

Programmable Systems

The H41q and H51q System Families

Catalogue



HIMA Paul Hildebrandt GmbH + Co KG
Industrie-Automatisierung

Attention:

Maintenance on supply, signal and data lines may only be executed by qualified personnel with consideration of all ESD protection measures. With direct contact of these lines the maintenance personnel have to be electrostatically discharged!

Important Note

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The technology is subject to changes without notice.

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Table of Contents

	Hints to the Structure of the Catalog and How to Use it	7
1	The HIMA PES	8
2	Conception of the HIMA PES	9
2.1	Safety and Availability	9
2.2	Designs and Types of the PES	10
2.2.1	Conception of H41q-M, MS / H51q-M, MS	11
2.2.2	Conception of H41q-H, HS / H51q-H, HS	11
2.2.3	Conception of H41q-HR, HRS / H51q-HR, HRS	12
3	The H41q System Family	13
3.1	Conceptions of the Safety Switch Off	15
3.2	PES H41q-M	17
3.2.1	System Structure	17
3.2.2	Central Module F 8653	17
3.2.3	Mechanical Structure and Design	19
3.2.4	24 V DC Supply and Distribution	19
3.2.5	5 V DC Supply and Distribution	19
3.2.6	The I/O Bus	19
3.3	PES H41q-H	21
3.3.1	System Structure	21
3.3.2	Central Module F 8653	21
3.3.3	Mechanical Structure and Design	23
3.3.4	24 V DC Supply and Distribution	23
3.3.5	5 V DC Supply and Distribution	23
3.3.6	The I/O Bus	23
3.4	PES H41q-HR	25
3.4.1	System Structure	25
3.4.2	Central Module F 8653	25
3.4.3	Mechanical Structure and Design	27
3.4.4	24 V DC Supply and Distribution	27
3.4.5	5 V DC Supply and Distribution	27
3.4.6	The I/O Bus	27
3.5	PES H41q-MS 	29
3.5.1	System Structure	29
3.5.2	Central Module F 8652	30
3.5.3	Mechanical Structure and Design	31
3.5.4	24 V DC Supply and Distribution	31
3.5.5	5V DC Supply and Distribution	31
3.5.6	The I/O Bus	31
3.5.7	Safety Shut Down	32
3.6	PES H41q-HS 	33
3.6.1	System Structure	33
3.6.2	Central Module F 8652	34
3.6.3	Mechanical Structure and Design	35
3.6.4	24 V DC Supply and Distribution	35
3.6.5	5 V DC Supply and Distribution	35
3.6.6	The I/O Bus	35

3.6.7	Safety Shut Down	36
3.7	PES H41-HRS 	37
3.7.1	System Structure	37
3.7.2	Central Module F 8652	38
3.7.3	Mechanical Structure and Design	39
3.7.4	24 V DC Supply and Distribution	39
3.7.5	5 V DC Supply and Distribution	39
3.7.6	The I/O Bus	39
3.7.7	Safety Shut Down	40
3.8	The Input/Output Level	41
3.8.1	24 V DC Supply and Distribution	41
3.8.2	I/O Modules	42
3.8.3	(Ex)i-Modules	42
3.8.4	Safety related Output Modules , for Requirement Class AK 1 to 6	43
3.8.5	General features of the Output Modules	43
3.9	System Voltage 24 V DC	45
3.10	Overview Assembly Kits	47
4	The H51q System Family	49
4.1	Conceptions of the Safety Switch Off	51
4.2	PES H51q-M	53
4.2.1	System Structure	53
4.2.2	Central Module F 8651	54
4.2.3	Coprocessor Module F 8621A	55
4.2.4	Communication Module F 8625/F 8626	55
4.2.5	Mechanical Structure and Design	56
4.2.6	24 V DC Supply and Distribution	56
4.2.7	5 V DC Supply and Distribution	56
4.2.8	The I/O Bus	56
4.3	PES H51q-H	59
4.3.1	System Structure	59
4.3.2	Central Module F 8651	60
4.3.3	Coprocessor Module F 8621A	61
4.3.4	Communication Module F 8625/F 8626	61
4.3.5	Mechanical Structure and Design	62
4.3.6	24 V DC Supply and Distribution	62
4.3.7	5 V DC Supply and Distribution	62
4.3.8	The I/O Bus	62
4.4	PES H51q-HR	65
4.4.1	System Structure	65
4.4.2	Central Module F 8651	66
4.4.3	Coprocessor Module F 8621A	67
4.4.4	Communication Module F 8625/F 8626	67
4.4.5	Mechanical Structure and Design	68
4.4.6	24 V DC Supply	68
4.4.7	5 V DC Supply and Distribution	68
4.4.8	The I/O Bus	68
4.5	PES H51q-MS 	71
4.5.1	System Structure	71
4.5.2	Central Module F 8650	72
4.5.3	Coprozessor-Baugruppe F 8621A	73
4.5.4	Communication Module F 8625/F 8626	73
4.5.5	Mechanical Structure and Design	74
4.5.6	24 V DC Supply and Distribution	74

4.5.7	5 V DC Supply and Distribution	74
4.5.8	The I/O Bus	74
4.5.9	Safety Shut Down	76
4.6	PES H51q-HS 	77
4.6.1	System Structure	77
4.6.2	Central Module F 8650	78
4.6.3	Coprocessor Module F 8621A	79
4.6.4	Communication Module F 8625/F 8626	79
4.6.5	Mechanical Structure and Design	80
4.6.6	24 V DC Supply and Distribution	80
4.6.7	5 V DC Supply and Distribution	80
4.6.8	The I/O Bus	80
4.6.9	Safety Shut Down	82
4.7	PES H51q-HRS 	83
4.7.1	System Structure	83
4.7.2	Central Module F 8650	84
4.7.3	Coprocessor Module F8621A	85
4.7.4	Communication Module F 8625/F 8626	85
4.7.5	Mechanical Structure and Design	86
4.7.6	24 V DC Supply	86
4.7.7	5 V DC Supply and Distribution	86
4.7.8	The I/O Bus	86
4.7.9	Safety Shut Down	88
4.8	The Input/Output Level	89
4.8.1	The I/O Subrack	89
4.8.2	24 V DC Power Supply and Distribution	89
4.8.3	5 V DC Supply and Distribution	91
4.8.4	Extension of the 5 V DC Power Supply	91
4.8.5	The I/O Bus	91
4.8.6	I/O Modules	91
4.8.7	(Ex)i-Modules	92
4.8.8	Safety related Output Modules , for Requirement Class 1 to 6	92
4.8.9	General features of the Output Modules	93
4.9	System Voltage 24 V DC	95
4.10	Overview Assembly Kits	97
5	Technical Data	99
5.1	Mechanical Design	99
5.2	System Data	99
5.3	Data of the Central Modules	99
5.4	Interfaces	100
5.4.1	RS 485 Interface	100
5.4.2	Ethernet Interface	100
5.4.3	Profibus-DP interface	100
5.5	Definition of Signals	101
5.6	Electromagnetic Compatibility (EMC)	101
5.6.1	Immunity	101
5.6.2	Emission	102
5.7	Other Technical Tests, Climatic Tests	102
6	Applications	105
6.1	Configuration Hints	105
6.1.1	Programming System ELOP II and Operating System	105
6.1.2	Modify Cabinet	105
6.1.3	Usable Building Blocks	105

Table of Contents

6.2	Replacing the central modules of the H41/H51 system families	105
6.3	System Extensions	106
6.4	Installation of older types of output modules	106
7	Installation and Connections	107
7.1	To Insert and to Withdraw Modules	107
7.1.1	I/O modules	107
7.1.2	Coupling Modules	107
7.1.3	Central Module (CU) and Coprocessor Module (CM)	107
7.1.4	Power Supplies	108
7.1.5	Communication Module F 8625	108
7.2	Earthing of the 24 V DC System Voltage	108
7.2.1	Floating Supply	108
7.2.2	Earthed Operation	109
7.3	Measures to Install a Cabinet According to the Requirements	109
7.4	Earthing in the HIMA PES	110
7.4.1	Earthing Cable Run	110
7.4.2	Fastening of the Earthing Strips	112
7.4.3	Interconnecting the Earth Terminals of Multiple Switchgear Cabinets.	112
7.5	Screening of Data Lines in the HIMA Communication Systems	112
7.6	Screening in the Input/Output Area	114
7.7	Lightning Protection in HIMA Communication Systems	115
8	Startup and Maintenance	117
8.1	Recommended Devices for Startup and Maintenance	117
8.2	Installing the System	117
8.3	Earthing the 24 V DC System Voltage	117
8.4	Starting up the Control Cabinet	117
8.4.1	Testing All Inputs and Outputs for External Voltage	117
8.4.2	Testing All Inputs and Outputs for Earth Faults	117
8.5	Power Supply	118
8.6	Functional Testing	118
8.6.1	Preparing Functional Testing	118
8.6.2	Testing in the Central Devices	118
8.6.3	Testing in the Input/Output Racks	119
8.6.4	Switching on the HIMA PES	119
8.6.5	Starting the Communication between Programming Device and PES	119
8.7	Alterations	120
8.7.1	Alterations of Constants, Parameters and Set Points of Timers	120
8.7.2	Alterations of the Program	120
8.8	Maintenance	120
8.8.1	Procedure to Exchange the Buffering Batteries	120
8.9	Fault Detection	121
8.9.1	Faults in the Central Device	121
8.9.2	Faults in the Input/Output modules	121
8.9.3	Repairing Modules	122
8.9.4	HIMA Service and Training	122

9	Overview Data Sheets	123
9.1	Assembly kits	123
9.2	Central Modules	124
9.3	Power Supplies	124
9.4	Input-/Output Modules	124
9.4.1	Digital Input Modules	124
9.4.2	Analog Input Modules	124
9.4.3	Output Modules	125
9.4.4	Current Distribution Modules and Subracks	125
9.4.5	Additional Devices	125
9.5	Communication Modules	125
9.6	Modules for I/O Bus Coupling	125
9.7	Bus connection modules for HIBUS	125
9.8	Relay Modules	126
9.9	Data Connecting Cables	126
9.10	General Hints to the Data Sheets	127
9.10.1	I/O Modules	127
9.10.2	Modules within the Central Rack	127
9.10.3	Kommunikationsbaugruppen	127
9.10.4	Symbols in the Data Sheet Diagrams	128
9.10.5	Color Code for Lead Marking	130
9.10.6	Description of the Order Code for the Cable Plug	130

Appendix

Data sheets of the assembly kits		B
Data sheets of the data cables		BV
Data sheets of the modules		F
Data sheets of the additional devices		H, K

For your notes

The H41q and H51q System Families

Hints to the Structure of the Catalog and How to Use it

The catalog contains the description of the HIMA **Programmable Electronic Systems (PES)** of the system families H41q and H51q.

The introduction contains general hints to the PES and is followed by the description of the individual types of PES. All the descriptions have the same structure so that they can each be used independently as device documentation. The data sheets of the assembly kits complete the device documentation. They are listed in the order of their component identification numbers (B xxxx). Each type of PES has a corresponding assembly kit (see 3.9 and 4.9, overview of assembly kits).

The data sheets of the central modules and IO modules which are usable in the PES are part of the appendix.

Furthermore, this catalog contains the data sheets for the connection cables (BV xxxx), hints to external circuits, technical data of the PES and hints for application.

The programming of the HIMA PES with programming system ELOP II, startup and maintenance, functions of the operating system, using in safety systems etc. are described in own manuals. A schedule of all HIMA documentations is listed in the USD (Update Service Documentation).

10 The HIMA PES

The HIMA PES mainly consists of the H41q and H51q system families. Both system families are based on the same hardware and software, and they are the 3rd generation of the field-proven HIMA PES to control preferably process engineering plants. Additionally personal computers are used for configuration, logging, operation, and trend recording.

Digital and analog inputs can be processed. Some input modules are designed for intrinsically safe circuits as well as for electric position sensors (proximity switches) according to DIN 19234. Digital and analog outputs are also available.

The HIMA PES are installed in subracks 19 inch 5 resp. 4 units high. The H41q system family is a compact system consisting of a subrack holding all components such as central unit, power supplies, fusing, and power distribution, as well as input/output modules.

The H51q system has a modular structure. A central rack 5 units high containing the central unit, interface port extensions, monitoring, and power supplies may have up to 16 associated input/output subracks 4 units high. The following diagram provides support in selecting the appropriate system for your PES task (see to the following page):

Characteristic	H41q	H51q
< 192 channels, single channel Note: 192 = 12 I/O modules x 16 channels/module. Max. number of I/O channels is reduced with modules having less than 16 channels (refer to the data sheets of the usable modules)	X	X
> 192 channels, single channel		X
< 96 channels, single channel Note: 96 = 6 I/O modules x 16 channels/module. Max. number of I/O channels is reduced with modules having less than 16 channels (refer to the data sheets of the usable modules)	X	X
> 96 channels redundant		X
max. 2 serial interfaces	X	X
> 2 serial interfaces		X
Control without PES-master	X	X
Control with PES-master		X

2 Conception of the HIMA PES

The HIMA PES of the H41q and H51q system families consist of module for central devices assembled in one subrack 5 units high 19 inch and of modules for binary and analog input/output signals which are assembled in H51q in 4 units 19 inch subracks.

The HIMA PES use personal computers with the programming system ELOP II for the configuration, monitoring, operation and documentation. The entry of the user's program and the compilation into the machine code is done only on the personal computer without connected PES. To load, test and to monitor the PLC the personal computer is connected via a serial interface or a bus system together with the PES.

2.1 Safety and Availability

HIMA PES are designed both for safety related applications up to requirement class 6  (class definition according to DIN V 19250) and for high availability. Depending on the required safety and availability, HIMA PES can be supplied as one-channel or two-channel (redundant) devices with the same modules in the central device as well as in the input/output level. Redundant modules increase the availability as in case of the failure of one module this is automatically switched off while the redundant module continues operation.

The following table gives an overview:

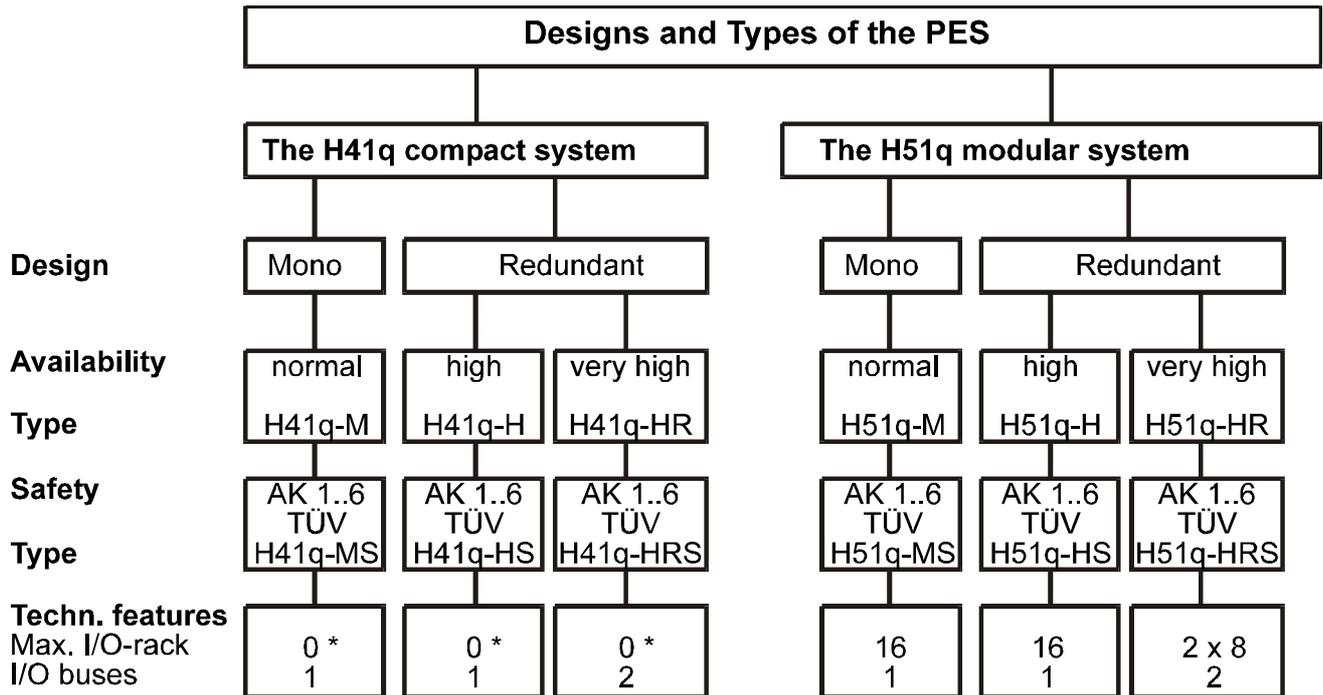
Safety / requirement class	AK 1..6	AK 1..6	AK 1..6
Availability	normal (M)	high (M)	very high (HR)
Central module	mono	redundant	redundant
I/O modules	mono ¹⁾	mono ¹⁾	redundant
I/O bus	mono	mono	redundant

Notes on the table:

¹⁾ individual I/O modules can also be used as redundant modules or connected to sensors in a 2-of-3 network to increase availability.

2.2 Designs and Types of the PES

The controls can be adapted to the requirements of the plant by equipping them with the appropriate central modules. The following structures are possible with the H41q resp. H51q system family:



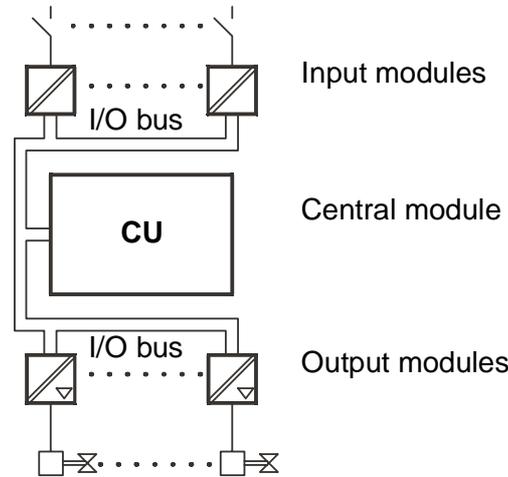
Notes:

AK = requirement class according to DIN V 19250

I/O = input and output

* Central modules and I/O modules are installed in the same subrack!

2.2.1 Conception of H41q-M, MS / H51q-M, MS



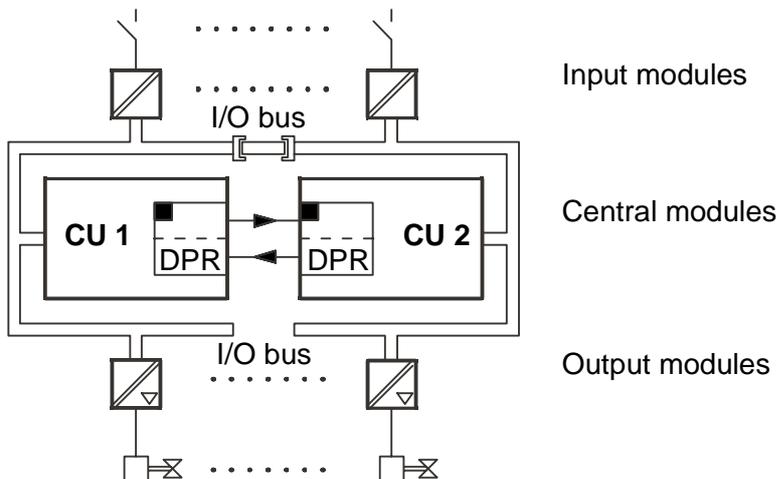
Characteristics	
CU	mono
I/O Mod.	mono
I/O bus	mono

H41q-M / H51q-M

single channel central module and single channel I/O bus

H41q-MS / H51q-MS  with double processors single channel central module and single channel I/O bus with TÜV test certificate up to requirement class 6 acc. to DIN V 19250.

2.2.2 Conception of H41q-H, HS / H51q-H, HS



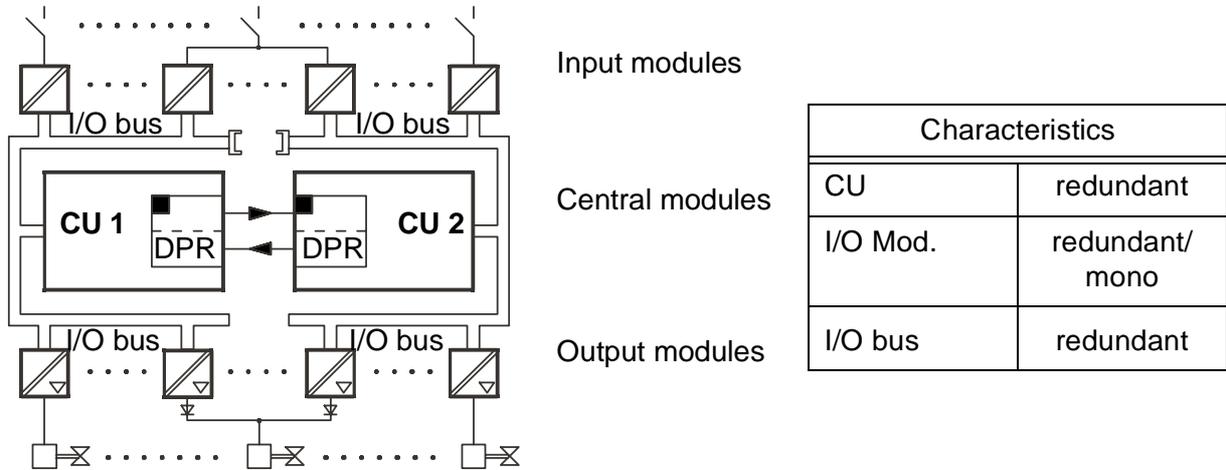
Characteristics	
CU	redundant
I/O Mod.	mono/ redundant
I/O bus	mono

H41q-H / H51q-H

redundant central modules and a single channel I/O bus for highly available PES.

H41q-HS / H51q-HS  with double processors redundant central modules and a single channel I/O bus for highly available and safety related PES with TÜV test certificate up to requirement class 6 according to DIN V 19250.

2.2.3 Conception of H41q-HR, HRS / H51q-HR, HRS



H41q-HR / H51q-H

Redundant central modules and two channel I/O bus for highly available PES.

H41q-HRS / H51q-HRS TUV with double processors redundant central modules and two channel I/O bus for highly available and safety related PES with TÜV test certificate up to requirement class 6 acc. to DIN V 19250.

Remarks to the drawings:

- CU = central module
- I/O Mod. = input / output modules
- I/O bus = bus system for input & output
- DPR = Dual Port RAM

3 The H41q System Family

The H41q system families comprises compact designed PES in single channel and redundant models, also with TÜV safety certificate  .

All testable input/output modules can be used with both redundant and single channel models of the central modules.

All modules of the H41q system family meet the requirements for Electro-magnetic compatibility and immunity according to article 10 of the EG-guideline 89/336/EEG for the electromagnetic conformity. This is demonstrated with the  sign within the data sheets of the modules. Also the systems and modules are wearing a sticky label with this sign.

All models of the H41q system family have all the components required for control tasks in a 19 inch subrack 5 units high with an integrated cable tray.

- Depending on the system model, one or two central modules controlled by micro processors
- Two interfaces RS485 on the central module for a transfer rate of up to 57600 bps
- The central module generates a watchdog signal to switch off the testable output modules as the second way of switch off in the case of a fault
- One or two power supply modules 24 V DC/5 V DC to generate the 5 V DC operating voltage for the central modules and the control voltage for the input/output modules
- Batteries mounted on the rear of the subrack to buffer the sRAM area and the real-time clock on the central module
- Three power distribution modules 24 V DC for fusing of the power supply for the inputs and outputs.
- A maximum of 12 slots for input and output modules for digital and analogue signals
- Direct connection of I/O modules to the central module. All functions necessary for the connection of the I/O bus are integrated in the H41q central module
- Integrated cable tray
- Additional modules to connect and to decouple the supply voltage 24 V DC, to supply the watchdog signal and as fan plug-in unit with fuse and fan run monitoring.

For your notes

3.1 Conceptions of the Safety Switch Off

In case of faults of output, coupling and central modules and group switch off

In the system descriptions the safety related PES H41q-MS, -HS, -HRS the ways for shut down if a fault occurs are shown. Depending on the fault location the reactions of the systems are fixed or they can be defined in the user's program by means of the building block H8-STA-3 and with activating of a system variable for emergency off.

Reaction to faults of safety related digital I/O modules during operation:

Location of fault	Measures in the user's program	Reaction of system
Output module  Single error (also voltage drop)		Module switch-off ¹⁾
	One building block H8-STA-3 per group	Group shut down ²⁾
	System variable for emergency off activated	WD switch-off of the appertaining CU ³⁾
I/O bus or double fault of output modules		WD switch-off of the appertaining CU ³⁾
Central module		WD switch-off of the appertaining CU
Input module		Operation of 0 signal for all inputs of this module

Definitions:

Double fault = fault within an output channel an the switch off electronic part of a testable output module.

Abbreviations in the table:

CU Central module
 I/O bus Input/output bus
 I/O-CON Coupling module
 I/O rack Input/output rack
 WD Watchdog signal
 Integrated safety shutdown

Explanation of the table:

1) Module switch off

A faulty testable output module with integrated safety shutdown  will be switched automatically to the safe deenergized safe status.

2) group shut down

If it is requested, a group shut down may be agreed in the user's program so, that all testable output modules appertaining to the group with the faulty module are also be switched off.

Inside the user's program up to 10 testable output modules can be assigned to one group by means of the building block H8-STA-3.

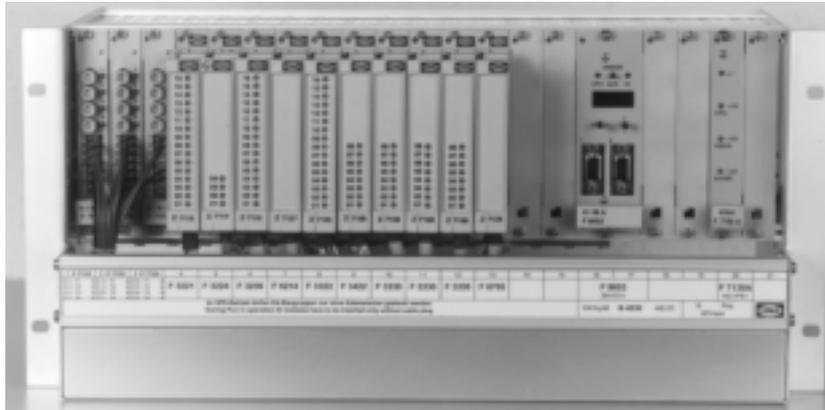
3) Switch off WD of the appertaining CU

In this case the watch dog signal (WD) of the appertaining central module will be switched off.

If systems with redundant central modules and a common I/O bus are used then the output modules are related to both central modules. In case of a fault both the watchdog signals of the central modules are switched off. That means all the I/O modules are switched off.

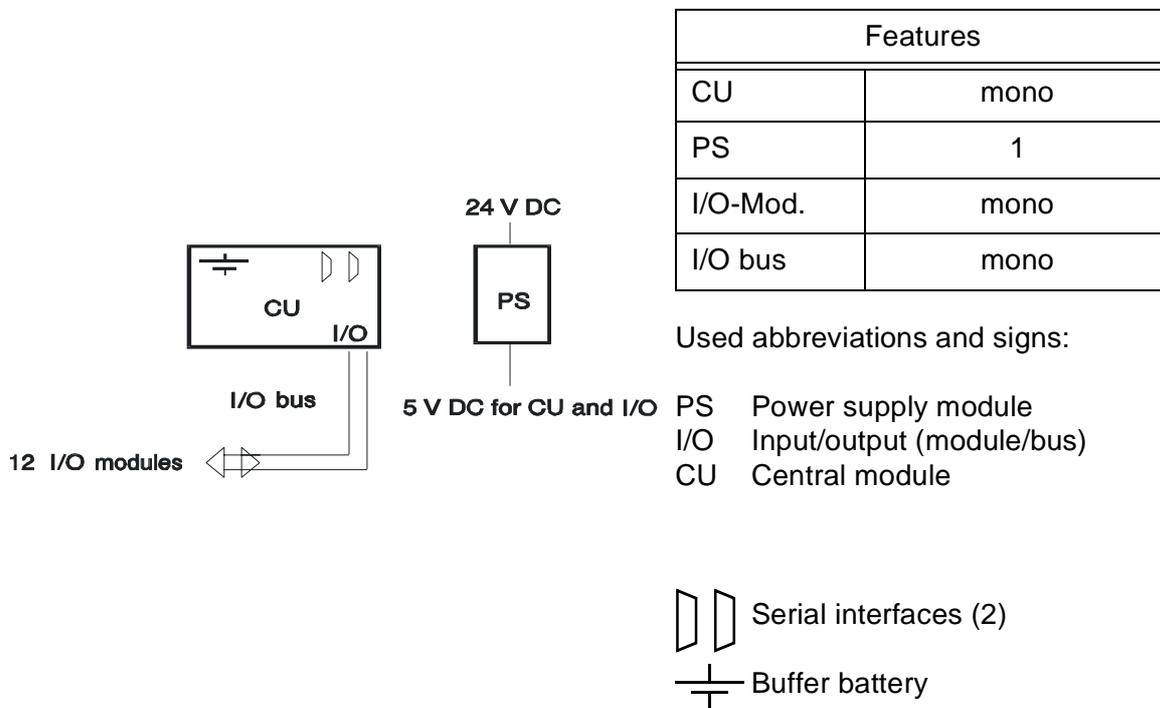
If systems with redundant central modules and redundant I/O bus are used then the output modules are related to one central module and one I/O bus. In case of a fault only the watch dog signal of the related central module is switched off. That means only the related I/O modules are switched off.

3.2 PES H41q-M



View of the PES H41q-M

3.2.1 System Structure



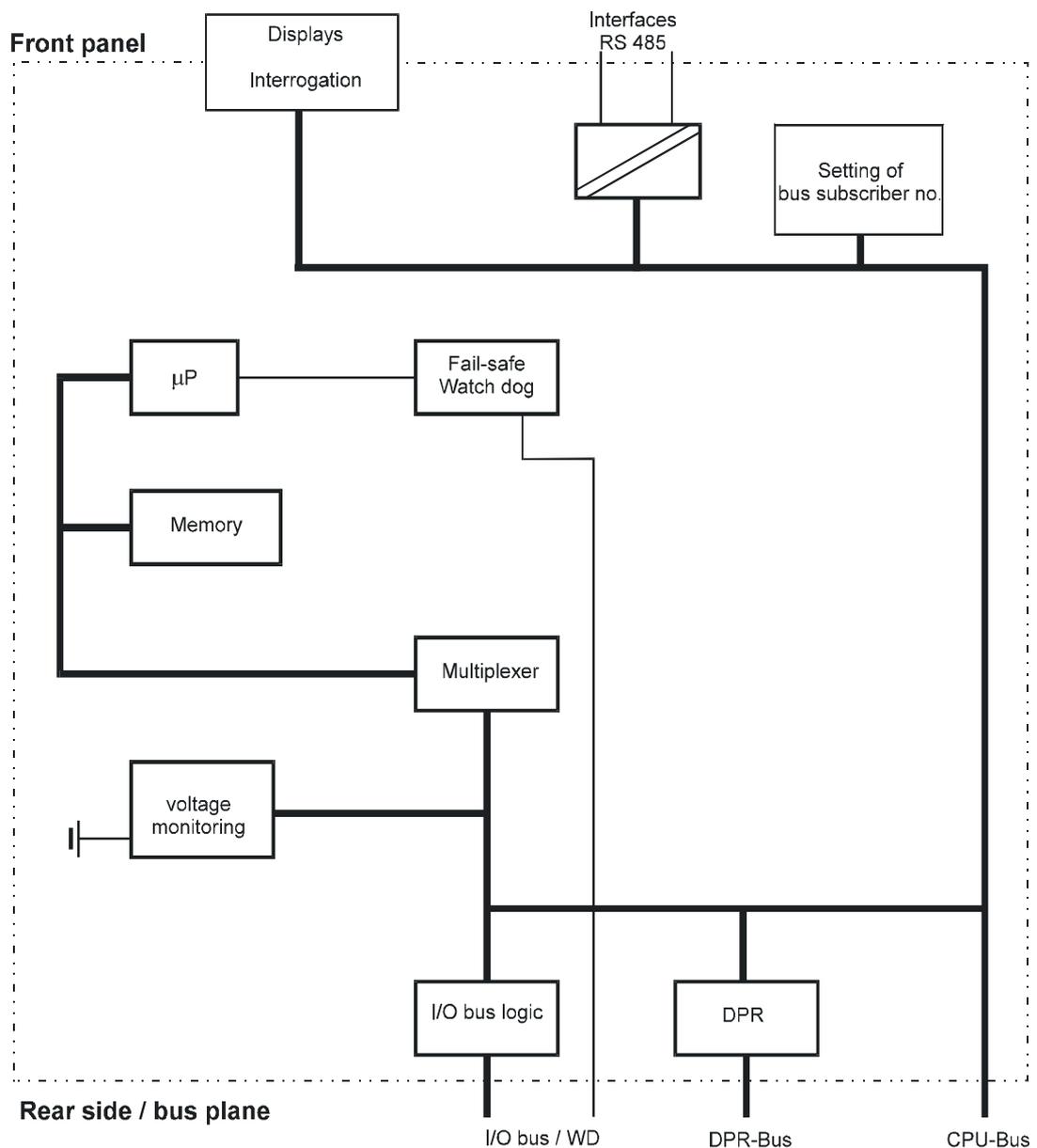
System structure of the H41q-M PES

3.2.2 Central Module F 8653

The central module of the PES H41q-M contains the essential functions demonstrated in the structure of the central module:

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM

- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H41q-M system)
- Dual Port RAM for fast memory access to the second central module (not used in the H41q-M system)
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transmission rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
- Power supply monitoring
- I/O-Bus logic for the connection to the input/output modules
- Hardware clock, battery backed
- Fail-safe watchdog
- Battery backup of the sRAMs via batterie with monitoring.



Structure of the central module F 8653

3.2.3 Mechanical Structure and Design

The data sheet of the B 4230 assembly kit shows the mechanical structure and design of the H41q-M PES.

3.2.4 24 V DC Supply and Distribution

For information to the connection of the supply voltage 24 V DC see B 4230, wiring assembly kit and chapter 3.8, I/O Level.

3.2.5 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 V DC power is needed by the CPU, the control of the interfaces, and the data register of the I/O modules. It is generated by a clocked 24 V DC/5 V DC power supply module bearing the F 7130A identification.

The 5 V DC output voltage of the power supply module (for the CPU, I/O, and the interfaces) are monitored on the central unit checking undervoltage or failure.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

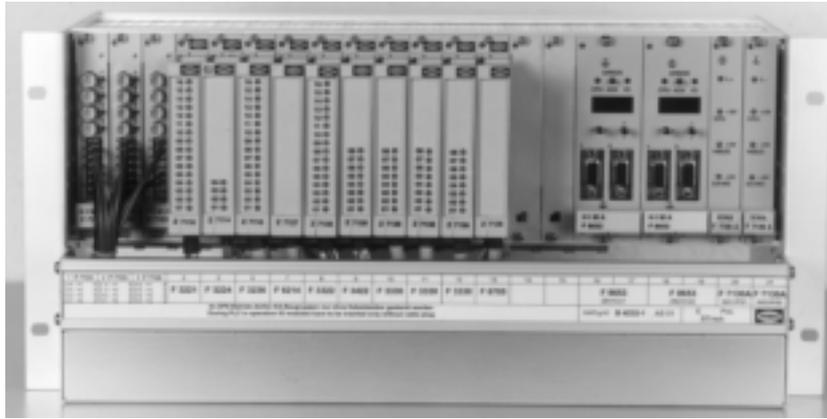
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by a lithium battery which is also on the central module.

3.2.6 The I/O Bus

Just plugging-in the central module into the subrack establishes connection to the I/O modules. No further steps are required.

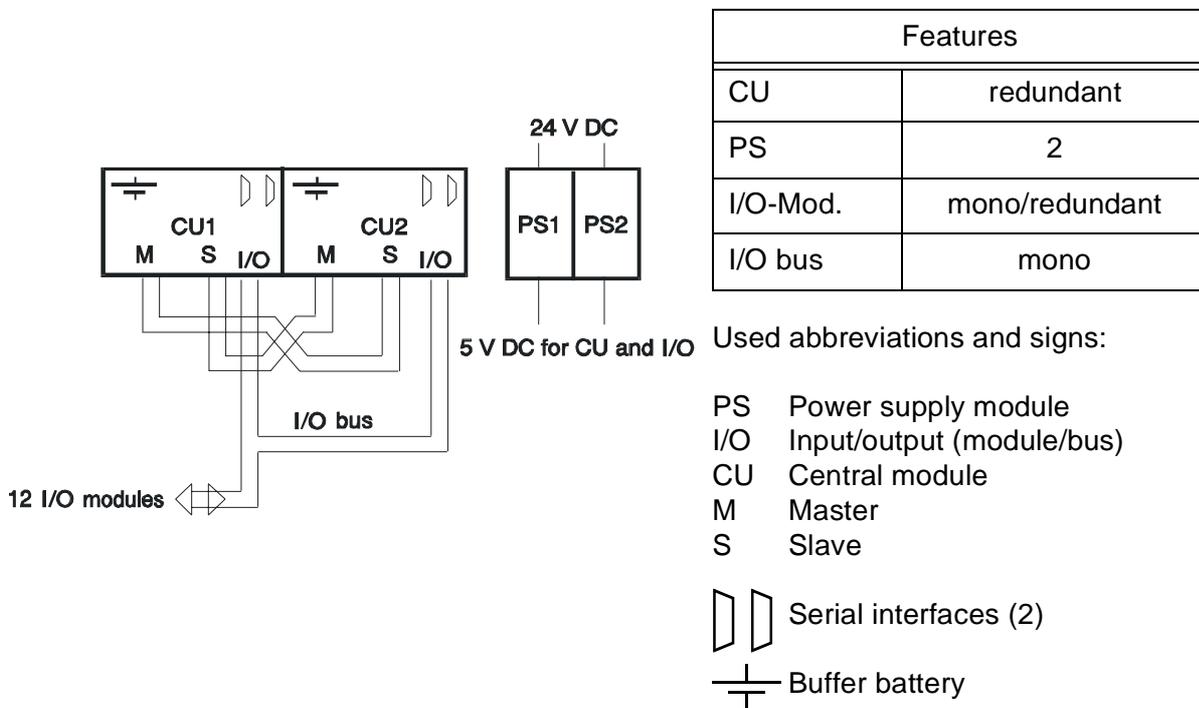
For your notes

3.3 PES H41q-H



View of the PES H41q-H

3.3.1 System Structure



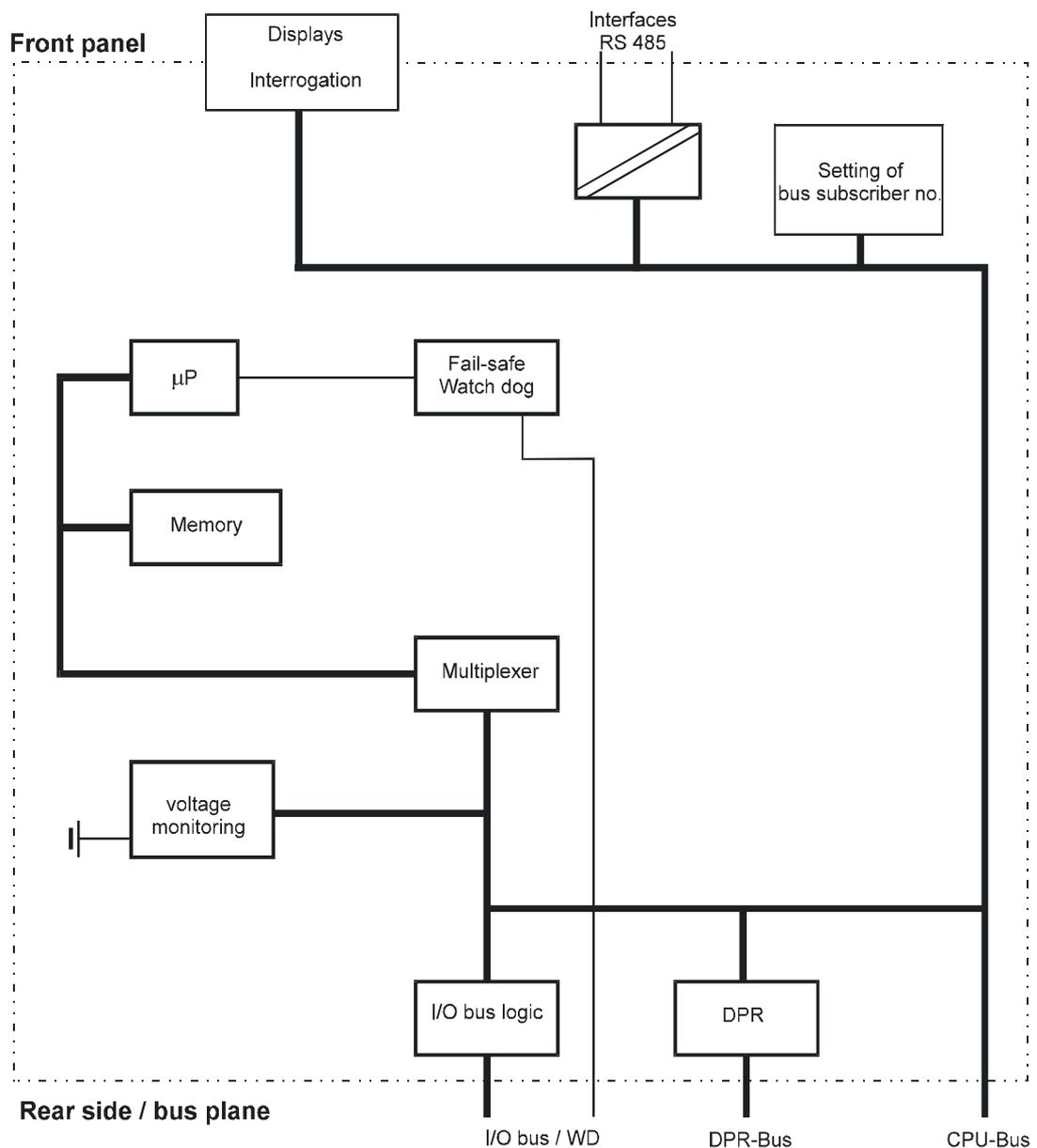
System structure of the H41q-H PES

3.3.2 Central Module F 8653

The central module of the PES H41q-H contains the essential functions demonstrated in the structure of the central module:

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM

- Multiplexer to connect I/O bus, DPR and redundant CU
- Dual Port RAM for fast memory access to the second central module
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transmission rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
- Power supply monitoring
- I/O-Bus logic for the connection to the input/output modules
- Hardware clock, battery backed
- Fail-safe watchdog
- Battery backup of the sRAMs via batteries with monitoring.



Structure of the central module F 8653

3.3.3 Mechanical Structure and Design

The data sheet of the B 4232-1 assembly kit shows the mechanical structure and design of the H41q-H PES.

3.3.4 24 V DC Supply and Distribution

The supply voltage may be fed two times to the system H41q-H (see also B 4232-1, wiring assembly kit and chapter 3.8, I/O Level).

3.3.5 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 V DC power is needed by the CPU, the control of the interfaces, and the I/O modules. It is generated by clocked 24 V DC/5 V DC power supply modules bearing the F 7130A identification. The subrack is equipped with two power supply modules. The power supply modules are paralleled. If one of them fails, the other supplies the PES.

The 5 V DC output voltage of the power supply modules (for the CPU, I/O, and the interfaces) are monitored on the central unit checking under-voltage or failure.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

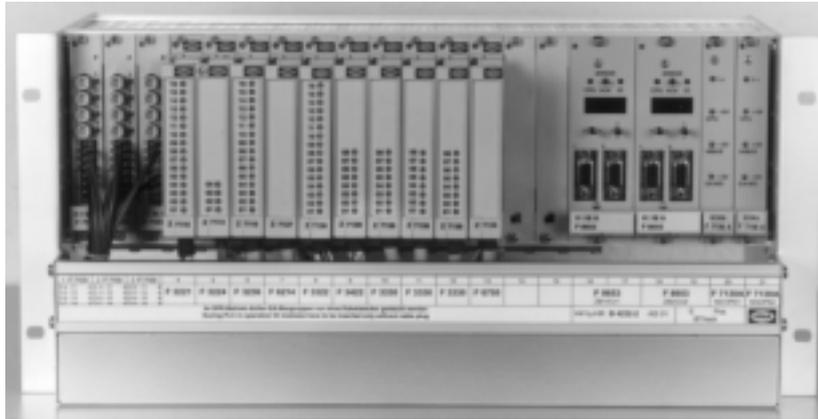
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by a lithium battery which is also on the central module.

3.3.6 The I/O Bus

Just plugging-in the central modules into the subrack establishes connection to the I/O modules. No further steps are required.

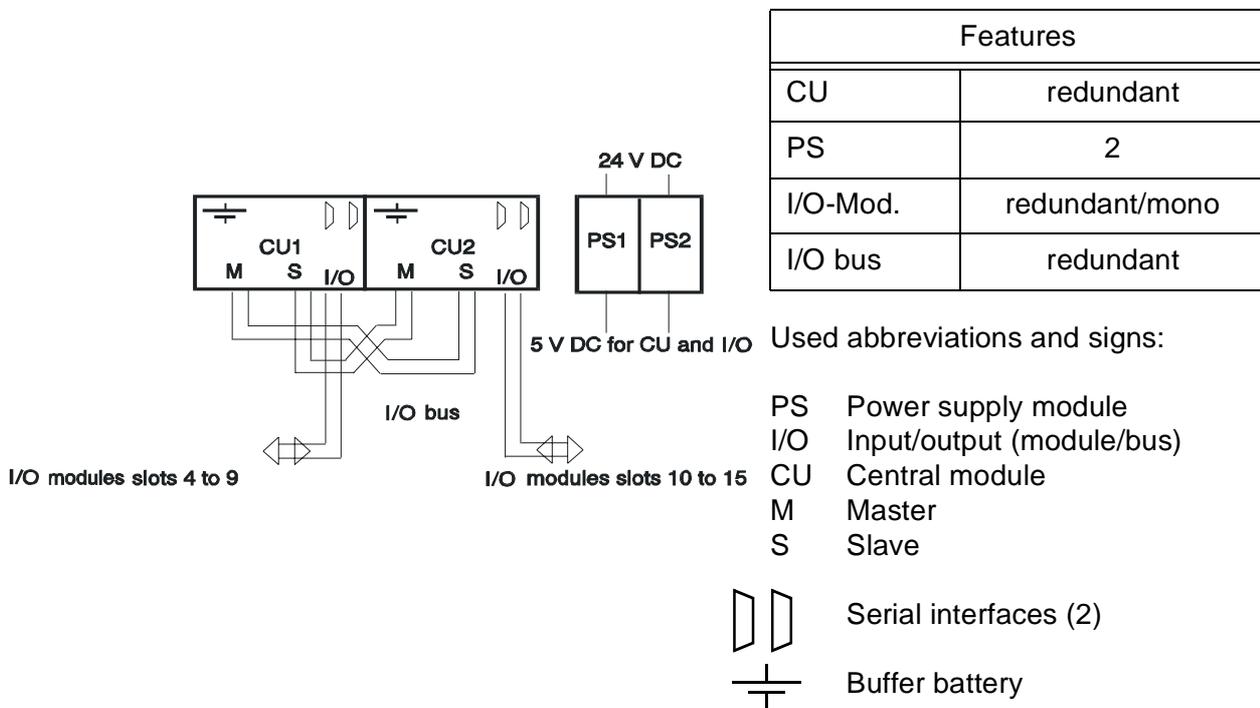
For your notes

3.4 PES H41q-HR



View of the PES H41q-HR

3.4.1 System Structure



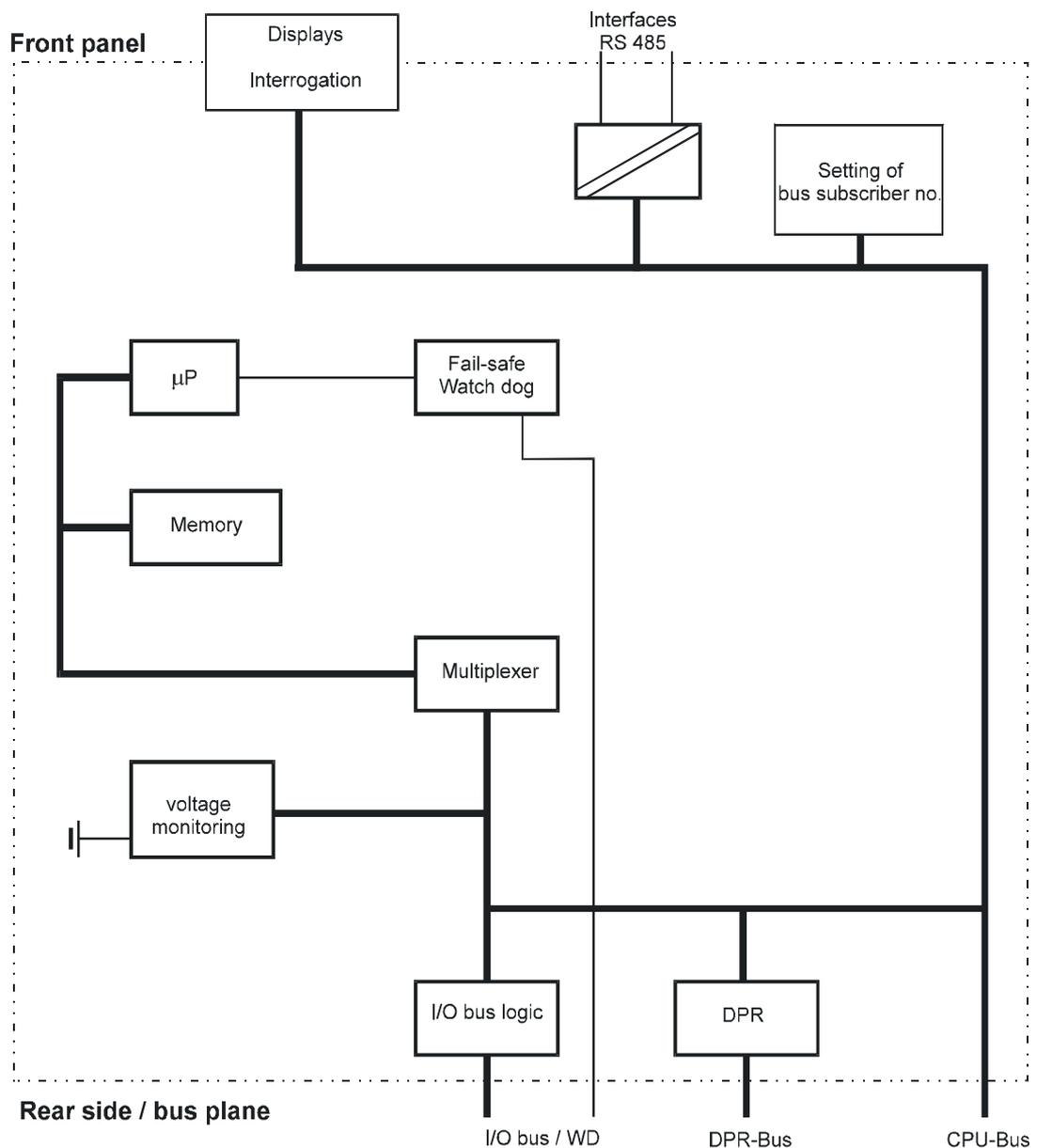
System structure of the H41q-HR PES

3.4.2 Central Module F 8653

The central module of the PES H41q-HR contains the essential functions demonstrated in the structure of the central module:

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM

- Multiplexer to connect I/O bus, DPR and redundant CU
- Dual Port RAM for fast memory access to the second central module
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transmission rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
- Power supply monitoring
- I/O-Bus logic for the connection to the input/output modules
- Hardware clock, battery backed
- Fail-safe watchdog
- Battery backup of the sRAMs via batteries with monitoring.



Structure of the central module F 8653

3.4.3 Mechanical Structure and Design

The data sheet of the B 4232-2 assembly kit shows the mechanical structure and design of the H41q-HR PES.

3.4.4 24 V DC Supply and Distribution

The supply voltage may be fed two times to the system H41q-HR (see also B 4232-2, wiring assembly kit and chapter 3.8, I/O Level).

3.4.5 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 V DC power is needed by the CPU, the control of the interfaces, and the I/O modules. It is generated by a clocked 24 V DC/ 5V DC power supply module bearing the F 7130A identification. The subrack is equipped with two power supply modules. The power supply modules are paralleled. If one of them fails, the other supplies the PES. The 5 V DC output voltage of the power supply modules (for the CPU, I/O, and the interfaces) are monitored on the central unit checking undervoltage and failure.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

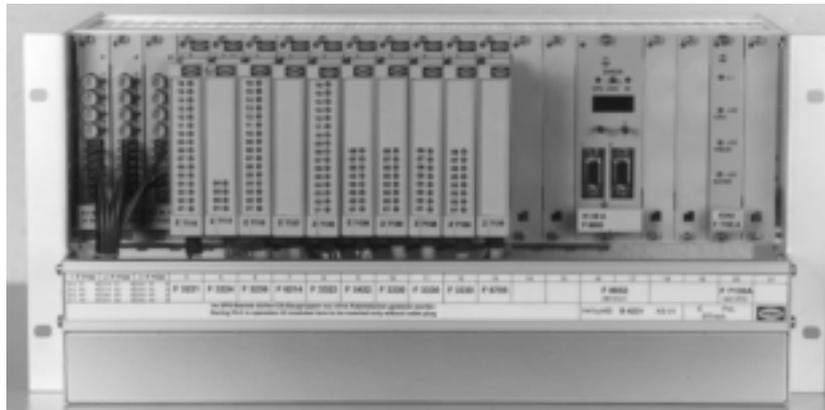
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by a lithium battery which is also on the central module.

3.4.6 The I/O Bus

Just plugging-in the central modules into the subrack establishes connection to the I/O modules. No further steps are required. With the redundant I/O bus the jumper plug Z 6007 at the rear of the subrack is not installed.

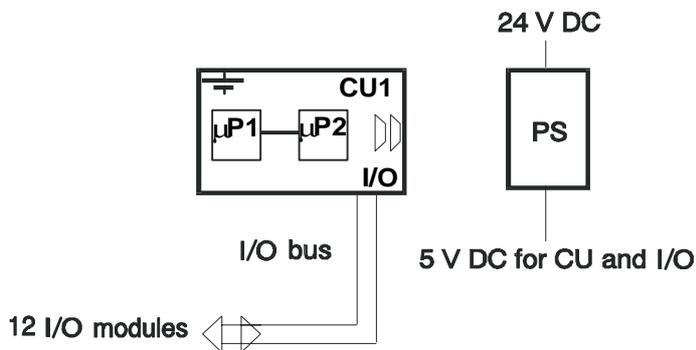
For your notes

3.5 PES H41q-MS



View of the PES H41q-MS

3.5.1 System Structure



Features	
CU	mono
PS	1
I/O-Mod.	mono
I/O bus	mono
TÜV tested	

Used abbreviations and signs:

- PS Power supply module
- I/O Input/output (module/bus)
- CU Central module
- μP1,2 Double processors

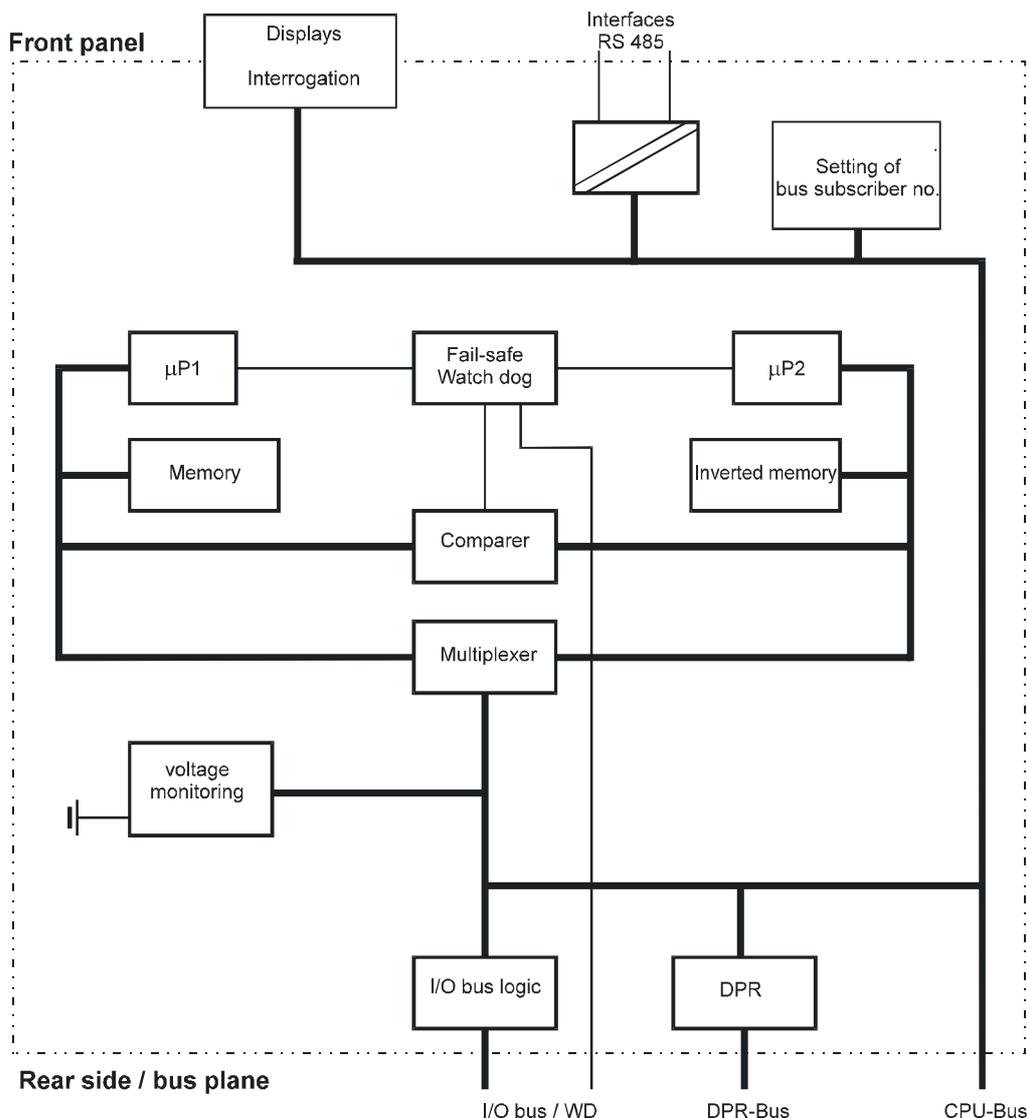
 Serial interfaces (2)

 Buffer battery

System structure of the H41q-MS PES

3.5.2 Central Module F 8652

The central module for safety related applications with TÜV certificate of the PES H41q-MS contains the following essential functions demonstrated in the structure of the central module:



Structure of the central module F 8652

- two clock-synchronised micro processors
- each mikroprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both micro processors, in case of a fault the watch dog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H41q-MS system)
- Battery backup of the sRAMs via batteries on the central module with monitoring and on the bus board
- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of

-
- other transm. rates by software (the software values have priority)
 - Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
 - Dual Port RAM for fast memory access to the second central module (not used in the H41q-MS system)
 - hardware clock, battery backed
 - I/O bus logic and connection to the input-/output modules
 - Fail-safe watchdog
 - power supply monitoring, testable (5 V system voltage)
 - Battery monitoring

3.5.3 Mechanical Structure and Design

The data sheet of the B 4231 assembly kit shows the mechanical structure and design of the H41q-MS PES.

3.5.4 24 V DC Supply and Distribution

For information to the connection of the supply voltage 24V DC see B 4231, wiring assembly kit and chapter 3.8, I/O Level.

3.5.5 5V DC Supply and Distribution

The 5V DC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5V DC power is needed by the CPU, the control of the interfaces, and the I/O modules. It is generated by a clocked 24 V DC/5 V DC power supply module bearing the F 7130A identification.

The 5 V DC output voltage of the power supply module (for the CPU, I/O, and the interfaces) are monitored on the central unit checking undervoltage or failure.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

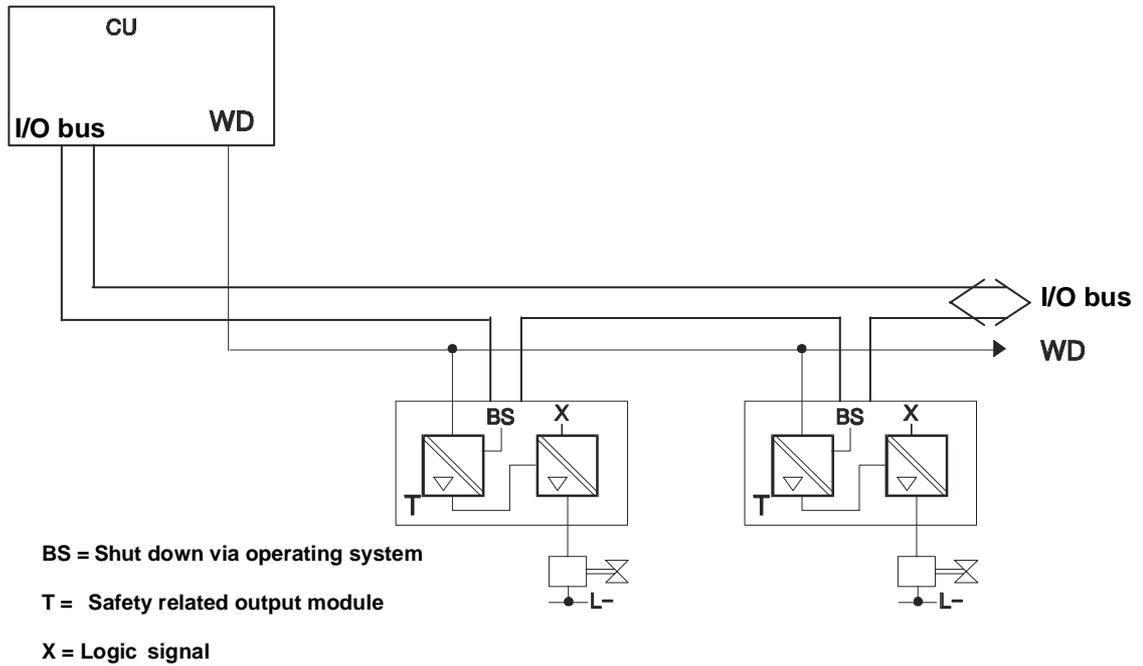
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by a lithium battery which is also on the central module.

3.5.6 The I/O Bus

Just plugging-in the central module into the subrack establishes connection to the I/O modules. No further steps are required.

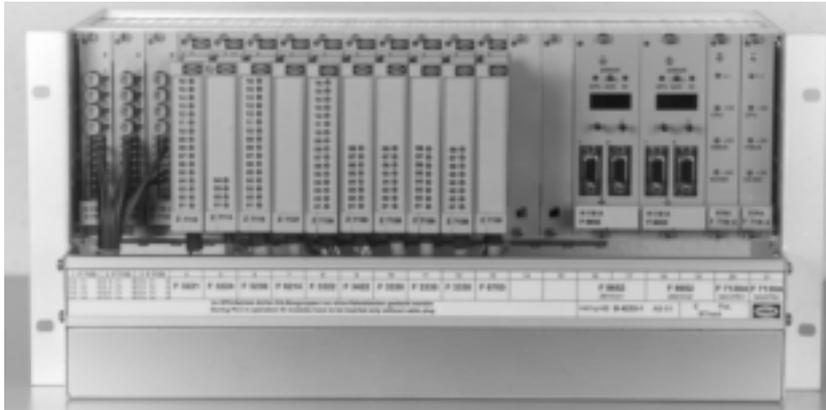
3.5.7 Safety Shut Down

In case of an error the plant is to be driven in the safe state. For systems with a defined safety state this is the lowest energetic state. According to the defined reaction on faults during operation (refer to the table in chapter 3.1) different levels of shut down are executed.



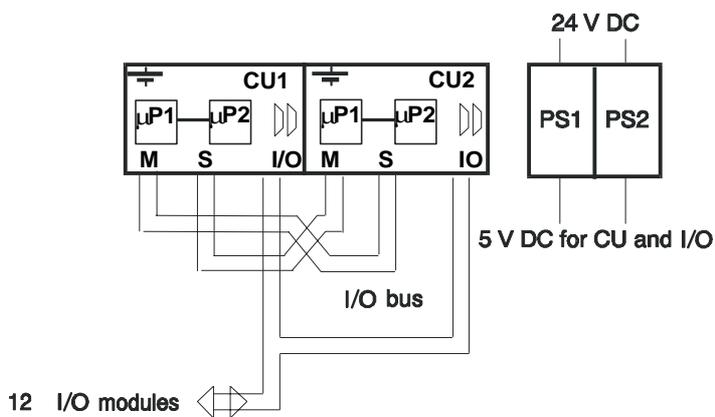
Shut down ways in the H41q-MS System

3.6 PES H41q-HS TÜV



View of the PES H41q-HS

3.6.1 System Structure



Features	
CU	redundant
PS	2
I/O-Mod.	mono/redundant
I/O bus	mono
TÜV tested	

Used abbreviations and signs:

PS Power supply module
 I/O Input/output (module/bus)
 CU Central module
 μ P1,2 Double processors

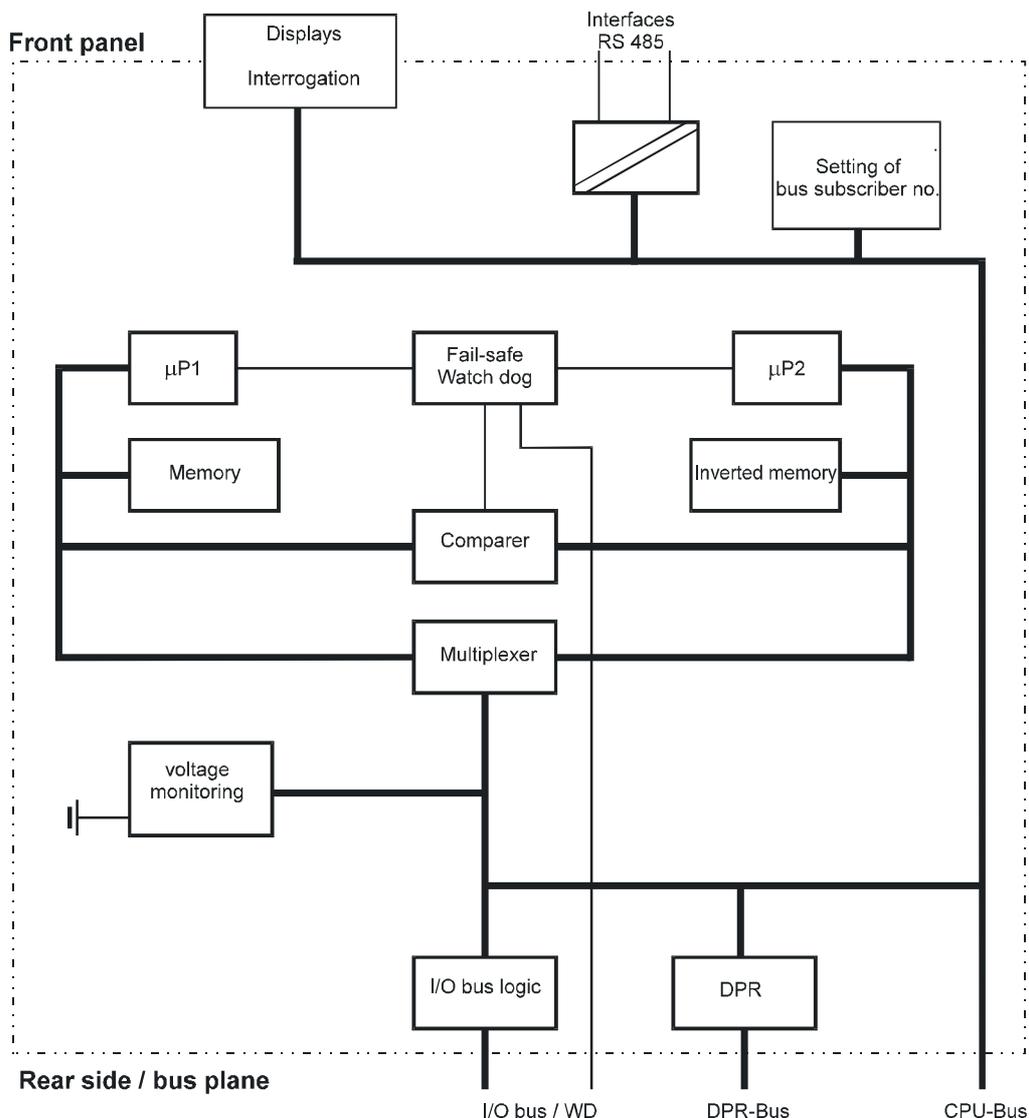
Serial interfaces (2)

Buffer battery

System structure of the H41q-HS PES

3.6.2 Central Module F 8652

The central module for safety related applications with TÜV certificate of the PES H41q-HS contains the following essential functions demonstrated in the structure of the central module:



Structure of the central module F 8652

- two clock-synchronised micro processors
- each mikroprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both micro processors, in case of a fault the watch dog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU
- Battery backup of the sRAMs via batteries on the central module with monitoring and on the bus board
- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transm. rates by software (the software values have priority)

-
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
 - Dual Port RAM for fast memory access to the second central module
 - hardware clock, battery backed
 - I/O bus logic and connection to the input-/output modules
 - Fail-safe watchdog
 - power supply monitoring, testable (5 V system voltage)
 - Battery monitoring

3.6.3 Mechanical Structure and Design

The data sheet of the B 4233-1 assembly kit shows the mechanical structure and design of the H41q-HS PES.

3.6.4 24 V DC Supply and Distribution

The supply voltage may be fed two times to the system H41q-HS (see also B 4233, wiring assembly kit and chapter 3.8, I/O Level).

3.6.5 5 V DC Supply and Distribution

The 5V DC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 V DC power is needed by the CPU, the control of the interfaces, and the I/O modules. It is generated by a clocked 24 V DC/5 V DC power supply module bearing the F 7130A identification. The subrack is equipped with two power supply modules. The power supply modules are paralleled. If one of them fails, the other supplies the PES.

The 5 V DC output voltage of the power supply modules (for the CPU, I/O, and the interfaces) are monitored on the central unit checking under-voltage and failure.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

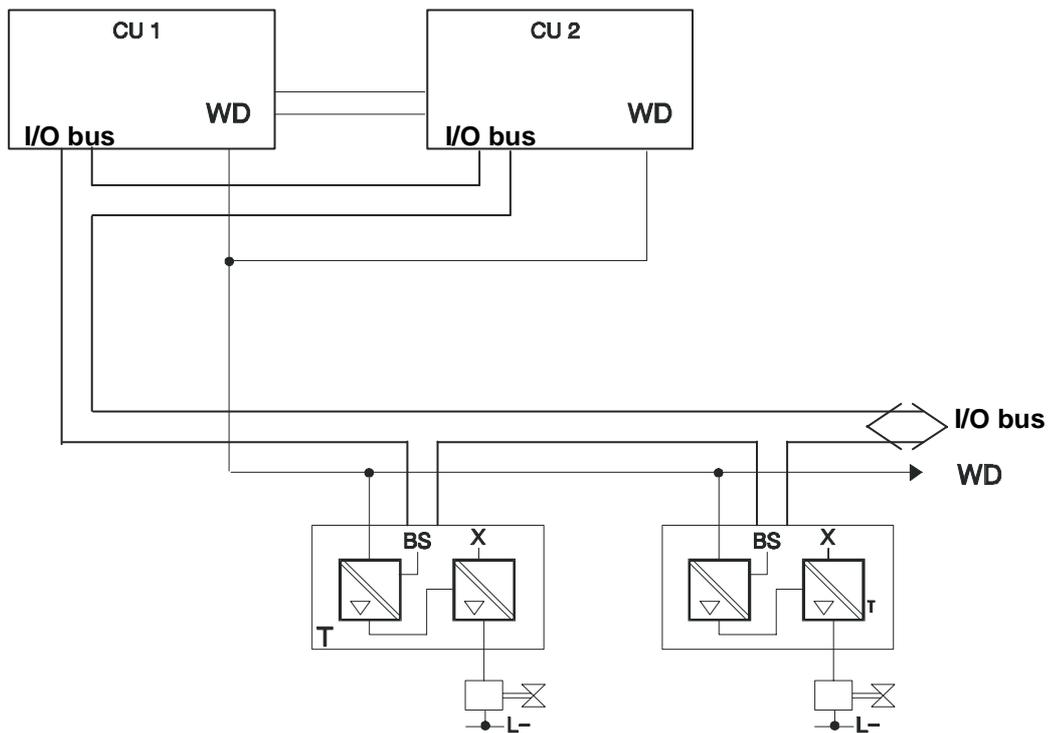
In case the 5 V DC system power fails hardware clock and RAM on the central module are buffered by a lithium battery which is also on the central unit.

3.6.6 The I/O Bus

Just plugging-in the central modules into the subrack establishes connection to the I/O modules. No further steps are required.

3.6.7 Safety Shut Down

In case of an error the plant is to be driven in the safe state. For systems with a defined safety state this is the lowest energetic state. According to the defined reaction on faults during operation (refer to the table in chapter 3.1) different levels of shut down are executed.



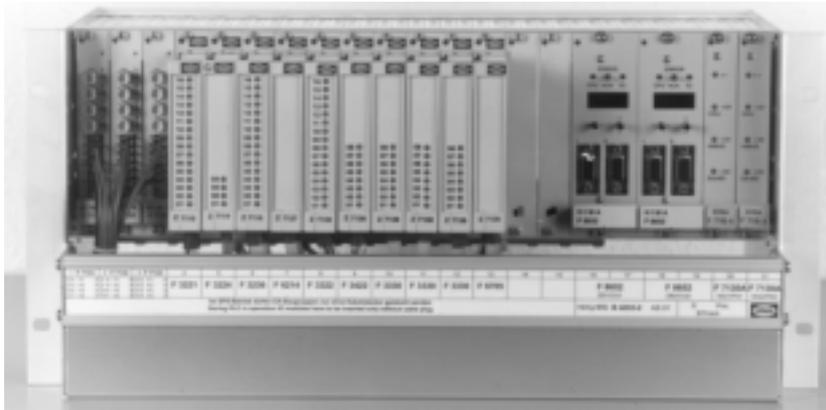
BS = Shut down via operating system

T = Safety related output module

X = Logic signal

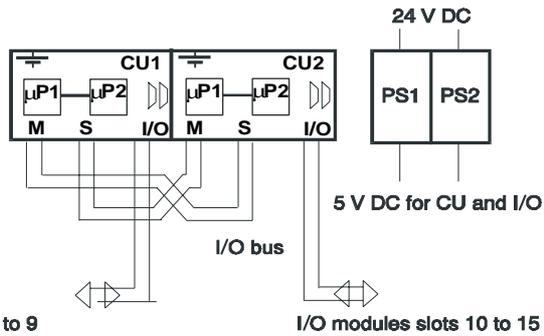
Shut-down ways in the H41q-HS system

3.7 PES H41-HRS



View of the PES H41q-HRS

3.7.1 System Structure



Features	
CU	redundant
PS	2
I/O-Mod.	redundant/mono
I/O bus	redundant
TÜV tested	

Used abbreviations and signs:

- PS Power supply module
- I/O Input/output (module/bus)
- CU Central module
- μP1,2 Double processors

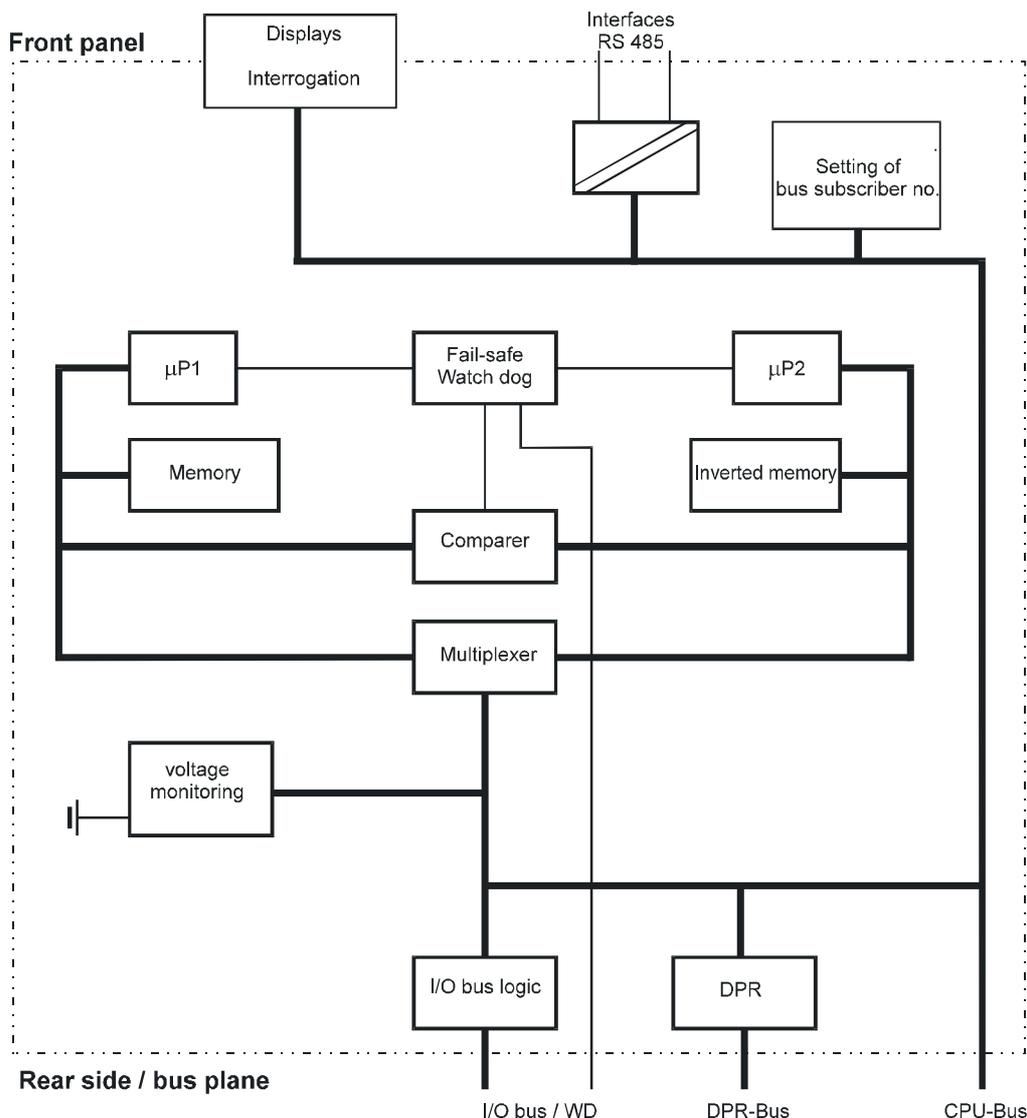
 Serial interfaces (2)

 Buffer battery

System structure of the H41q-HRS PES

3.7.2 Central Module F 8652

The central module for safety related applications with TÜV certificate of the PES H41q-HRS contains the following essential functions demonstrated in the structure of the central module:



Structure of the central module F 8652

- two clock-synchronised micro processors
- each mikroprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both micro processors, in case of a fault the watch dog will be set to the safe state and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU
- Battery backup of the sRAMs via batteries on the central module with monitoring and on the bus board
- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transm. rates by software (the software values have priority)

-
- Diagnostic display and 2 LEDs for information out of the system, I/O level and project
 - Dual Port RAM for fast memory access to the second central module
 - hardware clock, battery backed
 - I/O bus logic and connection to the input-/output modules
 - Fail-safe watchdog
 - power supply monitoring, testable (5 V system voltage)
 - Battery monitoring

3.7.3 Mechanical Structure and Design

The data sheet of the B 4233-2 assembly kit shows the mechanical structure and design of the H41q-HRS PES.

3.7.4 24 V DC Supply and Distribution

The supply voltage may be fed two times to the system H41q-HRS (see also B 4233-2, wiring assembly kit and chapter 3.8, I/O Level).

3.7.5 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired separately as it is already installed as part of the subrack.

The 5 V DC power is needed by the CPU, the control of the interfaces, and I/O modules. It is generated by clocked 24 V DC/5 V DC power supply modules bearing the F 7130A identification. The subrack is equipped with two power supply modules. The power supply modules are paralleled. If one of them fails, the other supplies the PES.

The 5 V DC output voltage of the power supply modules (for the CPU, I/O, and the interfaces) are monitored on the central unit checking under-voltage and failure.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

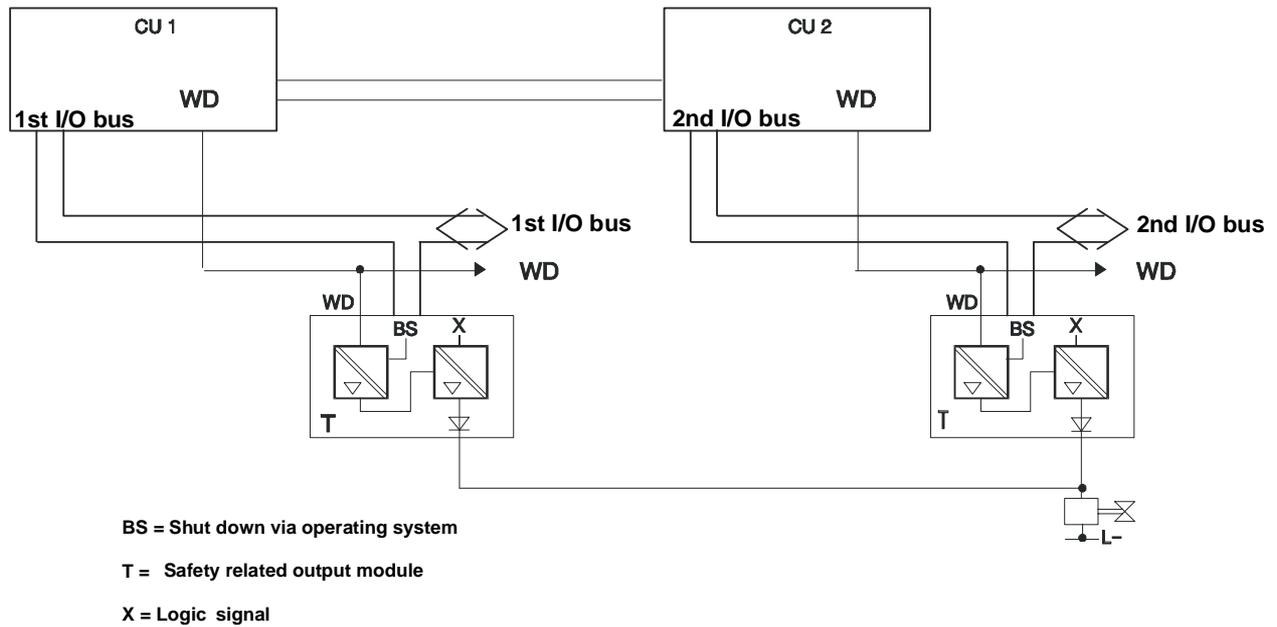
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by a lithium battery which is also on the central module.

3.7.6 The I/O Bus

Just plugging-in the central modules into the subrack establishes connection to the I/O modules. No further steps are required. With the redundant I/O bus the jumper plug Z 6007 on the rear of the subrack is not installed.

3.7.7 Safety Shut Down

In case of an error the plant is to be driven in the safe state. For systems with a defined safety state this is the lowest energetic state. According to the defined reaction on faults during operation (refer to the table in chapter 3.1) different levels of shut down are executed.



Shut down ways in the H41q-HRS system

3.8 The Input/Output Level

In the subrack, slots 4 to 15 are provided for the input/output modules. Any arrangement of I/O module types is possible. In PES with redundant I/O bus, the modules on slots 4 to 9 are assigned to the 1st I/O bus and 10 to 15 to the 2nd I/O bus.

Slots 1 to 3 hold the power distribution modules F 7133. The power distribution module F 7133 can be used to fuse the modules as well as the sensors and the actors. They are non-interactive and have a fuse monitoring for fuse fail by means of a LED and a contact.

There is a cable tray under the subrack. It is equipped with a receptacle for the cable which can be hinged to provide easy access to the cables.

3.8.1 24 V DC Supply and Distribution

Standard solution: The 24 V power L+ is distributed via a plug-in fusing and power distribution unit (refer to the HIMA articles). A 16 A back-up fuse is provided. The power for the input/output modules is fed in at the backside to the slots of the power distribution modules via XG.6/7/8. Each I/O module is related to a fuse on the module F 7133 (refer also to the description of the assembly kit B 4...). The supply of the I/O modules is either via the cable plug on the front side or via the connection already integrated in the I/O busboard (for (Ex)i modules and partly analog input modules).

The relation between the power distribution modules with 4 fuses and the slots of the I/O modules is as follows:

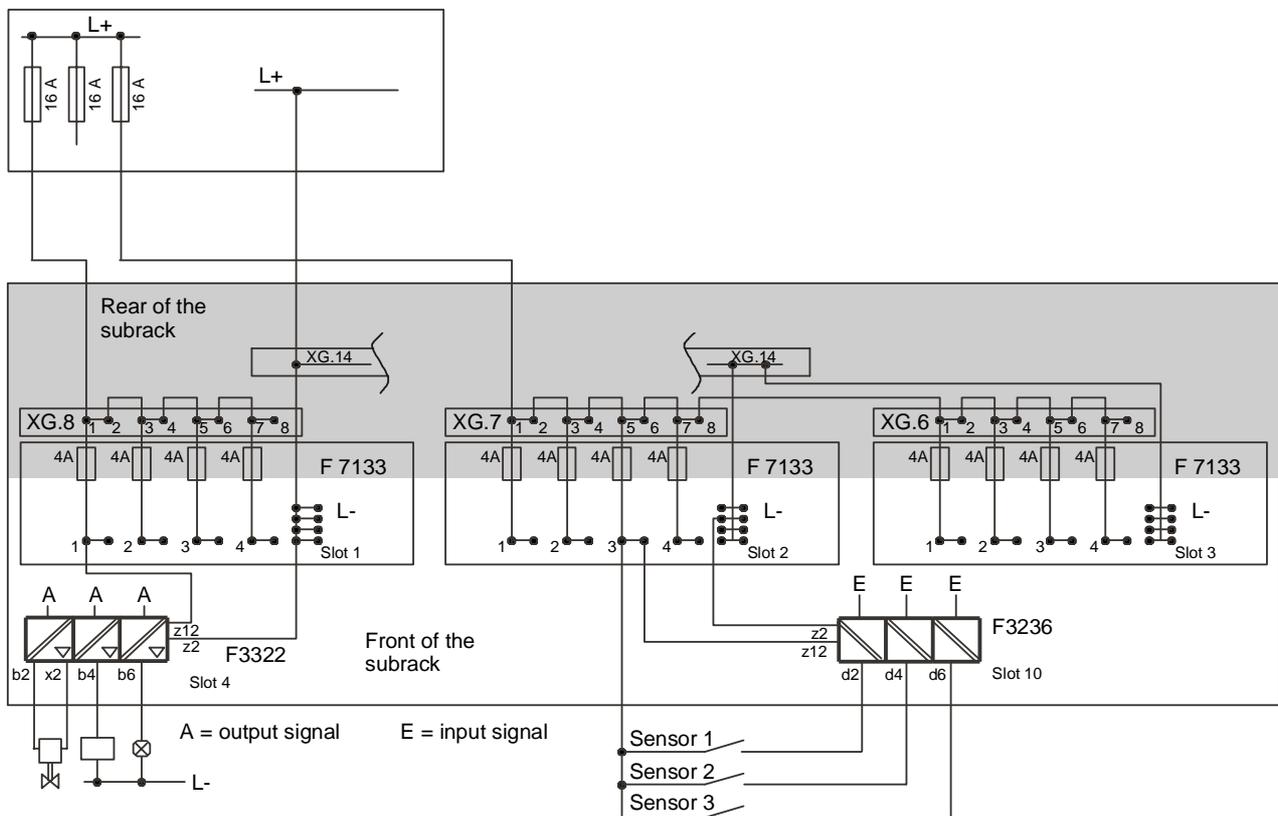
F 7133 in slot 1 supplies I/O slots 4 ... 7

F 7133 in slot 2 supplies I/O slots 8 ... 11

F 7133 in slot 3 supplies I/O slots 12 ... 15

L- is also taken from the plug-in power distribution unit to be connected to the potential distributor XG. 14. So all power distribution modules F 7133 are internal connected with L-. Via the front side of the power distribution modules the L- is also fed to the input/output modules via the cable plugs.

The circuit feeding the sensors is connected via the front to the F 7133 module. It is advisable to supply the input module and the pertaining sensors via the same circuit of the power distribution module F 7133.



Feeding and distribution 24 V DC

3.8.2 I/O Modules

The I/O modules are used for signal transfer and signal matching between the plant and the central modules. The input and output circuits are always fed into the I/O modules via cable plugs on the front side. The status of the digital output signals is shown on the LEDs of the cable plugs. The power supply is either via the cable plugs or via the I/O bus board. The order of the different I/O module types does not matter.

The I/O modules can be plugged or unplugged on-line.

3.8.3 (Ex)i-Modules

The current **(Ex)i modules** exist in 2 construction models:

- non-varnished with PCB covering
- varnished with PCB covering

Any models can be equipped together without free slots between.

Non varnished (Ex)i modules may combined together with non-(Ex)i modules without any restrictions. Also no free slots are necessary on the left or on the right.

With varnished (Ex)i modules with PCB covering the right slot has to remain free in combination with non-(Ex)i modules or has to be equipped with with a faceplate with partition plate M 2214. This is also valid for slot 15. The slot left to the (Ex)i module may be equipped with any other module. Spare slots are to be covered by faceplates M 2215 (4 units) or M 2217 (8 units).

Usable partition plates and faceplates:
M 2214 Faceplate with partition plate 100*160 mm
M 2215 Faceplate 4 units
M 2217 Face plate 8 units

Cable plugs for intrinsically safe circuits are marked and have coded pins, so that they can only be plugged into the appropriate modules.

3.8.4 Safety related Output Modules , for Requirement Class AK 1 to 6

All the safety related output modules fulfill the requirements of the requirement class AK6 without time limit in case of a fault of an output module module.

The safety related output modules have 3 semiconductors switched in series. That means that more than the required second independent component for safe shut down is now integrated in the output module. In the following this feature is called the integrated safety shut down. The data sheets of this output modules contain the sign  . If a new safety related output module should fail during operation then it will be automatically switched off with the integrated safety shut down  to get the safe de-energized status.

3.8.5 General features of the Output Modules

All output modules have the following special features:

- To increase the availability the outputs of the safety related output modules can be switched in parallel without external diodes
- No output voltage occurs when the supply voltage L- should be cut on the output module, so it is not necessary to wire the L- as a ring feeder
- The connection of inductive loads can be done without using diodes at the coil. However it is recommended to connect a diode directly at the inductive load avoiding noise voltages.
- The LED signalling the output status is controlled separately
- The design of the cable plugs enables the two pole connection of the actuators. Together with a two pole supply of the output module an earth fault detection will be simplified
- No time limit for operation in case of a defective output module.

For your notes

3.9 System Voltage 24 V DC

For supplying a HIMA system there are two different potentials available:

- L+ positive pole
- L- negative pole (reference pole)

The positive pole is usable also for power voltage and control voltage. To achieve the valid values for the connection of single phase mains supplies, power supply units with bridge rectification and smoothing are required or stabilized power supply units. With using of HIMA standard power supplies, the potential L+ met the requirements according to the NAMUR standard NE 21 to compensate voltage dips up to 20 ms per second.

The central devices of the family H41q have decoupling and buffering during voltage dips. Disturbances within the I/O level will be suppressed by the noise blanking.

Lamp loads with high starting current (7 ... 10 fold nominal current) are un-critical for HIMA power supplies with correct dimensioning.

For your notes

3.10 Overview Assembly Kits

The components required for a working system are included in assembly kits.

System	H41q-M	H41q-H	H41q-HR	H41q-MS	H41q-HS	H41q-HRS
Requirement class	–	–	–	AK 1-6	AK 1-6	AK 1-6
No./type of central module	1xF 8653	2xF 8653	2xF 8653	1xF 8652	2xF 8652	2xF 8652
No./type of power supply	1(2)x F 7130A	2x F 7130A	2x F 7130A	1(2)x F 7130A	2x F 7130A	2x F 7130A
Number I/O buses	1	1	2	1	1	2
max. no. I/O modules	12	12	2x6	12	12	2x6
Assembly kit numbers	B 4230	B 4232-1	B 4232-2	B 4231	B 4233-1	B 4233-2

Abbreviation: I/O Input/Output

Table: Assembly kits of the H41q system

For your notes

4 The H51q System Family

The H51q system family comprises modular designed PES in single channel and redundant models, also with TÜV safety certificate  .

All input/output modules can be used with both redundant and single channel models of the central devices.

All modules of the H51q system family meet the requirements for Electromagnetic compatibility and immunity according to article 10 of the EG-guideline 89/336/EEG for the electromagnetic conformity). This is demonstrated with the  sign within the data sheets of the modules. Also the systems and modules are wearing a sticky label with this sign.

The H51q system family consists of one 19 inch central rack 5 units high and up to 16 input/output racks in the 19 inch size 4 units high.

The central rack contains the following components:

- One or two (depends on the model) microprocessor-controlled central modules
- Up to three coprocessor modules, assigned to each central module
- Up to 8 interfaces RS 485 (2 on the central modules and 2 on each of up to 3 coprocessor modules) allows the connection of other systems resp. to built-up bus systems with PLC master with a transmission rate of up to 57600 bps
- One to three power supply modules 24 V DC/5 V DC to generate the 5 V DC operating voltage for the central modules and the control voltage for the input/output modules
- Power supply monitoring module with batteries to buffer the sRAM area and the real-time clock on the central modules
- Integrated cable tray
- Additional modules to connect and to decouple the supply voltage 24 V DC, to supply the watchdog signal and as fan plug-in unit with fuse and fan run monitoring

One I/O rack contains:

- Up to 4 power distribution modules to protect the input/output circuits
- One coupling module to connect the I/O bus, with fail-safe switch off of the watchdog signal in the case of a fault
- A maximum of 16 slots for input and output modules for digital and analogue signals.

For your notes

4.1 Conceptions of the Safety Switch Off

In case of faults of output, coupling and central modules and group switch off

In the system descriptions of the safety related PES H51q-MS, -HS, -HRS the ways for shut down if a fault occurs are shown. The reactions of the systems are fixed or they can be defined in the user's program by means of the building block H8-STA-3 and with activating of a system variable for emergency off.

Reaction to faults of safety related I/O modules during operation:

Location of fault	Measures in the user's program	Reaction of system
Output module  Single error (also voltage drop)		Module switch-off ¹⁾
	One building block H8-STA-3 per group	Group shut down ²⁾
	System variable for emergency off activated	WD switch-off of the appertaining CU ³⁾
I/O bus within I/O rack or double fault of output modules		WD switch-off of the appertaining IO-CON ⁴⁾
	System variable for emergency off activated	WD switch-off of the appertaining CU ³⁾
Central module (CU) or I/O bus betw. CU and IO- CON		WD switch-off of the appertaining CU
Input module		Operation of 0 signal for all inputs of this module

Definitions:

Double fault = fault within an output channel and the switch off electronic part of a testable output module.

Abbreviations in the table:

CU Central module
I/O bus Input/output bus
IO-CON Coupling module
I/O rack Input/output rack
WD Watchdog signal
 Integrated safety shutdown

Explanations to the table:

1) Module switch off

A faulty testable output module with integrated safety shutdown  will be switched automatically to the safe deenergized safe status.

2) Group shut down

If it is requested, a group shut down may be agreed in the user's program so, that all testable output modules appertaining to the group with the faulty module are also switched off.

Inside the user's program up to 10 testable output modules can be assigned to one group by means of the building block H8-STA-3.

3) Switch off WD of the appertaining CU

In this case the watch dog signal (WD) of the appertaining central module will be switched off.

If systems with redundant central modules and a common I/O bus are used then the output modules are related to both central modules. In case of a fault both the watch dog signals of the central modules are switched off. That means all the I/O modules are switched off.

If systems with redundant central modules and redundant I/O bus are used then the output modules are related to one central module and one I/O bus. In case of a fault only the watch dog signal of the related central module is switched off. That means only the related I/O modules are switched off.

4) Switch off of the appertaining coupling module (IO-CON)

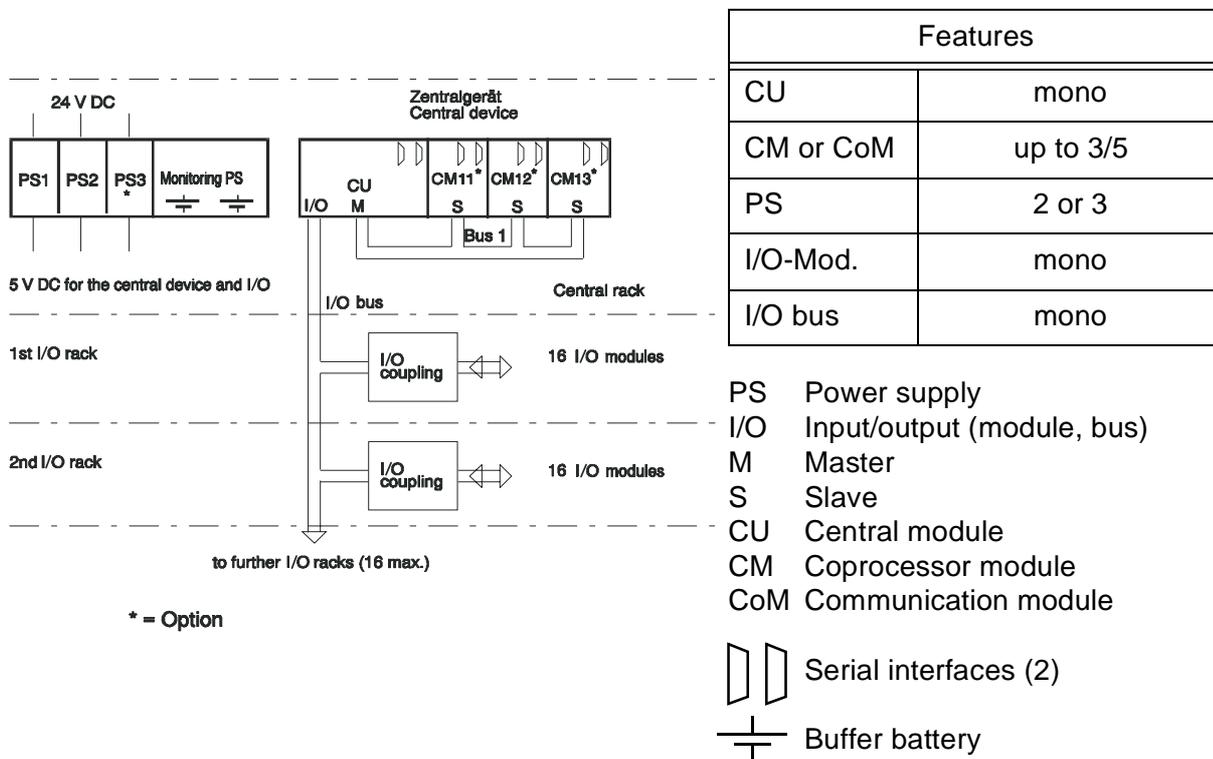
In this case the watch dog signal (WD) of the appertaining coupling module will be switched off. That means that all I/O modules related to this coupling module will be switched off.

4.2 PES H51q-M



View of the PES H51q-M

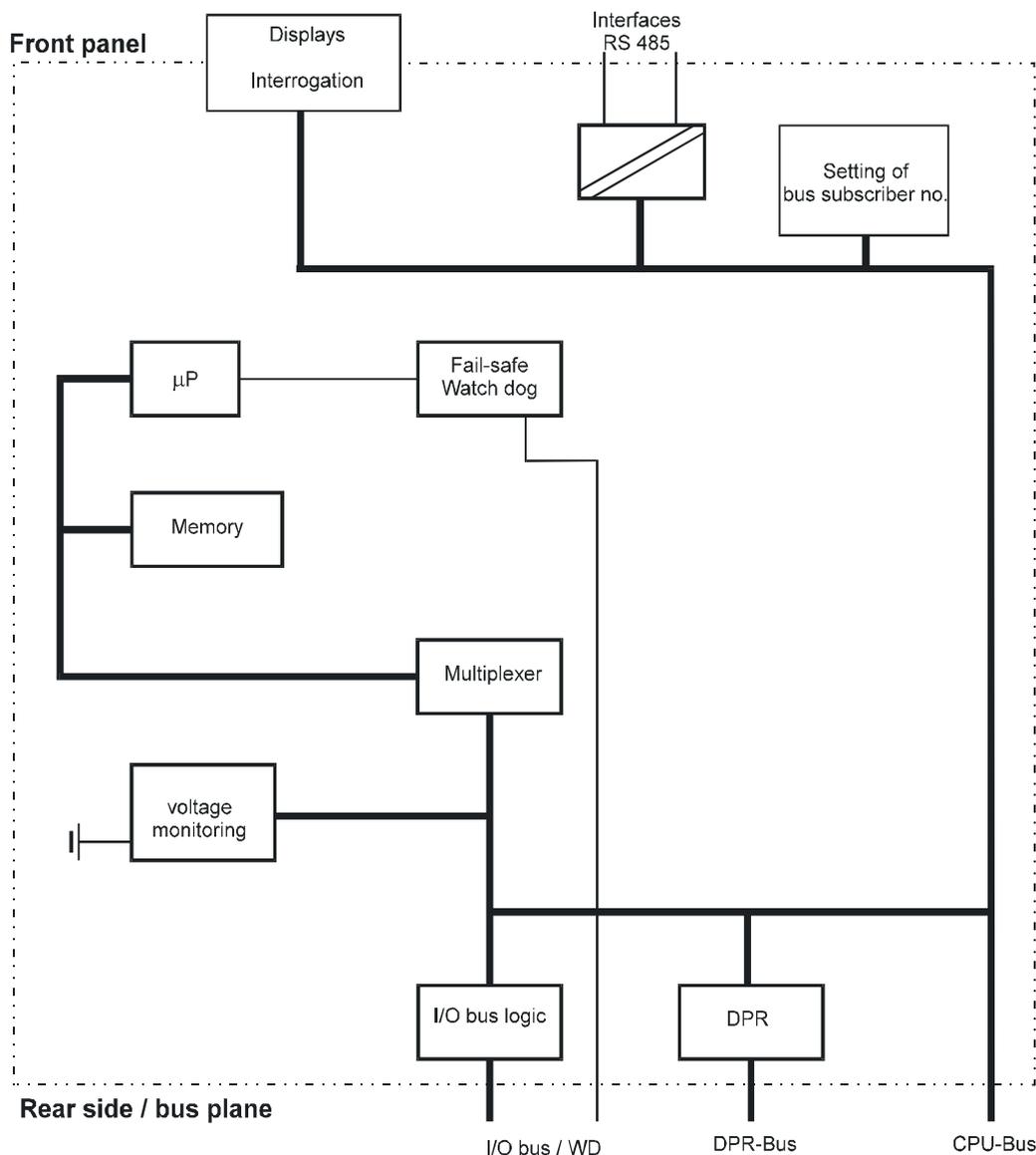
4.2.1 System Structure



System structure of the PES H51q-M

4.2.2 Central Module F 8651

The central module of the PES H51q-M contains the essential functions demonstrated in the structure of the central module:



Structure of the central module F 8651

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H51q-M system)
- Dual Port RAM for fast memory access to the second central module (not used in the H51q-M system)
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transmission rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user`s program
- Power supply monitoring
- I/O-Bus logic for the connection to the input/output modules

- Hardware clock, battery backed
- Fail-safe watchdog
- Battery backup of the sRAMs via batteries on the central module with monitoring.

4.2.3 Coprocessor Module F 8621A

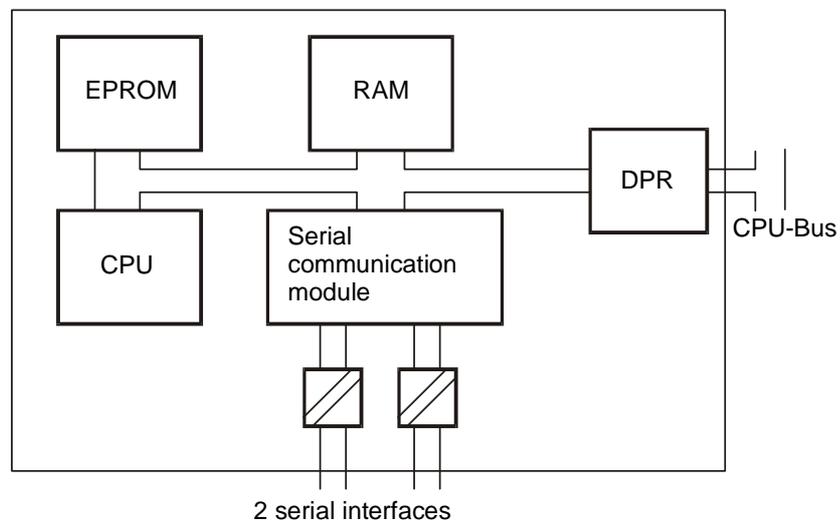
Next to each installed central module of the H51q-M PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note:

The RAM for the master project is buffered via the batteries on the monitoring module.

- Two interfaces RS 485, via communication software building block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via Bus 1.



Structure of the coprocessor module F 8621A

4.2.4 Communication Module F 8625/F 8626

Next to each installed central module of the H51q-M PES up to five communication modules can be installed. The communication module mainly contains:

- 32 Bit Microprocessor
- Operating system
- RAM for additional protocols
- F 8625 Ethernet interface
- F 8626 Profibus-DP interface
- Dual port RAM (DPR) for the communication with the central module via Bus 1.

4.2.5 Mechanical Structure and Design

The 19 inch and 5 units high central rack with integrated fan unit. For details and design of the mechanical structure see data sheet of the B 5230 assembly kit.

4.2.6 24 V DC Supply and Distribution

The 24 V DC power may be fed three times to the system H51q-M (see also B 5230 assembly kit, wiring assembly kit).

4.2.7 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired extra as it is already part of the installation.

To supply the I/O racks the 5 V power supply with corresponding GND is available at the rear side of the central rack.

The 5 V DC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 V DC power of the system via clocked 24 V DC/ 5 V DC power supply modules bearing the F 7126 identification. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

The output voltage of the power supply modules is checked as to under-voltage or failure by the monitoring module F 7131.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

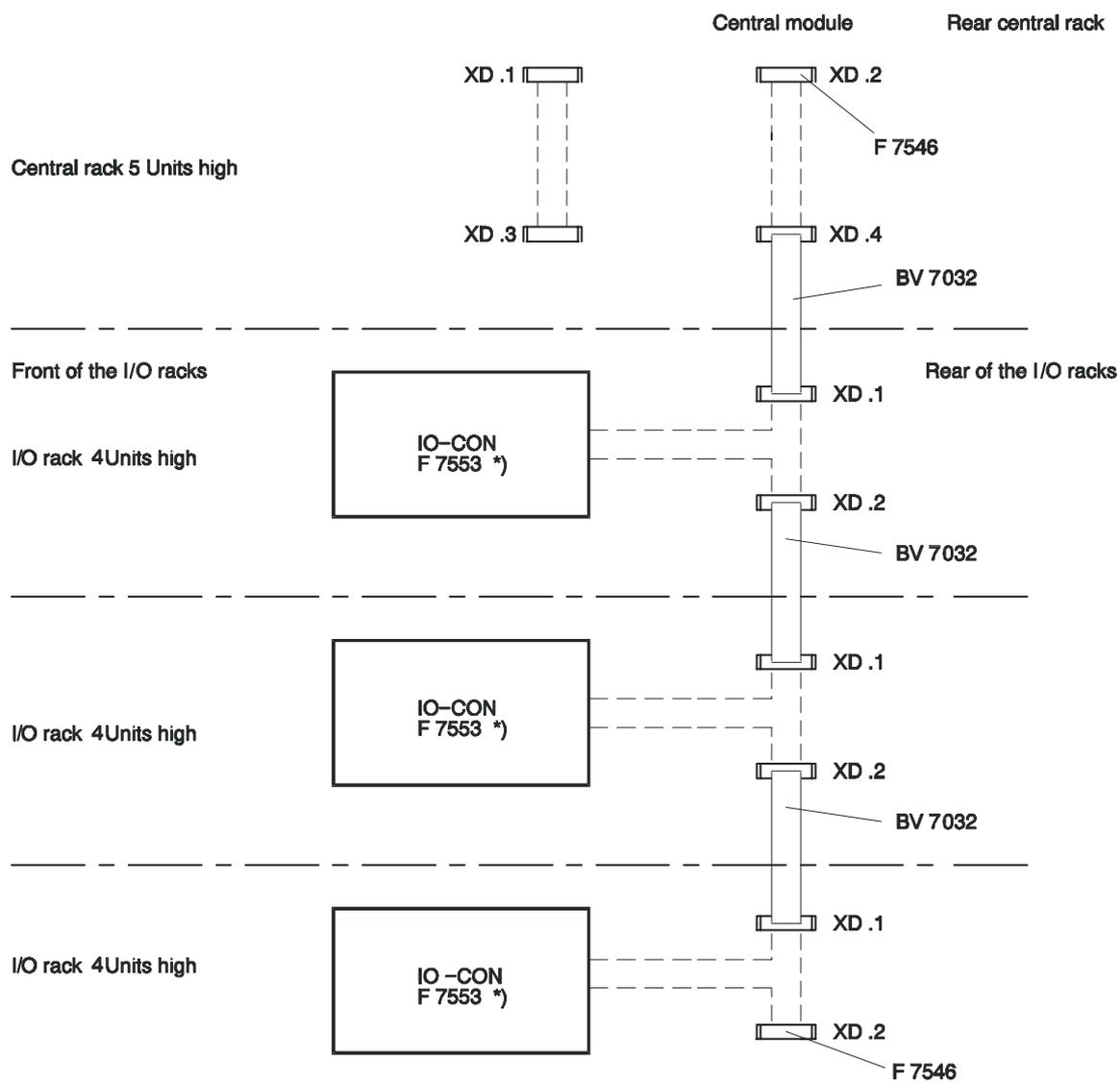
In case the 5 V system power fails hardware clock and sRAM on the central module are buffered by one lithium battery on the central module.

Two lithium batteries on the power supply monitoring module F 7131 are to buffer the sRAM on the coprocessor module.

4.2.8 The I/O Bus

The data connection of the I/O level with the central device is established via the I/O bus. The I/O bus coupling modules are already integrated in the central rack. With the I/O rack the connection to the I/O bus is via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable. To terminate the I/O bus, an F 7546 module is plugged in at the beginning and the end.

The construction principle is shown on the following page.



*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Construction principle of the I/O bus

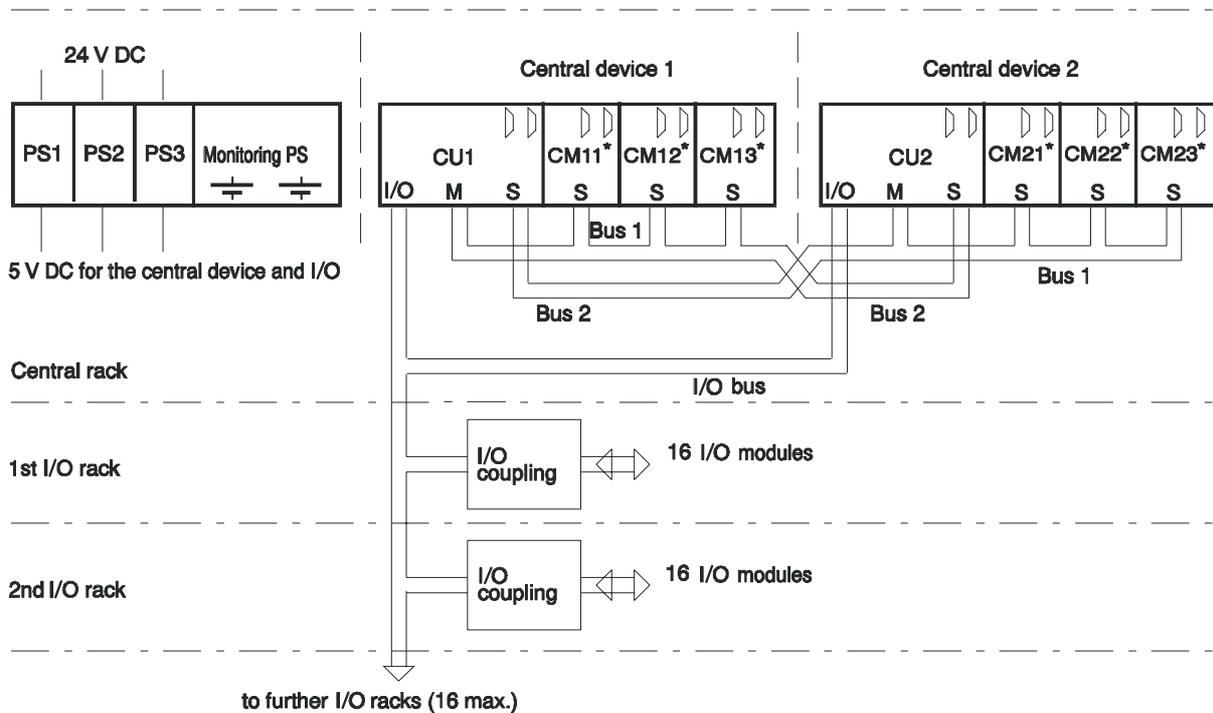
For your notes

4.3 PES H51q-H



View of the PES H51q-H

4.3.1 System Structure



* = Option

Features	
CU	redundant
CM or CoM	up to 3/5 per CU
PS	3
I(O-Mod.)	mono or redundant
I/O bus	mono

PS Power supply
 I/O Input/output (module, bus)
 M Master
 S Slave
 CU Central module
 CM Coprocessor module
 CoM Communication module

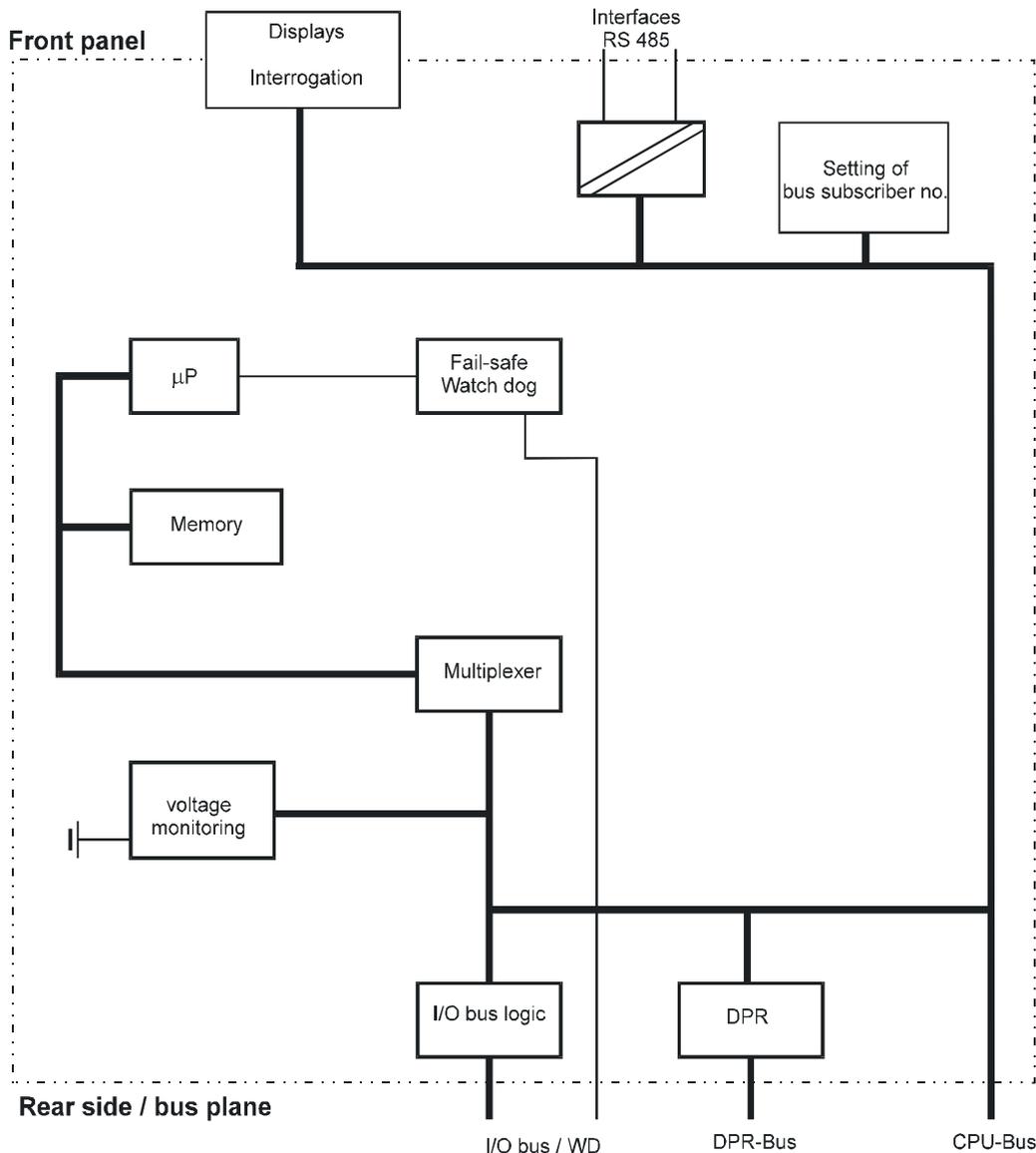
Serial interfaces (2)

Buffer battery

System structure of the PES H51q-H

4.3.2 Central Module F 8651

The central module of the PES H51q-H contains the essential functions demonstrated in the structure of the central module:



Structure of the central module F 8651

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H51q-M system)
- Dual Port RAM for fast memory access to the second central module (not used in the H51q-M system)
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transmission rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user`s program
- Power supply monitoring
- I/O-Bus logic for the connection to the input/output modules

- Hardware clock, battery backed
- Fail-safe watchdog
- Battery backup of the sRAMs via batteries on the central module with monitoring.

4.3.3 Coprocessor Module F 8621A

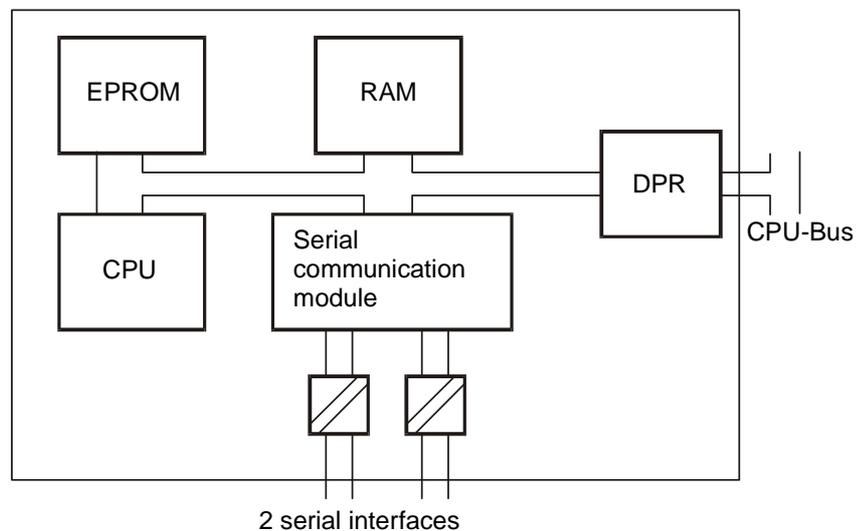
Next to each installed central module of the H51q-H PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note:

The RAM for the master project is buffered via the batteries on the monitoring module.

- Two interfaces RS 485, via communication software building block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via Bus 1.



Structure of the coprocessor module F 8621A

4.3.4 Communication Module F 8625/F 8626

Next to each installed central module of the H51q-H PES up to five communication modules can be installed. The communication module mainly contains:

- 32 Bit Microprocessor
- Operating system
- RAM for additional protocols
- F 8625 Ethernet interface
- F 8626 Profibus-DP interface
- Dual port RAM (DPR) for the communication with the central module via Bus 1.

4.3.5 Mechanical Structure and Design

The 19 inch and 5 units high central rack with integrated fan unit. For details and design of the mechanical structure see data sheet of the B 5232-1 assembly kit.

4.3.6 24 V DC Supply and Distribution

The 24 V DC power may be fed three times to the system H51q-H (see also B 5232-1 assembly kit, wiring assembly kit).

4.3.7 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired extra as it is already part of the installation.

To supply the I/O racks the 5 V DC power supply with corresponding GND is available at the rear side of the central rack.

The 5 V DC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 V DC power of the system via clocked 24 V DC /5 V DC power supply modules bearing the F 7126 identification. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

The output voltage of the power supply modules is checked as to under-voltage and failure by a monitoring module F 7131.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by one lithium battery on the central module.

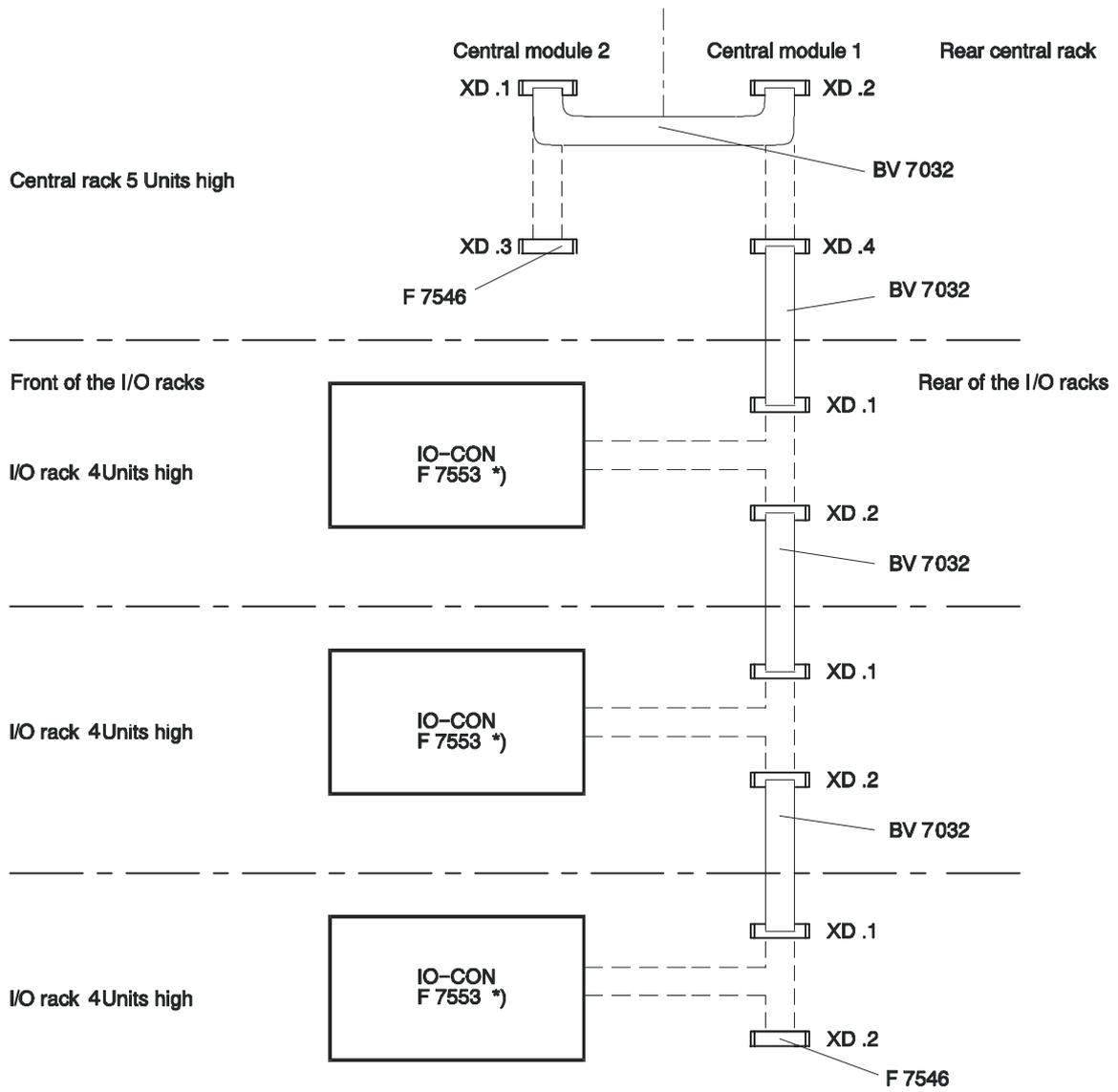
Two lithium batteries on the power supply monitoring module F 7131 are to buffer the sRAM on the coprocessor module.

4.3.8 The I/O Bus

The data connection of the I/O level with the central device is established via the I/O bus. The I/O bus coupling modules are already integrated in the central rack. A data cable BV 7032 is used to connect the I/O bus between central module 1 (XD.2) and central module 2 (XD.1).

With the I/O subrack the connection to the I/O bus is via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable. To terminate the bus, an F 7546 module is plugged in at the beginning and the end.

The construction principle of the I/O bus is shown on the following page.



*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Construction principle of the I/O bus

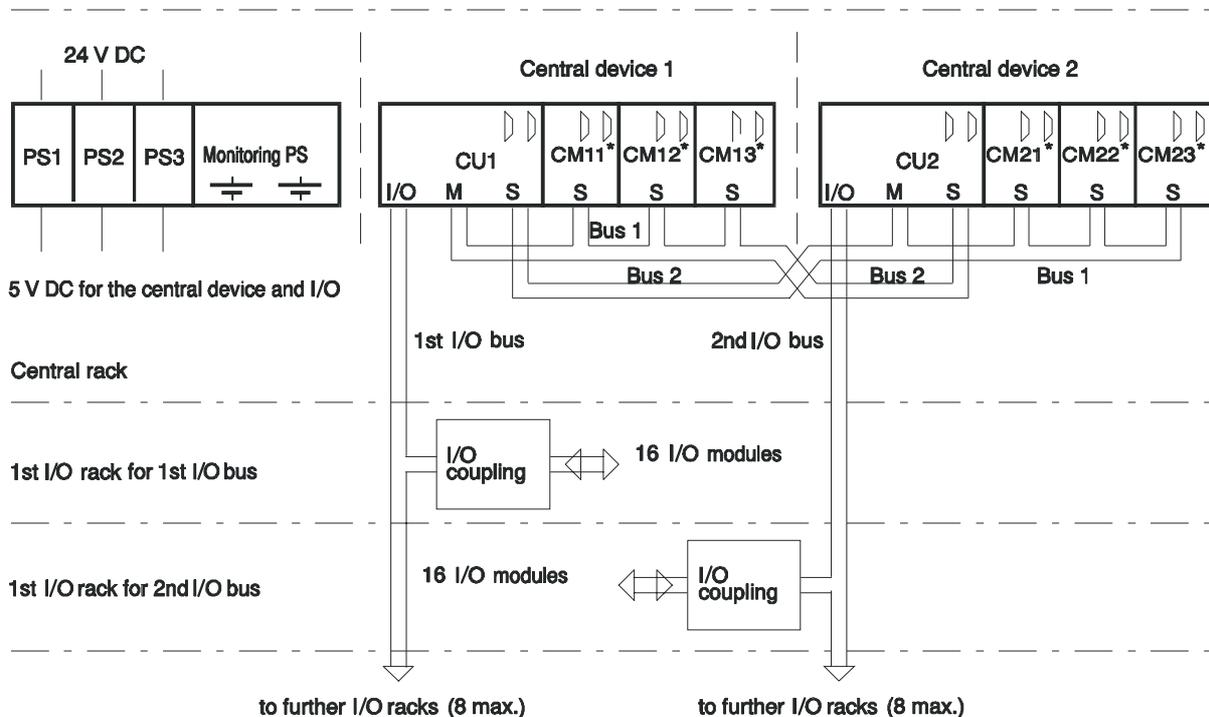
For your notes

4.4 PES H51q-HR



View of the PES H51q-HR

4.4.1 System Structure



* = Option

Features	
CU	redundant
CM or CoM	up to 3/5 per CU
PS	3
I/O-Mod.	redundant / mono
I/O bus	redundant

PS Power supply
 I/O Input/output (module, bus)
 M Master
 S Slave
 CU Central module
 CM Coprocessor module
 CoM Communication module

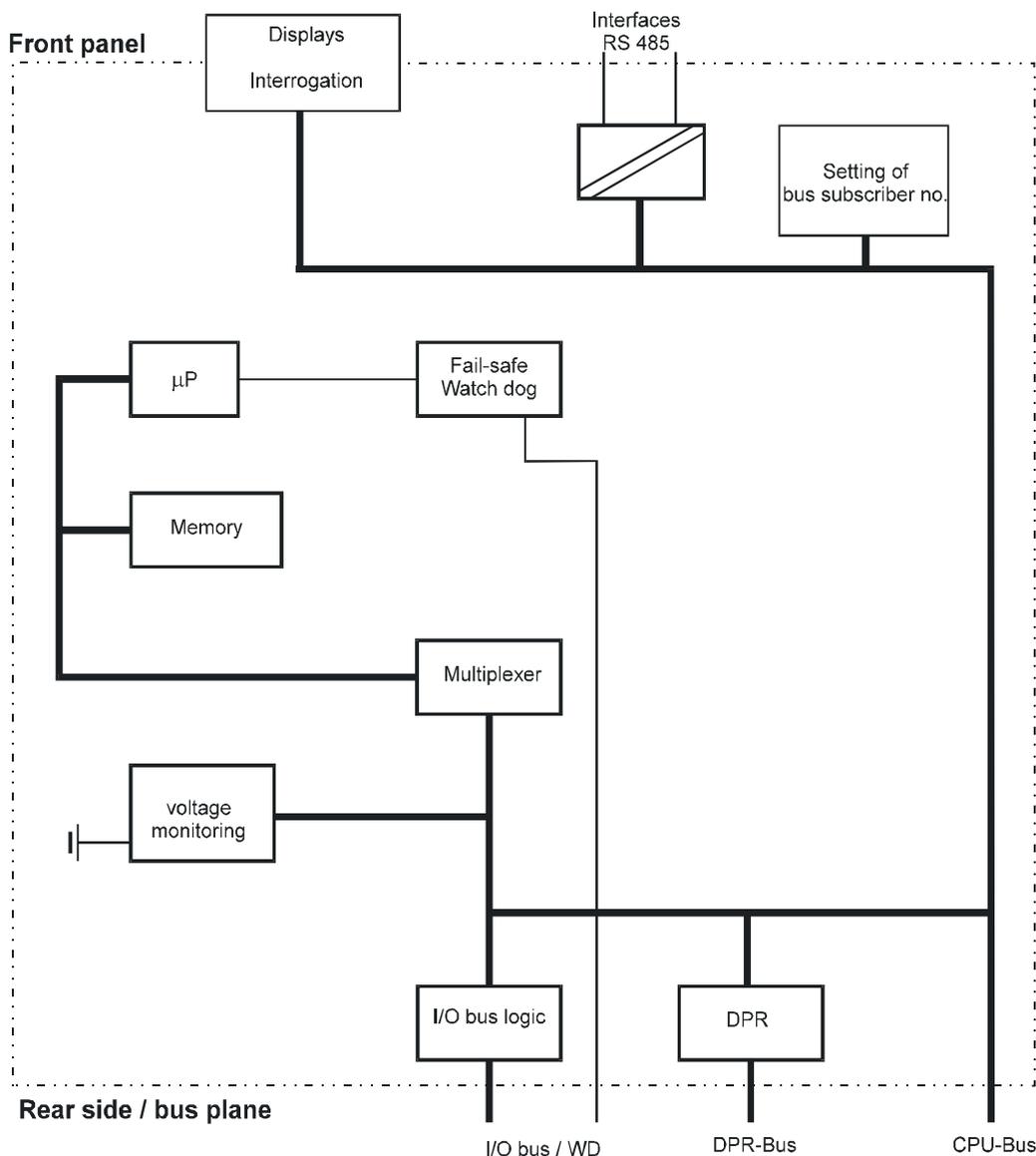
Serial interfaces (2)

Buffer battery

System structure of the PES H51q-HR

4.4.2 Central Module F 8651

The central module of the PES H51q-H contains the essential functions demonstrated in the structure of the central module:



Structure of the central module F 8651

- Microprocessor
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H51q-M system)
- Dual Port RAM for fast memory access to the second central module (not used in the H51q-M system)
- 2 interfaces RS 485 with galvanic isolation. Transmission rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transmission rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user`s program
- Power supply monitoring
- I/O-Bus logic for the connection to the input/output modules

- Hardware clock, battery backed
- Fail-safe watchdog
- Battery backup of the sRAMs via batteries on the central module with monitoring.

4.4.3 Coprocessor Module F 8621A

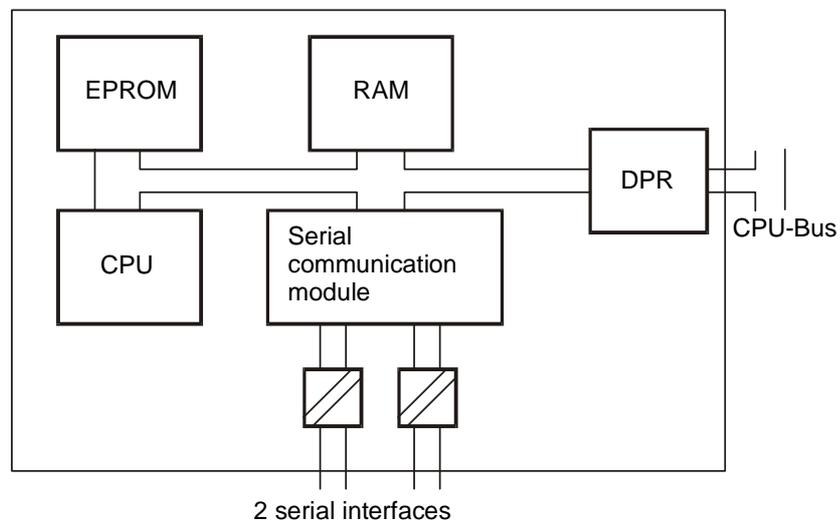
Next to each installed central module of the H51q-HR PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note:

The RAM for the master project is buffered via the batteries on the monitoring module.

- Two interfaces RS 485, via communication software building block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via Bus 1.



Structure of the coprocessor module F 8621A

4.4.4 Communication Module F 8625/F 8626

Next to each installed central module of the H51q-HR PES up to five communication modules can be installed. The communication module mainly contains:

- 32 Bit Microprocessor
- Operating system
- RAM for additional protocols
- F 8625 Ethernet interface
- F 8626 Profibus-DP interface
- Dual port RAM (DPR) for the communication with the central module via Bus 1.

4.4.5 Mechanical Structure and Design

The 19 inch and 5 units high central rack with integrated fan unit. For details and design of the mechanical structure see data sheet of the B 5232-2 assembly kit.

4.4.6 24 V DC Supply

The supply voltage 24 V DC may be fed three times to the system H51q-HR (see also B 5232-2 assembly kit, wiring assembly kit).

4.4.7 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired extra as it is already part of the installation.

To supply the I/O racks, on the rear of the central rack the supply voltage 5 V DC and the pertaining GND is available.

The 5 V DC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 V DC power of the system via clocked 24 V DC / 5 V DC power supply modules bearing the F 7126 identification. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

The output voltage of the power supply modules is checked as to undervoltage or failure by a monitoring module F 7131.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

In case the 5 V system power fails hardware clock and sRAM on the central module are buffered by one lithium battery on the central module.

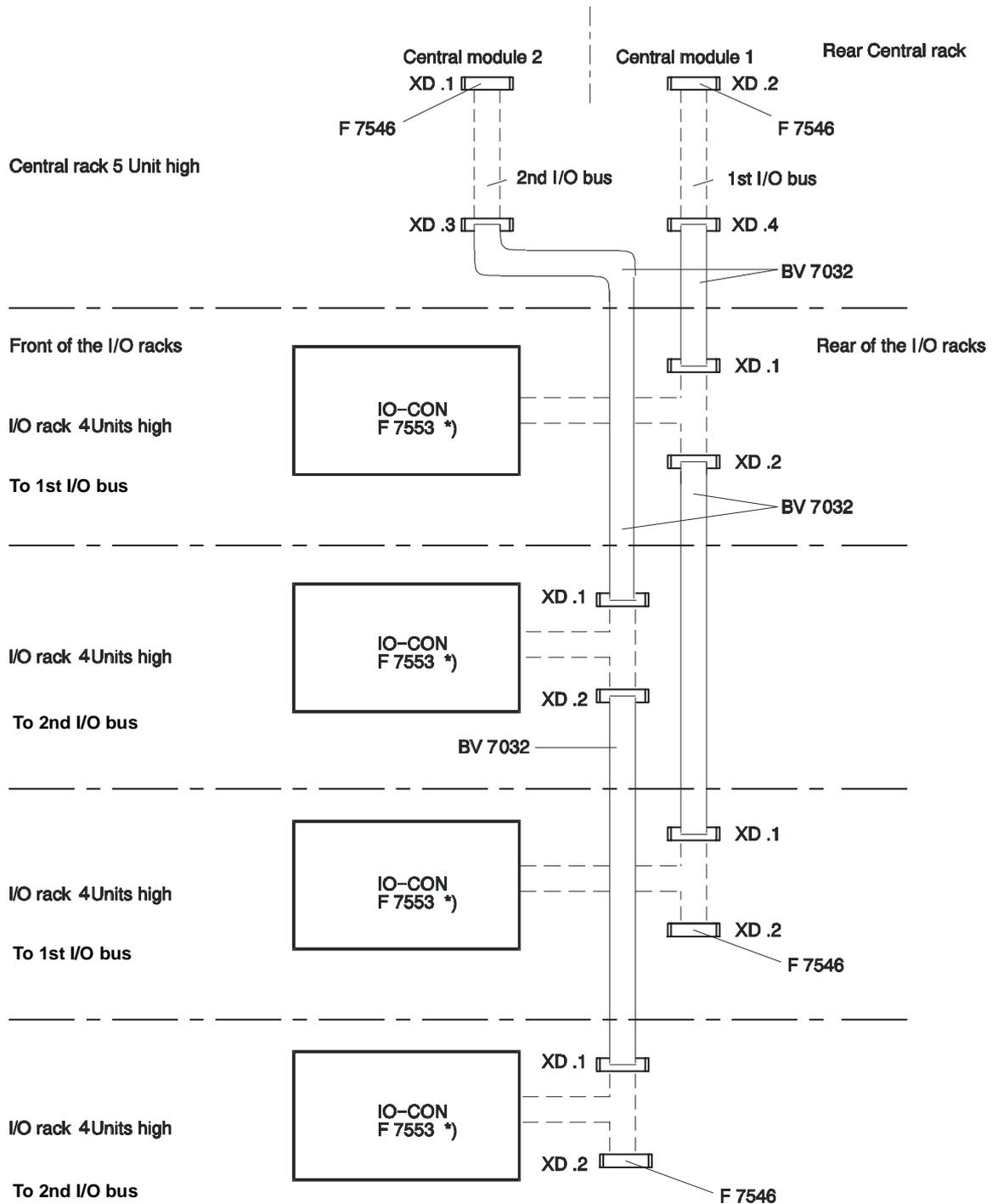
Two lithium batteries on the power supply monitoring module F 7131 are to buffer the sRAM on the coprocessor module.

4.4.8 The I/O Bus

The data connection of the I/O level with the central device is established via the I/O bus. Because the I/O bus is redundant each central device has its own I/O bus and thus also separated own I/O subracks. The 1st I/O bus is associated to central module 1 and the 2nd I/O bus associated to central module 2.

The I/O bus coupling modules are already integrated in the central rack. With the I/O subrack the connection to the I/O bus is via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable. To terminate the I/O bus, an F 7546 module is plugged in at the beginning and the end.

The construction principle of the I/O bus is shown on the following page.



*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Construction principle of the I/O bus

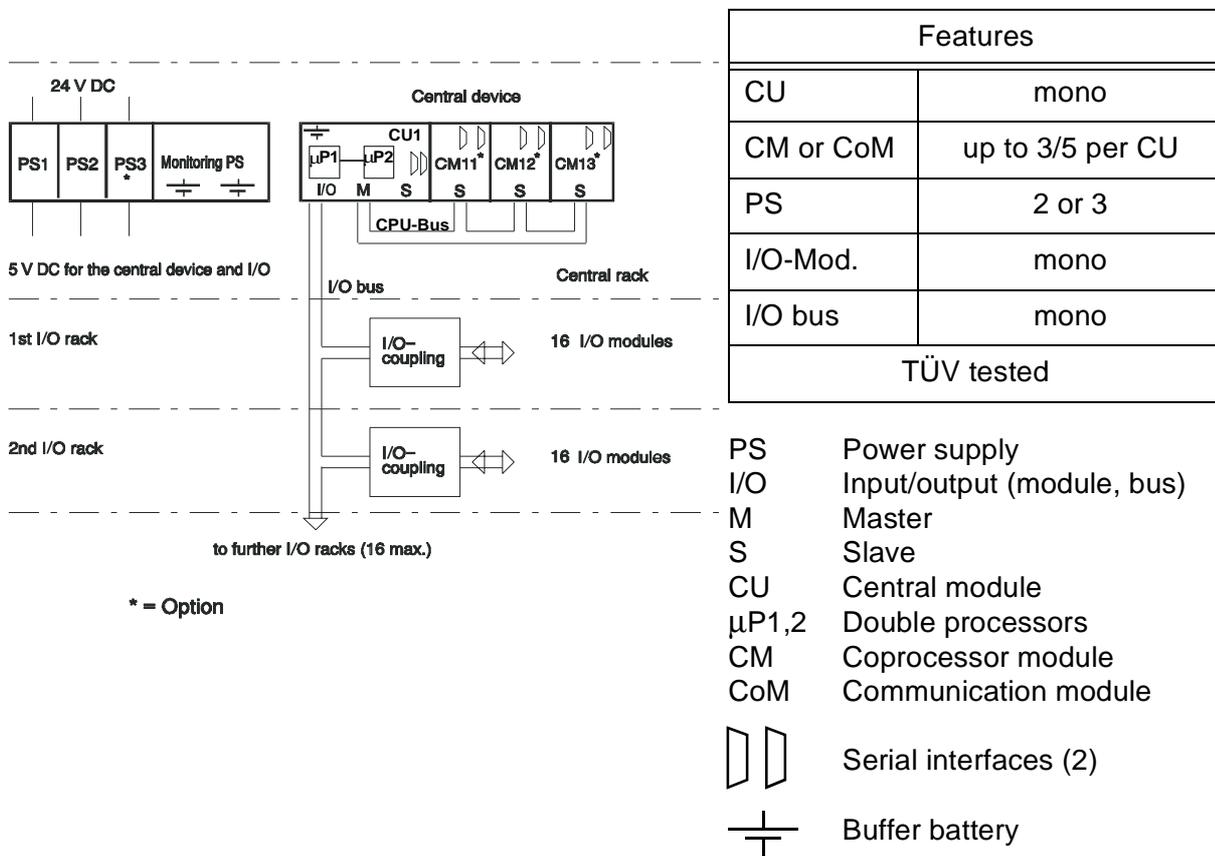
For your notes

4.5 PES H51q-MS



View of the PES H51q-MS

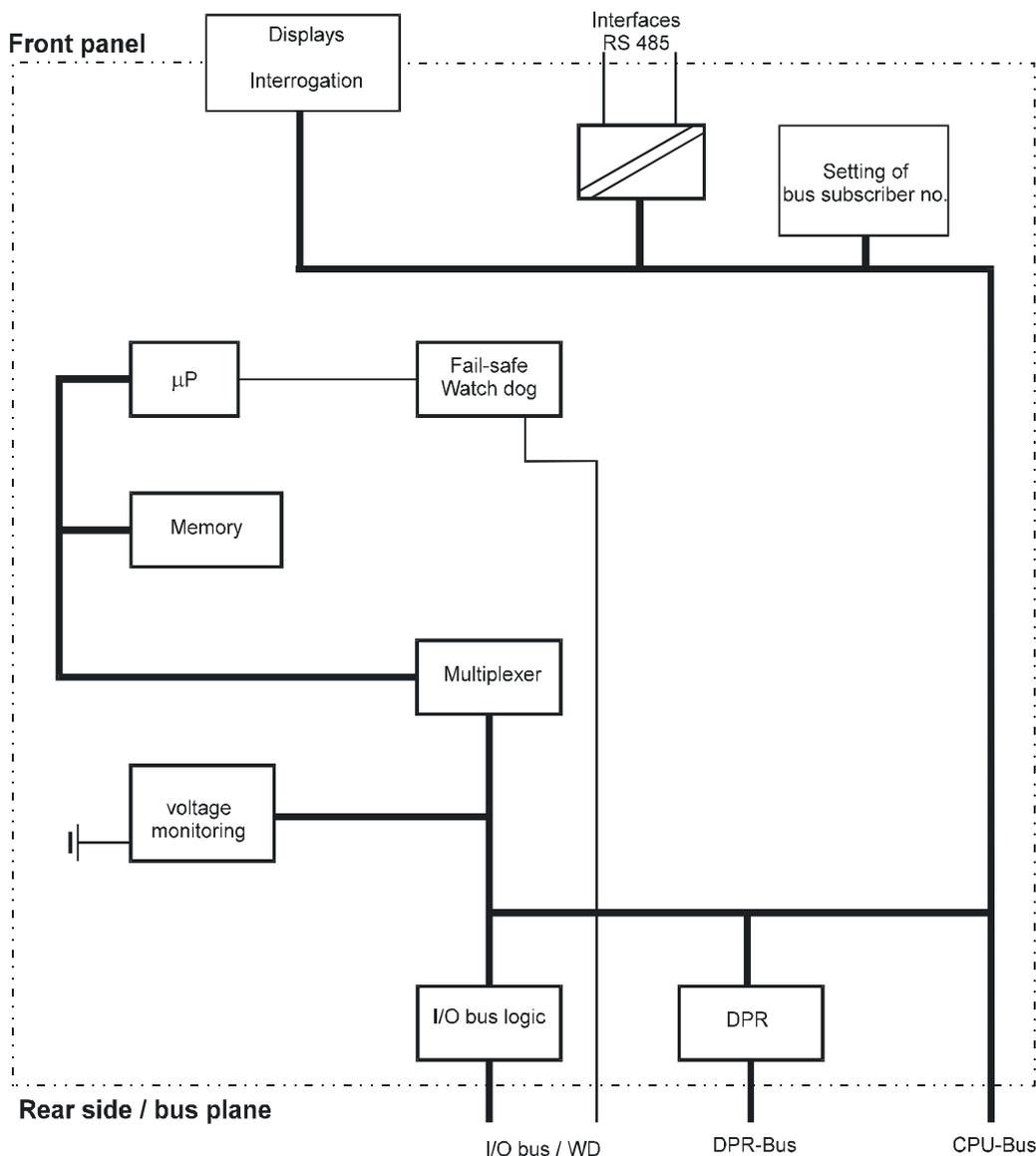
4.5.1 System Structure



System structure of the PES H51q-MS

4.5.2 Central Module F 8650

The central module for safety related applications with TÜV certificate of the PES H51q-MS contains the essential functions demonstrated in the structure of the central module:



Structure of the central module F 8650

These essential functions are

- two clock-synchronised micro processors
- each mikroprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both micro processors, in case of a fault the watch dog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU (not used in the H51q-MS system)
- Battery backup of the sRAMs via batteries on the central module with monitoring

- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transm. rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
- Dual Port RAM for fast memory access to the second central module (not used in the H51q-MS system)
- hardware clock, battery backed
- I/O bus logic and connection to the input-/output modules
- Fail-safe watchdog
- power supply monitoring, testable (5 V system voltage)
- Battery monitoring

4.5.3 Coprozessor-Baugruppe F 8621A

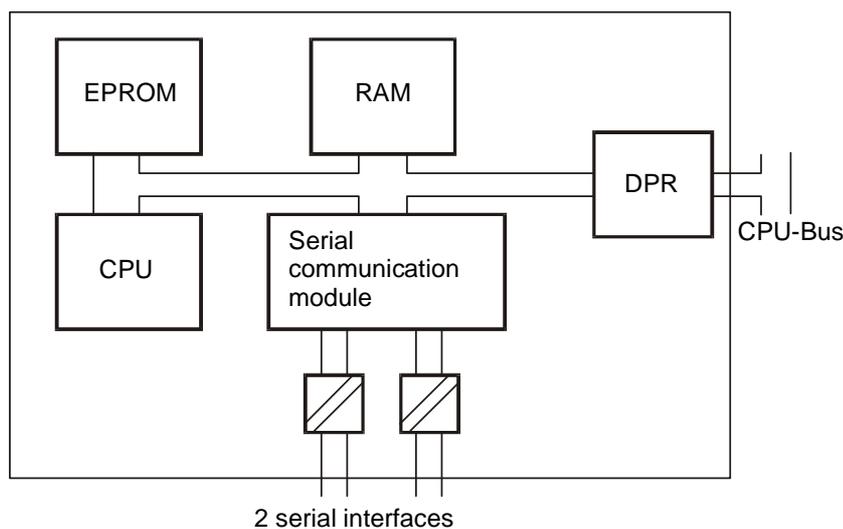
Next to each installed central module of the H51q-MS PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note:

The RAM for the master project is buffered via the batteries on the monitoring module.

- Two interfaces RS 485, via communication software building block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via Bus 1.



Structure of the coprocessor module F 8621A

4.5.4 Communication Module F 8625/F 8626

Next to each installed central module of the H51q-MS PES up to five communication modules can be installed. The communication module mainly contains:

- 32 Bit Microprocessor
- Operating system

-
- RAM for additional protocols
 - F 8625 Ethernet interface
 - F 8626 Profibus-DP interface
 - Dual port RAM (DPR) for the communication with the central module via CPU-Bus.

4.5.5 Mechanical Structure and Design

The 19 inch and 5 units high central rack with integrated fan unit. For details and design of the mechanical structure see data sheet of the B 5231 assembly kit.

4.5.6 24 V DC Supply and Distribution

The 24 V DC power may be fed three times to the system H51q-MS (see also B 5231 assembly kit, wiring assembly kit).

4.5.7 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired extra as it is already part of the installation.

To supply the I/O racks the 5V DC power supply with corresponding GND is available at the rear side of the central rack.

The 5 V DC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 V DC power of the system via clocked 24 V DC / 5 V DC power supply modules bearing the F 7126 identification. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

The output voltage of the power supply modules is checked as to under-voltage or failure by the monitoring module F 7131.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

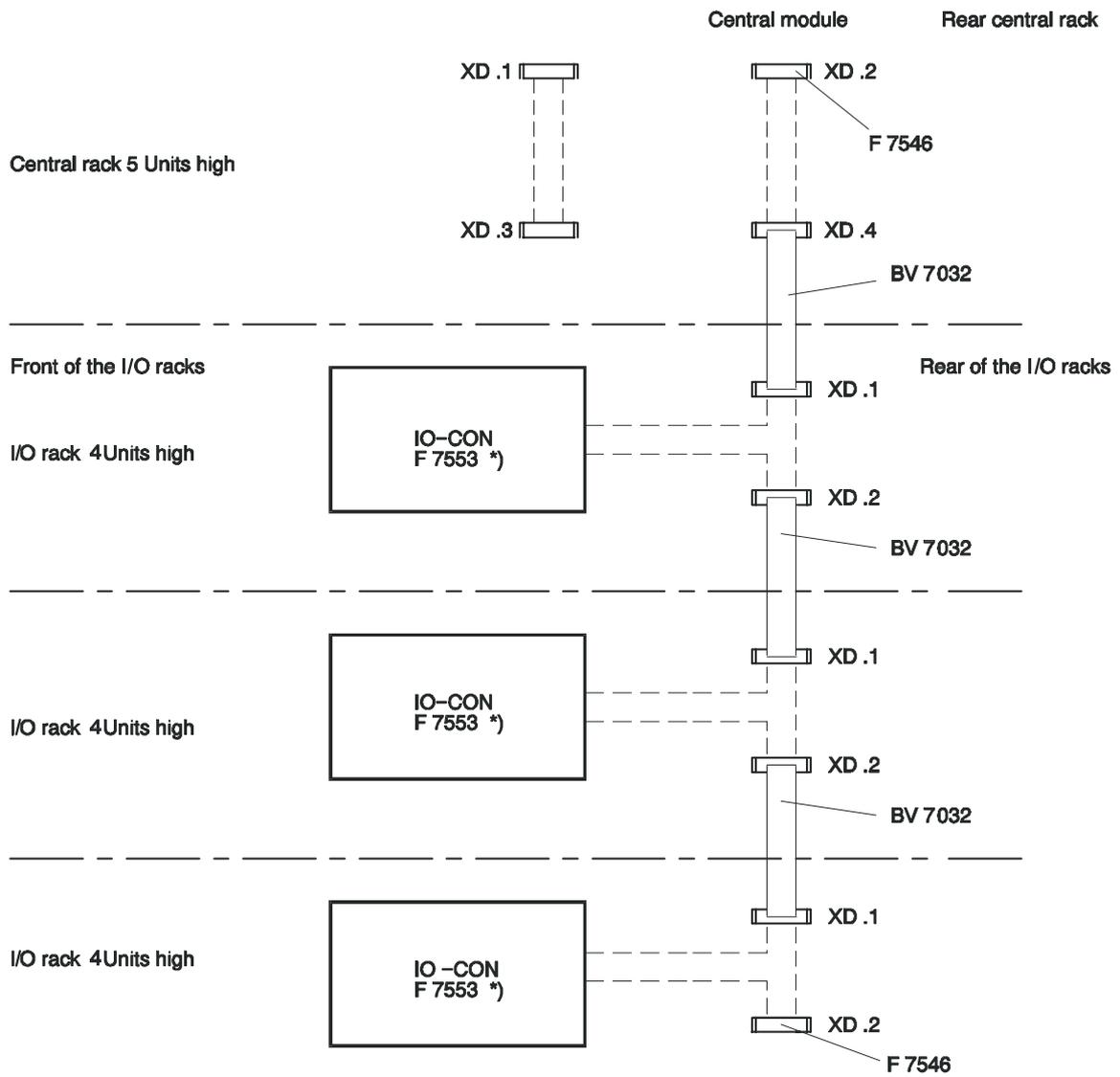
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by one lithium battery on the central module.

Two lithium batteries on the power supply monitoring module F 7131 are to buffer the sRAM on the coprocessor module.

4.5.8 The I/O Bus

The data connection of the I/O level with the central device is established via the I/O bus. The I/O bus coupling modules are already integrated in the central rack. With the I/O rack the connection to the I/O bus is via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable.

To terminate the bus, an F 7546 module is plugged in at the beginning and the end.

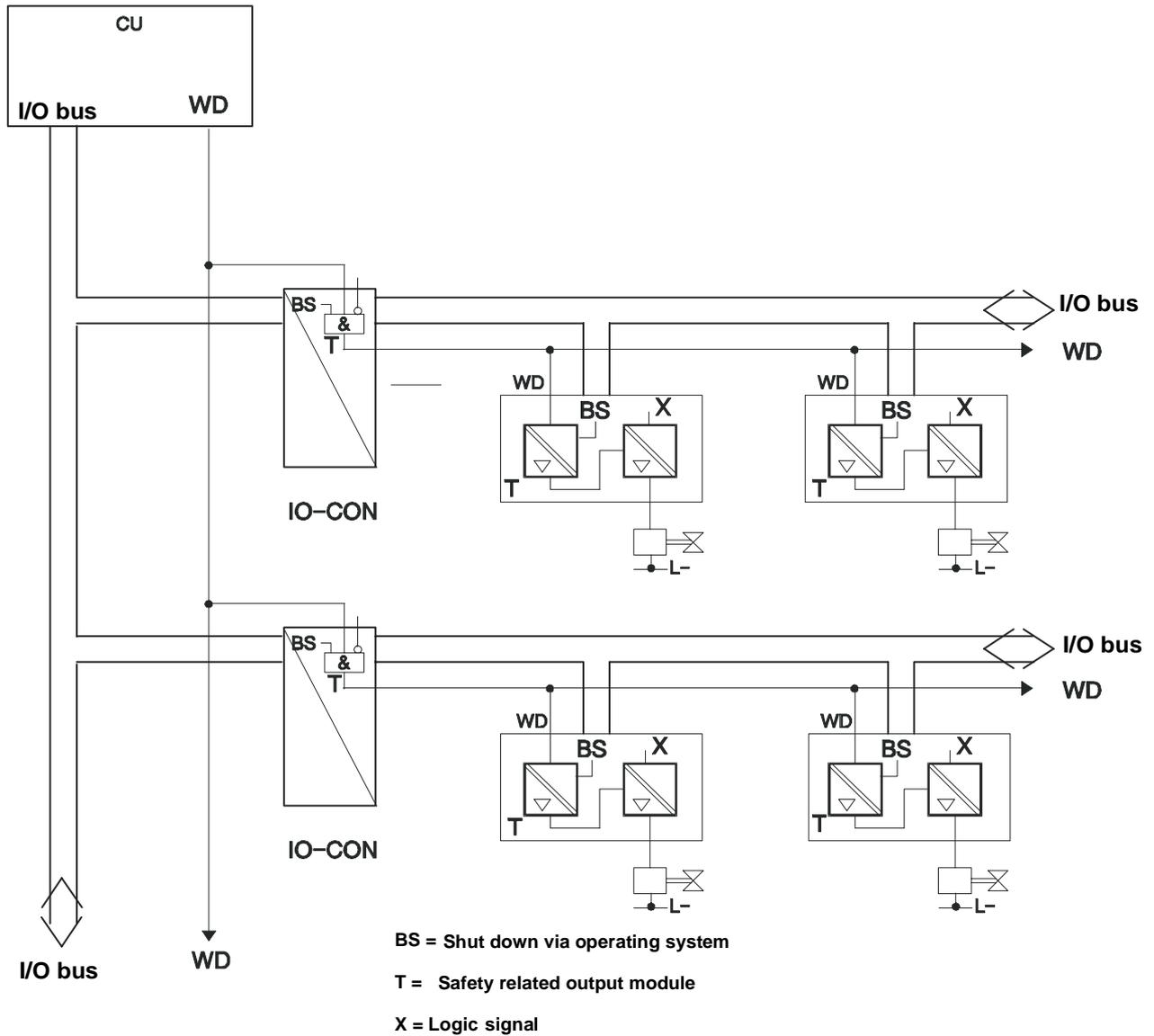


*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Construction principle of the I/O bus

4.5.9 Safety Shut Down

In case of an error the plant is to be driven in the safe state. For systems with a defined safety state this is the lowest energetic state. According to the defined reaction on faults during operation (refer to the table in chapter 4.1) different levels of shut down are executed.



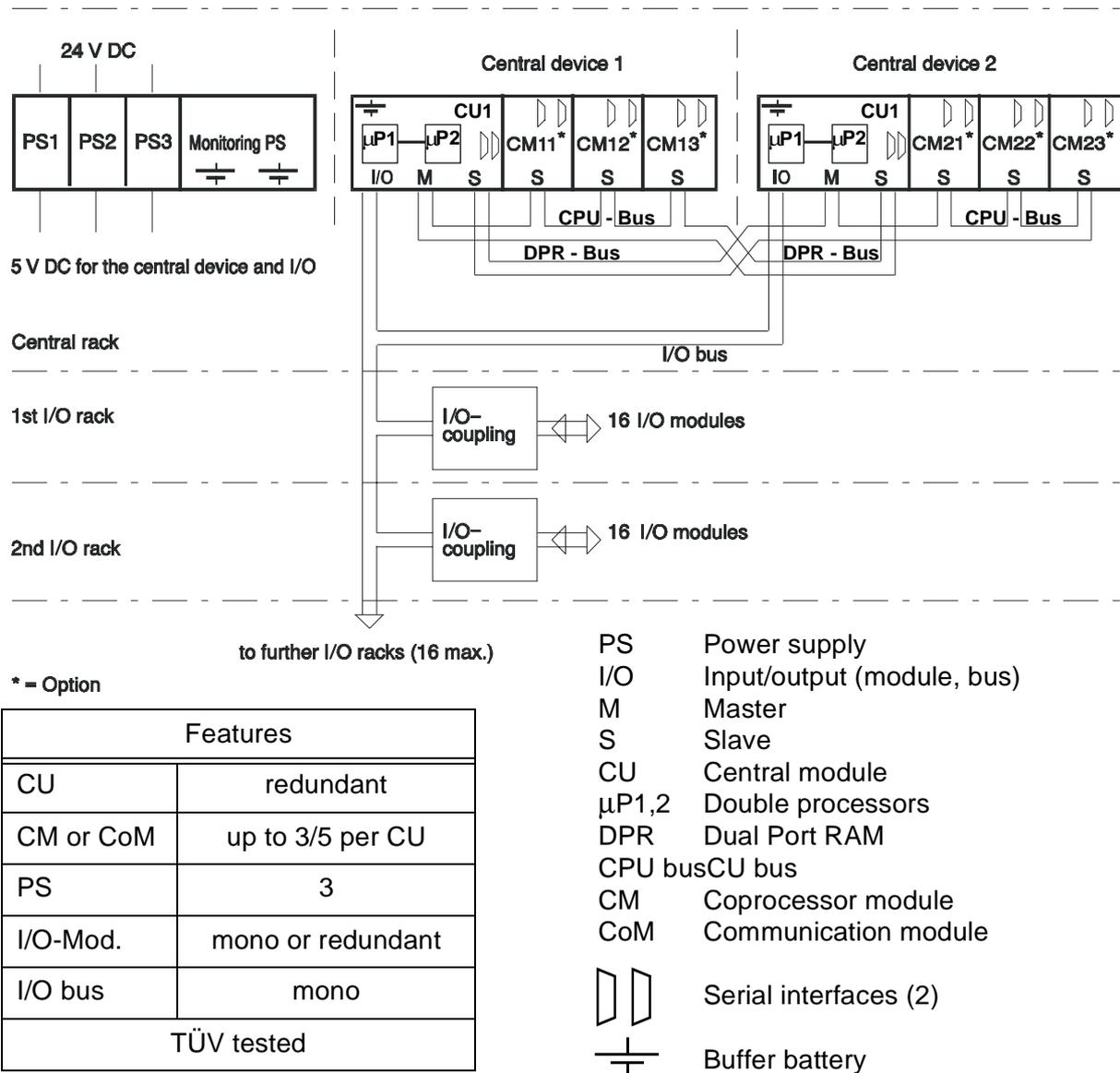
Shut down ways in the H51q-MS system

4.6 PES H51q-HS TÜV



View of the PES H51q-HS

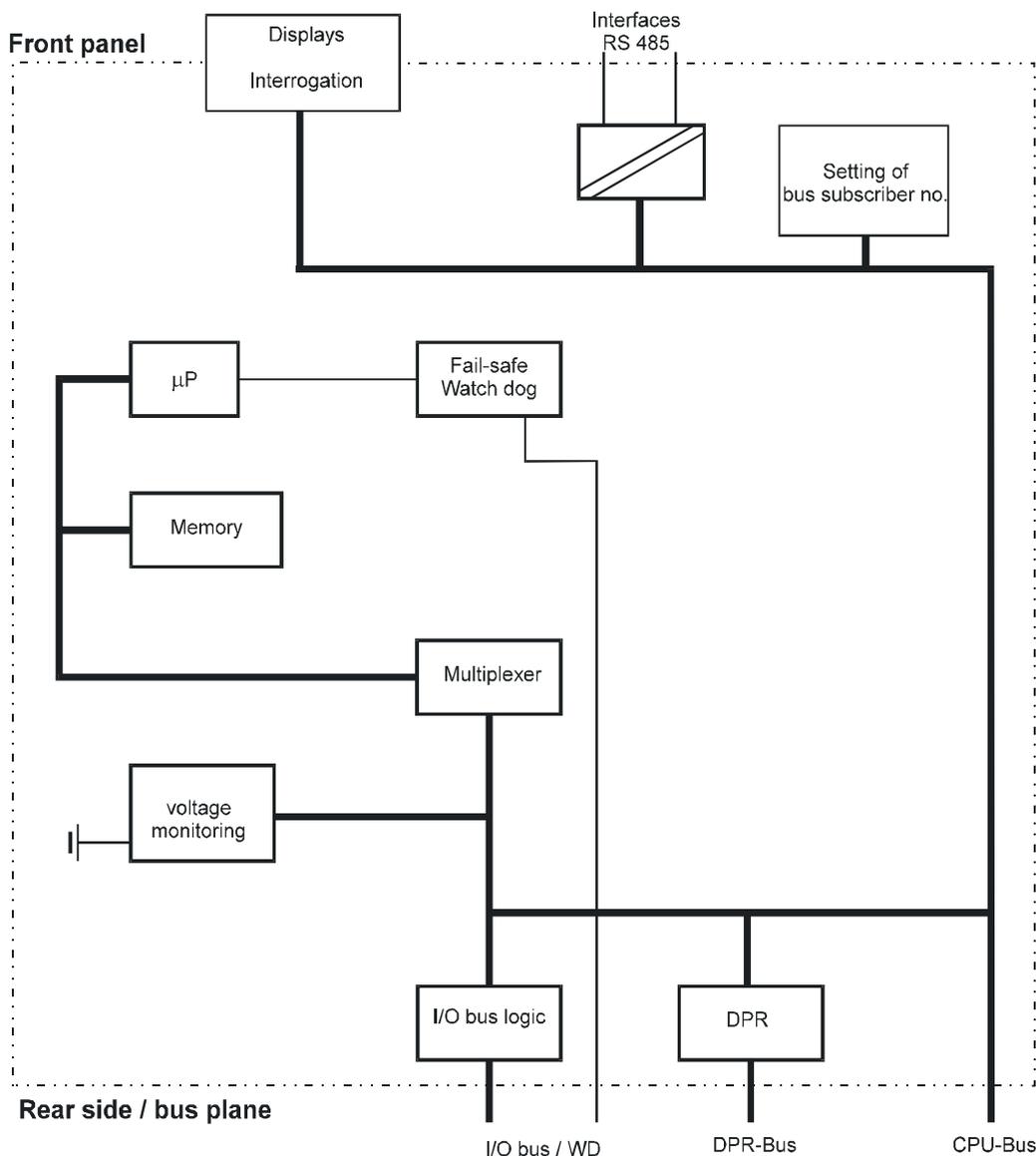
4.6.1 System Structure



System structure of the PES H51q-HS

4.6.2 Central Module F 8650

The central module for safety related applications with TÜV certificate of the PES H51q-HS contains the essential functions demonstrated in the structure of the central module:



Structure of the central module F 8650

These essential functions are

- two clock-synchronised micro processors
- each mikroprocessor with an own memory, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both micro processors, in case of a fault the watch dog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU
- Battery backup of the sRAMs via batteries on the central module with monitoring
- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600

- bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transm. rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
- Dual Port RAM for fast memory access to the second central module
- hardware clock, battery backed
- I/O bus logic and connection to the input-/output modules
- Fail-safe watchdog
- power supply monitoring, testable (5 V system voltage)
- Battery monitoring

4.6.3 Coprocessor Module F 8621A

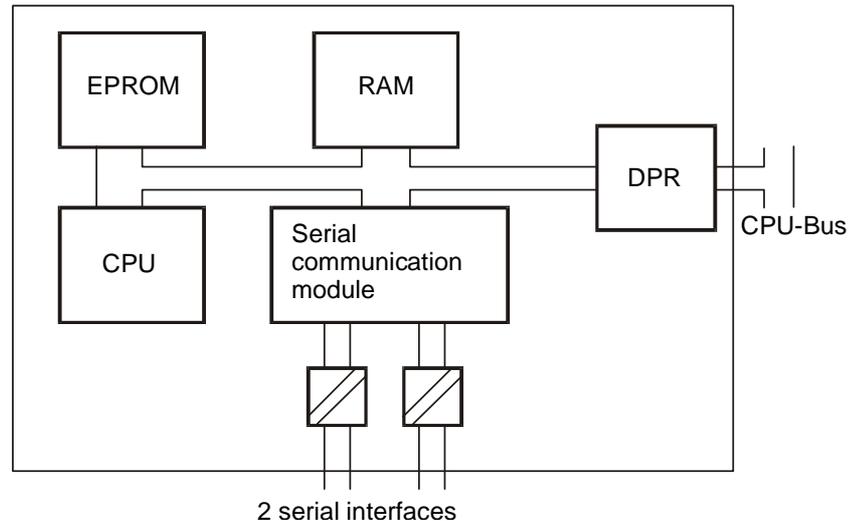
Next to each installed central module of the H51q-HS PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note:

The RAM for the master project is buffered via the batteries on the monitoring module.

- Two interfaces RS 485, via communication software building block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via Bus 1.



Structure of the coprocessor module F 8621A

4.6.4 Communication Module F 8625/F 8626

Next to each installed central module of the H51q-HS PES up to five communication modules can be installed. The communication module mainly contains:

- 32 Bit Microprocessor
- Operating system
- RAM for additional protocols
- F 8625 Ethernet interface

-
- F 8626 Profibus-DP interface
 - Dual port RAM (DPR) for the communication with the central module via CPU-Bus.

4.6.5 Mechanical Structure and Design

The 19 inch and 5 units high central rack with integrated fan unit. For details and design of the mechanical structure see data sheet of the B 5233-1 assembly kit.

4.6.6 24 V DC Supply and Distribution

The 24 V DC power may fed three times to the system H51q-HS (see also B 5233-1 assembly kit, wiring assembly kit).

4.6.7 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired extra as it is already part of the installation.

To supply the I/O racks the 5 V DC power supply with corresponding GND is available at the rear side of the central rack.

The 5 V DC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 V DC power of the system via clocked 24 V DC / 5 V DC power supply modules bearing the F 7126 identification. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

The output voltage of the power supply modules is checked as to under-voltage and failure by a monitoring module F 7131.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by one lithium battery on the central module.

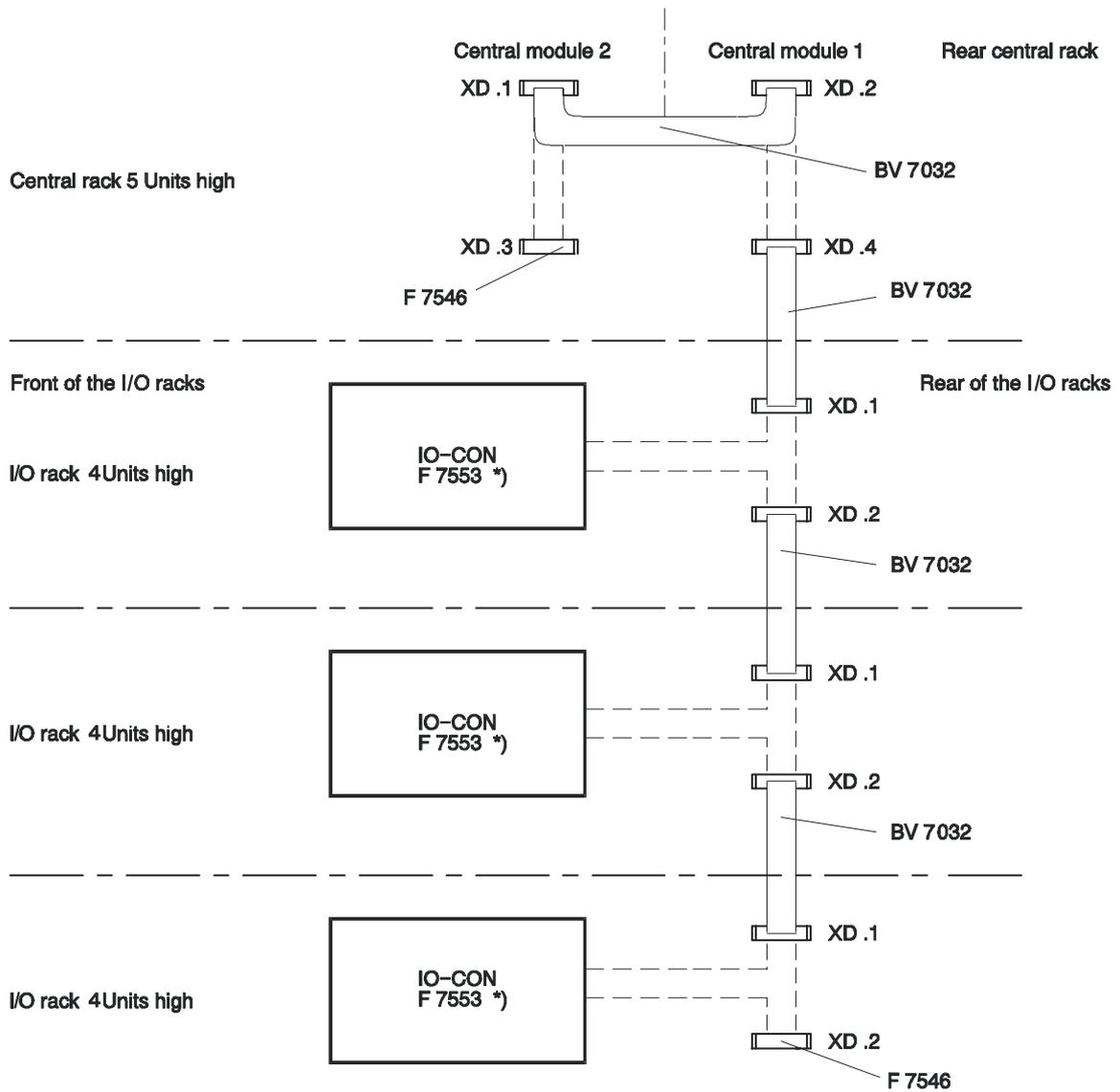
Two lithium batteries on the power supply monitoring module F 7131 are to buffer the sRAM on the coprocessor module.

4.6.8 The I/O Bus

The data connection of the I/O level with the central device is established via the I/O bus. The I/O bus coupling modules are already integrated in the central rack. A data cable BV 7032 is used to connect the I/O bus between central module 1 (XD.2) and central module 2 (XD.1).

With the I/O subrack the connection to the I/O bus is via a coupling module F 7553 installed in slot 17. The connection of the bus between the individual subracks is established at the rear side via the BV 7032 data cable.

To terminate the bus, an F 7546 module is plugged in at the beginning and the end.

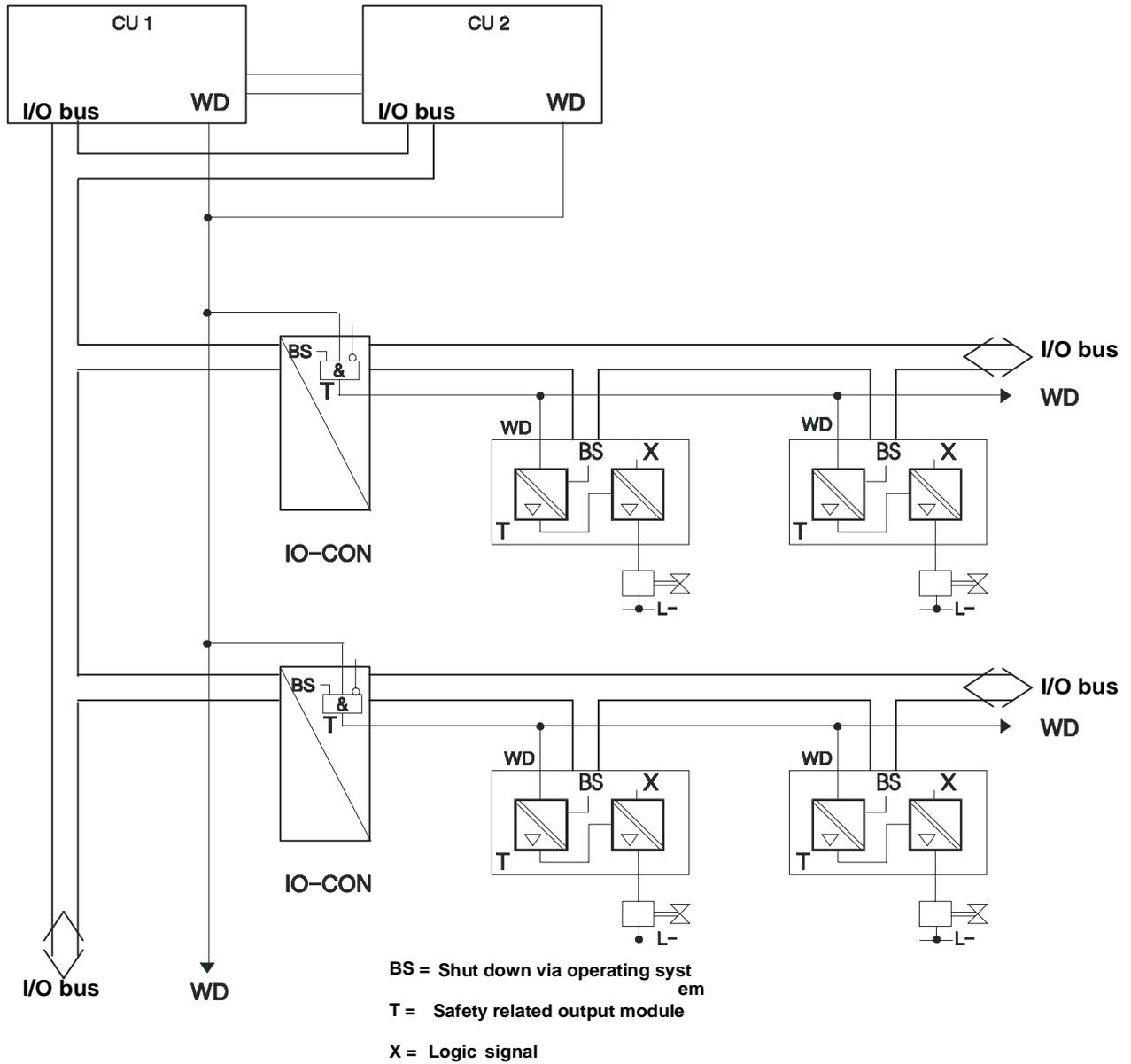


*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Construction principle of the I/O bus

4.6.9 Safety Shut Down

In case of an error the plant is to be driven in the safe state. For systems with a defined safety state this is the lowest energetic state. According to the defined reaction on faults during operation (refer to the table in chapter 4.1) different levels of shut down are executed.



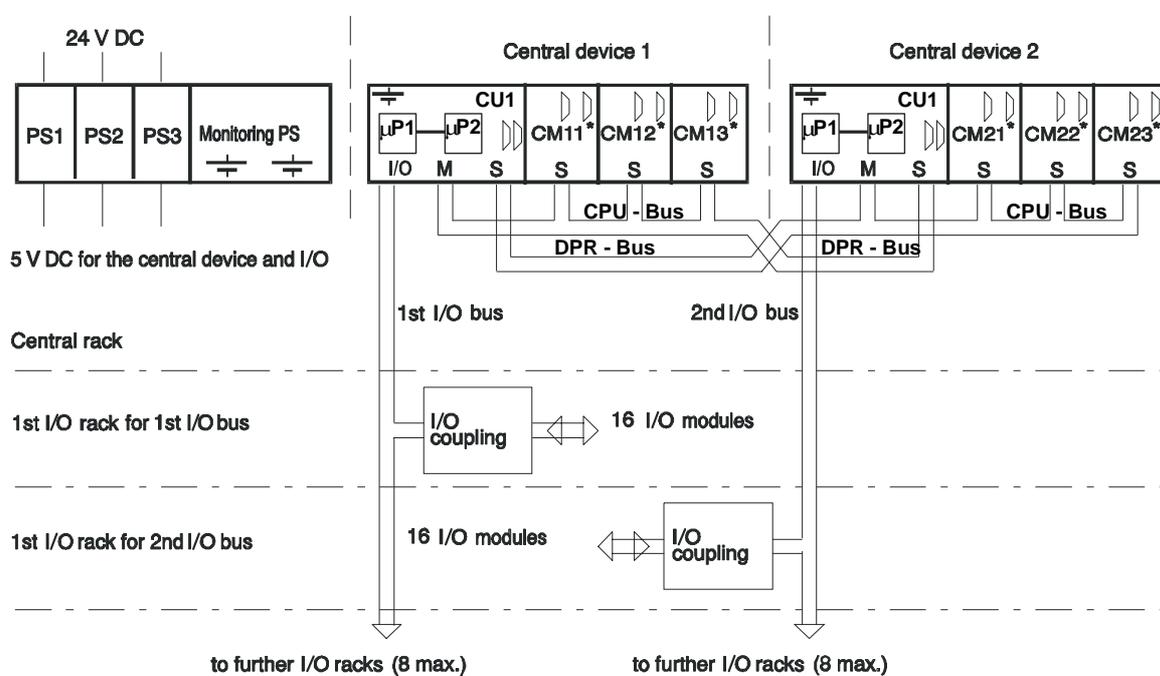
Shut down ways in the H51q-HS system

4.7 PES H51q-HRS



View of the PES H51q-HRS

4.7.1 System Structure



* = Option

Features	
CU	redundant
CM or CoM	up to 3/5 per CU
PS	3
I/O-Mod.	redundant
I/O bus	redundant
TÜV tested	

- PS Power supply
- I/O Input/output (module, bus)
- M Master
- S Slave
- CU Central module
- μP1,2 Double processors
- DPR Dual Port RAM
- CPU bus / CU bus
- CM Coprocessor module
- CoM Communication module

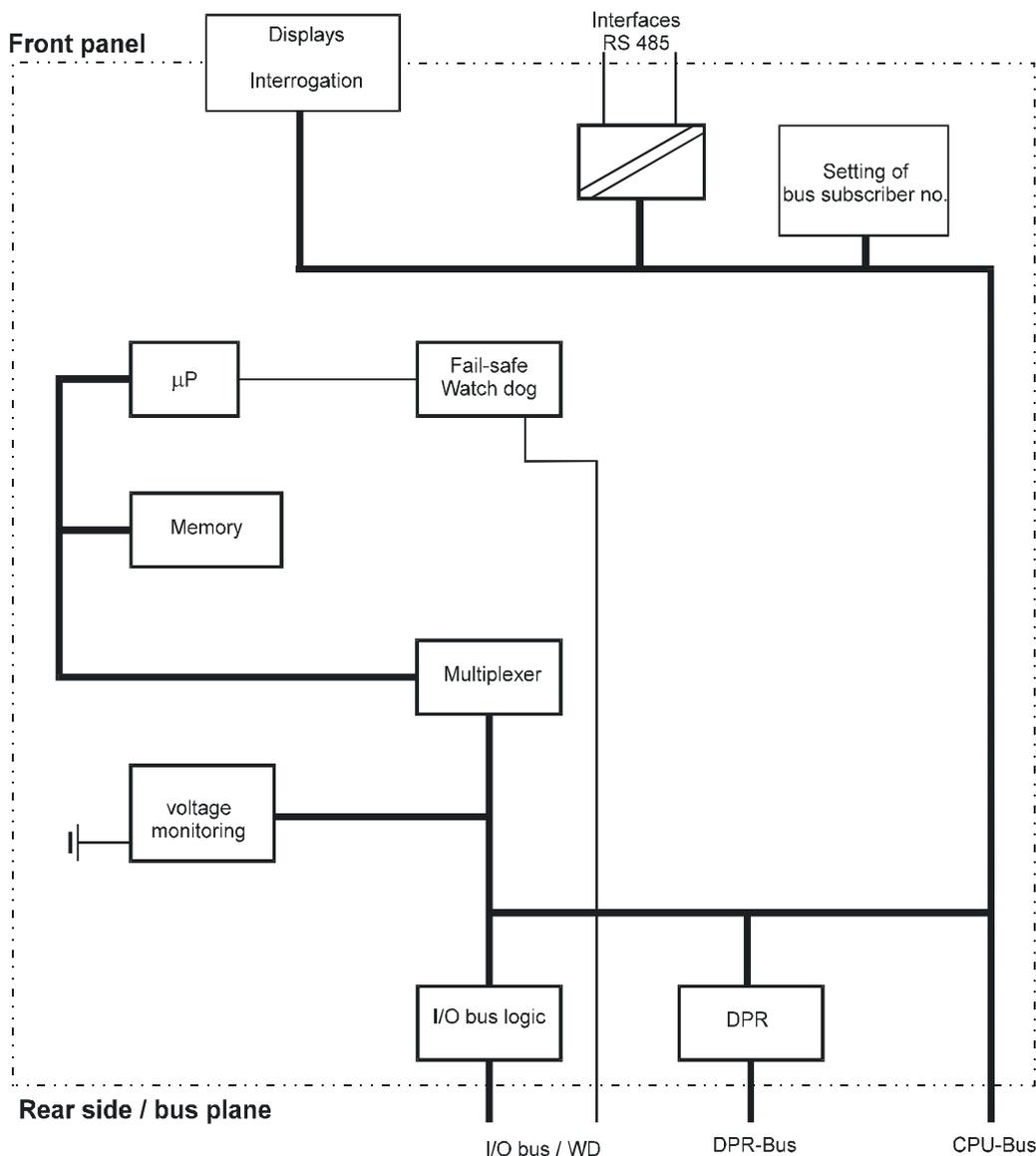
 Serial interfaces (2)

 Buffer battery

System structure of the PES H51q-HRS

4.7.2 Central Module F 8650

The central module for safety related applications with TÜV certificate of the PES H51q-HRS contains the essential functions demonstrated in the structure of the central module:



Structure of the central module F 8650

These essential functions are

- two clock-synchronised micro processors
- each mikroprocessor with an own data area, one processor operates with real data and program and the other one with inverted data and program
- testable hardware comparer for all the external accesses of both micro processors, in case of a fault the watch dog will be set to the safe status and the status of the processor is announced
- Flash-EPROMs of the program memory for the operating system and the user's program usable for min. 100.000 writing cycles
- Data memory in sRAM
- Multiplexer to connect I/O bus, DPR and redundant CU
- Battery backup of the sRAMs via batteries on the central module with monitoring

- 2 interfaces RS 485 with galvanic isolation. Transm. rate: max. 57600 bps. Set to 9600 bps and to 57600 bps by switch, or setting also of other transm. rates by software (the software values have priority)
- Diagnostic display and 2 LEDs for information out of the system, I/O level and user's program
- Dual Port RAM for fast memory access to the second central module
- hardware clock, battery backed
- I/O bus logic and connection to the input-/output modules
- Fail-safe watchdog
- power supply monitoring, testable (5 V system voltage)
- Battery monitoring

4.7.3 Coprocessor Module F8621A

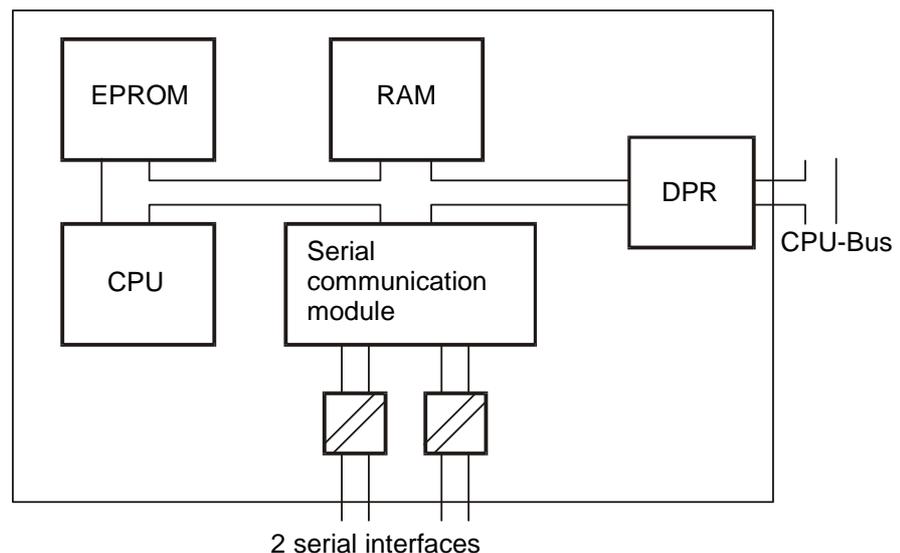
Next to each installed central module of the H51q-HS PES up to three coprocessor modules can be installed. The coprocessor module mainly contains:

- Microprocessor HD 64180 with a clock frequency of 10 MHz
- Operating system EPROM
- RAM for a PLC master project

Note:

The RAM for the master project is buffered via the batteries on the monitoring module.

- Two interfaces RS 485, via communication software building block setting of the baud rate up to 57600 bps
- Dual port RAM (DPR) for the communication with the central module via Bus 1.



Structure of the coprocessor module F8621A

4.7.4 Communication Module F 8625/F 8626

Next to each installed central module of the H51q-HRS PES up to five communication modules can be installed. The communication module mainly contains:

- 32 Bit Microprocessor
- Operating system

-
- RAM for additional protocols
 - F 8625 Ethernet interface
 - F 8626 Profibus-DP interface
 - Dual port RAM (DPR) for the communication with the central module via CPU-Bus.

4.7.5 Mechanical Structure and Design

The 19 inch and 5 units high central rack with integrated fan unit. For details and design of the mechanical structure see data sheet of the B 5233-2 assembly kit.

4.7.6 24 V DC Supply

The supply voltage 24 V DC may be fed three times to the system H51q-HRS (see also B 5233-2 assembly kit, wiring assembly kit).

4.7.7 5 V DC Supply and Distribution

The 5 V DC power supply does not have to be wired extra as it is already part of the installation.

To supply the I/O racks, on the rear of the central rack the supply voltage 5 V DC and the appertaining GND is available. The 5 V DC power needed for the microprocessor system and as control current for the I/O modules is generated from the 24 V DC power of the system via clocked 24 V DC / 5 V DC power supply modules bearing the F 7126 identification. One central rack can be equipped with a maximum of 3 power supply modules. The power supply modules are switched in parallel. One or two power supply modules are usually able to supply the PES. A further power supply module is used to increase availability.

The output voltage of the power supply modules is checked as to under-voltage or failure by a monitoring module F 7131.

In case of a faulty power supply module the operating system supplies the user's program via a system variable with this information.

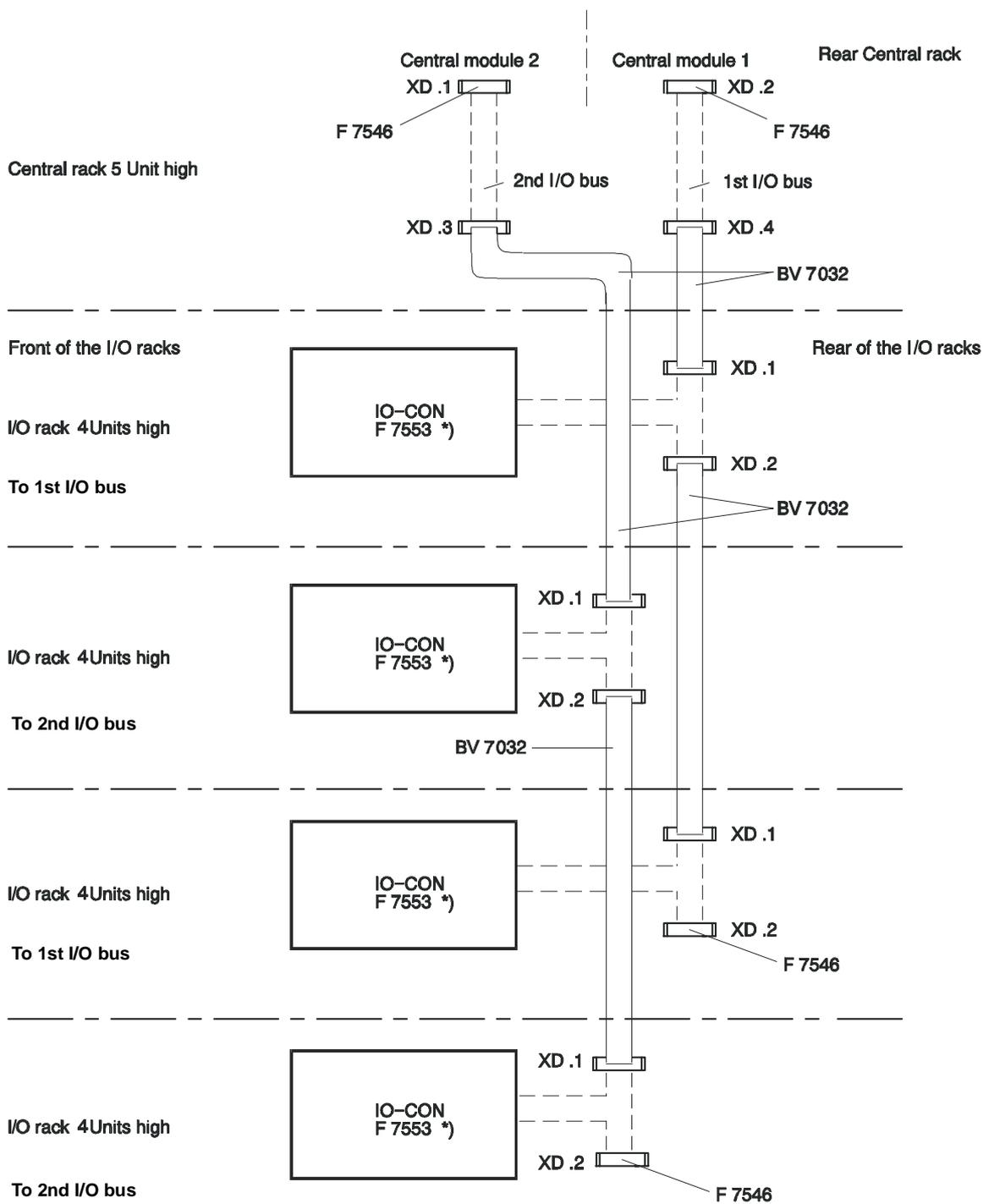
In case the 5 V DC system power fails hardware clock and sRAM on the central module are buffered by one lithium battery on the central module.

Two lithium batteries on the power supply monitoring module F 7131 are to buffer the sRAM on the coprocessor module.

4.7.8 The I/O Bus

The data connection of the I/O level with the central device is established via the I/O bus. Because the I/O bus is redundant each central device has its own I/O bus and thus also separated own I/O subracks. The 1st I/O bus is associated to central module 1 and the 2nd I/O bus associated to central module 2.

To terminate the bus, an F 7546 module is plugged in at the beginning and the end.

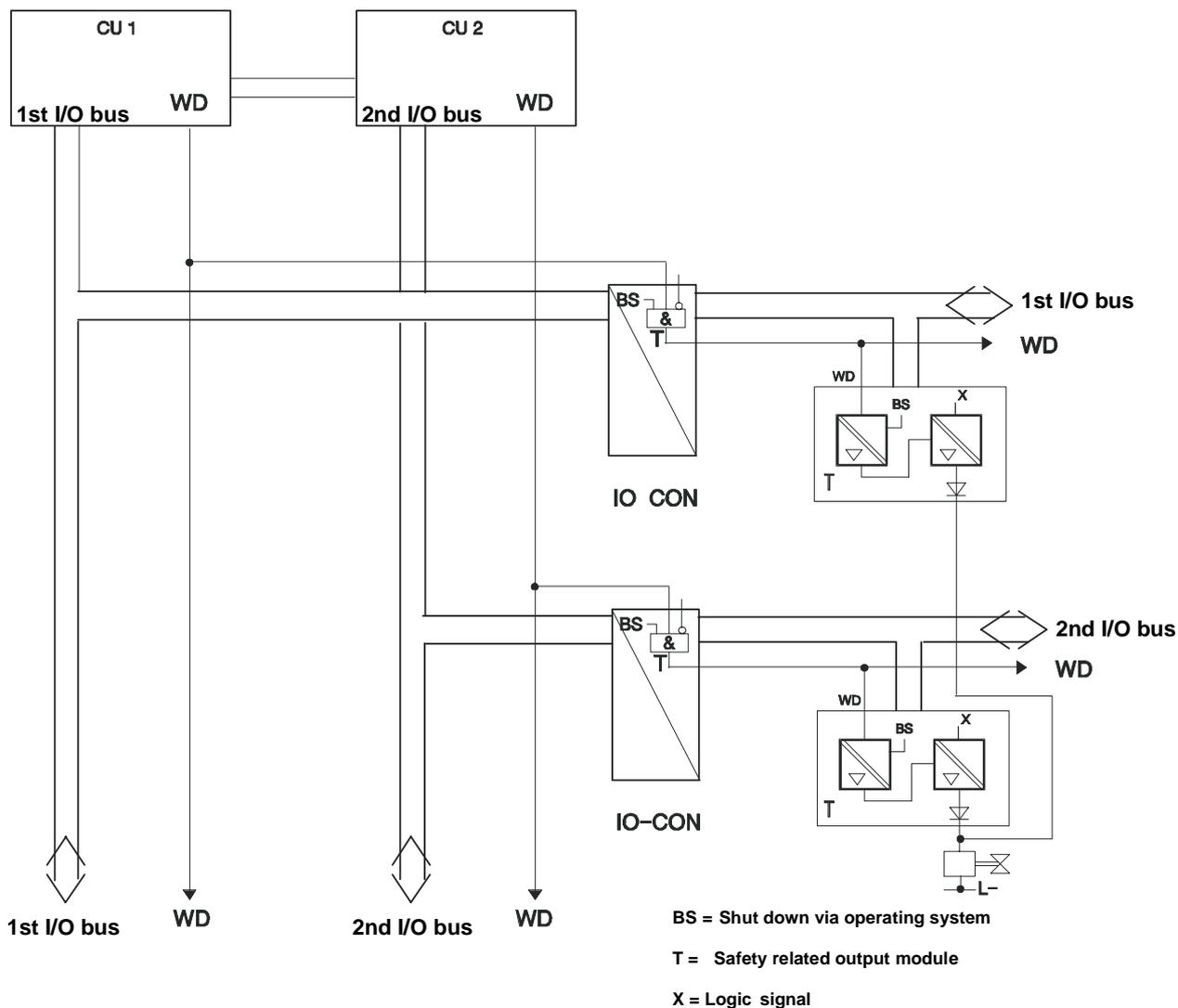


*) Set I/O rack address by means of a coding switch (refer to data sheet F 7553)

Construction principle of the I/O bus

4.7.9 Safety Shut Down

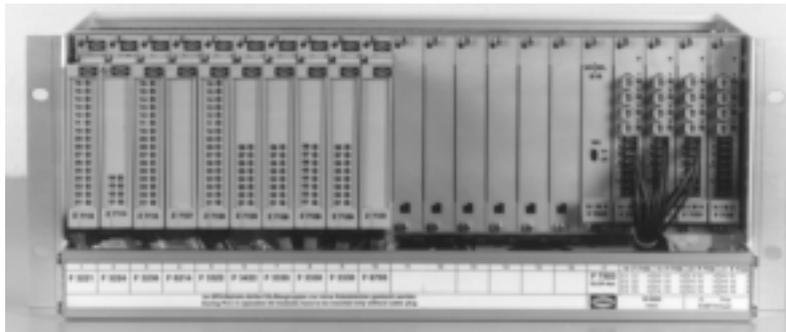
In case of an error the plant is to be driven in the safe state. For systems with a defined safety state this is the lowest energetic state. According to the defined reaction on faults during operation (refer to the table in chapter 4.1) different levels of shut down are executed. If in the H51q-HRS system a central shut down is necessary because of a fault the watchdog signal (WD) of the appertaining central module will be switched off.



Shut down ways in the H51q-HRS system

4.8 The Input/Output Level

The input/output subracks holding the input/output modules with their fuses, power distribution and I/O bus coupling are below the central racks. Up to 16 input/output subracks can be assigned to a PLC.



View of the 4 units high I/O subrack

4.8.1 The I/O Subrack

The I/O subrack fulfills the safety requirements of the requirement class 6.

Slots 1 to 16 are provided for any type of input/output modules of the HIMA automation system. Slot 17 is provided for the coupling module F 7553 for the I/O bus.

Slots 18 to 21 hold the power distribution modules F 7133. They are non-interactive and have a fuse monitoring for fuse fail by means of a LED and a contact. The power distribution module F 7133 can be used to fuse the I/O modules as well as the sensors and the actors.

There is a cable tray under the input/output subrack. It is equipped with a receptacle for the label which can be hinged to provide easy access to the cables.

4.8.2 24 V DC Power Supply and Distribution

Standard solution: The 24 V DC power is distributed via a plug-in fusing and power distribution unit (refer to the HIMA articles). For the input/output racks max. 25 A back-up fuses are provided for L+. The power for the input/output modules is fed in at the backside of the power distribution modules F 7133 via XG.7/8/9/10.

Each I/O module is related to a fuse on the module F 7133 (refer also to the description of the assembly kit B 9302).

The relation between the power distribution modules with 4 fuses each and the slots of the I/O modules is as follows:

F 7133 in slot 18 supplies I/O slots 1 ... 4

F 7133 in slot 19 supplies I/O slots 5 ... 8

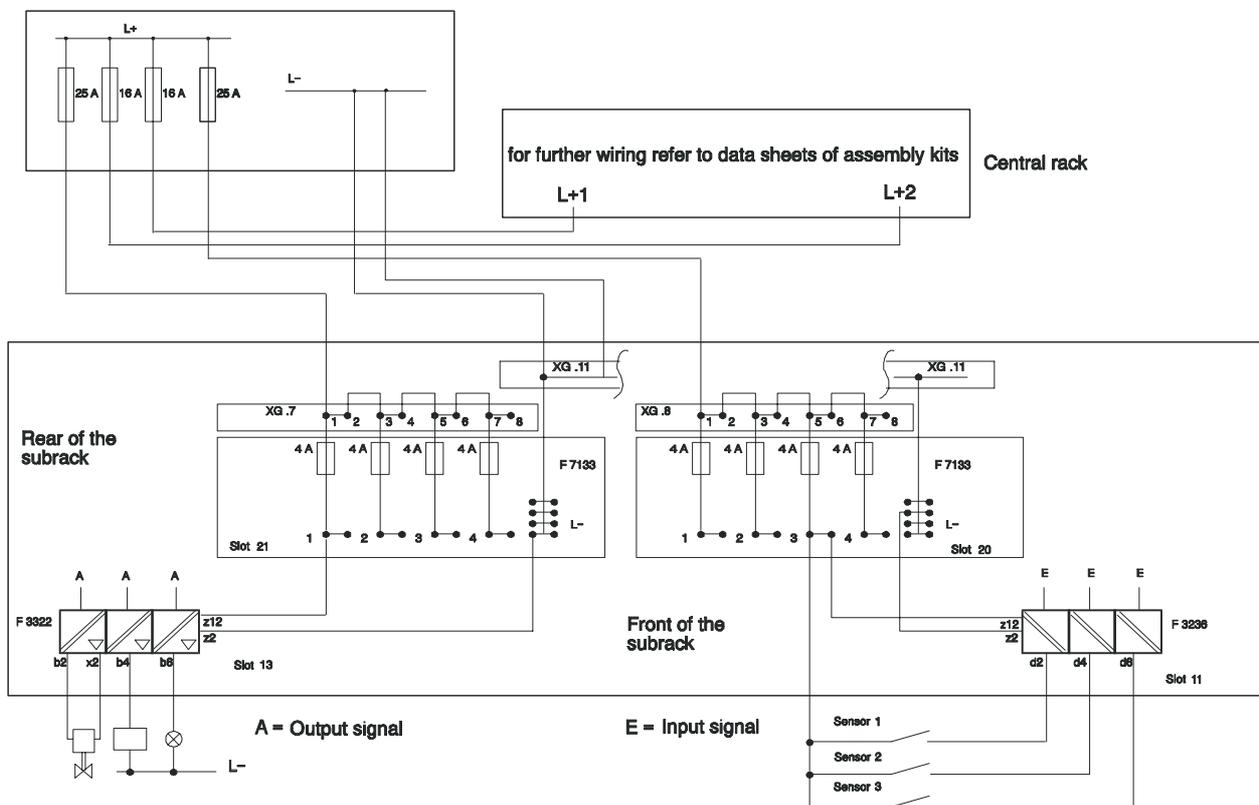
F 7133 in slot 20 supplies I/O slots 9 ... 12

F 7133 in slot 21 supplies I/O slots 13 ... 16

The supply of the I/O modules is either via the cable plug on the front side or via the connection already integrated in the I/O busboard (for (Ex)i modules and partly analog input modules).

L- is also taken from the plug-in power distribution unit to be connected to the potential distributor XG. 11 (at least two times, if 2-pole connected output modules are used with up to 4 feeding lines). So all power distribution modules F 7133 are internal connected with L-. Via the front side of the power distribution modules the L- is also fed to the input/output modules via the cable plugs.

The circuit feeding the sensors is fused by the front of the F 7133 module. It is advisable to supply the input module and the appertaining sensors via the same circuit of the power distribution module F 7133.



Feeding and distribution 24 V DC

4.8.3 5 V DC Supply and Distribution

The 5 V DC system voltage for the I/O subracks is taken from the flat pin plugs of the distributors XG.2 and XG .3 on the rear side of the central rack. The power is connected to the I/O subracks on the accordingly marked flat pin plugs XG. 4 for +5 V DC and XG.12 for GND on the rear side of the I/O subracks.

The power is internally distributed to the I/O modules via the bus board.

4.8.4 Extension of the 5 V DC Power Supply

If the power requirements of the 5 V circuits is > 18 A an additional power supply has to be used. For this purpose the B 9361 assembly kit can be used which provides the possibility of applying three 24 V/5 V power supplies F 7126 together with the monitoring module F 7131 in an additional subrack.

The 5 V output circuits of the additional power supply must not be switched in parallel with the ones from the central rack. Apart from them they supply their own circuits. The reference poles GND have to be connected together.

The power supply units of the additional power supply (assembly kit B 9361) emit monitoring signals. These signals can be taken from the XG1 terminal block on the rear side of the subrack (see B 9361 assembly kit). They can be fed into the PLC via digital input modules. In the logic of the PLC the signals are used to trigger an error message.

4.8.5 The I/O Bus

With the I/O subrack, the connection elements for the I/O bus are the F 7553 coupling module plugged into slot 17. The connection of the I/O bus between the individual I/O module subracks is established at the rear side via the BV 7032 data cable which is connected to the plugs XD. 1 and XD. 2. The I/O bus in the I/O module subracks is integrated in the bus board.

An F 7546 bus termination subassembly is plugged into the XD. 2 connector of the last I/O module subrack to terminate the I/O bus.

4.8.6 I/O Modules

The I/O modules are used for signal transfer and signal matching between the plant and the central devices. The input and output circuits are always fed into the I/O modules via cable plugs on the front side. The status of the digital signals is shown on the LEDs of the cable plugs. The power supply is either via the cable plugs or via the I/O bus board. The order of the different I/O module types does not matter.

4.8.7 (Ex)i-Modules

The current **(Ex)i modules** exist in 2 construction models:

- non-varnished with PCB covering
- varnished with PCB covering

Any models can be equipped together without free slots between.

Non varnished (Ex)i modules may combined together with non-(Ex)i modules without any restrictions. Also no free slots are necessary on the left or on the right.

With varnished (Ex)i modules with PCB covering the right slot has to remain free in combination with non-(Ex)i modules or has to be equipped with a faceplate with partition plate M 2214. This is also valid for slot 16. The slot left to the (Ex)i module may be equipped with any other module. Spare slots are to be covered by faceplates M 2215 (4 units) or M 2217 (8 units).

Usable partition plates and faceplates:

M 2214 Faceplate with partition plate 100*160 mm

M 2215 Faceplate 4 units

M 2217 Face plate 8 units

Cable plugs for intrinsically safe circuits are marked and have coded pins, so that they can only be plugged into the appropriate modules.

4.8.8 Safety related Output Modules , for Requirement Class 1 to 6

All the safety related output modules fulfill the requirements of the requirement class 6 without time limit in case of a fault of an output module.

The safety related output modules have 3 semiconductors switched in series. That means that more than the required second independent component for safe shut down is now integrated in the output module. In the following this feature is called the integrated safety shut down. The data sheets of this output modules contain the sign  . If a new safety related output module should fail during operation then it will be automatically switched off with the integrated safety shut down  to get the safe de-energized status.

The coupling module F 7553 which has to be installed in each I/O subrack is able to switch off the watch dog signal (WD) of the I/O subrack. Even in case of a very seldom second fault only the related I/O subrack will be switched off but not the entire system.

4.8.9 General features of the Output Modules

All output modules have the following special features:

- To increase the availability the outputs of the safety related output modules can be switched in parallel without additional diodes
- No output voltage occurs when the supply voltage L- should be cut on the output module, so it is not necessary to wire the L- as a ring feeder
- The connection of inductive loads can be done without using diodes at the coil. However it is recommended to connect a diode directly at the inductive load avoiding noise voltages.
- The LED signalling the output status is controlled separately
- The design of the cable plugs enables the two pole connection of the actuators. Together with a two pole supply of the output module an earth fault detection by means of a totalizing current transformer will be simplified
- No time limit for operation in case of a defective output module.

For your notes

4.9 System Voltage 24 V DC

For supplying a HIMA system there are two different potentials available:

- L+ positive pole
- L- negative pole (reference pole)

The positive pole is usable also for power voltage and control voltage. To achieve the valid values for the connection of single phase mains supplies, power supply units with bridge rectification and smoothing are required or stabilized power supply units. With using of HIMA standard power supplies, the potential L+ met the requirements according to the NAMUR standard NE 21 to compensate voltage dips up to 20 ms per second.

The central devices of the family H51q have decoupling and buffering during voltage dips. Disturbances within the I/O level will be suppressed by the noise blanking.

Lamp loads with high starting current (7 ... 10 fold nominal current) are un-critical for HIMA power supplies with correct dimensioning.

For your notes

4.10 Overview Assembly Kits

The components required for a working system are included in assembly kits.

System	H51q-M	H51q-H	H51q-HR	H51q-MS	H51q-HS	H51q-HRS
Requirement class	–	–	–	AK 1-6	AK 1-6	AK 1-6
No./type central mod.	1xF 8651	2xF 8651	2xF 8651	1xF 8650	2xF 8650	2xF 8650
Coprocessor mod.	(3x F 8621A)	(2x3x F 8621A)	(2x3x F 8621A)	(3x F 8621A)	(2x3x F 8621A)	(2X3x F 8621A)
Communication mod. (Ethernet interface)	(5x F 8625)	(2x5x F 8625)	(2x5x F 8625)	(5x F 8625)	(2x5x F 8625)	(2X5x F 8625)
Communication mod. (Profibus-DP interface)	(5x F 8626)	(2x5x F 8626)	(2x5x F 8626)	(5x F 8626)	(2x5x F 8626)	(2X5x F 8626)
No./type power supp.	2(3)x F 7126A	3x F 7126A	3x F 7126A	2(3)x F 7126A	3x F 7126A	3x F 7126A
5 V monitoring	monit. mod.	monit. mod.	monit. mod.	CU	CU	CU
Battery buffering	monit. mod.+CU	monit. mod.+CU	monit. mod.+CU	monit. mod.+CU	monit. mod.+CU	monit. mod.+CU
Number IO buses	1	1	2	1	1	2
Max. no. IO modules	256 in 16 I/O Sub- rack	256 in 16 I/O Sub- rack	2x128 in 2x8 I/O Subrack	256 in 16 I/O Sub- rack	256 in 16 I/O Sub- rack	2x128 in 2x8 I/O Subrack
Assembly kit no.	B 5230	B 5232-1	B 5232-2	B 5231	B 5233-1	B 5233-2

Abbreviations: CU central module
 CR central rack
 monit. mod. monitoring module
 I/O Input/Output

Details in brackets are options

Table: Assembly kits in the H51q system

For your notes

5 Technical Data

5.1 Mechanical Design

Structure	
H41q	one 19 inch subrack, 5 units high for central modules and IO modules
H51q	19 inch subrack, 1 central rack 5 units high, IO- racks 5 units high,
Modules in the central device	4 units and 8 units wide, 3 units high
Modules in the IO area	
H41q	4 units wide, 3 units high, max. 12 modules
H51q	4 and 8 units wide, 3 units high max. 256 modules with 4 units width
	1 unit wide = 5.08 mm (= 1 TE) 1 unit high = 44.45 mm (= 1 HE)
Connection of the cables	at the front via cable plugs with LED displays with digital modules

5.2 System Data

Operating voltage	24 V DC (Peripheral) 5 V DC (Microprocessor system)
Supply voltage	24 V DC +20 % -15 %, $r_{pp} \leq 15 \%$
Ambient conditions	0...+60 °C KUE according to IEC 68 pollution degree II according to DIN VDE 0160
Storage temperature	-40...+85 °C without battery -40...+75 °C (central modules and central racks with battery)

5.3 Data of the Central Modules

Type of processor	INTEL 386 EX
Clock frequency	25 MHz
Program memory	FlashEPROM for operating system and building blocks Flash-EPROM for user's program CMOS-RAM for variables

Battery backup for CMOS-RAM	Lithium battery on central modules
Battery monitoring	Measuring stage in central module
Diagnostic system	in the central module with 4 digit alphanumeric display and 2 LEDs
Diagnoses/ displays	information of the user's program Faults in the central device, IO bus, in safety related I/O modules, interfaces
Memory capacity for user	512 kbyte (logic, parameters, variables),
Basic cycle time	5 ms for single channel systems, 25 ms for redundant systems

5.4 Interfaces

5.4.1 RS 485 Interface

Interface type	2-wire bus interface with passive coupling (RS 485)
Number	2 interfaces on the central module
Interface extension in H51q	6 interfaces on 3 coprocessor modules
Baud rate	9600 bps up to 57600 bps
Connection to programming device	by RS 485 / RS 232 C converter, type H 7505 or BV 7043

5.4.2 Ethernet Interface

Interface type	Ethernet according to IEEE 802.3 with 10BaseT connection via RJ45
Interface extension in H51q	5 interfaces on 5 communication modules F 8625 (with redundant CU up to 10 interfaces)
Baud rate	10 Mbit/s

5.4.3 Profibus-DP interface

Interface type	Profibus-DP Slave coupling with RS 485
Interface extension in H51q	5 interfaces on 5 communication modules F 8626 (with redundant CU up to 10 interfaces)
Baud rate	up to 12 MBit/s

5.5 Definition of Signals

The signal definitions of the H41q and H51q systems are according to DIN 19238:

Input signals

L-signal (0-signal) - 3 ... + 5 V or open input
 H-signal (1-signal) + 13 ... + 33 V
 typ. switching point approx. 9 V

Output signals

L-signal (0-signal) 0 ... + 2 V
 H-signal (1-signal) + 16 ... + 30 V

5.6 Electromagnetic Compatibility (EMC)

All modules of the systems H41q and H51q meet the requirements of the EMC directive of the European Union and have the  sign.

5.6.4 Immunity

The test level is defined in the following standard:

EN 50 082-2 Electromagnetic Compatibility (EMC),
 Generic Immunity Standard Industrial environment

Standard	Test	Test value
NAMUR NE 2105/93	Mains interrupt total system	0...20 ms per 1 s: no malfunction
NAMUR NE 2105/93	Inrush current limiting	$I_{\max} \leq 15 * I_N$
IEC 1000-4-2 (DIN EN 61000-4-2)	Electrostatic discharge (ESD)	Contact: 6 kV, air discharge: 8 kV
IEC 1000-4-3 (DIN EN 61000-4-3)	Radio-frequency interference (RFI), radiated	10 V/m
IEC 1000-4-4 (DIN EN 61000-4-4)	Burst ¹⁾ (power supply lines) Burst ¹⁾ (data lines)	2 kV 2 kV (for process control) 1kV (no process control)
IEC 1000-4-5 (DIN EN 61000-4-5)	Surge pulse ²⁾ (power supply lines)	1 kV
IEC 1000-4-6 (DIN EN 61000-4-6)	Radio-frequency interference (RFI), conducted	10 V

¹⁾ fast transient disturbances

²⁾ transient disturbances with high energy

At an interference exceeding the limits shown above the system reacts safety-related.

5.6.5 Emission

EN 50 081-2 Electromagnetic Compatibility (EMC),
Generic emission standard Industrial Environment

EN 55 011 Suppression of Radio Disturbances of electrical
appliances and systems Measurement of the radio
interference voltage at 150 kHz to 30 MHz
Measurement of the interference field strength
at 30 to 1000 MHz

The systems H41q and H51q do not exceed the limit values of the class A
for the group 1 and provided for the usage in industrial environment.

5.7 Other Technical Tests, Climatic Tests

The tests listed in the following table are fulfilled from all PES of the H41q/
H51q system families.

Type of test	Test basis	Test conditions
Constant cold	IEC 68 / 08.85 part 2-1	0° C at U _{op} = 20.4 V
	IEC 68 / 03.80 part 2-2	60° C at U _{op} = 28.8 V
	IEC 68 / 12.86 part 2-3	4 days at 40° C and 93 % rel. humidity, non-operating. After that the rel. humidity is reduced to 75 % in 30 min. After that the temperature is reduced to 25 °C and follo- wing function test is performed.
Damp heat, cyclic	IEC 68 / 09.86 Teil 2-30	As "Damp heat" with 2 cycles within 24 h
Transport and storage temperature	VDE 0160, section 5.2.1	
Constant cold	IEC 68 / 08.85 part 2-1	-25° C for 16 h non operating, following function test
Constant dry heat	IEC 68 / 03.80 part 2-2	70° C for 16 h non operating, following function test
Damp heat	IEC 68 / 12.86 part 2-3	4 days at 40° C and 93 % rel. humidity, non-operating. After that the rel. humidity is reduced to 75 % in 30 min. After that the temperature is reduced to 25 °C and follo- wing a function test is performed.
Surface temperature rise	VDE 0160, section 7.2.3	60° C at U _{op} = 28.8 V. After that check of the temperaturvalues of the covers within normal arms reach.

Technical Data

Type of test	Test basis	Test conditions																																	
Impulse strength on the DC connection of rectifier-networks	VDE 0160, section 7.3.1.2	<table border="1"> <tr> <td>Overvoltages</td> <td colspan="2">3 voltage peaks with 1s distance</td> </tr> <tr> <td>Rise time</td> <td colspan="2">$t_r = 0.1 \text{ ms}$</td> </tr> <tr> <td>Amplitude height</td> <td colspan="2">2.3 x the value of the supply voltage</td> </tr> <tr> <td>Loop duration</td> <td colspan="2">$T = 1.3 \text{ ms}$</td> </tr> </table>	Overvoltages	3 voltage peaks with 1s distance		Rise time	$t_r = 0.1 \text{ ms}$		Amplitude height	2.3 x the value of the supply voltage		Loop duration	$T = 1.3 \text{ ms}$																						
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Amplitude height	2.3 x the value of the supply voltage																																		
Loop duration	$T = 1.3 \text{ ms}$																																		
Short-circuit strength	VDE 0160, section 7.3.3	<p>With operating temperatur the outputs are shorted until the final temperature is reached.</p> <p>After that removing of the short circuit and function test.</p>																																	
Protection by using functional extra-low voltage with safe isolation	Coupling elements according to DIN VDE 0884	The decisive voltage of 25 V AC resp. 60 V DC is given for the worst operating state and with agreed using.																																	
Clearance and creepage distances between circuits 24 V/24 V or 24 V/5 V	VDE 0110 / 01.89 part 1 VDE 0160, section 5.7	<table border="1"> <thead> <tr> <th colspan="3"><u>Clearance distance</u></th> </tr> <tr> <th>Pollution degree</th> <th>II</th> <th>III</th> </tr> </thead> <tbody> <tr> <td>Rated voltage of the printed conductor material glas-reinforced plastic</td> <td>50 V</td> <td>250 V</td> </tr> <tr> <td>Clearance distance for PCBs</td> <td>0.1 mm</td> <td>5.5 mm</td> </tr> <tr> <td>Clearance distance for equipment</td> <td>0.2 mm</td> <td></td> </tr> <tr> <td>Rated impulse voltage</td> <td>0.5 kV</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="3"><u>Creepage distance</u></th> </tr> <tr> <th>Pollution degree</th> <th>II</th> <th>III</th> </tr> </thead> <tbody> <tr> <td>Rated voltage of the printed conductor material glas-reinforced plastic</td> <td>50 V</td> <td>250 V</td> </tr> <tr> <td>Creepage distance for PCBs</td> <td>0.04mm</td> <td>2 mm</td> </tr> <tr> <td>Creepage distance for equipment</td> <td>0.5 mm</td> <td>2.5 mm</td> </tr> </tbody> </table>	<u>Clearance distance</u>			Pollution degree	II	III	Rated voltage of the printed conductor material glas-reinforced plastic	50 V	250 V	Clearance distance for PCBs	0.1 mm	5.5 mm	Clearance distance for equipment	0.2 mm		Rated impulse voltage	0.5 kV		<u>Creepage distance</u>			Pollution degree	II	III	Rated voltage of the printed conductor material glas-reinforced plastic	50 V	250 V	Creepage distance for PCBs	0.04mm	2 mm	Creepage distance for equipment	0.5 mm	2.5 mm
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Type of test	Test basis	Test conditions
Oscillation sinoidal	DIN/IEC 68-2-6:1995	Test F _a Frequency area: 10 - 150 Hz Acceleration: 1 g Number of sweep cycles: 10x (1 octave/min) System in operation
Shock	DIN/IEC 68-2-27:1987	Test E _a Amplitude: 15 g/11 ms System in operation

6 Applications

6.1 Configuration Hints

6.1.1 Programming System ELOP II and Operating System

For programming and operation of the H41q/H51q PES the version ≥ 1.31 is required.

Required operating system: BS 41q/51q V 7.0-7.

6.1.2 Modify Cabinet

In ELOP II: After RT declaration, the cabinet can be configured within the resource.

6.1.3 Usable Building Blocks

All standard building blocks of HIMA are included in the operating system. Therefore the user's program only contains the call of the building block and not the code itself.

For information to the current status of the building blocks refer to the most recent state of the operating system description.

6.2 Replacing the central modules of the H41/H51 system families

If central modules of the H41/H51 system families are replaced by those out of the H41q/H51q system families in the existing assembly kits two connections have to be rewired (refer also to the data sheets in the H41/H51 catalogue):

In the assembly kits of the **H41** system family:

- Remove connection XG22:9 to XG11:3 at XG22.9 and connect it to XG.22:4.
- Remove connection XG23:9 to XG10:3 at XG23.9 and connect it to XG.23:4.

In the assembly kits of the **H51** system family:

- Remove connection XG24:9 to XG1:3 at XG24.9 and connect it to XG.24:1.
- Remove connection XG25:9 to XG1:7 at XG25.9 and connect it to XG.25:1.

6.3 System Extensions

If an existing H51 system is changed in a H51q system and I/O racks out of the assembly kit are still part of the system it could be extend always with I/O racks out of the assembly kit B 9302. This extensions are covered through the TÜV certificate of the Bavarian TÜV. The control in operation is protected for continued existence also after the end of the certificate.

6.4 Installation of older types of output modules

For modules which where installed in conjunction with the IO-rack in the B 9301 assembly kit (F 3311, F 3312, F 3313, F 3314, F 3321, F 3323, F 3412, F 3413, F 6701) there are some specialities with installation in the IO rack of the B 9302 assembly kit.

The using of this modules also of the testable modules like F 3313, F 3314 and F 3323 is **not** admissible for safety related outputs! Because of the new designed realization of the shut down in the B 9302 assembly kit the supply voltage of an old output module can not be switched off automatically in case of a defective central module and so the outputs of the corresponding module can not be reset independent from the CPU.

The outputs will be frozen if:

- the central module or both central modules are failed or withdrawn
- the system changes to the STOP mode in case of a fault
- the system is set to the STOP mode by means of the programmer unit.

The outputs of the module may have H- or L-signal in the case of a fault. This is also valid for testable as for non-testable output modules. Switching off is only possible by withdrawing the module, the cable connector or by interrupting the modules supply voltage.

7 Installation and Connections

7.1 To Insert and to Withdraw Modules

The modules of the HIMA PES H41q, H51q may be withdrawn and inserted without disadvantageous influence for the system.

The modules may not be cant by a screwdriver or by vibrations.

7.1.1 I/O modules

Withdraw:

1. Remove fixing screws of the module.
2. Withdraw the module together with the cable plug.
3. Screw off the cable plug.

Insert:

1. Insert and fix the module without cable plug.
2. Plug in the cable plug and fix it by the screws.
3. With testable modules, press the ACK key on the central module.

7.1.2 Coupling Modules

Withdraw:

1. Switch off the module
2. Remove fixing screws of the module
3. Withdraw the module.

Insert:

1. Insert and fix the module
2. Switch on the module.

7.1.3 Central Module (CU) and Coprocessor Module (CM)

Withdraw:

1. Remove the screws of the data cable plugs.
2. Withdraw the data cable and bend it byside.
3. Remove the fixing screws of the module.
4. Withdraw the fixing screws completely till to the stop.
5. Separate the module from the bus board by means of the ejection lever (label) and than withdraw it completely.
6. Do not touch the components of the module! Watch for the EMC rules for CMOS components!

Insert:

1. Check the settings of the switches and jumpers according to the data sheet.
2. Withdraw the fixing screws of the frontplate completely till to the stop.
3. Insert module into the rack till to the stop.
4. Fix the screws.
5. Plug in the data cable and fix their screws.

7.1.4 Power Supplies

Withdraw:

1. Check the LEDs on the power supplies F 7126, F 7130A and of the monitoring modules F 7127, F 7131 (luminated LEDs indicate correct modules, dark LED indicates defective module.
Change only defective module, otherwise switching off of the PLC!)
2. If the LED is off check the 24 V DC feeding.
3. Before withdrawing the faulty power supply F 7126, F 7130A check the output voltage of all the other power supplies and in case of F 7126 adjust it to 5.4 V if necessary!
4. Screw off the faulty power supply and withdraw it.

Insert:

1. Insert power supply and fix it by screws.
2. Check the output voltage and adjust it if necessary.

7.1.5 Communication Module F 8625

Withdraw:

1. Disconnect the ethernet cable and bend it byside.
2. Remove fixing screws of the module.
3. Withdraw module with HSR cable connected.
4. Remove HSR cable.

Insert:

1. Check settings acc. to data sheet.
2. Insert module without cable and fix it.
3. Connect HSR cable.
4. Connect ethernet cable.

7.2 Earthing of the 24 V DC System Voltage

Please regard the requirements of the SELV EN 60950 or PELV EN 60904. To improve the electromagnetic compatibility an instrument earth is provided. The instrument earth is designed within the cabinet in such a way that it fulfils the requirements of a protection earth.

All H41q/H51q systems can be operated with earthed L- or not earthed.

7.2.1 Floating Supply

With several undetected earth faults faulty control signals may be released. To prevent this, with floating operation in any case an earth fault monitoring system must be provided (ref. also to VDE 0116).

An earth fault can only be located by switching off a partial function (separation of lines). If both poles are feed to supply an output circuit an earth fault can be detected.

7.2.2 Earthed Operation

It is prerequisite that the earthing conditions be excellent and there is a separate earth connection (if possible) through which no external currents flow. Only the earthing of the L- negative pole is permitted. Earthing of the L+ positive pole is not permissible, as any earth fault on the sensor line would result to an overriding of the sensor concerned.

L- may only be earthed at one point within the system. Generally L- is earthed directly behind the power supply (e. g. on the bus bar). The earthing should be easy to access and disconnect. The earthing resistance must be ≤ 2 Ohm.

7.3 Measures to Install a Cabinet According to the Requirements

According to the guideline 89/336/EEG of the European Council (also law for EMC in the Federal Republic of Germany), since January, 1st 1996 all electrical equipments have to be provide with the CE symbol in relation of Electromagnetic Compatibility (EMC) within the European Union.

All modules of the HIMA system families H41q/H51q are supplied with the CE symbol.

To prevent also EMC problems with the installation of controls (PLCs) in cabinets and frames, the following measures are required:

- Installation of the **H 7013** HIMA module as power supply filtre directly on the 24 V DC feeding. The filtre is not required if power supplies with the CE symbol are used e. g. the HIMA standard power supplies 600S24 and 1200S24.
- Correct and interference-free electrical installation in the ambient of the control, e. g. no power current cables should run together with the 24 V cables.
- If the 24 V feeding is installed in an own power supply cabinet separated from the cabinets with PLCs, no filtre H 7013 is necessary if the all the cabinets are installed near by the others.
- Furthermore please notice the hints within the main catalogue concerning earthing, screening and cable run to sensors and actors.

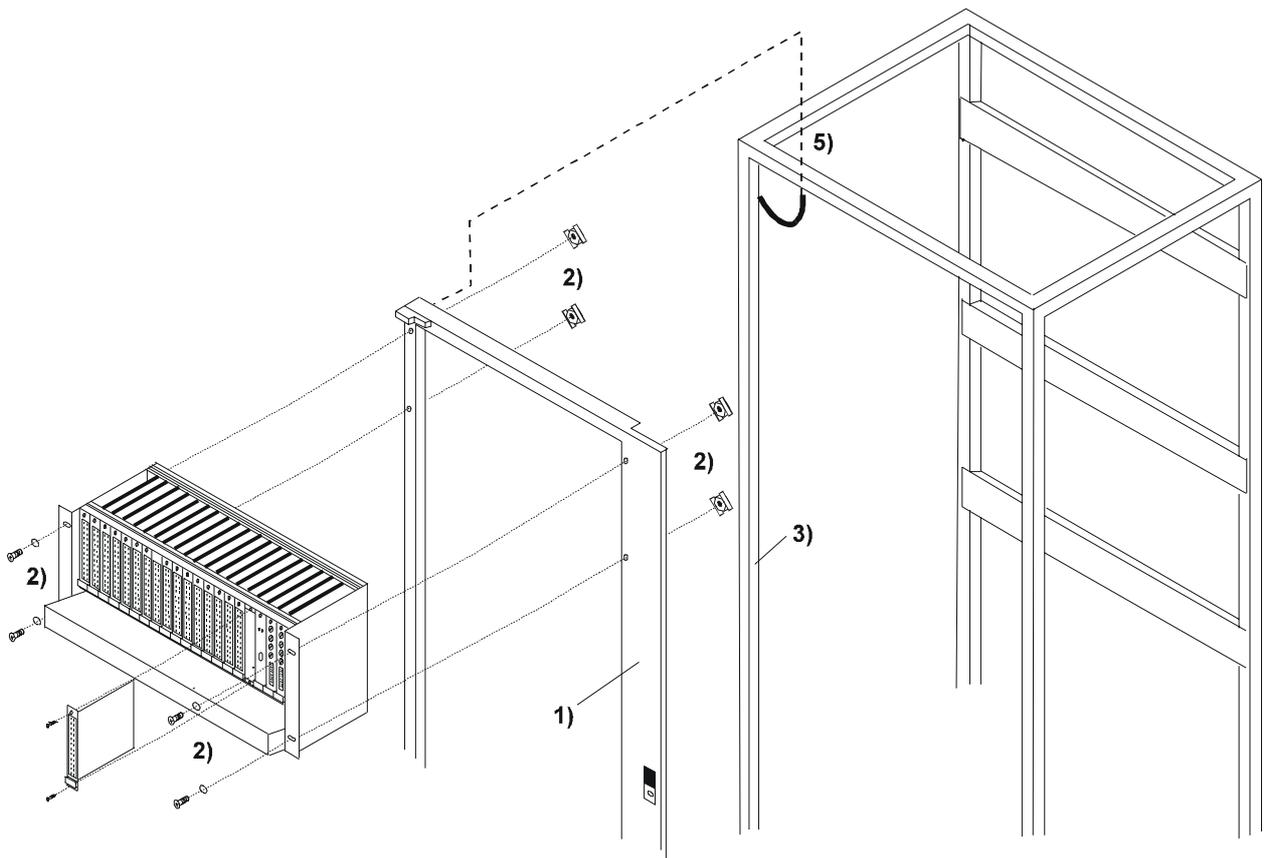
7.4 Earthing in the HIMA PES

Reliable earthing and thus the fulfilment of the valid EMC regulations in HIMA systems is achieved by the measures described below.

7.4.1 Earthing Cable Run

All touchable plates of the 19-inch HIMA components (e. g. blind plates and subracks) are electrically conductive passivated (ESD protection, ESD = Elerostatic Discharge). The safe electrical connection between built-in components, such as subracks, and the cabinet is made via captive nuts with claws. The claws penetrate the surface of the swing frame (1) and thus guarantee a safe electrical contact. The screws and washers used are made of high-grade steel to avoid electrical corrosion (2).

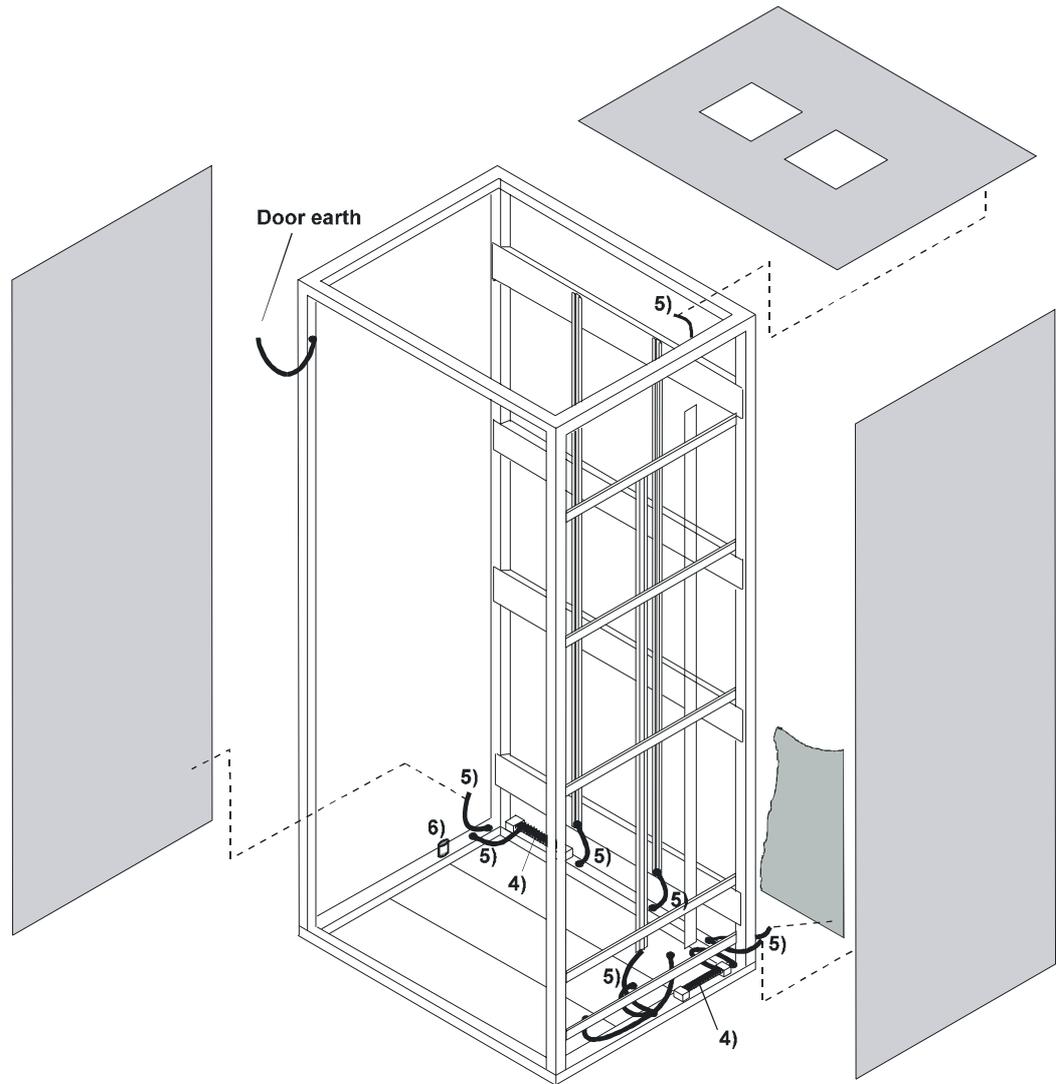
The parts of the cabinet framework (3) are welded together and therefore make up an electrically conductive constructional element. Bottom plate and top plate, side panels, rear panel, swing frame, door, mounting rails and mounting plates (if existing) are conductively connected to the cabinet framework via short earthing strips having a cross section of 16 mm² or 25 mm². The earthing strips are covered with a yellow/green identifying sheath (5).



Installation and Connections

As a standard, two M 2500 (4) busbars on insulators are already installed in the cabinet and are connected to the cabinet framework via 25 mm² (5) earthing strips. On the other hand the busbars can be used for a potential separated from the earthing by removing the earthing strips (e.g. for the screening of field cables)(4).

For the connection of the customers earthing an M8 screw bolt is provided on the cabinet framework (6).



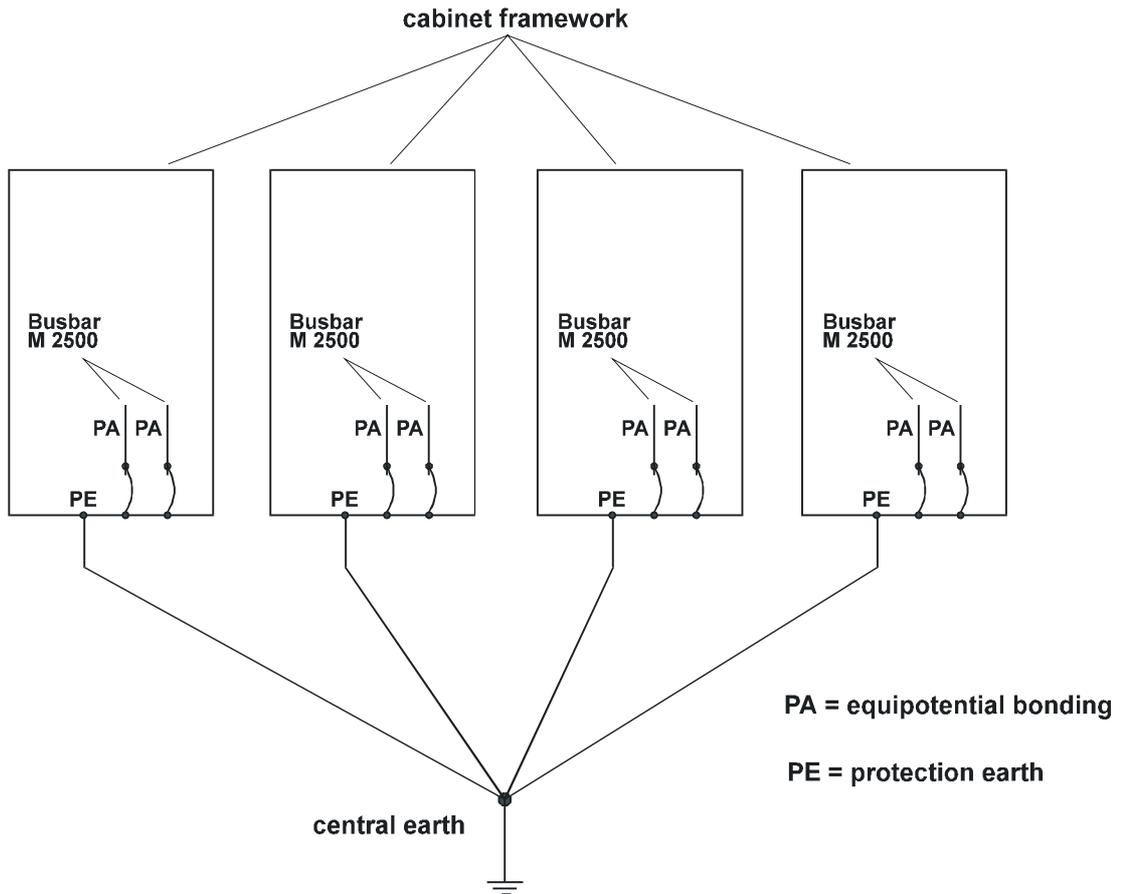
Size of the Earthing Straps:

Location of installation	Cross section	Length
Side panels, rear panel	16 mm ²	170 mm
Mounting rails, (single-sided with connector sleeve)	16 mm ²	300 mm
Door, top plate, bottom plate	16 mm ²	300 mm
swing frame	25 mm ²	300 mm
M 2500 potential bar, (single-sided with connector sleeve)	25 mm ²	300 mm

7.4.2 Fastening of the Earthing Strips

Regard the correct connection of the earthing straps!

7.4.3 Interconnecting the Earth Terminals of Multiple Switchgear Cabinets.



The earth must be with less interference voltage as possible. If this cannot be achieved, a separate earth for the control has to be installed.

7.5 Screening of Data Lines in the HIMA Communication Systems

Reliable screening of data lines in HIMA communication systems is achieved by the following measures:

The connection ¹⁾ of the cable screen from the bus subscribers (H41q, H51q) to the bus terminals (H 7506) is established on the bus subscribers side. Via the plug case and the metal front plate a connection is established via the PCB layout to the PE cabinet earth. The other side of the cable screen is not connected.

7.6 Screening in the Input/Output Area

Pay attention, that with the field cable installation the cables to sensors and actors are separated from power supply cables and in a sufficient distance from electromagnetic active devices (motors, transformers).

Cables to the input modules of the H41q/H51q systems have to be installed interference-free as possible e. g. as screened cables.

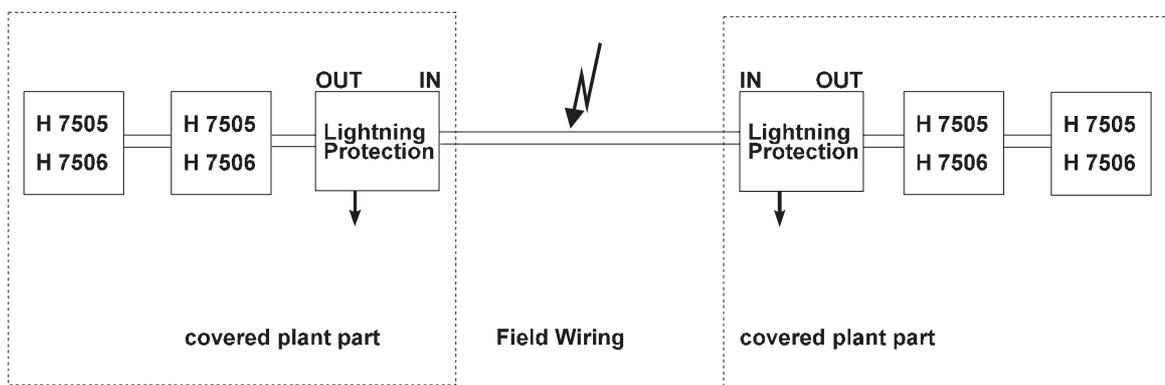
With cable connectors having a screen termination line this has to be connected to the bus bar of the I/O rack under the slot of the module.

7.7 Lightning Protection in HIMA Communication Systems

Due to the complete screening of the field wiring of HIMA communication systems and with correct installation of the system earthing problems in form of high energetic influences caused of flash of lightning might not occur.

If nevertheless a lightning protection should be designed, it could be provided by using special lightning protection modules. For this the module of type MTRS485 "DATA-MODUTRAB" from Phoenix company is used up to now. The module is provided for coarse protection (influences up to 10 kA) and fine protection (influences up to 400 A).

The connection of the lightning protection modules is according to the scetch below:



Planning hints:

The using of this lightning protection module reduces the max. possible transmission length because of its series resistance.

For HIBUS-2 the max. transmissions length is 1200 m with 0.25 mm² wiring cross section resp. 2400 m with 0.5 mm² wiring cross section. The loop resistance is 180 Ω in both cases. The calculation of the remaining length of the bus refers on a continuous wiring with the same cross section according to the formular:

$$L_R = ((180 \Omega - n \times 4,4 \Omega) / (2 \times R_L)) \times 1000 \text{ with}$$

L_R = remaining length in m

n = number of line protection modules per direction

R_L = line resistance in Ω/km

The result is a remaining length of 1141 m (2 modules, $R_L = 75 \Omega/\text{km}$) for 0.25 mm² resp. 2313 (2 modules, $R_L = 37 \Omega/\text{km}$) for 0,5 mm² cross section.

The line protection modules should not be installed in the same cabinet as the PES.

For your notes

8 Startup and Maintenance

The tests and recommended measures for the startup, maintenance and fault detection are briefly summarized.

To limit the extent of the documentation, The chapters concerned in this catalogue and in the other printouts of the HIMA system documentation are referred to.

8.1 Recommended Devices for Startup and Maintenance

- Personal computer, for the work on site as portable computer. All projects of the system in their current state and the HIMA system software should be on the hard disk.
- High resistance multimeter with ohmmeter
- Sensors to simulate analog signals.

8.2 Installing the System

The control cabinets are delivered with the modules plugged in and fixed with screws, and with free connectors. They have been tested with these modules in the factory, so that the following tests concentrate on the correct external installation.

8.3 Earthing the 24 V DC System Voltage

Refer to chapter 7.2.

8.4 Starting up the Control Cabinet

8.4.1 Testing All Inputs and Outputs for External Voltage

Impermissible external voltages (especially e.g. 230 V AC to earth or L-) can be measured with a multimeter or with the HIMA digitest device. We recommend checking each connection for impermissible external voltage.

8.4.2 Testing All Inputs and Outputs for Earth Faults

When testing the external cables for insulating resistance, short circuits and wire breaks, the cables must be disconnected at both ends in order to avoid damaging or destroying the modules with excessive voltage.

The testing for earth faults is carried out after the disconnection of the free connectors for the sensors and control elements. The voltage connections of the free connectors on the potential distributors must also be disconnected, and the negative pole must be separated at the control elements.

If the negative pole is set up for earthed operation, the earth connection must be interrupted while testing for earth faults. This also applies for the earth connection of possibly existing earth fault testing facilities.

Any connection can be tested to earth with an ohmmeter or a special testing device.

Note: In this state the system is set up for testing if individual lines or a group of lines are insulated against earth, but not if two lines are insulated against each other. Otherwise there is a risk of damage.

The guideline for test voltages and insulating resistance is DIN VDE 0100, part 600 section 9.

8.5 Power Supply

The input/output modules and their free connectors are fixed with screws. To prevent the loosening of all screws and the pulling out of the input/output modules, the 24 V DC operation voltage has to be checked for correct polarity, level and ripple before it is connected.

8.6 Functional Testing

8.6.1 Preparing Functional Testing

For functional testing check the equipment of the control cabinet completely with help of the label and/or documentation printout "I/O subrack". All free connectors of the input/output modules have to be connected to the allocated input/output racks, and the voltage connections of the cable connectors to the allocated voltage distributors. All control elements (control devices) must be released by the factory management or be driven without auxiliary power.

8.6.2 Testing in the Central Devices

The essential tests in the central devices of the H41q/H51q system are:

Central module	switch positions for station no. and transmission rate, version of the operational system via display
Communication module F 8621A (only H51q systems)	operating system EPROM
Communication module F 8625 (only H51q systems)	switch positions for module number and mono/redundant using
Communication module F 8626 (only H51q systems)	switch positions for station address on the Profibus-DP

I/O bus connection refer to the data sheet of the appertaining assembly kit

We recommend marking all required switch positions etc. in copies of the data sheets of the respective control cabinet and keeping the copies in the pocket of the cabinet door. Should modules have to be exchanged, the necessary information will thus be immediately available.

8.6.3 Testing in the Input/Output Racks

The essential tests in the input/output racks are:

Connection module (F 7553) (only H51q systems)	switch position for coding the rack according to resource type Wiring, especiall watchdog signal, refer to data sheets of the assembly kits and the safety manual
--	--

For the construction of the I/O bus refer to the data sheets of the B 9302 assembly kit and of the H41q ass. kits.

The input/output racks themselves have no code. You only have to pay attention to the correct position of the module and the corresponding cable connector. The existing fuse modules including fuses have to be checked for completeness. Also check the correct assignment of the 24 V supply to the slots of such modules which need the feeding via the rear bus.

8.6.4 Switching on the HIMA PES

After the operating voltage has been connected, the HIMA PES goes into RUN operation, if the user program has been loaded and no error has been found in the system.

If STOP is displayed there is an error. Only after the correction of the error, e.g. setting the correct switch position or jumper, correct connecting lines, or possibly after the exchange of a module etc. is the RUN operation started.

Errors can be called via 2 buttons via the diagnostic display or via the menu "Detailed Error Display" (refer to the documentation of the operating system) or after the start of the communication between programming device and PES.

8.6.5 Starting the Communication between Programming Device and PES

For construction and startup of the communication between programming device and PES refer to the documentations user manual ELOP II and user manual resource type.

Communication faults can be checked with help of a program for monitoring, logging and analyzing of the data communication (refer to manual "HI-KA").

8.7 Alterations

8.7.1 Alterations of Constants, Parameters and Set Points of Timers

Refer to the user manual ELOP II.

8.7.2 Alterations of the Program

Refer to the user manual ELOP II.

8.8 Maintenance

Attention: Maintenance on supply, signal and data lines may only be executed by qualified personnel with consideration off all ESD protection measures. With direct contact of this lines the maintenance personnel have to be electrostatic discharged!

HIMA PES are designed for tough industrial conditions. Electronic elements have a very low failure rate after the initial operating phase of approx. 500 to 1000 h. This initial operating time is already attained in the course of functional tests at the factory and when putting the system into operation.

Wear can only occur in relay outputs with heavy loads and/or those which are often switched if relay output modules are used. When wear of this kind occurs they should be completely replaced as a preventive measure. We recommended exchanging electrolytic capacitors within the power supply every 5 years.

8.8.1 Procedure to Exchange the Buffering Batteries

Lithium batteries are used to buffer the RAMs. We recommend exchanging of these batteries approx. every 2,5 years.

Power supply monitoring module F 7131:

Battery: CR-1/2 AA-CB, HIMA-Part no. 44000016

The module can be pulled out under voltage. Then a system alarm will be released and on the display of the central module the message BATE (fault external buffering battery) occurs. Then unsolder batteries (1st + pole, then - pole). With soldering of the new batteries regard for correct polarization and solder at first the - pole and then the + pole.

Central module: F 8650, F 8651, F 8652, F 8653:

Battery: CR 2477N, HIMA-part no. 44000018

The module may be pulled out under voltage. With single channel systems this results in a shut down of the plant, in redundant systems the system reaction if a central module is pulled out depends on the configuration.

Coprocessor module F 8621A:

This module which may be installed as an option within the central rack of the H51q system family is buffered via the batteries on the F7131 power supply monitoring module.

8.9 Fault Detection

8.9.1 Faults in the Central Device

If there is a faulty central module in PES with one central module, this is usually recognized when the PES switches off.

If there are faults in PES with redundant central modules, the device having no failure takes over the operation without interruption. The diagnosis display on the functioning central module indicates MONO and the diagnosis display of the faulty central module shows STOP. If you press the buttons on the front of the faulty central module, the type numbers of the possible faults are displayed (refer to the manual "Functions of the Operating Systems").

When the programming device is connected it serves the possibility to display the errors found. These values are stored in the RAM (memory) of the PES. These values are important to get a clear analysis of the errors. They should be saved with "Print" or "Export" (refer to the user manual ELOP II).

Attention has to be paid to correct switch positions and correct version of the operational system (on the display) if the central module is replaced (for insertion and withdrawing of modules within the central rack refer to chapters 7.1.3 and 7.1.4).

If the user program has to be loaded after exchanging the central module then pay attention that with redundant PES the correct central module will be loaded. Also pay attention that the code version of the existing and user program to be load is the same.

8.9.2 Faults in the Input/Output modules

Faults on **safety related** input/output modules are recognized automatically by the PES during operation and they are displayed on the diagnosis display by I/O error with the indication of the faulty position.

If an input/output module has a line monitoring also the feeding lines to sensors and actors are checked and faults are indicated on the diagnosis display additionally with the defective channel number. In this case also the external wiring has to be checked and the module must not be changed.

The effect of faulty channels of **not safety related** input/output modules will be the difference between the signal status in the logic and of the appertaining LEDs on the cable connector. If the logic signal does not match the LED display, the respective input/output module must be exchanged. With output modules you should first check whether the control element works or whether there is a line break.

Input/output modules can be inserted and pulled out during operation. For Insertion and withdrawing of input/output modules refer to chapter 7.1.1.

8.9.3 Repairing Modules

As already described the modules of the HIMA PES have a high reliability, so that modules will fail only in long time intervals. We do not recommend establishing a repair by the user as special testing programs are necessary the legal requirements for intrinsically safe and fail-safe modules.

Defective modules are sent to HIMA for repair with a short fault description after they have been checked on the customer's premises. The fault description should contain:

- fault history
- measurements to repair up till now
- Detailed failure diagnosis (refer to the user manual ELOP II and the user manual resource type), in case of redundant PES the diagnosis of both central modules should be sent

With input/output modules the fault description should contain an information to the measures to repair up till now (check of the power supply, exchange of the module).

8.9.4 HIMA Service and Training

Appointments can be made with the Service Department VTS concerning startup, testing or modifying of the control cabinets as well as the extent of the work to be done.

HIMA makes special training based on the current training program for its software programs and the hardware of the PES. This training usually takes place in HIMA. We also offer training on site on the customer's premises. Please send for information on the current training program as well as for the dates of the internal training at HIMA. Offers and external training or special training can also be appointed.

9 Overview Data Sheets

In the appendix you can find the data sheets for the assembly kits, the data connection cables and the modules in alphanumerical order. The following lists and tables gives you an overview.

9.1 Assembly kits

B 4230	System H41q-M 19 inch, 5 units high
B 4231	System H41q-MS 19 inch, 5 units high
B 4232-1	System H41q-H 19 inch, 5 units high
B 4232-2	System H41q-HR 19 inch, 5 units high
B 4233-1	System H41q-HS 19 inch, 5 units high
B 4233-2	System H41q-HRS 19 inch, 5 units high
B 5230	System H51q-M central rack 19 inch, 5 units high
B 5231	System H51q-MS central rack 19 inch, 5 units high
B 5232-1	System H51q-H central rack 19 inch, 5 units high
B 5232-2	System H51q-HR central rack 19 inch, 5 units high
B 5233-1	System H51q-HS central rack 19 inch, 5 units high
B 5233-2	System H51q-HRS central rack 19 inch, 5 units high
B 9302	I/O subrack 19 inch, 4 units high, for H51q
B 9361	Additional power supply 5 V DC, 5 units high, for H51q

9.2 Central Modules

Type	PES	safety related AK 1-6	Double processor
F 8650	H51q-MS, HS, HRS	•	yes
F 8651	H51q-M, H, HR		no
F 8652	H41q-MS, HS, HRS	•	yes
F 8653	H41q-M, H, HR		no

9.3 Power Supplies

F 7126 Power supply 24 V DC / 5 V DC, for H51q
 F 7130A Power supply 24 V DC / 5 V DC, for H41q

9.4 Input-/Output Modules

For the appertaining software building block refer to the description of the used operating system.

9.4.1 Digital Input Modules

Contact	Prox. switch	safety related AK 1...6	LS & LB	safe isolation	(Ex)i	Counter	Space requirement	Type
•				•			4 TE	F 3221
•	•			•			4 TE	F 3222
•	•			•	•		4 TE	F 3223
•	•			•	•		4 TE	F 3224
•		•		•			4 TE	F 3236
	•	•	•	•			4 TE	F 3237
	•	•	•	•	•		8 TE	F 3238
•				•		•	4 TE	F 5203

LS = line short circuit monitoring
 LB = line break monitoring
 TE = units width

9.4.2 Analog Input Modules

0/4...20 mA	Voltage	safety related AK 1...6	Pt100	safe isolation	(Ex)i	Space requirement	Type
•	0...10 V			•	•	4 TE	F 6208
•	0...1/5/10 V	•		•		4 TE	F 6214
•	0...1/5/10 V		•	•		4 TE	F 6215
•	0...1/5/10 V		•	•		4 TE	F 6216
•	0...1/5/10 V		•	•		8 TE	F 6216A
•	0...5/10 V	•		•		4 TE	F 6217

9.4.3 Output Modules

24 V DC	> 24 V	safety related AK 1...6	LS & LB	safe isolation	Load	Space requirement	Type
•				•	≤ 0.5 A	4 HE	F 3322
•		•		•	≤ 0.5 A	4 HE	F 3330
•		•	•	•	≤ 0.5 A	4 HE	F 3331
•				•	≤ 2 A	4 HE	F 3332
•		•		•	≤ 2 A	4 HE	F 3333
•		•	•	•	≤ 2 A	4 HE	F 3334
	•			•	≤4 A, ≤60 V	4 HE	F 3422
		•		•	0...20 mA	4 HE	F 6705
				•	0...20 mA	4 HE	F 6706

LS = line short circuit monitoring
 LB = line break monitoring
 TE = units width

9.4.4 Current Distribution Modules and Subracks

F 7133 4-fold power distribution with fuse monitoring

9.4.5 Additional Devices

F 7131 Power supply monit. with buffer batteries for H51q

H 7013 Power supply filtre

9.5 Communication Modules

F 8621A H51q coprocessor module

F 8625 Communication module for ethernet communication for H51q

F 8626 Communication module for Profibus-DP communication for H51q

9.6 Modules for I/O Bus Coupling

F 7553 Coupling module for H51q

9.7 Bus connection modules for HIBUS

H 7505 data signal converter RS 232C/ 20 mA/ 2-wire/ 4wire (HIBUS)

H 7506 Bus terminal module for 2 wire-buses

9.8 Relay Modules

H 4116	Relay in terminal box, safety related, 4 A
H 4122	Relay in terminal box, 4 A
H 4135	Relay in terminal box, safety related, for safety circuits

9.9 Data Connecting Cables

BV 7032	Data cable of the I/O bus
BV 7040	H 7506 <--> H 41q/H51q
BV 7043	H 41q/51q <--> RS 232 C (AT) without additional power supply
BV 7044	RS 232C (AT) <--> H 7505
BV 7045	HIKA connection cable
BV 7046	H 7506 <--> H41q/H51q single channel and redundant
BV 7048	H 7505 <--> H41q/H51q redundant
BV 7049	H41q/H51q redundant <--> optical fibre of Lütze
BV 7050	H41q/H51q single channel <--> optical fibre of Lütze
BV 7051	H 7506 <--> optical fibre of Lütze
BV 7052	H 7505 <--> HIMA systems single channel
BV 7053	HSR-cable for redundant communication module F 8625

9.10 General Hints to the Data Sheets

9.10.1 I/O Modules

The block diagrams already show the direction of signal flow from the top to the bottom.

With input modules the input signal (from sensor, proximity switch etc.) is lead via the cable connector and input module to the I/O bus or in the mechanical principle from the front to the rear side of the I/O subrack.

With output modules the result of the logic operation in the user's program is switched from the I/O bus to the output amplifier via the cable connector to the actuators (relay, magnetic valve etc.). The mechanical principle ist from the rear to the front side of the I/O subrack.

By knowing the direction of signal flow you also are able to see on which side the 5 V and 24 V operating voltages are fed in.

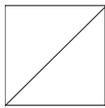
9.10.2 Modules within the Central Rack

Here you can see the essential components and the positions of switches and jumpers. Additionally the front view is shown. The essential functions are described in the system descriptions (chapter 3 for the H41q and chapter 4 for the H51q)

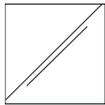
9.10.3 Kommunikationsbaugruppen

Applications for the using of the communication modules F 8625 and F 8626 are described in the appertaining data sheets.

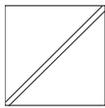
9.10.4 Symbols in the Data Sheet Diagrams



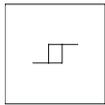
Function unit and signal converter



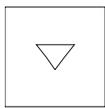
Function unit and signal converter with galvanic isolation



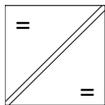
Function unit and signal converter with safety isolation



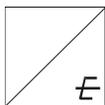
Trigger stage (threshold input)



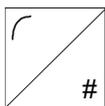
Amplifier in direction of signal flow



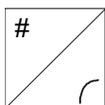
DC/DC converter



Transmitter



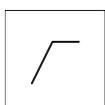
Analogue/Digital converter



Digital/Analogue converter



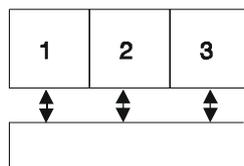
Automatic testing for operation



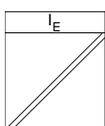
Signal contraction



Channel numbers according to "Modify Cabinet in ELOP II"

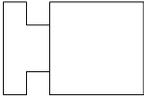
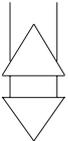
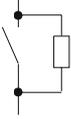


Module with automatically test functions



Threshold input for line break and line short circuit monitoring

Overview Data Sheets

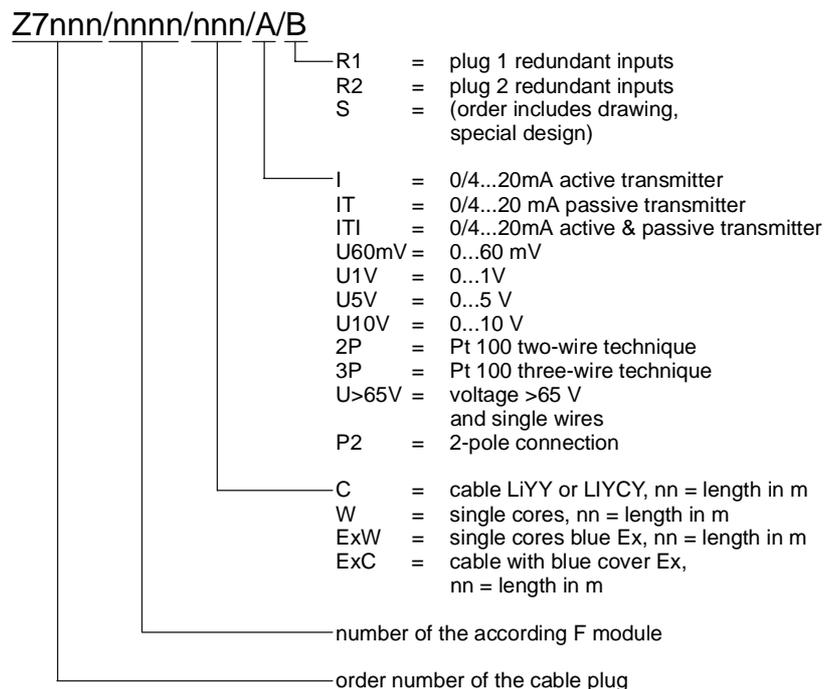
		Proximity switch without attenuation, high current to the amplifier
		Proximity switch with attenuation, low current to the amplifier
		Input filter, testable
		control block for registers
		Multiplexer
		I/O bus
		Indicator light (LED), off
02		no. of the channel
		Indicator light (LED), on (in function tables)
		Current source
		
		Sensor with resistor as near as possible on the sensor
		Diode
		Light-emitting diode
		Relais with reverse current diode
		Resistance thermometer Pt 100
		Fuse
		Fuse
		Power source

4F	On the input: Load of the signal 4F = 8 mA at 24 V signal range: +13 ... +33 V
100F	On the output: Loadability of the signal 100F = 200 mA
$\leq 15 W$	Loadability of the output $\leq 15 W$
L+	Positive pole of the 24 V DC supply voltage
EL+	Decoupled positive pole of the 24 V DC supply voltage
L-	Reference pole of the 24 V DC supply voltage
+5 V	Positive pole of the microprocessor system
GND	Reference pole of the microprocessor system

9.10.5 Color Code for Lead Marking

ws	white	rs	pink
br	brown	bl	blue
gn	green	rt	red
ge	yellow	sw	black
gr	grey	vio	violet

9.10.6 Description of the Order Code for the Cable Plug



Detailed examples for order codes see price list of the HIMA PES.

HIMA
... the safe decision.



HK 99.08E
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