (Double Word)	4 bytes	4	0000 0000 ... FFFF FFFF	–2 147 483 648 ... +2 147 483 647
REAL	4 bytes	4	–	$\pm 10^{-37}$... $\pm 10^{38}$

PLC project In any case, the PLC 802 Programming tool manages one project (logic operations, symbols and comments). The download function is intended to store all important information of a project in a control system.

The control system is able store max. 4,000 instructions and 1,000 symbols. The required PLC memory is influenced by the following components:

- Number of instructions
- Number and length of the symbol names
- Number and length of the comments

S7–200 ladder diagram

A ladder diagram is a graphical programming language similar to electric circuit diagrams. When creating a program using the ladder diagram form, then you will work with graphical components to create the networks of your logics. To create your program, you can use the following elements:

- Contacts constitute a switch through which the current can flow. Current, however, will only flow through a normally open contact if the contact is closed (logical value 1). Current will flow through a normally closed contact or a negated contact (NOT) if the contact is open (logical value 0).
- Coils constitute a relay or an output which is updated by the signal flow.
- Boxes constitute a function (e.g. a timer, counter or arithmetic operation) which is carried out at the moment when the signal flow reaches the box.

A network consists of the elements mentioned above, forming a closed circuit. The current flows from the left conductor bar (in the ladder diagram symbolized by a vertical line at the left window) through the closed contacts, enabling coils or boxes.

Overview of commands

Table 4-7 Operand identifers

Operand ID	Description	Range
V	Data	V0.0 to V79999999.7 (see Table 4–8)
T	Timers	T0 to T15
C	Counters	C0 to C31
I	Map of digital inputs	I0.0 to I7.7
Q	Map of digital outputs	Q0.0 to Q7.7
M	Flags	M0.0 to M127.7
SM	Special flags	SM0.0 to SM 0.6 (see Table 4–10)
AC	ACCU	AC0 ... AC3

Table 4-8 Generating the addresses for the V range (see user interface)

Type Code (DB No.)	Range No. (Channel/ Axis No.)	Subrange	Offset	Addressing
00 (00–79)	00 (00–99)	0 (0–9)	000 (000–999)	symbolic (8–digit)

Table 4-9 S802S Ranges of operands

Accessed by:	Memory Type	SINUMERIK 802SC
Bit (Byte.bit)	V	14000000.0–79999999.7
	I	0.0 – 7.7
	Q	0.0 – 7.7
	M	0.0 – 127.7
	SM	0.0 – 0.6
	T	0 – 15
	C	0 – 31
	L	0.0 – 59.7
Byte	VB	14000000–79999999
	IB	0 – 7
	QB	0 – 7
	MB	0 – 127
	SMB	0
	LB	0 – 59
	AC	0 – 3
Word	VW	14000000–79999998
	IW	0 – 6
	QW	0 – 6
	MW	0 – 126
	T	0 – 15
	C	0 – 31
	LW	0 – 58
	AC	0 – 3
Double Word	VD	14000000–79999994
	ID	0 – 4
	QD	0 – 4
	MD	0 – 124
	LD	0 – 56
	AC	0 – 3

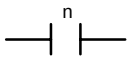
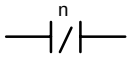
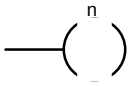
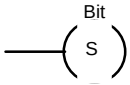
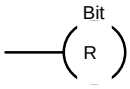
Table 4-10 Special Flag SM Bit Definition

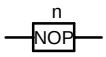
SM Bits	Description
SM 0.0	Flags with defined ONE signal
SM 0.1	Initial position: first PLC cycle ‘1’, following cycles ‘0’
SM 0.2	Buffered data lost – applicable only to the first PLC cycle (‘0’ data o.k., ‘1’ – data lost)
SM 0.3	POWER ON: first PLC cycle ‘1’, following cycles ‘0’
SM 0.4	60 s cycle (alternating ‘0’ for 30 s, then ‘1’ for 30 s)
SM 0.5	1 s cycle (alternating ‘0’ for 0.5 s, then ‘1’ for 0.5 s)
SM 0.6	PLC cycle (alternating, one “0” cycle, then one “1” cycle)

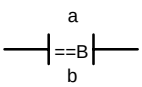
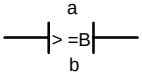
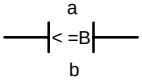
4.3.6 Instruction set

A detailed description of the instructions is to be found in the help system of the PLC 802 Programming Tool (Help > Contents and Index, “SIMATIC LAD Instructions”) and in the Documentation “S7–200 Automation System, CPU22x System Manual.

Table 4-11 Instruction set

BASIC BOOLEAN INSTRUCTIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Load **And** **Or**	normal open n=1 close n=0 open		n: V, I, Q, M, SM, T, C, L
Load Not **And Not** **Or Not**	normal close n=0 close n=1 open		n: V, I, Q, M, SM, T, C, L
Output	prior 0, n=0 prior 1, n=1		n: V, I, Q, M,T, C, L
Set (1 Bit)	prior 0, not set prior 1 or ↗		S_Bit: V, I, Q, M, T, C, L n =1
Reset (1 Bit)	prior 0, no reset prior 1 or ↗		S_Bit: V, I, Q, M, T, C, L n=1

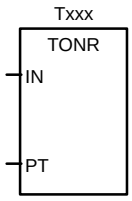
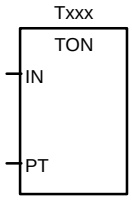
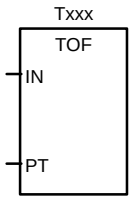
OTHER BOOLEAN INSTRUCTIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Edge Up	prior ↗ close (1 PLC cycle)		
Edge Down	prior ↘ close (1 PLC cycle)		
Logical Not	prior 0, later 1 prior 1, later 0		
No operation			n = 0 ... 255

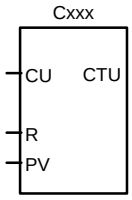
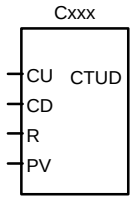
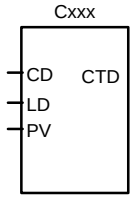
BYTE COMPARES (Unsigned)			
Instruction		**Ladder Symbol**	**Valid Operands**
Load Byte = **And Byte =** **Or Byte =**	a = b close a ≠ b open		a: VB, IB, QB, MB, SMB, AC, Constant, LB b: VB, IB, QB, MB, SMB, AC, Constant, LB
Load Byte ≥ **And Byte ≥** **Or Byte ≥**	a ≥ b close a < b open		
Load Byte ≤ **And Byte ≤** **Or Byte ≤**	a ≤ b close a > b open		

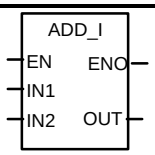
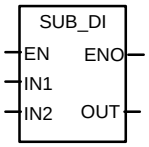
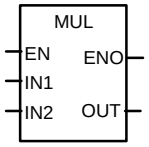
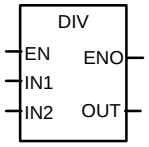
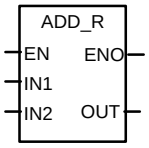
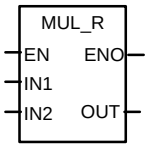
WORD COMPARES (Signed)			
Instruction		**Ladder Symbol**	**Valid Operands**
Load Word = **And Word =** **Or Word =**	a = b close a ≠ b open	a ==I b	a: VW, T, C, IW, QW, MW, AC, Constant, LW b: VW, T, C, IW, QW, MW, AC, Constant, **LW**
Load Word ≥ **And Word ≥** **Or Word ≥**	a ≥ b close a < b open	a > =I b	
Load Word ≤ **And Word ≤** **Or Word ≤**	a ≤ b close a > b open	a < =I b	

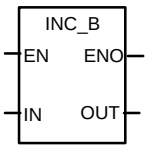
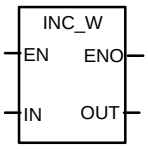
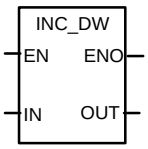
DOUBLE WORD COMPARES (Signed)			
Instruction		**Ladder Symbol**	**Valid Operands**
Load DWord = **And DWord =** **Or DWord =**	a = b close a ≠ b open	a ==D b	a: VD, ID, QD, MD, AC, Constant, LD b: VD, ID, QD, MD, AC, Constant, LD
Load DWord ≥ **And DWord ≥** **Or DWord ≥**	a ≥ b close a < b open	a > =D b	
Load DWord ≤ **And DWord ≤** **Or DWord ≤**	a ≤ b close a > b open	a < =D b	

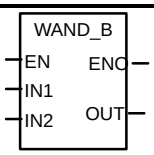
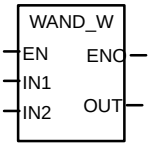
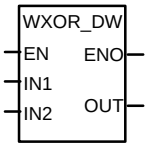
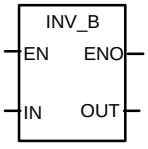
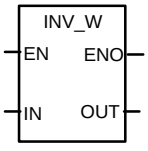
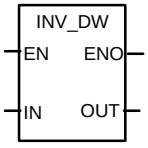
REAL WORD COMPARES (Signed)			
Instruction		**Ladder Symbol**	**Valid Operands**
Load RWord = **And RWord =** **Or RWord =**	a = b close a ≠ b open	a = =R b	a: VD, ID, QD, MD, AC, Constant, LD b: VD, ID, QD, MD, AC, Constant, LD
Load RWord ≥ **And RWord ≥** **Or RWord ≥**	a ≥ b close a < b open	a > =R b	
Load RWord ≤ **And RWord ≤** **Or RWord ≤**	a ≤ b close a > b open	a < =R b	

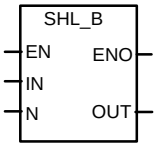
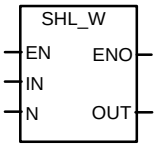
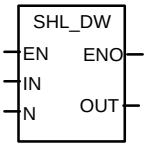
TIMER			
Instruction		**Ladder Symbol**	**Valid Operands**
Timer Retentive On Delay	EN=1, Start EN=0, Stop If $T_{Value} \geq PT$, T_{bit}=1		Enable: (IN) S0 Txxx: T0 – T15 Preset: (PT) VW, T, C, IW, QW, MW, AC, Constant 100 ms T0 – T15
Timer On Delay	EN=1, Start EN=0, Stop If $T_{Value} \geq PT$, T_{bit}=1		Enable: (IN) S0 Txxx: T0 – T15 Preset: (PT) VW, T, C, IW, QW, MW, AC, Constant 100 ms T0 – T15
Timer Of Delay	If $T_{Value} < PT$, T_{bit}=1		Enable: (IN) S0 Txxx: T0 – T15 Preset: (PT) VW, T, C, IW, QW, MW, AC, Constant 100 ms T0 – T15

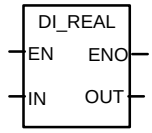
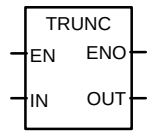
COUNTER			
Instruction		**Ladder Symbol**	**Valid Operands**
Count Up	CU ↗, Value+1 R=1, Reset If $C_{Value} \geq PV$, C_{bit}=1		Cnt Up: (CU) S1 Reset: (R) S0 Cxxx: C0 – 31 Preset: (PV) VW, T, C, IW, QW, MW, AC, Constant, LW
Count Up/Down	CU ↗, Value+1 CD ↗, Value–1 R=1, Reset If $C_{Value} \geq PV$, C_{bit}=1		Cnt Up: (CU) S2 Cnt Dn: (CD) S1 Reset: (R) S0 Cxxx: C0 – 31 Preset: (PV) VW, T, C, IW, QW, MW, AC,Constant, LW
Count Down	If $C_{Value} = 0$, C_{bit}=1		Cnt Down: (CD) S2 Reset: (R) S0 Cxxx: C0 – 31 Preset: (PV) VW, T, C, IW, QW, MW, AC, Constant, LW

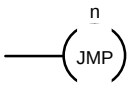
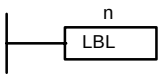
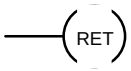
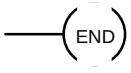
MATH OPERATIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Word Add **Word Subtract**	If EN = 1, b = a + b b = b – a		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VW, T, C, IW, QW, MW, AC, LW
DWord Add **DWord Subtract**	If EN = 1, b = a + b b = b – a		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD
Multiply	If EN = 1, b = a x b		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VD, ID, QD, MD, AC, LD
Divide	If EN = 1, b = b ÷ a Out: 16 bit remainder Out+2: 16 bit quotient		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VD, ID, QD, MD, LD
Add **Subtract** **Real Numbers**	If EN = 1, b = a + b b = b – a		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD
Multiply **Divide** **Real Numbers**	If EN = 1, b = a x b b = b ÷ a		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD

INCREMENT, DECREMENT			
Instruction		**Ladder Symbol**	**Valid Operands**
Increment **Decrement** **Byte**	If EN = 1, a = a + 1 a = a – 1		Enable: EN In: VB, IB, QB, MB, AC, Constant LB Out: VB, IB, QB, MB, AC, LB
Increment **Decrement** **Word**	If EN = 1, a = a + 1 a = a – 1 a = /a		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VW, T, C, IW, QW, MW, AC, LW
Increment **Decrement.**	If EN = 1, a = a + 1 a = a – 1		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD

LOGIC OPERATIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Byte AND **Byte OR** **Byte XOR**	If EN = 1, b = a AND b b = a OR b b = a XOR b		Enable: EN In: VB, IB, QB, MB, AC, Constant, LB Out: VB, IB, QB, MB, AC, LB
Word AND **Word OR** **Word XOR**	If EN = 1, b = a AND b b = a OR b b = a XOR b		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VW, T, C, IW, QW, MW, AC, LW
DWord AND **DWord OR** **DWord XOR**	If EN = 1, b = a AND b b = a OR b b = a XOR b		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD
Invert Byte	If EN = 1, a = /a		Enable: EN In: VB, IB, QB, MB, AC, Constant, LB Out: VB, IB, QB, MB, AC, LB
Invert Word	If EN = 1, a = /a		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VW, T, C, IW, QW, MW, AC, LW
Invert DWord	If EN = 1, a = /a		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD

SHIFT AND ROTATE OPERATIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Shift Right **Shift Left**	If EN = 1, a = a SR c bits a = a SL c bits		Enable: EN In: VB, IB, QB, MB, AC, Constant, LB Out: VB, IB, QB, MB, AC Count: VB, IB, QB, MB, AC, Constant, LB
Shift Right **Shift Left**	If EN = 1, a = a SR c bits a = a SL c bits		Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VW, T, C, IW, QW, MW, AC, LW Count: VB, IB, QB, MB,AC, Constant, LB
DWord Shift R **DWord Shift L**	If EN = 1, a = a SR c bits a = a SL c bits		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD Count: VB, IB, QB, MB, AC, Constant, LB

CONVERSION OPERATIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Convert Double Word Integer to a Real	If EN = 1, convert the double word integer i to a real number o.		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD
Convert a Real to a Double Word Integer	If EN = 1, convert the real number i to a double word integer o.		Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD

PROGRAM CONTROL FUNCTIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Jump to Label	If EN = 1, go to label n.		Enable: EN Label: WORD: 0–127
Label	Label marker for the jump.		Label: WORD: 0–127
Conditional Return from Subroutine	If EN = 1, exit the subroutine.		Enable: EN
Conditional End	If EN = 1, END terminates the main scan.		Enable: EN

PROGRAM CONTROL FUNCTIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Subroutine	If EN ↗, go to subroutine n.	n SBR EN x1 x2 x3 (x... optional paramete	Label: Constant : 0–63

MOVE, FILL AND FIND OPERATIONS			
Instruction		**Ladder Symbol**	**Valid Operands**
Move Byte	If EN = 1, copy i to o.	MOV_B EN ENO IN OUT	Enable: EN In: VB, IB, QB, MB, AC, Constant, LB Out: VB, IB, QB, MB, AC, LB
Move Word	If EN = 1, copy i to o.	MOV_W EN ENO IN OUT	Enable: EN In: VW, T, C, IW, QW, MW, AC, Constant, LW Out: VW, T, C, IW, QW, MW, AC, LW
Move DWord	If EN = 1, copy i to o.	MOV_DW EN ENO IN OUT	Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD
Move Real	If EN = 1, copy i to o.	MOV_R EN ENO IN OUT	Enable: EN In: VD, ID, QD, MD, AC, Constant, LD Out: VD, ID, QD, MD, AC, LD
Swap Bytes	If EN = 1, exchange MSB and LSB of w.	SWAP EN ENO IN	Enable: EN In: VW, IW, QW, MW, T, C, AC, LW

4.3.7 Programm organization

Each programmer should divide the user program into several closed program sections (subroutines). The S7–200 programming language allows the user to create structured user programs. There are two program types – main programs and subroutines. Eight program levels are possible.

A PLC cycle can be a multiple of the control–internal interpolation cycle (IPO cycle). The machine manufacturer must set the PLC cycle according to his/her own requirements (see machine data “PLC_IPO_TIME_RATIO”). The ratio IPO/ PLC of 1:1 is the fastest possible cyclic processing.

Example: The programmer programs a sequence control in the main program using his own defined cycle counter. The sequence control defines all cyclic signals in the subroutine (UP0); UP1/UP2 is called every two cycles, and UP 3 controls all signals in steps of three cycles.

4.3.8 Data organization

The data can be divided into three areas:

- non–retentive data
- retentive data
- machine data for the PLC (All these machine data are active after POWER ON.)

Most data, such as process map, timers and counters, are non–retentive data and deleted with each power–up.

The user has a certain area available for the retentive data (data range 14000000 –140000xx). All data that are wished to remain their validity even after POWER ON can be stored in this area.

The user can use the PLC MD (see user interface) to load his program with default data or to parameterize various program sections.

4.3.9 Interface to the control system

This interface can be selected on the operator panel using the softkeys **Diagnosis \ Start–up \ STEP7 connect.**

The V24 interface remains active even after restart or normal power–up. The connection (STEP7 connect active) to the control system can be checked in the PLC 802 Programming Tool menu “PLC/Information”. If the interface is active, e.g. the active PLC mode (Run/Stop) is displayed in this window.

4.3.10 Testing and monitoring the user program

The user program can be analyzed or checked for errors using the following methods:

- PLC Status menu (PCU)
- Status list menu (PCU)
- PLC 802 Programming Tool (see Help menu > Contents and Index, “Debugging” or documentation “S7–200 Automation System”, Section “Testing and Monitoring Your Program”)

4.4 PLC applications “Download/Upload/Copy/Compare”

The user can save or copy PLC applications in the control system or overwrite them by another PLC project.

This is possible using the

- Programming Tool 802
- WinPCIN (binary file)

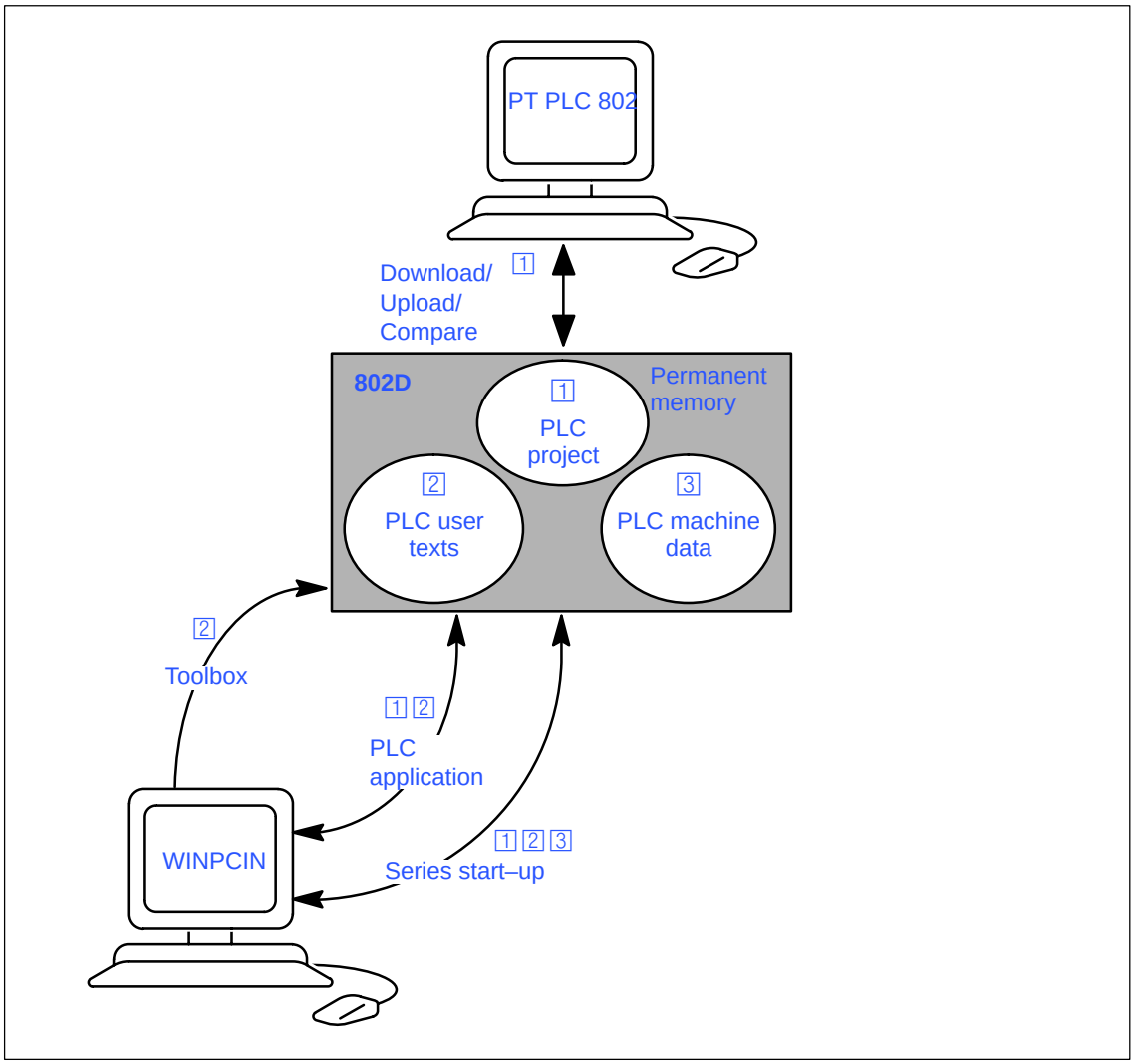


Fig. 4-5 PLC applications in the control system

Download

This function is used to write the transferred data to the permanent memory (load memory) of the control system.

- Download the PLC project using the PLC 802 Programming Tool (Step 7 connect on)
- Series start–up using the WinPCIN tool (PLC MD, PLC project and user alarm texts) Data In

The loaded PLC user program is transferred from the permanent memory to the user memory when the control is booted next time; it will be active from this moment.

Upload

The PLC applications can be saved using the PLC 802 Programming Tool or the tool PCIN.

- Upload PLC project using the PLC 802 Programming Tool (Step 7 connect on)

  Read out the project from the control system to reconstruct the current project in the PLC 802 Programming Tool.
- Series start–up “Start–up Data” using the tool PCIN (PLC MD, PLC Project and user alarm texts) Data Out
- Read out PLC applications using the Tool PCIN (PLC Project information and user alarm texts) Data Out

Compare

The project in the PLC 802 Programming Tool is compared with the project contained in the permanent memory (load memory) of the CNC.

Versions display

Calling via the softkey **Diagnosis / Service Display / Version**

- **Project**
  The transmitted project including user program, which is active in the PLC after the control system has powered up.

  The programmer can use the first comment line in the program title of the PLC 802 Programming Tool for his own additional information in the version display (see “View Properties“).

4.5 User Interface

This interface includes all signals between NCK/PLC and HMI/PLC. In addition, the PLC decodes the auxiliary function commands for straightforward further processing in the user program.

4.6 Technology Setting

Overview

The SINUMERIK 802S is supplied with the default machine data as a control system for turning machines (2 axes, 1 spindle). If you wish to set another technology (e.g. milling), the relevant machine data file must be loaded from the tool box into the control system.

The file with the technology machine data must be loaded after the control system has booted successfully, but prior to commissioning.

Sequence of operations

To change the technology setting, proceed as follows:

- Make a V24 link between PG/PC and the control system.
- Turn on the control system and wait until it has booted without errors.
- Press the **Start data inp.** softkey in the Services menu (use the V24 default interface settings).
- Select the technology machine data file techmill.ini (included in the toolbox) required for milling and transfer it to the PG/PC using WinPCIN.
- After the file has been transferred correctly, carry out POWER ON.
- The SINUMERIK 802S is now preset to the desired technology.

  Example: techmill. ini
  Default: 3 axes (X, Y and Z), 1 spindle, no transversal axis, G17 etc.

If you wish to reconfigure a SINUMERIK 802S control system to turning, carry out POWER ON with the default machine data (start–up switch position 1).

Note

All memory areas are initialized or loaded with stored default values (machine data).

The basic configuration of the SINUMERIK 802C must be carried out during the commissioning prior to the general configuration (MD input).

This need not to be done when series start–up is carried out. The configured machine data are contained in the series start–up file.

4.7 Commissioning

Initializing the control system

- Turn on the control system.
- The SINUMERIK 802S will load the standard machine data automatically.

4.7.1 Entering the general machine data

Overview

To make your work easier, the most important machine data of the individual subranges are listed. If more detailed information is required, the user is referred to the relevant chapters/ sections of this manual. The machine data and interface signals are described in detail in the descriptions of functions to which reference is made in the relevant lists.

Note

The general machine data are selected such (default values) that only a few machine data parameters have to be modified.

Entering the machine data (MD)

Before the machine data can be entered, the password for protection level 2 or 3 must be entered.

The following machine data ranges must be selected and modified (if necessary) using the appropriate softkeys:

- General machine data
- Axis machine data
- Other machine data
- Display machine data

Once entered, these data are immediately written to the data memory.

The machine data are activated depending on the Activation setting of the appropriate machine data, Section 4.1.2.

Note

Since these data are only stored in the memory backed up for a limited period of time, a data backup is necessary (see Section 4.1.4).

Machine data

The following machine data list contains all general and other machine data and setting data, which can be changed if necessary.

Number	Description	Default Value
10074	Division ratio of the PLC task factor for main run	2
11100	Number of auxiliary function groups	1
11200	Standard machine data loaded on next Power On	O_H
11210	MD backup of changed MD only	0FH
11310	Threshold for direction change of handwheel	2
11320	Handwheel pulses per detent position (handwheel number): 0...1	1
20210	Maximum angle for compensation blocks with TRC	100
20700	NC-Start disable without reference point	1
21000	Circle end point monitoring constant	0.01
22000	Auxiliary function group (aux. fct. no. in channel): 0...49	1
22010	Auxiliary function type (aux. fct. no. in channel): 0...49	“”
22030	Auxiliary function value (aux. fct. no. in channel): 0...49	0
22550	New tool compensation for M function	0

Setting data

Number	Explanation	Default-Value
41110	Jog feedrate	0
41200	Spindle speed	0
42000	Start angle	0
42100	Dry run feedrate	5000

4.7.2 Starting up the axes

Overview

The SINUMERIK 802S has up to three stepper motor feedrate axes (X, Y and Z). The stepper motor drive signals are output at connector **X7** for the:

- X axis at pins 1–3 (PULS1, DIR1 and EN1)
- Y axis at pins 4–6 (PULS2, DIR2 and EN2) and for the
- Z axis at pins 7–9 (PULS3, DIR3 and EN3).

Additional axes

The 2nd axis in the axis order, which when milling has the function of the Y axis can be used as an additional axis when turning. This is achieved by loading one of the files “turnax_U.ini” or “turnax_V.ini” or “turnax_W.ini” from the Toolbox and enabling these data.
Which files are selected is dependent on the desired axis name: U or V or W.
The additional axis is a linear axis with limited functionality, compared with the axes X and Z. It can be traversed together with the remaining axes. If the additional axis is traversed in a program block that contains G1 or G2/G3, using the axes (X, Z), then it will not be assigned a component of the feedrate F. In this case, the axis’ speed will depend on the path travel time of the axes X, Z. Its motion starts and ends together with the axes X, Z. The axis speed, however, cannot be greater than the limit value defined for the additional axis.
If the additional axis is programmed in a separate block, it will travel with the active feedrate F if G1 is programmed.
Both settable offsets (G54 ... G57) and programmable offsets (G158) are possible for the additional axis. Tool offsets are not effective in this axis.

Simulation/stepper motor drive

Setpoint output and pulse feedback can be switched between simulation and drive operation using the axis MD **30130_CRTLOUT_TYPE** and **30240_ENC_TYPE**.

Table 4-12

MD	Simulation	Normal Operation
30130	Value = 0 To test the axis, the actual value is fed back internally as an actual value. No setpoint output at connector **X7**.	Value = 2 The setpoint signals for stepper motor operation are output at connector **X7**. Real axis traversal is possible using a stepper motor.
30240	Value = 0	Value = 3 Internal pulse feedback from setpoint output to actual value input “ON”

Machine data default settings for stepper motor axes

The machine data list bloew contains the default machine data and their recommended settings with stepper motor axes connected.

After the machine data have been set, the stepper motor axes are ready to traverse, as far as the machine data are concerned, and only fine adjustments are required.

Number	Description	Default Value	Setting or Remark
30130	Output type of setpoint (setpoint branch): 0	0	2
30240	Type of actual value acquisition (actual position value) (encoder no.) 0: Simulation 3: Encoder for stepper motor	0	3
31020	Encoder markings per revolution (encoder no.)	1000	Steps per stepper motor revolution
31030	Pitch of leadscrew	10	Leadscrew pitch
31050 31060	Denominator load gearbox (control parameter no.): 0...5	1	Load and resolver transmission ratios
31100	Steps for monitoring rotation	2000	Repetition cycle of BERO in measuring system increments
31400	Schritte pro Schrittmotorumdrehung	1000	Steps per stepper motor revolution (must be identical to MD 31020)
32000	Maximum axis velocity	10000	30000 (max. axis velocity)
32100	Traversing direction (not control direction)	1	Reversal of direction of motion
32110	Sign actual value (control direction) (encoder no.)	1	Measuring system reversal
32200	Servo gain factor (control parameter set no.): 0...5	2,5	2.5 (position controller gain)
32260	Rated motor speed (setpoint branch): 0	3000	Motor speed
34070	Reference point positioning velocity	300	Positioning speed when referencing
34200	Type of position measuring system 0: No ref. point appr.; if absolute encoder exists: REFP_SET_POS accepted 1: Zero pulse (on encoder track) 2: BERO 3: Distance-coded reference marks 4: Bero with two edges 5: BERO cam	1	2: Single–edge BERO 4: Double–edge BERO
36200	Threshold value for velocity monitoring (control parameter set no.): 0...5	11500	Threshold value for velocity monitoring

To solve monitoring problems, set the following machine data:

Number	Description	Default Value	Setting or Remark
36000	Exact positioning coarse	0.04	0.5
36010	Exact positioning fine	0.01	0.1
36020	Delay exact positioning fine	1.0	4
36060	Maximum velocity/speed ”axis/ spindle stopped”	5.0	20

Parameterization example

Stepper motor: 10,000 [pulses per motor revolution]

Load gear: 1:1

Leadscrew pitch: 10 mm

Motor speed: 1,200 rpm

MD 30130 =2

MD 30240 =3

MD 31400 =10,000

MD 32260 =1,200 rpm

MD 32000 =12,000 mm/min

Stepper motor frequency

The parameterization is carried out using the machine data, which have already been mentioned, after **POWER-ON**.

The resulting stepper motor frequency is displayed with machine data MD 31350.

$$\text{MD 31350 [Hz]} = \frac{\text{Motor speed [rpm]} \bullet \text{steps per stepper motor revolution}}{60\ \text{[s]}}$$

This frequency must correspond to MD 32000.

Supplementary conditions

Servo gain

The default setting of the servo gain when controlling stepper motors without measuring system is K_V = 2.5 (MD: 32200, limit approx. 2.5).

Max. stepper motor frequency

The max. permissible stepper motor frequency is 500 kHz.

PLC interface signals when using a stepper motor in the controlled mode

When using a stepper motor as an axis (spindle), the PLC interface signals have to be used as follows:

The ”Servo enable” signal provided via the NC **will not be used to turn off** the drive (”Drive Enable” is always active). This pertains to the following signals:

- Servo Enable
- Positioning measuring system ON/OFF
- Parking
- Error responses

It is the user’s own responsibility to cause the PLC that the appropriate stepper motor drive is brought to “Safe Stop” or is switched off.

Rotation monitoring of the stepper motor using BERO

Overview

A stepper motor will no longer follow the setpoint if the load torque becomes too large. The rotation monitoring is intended to detect this faulty status.

At the moment when the BERO pulse occurs, the stepper motor setpoint position is compared with the BERO actual position and, in case of error, the “Error: Rotation monitoring signal” is created.

The rotation monitoring BERO must be overrun cyclically when the axes are traversed. Usually, a cyclically occurring BERO is used both referencing and for rotation monitoring.

It is possible to switch the BERO for rotation monitoring in parallel to the BERO for referencing. It must, however, be made sure that the rotation monitoring is disabled when referencing and that the rotation monitoring BERO does not provide a signal or the referencing BERO is switched off when rotation monitoring is active.

Machine data

The MD 31100 BERO_CYCLE must contain the repetition cycle of the BERO in actual–value increments. The MD 31110 BERO_EDGE_TOL will take into account any tolerances in the BERO switching edge.

Activation

The speed monitoring is activated via the user interface signal 380x5000.0. It comes into effect for the appropriate axis only **after** referencing.

Error case

The error “Rotation monitoring“ is signalled (interface signal 390x5000.0) and the monitoring is switched off. The reference point is lost. To re–enable rotation monitoring, rereferencing is required.

Note

The error “Rotation monitoring” will also always occur if the stepper motor has been controlled incorrectly even if the speed monitoring is not enabled. If deemed necessary, the user must take appropriate measures to ensure that the stepper motor is shut down reliably.

Bent acceleration characteristic

A characteristic feature of stepper motor drives is the drop of the available torque in the upper speed range (see Fig. 4-6).

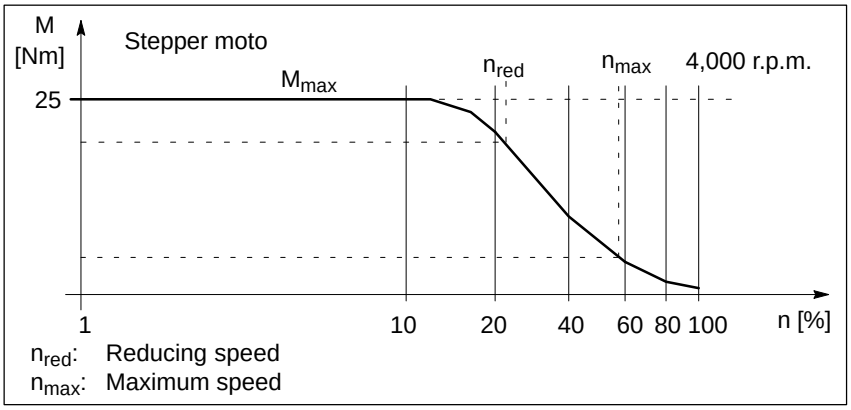


Fig. 4-6 Typical motor characteristic for a stepper drive

The optimum capacity utilization of such characteristics with a simultaneous overload protection can be achieved using the velocity–dependent acceleration characteristic ”Bent acceleration characteristic“.

Activation

In the AUTOMATIC mode, the bent acceleration characteristic is always active. The axis behavior is set via the parameterization of the characteristic.

For single motions in JOG mode, the bent acceleration characteristic can be enabled via **MD 35240 MA_ACCEL_TYPE_DRIVE = 1** (default value=0).

Note

- The bent acceleration characteristic can only be parameterized axis–related. The path traversing behavior results from the caluclation using the axes involved.
- MD 32420 JOG_AND_JERK_ENABLE=0
  Prerequisite for action of the bent acceleration characteristic in JOG.

Parameterization of the axis characteristic

The axial course of the acceleration characteristic must be parameterized using the following machine data:

Number	MD Identifier	Default Value	
		linear	circular
32000	MA_MAX_AX_VELO	10,000.0 mm/min	27.7 r.p.m.
32300	MA_MAX_AX_ACCEL	1 m/s^2	2.77 $rev's/s^2$
35220	MA_ACCEL_REDUCTION_SPEED_POINT	1	
35230	MA_ACCEL_REDUCTION_FACTOR	0	

* : The selection of the value depends on the motor characteristic.

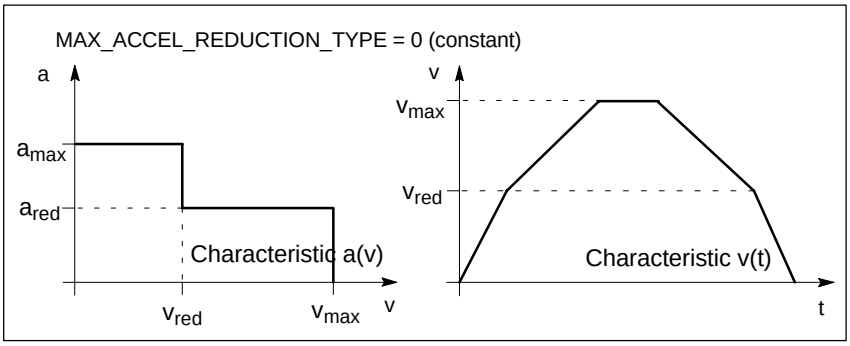


Fig. 4-7 Axial acceleration and velocity characteristics

Velocities:

v_{max}: MA_MAX_AX_VELO

v_{red}: MA_ACCEL_REDUCTION_SPEED_POINT · MA_MAX_AX_VELO

Accelerations:

a_{max}: MA_MAX_AX_ACCEL

a_{red}: (1 - MA_ACCEL_REDUCTION_FACTOR) · MA_MAX_AX_ACCEL

Service display of the axis drive behavior

SINUMERIK 802S provides two possibilities to evaluate the axis drive behavor:

Servo Trace

To provide axis service, the **Servo Trace** function is integrated in the Diagnosis menu, which can be used for graphical representation of the axis setpoint speed.

The Trace function is selected in the **Diagnosis/Service display/Servo Trace** operating area (cf. User's Guide "Operation..").

Axis value as an analog value

For service purposes, the axis setpoint value required for the stepper motor drive can additionally be provided as an analog value. Using a storage osciiloscope, this feature can be used to display the axis drive behavior when starting up individual axes.

To output the analog axis setpoint, with SINUMERIK 802S, the D/A converter of the spindle is used.

Connect the storage oscilloscope to **X3** (9–pin plug connector):

Pin 1 - setpoint ±10V

Pin 6 - analog ground

The axis setpoint value is switched using MD:

31500 AXIS_NUMBER_FOR_MONITORING

Example:

The axis setpoint value of the Z axis is to be output at connector X3.

To this end, enter the following value in the axis MD of the 3rd machine axis (Sp):

Turning: AXIS_NUMBER_FOR_MONITORING[AX4] = 2
(Z axis always has axis number 2)

Milling: AXIS_NUMBER_FOR_MONITORING[AX4] = 3
(Z axis always has axis number 3)

Note

With this setpoint assignment (AXIS_NUMBER_FOR_MONITORING unequal to 0), servo enable is always 0 (X3 pin 5/9).

After the measuring process, but at least before the spindle setpoint value is connected to X3, the MD

AXIS_NUMBER_FOR_MONITORING[AX4] = 0

must be set and the control system be switched off and back on again (POWER ON).

Dynamic adaptation for thread G331/G332

Function

The dynamic response of spindle and involved axis for the function G331 / G332– thread interpolation – can be adapted to the “slower” control loop. Usually, this concerns the Z axis, which is adapted to the more inert response of the spindle.
If an exact adjustment is carried out, it is possible to sacrifice of a compensating chuck for tapping. At least, higher spindle speeds/smaller compensation paths can be achieved.

Activation

The values for the adaptation are entered in MD 32910 DYN_MATCH_TIME [n], usually for the axis.
The adaptation is only possible if MD 32900 DYN_MATCH_ENABLE =1 has bee set for the axis/spindle.
With the function G331/G332 active, parameter block n (0...5) of the axis of
MD 32910 acting corresponding to the spindle gear stage automatically becomes active. The gear stage is dependent on the spindle speed with M40 or is set directly via M41...M45 (see also Section 4.5.3 “Start–up of the spindle”).

Number	Description	Default Value
32900	Dynamic response adaptation	0
32910	Time constant of dynamic adaption (control parameter set no): 0...5	0.0

Note

For axes involved in tapping or thread cutting, the same parameter set number is activated as with the current gear stage of the spindle (see “Description of Functions”, Section 3.2).
For example, if a load gear is active for an axis, then this transmission ratio (numerator, denominator) must also be entered in all of the remaining parameter sets used for thread operations, in addition to the parameter set with index =0.

Determination of value

The dynamic value of the spindle is stored for each individual stage in MD 32200 POSCTRL_GAIN[n] as the closed–loop gain (K_v). An adaptation of the axis to these values is carried out in MD 32910 DYN_MATCH_TIME [n] using the following rule:

$$\text{MD 32910 DYN\_MATCH\_TIME [n]} = \frac{1}{K_v[n]s_{pindle}} - \frac{1}{K_v[n]_{axis}}$$

The entry to be made in MD 32910 requires the time unit s. The values of MD 32200 POSCTRL_GAIN[n] for spindle and axis must be converted accordingly:

$$K_v[n]_{spindle} = \text{POSCTRL\_GAIN[n]}_{spindle} \frac{1000}{60}$$

$$K_v[n]_{axis} = \text{POSCTRL\_GAIN[n]}_{axis} \frac{1000}{60}$$

When using further gear stages with G331/G332, the adaptation must also be carried out in these parameter blocks.

Example for adaptation of the dynamic response of Z axis/spindle:
1st gear stage –> parameter set[1],
Supposed, for spindle K_V, MD 32200 POSCTRL_GAIN[1] = 0.5 is entered,
and for Z axis K_V, MD 32200 POSCTRL_GAIN[1] = 2.5 is entered.

The searched entry for the Z axis in

$$\text{MD 32910 DYN\_MATCH\_TIME [1]} = \frac{1}{K_v[1]_{spindle}} - \frac{1}{K_v[1]_z}$$

$$= \left(\frac{1}{0.5} - \frac{1}{2.5}\right) * \frac{60}{1000}$$

MD 32910 DYN_MATCH_TIME [1] = <u>0.0960</u> s
If necessary, for fine adaptation, in practice a more exact value must be determined. When traversing axis (e.g. Z axis) and spindle, the exact value for POSCTRL_GAIN is displayed on the service display.
MD 32900 DYN_MATCH_ENABLE must be set to = 1.
Example: service display for Z axis with POSCTRL_GAIN : 2.437 in 1,000/min
Exact calculation:

$$\text{MD 32910 DYN\_MATCH\_TIME [1]} = \left(\frac{1}{0,5} - \frac{1}{2,437}\right) * \frac{60}{1000} = \underline{0.0954}\ \text{s}$$

In practice, this value can be optimized. To this aim, first the thread is tested with compensating chuck and the calculated values. Then the values should be modified sensitively so that the difference path in the compensating chuck approximates to zero.
Now, the same values should be displayed for axis and spindle for POSCTRL_GAIN when tapping.

Note

If MD 32900 DYN_MATCH_ENABLE has been set to “1” for the drilling axis, it should also be set to “1” for all interpolating axes. This increases the traversing accuracy along the contour. However, the entries for these axes in MD 32910 DYN_MATCH_TIME [n] must be left at the value “0”.

Backlash compensation

Overview

The falsification of the axis travel due to mechanical backlash can be compensated (cf. Technical Manual “Description of Functions“).

Function

The axis–specific actual value is corrected by the backlash compensation value (MD32450 BACKLASH) each time the traversing direction changes.

Activation

The backlash compensation is active in all operating modes only after referencing.

Note

Which step size is added to the backlash compensation value is determined by MD36500 ENC_CHANGE_TOL.

Leadscrew error compensation(LEC)

Overview

The compensation values are determined using the measured error characteristic and are entered in the control system using special system variables during start-up. The compensation tables (cf. Technical Manual “Description of Functions“) must be created in the form of NC programs.

Function

With the leadscrew error compensation (LEC), the axis-specific actual position value is corrected by the appropriate compensation value.

If the compensation values are too large, it is possible that alarm message are output (e.g. contour monitoring, speed setpoint limitation).

Activation

The LEC is only activated in all operating modes if the following requirements are met:

- The number of compensation intermediate points must be defined. They are only active after Power ON (MD: MM_ENC_MAX_POINTS).

Warning

Changing the MD: MM_CEC_MAX_POINTS[t] or MM_ENC_COMP_MAX_POINTS automatically reorganizes the NC user memory when the control system is booting. All user data stored in the user memory (e.g. drive and MMC machine data, tool offsets, part programs, compensation tables etc.) are deleted.

- Enter the compensation value for the intermediate point N in the compensation value table (ENC_COMP_[0,N,Axi]).
- Select the distance between the individual intermediate points (ENC_COMP_STEP [0,Axi]).
- Select the start position (ENC_COMP_MIN [0,Axi]).
- Define the end position (ENC_COMP_MAX [0,Axi]).
- In the NC, set MD: ENC_COMP_ENABLE(0)=0. This is the only way to load the compensation table.
- The compensation values for the machine axes are entered into the NC memory by means of a part program (see also example in the Manual “Description of Functions“)
- Approach the reference points in the axes. Then start the NC program with the leadscrew error compensation table. The reference points must then be approached once more to set the LEC active. The LEC function is activated by setting the MD: ENC_COMP_ENABLE(0)=1 for each machine axis.
  - Another possibility to create the LEC compensation table is by reading out the LEC file from the NC via the V24 interface.

    MD: MM_ENC_MAX_POINTS must be set depending on the number of axes to be compensated. Select Service using the softkey, put the cursor to Data, and press the **Show** softkey. Then select “Leadscrew Error” using the cursor and press the **Data Out** softkey.

    Enter compensation values, intermediate point distance, start and end position in the received file _N_COMPLETE_EEC by means of the editor (e.g. in the PCIN/OUT program). Then re–read the edited file into the control system. Approach the reference point in the axes and set MD: ENC_COMP_ENABLE(0)=1. The LEC is thus activated.

4.7.3 Starting up the spindle

Overview

With the SINUMERIK 802S, the spindle is a subfunction of the entire axis functionality. The machine data of the spindle are therefore to be found under the axis machine data (from MD35000 onwards). For this reason, data have to be entered for the spindle, too; these data are described for axis start-up.

Note

The standard machine data include spindle adjustment in the 4th machine axis (SP).

In the SINUMERIK 802S, the 4th machine axis (SP) is always assigned to the spindle.

The spindle setpoint (±10 V analog voltage signal) is output to **X3**. The spindle measuring system must be connected to **X4**.

Simulation/spindle

The axis MD **30130_CTRLOUT_TYPE** and **30240_ENC_TYPE** can be used to switch the setpoint output between simulation and axis operation.

Table 4-13

MD	Simulation	Normal Mode
30130	Value = 0 To test the spindle, the spindle setpoint is internally fed back as an actual value. No setpoint output to connector X2	Value =1 The setpoint signals are output to X3. Real rotation of the spindle is possible.
30240	Value = 0	Value = 2

Spindle modes

The following modes are possible for the spindle:

- Control mode (M3, M4, M5)
- Oscillating mode (to assist gearbox change)
- Positioning mode (SPOS)

MD for spindle

Number	Explanation	Default Value
30130	Output type of setpoint (setpoint branch):	0
3020	Number of encoders	1
30240	Type of actual value acquisition (actual position value) (encoder no.) 0: Simulation 2: Square-wave generator, standard encoder (pulse multiplication)	0
30350	Output of axis signals with simulation axes	0
31020	Encoder markings per revolution (encoder no.)	2048
31030	Pitch of leadscrew	10
31040	Encoder mounted directly to the machine (encoder no:)	0
31050	Denominator load gearbox (control parameter no.): 0...5	1

Number	Explanation	Default Value
31060	Numerator load gearbox (control parameter set no.): 0...5	1
31070	Denominator resolver gearbox (encoder no.)	1
31080	Numerator resolver gearbox (encoder no.)	1
32100	Traversing direction (not control direction)	1
32110	Sign actual value (control direction) (encoder no.)	1
32200	Servo gain factor (control parameter set no.): 0...5	1
32260	Rated motor speed (setpoint branch): 0	3000
32700	Interpolatory compensation (encoder no.): 0,1	0
33050	Traversing distance for lubrication from PLC	100 000 000
35010	Gear change possible. Spindle has several gear steps	0
35040	Own spindle reset	0
35100	Maximum spindle speed	10000
35110	Maximum speed for gear change (gear stage no.): 0..5	500,...
35120	Minimum speed for gear change (gear stage no.): 0..5	50,...
35130	Maximum speed of gear stage (gear stage no.): 0...5	500,...
35140	Minimum speed of gearsetp (gear stage no.): 0...5	5,...
35150	Spindle speed tolerance	0.1
35160	Spindle speed limitation from PLC	1000
35220	Speed for reduced acceleration	1.0
35230	Reduced acceleration	0.0
35300	Position control switch-on speed	500
35350	Direction of rotation when positioning	3
35400	SPIND_OSZILL_DES_VELO	500
35410	SPIND_OSZILL_ACCEL	16
35430	SPIND_OSZILL_START_DIR	0
35440	SPIND_OSZILL_TIME_CW	1
35450	SPIND_OSZILL_TIME_CCW	0,5
35510	Feedrate enable for spindle stopped	0
36000 (nur bei SPOS)	Exact positioning coarse	0.04
36010 (nur bei SPOS)	Exact positioning fine	0.01
36020 (nur bei SPOS)	Delay exact positioning fine	1
36030 (only SPOS)	Zero-speed tolerance	0.2

Number	Explanation	Default Value
36040 (only SPOS)	Delay zero-speed monitoring	0.4
36050 (only SPOS)	Clamping tolerance	0.5
36060 (only SPOS)	Maximum velocity/speed ”axis/spindle stopped”	0,0138
36200	Threshold value for velocity monitoring (control parameter set no.): 0...5	31,94
36300	Encoder limit frequency	300000
36302	Encoder limit frequency at which encoder is switched on again. (Hysteresis)	99.9
36310	Zero mark monitoring (encoder no.): 0,1 0: Zero mark monitoring off, encoder HW monitoring on 1-99, >100: Number of recognized zero mark errors during monitoring 100: Zero mark monitoring off, encoder HW monitoring off	0
36610	Duration of the deceleration ramp for error states	0.05
36620	Cutout delay servo enable	0.1
36700	Automatic drift compensation	0
36710	Drift limit value for automatic drift compensation	1
36720	Drift basic value	0

SD for spindle

Number	Explanation	Default Value
43210	Progr. spindle speed limitation G25	0
43220	Progr. spindle speed limitation G26	1000
43230	Spindle speed limitation with G96	100

Spindle MD parameterization

Spindle machine data are entered depending on the gear stages. Each gear stage is assigned a parameter set.

The set of parameters selected corresponding to the current gear stage.

Example: 1st gear stage → set of parameters [1]

Note

The field containing the parameter “0” is **not** used for the spindle machine data..

Spindle configuration

Machine data for setpoint and actual values

Setpoints:

MD 30130 CTRLOUT_TYPE [AX4] = 1

Actual values:

MD 30200 NUM_ENCS[AX4] = 0 ;Spindle without encoder
MD 30200 NUM_ENCS[AX4] = 1 ;Spindle with encoder
MD 30240 ENC_TYPE[AX4] = 2

Matching the spindle encoder

Machine data required to match the encoders

Number	Description	Spindle	
31040	Encoder mounted directly to the machine	0	1
31020	Encoder markings per revolution	Increments /rev.	Incr./rev’s
31080	Numerator resolver gearbox	Motor rev’s	Load rev’s
31070	Denominator resolver gearbox	Encoder rev’s	Encoder rev’s
31060	Numerator load gearbox (control parameter set no.): 0...5	Motor rev’s	Motor rev’s
31050	Denominator load gearbox (control parameter no.): 0...5	Load rev’s	Load rev’s

Example 1 for encoder matching:

Spindle with square–wave encoder (500 pulses) mounted directly on the spindle. The internal multiplication = 4. The internal computational resolution amounts to 1,000 increments per degree.

$$\text{Internal resolution} = \frac{360 \text{ degrees}}{\text{MD31020} \cdot 4} \cdot \frac{\text{MD31080}}{\text{MD31070}} \cdot 1000$$

$$\text{Internal resolution} = \frac{360 \cdot 1 \cdot 1000}{500 \cdot 4 \cdot 1} = 180$$

One encoder increment amounts to 180 internal increments. One encoder increment amounts to 0.18 degrees (finest positioning possibility).

Example 2 for encoder matching:

Spindle with rotary encoder mounted on the motor (2,048 pulses), internal multiplication = 4, 2 gear stages existing:
Gear stage 1: Motor/spindle = 2.5/1
Gear stage 2: Motor/spindle = 1/1

Gear stage 1

$$\text{Internal resolution} = \frac{360 \text{ degrees}}{\text{MD31020} \cdot 4} \cdot \frac{\text{MD31080}}{\text{MD31070}} \cdot \frac{\text{MD31050}}{\text{MD31060}} \cdot 1{,}000 \text{ incr/degree}$$

$$\text{Internal resolution} = \frac{360 \text{ degrees}}{4 \cdot 2{,}048 \text{ pulses}} \cdot \frac{1}{1} \cdot \frac{1}{2.5} \cdot 1{,}000 \text{ pulses/deg.} = 17.5781$$

One encoder increment corresponds to 17.5781 internal increments. One encoder increment corresponds to 0.0175781 degrees (finest positioning possibility).

Gear stage 2

$$\text{Internal resolution} = \frac{360 \text{ degrees}}{\text{MD31020} \cdot 4} \cdot \frac{\text{MD31080}}{\text{MD31070}} \cdot \frac{\text{MD31050}}{\text{MD31060}} \cdot 1{,}000 \text{ inc./deg.}$$

$$\text{Internal resolution} = \frac{360 \text{ deg.}}{4 \cdot 2.048 \text{ pulses}} \cdot \frac{1}{1} \cdot \frac{1}{1} \cdot 1{,}000 \text{ pulses/deg.} = 43.945$$

One encoder increment corresponds to 43.945 internal increments. One encoder increment corresponds to 0.043945 degrees (finest positioning possibility).

Spindle setpoint adaptation

To adapt the spindle setpoint and its gear stage, the following axis MD and interface signals are relevant:

Number	Description
32010	Rapid traverse in jog mode
32020	Jog axis velocity
35110	Maximum speed for gear change (gear stage no.): 0..5
35120	Minimum speed for gear change (gear stage no.): 0..5
35130	Maximum speed of gear stage (gear stage no.): 0...5
35140	Minimum speed of gearsetp (gear stage no.): 0...5
35200	Acceleration in speed control mode [gear stage no.]: 0...5
31060	Numerator load gearbox (control parameter set no.): 0...5
31050	Denominator load gearbox (control parameter no.): 0...5
Interface signals	
	“Switch gear“ 39032000 bit 3
	“Actual gearstage” 38032000 bits 0 through 2

Number	Description
	“No speed monitoring when switching the gear” 38032000 bit 6
	“Gear has been switched” 38032000 bit 3
	“Setpoint gear stage” 39032000 bits 0 through 2
	“Positioning mode” 39032002 bit 5
	“Reciprocation by PLC”38032002 bit 4
	“Reciprocation mode” 39032002 bit 6
	“Control mode” 39032002 bit 7
	“Traversing minus” 39030004 bit 6
	“Traversing plus” 39030004 bit 7

The default settings of these MD has been selected such that spindle motion is possible both in the simulation mode (MD 30130=0) and with drive (MD 30130=1).

Reciprocation mode for gear change

The reciprocation mode of the spindle is intended to facilitate the gear change. For the reciprocation mode, the following axis MD and interface signals are relevant:

Number	Description
35400	Reciprocation speed
35410	Acceleration when reciprocating
35430	Start direction in reciprocation
35440	Reciprocation time for M3 direction
35450	Reciprocation time for M4 direction
	Interface signals
	“Switch gear“ 39032000 bit 3
	“Reciprocation speed” 38032002 bit 5
	“Reciprocation by PLC”38032002 Bit 4
	“Setpoint direction CCW“ bit 7
	“Setpoint direction CW” 38032002 bit 6
	“Reciprocation mode” 39032002 bit 6
	“Gear has been switched” 38032000 bit 3

4.7.4 Completing the start–up

After start–up of the control system by the machine manufacturer, the following should be observed prior to delivery to the end customer:

1. Change the default password for access level 2 from ”EVENING” to your own password.

   If the machine manufacturer uses the password ”EVENING” for access level 2 during the start–up work, the password must be changed.

   – Press the softkey **Change passw.**

   – Enter the new password and press OK to confirm.

   – Note the password in the Manufacturer Documentation.

2. Reset the access level.

   To save the data which have been set during the start–up, an internal data saving is required. To this aim, set access level 7 (end customer); otherwise, access level 2 will also be saved.

   – Press the softkey **Delete passw.**

   – The access level will be reset.

3. Carry out internal data saving.

   – Press the **Save data** softkey.

4.7.5 Starting up the cycles

Sequence of operations

When loading cycles into the control system, adhere to the following sequence of operations:

1. Save tool compensation data and zero offsets either on the FLASH or on the PG (programming device).
   These data can be selected from the **Services** menu by pressing the **Data outp./data...**softkey.
2. Load all files of the selected technology path from the toolbox diskette into the control system via the V24 interface.
3. Carry out POWER ON.
4. Reload the saved data.

4.8 Series machine start-up

Functionality

The objective of series machine start-up is:

- after commissioning, in order to bring another control system connected to the same machine type with minimum effort to the condition as after commissioning;

  or

- under service conditions (after replacing hardware components), to bring a new control system to the initial state with minimum effort.

Precondition

To carry out commissioning, a PC/PG provided with a V24 interface for data transfer from/to the control system is necessary.

In the PC/PG, the **WinPCIN** tool must be used.

Sequence of operations

1. Create the series machine start-up file (transfer from the control system to the PC/PG).:
   - Make a V24 cable connection between the PC/PG (COM port) and the SINUMERIK 802S (X8).
   - Make the following settings in the WinPCIN tool:
   - – Binary format
– Receive data
– Select the path where you want to save your data
– Save
– The PC/PG will set itself to “Receive” and will wait for data from the control system.
   - Enter the password for protection level 2 in the control system.
   - Call the **Services/RS232 setting** menu.
   - Select the **Start-up data** line from the **Services** menu and press **Start data outp.** to output the series machine start-up file.
2. Reading in the series machine start-up file into the SINUMERIK 802S:
   - Enter the V24 interface settings as described under 1).
   - Press the **Data In Start** button in the **Service** menu. The control system is thus ready to receive data.
   - Use the PCIN tool in the PC/PG to select the series start-up file from the **DATA_OUT** menu and start data transfer.
   - The control system is brought to “RESET with rebooting” three times during and at the end of data transfer. On completion of error-free data transfer, the control system is completely configured and ready to operate.

Series machine start-up file

The series machine start-up file contains:

- machine data
- R parameters
- display and alarm text files
- display machine data
- PLC user program
- main programs
- subroutines
- cycles

Software Update

5

5.1 Updating the system software using a PC/PG

General

The following reasons may require a system software update:

- You wish to install new system software (new software version).
- After hardware replacement, if software versions other than the supplied are to be loaded.

Note

In addition to the update procedure description below, the update diskette also contains a description of the update procedure in the readme.txt file.

Preconditions

To change the system software of the SINUMERIK 802S, you will need the following:

- Update software (2 diskettes)
- A PG/PC with V24 interface (COM1 or COM2) and an appropriate cable.

Update procedure

As far as not yet done, carry out external data saving before you update your updating system software (see Section 4.1.4 “Data Saving”).

1. Turn the hardware start–up switch to position “2” (software update on permanent memory).
2. Start the update file on your PC/PG by calling UPD_802.BAT on your diskette.

The installation is menu–assisted.

3. After the software has been prepared in the PC/PG completely, the message “Transfer the selected ...” appears on the display.
4. **Power On** ---> control system changes to the update condition.
   Various patterns appear on the screen.
5. After the patterns on the display of the SINUMERIK 802S have disappeared, start the transfer on the PC/PG.

The progress and the end of the update (and errors if any) are displayed on the PG/PC.

6. At the end of the update --> switch off the control system.
7. Turn the start–up switch to position “1” ---> switch on the control system
8. Booting with default values
9. Prior to next POWER ON ---> start–up switch to 0 position.

Note

Reload the externally saved user standard data via V24.

5.2 Updating the system software incl. user data without using a PC/PG

General

It is possible to transfer the entire contents of the memory of the control system including user data from one control system directly to another control system.

This can be necessary after updating the system software of a CNC and subsequent reloading the recovered user data (series start–up file) into this control system in order to bring further control systems to the same condition.

This reduces the time needed for the transfer.

Precondition

Cable connection from master control system (source control) to slave control (control system to be updated) via V24 interface.

Update sequence

1. Turn the hardware start–up switch of both control systems to position “2” (software update on permament memory).
2. Carry out **POWER ON** for slave control system ——> control system changes to the update condition.
   Various patterns appera on the screen.
3. After the patterns on the screen have disappeared, switch on the master control system on the slave control.

3 data blocks are transferred.

5.3 Update errors

Table 5-1 Update errors

Error Text	Explanation	Remedial Action
ERROR UPDATE	Error when updating the system software via V24 • Data already in receive buffer (send from PC side started too early) • Error when erasing the FLASH memory • Error when writing to the FLASH memory • Inconsistent data (incomplete or faulty)	• Repeat update • Check link between control system and PC/PG • Check diskette
SINUMERIK 802S UPDATE NO DATA	Update without programming the code FLASH completed (no data received, transfer not started)	

Technical Appendix

6

6.1 List of machine and setting data

Data type

BOOLEAN	Machine data bit (1 or 0)
BYTE	Integer values (from -128 to 127)
DOUBLE	Real and integer values (from $\pm$ 4.19 · 10^{-307} to $\pm$ 1.67 · 10^{308})
DWORD	Integer values (from -2.147 · 10^{9} to 2.147 · 10^{9})
STRING	Character string (max. 16 characters) consisting of upper-case letters with digits and underscore
UNSIGNED WORD	Integer values (from 0 to 65536)
SIGNED WORD	Integer values (from -32768 to 32767)
UNSIGNED DWORD	Integer values (from 0 to 4294967300)
SIGNED DWORD	Integer values (from -2147483650 to 2147483649)
WORD	Hex values (from 0000 to FFFF)
DWORD	Hex values (from 00000000 to FFFFFFFF)
FLOAT DWORD	Real values (from $\pm$8.43 · 10^{-37} to $\pm$3.37 · 10^{38})

6.1.1 Display machine data

Number	**MD Name**				
Representation	Name, Miscellaneous			**Activated**	User Class w/r
Unit	Standard value	Minimum value	Maximum value	Data type	
202	**$MM_FIRST_LANGUAGE**				
Decimal	Foreground language			**Power On**	2/3
0	1	1	2	Byte	
203	**$MM_DISPLAY_RESOLUTION**				
Decimal	Display resolution			**Power On**	2/3
0	3	0	5	Byte	
206	**$MM_USER_CLASS_WRITE_TOA_GEO**				
Decimal	User class Write tool geometry			**Immediately**	2/3
0	3	0	7	Byte	
207	**$MM_USER_CLASS_WRITE_TOA_WEAR**				
Decimal	User class Write tool wear data			**Immediately**	2/3
0	3	0	7	Byte	

208	$MM_USER_CLASS_WRITE_ZOA				
Decimal	User class Write settable zero offset			**Immediately**	2/3
0	3	0	7	Byte	

210	$MM_USER_CLASS_WRITE_SEA				
Decimal	User class Write setting data			**Immediately**	2/3
0	3	0	7	Byte	

216	$MM_USER_CLASS_WRITE_RPA				
Decimal	User class Write R parameters			**Immediately**	2/3
0	3	0	7	Byte	

217	$MM_USER_CLASS_SET_V24				
Decimal	User class Set V24			**Immediately**	2/3
0	3	0	7	Byte	

219	$MM_USER_CLASS_DIR_ACCESS				
Decimal	User class access directory			**Immediately**	2/3
0	3	0	7	Byte	

277	$MM_USER_CLASS_PLC_ACCESS				
Decimal	User class access PLC project			**Immediately**	2/3
0	3	0	7	Byte	

278	$MM_NCK_SYSTEM_FUNC_MASK				
Decimal	Option data to enable system–specific functions			**POWER ON**	2/2
0	0	0	15	Byte	

280	$MM_V24_PPI_ADDR_PLC				
Decimal	PPI address of the PLC			**POWER ON**	3/3
0	2	0	126	BYTE	

281	$MM_V24_PPI_ADDR_NCK				
Decimal	PPI address of the NCK			**POWER ON**	3/3
0	3	0	126	BYTE	

282	$MM_V24_PPI_ADDR_MMC				
Decimal	PPI address of the HMI			**POWER ON**	3/3
0	4	0	126	BYTE	

283	$MM_V24_PPI_MODEM_ACTIVE				
Decimal	Modem active			**Immediately**	3/3
0	0	0	1	BYTE	

284	$MM_V24_PPI_MODEM_BAUD				
Decimal	Modem baud rate			**Immediately**	3/3
0	7	5	9	BYTE	

285	$MM_V24_PPI_MODEM_PARITY				
Decimal	Modem parity			**Immediately**	3/3
0	0	0	2	BYTE	

6.1.2 General machine data

Number	MD Name				
Unit	Name, Miscellaneous		Activated		
HW / function	Standard value	Minimum value	Maximum value	D type	User class

10074	PLC_IPO_TIME_RATIO				
-	PLC task factor for main run		POWER ON		
	2	1	50	DWORD	2/7

10240	SCALING_SYSTEM_IS_METRIC				
-	Basic system metric		POWER ON		
_always	1	***	***	BOOLEAN	2/7

11100	AUXFU_MAXNUM_GROUP_ASSIGN				
-	Number of auxiliary functions distr. amongst aux. fct. groups		POWER ON		
_always	1	1	50	BYTE	2/7

11200	INIT_MD				
HEX	Standard machine data loaded on next Power On		POWER ON		
_always	0x0F	-	-	BYTE	2/7

11210	UPLOAD_MD_CHANGE_ONLY				
HEX	Saving only of modified MD (value=0: complete= no difference)		RESTART		
–	0x0F	–	–	BYTE	2/7

11310	HANDWH_REVERSE				
-	Threshold for direction change handwheel		POWER ON		
_always	2	0.0	plus	BYTE	2/7

11320	HANDWH_IMP_PER_LATCH				
-	Handwheel pulses per detent position (handwheel number): 0...1		POWER ON		
_always	1., 1.	-	-	DOUBLE	2/7

14510	USER_DATA_INT [n]				
kB	User data (INT) 0 ... 31		POWER ON		
_always	-	0	-	DWORD	2/7

14512	USER_DATA_HEX [n]				
kB	User data (Hex) 0 ... 31		POWER ON		
-	0	0	0xFF	BYTE	2/7

14514	USER_DATA_FLOAT [n]				
-	User data (Float) 0 ... 7		POWER ON		
-	0.0	...	...	DOUBLE	2/7

14516	USER_DATA_PLC_ALARM [n]				
-	User data (Hex) Alarm bit 0 ... 31		POWER ON		
-	0	0	0xFF	BYTE	2/7

6.1.3 Channel-Specific Machine Data

Number	MD Name				
Unit	Name, Miscellaneous		Activated		
HW / function	Standard value	Minimum value	Maximum value	D type	User class

20210	CUTCOM_CORNER_LIMIT				
Degrees	Maximum angle for compensation blocks with TRC		POWER ON		
_always	100	0.0	150.	DOUBLE	2/7

20700	REFP_NC_START_LOCK				
-	NC-Start disable without reference point		RESET		
_always	1	0	1	BOOLEAN	2/7

21000	CIRCLE_ERROR_CONST				
mm	Circle end point monitoring constant		POWER ON		
_always	0.01	0.0	plus	DOUBLE	2/7

22000	AUXFU_ASSIGN_GROUP				
-	Auxiliary function group (aux. fct. no. in channel): 0...49		POWER ON		
_always	1	1	15	BYTE	2/7

22010	AUXFU_ASSIGN_TYPE				
-	Auxiliary function type (aux. fct. no. in channel): 0...49		POWER ON		
_always	, ,	-	-	STRING	2/7

22030	AUXFU_ASSIGN_VALUE				
-	Auxiliary function value (aux. fct. no. in channel): 0...49		POWER ON		
_always	0	-	-	DWORD	2/7

22550	TOOL_CHANGE_MODE				
-	New tool compensation for M function		POWER ON		
_always	0	0	1	BYTE	2/7

27800	TECHNOLOGY_MODE				
-	Technology in the channel (value=0: milling, value=1: turning)		NEW CONF		
	1	0	1	BYTE	2/7

6.1.4 Axis-specific machine data

Number	MD Name				
Unit	Name, Miscellaneous		Activated		
HW / function	Standard value	Minimum value	Maximum value	D type	User class

30130	CTRLOUT_TYPE				
-	Output type of setpoint (setpoint branch): 0		POWER ON		
_always	0	0	2	BYTE	2/7

30200	NUM_ENCS				
-	Anzahl der Geber (1 oder kein Geber für die Spindel)		RESTART		
	1	0	1	BYTE	2/7

30240	ENC_TYPE				
-	Type of actual value acquisition (actual position value) (encoder no.) 0: Simulation 2: Square-wave generator, standard encoder (pulse multiplication) 3: Encoder for stepper motor		POWER ON		
_always	0, 0	0	4	BYTE	2/7

30350	SIMU_AX_VDI_OUTPUT				
-	Output of axis signals with simulation axes		POWER ON		
_always	0	***	***	BOOLEAN	2/7

30600	FIX_POINT_POS				
mm, degrees	Fixed-value positions of axis with G75 (position no.)		POWER ON		
_always	0.0	-	-	DOUBLE	2/7

31000	ENC_IS_LINEAR				
-	Direct measuring system (linear scale) (encoder no.)		POWER ON		
_always	0	***	***	BOOLEAN	2/7

31010	ENC_GRID_POINT_DIST				
mm	Division period for linear scales (encoder no.)		POWER ON		
_always	0.01	0.0	plus	DOUBLE	2/7

31020	ENC_RESOL				
-	Encoder markings per revolution (encoder no.)		POWER ON		
_always	2048	0.0	plus	DWORD	2/7

31030	LEADSCREW_PITCH				
mm	Pitch of leadscrew		POWER ON		
_always	10.0	0.0	plus	DOUBLE	2/7

31040	ENC_IS_DIRECT				
-	Encoder mounted directly to the machine (encoder no:)		POWER ON		
_always	0	***	***	BOOLEAN	2/7

31050	DRIVE_AX_RATIO_DENOM				
-	Denominator load gearbox (control parameter no.): 0...5		POWER ON		
_always	1, 1, 1, 1, 1, 1	1	2147000000	DWORD	2/7

31060	DRIVE_AX_RATIO_NUMERA				
-	Numerator load gearbox (control parameter set no.): 0...5		POWER ON		
_always	1, 1, 1, 1, 1, 1	1	2147000000	DWORD	2/7

31070	DRIVE_ENC_RATIO_DENOM				
-	Denominator resolver gearbox (encoder no.)		POWER ON		
_always	1	1	2147000000	DWORD	2/7

31080	DRIVE_ENC_RATIO_NUMERA				
-	Numerator resolver gearbox (encoder no.)		POWER ON		
_always	1	1	2147000000	DWORD	2/7

31090	JOG_INCR_WEIGHT		
mm, degrees	Evaluation of an increment with INC/handwheel	RESET	

31100	BERO_CYCLE				
-	Steps for monitoring rotation		POWER ON		
	2000	10	10000000	DWORD	2/7

31110	BERO_EDGE_TOL				
-	Step tolerance for monitoring rotation		POWER ON		
	50	10	10000000	DWORD	2/7

31350	FREQ_STEP_LIMIT				
-	Stepping rate at maximum velocity		NEW CONF		
Hz	250000	0.1	4000000	DOUBLE	2/7

31400	STEP_RESOL				
-	Steps per stepper motor revolution		POWER ON		
	1000	0	plus	DWORD	2/7

31500	AXIS_NUMBER_FOR_MONITORING				
-	Display setpoint of this axis ollwert for servicing		POWER ON		
	0	0	4	DWORD	2/7

32000	MAX_AX_VELO				
mm/min, rev/min	Maximum axis velocity		NEW CONF		
_always	10000.	0.0	plus	DOUBLE	2/7

6.1 List of machine and setting data

32010	JOG_VELO_RAPID				
mm/min, rev/min	Rapid treverse in jog mode		RESET		
_always	10000.	0.0	plus	DOUBLE	2/7

32020	JOG_VELO				
mm/min, rev/min	Jog axis velocity		RESET		
_always	2000.	0.0	plus	DOUBLE	2/7

32070	CORR_VELO				
%	Axis velocity for handwheel override, ext. ZO, cont. dressing, distance control		RESET		
_always	50	0.0	plus	DWORD	2/7

32100	AX_MOTION_DIR				
-	Traversing direction (not control direction)		POWER ON		
_always	1	-1	1	DWORD	2/7

32110	ENC_FEEDBACK_POL				
-	Sign actual value (control direction) (encoder no.)		POWER ON		
_always	1	-1	1	DWORD	2/7

32200	POSCTRL_GAIN				
1000/min	Servo gain factor (control parameter set no.): 0...5		NEW CONF		
_always	(2,5; 2,5; 2,5; 1), ...	0.0	plus	DOUBLE	2/7

32260	RATED_VELO				
rev/min	Rated motor speed (setpoint branch): 0		NEW CONF		
_always	3000	0.0	plus	DOUBLE	2/7

32300	MAX_AX_ACCEL				
mm/s^2, rev/s^2	Axis acceleration		NEW CONF		
_always	1	0	***	DOUBLE	2/7

32450	BACKLASH				
mm	Backlash		NEW CONF		
_always	0.000	*	*	DOUBLE	2/7

32700	ENC_COMP_ENABLE				
-	Interpolatory compensation (encoder no.): 0,1		POWER ON		
_always	0	***	***	BOOLEAN	2/7

32900	DYN_MATCH_ENABLE				
-	Dynamic response adaptation		NEW_CONF		
	0	0	1	BYTE	2/7

32910	DYN_MATCH_TIME				
-	Time constant of dynamic adaption (control parameter set no): 0...5			NEW_CONF	
	0	0.0	plus	DOUBLE	2/7

32920	AC_FILTER_TIME				
s	Smoothing factor time constant for adaptive control			POWER ON	
_always	0.0	0.0	plus	DOUBLE	2/7

33050	LUBRICATION_DIST				
mm, deg.	Traversing distance for lubrication from PLC			NEW CONF	
_always	100000000	0.0	plus	DOUBLE	2/7

34000	REFP_CAM_IS_ACTIVE				
-	Axis with reference point cam			RESET	
_always	1	***	***	BOOLEAN	2/7

34010	REFP_CAM_DIR_IS_MINUS				
-	Approach reference point in minus direction			RESET	
_always	0	***	***	BOOLEAN	2/7

34020	REFP_VELO_SEARCH_CAM				
mm/min, rev/min	Reference point approach velocity			RESET	
_always	5000.0	0.0	plus	DOUBLE	2/7

34030	REFP_MAX_CAM_DIST				
mm, deg.	Maximum distance to reference cam			RESET	
_always	10000.0	0.0	plus	DOUBLE	2/7

34040	REFP_VELO_SEARCH_MARKER				
mm/min, rev/min	Creep speed (encoder no.)			RESET	
_always	300.0	0.0	plus	DOUBLE	2/7

34050	REFP_SEARCH_MARKER_REVERSE				
-	Direction reversal to reference cams (encoder no.)			RESET	
_always	0	***	***	BOOLEAN	2/7

34060	REFP_MAX_MARKER_DIST				
mm, deg.	Maximum distance to reference mark. Max. distance to 2 reference marks for distance-coded measuring systems.			RESET	
_always	20.0	0.0	plus	DOUBLE	2/7

34070	REFP_VELO_POS				
mm/min, rev/min	Reference point positioning velocity			RESET	
_always	1000.0	0.0	plus	DOUBLE	2/7

34080	REFP_MOVE_DIST				
mm, deg.	Reference point distance/target point for distance-coded system			RESET	
_always	-2.0	-	-	DOUBLE	2/7

34090	REFP_MOVE_DIST_CORR				
mm, deg.	Reference point offset/absolute offset distance-coded			POWER ON	
_always	0.0	-	-	DOUBLE	2/7

34092	REFP_CAM_SHIFT				
mm, deg.	Electr. cam offset of incremental measuring systems with equidistant zero marks			RESET	
_always	0.0	0.0	plus	DOUBLE	2/7

34100	REFP_SET_POS				
mm, deg.	Reference point value/irrelevant for distance-coded system: 0 ... 3			RESET	
_always	0., 0., 0., 0.	-	-	DOUBLE	2/7

34110	REFP_CYCLE_NR				
-	Sequence of axes in channel-specific referencing -1: No obligatory reference point for NC Start 0: No channel-specific reference-point approach 1-15: Sequence in channel-specific reference point approach		RESET		
_always	1	-1	31	DWORD	2/7

34200	ENC_REFP_MODE				
-	Type of position measuring system 0: No ref. point appr.; if an absolute encoder exists: REFP_SET_POS accepted 1: Zero pulse (on encoder track) 2: BERO 3: Distance-coded reference marks 4: Bero with two edges 5. BERO cam		POWER ON		
_always	1	0	6	BYTE	2/7

35010	GEAR_STEP_CHANGE_ENABLE				
-	Gear change possible. Spindle has several gear steps		POWER ON		
_always	0	***	***	BOOLEAN	2/7

35040	SPIND_ACTIVE_AFTER_RESET				
-	Own spindle reset		POWER ON		
_always	0	***	***	BOOLEAN	2/7

35100	SPIND_VELO_LIMIT				
rev/min	Maximum spindle speed		POWER ON		
_always	10000	0.0	plus	DOUBLE	2/7

35110	GEAR_STEP_MAX_VELO				
rev/min	Maximum speed for gear change (gear stage no.): 0..5		NEW CONF		
_always	500, 500, 1000, 2000, 4000, 8000	0.0	plus	DOUBLE	2/7

35120	GEAR_STEP_MIN_VELO				
rev/min	Minimum speed for gear change (gear stage no.): 0..5		NEW CONF		
_always	50, 50, 400, 800, 1500, 3000	0.0	plus	DOUBLE	2/7

35130	GEAR_STEP_MAX_VELO_LIMIT				
rev/min	Maximum speed of gear stage (gear stage no.): 0...5		NEW CONF		
_always	500, 500, 1000, 2000, 4000, 8000	0.0	plus	DOUBLE	2/7

35140	GEAR_STEP_MIN_VELO_LIMIT				
rev/min	Minimum speed of gearsetp (gear stage no.): 0...5		NEW CONF		
_always	5, 5,10, 20, 40, 80	0.0	plus	DOUBLE	2/7

35150	SPIND_DES_VELO_TOL				
Factor	Spindle speed tolerance		RESET		
_always	0.1	0.0	1.0	DOUBLE	2/7

35160	SPIND_EXTERN_VELO_LIMIT				
rev/min	Spindle speed limitation from PLC		NEW CONF		
_always	1000	0.0	plus	DOUBLE	2/7

35200	GEAR_STEP_SPEEDCTRL_ACCEL				
rev/s^2	Acceleration in speed control mode [gear stage no.]: 0...5		NEW CONF		
_always	30, 30, 25, 20, 15, 10	2	***	DOUBLE	2/7

35210	GEAR_STEP_POSCTRL_ACCEL				
rev/s^2	Acceleration in position control mode (gear stage no.): 1...5		NEW CONF		
_always	30, 30, 25, 20, 15, 10	2	***	DOUBLE	2/7

35220	ACCEL_REDUCTION_SPEED_POINT				
Factor	Speed for reduced acceleration		RESET		
_always	1.0	0.0	1.0	DOUBLE	2/7

35230	ACCEL_REDUCTION_FACTOR				
Factor	Reduced acceleration			RESET	
_always	0.0	0.0	0.95	DOUBLE	2/7

35240	ACCEL_TYPE_DRIVE				
-	Type of acceleration			RESET	
	0	0	1	BOOLEAN	2/7

35300	SPIND_POSCTRL_VELO				
rev/min	Position control switch-on speed			NEW CONF	
_always	500	0.0	plus	DOUBLE	2/7

35350	SPIND_POSITIONING_DIR				
-	Direction of rotation when positioning			RESET	
_always	3	3	4	BYTE	2/7

35400	SPIND_OSCILL_DES_VELO				
rev/min	Reciprocation speed			NEW CONF	
_always	500	0.0	plus	DOUBLE	2/7

35410	SPIND_OSCILL_ACCEL				
rev/s^2	Acceleration during reciprocating			NEW CONF	
_always	16	2	***	DOUBLE	2/7

35430	SPIND_OSCILL_START_DIR				
–	Starting direction during reciprocation 0–2: As last direction of rotation (zero–speed M3) 3: M3 direction 4: M4 direction			RESET	
_always	0	0	4	BYTE	2/7

35440	SPIND_OSCILL_TIME_CW				
s	Reciprocation time for M3 direction			NEW CONF	
_always	1.0	0.0	plus	DOUBLE	2/7

35450	SPIND_OSCILL_TIME_CCW				
s	Reciprocation time for M4 direction			NEW CONF	
_always	0.5	0.0	plus	DOUBLE	2/7

35510	SPIND_STOPPED_AT_IPO_START				
-	Feedrate enable for spindle stopped			RESET	
_always	0	***	***	BOOLEAN	2/7

36000	STOP_LIMIT_COARSE				
mm, deg.	Exact positioning coarse			NEW CONF	
_always	0.04	0.0	plus	DOUBLE	2/7

36010	STOP_LIMIT_FINE				
mm, deg.	Exact positioning fine			NEW CONF	
_always	0.01	0.0	plus	DOUBLE	2/7

36020	POSITIONING_TIME				
s	Delay exact positioning fine			NEW CONF	
_always	1.0	0.0	plus	DOUBLE	2/7

36030	STANDSTILL_POS_TOL				
mm, deg.	Zero-speed tolerance			NEW CONF	
_always	0.2	0.0	plus	DOUBLE	2/7

36040	STANDSTILL_DELAY_TIME				
s	Delay zero-speed monitoring			NEW CONF	
_always	0.4	0.0	plus	DOUBLE	2/7

36050	CLAMP_POS_TOL				
mm, deg.	Clamping tolerance		NEW CONF		
_always	0.5	0.0	plus	DOUBLE	2/7

36060	STANDSTILL_VELO_TOL				
mm/min, rev/min	Maximum velocity/speed ”axis/spindle stopped”		NEW CONF		
_always	5 (0.014)	0.0	plus	DOUBLE	2/7

36100	POS_LIMIT_MINUS				
mm, deg.	1st software limit switch minus		RESET		
_always	-100000000	-	-	DOUBLE	2/7

36110	POS_LIMIT_PLUS				
mm, deg.	1st software limit switch plus		RESET		
_always	100000000	-	-	DOUBLE	2/7

36120	POS_LIMIT_MINUS2				
mm, deg.	2nd software limit switch minus		RESET		
_always	-100000000	-	-	DOUBLE	2/7

36130	POS_LIMIT_PLUS2				
mm, de-grees	2nd software limit switch plus		RESET		
_always	100000000	-	-	DOUBLE	2/7

36200	AX_VELO_LIMIT				
mm/min, rev/min	Threshold value for velocity monitoring (control parameter set no.): 0...5		NEW CONF		
_always	11500., 11500., 11500., 11500., ...	0.0	plus	DOUBLE	2/7

36300	ENC_FREQ_LIMIT				
Hz	Encoder limit frequency		POWER ON		
_always	300000	0	plus	DOUBLE	2/7

36302	ENC_FREQ_LIMIT_LOW				
%	Encoder limit frequency at which encoder is switched on again. (Hysteresis)		NEW CONF		
_always	99.9	0	100	DOUBLE	2/7

36310	ENC_ZERO_MONITORING				
-	Zero mark monitoring (encoder no.): 0,1 0: Zero mark monitoring off, encoder HW monitoring on 1-99, >100: Number of recognized zero mark errors during monitoring 100: Zero mark monitoring off, encoder HW monitoring off		NEW CONF		
_always	0, 0	0.0	plus	DWORD	2/7

36500	ENC_CHANGE_TOL				
mm, deg	portion of distance for backlash working		NEW CONF		
_always	0,1	0.0	plus	DOUBLE	2/7

36610	AX_EMERGENCY_STOP_TIME				
s	Duration of the deceleration ramp for error states		NEW CONF		
_always	0.05	0.0	plus	DOUBLE	2/7

36620	SERVO_DISABLE_DELAY_TIME				
s	Cutout delay servo enable		NEW CONF		
_always	0.1	0.0	plus	DOUBLE	2/7

36700	DRIFT_ENABLE				
-	Automatic drift compensation		NEW CONF		
_always	0	***	***	BOOLEAN	2/7

36710	DRIFT_LIMIT				
%	Drift limit value for automatic drift compensation		NEW CONF		
_always	1.000	0.0	plus	DOUBLE	2/7

36720	DRIFT_VALUE				
%	Drift basic value		NEW CONF		
_always	0.0			DOUBLE	2/7

38000	MM_ENC_COMP_MAX_POINTS				
-	Number of intermediate points for interpolatory compensation (SRAM)		POWER ON		
_always	0, 0	0	5000	DWORD	2/7

6.1.5 Setting data

Number	MD Name				
Unit	Name, Miscellaneous		Activated		
HW / function	Standard value	Minimum value	Maximum value	D type	User class

41110	JOG_SET_VELO				
mm/min	Axis speed for JOG		Immediately		
_always	0.0	0.0	plus	DOUBLE	4/4

41200	JOG_SPIND_SET_VELO				
rev/min	Speed for spindle JOG mode		Immediately		
_always	0.0	0.0	plus	DOUBLE	4/4

43210	SPIND_MIN_VELO_G25				
rev/min	Progr. spindle speed limitation G25		Immediately		
_always	0.0	0.0	plus	DOUBLE	4/4

43220	SPIND_MAX_VELO_G26				
rev/min	Progr. spindle speed limitation G26		Immediately		
_always	1000	0.0	plus	DOUBLE	4/4

43230	SPIND_MAX_VELO_LIMS				
rev/min	Spindle speed limitation with G96		Immediately		
_always	100	0.0	plus	DOUBLE	4/4

52011	STOP_CUTCOM_STORE				
	Alarm response for TRC and feedforward stop		Immediately		
-	1	0	1	BOOLEAN	4/4

6.2 PLC user interface signals

The following tables of the user interface signals between PLC and NC (and vice versa) are handled by the integrated fixed user program.

These signals can be displayed using PLC Status in the **Diagnosis/Start–Up/PLC Status** menu.

6.2.1 Address ranges

Operand Identifier	Description	Range
V	Data	V0.0 to V79999999.7 (see below)
T	Timers	T0 to T15
C	Counters	C0 to C31
I	Image of digital inputs	I0.0 to I7.7
Q	Image of digital outputs	Q0.0 to Q7.7
M	Flags	M0.0 to M127.7
SM	Special flags	SM0.0 to SM 0.6 (see below)
AC	ACCU	AC0 ... AC3

Generating the V address range

Type Identifier (DB No.)	Range No. (Channel / Axis No.)	Subrange	Offset	Addressing
10 (10-79)	00 (00-99)	0 (0-9)	000 (000-999)	symbolic (8-digit)

Definition of special flag bits (SM) (read–only)

SM Bits	Description
SM 0.0	Flags with a defined ONE signal
SM 0.1	Initial position: first PLC cycle ‘1’, following cycles ‘0’
SM 0.2	Buffered data lost - only valid in the first PLC cycle (‘0’ - data o.k., ‘1’ - data lost)
SM 0.3	Power On: first PLC cycle ‘1’, following cycles ‘0’
SM 0.4	60 s clock (alternating ‘0’ for 30 s, then ‘1’ for 30 s)
SM 0.5	1 s clock (alternating ‘0’ for 0.5 s, then ‘1’ for 0,5 s)
SM 0.6	PLC cycle clock (alternating one cycle ‘0’, then one cycle ‘1’)

Note

All empty user interface fields in the following tables are **Reserved for SIEMENS** and may neither be written, nor evaluated by the user!

All fields with a “0” contain the value “logic =”.

Variable access rights

[r]	is used to mark a read–only range
[r/w]	is used to mark a read/write range

6.2.2 Retentive data area

1400	Retentive Data [r/w]							
Data block	Interface NCK ———> PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
14000000	User Data							
14000001	User Data							
14000002	User Data							
	...							
	...							
	...							
14000062	User Data							
14000063	User Data							

6.2.3 NCK signals

2600	General signals to NCK [r/w]							
Data block	Interface PLC ———> NCK							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
26000000	Protection level 4	5	6	7		Acknowl. EMER-GENCY STOP	EMER-GENCY STOP	
26000001						Request remaining distances to go by the axes	Request remaining actual distances to go by the axes	
26000002								
26000003								

2700	General signals from NCK [r]							
Data block	Interface NCK ———> PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
27000000							EMER-GENCY STOP active	
27000001								
27000002		Drive ready						
27000003		Ambient tempera-ture alarm						NCK alarm present

3000	**Mode signals to NCK [r/w]**							
Data block			Interface PLC ———> NCK					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
30000000	Reset			Mode Change lock		Mode JOG	MDA	AUTOM.
30000001						Machine function REF		TEACH IN
30000002								
30000003								

3100	**Mode signals from NCK [r]**							
Data block			Interface NCK ———> PLC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
31000000					READY	Active mode JOG	MDA	AUTOM.
31000001						Active machine function REF		TEACH IN

6.2.4 Channel signals

Control signals to NC channel

3200	Signals to NCK channel [r/w]							
Data block	Interface PLC ———> NCK							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
32000000		Activate dry run feed	Activate M01	Activate Single Block [4]				
32000001	Activate Program Test							Activate Referenc-ing
32000002								Activate Skip Block
32000003								
32000004	Feed override [2]							
	H	G	F	E	D	C	B	A
32000005	Rapid traverse override [3]							
	H	G	F	E	D	C	B	A
32000006	Feed [1] override enabled	Rapid tra-verse override enabled		Program level abortion		Delete distance to go	Read–in disabled	Feed lock
32000007				NC stop axes plus spindle	NC stop	NC stop to block limit	NC start	NC start inhibited

Notes:

[1]+ Feed override enabled — Even if the feed override is not enabled (=100%), the 0% position is active.

[2]+ Feed override — 31 positions (Gray code) with 31 MD for % weighting

[3]+ Rapid traverse override — 31 positions (Gray code) with 31 MD for % weighting

[4]+ Single Block — Use the softkey to select Single Block Type Preselection (SBL1/SBL2) (see "User Manual"

Control signals to axes in the WCS

3200	Signals to NCK Channel [r/w]							
Data block	Interface PLC ———> NCK							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
32001000	Axis 1 in WCS Traversing keys +	 –	Rapid traverse override	Traversing key lock	Feed stop	Activate handwheel	2	1
32001001	Axis 1 in WCS Machine function continu-ous				1000 INC	100 INC	10 INC	1 INC
32001002								
32001003								
32001004	Axis 2 in WCS Traversing keys +	 –	Rapid traverse override	Traversing key lock	Feed Stop	Activate handwheel	2	1
32001005	Axis 2 in WCS Machine function continu-ous				1000 INC	100 INC	10 INC	1 INC
32001006								
32001007								
32001008	Axis 3 in WCS Traversing keys +	 –	Rapid traverse override	Traversing key lock	Feed stop	Activate handwheel	2	1
32001009	Axis 3 in WCS Machine function continu-ous				1000 INC	100 INC	10 INC	1 INC
32001010								
32001011								

Status signals from NC channel

3300	Signals from NCK channel [r]							
Data block	Interface NCK ———> PLC							
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
33000000			M0 / M1 active					
33000001	Program test active		M2 / M30 active	Block search active		Revolu-tional feed active		Referenc-ing active
33000002								
33000003	Channel state: Reset	inter-rupted	active	Program state: aborted	inter-rupted	stopped	waiting	running
33000004	NCK alarm with stop of ma-chining present	NCK alarm channel–specific present			All axes stopped	All axes refer-enced		
33000005								
33000006								
33000007								

Status signals: Axes in WCS

3300	**Signals from NCK channel [r]**							
Data block	Interface NCK ———> PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
33001000	Axis 1 in WCS Traversing command plus	minus					Handwheel active 2	1
33001001	Axis 1 in WCS	continu-ous			Machine function 1000 INC	100 INC	10 INC	1 INC
33001002								
33001003								
33001004	Axis 2 in WCS Traversing command plus	minus					Handwheel active 2	1
33001005	Axis 2 in WCS Active machine function	continu-ous			1000 INC	100 INC	10 INC	1 INC
33001006								
33001007								
33001008	Axis 3 in WCS Traversing command plus	minus					Handwheel active 2	1
33001009	Axis 3 in WCS Active machine function	continu-ous			1000 INC	100 INC	10 INC	1 INC
33001010								
33001011								

Transfer of auxiliary functions from the NC channel

2500	**Auxiliary functions from NCK channel [r]**							
Data block	Interface PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
25000000								Modify decoded M functions 0–99
25000001				Modify T funct. 1				
25000002								
25000003								

Decoded M signals (M0 – M99)

2500	M functions from NCK channel [r]							
Data block	Interface NCK							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
25001000	Dynamic M functions M7	M6	M5	M4	M3	M2	M1	M0
25001001	Dynamic M functions M15	M14	M13	M12	M11	M10	M9	M8
25001002	Dynamic M functions M23	M22	M21	M20	M19	M18	M17	M16
	...							
	...							
	...							
25001012	Dynamic M functions				M99	M98	M97	M96
25001013								
25001014								
25001015								

Notes:
+ Static M functions must be generated by the PLC user from the dynamic M functions.
+ Dynamic M functions are decoded by the basic program (M00 to M99).

Transferred T functions

2500	T functions from NCK channel [r]							
Data block	Interface PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
25002000	T function 1 (DINT)							

25002004	
25002008	
25002012	

6.2.5 Axis/spindle signals

Signals to axis/spindle
Common signals to axis/spindle

3800...3803	Signals to axis/spindle [r/w]							
Data block				Interface PLC ———> NCK				
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
380x0000	Feed override H	G	F	E	D	C	B	A
380x0001	Override enabled		Position encoder 1	Follow–up mode	Axes/ spindle lock			
380x0002					Clamping process running	Distance to go/ spindle reset	Servo enable	
380x0003		Speed/ spindle speed limitation						
380x0004	Traversing keys plus	minus	Rapid traverse override	Travers-ing key lock	Feed stop Spindle stop		Activate handwheel 2	1
380x0005		continu-ous			Machine function 1000 INC	100 INC	10 INC	1 INC
380x0006								
380x0007								

Signals to axis

3800...3802	Signals to axis [r/w]							
Data block				Interface PLC ———> NCK				
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
380x1000 (axis)	Delay Ref.–point approach				2nd software limit switch plus	2nd software limit switch minus	Hardware limit switch plus	Hardware limit switch minus
380x1001 (axis)								
380x1002 (axis)								
380x1003 (axis)								

Signals to spindle

3803	Signals to spindle [r/w]							
Data block				Interface PLC ———> NCK				
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
38032000 (spindle)					Gear is changed	Actual gear stage C	Actual gear stage B	Actual gear stage A
38032001 (spindle)		Invert M3/M4						Spindle feed override valid
38032002 (spindle)	Set direction of rotation CCW	Set direction of rotation CW	Reciprocating speed	Reciprocating by PLC				
38032003 (spindle)	Spindle override H	Spindle override G	Spindle override F	Spindle override E	Spindle override D	Spindle override C	Spindle override B	Spindle override A

Signals to stepper motor

3800...3803	Signals to axis/spindle [r/w]							
Data block	Interface PLC ——> NCK							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
380x5000 (stepper motor)								Rotation monitoring
380x5001 (stepper motor)								
380x5002								
380x5003								

General signals from axis/spindle

3900...3903	Signals from axis/spindle [r]							
Data block	Interface NCK ——> PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
390x0000	Position reached with exact pos. fine	Position reached with exact pos., coarse		Referenced/ synchronized 1		Encoder limit frequency exceeded 1		Spindle/ no axis
390x0001	Current controller active	Speed controller active	Position controller active	Axis/spindle stopped ($n < n_{min}$)				
390x0002								
390x0003								
390x0004	Motion command plus	Motion command minus					Handwheel active 2	Handwheel active 1
390x0005	Active machine function	Active machine function continuous			1000 INC	100 INC	10 INC	1 INC
390x0006								
390x0007								

Signals from axis

3900...3903	Signals from axis [r]							
Data block	Interface NCK ———> PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
390x1000 (axis)								
390x1001 (axis)								
390x1002 (axis)								Lubrication pulse
390x1003 (axis)								

Signals from spindle

3903	Signals from spindle [r]							
Data block	Interface NCK ———> PLC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
39032000 (spindle)					Change gear	Set gear stage C	B	A
39032001 (spindle)	Actual direction of rotation CW		Spindle within set range			Set speed increased	Set speed limited	Speed limit exceeded
39032002 (spindle)	Active spindle mode: Control mode	Reciprocating mode	Positioning mode		Tapping without compensating chuck			
39032003 (spindle)								

Axis actual value and distances to go

3900...3903			Signale von Achse/Spindel [r]					
Data block			Nahtstelle NCK ———> PLC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
390x5000 (Stepper motor)								Rotation monitoring error
390x5001 (Stepper motor)								
390x5002								
390x5003								

Axis actual value and distances to go

VD570								
Data block			Interface NCK ———> PLC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
570x0000 Axis actu-al values								
570x0004 Axis actual values								

6.2.6 Signals from/to MMC

Program control signals from MMC (retentive area) (see also signals to channel V32000000)

1700			MMC signals [r]					
Data block			Interface MMC ———> PLC					
DBB	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
17000000 (MMC —> PLC)		Dry run feed selected	M01 selected					
17000001 (MMC —> PLC)	Program test selected				Feed override for rapid traverse selected			

17000002 (MMC —> PLC)								Select Skip Block
17000003 (MMC —> PLC)								

Dynamic mode signals from MMC

1800			Signals from MMC [r]					
Data block			Interface MMC ———> PLC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
18000000								
18000001					Machine function			TEACH IN
18000002								
18000003								

General selection/status signals from MMC (retentive area)

1900			MMC Signals [r]					
Data block			Interface MMC ———> PLC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
19001000 (MMC —> PLC)								
19001001 (MMC —> PLC)								
19001002 (MMC —> PLC)								
19001003 (MMC —> PLC)	Machine axis						Axis number for handwheel 1 B	A
19001004 (MMC —> PLC)	Machine axis						Axis number for handwheel 2 B	A
19001005 (MMC —> PLC)								

19001006 (MMC ——> PLC)								

Control signals to operator panel (retentive range)

1900			Signals to operator panel [r/w]					
Data block			Interface PLC ———> MMC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
19005000						OP key lock		
19005001								
19005002								
19005003								

6.2.7 Machine control panel signals (MCP signals)

Status signals from MCP

1000			Signals from MCP [r]					
			Interface MCP ———>PLC					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
10000000	#8 JOG	#7 INC	#6 free	#5 free	#4 free	#3 free	#2 free	#1 free
10000001	#16 Axis key	#15 Spindle start	#14 Spindle stop	#13 Spindle start +	#12 MDA	#11 SBL	#10 AUTO	#9 REF
10000002	#24 Axis key	#23 Axis key	#22 Axis key	#21 Axis key	#20 Axis key	#19 Axis key	#18 Axis key	#17 Axis key
10000003	”0”	”0”	”0”	”0”	”0”	#27 NC START	#26 NC STOP	#25 NC RE-SET
10000004	”0”	”0”	”0”	Feed override E	D	C	B	A
10000005	”0”	”0”	”0”	Spindle override E	D	C	B	A

Control signals to MCP

1100			Signals to MCP [r/w]					
			Interface PLC ———> MCP					
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
11000000			L6	L5	L4	L3	L2	L1
11000001								

6.2.8 PLC machine data

INT values (MD 14510 USER_DATA_INT)

4500			Signals from NCK [r]					
Data block			Interface NCK ———> PLC					
Byte								
45000000	Int value (WORD/ 2 bytes)							
45000002	Int value (WORD/ 2 bytes)							
45000004	Int value (WORD/ 2 bytes)							
45000006	Int value (WORD/ 2 bytes)							
45000060	Int value (WORD/ 2 bytes)							
45000062	Int value (WORD/ 2 bytes)							

HEX values (MD 14512 USER_DATA_HEX)

4500	Signals from NCK [r]							
Data block	Interface NCK ———> PLC							
Byte								
45001000	Hex value (BYTE)							
45001001	Hex value (BYTE)							
45001002	Hex value (BYTE)							
45001003	Hex value (BYTE)							
45001030	Hex value (BYTE)							
45001031	Hex value (BYTE)							

FLOAT values (MD 14514 USER_DATA_FLOAT)

4500	Signals from NCK [r]							
Data block	Interface NCK ———> PLC							
Byte								
45002000	Float value (REAL/ 4 bytes)							
45002004	Float value (REAL/ 4 bytes)							
45002008	Float value (REAL/ 4 bytes)							
45002012	Float value (REAL/ 4 bytes)							
45002016	Float value (REAL/ 4 bytes)							
45002020	Float value (REAL/ 4 bytes)							
45002024	Float value (REAL/ 4 bytes)							
45002028	Float value (REAL/ 4 bytes)							

HEX–BYTE values (MD 14516 USER_DATA__PLC_ALARM)

4500	Signals from NCK [r]							
Data block	Interface NCK ———> PLC							
Byte								
45003000	Alarm reaction / clear criterion of alarm 700000							
45003001	Alarm reaction / clear criterion of alarm 700001							
45003002	Alarm reaction / clear criterion of alarm 700002							
45003031	Alarm reaction / clear criterion of alarm 700031							

6.2.9 User alarm

Alarm activation

1600	Alarm activation [r/w]							
Data block	Interface PLC ———> MMC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16000000	Activation of alarm no.							
	700007	700006	700005	700004	700003	700002	700001	700000
16000001	Activation of alarm no.							
	700015	700014	700013	700012	700011	700010	700009	700008
16000002	Activation of alarm no.							
	700023	700022	700021	700020	700019	700018	700017	700016
16000003	Activation of alarm no.							
	700031	700030	700029	700028	700027	700026	700025	700024

Variable for alarm

1600	Variable for alarm [r/w]							
Data block	Interface PLC ———> MMC							
Byte								
16001000	Variable for alarm 700000							
16001004	Variable for alarm 700001							
16001008	Variable for alarm 700002							
	...							
16001116	Variable for alarm 700029							
16001120	Variable for alarm 700030							
16001124	Variable for alarm 700031							

Active alarm response

1600	Active alarm response [r]							
Data block	Interface PLC ———> MMC							
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16002000				PLC–STOP	NOT–AUS	Feed lock of all axes	Read–in disable	NC start inhibited
16002001								
16002002								
16002003								

6.3 PLC user program for turning (UPGMTURN)

General

The PLC user program UPGMTURN is conceived for a turning machine with a switched three–phase spindle motor, 2 stepper motor axes and a toolholder with 4 to 6 tools. To adapt the program to the particular machine, it can be parameterized via PLC machine data.

The SINUMERIK 802S comes with this PLC user program (UPGMTURN) already integrated in the flash memory of the control system.

The PLC 802 Programming Tool is used for PLC programming. This programming tool includes the PLC program UPGMTURN as an example project (Note: The version of the UPGMTURN that comes with the tool must not necessarily be the same as the version that comes with the control system!).
The user can thus use this PLC project as a basis for his own PLC project.

6.3.1 Function

The **PLC user program (UPGMTURN)** processes all necessary signals from and to the NC and the machine control panel (MCP) and monitors the EMERGENCY STOP function. UPGMTURN handles axis and spindle signals, controls the toolholder, coolant and lubricant supply.

Processing operator signals

- Interfaces
  - HMC (Human Machine Communication) signals
  - MCP (machine control panel) signals
  - NCK signals
- Processed signals
  - NC start and stop
  - Spindle start and stop
  - Jog (X+, X-, Z+, Z- and rapid traverse override)

EMERGENCY STOP control

Synchronization of EMERGENCY STOP, acknowledging of EMERGENCY STOP and RESET of signals provided from the machine tool.

Axis control

- Axis enable
- Hardware limit switch monitoring
- Reference cam processing

Spindle control

- Programmed and manual spindle start and stop (M3, M4 and M5)
- Spindle brake
- 2-stage spindle speed control

Toolholder control

- Manual tool change
- Programmed tool change
- Toolholder clamping time control

Coolant control

- Manual coolant control ON and OFF
- Programmed coolant control ON and OFF

Lubricant control

- Manual lubricant control ON and OFF
- Time-controlled lubricant control ON and OFF

6.3.2 PLC machine data

The PLC machine data for configuring the user program are entered on the operator panel under the Parameter menu. The PLC machine data for parameterizing the integrated user program are described in the following Tables. During start-up of the SINUMERIK 802S, the PLC machine data must be set according to the machine tool used. The parameters come into effect with the next restart (POWER ON).

The function of all 16 inputs and 16 outputs of the SINUMERIK 802C basic variant can be set by means of the following parameters:

MD14512			**USER_DATA_HEX**					
Machine data			VB45001000 – VB45001011					
INDEX	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input valid							
[0]	I 0.7	I 0.6	I 0.5	I 0.4	I 0.3	I 0.2	I 0.1	I 0.0
	Input valid							
[1]	I 1.7	I 1.6	I 1.5	I 1.4	I 1.3	I 1.2	I 1.1	I 1.0
	Inpuit 0-active							
[2]	I 0.7	I 0.6	I 0.5	I 0.4	I 0.3	I 0.2	I 0.1	I 0.0
	Input 0-active							
[3]	I 1.7	I 1.6	I 1.5	I 1.4	I 1.3	I 1.2	I 1.1	I 1.0
	Output valid							

[4]	O 0.7	O 0.6	O 0.5	O 0.4	O 0.3	O 0.2	O 0.1	O 0.0
	Output valid							
[5]	O 1.7	O 1.6	O 1.5	O 1.4	O 1.3	O 1.2	O 1.1	O 1.0
	Output 0-active							
[6]	O 0.7	O 0.6	O 0.5	O 0.4	O 0.3	O 0.2	O 0.1	O 0.0
	Output 0-active							
[7]	O 1.7	O 1.6	O 1.5	O 1.4	O 1.3	O 1.2	O 1.1	O 1.0
	MCP customer key valid							
[8]	K7	K6	K5	K4	K3	K2	K1	K0
	MCP customer key valid							
[9]							K9	K8
	Rotation monitoring active							
[10]							Z axis	X axis
	Machine configuration							
[11]				Override active				Key assignment X axis

Input valid: 0 - demask input not used
1 - input is used

Output valid: 0 - demask output not used
1 - output is used

Input / output 0-active: 0 - All signals use positive logic as standard, i.e. logic 1-active (24V).
1 - When connecting to systems with negative logic, i.e. logic 0-active (0V).

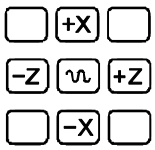
MCP customer key valid: 0 - Demask MCP customer keys not used
1 - MCP customer key is used

Rotation monitoring active: 0 - Rotation monitoring function is not used

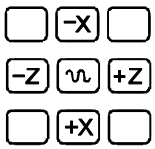
1 - Rotation monitoring is activated for the relevant axis (X, Z) after referencing the axis. The UPGMTURN sets the Rotation Monitoring interface signal (390x5000.0) (see ”Technical Manual: Rotation Monitoring of Step-Switching Motor with BERO”)

Machine configuration: (bit0) key assignment X axis to MCP

0 – tool behind turning center



1 – tool ahead of turning center



(Bit4) Override active
0 – not active
1 – active (V38030001.7=1)

MD14510	USER_DATA_INT
Machine data	VW 45000000 – VW45000008
INDEX	Int (2 bytes)
[0]	Toolholder positions (4 or 6)
[1]	Toolholder clamping time (unit: 100 ms)
[2]	Spindle brake hold time (unit: 100 ms)
[3]	Lubrication interval (unit: 1 min.)
[4]	Lubrication time (unit: 100 ms)

MD14510[0]: toolholder positions:

The number of positions must be 4 or 6; otherwise, no toolholder is detected.

MD14510[1]: toolholder clamping time:

Toolholder retraction time default value for clamping, a multiple of 100 ms.

MD14510[2]: Spindle brake hold time:

Time required to activate the spindle brake, a multiple of 100 ms.

The spindle brake is activated either by Spindle Stop from the machine control panel or by the M05 function in the NC part program.

MD14510[3]/[4]: Lubrication interval / time:

For automatic lubrication, a multiple of 1 minute must be entered for the lubrication interval and a multiple of 100 ms for the lubrication time.

6.3.3 Input/output configuration

The following tables show the assignments of the inputs/outputs and of the machine control panel keys, as well as their function in the UPGMTURN. Any signals not needed can be masked via PLC machine data.

Note

When installting the SINUMERIK 802S on your machine, make absolutely sure that the input/output assignment is carried out as described in the Table.

	Signal Description				
Inputs	**X2003**				
I0.0	Toolholder position: T1				
I0.1	Toolholder position: T2				
I0.2	Toolholder position: T3				
I0.3	Toolholder position: T4				
I0.4	Toolholder position: T5				
I0.5	Toolholder position: T6				
I0.6	Toolholder clamped				
I0.7	**Alarm input**				
	X2004				
I1.0	X+ limit switch				
I1.1	Z+ limit switch				
I1.2	X- limit switch				
I1.3	Z- limit switch				
I1.4	X reference point cam				
I1.5	Z reference point cam				
I1.6	Stepping drives ready				
I1.7	EMERGENCY STOP				
MSTT	Customer keys				
	User K1: Reduce spindle speed **<<**				
	User K2: Spindle jogging				
	User K3: Increase spindle speed **>>**				
	User K4: Manual tool change				
	User K5: Start manual lubrication				
	User K6: Cooling ON/OFF (toggle switch)				
	User K7: Reset alarm output				
	User K8: not assigned				
	User K9: not assigned				
	User K10: not assigned				
Outputs	**X2005**				
O0.0	Spindle **start CW (direction of rotation M3)**				
O0.1	Spindle **start CCW (direction of rotation M4)**				
O0.2	Spindle **stop** with brake				
O0.3	Coolant control				
O0.4	Toolholder motor CW (forward)				
O0.5	Toolholder motor CCW (reverse)				
O0.6	Lubricant control				
O0.7	Alarm output				
	X2006				
		M41	M42	M43	M44
O1.0	Spindle speed stage1	✓		✓	
O1.1	Spindle speed stage2		✓		✓
O1.2	Spindle speed stage3	✓	✓		
O1.3	Spindle speed stage4			✓	✓
O1.4	Spindle speed 1 (for display)				
O1.5	Spindle speed 2 (for display)				
O1.6	Spindle speed 3 (for display)				
O1.7	Spindle speed 4 (for display)				

Description of the input signals

- UPGMTURN supports only toolholders with a separate output for each position, i.e. absolute encoders are not supported. I0.0 to I0.5 are linked with the toolholder. When using versions with only 4 locations, the inputs I0.4, I0.5 must be marked as invalid inputs.
- With toolholders providing a “Toolholder clamped” signal, this signal should be connected to I0.6; otherwise, I0.6 will be marked invalid.
- Each axis of the system requires hardware limit switches for both directions (+/-). The limit switch signals are monitored from the NCK in all operating modes. In the event a limit switch is overrun, all axes are stopped, and only the axis resulted in responding of the limit switch can be traversed to the opposite direction in JOG mode.
- Referencing (delayed reference-point approach) requires a cam switch on the inputs I1.4 for the X axis and I1.5 for the Z axis. In addition, a reference-point switch (BERO) must be connected to the NCK input (X20) to ensure that the reference point is set exactly (see Start–up Guide).
- The drive ready signal is connected to input I1.6. As long as the signal is logic “0”, alarm 700003 is output.
- The alarm input can be used for alarm signals from the machine tool, e.g. for temperature monitoring relays or the like. The effect is the same as with EMERGENCY STOP - all axes and the spindle are stopped.

UPGMTURN function keys on the machine control panel

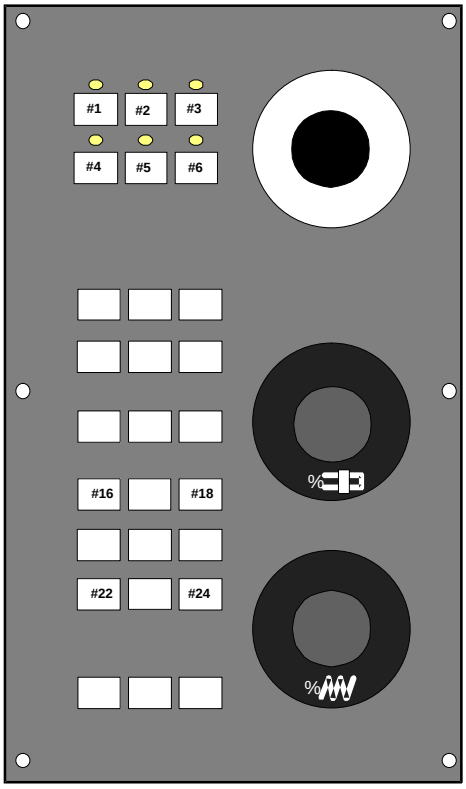


Fig. 6-1 Keyboard layout

- **#1**: Reduce spindle speed <<

#3: Increase spindle speed >>

UPGMTURN is designed for spindle control with 4 speed stages. These are either selected from the part program by means of M41, M42, M43, M44 or set via manual speed selection on the MCP using the customer keys #1 or #3. (Detailled description in Section 5.1 “Description of the Logics”)

- **#2:** Spindle jog mode (only in JOG mode)

  The spindle rotates with direction of rotation M3 and smallest speed. This function can only be activated in JOG mode.

- **#4:** Manual tool change (only JOG mode)

  Press the #4 key as long as the toolholder has reached the desired position. When you release the key, the UPGMTURN automatically starts the retraction clamping process. When you press #4 for a short time, the toolholder is moved by one position further and is clamped. The time for the retraction clamping process is set in the PLC machine data.

- **#5:** Manually initiated lubrication process

  When you press the #5 key, the output signal for lubrication is activated for one interval (set in the PLC machine data).

- **#6:** Coolant ON/OFF (toggle key, only in JOG mode)

- **#16:** Reset alarm output

  After the alarm source has been removed, the alarm output (O0.7) can be deactivated by pressing #16 (acknowledge alarm).

Description of the output signals

- O0.0 Control contact **Spindle CW** (direction of rotation M3)
- O0.1 Control contact **Spindle CCW** (direction of rotation M4)
- O0.2 **Spindle brake** active for one interval (set in the PLC machine data)

If spindles with only one direction of rotation are used, output O0.1 must be masked.

- O1.0, O1.1, O1.2, O1.3: Control signals - spindle speed stages

	M41	M42	M43	M44
O1.0	✓		✓	
O1.1		✓		✓
O1.2	✓	✓		
O1.3			✓	✓

These signals can be used either for selecting the speed stage of 2-stage a.c. motors and/or switching the gear.

1. If a **1-**stage a.c. motor is used as the spindle drive, O1.0, O1.1, O1.2, O1.3 must be masked.

2. If a **2-**stage a.c. motor is used as the spindle drive, only O1.0, O1.1 are used, and O1.2, O1.3 must be masked.

- O1.4, O1.5, O1.6, O1.7:

  Display of spindle speed stages (can be masked out if not needed).

	M41	M42	M43	M44
O1.4	✓			
O1.5		✓		
O1.6			✓	
O1.7				✓

- O0.3 Control output for coolant control
- O0.4 Control output for toolholder (forward)
- O0.5 Control output for toolholder (reverse). The output is activated for one interval (set in PLC MD) active.
- O0.6 Control output for lubrication system
- O0.7 Alarm output This signal can be used for controlling the step-switching drives or for display.

6.3.4 Description of the logics

Spindle control

- Input signals:

  M03, M04, M05, from part program

  M41, M42, M43, M44, from part program

  Spindle CW, CCW, Stop, from machine control panel

  Spindle->> from machine control panel

  Spindle<< - from machine control panel

- Output signals:

  Spindle CW (O0.0)

  Spindle CCW (O0.1)

  Spindle Brake (O0.2)

  Spindle speed 1 (O1.0)

  Spindle speed 2 (O1.1)

  Spindle speed 3 (O1.2)

  Spindle speed 4 (O1.3)

- **UPGMTURN** control

Precondition	Result
• AUTO mode **M03** active • JOG mode **Spindle CW key** pressed • JOG mode **Spindle Jog key** (#2) pressed	• Spindle **CW** (O0.0) active • Spindle CCW (O0.1) inactive
• AUTO mode **M04** active • JOG mode **Spindle CCW key** pressed	• Spindle **CCW** (O0.1) active • Spindle CW (O0.0) inactive
• AUTO mode **M05** active • JOG mode **Spindle STOP key** pressed	• **Spindle brake** (O0.2) active for the interval as specified in PLC-MD • Spindle CW and CCW inactive
• In AUTO mode Spindle speed controlled by M41, M42, M43, M44	O1.0: M41 ✓, M43 ✓ O1.1: M42 ✓, M44 ✓ O1.2: M41 ✓, M42 ✓ O1.3: M43 ✓, M44 ✓
• In JOG mode if **Spindle Jog key** pressed	as with **M41**; smallest speed is activated
In JOG mode Spindle speed **>> key** and spindle speed**<< key** control an internal pointer for changing the speed stages as in AUTO mode	---->> Speed stage 1 (identical to M41) Speed stage 2 (identical toM42) Speed stage 3 (identical to M43) Speed stage 4 (identical to M44)
• With speed stage 1 • With speed stage 2 • With speed stage 3 • With speed stage 4	O1.4 active; O1.5, O1.6, O1.7 inactive O1.5 active; O1.4, O1.6, O1.7 inactive O1.6 active; O1.4, O1.5, O1.7 inactive O1.7 active; O1.4, O1.5, O1.6 inactive

Note: ✓ means "active"

Toolholder control

- Input signals:

  I0.0, I0.1, I0.2, I0.3, I0.4, I0.5 toolholder locations

  I0.6 toolholder "Positioned"

  T function (tool number) in the part program

  Manual tool change on the machine control panel (C4)

- Output signals:

  Toolholder CW (O0.4)

  Toolholder CCW (O0.5)

- **UPGMTURN** control

Precondition	Result
• In AUTO mode **T** (0<= T <=5) is not identical to the current toolholder position	• **Toolholder CW** is active as long as the selected toolholder position is detected on the inputs; then **Toolholder CCW** is active for the interval set in the PLC MD.
• In JOG mode **Manual Tool Change key** pressed down	• **Toolholder CW** is active as long as the key is pressed down.

• once the **key** has been released	• **Toolholder CCW** is active for the interval set in the PLC MD.
• In JOG mode: pressing the **Manual Tool Change** key for a short time	• **Toolholder CW** is active as long as the next tool position is detected on the inputs; then **Toolholder CCW** is active for the interval set in the PLC MD.

Coolant control

- Input signals:

  M07, M08, M09 from the part program

  M07, M08 have the same function in the **UPGMTURN**

  Cooling ON/OFF (toggle switch) on the machine control panel (C6)

- Output signals:

  Coolant control (O0.3)

- **UPGMTURN** control:

Precondition	Result
• In AUTO mode when **M07** or **M08** has been output	• Coolant control active
• In AUTO mode when **M09** has been output	• Coolant control inactive
• In JOG mode when **Cooling ON/OFF** (C6) has been pressed for the first time	• Coolant control active
• when the key has been pressed for another time	• Coolant control active inactive

Lubricant control

- Input signals: **Manual lubrication** key (C5) on machine control panel
- Output signals: **Lubricant control** (O0.6)
- **UPGMTURN** control:

Precondition	Result
• In all operating modes when the set time for starting lubrication is reached (lubrication interval in PLC MD)	• **Lubricant control** (O0.6) is active for the time set in the PLC-MD
• In all operating modes when the **Manual lubrication** key has been pressed	• **Lubricant control** (O0.6) is active for the time set in the PLC-MD

Alarm control

- Input signals:

  EMERGENCY STOP (I1.7)
  X+ limit switch (I1.0)
  Z+ limit switch (I1.1)
  X- limit switch (I1.2)
  Z- limit switch (I1.3)

  Reset alarm output (C7) on machine control panel

- Output signals:

  Alarm output (O0.7)

- **UPGMTURN** control:

Precondition	Result
• In all operating modes when one of the inputs I1.0, I1.1, I1.2, I1.3 or I1.7 is active	**Alarm output** is active
• when the alarm output is active and the **Reset alarm output key** (C7) has been pressed	**Alarm output** is inactive

UPGMTURN alarms

The UPGMTURN carries out plausibility checks. In the event of any inconsistencies, PLC alarms are displayed on the user interface.

Alarm	Cause
700000 No turret reversal time specified	PLC-MD 14510[1] <= 0 Error: Toolholder clamping time
700001 Programmed T number > than MD	Programmed tool (T number) greater than set in PLC-MD 14510[0]
700002 Turred does not clamped	Toolholder not clamped after the clamping time has elapsed (PLC-MD 14510[1])
700003 Drive(s) not ready	Drives not ready

MMC signals

- Pass on program control signals from MMC to channel signals.
- Save handwheel selection from General Selection/MMC Status Signals as retentive data and recover last selection after Power On.
- Handwheel logics: Assignment handwheel – axis

6.3.5 UPGMTURN program structure

Program structure

Main program

Subroutine 0	PLC initialization for axis independent–variables. –Feedrate effective –Rapid override effective –Position–measuring system 1 and axis–dependent variables
Subroutine 1	Emergency Stop
Subroutine 2	Processing of machine control panel (MCP) signals – Emergency Stop and Reset – Jog control – NC Start and Stop
Subroutine 3	T function
Subroutine 4	Axis control for X axis – Axis Enable – Reference cam switch – Hardware limit switch
Subroutine 5	Reserved
Subroutine 6	Axis control for Z axis – Axis Enable – Reference cam switch – Hardware limit switch
Subroutine 7	Spindle control
Subroutine 8	reserved for spindle
Subroutine 9	reserved for spindle
Subroutine 10	Turret control
Subroutine 11	Checking tool position
Subroutine 12	Tool change
Subroutine 13	Tool position monitoring
Subroutine 14	Turret clamping
Subroutine 16	Cooling and lubricating
Subroutine 17	(reserved for subroutine 16)
Subroutine 18	(reserved for subroutine 16)
Subroutine 19	(reserved for subroutine 16)
Subroutine 20	Input and Output Control
Subroutine 21	(I/O level control)
Subroutine 22	ALARM Control
Subroutine 23	Handwheel Control
Subroutine 25	X axis jog operation for declined turning machine
Subroutine 26	X axis jog operation for horizontal turning machine

Flags used in the program

M0.0 – Single Block selection flag
M0.1 – Spindle started (either CW or CCW)
M0.2 – Status for increment selection
M0.3 – Coolant On/Off flag
M0.4 – Lubricating flag
M0.5 – Servo Enable condition
M0.6 – Spindle Jog flag
M0.7 – Spindle brake

M1.0 – No reversal time specified in PLC MD
M1.1 – Programmed T > max. T specified in MD
M1.2 – Turret not clamped (if in–position signal is defined)
M1.3 –
M1.4 –
M1.5 –
M1.6 –
M1.7 –

M2.0 – 1: Turret start CW
M2.1 – 1: Turret in position, and starts CCW
M2.2 – 1: Delay timer starts
M2.3 – 1: Manual tool change button pressed
M2.4 – 1: Turret position changed
M2.5 –
M2.6 –
M2.7 –
MB3 –
MB4 –
MB5 – Feedrate override
MB7 – Reserved (used for Shift Instr.)
MB6 – Jog Increment

MW8 – Input Buffer (for I0.0 ... I0.7)
MW9 – Input Buffer (for I1.0 ... I1.7)
MW10 – Output Buffer (for Q0.0 ... Q0.7)
MW11 – Output Buffer (for Q1.0 ... Q1.7)
MW12 – Buffer for user defined keys (K1 .. K8)
MW13 – Buffer for user defined keys (K9 .. K10)

MB14 – Buffer for logic definition
MB15 – Buffer for valid sigals
MB16 – Buffer for I/O signals

MB17 –

MB18 –

MB19 –

MB20 –

MW26 – Buffered brake time
MB28 – Spindle speed selection (in AUTO mode)
MB29 – Reserved for SHIFT instruction (MW28)
MB31 – Buffer for spindle speed selection

MD32 – Turret position buffer
MD36 – Buffer for programmed T funktion
MD40 – Current turret position
MD44 – Toolholder position

TIMER

T0	TON	for the spindle brake time control
T1	TON	for the turret reversal time control
T2	TON	for the lubricating time control

COUNTER

C0 – for the 1 min. timer for lubricating interval control

6.4 Application note: Unipolar spindle control

General

The spindle speed setpoint of the SINUMERIK 802S is generally output in the range from –10V to +10V (S... M3 or M4). Setpoint output with only positive polarity (0V to +10V) and an additional direction signal as required for unipolar frequency converters can be realized by programming in the NC part program and the PLC user program (two additional M commands for switching the direction signal, and M3 for starting rotation).
Direction reversal may only be carried out at setpoint zero (spindle stopped). It should taken into account that the setpoint is output from the NC but the direction signal is switched form the PLC, i.e. the user program must ensure that the new direction signal is only provided if the spindle has stopped. Rotation may only be started again if the direction signal has been output from the PLC.
Position–controlled spindle operation (SPOS= , G331,G332, LCYC84) is not possible with unipolar spindle control.

NC programming

```
N10 M5          ;Spindle Stop
N20 G4 F15      ;Dwelling if necessary, spindle must be at save stop;
                 can also be secured via the PLC user program
M23             ;M23 will be the new direction signal
N40 S200  M3    ;New spindle speed and start of rotation
...
N100 M5         ;Spindle Stop
```

PLC programming

according to the particular conditions with consideration of the abovementioned notes; for example, M23 and M24 are the M commands for the direction signals and must be evaluated from the user program accordingly; then the direction signal must be set.

Manual Machine

7

This description should be understood as an addition to the “Start–up Guide for the Sinumerik 802S”. Therefore, only the special features of the Sinumerik 802S with regard to the “Manual machine” user interface will be described here.

7.1 Hardware and software requirements for the installation

Hardware:

Notice

To ensure that the software is installed successfully when installing the software both for the first time and whenever installing new software in the future if the “Manufacturer protection level” is not enabled in the control system, the 802C standard operator panel (OP 020) is required, in addition to the machine control panel (because of the keys for entering the password).

The following components are required to install the Sinumerik 802S/C MM software:

- PG, PC or laptop with CD–ROM drive and serial interface (V24)
- V24 data cable
- OP 020 operator panel (standard operator panel); not always required with subsequent installations (provided that the “Manufacturer protection level” is still enabled in the control)
- Jumper on connector X1002, pin 24 —> pin 5 if no machine control panel (MCP) is connected.

Software:

The following requirements must be fulfilled, and the following components must be provided:

- PG, PC or laptop with operative WinPCIN program (if not yet installed, install it from the Toolbox)
- CD ROM with up–to–date toolbox for Sinumerik 802S/C MM
- At least software version 03.01.06–802S/C or higher must be installed on the Sinumerik 802S/C (otherwise, the operating system must be updated).

7.2 Loading the software

Preparatory work:

- If an operator panel other than the standard operator panel (OP 020) is installed on the machine and an initial or subsequent installation is carried out with which not the “Manufacturer protection level” is set in the control system, then the currently installed operator panel must be replaced by the standard operator panel (OP 020).
- If no machine control panel (MCP) is connected to the installed operator panel, then connect a jumper (pin 24 —> pin 5) to the connector X1002 of the operator panel; otherwise, the control system will not power up.
- Use an appropriate cable to connect PG, PC or laptop on which an operative WinPCIN program is installed to the V24 interface of the Sinumerik (connector X2).

Supplementary installation conditions:

If a language other than the first language is installed, switch to the second language English to install the “Manual machine”.

Installing the software:

To ensure successful installation, it is imperative to observe the sequence described below:

- Start the WinPCIn software on your PG, PC or laptop.
- Use an appropriate interface cable to connect the X2 interface of the Sinumerik (V24 interface) to COM 1 on the PG, PC or laptop.
- Turn on the control system.
- Use the  key to switch to the “Data” area.
- Press the “Diagnosis” function key.
- Press the “Start–up” function key.
- Use the  key to extend the menu range.
- Press the “Set passw.” function key.
- Type “EVENING” and press the “OK” function key. Make sure that the message “Access level: Manufacturer“ is displayed; otherwise, repeat the password input.
- Select the  key to switch back to the “Data” area.
- Press the “Services” function key.
- Press the “Settings” fucntion key.
- Press the “V24 binary” function key. Accept the settings displayed in the WinPCIN software (V24_ini) (19200 Bd, 1 stop bit, no parity, 8 data bits, Handshake RTS/CTS).
- Press the “OK” function key to accept the Sinumerik settings.
- Use the WinPCIN software to start the transfer of the file “manmach.arc” from the Toolbox CD ROM (in some cases, first the file has to be copied to the hard disk, as not every WinPCIN version can access a CD ROM drive).

- Press the “Input start” function key to start the data transfer on the control system.
- A box with the following question will appear on the control system: “Read in start–up data?”. If you wish to start this process, press the “OK” function key to confirm.
- If the data transfer has been started successfully, the message “V24 input running” is displayed. The data transfer will take approx. 15 minutes; during this time, it is imperative to prevent a power failure or an interruption of the data transfer. If sometimes the message “No text management available!” is displayed, this is normal and can therefore be ignored.

Notice

Under no circumstances may a power failure or an interruption of the data transfer occur while the data transfer is running! Otherwise, a new power–up of the control system can be suppressed due to an uncontrolled interruption of the data saving (in the flash memory). In this case, it is not possible to try to transfer the data once more; the operating system must be re–installed.

- After the transfer has been completed, press the “Error log” function key to check whether the “OK” message has been set for all data.
- Carry out Power ON. The user interface for the manual machine is installed.

The installation of the “Manual Machine” user interface is now completed. Now, however, the relevant default data are not yet set for machine data, tool data, MGUDs,..., and for the PLC program.

These data / default data must be loaded into the control system by transferring an appropriately adapted “initial.ini”. To this end, either use the “initial.ini” adapted by the machine manufacturer or load (when starting the project) the default machine data record included in the file “manmach.cnf” on the supplied CD ROM.

How to load the file “manmach.cnf” (default data record) is explained in the following:

- After the control system has powered up, press the  key to call the interactive password screenform.
- Enter the password “1111” and press the  key to confirm.
- Press the  once more and use the “OK” function key to switch to the standard user interface.

The further sequence corresponds to that as described for the installation of the user interface for the “Manual Machine” (see above). The individual difference is that the file “MM_2.ser” must be transferred from the Toolbox.

During the transfer, the control system reboots sometimes. The whole process takes approx. 5 minutes (depending on the amount of data).

At the completion of this process, the relevant machine data and – in some cases – also the standard PLC program must be adapted accordingly, depending on the hardware confirguration.

Two PLC projects are contained in the Toolbox:

- ManMach_MCP.ptp: designed for use on the standard machine control panel
- ManMach_3DIO.ptp: designed as described in Section 7.8 (with I/O modules)

7.3 Switching the user interface

From “Manual Machine” to Siemens standard:

To switch to the Siemens standard user interface, proceed as follows (always start from the 2nd extension of the basic menu):

- Press the  key to call the password input screenform.
- Enter the password “1111” and press the  key to confirm.
- Press the  key once more and then press the “OK” function key to switch to the standard user interface.

From Siemens standard to “Manual Machine”:

To switch back to the “Manual Machine” screenform, proceed as follows:

- Press the  key to switch to the main selection screenform.
- Press the  to extend the function key bar.
- Press the “Man. Mach” function key to switch to the “manual Machine” screenform area.

7.4 Switching the language

In the “Manual Machine” operating area:

How to switch the language in the “Manual Machine” operating area is described in detail in the “Operator’s Guide Sinumerik 802S/C, Manal Machine” in the Chapter “Service Functions“.

In the Siemens standard user interface:

- Press the  key to call the main selection screenform.
- Press the “Diagnosis” function key.
- Press the  key to extend the function key bar.
- Press the “Language changeover” function key to switch to the alternative language.

7.5 Additional machine data

Limitations:

MD 14514 [0]	$MN_USER_DATA_FLOAT [0]	Max. input value for “Cut meters”

Lubrication:

MD 14510 [1]	$MN_USER_DATA_INT [1]	Lubrication time (x 100ms)
MD 14510 [2]	$MN_USER_DATA_INT [2]	Lubrication pause (x 100ms)

Spindle shutdown in “Chuck key position”:

MD 14510 [0]	$MN_USER_DATA_INT [0]	Time monitoring Spindle positioning (x 100ms)
MD 14514 [1]	$MN_USER_DATA_FLOAT [1]	Starting speed Spindle positioning
MD 14514 [2]	$MN_USER_DATA_FLOAT [2]	Tolerance window Spindle positioning
MD 35160 [4]	$MA_SPIND_EXTERN_VELO_LIMIT [2]	Spindle speed limitation from PLC Spindle positioning

7.6 Input limitations with regard to the user interface

Spindle:	0 <	speed	< MD 35100 [4]	$MA_SPIND_VELO_LIMIT [4]
	0 <	cut meters	< MD 14514 [0]	$MN_USER_DATA_FLOAT [4]

Feedrate:	0 <	Time feedrate	< MD 32020 [1]	$MA_JOG_VELO [1]
	0 <	Revolutional feedrate	< MD 32050 [1]	$MA_JOG_REV_VELO [1]

7.7 Operation without machine control panel (MCP)

If you wish to run the control system without machine control panel (MCP), then connect a jumper between pin 24 and pin 5 to connector X1002 on the installed operator panel; otherwise, the cotnrol system will not power up.

7.8 I/O assignment in the standard PLC program

The standard PLC program supplied with the Toolbox is designed for subsequent I/O assignments where currently only modules of the DI/O16 type can be used.

7.8.1 Assignment of the digital inputs:

1st module:

I 0.0 *	Reference switch X axis	X2003	Pin 2	DI 0
I 0.1 *	Reference switch Z axis	X2003	Pin 3	DI 1
I 0.2	Limit position X axis	X2003	Pin 4	DI 2
I 0.3	Limit position Z axis (tailstock collision switch)	X2003	Pin 5	DI 3
I 0.4		X2003	Pin 6	DI 4
I 0.5	Chuck guard closed	X2003	Pin 7	DI 5
I 0.6	Lubrication filling level	X2003	Pin 8	DI 6
I 0.7	Lubrication pressure	X2003	Pin 9	DI 7
I 1.0		X2004	Pin 2	DI 8
I 1.1	Protective door closed	X2004	Pin 3	DI 9
I 1.2	Drive ready	X2004	Pin 4	DI 10
I 1.3 *	I2t monitoring of drive tripped	X2004	Pin 5	DI 11
I 1.4		X2004	Pin 6	DI 12
I 1.5		X2004	Pin 7	DI 13
I 1.6	Spindle jogging key	X2004	Pin 8	DI 14
I 1.7		X2004	Pin 9	DI 15

2nd module:

I 2.0	Retract axis (bypass limit switch)	X2003	Pin 2	DI 0
I 2.1 *	Q21 230V power supply missing	X2003	Pin 3	DI 1
I 2.2		X2003	Pin 4	DI 2
I 2.3 *	Q4 Motor circuit–breaker coolant pump tripped	X2003	Pin 5	DI 3
I 2.4 *	Q2 Motor circuit–breaker spindle external ventilation tripped	X2003	Pin 6	DI 4
I 2.5	Coolant pump is ON	X2003	Pin 7	DI 5
I 2.6	Single block active	X2003	Pin 8	DI 6
I 2.7 *	EMERGENCY STOP	X2003	Pin 9	DI 7
I 3.0		X2004	Pin 2	DI 8
I 3.1		X2004	Pin 3	DI 9
I 3.2		X2004	Pin 4	DI 10
I 3.3		X2004	Pin 5	DI 11
I 3.4	Spindle CCW rotation	X2004	Pin 6	DI 12
I 3.5	Spindle CW rotation	X2004	Pin 7	DI 13
I 3.6	Handwheel evaluation bit 1	X2004	Pin 8	DI 14
I 3.7	Handwheel evaluation bit 2	X2004	Pin 9	DI 15

3rd module:

I 4.0	Spindel override bit 1	X2003	Pin 2	DI 0
I 4.1	Spindel override bit 2	X2003	Pin 3	DI 1
I 4.2	Spindel override bit 3	X2003	Pin 4	DI 2
I 4.3	Spindel override bit 4	X2003	Pin 5	DI 3
I 4.4	Feed override bit 1	X2003	Pin 6	DI 4
I 4.5	Feed override bit 2	X2003	Pin 7	DI 5
I 4.6	Feed override bit 3	X2003	Pin 8	DI 6
I 4.7	Feed override bit 4	X2003	Pin 9	DI 7
I 5.0	Star handle axis direction X+	X2004	Pin 2	DI 8
I 5.1	Star handle axis direction X–	X2004	Pin 3	DI 9
I 5.2	Star handle axis direction Z+	X2004	Pin 4	DI 10
I 5.3	Star handle axis direction Z–	X2004	Pin 5	DI 11
I 5.4	Rapid traverse override axes	X2004	Pin 6	DI 12
I 5.5	Star handle 0 position	X2004	Pin 7	DI 13
I 5.6	Cycle start key	X2004	Pin 8	DI 14
I 5.7 *	Cycle stop key	X2004	Pin 9	DI 15

All inputs marked with a * possess an inverted logics, i.e. their meanings refer to the signal status “LOW”, and with all of the remaining inputs to the signal status “HIGH”.

7.8.2 Assignment of the digital outputs:

1st module:

O 0.0		X2005	Pin 2	DO 0
O 0.1	Pulse enable drive I/RF module	X2005	Pin 3	DO 1
O 0.2	Pulse enable drive	X2005	Pin 4	DO 2
O 0.3	Coolant pump ON	X2005	Pin 5	DO 3
O 0.4	Secondary power ON	X2005	Pin 6	DO 4
O 0.5	Fault general	X2005	Pin 7	DO 5
O 0.6	Fault lubrication	X2005	Pin 8	DO 6
O 0.7		X2005	Pin 9	DO 7
O 1.0	Ready	X2006	Pin 2	DO 8
O 1.1		X2006	Pin 3	DO 9
O 1.2		X2006	Pin 4	DO 10
O 1.3	Lubrication axes	X2006	Pin 5	DO 11
O 1.4		X2006	Pin 6	DO 12
O 1.5		X2006	Pin 7	DO 13
O 1.6		X2006	Pin 8	DO 14
O 1.7		X2006	Pin 9	DO 15

2nd module:

O 2.0	Spindle contactor (control)	X2005	Pin 2	DO 0
O 2.1		X2005	Pin 3	DO 1
O 2.2	Bypass axis limit switch	X2005	Pin 4	DO 2
O 2.3		X2005	Pin 5	DO 3
O 2.4		X2005	Pin 6	DO 4
O 2.5		X2005	Pin 7	DO 5
O 2.6		X2005	Pin 8	DO 6
O 2.7		X2005	Pin 9	DO 7
O 3.0		X2006	Pin 2	DO 8
O 3.1		X2006	Pin 3	DO 9
O 3.2		X2006	Pin 4	DO 10
O 3.3		X2006	Pin 5	DO 11
O 3.4		X2006	Pin 6	DO 12
O 3.5		X2006	Pin 7	DO 13
O 3.6		X2006	Pin 8	DO 14
O 3.7		X2006	Pin 9	DO 15

3rd module:

O 4.0		X2005	Pin 2	DO 0
O 4.1	PLC cycle time	X2005	Pin 3	DO 1
O 4.2		X2005	Pin 4	DO 2
O 4.3		X2005	Pin 5	DO 3
O 4.4		X2005	Pin 6	DO 4
O 4.5		X2005	Pin 7	DO 5
O 4.6		X2005	Pin 8	DO 6
O 4.7		X2005	Pin 9	DO 7
O 5.0		X2006	Pin 2	DO 8
O 5.1		X2006	Pin 3	DO 9
O 5.2		X2006	Pin 4	DO 10
O 5.3		X2006	Pin 5	DO 11
O 5.4		X2006	Pin 6	DO 12
O 5.5		X2006	Pin 7	DO 13
O 5.6		X2006	Pin 8	DO 14
O 5.7		X2006	Pin 9	DO 15

7.9 Default assignment of special data for the “Manual machine”

Machine data:

MD 12010	$MN_OVR_FACTOR_AX_SPEED[1]	0.1
MD 12010	$MN_OVR_FACTOR_AX_SPEED[2]	0.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[3]	0.3
MD 12010	$MN_OVR_FACTOR_AX_SPEED[4]	0.4
MD 12010	$MN_OVR_FACTOR_AX_SPEED[5]	0.5
MD 12010	$MN_OVR_FACTOR_AX_SPEED[6]	0.6
MD 12010	$MN_OVR_FACTOR_AX_SPEED[7]	0.7
MD 12010	$MN_OVR_FACTOR_AX_SPEED[8]	0.8
MD 12010	$MN_OVR_FACTOR_AX_SPEED[9]	0.9
MD 12010	$MN_OVR_FACTOR_AX_SPEED[10]	0.95
MD 12010	$MN_OVR_FACTOR_AX_SPEED[11]	1
MD 12010	$MN_OVR_FACTOR_AX_SPEED[12]	1.05
MD 12010	$MN_OVR_FACTOR_AX_SPEED[13]	1.1
MD 12010	$MN_OVR_FACTOR_AX_SPEED[14]	1.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[15]	1.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[16]	1.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[17]	1.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[18]	1.2

MD 12010	$MN_OVR_FACTOR_AX_SPEED[19]	1.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[20]	1.2
MD 12010	$MN_OVR_FACTOR_AX_SPEED[21]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[1]	0.1
MD 12030	$MN_OVR_FACTOR_FEEDRATE[2]	0.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[3]	0.3
MD 12030	$MN_OVR_FACTOR_FEEDRATE[4]	0.4
MD 12030	$MN_OVR_FACTOR_FEEDRATE[5]	0.5
MD 12030	$MN_OVR_FACTOR_FEEDRATE[6]	0.6
MD 12030	$MN_OVR_FACTOR_FEEDRATE[7]	0.7
MD 12030	$MN_OVR_FACTOR_FEEDRATE[8]	0.8
MD 12030	$MN_OVR_FACTOR_FEEDRATE[9]	0.9
MD 12030	$MN_OVR_FACTOR_FEEDRATE[10]	0.95
MD 12030	$MN_OVR_FACTOR_FEEDRATE[11]	1
MD 12030	$MN_OVR_FACTOR_FEEDRATE[12]	1.05
MD 12030	$MN_OVR_FACTOR_FEEDRATE[13]	1.1
MD 12030	$MN_OVR_FACTOR_FEEDRATE[14]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[15]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[16]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[17]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[18]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[19]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[20]	1.2
MD 12030	$MN_OVR_FACTOR_FEEDRATE[21]	1.2
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[1]	0.1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[2]	0.2
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[3]	0.3
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[4]	0.4
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[5]	0.5
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[6]	0.6
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[7]	0.7
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[8]	0.8
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[9]	0.9
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[10]	0.95
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[11]	1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[12]	1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[13]	1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[14]	1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[15]	1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[16]	1
MD 12050	$MN_OVR_FACTOR_RAPID_TRA[17]	1
MD 12202	$MN_PERMANENT_FEED[0]	350
MD 12202	$MN_PERMANENT_FEED[1]	1000

MD 12202	$MN_PERMANENT_FEED[2]	2000
MD 12202	$MN_PERMANENT_FEED[3]	3500
MD 14510	$MN_USER_DATA_INT[0]	300
MD 14510	$MN_USER_DATA_INT[1]	20
MD 14510	$MN_USER_DATA_INT[2]	600
MD 14514	$MN_USER_DATA_FLOAT[0]	1000
MD 14514	$MN_USER_DATA_FLOAT[1]	22
MD 14514	$MN_USER_DATA_FLOAT[2]	15
MD 18118	$MN_MM_NUM_GUD_MODULES	2
MD 18120	$MN_MM_NUM_GUD_NAMES_NCK	14
MD 18150	$MN_MM_GUD_VALUES_MEM	30
MD 20150	$MC_GCODE_RESET_VALUES[7]	2
MD 20150	$MC_GCODE_RESET_VALUES[14]	2
MD 20150	$MC_GCODE_RESET_VALUES[27]	1
MD 31090	$MA_JOG_INCR_WEIGHT[AX1]	0.0005
MD 32084	$MA_HANDWH_STOP_COND[AX1]	H2ff
MD 32084	$MA_HANDWH_STOP_COND[AX3]	H2ff
MD 35040	$MA_SPIND_ACTIVE_AFTER_RESET[AX4]	1
MD 35160	$MA_SPIND_EXTERN_VELO_LIMIT[AX4]	18

Setting data:

MD 41110	$SN_JOG_SET_VELO	500
MD 41120	$SN_JOG_REV_SET_VELO	0.2
MD 41130	$SN_JOG_ROT_AX_SET_VELO	100
MD 41200	$SN_JOG_SPIND_SET_VELO	100
MD 42100	$SC_DRY_RUN_FEED	10
MD 42440	$SC_FRAME_OFFSET_INCR_PROG	0
MD 42442	$SC_TOOL_OFFSET_INCR_PROG	0
MD 43300	$SA_ASSIGN_FEED_PER_REV_SOURCE[AX4]	0

R parameters:

R[4]	1

notice

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notice

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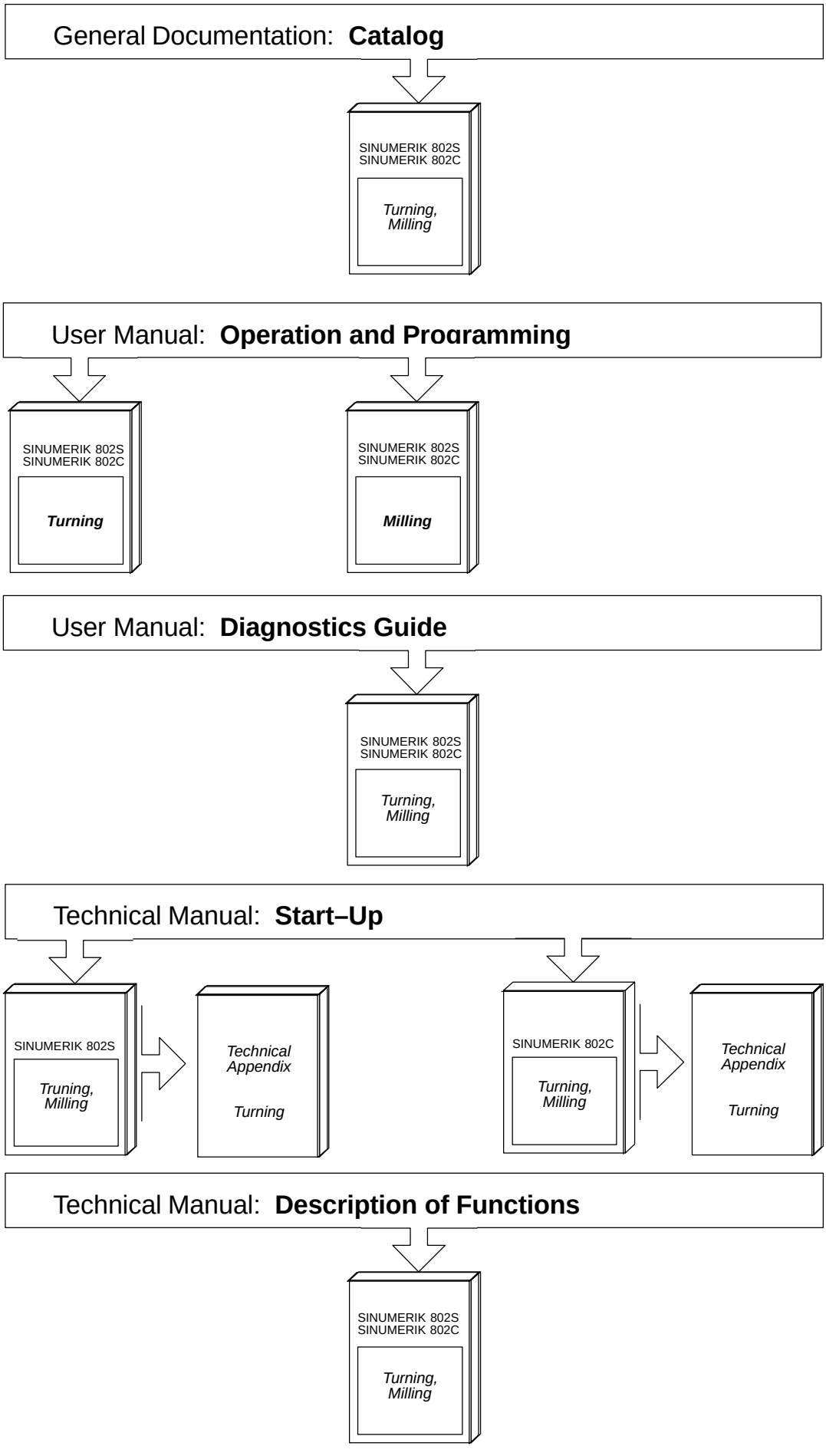

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