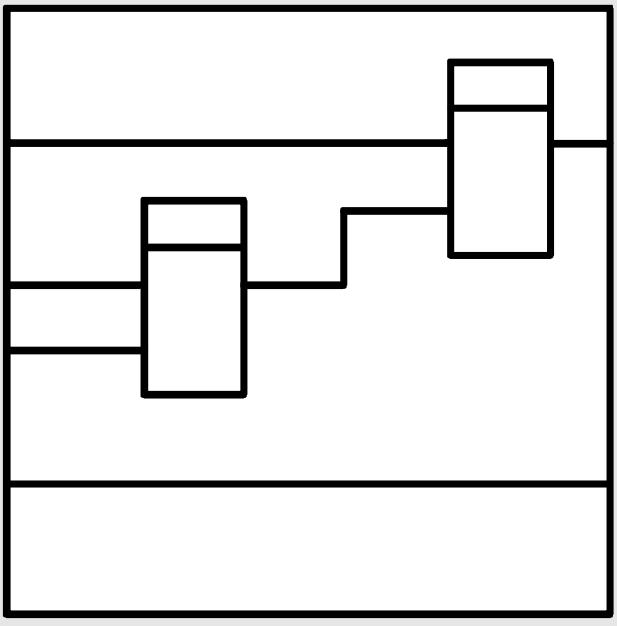
SIMADYN D
Digital Control System

User Manual

Processor module PT20



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User Manual, Processor module PT20

Edition		Edition status
1	Processor module PT20	09.94
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3	Processor module PT20	04.97

We have checked the contents of this Manual to ensure that they coincide with the described hardware and software. However, deviations cannot be completely ruled-out, so we cannot guarantee complete conformance. However, the information in this document is regularly checked and the necessary corrections included in subsequent editions. We are thankful for any recommendations or suggestions.

Contents

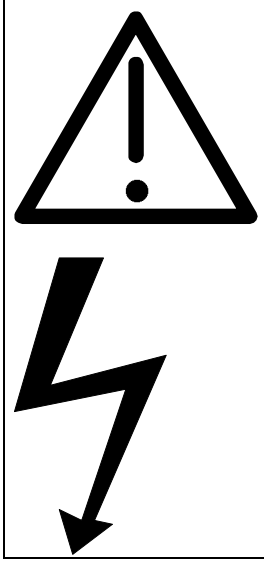
N O T E !

The information in this Manual does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, please contact your local Siemens office.

Further, the contents of this Manual shall not become a part of or modify any prior or existing agreement, committment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties nor modify the existing warranty.

Warning information



W A R N I N G !

Electrical equipment has components which are at dangerous voltage levels.

If these instructions are not strictly adhered to, severe bodily injury and material damage can result.

Only appropriately qualified personnel may work on this equipment or in its vicinity.

This personnel must be completely knowledgeable about all the warnings and service measures according to this User Manual.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

Definitions

* **QUALIFIED PERSONNEL**

For the purpose of this User Manual and product labels, a “Qualified person” is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.
3. Trained in rendering first aid.

* **DANGER**

For the purpose of this User Manual and product labels, “Danger” indicates death, severe personal injury and/or substantial property damage will result if proper precautions are not taken.

* **WARNING**

For the purpose of this User Manual and product labels, “Warning” indicates death, severe personal injury or property damage can result if proper precautions are not taken.

* **CAUTION**

For the purpose of this User Manual and product labels, “Caution” indicates that minor personal injury or material damage can result if proper precautions are not taken.

* **NOTE**

For the purpose of this User Manual, “Note” indicates information about the product or the respective part of the User Manual which is essential to highlight.

C A U T I O N !

This board contains components which can be destroyed by electrostatic discharge. Prior to touching any electronics board, your body must be electrically discharged. This can be simply done by touching a conductive, grounded object immediately beforehand (e.g. bare metal cabinet components, socket protective conductor contact).

W A R N I N G !

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the safety instructions can result in severe personal injury or property damage.

It is especially important that the warning information in all of the relevant Operating Instructions are strictly observed.

1. Ordering information

PT20: 6DD 1606-1AC0 processor module PT20 SWE No.: 465 606 9102.00

2. Function description

The PT20 processor module in the SIMADYN D system is used for processing technological open- and closed-loop control and arithmetic tasks.

The board contains an 80C186-20 MHz 16-bit microprocessor with the associated periphery.

Plug-in program memory modules (MS4x) are used (slot X50) to program the board with the user program and also with the system firmware (operating system, monitor program, code of the function blocks ...). The user program runs on the processor under the real-time SIMADYN D operating system. This guarantees, depending on the interrupts configured, controlled, fixed cycle times of ≥ 1 ms.

The serial interfaces (connector X01/X02) are communications- and service interfaces.
During normal operataion, the configured code number of the processor module is indicated on the 7-segment display H1 on the board front panel. If the board develops a fault, the display flashes with a fault code. The HEX monitor can be activated when a fault signal appears, by depressing key S1.

A board reset (restart), can be initiated with the double test socket X10, X11. In this case, both sockets must be jumpered using a switch or short-circuit plug connector. Socket X10 is the reference ground.

A 60-pin test connector X4/X41 is provided on the basic PT20 board for hardware diagnostics using a logic analyser (intermediate adapter required), or the recording device. For the recording device, the PT20/X9 10-pin connector is also required.
Three "watchdogs" are provided for each processor module to monitor the hardware and software.

The hardware monitoring functions check:
- Ready signal delay for system bus accesses
- Double address coding errors
- Whether addresses are accessed, which are unused
- System bus fault messages

The software monitoring functions check:
- Whether the processor still runs cyclically.
- Whether the interrupt control of the serial interface, timer and inputs operate fault-free

If the monitoring function identifies a fault/error, a "non-maskable interrupt" (NMI) is generated, and the processor attempts to remove the cause of the fault to re-establish cyclic operation. If the cause of the fault is the processor itself, the board is de-activated and the decimal point in the 7-segment display is lit. The "system error" bus line is simultaneously activated.

3. Board design

- Connection for the SIMADYN D local bus

- Version for operation with natural air cooling

- CPU 80C186 - 20 MHz

- 64 K byte RAM, battery buffered from the power supply

- Use of the MS4x SIMADYN D memory module

  MS41: EPROM 512 K * 8, EEPROM 2 K * 8
  MS45: RAM 512 K * 8, EEPROM 8 K * 8

- 7 Analog inputs
  Multiplexed inputs, resolution 11 bits + sign

- 4 analog outputs
  +/- 10 V output voltage

- 24 binary inputs
  can be used interrupt-controlled

- 16 binary outputs

- 2 speed sensing inputs

- 2 serial interfaces
  either 20 mA (TTY) or V24 (RS 232) and RS 485

- SIMADYN D diagnostics connector (can only be used with intermediate adapter)

- Real-time clock, 10 ms resolution

- Board coding for identification

4. Application information

The PT20 processor module can be used in both the large (SR8/9) as well as small subracks (SR4/7). It occupies two slots. To ensure perfect operation, the board (also during start-up) must be screwed to the subrack.

If the board is inserted in an adapter, the front panel must be connected to the rack housing using a short cable. It is not permissible that the board is inserted or withdrawn under voltage.

4.1. Serial interfaces

Serial interfaces X01 and X02 are located on the front panel at the 25-pin sub-D plug connector X01. The X01 can either be operated as 20 mA (TTY) or as V24 (RS232) interface.
An interface circuit (hybrid module) must be inserted at slot X51, if the X01 interface is to be used. Presently, the following hybrid modules are available:

SS1 : 20 mA (TTY) MLFB: 6DD1688-1AA0

SS2 : V.24 (RS 232) 6DD1688-1AB0

Caution: Observe the mounting position! (observe the printed information on the board)

The X02 serial interface provides the RS485 signal level. A hybrid module is not inserted to use interface X02. The signal level must be converted externally if a 20 mA (TTY) or a V.24 (RS 232) interface is to be established via interface X02.

4.2. Interface modules

The system signals are fed to the PT20 processor module via interface modules. Modules SU10 and SE51 are provided (Fig. 1) for the analog inputs/outputs and the pulse encoder connection at connector X5. The binary inputs/outputs can be connected via module SU10, or via the other binary input/output modules available in the SIMADYN D program.
The modules are connected to a ribbon cable. Screened cables should be used to enhance the noise immunity. If other modules besides the SE51 or SU10 are used, the ribbon cable of the modules used must be split-up corresponding to the particular module, in steps of 10 (Fig. 2).

Type:	SU10	25-pin terminal block	MLFB: 6DD1681-0FG0
	SU12	10-pin terminal block	6DD1681-0AJ1
	SB10	8 binary inputs/outputs, LED	6DD1681-0AE2
	SB60	8, 220V/24V binary inputs	6DD1681-0AF4
	SB70	8, 24V/220V binary outputs	6DD1681-0AG2
	SB71	8, 24V binary outputs, LED	6DD1681-0DH1
	SE51	Pulse encode connection	6DD1681-0FB0
	SC42	50-core ribbon cable, 2 m	6DD1684-0EC0
	SC44	50-core to 5x10 core ribbon cable, 2m	6DD1684-0EE0
	SC45	50-core, screen ribbon cable, 2m	6DD1684-0EF0
	SC53	50-core to 2x26 core ribbon cable, 2m	6DD1684-0EE0

4.3. Speed sensing

The NAV and NAV04 blocks may only be configured at speed input 1. The NAV00x blocks can be configured at both inputs.
The speed encoder connections, according to the push-pull or common mode principle via SE51 at PT20 are illustrated in Figs. 3 and 4.
The speed inputs can also be connected via sub-D connectors, using terminal block SE51.

5. Technical data

5.1. GENERAL INFORMATION

INSULATION GROUP	A acc. to VDE 0110 Para. 13 Group 2 at 24 V DC, 15 V DC, 5 V DC
AMBIENT TEMPERATURE	0 to +55 degrees C with natural air cooling
STORAGE TEMPERATURE	-40 to + 70 degrees C
HUMIDITY CLASS	F acc.to DIN 40040
ALTITUDE RATING	S acc. to DIN 40040
MECHANICAL STRESSING	Mounted in stationary equipment which is not necessarily vibration-free
PACKAGING SYSTEM	ES 902 C
DIMENSIONS	233.4 * 220 mm
BOARD WIDTH	2 slots, 40.28mm
WEIGHT	1.0 kg
CURRENT DRAIN	P5 2.1 A P15 110 mA + encoder load N15 130 mA VCRAM 0.5 mA P24 0.1 A + load, binary outputs

5.2. BINARY INPUTS

No.	24 , non-floating, interrupt-capable
INPUT VOLTAGE	+24 V rated voltage
for 0 signal	-1 V to +6 V or open-circuit binary inputs
for 1 signal	+13 V to +33 V
Input current	
for 1 signal	approx. 5 mA
Delay time	500 usec.

5.3. BINARY OUTPUTS

No.	16, non-floating
POWER SUPPLY VOLTAGE	External
-RATED VALUE	24 V DC
-RIPPLE	3.6 V -DC
-PERMISSIBLE RANGE	+ 20 to + 30 V incl. ripple
-BRIEFLY	+ 35 V less than 0.5 sec..
OUTPUT CURRENT FOR 1 SIGNAL	
-RATED VALUE	50 mA
-PERMISSIBLE RANGE	0.2mA to 50 mA
SHORT-CIRCUIT PROTECTION	electronic
LIMITING INDUCTIVE	
TURN-OFF VOLTAGES	to Vcc+ 1V
TOTAL LOAD	80% at 50 degrees C, all outputs, 50 mA
RESIDUAL CURRENT	20 uA at 0 signal
SIGNAL LEVEL	
-AT 0 SIGNAL	max. 3V
-AT 1 SIGNAL	min. supply, - 2.5V
Switching delay	max. 15 usec.

5.4. ANALOG OUTPUTS

No.	4
OUTPUT VOLTAGE, min	-10 V
OUTPUT VOLTAGE, max	+10 V
OUTPUT CURRENT, max	7.5 mA
RESOLUTION	11 bit + VZ (corresponding to 5 mV)
Absolute ACCURADCY	+/- 0.25% (+/- 25 mV)
SHORT-CIRCUIT PROTECTION	to
GROUND	66 OHM

5.5. ANALOG INPUTS

No.	7 (multiplexed, via A/D conversion)
INPUT VOLTAGE, min	-10 V
INPUT VOLTAGE, max	+10 V
INPUT RESISTANCE	20 KOHM (differential amplifier input)
RESOLUTION	11 bits + sign (corresponding to 5 mV)
Absolute ACCURACY	+/- 0.25% (+/- 25 mV)

5.6. SPEED SENSING

No. Track A, track B, zero pulse, Monitoring signal and synchronizing enable	2 (using a pulse encoder)
PULSE FREQUENCY, max.	100 kHz, mark-space ratio 1:1
PULSE AMPLITUDE	8-30 V
SIGNAL LEVEL	
1 signal	> 8 V
0 signal	< 5 V
INPUT CURRENT, max.	4.5 mA
SMOOTHING, track A, track B, zero pulse, Synchronizing enable, 1 usec SMOOTHING monitoring signal 500 usec	
POWER SUPPLY CONNECTION for the pulse encoder	
Output voltage	14 V
Output current, max.	100 mA

6. Connector assignment of the PT20

6.1.Connector X5: Analog inputs/outputs and speed sensing

(50-pin flat connector)

Pin Nr	Designator	Connector	Explanation
1	Input 1+	X5 A	Analog input 1
2	Input 1-	X5 A	Analog input 1
3	Input 2+	X5 B	Analog input 2
4	Input 2-	X5 B	Analog input 2
5	Input 3+	X5 C	Analog input 3
6	Input 3-	X5 C	Analog input 3
7	Input 4+	X5 D	Analog input 4
8	Input 4-	X5 D	Analog input 4
9	Output 1	X5 H	Analog output 1
10	Analog GND	X5 H	Analog output 1
11	Input 5+	X5 E	Analog input 5
12	Input 5-	X5 E	Analog input 5
13	Input 6+	X5 F	Analog input 6
14	Input 6-	X5 F	Analog input 6
15	Input 7+	X5 G	Analog input 7
16	Input 7-	X5 G	Analog input 7
17	NC		
18	NC		
19	Output 2	X5 J	Analog output 2
20	Analog GND	X5 J	Analog output 2
21	Output 3	X5 K	Analog output 3
22	Analog GND	X5 K	Analog output 3
23	Output 4	X5 L	Analog output 4
24	Analog GND	X5 L	Analog output 4
25	NC		
26	NC		
27	NC		
28	NC		
29	GND		
30	NC		
31	Track, 1A+	X5 M	Speed sensing 1 ,track A
32	Track, 1A-	X5 M	Inverted signal or ref. track A
33	Track, 1B+	X5 M	Speed sensing 1, track B
34	Track, 1B-	X5 M	Inverted signal or ref. track B
35	Zero pulse 1+		Speed sensing 1, zero pulse
36	Zero pulse 1-		Inverted signal or ref., zero pulse
37	Syn. 1+		Enable synchronism, speed sensing 1, 2
38	Syn. 1-		Inverted signal or ref. enable
39	GND ext.		Reference control 1, 2, P15
40	P15		Power supply for speed encoder (15V)
41	Track, 2A+	X5 N	Speed sensing 2, track A
42	Track, 2A-	X5 N	Inverted signal or ref. track A
43	Track, 2B+	X5 N	Speed sensing 2, track B
44	Track, 2B-	X5 N	Inverted signal or ref. track B
45	Zero pulse 2+		Speed sensing 1, zero pulse
46	Zero pulse 2-		Inverted signal or ref., zero pulse
47	Control 1		Monitoring signal, speed encoder 1
48	Control 2		Monitoring signal, speed encoder 1
49	R pot.		100 kOHM for potential coupling
50	GND ext.		Ref. control 1, 2, P15

6.2. Connector X6: Assignment of the binary inputs and outputs

(50-pin flat connector)

Pin No.	Designator	Connector	Explanation
1	Input 1	X6 A	Binary inputs 1 - 8
2	Input 2	X6 A	
3	Input 3	X6 A	
4	Input 4	X6 A	
5	Input 5	X6 A	
6	Input 6	X6 A	
7	Input 7	X6 A	
8	Input 8	X6 A	
9	P external		External power supply for inputs and outputs (24V)
10	M external		
11	Input 9	X6 B	Binary inputs 9 - 16
12	Input 10	X6 B	
13	Input 11	X6 B	
14	Input 12	X6 B	
15	Input 13	X6 B	
16	Input 14	X6 B	
17	Input 15	X6 B	
18	Input 16	X6 B	
19	P external		External power supply for inputs and outputs (24V)
20	M external		
21	Input 17	X6 C	Binary inputs 17 - 24
22	Input 18	X6 C	
23	Input 19	X6 C	
24	Input 20	X6 C	
25	Input 21	X6 C	
26	Input 22	X6 C	
27	Input 23	X6 C	
28	Input 24	X6 C	
29	P external		External power supply for inputs and outputs (24V)
30	M external		
31	Output 1	X6 D	Binary outputs 1 - 8
32	Output 2	X6 D	
33	Output 3	X6 D	
34	Output 4	X6 D	
35	Output 5	X6 D	
36	Output 6	X6 D	
37	Output 7	X6 D	
38	Output 8	X6 D	
39	P external		External power supply for inputs and outputs (24V)
40	M external		
41	Output 9	X6 E	Binary outputs 9 - 16
42	Output 10	X6 E	
43	Output 11	X6 E	
44	Output 12	X6 E	
45	Output 13	X6 E	
46	Output 14	X6 E	
47	Output 15	X6 E	
48	Output 16	X6 E	
49	P external		External power supply for inputs and outputs (24V)
50	M external		

6.3. Connector assignment of the serial interfaces X01 / 02

PIN	V24		20 mA (TTY)	
1	FRAME GROUND		FRAME GROUND	
2	TRANSMIT DATA	OUT*D	---	
3	TRANSMIT DATA IN	R*D	---	
4	REQUEST TO SEND OUT	*RTS	---	
5	CLEAR TO SEND	*CTS	---	
6	+ OUT TRANSMIT DATA	(X02)	+ OUT TRANSMIT DATA	(X02)
7	GROUND		GROUND	
8	- OUT TRANSMIT DATA	(X02)	- OUT TRANSMIT DATA	(X02)
9	GROUND		GROUND	
10	---		CURRENT LOOP + TRANSMIT	+T*D
11	+ 15 V		+ 15 V	
12	---		20 mA SOURCE 1	
13	---		CURRENT LOOP + RECEIVE	+R*D
14	---		CURRENT LOOP - RECEIVE	-R*D
15	+ IN RECIVE DATA	(X02)	+ IN RECIVE DATA	(X02)
16	---		20 mA SOURCE 2	
17	- IN RECIVE DATA	(X02)	- IN RECIVE DATA	(X02)
18	GROUND		GROUND	
19	---		CURRENT LOOP - TRANSMIT	-T*D
20	DATA TERMINAL READY OUT		---	
21	---		20 mA DRAIN 1	
22	+ 5 V		+ 5 V	
23	+ 5 V		+ 5 V	
24	TRANSMIT RECEIVE CLOCK	*TR*C	20 mA DRAIN 2	
25	- 15 V		- 15 V	

7. STRUC L mask of the PT20 board in the master program

STRUC-L MASK

```
      : PT20       "PROCESSOR MODULE, TECHNOLOGY, L bus"
PIJ 1N = 0         "ALARM PROCESSING FP"
SFJ 1N = 0               "SYSTEM ERROR FP"
PRX 1N = 0         "SPECIAL COMMUNICATIONS FP, RECEIVE"
PJ1 1N = ?               "1st PERMANENT PROCESSING FP"
PJ2 1N = 0
PJ3 1N = 0
PJ4 1N = 0
PJ5 1N = 0
PJ6 1N = 0
PJ7 1N = 0
PJ8 1N = 0
PTX 1N = 0               "SPECIAL COMMUNICATIONS FP, SEND"
ILS IK = 0         "L bus interrupt send"
T0  TG = ?         "BASIC SAMPLING TIME"
T1  TS = ?         "1st SAMPLING TIME *T0, generated LB connect."
T2  TS = ?         "2nd SAMPLING TIME     "          "
T3  TS = ?         "3rd SAMPLING TIME     "          "
T4  TS = ?         "4th SAMPLING TIME     "          "
T5  TS = ?         "5th SAMPLING TIME     "          "
TY  TX = T?        "SYSTEM FP-SAMPLING TIME"
SSM 2C = 0         "Length, SAVE range,(n*1+2) kbyte"
ISE 1C = N         "Ignore failure signal (RDYINT) (Y/N) ?"
CCT 8R = 0         "SEND COMMUNICATION NAMES.TX"
CCR 8R = 0         "RECEIVE COMMUNICATION NAMES.TX"
COP 8R = 0         "CONTROL COMMUNICATION NAMES.TX"
CMS 8N = 0         "MESSAGE SYSTEM NAMES"
CTS 8N = 0         "TRANSPORT SYSTEM NAMES"
MS  2M = 0         "MESSAGE SYSTEM"
X01 1M = 0         "1ST SERIAL INTERFACE"
X02 1M = 0         "2ND SERIAL INTERFACE"
X5A 1K <           "A/D CONVERTER 1, PIN 1/2"
X5B 1K <           "A/D CONVERTER 2, PIN 3/4"
X5C 1K <           "A/D CONVERTER 3, PIN 5/6"
X5D 1K <           "A/D CONVERTER 4, PIN 7/8"
X5E 1K <           "A/D CONVERTER 5, PIN 11/12"
X5F 1K <           "A/D CONVERTER 6, PIN 13/14"
X5G 1K <           "A/D CONVERTER 7, PIN 15/16"
X5M 4K <           "SPEED SENSING 1, PIN 31/32,33/34,35/36"
X5N 4K <           "SPEED SENSING 2, PIN 41/42,43/44,45/46"
X6A 8K <           "BINARY INPUT 1, PIN 1-8/10"
6B 8K <            "BINARY INPUT 2, PIN 11-18/20"
X6C 8K <           "BINARY INPUT 3, PIN 21-28/30"
X5H 1K >           "D/A CONVERTER 1, PIN 9/10"
X5J 1K >           "D/A CONVERTER 2, PIN 19/20"
X5K 1K >           "D/A CONVERTER 3, PIN 21/22"
X5L 1K >           "D/A CONVERTER 4, PIN 23/24"
X6D 8K >           "BINARY OUTPUTS 1, PIN 31-38/40"
X6E 8K >           "BINARY OUTPUTS 2, PIN 41-48/50"
PT20 requires 2 submodules
```

Connector X5/6 can be addressed from the following function blocks.

X6A -- X6B -- X6C --		-- BII8 -- SBI8	Binary input (8 binary values) Input, status byte
X5A bis X5G --	--	-- ADC	A/D converter
X5H bis X5L --	--	-- DAM	D/A converter
X5M to X5N	--	-- NAV00x	Speed sensing
X6D -- X6E --	--	-- BIQ8 -- SBQ	Binary output (8 binary values) Output, status byte

8. Others

8.1. Attachments

8.1.1. Block diagram

Block diagram PT20 3SE.465606.9100.00 SU

8.1.2. Dimension drawing and table of the plug connectors

Dimension drawing with view of the front panel and table of the plug connectors used: 3SE.465606.9102.00 MB

8.1.3. Layout diagram

Layout diagram 3SE.465606.9102.00 AO

8.1.4. Diagrams

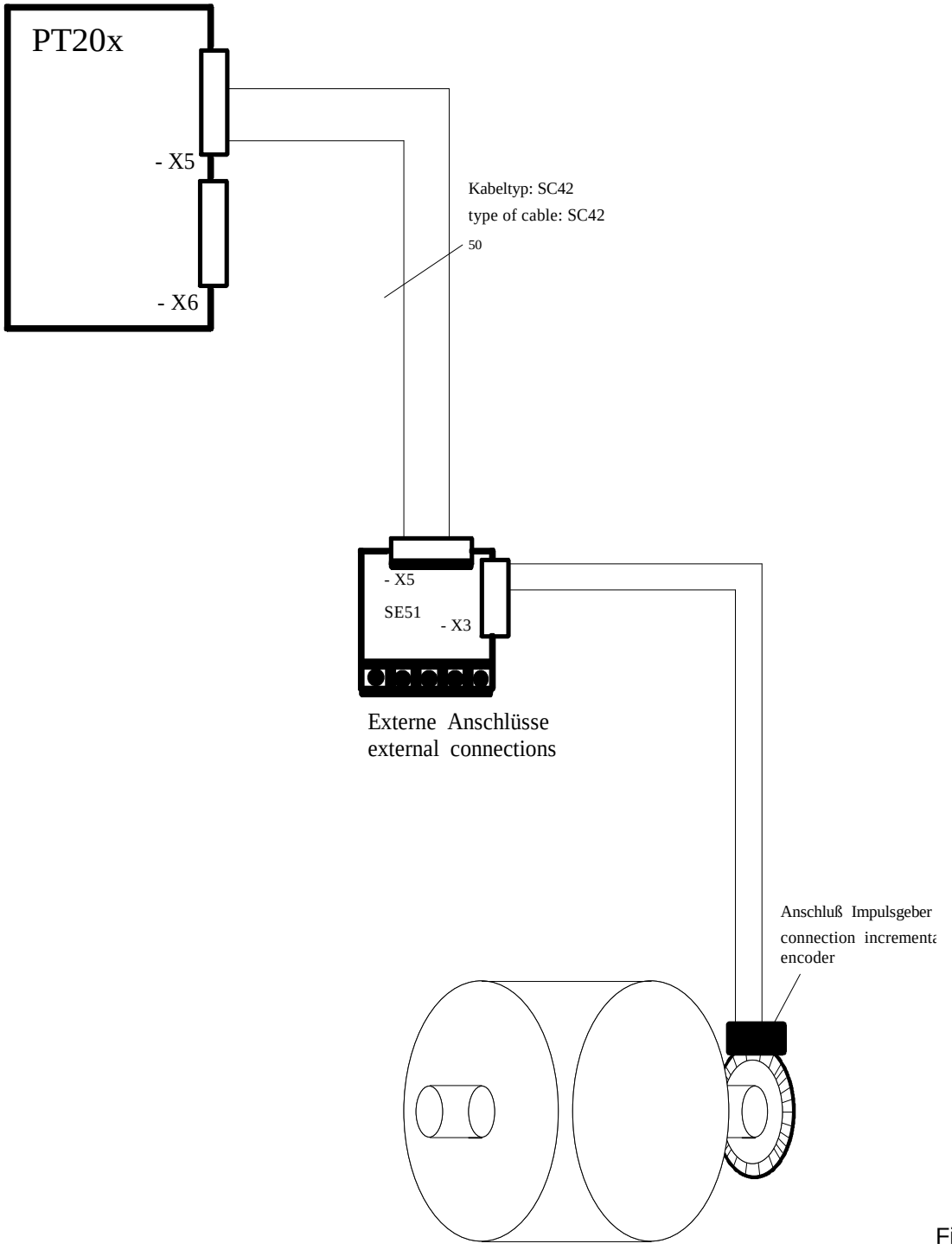
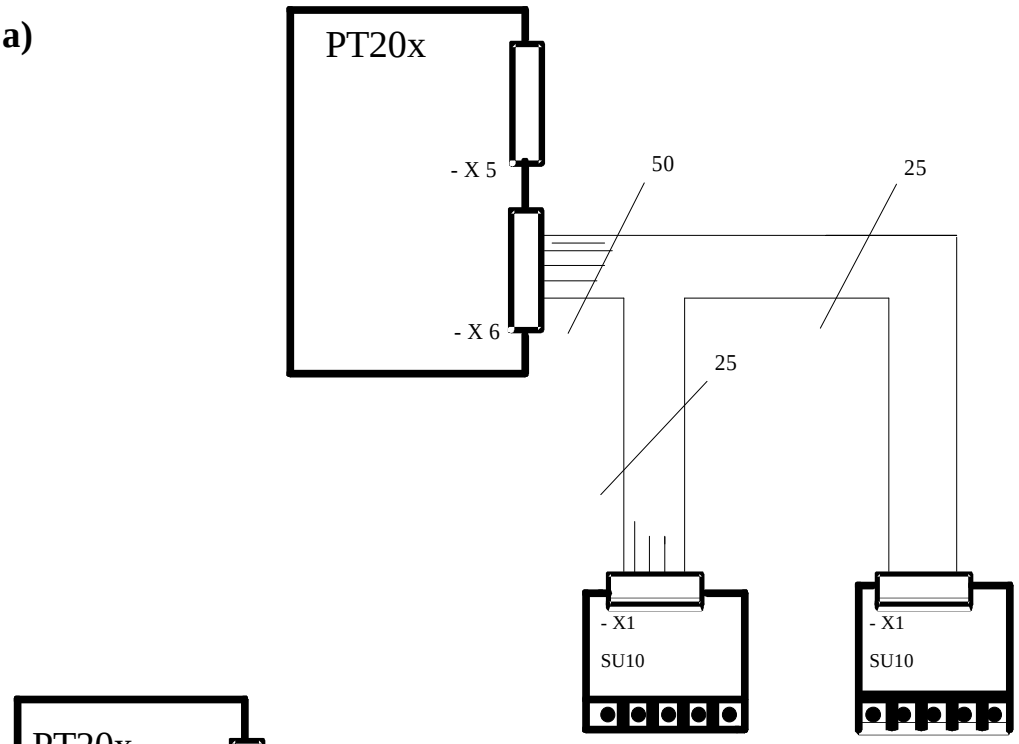
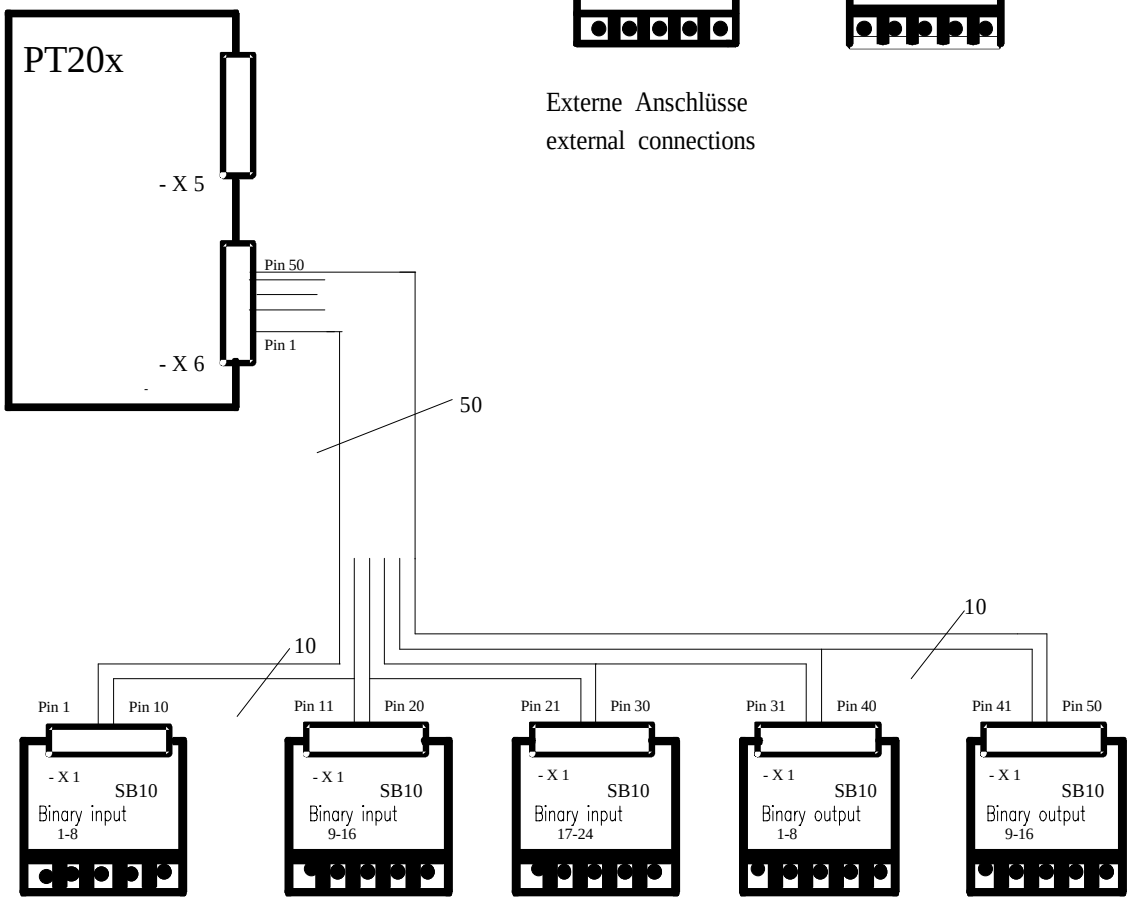


Fig. 1

a)



Externe Anschlüsse
external connections



Externe Anschlüsse
external connections

Fig. 2

Anschluß eines Impulsgebersgebers nach dem Gegentaktprinzip über SE51 an die PT20x:
Beispiel mit externer Stomversorgung und Anschluß an Drehzahlerfassung 2

connection of incremental encoder to PT20x:
example with external power supply

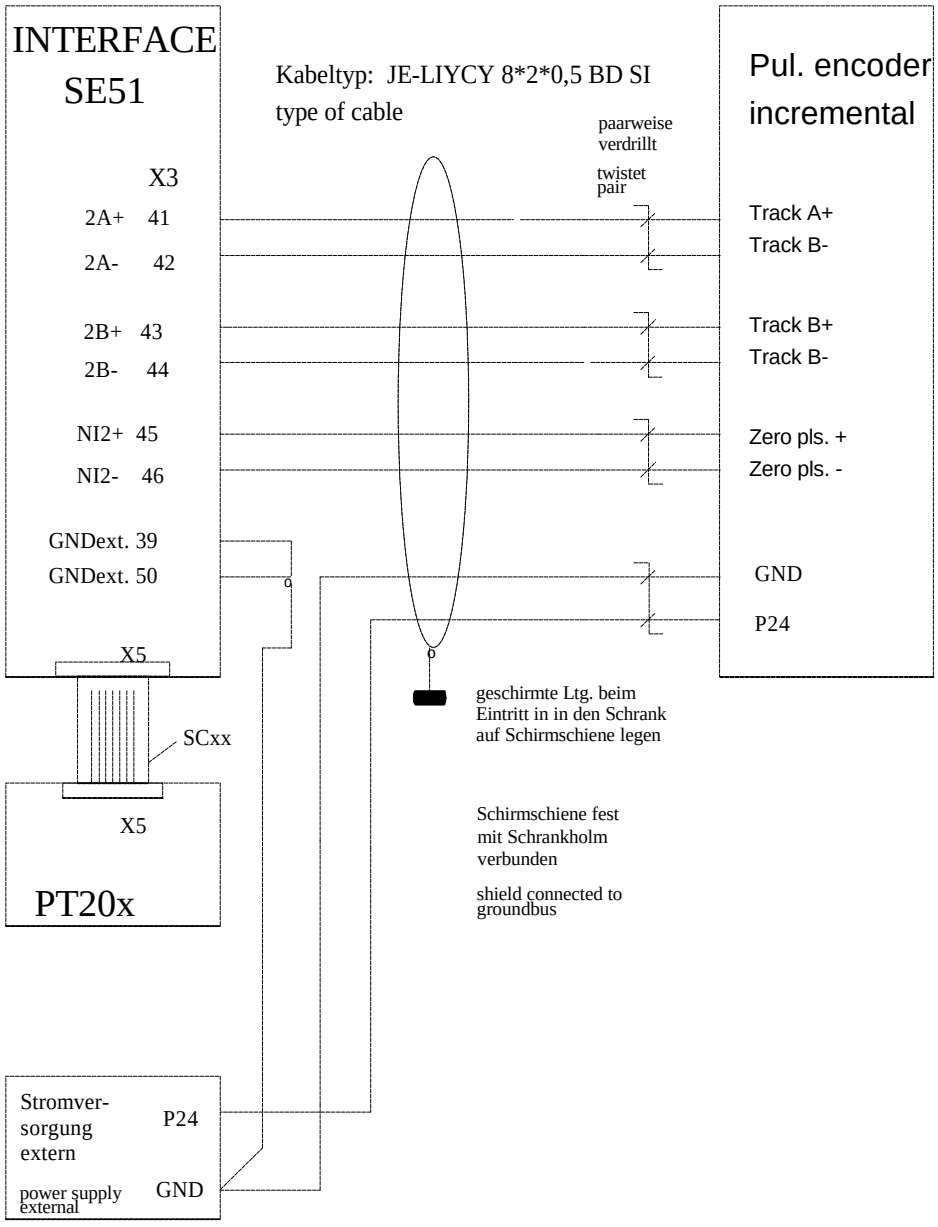


Fig. 3

Anschluß eines Impulsgebers nach dem Gleichtaktprinzip über SE51 an die PT20x:

Beispiel mit interner Stomversorgung und Anschluß an Drehzahlerfassung 1

connection of incremental encoder to PT20x:
example with internal power supply from interface SE51

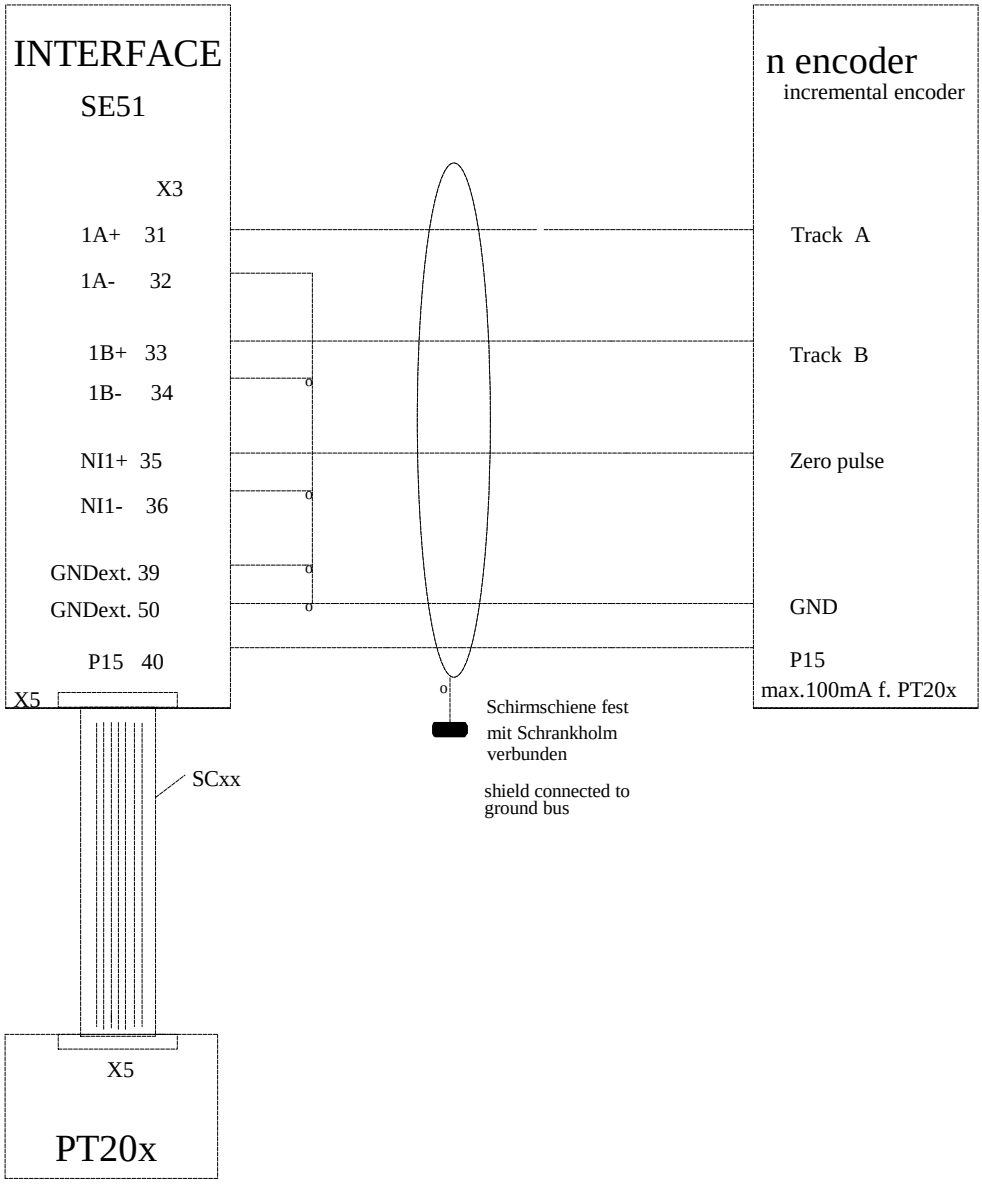


Fig. 4

8.2. Terminology/abbreviations

9. ECB instructions

Components which can be destroyed by electrostatic discharge (ECB)

Generally, electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board. This can be simply done by touching a conductive, grounded object directly beforehand (e.g. bare metal cubicle components, socket outlet protective conductor contact.

Boards must not come into contact with highly-insulating materials - e.g. plastic foils, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

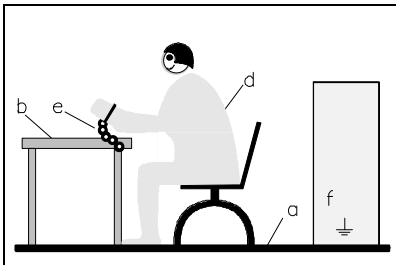
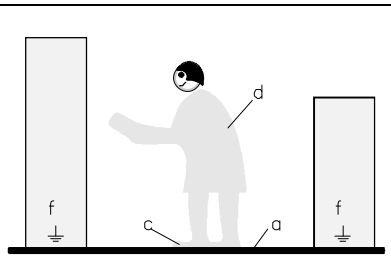
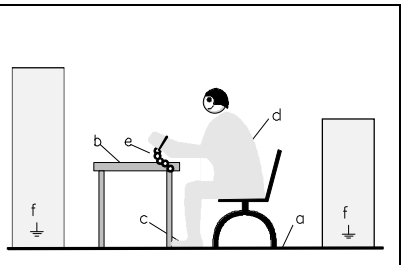
When soldering, the soldering iron tip must be grounded.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes, metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packing material, e.g. conductive foam rubber or household aluminum foil.

The necessary ECB protective measures are clearly shown in the following diagram.

a = Conductive floor surface
b = ECB table
c = ECB shoes
d = ECB overall
e = ECB chain
f = Cubicle ground connection

		
Seated	Standing	Standing/sitting

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