

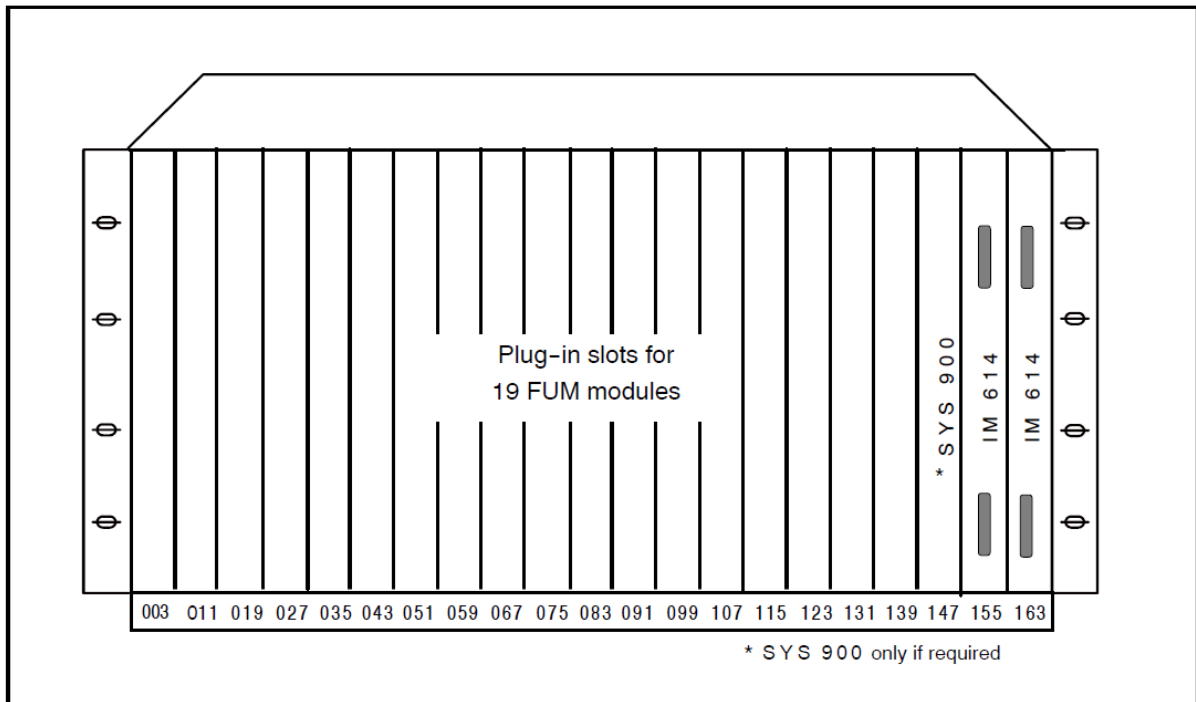
FUM

1	EU 902	1-3
1.1	APPLICATION	1-3
1.2	DESIGN	1-6
1.2.1	System features	1-6
1.2.2	Components	1-6
1.2.3	Slots.....	1-7
1.2.4	Connecting Cables	1-7
1.2.5	Bus Terminating Connector 6ES5 760--0HA11	1-8
1.2.6	Redundant Backplane Bus	1-8
1.2.7	Sensor Supply	1-8
1.2.8	Fuse Monitoring.....	1-8
1.2.9	Power Supply	1-9
1.3	POWER DISTRIBUTION	1-11
2	COMMISSIONING	2-12
2.1	INSTALLATION IN TELEPERM XP CABINETS	2-12
2.2	STANDARD DESIGN	2-12
2.3	REDUNDANT SUPPLY	2-12
2.4	SYS 900 MONITORING AND SIGNALLING MODULE	2-13
2.5	SETTING THE RACK ADDRESS	2-13
3	FUM210 MONITORING AND SIGNALLING MODULE	3-14
3.1	UTILIZATION	3-14
3.2	FUNCTIONS	3-15
3.3	DESIGN	3-17
3.3.1	Mechanical Structure	3-17
3.3.2	Functional Structure.....	3-17
3.4	MODE OF OPERATION	3-18
3.4.1	Module Outputs.....	3-18
3.4.2	Binary Signal Acquisition.....	3-19
3.4.3	Signal Conditioning	3-20
3.4.4	Signal Delay.....	3-20
3.5	SIGNAL PROCESSING.....	3-20
3.5.1	Software Delay.....	3-20
3.6	STARTING (RESTARTING).....	3-21
3.7	COMMISSIONING, OPERATION.....	3-21
3.8	MAINTENANCE, DIAGNOSTICS	3-22
3.8.1	RAM Area.....	3-23
3.8.2	EPROM Area	3-23
3.8.3	Module Fault	3-23
3.9	SPARE PARTS	3-23
3.10	PIN ASSIGNMENT OF THE BACKPLANE CONNECTOR X5.....	3-24
4	FUM 210 DRIVE CONTROL.....	4-25
4.1	UTILIZATION	4-25
4.2	FUNCTIONS	4-26
4.3	MODE OF OPERATION	4-30
4.3.1	Actuators	4-31
4.4	STARTING (RESTARTING).....	4-33
4.5	COMMISSIONING, OPERATION.....	4-33
4.6	MAINTENANCE, DIAGNOSTICS	4-34
4.6.1	RAM Area.....	4-35
4.6.2	EPROM Area	4-35
4.6.3	Module Fault	4-35

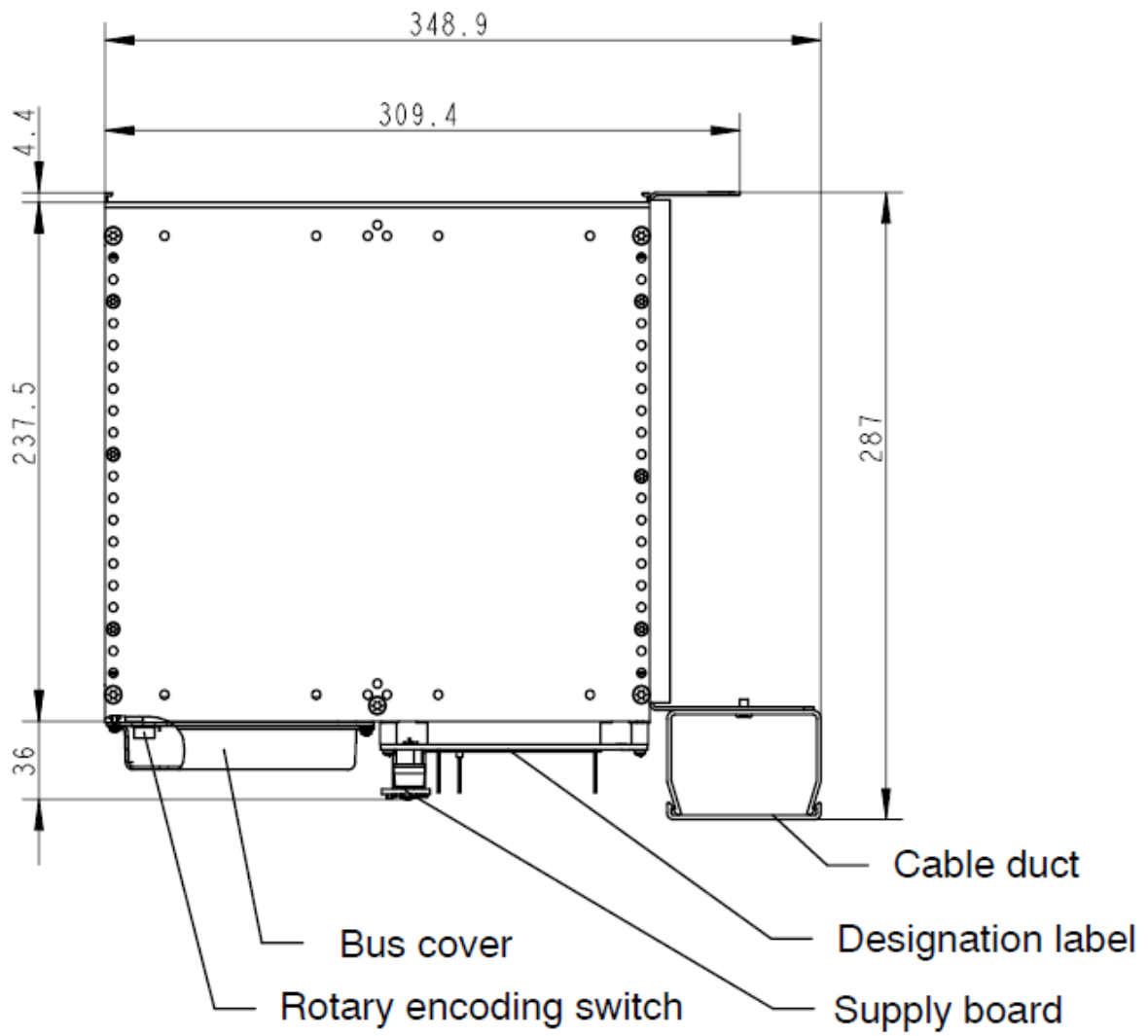
4.7	SPARE PARTS	4-35
4.8	PIN ASSIGNMENT OF THE BACKPLANE CONNECTOR X5	4-36
5	FUM 230A SENSOR CONDITIONING MODULE FOR ANALOG SIGNALS	5-37
5.1	UTILIZATION	5-37
5.2	FUNCTIONS	5-37
5.3	DESIGN	5-40
5.3.1	Mechanical Design	5-40
5.3.2	Functional Design	5-40
5.4	MODE OF OPERATION	5-41
5.4.1	Transducer Power Supply	5-41
5.4.2	Analog Signal Acquisition	5-41
5.4.3	Analog Signal Processing	5-43
5.4.4	Limit Signal Generation	5-45
5.4.5	Analog Signal Simulation	5-46
5.4.6	Redundant Configuration of two FUM 230 Modules	5-46
5.5	COMMISSIONING, HANDLING	5-49
5.6	SERVICE, DIAGNOSIS	5-49
5.6.1	RAM Area	5-50
5.6.2	EPROM Area	5-50
5.6.3	Module Fault	5-50
5.7	SPARE PARTS	5-50
6	FUM 230C SENSOR CONDITIONING MODULE FOR ANALOG SIGNALS	6-52
6.1	UTILISATION	6-52
6.2	FUNCTIONS	6-52
6.3	DESIGN	6-55
6.3.1	Mechanical Design	6-55
6.3.2	Functional Design	6-55
6.4	MODE OF OPERATION	6-56
6.4.1	Transducer Power Supply	6-56
6.4.2	Analog Signal Acquisition	6-56
6.4.3	Analog Signal Processing	6-58
6.4.4	Limit Signal Generation	6-60
6.4.5	Analog Signal Simulation	6-61
6.5	COMMISSIONING, HANDLING	6-61
6.6	MODULE SETTINGS	6-61
6.6.1	Module Use in Single--module Configuration	6-62
6.6.2	Module Use as Coupling Module	6-65
6.6.3	Module Parallel Connection (Redundancy)	6-66
6.7	SERVICE, DIAGNOSIS	6-69
6.7.1	RAM Area	6-70
6.7.2	EPROM Area	6-70
6.7.3	Module Fault	6-70
6.8	SPARE PARTS	6-71
6.9	CONNECTOR PIN ASSIGNMENTS OF THE X5 BACKPLANE CONNECTOR	6-71

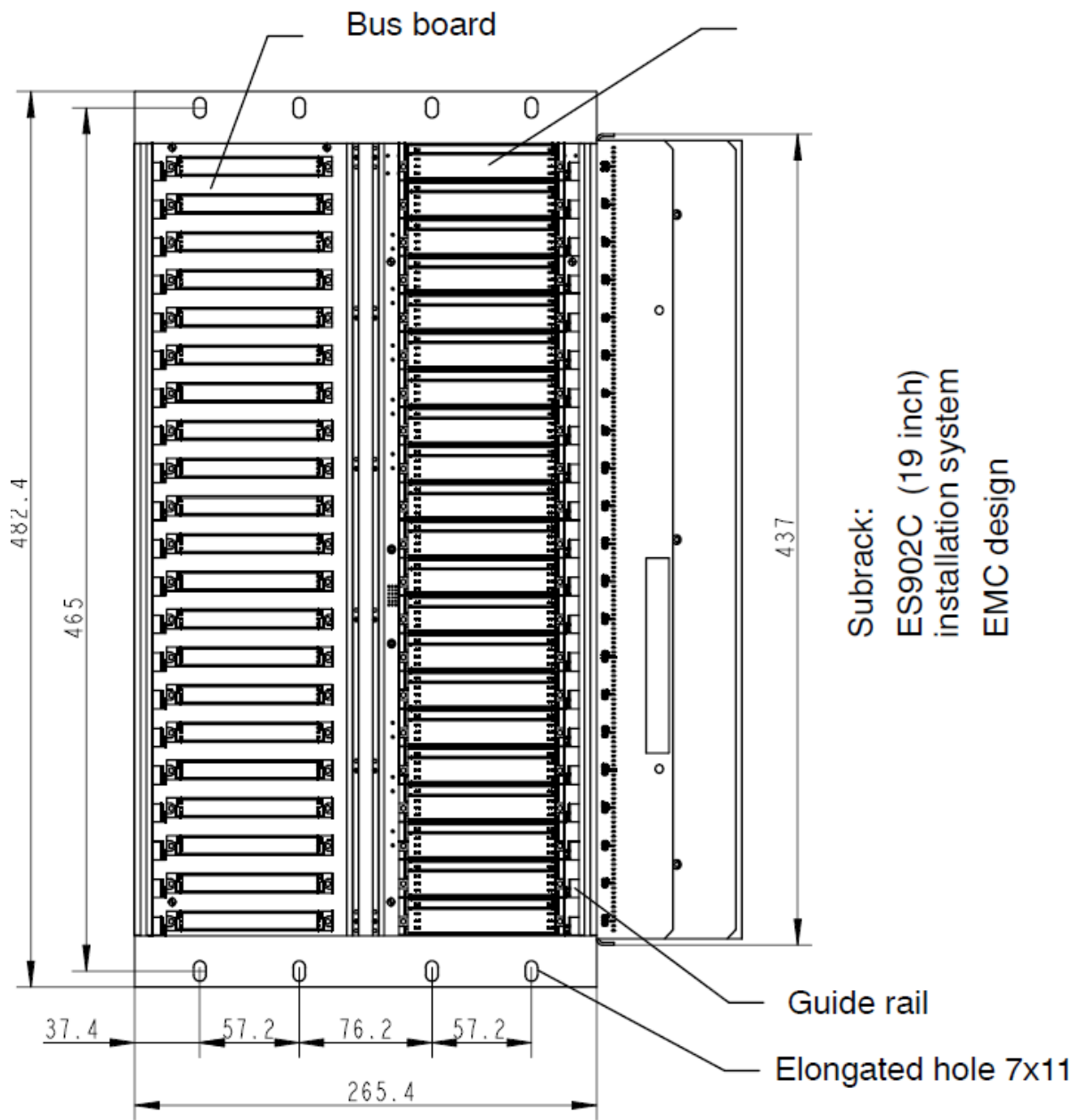
1 EU 902

1.1 Application



The EU 902 rack is a component of the TELEPERM XP cabinet (cf. Packaging System). It is used for accommodating modules of the individual control level of the TELEPERM XP AS 620 B automation system with FUM B. The rack is able to accommodate two IM 614 interface modules (that connect to the AP automation processor) and up to 19 function modules (FUM) that provide the connection to the process. If necessary, an SYS 900 monitoring and signalling module can be installed instead of a function module.





1.2 Design

1.2.1 System features

- 19 - in packaging system ES 902 C--EMV (SIPAC)
- Installation width 482,6 mm
- Installation height with cable duct 348 mm
- A rack requires 8 height units for cabinet installation (1 height unit = 44.45 mm)
- The attachment level is at the front
- P.c.b. format of the FUM modules (H x D = 233.35 mm x 220 mm)
- Module front panels in 20.32--mm pitch
- Connector to DIN 41612
- M1 front system as insertion and removal aid for the modules

1.2.2 Components

- Rear plug--in connector for the IM 614 interface module and function modules (FUM)
- Power supply and process signals style G, 64--pin with slot (lower subrack tier)
- Bus interfaces style C, 96--pin (upper rack tier)
- Guide rails at top and bottom
- 1 cable duct for marshalling cables
- 1 bus board with rotary encoding switch (backplane of upper subrack tier)
- 1 supply board with fuses and wrapfield (backplane of lower subrack tier)
- 1 plug--in module for fuse monitoring
- 1 annotation template for the wrap field
- 1 insertable jumper between 1LEXT and 2LEXT for standard supply
- 1 backplane bus cover

1.2.3 Slots

The EU 902 rack has a free capacity of 21 slots with a module installation pitch of 20.32 mm. This includes 19 slots for the function modules that provide the connection to the process signals and 2 slots for the IM 614 interface modules that connect to the AP automation processor of the group control level. An SYS 900 monitoring and signalling module can replace a function module in slot 147. In this case the basic wiring of the supply board has to be modified.

- Slots 003 ... 139 18 function modules of the AS 620 B/F
- Slot 147 (can be configured) 1 function module of the AS 620 B/F or 1 SYS 900 monitoring and signalling module
- Slots 155 ... 163 2 IM 614 interface modules

1.2.4 Connecting Cables

The EU 902 rack is connected to the AP automation system via the IM 304 and IM 614 interface modules. The IM 304 interface module (standard S5) is installed in the central controller of the group control level. A single --channel or a dual--channel connection can be established (see Instructions AS 620 B (FUM)). In such a configuration, the bus runs from the first IM 614 to the second IM 614, etc and to the last IM 614 of the bus chain. The interface modules are connected with each other via screened cable assemblies with metallic connector hoods. Slide locks fix the connectors to the front panels of the interface modules. The maximum distance between an IM 304 and the last IM 614 of a bus chain is 100 meters.

IM 304 -- IM 614 connection with the 6ES5 721-- connecting cable

The 6ES5 721--OB... Connecting cable is used for establishing the link between the IM 304 and IM 614 (first expansion unit of the bus chain) interface modules. This connecting cable has two 50--way sub miniature 'D' connectors fitted. The cable length depends on the cabinet structure (including connections between cabinets).

IM 614 -- IM 614 connection with the 6DP 8801--8AA (SKL 801) connecting cable

The 6DP 8801--8AA (SKL 801) connecting cable is used for establishing the link between the IM 614 interface modules (connection between the EU 902 racks). The cable is 250 mm long and has two 50--way sub miniature "D" connectors fitted.

1.2.5 Bus Terminating Connector 6ES5 760--0HA11

The bus to and between the EU 902 racks must be terminated with a terminating connector that is installed on the last IM 614 interface module of each chain. The bus terminating connector consists of a 50-way sub miniature "D" connector with integrated terminating resistors. It is plugged into the free top connector on the front panel of the IM 614 interface module. The connector has a metallic hood and a slide lock.

1.2.6 Redundant Backplane Bus

The bus connections between the different slots are implemented on the bus board in the rack backplane. It interconnects the 96--way female connectors of the upper rack tier. Each FUM slot has two bus connections, one to the interface module in slot 155 (bus 1) and one to the interface module in slot 163 (bus 2).

1.2.7 Sensor Supply

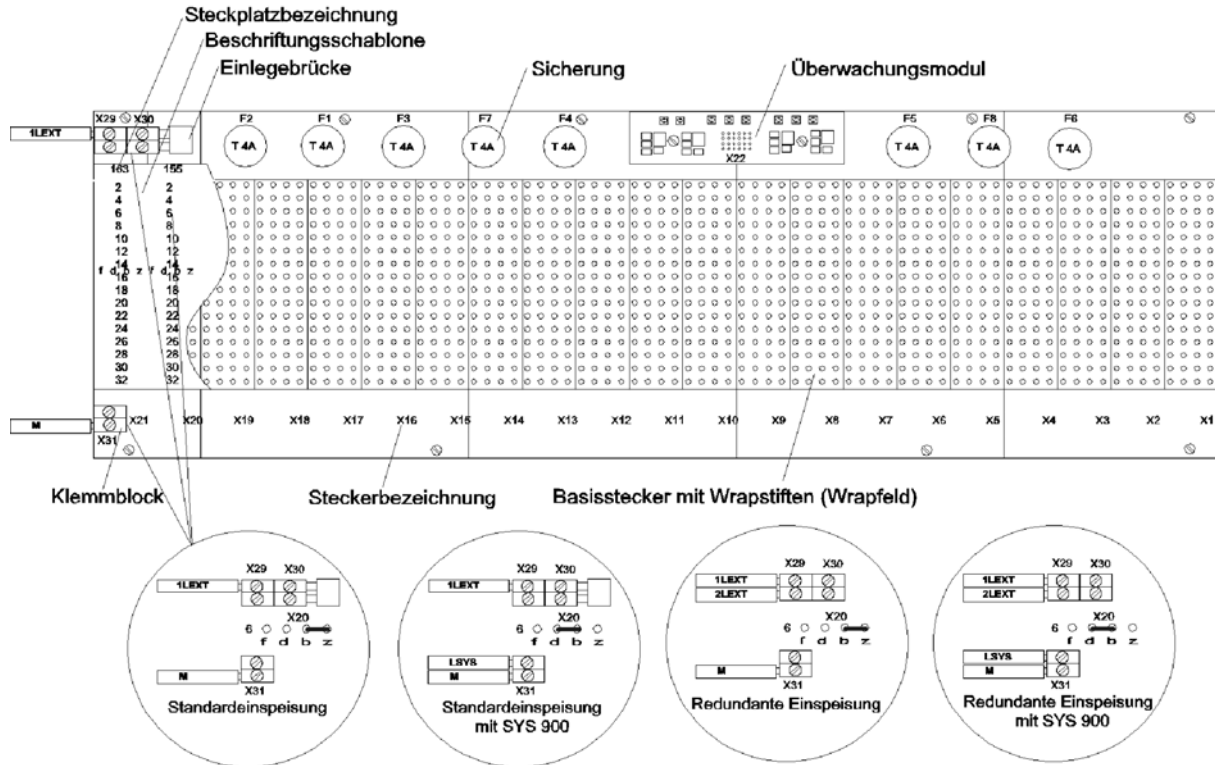
The pins z8 to z32, b8 to b32 and f8 to f32 of the X20 and X21 connectors are at disposition to connect the reference potentials of the sensor supply of four--wire measuring transducers. These pins are on M potential. The connection to the cabinet wiring block (SAE or SAS) is realized with individual wires (equipment wire 7Y, wire diameter 0.5 mm according to SN 54233). One pin can be wrapped with up to three wires. The operating potential DC 24 V of the sensor supply supplies the FUM module related to the transducer via a current limiting output. Two-wire measuring transducers are only connected to the correspondent FUM module.

1.2.8 Fuse Monitoring

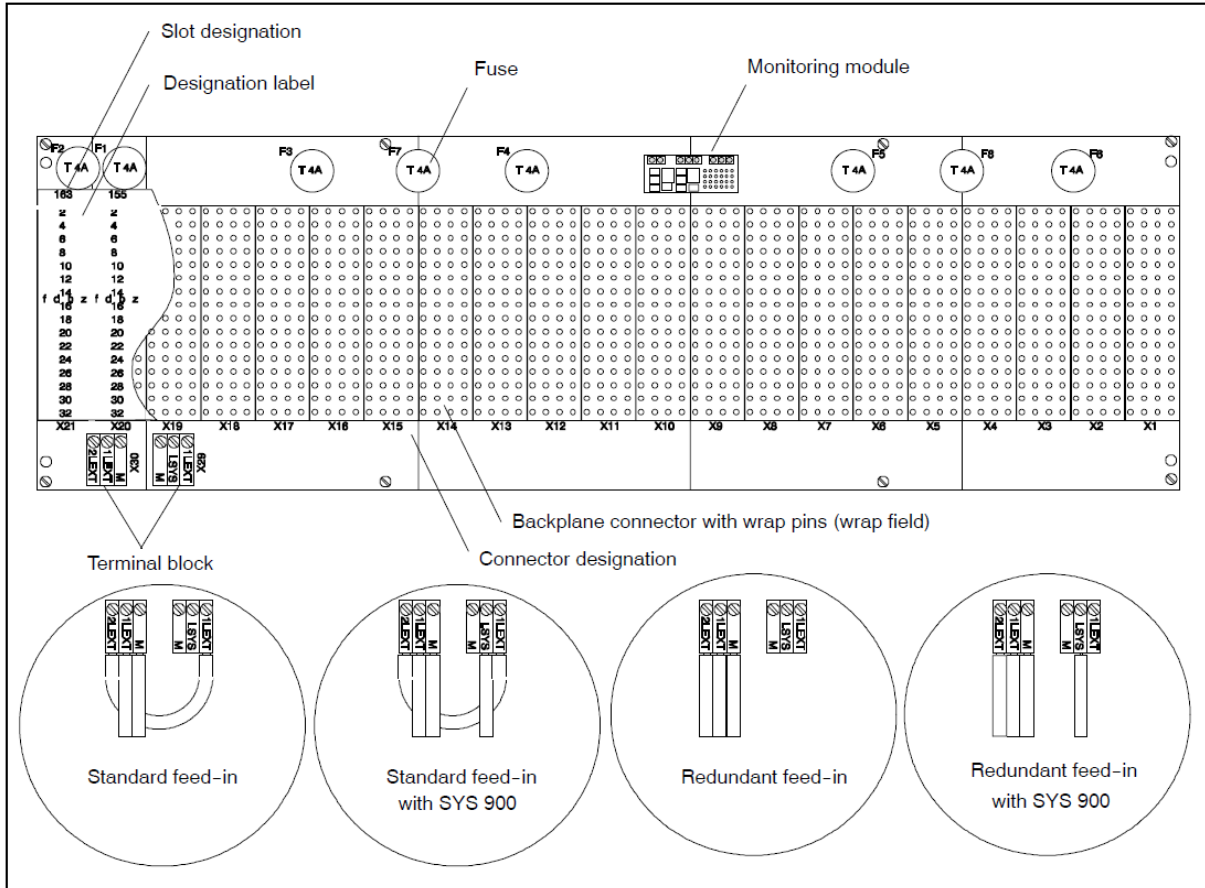
A plug--in monitoring module is plugged on the top center of the supply board. This module monitors the fuses of the supply board. A steady light of the correspondent LED of the module signals a blown fuse as well as one of the group messages UEL+, ULM and UEBUS to the SYS 900 monitoring and signalling module. The connection to the alarm outputs (connector X21, pins d6, b6 and z6) with the SYS 900 is realized by means of three individual wires (equipment wire 7Y, wire diameter 0.5 mm according to SN 54233). The alarm outputs of the monitoring module can also be connected to the inputs of the SIMATIC S5 module 6ES5482-4UA11 (DE/DA). The module can be removed and inserted during operation of the rack for repair.

1.2.9 Power Supply

The rack supply with the voltage potentials DC 24 V and M occurs from the cabinet busbar to the supply board in the lower rack tier via the lateral transfer module. Screw terminal blocks to feed in the 1LEXT, 2LEXT, LSYS and M potentials are located on the supply platine. The connection to the transfer module is realized with individual lines 2.5 mm². With the standard feeder the 1LEXT and 2LEXT potentials are jumpered to the terminal blocks. Supply is carried out at 1LEXT and M.



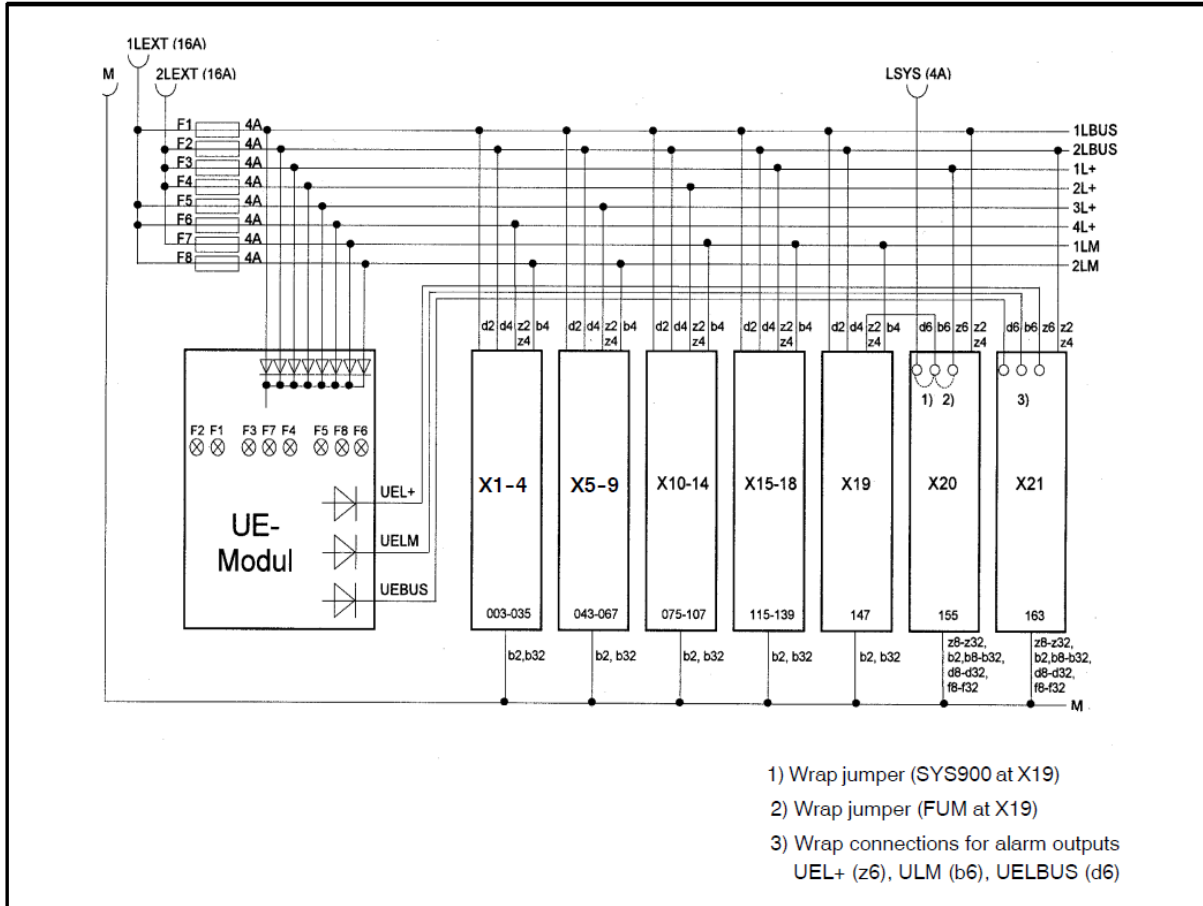
Power supply board EU 902 new 6DP 9902--8BA (rear view)



Power supply board EU 902 old 6DP 9902--8AA (rear view)

1.3 Power Distribution

The potential distribution takes place on the rack backplane.



Potential distribution in the EU 902 rack

The power supply to the modules is as follows:

- Operating voltage of the function modules
 - Operating voltage of bus interfaces 1 of FUMs and interface module 1
 - Operating voltage of bus interfaces 2 of FUMs and interface module 2
 - Signalling voltage of the function modules
 - M potential
 - SYS 900 operating voltage (tier A only)
- 1 L+, 2 L+, 3L+ and 4L+
 1LBUS
 2LBUS
 1LM and 2LM
 M
 LSYS (to be configured)

2 Commissioning

2.1 Installation in TELEPERM XP Cabinets

The EU 901 rack is inserted from the front into the supporting structure of the TELEPERM XP cabinets, and fixed there with screws.
See Description "Packaging system, Installation" in the AS 620 System Manual (Order No. 6DP6200--2...).

2.2 Standard Design

The EU 902 rack is wired for a standard equipment (delivery state). Only IM614 interface modules and function modules (FUM) can be accommodated in this standard design. In this case the potentials 1LEXT and 2LEXT are jumpered to the terminal blocks. The operating voltage of slot 147 is connected to 1L+ via a wrapped wire (Fig. 4, jumper X20.z6 -- X20.b6).
In the standard design the entire rack is supplied via an automatic circuit--breaker 16 A on the lateral transfer module.

2.3 Redundant Supply

When function modules are used in a redundant way in the same rack the jumper at the terminal blocks between 1LEXT and 2LEXT must be removed, contrary to the standard design.
The incoming power is supplied separately from the terminals 1LEXT and 2LEXT via 2 automatic circuit- breakers 16 A on the lateral transfer module.
In case of a redundant supply the slots 003 to 067 are fed by 1LEXT (Fig. 4, X1 -- X9) and the slots 075 to 147 by 2LEXT (Fig. 4, X10 -- X19). The function modules linked to each other are configured to be inserted in the redundant halves of the rack.

Caution

The whole wiring modification may only be performed after the power to the rack has been switched off. The rules for handling electrostatic sensitive equipment must be observed.

2.4 SYS 900 Monitoring and Signalling Module

When a SYS 900 monitoring and signalling module is inserted in the slot 147 of an EU 902 rack, the operating voltage of slot 147 must be connected to the LSYS supply terminal. Contrary to the standard design

- the wrap connection X20.z6 -- X20.b6 has to be removed
- the wrap connection X20.b6 -- X20.d6 must be established
- supply via an automatic circuit--breaker 4 A on the lateral transfer module on the LSYS terminal

Caution

The whole wiring modification may only be performed after the power to the rack has been switched off. The rules for handling electrostatic sensitive equipment must be observed.

2.5 Setting the Rack Address

There is a rotary encoding switch on the EU 902 rack that permits to set the rack address. The rack address is read by the IM 614 interface modules, and used for address decoding. The selected rack address can be read via the DS diagnosis system.

The encoding switch is located on the bus board (upper rack tier, top left). It can be accessed through an opening in the bus cover.

The switch positions are marked between "0" and "F" on the rotary encoding switch.

The address is selected according to the following table:

Rack address TN	IM 614 base address	S1 switch position
03	F 3000H	3
04	F 4000H	4
05	F 5000H	5
06	F 6000H	6
07	F 7000H	7
08	F 8000H	8
09	F 9000H	9
10	F A000H	A

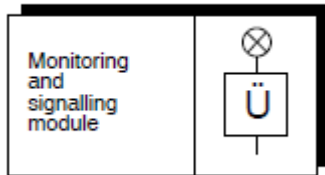
Caution

The encoding switches may only be actuated after the power to the rack has been switched off. The rules for handling electrostatic sensitive equipment must be observed.

Note

**The first FUM B rack has the rack number TN = 03 !
Switch settings S1 = 0 or 1 or 2 are impermissible.**

3 FUM210 monitoring and signalling module



FUM210 monitoring and signalling module

- 16 binary outputs
- 16 binary outputs (120 mA)
- Monitoring cabinet-related equipment
- Triggering cabinet indicator lamps

3.1 Utilization

The FUM 210 module can be used in the AS 620 B automation system in one of the following ways:

- Sensor conditioning for binary signals (BT function)
- High speed binary signal conditioning (BT--I function)
- Modules for individual controls (ESG function)
- Binary signal output (F210BIN--function)
- Monitoring and signalling module (monitoring and signalling function)

The FUM210 module is one of the four monitoring and signalling modules (FUM210, SYS 900, S5--DEDA, SIM--DEDA) that are employed in the AS 620 automation system.

The FUM210 module (monitoring and signalling module) replaces the SYS900 module in the AS 620 B automation system (please refer to important note in chapter 1.2). It signals and indicates malfunctions on the associated modules, components, and power supply units.

If the FUM210 module is used as the master monitoring module in an I&C cabinet, it monitors all general signalling contacts of the cabinet (such as door contacts, temperature monitors, heat exchangers), triggers the cabinet indicator lamps and, if there are any, the cabinet row lamps.

The dynamization of the fault signals enable newly occurred malfunctions to be detected (blinking light) even if an acknowledged fault (steady light) is still pending.

FUM210 module (monitoring and signalling function) used in AS620 B with FUM B is mounted in slot 147 of the top EU 901 resp. EU 902 rack in cabinets that only contain EU 901 resp. EU 902 racks (cabinet type C).

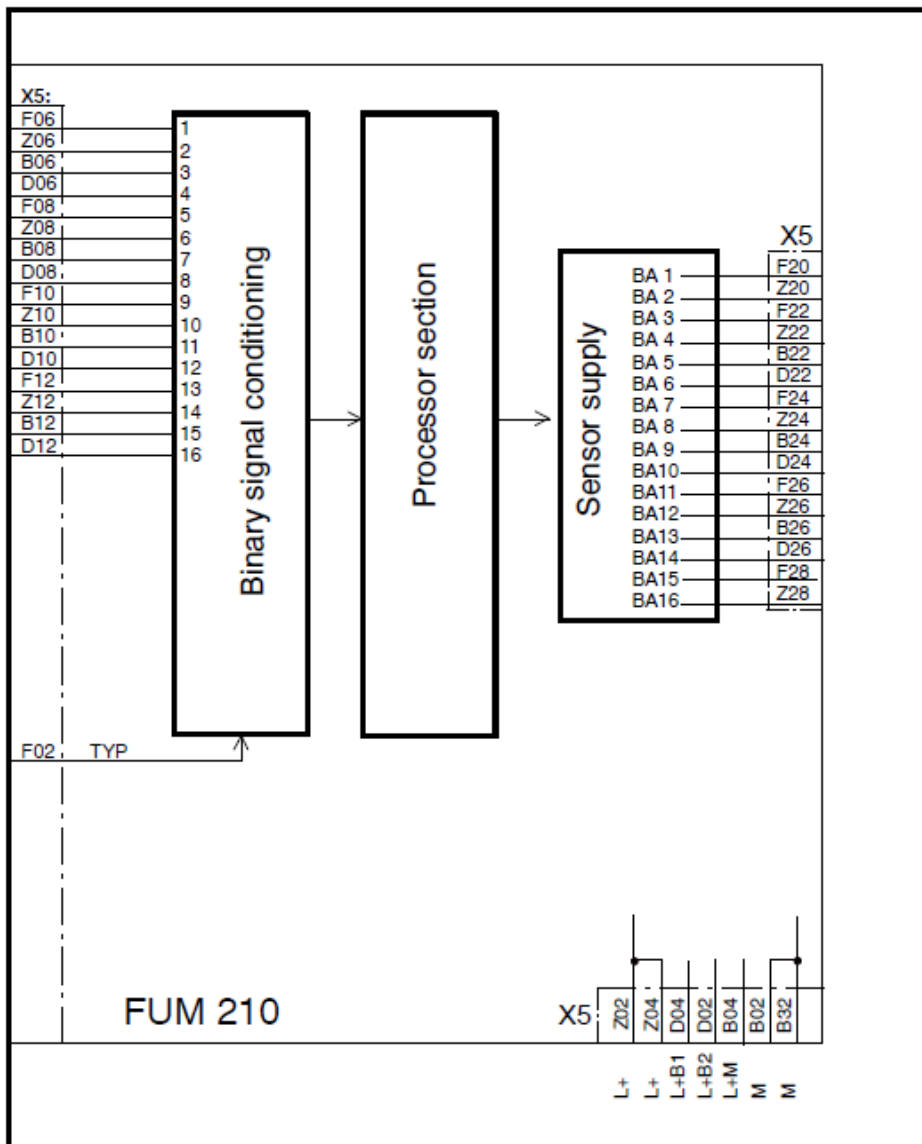
3.2 Functions

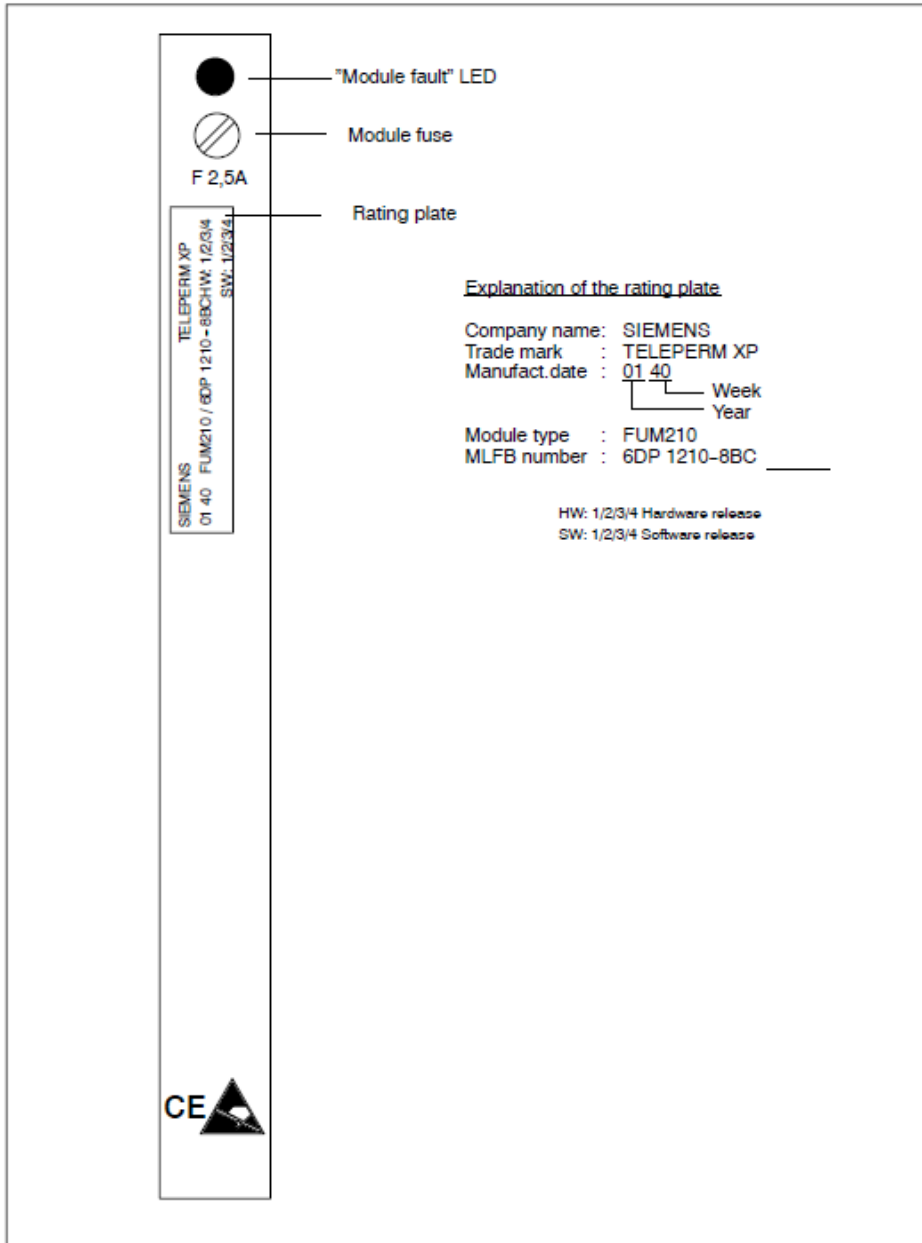
The module has the following functions:

- Sensing up to 13 error states
- Inverting the input signals (sensing NC contacts)
- Output common alarms
- 2-Hz blinking frequency generation
- Triggering and testing the cabinet indicator lamps
- Triggering and testing the cabinet row lamp
- Power supply for monitoring the operating voltages and cabinet doors
- Processing the acknowledgement signal for the cabinet indicator lamps

Note

Do **not** use the FUM210 module in the AS 620 F automation system with APF.
 If the FUM210 module is used in an AS 620 B (EU 901 resp. EU 902 rack), the FX 55 MELD function block (Triggering the lamp guidance system) must be invoked in the higher-level APF.





3.3 Design

3.3.1 Mechanical Structure

The basic structure of the modules of the individual control level is explained in the AS 620 (FUM) Operating Instructions in the AS 620 System Manual (Order No. 6DP 6200--2...).

The mechanical structure of the FUM210 module has the following features:

- Printed circuit board in the format 233 mm x 220 mm (extended double Euro format) for the ES 902 C packaging system.
- Slot width 20.32 mm (1 1/3 standard slots)
- Metallic front panel; front panel layout see Fig. 2
- Front panel width 20 mm; front panel height 230,35 mm
- Two DIN 41612 connectors one above the other at the rear

Upper male connector (X1), C style; 96 way as bus interface to connect the two buses in the rack.

Lower male connector (X5); G style; 64 way as I/O interface for all input and output signal connections to the electronics cabinet, internal and external components, and the module power supply.

3.3.2 Functional Structure

The functional structure of the FUM210 module has the following features:

- I/O section. The module employs the I/O section to sense the fault and indicator signals of the I&C cabinet and to trigger the cabinet lamps and/or cabinet row lamp.
- Processor section. This section implements the module logic in the software.
- Two identical and independent bus interfaces that provide for communication with the higher level.
- Power supply unit to provide the voltages required on the module.

The slot of the module is keyed. The module may be replaced with a module of the same type. Merely the module fuse must be removed before a module is installed or removed. No further selection, addressing, or programming is required on the module.

3.4 Mode of Operation

3.4.1 Module Outputs

Sensor supply output (BT--function):

14 short--circuit and overload--proof driver outputs are available for the sensor supply. The levels of the output drivers are read back and monitored by the module processor.

Binary signal output (F210BIN function):

The F210BIN function can be used to output 16 binary signals from the PAA_E.

The outputs are protected against reverse voltage and back--e.m.f. by means of longitudinal diodes and suppressor diodes.

The outputs are provided with automatic reclosing. As soon as there is no overload or short circuit present they automatically take up their function again when an output signal (high signal) is present internally.

The corresponding outputs are connected when two modules are circuited parallel in order to increase the availability.

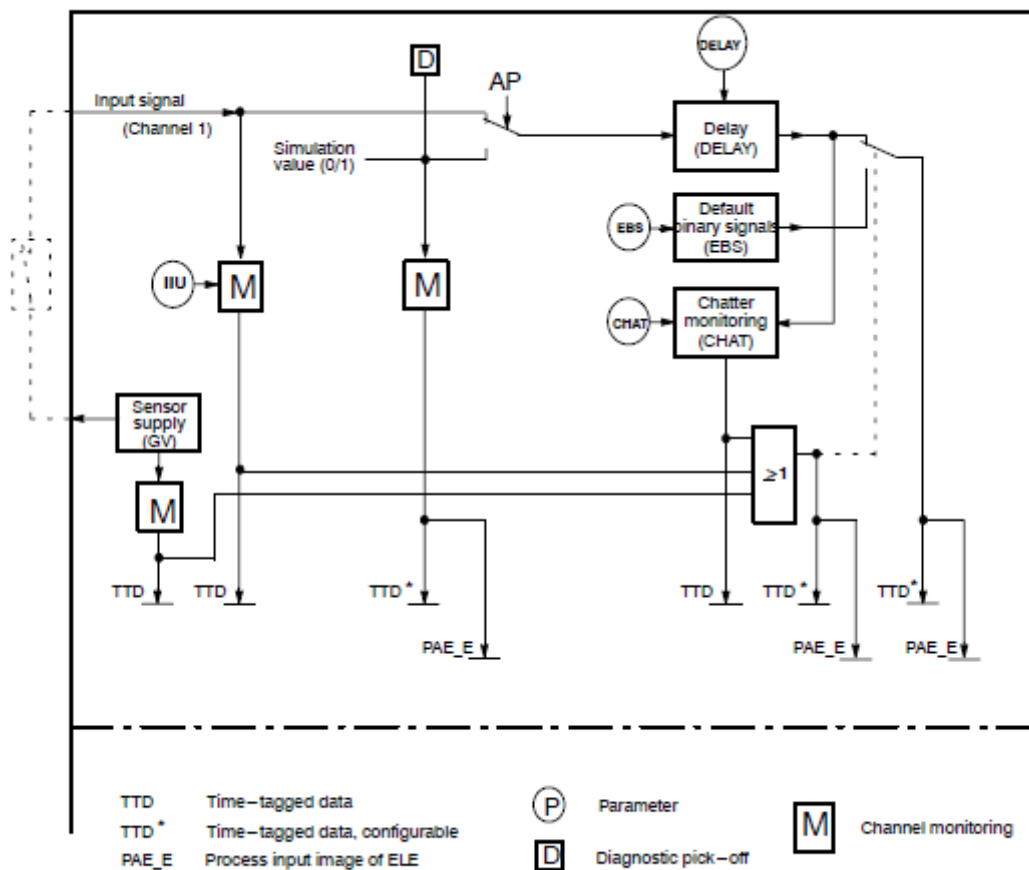
3.4.2 Binary Signal Acquisition

28 Input channels are realized on the module. Section 4 "Technical data" contains the specification of the inputs.

The following sensor/signal types can be processed by the FUM210 module:

- Type 1 : Changeover contact with 47 kΩ bridging resistance
- Type 2 : Changeover contact without 47 kΩ bridging resistance
- Type 3 : Single contact with 47 kΩ bridging resistance
- Type 4 : Single contact without 47 kΩ bridging resistance
- Type 5 : Standard binary signal, single signal (e.g. three-wire proximity switch)
- Type 6 : Standard binary signal, changeover signal (e.g. four-wire proximity switch)

A maximum changeover time of 200 ms applies for types 1, 2 and 6.



3.4.3 Signal Conditioning

The signals present at the inputs are transferred via voltage dividers and each evaluated by a corresponding comparator. The static destruction limit of the inputs amounts to ≤ 33 V.

- Contact inputs (types 1, 2, 3, 4)
In order to attain high switching voltages between the contact points of the sensor the sensor signal inputs are connected through resistors with an auxiliary supply generated internally in the module of typically - 24 V. The switching voltage at contacts without bridging resistors amounts to typically 45 V. Section 4 "Technical data" contains the values for sensors with bridging resistors as well as redundancies.
- Binary signal inputs (types 5, 6)
If binary signal types 5 and 6 are to be processed through the module, a bridge must be created from module pin X5.F02 (signal TYP) to M on the backplane. This eliminates the negative auxiliary supply L-(-24 V) which is used for the non-solid-state sensors in order to increase the switching voltage. Signals from electronic sensors with 3- or 4-wire connection (e.g. SIEMENS BERO) can also be processed in this function.

3.4.4 Signal Delay

The sensor signals are delayed by hardware means to suppress interference. The signal delay depends on the type of sensor and the height of the input level. The typical signal delay period amounts to 3 ms.

The signal delay for sensors with changeover signals is furthermore influenced by the changeover time of the sensor. For a changeover time of 0 ms the delay typically also amounts to 3 ms.

3.5 Signal Processing

The signals are read in cyclically by the module processor and processed further in accordance with the parameter settings as well as monitored.

The conditioned signals and the messages generated when a monitoring function triggers are stored in the communications buffer of the bus interfaces in order to exchange data with the higher-order level.

3.5.1 Software Delay

The software delay can be used to delay the binary signals by between 0 and 10 s, parameterizable on steps of 0.1 s, if required (parameter: delay DELAY). After the time as expired the signal present is processed further.

The signal is suppressed if the signal changes its state again before the delay time set has expired. At high speed binary signal conditioning no software delay can be set.

3.6 Starting (Restarting)

Starting and restarting a function module of the TELEPERM XP process control system are triggered by insertion of the module fuse, return of the internal 5--V supply voltage or by a RESET command from the higher-order level.

Starting and restarting are signalled by steady light on the "Module fault" LED until module synchronization, by 8 Hz flickering light from synchronization on. When cyclic operation is taken up, no light is indicated unless a fault occurs during starting up.

During the starting phase self-tests of the CPU, EPROM, RAM and bus interfaces are carried out, the memory is pre--assigned and communication with the higher--order level is initiated. After parameterize by the higher-order level and successful initializing of the module by the module processor, the module goes over to cyclic operation.

3.7 Commissioning, Operation

The FUM 210 module can be used in the automation system without presetting. The cabinet or the subrack does not have to be deactivated in order to insert or remove the module.

Note

The fuse in the front panel must be removed before the module is inserted and removed. The fuse is inserted again when module inserted. The module type is recognized by the higher--order level (AP) when the module has been inserted. If the higher--order level has a suitable parameter record for this slot; the module is initialized automatically and takes over the parameterized functions.

Caution

In order to ensure the mechanical strength and contacting of the backplane connector make sure when inserting the module that the locking noses at the levers of the inserting and removing facility lock into the locking hooks provided.

3.8 Maintenance, Diagnostics

Diagnostic points at which the entire module-internal signal states can be scanned are stipulated for all the FUM modules as required by the respective functionality. Such signal states are e.g. input signals and module-internal result signals which are stored in the external RAM and in the EPROM of the module.

The DS 670 diagnostic system provides a number of extensive diagnostic functions for the modules with which for example the following signals can be read out:

- Programming errors in the operating system or in the module logic
- Errors in the module logic
- Incorrect parameters from the higher--order level
- Module--fuse monitoring function F1 has triggered
- Voltage monitoring function has triggered
- An auxiliary supply has failed
- Bus interface 1 (2) is not initialized
- Bus interface 1 (2) is faulty
- SYNC signal in the bus system 1 (2) is faulty
- Data error in the bus system 1 (2)
- Heartbeat error in the bus system 1 (2)
- TTD buffer overflow in the bus system 1 (2)
- Error in the module--specific INIT program (or ZYKL, NOTB, MELD, ZEIT, ALARM, GENAB programs)
- Incorrect transfer values from the operating system
- Incorrect scanning time
- Lamp guidance system triggered
- No valid SYNC signal in the bus system 1 (2)
- SYNC signal error in the bus system 1 (2), delayed
- Heartbeat in the bus system 1 (2), delayed

3.8.1 RAM Area

The following data are stored in the RAM area of the module:

- Process input image PAE_E
- All parameters
- All the existing error states (error TTDs, system TTDs)

3.8.2 EPROM Area

The following data are stored in the EPROM area of the module logic:

- Module type
- Software release
- Hardware release
- Kind of module

3.8.3 Module Fault

Faults recognized by the monitoring are

- Entered in the process image (PAE_E) (as a common alarm),
- Transferred as TTDs to the process control level and
- Indicated by a flashing light on the "Module fault" LED

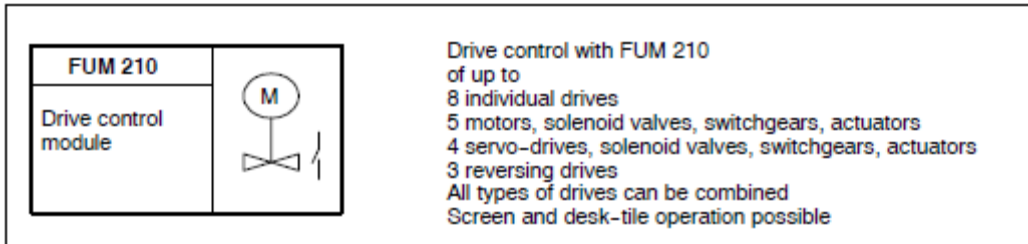
3.9 Spare Parts

Designation	Order No.
FUM 210 function module	6DP 1210-8BCA
Module fuse FF 4A (very quick)	Part No. GWE:000000209 528
Replacement part: F 2,5A (quick)	Part No. GWE: 000000583096

3.10 Pin Assignment of the Backplane Connector X5

Z02	L+	B02	M (0 V)	D02	L+B2	F02	TYP
Z04	L+	B04	L+M	D04	L+B1	F04	
Z06	BE2	B06	BE3	D06	BE4	F06	BE1
Z08	BE6	B08	BE7	D08	BE8	F08	BE5
Z10	BE10	B10	BE11	D10	BE12	F10	BE9
Z12	BE14	B12	BE15	D12	BE16	F12	BE13
Z14	BE18	B14	BE19	D14	BE20	F14	BE17
Z16	BE22	B16	BE23	D16	BE24	F16	BE21
Z18	BE26	B18	BE27	D18	BE28	F18	BE25
Z20	GV2/BA2	B20		D20		F20	GV1/BA1
Z22	GV4/BA4	B22	GV5/BA5	D22	GV6/BA6	F22	GV3/BA3
Z24	GV8/BA8	B24	GV9/BA9	D24	GV10/BA10	F24	GV7/BA7
Z26	GV12/BA12	B26	GV13/BA13	D26	GV14/BA14	F26	GV11/BA11
Z28	BA16	B28		D28		F28	BA15
Z30		B30		D30		F30	
Z32		B32	M(0V)	D32		F32	

4 FUM 210 Drive Control



4.1 Utilization

The FUM 210 module can be used in the AS 620 B automation system either as:

- Sensor conditioning for binary signals (GB function)
- Module for drives (individual controls/ESG functions)

The present description explains the "Individual drive control".

Note

The FUM 210 6DP1210--8AB/8BA/8BB/8BC is compatible with the FUM 210 6DP1210--8AA concerning the function and the pins.

The FUM 210 6DP1210--8AB/8BB contains an additional function for sensor conditioning for binary signals (fast binary signal acquisition).

The FUM 210 6DP1210--8BC contains two additional functions:

- 1) binary signal output
- 2) monitoring and signalling

4.2 Functions

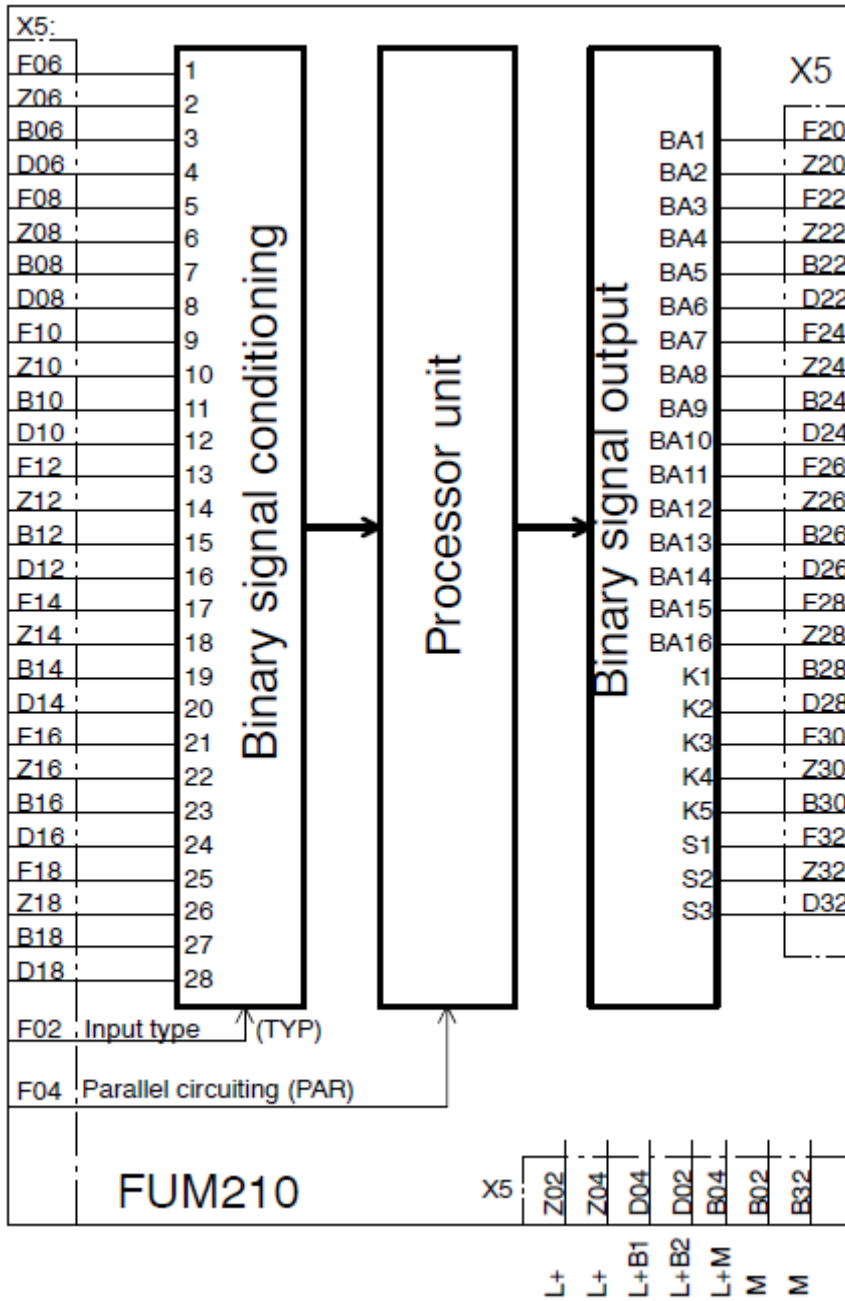
The FUM 210 individual drive control module is used to control and monitor various branches. The FUM 210 module enables all the drive--control variations to be covered -- with the exception of the direct control of solenoid valves (> 120 mA).

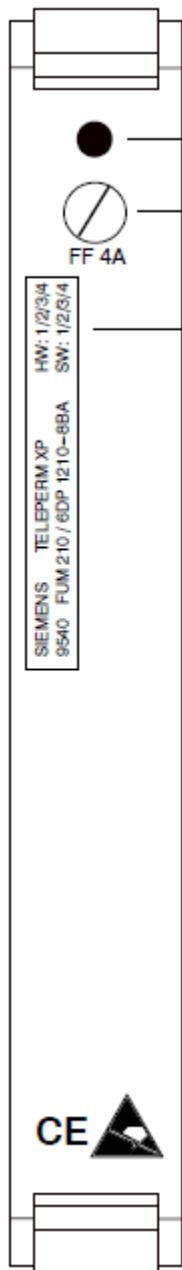
The following types of drives can be controlled:

Type of drive 1:	Individual drive with screen operation Max. of 2 check--back messages, no check commands
Type of drive 2:	Motor, solenoid valve or switchgear with screen operation
Type of drive 3:	Actuator with screen operation Single contacts for limit check--back messages
Type of drive 4:	Servo--drive with screen operation Single contacts for limit check--back messages
Type of drive 5:	Solenoid valve with screen operation Changeover contacts for check--back messages
Type of drive 6:	Actuator with screen operation Changeover contacts for limit check--back messages
Type of drive 7:	Servo--drive with screen operation Changeover contacts for limit check--back messages
Type of drive 8:	Reversing drive with screen operation Switchgear with 3 contactor relays
Type of drive 9:	Reversing drive with screen operation Switchgear with 4 contactor relays
Type of drive 10:	Motor, solenoid valve or switchgear with screen and desk--tile operation
Type of drive 11:	Actuator with screen and desk--tile operation Single contacts for limit check--back messages
Type of drive 12:	Solenoid valve with screen and desk--tile operation Changeover contacts for check--back messages
Type of drive 13:	Servo--drive with screen and desk--tile operation Changeover contacts for limit check--back messages
Type of drive 14:	Servo--drive with screen and desk--tile operation Single contacts for limit check--back messages
Type of drive 15:	Servo--drive with screen and desk--tile operation Changeover contacts for limit check--back messages
Type of drive 16:	Reversing drive with screen and desk--tile operation Switchgear with 3 contactor relays
Type of drive 17:	Reversing drive with screen and desk--tile operation Switchgear with 4 contactor relays

The FUM 210 module does not have a fixed assignment of the hardware inputs and outputs to the types of drives and therefore no fixed number of channels. When the required drive function is being configured with the ES 680, free binary inputs, binary outputs, check command outputs and message outputs of the function module are assigned to the drive function. This results in a higher degree of flexibility which allows a free combination of the types of drives and ensures optimal utilization of the hardware resources. With a standard drive type the assignment results for example in the following control possibilities:

Kind of drive	Type of drive (without/with desk tile)	Number with- out desk tile	Number with desk tile
Individual drive	1 / -	8	-
Motor, solenoid valve, switchgear	2 / 10	5	3
Actuator Single contacts for limit check-back messages	3 / 11	5	3
Servo-drive Single contacts for limit check-back messages	4 / 14	4	2
Solenoid valve Changeover contacts for check-back messages	5 / 12	4	2
Actuator Changeover contacts for limit check-back mes.	6 / 13	4	2
Servo-drive Changeover contacts for limit check-back mes.	7 / 15	3	2
Reversing drive Switchgear with 3 contactor relays	8 / 16	3	2
Reversing drive Switchgear with 4 contactor relays	9 / 17	2	2





LED "Module fault"

Module fuse
FF 4A

Name plate

Explanation of the name plate

Company name: SIEMENS
Trade mark : TELEPERM XP
Manufact. date : 95 40

└─┬─┘ Manufact. week
└───┘ Year of manufact.

Module type : FUM 210 HW: 1/2/3/4 hardware release version
MLFB number : 6DP 1210-8BA SW: 1/2/3/4 software release version

4.3 Mode of Operation

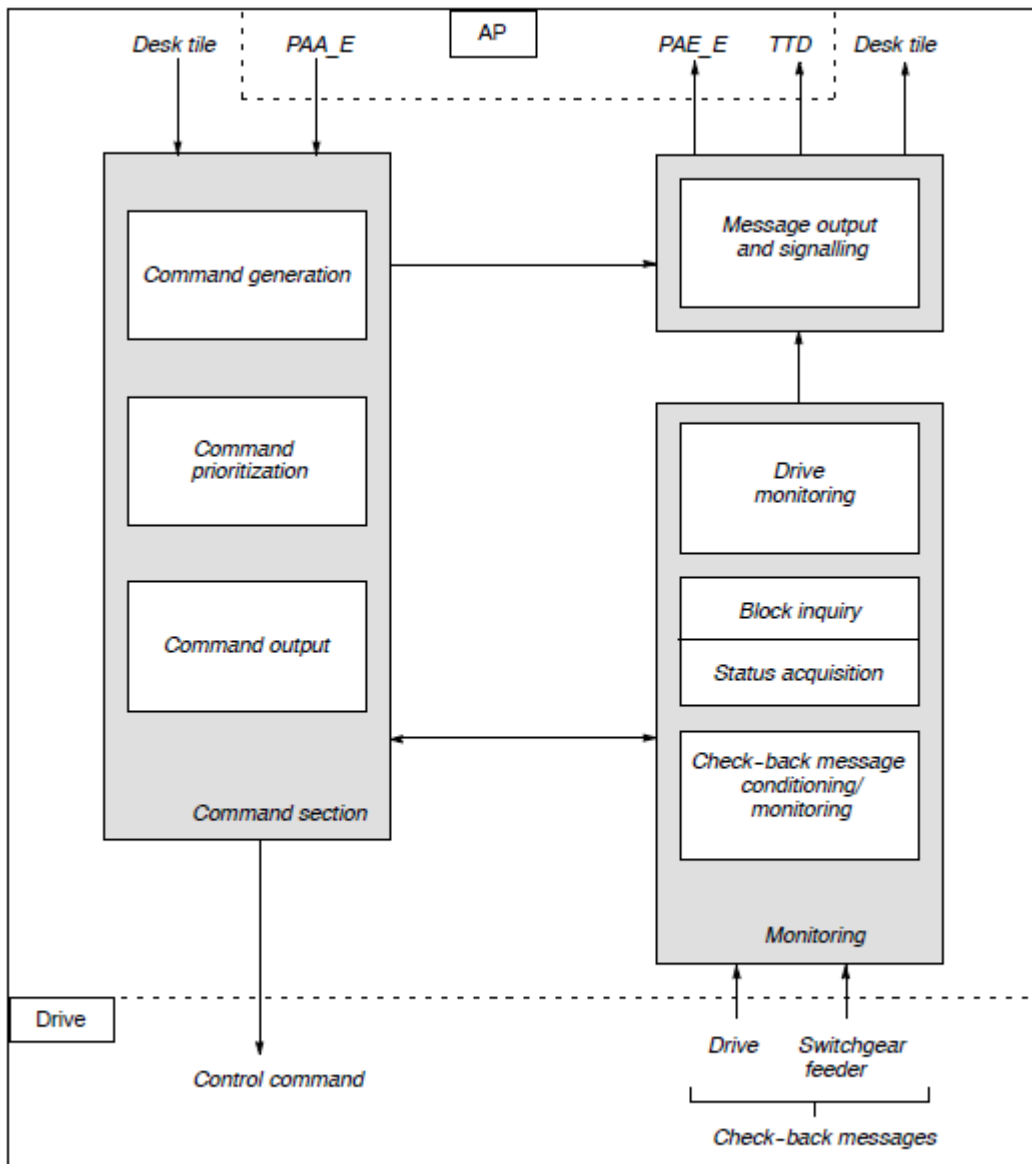


Fig. 3: Software functions

4.3.1 Actuators

The following features are of importance

- Driving motor:
Sense of rotation anticlockwise, clockwise
- Armature settings:
Travel--dependent OPEN/CLOSED intermediate position
Torque--dependent OPEN/CLOSED (in normal operation)
- Limit switch:
Travel--dependent (WE) 2 changeover (snap--action) contacts or 2 single contacts
Torque--dependent (DE) 2 single contacts (NC contacts)
- Switchgear:
Plug-in unit 2 contactor relays (one per command direction)

Contrary to switchgear drives the actuator has no input "test position".

An actuator can bring an armature into any position by means of control commands.

The various groups of control commands and their origin are:

- Protection commands from the automation processor (AP),
- Automatic commands from the automation processor (AP),
- Manual command from the screen or desk tile
- Manual commands from the local control

With the exception of the manual commands from the desk tile and the local control all the control commands come from the higher--order level (AP). These control commands are entered into the process image (PAA_E) in the form of a control word via the bus interface of the FUM 210 module.

The desk tile commands are placed directly to the inputs of the FUM 210 module via the wiring.

The **command generation** function links all the commands with the corresponding enables and form them into complete commands.

The complete commands are processed and stored in accordance with the stipulated **priorities** or parameters.

The commands are stored since the commands are only given briefly on the input side while the run time of the actuator from one limit to the other can be very long. The user stipulates by means of a parameter whether the control command is to be terminated when the travel--dependent or the torque-dependent check-back message arrives.

Termination of the control command by the stored torque is effected in the **command output**.

Normally excessive torque only occurs when the unit is travelled into the gasket seat in the CLOSED direction or into the so--called reverse gasket in the OPEN direction. In both cases this only happens when the travel- dependent limit position has been overridden and it has been stipulated in the parameter (parameter EIZ) that commands are not to be terminated by the travel--dependent check--back message.

The check-back contacts are monitored in order to ensure that the information on the limit positions really corresponds to the actual position of the drive (**check--back signal conditioning and monitoring**).

The check-back message (actual state) and the direction of travel (desired state) of the drive are made available to the higher--order level through the process image, or in the case of desk--tile operation displayed directly via the corresponding outputs.

When the module is switched on the first time all the function units which depend on check--back messages are adapted to the current status of the check--back messages.

If no check--back contacts have been parameterized, the OFF setting is followed. This means that an active OFF command is output and the function units are corrected to the value.

If the torque (DE) is triggered before the travel--dependent check--back message (WE) arrives, this is recognized by the **torque monitoring function** as a fault and signalled (DE before WE).

"DE before WE" is mostly caused by sluggishness of the armature. Since the torque is stored and always terminates the control command present in the command direction, it is no longer possible to travel in this direction. In order to reverse the disable command or to be able to delete the torque memory a control command in the opposite direction must be given. The drive travels in the opposite direction without the corresponding process enable until disabling has been reversed.

In addition the reverse behaviour is also detected, i.e. when WE command termination has been parameterized and a torque nevertheless occurs at the drive (DE after WE).

The **run--time monitoring function** determines whether a given control command has also been executed on time (within the parameterized monitoring time).

Triggering of the run--time monitoring function does not lead to the control command being terminated.

If the drive still reaches the desired limit position with delay, the signal is acknowledged automatically.

The **limit position monitoring function** recognizes through a desired--actual value comparison whether the actuator has left the current position without a corresponding control command having been given via the module. The module then signals a status discrepancy.

A parameter setting (parameter WEF) can also be used by the user to stipulate that protection commands are still to be effective against the normally common command termination, i.e. the branch can be brought back into the preferred position both in the case of a check--back error and a status discrepancy.

The **"Message at protection executed" function** of the monitoring recognizes whether a protection command has really been executed and the armature moved in the process.

Triggering of one of the above--mentioned monitoring devices is signalled via the process image (PAE_E). In order to ensure that only the real error cause is displayed, the subsequent messages are suppressed. In addition the acknowledgement menu on the screen indicates whether the existing fault can be acknowledged or whether repair is obligatory.

Acknowledgement is effected by means of acknowledgement commands which are either issued via the process image PAA_E (from the OM 650 or automatic system) or via the desk tile (command key without enabling).

The **status acquisition function** recognizes whether the status last occupied has been reached through a manual, automatic or protection command. The status messages are also transferred to the higher-order level through the process image PAE_E.

The **block inquiry function** allows the user to check whether the command direction selected is free by pressing the corresponding desk--tile command button (without enable button), i.e. whether a manual command given afterwards would also pass through or whether it is possibly disabled because of a non-existent process enable or an existing opposing automatic or protection command. Possible command disabling is indicated by a steady light on the "Fault" indicator lamp on the desk tile.

4.4 Starting (Restarting)

Starting and restarting of the module are initiated by the insertion of the module fuse, return of the internal +5-V supply voltage or by a RESET command from the higher--order level.

Until synchronization of the module starting and restarting are indicated by steady light of the "Module fault" LED and after synchronization by flicker light (8 Hz). When cyclic operation starts the light goes out, provided no fault has occurred during the starting--up phase.

During the starting--up phase the self--tests of the CPU, EPROM, RAM and bus interfaces are carried out, the memory pre--assigned and communication with the higher--order level taken up. After parameterization by the higher--order level (see Section 13) and successful initialization of the module by the module processor the module goes over to cyclic operation.

All function blocks which depend on check--back messages must be adapted to the current status of the check--back messages. This is effected by the "adjustment" of the module. If a check--back error RM F1E/A is recognized during starting/restarting, it cannot be adjusted. No commands are output; except for AZB, NOSD, NOFF and KLE the PAE_E process image is set to "0".

From release 3 onwards an updating of CB/ CLC, CB/MAN, BL/CLC, STU and NO/FAUL in the PAE_E is also implemented in the servo drive. The "Module fault" LED displays a flashing light 2 Hz. In case of desk--tile operation the "Fault" indicator light displays steady light -- the "ON/OPEN", "OFF/CLOSED" and "STOP" indicator lamps are not triggered. In the case of servo driving the operating mode indicator on the desk--tile is not triggered.

Servo--drives go into the "Manual/Open--loop control" operating mode during starting/restarting.

4.5 Commissioning, Operation

The FUM 210 module can be used in the automation system without presetting. The cabinet or the subrack does not have to be deactivated in order to insert or remove the module.

Note

The fuse in the front panel must be removed before the module is inserted and removed. The fuse is inserted again when module inserted. The module type is recognized by the higher--order level (AP) when the module has been inserted. If the higher--order level has a suitable parameter record for this slot; the module is initialized automatically and takes over the parameterized functions.

Caution

In order to ensure the mechanical strength and contacting of the backplane connector make sure when inserting the module that the locking noses at the levers of the inserting and removing facility lock into the locking hooks provided.

4.6 Maintenance, Diagnostics

Diagnostic points at which the entire module-internal signal states can be scanned are stipulated for all the FUM modules as required by the respective functionality. Such signal states are e.g. input signals and module-internal result signals which are stored in the external RAM and in the EPROM of the module.

The DS 670 diagnostic system provides a number of extensive diagnostic functions for the modules with which for example the following signals can be read out:

- Programming errors in the operating system or in the module logic
- Errors in the module logic
- Incorrect parameters from the higher-order level
- Module-fuse monitoring function F1 has triggered
- Voltage monitoring function has triggered
- An auxiliary supply has failed
- Bus interface 1 (2) is not initialized
- Bus interface 1 (2) is faulty
- SYNC signal in the bus system 1 (2) is faulty
- Data error in the bus system 1 (2)
- Heartbeat error in the bus system 1 (2)
- TTD buffer overflow in the bus system 1 (2)
- Error in the module-specific INIT program (or ZYKL, NOTB, MELD, ZEIT, ALARM, GENAB programs)
- Incorrect transfer values from the operating system
- Incorrect scanning time
- Lamp guidance system triggered
- No valid SYNC signal in the bus system 1 (2)
- SYNC signal error in the bus system 1 (2), delayed
- Heartbeat in the bus system 1 (2), delayed

4.6.1 RAM Area

The following data are stored in the RAM area of the module:

- Process input image PAE_E
- All parameters
- All the existing error states (error TTDs, system TTDs)

4.6.2 EPROM Area

The following data are stored in the EPROM area of the module logic:

- Module type
- Software release
- Hardware release
- Kind of module

4.6.3 Module Fault

Faults recognized by the monitoring are

- Entered in the process image (PAE_E) (as a common alarm),
- Transferred as TTDs to the process control level and
- Indicated by a flashing light on the "Module fault" LED

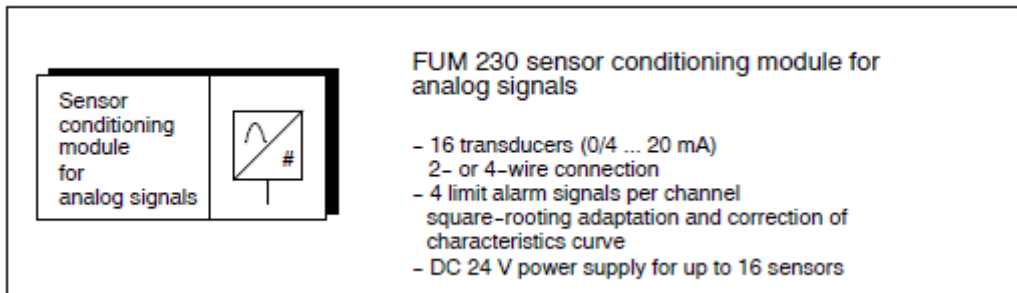
4.7 Spare Parts

Designation	Order No.
FUM 210 function module	6DP 1210-8BCA
Module fuse FF 4A (very quick)	Part No. GWE:000000209 528
Replacement part: F 2,5A (quick)	Part No. GWE: 000000583096

4.8 Pin Assignment of the Backplane Connector X5

Z02	L+	B02	M(0V)	D02	L+B2	F02	TYP
Z04	L+	B04	L+M	D04	L+B1	F04	PAR
Z06	BE2	B06	BE3	D06	BE4	F06	BE1
Z08	BE6	B08	BE7	D08	BE8	F08	BE5
Z10	BE10	B10	BE11	D10	BE12	F10	BE9
Z12	BE14	B12	BE15	D12	BE16	F12	BE13
Z14	BE18	B14	BE19	D14	BE20	F14	BE17
Z16	BE22	B16	BE23	D16	BE24	F16	BE21
Z18	BE26	B18	BE27	D18	BE28	F18	BE25
Z20	BA2	B20	---	D20	---	F20	BA1
Z22	BA4	B22	BA5	D22	BA6	F22	BA3
Z24	BA8	B24	BA9	D24	BA10	F24	BA7
Z26	BA12	B26	BA13	D26	BA14	F26	BA11
Z28	BA16	B28	K1	D28	K2	F28	BA15
Z30	K4	B30	K5	D30	---	F30	K3
Z32	M2	B32	M(0V)	D32	M3	F32	M1

5 FUM 230A Sensor Conditioning Module for Analog Signals



5.1 Utilization

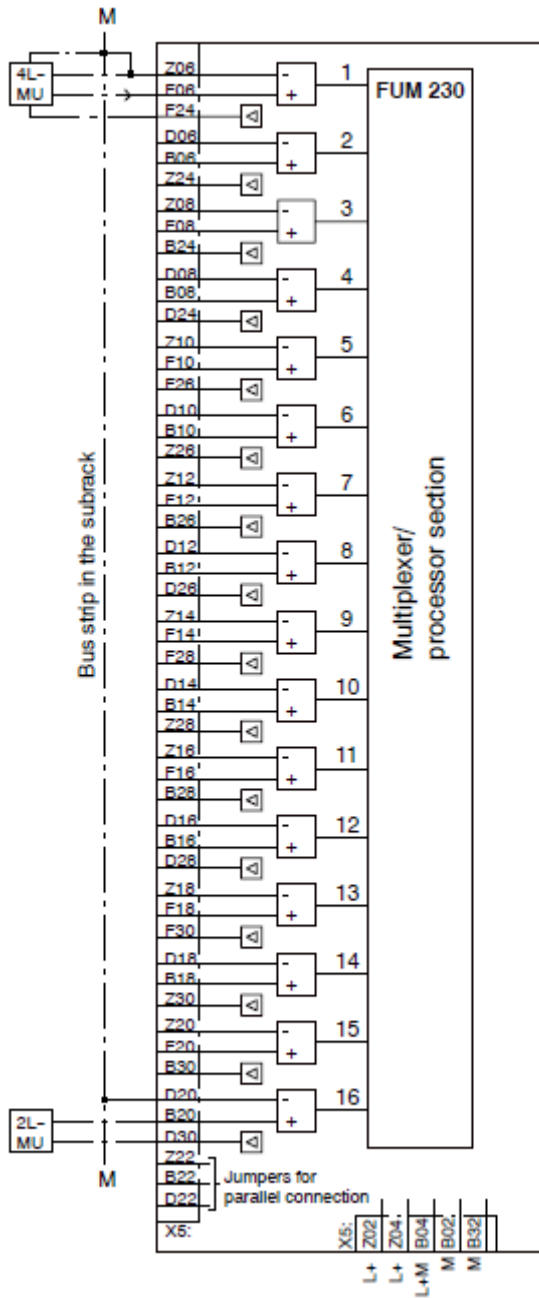
The FUM 230 function module is an analog input module for current signals in the range between 0/4 and 20 mA. The transducer power supplies are also accommodated on the module. The module is employed in the AS 620 B automation system. The AS 620 B is associated with the TELEPERM XP process control system.

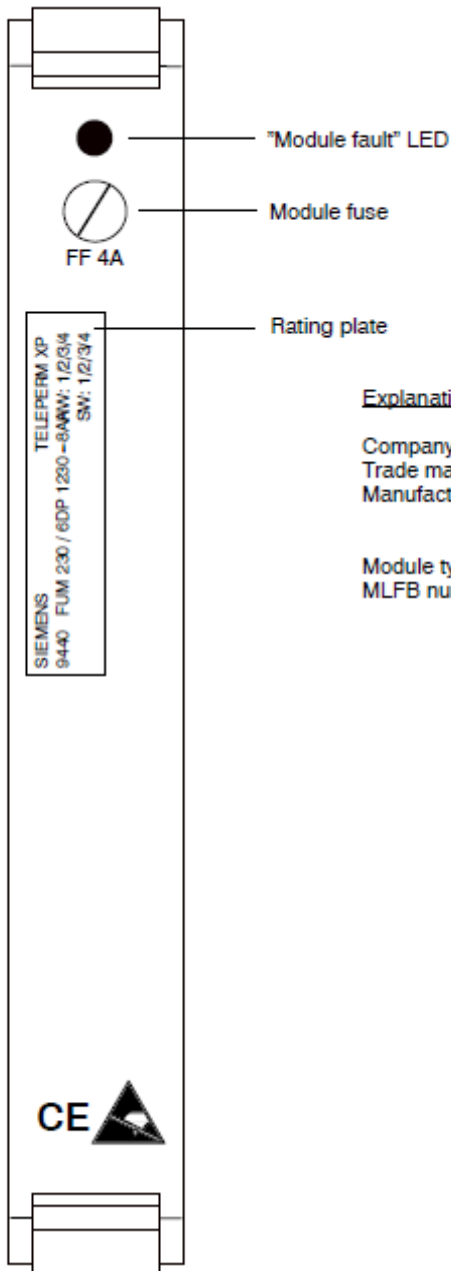
5.2 Functions

The FUM 230 function module is used for inputting up to 16 current signals in the range 0 ... 20 mA or 4 ... 20 mA, and for conditioning, monitoring and distributing the signals. In addition, the function module is capable of supplying DC 24 V to up to 16 transducers with 2-- or 4--wire connection.

Note

The function and the pins of the FUM 230 function module designated as 6DP1230--8BB are compatible with the 6DP1230--8AA function module. The 6DP1230--8AA function module may be upgraded to the software and hardware level of the 6DP1230--8BB with an upgrade kit.





Explanation of the rating plate:

Company name: SIEMENS
Trade mark : TELEPERM XP
Manufact. date : 94 40
 └─ Week
 └─ Year

Module type : FUM 230
MLFB number : 6DP 1230-8AA 1/2/3/4

HW: 1/2/3/4 hardware release version
SW: 1/2/3/4 hardware release version

5.3 Design

5.3.1 Mechanical Design

The fundamental structure of modules of the individual control level of the AS 620 B FUM variant is described in the Instructions C79000--B8076--C620 in Register 3 of the System Manual AS 620.

The mechanical structure of the FUM 230 function module has the following features:

- Printed circuit board in the format 233 mm x 220 mm (extended double Eurocard format) for the ES 902C packaging system
- 20,32 mm slot width (1 1/3 standard slots)
- Metallic front panel; see Fig. 2 for front panel layout
- 20 mm front panel width; 230,35 mm front panel height
- Two DIN 41612 connectors on the back panel, one above the other:

Upper edge connector (X1); C style, 96--way, bus interfaces

Lower edge connector (X5, G style, 64--way, I/O interface for field wiring)

5.3.2 Functional Design

The following are the features of the functional structure of the FUM 230 function module:

- The interfaces of the input and output section connect the module with the field devices
- The processor section implements signal processing and handles communications with the group control level
- Redundant bus interfaces for communications with the group control level
- The power supply unit generates all voltages required on the module

The module is keyed for its slot. It may be replaced with a module of the same type. Merely remove the module fuse in the front panel before you remove or install the module. Ensure that the jumpers have correctly been set when you connect function modules in parallel.

5.4 Mode of Operation

Fig. 1 shows the software functions the module processor is able to perform. Chapters 5.4.1 through 5.4.6 describe the normal response of the function module in non-redundant mode. The switches S101 through S116 on the module are closed in this mode (state upon delivery). Chapter 5.5 describes the peculiarities of the function module in redundant mode.

5.4.1 Transducer Power Supply

The FUM 230 function module is able to supply DC 24 V to a maximum of 16 transducers in 2-wire or 4-wire configurations. This is done via short-circuit-proof and overload-proof electronic drivers that are able to supply a permanent current of a maximum of 120 mA.

Series and parallel diodes protect the outputs against polarity reversal and counter e.m.f.. The outputs are monitored for overvoltage or short-circuit conditions (see Chapter 3.8 Error Control Characteristics).

Note

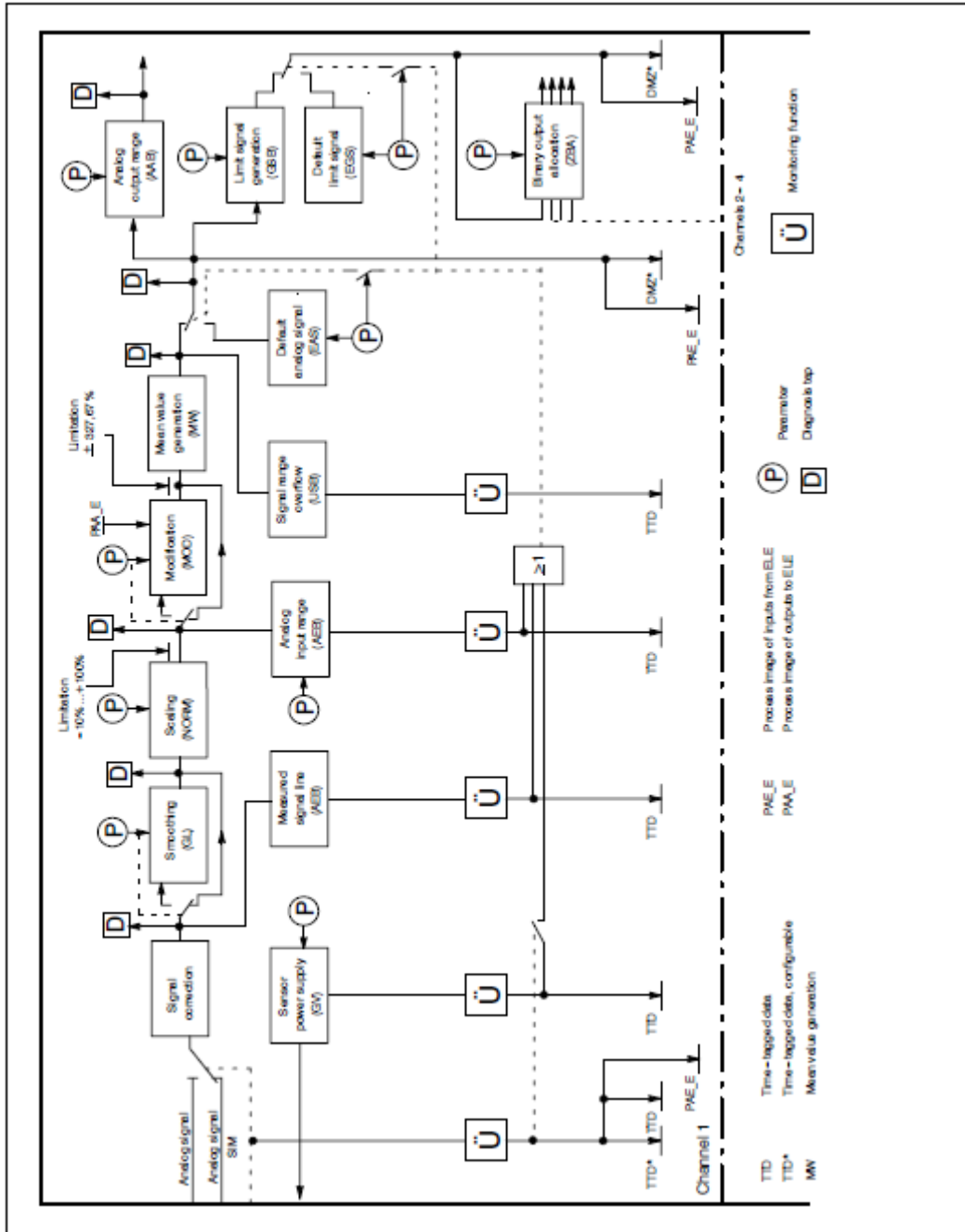
The sensor power supply reference potential for transducers in 4-wire configuration is based on the ground bar (bus strip) in the subrack concerned

5.4.2 Analog Signal Acquisition

Signal Ranges

The function module is able to process analog signals in the ranges 0 ... 20 mA and 4 ... 20 mA. The signal range of each individual channel may be selected through the **Analog input range** parameter (AEB).

Fig. 1 shows the software functions that can be performed by the module processor of the FUM 230 module.



Signal Conditioning

10-Ω loads are used for converting the current signals at the analog inputs into voltage signals which are processed further.

The input circuitry is fit to withstand overdriving of up to +/- 250 mA. This means that they are also short circuit proof with respect to the transducer power supply on the module. Up to four channels may simultaneously be overdriven. The permissible common mode voltage is +/- 5 V.

Jumpers or switches on module and wiring field need not be set (state upon delivery) if the module is used in no redundant mode.

Note

The reference potential for the inputs (-) is based on the ground bar (bus strip) in the subrack concerned (see Fig. 1).

Signal Filter

To suppress interference, the analog signals are smoothed by a second order hardware filter (40 dB attenuation at 50 Hz). The circuitry is designed such that there will be no overshooting when the signal transitions.

Analog-to-Digital Conversion

The filtered signals are fed to an analog-to-digital converter (ADC) via an analog multiplexer. The ADC employs the successive approximation method for digitizing the signals. Its resolution is 14 bits; converting an analog value takes 10 μs.

5.4.3 Analog Signal Processing

Sampling periods

The module processor reads the analog signals via the ADC in a time-controlled fashion and processes the signal according to the setting of the parameters. The following sampling periods result from the number of channels selected:

Channels selected	≤ 4	5 ... 8	9 ... 12	13 ... 16
Sampling period	25 ms	40 ms	50 ms	60 ms

Software Smoothing

Software smoothing permits additional filtering of the digitized signals. It consists of a first order timing element that can be set in steps of 0.1 seconds to a value between 0.1 and 10 seconds. The “**Smoothing**” (GL) parameter permits filtering separately to be selected for each individual channel.

Overflow Range

Input values up to 10% above or below the nominal input range (overflow range) are linearly processed. The input signal is delimited to +110 % or -10 % of the nominal input range, respectively, if it is above or below the nominal input range.

Nominal range (in accordance with parameterized physical starting value and end value)	Overflow range	
Input signal	Input signal	Overflow related to physical nominal range
0 ... 20 mA 4 ... 20 mA	-2.0 ... 22.0 mA 2.4 ... 21.6 mA	-10 bis 110 % -10 bis 110 %

Modification

The “**Modification**” (MOD) parameter permits multiplication or square rooting to be configured for each individual channel.

Multiplication

The scaled signals may be multiplied by a correction factor. This is necessary, for example, if the differential pressure method is employed for flow measurements, and if variations in the medium density must be compensated for measurement. AP calculates the correction factor (standard function block) which is then transferred to the module via the PAA_E process image. The correction factor is calculated in fixed point format without sign. The value 10 000 corresponds to the factor 1.0. A root extraction of the transferred factor can be configured for flow measurements with root--extracting transmitters and correction calculation on the module.

Square Rooting

If analog signals are processed that follow a square--law characteristic curve (if a differential pressure transducer is used, for example), a square--rooting adaptation of the characteristic curve of the scaled signal may be performed. Square rooting is performed in the positive quadrant only.

Mean Value Generation

Mean value generation (MW) is performed after modification (see Fig. 3). Mean value generation suppresses small fluctuations of the resulting signals. Mean value generation is only effective inside a delta band of 20 digits.

5.4.4 Limit Signal Generation

Limit signal generation (GSB) permits the following selections to be made for each individual channel: Is a limit signal to be generated (yes/no), the direction of the crossing signal that will trigger a response, and the hysteresis between response and resetting the limit signal. Up to four limit signals may be generated for each input signal.

Direction of Response: UL (upper limit value \geq max)

- Direction of response
The analog signal is \geq selected limit value.
- Reset condition
The alarm is reset when the analog value is less than the selected limit value minus the selected hysteresis.
- Effect on the process image
The limit signal is transferred to the process image.
- Effect on time-tagged data
A "Limit signal n.m" signal TTD is produced if at least one of the possible signal TTDs of the channel has been provided with parameters.
- Effect on internal processing
Provided that limit signals have been selected, they may be replaced with defined alternative limit signals in the event of a channel fault.

Direction of Response: LL (lower limit value \leq min)

- Direction of response
The analog signal is \leq selected limit value.
- Reset condition
The alarm is reset when the analog value is greater than the selected limit value minus the selected hysteresis.
- Effect on the process image
The limit signal is transferred to the process image.
- Effect on time--tagged data
A "Limit signal n.m" signal TTD is produced if at least one of the possible signal TTDs of the channel has been provided with parameters.
- Effect on internal processing
Provided that limit signals have been selected, they may be replaced with defined alternative limit signals in the event of a channel fault.

5.4.5 Analog Signal Simulation

Independently of the existing input signal, an analog value may be simulated by software. The simulated value is processed instead of the input variable. A signal TTD and a "Simulated channel" error TTD are produced in this process. The "Simulated channel" bit is set in the PAE--E (process inputs map).

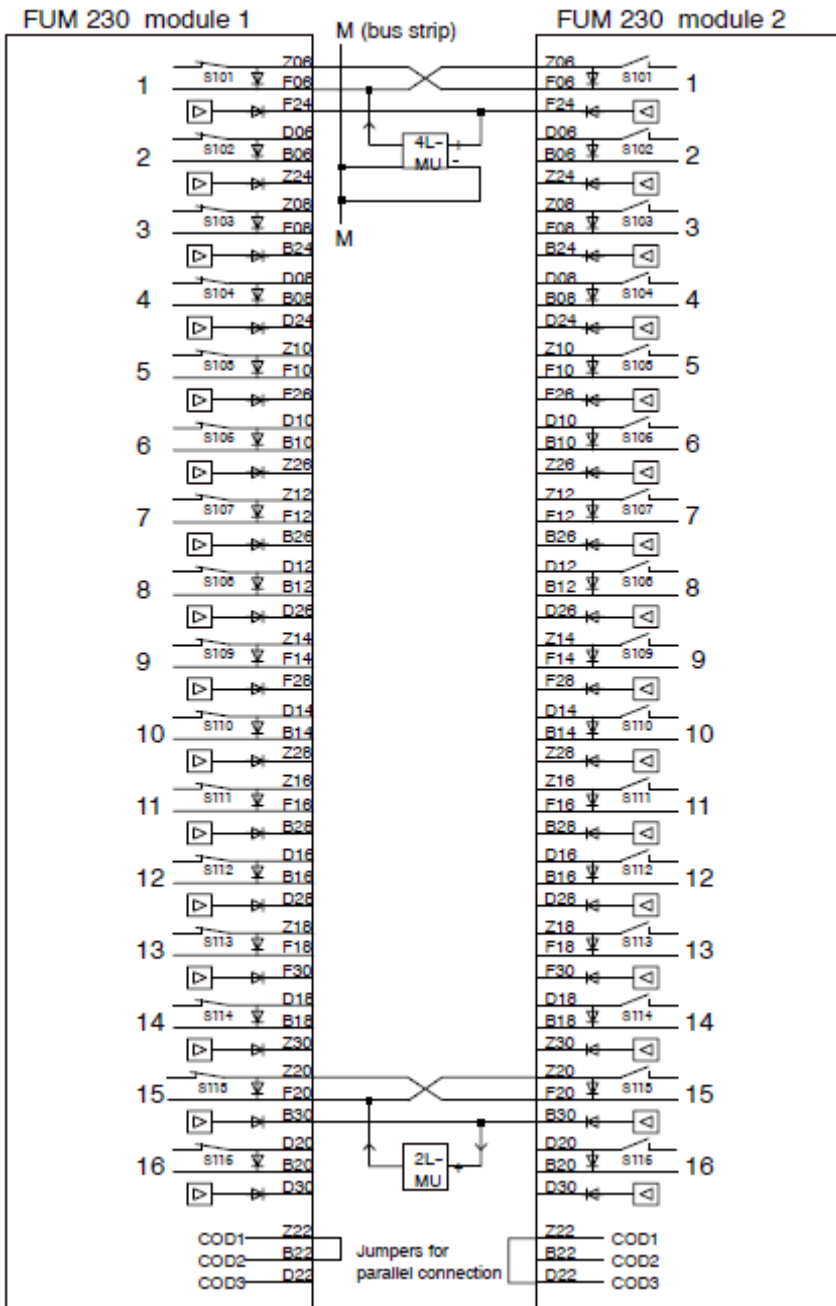
5.4.6 Redundant Configuration of two FUM 230 Modules

To increase the availability of processing the current signals from the transducers, two FUM 230 modules may be used in a redundant configuration.

The corresponding outputs of the transducer supply are merely connected with each other. The analog signals are fed in series via both modules. For each module, a jumper (jumper X5.Z22--X5.B22 for module 1 and jumper X5.Z22--X5.D22 for module 2) must be set in the wiring backplane of the subrack. Switches S101 through S116 must be opened on the module that is connected in parallel.

Note

To be able to replace a failed module in a redundant configuration, there are diodes on the module that carry the signal current when a module is replaced. In addition to the voltage drops on the feeder lines, the input protection circuitry of the redundant structure requires configuration to take an effective input voltage of $U_E \pm 4V$ into account. This is also the maximum effective input voltage if one of the parallel modules has not been inserted.



Note

Transducers in a 2--wire configuration are supplied with power via the measuring lines. The resistance of the lines is known as load. Together with the input voltage of the FUM 230 module, the resulting voltage across the transducer terminals is lower than the supply voltage from the module. The following formula gives the maximum permissible line load:

$$R_{Bmax} = \frac{U_{GVmin} - U_{MUmin} - U_{Emax}}{I_{max}}$$

; R_B : Load

; U_{GV} : FUM 230 sensor supply output voltage

; U_{MU} : Transducer terminal voltage

; U_E : Effective input voltage at the module

; I : Measuring current

Typical calculation for a redundant configuration with a 2--wire transducer:

$U_{GVmin} = 17,5 \text{ V}$ (from Chapter 4, Specifications);

$U_{MUmin} = 12,0 \text{ V}$ (from the transducer's data sheet);

$U_{Emax} = 4 \text{ V}$

$I_{max} = 22 \text{ mA}$

====> $R_{Bmax} = 68\Omega$

With a specific line resistance of $40 \Omega/\text{km}$, the resulting permissible line length is 1700 m and, consequently, the maximum distance to the process is 850 m.

5.5 Commissioning, Handling

If it is used in a single-module configuration, the FUM 230 function module can directly be installed in the automation system. The settings of switches or jumpers need not be changed (state upon delivery). If it is used in a redundant configuration, however, the specifications of Chapter must be observed. Remove the module fuse of the FM 230 module from the top of the front panel before you remove or insert the module. The power supplies of cabinet and/or subrack need not be switched off in this case. Provided that parameters have been stored on the next higher level during commissioning, the system automatically integrates the module.

5.6 Service, Diagnosis

Diagnosis points have been defined for all ELE modules that permit module-internal signal states to be interrogated. They depend on module functionality and include, for example, input signals and resulting module-internal signals that are stored in the external RAM and in the module's EPROM. The DS diagnosis system provides various powerful diagnosis functions for the modules. These functions permit the following messages to be read, for example:

- Programming error in the operating system or in the module logic
- Fault in the module logic
- Incorrect parameters from the next higher level
- Module fuse monitoring function F1 has responded
- Voltage monitoring function has responded
- One auxiliary voltage is missing
- Bus interface 1 (2) has not been initialized
- Malfunction in bus interface 1 (2)
- Incorrect SYNC signal in bus system1 (2)
- Data error in bus system1 (2)
- Heartbeat error in bus system1 (2)
- TTD buffer overflow in bus system1 (2)
- Malfunction in the module-internal INIT program (or ZYKL, NOTB, MELD, ZEIT, ALARM, GENAB program)
- Incorrect values have been transferred from the operating system
- Incorrect sampling period
- Lamp guidance system has been triggered
- No valid SYNC signal in bus system1 (2)
- SYNC signal error in bus system1 (2) delayed
- Heartbeat in bus system1 (2) delayed
- Response of the voltage monitoring function of bus interface 1 (2) was delayed

5.6.1 RAM Area

The following data items are stored in the RAM area of the module:

- Process image of the inputs; PAE_E
- Signal correction output data

- Corrected analog signals
 - Smoothing input and output data

- Unprocessed analog signals
- Smoothed analog signals
 - Scaling input and output data

- Unprocessed analog signals
- Scaled analog signals
 - Mean value generation input and output data

- Unprocessed analog signals
- Averaged analog signals
 - All pending error states (error TTD, system TTD)
 - All parameters

5.6.2 EPROM Area

The following data items are stored in the EPROM area of the module:

- Module version
- Software revision level
- Hardware revision level
- Module type

5.6.3 Module Fault

Any malfunction that is detected by the output monitoring function is

- signalled via the PAE_E to the next higher level,
- transferred as TTD, and
- indicated by the "Module fault" LED blinking ON and OFF

5.7 Spare Parts

Name	Order no.
Input/sensor conditioning module for current signals 0/4 ... 20 mA	6DP 1230-8AA/8BB
Module fuse FF 4A (very quick)	Part No. GWE:000000209 528

Connector Pin Assignments of the X5 Backplane Connector

Z02	L+ (24 V)	B02	M (0 V)	D02	L+B2 (24 V)	F02	----
Z04	L+ (24 V)	B04	L+M (24 V)	D04	L+B1 (24 V)	F04	----
Z06	IE1-	B06	IE2+	D06	IE2-	F06	IE1+
Z08	IE3-	B08	IE4+	D08	IE4-	F08	IE3+
Z10	IE5-	B10	IE6+	D10	IE6-	F10	IE5+
Z12	IE7-	B12	IE8+	D12	IE8-	F12	IE7+
Z14	IE9-	B14	IE10+	D14	IE10-	F14	IE9+
Z16	IE11-	B16	IE12+	D16	IE12-	F16	IE11+
Z18	IE13-	B18	IE14+	D18	IE14-	F18	IE13+
Z20	IE15-	B20	IE16+	D20	IE16-	F20	IE15+
Z22	COD1	B22	COD2	D22	COD3	F22	----
Z24	GV2	B24	GV3	D24	GV4	F24	GV1
Z26	GV6	B26	GV7	D26	GV8	F26	GV5
Z28	GV10	B28	GV11	D28	GV12	F28	GV9
Z30	GV14	B30	GV15	D30	GV16	F30	GV13
Z32	----	B32	M(0V)	D32	----	F32	----

6 FUM 230C Sensor Conditioning Module for Analog Signals

6.1 Utilisation

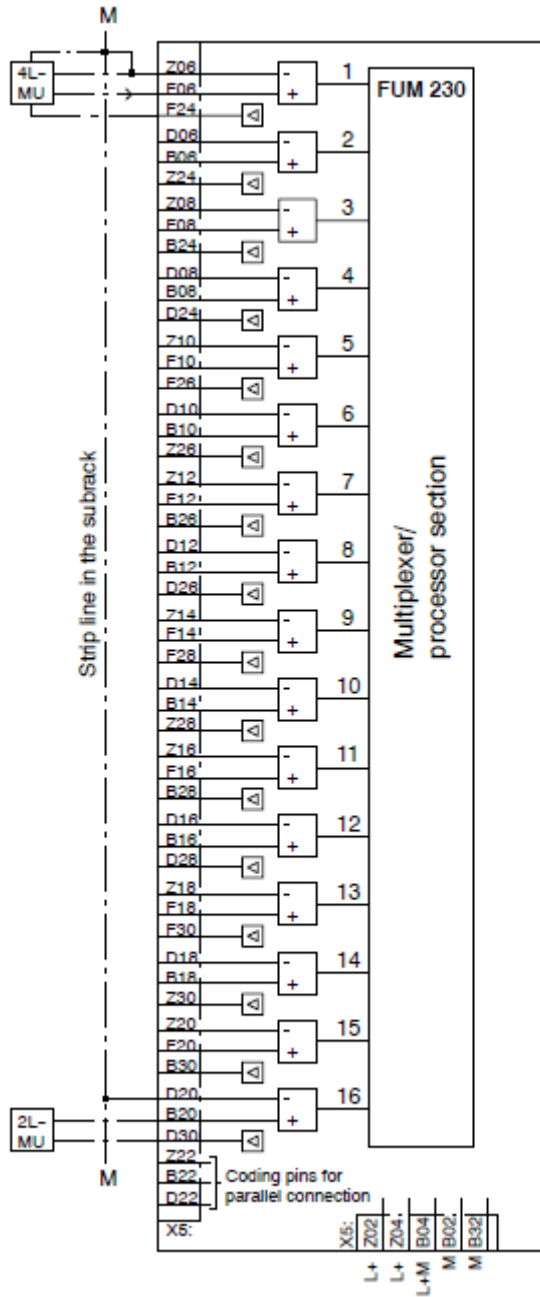
The FUM 230 function module is an analog input module for current signals in the range 0 ... 20 mA or 4 ... 20 mA. Transducers can also be supplied with the module. The module is employed in the AS 620 B automation system. The AS 620 B is associated with the TELEPERM XP process control system.

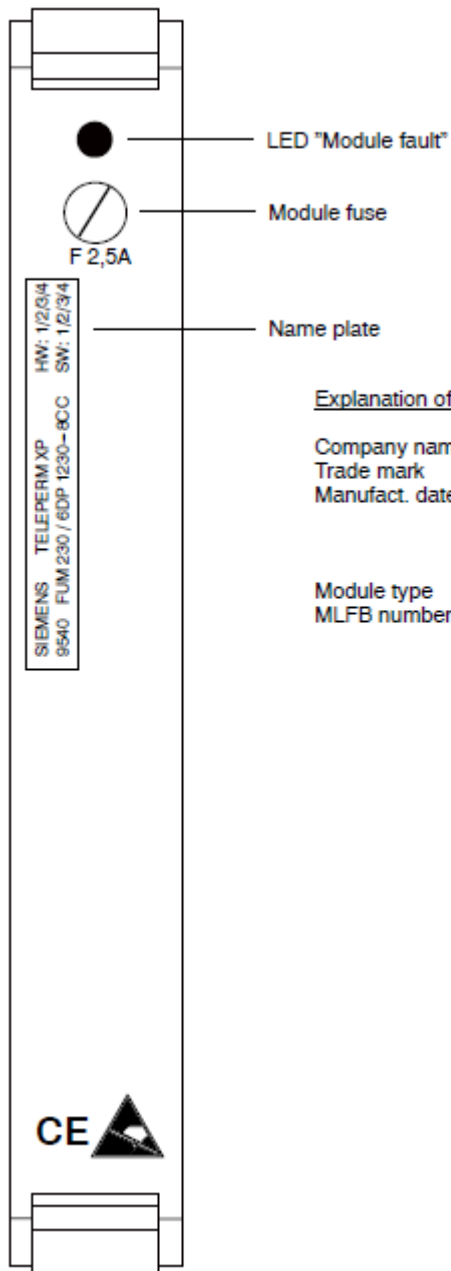
6.2 Functions

The FUM 230 function module is used for inputting up to 16 current signals in the range 0 ... 20 mA or 4 ... 20 mA, and for conditioning, monitoring and distributing the signals. In addition, the function module is capable of supplying DC 24 V to up to 16 transducers with 2-- or 4--wire connection. To increase the availability in signal conditioning, two function modules may be connected in parallel (redundancy).

Connecting HART(R) transducers is possible. Observe the requirements of the HART(R) transducer supply concerning the residual ripple. The module does not interpret the HART(R) protocol. The FM 230 function module permits the following functions to be implemented:

- DC 24 V / 120 mA auxiliary power supplies for up to 16 transducers (short--circuit--proof and overload proof)
- Monitoring the sensor power supply for short--circuit, overload and failure
- Acquiring and conditioning up to 16 analog signals in the ranges 0/4 ... 20 mA
- Additionally monitoring the measuring range of the analog signals and 4 ... 20 mA or 4 ... 20 mA for broken--wire conditions
- Limit signal generation and measured value modification (correction factor, square--rooting)
- Generation of time-tagged data
- Analog signal simulation of the 16 channels through software functions.





Explanation of the name plate

Company name: SIEMENS
Trade mark : TELEPERM XP
Manufact. date : 95 40

└─┬─┘ Manufact. week
└───┘ Year of manufact.

Module type : FUM 210 HW: 1/2/3/4 hardware release version
MLFB number : 6DP 1230-8CC SW: 1/2/3/4 software release version

6.3 Design

6.3.1 Mechanical Design

The fundamental structure of modules of the individual control level of the AS 620 B FUM variant is described in the Instructions C79000--B8076--C620 in Register 3 of the System Manual AS 620 (Order No. 6DP6200--2...).

The mechanical structure of the FUM 230 function module has the following features:

- Printed circuit board in the format 233 mm x 220 mm (extended double Eurocard format) for the ES 902C packaging system.
- 20.32 mm slot width (1 1/3 standard slots)
- Metallic front panel; see Fig. 2 for front panel layout
- 20 mm front panel width; 230,35 mm front panel height
- Two connectors on the back panel, one above the other:
Upper edge connector (X1), 96--way, bus interfaces
Lower edge connector (X5), 64--way, I/O interface for field wiring

6.3.2 Functional Design

The following are the features of the functional structure of the FUM 230 function module:

- The interfaces of the input and output section connect the module with the field devices
- The processor section implements signal processing and handle communications with the next higher level
- Two redundant bus interfaces for communications with the next--higher level
- The power supply unit generates all voltages required on the module

The module is keyed for its slot. It may be replaced with a module of the same type. Merely remove the module fuse in the front panel before you remove or install the module.

Ensure that the jumpers have correctly been set when you connect HART_(R) transducers, if used as coupling module or in parallel.

6.4 Mode of Operation

6.4.1 Transducer Power Supply

The FUM 230 function module is able to supply DC 24 V to a maximum of 16 transducers in 2-wire or 4 - wire configurations. This is done via short-circuit-proof and overload-proof electronic drivers that are able to supply a permanent current of a maximum of 120 mA.

Series and suppressor diodes protect the outputs against polarity reversal and counter e.m.f.. The outputs are monitored for overvoltage, short-circuit or failure (see Chapter 3.7 Error Control Characteristics).

The outputs are equipped with automatic restart. When the internal output command (H signal) is still present they take automatically their function back as soon as the overvoltage or short-circuit disappears.

Observe the ripple of the TELEPERM XP cabinet supply when supplying HART(R) transducers. Supply has to occur externally for currents higher than 120 mA.

6.4.2 Analog Signal Acquisition

Signal Ranges

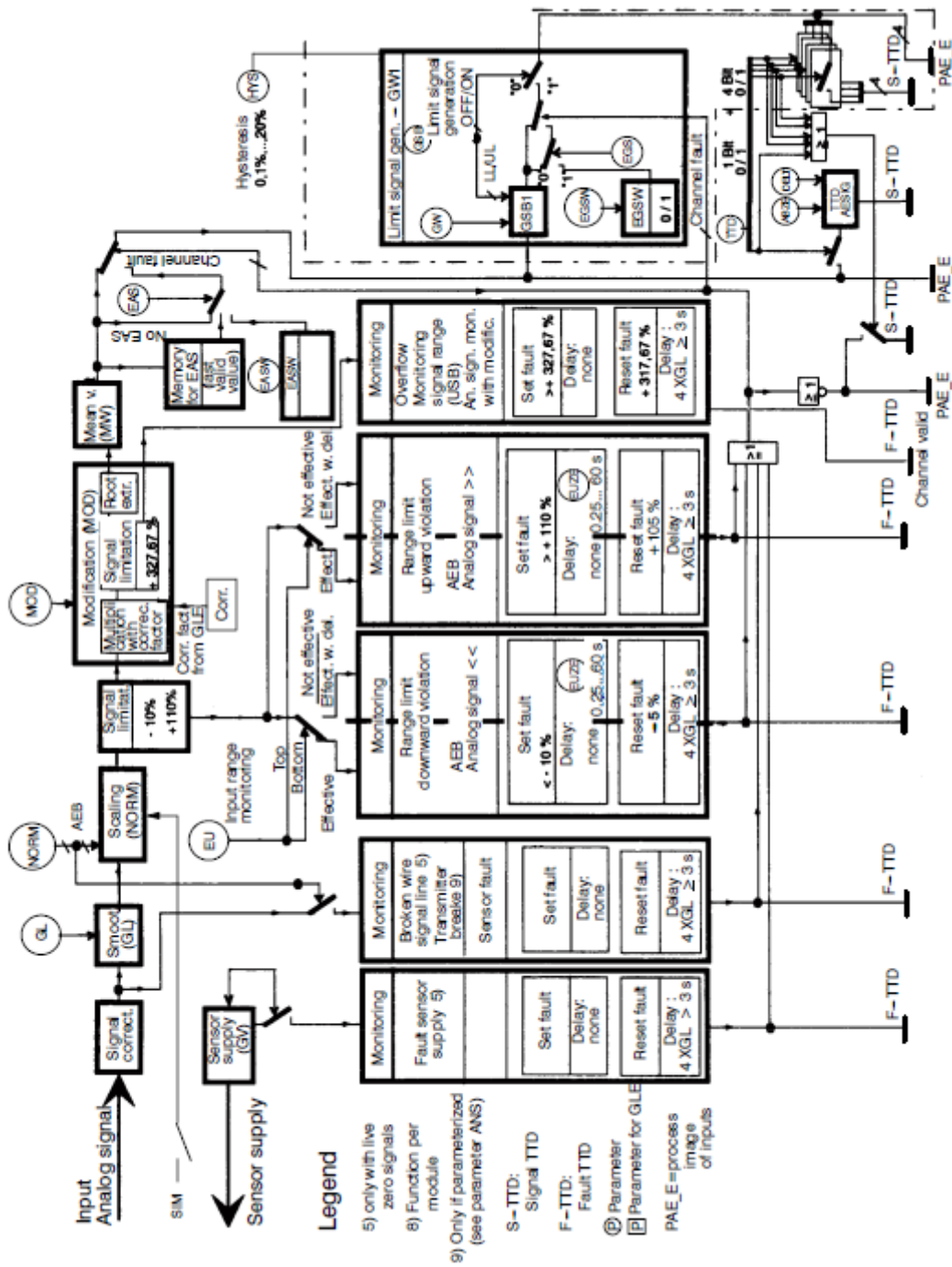
The function module is able to process analog signals in the ranges 0 ... 20 mA and 4 ... 20 mA. The signal range of each individual channel may be selected through the **analog input range** parameter (AEB).

Signal Conditioning

10-Ω rated loads are used for converting the current signals at the analog inputs into voltage signals. The input load is increased to 250 Ω when HART(R) transducers are connected. The module input circuitry is fitted to withstand without damage overdriving of up to +/- 250 mA when standard inputs with a 10-Ω input load are used. The maximum fault current is simultaneously permissible for 4 inputs.

However the additional resistor of 240 Ω is not specially protected when HART(R) transducers are used; the permissible current is 40 mA.

Jumpers or switches on module and wiring field need not be set (state upon delivery) if the module is used in non-redundant mode with standard transducers.



Signal Filter

To suppress interference, the analog signals are smoothed by a second order hardware filter (-40 dB attenuation at 50/60 Hz). The circuitry is designed such that there will be no overshooting when the signal transitions.

Analog-to-Digital Conversion

The filtered signals are fed to an analog-to-digital converter (ADC) via an analog multiplexer. The ADC employs the successive approximation method for digitizing the signals. Its resolution is 14 bits; converting an analog value takes 11 ms.

6.4.3 Analog Signal Processing

Sampling periods

The module processor reads the analog signals via the ADC in a time-controlled fashion and processes the signal according to the setting of the parameters. The following sampling periods result from the number of parameterized channels selected:

Channels selected	≤ 4	5 ... 8	9 ... 12	13 ... 16
Sampling period	25 ms	40 ms	60 ms	75 ms

Software Smoothing

Software smoothing permits additional filtering of the digitized signals. It consists of a first order timing element that can be set in steps of 0.1 second to a value between 0.1 and 10 seconds. The "Smoothing" (GL) parameter permits filtering separately to be selected for each individual channel.

Overflow Range

Input values up to 10% above or below the nominal input range (overflow range) are linearly processed.

The input signal is delimited to +110 % or -10 % of the nominal range, respectively, if it is above or below the nominal input range.

Nominal range (in accordance with parameterized physical starting value and end value)	Overflow range	
Input signal	Input signal	Overflow related to physical nominal range
0 ... 20 mA	-2.0 ... 22.0 mA	-10 ... 110 %
4 ... 20 mA	2.4 ... 21.6 mA	-10 ... 110 %

Modification

The "**Modification**" (MOD) parameter permits multiplication or square rooting with a correction factor to be configured for each individual channel.

Multiplication

The scaled signals may be multiplied by a correction factor. This is necessary, for example, if the differential pressure method is employed for flow measurements, and if variations in the medium density must be compensated for measurement. The correction factor is calculated by the AP (standard FB) and transferred to the module with the PAA_E process image. It is computed in floating-point format without sign. The value 10,000 corresponds there to the factor 1.0. A square rooting of the transferred correction factor can be configured for flow measurements with square-rooting transmitters and subsequent correction calculation

Square Rooting

If analog signals are processed that follow a square-law characteristic curve (if a differential pressure transducer is used, for example), a square-rooting adaptation of the characteristic curve of the scaled signal may be performed. Square rooting is performed in the positive quadrant only.

Mean Value Generation

Mean value generation (MW) is performed after modification (see Fig. 3). Mean value generation suppresses small fluctuations of the resulting signals. Mean value generation is only effective inside a delta band of 20 digits.

6.4.4 Limit Signal Generation

Limit signal generation (GSB) permits the following selections to be made for each individual channel: Is a limit signal to be generated, the direction of the crossing signal that will trigger a response, and the hysteresis between response and resetting the limit signal (HYS). Up to four limit signals with the same hysteresis may be generated for each input signal.

Direction of Response: UL (upper limit value max)

- **Direction of response**
The analog signal is \geq selected limit value.
- **Reset condition**
The alarm is reset when the analog value is less than the selected limit value minus the selected hysteresis.
- **Effect on the process image**
The limit signal and the inverted limit signal are transferred to the process image.
- **Effect on time--tagged data**
A "Limit signal n.m" signal TTD is produced if GS is provided with parameters.
- **Effect on internal processing**
Provided that limit signals have been selected, they may be replaced with defined alternative limit signals in the event of a channel fault.

Direction of Response: LL (lower limit value min)

- **Direction of response**
The analog signal is \leq selected limit value.
- **Reset condition**
The alarm is reset when the analog value is greater than the selected limit value minus the selected hysteresis.
- **Effect on the process image**
The limit signal and the inverted limit signal are transferred to the process image.
- **Effect on time--tagged data**
A "Limit signal n.m" signal TTD is produced if GS is provided with parameters.
- **Effect on internal processing**
Provided that limit signals have been selected, they may be replaced with defined alternative limit signals in the event of a channel fault.

6.4.5 Analog Signal Simulation

Independently of the existing input signal, an analog value may be simulated by the hand-held operator input device or by ES 680. The simulated value is processed, according to scaling/linearizing, instead of the input variable. A signal TTD (when parameterized and a "Simulated channel" error TTD are produced in this process. The "Simulated channel" bit is set in the PAE-E (process inputs image).

6.5 Commissioning, Handling

If it is used in a single-module configuration, the FUM 230 function module can directly (without presetting) be installed in the automation system. If it is used in a redundant configuration however, the specifications of Chapter 5.1 must be observed. The cabinet or the subrack does not have to be deactivated in order to insert or remove the module.

Note

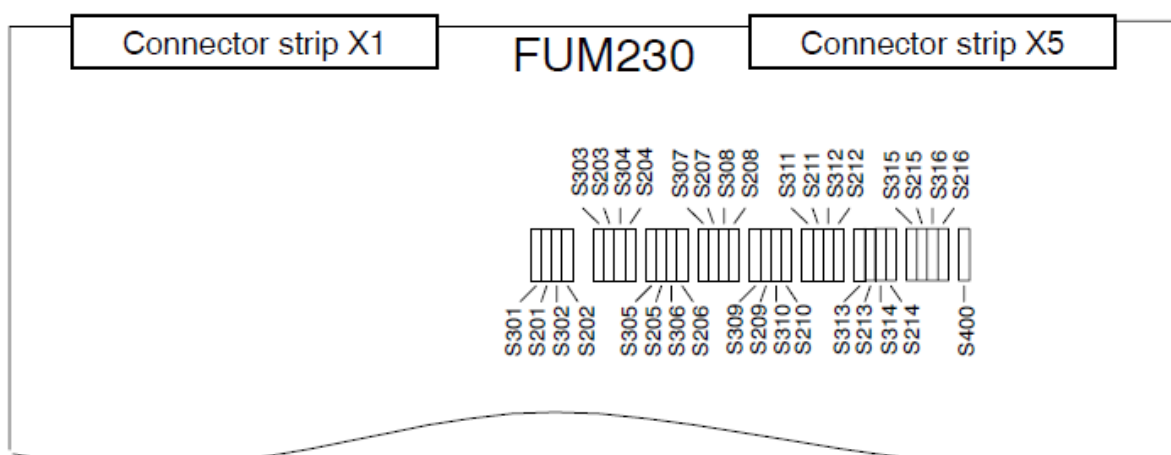
The fuse in the front panel must be removed before the module is inserted and removed. The fuse is inserted again when module inserted. The module type is recognized by the higher-order level (AP) when the module has been inserted. If the higher-order level has a suitable parameter record for this slot, the module is initialized automatically and takes over the parameterized functions.

Caution

In order to ensure the mechanical strength and contacting of the backplane connector make sure when inserting the module that the locking noses at the levers of the inserting and removing facility lock into the locking hooks provided.

6.6 Module Settings

Different coding switches must be set on the FM 230 module depending on the application. All switches are closed upon delivery. The module switch positions are shown below:



6.6.1 Module Use in Single--module Configuration

When the module is used in single--module configuration and with the 10 Ω standard input as shown jumpers or switches on module and wiring field need not be set, the coding switches are closed (state upon delivery).

When HART® transducers are connected the corresponding 240 Ω resistances must be inserted in opening the switches S301 to S316. Mixing standard transducers and HART® transducers is possible. For redundant (parallel) FUM channels the switch position must be "closed" and an external 240 Ω resistor must be used.

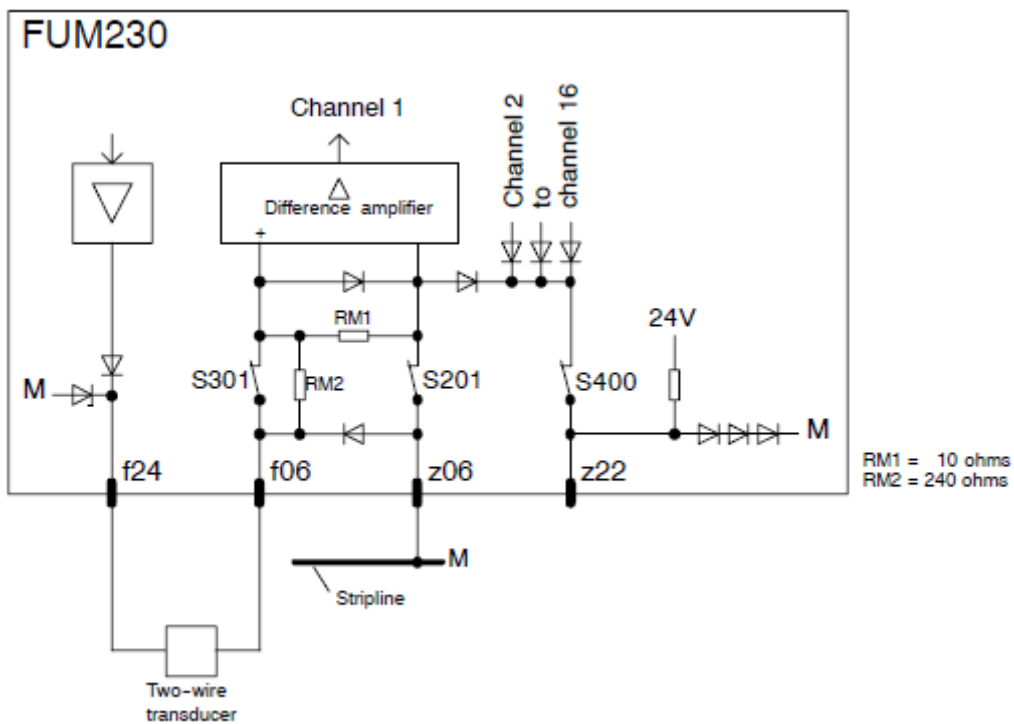
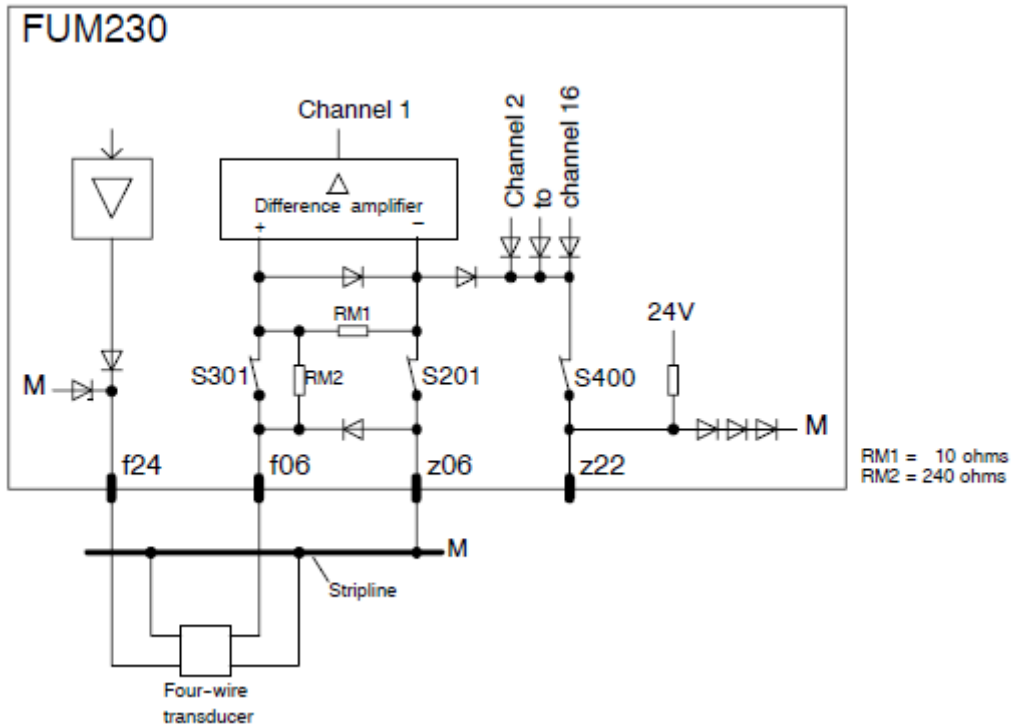
Observe the requirements for the HART® transducer supply concerning the TXP cabinet supply! A new filtering is not made on the module.

Switch positions in single-module configuration, connection of 16 standard transducers (state upon delivery):

Switch	S201 to S216	S301 to S316	S400
closed	x	x	x
open			

Switch positions in single-module configuration, connection of 16 HART® transducers:

Switch	S201 to S216	S301 to S316	S400
closed	x		x
open		x	



Planning note

- Transducers in two-wire connection are supplied with the signal lines. The effective line resistance is called load. With the FUM 230 input resistance it causes the terminal resistance of the transducer to be smaller than the module supply voltage. The permissible line load results from the following formula:

$$R_{Bmax} = \frac{(L+) - 2V - U_{MUmin}}{I_{max}} - R_E$$

; R _B	: Load
; L+	: Supply voltage
; U _{MU}	: Terminal voltage transducer
; R _E	: Effective input load of the FUM 230 module
; I	: Measured current

Due to the small input resistance of 10 Ω this relation is not critical with the FUM 230 module for standard transducers. When HART[®] transducers are used the input resistance increase to 250 Ω and the possible process distance mainly depends on the transducer terminal voltage.

The permissible line load can be calculated with the preceding formula:

Data:	L+	= 20 V;
	U _{MUmin}	= 11 V (12 V) (from Data sheet of HART [®] transducer);
	R _E	= 250 Ω
	I _{max}	= 22 mA
⇒	R _{Bmax}	= 68.1 Ω (22.7 Ω)

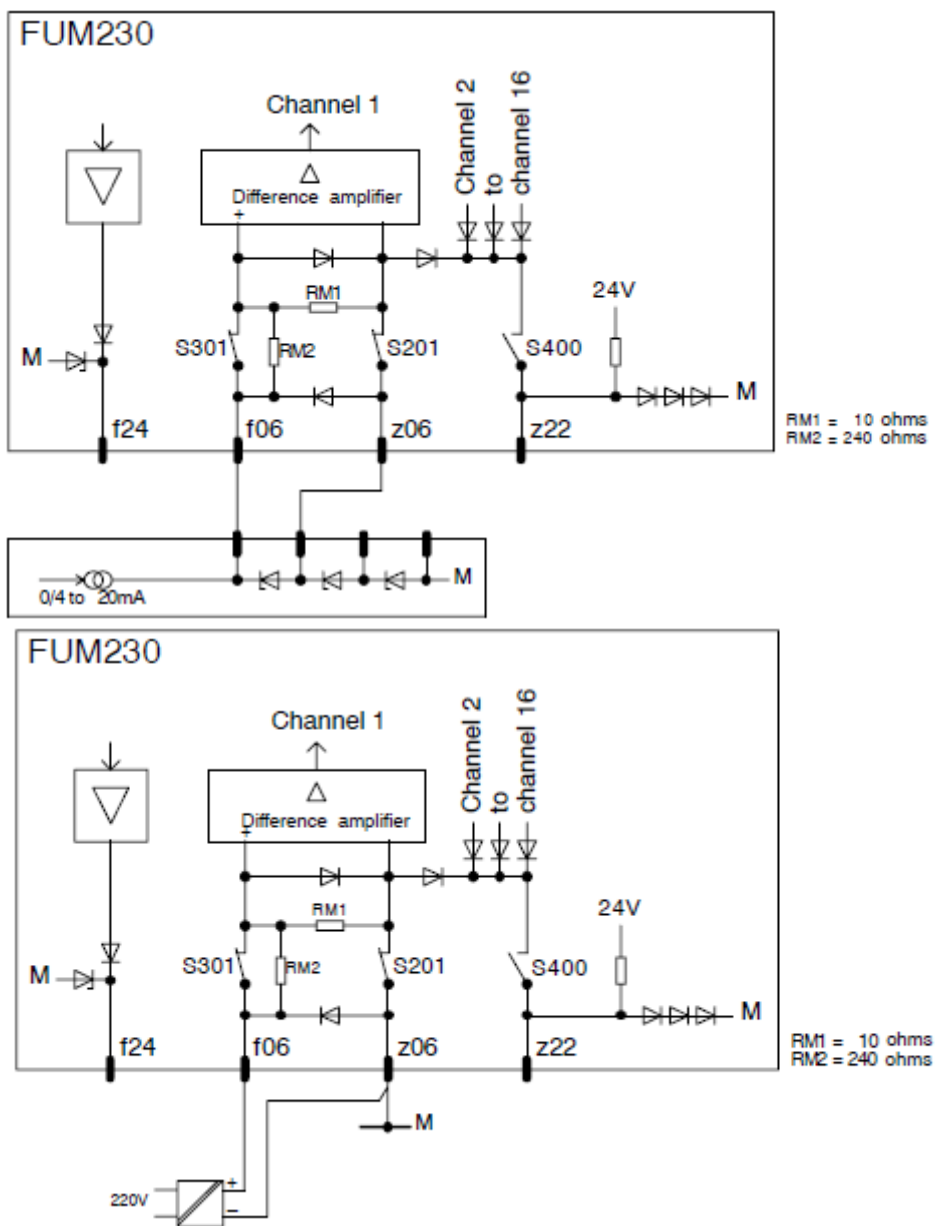
From this a HART[®] transducer with a terminal voltage ≥ 11 V (12 V) and a specific line resistance of 40 Ω/km gives a line length of 1700 m (560 m) and so a permissible process distance of max. 850 m (280 m). Doubling this distance can be achieved in connecting in parallel 2 wires.

6.6.2 Module Use as Coupling Module

The module is designed for a common-mode voltage of up to 33 V to also be used as coupling module for analog signals 0/4 to 20 mA as shown Fig. 9. In this case the coding switch S400 must be open (closed on delivery). The module sensor supplies are not used, a parallel connection of two modules is not possible.

Switch position for individual circuit, connection of 16 analog signals:

Switch	S201 to S216	S301 to S316	S400
closed	x	x	
open			x



6.6.3 Module Parallel Connection (Redundancy)

If two modules are connected in parallel to increase the availability the analog signals are led in series over both modules. Fig. 10 shows the parallel connection of channel 1.

Module 1 needs no setting/coding (state upon delivery). The switches S201 to S216 must be opened on the parallel-connected module (module 2), further the signal COD1 (X5.z22) has to be connected to M in the subrack wiring field (see Fig.10) The COD1 signal exists only once in each module. It is not possible to connect individual channels in parallel and have the "HART transducers" setting: Switch positions for parallel connection, 16 standard transducers:

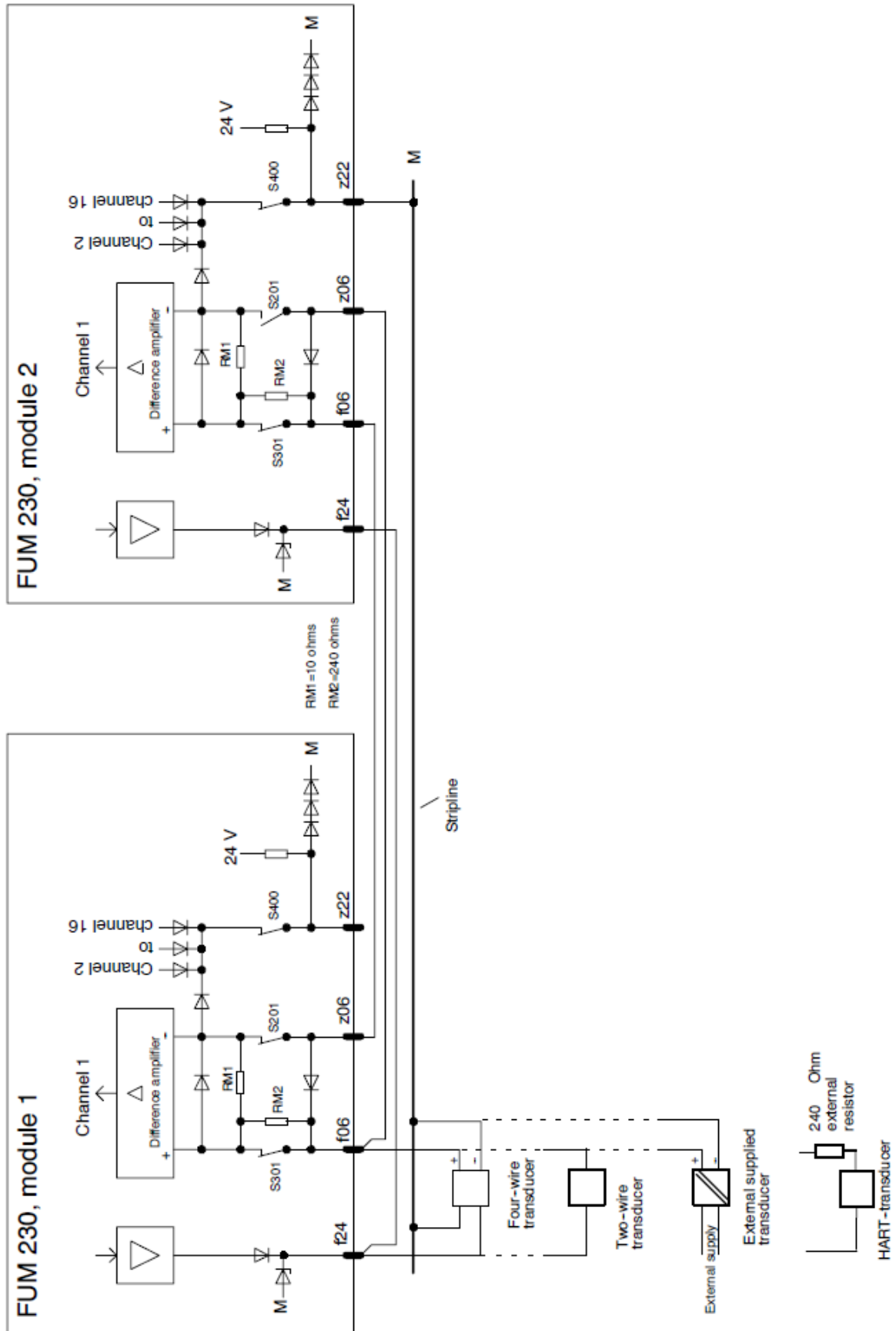
- **Module 1 (state upon delivery)**

Switch	S201 to S216	S301 to S316	S400
closed	x	x	x
open			

- **Module 2**

Switch	S201 to S216	S301 to S316	S400
closed		x	x
open	x		

Use of HART® transducers: For redundant (parallel) FUM channels the switch position must be "closed" and an external 240 ohm resistor must be used.



Planning note

- In redundancy mode, to permit a module exchange without disturbing the process in case of a module failure, the modules are fitted with diodes that take over the signal current during exchange. When planning take into account an effective input voltage of $U_E \leq 4 \text{ V}$ additionally to the voltage drop on the supply lines due to the input protection circuit for redundancy. In the same time it is the maximum effective input voltage when one of the parallel-connected module is not inserted, e.g. during repair.

The permissible line load when parallel-connected results from the following formula:

$$R_{B\max} = \frac{L+ - 2 \text{ V} - U_{MU\min} - U_{E\max}}{I_{\max}}$$

; R_B	: Load
; U_{MU}	: Terminal voltage transducer
; U_E	: Effective input voltage of the module
; I	: Measured current

Calculation example for redundancy for a two-wire transducer use:

$L+$	$=$	20 V
$U_{MU\min}$	$=$	12 V (from Data sheet of transducer);
$U_{E\max}$	$=$	4 V
I_{\max}	$=$	22 mA
$\Rightarrow R_{B\max}$	$=$	90.9Ω

With a specific line resistance of $40 \Omega/\text{km}$ it results, for the parallel connection, a permissible line length of 2270 m and so a permissible process distance of 1135 m .

6.7 Service, Diagnosis

Diagnosis points have been defined for all ELE modules that permit module--internal signal states to be interrogated. They depend on module functionality and include, for example, input signals and resulting module- internal signals that are stored in the external RAM and in the module's EPROM. The DS diagnosis system provides various powerful diagnosis functions for the modules. These functions permit the following messages to be read, for example:

- Programming error in the operating system or in the module logic
- Fault in the module logic
- Incorrect parameters from the next higher level
- Module fuse monitoring function F1 has responded
- Voltage monitoring function has responded
- One auxiliary voltage is missing
- Bus interface 1 (2) has not been initialized
- Malfunction in bus interface 1 (2)
- Incorrect SYNC signal in bus system1 (2)
- Data error in bus system1 (2)
- Heartbeat error in bus system1 (2)
- TTD buffer overflow in bus system1 (2)
- Malfunction in the module--internal INIT program (or ZYKL, NOTB, MELD, ZEIT, ALARM, GENAB program)
- Incorrect values have been transferred from the operating system
- Incorrect sampling period
- Lamp guidance system has been triggered
- No valid SYNC signal in bus system1 (2)
- SYNC signal error in bus system1 (2) delayed
- Heartbeat in bus system1 (2) delayed
- Response of the voltage monitoring function of bus interface 1 (2) was delayed

6.7.1 RAM Area

The following data items are stored in the RAM area of the module:

- Process image of the inputs; PAE_E
- Signal correction output data

- Corrected analog signals
 - Smoothing input and output data

- Unprocessed analog signals
- Smoothed analog signals
 - Scaling input and output data

- Unprocessed analog signals
- Scaled analog signals
 - Mean value generation input and output data

- Unprocessed analog signals
- Averaged analog signals
 - All pending error states (error TTD, system TTD)
 - All parameters

6.7.2 EPROM Area

The following data items are stored in the EPROM area of the module:

- Module version
- Software revision level
- Hardware revision level
- Module type

6.7.3 Module Fault

Any malfunction that is detected by the output monitoring function is

- signalled via the PAE_E to the next higher level,
- transferred as TTD, and
- indicated by the "Module fault" LED blinking ON and OFF

6.8 Spare Parts

Name	Order No.
FUM 230 function module Module fuse FF 4A (super quick) Replacement part: F 2,5A (quick) IEC 60127-2/I IEN 60127-2/I	6DP 1230-8CC Part No. GWE: 000000209528 Part No. GWE: 000000583096

6.9 Connector Pin Assignments of the X5 Backplane Connector

Z02	L+	B02	M (0 V)	D02	L+B2	F02	----
Z04	L+	B04	L+M	D04	L+B1	F04	----
Z06	IE1-	B06	IE2+	D06	IE2-	F06	IE1+
Z08	IE3-	B08	IE4+	D08	IE4-	F08	IE3+
Z10	IE5-	B10	IE6+	D10	IE6-	F10	IE5+
Z12	IE7-	B12	IE8+	D12	IE8-	F12	IE7+
Z14	IE9-	B14	IE10+	D14	IE10-	F14	IE9+
Z16	IE11-	B16	IE12+	D16	IE12-	F16	IE11+
Z18	IE13-	B18	IE14+	D18	IE14-	F18	IE13+
Z20	IE15-	B20	IE16+	D20	IE16-	F20	IE15+
Z22	COD1	B22	COD2*	D22	COD3*	F22	----
Z24	GV2	B24	GV3	D24	GV4	F24	GV1
Z26	GV6	B26	GV7	D26	GV8	F26	GV5
Z28	GV10	B28	GV11	D28	GV12	F28	GV9
Z30	GV14	B30	GV15	D30	GV16	F30	GV13
Z32	----	B32	M(0V)	D32	----	F32	----

The COD2 and COD 3 signals are only required when the 6DP 1230--8CC module replaces an older module of -8AA or -8BB type in an existing plant cabling. Then the module is compatible and the cabling has not to be changed.

SIEMENS