

Start-Up 01/2002 Edition

sinumerik

SINUMERIK 802C

**SIEMENS**



# SIEMENS

## SINUMERIK 802C

### Start-Up

#### Valid for

*Control*  
SINUMERIK 802C

*Software Version*  
3

01.2002 Edition

|                               |   |
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| Numerical Control System      | 1 |
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# SINUMERIK® Documentation

## Printing history

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

The 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.

| <b>Edition</b> | <b>Order-No.</b>   | <b>Remark</b> |
|----------------|--------------------|---------------|
| 04.00          | 6FC5597-3AA20-0BP2 | <b>A</b>      |
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This Manual is included on the documentation on CD-ROM (**DOCONCD**)

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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.

---

## 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.

---



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### 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 undesired event or status **can** occur if the appropriate note is not observed.

---

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### 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.

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# SINUMERIK 802C Control System

## 1.1 Components of the SINUMERIK 802C

### What is SINUMERIK?

The SINUMERIK 802C is a microprocessor-controlled numerical control system for simple machine tools with stepper motor drives .

### Hardware components

It consists of the following hardware components:

- ENC: Control component for a maximum of 3 analog 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

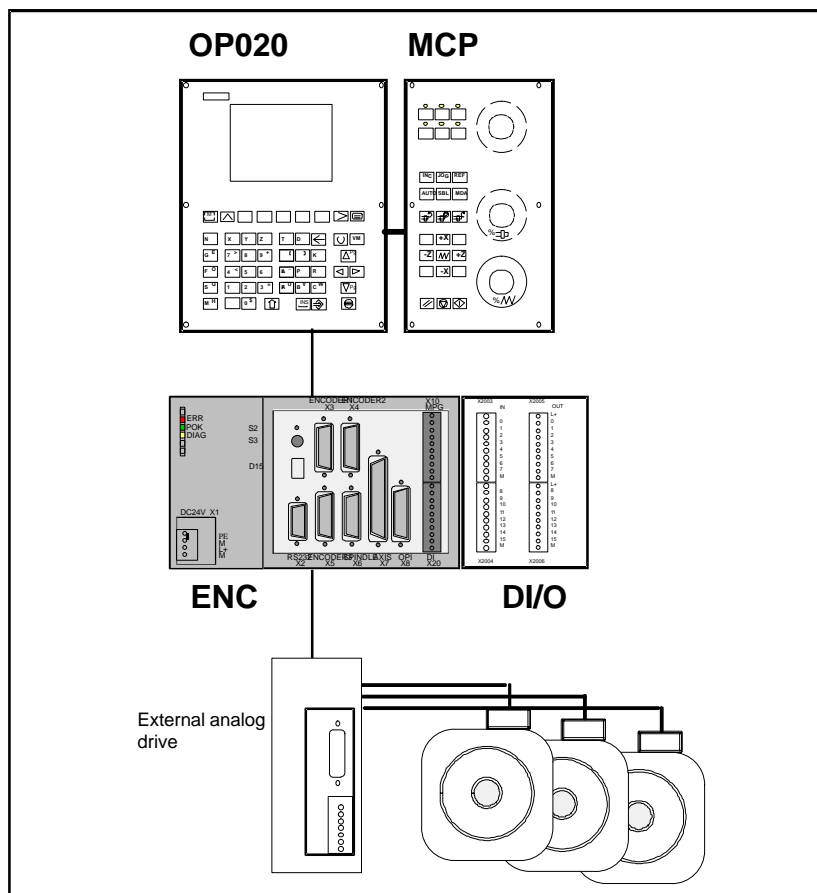


Fig. 1-1 SINUMERIK 802C hardware components (example configuration)

## Software components

The SINUMERIK 802C 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 802C to the machine functions (see also Description of Functions “Integrated User Program for SINUMERIK 802C”).

- 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
  - 802C system software, packed, for loading and programming the SINUMERIK 802C 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  | V <sub>ss</sub> |    |
| 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<br>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

## 2.1 Installing and removing the SINUMERIK 802C



---

**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:

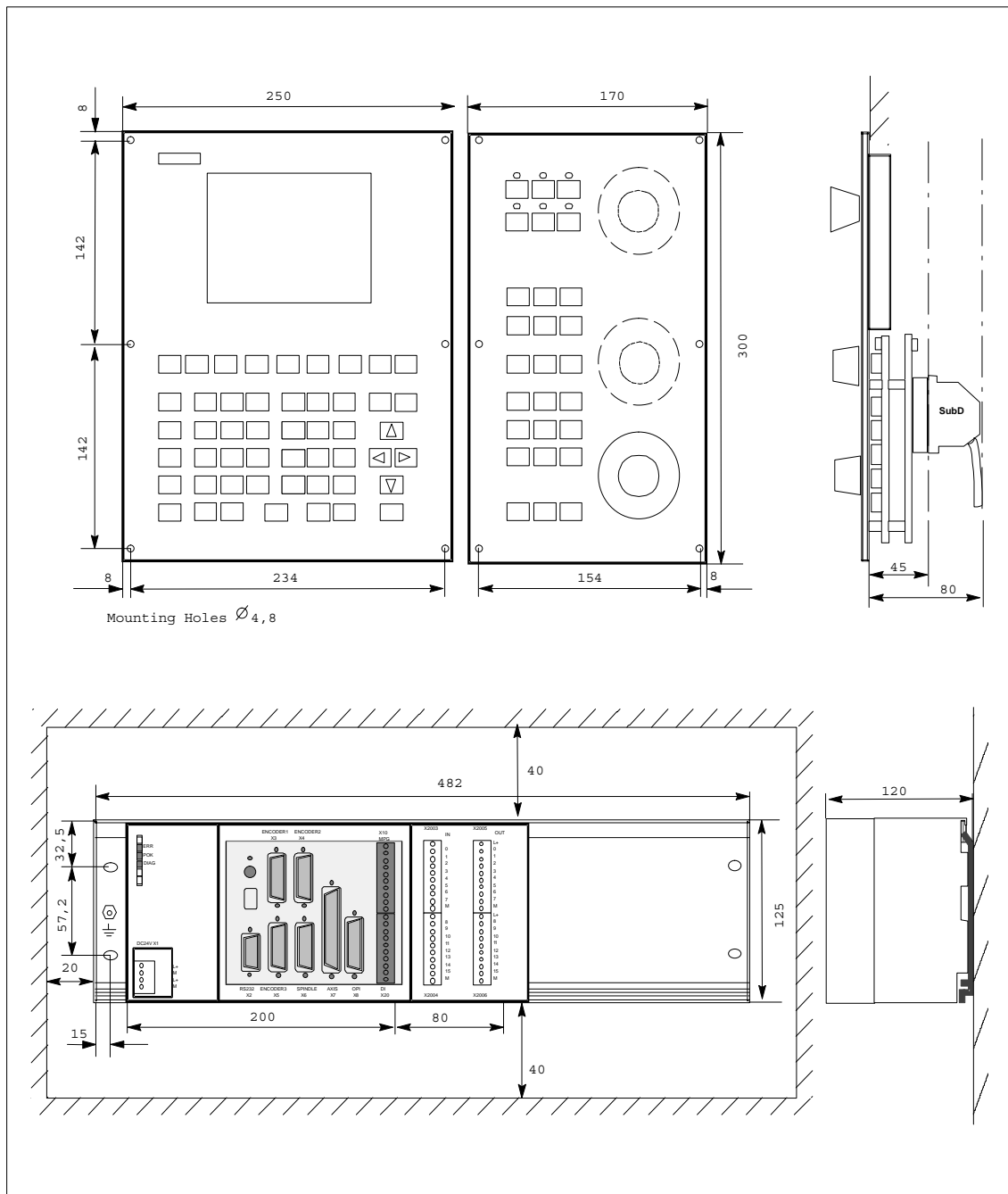


Fig. 2-1 Mounting dimensions for SINUMERIK 802C

## 2.2 Interfaces and cables

### Position of the interfaces and front panel elements

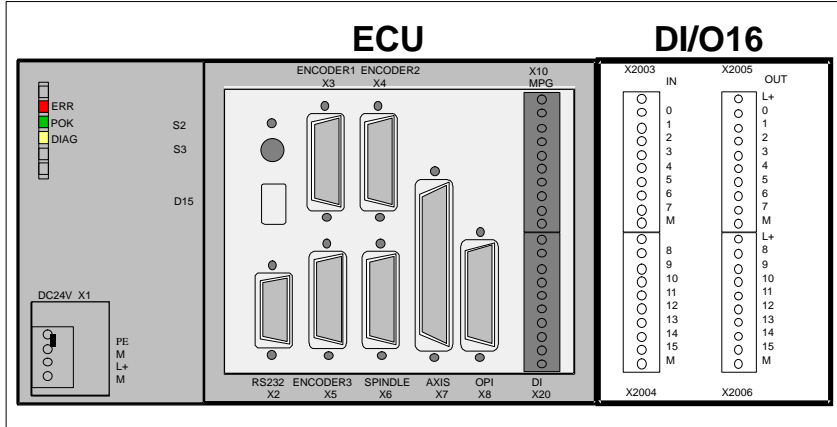


Fig. 2-2 User interfaces

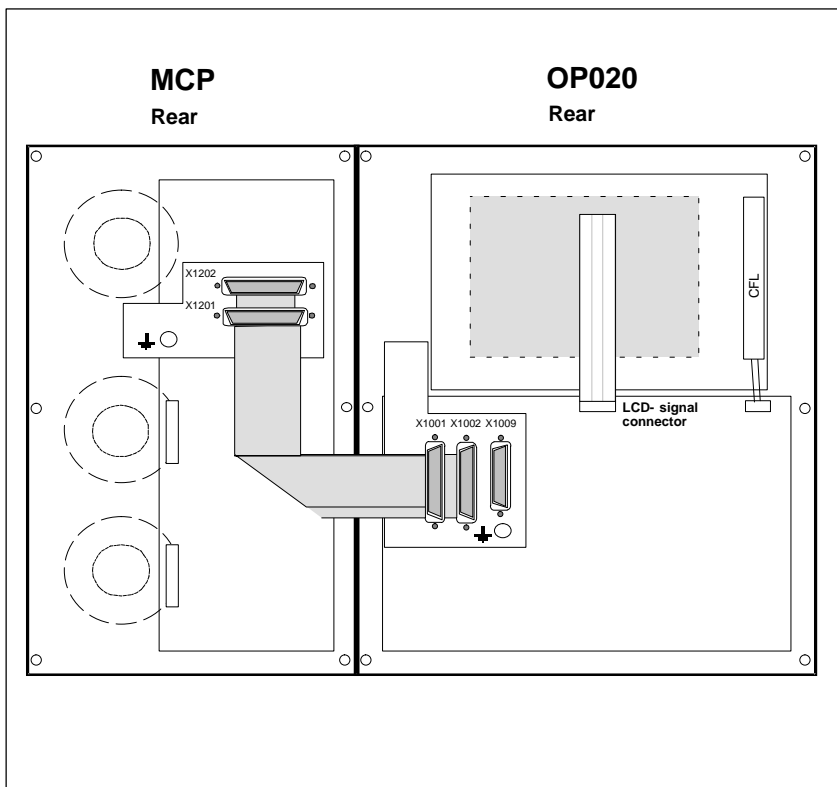


Fig. 2-3 Rear of machine control panel and operator panel

## Interfaces

### ENC

- **X1 power supply terminals (DC24V)**  
4-pin screw-type terminal block for connecting the 24 V load power supply
- **X2 RS232 interface (V24)**  
9-pin sub-D plug connector
- **X3 to X5 measuring system interfaces (ENCODER)**  
three 15-pin sub-D plug connectors for connecting incremental position encoders (RS422)
- **X6 spindle interface (SPINDLE)**  
9-pin sub-D socket for connecting a spindle drive with analog interface
- **X7 drive interface (AXIS)**  
50-pin sub-D socket connector for connecting the power sections for a maximum of four analog drives including spindle
- **X8 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 digital inputs (DI)**  
10-pin front connector for connecting the NC READY relay

### D/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 **S**

**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.

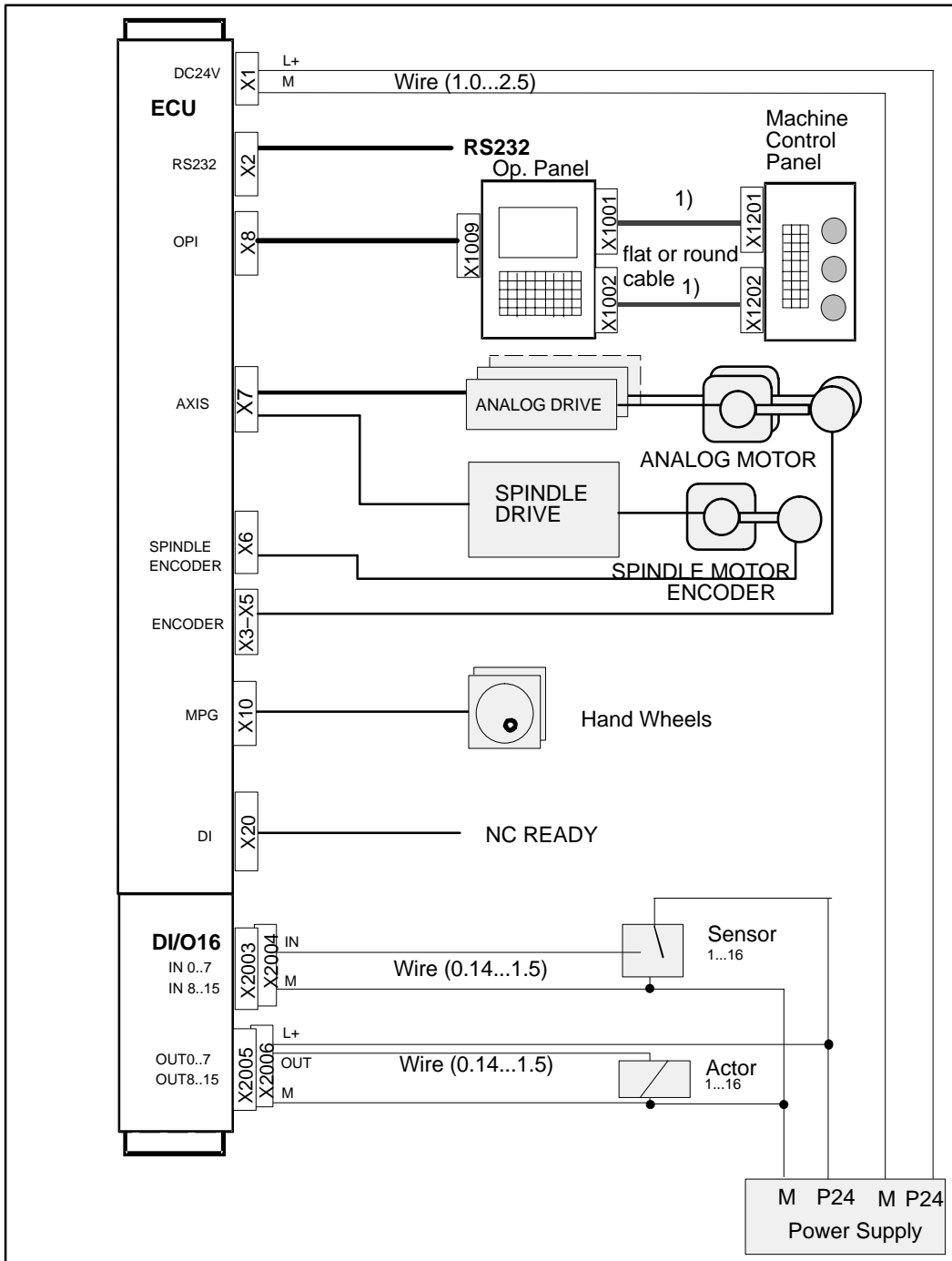


Fig. 2-4 SINUMERIK 802C connection diagram

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

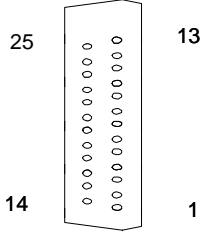
**Operator panel interface**

|                        |                             |
|------------------------|-----------------------------|
| Connector designation: | <b>X8</b>                   |
|                        | OP020                       |
| Connector type:        | 25-pin sub-D plug connector |

2.3 Connecting the individual components

Table 2-1 Pin assignment of connector X8

| 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   |     |         |      |



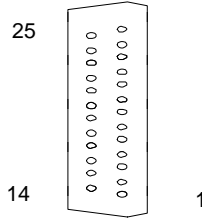
Connector pin assignment on the OP side

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 and the spindle (X7)****Connector pin assignment on the ENC side****Feed drive interface**

Connector designation: **X7**  
 AXIS 1-4  
 Connector type: 50-pin sub-D plug connector

Table 2-3 Pin assignment of connector X7

| X7  |        |      |     |        |      |     |        |      |
|-----|--------|------|-----|--------|------|-----|--------|------|
| Pin | Signal | Type | Pin | Signal | Type | Pin | Signal | Type |
| 1   | SW1    | VO   | 18  |        |      | 34  | BS1    | VO   |
| 2   | BS2    | VO   | 19  |        |      | 35  | SW2    | VO   |
| 3   | SW3    | VO   | 20  |        |      | 36  | BS3    | VO   |
| 4   | BS4    | VO   | 21  |        |      | 37  | SW4    | VO   |
| 5   |        |      | 22  |        |      | 38  |        |      |
| 6   |        |      | 23  |        |      | 39  |        |      |
| 7   |        |      | 24  |        |      | 40  |        |      |
| 8   |        |      | 25  |        |      | 41  |        |      |
| 9   |        |      | 26  |        |      | 42  |        |      |
| 10  |        |      | 27  |        |      | 43  |        |      |

2.3 Connecting the individual components

|    |       |   |    |  |  |    |       |   |
|----|-------|---|----|--|--|----|-------|---|
| 11 |       |   | 28 |  |  | 44 |       |   |
| 12 |       |   | 29 |  |  | 45 |       |   |
| 13 |       |   | 30 |  |  | 46 |       |   |
| 14 | RF1.1 | K | 31 |  |  | 47 | RF1.2 | K |
| 15 | RF2.1 | K | 32 |  |  | 48 | RF2.2 | K |
| 16 | RF3.1 | K | 33 |  |  | 49 | RF3.2 | K |
| 17 | RF4.1 | K |    |  |  | 50 | RF4.2 | K |

**Signal names**

SWn                      Setpoint  
 BSn                      Reference potential for setpoint  
 RFn.1, RFn.2        Servo enable contact

**Signal level**

RS422

**Signal type**

O                      Signal output

**Axis assignment**

1                      X axis  
 2                      Y axis  
 3                      Z axis  
 4                      Spindle



Table 2-4 Cable assignment (for type 6FX2 002–3AD01)

| NC Side   |     | Cable        | Drive Side  |          |
|---|-----|--------------|-------------|----------|
|   | PIN | Core Color   | Signal Name | PIN      |
|  | 14  | black        | 1st axis    | 1.9      |
|   | 47  | brown        |             | 1.65     |
|   | 34  | red          |             | 1.4      |
|   | 1   | orange       |             | 1.56     |
|   | 15  | yellow       | 2nd axis    | 2.9      |
|   | 48  | green        |             | 2.65     |
|   | 2   | blue         |             | 2.14     |
|   | 35  | purple       | 2.56        | 3rd axis |
|   | 16  | gray         | 3.9         |          |
|   | 49  | pink         | 3.65        |          |
|   | 36  | white/black  | 3.14        |          |
|   | 3   | white/brown  | 3.56        | Spindle  |
|   | 17  | white/red    | 4.9         |          |
|   | 50  | white/orange | 4.65        |          |
|   | 4   | white/yellow | 4.14        |          |
|   | 37  | white/green  | 4.56        |          |

### Drives with analog interface Signals

One voltage and one enable signal each is output.

- **SWn (SETPOINT)**

Analog voltage signal in the range  $\pm 10$  V to output a speed setpoint

- **Sn (REFERENCE SIGNAL)**

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

- **RFn (SERVO ENABLE)**

Relay contact pair controlling the enable of the power section, e.g. of a SIMODRIVE drive unit controlled via a PLC program.

### Signal parameters

The setpoint is output as an analog differential signal.

Table 2-5 Electrical parameters of the signal outputs for step-switching drives

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

2.3 Connecting the individual components

**Relay contact**

Table 2-6 Electrical parameters of the relay contacts RFn.1 and RFn.2

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

**Cable length:** max. 35 m

**2.3.3 Connecting the measuring systems (X3 ... X6)**

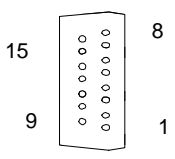
**Pin assignment of the connector on the ENC side**

**Measuring system interface (incremental encoder)**

Connector designation: **X3 ... X6**  
 ENCODER  
 Connector type: 15-pin sub-D plug connector

Table 2-7 Pin assignment of the female connector X3 ... X6

| X3 ... X6 |        |      |     |        |      |
|-----------|--------|------|-----|--------|------|
| 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)

### Connectable encoder types

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<br>Output signals:<br>Track A as true and negated signal ( $U_{a1}, \overline{U_{a1}}$ )<br>Track B as true and negated signal ( $U_{a2}, \overline{U_{a2}}$ )<br>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: | $90^\circ \pm 30^\circ$   |
| Current consumption:                 | max. 300 mA   |

### Cable lengths

The maximum cable length depends on the specifications of the encoder power supply and on the transmission frequency.

To provide fault-free operation, make sure that the following values are not exceeded when using preassembled interconnecting cables from SIEMENS:

Table 2-8 Maximum cable lengths depending on the encoder power supply

| Supply Voltage | Tolerance       | Current Consumption | Max. Cable Length |
|----------------|-----------------|---------------------|-------------------|
| 5 V DC         | 4.75 V...5.25 V | $\leq 300$ mA       | 25 m              |
| 5 V DC         | 4.75 V...5.25 V | $\leq 220$ mA       | 35 m              |

Table 2-9 Maximum cable lengths depending on the transmission frequency

| Encoder Type | Frequency | Max. Cable Length |
|--------------|-----------|-------------------|
| incremental  | 1 MHz     | 10 m              |
|              | 500 kHz   | 35 m              |

## 2.3.4 Configuration of the RS232 interface connection (X8)

### Pin assignment of the connector on the ENC side

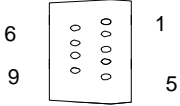
#### RS232 interface

|                        |                            |
|------------------------|----------------------------|
| Connector designation: | <b>X2</b>                  |
|                        | RS232                      |
| Connector type:        | 9-pin sub-D plug connector |

2.3 Connecting the individual components

Table 2-10 Pin assignment of connector X2

| 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 ( $\pm 12$  V)

**Signal type**

|    |                |
|----|----------------|
| I  | Input          |
| O  | Output         |
| VO | Voltage output |

**Cable for WinPCIN**

Table 2-11 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      |
| 8     | CTS    | 4      |
| 9     |        |        |

### 2.3.5 Connecting handwheels (X10)

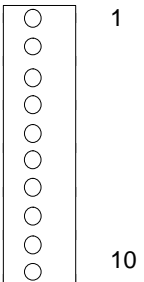
#### Pin assignment of the connector on the ENC side

##### Handwheel interface

Connector designation: **X10**  
**MPG**  
 Connector type: 10-pin mini-Combicon plug connector

Table 2-12 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 ( $U_{a2}$ ,  $\overline{U_{a2}}$ )

2.3 Connecting the individual components

Max. output frequency: 500 kHz  
 Phase offset between tracks A and B:  $90^\circ \pm 30^\circ$   
 Supply: 5 V, max. 250 mA

2.3.6 Connecting NCREADY (X20)

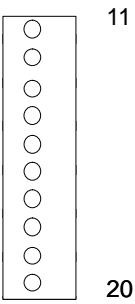
Pin assignment of the connector on the ENC side

**BERO input interface**

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

Table 2-13 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)

**Signal type**

K Switching contact

**NC-READY output**

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

Table 2-14 Electrical parameters of the NCREADY relay contact

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

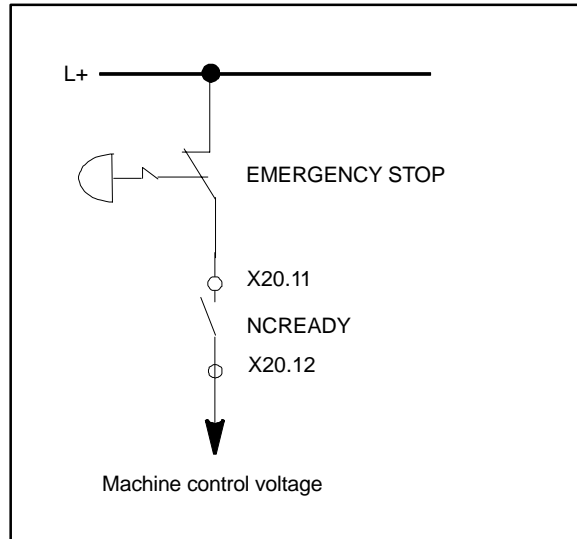


Fig. 2-5

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

### 2.3.7 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

2.3 Connecting the individual components

Table 2-15 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 2-16 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

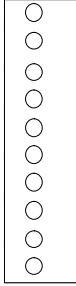
#### Interface for digital outputs

Connector designation: **X2005, X2006**  
**OUT**

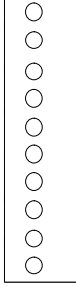
Connector type: 10-pin plug connector

Table 2-17 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    |



2.3 Connecting the individual components

**Signal names**

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

**Signal type**

V Voltage input  
 O Output (24 V signal)

Table 2-18 Electrical parameters of the digital outputs

| Parameter                   | Value  | Unit | Note                                      |
|-----------------------------|--------|------|---|
| "1" signal, nominal voltage | 24     | V    |   |
| Voltage drop                | max. 3 | V    |   |
| "1" signal, output current  | 0.5    | A    | Simultaneity factor<br>0.5 per 16 outputs |
| "0" signal, leakage current | max. 2 | mA   |   |

**Connecting sensors and actuators**

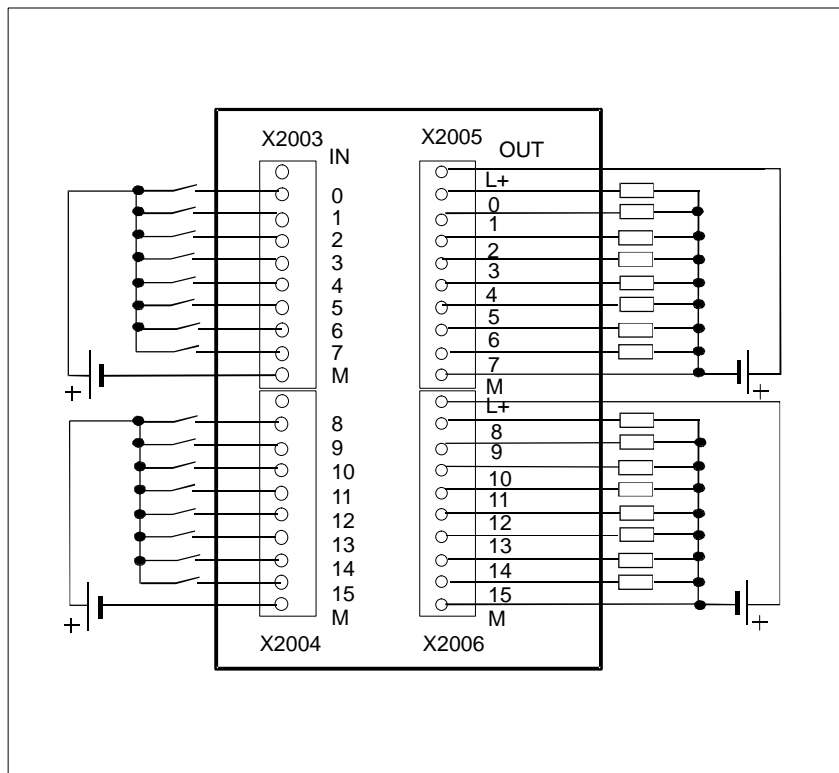


Fig. 2-6 Connecting the digital inputs and outputs

## 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 2-19 Electrical parameters of the load power supply

| Parameter                 | Min. | Max. | Units           | Conditions                    |
|---------------------------|------|------|-----------------|-------------------------------|
| Voltage range mean value  | 20.4 | 28.8 | V               |                               |
| Ripple                    |      | 3.6  | V <sub>ss</sub> |                               |
| Non-periodic overvoltage  |      | 35   | V               | 500 ms cont.<br>50 s recovery |
| Rated current consumption |      | 1    | A               |                               |
| Starting current          |      | 2.6  | A               |                               |

### Pin connector assignment on the ENC side

Table 2-20 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).

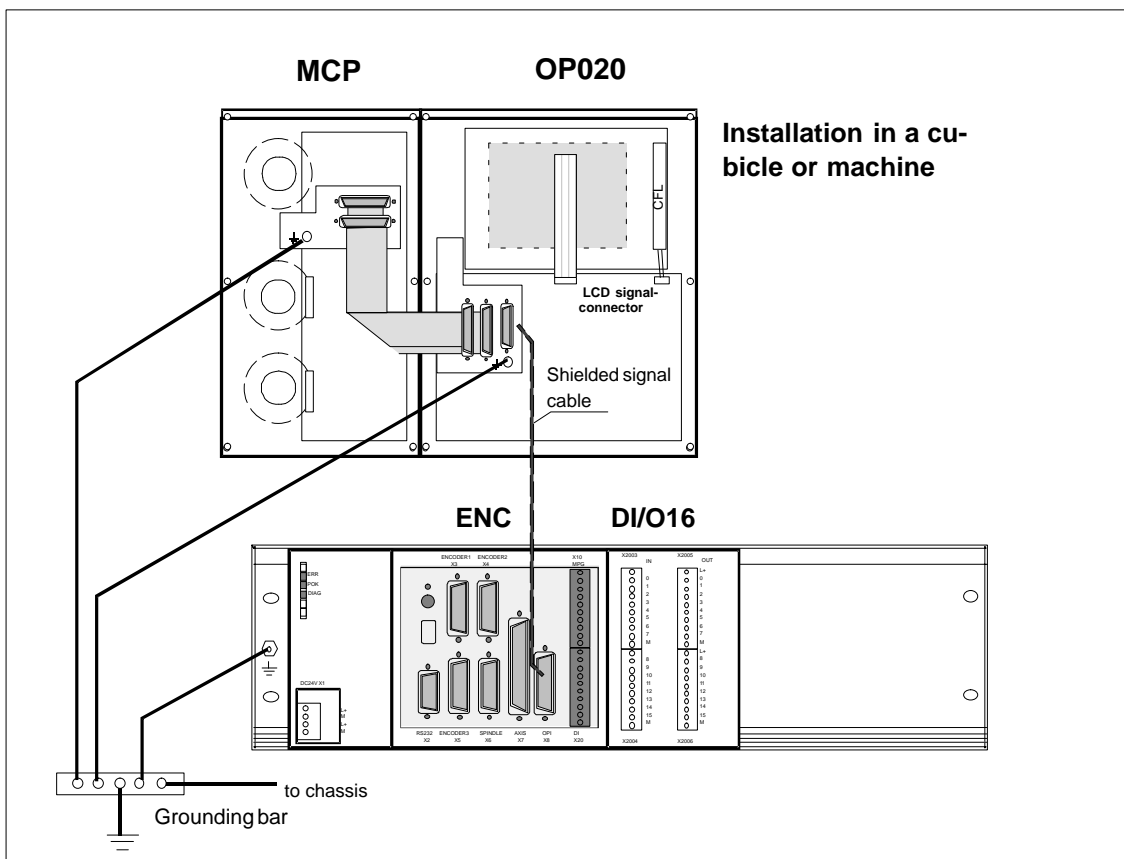


Fig. 2-7 Grounding diagram for MCP/OP020 installation in a cubicle or machine

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 ).

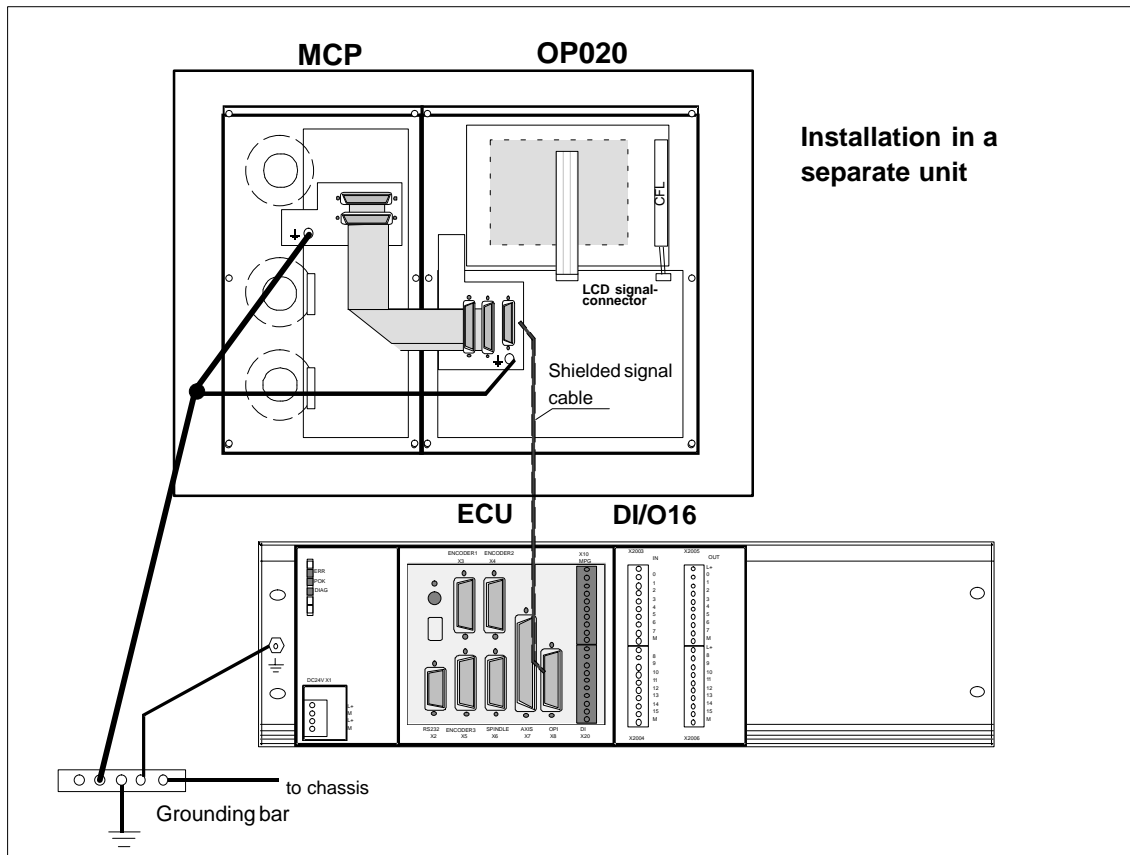


Fig. 2-8 Grounding diagram for MCP/OP020 installation in a panel

## 2.6 LEDs and operating elements on the ENC

### Error and status LEDs

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

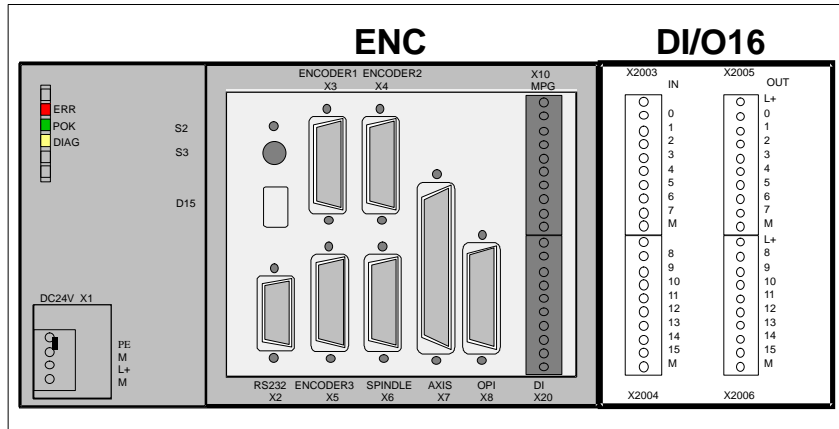


Fig. 2-9 User interfaces

### 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 (S3)

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 Drives



---

### **Lesehinweis**

Manufacturer documentation of the drives

---





# Start-Up

## 4.1 General

### Start-up requirements

- The following is required:
  - User's Guide: "Operation and Programming, SINUMERIK 802C"
  - **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 802C can be started 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 802C 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

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 <sup>2</sup> | in/s <sup>2</sup> |
| m/s <sup>3</sup> | in/s <sup>3</sup> |
| 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

## 4.2 Turning on and booting the control system

### 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.2-9), 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. 2-9).

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)

| <b>Result</b>                  |   |
|--------------------------------|---|
| User data exist, no boot error | Control system changes to <b>JOG/Ref.point approach</b> mode, yellow <b>LED DIAG</b> (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).<br>Any deviations from normal booting are displayed on the screen. |

## Booting with default machine data(Start-up switch position 1)

| <b>Result</b>  |
|--|
| 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)

| <b>Result</b>  |
|--|
| 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.

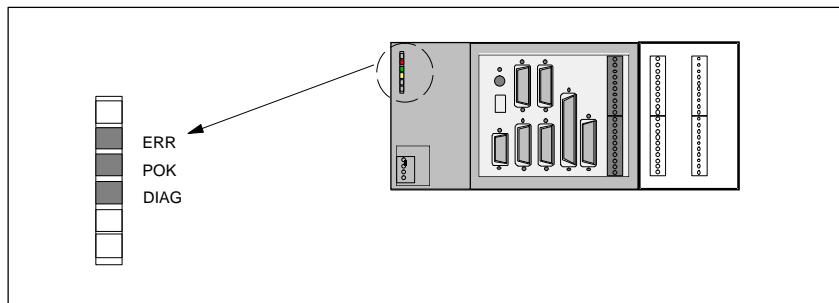


Fig. 4-1 LED

Table 4-3 Boot errors

| Error Message                  | Remedial Action   |
|--------------------------------|---|
| ERROR EXCEPTION                | <ol style="list-style-type: none"> <li>1. Check the connections of the plugged or connected modules (PLC D/IO modules).</li> <li>2. Switch off the control system and back on again (POWER ON).</li> <li>3. Carry out a software update.</li> <li>4. Replace the hardware components.</li> <li>5. Inform the hotline if necessary.</li> </ol> |
| 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 802C 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 802C 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 802C 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**

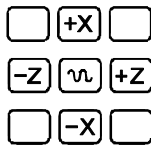
- Set MD20700 to zero.
- Use the **Diagnosis/StartUp switch/PLC** softkey to select Simulation. You can check the current setting via **Diagnosis/Service display/Version/PLC application**.
- Select the desired key and check your setting by pressing the key.

**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 |
|---|-------------------------------|-----------------------|----------------|----------------------------|--------------------------------------|
|   | <b><u>NCK start-up *</u></b>  |                       |                |                            |                                      |
| Normal power-up<br><b>Position 0</b>              | Normal power-up               | User program          | Run            | Unchanged                  | Accept active PLC MD                 |
| Power-up with default values<br><b>Position 1</b> | Power-up with default values  | User program          | Run            | Deleted                    | Standard PLC MD                      |
| Power-up with saved data<br><b>Position 3</b>     | Power-up with saved data      | User program          | Run            | Saved data                 | Saved PLC MD                         |
| PLC Stop after POWER ON<br><b>Position 4</b>      |                               | Unchanged             | Stop           | Unchanged                  | Accept active PLC MD                 |
|   | <b><u>PLC start up **</u></b> |                       |                |                            |                                      |
|   | 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 occurred 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 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

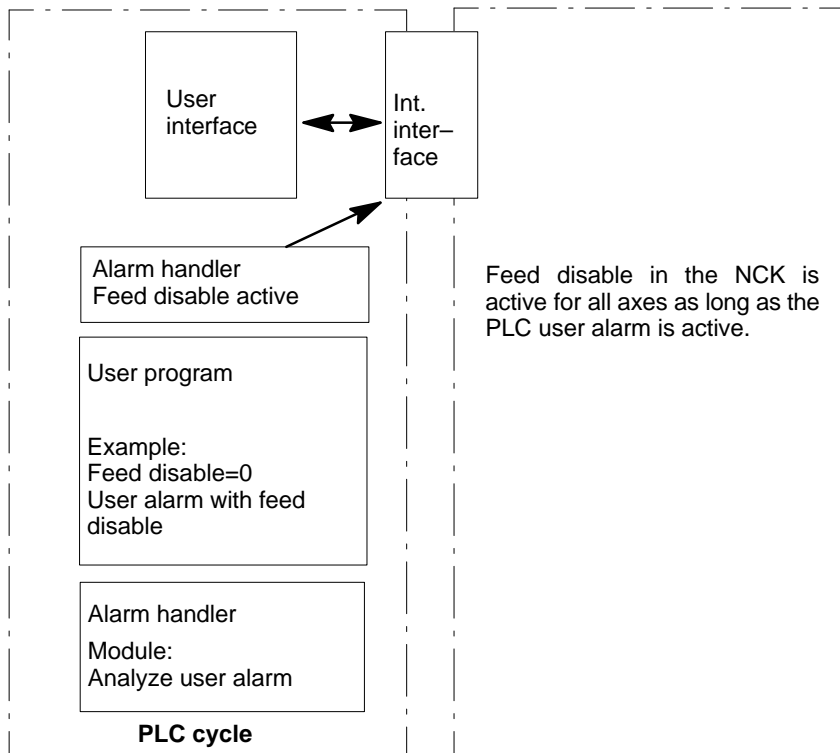


Fig. 4-2 User alarm with Feed Disable alarm response

### 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

...

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.

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)

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.



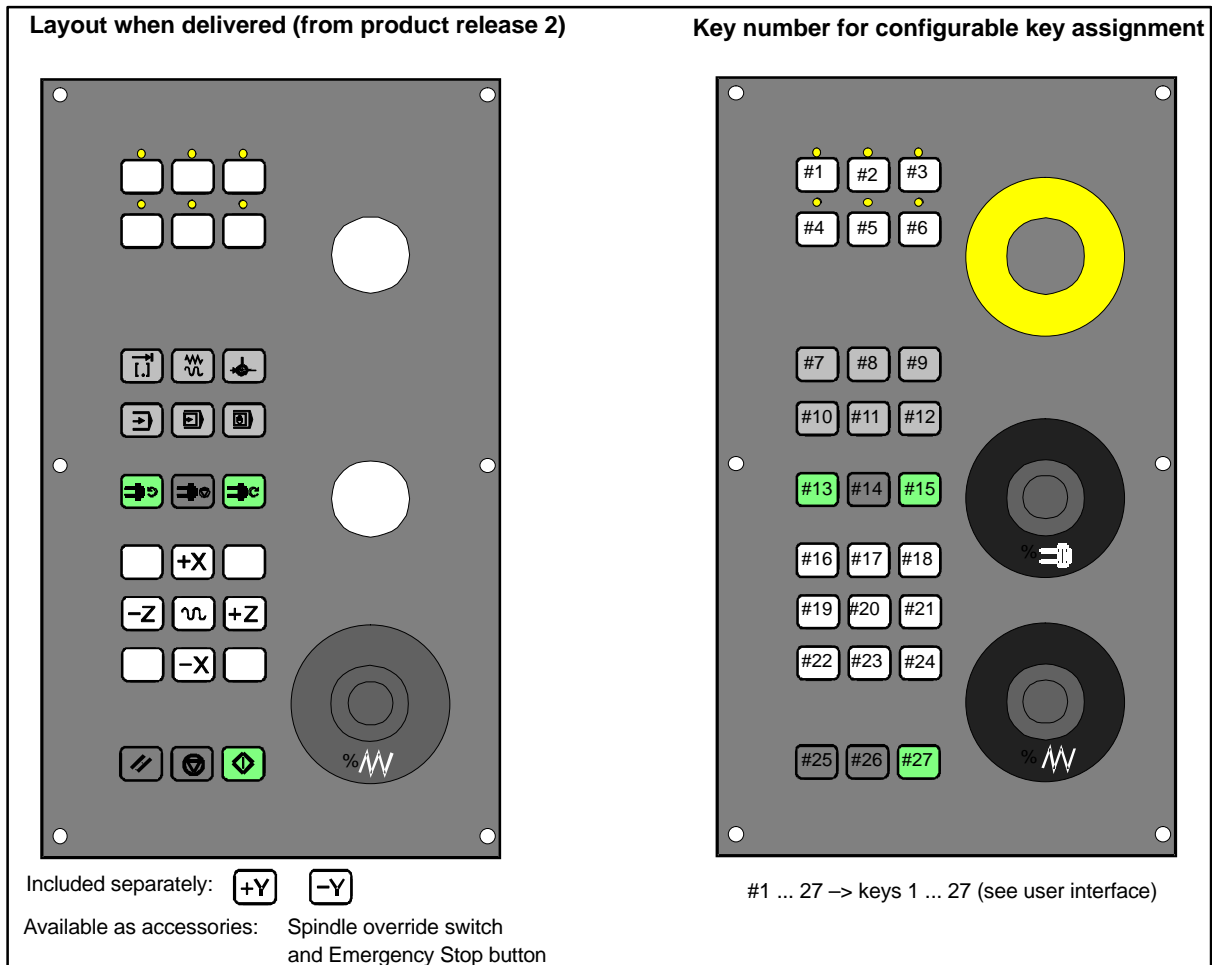


Fig. 4-3 Layout of the machine control panel

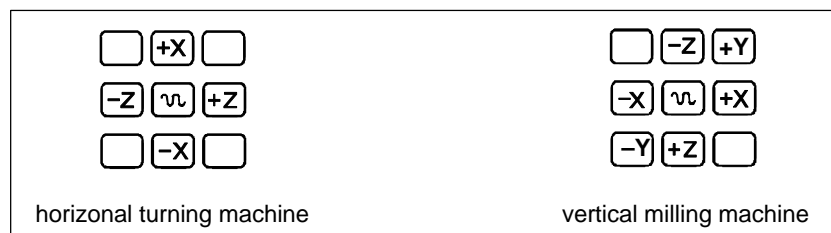


Fig. 4-4 Examples for the assignment of the axis keyboard

### 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 delivered 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 result 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<br><b>MW3, MW5 ... are not permissible</b>         |
| Flag double–word | MD0,MD4,MD8<br><b>MD1,MD2,MD3, MD5 ... are not permissible</b> |

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<br>(Double Word) | 4 bytes | 4                 | 0000 0000 ... FFFF FFFF    | –2 147 483 648 ...<br>+2 147 483 647 |
| REAL                   | 4 bytes | 4                 | –                          | $\pm 10^{-37} \dots \pm 10^{38}$     |

## 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 to 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 identifiers

| 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<br>(00-79)      | 00<br>(00-99)                | 0<br>(0-9) | 000<br>(000-999) | symbolic<br>(8-digit) |

Table 4-9 S802C 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) |

Table 4-10 , FortsetzungSpecial Flag SM Bit Definition

| SM Bits | Description  |
|---------|--|
| 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.

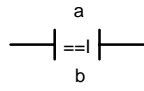
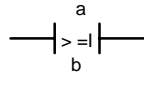
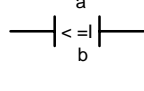
4.3 Starting up the PLC

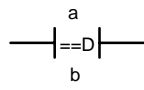
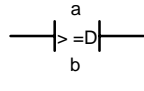
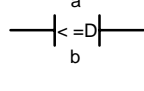
Table 4-11 Instruction set

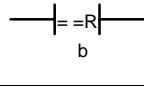
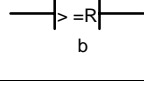
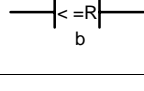
| BASIC BOOLEAN INSTRUCTIONS |                                   |               |                            |                                   |
|----------------------------|-----------------------------------|---------------|----------------------------|-----------------------------------|
| Instruction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

| OTHER BOOLEAN INSTRUCTIONS |                                      |               |                |
|----------------------------|--------------------------------------|---------------|----------------|
| Instruction                |                                      | Ladder Symbol | Valid Operands |
| <b>Edge Up</b>             | prior ↗ close<br>(1 PLC cycle)       |               |                |
| <b>Edge Down</b>           | prior ↘ close<br>(1 PLC cycle)       |               |                |
| <b>Logical Not</b>         | prior 0, later 1<br>prior 1, later 0 |               |                |
| <b>No operation</b>        |                                      |               | n = 0 ... 255  |

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

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

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

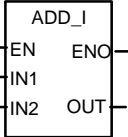
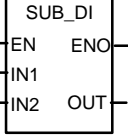
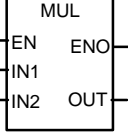
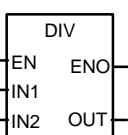
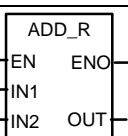
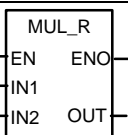
| REAL WORD COMPARES (Signed)   |   |  |
|---|---|--|
| Instruction   | Ladder Symbol   | Valid Operands   |
| <b>Load RWord =</b> a = b close<br><b>And RWord =</b> a ≠ b open<br><b>Or RWord =</b> |  | a: VD, ID, QD, MD, AC, Constant, LD<br>b: VD, ID, QD, MD, AC, Constant, LD |
| <b>Load RWord ≥</b>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

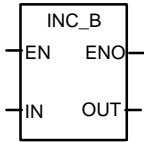
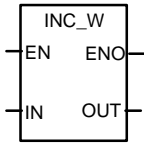
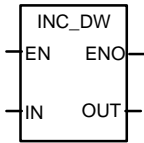
4.3 Starting up the PLC

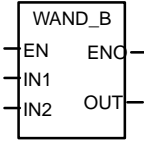
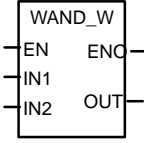
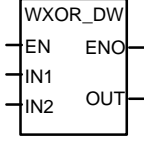
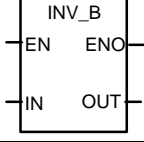
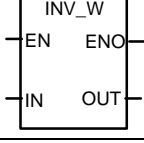
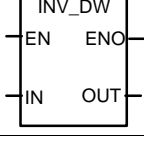
| TIMER   |               |  |
|---|---------------|--|
| Instruction   | Ladder Symbol | Valid Operands   |
| <b>Timer Retentive On Delay</b><br>EN=1, Start<br>EN=0, Stop<br>If $T_{Value} \geq PT$ ,<br>$T_{bit}=1$ |               | Enable: (IN)<br>S0<br>Txxx: T0 – T15<br>Preset: (PT)<br>VW, T, C, IW,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

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



| MATH OPERATIONS   |   |   |
|---|---|---|
| Instruction   | Ladder Symbol   | Valid Operands  |
| <b>Word Add</b> If EN = 1,<br><b>Word Subtract</b> $b = a + b$<br>$b = b - a$                       |    | Enable: EN<br>In: VW, T, C, IW, QW, MW, AC, Constant, LW<br>Out: VW, T, C, IW, QW, MW, AC, LW |
| <b>DWord Add</b> If EN = 1,<br><b>DWord Subtract</b> $b = a + b$<br>$b = b - a$                     |    | Enable: EN<br>In: VD, ID, QD, MD, AC, Constant, LD<br>Out: VD, ID, QD, MD, AC, LD             |
| <b>Multiply</b> If EN = 1,<br>$b = a \times b$  |    | Enable: EN<br>In: VW, T, C, IW, QW, MW, AC, Constant, LW<br>Out: VD, ID, QD, MD, AC, LD       |
| <b>Divide</b> If EN = 1,<br>$b = b \div a$<br>Out:<br>16 bit remainder<br>Out+2:<br>16 bit quotient |    | Enable: EN<br>In: VW, T, C, IW, QW, MW, AC, Constant, LW<br>Out: VD, ID, QD, MD, LD           |
| <b>Add</b> If EN = 1,<br><b>Subtract</b> $b = a + b$<br><b>Real Numbers</b> $b = b - a$             |   | Enable: EN<br>In: VD, ID, QD, MD, AC, Constant, LD<br>Out: VD, ID, QD, MD, AC, LD             |
| <b>Multiply</b> If EN = 1,<br><b>Divide</b> $b = a \times b$<br><b>Real Numbers</b> $b = b \div a$  |  | Enable: EN<br>In: VD, ID, QD, MD, AC, Constant, LD<br>Out: VD, ID, QD, MD, AC, LD             |

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

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

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

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

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

| PROGRAM CONTROL FUNCTIONS                                    |               |   |
|--|---------------|---|
| Instruction  | Ladder Symbol | Valid Operands  |
| <b>Subroutine</b><br>If EN $\nearrow$ , go to sub-routine n. |               | Label: Constant : 0–63  |
| MOVE, FILL AND FIND OPERATIONS                               |               |   |
| Instruction  | Ladder Symbol | Valid Operands  |
| <b>Move Byte</b><br>If EN = 1, copy i to o.                  |               | Enable: EN<br>In: VB, IB, QB, MB, AC, Constant, LB<br>Out: VB, IB, QB, MB, AC, LB             |
| <b>Move Word</b><br>If EN = 1, copy i to o.                  |               | Enable: EN<br>In: VW, T, C, IW, QW, MW, AC, Constant, LW<br>Out: VW, T, C, IW, QW, MW, AC, LW |
| <b>Move DWord</b><br>If EN = 1, copy i to o.                 |               | Enable: EN<br>In: VD, ID, QD, MD, AC, Constant, LD<br>Out: VD, ID, QD, MD, AC, LD             |
| <b>Move Real</b><br>If EN = 1, copy i to o.                  |               | Enable: EN<br>In: VD, ID, QD, MD, AC, Constant, LD<br>Out: VD, ID, QD, MD, AC, LD             |
| <b>Swap Bytes</b><br>If EN = 1, exchange MSB and LSB of w.   |               | Enable: EN<br>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 (sub-routines). 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)

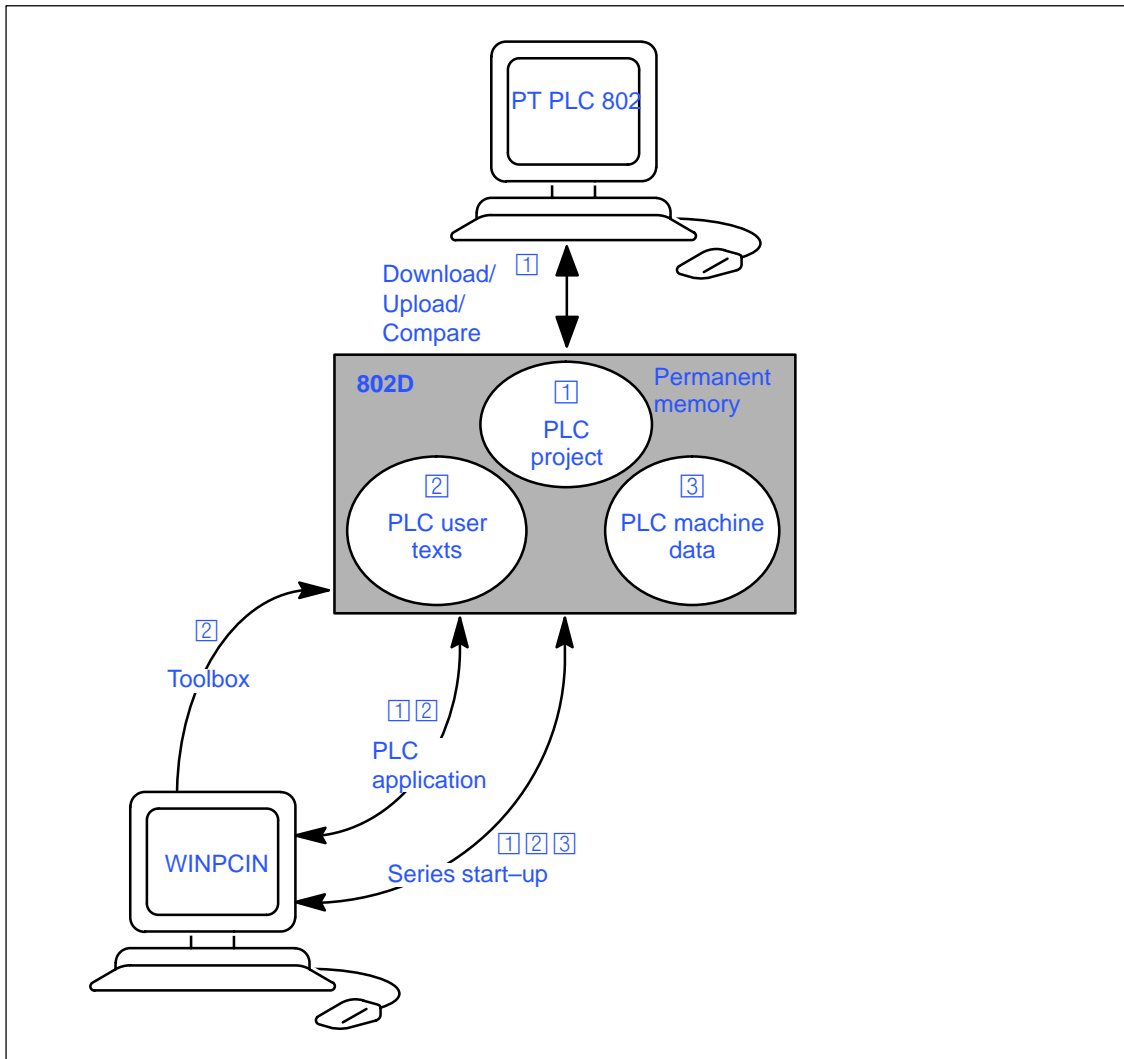


Fig. 4-5 PLC applications in the control system

## 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 802C 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).

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### Note

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

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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 802C 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                  | OH            |
| 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 802C 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).

### 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<br>To test the axis, the actual value is fed back internally as an actual value. No setpoint output at connector <b>X7</b> . | Value = 2<br>The setpoint signals for stepper motor operation are output at connector <b>X7</b> . Real axis traversal is possible using a stepper motor. |
| 30240 | Value = 0  | Value = 3<br>Internal pulse feedback from setpoint output to actual value input "ON"   |

### Machine data for axes and spindle

| Number | Explanation  | Default Value |
|--------|--|---------------|
| 30130  | Output type of setpoint (setpoint branch):   | 0             |
| 30200  | Number of encoders   | 1             |
| 30240  | Type of actual value acquisition (actual position value) (encoder no.)<br>0: Simulation<br>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              |
| 32250                   | Rated output voltage                                      | 80             |
| 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<br>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                   | Reciprocation speed                                       | 500            |
| 35410                   | Acceleration during reciprocating                         | 16             |
| 35430                   | Starting direction during reciprocation                   | 0              |
| 35440                   | Reciprocation time for M3 direction                       | 1              |
| 35450                   | Reciprocation time for M4 direction                       | 0,5            |
| 35510                   | Feedrate enable for spindle stopped                       | 0              |
| 36000<br>(only<br>SPOS) | Exact positioning coarse                                  | 0.04           |
| 36010<br>(only<br>SPOS) | Exact positioning fine                                    | 0.01           |
| 36020<br>(only<br>SPOS) | Delay exact positioning fine                              | 1              |

| Number               | Explanation  | Default Value                          |
|----------------------|--|--|
| 36030<br>(only SPOS) | Zero-speed tolerance   | 0.2                                    |
| 36040<br>(only SPOS) | Delay zero-speed monitoring  | 0.4                                    |
| 36050<br>(only SPOS) | Clamping tolerance   | 0.5                                    |
| 36060<br>(only SPOS) | Maximum velocity/speed "axis/spindle stopped"  | 5 (axis);<br>0.0138<br>(spindle)       |
| 36200                | Threshold value for velocity monitoring (control parameter set no.): 0...5   | 11500<br>(axis);<br>31,94<br>(spindle) |
| 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.):<br>0,1 0: Zero mark monitoring off, encoder<br>HW monitoring on<br>1-99, >100: Number of recognized zero mark errors<br>during monitoring<br>100: Zero mark monitoring off, encoder<br>HW monitoring off | 0                                      |
| 36400                | Contour Tol  | 1                                      |
| 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                                      |

## Matching encoder to axis/spindle

### Machine data for encoder adjustment

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

**Example 1 for encoder matching:**

Axis with rotary encoder (500 pulses) mounted directly on the motor. The internal multiplication factor is 4. The internal computational resolution amounts to 1,000 increments per degree.

|        |             |         |   |
|--------|-------------|---------|---|
|        | 360 degrees | MD31080 | 1 |
| Inter- | MD          | M       | 0 |
| nal    | 310         | D       | 0 |
| reso-  | 20          | 3       | 0 |
| lution | 4           | 1       | 0 |
| =      |             | 0       |   |
|        |             | 7       |   |
|        |             | 0       |   |

|        |                |   |
|--------|----------------|---|
|        | 360 · 1 · 1000 | = |
| Inter- | 5              | 1 |
| nal    | 0              | 8 |
| reso-  | 0              | 0 |
| lution | ·              |   |
| =      | 4              |   |
|        | ·              |   |
|        | 1              |   |

One encoder increment corresponds to 180 internal increments. One encoder increment corresponds to 0.18 degrees (minimum positioning step).

**Example 2 for encoder matching:**

Spindle with rotary encoder on motor (2,048 pulses), internal multiplication = 4, 2 speed stages exist:

Gear stage 1: Motor/spindle = 2.5/1

Gear stage 2: Motor/spindle = 1/1

Gear stage 1

$$\text{Internal resolution} = \frac{360 \text{ degrees}}{MD31080 \cdot MD31050} \cdot \dots$$

|     |   |   |    |
|-----|---|---|----|
| MD  | M | M | 1  |
| 310 | D | D | ,  |
| 20  | 3 | 3 | 0  |
| 4   | 1 | 1 | 0  |
|     | 0 | 0 | 0  |
|     | 7 | 6 | i  |
|     | 0 | 0 | n  |
|     |   |   | c  |
|     |   |   | r/ |
|     |   |   | d  |
|     |   |   | e  |
|     |   |   | g  |

$$\text{Internal resolution} = \frac{360 \text{ degrees}}{4 \cdot 1 \cdot 1} = 1,0000 \text{ pulses}$$

One encoder increment corresponds to 43.945 internal increments. One encoder increment corresponds to 0.043945 degrees (minimum positioning step).

**Machine data default settings for analog motor axes**

The machine data list below contains the default machine data with their recommended settings with the analog motor axes connected.

After they have been set, the axis are ready to be traversed, as far as the machine data are concerned, and only fine settings have to be done.

| Number | Description  | Default Value | Setting or Remark             |
|--------|--|---------------|-------------------------------|
| 30130  | Output type of setpoint (setpoint branch): 0   | 0             | 1                             |
| 30240  | Type of actual value acquisition (actual position value) (encoder no.)<br>0: Simulation<br>2: Encoder external | 0             | 2                             |
| 31020  | Encoder markings per revolution (encoder no.)  | 2048          | Steps per encoder revolution  |
| 31030  | Pitch of leadscrew   | 10            | Leadscrew pitch               |
| 31050  | Denominator load gearbox (control parameter no.): 0...5  | 1             | Load gear transmission ratios |

| Number | Description  | Default Value | Setting or Remark  |
|--------|--|---------------|--|
| 31060  | Nominator load gearbox (control parameter no.) 0...5                       | 1             | Load gear transmission ratios (MD31080:MD31050)                |
| 31070  | Denominator resolver gearbox (control parameter no.): 0...5                | 1             | Load gear transmission ratios                                  |
| 31080  | Nominator resolver gearbox (control parameter no.): 0...5                  | 1             | Load gear transmission ratios (MD31080:MD31050)                |
| 32000  | Maximum axis velocity  | 10000         | 30,000 (max. axis velocity)                                    |
| 32100  | Traversing direction (not control direction)                               | 0             | Reversal of direction of movement                              |
| 32110  | Sign actual value (control direction) (encoder no.)                        | 0             | Measuring system reversal                                      |
| 32200  | Servo gain factor (control parameter set no.): 0...5                       | 1,0           | 1.0 (position controller gain)                                 |
| 32250  | Rated output voltage   | 80%           | The speed defined in MD32260 is reached at the setpoint of 8 V |
| 32260  | Rated motor speed (setpoint branch): 0                                     | 3000          | Motor speed  |
| 34070  | Reference point positioning velocity                                       | 300           | Positioning velocity when referencing                          |
| 34200  | Type of position measuring system<br>1: Zero pulse (on encoder track)      | 1             | Zero pulse   |
| 36200  | Threshold value for velocity monitoring (control parameter set no.): 0...5 | 11500         | Threshold monitoring for velocity monitoring in the axis       |
|        |  | 31,94         | Threshold value for speed monitoring in the spindle            |

To solve monitoring problems, the following machine data must be set.

| Number | Description                                   | Default Value | Setting or Remark                              |
|--------|---|---------------|--|
| 36000  | Exact positioning coarse                      | 0.04          | Exact stop coarse                              |
| 36010  | Exact positioning fine                        | 0.01          | Exact stop fine                                |
| 36020  | Delay exact positioning fine                  | 1.0           | Positioning delay time                         |
| 36060  | Maximum velocity/speed "axis/spindle stopped" | 5.0           | Threshold velocity for "Axis at standstill"    |
|        |   | 0.013889      | Threshold velocity for "Spindle at standstill" |



### Parameterization example

|                  |   |
|------------------|---|
| Encoder:         | 2500 [10,000 pulses per motor revolution] |
| Load gear:       | 1:1                                       |
| Leadscrew pitch: | 10 mm                                     |
| Motor speed:     | 1,200 rpm                                 |
| MD 30130         | =1  |
| MD 30240         | =2  |
| MD 31020         | =2500                                     |
| MD 32250         | =80%                                      |
| MD 32260         | =1,200 rpm                                |
| MD 32000         | =12,000 mm/min                            |

The hardware of the drive must be set such that it will reach exactly 1,200 rpm at 8 V.

### Servo gain

The servo gain default setting is  $K_v=1$  (corresponds to 1mm following error at a velocity of 1m/min).

The servo gain can or has to be adapted according to the particular mechanical conditions. Too high gain will result in vibrations, too low gain in a too high following error. It is imperative that the drive observes the set speed characteristic (MD32250, MD32260). In addition, the continuous characteristic of the speed when passing zero is also imperative.

## Service display of the axis behavior

### 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 Manual "Operation..").

## 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 been set for the axis/spindle.

With active function G331/G332, parameter block n (0...5) of the axis of MD 32910 becomes automatically active, which acts corresponding to the gear stage for the spindle. The gear stage is dependent on the spindle speed with M40 or is directly set by M41...M45 (see also Section 4.5.3 Start-up of the spindle).

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

**Determination of value**

The dynamic value of the spindle is stored for each individual stage in MD 32200 POSCTRL\_GAIN[n] as closed-loop gain. An adaptation of the axis to these values must be made in MD 32910 DYN\_MATCH\_TIME [n] in accordance with the following instruction:

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

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:

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

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

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 the Z axis/spindle:**

1st gear stage → parameter block[1],  
 for spindle– $K_v$ , MD 32200 POSCTRL\_GAIN[1] = 0.5 is entered,  
 for axis Z– $K_v$ , MD 32200 POSCTRL\_GAIN[1] = 2.5 is entered.,

The searched entry for the Z axis in

$$\begin{aligned} \text{MD 32910 DYN\_MATCH\_TIME [1]} &= \frac{1}{K_v[1]_{\text{spindle}}} - \frac{1}{K_v[1]_z} \\ &= \left( \frac{1}{0.5} - \frac{1}{2.5} \right) * \frac{1}{60} \\ &= \left( 2 - 0.4 \right) * \frac{1}{60} \\ &= 1.6 * \frac{1}{60} \\ &= 0.0267 \text{ s} \end{aligned}$$

$$\text{MD 32910 DYN\_MATCH\_TIME [1]} = \underline{0.0960} \text{ s}$$

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:

$$\begin{aligned} \text{MD 32910 DYN\_MATCH\_TIME [1]} &= \left( \frac{1}{0.5} - \frac{1}{2.437} \right) * \frac{1}{60} \\ &= \left( 2 - 0.4103 \right) * \frac{1}{60} \\ &= 1.5897 * \frac{1}{60} \\ &= \underline{0.0954} \text{ s} \end{aligned}$$

In practice, this value can be optimized. To this aim, the thread is first tested with compensating chuck and the calculated values. Then the values should be modified sensitively such that the difference path in the compensating chuck approximates to zero.

Now, the POSCTRL\_GAIN values displayed on the service display for axis and spindle should be identical.

**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 axis travel due to mechanical backlash can be compensated (cf. Technical Manual “Description of Functions”).

**Funktion**

The axis-specific actual value is corrected by the backlash compensation value (MD32450 BACKLASH) with each change of the traversing direction.

**Activation**

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

**Leadscrew error compensation (LEC)****Overview**

The compensation values are determined by means of the measured error curve and 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**

The leadscrew error compensation (LEC) changes the axis-specific actual position by the associated compensation value.

If the compensation values are too high, an alarm message can be 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).

**Caution**

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 802C, 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). For this reason, data have to be entered for the spindle, too; these data are described for axis start-up.

---

#### Note

With SINUMERIK 802C, the 4th machine axis (SP) is fixed for the spindle.

---

The spindle settings for the 4th machine axis are contained in the default machine data.

The spindle setpoint ( $\pm 10$  V analog voltage signal) is output to **X7**. The spindle measuring system must be connected to **X6**.

#### 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

see MD for axis and spindle

**SD for spindle**

| Number | Description                         | 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 record.

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

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

**Note**

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

**Machine data for setpoint and actual values****Setpoints:**

MD 30130 CTRLOUT\_TYPE [AX4] = 1

**Actual values:**

MD 30200 NUM\_ENC[AX4] = 0 ;Spindle without encoder

MD 30200 NUM\_ENC[AX4] = 1 ;Spindle with encoder

MD 30240 ENC\_TYPE[AX4] = 2

**Interface signals of the spindle**

|  | Interface signals                                      |
|--|--|
|  | "Speed change" 39032000 Bit 3                          |
|  | "Actual gear stage" 38032000 bits 0 to 2               |
|  | "No speed monitoring on gear change"<br>38032000 bit 6 |
|  | "Speed is changed" 38032000 Bit 3                      |
|  | "Set gear stage" 39032000 bits 0 to 2                  |
|  | "Positioning mode" 39032002 bit 5                      |
|  | "Oscillating through PLC"38032002 bit 4                |
|  | "Oscillating mode" 39032002 bit 6                      |
|  | "Control mode" 39032002 bit 7                          |

|  | Interface signals                 |
|--|-----------------------------------|
|  | "Traversing minus" 39030004 bit 6 |
|  | "Traversing plus" 39030004 bit 7  |

## Reciprocation mode for gear change

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

| Number                   | Description                                    |
|--------------------------|--|
| <b>Machine data</b>      |  |
| 35400                    | Reciprocation speed                            |
| 35410                    | Acceleration when reciprocating                |
| 35430                    | Start direction in reciprocation               |
| 35440                    | Reciprocation time for M3 direction            |
| 35450                    | Reciprocation time for M4 direction            |
| <b>Interface signals</b> |  |
|                          | "Change gear" 39032000 bit 3                   |
|                          | "Reciprocation speed" 38032002 bit 5           |
|                          | "Reciprocating by PLC" 38032002 bit 4          |
|                          | "Set direction of rotation CCW" 38032002 bit 7 |

### 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 final 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 (final 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 softkey **Save data.**

### 4.7.5 Cycle start-up

#### Sequence of operations

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

1. Save tool offset data and zero offsets either on the FLASH or on the PG (programming device).  
These data can be selected in 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 recovered 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 **PCIN** 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

### 5.1 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.

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#### 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.

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#### 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.

## 5.2 Updating the system software incl. user data without using a 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.

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### Note

Reload the externally saved user standard data via V24.

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## 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 permanent memory).
  2. Carry out **POWER ON** for slave control system —> control system changes to the update condition.  
Various patterns appear 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<br>UPDATE                        | Error when updating the system software via V24 <ul style="list-style-type: none"> <li>• Data already in receive buffer (send from PC side started too early)</li> <li>• Error when erasing the FLASH memory</li> <li>• Error when writing to the FLASH memory</li> <li>• Inconsistent data (incomplete or faulty)</li> </ul> | <ul style="list-style-type: none"> <li>• Repeat update</li> <li>• Check link between control system and PC/PG</li> <li>• Check diskette</li> </ul> |
| SINUMERIK<br>802S<br>UPDATE<br>NO DATA | Update without programming the code FLASH completed (no data received, transfer not started)  |  |

## Technical Appendix

### 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<br>(from $\pm 4.19 \cdot 10^{-307}$ to $\pm 1.67 \cdot 10^{308}$ )           |
| DWORD          | Integer values (from $-2.147 \cdot 10^9$ to $2.147 \cdot 10^9$ )                                     |
| STRING         | Character string (max. 16 characters) consisting of<br>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 $\pm 8.43 \cdot 10^{-37}$ to $\pm 3.37 \cdot 10^{38}$ )                            |

#### 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          |                |
| <b>202</b>     | <b>\$MM_FIRST_LANGUAGE</b>            |               |               |                    |                |
| Decimal        | Foreground language                   |               |               | <b>Power On</b>    | 2/3            |
| 0              | 1                                     | 1             | 2             | Byte               |                |
| <b>203</b>     | <b>\$MM_DISPLAY_RESOLUTION</b>        |               |               |                    |                |
| Decimal        | Display resolution                    |               |               | <b>Power On</b>    | 2/3            |
| 0              | 3                                     | 0             | 5             | Byte               |                |
| <b>206</b>     | <b>\$MM_USER_CLASS_WRITE_TOA_GEO</b>  |               |               |                    |                |
| Decimal        | User class Write tool geometry        |               |               | <b>Immediately</b> | 2/3            |
| 0              | 3                                     | 0             | 7             | Byte               |                |
| <b>207</b>     | <b>\$MM_USER_CLASS_WRITE_TOA_WEAR</b> |               |               |                    |                |
| Decimal        | User class Write tool wear data       |               |               | <b>Immediately</b> | 2/3            |
| 0              | 3                                     | 0             | 7             | Byte               |                |

6.1 List of machine and setting data

|            |   |   |                    |      |
|------------|---|---|--------------------|------|
| <b>208</b> | <b>\$MM_USER_CLASS_WRITE_ZOA</b>                |   |                    |      |
| Decimal    | User class Write settable zero offset           |   | <b>Immediately</b> | 2/3  |
| 0          | 3   | 0 | 7                  | Byte |
| <b>210</b> | <b>\$MM_USER_CLASS_WRITE_SEA</b>                |   |                    |      |
| Decimal    | User class Write setting data                   |   | <b>Immediately</b> | 2/3  |
| 0          | 3   | 0 | 7                  | Byte |
| <b>216</b> | <b>\$MM_USER_CLASS_WRITE_RPA</b>                |   |                    |      |
| Decimal    | User class Write R parameters                   |   | <b>Immediately</b> | 2/3  |
| 0          | 3   | 0 | 7                  | Byte |
| <b>217</b> | <b>\$MM_USER_CLASS_SET_V24</b>                  |   |                    |      |
| Decimal    | User class Set V24                              |   | <b>Immediately</b> | 2/3  |
| 0          | 3   | 0 | 7                  | Byte |
| <b>219</b> | <b>\$MM_USER_CLASS_DIR_ACCESS</b>               |   |                    |      |
| Decimal    | User class access directory                     |   | <b>Immediately</b> | 2/3  |
| 0          | 3   | 0 | 7                  | Byte |
| <b>277</b> | <b>\$MM_USER_CLASS_PLC_ACCESS</b>               |   |                    |      |
| Decimal    | User class access PLC project                   |   | <b>Immediately</b> | 2/3  |
| 0          | 3   | 0 | 7                  | Byte |
| <b>278</b> | <b>\$MM_NCK_SYSTEM_FUNC_MASK</b>                |   |                    |      |
| Decimal    | Option data to enable system-specific functions |   | <b>POWER ON</b>    | 2/2  |
| 0          | 0   | 0 | 15                 | Byte |
| <b>280</b> | <b>\$MM_V24_PPI_ADDR_PLC</b>                    |   |                    |      |
| Decimal    | PPI address of the PLC                          |   | <b>POWER ON</b>    | 3/3  |
| 0          | 2   | 0 | 126                | BYTE |
| <b>281</b> | <b>\$MM_V24_PPI_ADDR_NCK</b>                    |   |                    |      |
| Decimal    | PPI address of the NCK                          |   | <b>POWER ON</b>    | 3/3  |
| 0          | 3   | 0 | 126                | BYTE |
| <b>282</b> | <b>\$MM_V24_PPI_ADDR_MMC</b>                    |   |                    |      |
| Decimal    | PPI address of the HMI                          |   | <b>POWER ON</b>    | 3/3  |
| 0          | 4   | 0 | 126                | BYTE |
| <b>283</b> | <b>\$MM_V24_PPI_MODEM_ACTIVE</b>                |   |                    |      |
| Decimal    | Modem active                                    |   | <b>Immediately</b> | 3/3  |
| 0          | 0   | 0 | 1                  | BYTE |
| <b>284</b> | <b>\$MM_V24_PPI_MODEM_BAUD</b>                  |   |                    |      |
| Decimal    | Modem baud rate                                 |   | <b>Immediately</b> | 3/3  |
| 0          | 7   | 5 | 9                  | BYTE |
| <b>285</b> | <b>\$MM_V24_PPI_MODEM_PARITY</b>                |   |                    |      |
| Decimal    | Modem parity                                    |   | <b>Immediately</b> | 3/3  |
| 0          | 0   | 0 | 2                  | BYTE |

6.1 List of machine and setting data

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 |  |
| <b>10074</b>  | <b>PLC_IPO_TIME_RATIO</b>                                      |               |               |           |            |  |
| -             | PLC task factor for main run                                   |               |               | POWER ON  |            |  |
|               | 2  | 1             | 50            | DWORD     | 2/7        |  |
| <b>10240</b>  | <b>SCALING_SYSTEM_IS_METRIC</b>                                |               |               |           |            |  |
| -             | Basic system metric  |               |               | POWER ON  |            |  |
| _always       | 1  | ***           | ***           | BOOLEAN   | 2/7        |  |
| <b>11100</b>  | <b>AUXFU_MAXNUM_GROUP_ASSIGN</b>                               |               |               |           |            |  |
| -             | Number of auxiliary functions distr. amongst aux. fct. groups  |               |               | POWER ON  |            |  |
| _always       | 1  | 1             | 50            | BYTE      | 2/7        |  |
| <b>11200</b>  | <b>INIT_MD</b>   |               |               |           |            |  |
| HEX           | Standard machine data loaded on next Power On                  |               |               | POWER ON  |            |  |
| _always       | 0x0F   | -             | -             | BYTE      | 2/7        |  |
| <b>11210</b>  | <b>UPLOAD_MD_CHANGE_ONLY</b>                                   |               |               |           |            |  |
| HEX           | Saving only of modified MD (value=0: complete= no difference)  |               |               | RESTART   |            |  |
| -             | 0x0F   | -             | -             | BYTE      | 2/7        |  |
| <b>11310</b>  | <b>HANDWH_REVERSE</b>  |               |               |           |            |  |
| -             | Threshold for direction change handwheel                       |               |               | POWER ON  |            |  |
| _always       | 2  | 0.0           | plus          | BYTE      | 2/7        |  |
| <b>11320</b>  | <b>HANDWH_IMP_PER_LATCH</b>                                    |               |               |           |            |  |
| -             | Handwheel pulses per detent position (handwheel number): 0...1 |               |               | POWER ON  |            |  |
| _always       | 1., 1.   | -             | -             | DOUBLE    | 2/7        |  |
| <b>14510</b>  | <b>USER_DATA_INT [n]</b>                                       |               |               |           |            |  |
| kB            | User data (INT) 0 ... 31                                       |               |               | POWER ON  |            |  |
| _always       | -  | 0             | -             | DWORD     | 2/7        |  |
| <b>14512</b>  | <b>USER_DATA_HEX [n]</b>                                       |               |               |           |            |  |
| kB            | User data (Hex) 0 ... 31                                       |               |               | POWER ON  |            |  |
| -             | 0  | 0             | 0xFF          | BYTE      | 2/7        |  |
| <b>14514</b>  | <b>USER_DATA_FLOAT [n]</b>                                     |               |               |           |            |  |
| -             | User data (Float) 0 ... 7                                      |               |               | POWER ON  |            |  |
| -             | 0.0  | ...           | ...           | DOUBLE    | 2/7        |  |
| <b>14516</b>  | <b>USER_DATA_PLC_ALARM [n]</b>                                 |               |               |           |            |  |
| -             | 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 |  |



|              |  |     |      |          |     |  |
|--------------|--|-----|------|----------|-----|--|
| <b>20210</b> | <b>CUTCOM_CORNER_LIMIT</b>                                     |     |      |          |     |  |
| Degrees      | Maximum angle for compensation blocks with TRC                 |     |      | POWER ON |     |  |
| _always      | 100  | 0.0 | 150. | DOUBLE   | 2/7 |  |
| <b>20700</b> | <b>REFP_NC_START_LOCK</b>                                      |     |      |          |     |  |
| -            | NC-Start disable without reference point                       |     |      | RESET    |     |  |
| _always      | 1  | 0   | 1    | BOOLEAN  | 2/7 |  |
| <b>21000</b> | <b>CIRCLE_ERROR_CONST</b>                                      |     |      |          |     |  |
| mm           | Circle end point monitoring constant                           |     |      | POWER ON |     |  |
| _always      | 0.01   | 0.0 | plus | DOUBLE   | 2/7 |  |
| <b>22000</b> | <b>AUXFU_ASSIGN_GROUP</b>                                      |     |      |          |     |  |
| -            | Auxiliary function group (aux. fct. no. in channel): 0...49    |     |      | POWER ON |     |  |
| _always      | 1  | 1   | 15   | BYTE     | 2/7 |  |
| <b>22010</b> | <b>AUXFU_ASSIGN_TYPE</b>                                       |     |      |          |     |  |
| -            | Auxiliary function type (aux. fct. no. in channel): 0...49     |     |      | POWER ON |     |  |
| _always      | , ,  | -   | -    | STRING   | 2/7 |  |
| <b>22030</b> | <b>AUXFU_ASSIGN_VALUE</b>                                      |     |      |          |     |  |
| -            | Auxiliary function value (aux. fct. no. in channel): 0...49    |     |      | POWER ON |     |  |
| _always      | 0  | -   | -    | DWORD    | 2/7 |  |
| <b>22550</b> | <b>TOOL_CHANGE_MODE</b>  |     |      |          |     |  |
| -            | New tool compensation for M function                           |     |      | POWER ON |     |  |
| _always      | 0  | 0   | 1    | BYTE     | 2/7 |  |
| <b>27800</b> | <b>TECHNOLOGY_MODE</b>   |     |      |          |     |  |
| -            | 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 |  |
| <b>30130</b>     | <b>CTRLOUT_TYPE</b>  |               |               |           |            |  |
| -                | Output type of setpoint (setpoint branch): 0   |               |               | POWER ON  |            |  |
| _always          | 0  | 0             | 2             | BYTE      | 2/7        |  |
| <b>30200</b>     | <b>NUM_ENCS</b>  |               |               |           |            |  |
| -                | Anzahl der Geber (1 oder kein Geber für die Spindel)   |               |               | RESTART   |            |  |
|                  | 1  | 0             | 1             | BYTE      | 2/7        |  |
| <b>30240</b>     | <b>ENC_TYPE</b>  |               |               |           |            |  |
| -                | Type of actual value acquisition (actual position value) (encoder no.)<br>0: Simulation<br>2: Square-wave generator, standard encoder (pulse multiplication)<br>3: Encoder for stepper motor |               |               | POWER ON  |            |  |
| _always          | 0, 0   | 0             | 4             | BYTE      | 2/7        |  |
| <b>30350</b>     | <b>SIMU_AX_VDI_OUTPUT</b>  |               |               |           |            |  |
| -                | Output of axis signals with simulation axes  |               |               | POWER ON  |            |  |
| _always          | 0  | ***           | ***           | BOOLEAN   | 2/7        |  |
| <b>30600</b>     | <b>FIX_POINT_POS</b>   |               |               |           |            |  |
| mm, de-<br>grees | Fixed-value positions of axis with G75 (position no.)  |               |               | POWER ON  |            |  |
| _always          | 0.0  | -             | -             | DOUBLE    | 2/7        |  |

6.1 List of machine and setting data

|                    |   |     |            |         |     |
|--------------------|---|-----|------------|---------|-----|
| <b>31000</b>       | <b>ENC_IS_LINEAR</b>  |     |            |         |     |
| -                  | Direct measuring system (linear scale) (encoder no.)                            |     | POWER ON   |         |     |
| _always            | 0   | *** | ***        | BOOLEAN | 2/7 |
| <b>31010</b>       | <b>ENC_GRID_POINT_DIST</b>  |     |            |         |     |
| mm                 | Division period for linear scales (encoder no.)                                 |     | POWER ON   |         |     |
| _always            | 0.01  | 0.0 | plus       | DOUBLE  | 2/7 |
| <b>31020</b>       | <b>ENC_RESOL</b>  |     |            |         |     |
| -                  | Encoder markings per revolution (encoder no.)                                   |     | POWER ON   |         |     |
| _always            | 2048  | 0.0 | plus       | DWORD   | 2/7 |
| <b>31030</b>       | <b>LEADSCREW_PITCH</b>  |     |            |         |     |
| mm                 | Pitch of leadscrew  |     | POWER ON   |         |     |
| _always            | 10.0  | 0.0 | plus       | DOUBLE  | 2/7 |
| <b>31040</b>       | <b>ENC_IS_DIRECT</b>  |     |            |         |     |
| -                  | Encoder mounted directly to the machine (encoder no.)                           |     | POWER ON   |         |     |
| _always            | 0   | *** | ***        | BOOLEAN | 2/7 |
| <b>31050</b>       | <b>DRIVE_AX_RATIO_DENOM</b>   |     |            |         |     |
| -                  | Denominator load gearbox (control parameter no.): 0...5                         |     | POWER ON   |         |     |
| _always            | 1, 1, 1, 1, 1, 1  | 1   | 2147000000 | DWORD   | 2/7 |
| <b>31060</b>       | <b>DRIVE_AX_RATIO_NUMERA</b>  |     |            |         |     |
| -                  | Numerator load gearbox (control parameter set no.): 0...5                       |     | POWER ON   |         |     |
| _always            | 1, 1, 1, 1, 1, 1  | 1   | 2147000000 | DWORD   | 2/7 |
| <b>31070</b>       | <b>DRIVE_ENC_RATIO_DENOM</b>  |     |            |         |     |
| -                  | Denominator resolver gearbox (encoder no.)                                      |     | POWER ON   |         |     |
| _always            | 1   | 1   | 2147000000 | DWORD   | 2/7 |
| <b>31080</b>       | <b>DRIVE_ENC_RATIO_NUMERA</b>   |     |            |         |     |
| -                  | Numerator resolver gearbox (encoder no.)  |     | POWER ON   |         |     |
| _always            | 1   | 1   | 2147000000 | DWORD   | 2/7 |
| <b>31090</b>       | <b>JOG_INCR_WEIGHT</b>  |     |            |         |     |
| mm, de-<br>grees   | Evaluation of an increment with INC/handwheel                                   |     | RESET      |         |     |
| <b>32000</b>       | <b>MAX_AX_VELO</b>  |     |            |         |     |
| mm/min,<br>rev/min | Maximum axis velocity   |     | NEW CONF   |         |     |
| _always            | 10000.  | 0.0 | plus       | DOUBLE  | 2/7 |
| <b>32010</b>       | <b>JOG_VELO_RAPID</b>   |     |            |         |     |
| mm/min,<br>rev/min | Rapid treverse in jog mode  |     | RESET      |         |     |
| _always            | 10000.  | 0.0 | plus       | DOUBLE  | 2/7 |
| <b>32020</b>       | <b>JOG_VELO</b>   |     |            |         |     |
| mm/min,<br>rev/min | Jog axis velocity   |     | RESET      |         |     |
| _always            | 2000.   | 0.0 | plus       | DOUBLE  | 2/7 |
| <b>32070</b>       | <b>CORR_VELO</b>  |     |            |         |     |
| %                  | Axis velocity for handwheel override, ext. ZO, cont. dressing, distance control |     | RESET      |         |     |
| _always            | 50  | 0.0 | plus       | DWORD   | 2/7 |
| <b>32100</b>       | <b>AX_MOTION_DIR</b>  |     |            |         |     |
| -                  | Traversing direction (not control direction)                                    |     | POWER ON   |         |     |
| _always            | 1   | -1  | 1          | DWORD   | 2/7 |

6.1 List of machine and setting data

|   |   |     |      |          |         |     |
|---|---|-----|------|----------|---------|-----|
| <b>32110</b>                              | <b>ENC_FEEDBACK_POL</b>   |     |      |          |         |     |
| -   | Sign actual value (control direction) (encoder no.)                 |     |      | POWER ON |         |     |
| _always                                   | 1   | -1  | 1    |          | DWORD   | 2/7 |
| <b>32200</b>                              | <b>POSCTRL_GAIN</b>   |     |      |          |         |     |
| 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 |
| <b>32250</b>                              | <b>RATED_OUTVAL</b>   |     |      |          |         |     |
| %   | Ratedoutput voltage (setprint brauch):0                             |     |      | NEW CONF |         |     |
| _always                                   | 80  | 0.0 | 10   |          | DOUBLE  | 2/7 |
| <b>32260</b>                              | <b>RATED_VELO</b>   |     |      |          |         |     |
| rev/min                                   | Rated motor speed (setpoint branch): 0                              |     |      | NEW CONF |         |     |
| _always                                   | 3000  | 0.0 | plus |          | DOUBLE  | 2/7 |
| <b>32300</b>                              | <b>MAX_AX_ACCEL</b>   |     |      |          |         |     |
| mm/s <sup>2</sup> ,<br>rev/s <sup>2</sup> | Axis acceleration   |     |      | NEW CONF |         |     |
| _always                                   | 1   | 0   | ***  |          | DOUBLE  | 2/7 |
| <b>32450</b>                              | <b>BACKLASH</b>   |     |      |          |         |     |
| mm  | Backlash  |     |      | NEW CONF |         |     |
| _always                                   | 0.000   | *   | *    |          | DOUBLE  | 2/7 |
| <b>32700</b>                              | <b>ENC_COMP_ENABLE</b>  |     |      |          |         |     |
| -   | Interpolatory compensation (encoder no.): 0,1                       |     |      | POWER ON |         |     |
| _always                                   | 0   | *** | ***  |          | BOOLEAN | 2/7 |
| <b>32900</b>                              | <b>DYN_MATCH_ENABLE</b>   |     |      |          |         |     |
| -   | Dynamic response adaptation   |     |      | NEW_CONF |         |     |
|   | 0   | 0   | 1    |          | BYTE    | 2/7 |
| <b>32910</b>                              | <b>DYN_MATCH_TIME</b>   |     |      |          |         |     |
| -   | Time constant of dynamic adaption (control parameter set no): 0...5 |     |      | NEW_CONF |         |     |
|   | 0   | 0.0 | plus |          | DOUBLE  | 2/7 |
| <b>32920</b>                              | <b>AC_FILTER_TIME</b>   |     |      |          |         |     |
| s   | Smoothing factor time constant for adaptive control                 |     |      | POWER ON |         |     |
| _always                                   | 0.0   | 0.0 | plus |          | DOUBLE  | 2/7 |
| <b>33050</b>                              | <b>LUBRICATION_DIST</b>   |     |      |          |         |     |
| mm, deg.                                  | Traversing distance for lubrication from PLC                        |     |      | NEW CONF |         |     |
| _always                                   | 100000000   | 0.0 | plus |          | DOUBLE  | 2/7 |
| <b>34000</b>                              | <b>REFP_CAM_IS_ACTIVE</b>   |     |      |          |         |     |
| -   | Axis with reference point cam                                       |     |      | RESET    |         |     |
| _always                                   | 1   | *** | ***  |          | BOOLEAN | 2/7 |
| <b>34010</b>                              | <b>REFP_CAM_DIR_IS_MINUS</b>  |     |      |          |         |     |
| -   | Approach reference point in minus direction                         |     |      | RESET    |         |     |
| _always                                   | 0   | *** | ***  |          | BOOLEAN | 2/7 |
| <b>34020</b>                              | <b>REFP_VELO_SEARCH_CAM</b>   |     |      |          |         |     |
| mm/min,<br>rev/min                        | Reference point approach velocity                                   |     |      | RESET    |         |     |
| _always                                   | 5000.0  | 0.0 | plus |          | DOUBLE  | 2/7 |
| <b>34030</b>                              | <b>REFP_MAX_CAM_DIST</b>  |     |      |          |         |     |
| mm, deg.                                  | Maximum distance to reference cam                                   |     |      | RESET    |         |     |
| _always                                   | 10000.0   | 0.0 | plus |          | DOUBLE  | 2/7 |

6.1 List of machine and setting data

|                    |  |     |      |          |     |  |
|--------------------|--|-----|------|----------|-----|--|
| <b>34040</b>       | <b>REFP_VELO_SEARCH_MARKER</b>   |     |      |          |     |  |
| mm/min,<br>rev/min | Creep speed (encoder no.)  |     |      | RESET    |     |  |
| _always            | 300.0  | 0.0 | plus | DOUBLE   | 2/7 |  |
| <b>34050</b>       | <b>REFP_SEARCH_MARKER_REVERSE</b>  |     |      |          |     |  |
| -                  | Direction reversal to reference cams (encoder no.)   |     |      | RESET    |     |  |
| _always            | 0  | *** | ***  | BOOLEAN  | 2/7 |  |
| <b>34060</b>       | <b>REFP_MAX_MARKER_DIST</b>  |     |      |          |     |  |
| 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 |  |
| <b>34070</b>       | <b>REFP_VELO_POS</b>   |     |      |          |     |  |
| mm/min,<br>rev/min | Reference point positioning velocity   |     |      | RESET    |     |  |
| _always            | 1000.0   | 0.0 | plus | DOUBLE   | 2/7 |  |
| <b>34080</b>       | <b>REFP_MOVE_DIST</b>  |     |      |          |     |  |
| mm, deg.           | Reference point distance/target point for distance-coded system  |     |      | RESET    |     |  |
| _always            | -2.0   | -   | -    | DOUBLE   | 2/7 |  |
| <b>34090</b>       | <b>REFP_MOVE_DIST_CORR</b>   |     |      |          |     |  |
| mm, deg.           | Reference point offset/absolute offset distance-coded  |     |      | POWER ON |     |  |
| _always            | 0.0  | -   | -    | DOUBLE   | 2/7 |  |
| <b>34092</b>       | <b>REFP_CAM_SHIFT</b>  |     |      |          |     |  |
| mm, deg.           | Electr. cam offset of incremental measuring systems with equidistant zero marks  |     |      | RESET    |     |  |
| _always            | 0.0  | 0.0 | plus | DOUBLE   | 2/7 |  |
| <b>34100</b>       | <b>REFP_SET_POS</b>  |     |      |          |     |  |
| mm, deg.           | Reference point value/irrelevant for distance-coded system: 0 ... 3  |     |      | RESET    |     |  |
| _always            | 0., 0., 0., 0.   | -   | -    | DOUBLE   | 2/7 |  |
| <b>34110</b>       | <b>REFP_CYCLE_NR</b>   |     |      |          |     |  |
| -                  | Sequence of axes in channel-specific referencing<br>-1: No obligatory reference point for NC Start<br>0: No channel-specific reference-point approach<br>1-15: Sequence in channel-specific reference point approach |     |      | RESET    |     |  |
| _always            | 1  | -1  | 31   | DWORD    | 2/7 |  |
| <b>34200</b>       | <b>ENC_REFP_MODE</b>   |     |      |          |     |  |
| -                  | Type of position measuring system<br>0: No ref. point appr.; if an absolute encoder exists: REFP_SET_POS accepted<br>1: Zero pulse (on encoder track)  |     |      | POWER ON |     |  |
| _always            | 1  | 0   | 6    | BYTE     | 2/7 |  |
| <b>35010</b>       | <b>GEAR_STEP_CHANGE_ENABLE</b>   |     |      |          |     |  |
| -                  | Gear change possible. Spindle has several gear steps   |     |      | POWER ON |     |  |
| _always            | 0  | *** | ***  | BOOLEAN  | 2/7 |  |
| <b>35040</b>       | <b>SPIND_ACTIVE_AFTER_RESET</b>  |     |      |          |     |  |
| -                  | Own spindle reset  |     |      | POWER ON |     |  |
| _always            | 0  | *** | ***  | BOOLEAN  | 2/7 |  |
| <b>35100</b>       | <b>SPIND_VELO_LIMIT</b>  |     |      |          |     |  |
| rev/min            | Maximum spindle speed  |     |      | POWER ON |     |  |
| _always            | 10000  | 0.0 | plus | DOUBLE   | 2/7 |  |
| <b>35110</b>       | <b>GEAR_STEP_MAX_VELO</b>  |     |      |          |     |  |
| 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 |  |

6.1 List of machine and setting data

|              |   |     |      |          |  |     |  |
|--------------|---|-----|------|----------|--|-----|--|
| <b>35120</b> | <b>GEAR_STEP_MIN_VELO</b>   |     |      |          |  |     |  |
| 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 |  |
| <b>35130</b> | <b>GEAR_STEP_MAX_VELO_LIMIT</b>   |     |      |          |  |     |  |
| 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 |  |
| <b>35140</b> | <b>GEAR_STEP_MIN_VELO_LIMIT</b>   |     |      |          |  |     |  |
| 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 |  |
| <b>35150</b> | <b>SPIND_DES_VELO_TOL</b>   |     |      |          |  |     |  |
| Factor       | Spindle speed tolerance   |     |      | RESET    |  |     |  |
| _always      | 0.1   | 0.0 | 1.0  | DOUBLE   |  | 2/7 |  |
| <b>35160</b> | <b>SPIND_EXTERN_VELO_LIMIT</b>  |     |      |          |  |     |  |
| rev/min      | Spindle speed limitation from PLC   |     |      | NEW CONF |  |     |  |
| _always      | 1000  | 0.0 | plus | DOUBLE   |  | 2/7 |  |
| <b>35200</b> | <b>GEAR_STEP_SPEEDCTRL_ACCEL</b>  |     |      |          |  |     |  |
| 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 |  |
| <b>35210</b> | <b>GEAR_STEP_POSCTRL_ACCEL</b>  |     |      |          |  |     |  |
| 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 |  |
| <b>35220</b> | <b>ACCEL_REDUCTION_SPEED_POINT</b>  |     |      |          |  |     |  |
| Factor       | Speed for reduced acceleration  |     |      | RESET    |  |     |  |
| _always      | 1.0   | 0.0 | 1.0  | DOUBLE   |  | 2/7 |  |
| <b>35230</b> | <b>ACCEL_REDUCTION_FACTOR</b>   |     |      |          |  |     |  |
| Factor       | Reduced acceleration  |     |      | RESET    |  |     |  |
| _always      | 0.0   | 0.0 | 0.95 | DOUBLE   |  | 2/7 |  |
| <b>35240</b> | <b>ACCEL_TYPE_DRIVE</b>   |     |      |          |  |     |  |
| -            | Type of acceleration  |     |      | RESET    |  |     |  |
|              | 0   | 0   | 1    | BOOLEAN  |  | 2/7 |  |
| <b>35300</b> | <b>SPIND_POSCTRL_VELO</b>   |     |      |          |  |     |  |
| rev/min      | Position control switch-on speed  |     |      | NEW CONF |  |     |  |
| _always      | 500   | 0.0 | plus | DOUBLE   |  | 2/7 |  |
| <b>35350</b> | <b>SPIND_POSITIONING_DIR</b>  |     |      |          |  |     |  |
| -            | Direction of rotation when positioning  |     |      | RESET    |  |     |  |
| _always      | 3   | 3   | 4    | BYTE     |  | 2/7 |  |
| <b>35400</b> | <b>SPIND_OSCILL_DES_VELO</b>  |     |      |          |  |     |  |
| rev/min      | Reciprocation speed   |     |      | NEW CONF |  |     |  |
| _always      | 500   | 0.0 | plus | DOUBLE   |  | 2/7 |  |
| <b>35410</b> | <b>SPIND_OSCILL_ACCEL</b>   |     |      |          |  |     |  |
| rev/s^2      | Acceleration during reciprocating   |     |      | NEW CONF |  |     |  |
| _always      | 16  | 2   | ***  | DOUBLE   |  | 2/7 |  |
| <b>35430</b> | <b>SPIND_OSCILL_START_DIR</b>   |     |      |          |  |     |  |
| -            | Starting direction during reciprocation<br>0-2: As last direction of rotation (zero-speed M3)<br>3: M3 direction<br>4: M4 direction |     |      | RESET    |  |     |  |
| _always      | 0   | 0   | 4    | BYTE     |  | 2/7 |  |

6.1 List of machine and setting data

|                    |   |     |          |         |     |
|--------------------|---|-----|----------|---------|-----|
| <b>35440</b>       | <b>SPIND_OSCILL_TIME_CW</b>   |     |          |         |     |
| s                  | Reciprocation time for M3 direction   |     | NEW CONF |         |     |
| _always            | 1.0   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>35450</b>       | <b>SPIND_OSCILL_TIME_CCW</b>  |     |          |         |     |
| s                  | Reciprocation time for M4 direction   |     | NEW CONF |         |     |
| _always            | 0.5   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>35510</b>       | <b>SPIND_STOPPED_AT_IPO_START</b>   |     |          |         |     |
| -                  | Feedrate enable for spindle stopped   |     | RESET    |         |     |
| _always            | 0   | *** | ***      | BOOLEAN | 2/7 |
| <b>36000</b>       | <b>STOP_LIMIT_COARSE</b>  |     |          |         |     |
| mm, deg.           | Exact positioning coarse  |     | NEW CONF |         |     |
| _always            | 0.04  | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36010</b>       | <b>STOP_LIMIT_FINE</b>  |     |          |         |     |
| mm, deg.           | Exact positioning fine  |     | NEW CONF |         |     |
| _always            | 0.01  | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36020</b>       | <b>POSITIONING_TIME</b>   |     |          |         |     |
| s                  | Delay exact positioning fine  |     | NEW CONF |         |     |
| _always            | 1.0   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36030</b>       | <b>STANDSTILL_POS_TOL</b>   |     |          |         |     |
| mm, deg.           | Zero-speed tolerance  |     | NEW CONF |         |     |
| _always            | 0.2   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36040</b>       | <b>STANDSTILL_DELAY_TIME</b>  |     |          |         |     |
| s                  | Delay zero-speed monitoring   |     | NEW CONF |         |     |
| _always            | 0.4   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36050</b>       | <b>CLAMP_POS_TOL</b>  |     |          |         |     |
| mm, deg.           | Clamping tolerance  |     | NEW CONF |         |     |
| _always            | 0.5   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36060</b>       | <b>STANDSTILL_VELO_TOL</b>  |     |          |         |     |
| mm/min,<br>rev/min | Maximum velocity/speed "axis/spindle stopped"                                 |     | NEW CONF |         |     |
| _always            | 5 (0.014)   | 0.0 | plus     | DOUBLE  | 2/7 |
| <b>36100</b>       | <b>POS_LIMIT_MINUS</b>  |     |          |         |     |
| mm, deg.           | 1st software limit switch minus   |     | RESET    |         |     |
| _always            | -100000000  | -   | -        | DOUBLE  | 2/7 |
| <b>36110</b>       | <b>POS_LIMIT_PLUS</b>   |     |          |         |     |
| mm, deg.           | 1st software limit switch plus  |     | RESET    |         |     |
| _always            | 100000000   | -   | -        | DOUBLE  | 2/7 |
| <b>36120</b>       | <b>POS_LIMIT_MINUS2</b>   |     |          |         |     |
| mm, deg.           | 2nd software limit switch minus   |     | RESET    |         |     |
| _always            | -100000000  | -   | -        | DOUBLE  | 2/7 |
| <b>36130</b>       | <b>POS_LIMIT_PLUS2</b>  |     |          |         |     |
| mm, deg.           | 2nd software limit switch plus  |     | RESET    |         |     |
| _always            | 100000000   | -   | -        | DOUBLE  | 2/7 |
| <b>36200</b>       | <b>AX_VELO_LIMIT</b>  |     |          |         |     |
| mm/min,<br>rev/min | Threshold value for velocity monitoring<br>(control parameter set no.): 0...5 |     | NEW CONF |         |     |
| _always            | 11500., 11500., 11500.,<br>11500., ...  | 0.0 | plus     | DOUBLE  | 2/7 |

6.1 List of machine and setting data

|              |   |     |          |         |     |  |
|--------------|---|-----|----------|---------|-----|--|
| <b>36300</b> | <b>ENC_FREQ_LIMIT</b>   |     |          |         |     |  |
| Hz           | Encoder limit frequency   |     | POWER ON |         |     |  |
| _always      | 300000  | 0   | plus     | DOUBLE  | 2/7 |  |
| <b>36302</b> | <b>ENC_FREQ_LIMIT_LOW</b>   |     |          |         |     |  |
| %            | Encoder limit frequency at which encoder is switched on again. (Hysteresis)   |     | NEW CONF |         |     |  |
| _always      | 99.9  | 0   | 100      | DOUBLE  | 2/7 |  |
| <b>36310</b> | <b>ENC_ZERO_MONITORING</b>  |     |          |         |     |  |
| -            | Zero mark monitoring (encoder no.): 0,1<br>0: Zero mark monitoring off, encoder HW monitoring on<br>1-99, >100: Number of recognized zero mark errors during monitoring<br>100: Zero mark monitoring off, encoder HW monitoring off |     | NEW CONF |         |     |  |
| _always      | 0, 0  | 0.0 | plus     | DWORD   | 2/7 |  |
| <b>36400</b> | <b>CONTOU_TOL</b>   |     |          |         |     |  |
| mm, deg.     | Contour monitoring tolerance band   |     | NEW CONF |         |     |  |
| _always      | 1.0   | *** | ***      | DOUBLE  | 2/2 |  |
| <b>36500</b> | <b>ENC_CHANGE_TOL</b>   |     |          |         |     |  |
| mm, deg      | Portion of distance for backlash working  |     | NEW CONF |         |     |  |
| _always      | 0,1   | 0.0 | plus     | DOUBLE  | 2/7 |  |
| <b>36610</b> | <b>AX_EMERGENCY_STOP_TIME</b>   |     |          |         |     |  |
| s            | Duration of the deceleration ramp for error states  |     | NEW CONF |         |     |  |
| _always      | 0.05  | 0.0 | plus     | DOUBLE  | 2/7 |  |
| <b>36620</b> | <b>SERVO_DISABLE_DELAY_TIME</b>   |     |          |         |     |  |
| s            | Cutout delay servo enable   |     | NEW CONF |         |     |  |
| _always      | 0.1   | 0.0 | plus     | DOUBLE  | 2/7 |  |
| <b>36700</b> | <b>DRIFT_ENABLE</b>   |     |          |         |     |  |
| -            | Automatic drift compensation  |     | NEW CONF |         |     |  |
| _always      | 0   | *** | ***      | BOOLEAN | 2/7 |  |
| <b>36710</b> | <b>DRIFT_LIMIT</b>  |     |          |         |     |  |
| %            | Drift limit value for automatic drift compensation  |     | NEW CONF |         |     |  |
| _always      | 1.000   | 0.0 | plus     | DOUBLE  | 2/7 |  |
| <b>36720</b> | <b>DRIFT_VALUE</b>  |     |          |         |     |  |
| %            | Drift basic value   |     | NEW CONF |         |     |  |
| _always      | 0.0   |     |          | DOUBLE  | 2/7 |  |
| <b>38000</b> | <b>MM_ENC_COMP_MAX_POINTS</b>   |     |          |         |     |  |
| -            | 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 |  |
| <b>41110</b>  | <b>JOG_SET_VELO</b>        |               |               |        |            |  |
| mm/min        | Axis speed for JOG         |               | Immediately   |        |            |  |
| _always       | 0.0                        | 0.0           | plus          | DOUBLE | 4/4        |  |
| <b>41200</b>  | <b>JOG_SPIND_SET_VELO</b>  |               |               |        |            |  |
| rev/min       | Speed for spindle JOG mode |               | Immediately   |        |            |  |
| _always       | 0.0                        | 0.0           | plus          | DOUBLE | 4/4        |  |

6.1 List of machine and setting data

|              |   |     |      |             |     |
|--------------|---|-----|------|-------------|-----|
| <b>43210</b> | <b>SPIND_MIN_VELO_G25</b>                   |     |      |             |     |
| rev/min      | Progr. spindle speed limitation G25         |     |      | Immediately |     |
| _always      | 0.0   | 0.0 | plus | DOUBLE      | 4/4 |
| <b>43220</b> | <b>SPIND_MAX_VELO_G26</b>                   |     |      |             |     |
| rev/min      | Progr. spindle speed limitation G26         |     |      | Immediately |     |
| _always      | 1000  | 0.0 | plus | DOUBLE      | 4/4 |
| <b>43230</b> | <b>SPIND_MAX_VELO_LIMS</b>                  |     |      |             |     |
| rev/min      | Spindle speed limitation with G96           |     |      | Immediately |     |
| _always      | 100   | 0.0 | plus | DOUBLE      | 4/4 |
| <b>52011</b> | <b>STOP_CUTCOM_STORE</b>                    |     |      |             |     |
|              | 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<br>(10-79)            | 00<br>(00-99)                  | 0<br>(0-9) | 000<br>(000-999) | symbolic<br>(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

| <b>2600</b> |                  | <b>General signals to NCK [r/w]</b> |       |       |       |  |  |                        |  |
|-------------|------------------|-------------------------------------|-------|-------|-------|--|--|------------------------|--|
| 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 |                                     |       |       |       |  | Acknowl.<br>EMER-<br>GENCY<br>STOP                       | EMER-<br>GENCY<br>STOP |  |
|             | 4                | 5                                   | 6     | 7     |       |  |  |                        |  |
| 26000001    |                  |                                     |       |       |       | Request<br>distances<br>to go by<br>the axes | Request<br>actual dis-<br>tances to<br>go by the<br>axes |                        |  |
| 26000002    |                  |                                     |       |       |       |  |  |                        |  |
| 26000003    |                  |                                     |       |       |       |  |  |                        |  |

| <b>2700</b> |       | <b>General signals from NCK [r]</b>  |       |       |       |       |                                  |                         |
|-------------|-------|--------------------------------------|-------|-------|-------|-------|----------------------------------|-------------------------|
| Data block  |       | Interface NCK → PLC                  |       |       |       |       |                                  |                         |
| Byte        | Bit 7 | Bit 6                                | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1                            | Bit 0                   |
| 27000000    |       |                                      |       |       |       |       | EMER-<br>GENCY<br>STOP<br>active |                         |
| 27000001    |       |                                      |       |       |       |       |                                  |                         |
| 27000002    |       | Drive<br>ready                       |       |       |       |       |                                  |                         |
| 27000003    |       | Ambient<br>tempera-<br>ture<br>alarm |       |       |       |       |                                  | NCK<br>alarm<br>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 |       | JOG   | MDA   | AUTOM.   |
| 30000001   |       |                           |                     |                  |       | 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 | JOG   | MDA   | AUTOM.   |
| 31000001   |       |                           |                     |       |       | 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 <sup>4)</sup> |       |       |       |                      |
| 32000001   | Activate Program Test |                              |                     |                                     |       |       |       | Activate Referencing |
| 32000002   |                       |                              |                     |                                     |       |       |       | Activate Skip Block  |
| 32000003   |                       |                              |                     |                                     |       |       |       |                      |

|          |                                       |                                 |   |                           |         |                        |                  |                    |
|----------|---------------------------------------|---------------------------------|---|---------------------------|---------|------------------------|------------------|--------------------|
| 32000004 | Feed override <sup>2)</sup>           |                                 |   |                           |         |                        |                  |                    |
|          | H                                     | G                               | F | E                         | D       | C                      | B                | A                  |
| 32000005 | Rapid traverse override <sup>3)</sup> |                                 |   |                           |         |                        |                  |                    |
|          | H                                     | G                               | F | E                         | D       | C                      | B                | A                  |
| 32000006 | Feed <sup>1)</sup> override enabled   | Rapid traverse 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:

- <sup>1)</sup>+ Feed override enabled Even if the feed override is not enabled (=100%), the 0% position is active.
- <sup>2)</sup>+ Feed override 31 positions (Gray code) with 31 MD for % weighting
- <sup>3)</sup>+ Rapid traverse override 31 positions (Gray code) with 31 MD for % weighting
- <sup>4)</sup>+ 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<br>+      - |                              | Rapid traverse override | Traversing key lock | Feed stop | Activate handwheel<br>2      1 |        |       |
| 32001001   | Axis 1 in WCS               |                              |                         |                     |           |                                |        |       |
|            | continuous                  |                              |                         |                     | 1000 INC  | 100 INC                        | 10 INC | 1 INC |
| 32001002   |                             |                              |                         |                     |           |                                |        |       |
| 32001003   |                             |                              |                         |                     |           |                                |        |       |
| 32001004   | Axis 2 in WCS               |                              |                         |                     |           |                                |        |       |
|            | Traversing keys<br>+      - |                              | Rapid traverse override | Traversing key lock | Feed Stop | Activate handwheel<br>2      1 |        |       |
| 32001005   | Axis 2 in WCS               |                              |                         |                     |           |                                |        |       |
|            | continuous                  |                              |                         |                     | 1000 INC  | 100 INC                        | 10 INC | 1 INC |
| 32001006   |                             |                              |                         |                     |           |                                |        |       |
| 32001007   |                             |                              |                         |                     |           |                                |        |       |

6.2 PLC user interface signals

|          |                                |            |                         |                     |           |                    |              |
|----------|--------------------------------|------------|-------------------------|---------------------|-----------|--------------------|--------------|
| 32001008 | Traversing keys                |            | Rapid traverse override | Traversing key lock | Feed stop | Activate handwheel |              |
|          | +                              | -          |                         |                     |           | 2                  | 1            |
| 32001009 | Axis 3 in WCS Machine function |            |                         |                     |           |                    |              |
|          |                                | continuous |                         |                     | 1000 INC  | 100 INC            | 10 INC 1 INC |
| 32001010 |                                |            |                         |                     |           |                    |              |
| 32001011 |                                |            |                         |                     |           |                    |              |

Status signals from NC channel

| <b>3300</b> |  | <b>Signals from NCK channel [r]</b> |                 |                     |                  |                           |         |                     |
|-------------|--|-------------------------------------|-----------------|---------------------|------------------|---------------------------|---------|---------------------|
| 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                            |                                     |                 | Program state       |                  |                           |         |                     |
|             | Reset                                    | inter-rupted                        | active          | aborted             | inter-rupted     | stopped                   | waiting | running             |
| 33000004    | NCK alarm with stop of machining present | NCK alarm channel-specific present  |                 |                     | All axes stopped | All axes refer-enced      |         |                     |
| 33000005    |  |                                     |                 |                     |                  |                           |         |                     |
| 33000006    |  |                                     |                 |                     |                  |                           |         |                     |
| 33000007    |  |                                     |                 |                     |                  |                           |         |                     |

**Status signals: Axes in WCS**

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

**Transfer of auxiliary functions from the NC channel**

| <b>2500</b> |       | <b>Auxiliary functions from NCK channel [r]</b> |       |                   |       |       |       |                                  |
|-------------|-------|---|-------|-------------------|-------|-------|-------|----------------------------------|
| Data block  |       | Interface PLC                                   |       |                   |       |       |       |                                  |
| Byte        | Bit 7 | Bit 6   | Bit 5 | Bit 4             | Bit 3 | Bit 2 | Bit 1 | Bit 0                            |
| 25000000    |       |   |       |                   |       |       |       | Modify de-coded M functions 0–99 |
| 25000001    |       |   |       | Modify T funct. 1 |       |       |       |                                  |
| 25000002    |       |   |       |                   |       |       |       |                                  |
| 25000003    |       |   |       |                   |       |       |       |                                  |

**Decoded M signals (M0 – M99)**

| <b>2500</b> |                     | <b>M functions from NCK channel [r]</b> |       |       |       |       |       |       |
|-------------|---------------------|---|-------|-------|-------|-------|-------|-------|
| 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 |       |       |       |

6.2 PLC user interface signals

|          |                                    |                                |                         |                     |                          |                                     |                                |       |
|----------|------------------------------------|--------------------------------|-------------------------|---------------------|--------------------------|-------------------------------------|--------------------------------|-------|
| 380x0002 |                                    |                                |                         |                     | Clamping process running | Delete distance to go/spindle reset | Servo enable                   |       |
| 380x0003 |                                    | Speed/spindle speed limitation |                         |                     |                          |                                     |                                |       |
| 380x0004 | Traversing keys<br>plus      minus |                                | Rapid traverse override | Traversing key lock | Feed stop Spindle stop   |                                     | Activate handwheel<br>2      1 |       |
| 380x0005 |                                    | continuous                     |                         |                     | 1000 INC                 | 100 INC                             | 10 INC                         | 1 INC |
| 380x0006 | Machine function                   |                                |                         |                     |                          |                                     |                                |       |
| 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<br>(axis) | Delay Ref.-point approach |                       |       |       | 2nd software limit switch<br>plus      minus |       | Hardware limit switch<br>plus      minus |       |
| 380x1001<br>(axis) |                           |                       |       |       |  |       |  |       |
| 380x1002<br>(axis) |                           |                       |       |       |  |       |  |       |
| 380x1003<br>(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<br>(spindle) |       |                          |       |       | Gear is changed | Actual gear stage<br>C      B      A |       |              |
|                       |       |                          |       |       |                 |                                      |       | Spindle feed |

|                       |                           |                 |                             |                              |   |   |   |                   |
|-----------------------|---------------------------|-----------------|-----------------------------|------------------------------|---|---|---|-------------------|
| 38032001<br>(spindle) |                           | Invert<br>M3/M4 |                             |                              |   |   |   | override<br>valid |
| 38032002<br>(spindle) | Set direction of rotation |                 | Recipro-<br>cating<br>speed | Recipro-<br>cating<br>by PLC |   |   |   |                   |
|                       | CCW                       | CW              |                             |                              |   |   |   |                   |
| 38032003<br>(spindle) | Spindle override          |                 |                             |                              |   |   |   |                   |
|                       | H                         | G               | F                           | E                            | D | C | B | A                 |

**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<br>with exact<br>pos.<br>fine | with exact<br>pos.,<br>coarse |                                  | Refer-<br>enced/<br>synchro-<br>nized 1      |                     | Encoder<br>limit fre-<br>quency<br>exceeded<br>1 |                  | Spindle/<br>no axis |
| 390x0001    | Current<br>controller<br>active                | Speed<br>controller<br>active | Position<br>controller<br>active | Axis/spindle<br>stopped<br>( $n < n_{min}$ ) | Follow-up<br>active |  |                  |                     |
| 390x0002    |  |                               |                                  |  |                     |  |                  |                     |
| 390x0003    |  |                               |                                  |  |                     |  |                  |                     |
| 390x0004    | Motion command                                 |                               |                                  |  |                     |  | Handwheel active |                     |
|             | plus   | minus                         |                                  |  |                     |  | 2                | 1                   |
| 390x0005    | Active machine function                        |                               |                                  |  | 1000<br>INC         | 100<br>INC                                       | 10<br>INC        | 1<br>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<br>(axis) |       |       |                       |       |       |       |       |       |

6.2 PLC user interface signals

|                    |  |  |  |  |  |  |  |                   |
|--------------------|--|--|--|--|--|--|--|-------------------|
| 390x1001<br>(axis) |  |  |  |  |  |  |  |                   |
| 390x1002<br>(axis) |  |  |  |  |  |  |  | Lubrication pulse |
| 390x1003<br>(axis) |  |  |  |  |  |  |  |                   |

**Signals from spindle**

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

**6.2.6 Signals from/to MMC**

**Program control signals from MMC (retentive area)**

(see also signals to channel V32000000)

| <b>1700</b>                |                       | <b>MMC signals [r]</b> |              |       |   |       |       |             |
|----------------------------|-----------------------|------------------------|--------------|-------|---|-------|-------|-------------|
| Data block                 |                       | Interface MMC ———> PLC |              |       |   |       |       |             |
| DBB                        | Bit 7                 | Bit 6                  | Bit 5        | Bit 4 | Bit 3                                     | Bit 2 | Bit 1 | Bit 0       |
| 17000000<br>(MMC ———> PLC) |                       | Dry run feed selected  | M01 selected |       |   |       |       |             |
| 17000001<br>(MMC ———> PLC) | Program test selected |                        |              |       | Feed override for rapid traverse selected |       |       |             |
| 17000002                   |                       |                        |              |       |   |       |       | Select Skip |

|                            |  |  |  |  |  |  |  |  |       |
|----------------------------|--|--|--|--|--|--|--|--|-------|
| (MMC →<br>PLC)             |  |  |  |  |  |  |  |  | Block |
| 17000003<br>(MMC →<br>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<br>(MMC →<br>PLC) |              |                     |       |       |       |                                    |       |       |  |
| 19001001<br>(MMC →<br>PLC) |              |                     |       |       |       |                                    |       |       |  |
| 19001002<br>(MMC →<br>PLC) |              |                     |       |       |       |                                    |       |       |  |
| 19001003<br>(MMC →<br>PLC) | Machine axis |                     |       |       |       | Axis number for handwheel 1<br>B A |       |       |  |
| 19001004<br>(MMC →<br>PLC) | Machine axis |                     |       |       |       | Axis number for handwheel 2<br>B A |       |       |  |
| 19001005<br>(MMC →<br>PLC) |              |                     |       |       |       |                                    |       |       |  |
| 19001006<br>(MMC →<br>PLC) |              |                     |       |       |       |                                    |       |       |  |

**Control signals to operator panel (retentive range)**

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

**6.2.7 Machine control panel signals (MCP signals)**

**Status signals from MCP**

| <b>1000</b> |                 | <b>Signals from MCP [r]</b> |                        |                           |                 |                    |                 |                      |
|-------------|-----------------|-----------------------------|------------------------|---------------------------|-----------------|--------------------|-----------------|----------------------|
|             |                 | Interface MCP —> PLC        |                        |                           |                 |                    |                 |                      |
| Byte        | Bit 7           | Bit 6                       | Bit 5                  | Bit 4                     | Bit 3           | Bit 2              | Bit 1           | Bit 0                |
| 10000000    | #8<br>JOG       | #7<br>INC                   | #6<br>free             | #5<br>free                | #4<br>free      | #3<br>free         | #2<br>free      | #1<br>free           |
| 10000001    | #16<br>Axis key | #15<br>Spindle<br>start     | #14<br>Spindle<br>stop | #13<br>Spindle<br>start + | #12<br>MDA      | #11<br>SBL         | #10<br>AUTO     | #9<br>REF            |
| 10000002    | #24<br>Axis key | #23<br>Axis key             | #22<br>Axis key        | #21<br>Axis key           | #20<br>Axis key | #19<br>Axis key    | #18<br>Axis key | #17<br>Axis key      |
| 10000003    | "0"             | "0"                         | "0"                    | "0"                       | "0"             | #27<br>NC<br>START | #26<br>NC STOP  | #25<br>NC RE-<br>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**

| <b>1100</b> |       | <b>Signals to MCP [r/w]</b> |       |       |       |       |       |       |
|-------------|-------|-----------------------------|-------|-------|-------|-------|-------|-------|
|             |       | 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)**

| <b>4500</b> |                           | <b>Signals from NCK [r]</b> |  |  |  |  |  |  |
|-------------|---------------------------|-----------------------------|--|--|--|--|--|--|
| 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)**

| <b>4500</b> |                  | <b>Signals from NCK [r]</b> |  |  |  |  |  |  |
|-------------|------------------|-----------------------------|--|--|--|--|--|--|
| 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)**

| <b>4500</b> |                             | <b>Signals from NCK [r]</b> |  |  |  |  |  |  |
|-------------|-----------------------------|-----------------------------|--|--|--|--|--|--|
| 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)**

| <b>4500</b> |  | <b>Signals from NCK [r]</b> |  |  |  |  |  |  |
|-------------|--|-----------------------------|--|--|--|--|--|--|
| 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**

| <b>1600</b> |                         | <b>Alarm activation [r/w]</b> |        |        |        |        |        |        |
|-------------|-------------------------|-------------------------------|--------|--------|--------|--------|--------|--------|
| 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**

| <b>1600</b> |                           | <b>Variable for alarm [r/w]</b> |  |  |  |  |  |  |
|-------------|---------------------------|---------------------------------|--|--|--|--|--|--|
| 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**

| <b>1600</b> |       | <b>Active alarm response [r]</b> |       |          |         |                       |                 |                    |
|-------------|-------|----------------------------------|-------|----------|---------|-----------------------|-----------------|--------------------|
| 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    |       |                                  |       |          |         |                       |                 |                    |

**Axis actual value and distances to go**

| <b>5700 ... 5704</b> |                            |       | <b>Signals from axis/spindle [r]</b> |       |       |       |       |       |
|----------------------|----------------------------|-------|--------------------------------------|-------|-------|-------|-------|-------|
| Data block           |                            |       | Interface PLC —> MMC                 |       |       |       |       |       |
| Byte                 | Bit 7                      | Bit 6 | Bit 5                                | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| 570x0000             | Axis actual value (REAL)   |       |                                      |       |       |       |       |       |
| 570x0004             | Axis distance to go (REAL) |       |                                      |       |       |       |       |       |

## Technical Appendix

### 6.3 Application note: unipolar spindle control

#### General

With SINUMERIK 802C, the spindle speed setpoint is generally output in the range from –10V through +10V (S... M3 or M4). A setpoint output with positive polarity only (0V through +10V) and an additional direction signal, as it is required for unipolar frequency converters, can be realized via appropriate programming in the NC part program and in the PLC user program (additionally, two M commands for switching the direction signal and M3 for starting rotation). A direction reversal may only be carried out with setpoint zero (spindle at standstill). It should be taken into account that the setpoint output is provided by the NC, but switching of the direction signal is provided by the PLC. In other words: It must be ensured by the user program that the new direction signal is only provided if the spindle has stopped. A new rotation start may only be provided after the direction signal has been output by the PLC.

Position-controlled spindle mode (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 have stopped safely
                  what can also be provided by the PLC user program
N30 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 and requirements, taking into account what was mentioned below;

M23 and M24, for example, are the M commands for the direction signals and must be evaluated accordingly by the user program; then, the direction signal must be set.



# Manual Machine

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” function 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.

---

### Note

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 configuration.




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)

**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 control 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 |

## 7.9 Default assignment of special data for the “Manual machine”

**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  |

## 7.9 Default assignment of special data for the "Manual machine"

|          |                               |      |
|----------|-------------------------------|------|
| 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 |

## 7.9 Default assignment of special data for the "Manual machine"

|          |                                    |        |
|----------|------------------------------------|--------|
| 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 |
|------|---|





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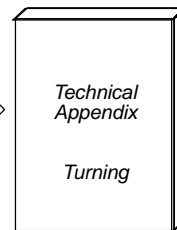
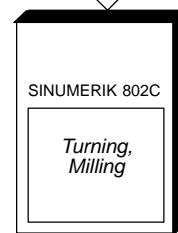
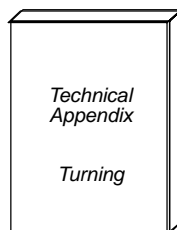
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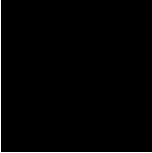


## Technical Manual: **Start-Up**



## Technical Manual: **Description of Functions**





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