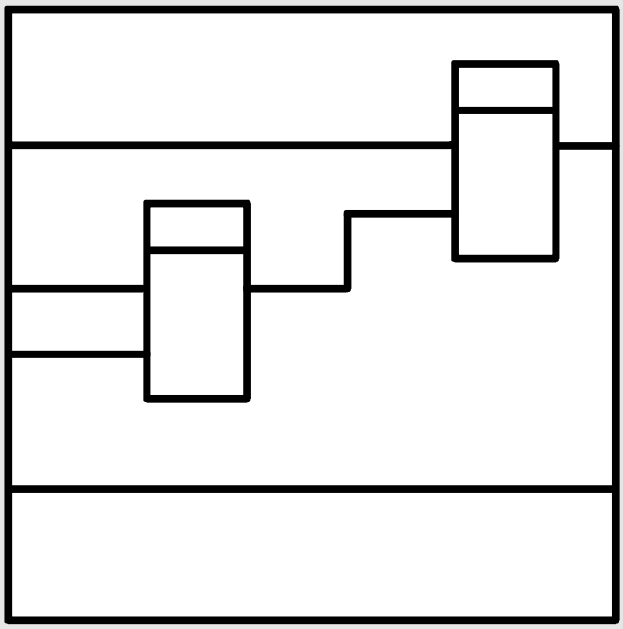
SIMADYN D
Digital Control System

User Manual

Processor board PT10



Edition 05.95

DK-Nr. 224162

User Manual, Processor board PT10

Edition		Edition status
1	Processor board PT10	11.94
2	Processor board PT10	05.95

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

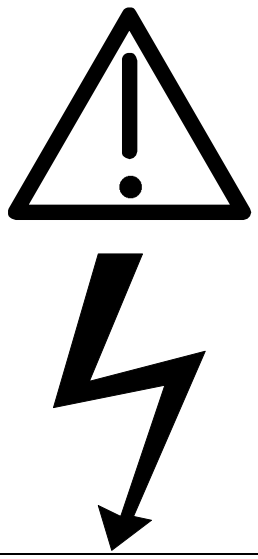
N O T E !

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

Type:	Order No. (MLFB)	Designation	Internal item number
PT10:	6DD 3440-0AB0	Processor board PT10	465 440 9001.00
SE58:	6DD 3460-0AB0	Terminal block for PT10	465 460 9001.00
SC58:	6DD 3461-0AB0	40-core screened round cable for PT10	465 461 9001.00
SC60:	6DD 3461-0AE0	34-core screened round cable for PT10	465 461 9004.00
PT10P1:	6DD 3440-0AB3	Package consisting of PT10, SE58, SC58, SC60	465 440 9001.30
MS47:	6DD 3440-0AB2	Memory submodule for PT10	465 440 9001.20
SE59:	6DD 3460-0AC0	Incremental encoder module for PT10	456 440 9002.00
PP1I:	6DD 1670-0AE0	Parallel prommer (desktop unit)	465 670 9004.00
PP1X:	6DD 1670-0AD0	Parallel prommer (chassis unit)	465 670 9005.00
UP3:	6DD 3462-0AB0	Programming adapter for MS47	465 462 9001.00
SW20:	6DD 3470-0AC0	Angular synchronism on memory submodule MS47	
SW20:	6DD 3470-0AC2	" on floppy disk	
SW20:	6DD 3481-0BA0	Description, angular synchronism	
SW30:	6DD 3470-0AD0	Axial winder on memory submodule MS47	
SW30:	6DD 3470-0AD2	" on floppy disk	
SW30:	6DD 3481-0CA0	Description, axial winder	
SRT:	6DD 1682-0CF0	Technology box SRT	465 682 9025.00

2. Function description

The *PT10* processor board is used in 6SE12/13, 6RA24 converters and in the SRT technology box. It is used to process technological open- and closed-loop control and arithmetic functions and occupies one slot.

The board contains a 16-bit microprocessor 80C186-20 MHz with the associated peripherals. The input and output of binary and analog signals and the incremental encoder signals is realized via terminal block *SE58.* The connection between PT10 and SE58 is realized through *SC58* and *SC60* round cables.
The *SE59* option board can be used to sense incremental encoder signals. It is plugged onto the processor board.
The plug-in MS47 program memory modules are used as data medium for the board user program as well as for the system firmware (operating system, monitoring program, function block code...). The user program runs on the processor under the SIMADYN D real-time operating system. This guarantees, depending on the configuring using interrupts, controlled cycle times of ≥ 1 ms. An LED (D5) indicates that the board is operating cyclically, error-free.

The boards are programmed using the UP3 programming adapter on PG710, PG730, PG750 programming units or with the parallel programming units PP1I and PP1X. The programming units can be connected to the parallel interface of standard PCs.
The SW 20 software package (angular synchronism) and SW30 (axial winder) are available for standard applications. The standard software packages are designed, both for use with the CS51 communications board and without it. It can also be used in the technology box SRT without a basic converter (6SE12/13, 6RA24).

Serial interfaces X01 and X02 (connectors X3/X4) serve as communications- and service interfaces.
The HEX monitor can be activated using jumper J1 for diagnostics and monitoring purposes. When the jumper is inserted, the hex monitor is enabled at restart, or when an error message is present, outputs the associated information.
Three watchdogs are provided for each processor board to monitor the functioning of 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 process still runs cyclically.
- whether the interrupt control of the serial interface, timer and inputs operate error-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/error is the processor itself, the board is de-activated.

3. Board design

- Dual port RAM 2 K * 8 to couple with the basic converter unit

- Connection for coupling to the dual port RAM of the interface board

- Version for operation with natural air cooling

- CPU 80C186 - 20 MHz

- RAM 128 kbyte

- Use of the MS47 SIMADYN D memory module

  MS47 EPROM 256 K * 16 EEPROM 2 K * 8

- 7 differential analog inputs
  inputs, multiplexed, resolution 11 bits + sign

- 4 analog outputs
  ± 10 V output voltage

- 16 binary inputs
  can be used, interrupt-controlled

- 8 binary outputs with P24 connection for external supply of the binary outputs

- 2 inputs for sensing speed, position and angle

- 2 serial interfaces, either V24 (RS232) or RS 485 for X01 (X3), and RS 485 for X02 (X4)

- Board coding for identification

4. Application and installation information

The PT10 processor board can be used in both MKT racks (6SE12/13 and 6RA24) as well as in the SRT technology box. It occupies one slot. To ensure perfect operation, the board (also during start-up), must be screwed to the subrack. It is not permissible that the board is inserted or withdrawn under voltage.

4.1. Jumper setting

J1: Reserved for future applications

J2: Acknowledgement

Pins1-2, open	Standard operation
Pins1-2, jumpered	Acknowledging system error messages If this jumper is inserted at run-up (RESET), the hex monitor on PT10 is started for debugging purposes. This function should only be set for diagnostics.

J3: Settings of interface X01:
Pins 1-2, jumpered: V24 interface
Pins 2-3, jumpered: RS485 interface

J8,J13: Only for factory testing.
The jumpers are not inserted

Factory settings:

J1	Pins 1-2, jumpered	jumper store (for jumpering J2)
J2	Pins 1-2, open	standard operation
J3	Pins 1-2, jumpered	X01 as V24 interface

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	MKT
DIMENSIONS	233.4 * 220 mm
BOARD WIDTH	1 slot
WEIGHT	1.0 kg
CURRENT DRAIN	P5 1.2 A (inc. SE59 and MS47) P15 150 mA + encoder load N15 170 mA VCRAM 0.5 mA P24 0.1 A + load, binary outputs

5.2. BINARY INPUTS

NUMBER	16, non-floating, interrupt-capable
INPUT VOLTAGE	+24 V rated voltage
for 0 signal	-1 V to +6 V or binary inputs open
for 1 signal	+13 V to +33 V
Input current	
for 1signal	approx. 5 mA
Delay time	500 usec.

5.3. BINARY OUTPUTS

NUMBER	8, 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 0.5sec.
OUTPUT CURRENT FOR 1 SIGNAL	
-RATED VALUE	50 mA
-PERMISSIBLE RANGE	0.2 mA 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

NUMBER	4
OUTPUT VOLTAGE, min	-10 V
OUTPUT VOLTAGE, max	+10 V
OUTPUT CURRENT, max	7.5 mA
RESOLUTION	11 bits + sign (corresponding to 5 mV)
ABSOLUTE ACCURACY	+/- 0.25% (+/- 25 mV)
SHORT-CIRCUIT PROTECTION TO GROUND	66 OHM

5.5. ANALOG INPUTS

NUMBER	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

NUMBER Track A, track B, zero pulse, Monitoring signal and Synchronizing enable	2 (using a pulse encoder)
PULSE FREQUENCY, max.	300 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, Synchronising 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 PT10

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

(40-pin flat connector)

Pin No.	Designation	Connector	Explanation
1	Input 1+	X5 A	Analog input 1
2	Input 1-	X5 A	"
3	Input 2+	X5 B	Analog input 2
4	Input 2-	X5 B	"
5	Input 3+	X5 C	Analog input 3
6	Input 3-	X5 C	"
7	Input 4+	X5 D	Analog input 4
8	Input 4-	X5 D	"
9	Output 1	X5 H	Analog output 1
10	Analog GND	X5 H	Ref., analog outputs
11	Input 5+	X5 E	Analog input 5
12	Input 5-	X5 E	"
13	Input 6+	X5 F	Analog input 6
14	Input 6-	X5 F	"
15	Input 7+	X5 G	Analog input 7
16	Input 7-	X5 G	"
17	Output 2	X5 J	Analog output 2
18	Analog GND	X5 J	Ref., analog outputs
19	Output 3	X5 K	Analog output 3
20	Output 4	X5 L	Analog output 4
21	Track 1A+	X5 M	Speed sensing 1, track A
22	Track 1A-	X5 M	Inverted signal or ref., track A
23	Track 1B+	X5 M	Speed sensing 1, track B
24	Track 1B-	X5 M	Inverted signal or ref., track B
25	Zero pulse 1+		Speed sensing 1, zero pulse
26	Zero pulse 1-		Inverted signal or ref., zero pulse
27	Rough pulse 1		Rough pulse for speed sensing 1
28	GND ext.		Ground encoder supply and ref., rough pulse
29	GND ext.		"
30	P15		Encoder supply (15V)
31	Track 2A+	X5 N	Speed sensing 2, track A
32	Track 2A-	X5 N	Inverted signal or ref., track A
33	Track 2B+	X5 N	Speed sensing 2, track B
34	Track 2B-	X5 N	Inverted signal or ref., track B
35	Zero pulse 2+		Speed sensing 1, zero pulse
36	Zero pulse 2-		Inverted signal or ref., zero pulse
37	Rough pulse 2		Rough pulse for speed sensing 1
38	GND ext.		Ground, encoder power supply and ref., rough pulse
39	P15		Encoder power supply(15V)
40	GND ext.		Ground, encoder power supply and ref. rough pulse

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

(34-pin flat connector)

Pin No.	Designation	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	Output 1	X6 C	Binary outputs 1 - 8
22	Output 2	X6 C	
23	Output 3	X6 C	
24	Output 4	X6 C	
25	Output 5	X6 C	
26	Output 6	X6 C	
27	Output 7	X6 C	
28	Output 8	X6 C	
29	P external		External power supply for inputs and outputs (24V)
30	M external		
31	n. c.		
32	n. c.		
33	n. c.		
34	n. c.		

6.3. Connector assignment of serial interface X01 (X3)

PIN	V24		EIA 485	
1	---		RECEIVE DATA	+RxD
2	RECEIVE DATA	RxD	---	
3	TRANSMIT DATA	TxD	---	
4	---		RECEIVE DATA	-RxD
5	GND		GND	
6	---		TRANSMIT DATA	+TxD
7	n. c.		n. c.	
8	*BOOT		*BOOT	
9	---		TRANSMIT DATA	-TxD

6.4. Connector assignment of serial interface X02 (X4)

PIN	EIA 485	
1	RECEIVE DATA	+RxD
2	RECEIVE DATA	-RxD
3	GND	
4	TRANSMIT DATA	+TxD
5	TRANSMIT DATA	-TxD

7. Supplementary components

7.1. SE59, submodule for speed sensing and positioning

Submodule *SE59* is used for speed sensing and positioning. The plant signals are fed-in through terminal block *SE58* and round cable *SC58* to the *PT10* board. It is inserted on the board. Using the submodule, incremental encoder signals, with and without push-pull signals from 15 V to 24V can be connected-up and encoders with TTL output signals (only with push-pull signals).
Switches S01-S06 on the submodule are used to changeover to encoders with or without push-pull signals. The switch position can be individually changed for each signal.

Switch position, open
Signals (not push-pull) for an encoder power supply between 15 V and 24 V.

Switch position, closed:
Signals with push-pull signals

S01	Sensing 1, track A
S02	" , track B
S03	" , zero pulse
S04	Sensing 2, track A
S05	" , track B
S06	" , zero pulse

Figs. 3, 4 show how an incremental encoder is connected-up to PT10 via SE58 using either the push-pull or common mode principle.

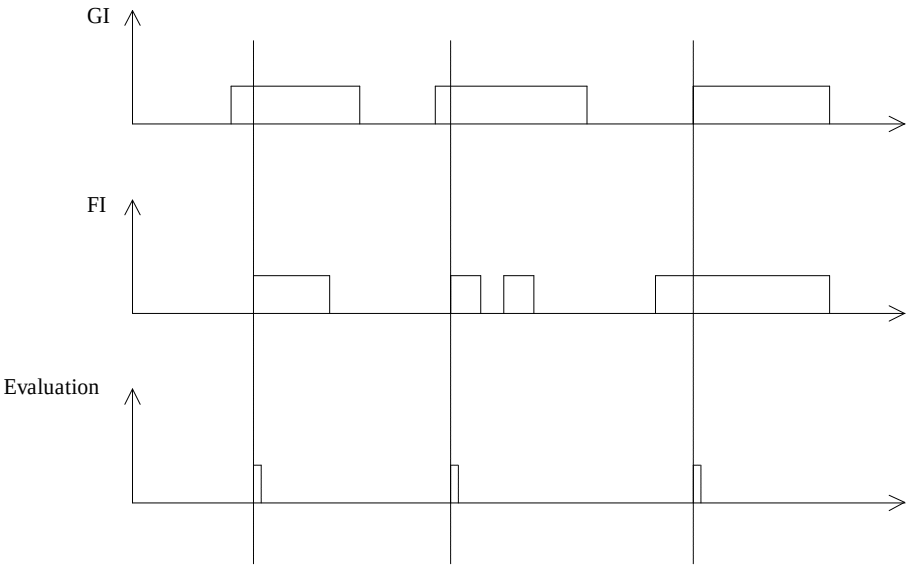
The rough pulses of the particular sensing system can be used to suppress or inject zero pulses for positioning tasks. The influence of the rough pulses can be changed per software. The settings are described in the relevant function blocks associated with the speed sensing.

7.2. Interaction between rough- (GI) and fine pulses (FI)

7.2.1. Type 0

No rough pulse available: Only the fine pulse is evaluated.

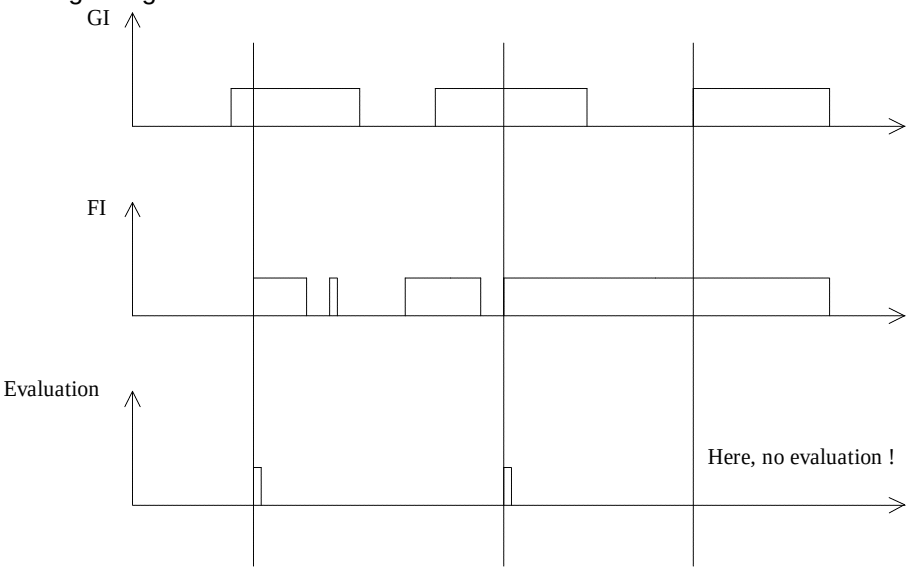
7.2.2. Type 1



The evaluation is enabled once by GI. The next single evaluation is initiated by resetting and then setting GI again. Only the rising edge is evaluated. The sequence of FI and GI is irrelevant.

7.2.3. Type 2

The difference to type 1 is that the evaluation is only realized for the sequence GI --> FI.
The evaluation is enabled once by GI. The next single evaluation is initiated by resetting and then setting GI again.



7.2.4. Control register

The various situations can be set using a control register. This register is set via the various function blocks and is assigned as follows:

Bit 0 Bit 1	Rough pulse, sensing 1 Rough pulse, sensing 1	00 = Type 0 01 = Type 1 11 = Type 2
Bit 2 Bit 3	Rough pulse, sensing 2 Rough pulse, sensing 2	00 = Type 0 01 = Type 1 11 = Type 2

7.3. SE58, terminal block for connecting plant signals

The block is used to connect-up input-, output- and incremental encoder signals on the plant side. It is snapped onto mounting rails. The binary input signals, binary output signals and the incremental encoder signals are displayed via red LEDs, which have the particular terminal designation.
The connection to the PT10 board is established through the screened SC58 and SC60 ribbon cables.

7.3.1.Terminal assignment of terminal block SE58, pin row X5

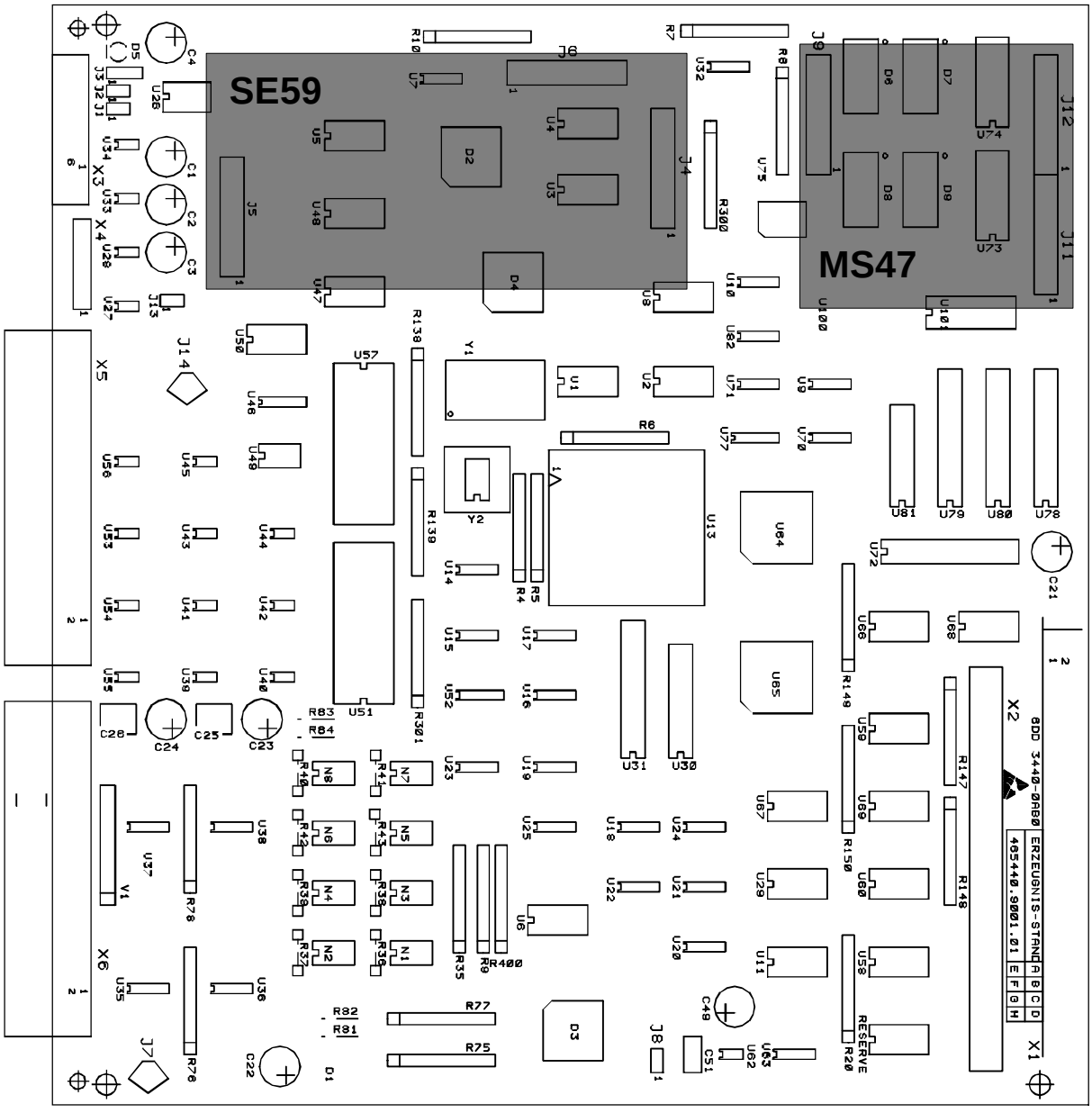
Pin No.	Designation	Explanation
501	Input 1+	Analog input 1
502	Input 1-	"
503	Input 2+	Analog input 2
504	Input 2-	"
505	Input 3+	Analog input 3
506	Input 3-	"
507	Input 4+	Analog input 4
508	Input 4-	"
509	Output 1	Analog output 1
510	Analog GND	Ref., analog outputs
511	Input 5+	Analog input 5
512	Input 5-	"
513	Input 6+	Analog input 6
514	Input 6-	"
515	Input 7+	Analog input 7
516	Input 7-	"
519	Output 2	Analog output 2
520	Analog GND	Ref., analog outputs
521	Output 3	Analog output 3
522	Analog GND	Ref., analog outputs
523	Output 4	Analog output 4
524	Analog GND	Ref., analog outputs
531	Track 1A+	Speed sensing 1, track A
532	Track 1A-	Inverted signal or ref., track A
533	Track 1B+	Speed sensing 1, track B
534	Track 1B-	Inverted signal or ref., track B
535	Zero pulse 1+	Speed sensing 1, zero pulse
536	Zero pulse 1-	Inverted signal or ref., zero pulse
537	Rough pulse 1	Rough pulse for speed sensing 1
538	GND ext.	Ground, encoder power supply and ref. rough pulse.
539	GND ext.	"
540	P15	Encoder power supply (15V)
541	Track 2A+	Speed sensing 2, track A
542	Track 2A-	Inverted signal or ref., track A
543	Track 2B+	Speed sensing 2, track B
544	Track 2B-	Inverted signal or ref., track B
545	Zero pulse 2+	Speed sensing 1, zero pulse
546	Zero pulse 2-	Inverted signal or ref., zero pulse
547	Rough pulse 2	Rough pulse for speed sensing 1
548	GND Ext.	Ground, encoder power supply and ref., rough pulse
549	GND Ext.	Ground, encoder power supply and ref., rough pulse

7.3.2. Terminal assignment of terminal block SE58, pin row X6

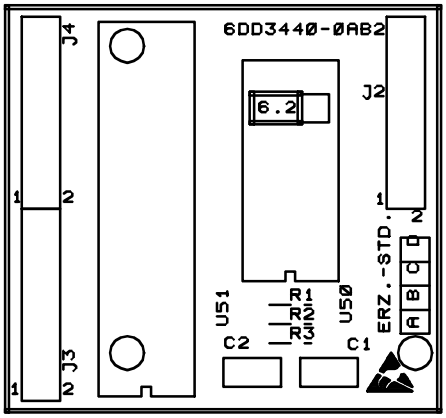
Pin No.	Designation	Explanation
601	Input 1	Binary inputs 1 - 8
602	Input 2	
603	Input 3	
604	Input 4	
605	Input 5	
606	Input 6	
607	Input 7	
608	Input 8	
609	P external	External power supply for inputs and outputs (24V)
610	M external	
611	Input 9	Binary inputs 9 - 16
612	Input 10	
613	Input 11	
614	Input 12	
615	Input 13	
616	Input 14	
617	Input 15	
618	Input 16	
619	P external	External power supply for inputs and outputs (24V)
620	M external	
631	Output 1	Binary outputs 1 - 8
632	Output 2	
633	Output 3	
634	Output 4	
635	Output 5	
636	Output 6	
637	Output 7	
638	Output 8	
639	P external	External power supply for inputs and outputs (24V)
640	M external	

8. Others

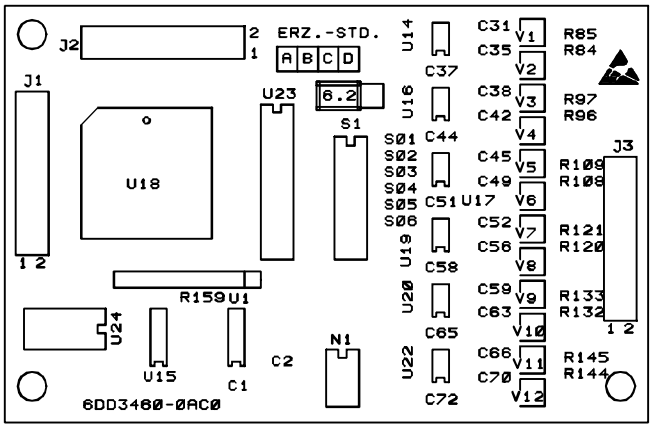
8.1. Layout diagram PT10



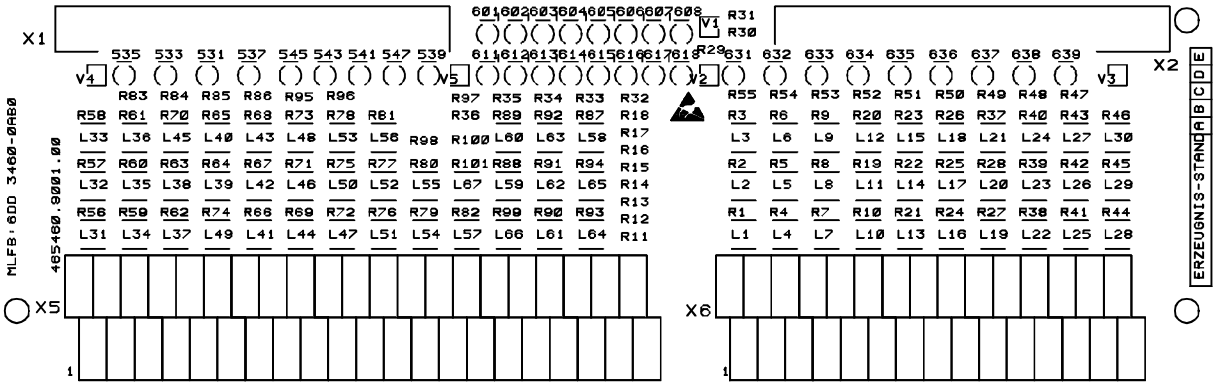
8.2. Layout diagram MS47



8.3. Layout diagram SE59



8.4. Layout diagram SE58



8.5. Diagrams

Anschluß eines Impulsgebers nach dem Gegentaktprinzip über SE58 an die PT
Beispiel mit externer Stromversorgung und Anschluß an Drehzahlerfassung 2

connection of incremental encoder to PT10:
example with external power supply

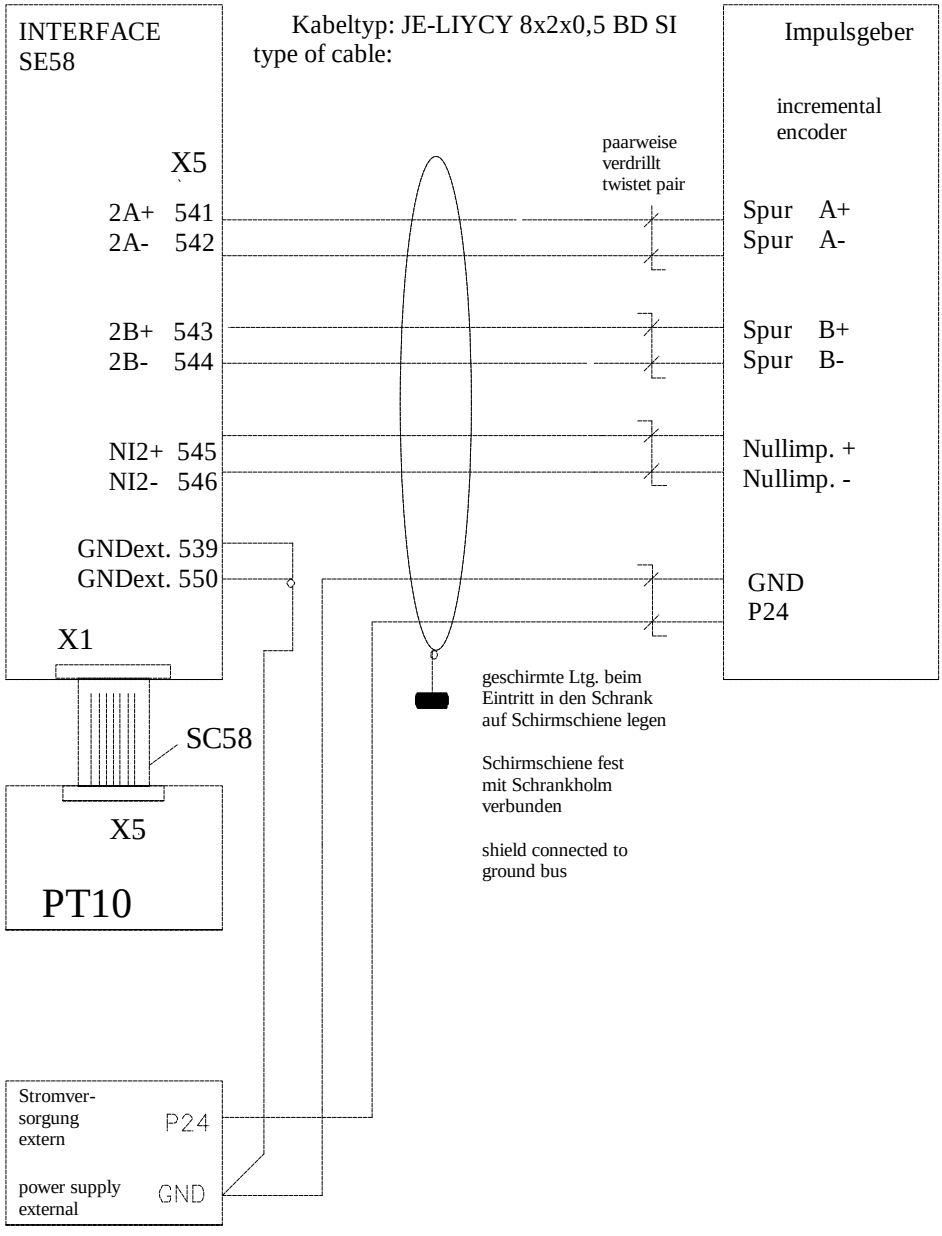


Fig. 1

Anschluß eines Impulsgebers nach dem Gleichtaktprinzip über SE58 an die PT10:
Beispiel mit interner Stromversorgung und Anschluß an Drehzahlerfassung 1

connection of incremental encoder to PT10:
example with internal power supply from interface SE58

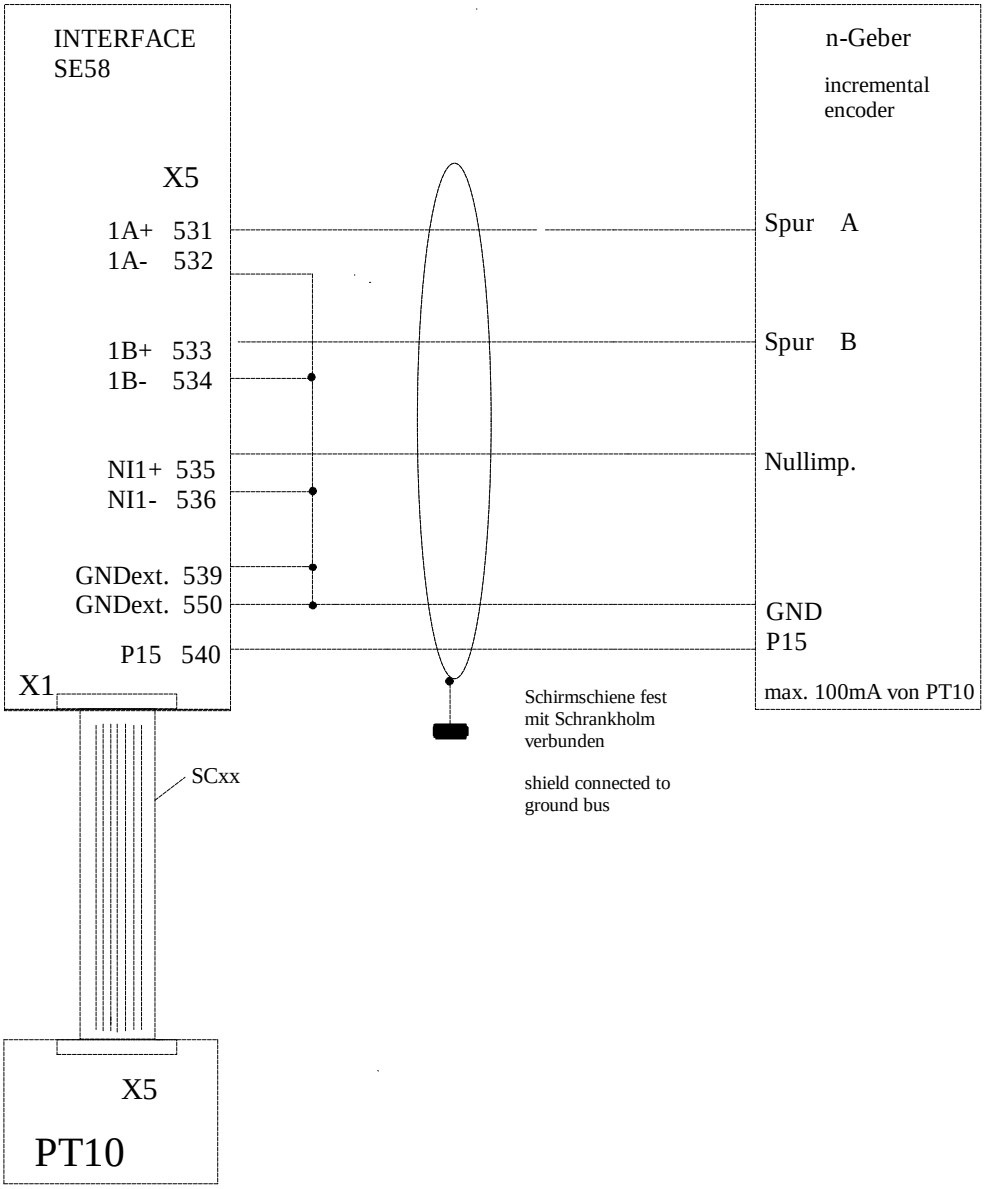


Fig. 2

8.6. Dimension drawing

Dimension drawing 3SE.465440.9001.00 MB

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.

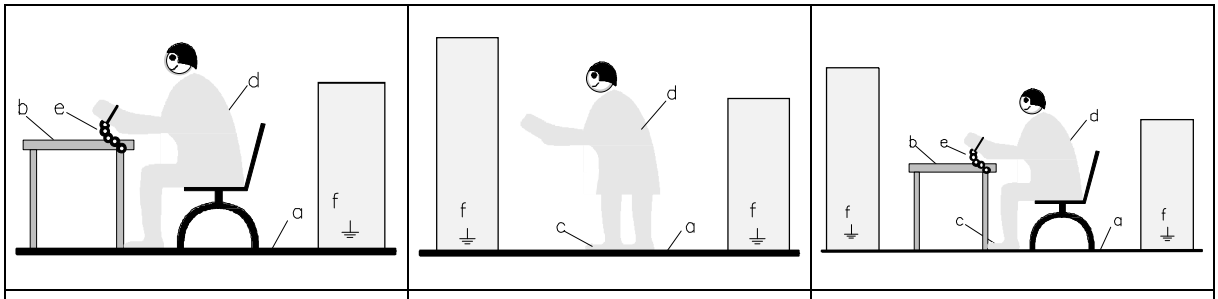
When soldering, the soldering iron tip must be grounded.

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.

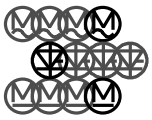
The necessary ECB protective measures are clearly shown in the following diagram.

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



Seated	Standing	Standing/sitting

Drives and Standard Products
Motors and Drives Systems Group
Postfach 3269, D-91050 Erlangen



System-Based
Technology