

Sensor Requirements

The following requirements must be satisfied by the sensor signals to the module inputs.

- Signal sequence for up-counting

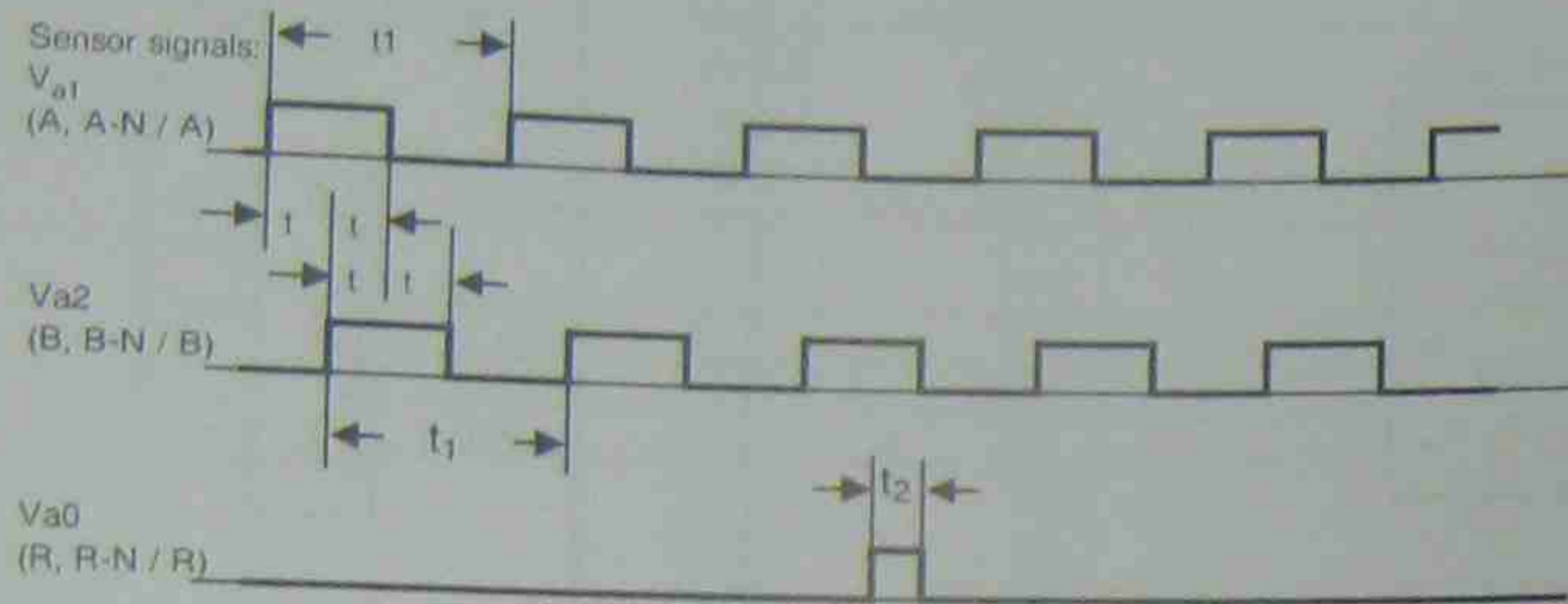


Figure 16-14. Signal Sequence for Up-Counting

- Pulse time of the sensors

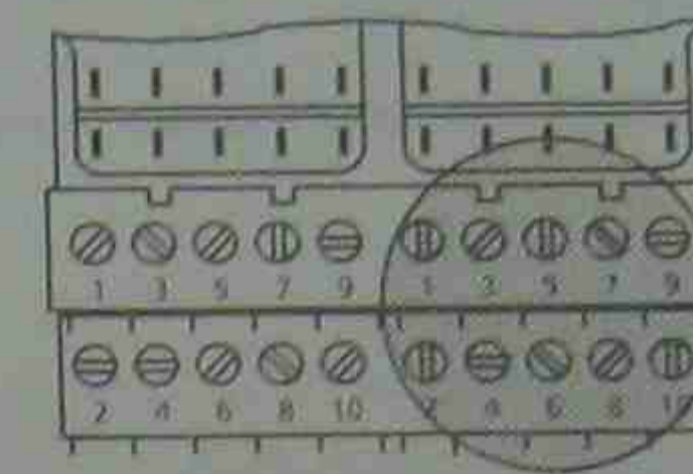
	5 V-Sensors	24 V-Sensors	Pulses
t	$\geq 500 \text{ ns}$	$\geq 10 \mu\text{s}$	V_{a1} = Position decoder count pulses (A)
t_1	$\geq 2 \mu\text{s}$	$\geq 40 \mu\text{s}$	V_{a2} = Position decoder count pulses (B)
t_2	$\geq 500 \text{ ns}$	$\geq 10 \mu\text{s}$	V_{a0} = Position decoder ref. pulse (R)

- Minimum edge steepness

5 V - differential signals according to RS 422A (A, A-N, B, B-N, R, R-N): $5 \text{ V}/\mu\text{s}$
 24 V - count pulses and reference pulse (A, B, R): $0.3 \text{ V}/\mu\text{s}$
 24 V - enable and reference signal: $0.3 \text{ mV}/\mu\text{s}$

Terminal Block

Proximity switches can be connected (contacts, two-wire BERO proximity limit switches) to the inputs on the terminal block.



Terminal	Terminal Assignment
1	24-V DC supply for the module
2	Ground
3	24-V DC supply for enable signal
4	DI enable signal
5	DQ 24 V / 0.5 A setpoint (Q0)
6	Ground
7	24-V DC supply for reference signal
8	DI reference signal
9	DQ 24-V / 0.5 A setpoint 2 (Q1)
10	Ground

Figure 16-15. Assignment Diagram for the Terminal Block

- **Assignment of Inputs on the Terminal Block**
Two-wire BERO proximity limit switches can be connected to the reference input. The enable input can also be driven by a 24-V DC digital output module.
- **Outputs on the Terminal Block**
There are two short-circuit protected 24-V DC digital outputs on the terminal block.
- **Short-Circuit Indication**
A shorted output is indicated by the red LED on the front panel.

FB10 STL	Description
NAME :UHR-STEL	SETTING THE CLOCK
DES :WDAY I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :DAY I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :MON I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :YEAR I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :HOUR I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :AMPM I/Q/D/B/T/C: I BI/BY/W/D: BI	
DES :MIN I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :SEC I/Q/D/B/T/C: I BI/BY/W/D: BY	
DES :ERR I/Q/D/B/T/C: Q BI/BY/W/D: BI	
DES :MODE I/Q/D/B/T/C: I BI/BY/W/D: BI	
:A =MODE	24HR-MODE = 0, 12HR-MODE = 1
:F 11.1	(CLOCK MODE STATUS WORD BIT 1)
:AN F 20.0	FLAG IS RESET IF SETTINGS ALREADY
:JC =M001	READ INTO CLOCK DATA AREA
:R F 20.0	
:	
:C DB 2	CLOCK DATA AREA
:L =WDAY	STORE VALUE FOR WEEKDAY
:T DR 4	
:L =DAY	STORE VALUE FOR DAY
:T DR 5	
:L =MON	STORE VALUE FOR MONTH
:T DR 5	
:L = YEAR	STORE VALUE FOR YEAR
:T DL 6	
:L =HOUR	STORE VALUE FOR HOUR
:ON =AMPM	IF 12-HOUR MODE IS SET, AND
:ON =MODE	AM/PM BIT = 1 (AFTERNOON), THE
:JC =MORN	RELEVANT BIT IN THE CLOCK AREA
:L KH 0080	IS SET
:OW	
MORN :T DR 6	
:L =MIN	STORE VALUE FOR MINUTES
:T DL 7	
:L =SEC	STORE VALUE FOR SECONDS
:T DR 7	
:AN F 11.2	TRANSFER SETTINGS
:S F 11.2	(STATUS WORD IS FW10)
:L KT 020.1	START MONITORING TIME
:SE T 10	
M001 :A T 10	BEC, IF MONITORING TIME
:BEC	NOT YET ELAPSED

FB10 STL (continued)	Explanation
:AN F 11.2	HAVE SETTINGS BEEN TRANSFERRED?
:JC =M002	IF YES, JUMP TO M002
:S =ERR	SET ERROR BIT IF THERE ARE ERRORS
:BEU	
M002 :AN F 11.0	WERE THERE ERRORS WHILE ENTERING SETTINGS?
:RB =ERR	IF NO, RESET ERROR BIT
:BEC	IF NO ERROR, THEN BEC
:S =ERR	IF AN ERROR, SET ERROR BIT
:BE	

Example: Program for reading the current time and the current date

The time is stored in flag bytes FY30 to FY36, depending on an external event, simulated here by a positive edge at input I 32.5. Flag F 13.1 indicates which mode the clock is operating in. Flag F 13.0 is the AM/PM bit in the 12-hour mode.

The clock data area is in DB2 beginning with DW0, and the status word is FW10.

OB1 STL	Explanation
:	=====
:	READING TIME AND DATE
:	=====
:A I 32.5	TIME AND DATE ARE
:AN F 0.1	STORED IN FY30 TO FY36 IN CASE OF A
:F 0.0	POSITIVE EDGE AT I 32.5.
:A I 32.5	(EXTERNAL EVENT)
:F 0.1	
:	
:A F 0.0	EDGE TRIGGER FLAG
:JC FB 13	
NAME :UHR-LES	(READING TIME AND DATE)
WDAY : FY 30	WEEKDAY
DAY : FY 31	DAY
MON : FY 32	MONTH
YEAR : FY 33	YEAR
HOUR : FY 34	HOUR
AMPM : F 13.0	F 13.0 = 1, AFTERNOON IN 12H-MODE
MIN : FY 35	MINUTES
SEC : FY 36	SECONDS
MODE : F 13.1	F 13.1 = 1, IN 12-HOUR MODE
:BE	

FB13 STL	Explanation
NAME :UHR-LES	READING THE CLOCK
DES :WDAY I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :DAY I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :MON I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :YEAR I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :HOURL I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :AMPM I/Q/D/B/T/C: 0 BI/BY/W/D/:BI	
DES :MIN I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :SEC I/Q/D/B/T/C: 0 BI/BY/W/D/:BY	
DES :MODE I/Q/D/B/T/C: 0 BI/BY/W/D/:BI	
:C DB 2	
:L DR 0	WEEKDAY
:T =WDAY	
:L DL 1	DAY
:T =DAY	
:L DR 1	MONTH
:T =MON	
:L DL 2	YEAR
:T =YEAR	
:L DR 2	HOUR
:L KH 007F	ERASE AM/PM BIT (ONLY RELEVANT IN 12-HOUR MODE)
:AW	
:T =HOURL	
:TB D 2.7	DISPLAY AM/PM BIT (ONLY RELEVANT IN 12-HOUR MODE)
:= =AMPM	
:L DL 3	MINUTE
:T =MIN	
:L DR 3	SECOND
:T =SEC	
:A F 11.1	DISPLAY CLOCK MODE
:= =MODE	MODE = 1, IN 12-HOUR MODE
:BE	

Storing the Updated Time/Date after a RUN to STOP Switch

Note

- This clock data area is only written to if the following requirements are met.
- Bit 5 in the status word is set to "1".
 - A RUN to STOP switch or a Power OFF has taken place.
 - The necessary memory space is available in the operand area.

This enables you to detect a RUN to STOP switch or a Power OFF even if the programmable controller has since gone back to RUN mode. The time and date of the last RUN to STOP switch or Power OFF are in words 18 to 21 (see Table 13.3)

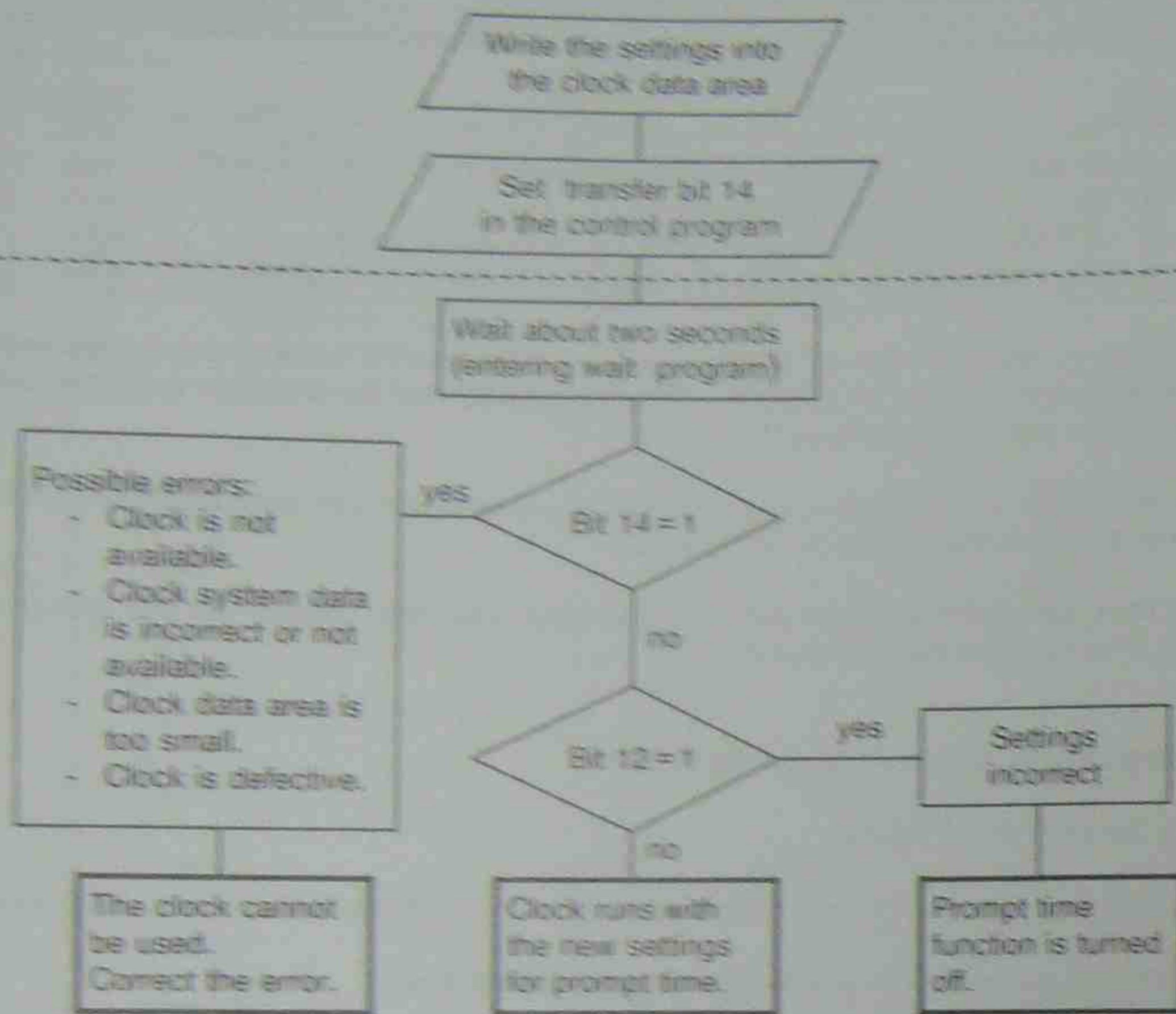
If several RUN to STOP switches have occurred before you read out this clock data area, you will only be able to determine the time of the last switch.

If you do not have sufficient memory for this clock data area, you either cannot use this area or use only part of it. This has no impact on anything else.

13.7.2 Programming the Prompt Function

Transferring Settings to the Clock

- You can store the settings in the clock data area by using transfer operations (see Table 13-10).
- The AM/PM flag (bit number 7) is only significant in 12-hour mode.
Bit 7 = 1 means PM
Bit 7 = 0 means AM
- You must transfer the clock data in BCD code.
TIP: The "KC" data format loads a BCD constant into ACCU 1 and is therefore especially suitable.
- If you enter the value "255_D" or "FF_H" in a byte as the prompt time, this byte will be ignored when evaluating "Prompt time reached". This makes it easy to program, for example, an alarm that is repeated daily by entering the value in the "255_D" or "FF_H" in the "Weekday", "Date" and "Month" settings.
- You can transfer the prompt time settings to the clock by initiating bit 14 in the status word.
- Bit 14 in the status word causes the transfer of prompt time settings to the clock.
- The settings are transferred 1 second after the start of the next cycle.
- Bit 12 in the status word displays incorrect settings.



* The lower part of the flow chart has only a diagnostic function. There is nothing you must perform.

Figure 13-8. Flowchart - Transferring a New Prompt Time

Prompt Time Sequence

- Bit 13 in the status word is set after the prompt time has elapsed.
- Bit 13 remains set until you reset it in the control program.
- The prompt time can be read at any time.



Caution

If the prompt time is reached in the STOP mode or during Power OFF, the prompt time cannot be evaluated. It is always deleted on restart.

Example: Setting and evaluating the prompt time

In the example program, the status of input I 32.6 determines whether the settings for the prompt time are transferred. Before setting input I 32.6, you must transfer the settings to flag bytes FY130 and FY135. Enter values that you do not wish to be evaluated as FF_h.

You set the clock mode with input I 33.0. Use input I 32.1 to specify the the AM/PM bit for 12-hour mode.

If the preset prompt time has been reached, set flag F 13.2. Any errors made while entering the prompt time are displayed in flag F 12.2.

The clock data is stored in DB2 beginning with data word DW0, and the status word is flag word FW10.

OB1 STL	Explanation
;
;	SETTING AND EVALUATING THE PROMPT TIME
;
;	LOAD VALUES INTO FY130 TO FY135
;	FIRST.
;-A I 32.6	TRIGGER SETTING OF PROMPT TIME
;-S F 20.1	BY SETTING F 20.1 (RESET IN FB11)
;-20 FB 11	
NAME :WECK1-ST	(SET AND EVALUATING PROMPT TIME)
WDRY : FY 130	WEEKDAY
DAY : FY 131	DAY
MON : FY 132	MONTH
HOUR : FY 133	HOUR
AMPW : I 32.1	AMPW-BIT (ONLY IMPORTANT IN 12-HOUR MODE)
MIN : FY 134	MINUTES
SEC : FY 135	SECONDS
ERR : F 12.2	ERROR BIT
ALRM : F 13.2	DISPLAYS THAT PROMPT TIME IS REACHED.
MODE : I 33.0	12-HOUR MODE: I 33.0 = 1
;-BE	

FB11 STL	Explanation
WECKZ-ST	SETTING THE PROMPT TIME
WDAY I/Q/D/B/T/C: I BI/RY/W/D: BY	
DATE I/Q/D/B/T/C: I BI/RY/W/D: BY	
MON I/Q/D/B/T/C: I BI/RY/W/D: BY	
HOUR I/Q/D/B/T/C: I BI/RY/W/D: BY	
AMPM I/Q/D/B/T/C: I BI/RY/W/D: BI	
MIN I/Q/D/B/T/C: I BI/RY/W/D: BY	
SEC I/Q/D/B/T/C: I BI/RY/W/D: BY	
ERR I/Q/D/B/T/C: Q BI/RY/W/D: BI	
ALRM I/Q/D/B/T/C: Q BI/RY/W/D: BI	
MODE I/Q/D/B/T/C: I BI/RY/W/D: BI	
A -MODE	24 HOUR MODE = 0, 12 HOUR = 1
R F 11.1	(SET CLOCK MODE)
A F 10.6	DISPLAY PROMPT TIME REACHED
S -ALRM	(BIT 13 IN STATUS WORD)
R F 10.6	RESET BIT AFTER EVALUATION
AN F 20.1	FLAG IS RESET IF SETTINGS HAVE ALREADY
JC -M001	BEEN READ INTO THE CLOCK DATA AREA
R F 20.1	
C DB 2	CLOCK DATA AREA
L -WDAY	STORE VALUE FOR WEEKDAY
T DR 8	
L -DAY	STORE VALUE FOR DATE
T DL 9	
L -MON	STORE VALUE FOR MONTH
T DR 9	

FB11 STL (continued)	Description
L -HOUR	STORE VALUE FOR HOURS
ON -AMPM	IF AM/PM = 1 (AFTERNOON) AND
ON -MODE	12-HOUR MODE IS SET, THE
JC -MORN	CORRESPONDING BIT IN THE CLOCK
L KH 0980	DATA AREA IS SET
ON	
MORN :T DR 10	
L -MIN	STORE VALUE FOR MINUTES
T DL 11	
L -SEC	STORE VALUE FOR SECONDS
T DR 11	
AN F 10.6	TRANSFER SETTINGS
S F 10.6	(BIT 14 IN STATUS WORD FW10)
L KT 020.1	START MONITORING TIME
SE T 11	
M001 :A T 11	BEC, IF MONITORING TIME NOT YET
BEC	ELAPSED
AN F 10.6	HAVE SETTINGS BEEN TRANSFERRED?
JC -M002	IF YES, JUMP TO M002
S -ERR	IF ERROR, SET ERROR BIT
BEC	
M002 :AN F 10.4	ERROR WHEN ENTERING SETTINGS?
RB -ERR	IF NO, RESET ERROR BIT
BEC	BEC, IF NO ERROR
S -ERR	IF ERROR, SET ERROR BIT
BE	

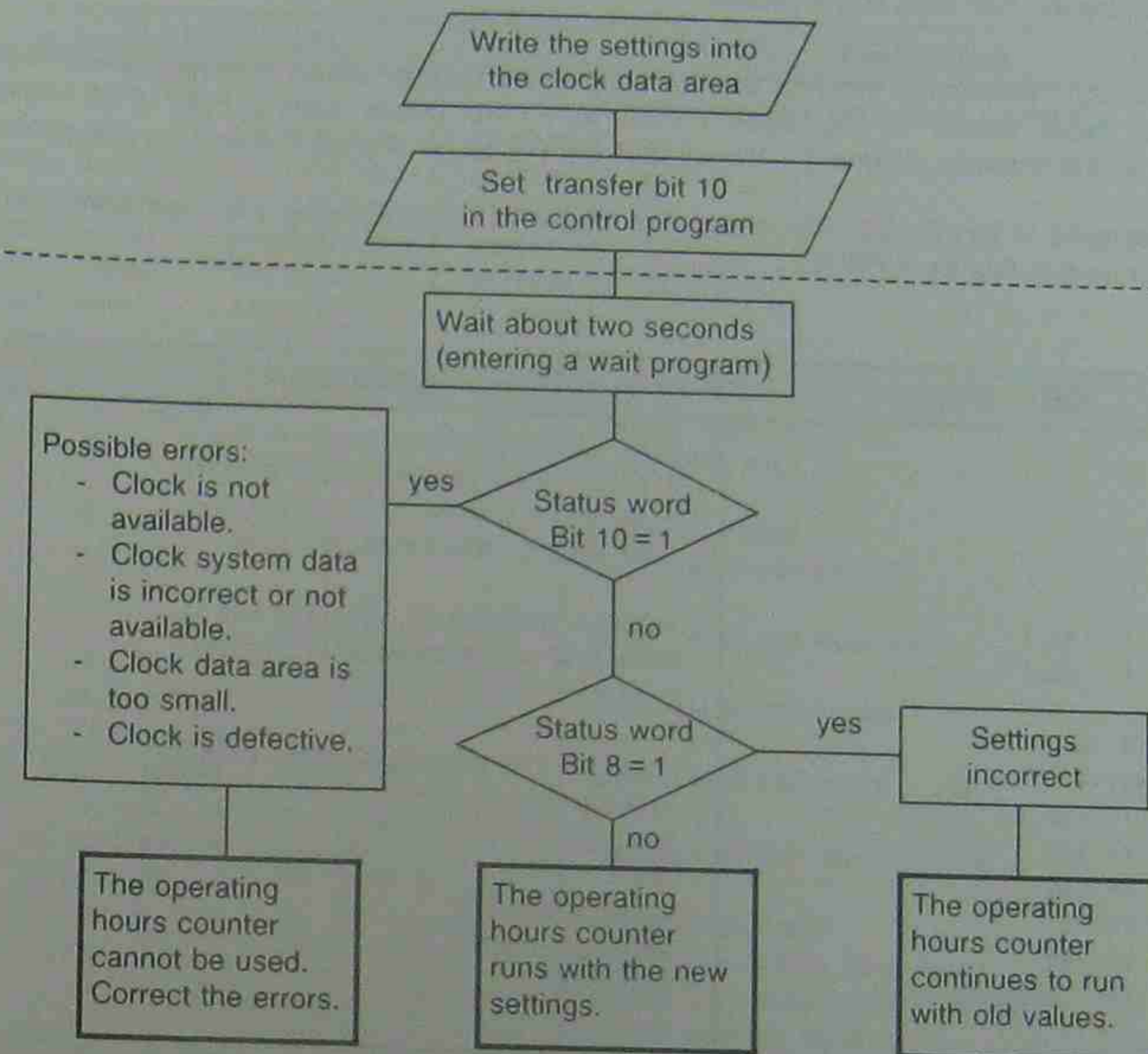
13.7.3 Programming the Operating Hours Counter

You can enable the operating hours counter with bit 9 of the status word. This allows you to establish, for example, the number of hours a motor has been in operation. The operating hours counter is active only in the RUN mode.

Transferring Settings to the Operating Hours Counter

You can preset the operating hours counter with a certain start value.

- The clock data must be transferred in BCD code.
TIP: The "KC" data format loads a BCD constant into ACCU 1 and is therefore especially suitable for entering the settings.
- If you do not want a value (for example minutes) to be transferred, entering the relevant byte as "255_D" or "FF_H". The current value for this variable is then retained.
- After you have transferred the settings to the clock data area, you must set bit 10 in the status word for the clock to accept the clock data.
- Bit 8 in the status word displays incorrect settings.



* The lower part of the flow chart has only a diagnostic function. There is nothing you must perform.

Figure 13-9. Flowchart - Transferring Settings to the Operating Hours Counter

Example: Setting the operating hours counter

The status of I 32.7 determines whether the operating hours counter values are transferred. You must transfer these values to flag bytes FY136 to FY140 before setting input I 32.7 (not implemented in the example program). Values that are not to be changed should be preset with FF_h.

Errors are displayed in flag F 12.3. The clock data area is in DE2 beginning with data word DW0, and the status word is flag word FW10.

OB1 STL	Explanation
;	*****
;	SETTING THE OPERATING HOURS COUNTER
;	*****
;	LOAD VALUES INTO FY136 TO FY140
;	*****
;	TRANSFER TRANSFER BY SETTINGS FOR
LD I 32.7	OPERATING HOURS COUNTER BY SETTING
LD F 25.2	F 25.2
;	*****
LDV FB 12	(SETTING THE OPERATING HOURS COUNTER)
NAME :SETROT-5	SECONDS
SEC : FY 136	MINUTES
MIN : FY 137	HOURS
HOUR0 : FY 138	HOURS X 100
HOUR2 : FY 139	ERRORS X 10000
HOUR4 : FY 140	ERROR BIT
ERR : F 12.3	
BE	

FB12 STL	Explanation
NAME :SETROT-5	SETTING THE OPERATING HOURS COUNTER
ORG :SEC 1/0/0/0/1/0/0 1 00/00/00/00	BY
ORG :MIN 1/0/0/0/1/0/0 1 00/00/00/00	BY
ORG :HOUR0 1/0/0/0/1/0/0 1 00/00/00/00	BY
ORG :HOUR2 1/0/0/0/1/0/0 1 00/00/00/00	BY
ORG :HOUR4 1/0/0/0/1/0/0 1 00/00/00/00	BY
ORG :ERR 1/0/0/0/1/0/0 0 00/00/00/00	BY
LD F 25.2	FLAG IS RESET IF SETTINGS
JC :HOUR0	ALREADY READ INTO THE
LD F 25.2	CLOCK DATA AREA
;	
LD SB 2	CLOCK DATA AREA
LD :SEC	STORE VALUE FOR SECONDS
LD DR 05	
LD :MIN	STORE VALUE FOR MINUTES
LD DL 04	
LD :HOUR0	STORE VALUE FOR HOURS
LD DR 04	
LD :HOUR2	STORE VALUE FOR HOURS X 100
LD DL 07	
LD :HOUR4	STORE VALUE FOR HOURS X 1000
LD DR 07	
LD F 10.2	TRANSFER SETTINGS
LD F 10.2	(BIT 10 IN STATUS WORD FW05)
LD F 09.1	ENABLE OPERATING HOURS COUNTER
;	IF NOT ALREADY ENABLED
LD RT 00.1	START MONITORING TIME
LD T 02	
MOV :R T 02	END OF MONITORING TIME NOT YET
SEC	ELAPSED
LD F 10.2	HAVE SETTINGS BEEN TRANSFERRED?
JC :HOUR0	IF YES, JUMP TO MOV
LD :ERR	IF ERROR, SET ERROR BIT
BE	
MOV :AN F 10.1	ERROR WHEN ENTERING SETTINGS?
LD :ERR	IF NO, RESET ERROR BIT
SEC	SEC IF NO ERROR
LD :ERR	IF ERROR, SET ERROR BIT
BE	

Reading the Current Operating Hours Counter

The current data is stored in words 12 to 14 of the clock data area. You can use load operations to read out the data.

Example: Reading the operating hours counter

You need to switch off a machine for inspection after every 300 hours of operation. Flag F 12.4 is set when the machine is switched off. After 300 hours of operation, a jump is made to PB5 to switch the machine off (not programmed in the example). The clock data area is in DB2 beginning with flag word FW0, and the status word is flag word FW10.

OB1 STL	Explanation
:JU FB 14 NAME :BETR-LES : :BE	EVALUATE OPERATING HOURS COUNTER

FB14 STL	Explanation
NAME :BETR-LES :C DB 2 :A F 12.4 :BEC : :L DL 14 : :L KC 003 :>KF :BEC : :S F 12.4 :JU PB 5 : : :BE	READING THE OPERATING HOURS COUNTER DB IN WHICH THE CLOCK DATA IS LOCATED. IF AUXILIARY FLAG 12.4 IS SET, OFF, THE MACHINE IS ALREADY → BLOCK END LOAD HOUR VALUE X 100 IN ACCU 1 COMPARE TO 3 (=300 HOURS) END IF 300 HOURS NOT YET REACHED SET AUXILIARY FLAG JUMP TO PB5 WHEN 300 OPERATING HOURS REACHED

13.7.4 Entering the Clock Time Correction Factor

You can configure a correction value that increases the exactness of the integral real-time clock. The correction value is displayed in seconds/month. The month is defined as 30 days.

Absolute Address RAM Memory	Range	System Data Word
50 18	- 400 _D to + 400 _D seconds/month	12

Example: You determined that the clock runs 12 seconds slow in a four day period. That would be 90 seconds in 30 days. The correction value is + 90 seconds/month.

Note

Use the data KF format to enter the correction value. You then do not have to convert the value to other numbering systems.

STL	Explanation
FB10 L KF + 90 T RS 12 BE	LOAD THE + 90 SECONDS CORRECTION VALUE INTO ACCU 1 AND STORE IT IN SYSTEM DATA WORD 12.

Note

The correction value you have entered is read in after the next minute change. If an error occurs when a setting is entered, bit 15 in system data word 11 is set.

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14 Programmable Controller to SINEC L1

SINEC L1 is a local area network that enables SIMATIC S5 programmable controllers to communicate with each other. It operates on the master-slave principle.

You will find more exact information on the SINEC L1 in the *SINEC L1* manual. You need to understand the SINEC L1 operating system before continuing with this chapter.

The S5-90U/S5-95U can be connected directly to the SINEC L1 as a slave. The information you need to perform this operation is explained in this chapter.

14.1 Connection of the Programmable Controllers to the L1 Bus Cable

Bus terminal BT 777 is the signal level converter that connects the programmable controller to the L1 bus cable. The procedure is as follows:

- ▶ Connect the L1 bus cable to bus terminal BT 777.

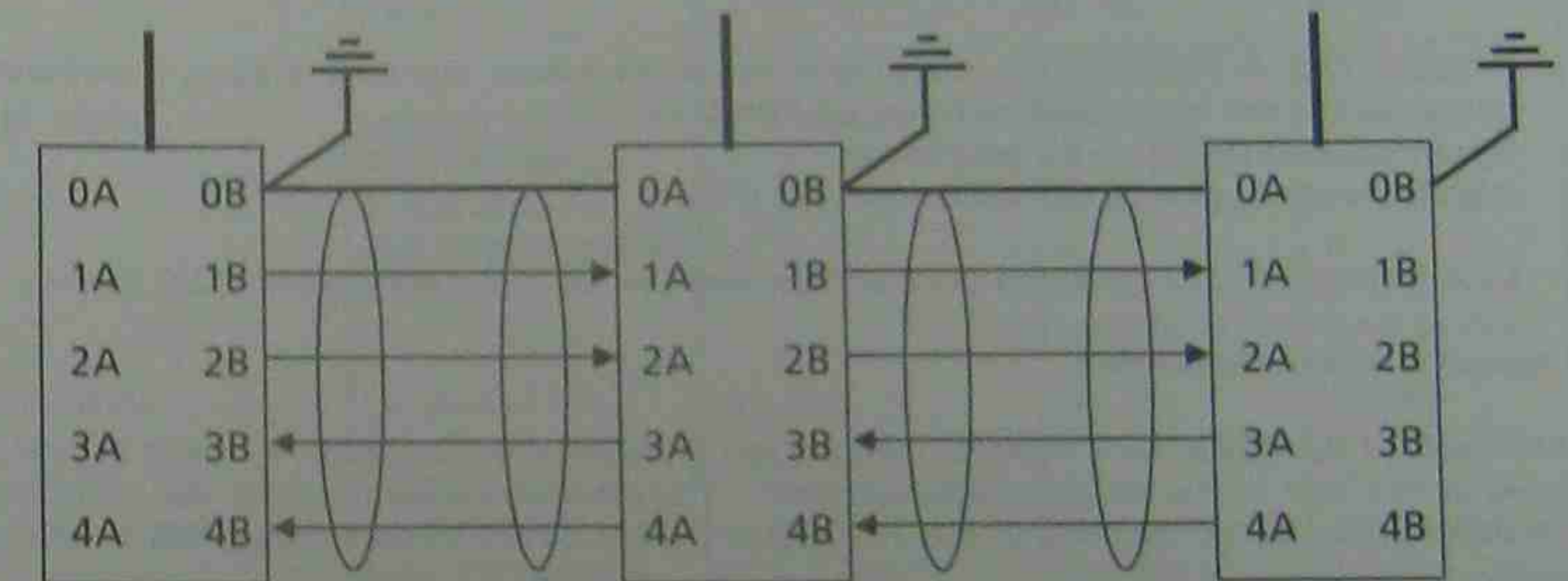


Figure 14-1. Connection of the Bus Cable

- ▶ For the S5-90U:
Supply bus terminal BT 777 with 5 V (Terminal C = +5 V (5.0 to 5.3 V; 0.3 A);
Terminal D = Ground)

Note

Refer to the section "Bus Terminals for non-Siemens Nodes" in the *SINEC L1* manual, beginning with Version 5, section 1.3.4. If there is a power failure with the S5-90U, the 5-V supply to the bus terminals must be turned off, otherwise no other bus functions are possible.

For the S5-95U the bus terminal is supplied by the PG/OP/SINEC L1 port.

- ▶ Insert the connector of the bus terminal cable into the PG/OP/SINEC L1 port.

14.2 Setting Parameters in the Programmable Controller for Exchanging Data

The programmable controller requires the following information for the handling of data exchange via the L1 bus:

- Location of the data to be sent (data block or flag area)
Name: **Send Mailbox**, abbreviated: **SF**
- Location of the data to be received (data block or flag area)
Name: **Receive Mailbox**, abbreviated: **EF**
- Storage location of the coordinating information for sending data (e.g., the message: "Send Mailbox is enabled")
Name: **Coordination Byte Send**, abbreviated: **KBS**
- Storage location of the coordinating information for receiving data (e.g., the message: "Receive data can be read")
Name: **Coordination Byte Receive**, abbreviated: **KBE**
- **Programmer number** (necessary if you want to transmit programmer functions over the SINEC L1 local area network), abbreviated: **PGN**

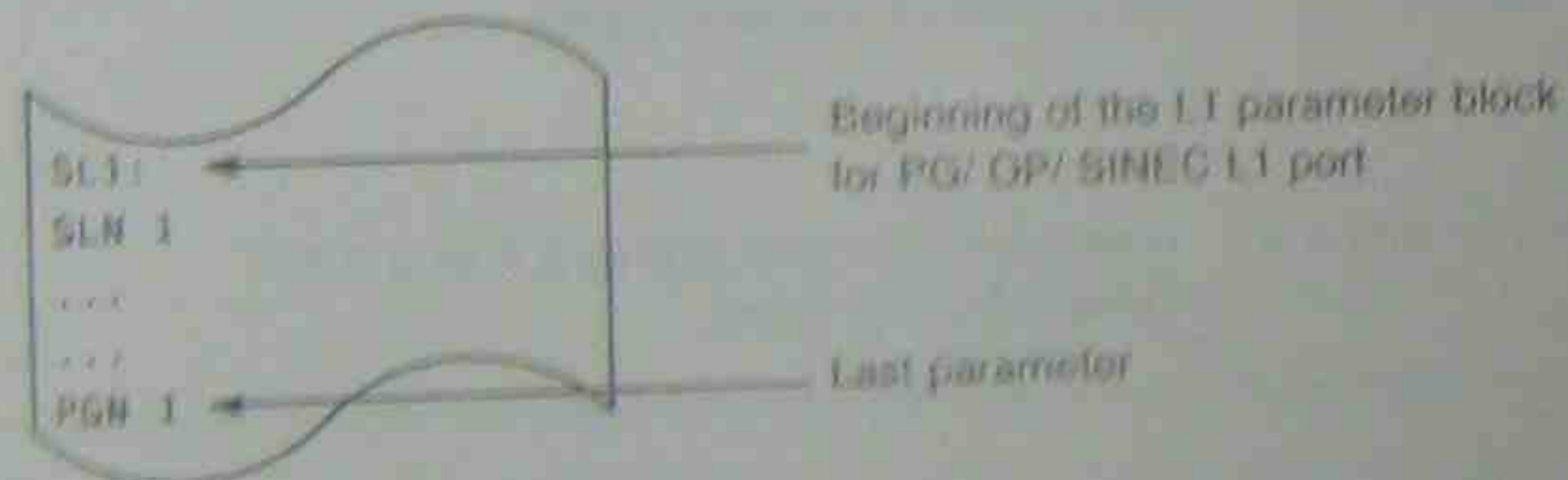
You set the parameters in DB1. Proceed as follows:

A default DB1 is integrated into the programmable controller's operating system; it contains default parameters for the data exchange via SINEC L1.

- ▶ Display the default DB1 on the programmer (transfer function, source: PC, destination: FD (PG))
- ▶ Look for the SINEC L1 parameter block with the block ID "SL1:" for the PG/OP/SINEC L1 port.

A special feature of the S5-95U:

The SINEC L1 parameter block is placed between two "#" comment characters. It cannot be interpreted in this form by the programmable controller. Therefore, you must overwrite the comment characters placed before the block ID (SL 1) and after the last SINEC L1 parameter (PGN 1) with a space.



- ▶ Edit the default parameter according to your requirements. Do not change the syntax.

Example:

- The S5-95U participates in the SINEC L1 network as a slave with the slave number 2
- Send Mailbox (SF) in DB2 beginning with data word 0
- Receive Mailbox (EF) in DB2 beginning with data word 10
- Coordination Byte Send (KBS) is flag byte 0 (MB0)
- Coordination Byte Receive (KBE) is flag byte 2 (MB2)
- Programmer bus number (PGN) is 1.

Table 14-1 shows how to change default parameters for the example given above and which parameter settings are permitted.

Table 14-1. Setting Parameters for the SINEC L1 Interface

Default DB1; Block: SINEC L1 to PG/ OP/ SINEC L1 Port	Explanation	Modifications Necessary for the Example	Valid Parameters for S5-90U	Valid Parameters for S5-95U
...				
SL1:	Block ID "SINEC L1 to Interface SL1"	no modification necessary	-	-
SLN 1	Slave number of the S5-95U; default: 1	SLN z	SLN x (x = 1 to 30)	SLN x (x = 1 to 30)
SF DB2DW0	Location of the Send Mailbox; default location: DB2 beginning with DW0	SF DB2DW0	SF DBxDWy (x = 2 to 63; y = 0 to 255) or SF MBz (z = 0 to 127)	SF DBxDWy (x = 2 to 255; y = 0 to 255) or SF MBz (z = 0 to 255)
EF DB3DW0	Location of the Receive Mailbox; default location: DB3 beginning with DW0	EF DB2DW10	EF DBxDWy (x = 2 to 63; y = 0 to 255) or EF MBz (z = 0 to 127)	EF DBxDWy (x = 2 to 255; y = 0 to 255) or EF MBz (z = 0 to 255)
KBE MB100	Location of the Coordination Byte Receive; default location flag byte 100 (MB100)	KBE MB2	KBE MBx (x = 0 to 127) or KBE DByDWz* (y = 2 to 63; z = 0 to 255)	KBE MBx (x = 0 to 255) or KBE DByDWz* (y = 2 to 255; z = 0 to 255)
KBS MB101	Location of the Coordination Byte Send; default location flag byte 101 (MB101)	KBS MB0	KBS MBx (x = 0 to 127) or KBS DByDWz* (y = 2 to 63; z = 0 to 255)	KBS MBx (x = 0 to 255) or KBS DByDWz* (y = 2 to 255; z = 0 to 255)
PGN 1	Programmer bus number (necessary if you want to transmit programmer functions over SINEC L1; default: 1)	PGN 1 no modification necessary	PGN x (x = 1 to 30)	PGN x (x = 1 to 30)

* The KBE/KBS is in the high-order byte of the given data word.

Transfer the changed DB1 to the programmable controller. The default DB1 is overwritten.

If you now go from STOP to RUN or from POWER OFF to POWER ON (with a battery inserted), the programmable controller accepts the changed parameters and stores them in the system data area.

14.3 Coordination of Data Exchange in the Control Program

After you set the parameters, the control program for data exchange has to be created. The control program relies on the coordination information that the operating system makes available in the coordination bytes (see Figure 14-2).

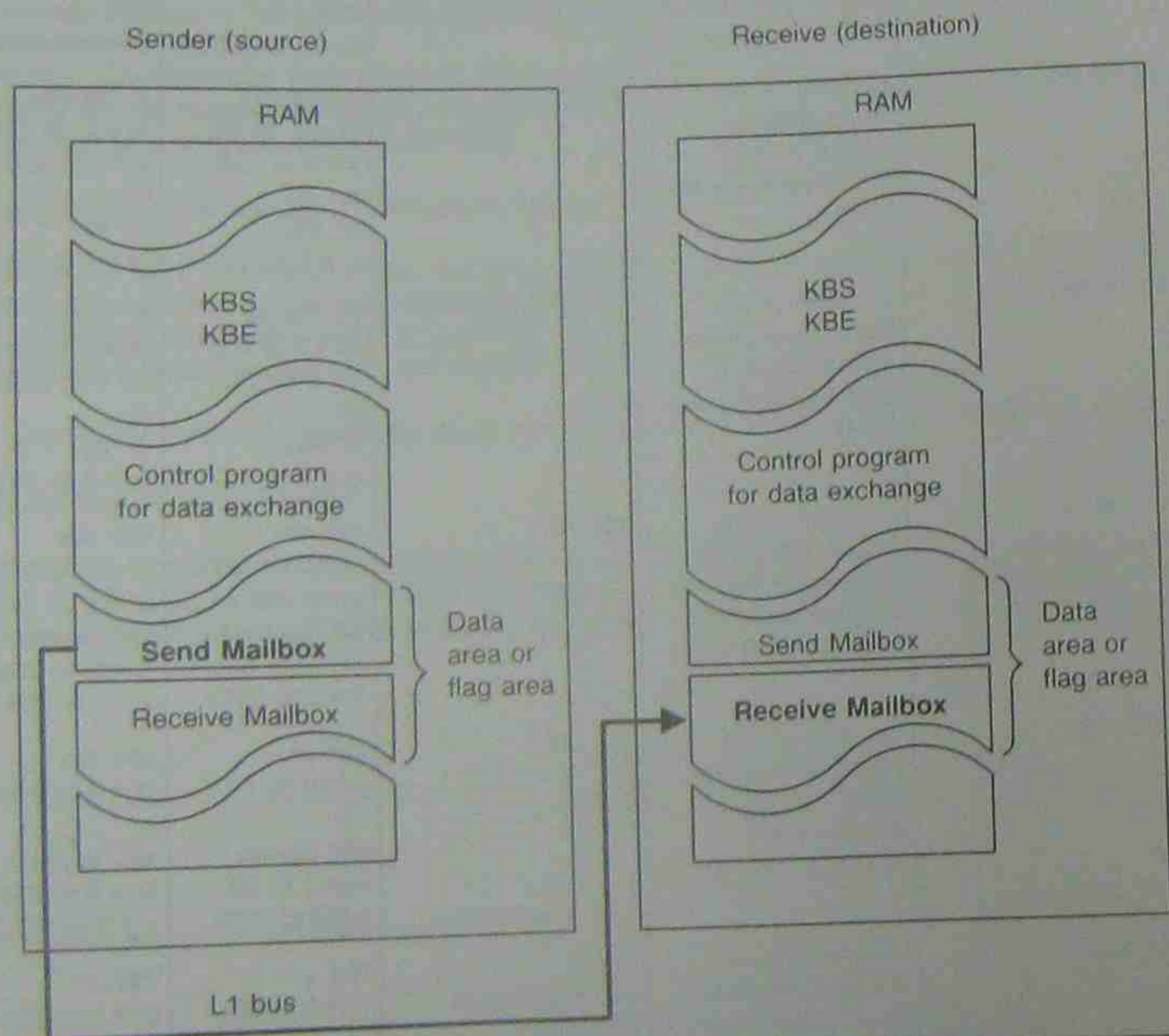


Figure 14-2. Data Exchange between Sender and Receiver (Principle)

In the following paragraphs, you will learn how to control the sending and receiving of data.

14.3.1 Sending Data

The prerequisites for sending data are as follows:

- The parameters are set in DB1 for the location of the Send Mailbox (see section 14.2).
- The data to be sent, additional information (length of the send data "net data"), and destination slave number are then transferred to the Send Mailbox.

Figure 14-3 shows which information has to be stored in what part of the Send Mailbox.

Example:
Send Mailbox in the flag area
(beginning with flag byte 1)

Example:
Send Mailbox in a data block
(beginning with DW1)

		DL	DR
Flag byte 1	Length of the "net data" (0 to 64 bytes)	DW1	Length of the "net data"
Flag byte 2	Numb. of the dest. slave	DW2	Number of the destination slave
Flag byte 3	Data ("net data") maximum of 64 bytes		1st data byte
			2nd data byte
Flag byte 66		DW33	63rd data byte
			64th data byte

* Number of the receiver: 0 = Master
1 to 30 = Slaves
31 = Broadcast

Figure 14-3. Structure of the Send Mailbox

Structure of the Coordination Byte Send (KBS)

Figure 14-4 shows the structure of the Coordination Byte Send (KBS).

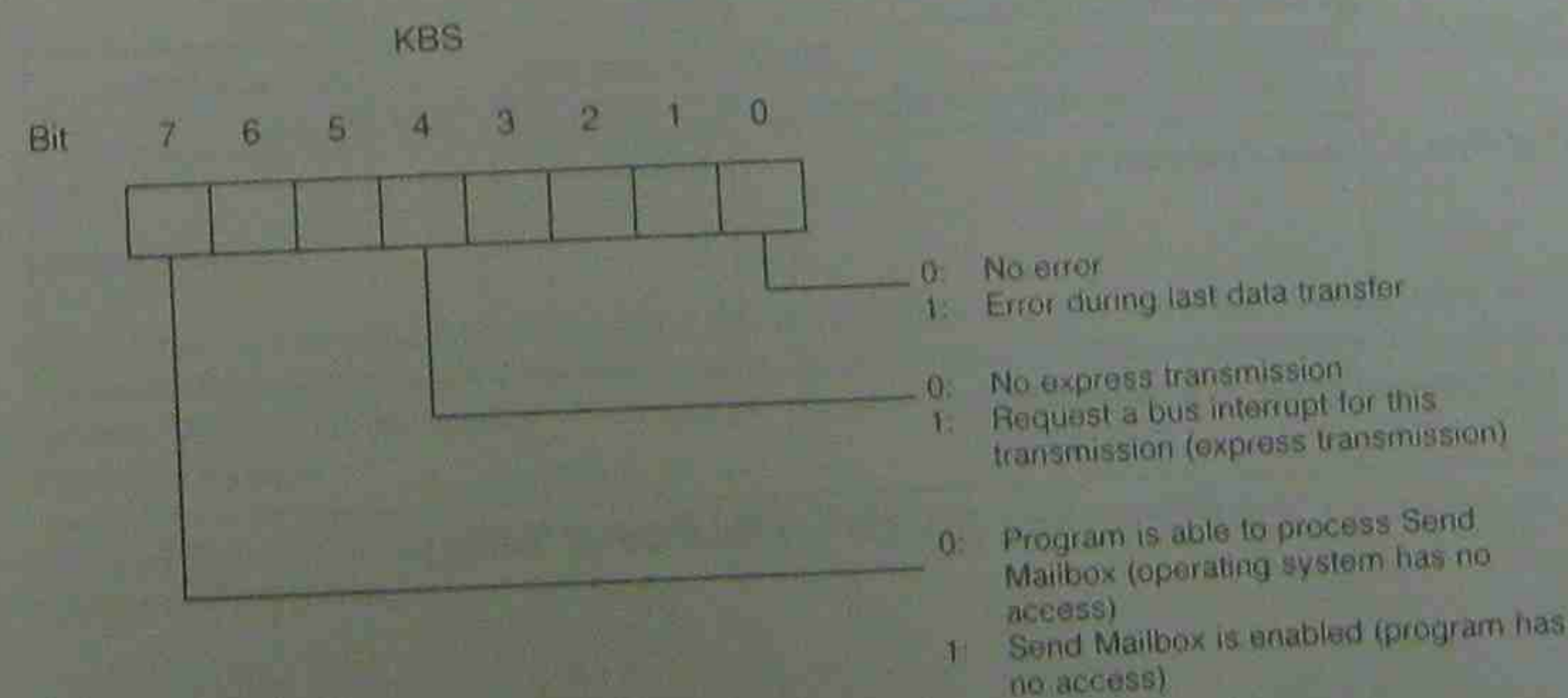


Figure 14-4. Structure of the Coordination Byte Send (KBS)

The control program for sending data should be structured as follows.

- ▶ Check bit 7 in the KBS to see if data is currently being sent. (If the programmable controller is sending data, bit 7 is set. During this phase, the Send Mailbox can not be modified and no transmission can be started.)
- ▶ When bit 7 in the KBS has been reset, you can start the transmission by setting bit 7.
- ▶ When bit 7 has been reset by the operating system after data has been sent, you can evaluate possible errors.

You achieve the following by setting bit 4 in the KBS (express transmission).

- The sending programmable controller treats this message preferentially (possibly by overwriting a telegram not yet sent).
- The receiver treats the message as an express transmission.

In case of an error, the operating system sets bit 0 of the KBS. The error message is not valid until bit 7 has been reset in the KBS.

14.3.2 Receiving Data

The prerequisites for receiving data are as follows.

The parameters for the location of the Receive Mailbox (see section 14.2) and the Coordination Byte Receive (KBE) (see section 14.2) have been set in DB1. Figure 14-5 shows you which information has to be stored in what part of the Receive Mailbox.

Example:
Receive Mailbox in the flag area
(beginning with flag byte 1)

Flag Byte 1	Length of "net data" (in bytes)
Flag Byte 2	Source slave number*
Flag Byte 3	Data ("net data")

Example:
Receive Mailbox in a data block
(beginning with data word 1)

	DL	DR
DW1	Length of the "net data"	Source slave number*
DW2	1st data byte	2nd data byte
DW3	3rd data byte	4th data byte

* Number of the sender: 0 = Master
1 to 30 = Slave

Figure 14-5. Structure of the Receive Mailbox

Structure of the Coordination Byte Receive (KBE)

The control program for receiving data should be structured as follows.

- ▶ Check bit 7 of the KBE to see if it is possible to read the data from the Receive Mailbox. Bit 7 must be set to "0" so that the Receive Mailbox can be read.

In addition, you can scan through the KBE for the following errors and operating conditions.

- At least one slave has failed.
- The bus is in "RUN" ("STOP") mode.
- The received data pack comes as an express transmission.

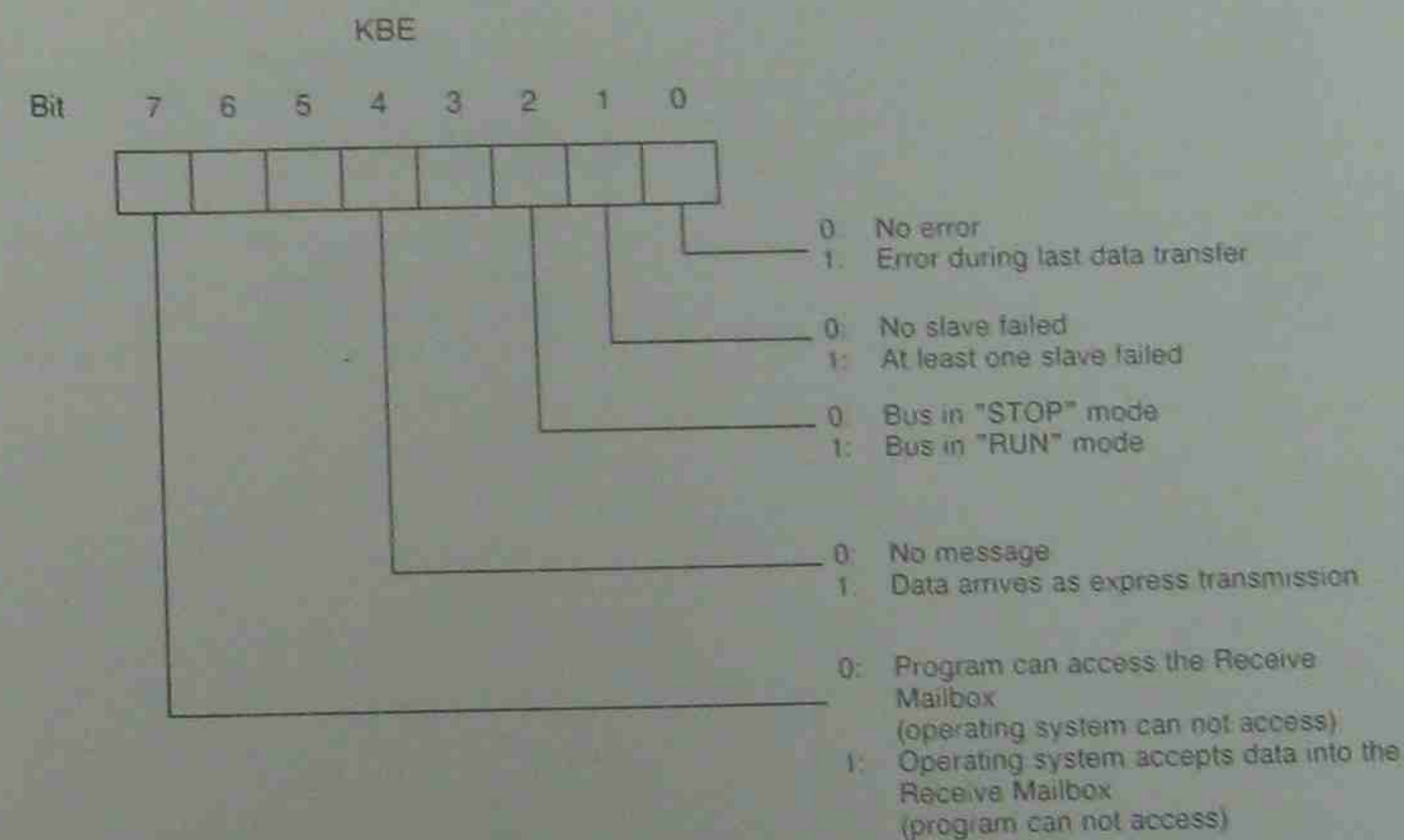


Figure 14-6. Structure of the Coordination Byte Receive (KBE)

Special Features

If you have reserved too little memory for the Receive Mailbox, the available memory area is filled up completely (flag area FY0 to FY255, data block DW0 to DW255). Therefore, the remaining receive data cannot be stored. In this case, the programmable controller does not generate an overflow message.

You can find sample programs for sending and receiving data in the SINEC L1 manual (in the chapter on "Programming").

15	Module Spectrum	
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15 Module Spectrum

15.1 General Technical Specifications

Climatic Environmental Conditions		Electromagnetic Compatibility (EMC)	
Temperatures Operating - horizontal design 0 to +50° C (32 to 120° F) - vertical design 0 to +45° C (32 to 104° F) (Air intake temperatures, measured on the underside of the module) Nonoperating -40 to +70° C (-40 to +150° F) Temperature change - operating max. 10° C/h (180° F/h) - nonoperating max. 20° C/h (360° F/h) in DIN 40040 Relative humidity 15 to 95% (no condensation)		Noise Immunity Radiated electromagnetic field test to IEC 501-3 field strength 3 V/m Fast transient burst to IEC 501-4, case III Power supply modules - Supply voltage 24 V DC 1 kV - Supply voltage 115/230 V AC 2 kV - Analog input/output modules 1 kV - Digital input/output modules for V = 24 V 1 kV for V = 24 V 2 kV Communications interface 1 kV	
Atmospheric pressure - operating 850 to 1050 hPa - nonoperating 650 to 1050 hPa Pollutants - SO ₂ ≤ 0.5 ppm, (rel. humidity ≤ 60%, noncondensing) - H ₂ S ≤ 0.1 ppm, (rel. humidity ≤ 60%, noncondensing)		IEC/VDE Safety Information Degree of protection to IEC 529 - Type IP 20 - Class 1 to IEC 536 Insulation rating to VDE 0160 (05, 1988) between electrically independent circuits and with circuits connected to a central grounding point to VDE 0160 (05, 1988) between all circuits and a central grounding point (standard mounting rail) to VDE 0160 (05, 1988)	
Mechanical Environmental Conditions Vibration to IEC 68-2-6 - tested with 10 to 57 Hz, (const. accel. 0.16 mm) 57 to 150 Hz, (const. accel. 2 g) Shock to IEC 68-2-27 - tested with 12 shocks (semisinusoidal 15 g /14 ms) Free-fall to IEC 68-2-31 - tested with height of fall 50 mm		Test voltage to VDE 0160 (05, 1988) for a rated voltage V _{input} of the circuits (AC/DC) V _{input} = 0 to 50 V 500 V V _{input} = 50 to 125 V 1250 V V _{input} = 125 to 250 V 1500 V	
Electromagnetic Compatibility (EMC) Noise Immunity Electrostatic discharge test to IEC 501-2 (Discharge on all parts that are accessible to the operator during normal operation) 2 kV (rel. humidity 30 to 95%)			

15.2 Programmable Controllers

Technical Specifications S5-90U

Dimensions and Weight		Data for I/Os	
Dimensions WxHxD	(mm) 145x135x91 (in.) 5.7x5.3x5.7	For digital inputs: Floating - Isolated in groups of 10 Input voltage L+ - Rated value - At "0" signal - At "1" signal Input current - At "1" signal Response time - From "0" to "1" - From "1" to "0" Connection of 2-wire BERO proximity switches Residual current for "0" signal Cable length unshielded	yes* (optocoupler) 10 24 V DC 0 to 5 V DC 13 to 30 V DC typ. 8.5 mA (at 24 V DC) typ. 2.8 ms typ. 3.6 ms possible ≤ 1.5 mA max. 100 m (330 ft.)
Weight-S5-90U	approx. 1.0 kg / 2.2 lbs.	For interrupt input: Floating Input voltage and current as for digital inputs (see Specific Onboard I/O Data) Response time - From "0" to "1" - From "1" to "0" Pulse duration for signal "0" or "1" Cable length unshielded Counter input: Floating Input voltage and current as for digital inputs (see Specific Onboard I/O Specifications) Response time - From "0" to "1" - From "1" to "0" Counter frequency Pulse duration for signal "0" or "1" Cable length (unshielded)	yes** yes** typ. 40 μs typ. 180 μs ≥ 500 μs 50 m (164.05 ft.) yes** yes** typ. 40 μs typ. 180 μs max. 1 kHz ≥ 500 μs 50 m (165 ft.)
Weight-memory subm.	approx. 0.02 kg / 0.7 oz.	For digital outputs: Outputs Floating - Isolated in groups of 1 Continuous current I _{th} Relay type Switching capacity of the contacts - Resistive load - Inductive load Operating cycles of the contacts according to VDE 0660, Section 200 - AC-11 - DC-11 Switching frequency Cable length unshielded	Relay outputs, contact wiring, Vanstor SIOV-S10-K275 yes 1 3 A Dold OW5699 max. 3 A at 250 V AC max. 1.5 A at 30 V DC max. 0.5 A at 250 V AC max. 0.5 A at 30 V DC 1x10 ⁶ 0.5x10 ⁶ max. 10 Hz max. 100 m (330 ft.)
Internal Technical Specifications			
Memory capacity - Internal RAM - EPROM / EEPROM submodule	2 K statements		
Execution time - Per binary operation Scan time monitoring	approx. 2 μs approx. 300 ms		
Flags	1024 (512 retentive)		
Timers: number/range	32 / 0.01 to 9990 s		
Counters: number/range	32 (8 retentive) / 0 to 999		
Inputs/outputs (onboard): Digital inputs Interrupt input* Counter input* Digital outputs	8 1 1 6		
Inputs/outputs (external I/O): Digital inputs/outputs - total Analog inputs/outputs - total	max. 48 max. 8		
Permissible blocks: Organization blocks Program blocks Function blocks Data blocks Operation set	1, 3, 21, 22 0 to 63 0 to 63 2 to 63 119		
Power Supply (Internal)			
Input voltage - Rated value - Permissible range	115 V/230 V AC 93 to 127 V / 187 to 253 V		
System frequency - Permissible range	50 to 60 Hz		
Current consumption from 230 V for the S5-90U	40 mA		
Output voltage - V 1 (for sensor) - V 2 (for programmer)	+ 24 V + 5.2 V		
Output current - From V 1 - From V 2 Short-circuit protection Class of protection Floating V 1 Floating V 2	≤ 100 mA ≤ 100 mA electronic Class I yes no		
Back-up battery - Life expectancy - Service life (at 25° C/77° F) Power losses of the module	Lithium battery (3.4 V / 850 mAh) min. 1 year approx. 5 years typ. 10.5 W		

* You can also use this input as a digital input.

** All inputs are nonfloating in relation to one another.

Technical Specifications S5-95U

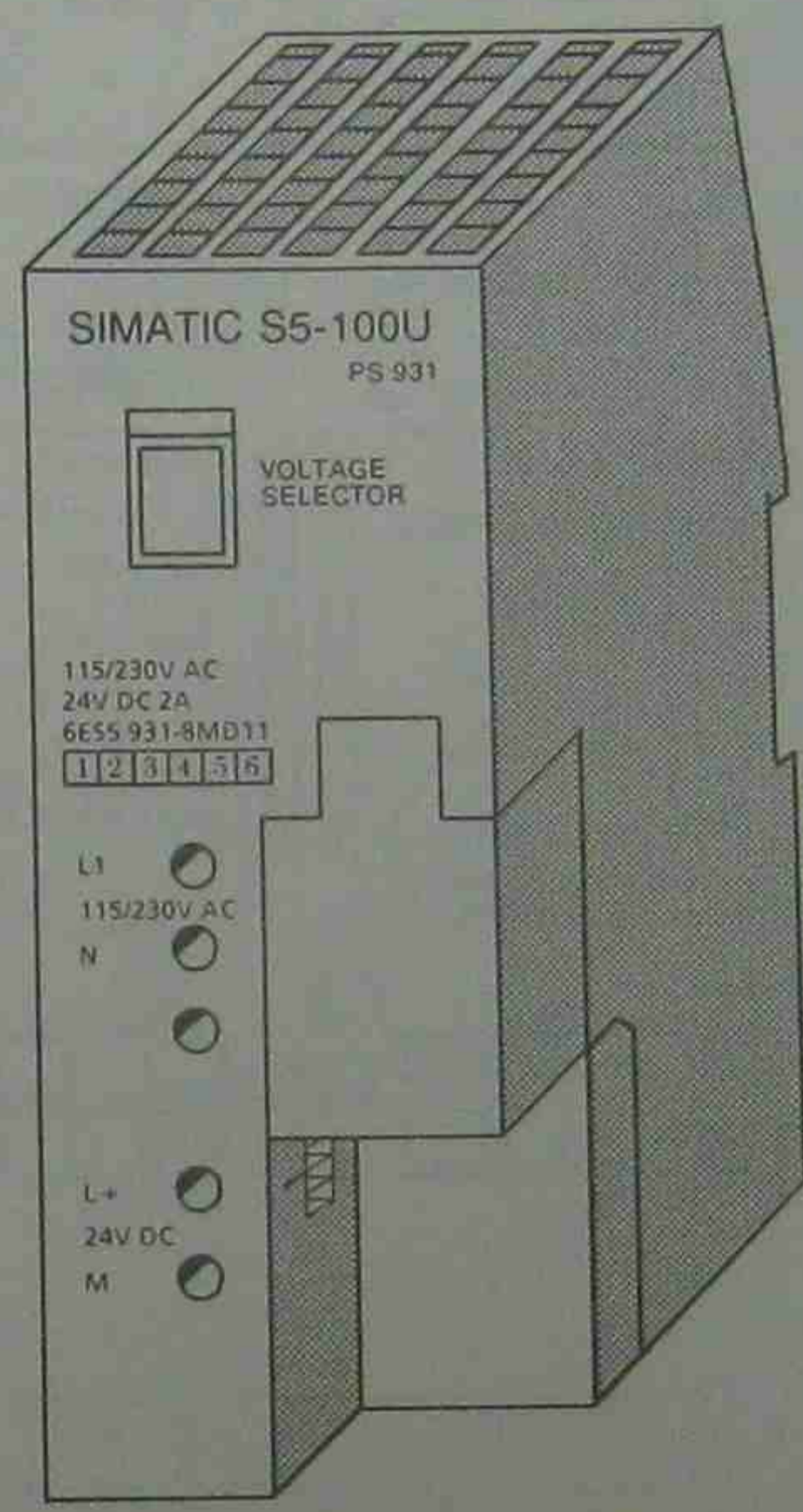
Dimensions and Weight		Power Supply (Internal)	
Dimensions WxHxD	(mm) 145x135x146 (in.) 5.7x5.3x5.7	Input voltage - rated value - permissible range	24 V DC 20 to 30 V
Weight-S5-95U	approx. 1.5 kg / 3.3 lbs	Current consumption from 24 V - for the PLC - for full external I/O configuration	typ. 160 mA typ. 1 A
Weight-memory submodule	approx. 0.1 kg / 3.5 oz.	Output voltage - V 1 (for external I/O) - V 2 (for programmer)	+ 9 V + 5.2 V
Internal Technical Specifications		Output current - from V 1 - from V 2 Short-circuit protection Class of protection Floating Back-up battery - life expectancy - service life (at 25° C/77° F) Power loss of the module	≤ 1 A ≤ 0.65 A electronic Class I no Lithium battery (3.4 V / 850 mAh) min. 1 year approx. 5 years typ. 12 W
Memory capacity - internal RAM - EPROM / EEPROM submodule	min. 8K words (4 K statements) and 4K for data blocks	Execution time - per binary operation Scan time monitoring	approx. 2 μs approx. 300 ms
Clock - accuracy t _g - Variation due to temp. change t _v (ambient temperature T _A in °C)	± 1 s/Day at 25 °C (77 °F) 0 to 60 °C (32 to 140 °F) → + 1 s to -10 s	Flags	2048 (512 retentive)
Timers: number/range	128/0.01 to 9990 s	Counters: number/range	128/(8 retentive) 0 to 999
Inputs/outputs (onboard): Digital inputs Digital outputs Interrupt inputs Counter inputs Analog inputs Analog output (0 to 10V; 0 to 20mA)	16 16 4 2 8 1	Inputs/outputs (external I/O): Digital inputs/outputs - total Analog inputs/outputs - total	max. 256 max. 16
Permissible blocks: Organization blocks	1, 3, 13, 21, 22, 31, 34, 251	Permissible blocks: Organization blocks	1, 3, 13, 21, 22, 31, 34, 251
Program blocks Function blocks - programmable - integrated Sequence blocks Data blocks Operation set	0 to 255 0 to 255 240 to 243, 250, 251 0 to 255 2 to 255 approx. 140	Specific Onboard I/O Specifications For digital inputs: Floating - isolated in groups of Input voltage - rated value - at "0" signal - at "1" signal Input current - at "0" signal - at "1" signal Response time - from "0" to "1" - from "1" to "0" Cable length unshielded	yes 16 24 V -30 to +5 V DC +13 to +30 V DC < 1.5 mA (Input residual current, 2-wire BERO proximity switch) < 6.5 mA (at 30 V) typ. 2.5 ms typ. 2.0 ms max. 100 m/330 ft

For digital outputs:		For analog outputs:	
Floating	yes	Floating	no
- isolated in groups of 16	16	Digital representation of the signal	11 bits
Load voltage L+	24 V DC	Voltage output	0 to 10 V
- rated value	20 to 30 V DC	- Output range (rated value)	$\geq 2.5 \text{ k}\Omega$
- permissible range (including ripple)		- Load resistance	typ. 20 μs (including settling time*)
Output current for "1" signal	max. 0.5 A	- Conversion time	yes
Lamp load	max. 5 W	- Short-circuit protection	max. 30 mA
Residual current for "0" signal	$\leq 50 \mu\text{A}$	- Short-circuit current	1 %
Output voltage		- Total error limit (0 to 60° C)	max. 100 mV/328 ft
- for "0" signal	max. 0.5 V (at 6k Ω load resistance)	- Cable length (shielded)	
- for "1" signal	max. L+ - 0.6 V (at 0.5 A and 24 V DC)	Current output	0 to 20 mA
Short-circuit protection	yes, electronic	- Output range (rated value)	$\leq 300 \Omega$
Limitation of the voltage induced on circuit interruption (internal)	-16 V	- Load resistance	max. 3.0 μs
Switching frequency		- Conversion time	1.1 %
- resistive load	max. 100 Hz	- Total error limit (0 to 60° C/140° F)	
- inductive load	max. 2 Hz	- Cable length (shielded)	100 m/330 ft.
Total current	6 A	For interrupt inputs:	
Setting a digital output	8 A ($\leq 50^\circ \text{C}/122^\circ \text{F}$) possible	Floating	no
Parallel switching of output	yes, 0.5 A each	Input voltages and currents as for digital inputs	(see Specific Onboard I/O Specifications)
Cable length, unshielded	max. 100 m/330 ft	Response time	
		- from "0" to "1"	typ. 75 μs
		- from "1" to "0"	typ. 140 μs
		Pulse duration	$\geq 500 \mu\text{s}^{**}$
		Cable length (shielded)	100 m/330 ft.
For analog inputs:		Counter inputs:	
Floating	no	Floating	no
Input range (rated value)	0 to +10 V	Input voltages and currents as for digital inputs	(see Specific Onboard I/O Specifications)
Permissible input voltage	-10 to +30 V	Response time	
Input resistance	20 k Ω	- from "0" to "1"	typ. 10 μs
Digital representation of the signal	11 bits	- from "1" to "0"	typ. 15 μs
Measuring principle	Instantaneous value coding (successive approx.)	Counter frequency**	counter A: 5 kHz counter B: 2 kHz
Conversion time	40 μs	Pulse duration	$\geq 100 \mu\text{s}$
Internal settling time	1.1 ms	Cable length (shielded)	100 m/330 ft.
Error indication for overranging	yes		
Total error limit (0 to 60° C)	1.68 %		
Cable length (shielded) for R _{sensor}	max. 100 m/330 ft < 100 Ω		

The settling time of the analog output increases with the capacitive load on longer cables.
without connection of a programmer, operator panel or SINEC L1

15.3 Power Supply Module

Power Supply Module PS 931 115/230 V AC; 24 V DC/2A (6ES5 931-8MD11)



The image shows a SIMATIC S5-100U PS 931 power supply module. It features a terminal block with terminals labeled L1, N, L+, and M. A voltage selector switch is located on the front panel. The module is designed for 115/230V AC input and provides a 24V DC output at 2A.

Technical specifications

Input voltage	115/230 V AC
- rated value	86 to 127 V/187 to 253 V
- permitt. range	
Line frequency	50/60 Hz
- rated value	47 to 63 Hz
- permitt. range	
Input current at 115/230 V	0.9/0.6 A
- rated value	
Efficiency	approx. 85%
Power consumption	approx. 60 W
Output voltage	24 V DC
- rated value	22.8 to 25.2 V
- permitt. range	
- open-circuit voltage	yes
Output current	2 A
- rated value	
Permitt. ambient temperature of PLC	0 to 60 °C
- horizontal arrangement	(32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Buffering of line voltage dips	20 ms at 187 V/2 A
- duration of voltage dips	1 s
- repetition rate	
Short-circuit protection	power limiting, electronic cutoff, non-latching
Fault LED	no
Protection class	1
Galvanic isolation	yes
Conductor cross-sectional area	2 x 0.5 to 1.5 mm ²
- stranded*	2 x 0.5 to 2.5 mm ²
- solid	
Insulation rating	VDE 0160 and VDE 0805 (transformer)
Rated insulation voltage (+24 V to L1)	250 V AC
- insulation group	2 x B
- tested with	2830 V AC
Dimensions W x H x D in mm	45.4 x 135 x 120
Power loss of the module	typ. 8.5 W
Weight	approx. 500 g (1.1 lbs.)

* with core end sleeves

The diagram illustrates the internal wiring of the power supply module. It shows the connection of the input terminals L1, N, L+, and M. A 1.6 A fuse is connected between L1 and N. Two 4.7 nF capacitors are connected in parallel between L1 and N. The output terminals L+ and M are connected to the secondary winding of the transformer.

15-4

EWA 4NEB 812 6065-02a

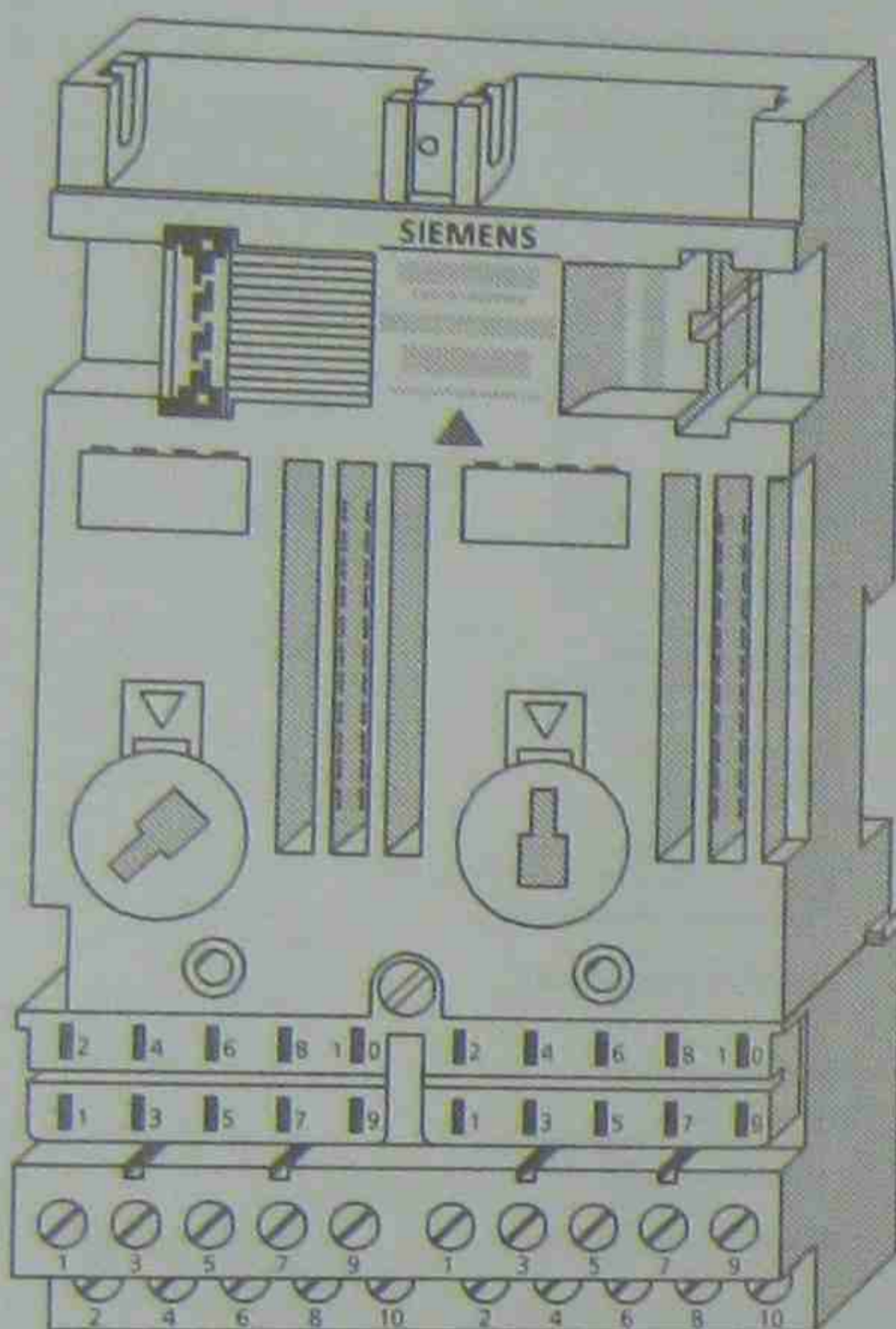
EWA 4NEB 812 6065-02a

15-5

15.4 Bus Units

Bus Unit (SIGUT Screw-type Terminals)

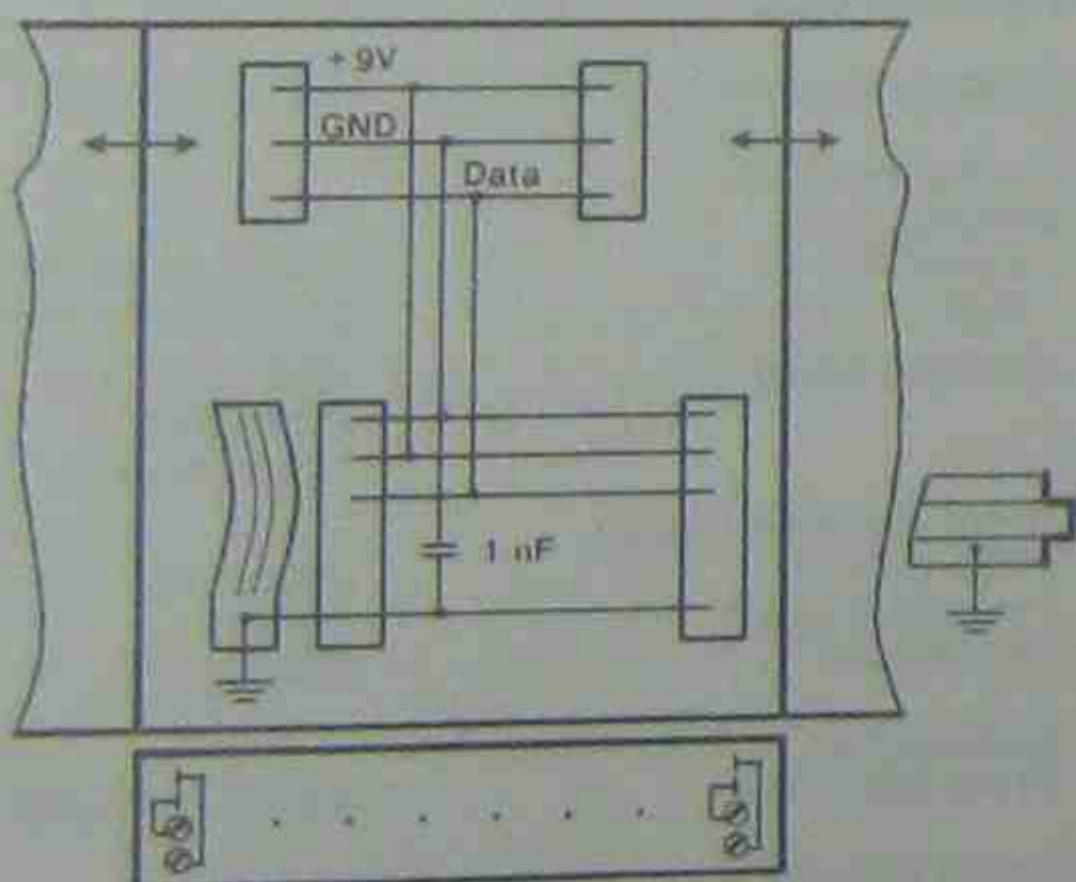
(6ES5 700-8MA11)



Technical specifications

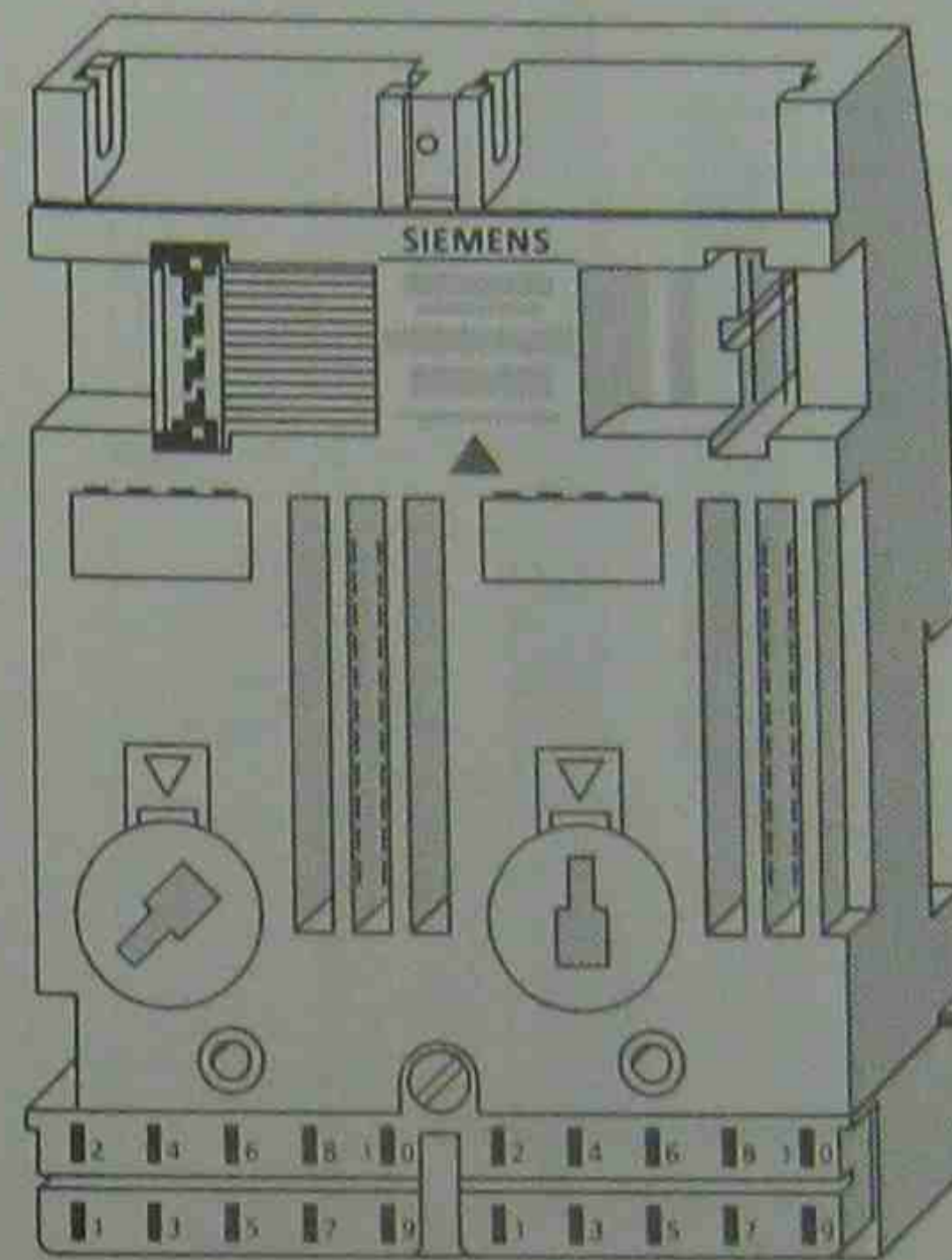
Type of connection		SIGUT screw-type terminals
Number of plug-in modules		2
Number of bus units per programmable controller	max.	16
Connection between two bus units		flat ribbon
Number of terminals		10 per slot
Insulation rating		VDE 0160
Rated insulation voltage (+9 V to ↓)		12 V AC
- insulation group		1 × B
- tested with		500 V AC
Conductor cross sectional area		
- stranded*		2 × 0.5 to 1.5 mm ²
- solid		2 × 0.5 to 2.5 mm ²
Current consumption - from +9 V (CPU)	typ.	1 mA
Dimensions W × H × D (in mm)		91.5 × 162 × 39
Weight	approx.	300 g (10.6 oz.)

* with core end sleeves



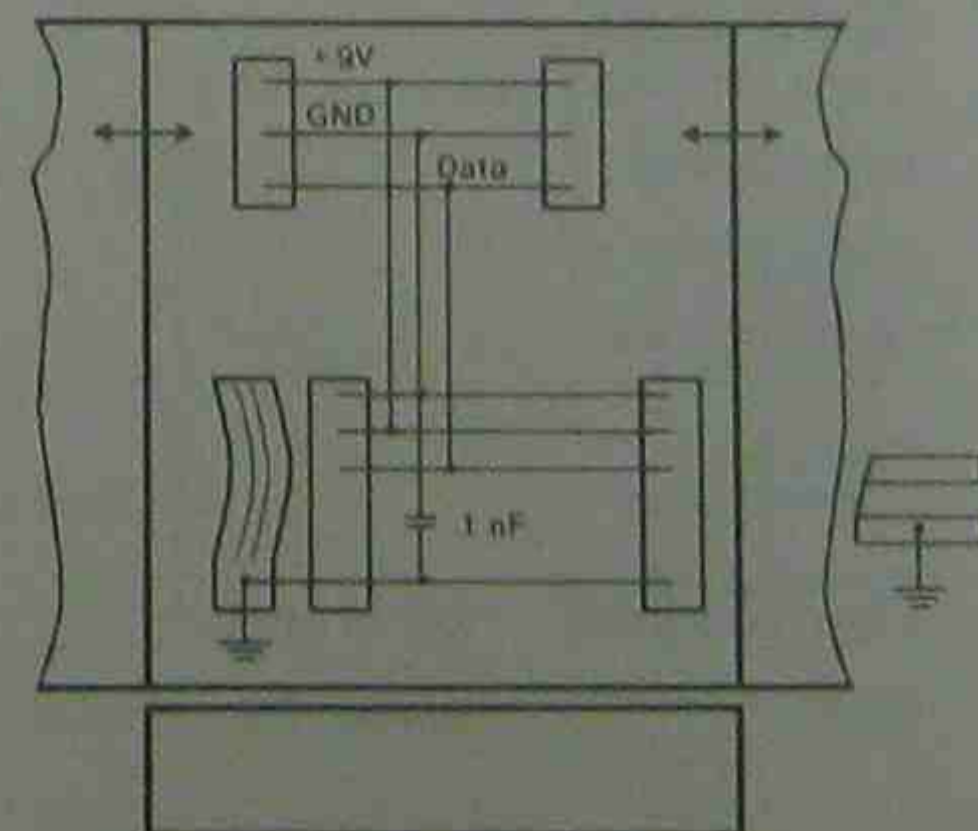
Bus Unit (Crimp Snap-in Connections)

(6ES5 700-8MA21)



Technical specifications

Type of connection		Crimp snap-in
Number of plug-in modules		2
Number of bus units per programmable controller	max.	16
Connection between two bus units		flat ribbon
Number of terminals		10 per slot
Conductor cross sectional area		
- stranded		0.5 to 1.5 mm ²
Insulation rating		VDE 0160
Rated insulation voltage (+9 V to ↓)		12 V AC
- insulation group		1 × B
- tested with		500 V AC
Current consumption - from +9 V (CPU)	typ.	1 mA
Dimensions W × H × D (in mm)		91.5 × 135 × 39
Weight	approx.	250 g (8.8 oz.)



15.5 Interface Modules

IM 315 Interface Module

(6ES5 315-8MA11)

The diagram shows the IM 315 interface module. The top part is a perspective view of the module with a cable connected to its top. The bottom part is a schematic diagram of the module's internal wiring. It shows a +5V supply line, a GND line, and a Data line. The schematic includes a 1 μF capacitor connected to the Data line and a ground connection. Labels 'input' and 'output' are shown with arrows pointing to the respective terminals.

Technical specifications	
Current supply to the expansion unit	max. 1 A
Number of interface modules per PLC	max. 1
Permissible potential difference between IM 315 and central ground point (CPU)	±1 V
Insulation rating	VDE 0160
Rated insulation voltage (+5 V to GND)	12 V AC
Insulation group	1 x B
Insulation tested with	500 V AC
Dimensions W x H x D in mm	2 x (45.4 x 125 x 39)
Current consumption from +5 V (CPU)	typ. 1 mA
Weight	approx. 280 g (9.8 oz.)

IM 316 Interface Module

(6ES5 316-8MA12)

The diagram shows the IM 316 interface module. The top part is a perspective view of the module with two cables connected to its top. The bottom part is a schematic diagram of the module's internal wiring. It shows a +5V supply line, a GND line, and a Data line. The schematic includes a 1 μF capacitor connected to the Data line and a ground connection. Labels 'output' and 'input' are shown with arrows pointing to the respective terminals.

Technical specifications	
Current supply to the expansion unit	max. 1 A
Number of interface modules per PLC	max. 4
Cable connectors for the IM 316	
- Cable connector (0.5 m/1.6 ft.)	6ES5 712-8AF00
- Cable connector (2.5 m/8.2 ft.)	6ES5 712-8BC00
- Cable connector (5.0 m/16.4 ft.)	6ES5 712-8DF00
- Cable connector (15 m/53 ft.)	6ES5 712-8C800
Cable insulation in ducts	permissible
Permissible potential difference between IM 316 and central ground point (CPU)	±1 V
Insulation rating	VDE 0160
Rated insulation voltage (+5 V to GND)	12 V AC
Insulation group	1 x B
Dimensions W x H x D in mm	45.4 x 125 x 39
Current consumption from +5 V (CPU)	typ. 27 mA
Weight	approx. 120 g (4.2 oz.)

15.6 Digital Modules

15.6.1 Digital Input Modules

Digital Input Module 4 x 24 V DC

(6ES5 420-8MA11)

Address designation (for ET 100U only)	4 DI
Number of inputs	4
Galvanic isolation	no
- in groups of	4
Input voltage L+	24 V DC
- rated value	0 to 5 V
- "0" signal	13 to 33 V
- "1" signal	
Input current at "1" signal	typ. 7 mA
Inherent delay	typ. 2.5 ms
- from "0" to "1"	typ. 5 ms
- from "1" to "0"	
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage* (+9 V to +) - insulation group	12 V AC 1 x B
Fault LED (red)	no input voltage L+
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Connection of 2-wire BERO proximity switches - residual current	possible ≤ 1.5 mA
Current consumption - from +9 V (CPU)	typ. 16 mA
Power loss of the module	typ. 0.8 W
Weight	approx. 205 g (7.2 oz.)

* Relevant only for isolated assembly in the ET 100U

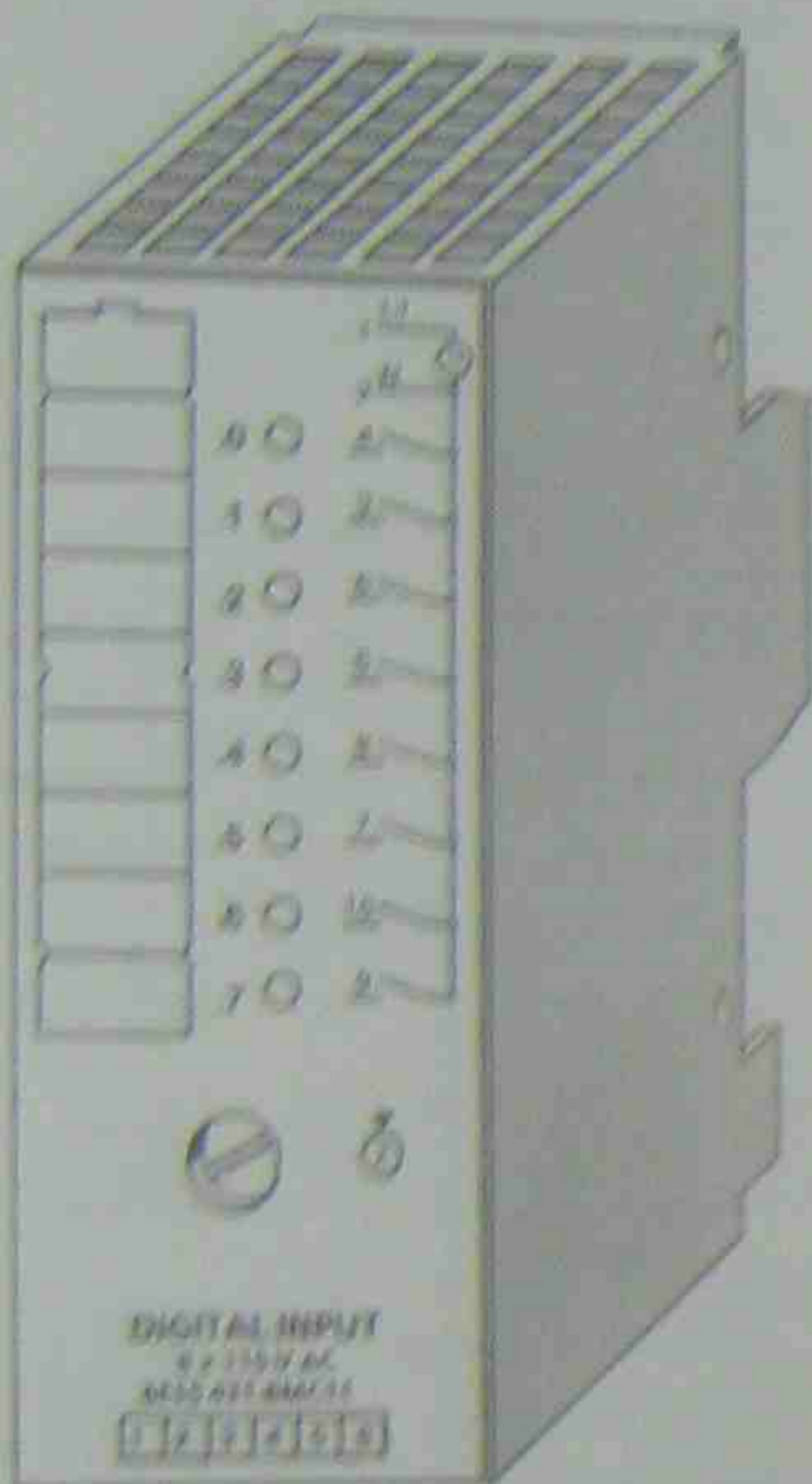
Digital Input Module 8 x 24 V DC

(6ES5 431-8MA11)

Address designation (for ET 100U only)	8 DI
Number of inputs	8
Galvanic isolation	yes (optocoupler)
- in groups of	8
Input voltage L+	24 V DC
- rated value	0 to 5 V
- "0" signal	13 to 33 V
- "1" signal	
Input current at "1" signal	typ. 8.7 mA
Inherent delay	typ. 5.5 ms
- from "0" to "1"	typ. 4 ms
- from "1" to "0"	
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to +) - insulation group - tested with	12 V AC 2 x B 500 V AC
Rated insulation voltage (+9 V to L +) - insulation group - tested with	30 V AC 2 x B 500 V AC
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Connection of 2-wire BERO proximity switches - residual current	possible ≤ 1.5 mA
Current consumption - from +9 V (CPU)	typ. 32 mA
Power loss of the module	typ. 2 W
Weight	approx. 190 g (6.7 oz.)

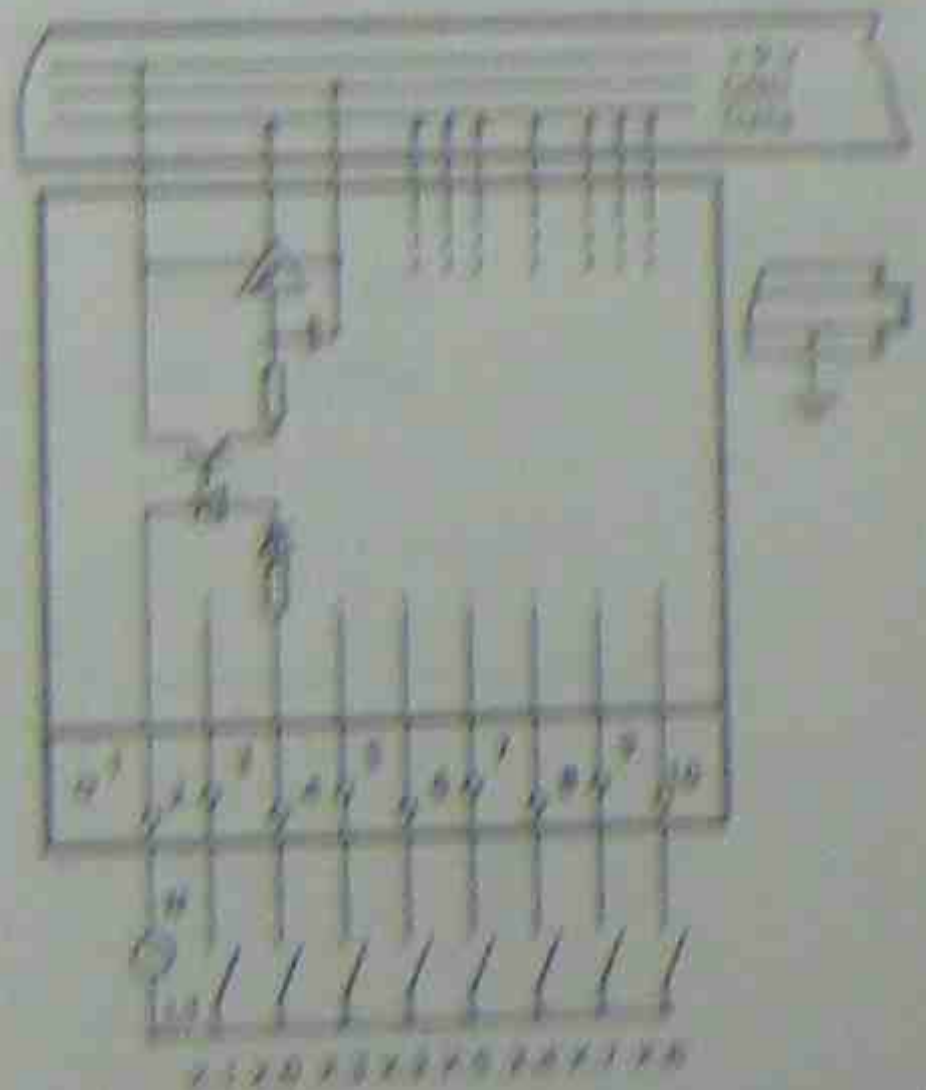
Digital Input Module 8 x 115 V AC

(6ES5 431-8MC11)



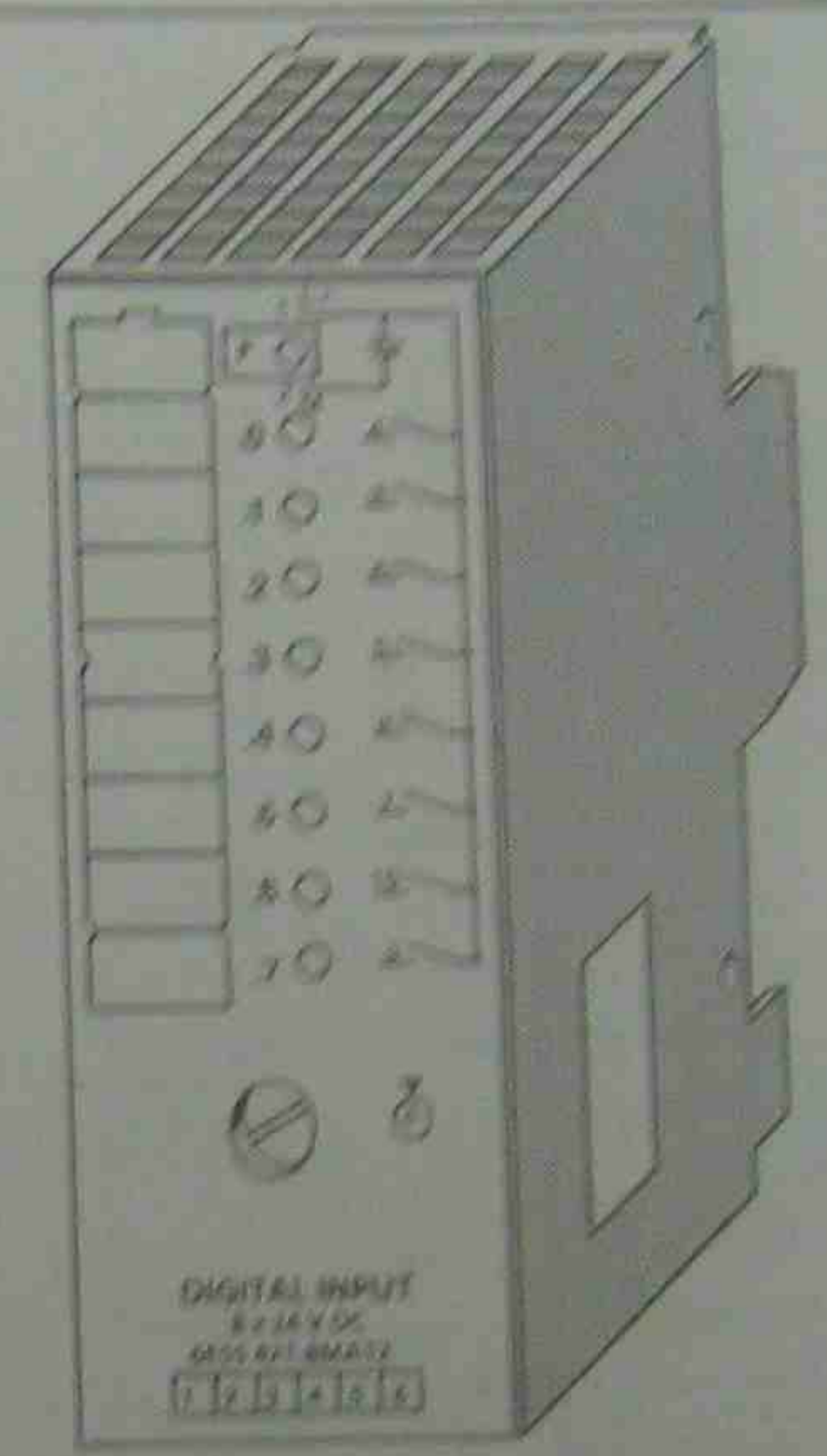
Technical specifications

Address designation (for ET 100U only)	8 DI
Number of inputs (absolute isolation - in groups of)	8
Input voltage L-L	115 V AC/DC
- rated value	0 to 80 V
- "0" signal	85 to 135 V
- "1" signal	47 to 62 Hz
Input current at "1" signal	typ. 12 mA at 115 V AC typ. 2.6 mA at 115 V DC
Isolation delay	typ. 10 ms
- from "0" to "1"	typ. 20 ms
- from "1" to "0"	
Length of cable (unshielded)	max. 100 m (330 ft.)
Insulation rating	VDE 0150
Rated insulation voltage (+9 V to -)	125 V AC
- insulation group	2 x B
- tested with	1250 V AC
Rated insulation voltage (+9 V to -)	12 V AC
- insulation group	1 x B
- tested with	500 V AC
Permissible ambient temperature of PLC	
- horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Connection of 2-wire BEMC proximity switches (residual current)	possible ≤ 4 mA
Current consumption (from +9 V (CPU))	typ. 32 mA
Power loss of the module	typ. 2.5 W
Weight	approx. 260 g (9 oz.)



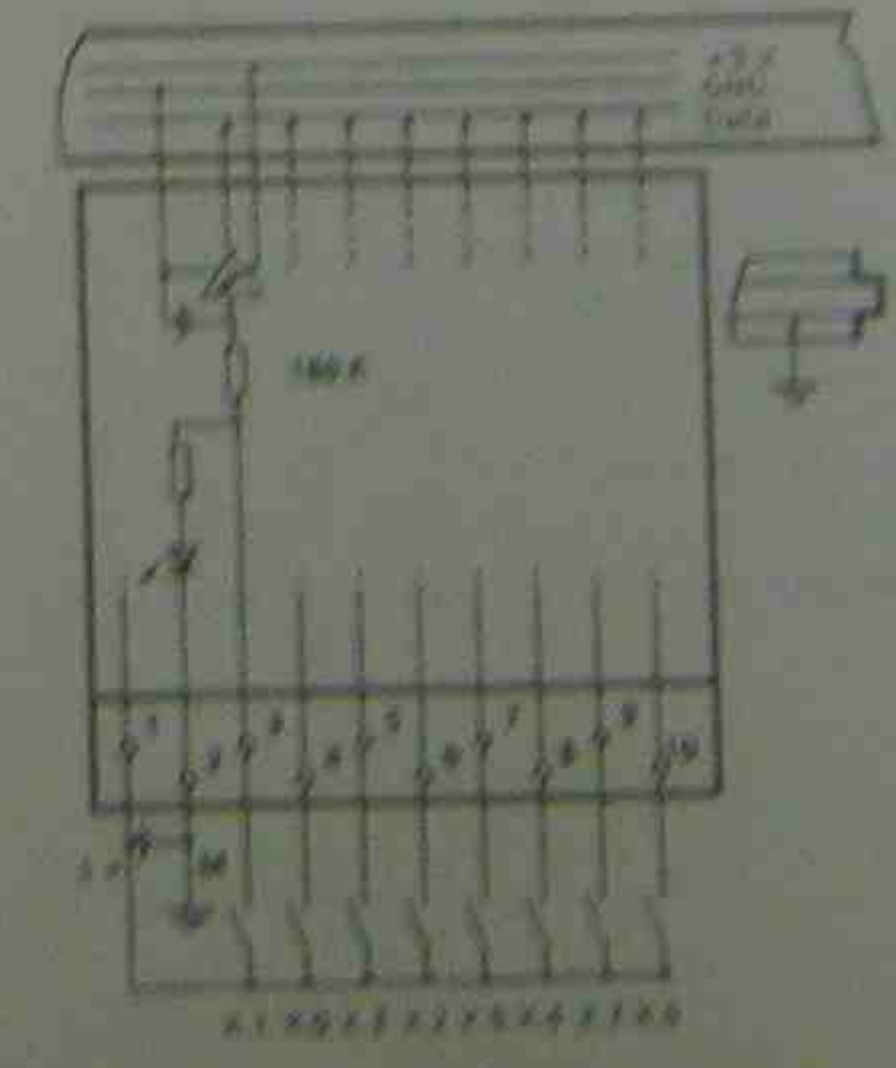
Digital Input Module 8 x 24 V DC

(6ES5 421-8MA12)



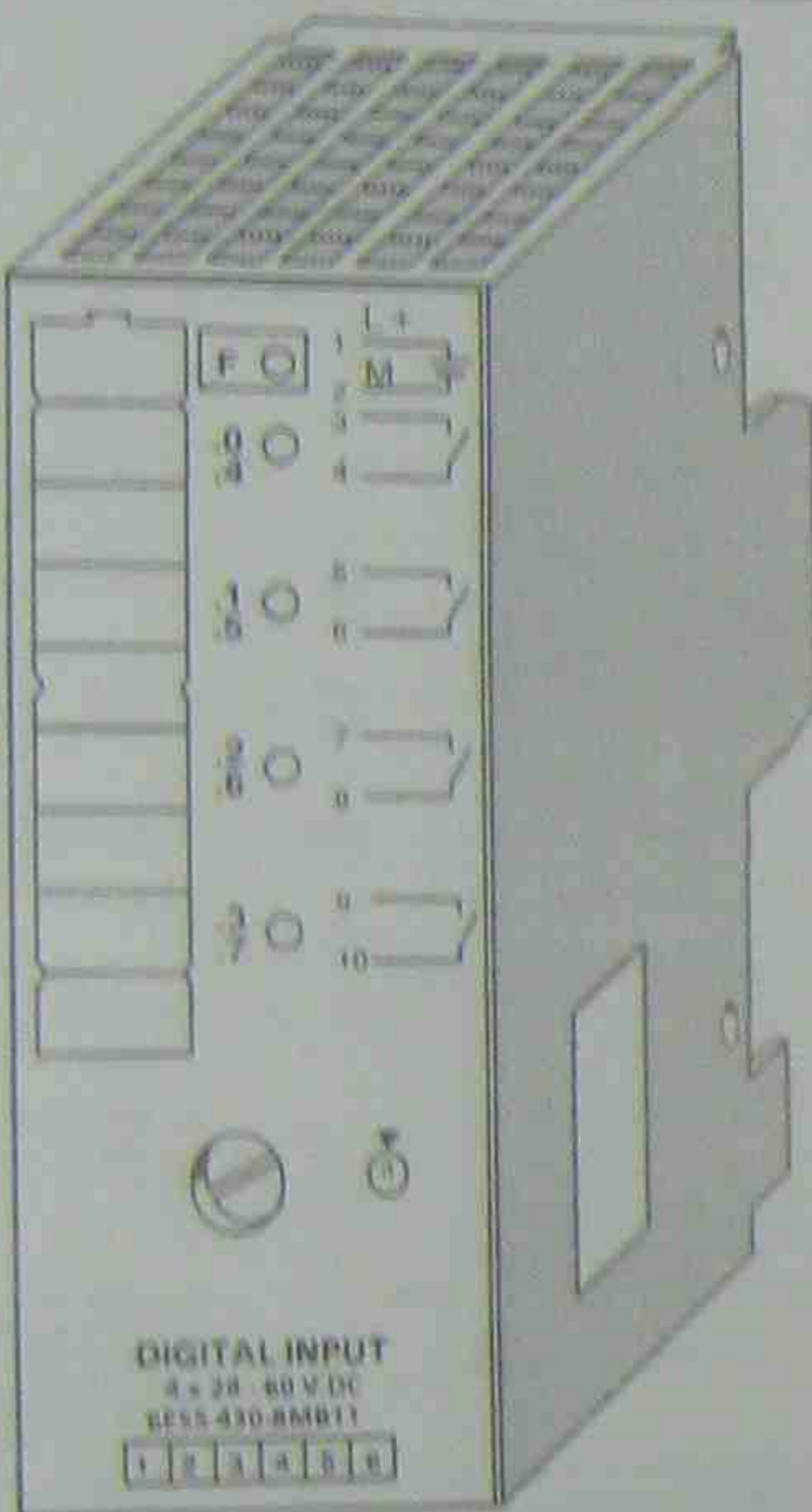
Technical specifications

Address designation (for ET 100U only)	8 DI
Number of inputs (absolute isolation - in groups of)	8
Input voltage L-L	24 V DC
- rated value	0 to 5 V
- "0" signal	5 to 9 V
- "1" signal	13 to 30 V
Input current at "1" signal	typ. 7 mA at 24 V
Isolation delay	typ. 2.3 ms
- from "0" to "1"	typ. 4.5 ms
- from "1" to "0"	
Length of cable (unshielded)	max. 100 m (330 ft.)
Insulation rating	VDE
Rated insulation voltage (+9 V to -)	12 V AC
- insulation group	1 x B
Fault LED (red)	no input voltage L-L
Permissible ambient temperature of PLC	
- horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Connection of 2-wire BEMC proximity switches (residual current)	possible ≤ 1.5 mA
Current consumption (from +9 V (CPU))	typ. 34 mA
Power loss of the module	typ. 1.5 W
Weight	approx. 190 g (6.7 oz.)



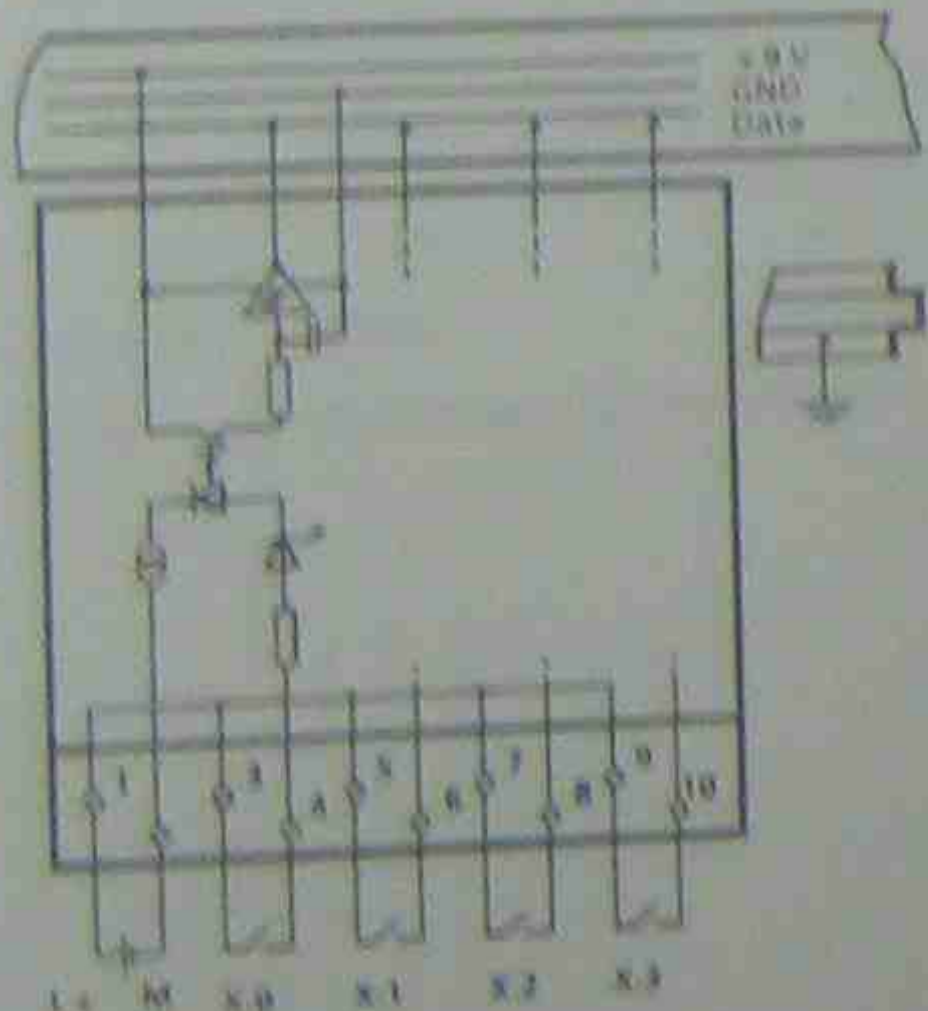
Digital Input Module 4 × 24 to 60 V DC

(6ES5 430-8MB11)



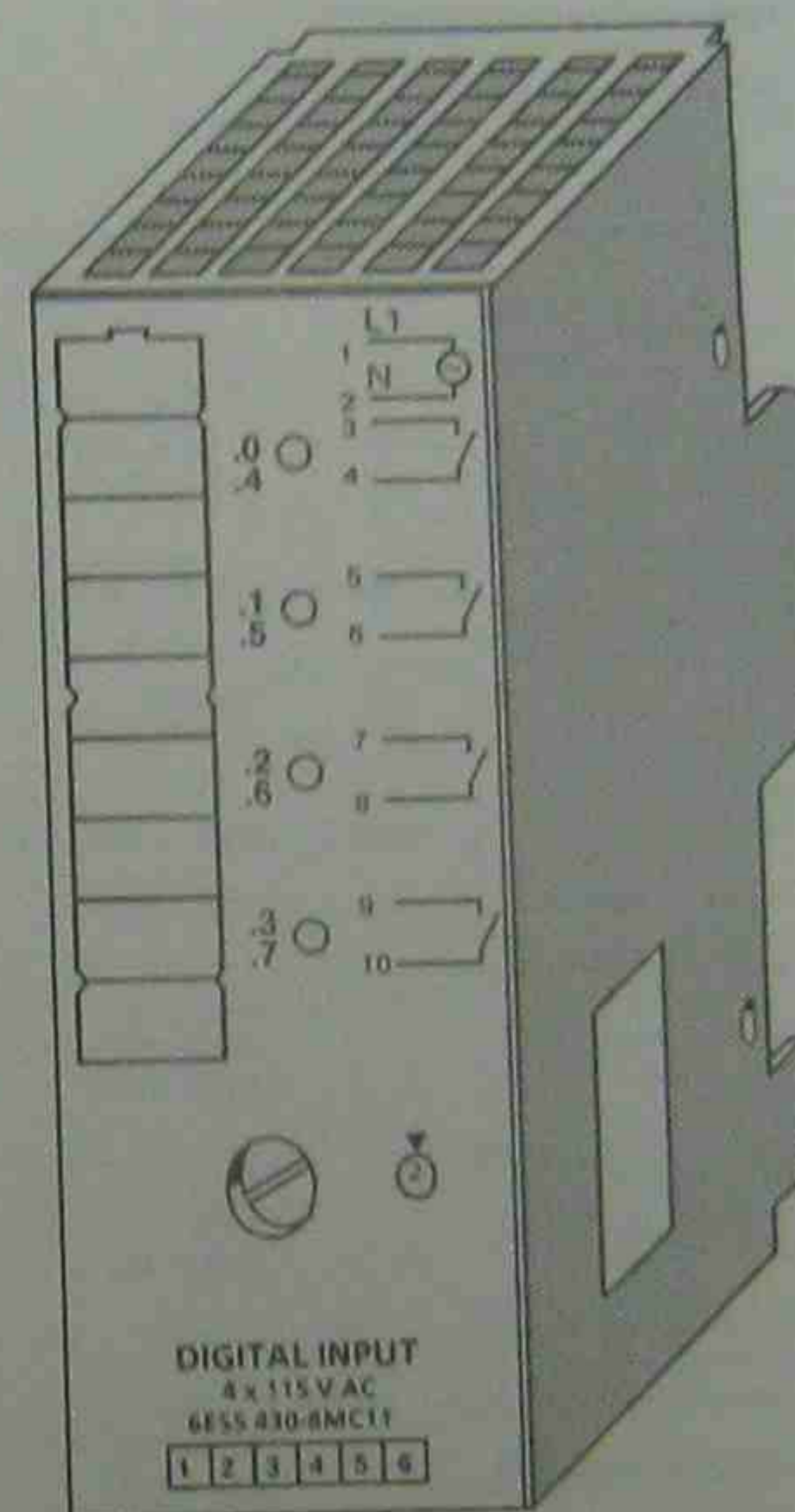
Technical specifications

Address designation (for ET 100U only)	4 DI
Number of inputs	4
Galvanic isolation	yes (optocoupler)
- in groups of	4
Input voltage L +	24 to 60 V DC
- rated value	13 to 72 V
- "1" signal	33 to 8 V
- "0" signal	
Input current at "1" signal	typ. 4.5 to 7.5 mA
Inherent delay	
- from "0" to "1"	typ. 3 ms (1.4 to 5 ms)
- from "1" to "0"	typ. 3 ms (1.4 to 5 ms)
Fault LED (red)	no input voltage L +
Connection of 2-wire BERO proximity switches	possible
- residual current	≤ 1.5 mA
Permissible ambient temperature of PLC	
- horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable	
- unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to +)	12 V AC
- insulation group	1 × B
- tested with	500 V AC
Rated insulation voltage (+9 V to L +)	60 V AC
- insulation group	2 × B
- tested with	1250 V AC
Current consumption	
- from +9 V (CPU)	typ. 5 mA
- from L +	max. 35 mA
Power loss of the module	
	max. 2 W
Weight	approx. 200 g (7 oz.)



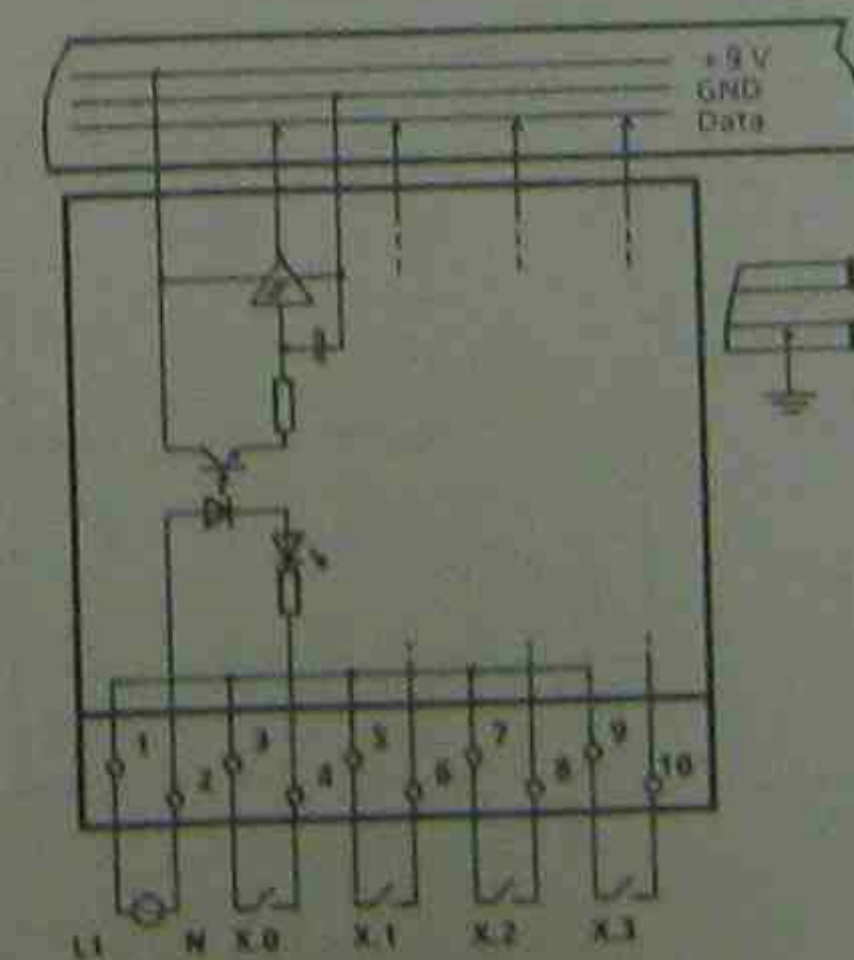
Digital Input Module 4 × 115 V AC

(6ES5 430-8MC11)



Technical specifications

Address designation (for ET 100U only)	4 DI
Number of inputs	4
Galvanic isolation	yes (optocoupler)
- in groups of	4
Input voltage L1	115 V AC/DC
- rated value	0 to 40 V
- "0" signal	85 to 135 V
- "1" signal	47 to 63 Hz
- frequency	
Input current at "1" signal	typ. 14 mA at 115 V AC
	typ. 6 mA at 115 V DC
Inherent delay	
- from "0" to "1"	typ. 10 ms
- from "1" to "0"	typ. 20 ms
Length of cable	
- unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to L1)	125 V AC
- insulation group	2 × B
- tested with	1250 V AC
Rated insulation voltage (+9 V to +)	12 V AC
- insulation group	1 × B
- tested with	500 V AC
Permissible ambient temperature of PLC	
- horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Connection of 2-wire BERO proximity switches	possible
- residual current	≤ 5 mA
Current consumption	
- from +9 V (CPU)	typ. 16 mA
Power loss of the module	
	typ. 2.8 W
Weight	approx. 210 g (7.4 oz.)

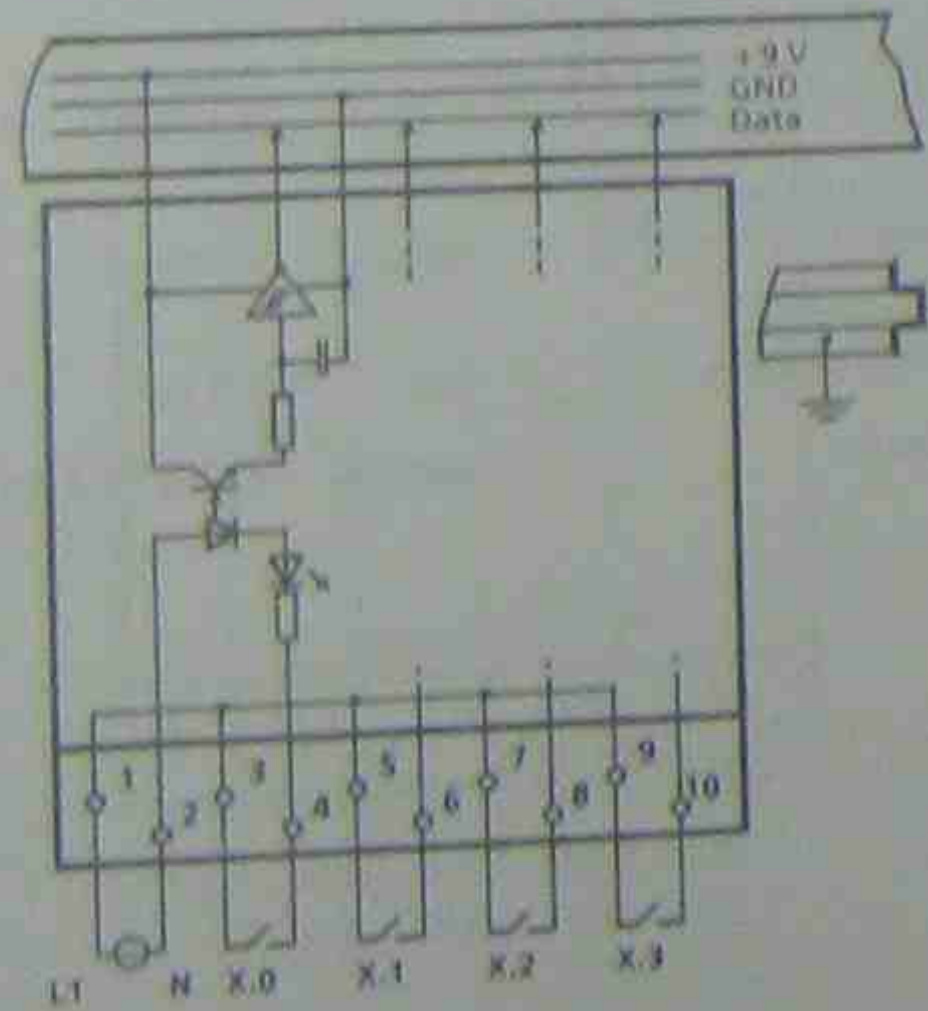
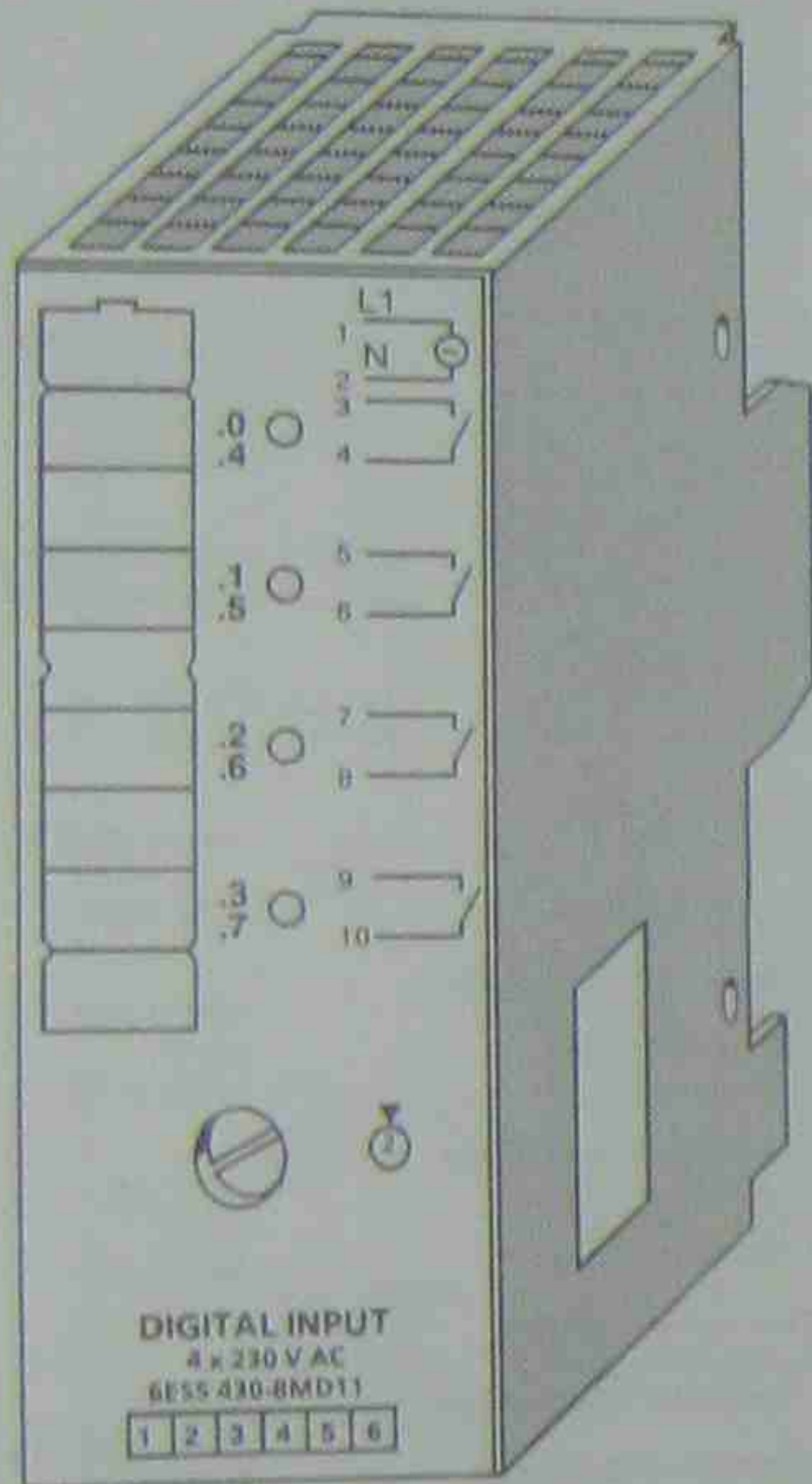


Digital Input Module 4 x 230 V AC

(6ES5 430-8MD11)

Technical specifications

Address designation (for ET 100U only)		4 DI
Number of inputs		4
Galvanic isolation		yes (optocoupler)
- in groups of		4
Input voltage L1		230 V AC
- rated value		0 to 70 V
- "0" signal		170 to 264 V
- "1" signal		47 to 63 Hz
- frequency		
Input current at "1" signal	typ.	16 mA at 230 V
Inherent delay		
- from "0" to "1"	typ.	10 ms
- from "1" to "0"	typ.	20 ms
Length of cable		
- unshielded	max.	100 m (330 ft.)
Insulation rating		VDE 0160
Rated insulation voltage (+9 V to L1)		250 V AC
- insulation group		2 x B
- tested with		1500 V AC
Rated insulation voltage (+9 V to -)		12 V AC
- insulation group		1 x B
- tested with		500 V AC
Permissible ambient temperature of PLC		
- horizontal arrangement		0 to 50 °C (32 to 140 °F)
- vertical arrangement		0 to 40 °C (32 to 104 °F)
Connection of 2-wire BERO proximity switches		possible
- residual current		≤ 5 mA
Current consumption		
- from +9 V (CPU)	typ.	16 mA
Power loss of the module	typ.	2.5 W
Weight	approx.	210 g (7.4 oz.)

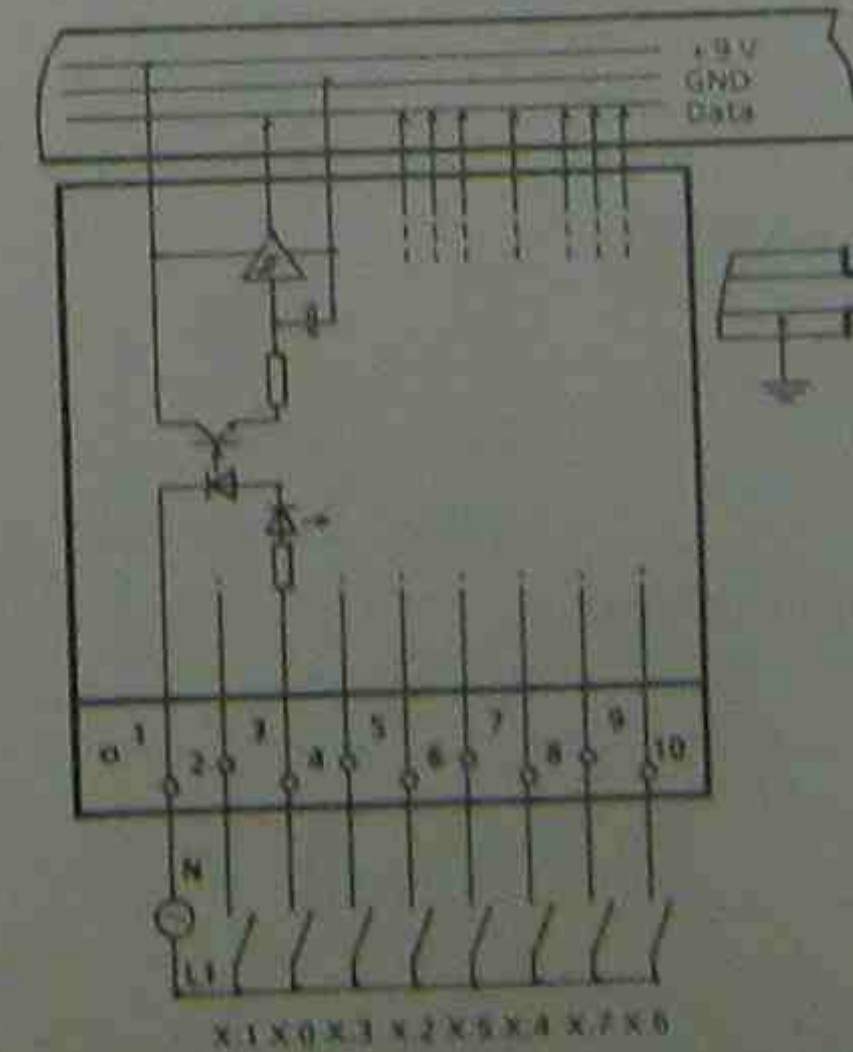
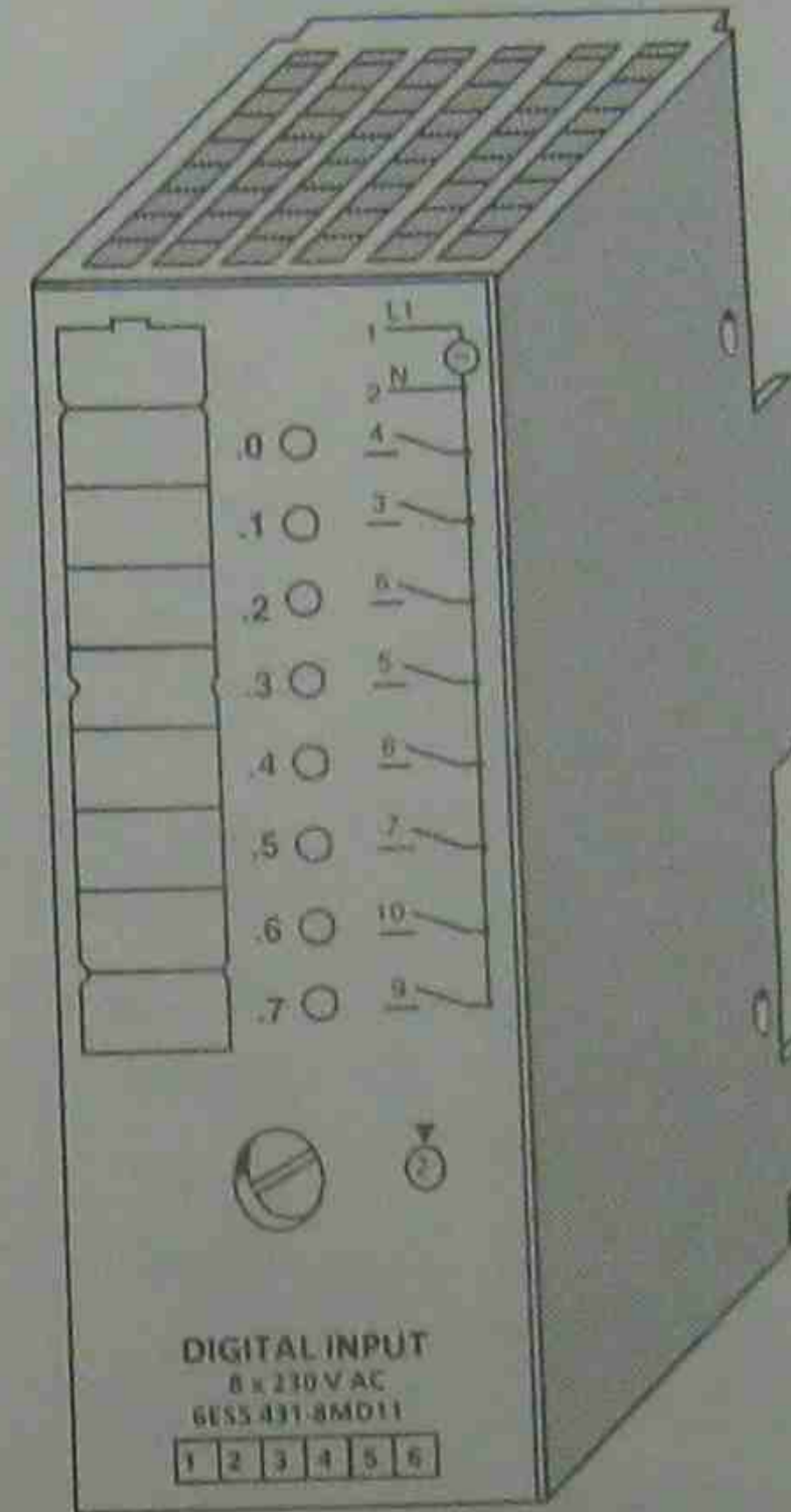


Digital Input Module 8 x 230 V AC

(6ES5 431-8MD11)

Technical specifications

Address designation (for ET 100U only)		8 DI
Number of inputs		8
Galvanic isolation		yes (optocoupler)
- in groups of		8
Input voltage L1		230 V AC/DC
- rated value		0 to 95 V
- "0" signal		195 to 253 V
- "1" signal		47 to 63 Hz
- frequency		
Input current at "1" signal	typ.	16 mA at 230 V AC
	typ.	1.8 mA at 230 V DC
Inherent delay		
- from "0" to "1"	typ.	10 ms
- from "1" to "0"	typ.	20 ms
Length of cable		
- unshielded	max.	100 m (330 ft.)
Insulation rating		VDE 0160
Rated insulation voltage (+9 V to L1)		250 V AC
- insulation group		2 x B
- tested with		1500 V AC
Rated insulation voltage (+9 V to -)		12 V AC
- insulation group		1 x B
- tested with		500 V AC
Permissible ambient temperature of PLC		
- horizontal arrangement		0 to 60 °C (32 to 140 °F)
- vertical arrangement		0 to 40 °C (32 to 104 °F)
Connection of 2-wire BERO proximity switches		possible
- residual current		≤ 5 mA
Current consumption		
- from +9 V (CPU)	typ.	32 mA
Power loss of the module	typ.	3.6 W
Weight	approx.	260 g (9 oz.)



Digital Input Module 8 x 5 to 24 V DC

(6ES5 433-8MA11)

EXPERTENGRAFIK TEXT

Wahlweise nach "S1" = Selectable according to "S1"

Technical Specifications

Address designation (for ET 100U only)	8 DI
Number of inputs	8
Galvanic isolation - in groups of	yes (optocoupler) 8
Input voltage L+ - rated value	5 to 24 V DC
- "0" signal	V _{in} approx. 25% L+
- "1" signal	V _{in} approx. 45% L+
Permissible range	4.5 to 30 V
Input resistance	4.7 kΩ to L+ or M; reversible on the back of the module*
The LED displays the evaluated signal	
Inherent delay	approx. 1 ms or 10 ms; reversible on the back of the module*
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+ 9 V to L+)	30 V AC
- insulation group	2 x B
- tested with	500 V AC
Rated insulation voltage (+ 9 V to ⚭)	12 V AC
- insulation group	2 x B
- tested with	500 V AC
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Current consumption - from + 9 V (CPU)	typ. 6 mA
- from L+	typ. 60 mA
Power loss of the module	typ. 2.4 W
Weight	approx. 225 g (8 oz.)

* reversible in groups of 8

15.6.2 Digital Output Modules

Digital Output Module 4 x 24 V DC/0.5 A

(6ES5 440-8MA11)

Technical specifications

Address designation (for ET 100U only)	4 DO
Number of outputs	4
Galvanic isolation - in groups of	no 4
Load voltage L+ - rated value	24 V DC
- permissible range (including ripple)	20 to 30 V
- value at t < 0.5 s	35 V
Output current for "1" signal - rated value	0.5 A
- permissible range	5 to 500 mA
- lamp load	max. 5 W
Residual current at "0" signal	max. 0.5 mA
Output voltage - "1" signal	max. L+ (- 1.2 V)
Short-circuit protection	short-circuit protected output with autom. switch on when the short-circuit does not exist any more
Fault LED (red)	short-circuit/no load voltage L+
Error diagnostics	possible
Voltage induced on circuit interruption (internal) limited to	- 15 V
Switching frequency - resistive load	max. 100 Hz
- inductive load	max. 2 Hz
Total permissible current of outputs	2 A
Driving of digital input	possible
Paralleling of outputs - maximum current	possible 0.8 A
Permissible ambient temperature - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage* (+ 9 V to ⚭)	12 V AC
- insulation group	1 x B
Current consumption - from + 9 V (CPU)	typ. 15 mA
- from L+ (without load)	typ. 25 mA
Power loss of the module	typ. 3 W
Weight	approx. 200 g (7 oz.)

* Relevant only for isolated assembly in the ET 100U

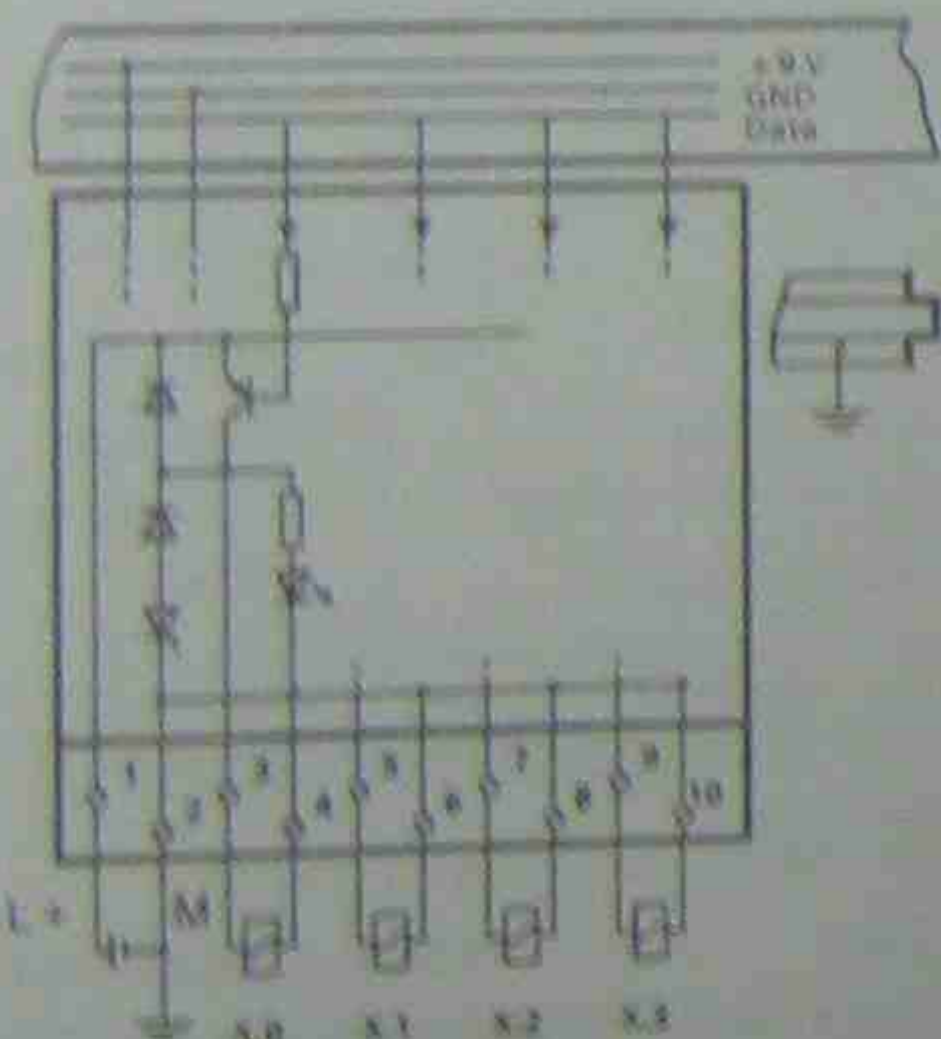
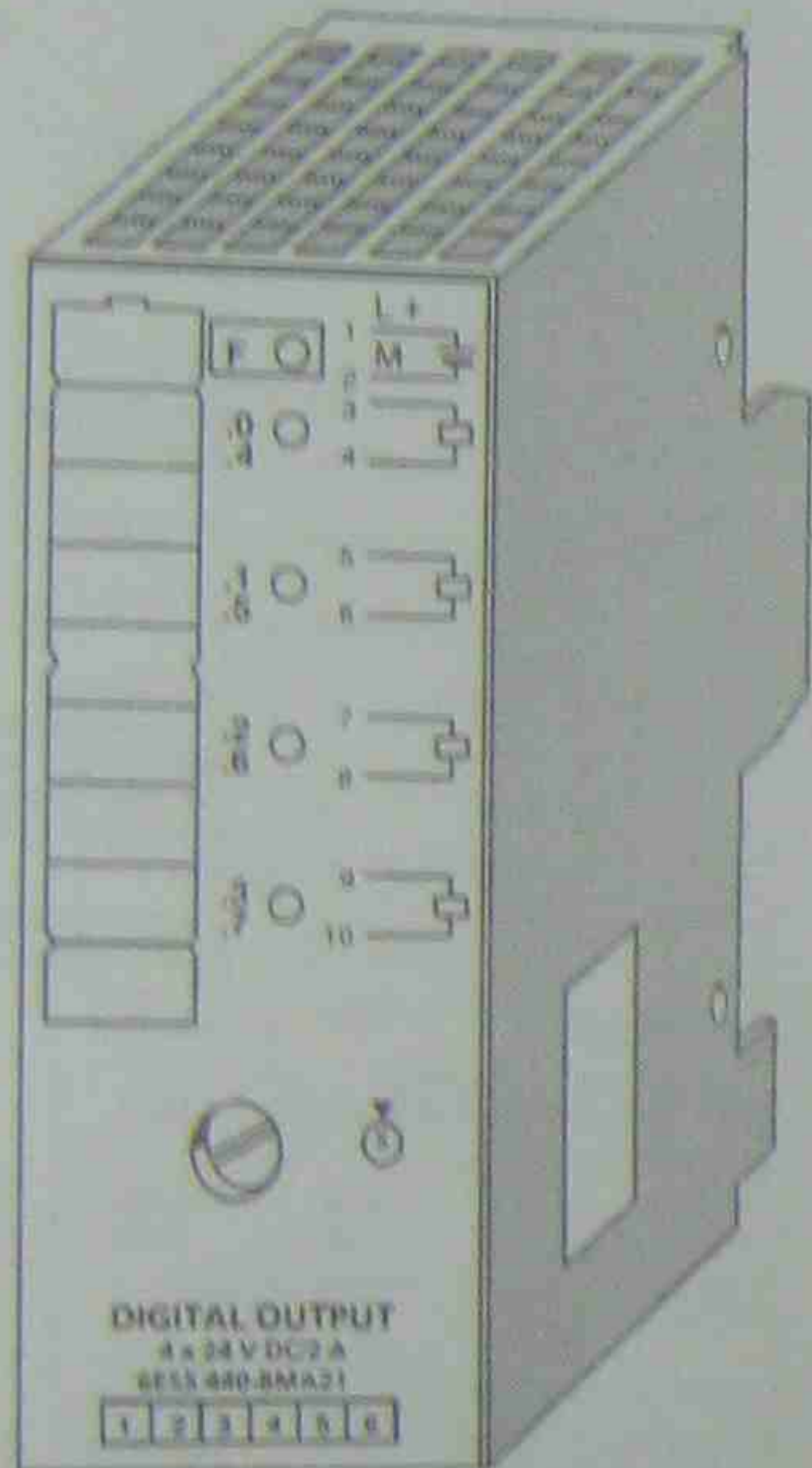
Digital Output Module 4 x 24 V DC/2 A

(6ES5 440-8MA21)

Technical specifications

Address designation (for ET 100U only)	4 DO
Number of outputs	4
Galvanic isolation - in groups of	no
Load voltage L+ - rated value	24 V DC
- permissible range	20 to 30 V
Output current for "1" signal - rated value	2 A
- permissible range - lamp load	max. 5 mA to 2 A
Residual current at "0" signal	max. 1 mA
Output voltage - "1" signal	max. L+ (-1.5 V)
Short-circuit protection	short-circuit protected output with autom. switch on when the short-circuit does not exist any more
Fault LED (red)	short-circuit/no load voltage L+ possible
Error diagnostics	possible
Voltage induced on circuit interruption (internal) limited to	- 15 V
Switching frequency - resistive load	max. 100 Hz
- inductive load	max. 2 Hz
Total permissible current of outputs	4 A
Driving of digital input	possible
Paralleling of outputs - maximum current	possible 3.2 A
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage* (+9 V to -)	12 V AC
- insulation group	1 x B
Current consumption - from +9 V (CPU)	typ. 15 mA
- from L+ (without load)	typ. 25 mA
Power loss of the module	typ. 4.8 W
Weight	approx. 200 g (7 oz.)

* Relevant only for isolated assembly in the ET 100U



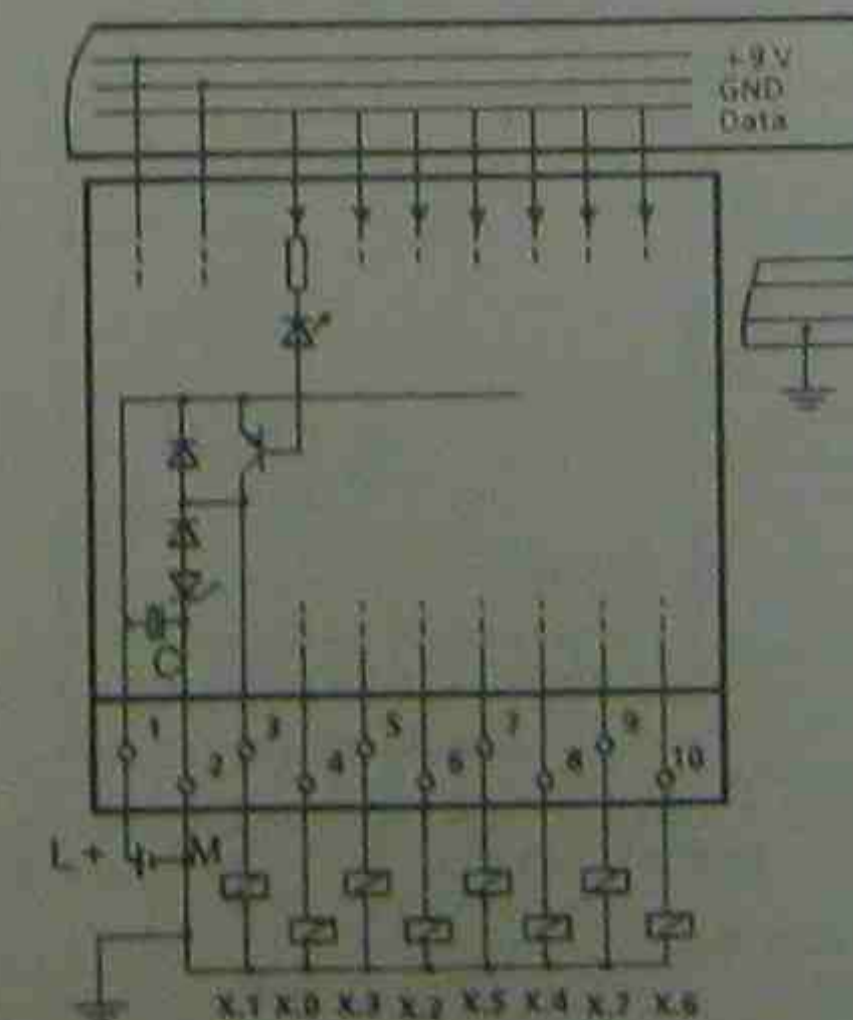
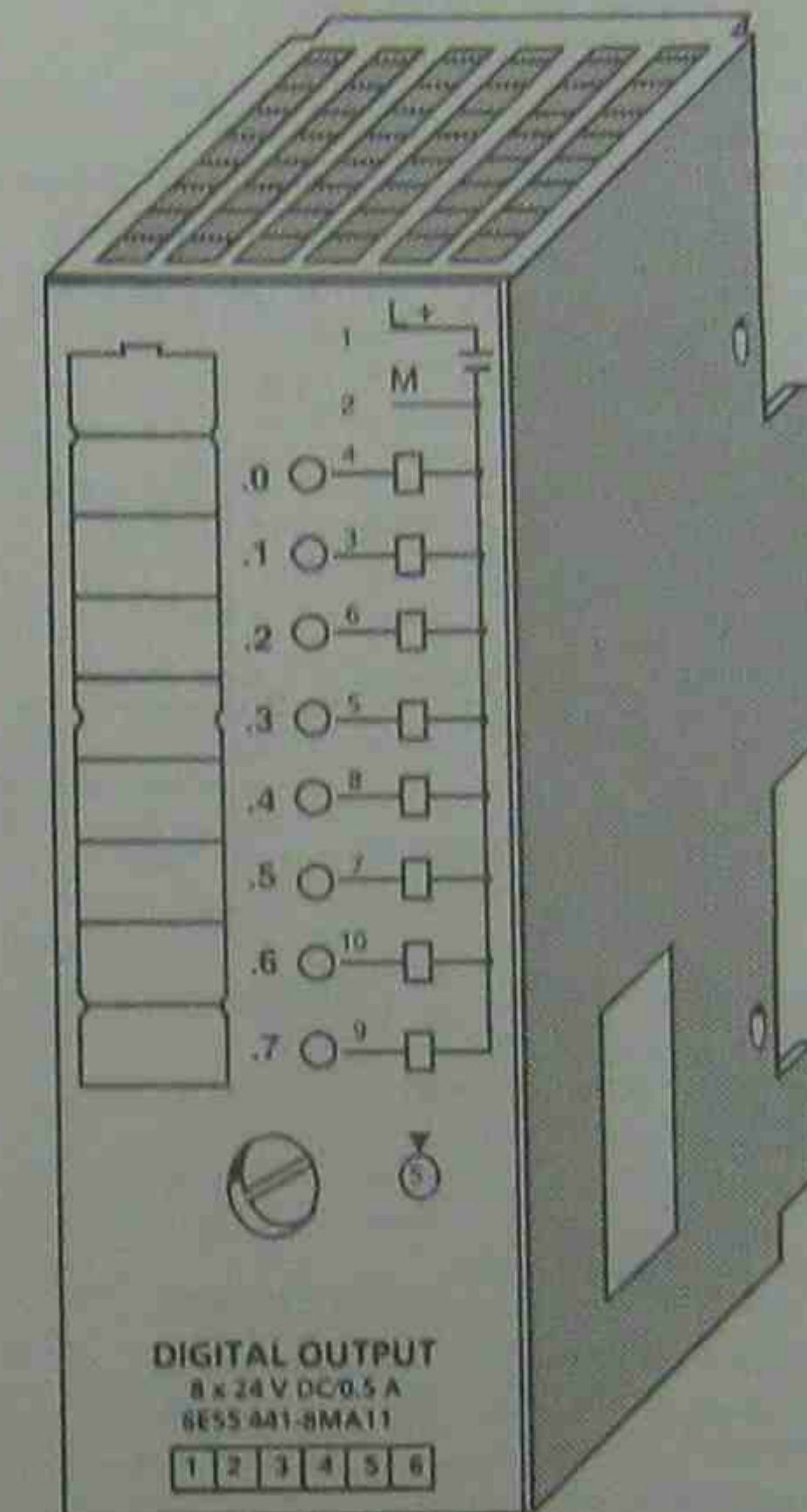
Digital Output Module 8 x 24 V DC/0.5 A

(6ES5 441-8MA11)

Technical specifications

Address designation (for ET 100U only)	8 DO
Number of outputs	8
Galvanic isolation - in groups of	no 8
Load voltage L+ - rated value	24 V DC
- permissible range (including ripple)	20 to 30 V
- value at t < 0.5 s	35 V
Warning	
Capacitor remains loaded after switch off of L+	
Output current for "1" signal - rated value	0.5 A at 60 °C (140 °F) 1 A at 30 °C (86 °F)
- permissible range - lamp load	max. 5 mA to 1 A 5 W
Residual current at "0" signal	max. 1.0 mA
Output voltage - "1" signal	max. L+ (-1.2 V)
Short-circuit protection	none
Voltage induced on circuit interruption (internal) limited to	- 15 V
Switching frequency - resistive load	max. 100 Hz
- inductive load	max. 2 Hz
Total permissible current of outputs	4 A
Driving of digital input	possible
Paralleling of 2 outputs - maximum current	possible 0.8 A
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage* (+9 V to -)	12 V AC
- insulation group	1 x B
Current consumption - from +9 V (CPU)	typ. 14 mA
- from L+ (without load)	typ. 15 mA
Power loss of the module	typ. 3.5 W
Weight	approx. 220 g (7.7 oz.)

* Relevant only for isolated assembly in the ET 100U



Digital Output Module 4 x 24 to 60 V DC/0.5 A

(6ES5 450-8MB11)

Technical specifications

Address designation (for ET 100J only)	4 50
Number of outputs	4
Group designation in groups of	yes (optional) 4
Load voltage L+ - rated value	24 to 60 V DC
- permissible range	20 to 72 V
Output current for "1" signal - rated value	0.5 A
- permissible range	5 mA to 0.5 A
- lamp load	max. 5 to 12 W
Residual current at "1" signal	max. 1 mA
Short-circuit protection	short-circuit protected output with auto. switch on when the short-circuit does not clear any more
Fault LED (red)	short-circuit to load voltage L+ possible
Extra diagnostics	
Voltage induced on circuit when open (internal) limited to	30 V
Switching frequency - resistive load	max. 100 Hz
- inductive load	max. 2 Hz
Total permissible current of outputs	2 A
Driving of digital input	possible
Paralleling of 2 outputs - maximum current	possible 2 x 0.5 A
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable (unshielded)	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+ 9 V to L+)	60 V AC
- insulation group - tested with	2 x B 500 V AC
Rated insulation voltage (+ 9 V to -)	12 V AC
- insulation group - tested with	1 x B 500 V AC
Current consumption - from + 9 V (CPU)	typ. 15 mA
- from L+ (without load)	typ. 30 mA (at 60 V)
Power loss of the module	typ. 5 W
Weight	approx. 200 g (7 oz.)

Digital Output Module 4 x 115 to 230 V AC/1 A

(6ES5 450-8MD11)

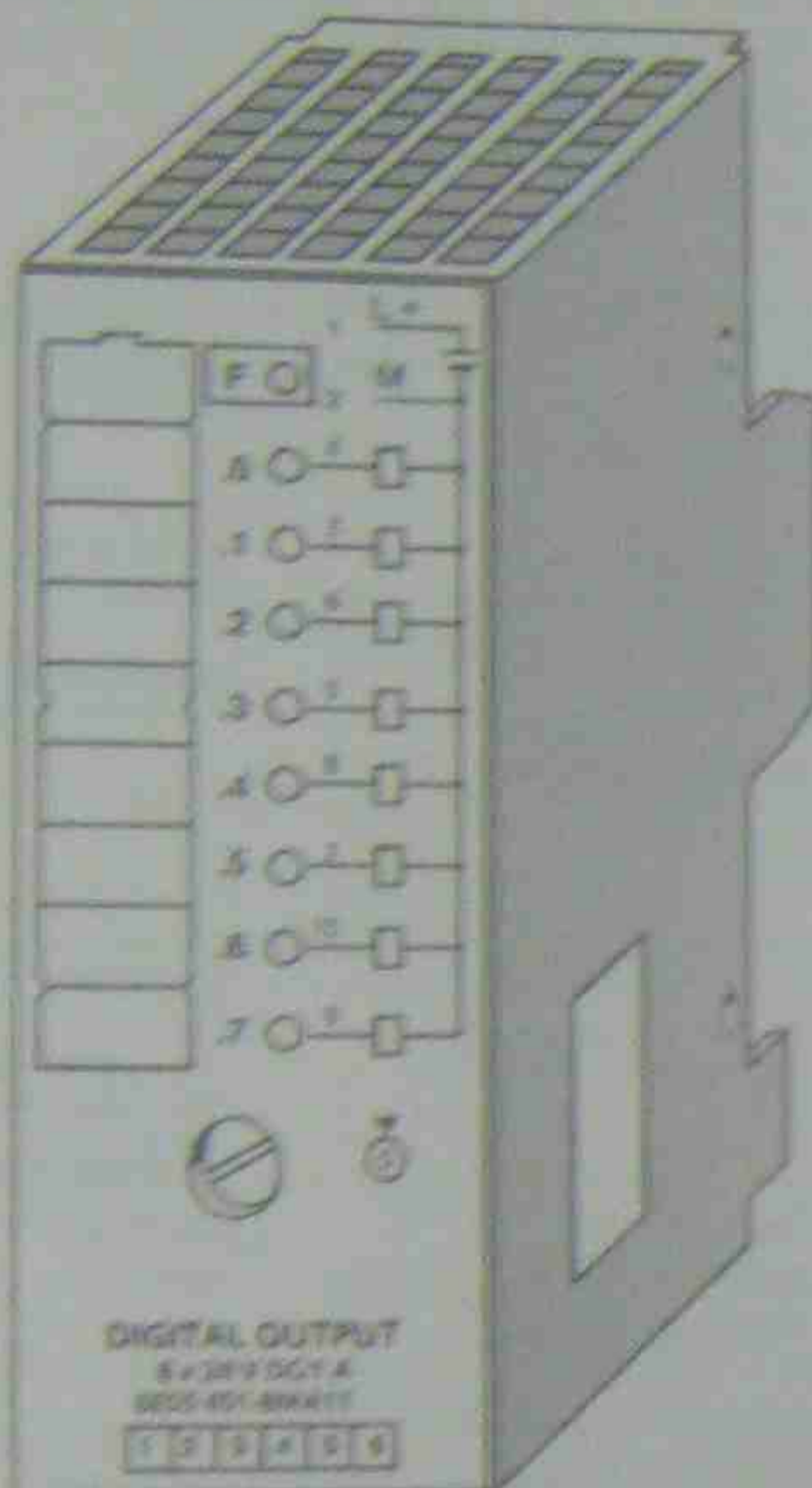
Technical specifications

Address designation (for ET 100J only)	4 50
Number of outputs	4
Group designation - in groups of	yes 4
Load voltage L1 - rated value	115 to 230 V AC
- frequency	max. 47 to 60 Hz
- permissible range	85 to 264 V
Output current for "1" signal - rated value	1 A
- permissible range	50 mA to 1 A
- lamp load	max. 25/50 W
Contact current closing rating	determined by the size of the fuse
Residual current at "0" signal	max. 25 mA
Output voltage - "1" signal	max. L1 (- 7 V)
Signal status display (green LEDs)	only with load connected
Short-circuit protection	fuse (10 A extra fast) (Wickmann No. 19231, or 6ES5 960-3BC41)
Fault LED (red)	fuse blown
Switching frequency	max. 10 Hz
Permissible current of all outputs	4 A
Driving of digital input	possible
Paralleling of outputs	not possible
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+ 9 V to L1)	250 V AC
- insulation group - tested with	2 x B 1500 V AC
Rated insulation voltage (+ 9 V to -)	12 V AC
- insulation group - tested with	1 x B 500 V AC
Current consumption - from + 9 V (CPU)	typ. 14 mA
Power loss of the module	typ. 3.5 W
Weight	approx. 315 g (11 oz.)

* Indication only given if load voltage is applied and at least one load is connected

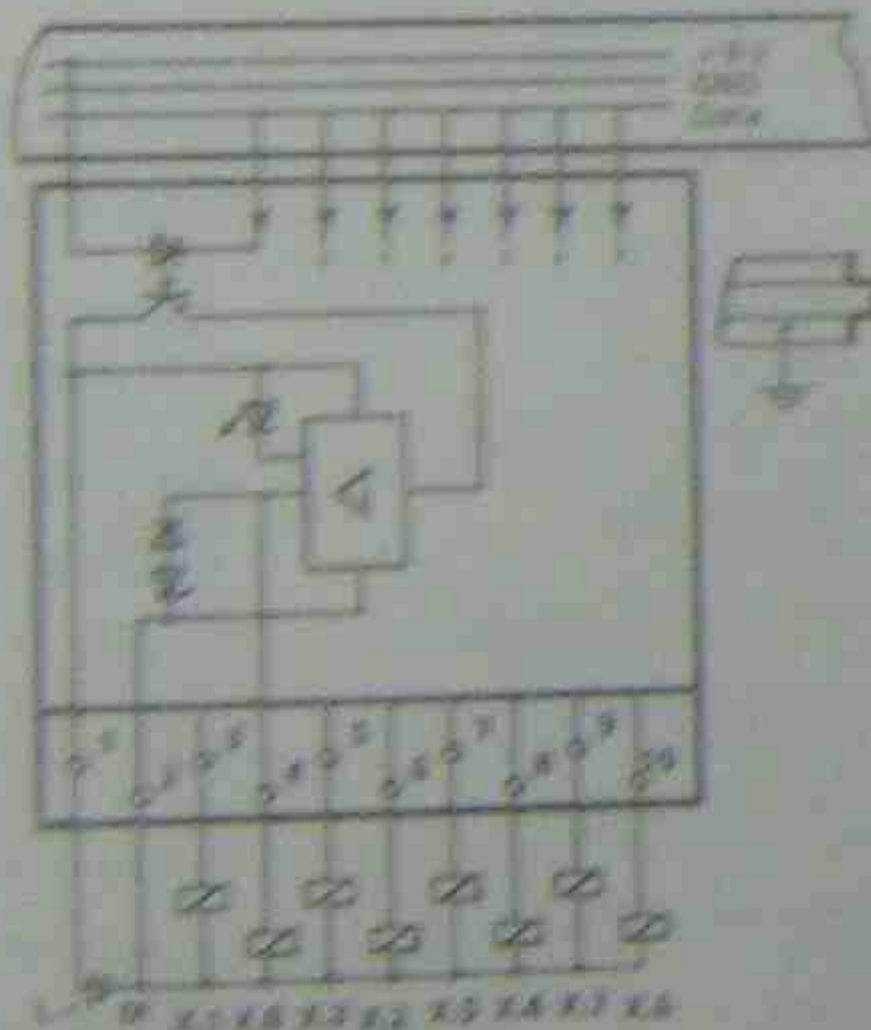
Digital Output Module 8 x 24 V DC/1 A

(6ES5 451-8MA11)



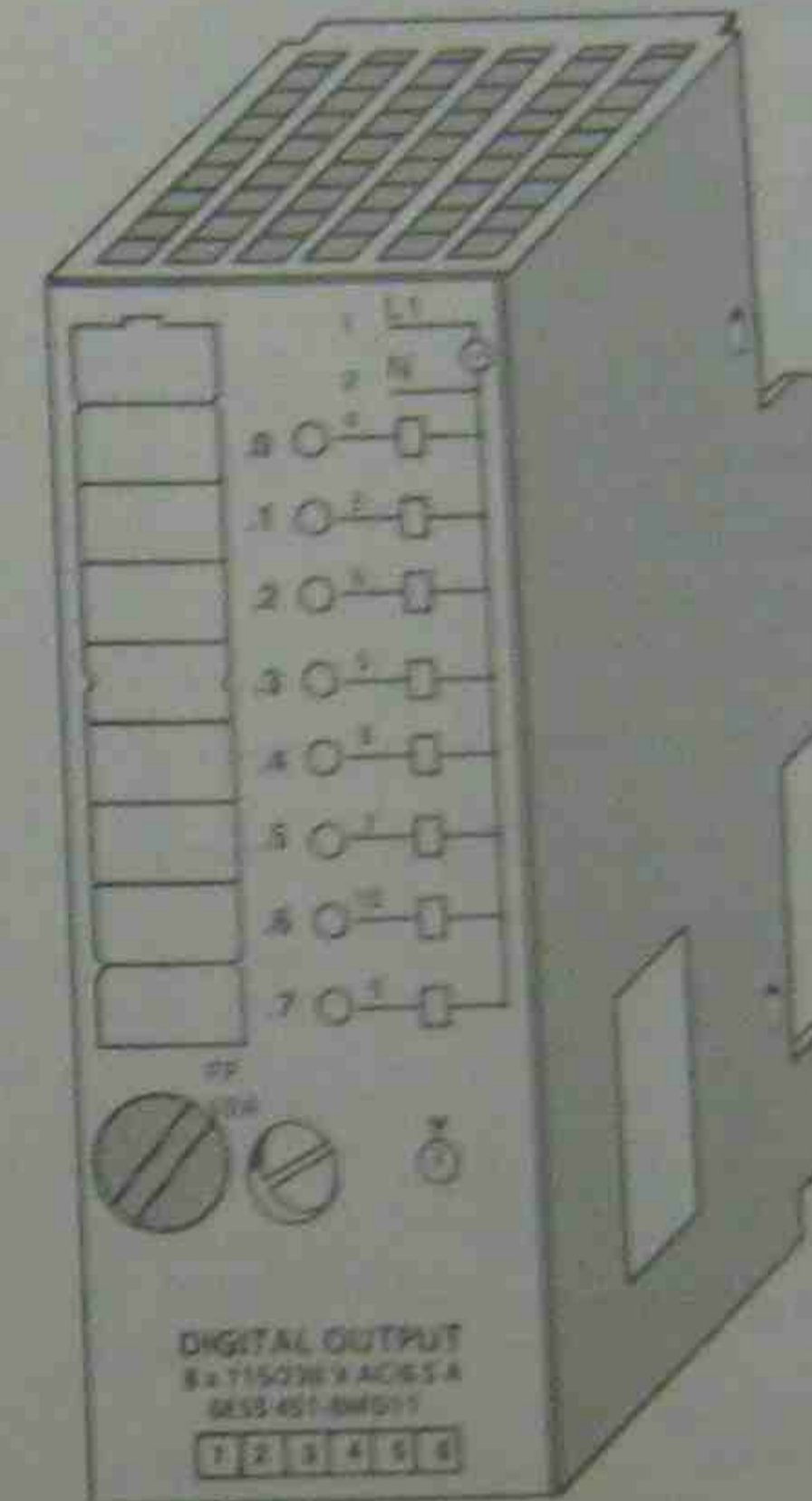
Technical specifications

Address designation (for ET 100U only)	8 DO
Number of outputs	8
Galvanic isolation - in groups of	yes (optocoupler) 3
Load voltage L+ - rated value	24 V DC
- permissible range (including ripple)	20 to 30 V
- value at 1+3.5 s	35 V
Output current for "1" signal - rated value	1 A
- permissible range - lamp load	5 mA to 1 A
max.	12 W
Residual current at "0" signal	max. 1.0 mA
Output voltage - at "1" signal	max. L+ (-0.8 V)
Short-circuit protection	short-circuit protected output with autom. switch on when the short-circuit does not exist any more
Fault LED (red)	short-circuit
Voltage induced on output interruption (inductance) limited to	-15 V
Switching frequency - resistive load	max. 100 Hz
- inductive load	max. 2 Hz
Permissible current of all outputs	5 A
Driving of digital input	possible
Paralleling of 2 outputs - maximum current	possible 1.2 A
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 150 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+ 9 V to L+)	24 V AC
- insulation group - tested with	2 x B 500 V AC
Rated insulation voltage (+ 9 V to -)	12 V AC
- insulation group - tested with	1 x B 500 V AC
Current consumption - from +9 V (CPU)	typ. 24 mA
- from L+ (without load)	typ. 200 mA
Power loss of the module	typ. 4 W
Weight	approx. 230g (8 oz.)



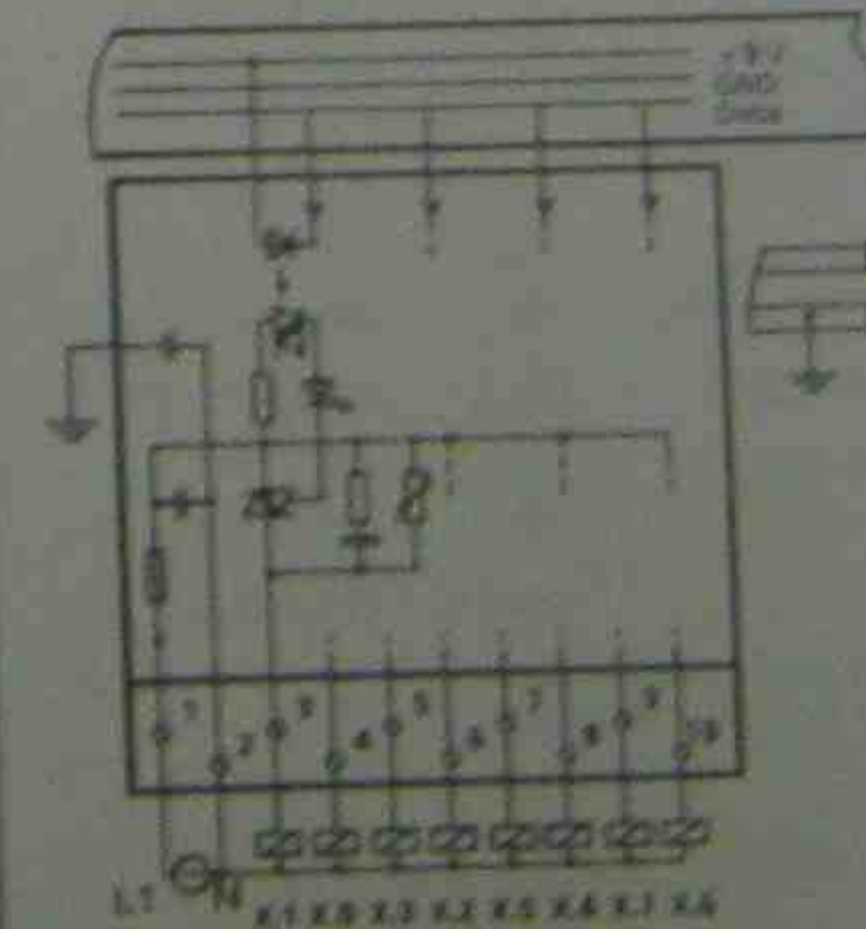
Digital Output Module 8 x 115 to 230 V AC/0.5 A

(6ES5 451-8MD11)



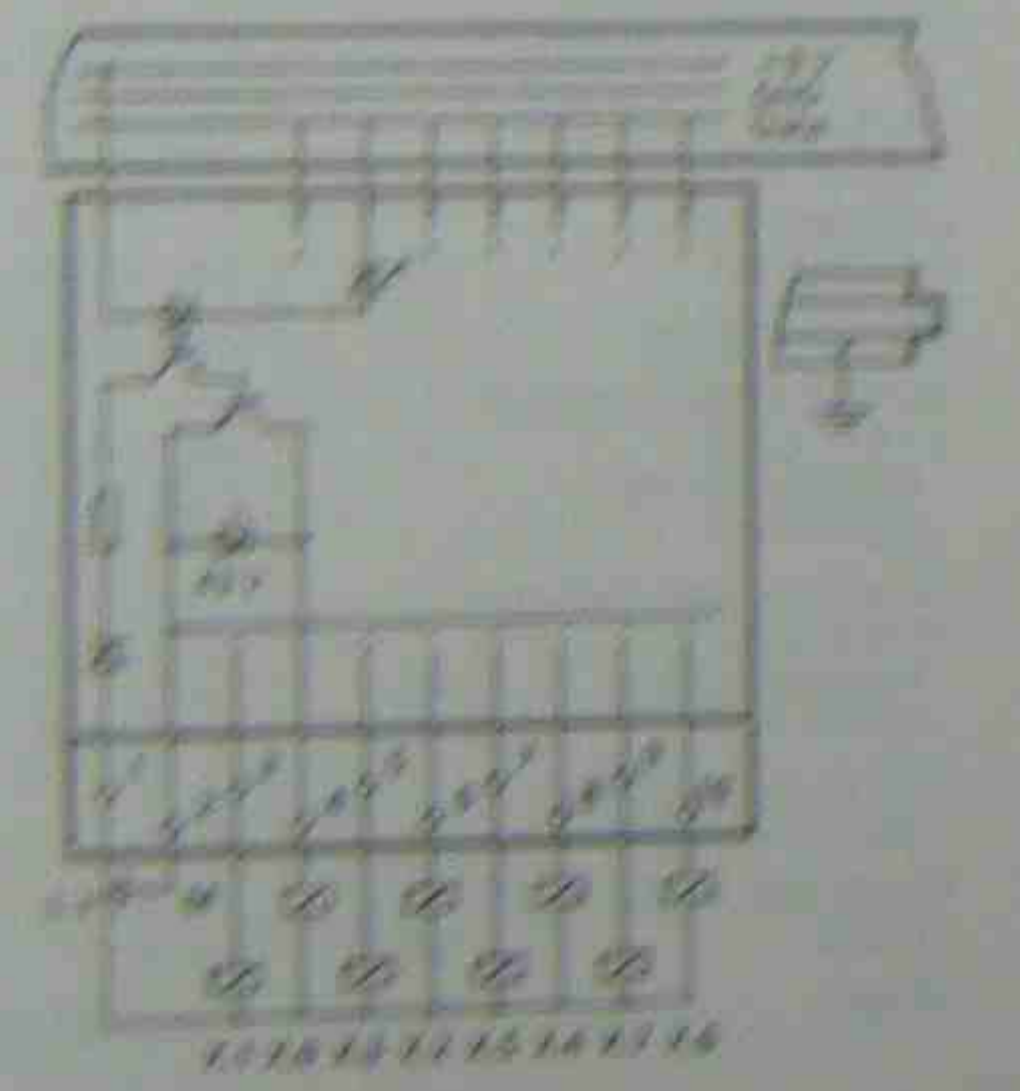
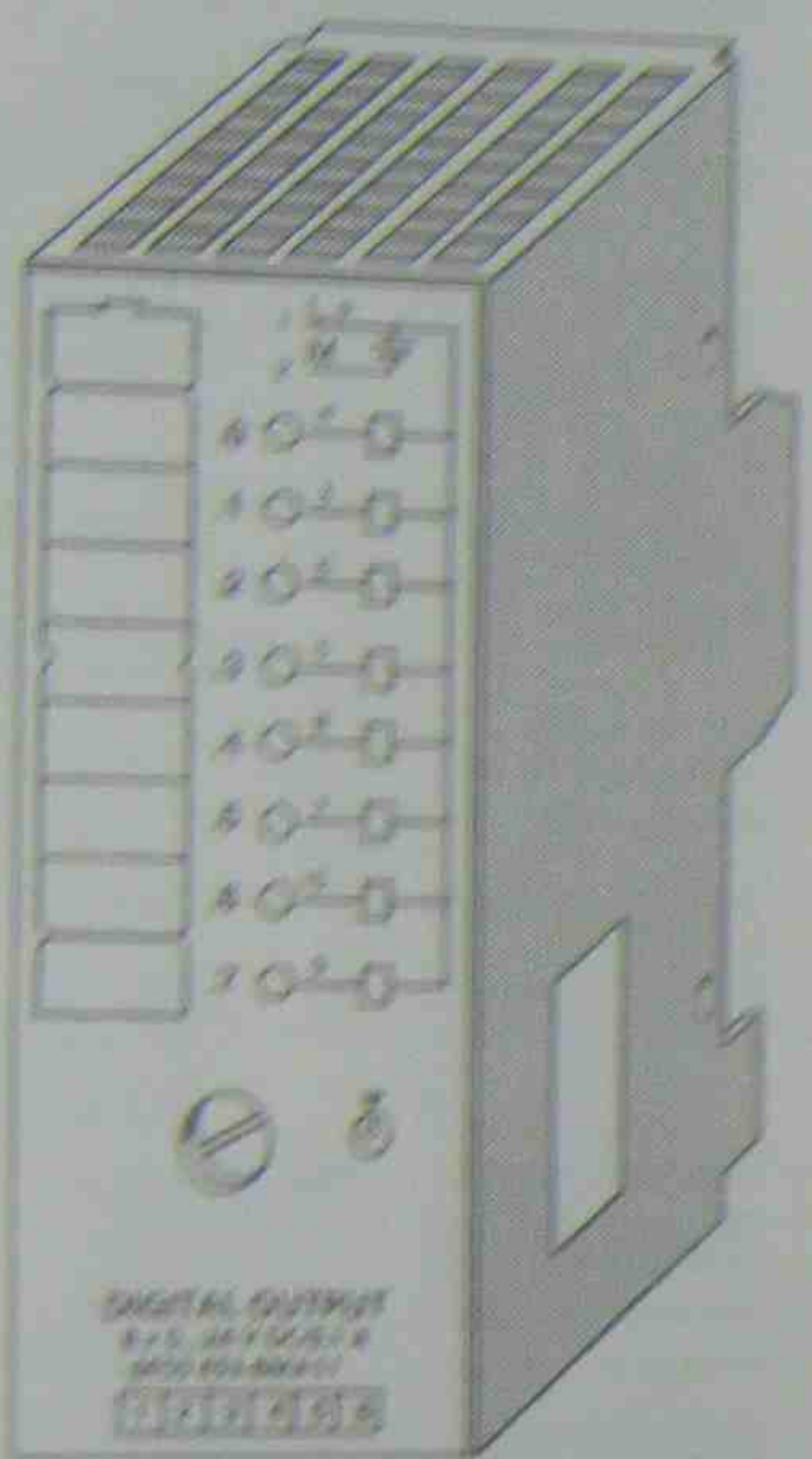
Technical specifications

Address designation (for ET 100U only)	8 DO
Number of outputs	8
Galvanic isolation - in groups of	yes (optocoupler) 3
Load voltage L1 - rated value	115 to 230 V AC
- frequency	max. 47 to 63 Hz
- permissible range	85 to 254 V
Output current for "1" signal - rated value	0.5 A
- permissible range - lamp load	50 mA to 0.5 A
max.	25/50 W
Contact current closing rating	determined by the size of the fuse
Residual current at "0" signal	max. 3/5 mA
Output voltage - at "1" signal	max. L1 (-7 V)
Signal Status Display (green LEDs)	only with load connected
Short-circuit protection	fuse (10 A extra fast) (Wickmann No. 19231, or 6ES5 980-38C41)
Switching frequency	max. 10 Hz
Permissible current of all outputs	4 A
Driving of digital input	possible
Paralleling of outputs	not possible
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+ 9 V to L1)	250 V AC
- insulation group - tested with	2 x B 1500 V AC
Rated insulation voltage (+ 9 V to -)	12 V AC
- insulation group - tested with	1 x B 500 V AC
Current consumption - from +9 V (CPU)	typ. 25 mA
Power loss of the module	typ. 3.5 W
Weight	approx. 270 g (9 oz.)



Digital Output Module 8 x 5 to 24 V DC/0.1 A

(6ES5 453-8MA11)



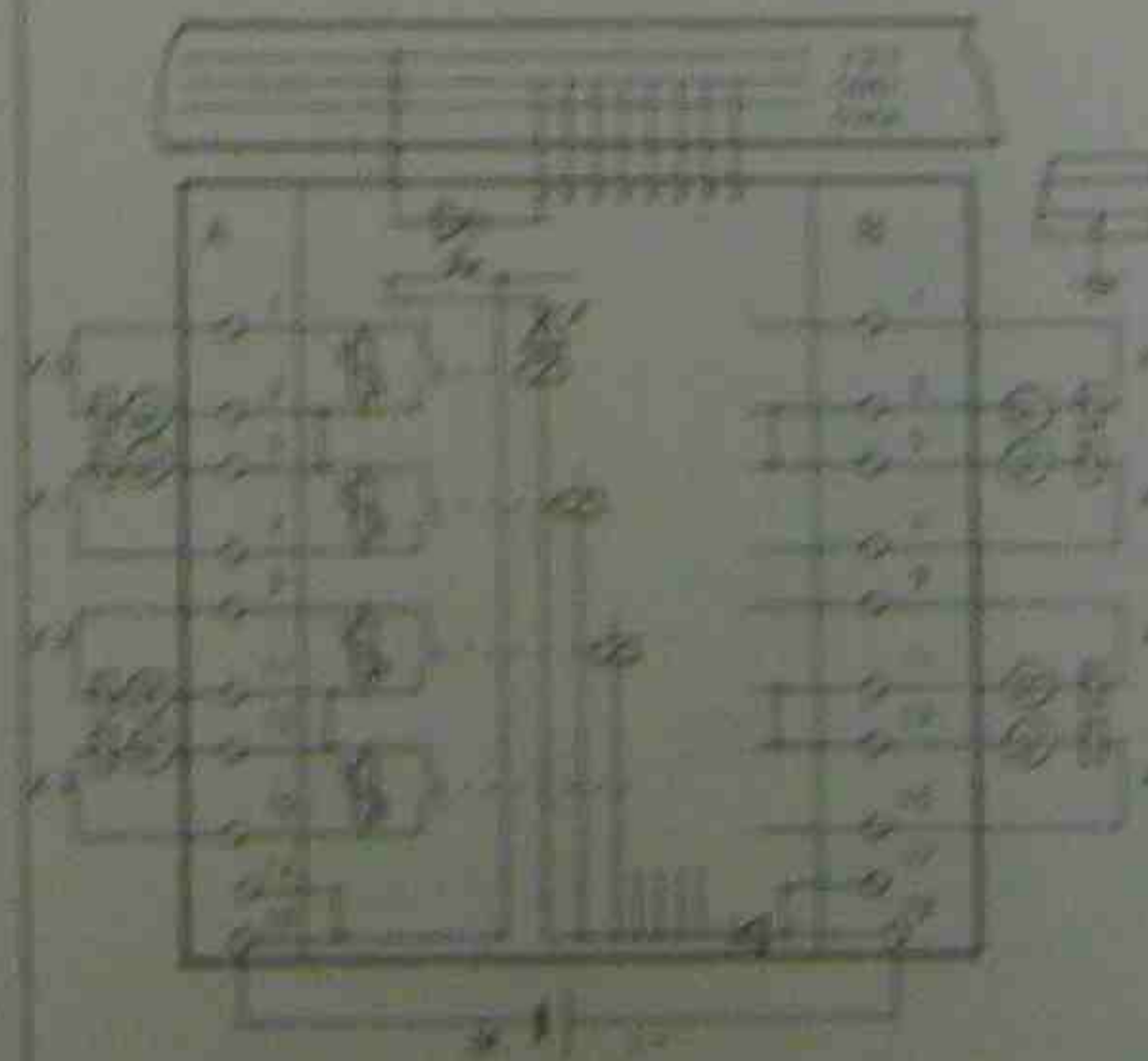
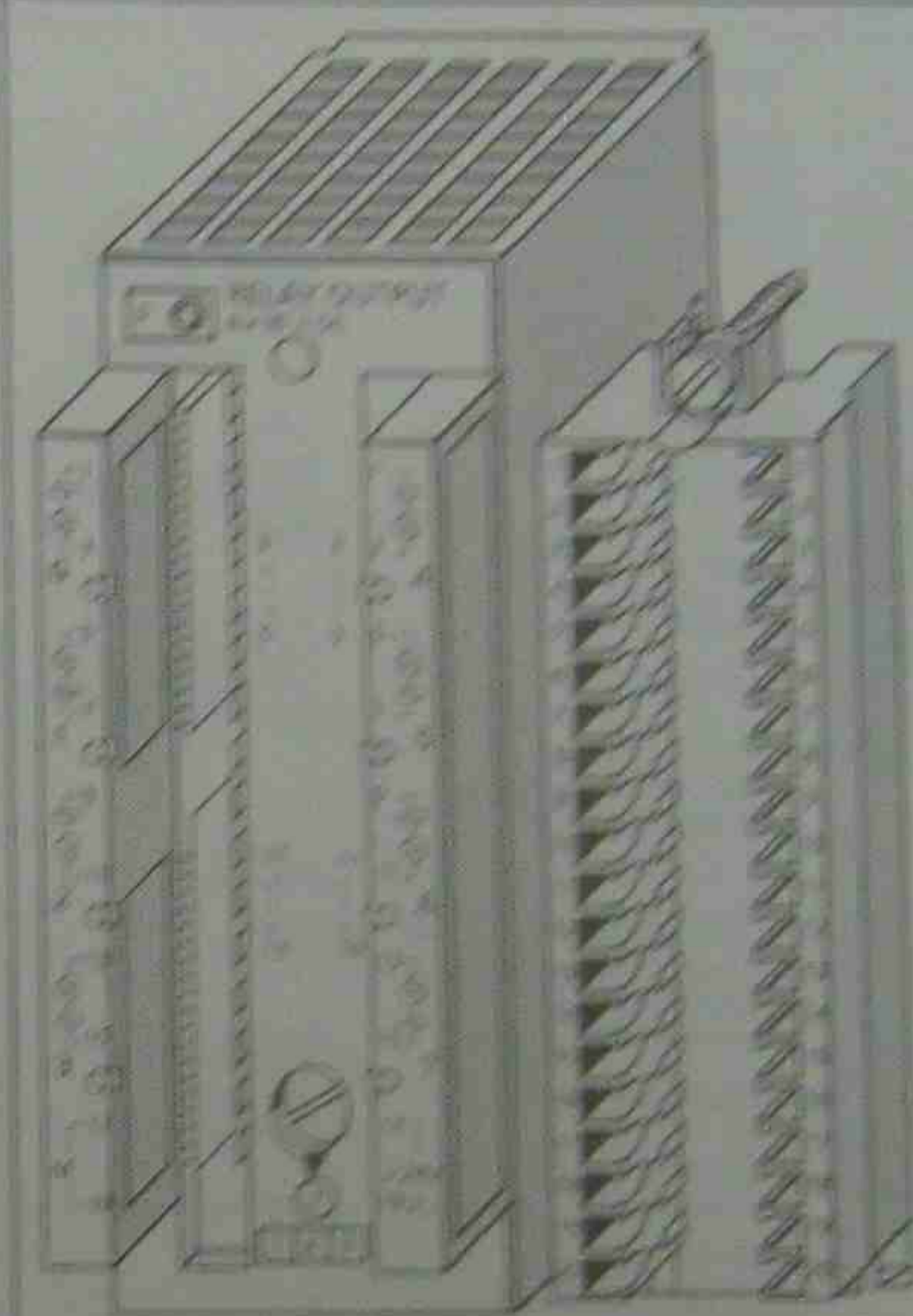
Technical specifications

Address designation (for ET 1000 only)		4 50
Number of outputs		8
Output voltage		5 to 24 V DC
Output current		0.1 A
Output voltage range (including ripple)		4.75 to 30 V
Output voltage range (without ripple)		5 to 24 V
Output voltage		TTL-compatible
Output current (typical)		100 mA
Short-circuit protection		yes
Voltage allowed on output (short-circuit, internal limit)		-15 V (at 24 V)
Switching frequency		max. 100 Hz
Switching capacity		max. 2 VA
Flexibility of 2 outputs		variable
Permissible ambient temperature of PLC		0 to 50 °C
Humidity		5% to 95% (non-condensing)
Length of cable (unshielded)	max.	100 m (330 ft.)
Insulation rating		VDE 0150
Rated insulation voltage (L-N)		12 V AC
Insulation group		1 x B
Insulation with		500 V AC
Current consumption (typical)		25 mA
Current consumption (max. at 5 V DC)		25 mA
Power loss of the module		1 W
Weight	approx.	225 g (8 oz.)

* Connector with open contacts, switching to 0 position

Relay Output Module 8 x 30 V DC/250 V AC
 Clamp Snap-in Connector, 45-pin
 Screw Plug Connector, 25-pin
 Screw Plug Connector, 45-pin

(6ES5 451-8MA12)
 (6ES5 450-8MA12)
 (6ES5 455-8MA21)
 (6ES5 455-8MA11)

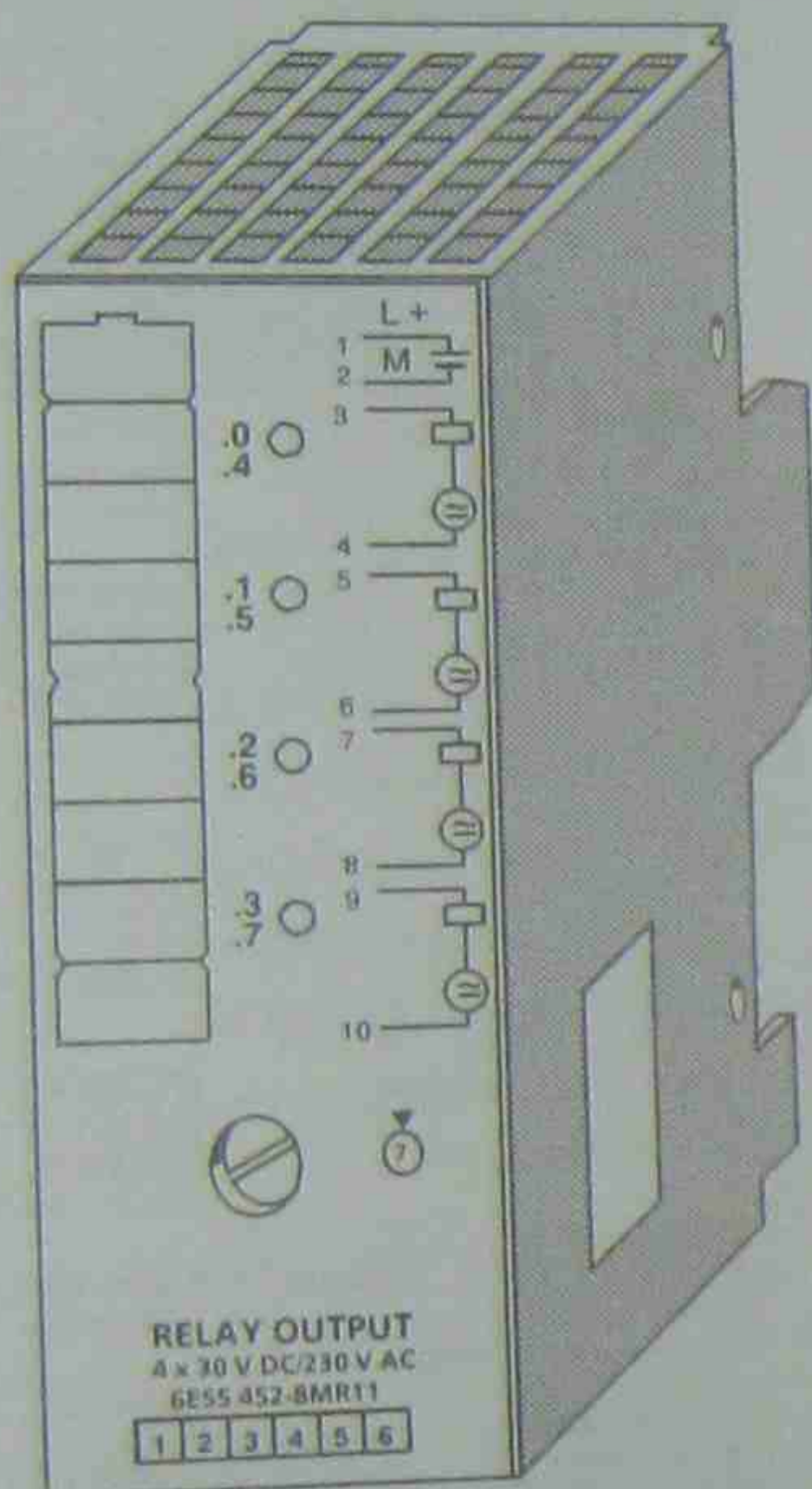


Technical specifications

Address designation (for ET 1000 only)		4 50
Outputs		8 relay outputs, contact switching, screw 25-pin, 50 x 25
Output voltage		30 V
Output current (typical)		2 with signal, 0.1 A
Continuous current (typical)		0.1 A
Relay type		Cont. DM 9599
Switching capacity of the contacts		max. 0.1 A at 250 V AC
Switching capacity of the contacts		max. 0.1 A at 30 V DC
Switching capacity of the contacts		max. 0.1 A at 250 V AC
Switching capacity of the contacts		max. 0.1 A at 30 V DC
Operating modes of the contacts according to VDE 0150, part 250		1 x NF
AC - 11		0.5 x NF
DC - 11		0.5 x NF
Switching frequency	max.	10 Hz
Fast stop time		10 ms (typical)
Permissible ambient temperature of PLC		0 to 50 °C
Humidity		5% to 95% (non-condensing)
Humidity		5% to 95% (non-condensing)
Humidity		5% to 95% (non-condensing)
Length of cable (unshielded)	max.	100 m (330 ft.)
Insulation rating		VDE 0150
Rated insulation voltage (L-N)		12 V AC
Insulation group		2 x B
Insulation with		500 V AC
Rated insulation voltage (L-N)		12 V AC
Insulation group		2 x B
Insulation with		500 V AC
Supply voltage (L-N)		24 V DC
Output current (typical)		0.1 A
Output current (max. at 5 V DC)		0.1 A
Output current (typical)		0.1 A
Output current (max. at 5 V DC)		0.1 A
Power loss of the module		1.5 W
Weight	approx.	305 g (11 oz.)

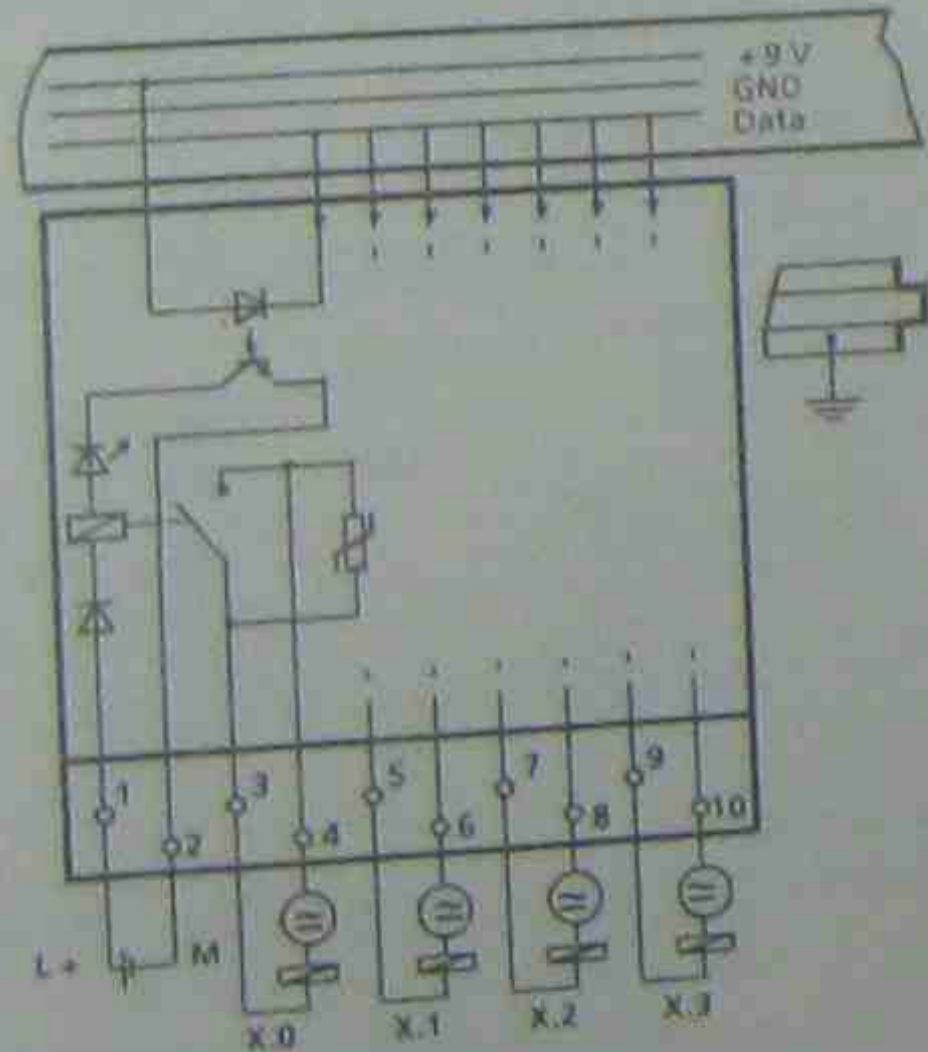
Relay Output Module 4 x 30 V DC/230 V AC

(6ES5 452-8MR11)



Technical specifications

Address designation (for ET 100U only)	4 DO
Outputs	4 relay outputs, contact switching varistor SIOV-S07-K275
Galvanic isolation - in groups of	yes (optocoupler) 1
Continuous current I_{th}	5 A
Relay type	Siemens V 23127-D 0006-A402
Switching capacity of the contacts - resistive load	max. 5 A at 250 V AC 2.5 A at 30 V DC
- inductive load	max. 1.5 A at 250 V AC 0.5 A at 30 V DC
Operating cycle of the contacts according to VDE 0860, part 200 - AC-11	1.5×10^6
- DC-11	0.5×10^6
Switching frequency	max. 10 Hz
Permissible ambient temperature of PLC - horizontal arrangement	0 to 60 °C (32 to 140 °F)
- vertical arrangement	0 to 40 °C (32 to 104 °F)
Length of cable - unshielded	max. 100 m (330 ft.)
Insulation rating	VDE 0160
Rated insulation voltage (+ 9 V to L1) - insulation group - tested with	250 V AC 2 x B 1500 V AC
Rated insulation voltage (+ 9 V to ↓) - insulation group - tested with	12 V AC 1 x B 500 V AC
Rated insulation voltage (between contacts) - insulation group - tested with	250 V AC 2 x B 1500 V AC
Supply voltage L+ (for the relay) - rated value - ripple V_{pp}	max. 24 V DC 3.6 V
- permissible range (ripple included) - value at $t < 0.5$ s	20 to 30 V 35 V
Current consumption - from + 9 V (CPU)	typ. 14 mA
- from L+	typ. 100 mA
Power loss of the module	typ. 2 W
Weight	approx. 240 g (8 oz.)

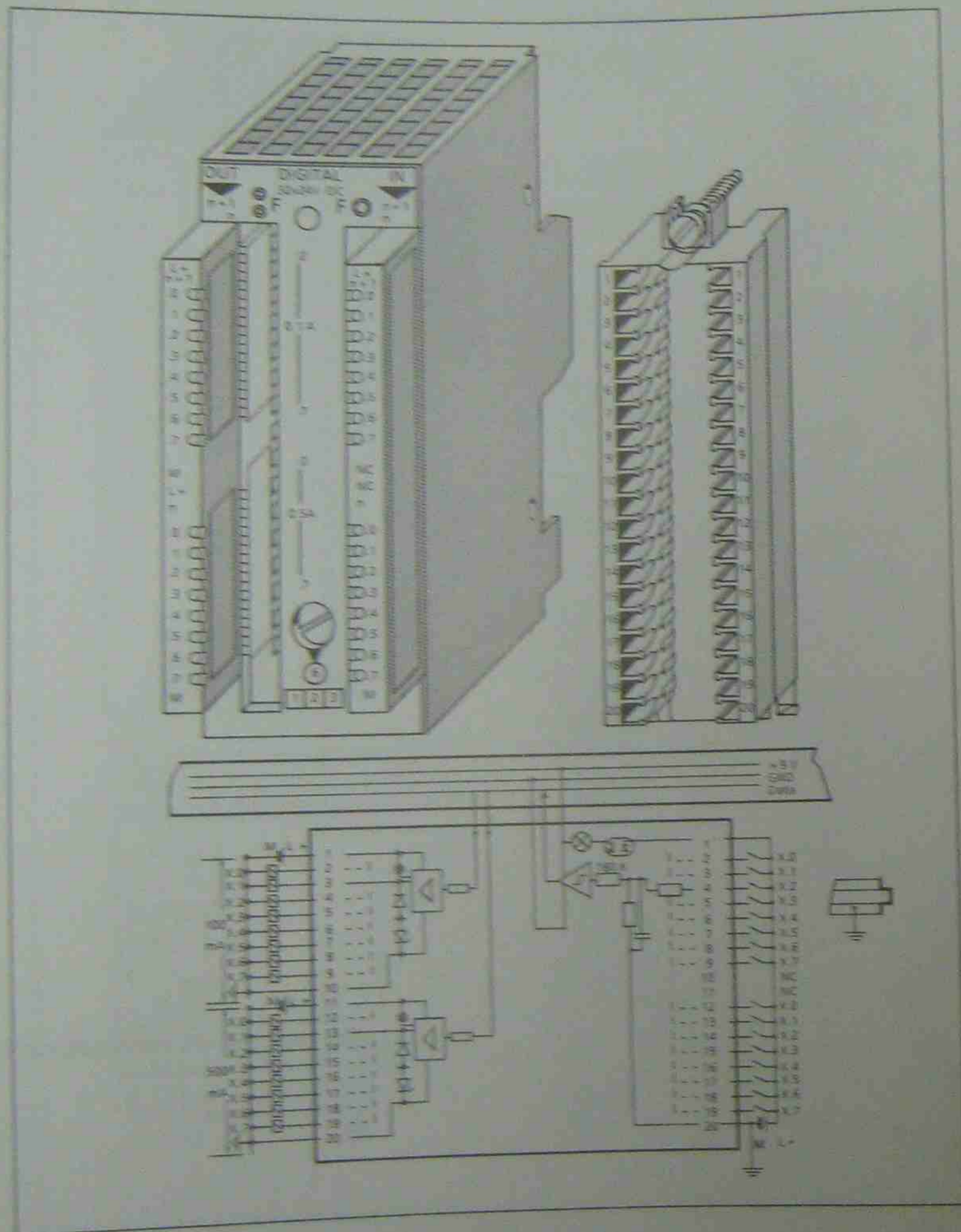


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15.6.3 Digital Input/Output Modules

Digital Input/Output Module with LED Display
 Crimp Snap-in Connector, 40-pin
 Screw Plug Connector, 40-pin

(6ES5 482-8MA12)
 (6ES5 490-8MA12)
 (6ES5 490-8MB11)



Digital Input/Output Module with LED Display (continued)

6ES5 482-8MA12

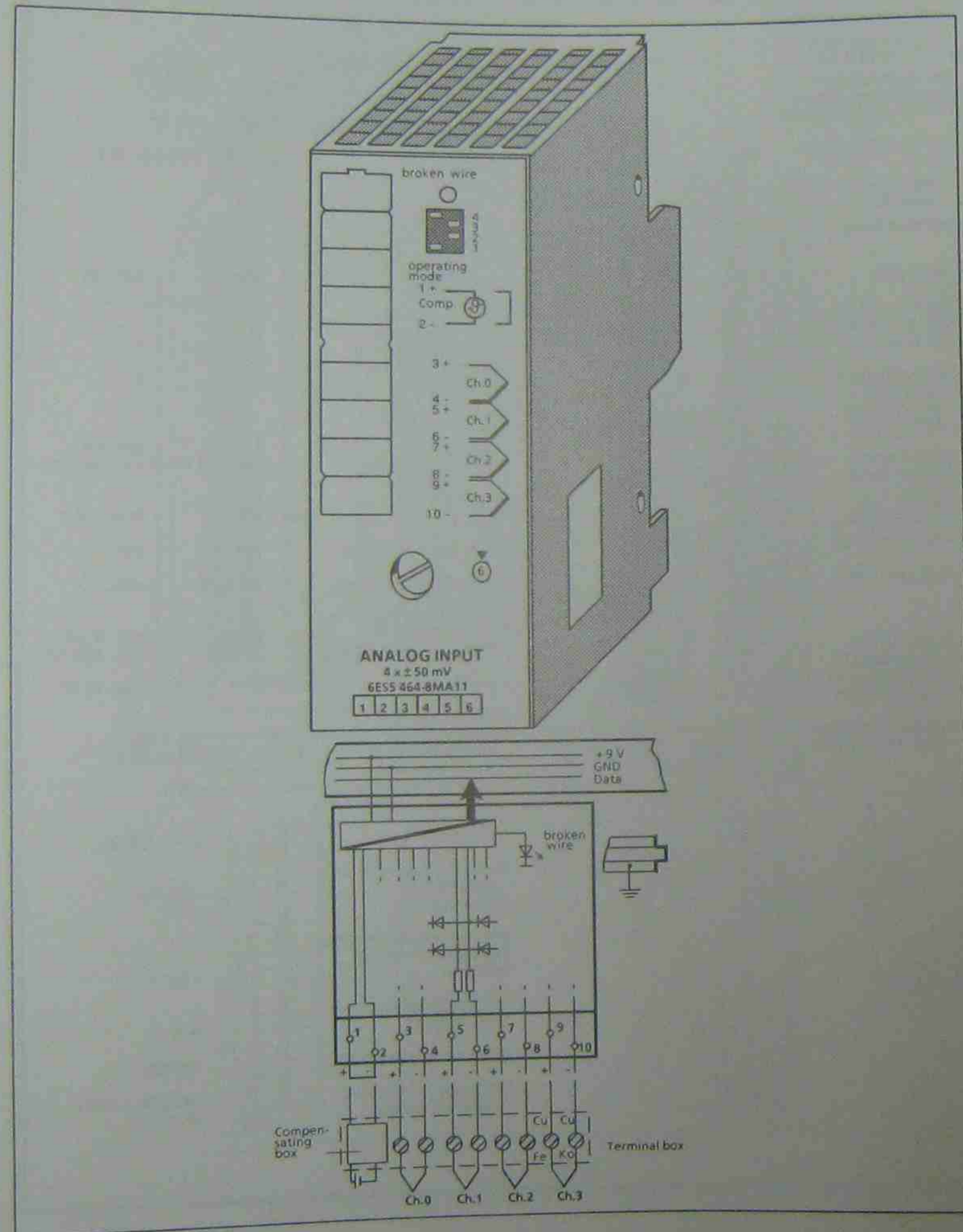
Technical specifications			
Address designation (for ET 100U only)	1 AX	Rated insulation voltage (+9 V to +)	12 V AC 1 x B
Permissible ambient temperature of the unit	- horizontal arrangement	- insulation group	typ. 4.5 W
	- vertical arrangement		approx. 190 g (7 oz.)
Cable length - unshielded	100 m (330 ft.)		
Insulation rating	VDE 0160		
Input side		Output side	
Number of inputs	16	Number of outputs	100 mA 500 mA
Galvanic isolation	no	- pins 2 through 9	8
- in groups of	16	- pins 12 through 19	8
Input voltage L+	24 V DC	Galvanic isolation	no
- rated value	0 to 5 V	- in groups of	8
- for "0" signal	13 to 30 V	Output current I_{out}	100 mA 500 mA
- for "1" signal		with "1" signal	5 to 100 mA 5 to 500 mA
Input current with "1" signal	typ. 4.5 mA	- rated value	
Inherent delay	typ. 4 ms	- permissible range	
- from "0" to "1"	typ. 3 ms	Residual current with "0" signal	max. 0.6 mA max. 1 mA
- from "1" to "0"		Short-circuit protection	yes yes
Fault LED (red)	indicates interruption of L+ / M supply	Short-circuit indication	red LED red LED
Connection of two-wire BERO proximity switches - residual current	possible ≤ 1.5 mA	Current consumption	
Current consumption - from +9 V (CPU)	typ. 50 mA	- from +9 V (CPU)	typ. 5 mA
		- from L+ (without load)	typ. 35 mA
		Lamp load	max. 2 W max. 10 W
		Load voltage L+	24 V DC
		- rated value	20 to 30 V
		- permissible range (in pole included)	35 V
		- value at $t < 0.5$ s	
		Output voltage with "1" signal	L+ (-0.6 V)
		Switching frequency with	
		- resistive load	100 Hz
		- inductive load	2 Hz
		Voltage induced on circuit interruption (internal) limited to	- 15 V
		Permissible total current of the outputs	4 A
		Driving of a digital input	possible
		Paralleling of outputs - maximum current	possible in pairs (0.8 x I_{out})

15.7 Analog Modules

15.7.1 Analog Input Modules

Analog Input Module 4 × ± 50 mV

(6ES5 464-8MA11)



Analog Input Module 4 × ± 50 mV (continued)

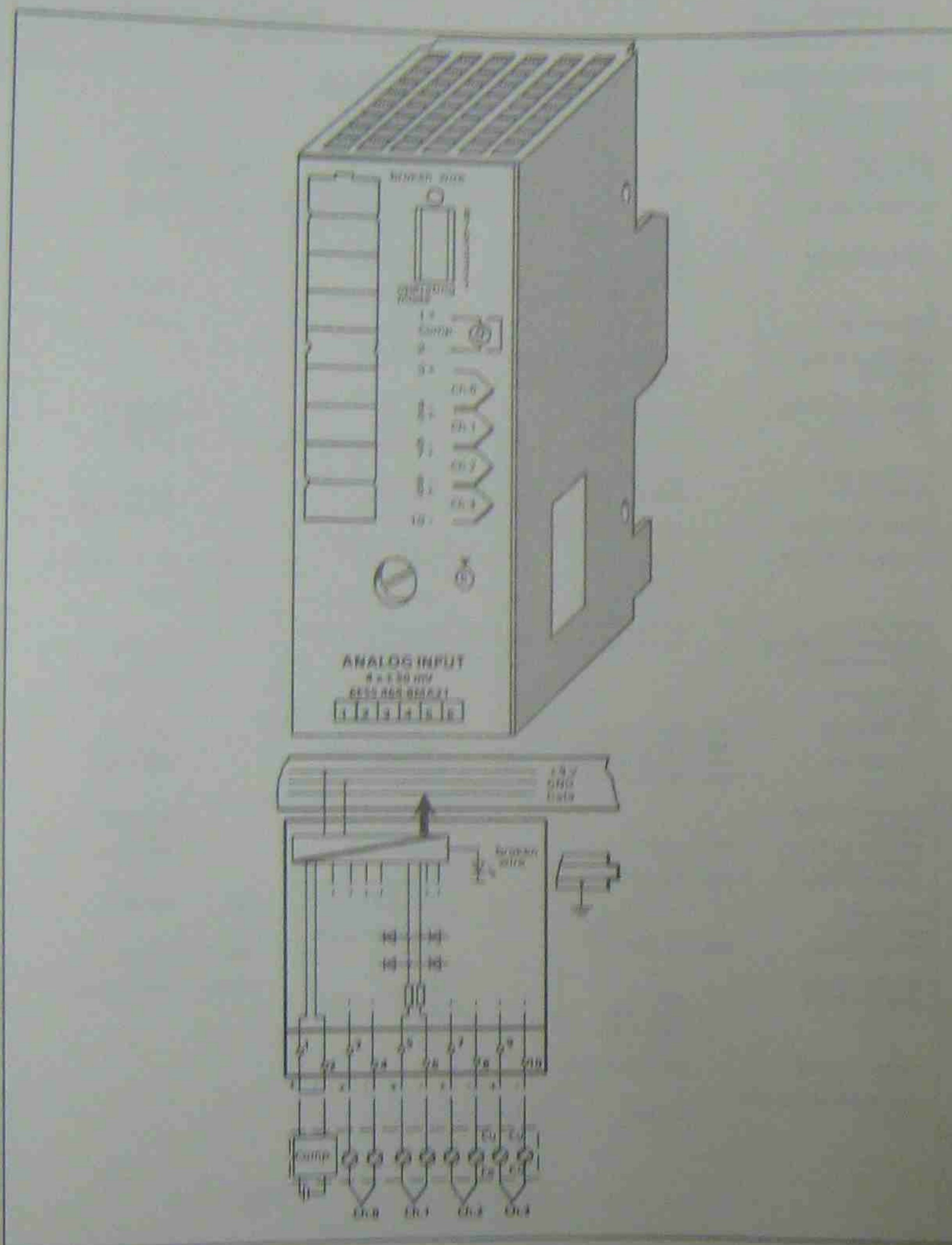
(6ES5 464-8MA11)

Technical specifications

Address designation (for ET 100U only)	4 AI	Noise suppression for $f = nx$ (50/60 Hz ± 1%); $n = 1, 2, \dots$	
Input ranges (rated values)	± 50 V	- common-mode rejection ($V_{pp} = 1$ V)	min. 86 dB
Number of inputs	1, 2 or 4 (selectable)	- series-mode rejection (peak value of noise < rated value of input range)	min. 40 dB
Galvanic isolation	yes (inputs to grounding point; not between inputs)	Basic error limits	± 0.15 %
Input resistance	≥ 10 MΩ	Operational error limits (0 to 60 °C) (32 to 140 °F)	± 0.4 %
Connection method of sensors	two-wire connection	Single errors	
Digital representation of input signal	12 bits + sign (2048 units = rated value)	- linearity	± 0.05 %
Measured value representation	two's complement (left-justified)	- tolerance	± 0.05 %
Measuring principle	integrating	- polarity reversal error	± 0.05 %
Conversion principle	voltage-time conversion (dual slope)	Temperature error	
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 16.6 ms at 60 Hz	- final value	± 0.01 %/K
Encoding time per input		- zero point	± 0.002 %/K
- for 2048 units	max. 60 ms at 50 Hz max. 50 ms at 60 Hz	Length of cable - shielded	max. 50 m (164 ft.)
- for 4095 units	max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	Supply voltage L +	none
Permissible voltage difference		Connection of compensating box	possible
- between inputs	max. ± 1V	Insulation rating	VDE 0160
- between inputs and central ground point	max. 75 V DC/60 V AC	Rated insulation voltage (+9 V to +)	12 V AC 1 × B 500 V AC
Permissible input voltage (destruction limit)	max. 24 V DC	- insulation group - tested with	
Fault indication for - range exceeded	yes (more than 4095 units)	Rated insulation voltage (inputs to +9 V)	60 V AC 1 × B 500 V AC
- sensor wire break	yes (selectable)	- insulation group - tested with	
- general indication of wire break	red LED	Current consumption - from +9 V (CPU)	typ. 70 mA
		Power loss of the module	typ. 0.7 W
		Weight	approx. 230 g (8 oz.)

Analog Input Module 4 x ± 50 mV

(6ES5 464-8MA21)



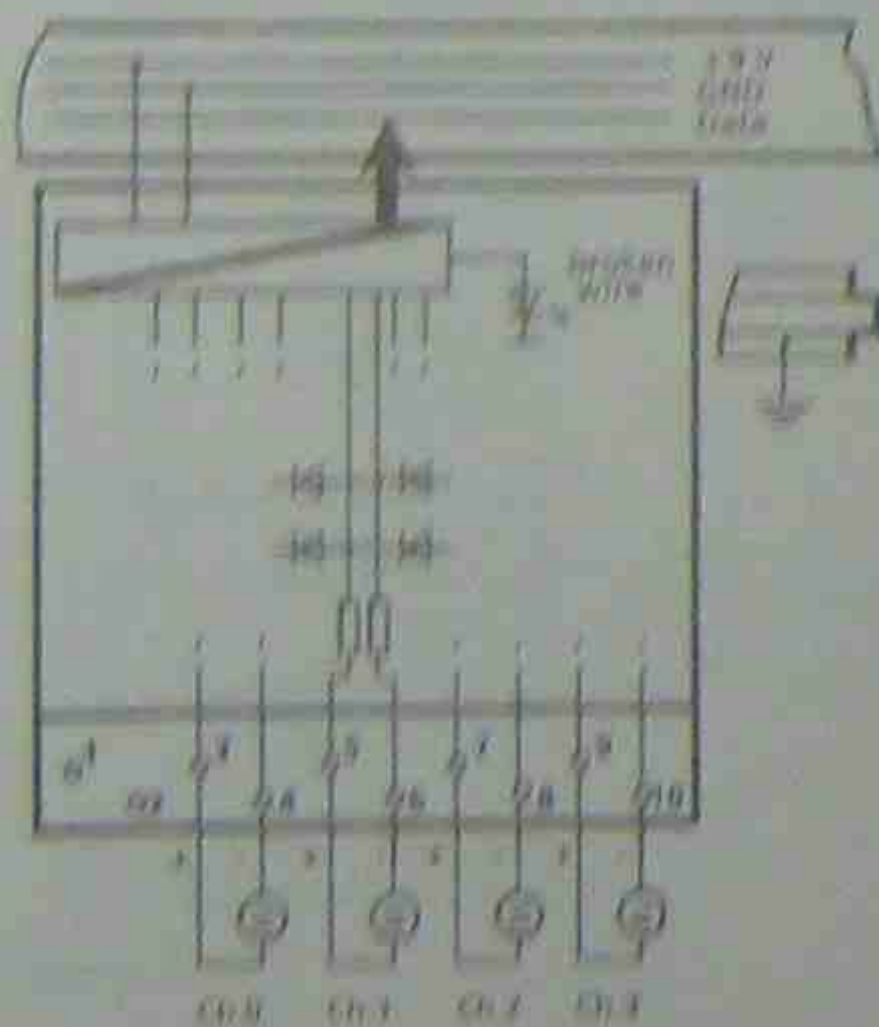
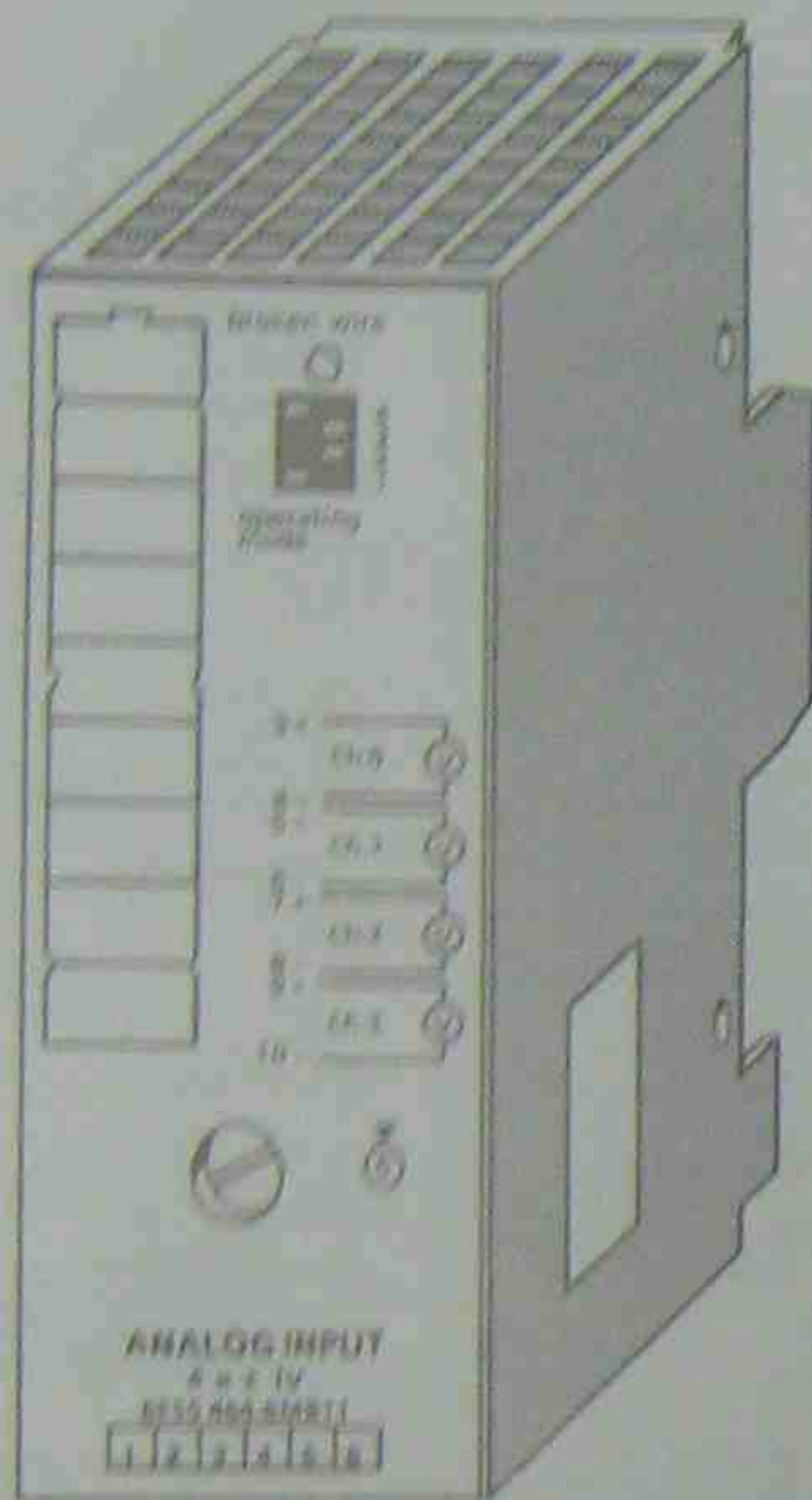
Analog Input Module 4 x ± 50 mV (continued)

(6ES5 464-8MA21)

Technical specifications			
Address designation (for ET 100U only)	4 AI	Noise suppression for $T = n \times (50/55 \text{ Hz} \pm 1\%)$ $n = 1, 2, \dots$	
Input range (rated values)	± 50 mV	common mode rejection ($U_{CM} = 1 \text{ V}$)	min. 86 dB
Number of inputs	1, 2 or 4 (selectable)	single mode rejection (peak value of noise = rated value of input range)	min. 40 dB
Galvanic isolation	yes (inputs to grounding point, not between inputs)	Basic error limits	± 0.15%
Input resistance	≥ 10 MΩ	Operating error limits (0 to 50 °C) (32 to 140 °F)	± 0.4%
Connection method of sensors	two-wire connection	Single errors	
Digital representation of input signal	12 bits + sign (2048 units = rated value)	- linearity	± 0.05%
Measured value representation	two's complement (left-justified)	- tolerance	± 0.05%
Measuring principle	integrating	- polarity reversal error	± 0.05%
Conversion principle	voltage-time conversion (dual slope)	Temperature error	
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 15.6 ms at 60 Hz	- final value	± 0.01 %/K
Encoding time per input		- zero point	± 0.002 %/K
- for 2048 units	max. 60 ms at 50 Hz max. 50 ms at 60 Hz	Linearization exactness for rated range (for types J, K, L)	± 1 °C (1.8 °F)
- for 4095 units	max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	Characteristic linearization for the following thermoelements	
Permissible voltage difference		- Nickel-Chromium/ Nickel-Aluminum (Type K)	IEC 584
- between inputs	max. ± 1 V	- Iron/Copper-Nickel (Type J)	IEC 584
- between inputs and central ground point	max. 75 V DC/60 V AC	- Iron/Copper-Nickel (Type L)	DIN 43710
Permissible input voltage (destruction limit)	max. 24 V DC	Length of cable	
Fault indication for		- shielded	max. 50 m (164 ft.)
- range exceeded	yes (more than 4095 units)	Supply voltage L +	none
- sensor wire break	yes (selectable)	Connection of compensating box	possible
- general indication of wire break	red LED	Insulation rating	VDE 0160
		Rated insulation voltage (+ 9 V to ±)	12 V AC
		- insulation group	1 x B
		- tested with	500 V DC
		Rated insulation voltage (inputs to + 9 V)	60 V AC
		- insulation group	1 x B
		- tested with	500 V AC
		Current consumption - from + 9 V (CPU)	typ. 100 mA
		Power loss of the module	typ. 0.7 W
		Weight	approx. 230 g (8.1 oz.)

Analog Input Module 4 x ± 1 V

(6ES5 464-8MB11)



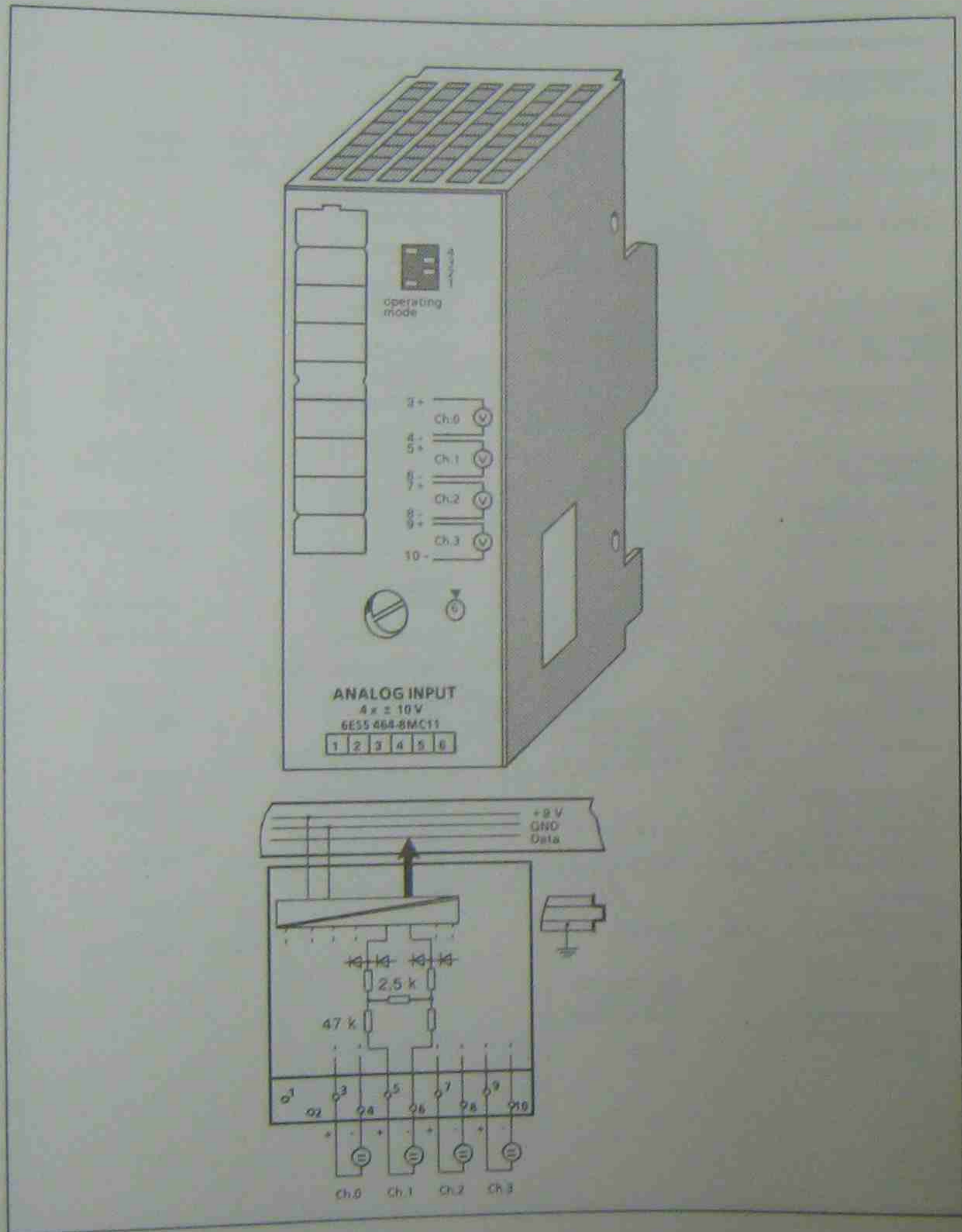
Analog Input Module 4 x ± 1 V (continued)

(6ES5 464-8MB11)

Technical specifications			
Address designation (for ET 100U only)	4 AI	Noise suppression for 1 = n (50/60 Hz ± 1%; n = 1, 2, ...)	
Input ranges (rated values)	± 1 V	- common-mode rejection ($V_{pp} = 1 V$)	min. 86 dB
Number of inputs	1, 2 or 4 (selectable)	- sense-mode rejection (typical value of noise < rated value of input ranges)	min. 40 dB
Galvanic isolation	yes (inputs to grounding point; not between inputs)	Basic error limits	± 0.1 %
Input resistance	≥ 10 MΩ	Operational error limits (0 to 60 °C) (32 to 140 °F)	± 0.35 %
Connection method of sensors	two-wire connection	Scale errors	
Digital representation of input signal	12 bits + sign (2048 units = rated value)	- linearity	± 0.05 %
Measured value representation	two's complement (left-justified)	- tolerance	± 0.05 %
Measuring principle	integrating	- polarity reversal error	± 0.05 %
Conversion principle	voltage-time conversion (dual slope)	Temperature error	
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 16.6 ms at 60 Hz	- final value	± 0.01 %/K
Encoding time per input		- zero point	± 0.002 %/K
- for 2048 units	max. 60 ms at 50 Hz max. 50 ms at 60 Hz	Length of cable	
- for 4095 units	max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	- shielded	max. 200 m (660 ft.)
Permissible voltage difference		Supply voltage L+	none
- between inputs	max. ± 1 V	Connection of compensating box	not possible
- between inputs and central ground point	max. 75 V DC/60 V AC	Insulation rating	VDE 0160
Permissible input voltage (destruction limit)	max. 24 V DC	Rated insulation voltage (+9 V to +)	
Fault indication for		- insulation group	1 × B
- range exceeded	yes (more than 4095 units)	- tested with	500 V AC
- sensor wire break	yes (selectable)	Rated insulation voltage (inputs to +9 V)	
- general indication of wire break	red LED	- insulation group	1 × B
		- tested with	500 V AC
		Current consumption (from +9 V (CPU))	typ. 70 mA
		Power loss of the module	typ. 0.7 W
		Weight	approx. 230 g (8 oz.)

Analog Input Module 4 x ± 10 V

(6ES5 464-8MC11)



Analog Input Module 4 x ± 10 V (continued)

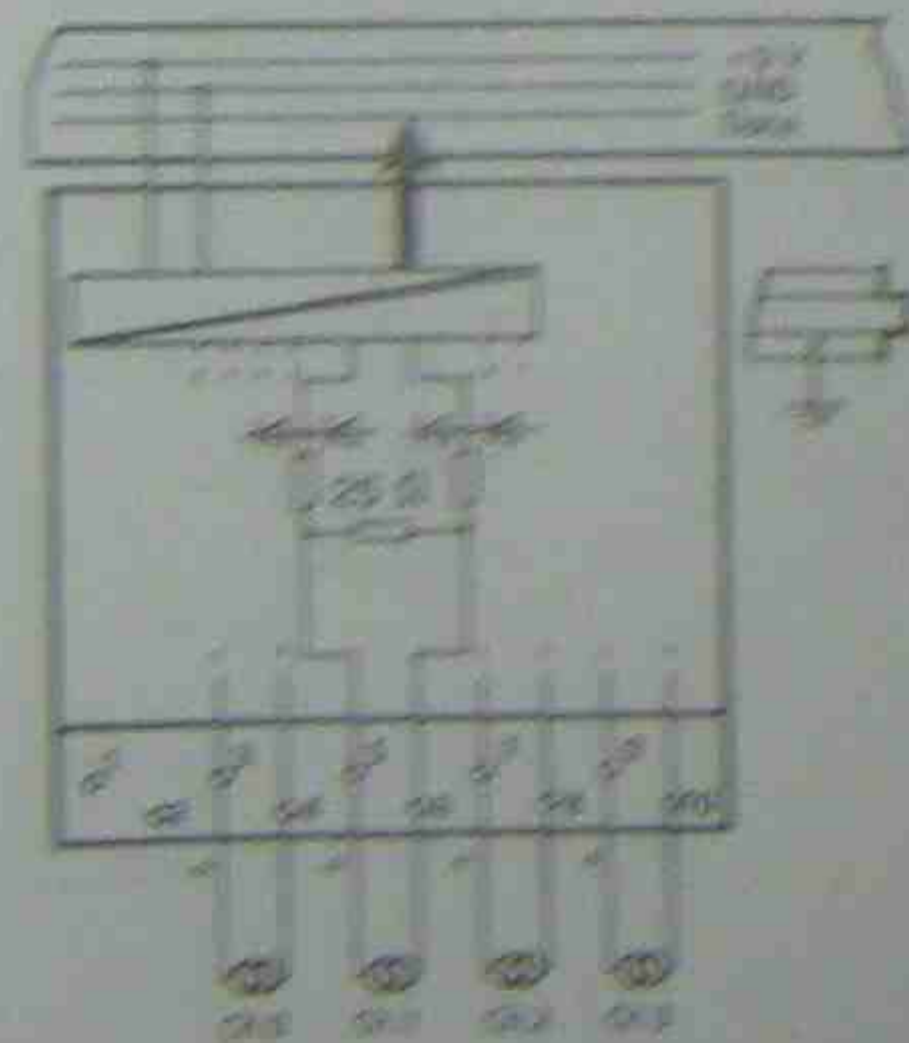
(6ES5 464-8MC11)

Technical specifications

Address designation (for ET 100U only)	4 AI	Noise suppression for $f = n \times (50/60 \text{ Hz} \pm 1\%)$; $n = 1, 2, \dots$	min.	85 dB
Input ranges (rated values)	± 10 V	- common-mode rejection ($V_{pp} = 1 \text{ V}$)	min.	40 dB
Number of inputs	1, 2 or 4 (selectable)	- series-mode rejection (peak value of noise < rated value of input range)		
Galvanic isolation	yes (inputs to grounding point; not between inputs)	Basic error limits		± 0.2 %
Input resistance	≥ 50 kΩ	Operational error limits (0 to 50 °C) (32 to 140 °F)		± 0.45 %
Connection method of sensors	two-wire connection	Single errors		
Digital representation of input signal	12 bits + sign (2048 units = rated value)	- linearity		± 0.05 %
Measured value representation	two's complement (left-justified)	- tolerance		± 0.05 %
Measuring principle	integrating	- polarity reversal error		± 0.05 %
Conversion principle	voltage-time conversion (dual slope)	Temperature error		
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 16.6 ms at 60 Hz	- final value		± 0.01 %/K
Encoding time per input		- zero point		± 0.002 %/K
- for 2048 units	max. 60 ms at 50 Hz max. 50 ms at 60 Hz	Length of cable		
- for 4095 units	max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	- shielded	max.	200 m (660 ft.)
Permissible voltage difference		Supply voltage L+		none
- between inputs	max. ± 1 V	Connection of compensating box		not possible
- between inputs and central ground point	max. 75 V DC/60 V AC	Insulation rating		VDE 0160
Permissible input voltage (destruction limit)	max. 50 V DC	Rated insulation voltage (+9 V to +)		12 V AC
Fault indication for		- insulation group		1 × B
- range exceeded	yes (more than 4095 units)	- tested with		500 V AC
- sensor wire break	no	Rated insulation voltage (inputs to +9 V)		60 V AC
- general indication of wire break	no	- insulation group		1 × B
		- tested with		500 V AC
		Current consumption		
		- from +9 V (CPU)	typ.	70 mA
		Power loss of the module	typ.	0.7 W
		Weight	approx.	230 g (8 oz.)

Analog Input Module 4 x ± 20 mA

(BES5 464-8MD11)



Analog Input Module 4 x ± 20 mA (continued)

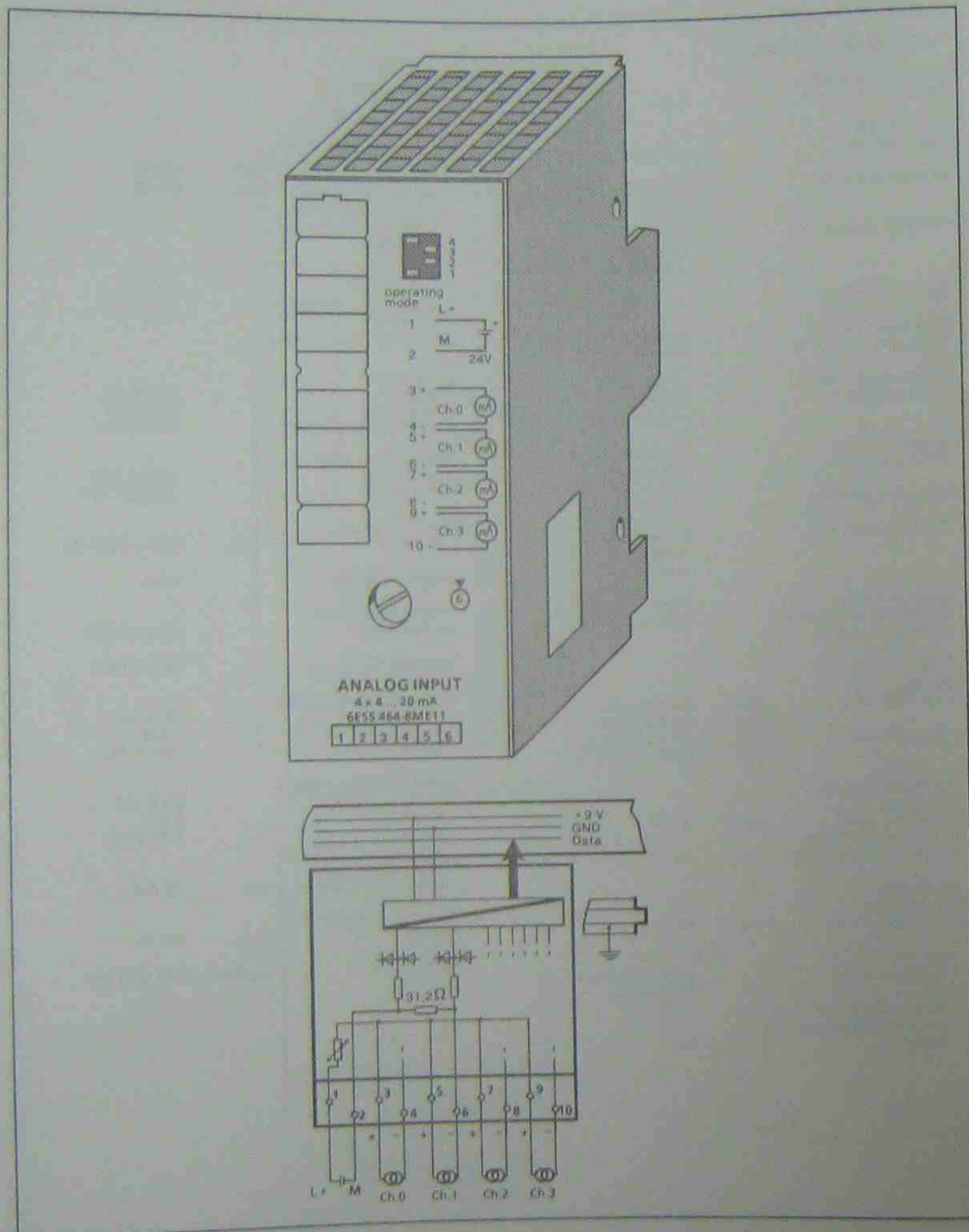
(BES5 464-8MD11)

Technical specifications

Address designation (for ET 100U only)	4 A	Noise suppression for 1 mA	SS/95 mA ± 1%	min.	60 dB
Input ranges (rated values)	± 20 mA	series-mode rejection (1 mA ± 1%)	min.	40 dB	
Number of inputs	1, 2 or 4 (selectable)	series-mode rejection (peak value of noise < rated value of input range)	min.	40 dB	
Galvanic isolation	yes (inputs or grounding point not between inputs)	Base error limits		± 0.2 %	
Input resistance	≥ 25 kΩ	Operational error limits (0 to 50 °C)		± 0.40 %	
Connection method of sensors	two-wire connection	Operational error limits (22 to 140 °F)		± 0.40 %	
Signal representation of input signal	12-bit + sign (2048 units, < rated value)	Single errors		± 0.05 %	
Measured value representation	two's complement (left-justified)	linearity		± 0.05 %	
Measuring principle	integrating	hysteresis		± 0.05 %	
Conversion principle	voltage-line conversion (stair steps)	saturny reversed error		± 0.05 %	
Integrator time (adjustable for optimum noise suppression)	20 ms at 50 Hz 10.8 ms at 60 Hz	Temperature error		± 0.01 %/K	
Exciting time per input		zero point		± 0.002 %/K	
- for 2048 units	max. 90 ms at 50 Hz	Length of cable (shielded)	max.	200 m (660 ft.)	
- for 4096 units	max. 180 ms at 50 Hz	Supply voltage U ₊		none	
	max. 360 ms at 60 Hz	Connection of compensating line		not possible	
Permissible voltage difference		Insulation rating		ULTE 1150	
- between inputs	max. ± 1 V	Rated insulation voltage (-5 V to +)		12 V AC	
- between inputs and central ground point	max. 75 V DC/60 V AC	- insulation group		1 × 3	
Permissible input voltage (construction limit)	max. 60 mA	- tested with		300 V AC	
Fault indication for		Rated insulation voltage (input to +5 V)		60 V AC	
- range exceeded	yes (more than 4096 units)	- insulation group		1 × 3	
- sensor wire break	no	- tested with		300 V AC	
- general indication of wire break	no	Current consumption (from +5 V (CPU))	typ.	75 mA	
		Power loss of the module	typ.	3.7 W	
		Weight	approx.	230 g (8 oz.)	

Analog Input Module 4 x ± 4 to 20 mA

(6ES5 464-8ME11)



Analog Input Module 4 x ± 4 to 20 mA (continued)

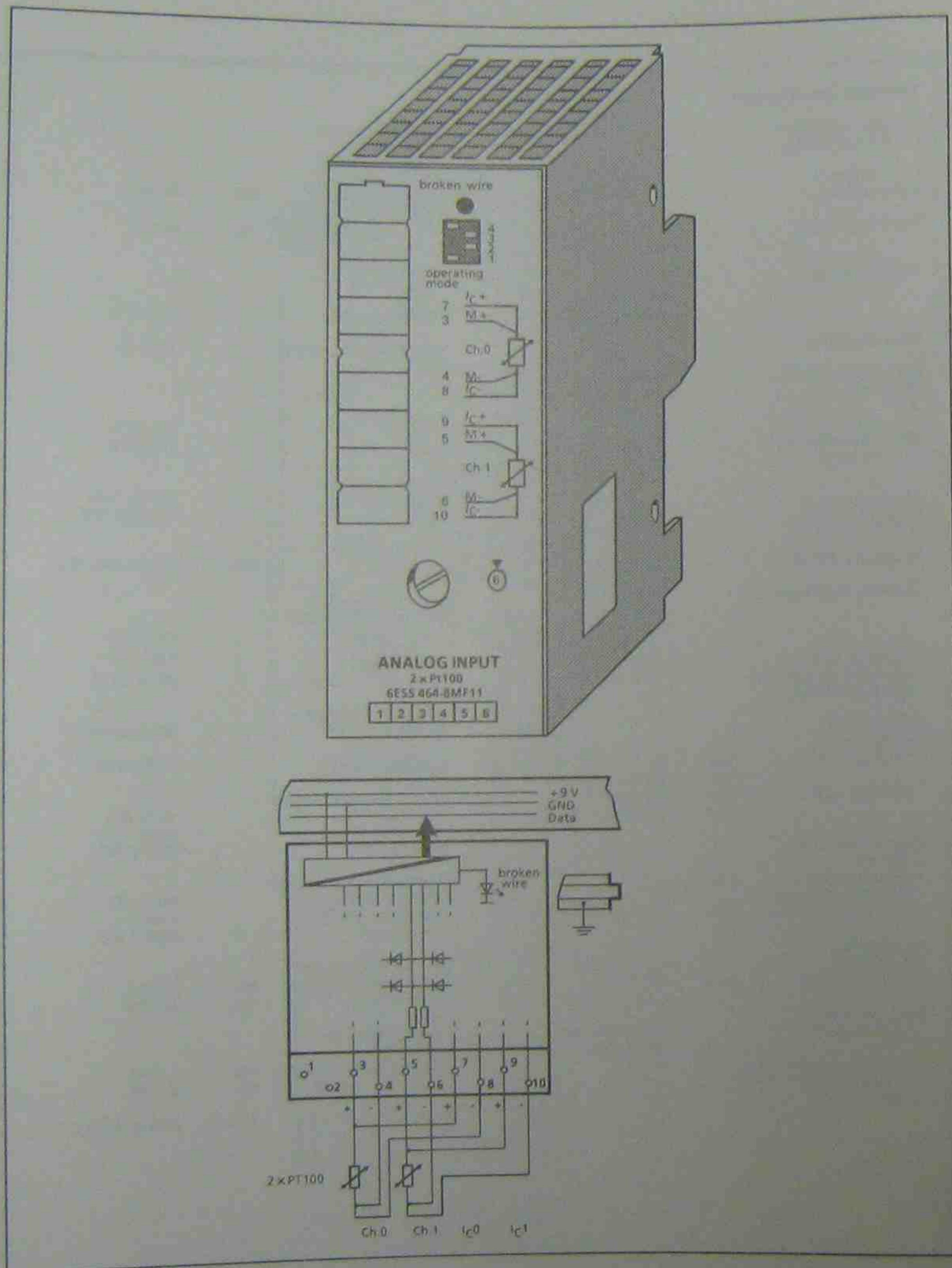
(6ES5 464-8ME11)

Technical specifications

Address designation (for ET 100U only)	4 AI	Noise suppression for 1 = nx (50/60 Hz ± 1%); n = 1, 2, ...	min.	86 dB
Input ranges (rated values)	± 4 to 20 mA	- common-mode rejection (V _{pp} = 1 V)	min.	40 dB
Number of inputs	1, 2 or 4 (selectable)	- series-mode rejection (peak value of noise < rated value of input range)		
Galvanic isolation	yes (inputs to grounding point; not between inputs)	Basic error limits		± 0.15 %
Input resistance	≥ 31.25 kΩ	Operational error limits (0 to 60 °C) (32 to 140 °F)		± 0.4 %
Connection method of sensors	two-wire connection for 2/4 wire transducers	Single errors		
Digital representation of input signal	12 bits + sign (2048 units = rated value)	- linearity		± 0.05 %
Measured value representation	two's complement (left-justified)	- tolerance		± 0.05 %
Measuring principle	integrating	Temperature error		
Conversion principle	voltage-time conversion (dual slope)	- final value		± 0.01 %/K
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 16.6 ms at 60 Hz	- zero point		± 0.002 %/K
Encoding time per input		Length of cable - shielded	max.	200 m (660 ft.)
- for 2048 units	max. 60 ms at 50 Hz	Supply voltage L+ for 2-wire transducers		
- for 4095 units	max. 50 ms at 60 Hz max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	- rated value		24 V DC
Permissible voltage difference		- ripple V _{pp}		3.6 V
- between inputs	max. ± 1 V	- permissible range		20 to 30 V
- between inputs and central ground point	max. 75 V DC/60 V AC	Connection of compensating box		not possible
Permissible input voltage (destruction limit)	max. 80 mA	Insulation rating		VDE 0160
Fault indication for - range exceeded	yes (more than 4095 units) no	Rated insulation voltage (+9 V to +)		12 V AC 1 × B 500 V AC
- sensor wire break	no	- insulation group		
- general indication of wire break	no	- tested with		
		Rated insulation voltage (inputs to +9 V)		60 V AC 1 × B 500 V AC
		- insulation group		
		- tested with		
		Current consumption		
		- from +9 V (CPU)	typ.	70 mA
		- from L+	typ.	80 mA
		Power loss of the module		
		- for 2-wire transducers	typ.	1.0 W
		- for 4-wire transducers	typ.	0.7 W
		Weight	approx.	230 g (8 oz.)

Analog Input Module 2xPT 100/ ± 500 mV

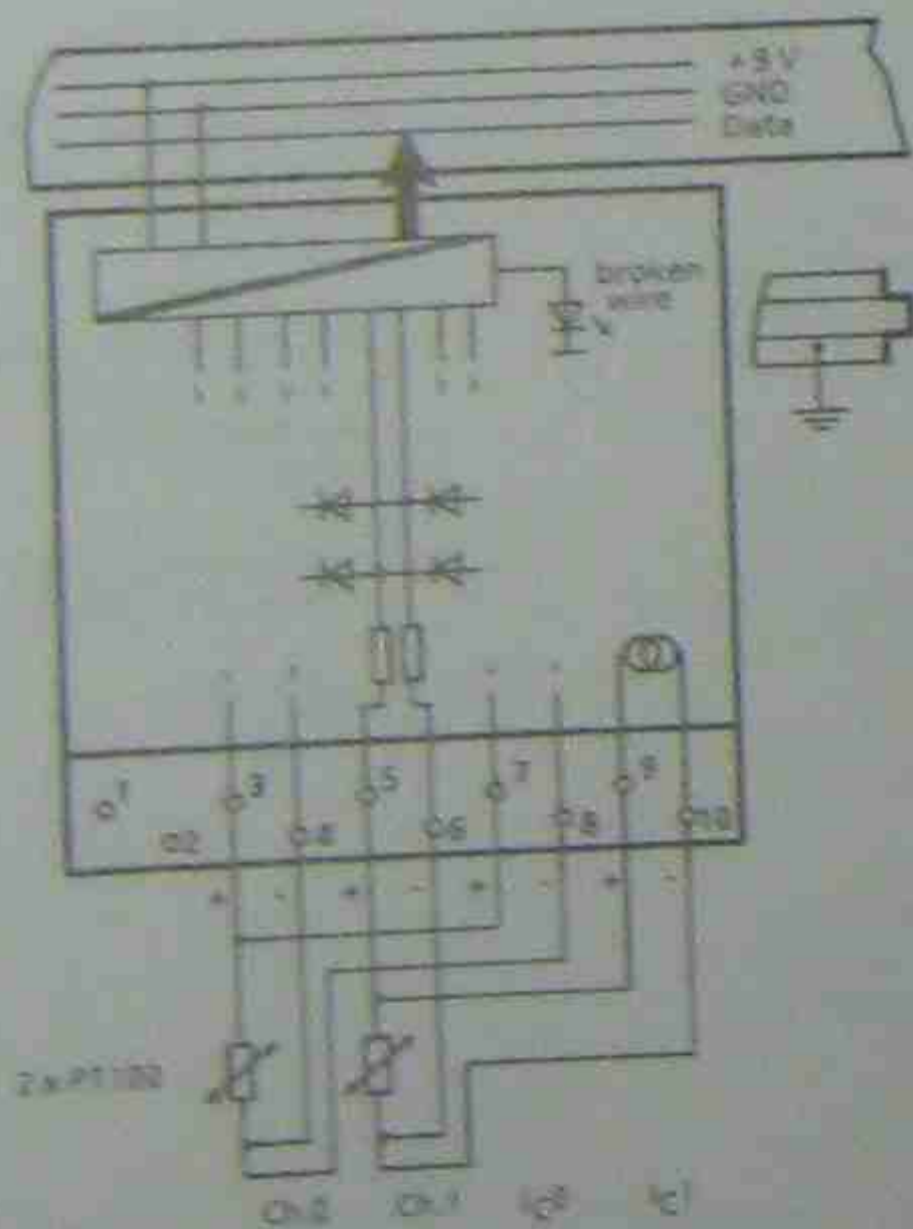
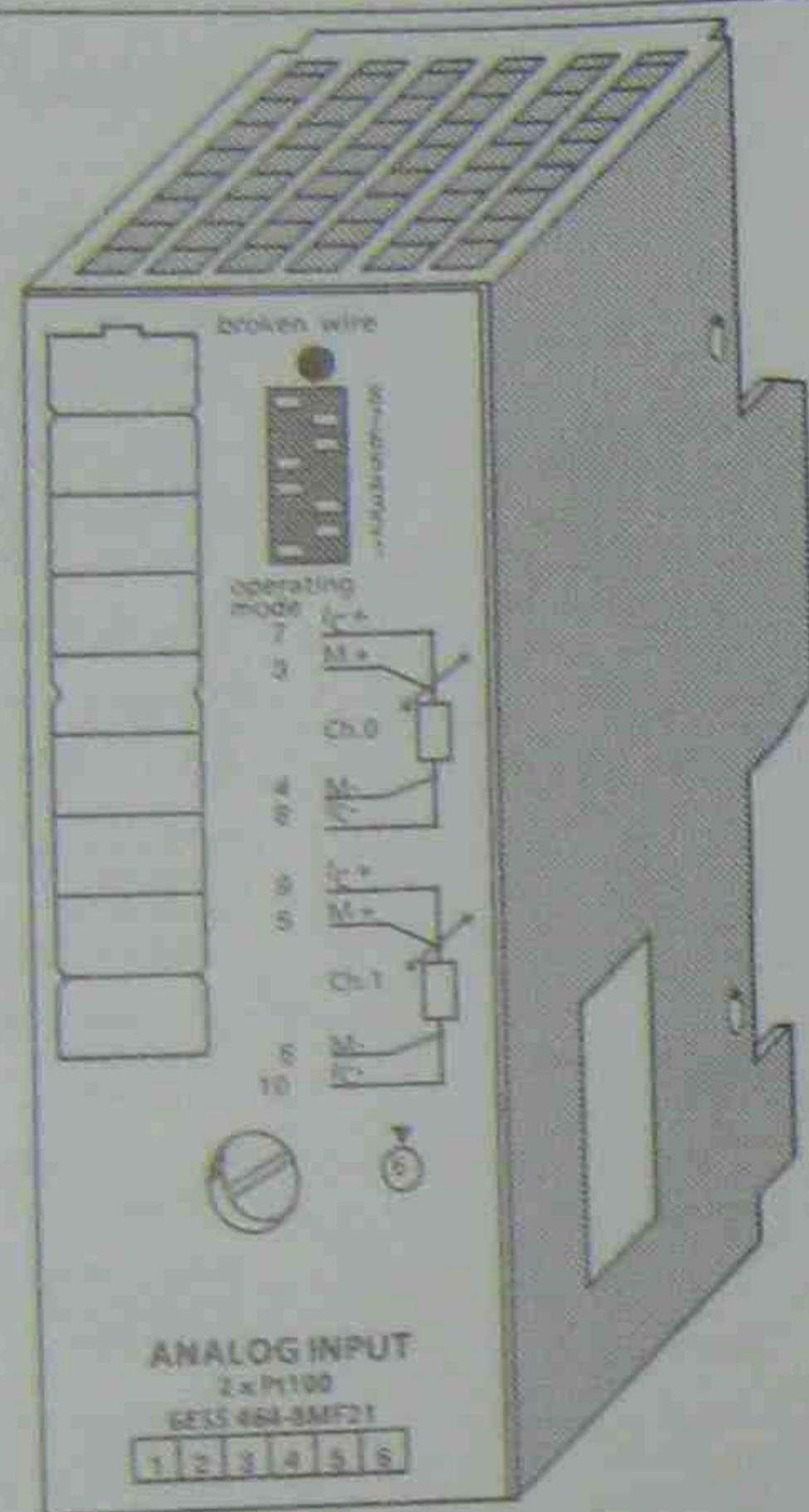
(6ES5 464-8MF11)



Analog Input Module 2xPT 100/ ± 500 mV (continued)

(6ES5 464-8MF11)

Technical specifications			
Address designation (for ET 100U only)	2 AI	Noise suppression for $f = n \times (50/60 \text{ Hz} \pm 1\%)$ $n = 1, 2, \dots$	
Input range (rated values)		- common mode rejection ($V_{pp} = 1 \text{ V}$)	min. 86 dB
- resistance sensor (PT 100)	0 to 200 Ω (max. 400 Ω) $\pm 500 \text{ mV}$	- series mode rejection (peak value of noise < rated value of input range)	min. 40 dB
- voltage sources		Basic error limits	$\pm 0.15\%$
Number of inputs	1 or 2 (selectable)	Operating error limits (0 to 60 °C) (32 to 140 °F)	$\pm 0.4\%$
Galvanic isolation	yes (inputs to grounding point, not between inputs)	Single errors	
Input resistance	$\geq 10 \text{ M}\Omega$	- linearity	$\pm 0.05\%$
Connection method of sensors	two or four-wire connection	- tolerance	$\pm 0.05\%$
Digital representation of input signal	12 bits + sign (2048 units = rated value)	- polarity reversal error	$\pm 0.05\%$
Measured value representation	two's complement (left-justified)	Temperature error	
Measuring principle	integrating	- final value	$\pm 0.01\%/K$
Conversion principle	voltage-time conversion (dual slope)	- zero point	$\pm 0.002\%/K$
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 16.6 ms at 60 Hz	Length of cable - shielded	max. 200 m (660 ft.)
Encoding time per input		Supply voltage L+ Auxiliary current for PT 100	none 2.5 mA
- for 2048 units	max. 60 ms at 50 Hz max. 50 ms at 60 Hz	Resistance sensor	
- for 4095 units	max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	- tolerance	$\pm 0.05\%$
Permissible voltage difference		- temperature error	$\pm 0.006\%/K$
- between inputs	max. $\pm 1 \text{ V}$	- load dependency	$\pm 0.02\%/100 \Omega$
- between inputs and central ground point	max. 75 V DC/60 V AC	Insulation rating	VDE 0160
Permissible input voltage (destruction limit)	max. 24 V DC	Rated insulation voltage (+9 V to \downarrow)	12 V AC
Fault indication for		- insulation group	1 x B
- range exceeded	yes (more than 4095 units)	- tested with	500 V AC
- sensor wire break	yes (selectable)	Rated insulation voltage (inputs to +9 V)	60 V AC
- general indication of wire break	red LED	- insulation group	1 x B
		- tested with	500 V AC
		Current consumption - from +9 V (CPU)	typ. 70 mA
		Power loss of the module	typ. 0.9 W
		Weight	approx. 230 g (8 oz.)

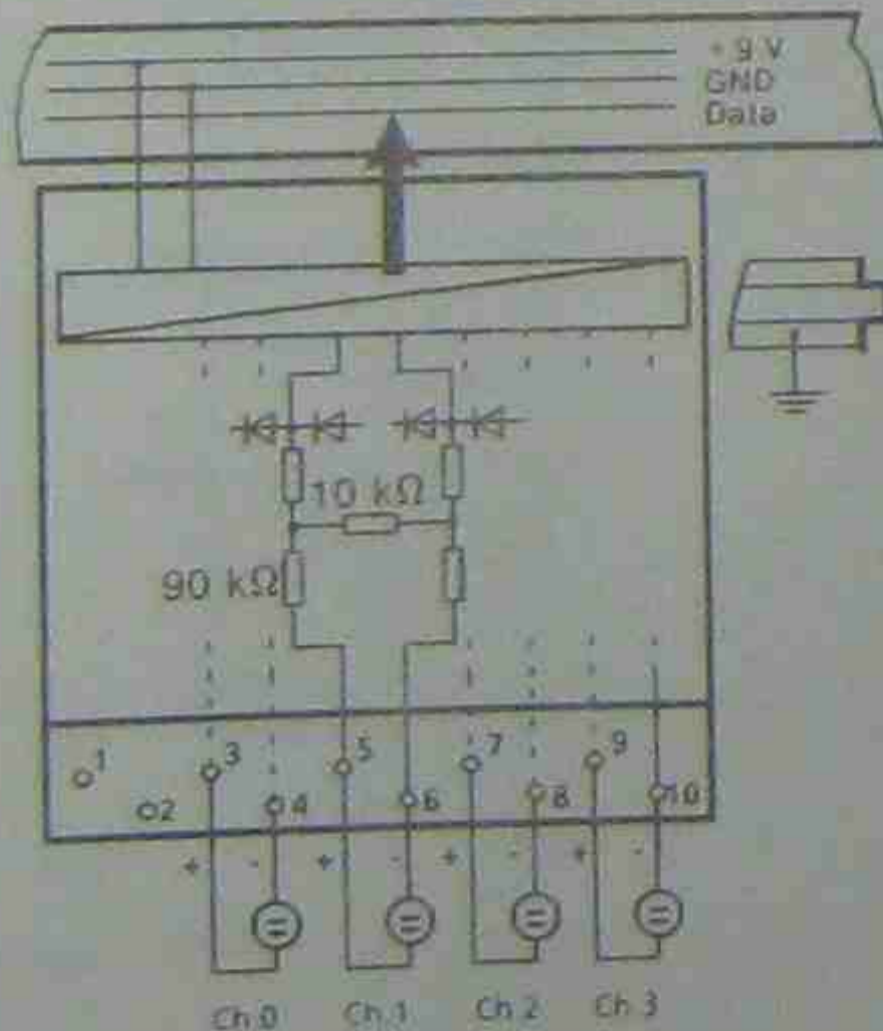
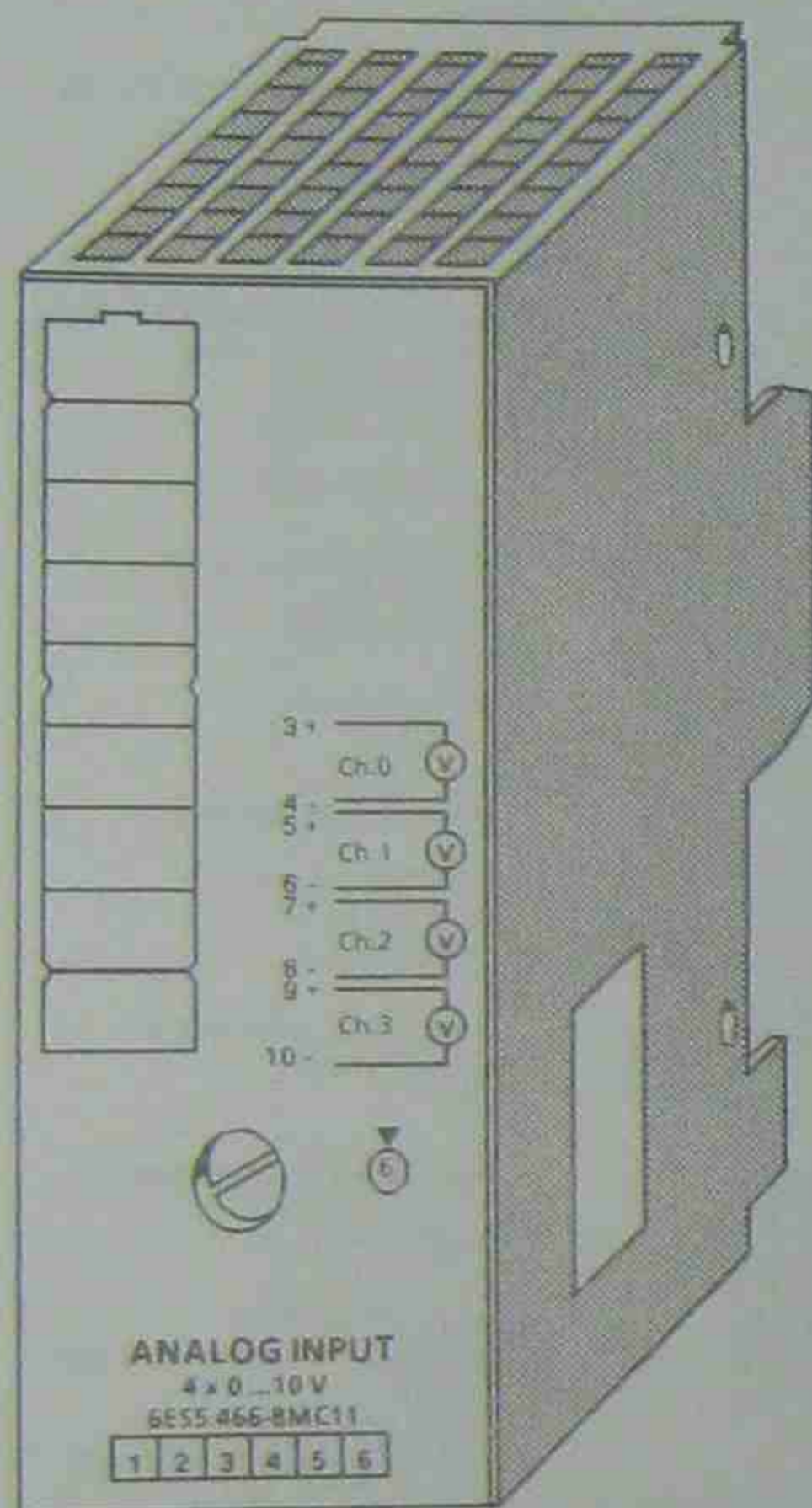


Technical specifications

Address designation (for ET 100U only)	2 AI	Noise suppression for $f = n\omega$ (50/60 Hz $\pm 1\%$): $n = 1, 2, \dots$ - common mode rejection ($V_{pp} = 1 V$)	min. 86 dB
Input range (rated values)	0 to 200 Ω (max. 400/ $\pm 500 \Omega$)	- series-mode rejection (peak value of noise < rated value of input range)	min. 40 dB
- resistance sensor (PT 100)			
- voltage source			
Number of inputs	1 or 2 (selectable)	Basic error limits	$\pm 0.15\%$
Galvanic isolation	yes (inputs to grounding point; not between inputs)	Operational error limits (0 to 60 °C) (32 to 140 °F)	$\pm 0.4\%$
Input resistance	$\geq 10 M\Omega$	Single errors - linearity - tolerance - polarity reversal error	$\pm 0.05\%$ $\pm 0.05\%$ $\pm 0.05\%$
Connection method of sensors	two- or four-wire connection	Temperature error - final value - zero point	$\pm 0.01\%/K$ $\pm 0.002\%/K$
Digital representation of input signal	12 bits + sign (2048 units = rated value)	Linearization exactness in rated range	$\pm 0.5\text{ }^\circ C$ (0.9 °F)
Measured value representation	two's complement (left-justified)	Characteristic linearization of PT 100-characteristic curve	DIN IEC 751
Measuring principle	integrating	Length of cable - shielded	max. 200 m (660 ft.)
Conversion principle	voltage-time conversion (dual slope)	Supply voltage L + Auxiliary current for PT 100	none 2.5 mA
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz 16.6 ms at 60 Hz	Resistance-type sensor - tolerance - temperature error - influence of load variation	$\pm 0.05\%$ $\pm 0.006\%/K$ $\pm 0.02\%/100 \Omega$
Encoding time per input	max. 60 ms at 50 Hz max. 50 ms at 60 Hz	Insulation rating	VDE 0160
- for 2048 units	max. 80 ms at 50 Hz max. 66.6 ms at 60 Hz	Rated insulation voltage (+9 V to +) - insulation group - tested with	12 V AC 1 x B 500 V AC
- for 4095 units		Rated insulation voltage (inputs to +9V) - insulation group - tested with	60 V AC 1 x B 500 V AC
Permissible voltage difference - between inputs - between inputs and central ground point	max. $\pm 1 V$ max. 75 V DC/60 V AC	Current consumption - from +9 V (CPU)	typ. 100 mA
Permissible input voltage (destruction limit)	max. 24 V DC	Power loss of the module	typ. 0.9 W
Fault indication for - range exceeded	yes (more than 4095 units)	Weight	approx. 230 g (8 oz.)
- sensor wire break	yes (selectable)		
- general indication of wire break	red LED		

Analog Input Module 4 x +0 to 10 V

(6ES5 466-8MC11)



Analog Input Module 4 x +0 to 10 V (continued)

(6ES5 466-8MC11)

Technical specifications

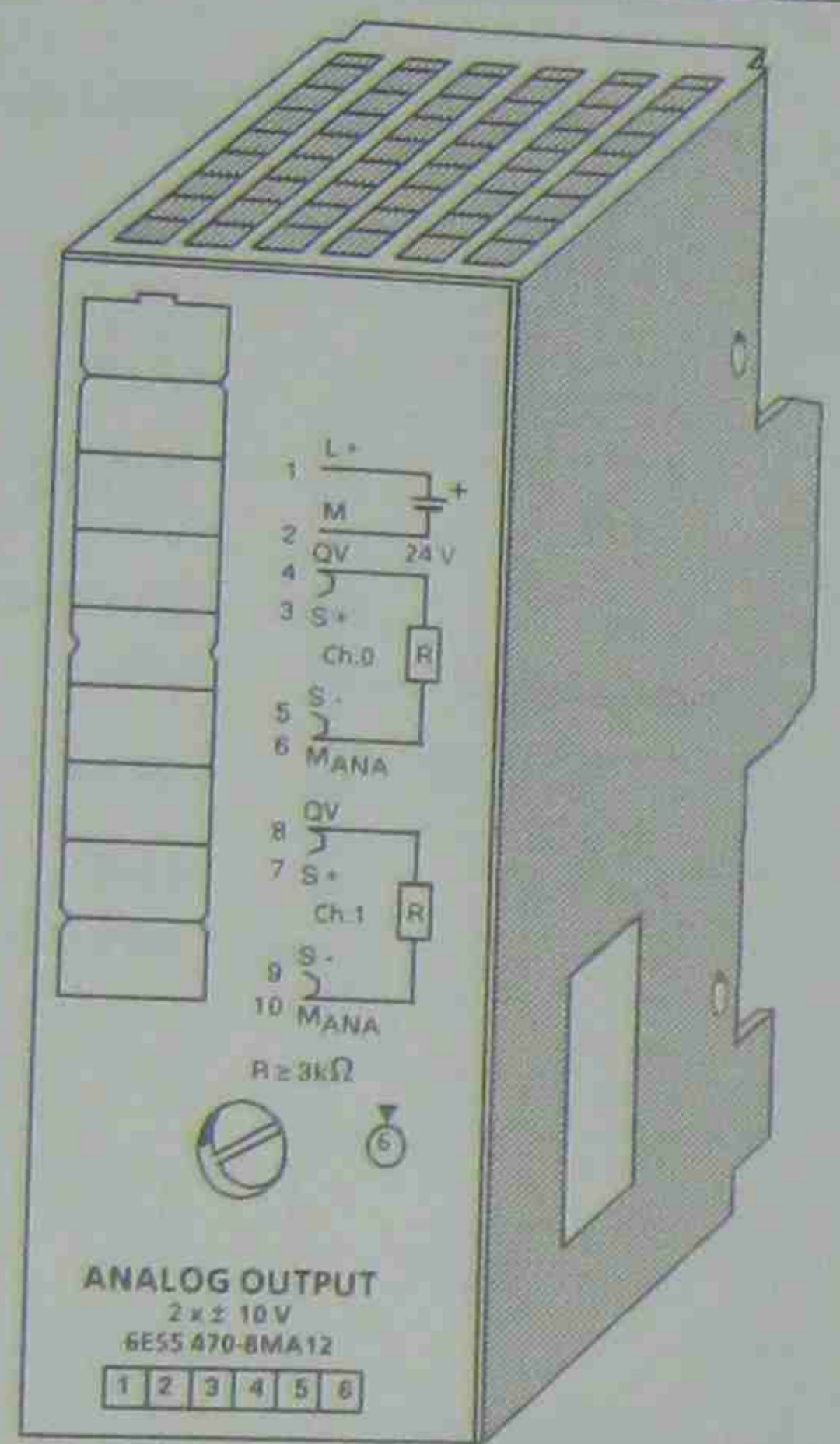
Address designation (for ET 100U only)	4 AI	Basic error limits	±0.4%
Input ranges (rated values)	+0 to 10 V	Operational error limits (0 to 60 °C) (32 to 140 °F)	±0.6%
Number of inputs	4	Single errors - linearity	±0.1%
Galvanic isolation	no	- tolerance	±0.1%
Input resistance	100 kΩ	Temperature error - final value	±0.01% K
Connection for the signal sensor	2-wire connection	- zero point	±0.01% K
Digital representation of the input signal	8 bits (256 units = rated value)	Length of cable - shielded	max. 200 m (660 ft.)
Representation of the measured value	binary *	Supply voltage L +	none
Measuring principle	successive approximation	Current consumption - from + 9 V (CPU)	typ. 100 mA
Conversion time	100 μs	Power loss of the module	typ. 0.9 W
Encoding time per input	5 ms	Weight	approx. 200 g (7 oz.)
Permissible voltage difference - between inputs	max. ±1 V		
Permissible input voltage (destruction limit)	max. 60 V DC		
Fault indication for - range exceeded	no		
- sensor wire break	no		
- general indication of wirebreak	no		
Noise suppression - common mode interference (V _{pp} = 1 V) min.	86 dB		

Units	Input voltage in V	Bit							
		7 2 ⁷	6 2 ⁶	5 2 ⁵	4 2 ⁴	3 2 ³	2 2 ²	1 2 ¹	0 2 ⁰
255	9.961	1	1	1	1	1	1	1	1
254	9.922	1	1	1	1	1	1	1	0
192	7.500	1	1	0	0	0	0	0	0
191	7.461	1	0	1	1	1	1	1	1
128	5.000	1	0	0	0	0	0	0	0
127	4.961	0	1	1	1	1	1	1	1
64	2.500	0	1	0	0	0	0	0	0
63	2.461	0	0	1	1	1	1	1	1
1	0.039	0	0	0	0	0	0	0	1
0	0.000	0	0	0	0	0	0	0	0

15.7.2 Analog Output Modules

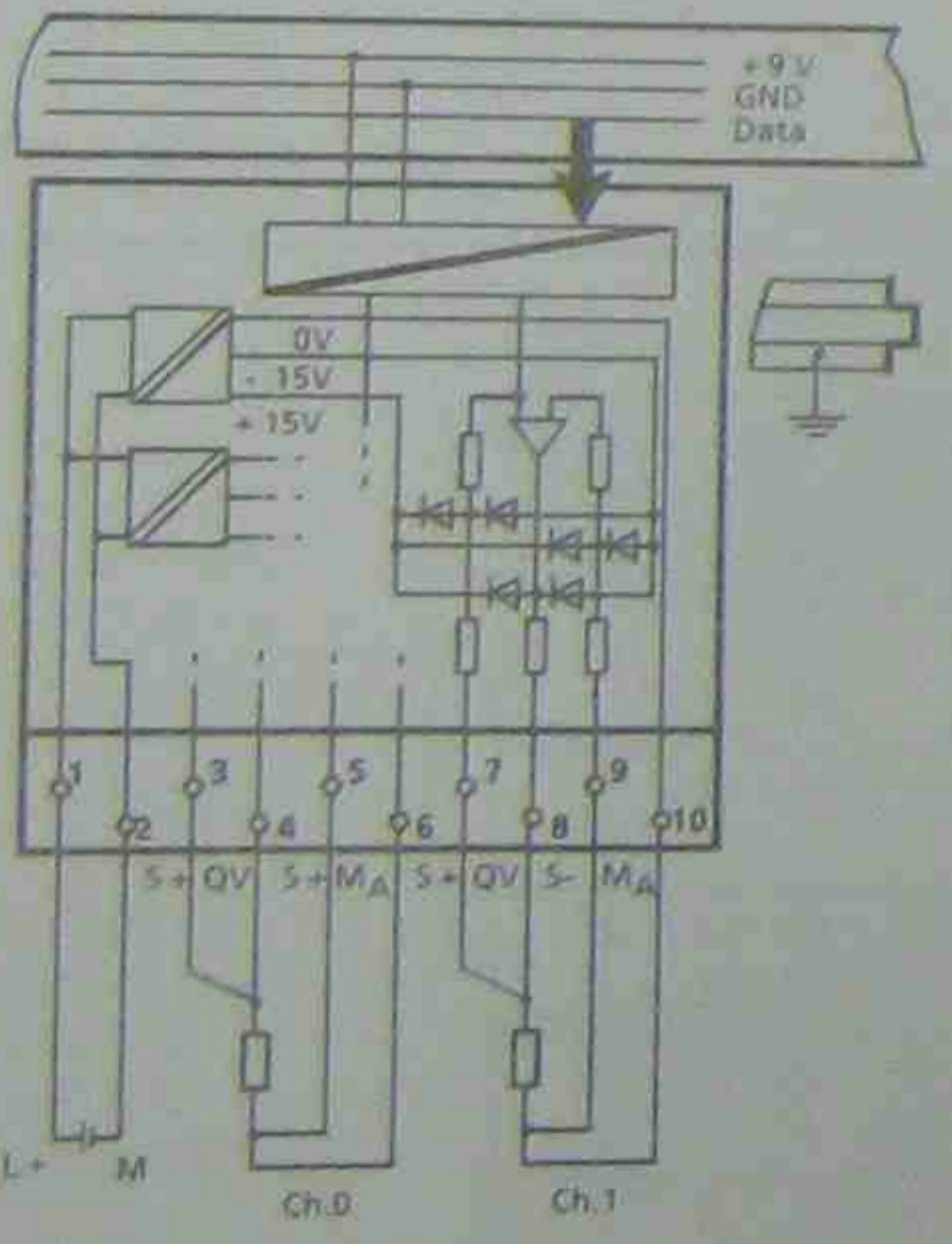
Analog Output Module 2 x ± 10 V

(6ES5 470-8MA12)



Technical specifications

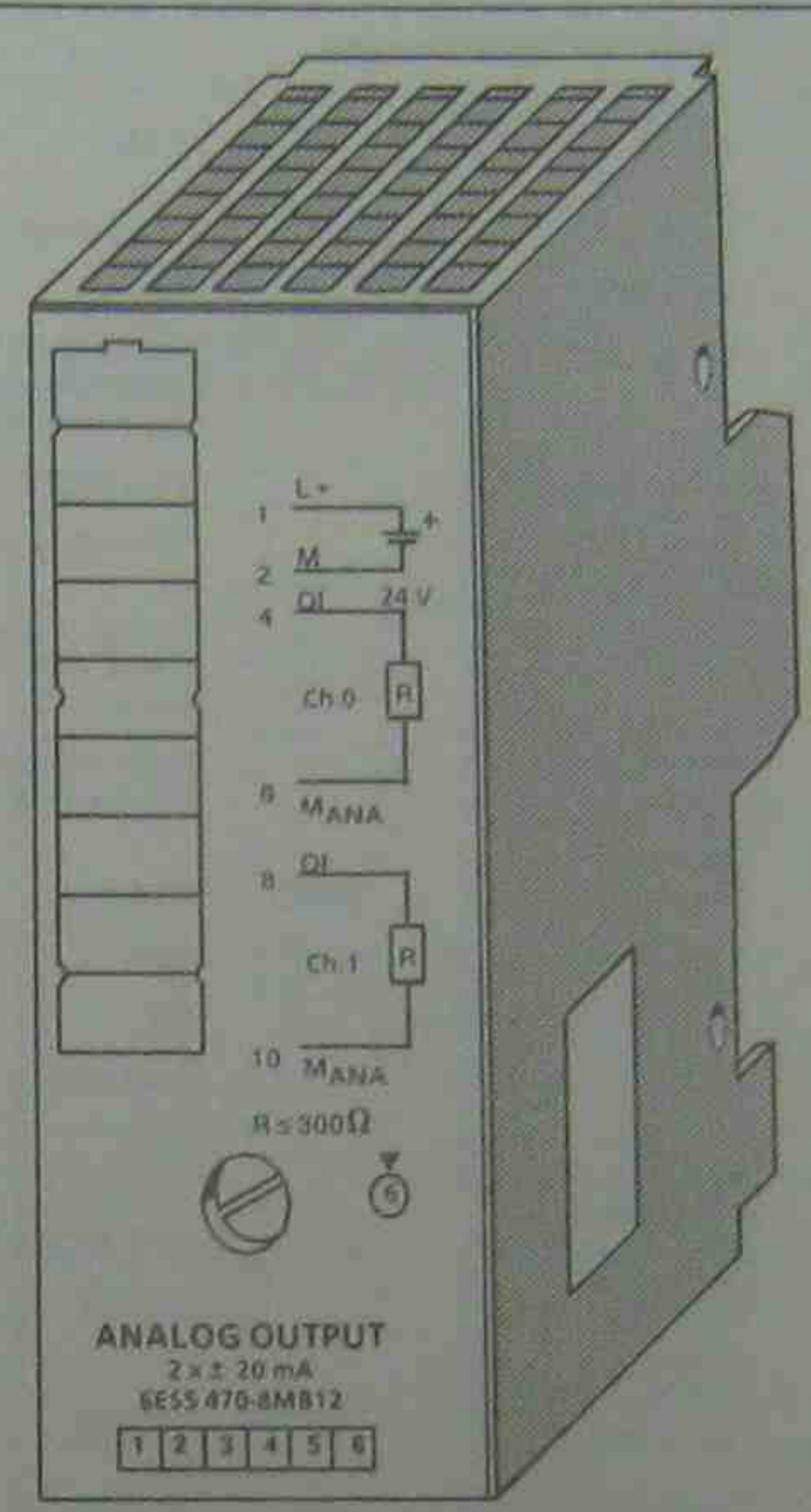
Address designation (for ET 100U only)	2 AO
Output range (rated values)	± 10 V
Number of outputs	2
Galvanic isolation	yes (outputs to grounding point and between outputs)
Input resistance	≥ 3.3 kΩ
Connection method	two- or four-wire connection
Digital representation of output signal	11 bits + sign (1024 units = rated value)
Measured value representation	two's complement (left-justified)
Conversion time (0 to 100%)	max. 0.15 ms
Permissible overload	25%
Short-circuit protection	yes
Short-circuit current	± 30 mA
Permissible voltage difference to ground and between outputs	max. 75 V DC/60 V AC
Basic error limits	± 0.3%
Operational error limits (0 to 60 °C) (32 to 140 °F)	± 0.6%
Single errors	
- linearity	± 0.2%
- polarity reversal error	± 0.1%
- temperature error	± 0.01%/K
Length of cable - shielded	max. 200 m (660 ft.)
Supply voltage L+ (peripheral)	
- rated value	24 V DC
- ripple V _{pp}	3.6 V
- permissible range (ripple included)	20 to 30 V
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to)	12 V AC
- insulation group	1 x B
- tested with	500 V AC
Rated insulation voltage (Output to L+, between outputs, output to +9V)	60 V AC
- insulation group	1 x B
- tested with	500 V AC
Current consumption	
- from +9 V (CPU)	typ. 80 mA
- from L+	typ. 100 mA
Power loss of the module	typ. 3.1 W
Weight	approx. 290 g (10 oz.)



Legend:
QV: Analog output "voltage"

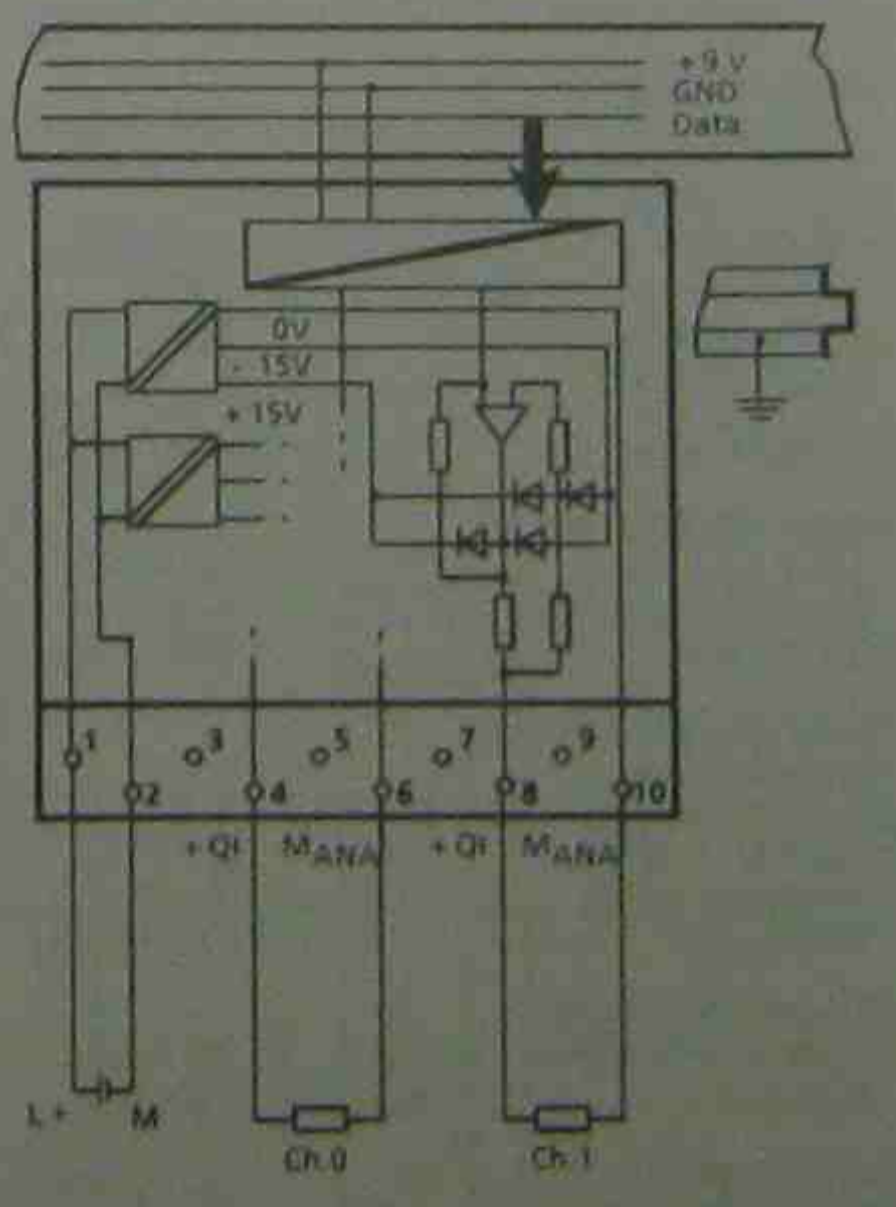
Analog Output Module 2 x ± 20 mA

(6ES5 470-8MB12)



Technical specifications

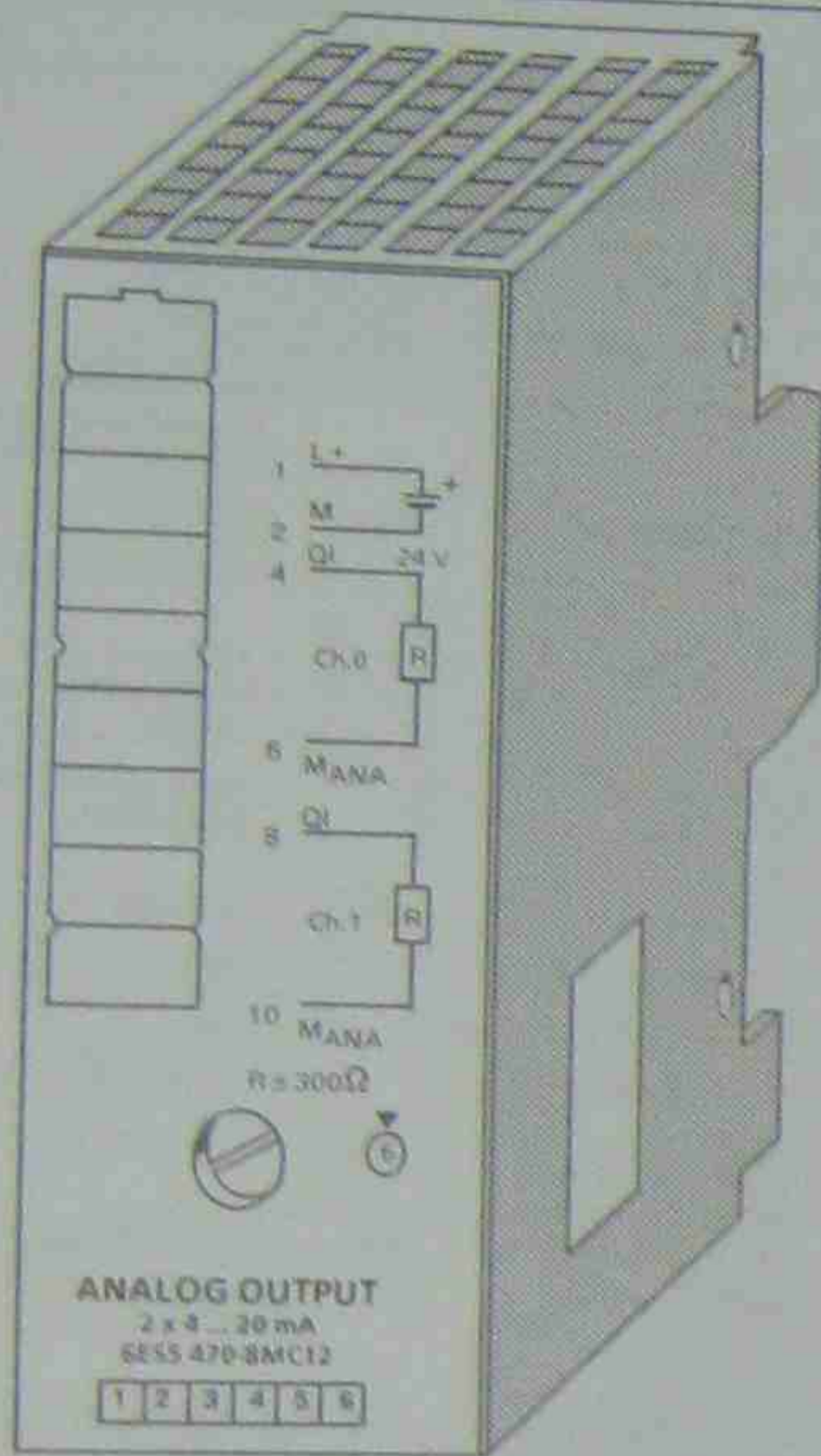
Address designation (for ET 100U only)	2 AO
Output range (rated values)	± 20 mA
Number of outputs	2
Galvanic isolation	yes (outputs to grounding point and between outputs)
Input resistance	max. 300 Ω
Connection method	two-wire connection
Digital representation of output signal	11 bits + sign (1024 units = rated value)
Measured value representation	two's complement (left-justified)
Conversion time (0 to 100%)	max. 0.15 ms
Permissible overload	25%
Short-circuit protection	yes
Short-circuit current	± 30 mA
Permissible voltage difference to central ground point and between outputs	max. 75 V DC/60 V AC
Basic error limits	± 0.3%
Operating error limits (0 to 60 °C) (32 to 140 °F)	± 0.6%
Single errors	
- linearity	± 0.2%
- polarity reversal error	± 0.1%
- temperature error	± 0.01%/K
Length of cable - shielded	max. 200 m (660 ft.)
Supply voltage L+ (peripheral)	
- rated value	24 V DC
- ripple V _{pp}	3.6 V
- permissible range (ripple included)	20 to 30 V
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to)	12 V AC
- insulation group	1 x B
- tested with	500 V AC
Rated insulation voltage (output to L+, between outputs, output to +9V)	60 V AC
- insulation group	1 x B
- tested with	500 V AC
Current consumption	
- from +9 V (CPU)	typ. 80 mA
- from L+	typ. 130 mA
Power loss of the module	typ. 3.8 W
Weight	approx. 290 g (10 oz.)



Legend:
QI: Analog output "current"

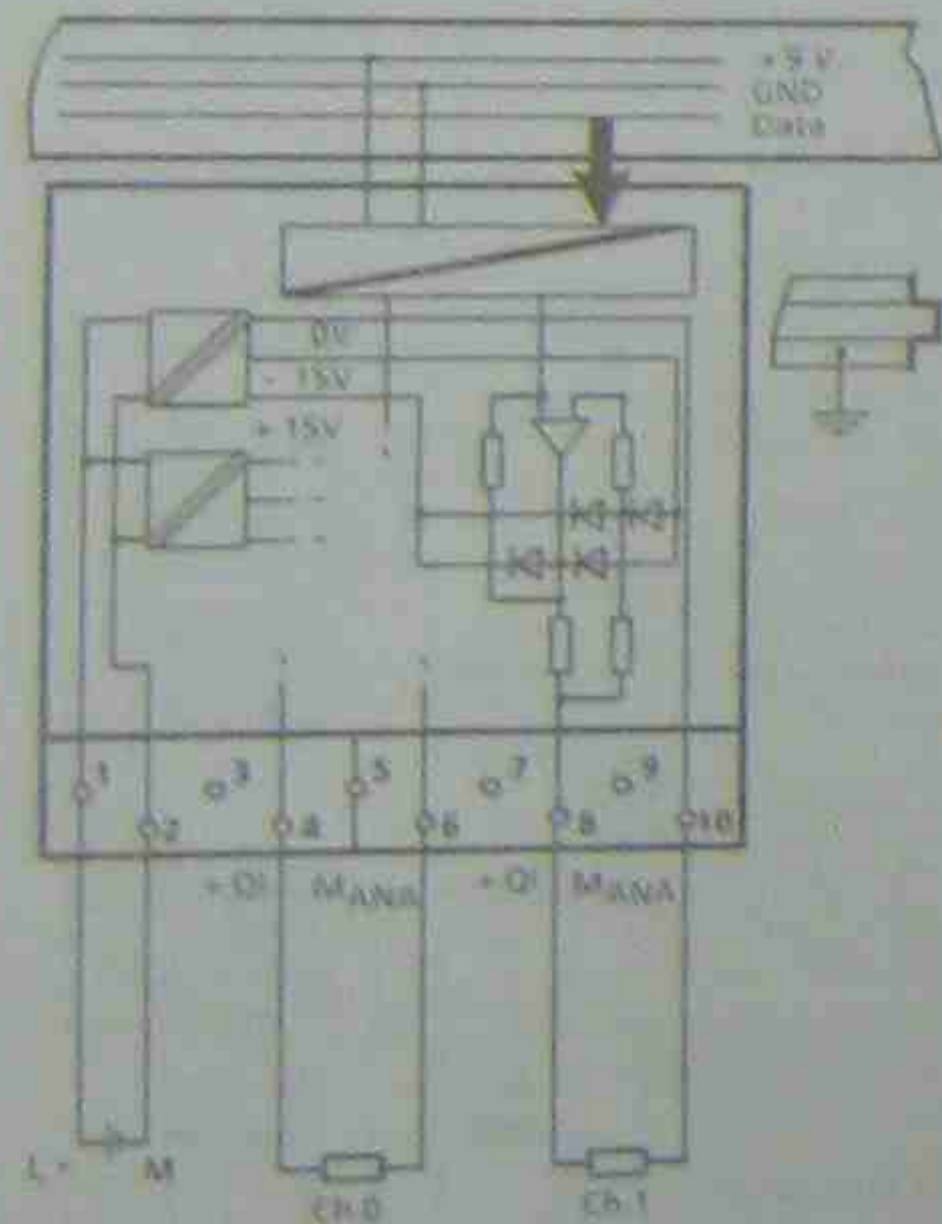
Analog Output Module 2 x 4 to 20 mA

(6ES5 470-8MC12)



Technical specifications

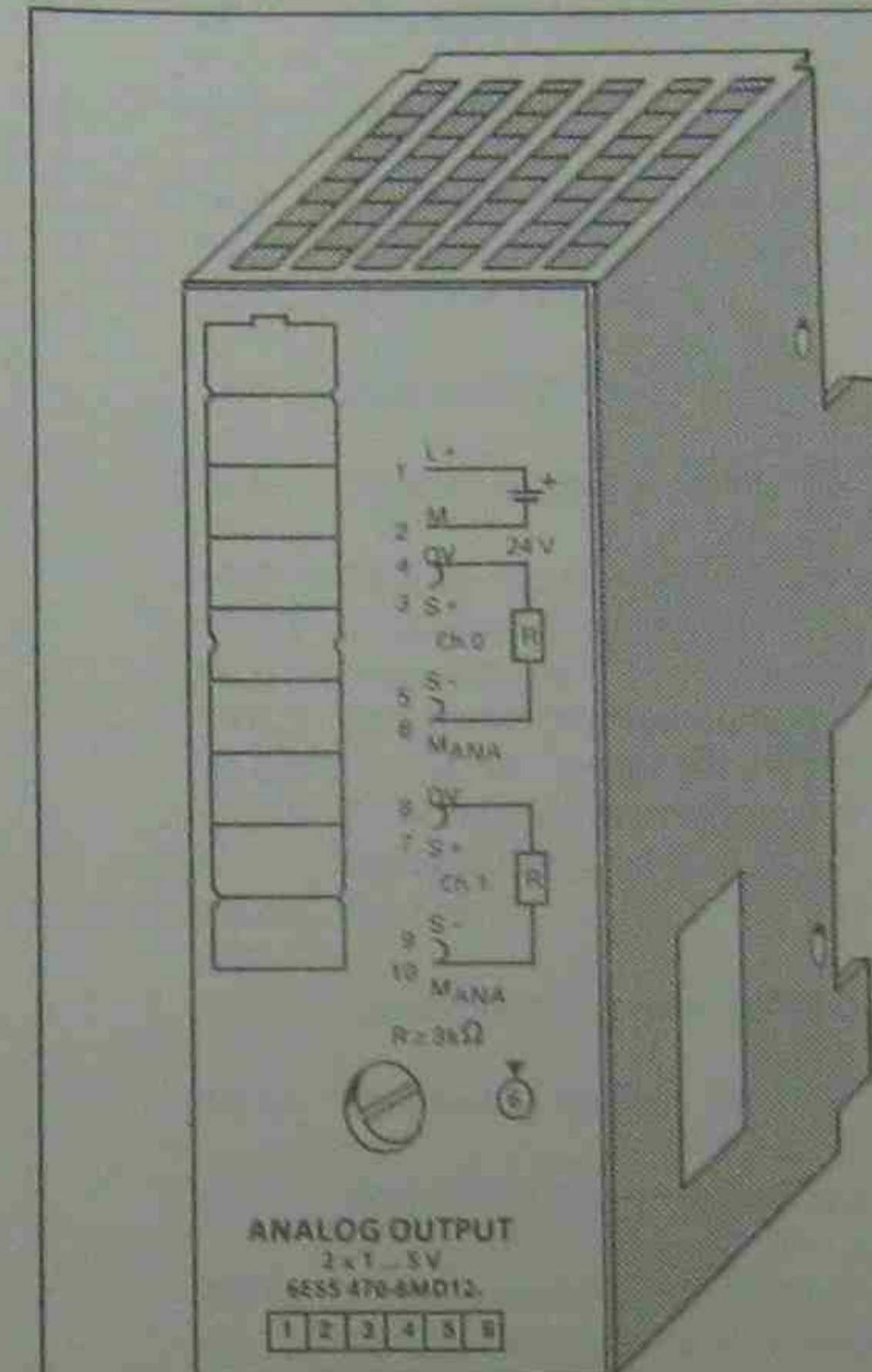
Address designation (for ET 100U only)	2 AQ
Output range (rated value)	4 to 20 mA
Number of outputs	2
Galvanic isolation	yes (outputs to grounding point and between outputs)
Load resistance	max. 300 Ω
Connection method	two-wire connection
Digital representation of output signal	11 bits + sign (1024 units = rated value)
Measured value representation	two's complement (left-justified)
Conversion time (0 to 100%)	max. 0.15 ms
Permissible overload	25%
Short-circuit protection	yes
Short-circuit current	± 30 mA
Permissible voltage difference to central ground point and between outputs	max. 75 V DC/60 V AC
Basic error limits	± 0.2%
Operating error limits (0 to 60 °C) (32 to 140 °F)	± 0.06%
Single errors	
- linearity	± 0.2%
- temperature error	± 0.01%/K
Length of cable - shielded	max. 200 m (660 ft.)
Supply voltage L+	
- rated value	24 V DC
- ripple V _{pp}	3.6 V
- permissible range (ripple included)	20 to 30 V
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to +)	12 V AC
- insulation group	1 x B
- tested with	500 V AC
Rated insulation voltage (outputs to L+, between outputs, output to +9 V)	60 V AC
- insulation group	1 x B
- tested with	500 V AC
Current consumption	
- from +9 V (CPU)	typ. 80 mA
- from L+	typ. 130 mA
Power loss of the module	typ. 3.8 W
Weight	approx. 290 g (10 oz.)



Legend: Analog output "current"

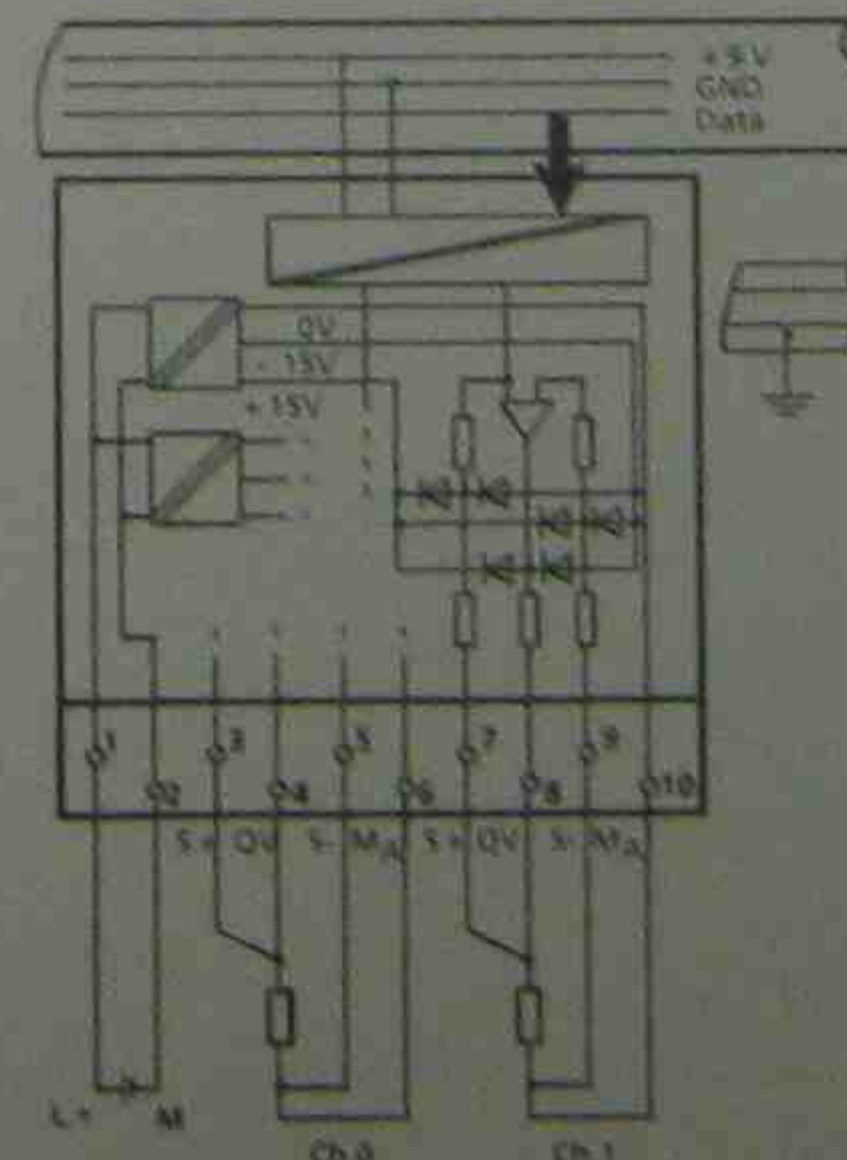
Analog Output Module 2 x 1 to 5 V

(6ES5 470-8MD12)



Technical specifications

Address designation (for ET 100U only)	2 AQ
Output range (rated values)	1 to 5 V
Number of outputs	2
Galvanic isolation	yes (outputs to grounding point and between outputs)
Input resistance	min. 3.3 kΩ
Connection method	two- or four-wire connection
Digital representation of output signal	11 bits + sign (1024 units = rated value)
Measured value representation	two's complement (left-justified)
Conversion time (0 to 100%)	max. 0.15 ms
Permissible overload	25%
Short-circuit protection	yes
Short-circuit current	± 30 mA
Permissible voltage difference to central ground point and between outputs	max. 75 V DC/60 V AC
Basic error limits	± 0.2%
Operating error limits (0 to 60 °C) (32 to 140 °F)	± 0.06%
Single errors	
- linearity	± 0.2%
- temperature error	± 0.01%/K
Length of cable - shielded	max. 200 m (660 ft.)
Supply voltage L+	
- rated value	24 V DC
- ripple V _{pp}	3.6 V
- permissible range (ripple included)	20 to 30 V
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to +)	12 V AC
- insulation group	1 x B
- tested with	500 V AC
Rated insulation voltage (outputs to L+, between outputs, output to +9 V)	60 V AC
- insulation group	1 x B
- tested with	500 V AC
Current consumption	
- from +9 V (CPU)	typ. 80 mA
- from L+	typ. 100 mA
Power loss of the module	typ. 3.1 W
Weight	approx. 290 g (10 oz.)



21
2

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16 Function Modules

16.1 Comparator Module 2 × 1 to 20 mA/0.5 to 10 V (6ES5 461-8MA11)

Technical Specifications	
Address designation (for ET 100U only)	4 DI
Channels	2
Galvanic isolation	yes
Current or voltage measurement	switch-selectable
Switch position "0"	no measuring
Display	green LED for actual value ≥ setpoint
Setpoint adjustment	with potentiometer
Setting error	≤ ± 10 %
Reproducibility	≤ ± 2 %
Hysteresis	≤ 10 %
"V" measuring range	0.5 to 10 V DC
Input resistance	47 kΩ
Inherent delay	typ. 5 ms
Input voltage	max. 100 V DC (≤ 0.5 s)
"I" measuring range	0.5 to 20 mA
Input resistance	500 Ω
Overload capability	100 %
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to measuring circuit and between measuring circuits)	30 V AC
- insulation - tested with	2 × B 500 V AC
Rated insulation voltage (+9 V to ±)	12 V AC
- insulation group - tested with	1 × B 500 V AC
Length of cable - shielded	200 m (660 ft.)
- unshielded	100 m (330 ft.)
Current consumption - from +9 V (CPU)	typ. 35 mA
Power losses of the module	typ. 0.3 W
Weight	approx. 200 g (7oz.)

Function

The module has two isolated comparators for voltage or current measurement (selector switch with positions U/I). When the preset value is reached, the LED of the respective channel lights up and sends a "1" signal to the programmable controller.

The module must be removed or the measuring circuit disconnected before you select the function.

In switch position "0", the comparator is switched off; if scanned, a "0" signal results.

The response threshold of the comparator is set by a selector on the front panel. The selector has scale divisions to simplify adjustment.

Installation

The comparator module is mounted on a bus unit like any other input or output module (see section 3.2.1).

Wiring

See schematic diagram. Unused inputs can be left open.

Addressing

The comparator module is addressed like as a 2-channel digital input module (channel "0" or "1").

Scan	A	I	x . 0	Channel "0"
(examples)	O	I	x . 1	Channel "1"
				Channel number
				Slot address

Figure 16-1. Scanning the Comparator Module

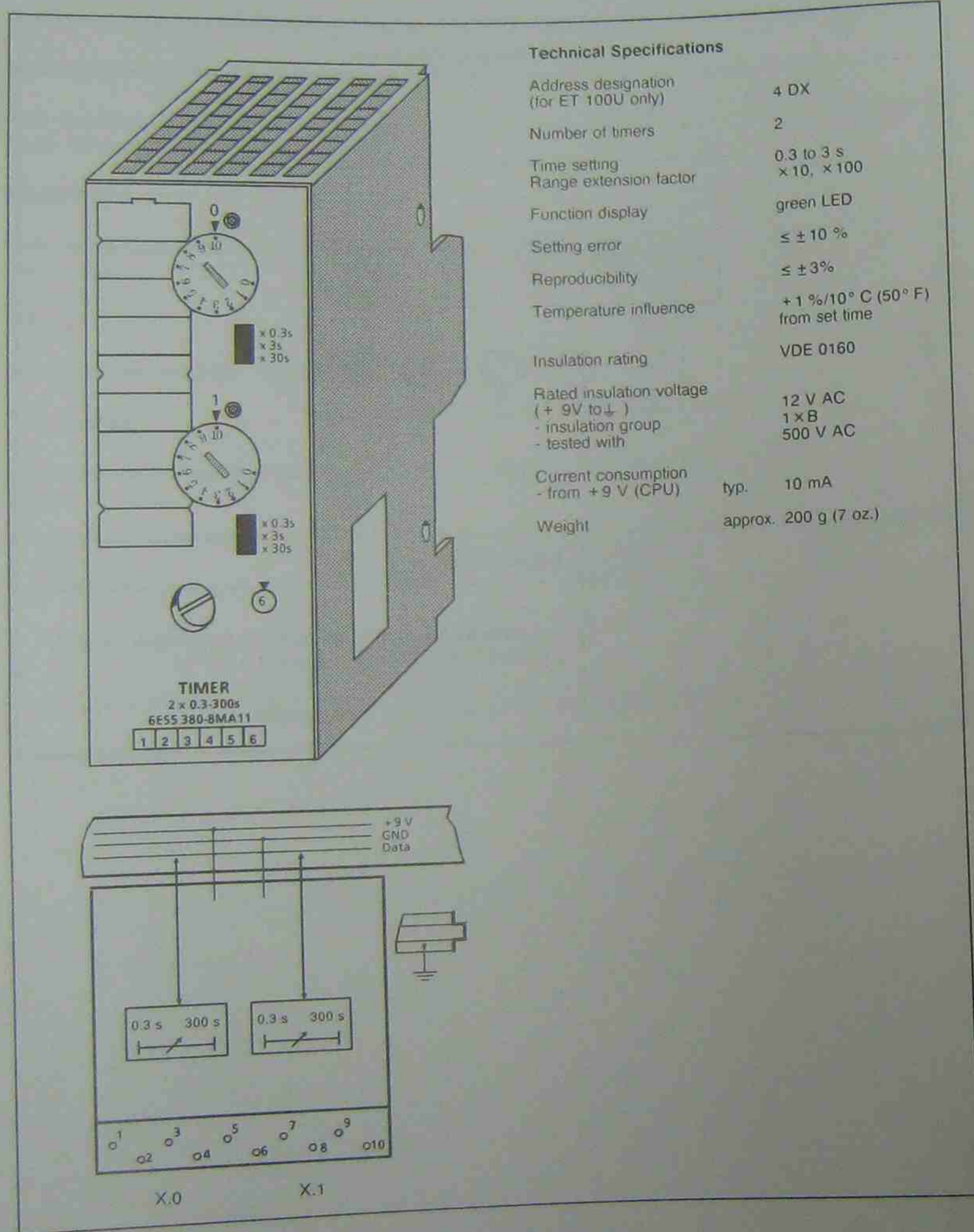
Typical Application

A comparator module is mounted at slot 4. The current source is connected to channel 1. If the Schmitt trigger 1 detects that the current has exceeded the preset value, a switch (output 5.1) is to be operated.

Terminal Connections	
STL	Explanation
A I 4.1 = Q 5.1	As soon as the limit is reached or exceeded, input 4.1 becomes "1"; this sets output 5.1 to "1".

16.2 Timer Module 2 x 0.3 to 300 s

(6ES5 380-8MA11)



Technical Specifications

Address designation (for ET 100U only)	4 DX
Number of timers	2
Time setting	0.3 to 3 s
Range extension factor	x 10, x 100
Function display	green LED
Setting error	≤ ± 10 %
Reproducibility	≤ ± 3%
Temperature influence	+ 1 %/10° C (50° F) from set time
Insulation rating	VDE 0160
Rated insulation voltage (+ 9V to +)	12 V AC
- insulation group	1xB
- tested with	500 V AC
Current consumption - from + 9 V (CPU)	typ. 10 mA
Weight	approx. 200 g (7 oz.)

Function

The module contains two pulse timers. As long as the timer is running, the LED of the respective channel is lit; a "1" is reported to the CPU.

The pulse duration is preselected with the time range selector "x 0.3s / x 3s / x 30s" in a definite range and then set to the exact value by means of a potentiometer on the front panel. This selector has scale divisions to simplify setting. (time value = time range x scale value)

Example: Time range: x 3s
 Scale value: 7
 Set time: 7 x 3s = 21s

Installation

The counter is inserted into a bus unit like any other input or output module (see section 3.2.1).

Wiring

No wiring is required.

Addressing

A timer module is addressed like a two-channel digital module (channel "0" or "1").

The timer module is addressed like a digital output module for starting, resetting, or interrupting the pulse. The signal status is scanned like a digital input module.

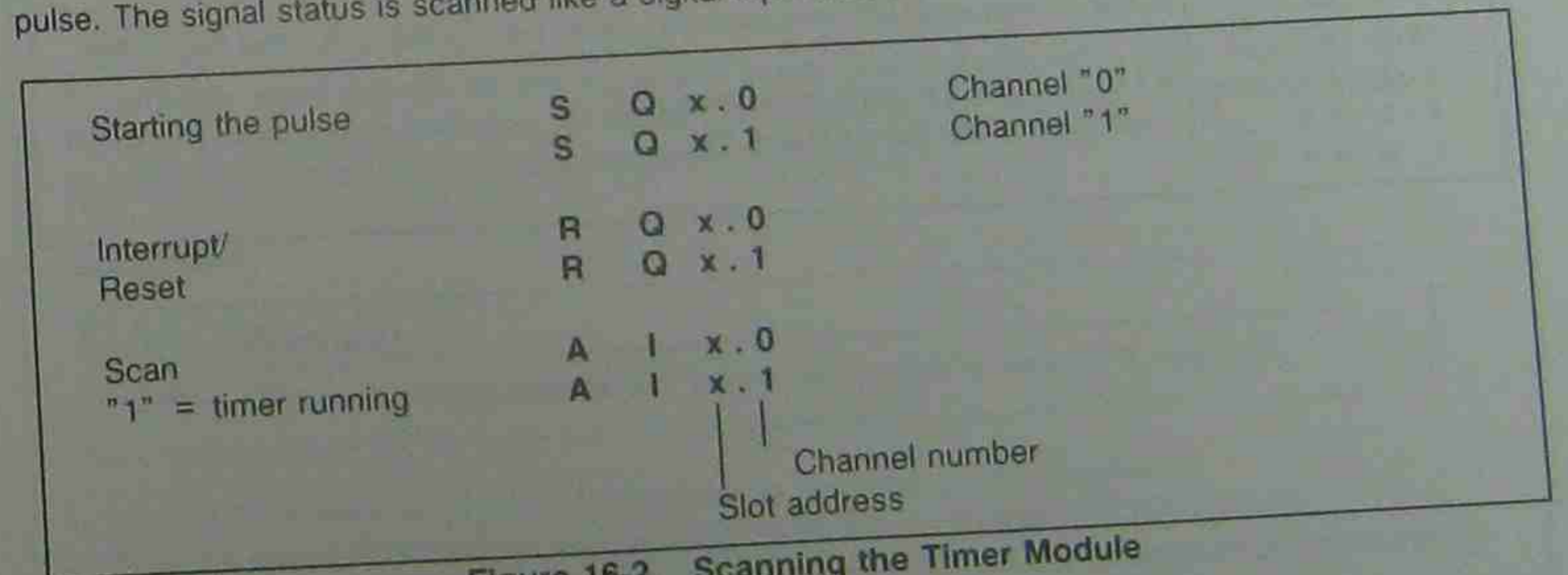


Figure 16-2. Scanning the Timer Module

Typical Application as "On-Delay Timer"

A timer module is mounted at slot 5. A time of 270 s is set on channel "0" of this module by means of the time-range selector and the potentiometer. The timer is started when input 0.0 is "1".
A lamp lights up (output 4.0) when the timer has run down.

Terminal Connections

No process peripherals are connected to this module.
Unlike the internal timers, times can be set or modified using a timer module without making any program modifications.

STL

Explanation

A I 0.0	The timer must not be scanned in the program scan cycle in which it was enabled since the CPU would not receive the acknowledgement that the timer had started until one program scan later.
AN I 5.0	
A F 65.0	
S Q 4.0	If flag 65.0 is "1" and the timer has run down (AN I 5.0), output 4.0 is set to "1".
A I 5.0	
= F 65.0	If the "Timer started" message has been sent to the CPU, the flag is set.
AN I 0.0	
R Q 4.0	If I 0.0 is "0", the lamp is switched off.
A I 0.0	
= Q 5.0	The timer is started if I 0.0 is "1".

16.3 Simulator and Simulator Module

16.3.1 Simulator only for the S5-90U

(6ES5 788-8MK11)

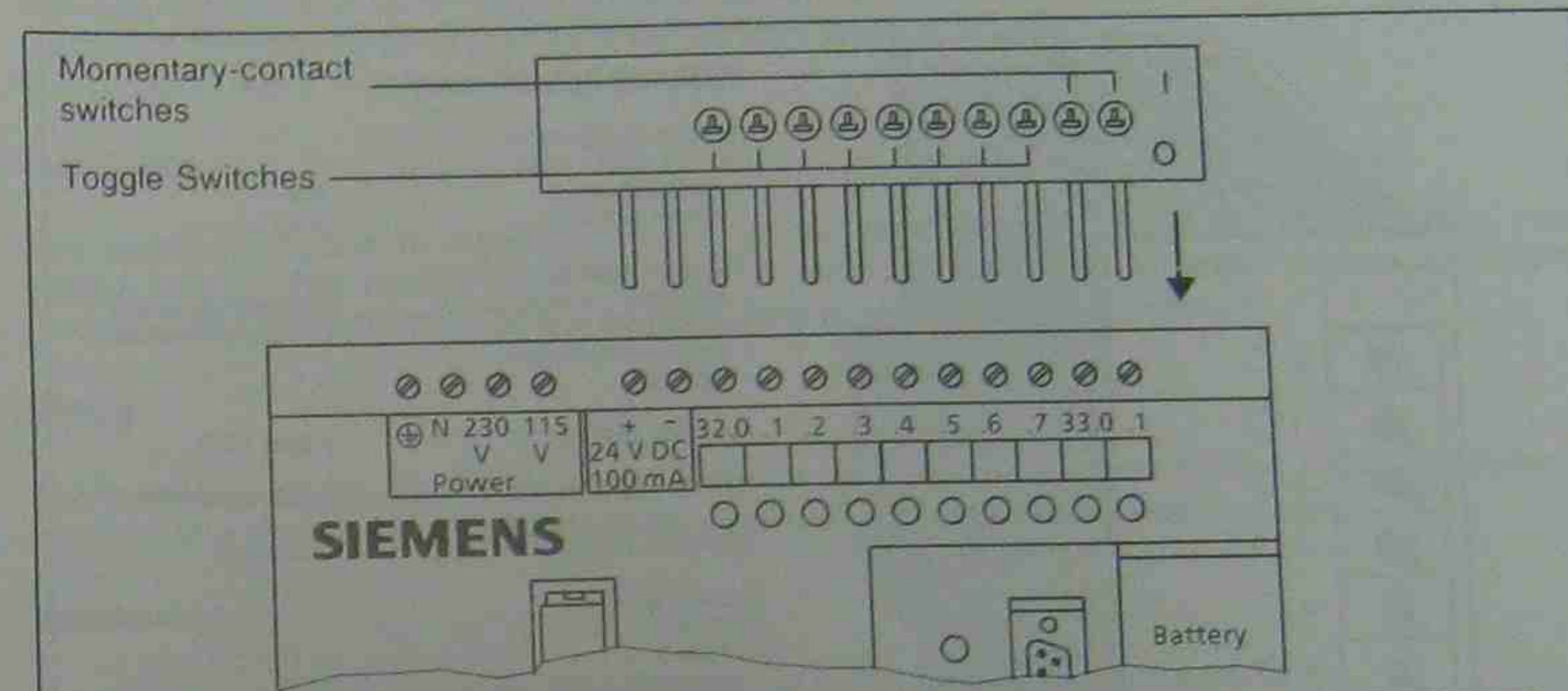


Figure 14-3. Installing and Removing a Simulator on a Programmable Controller

Function

To simulate input signals on the 10 digital inputs, insert a simulator (see Appendix C). There are eight toggle switches for digital inputs 32.0 to 32.7 and two momentary-contact switches for interrupt input 33.0 and counter input 33.1.

Installation



Warning

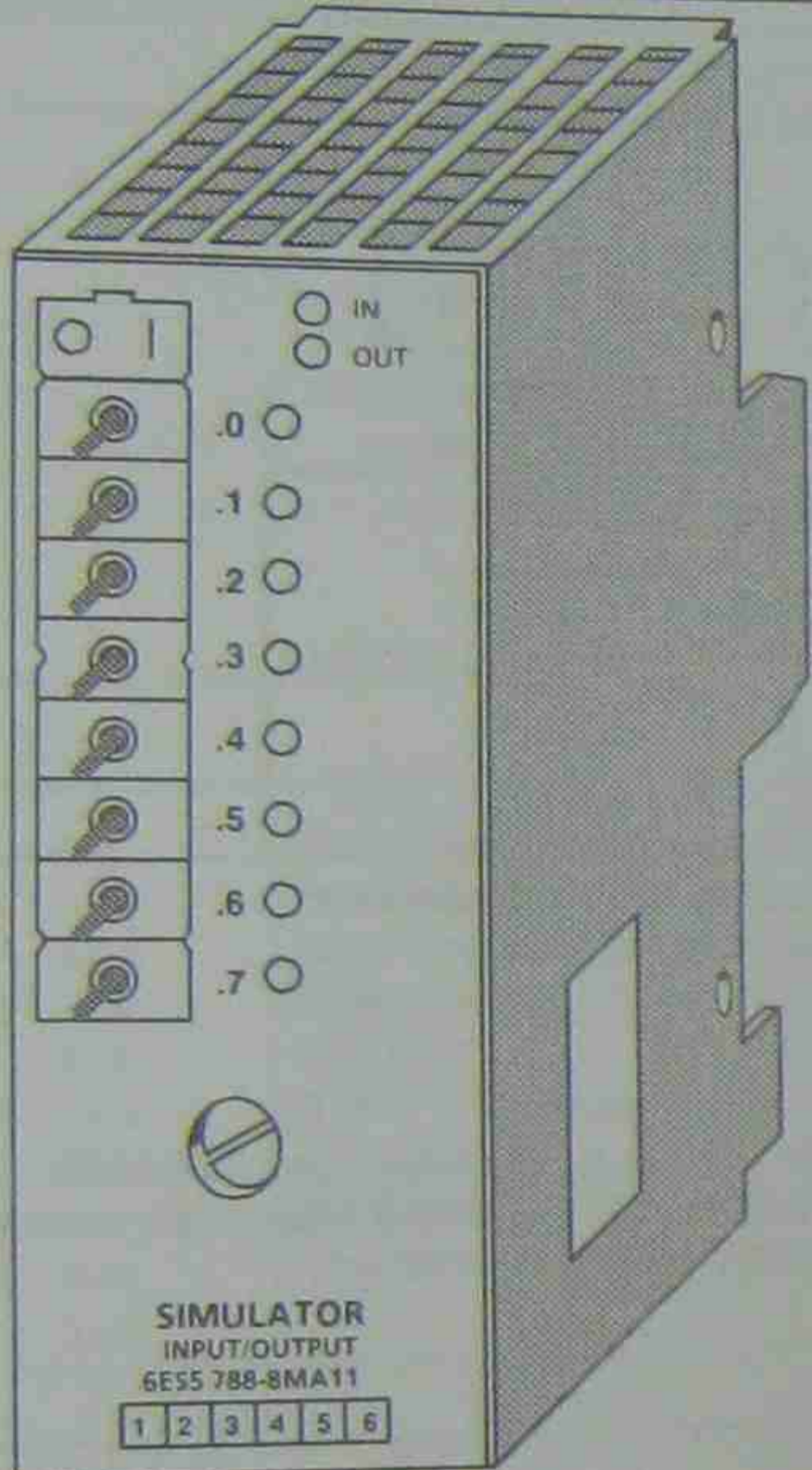
Disconnect the power supply before you install or remove a module!

- ▶ Unplug the power supply: the programmable controller is de-energized.
- ▶ Plug the simulator into the programmable controller as illustrated in Figure 14-3.
- ▶ Screw the simulator contacts to the connection terminals of the programmable controller.

Turn a switch to ON to input a "1" signal. The respective LED lights up.

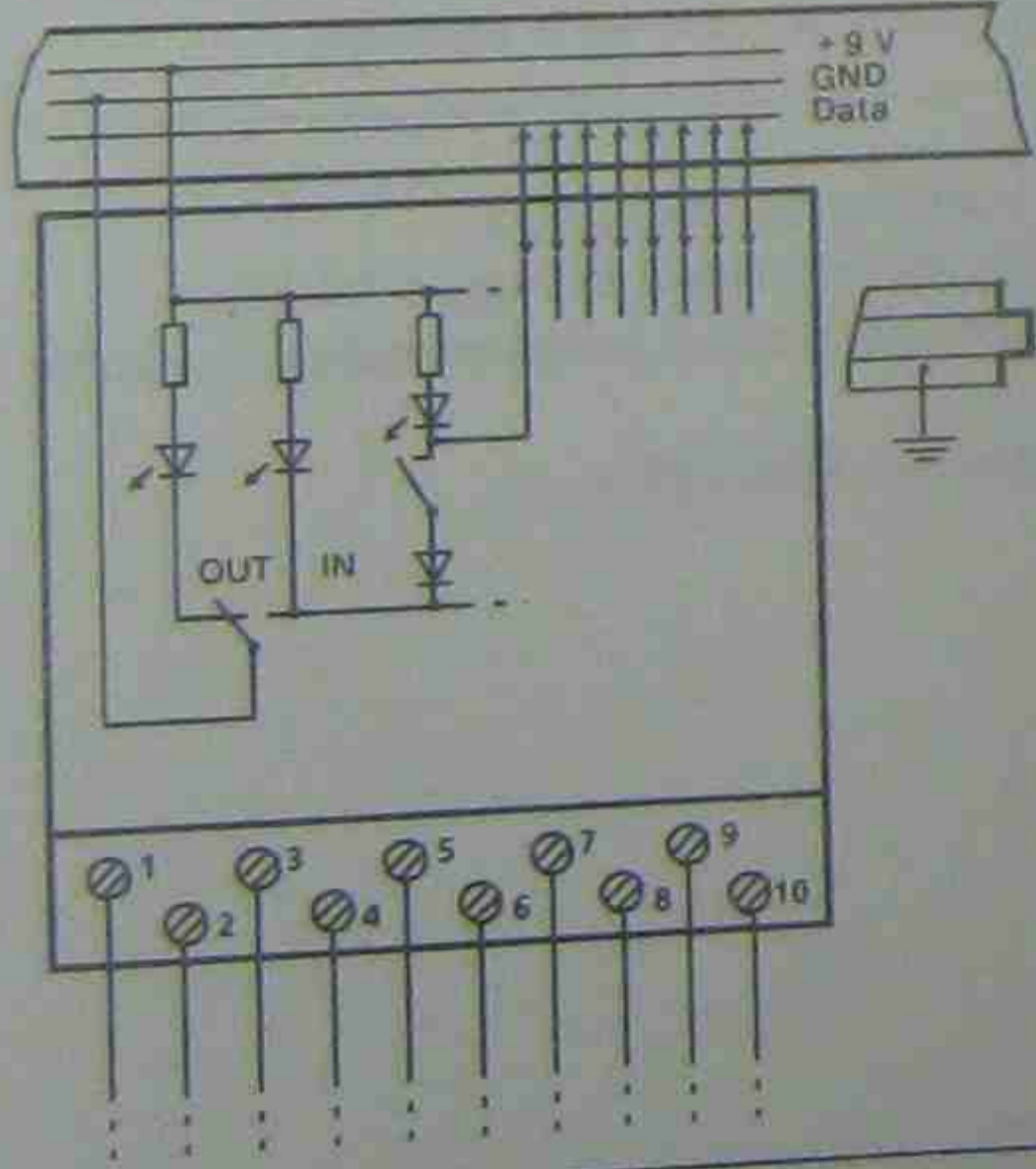
16.3.2 Simulator Module

(6ES5 788-8MA11)



Technical Specifications

Address designation (for ET 100U only)	8DI 8DO
- input simulator	
- output simulator	
Function selection	selected by switch on rear of module
- simulation of 8 input signals	
- display of 8 output signals	
Function display	yellow LED
"0"/"1" input signals	switch-selectable
Insulation rating	VDE 0160
Rated insulation voltage (+9 V to ↓)	12 V AC 1×B 500 V AC
- insulation group	
- tested with	
Signal status display for input/output	green LEDs
Current consumption - from +9 V (CPU)	30 mA
Power loss of the module	typ. 0.3 W
Weight	190 g (6.7 oz.)



Function

Simulator modules are 8-channel modules that can simulate digital input signals and display output signals.

The type of module to be simulated (input or output) is selected by means of a switch on the rear of the module and displayed by two LEDs on the front panel. The module cannot simulate interrupt inputs.

Installation

The simulator module is inserted into a bus unit like any other input or output module (see section 3.2.1). The module does not have a coding key and can therefore replace any digital module. The coding element on the bus unit does not have to be readjusted.

Wiring

There is no electrical connection between the module and the terminal block. It can therefore be inserted into slots that have already been wired and connected to the power supply.

Addressing

A simulator module is addressed like a 8-channel digital module (channels 0 to 7).

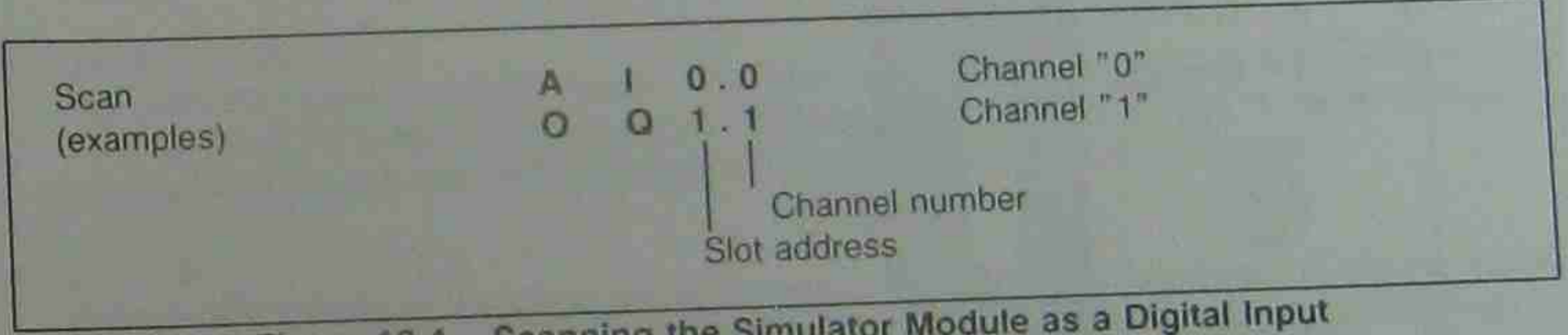


Figure 16-4. Scanning the Simulator Module as a Digital Input

Typical Application

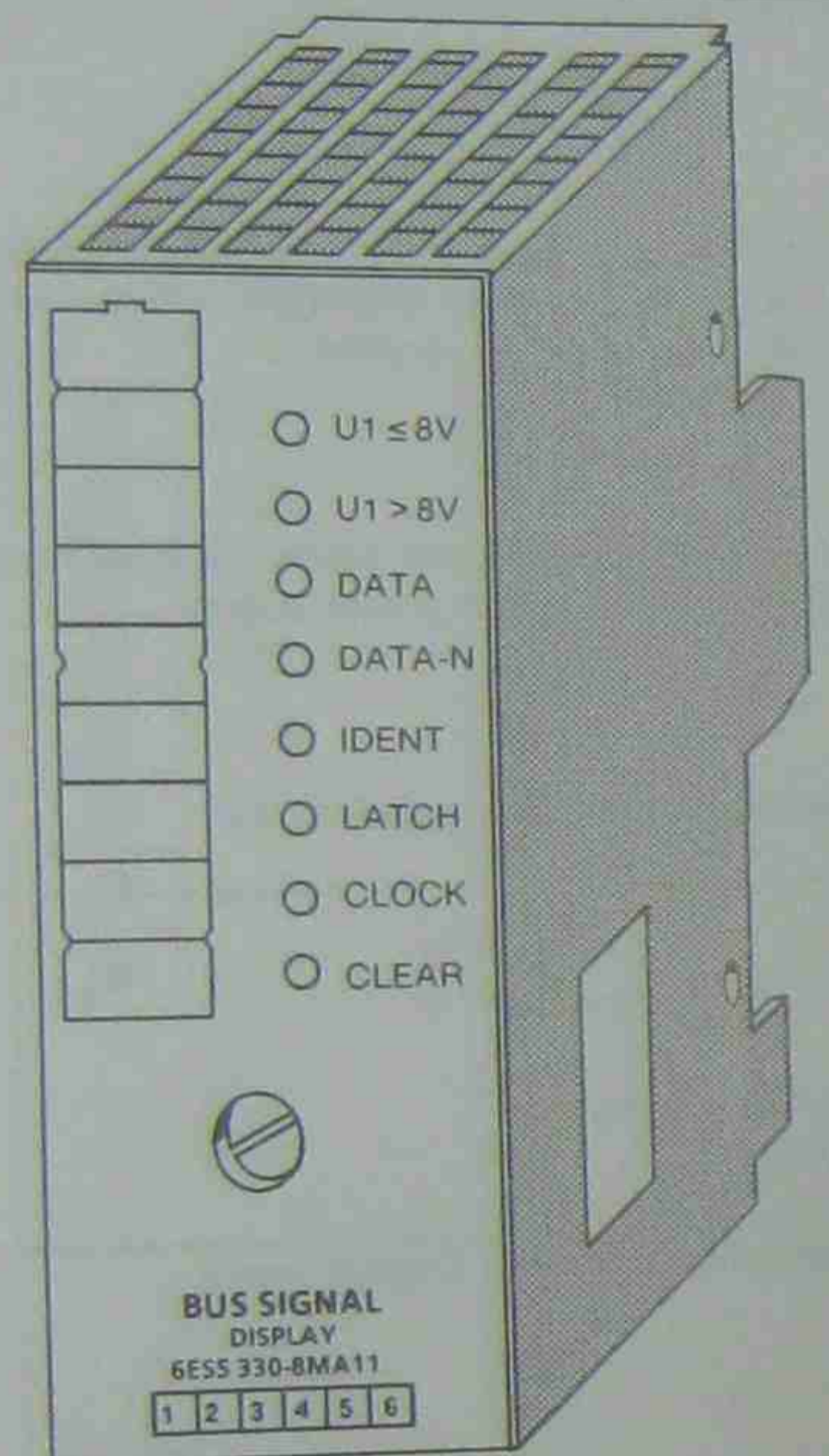
The CPU is in the "RUN" mode, the green LED is lit but the PLC is malfunctioning. You have also discovered that the fault must be in a particular I/O module. If the module has no fault indicator, check to see if:

- the power supply is connected
- the bus connections and interface modules are plugged in correctly

Then, try to access the module via the process image ("STATUS" or "STATUS VAR"). If this procedure is not successful, replace the module with the simulator module. Perform a second check with the "STATUS" or "STATUS VAR" function. If the simulator performs, the input/output module you replaced is defective.

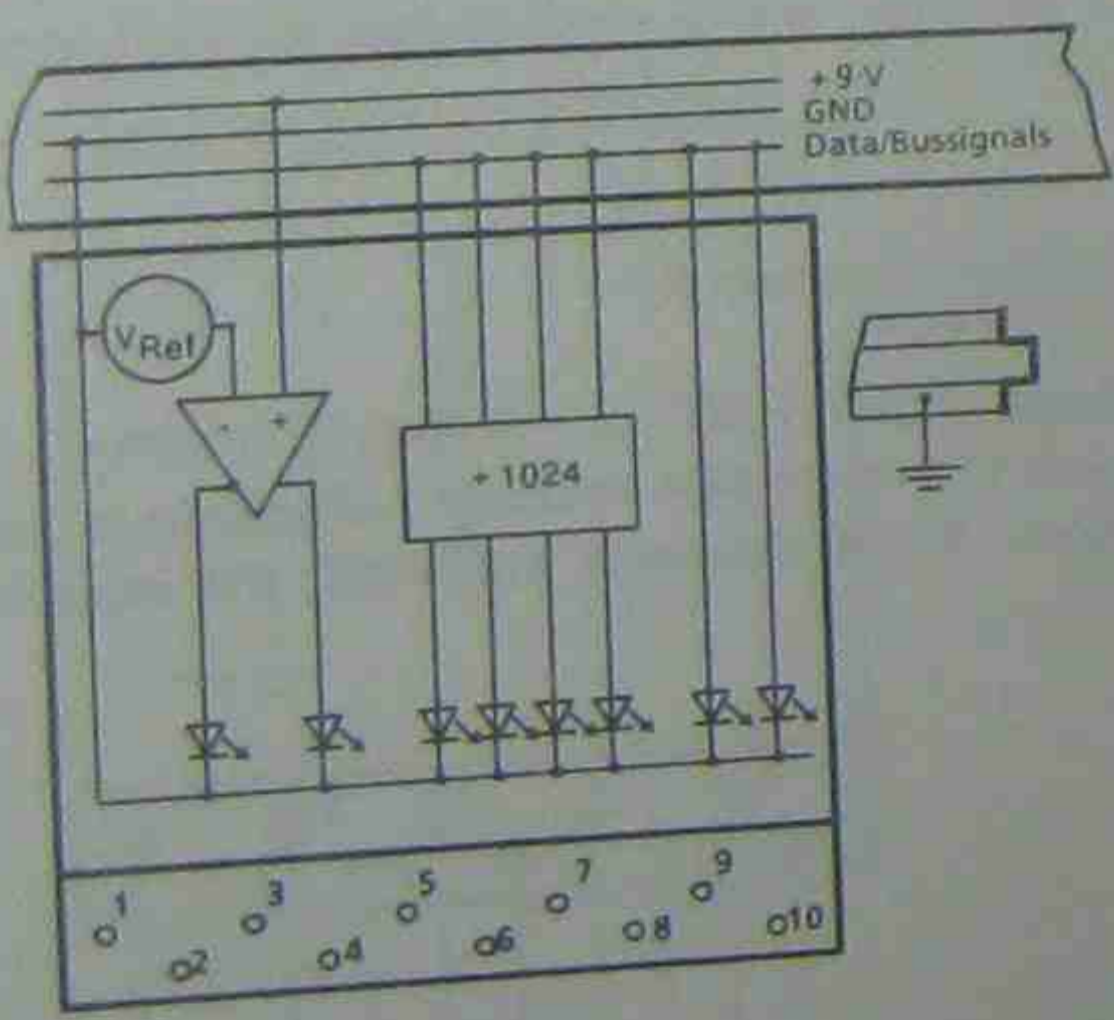
16.4 Diagnostic Module

(6ES5 330-8MA11)



Technical Specifications

Insulation rating	VDE 0160
Rated insulation voltage (+9 V to +)	12 V AC
- insulation group	1xB
- tested with	500 V AC
Voltage monitor - undervoltage	red LED
- voltage ok	green LED
Signal status display for control signals	yellow LEDs
Current consumption - from +9 V (CPU)	25 mA
Power loss of the module	typ. 0.3 W
Weight	approx. 175 g (6.1 oz.)



Function

The diagnostic module is used for monitoring the S5-100U I/O bus. LEDs on the front panel display the signal states of the control lines and the supply voltage for the I/O bus.

- IDENT**
 The programmable controller executes an IDENT run after each change from "STOP" to "RUN" mode and after any changes in the configuration in order to determine the current configuration of the programmable controller. The "IDENT" LED lights up briefly. If the LED lights up in the "RUN" mode, this indicates that a faulty I/O module has been plugged in.
- CLEAR**
 The CLEAR signal line is only "1" in the "STOP" mode in normal operation. The outputs of the output modules are disabled. If CLEAR is "1" in the "RUN" mode, the control line itself may be defective (no contact).
- LATCH/CLOCK**
 These two control lines control data interchange between the CPU, the I/O bus, and the I/O modules. During normal operation, both LEDs must flash (programmable controller in "RUN" mode). The flashing frequency provides information on the speed of the serial bus. If both LEDs show a steady light in the "RUN" mode, the bus unit that the diagnostic module is plugged into is defective.
- DATA/DATA-N**
 The alternate lighting up of the "DATA" and "DATA-N" LEDs indicates data flow on the I/O bus. If these two LEDs show a steady light (as in the case of the "LATCH" and "CLOCK" LEDs), this indicates that the bus unit that the diagnostic module is plugged into is defective.
- U1 ≤ 8V**
 If the supply voltage of a slot remains at a value $U1 \leq 8V$, proper functioning of the I/O modules is no longer guaranteed. The low supply voltage can be explained by an excessively high bus load ($> 1 A$). If this LED flickers, noise pulses are superimposed on the supply voltage $U1$ (e.g., by the coupling of noise pulses). The LED lights up briefly if the programmable controller is switched on or off.
- U1 > 8V**
 The supply voltage of the I/O bus is O.K.

Installation

The diagnostic module is plugged into a bus unit like any other input or output module (see section 3.2.1). The module has no mechanical coding and the coding element on the bus unit does not have to be reset.

Note

The module can be plugged in and removed regardless of the operating status of the programmable controller.

Wiring

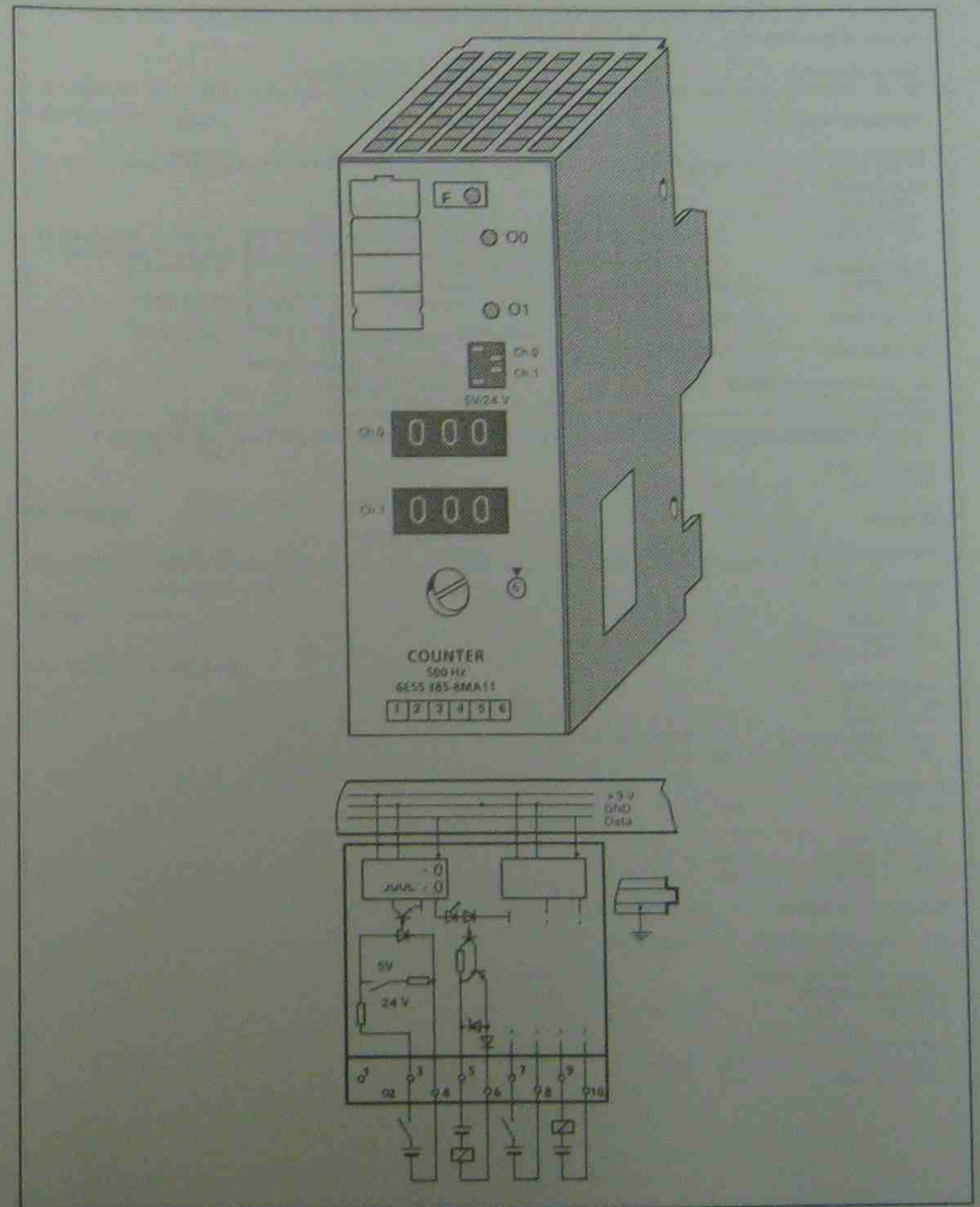
No wiring is required. Existing wiring does not have to be removed.

Addressing

There is no addressing since the module cannot be addressed by the programmable controller.

16.5 Counter Module 2x0 to 500 Hz

(6ES5 385-8MA11)



Technical Specifications

Address designation (for ET 100U only)	4DX	Total permissible current of outputs	1 A
Number of inputs	2	Driving a digital input	possible
Galvanic isolation	yes	Paralleling of outputs - max. current	possible 0.5 A
Input voltage - rated value - for "0" signal - for "1" signal	5 V/24 V DC 0 to 0.8/33 to 5 V 3 to 5 V/13 to 33 V	Permissible ambient temperature for the unit - horizontal arrangement - vertical arrangement	0 to 60° C (32 to 140° F) 0 to 40° C (32 to 104° F)
Input current for "1" signal	typ. 1.5/8.5 mA	Length of cable - unshielded	max. 100 m (330 ft.)
Inherent delay	typ. 180 µs	Insulation rating	VDE 0160
Input frequency	max. 500 Hz	Rated insulation voltage (inputs and outputs to each other and to + ; input to +9 V) - insulation group - tested with	60 V AC 1 x B 1250 V AC
Connection of 2-wire BERO proximity switches (24 V DC) - quiescent current	possible ≤ 1.5 mA	Current consumption - from +9 V (CPU)	typ. 20 mA
Length of cable - unshielded	max. 50 m (165 ft.)	Power loss of the module	typ. 2.5 W
Outputs	2	Weight	approx. 200 g (7 oz.)
Galvanic isolation	yes		
Supply voltage L+ (for load) - rated value - permissible range (including ripple)	24 V DC 20 to 30 V		
Output current for "1" signal - rated value - permissible range - lamp load	0.5 A 0.5 to 500 mA max. 5 W		
Residual current at "0" signal	max. 1 mA		
Output voltage - for "0" signal - for "1" signal	max. 3 V max. L+2.5 V		
Short-circuit protection	electronic		
Fault indication (red LED)	short-circuit		
Voltage induced on circuit interruption (internal) limited to	L+47 V		
Switching frequency - resistive load - inductive load	max. 100 Hz max. 2 Hz		

Function

The module consists of two independent down counters with isolated inputs and outputs. It counts input signals up to a frequency of 500 Hz from a set value down to the value "0". When zero is reached, the 24-V DC output of the module is energized.

At the same time, a green LED on the module lights up and the input signal (I x.0 or I x.1) is set to "1".

The setpoint (0 to 999) can be entered via the three-digit thumbwheel switches on the front panel of the module.

The input voltage ranges can be set for 5 V DC or 24 V DC on rocker switches on the front panel.

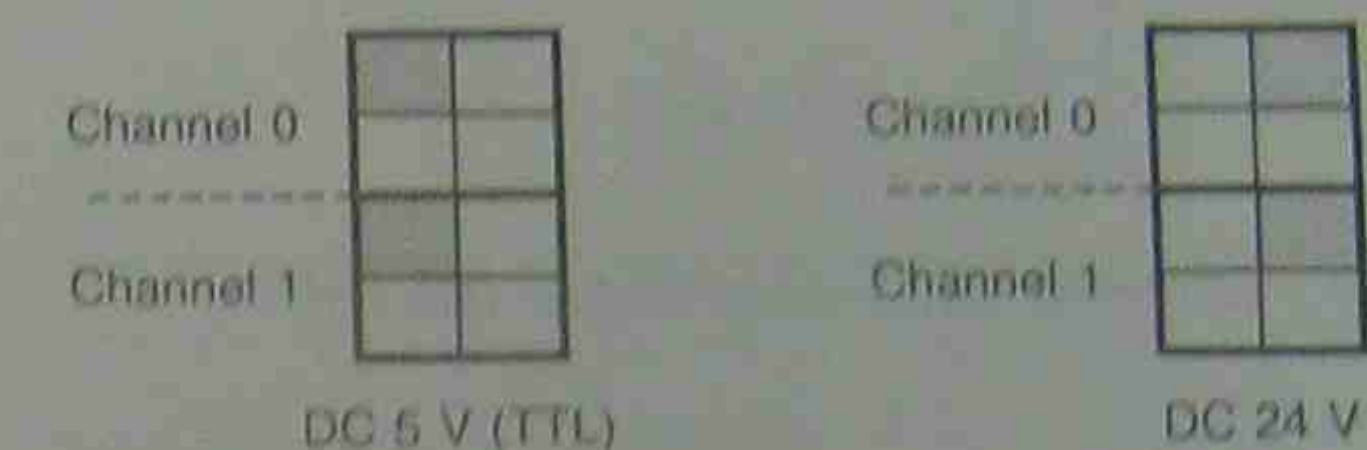


Figure 16-5. Setting the Input Voltage Range on the Counter Module (500 Hz)

Installation

The counter module is plugged into a bus unit like any other module (see section 3.2.1).

Wiring

See schematic diagram.

Addressing

A counter module can be addressed like a two-channel digital module (channel "0" or "1"). For enabling and resetting the counter, you address the module like a digital output module. The counter reading is scanned in the same way as a digital input module.

Counter enable (Set to start value)	S	Q	x.0	Channel "0"
	S	Q	x.1	Channel "1"
Counter reset	R	Q	x.0	
	R	Q	x.1	
Scan "1" = Counter at zero	A	I	x.0	
	A	I	x.1	

| Channel number
| Slot address

Figure 16-6. Scanning the Counter Module (500 Hz)

Timing Diagram

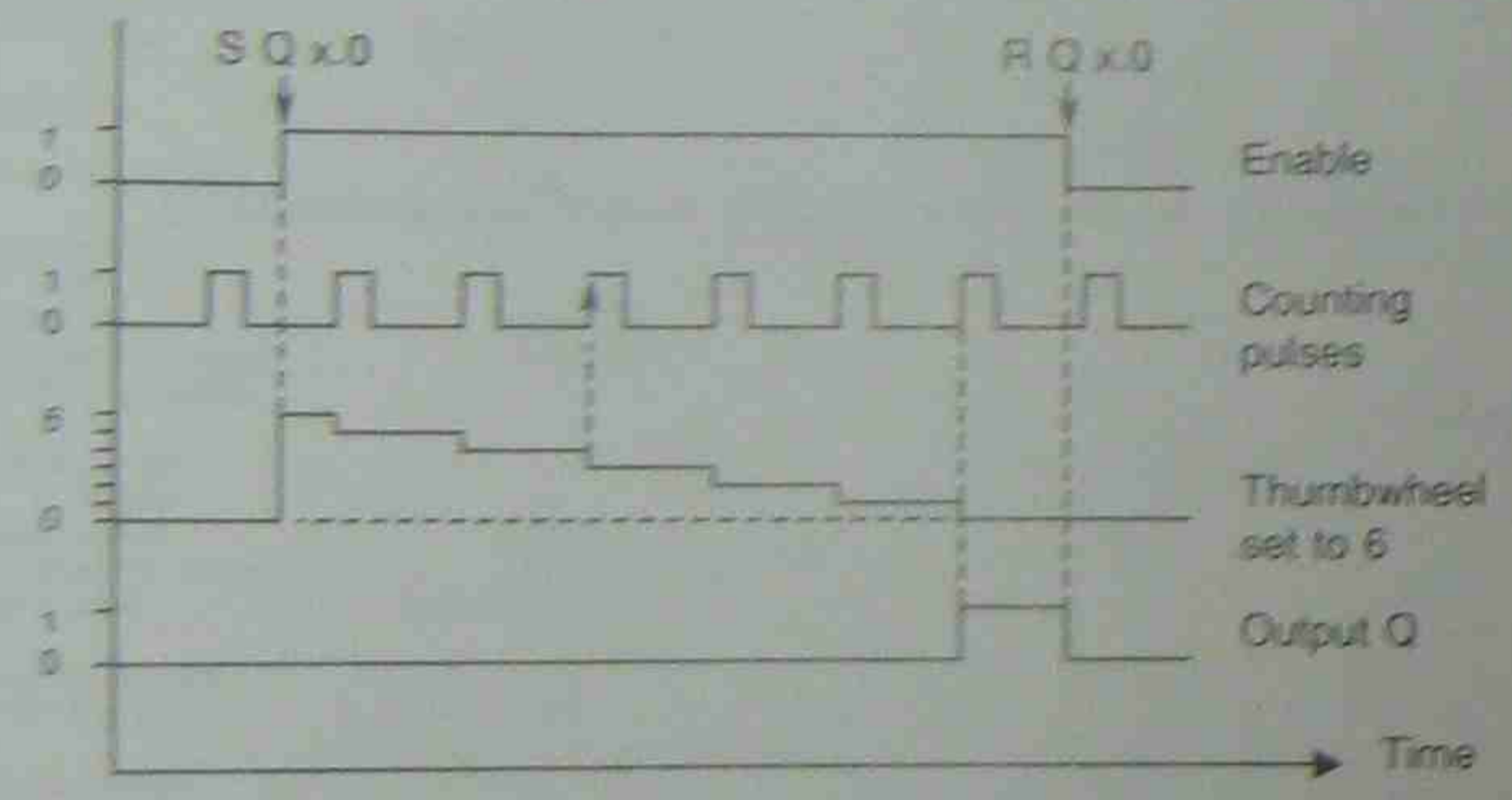
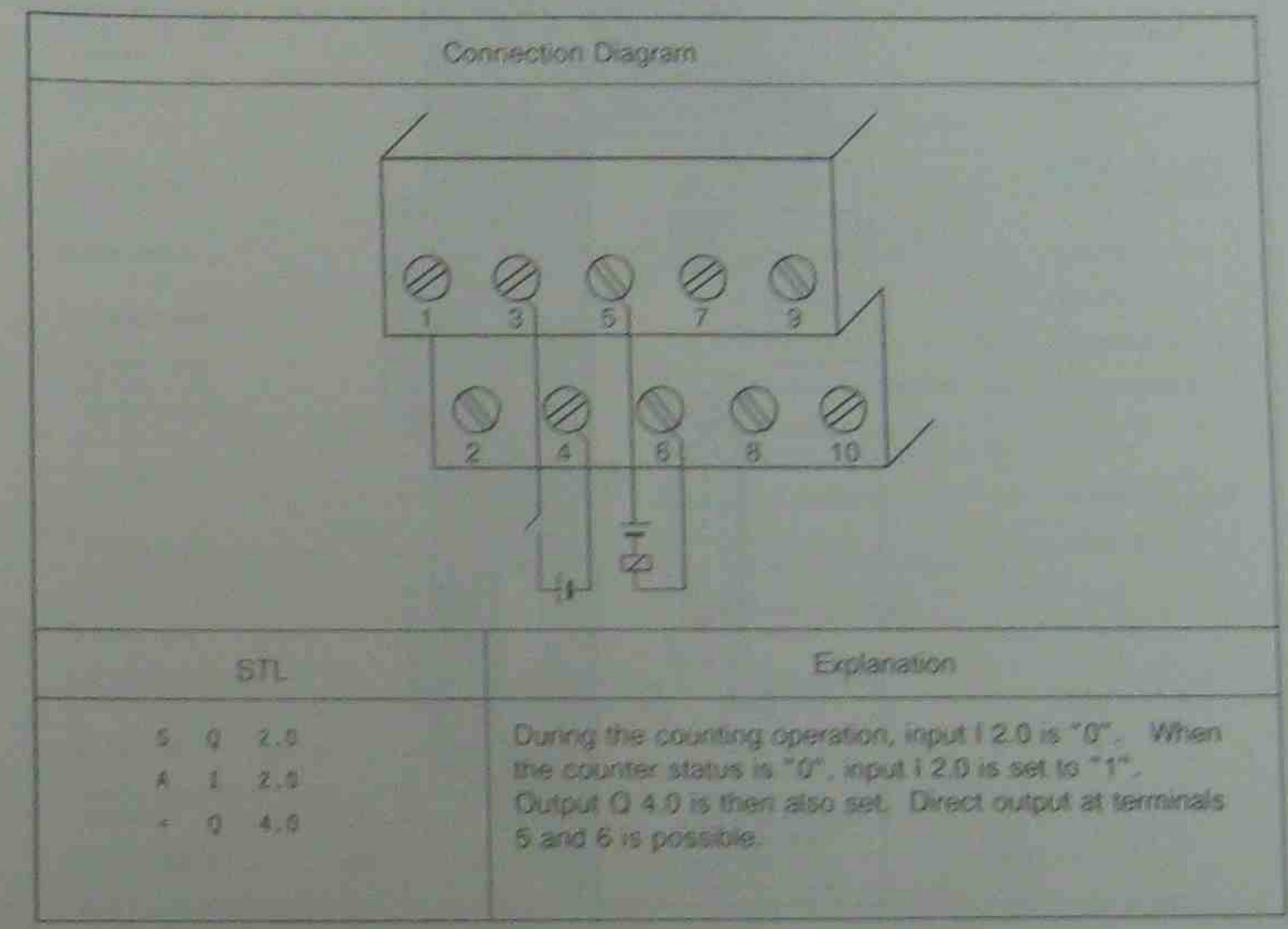


Figure 16-7. Timing Diagram: Setting and Resetting an Output of the Counter Module (500 Hz)

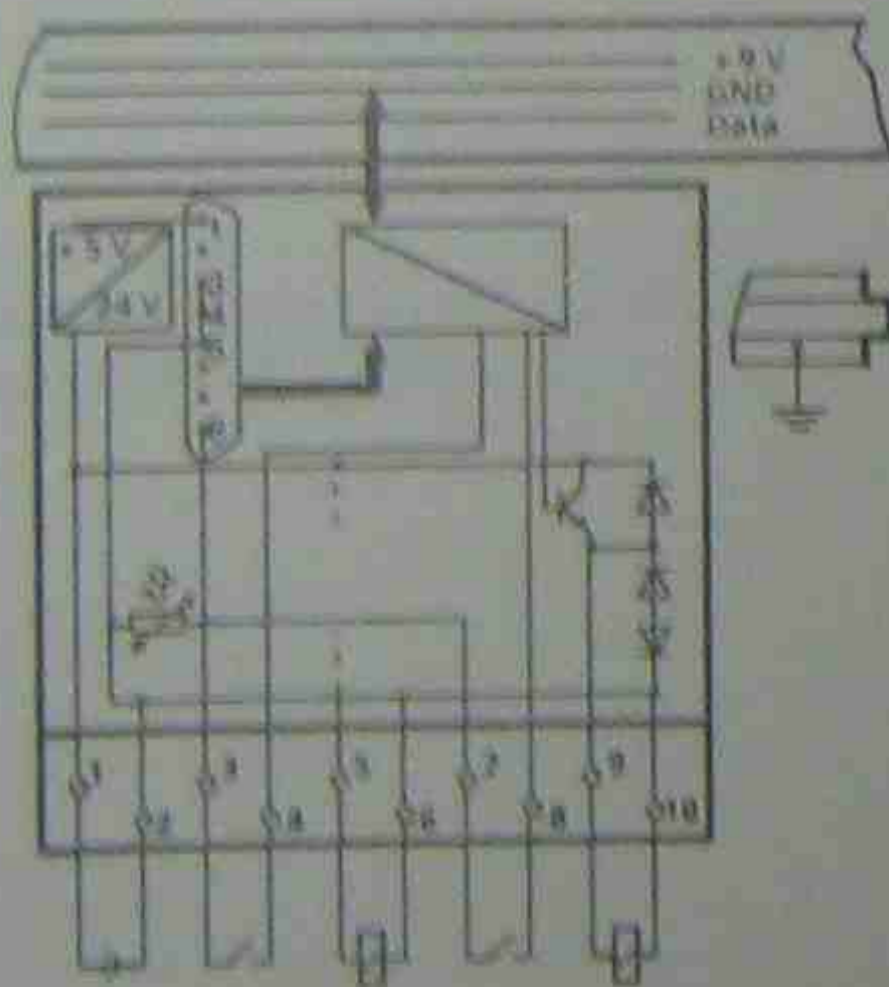
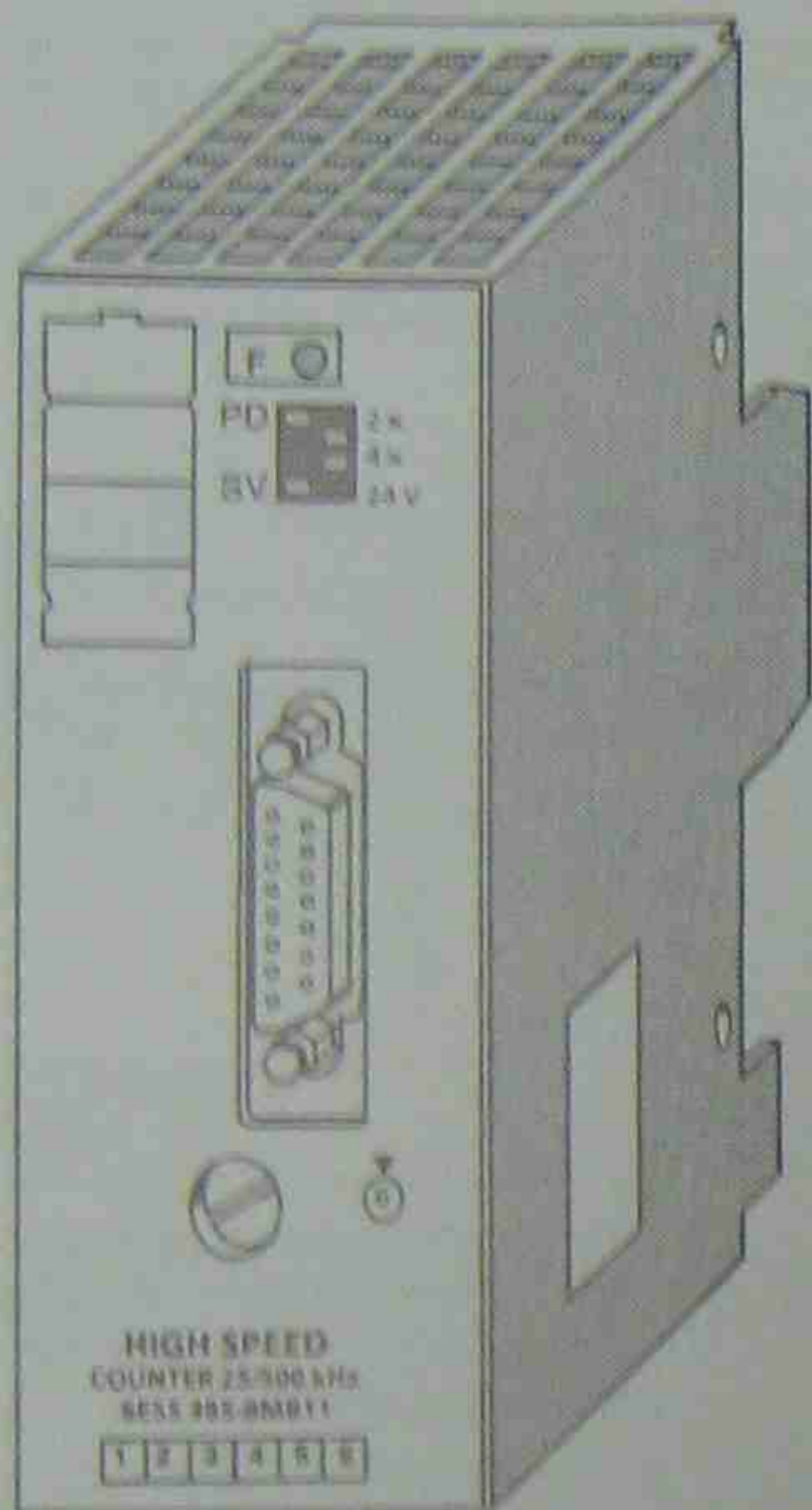
Typical Application

A counter module is plugged into slot 2. A value of 100 is set on channel "0" of this module via the three-digit thumbwheel switches. The incoming pulses are counted once the counter has been enabled by the control program. As soon as 100 pulses have been counted, a signal (output 4.0) is released.



16.6 Counter Module 25/500 kHz

(6ES5 385-8MB11)



Technical Specifications

Address designation (for ET 100 only)	2AX	Power supply for decoder	24 V from L+ (PTC thermistor)
Operating mode (switch-selectable) - position decoder - counter	PD C	Output current	max. 300 mA, short-circuit-proof
Decoder inputs	1 decoder 5 V (differential input) or 1 decoder 24 V DC	Digital Inputs	reference and enabling
Digital inputs	2; reference and enabling	Rated input voltage	24 V DC
Digital outputs	2; setpoints reached 1 and 2	Input voltage - "0" signal - "1" signal	- 33 to +5 V DC + 13 to 33 V DC
Galvanic isolation	no	Rated input current for "1" signal and at 24 V	typ. 8.5 mA
Counting range Operating mode - position decoder - counter	two's complement (KF) - 32768 to +32767 unipolar representation (KH) 0 to 65535	Input frequency	max. 100 Hz
Counting mode - position decoder - counter	forwards/backwards up	Inherent delay	typ. 3 ms (1.4 to 5 ms)
Setpoint input	via program	Cable length (unshielded)	max. 100 m (330 ft.)
5-V Decoder Input	15-pin Cannon sub-miniature D connector	Short-circuit protection (cable impedance up to 15 Ω)	
Input signals - position decoder - counter	differential signals to RS 422 A A-N, B B-N, R R-N A A-N	Digital Outputs	setpoints 1 and 2
Counting frequency	max. 500 kHz	Output current (resistive, inductive load)	5 mA to 0.5 A
Cable length (shielded)	max. 50 m (165 ft.)	Residual current for "0" signal	max. 0.5 mA
Power supply for decoder	5 V from L+ via voltage transformer	Switching current for lamps	0.22 A (5 W)
Output current	max. 300 mA, short-circuit-proof	Limitation of inductive interrupting voltage	to -15 V
24-V Decoder Input	15-pin Cannon sub-miniature D connector	Output voltage - "1" signal - "0" signal	min. L+ - 2.2 V max. 3 V
Rated input voltage	24 V DC	Cable length (unshielded)	max. 100 m (330 ft.)
Input signals - position decoder - counter	A, B, R A	Short-circuit protection (cable impedance up to 15 Ω)	electronic
Input voltage - "0" signal - "1" signal	- 33 to 5 V DC + 13 to 33 V DC	Short-circuit indication (short-circuit to M)	red LED
Rated input current for "1" signal	typ. 8.5 mA	Supply voltage L+ - rated value - ripple V_{rip} - permissible range (including ripple)	max. 24 V DC 3.6 V 20 to 30 V DC
Counting frequency	max. 25 kHz	Fuse (internal)	T 5 A
Cable length (shielded)	max. 100 m (330 ft.)	Current consumption - from L+ without decoder supply - without load - internal (+9 V)	30 mA 70 mA
		Power consumption of the module	typ. 1.9 W + total output current (I_A) × 1.1 V
		Weight	approx. 250 g (9 oz.)

Function

The counter module can be used as an up-counter or as an up/down counter for a position decoder. The counting pulses are supplied by a sensor that you can connect to the 15-pin subminiature D female connector of the module. You can choose from two types of sensors that fulfill the following requirements.

- 5-V error voltages according to RS 422 (up to 500 kHz)
- 24-V signals (up to 25 kHz)

As additional inputs, the module has an enable input and a reference input connected to terminals on the 10-terminal strip that is on the bottom of the bus unit.

By using the STEP 5 program, you can assign two setpoints via the I/O bus. These setpoints are output to channels 0 and 1 in the I/O slot for the module. Once the counter status reaches one of these values, the respective output completes the circuit at terminal block (Q0 or Q1). The status of the outputs is displayed in the diagnostic byte in status bits S1 and S2.

You can also read the following values by using the STEP 5 program.

- The updated count (load IW channel 1 and 2)
- The diagnostic byte (load IW channel 0 high byte)

You can preselect the following items on the operating mode switch.

- Function mode (counter/position decoder)
- Position resolution (X1, X2, or X4)
- Input voltage range of the sensor (5 V DC or 24 V DC)

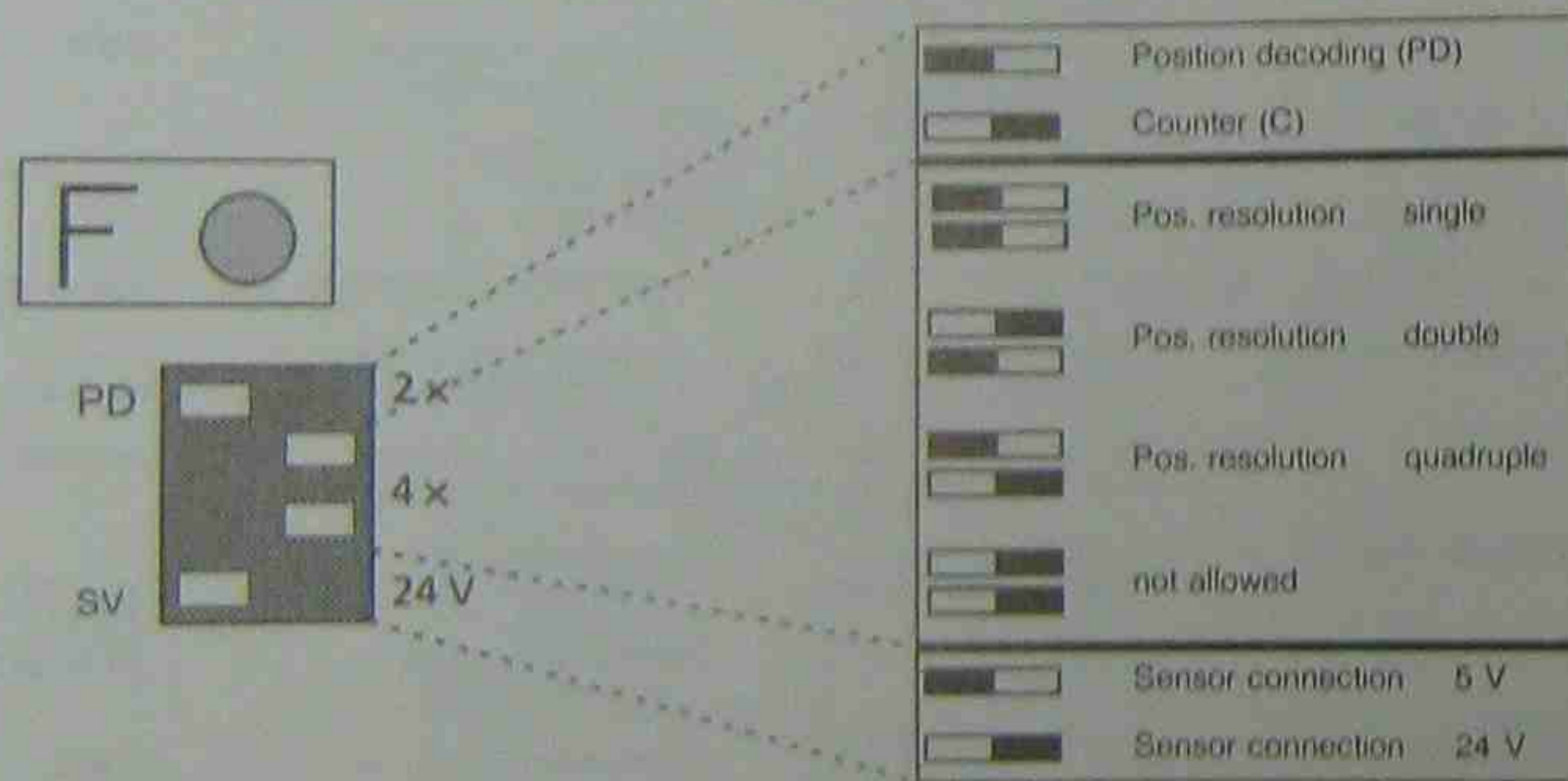


Figure 16-8. Switch Positions on the Operating Mode Switch

16.6.1 Installation Guidelines

Installing and Removing the Module

The counter module is plugged into a bus unit like other I/Os. The counter module can only be plugged into slots 0 through 7. Set the coding key to number 6 on the bus unit.

Installing or Removing the Sensor

Disconnect the 24-V DC power supply (terminals 1 and 2 of the terminal block) before connecting or disconnecting the transducer cables.



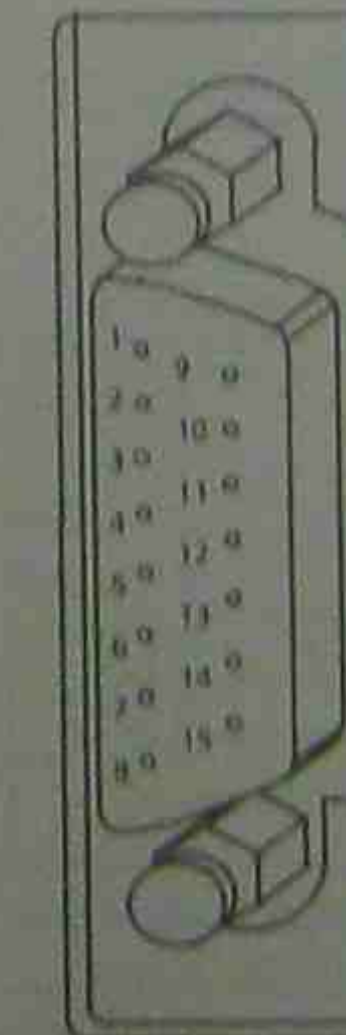
Warning

Connecting or disconnecting the 5-V transducer cable while the module is energized can cause damage to the sensor.

Connection of Pulse and Position Sensors

Connect pulse and position sensors on the front plate by means of a 15-pin sub-D female connector. The correct cable connectors are listed in Appendix D. The module can supply the sensors (5 V DC or 24 V DC).

Basically, all sensors can be connected if they fulfill the requirements of the system signals and supply voltage. Sensors with OPEN-COLLECTOR outputs cannot be connected to the module. The shield connection of the sensors must be connected to the metallic front connector cover.



Pin	Assignment
1	5 V Supply voltage
2	5 V Sensor line
3	Ground
4	
5	
6	Rectang.-wave signal A-N (5 V)
7	Rectang.-wave signal A (5 V)
8	Supply voltage (24 V)
9	Rectang.-wave signal B (5 V)
10	Rectang.-wave signal B-N (5 V)
11	Reference pulse R (5 V)
12	Reference pulse R-N (5 V)
13	Rectang.-wave signal A (24 V)
14	Rectang.-wave signal B (24 V)
15	Reference pulse R (24 V)

Figure 16-9. Pin Assignment of the 15-Pin Sub-D Female Connector

- Connecting Counting Pulse Sensors for 5-V Differential Signal to RS 422

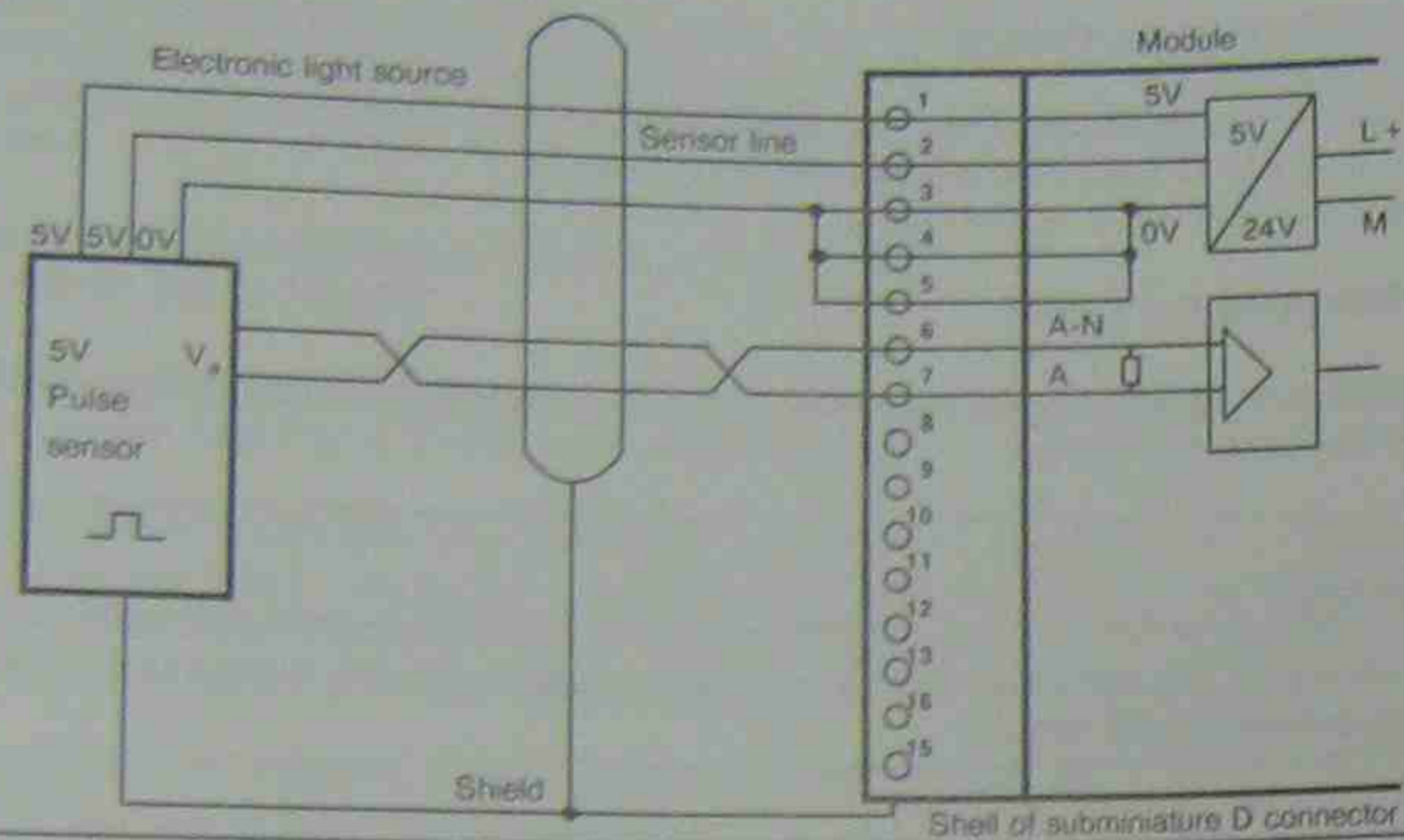


Figure 16-10. Connecting a Counting Pulse Sensor for 5-V Differential Signal to RS 422

- Connecting a 5-V Position Sensor to RS 422

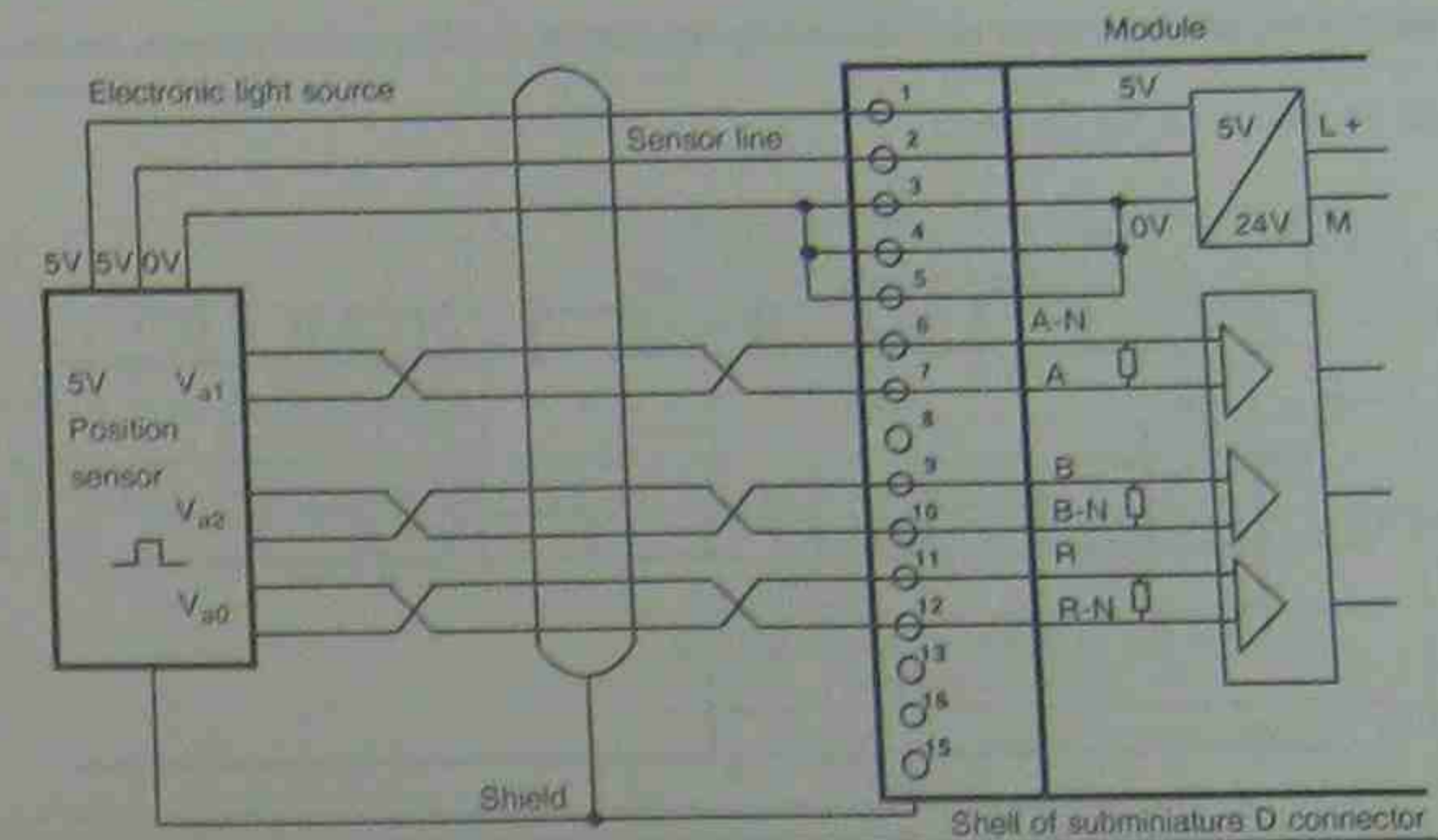


Figure 16-12. Connecting a 5-V Position Sensor to RS 422

- Connecting a Counting Pulse Sensor for 24 V DC

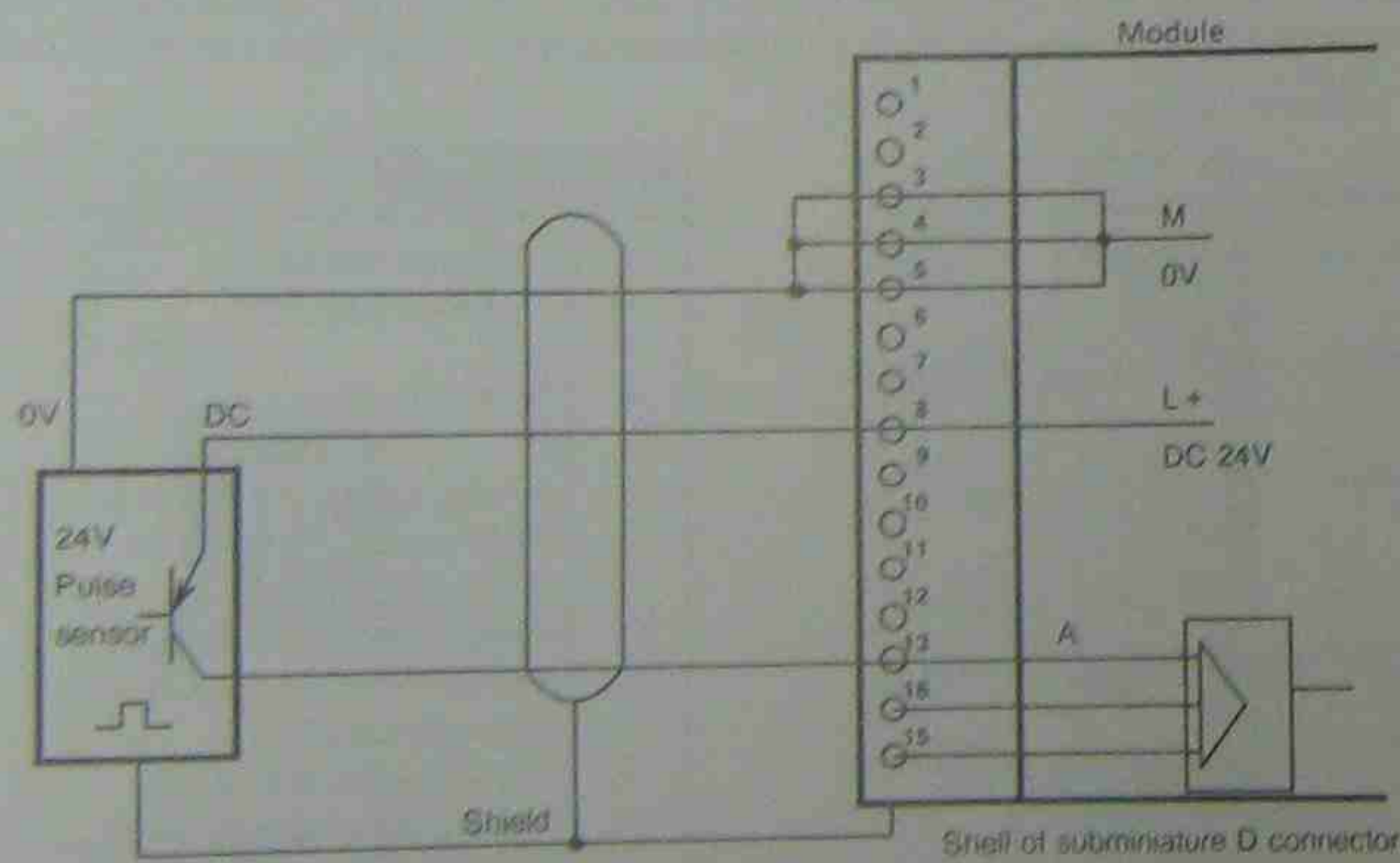


Figure 16-11. Connecting a Counting Pulse Sensor for 24 V DC

- Connecting a 24-V DC Position Sensor

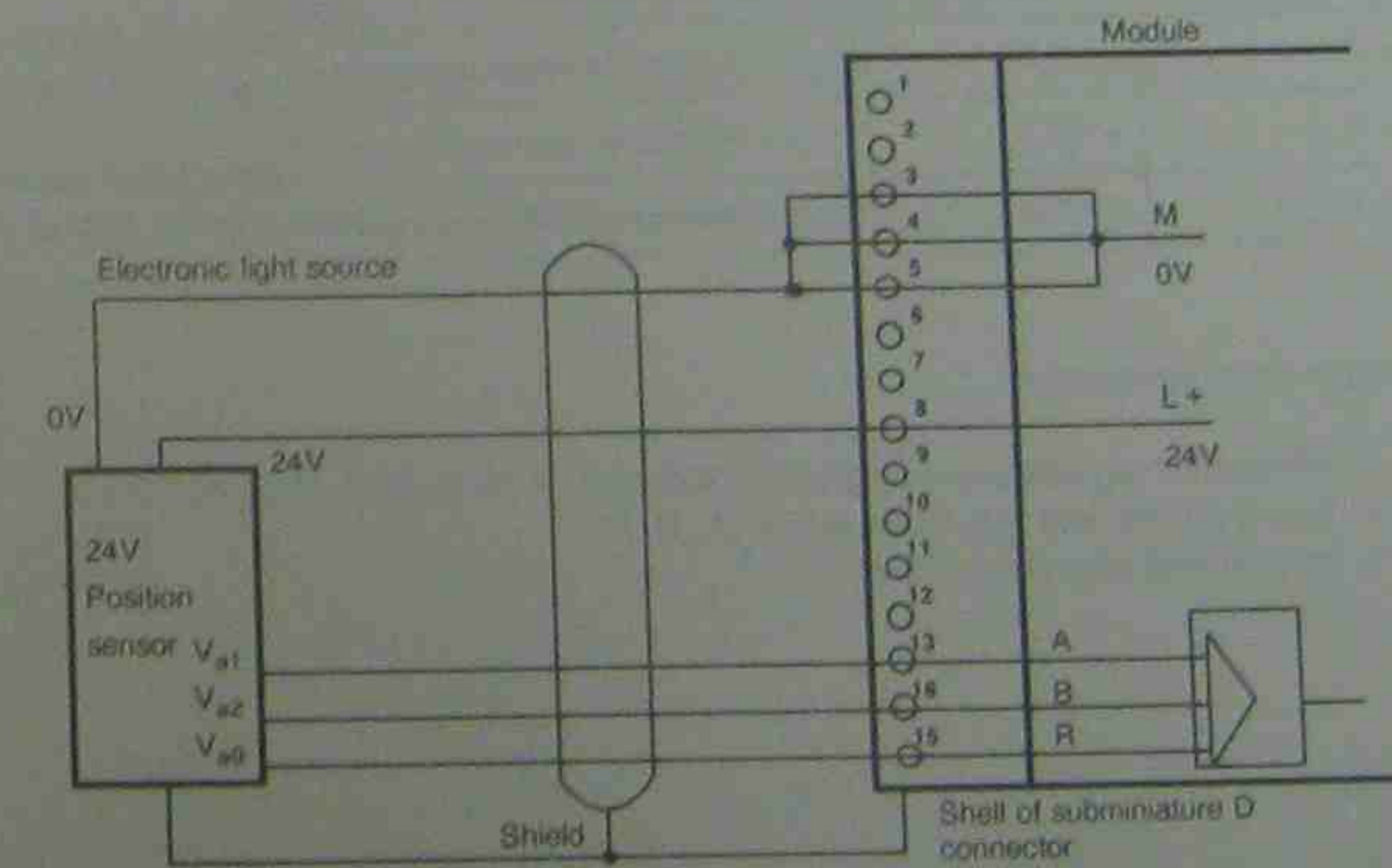


Figure 16-13. Connecting a 24 V-DC Position Sensor