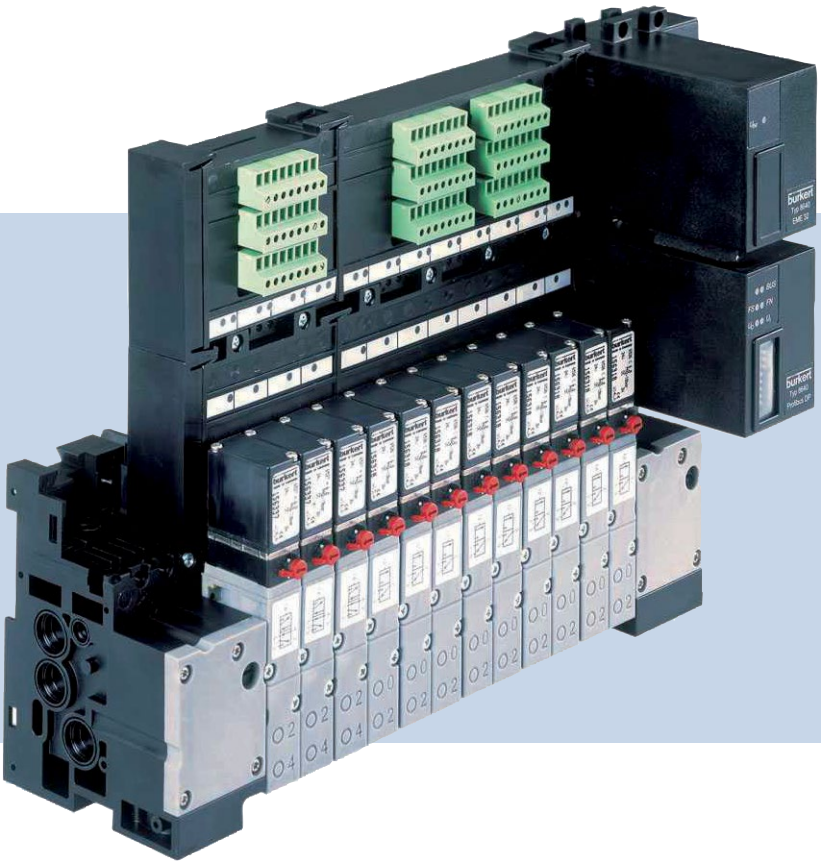
bürkert
FLUID CONTROL SYSTEMS

Type 8640
AirLINE

Modular valve terminal



Operating Instructions

MAN 1000010102 EN Version: R Status: RL (released | freigegeben) printed: 22.01.2019

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Operating Instructions 1901/24_EU-en_00800665 / Original DE

Valve terminal type 8640

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1. OPERATING INSTRUCTIONS

The operating instructions describe the entire life cycle of the device. Keep these instructions in a location which is easily accessible to every user, and make these instructions available to every new owner of the device.

WARNING!

The operating instructions contain important safety information!

Failure to observe these instructions may result in hazardous situations.

- The operating instructions must be read and understood.

1.1. Symbols

DANGER!

Warns of an immediate danger!

- Failure to observe the warning will result in a fatal or serious injury.

WARNING!

Warns of a potentially dangerous situation!

- Failure to observe the warning may result in serious injuries or death.

CAUTION!

Warns of a possible danger!

- Failure to observe this warning may result in a moderate or minor injury.

NOTE!

Warns of damage to property!

- Failure to observe the warning may result in damage to the device or the equipment.

Indicates important additional information, tips and recommendations.

Refers to information in these operating instructions or in other documentation.

→ designates a procedure which you must carry out.

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2. AUTHORIZED USE

Use of the valve terminal type 8640 for purposes other than those for which it is intended may represent a hazard to persons, nearby equipment and the environment.

- Do not use the device outdoors unprotected.
- Use according to the authorized data, service and operating conditions specified in the contract documents and operating instructions. These are described in the chapter on "Technical data".
- The device may be used only in conjunction with third-party devices and components recommended and authorized by Bürkert.
- Correct transportation, storage, and installation, as well as careful use and maintenance are essential for reliable and faultless operation.
- Use the device only as intended.

2.1. Restrictions

If exporting the system/device, observe any existing restrictions.

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3. BASIC SAFETY INSTRUCTIONS

These safety instructions do not make allowance for any:

- Contingencies and events which may arise during the installation, operation and maintenance of the devices.
- Local safety regulations – the operator is responsible for observing these regulations, also with reference to the installation personnel.

Danger – high pressure!

- Before dismounting pneumatic lines and valves, turn off the pressure and vent the lines.

Risk of electric shock!

- Before reaching into the device or the equipment, switch off the power supply and secure to prevent reactivation!
- Observe applicable accident prevention and safety regulations for electrical equipment!

Risk of burns/risk of fire if used continuously through hot device surface!

- Keep the device away from highly flammable substances and media and do not touch with bare hands.

General Hazardous Situations.

To prevent injuries:

- Do not supply the medium connectors of the system with aggressive or flammable media.
- Do not physically stress the body (e.g. by placing objects on it or standing on it).
- Note that pipes and valves must not become detached in systems which are under pressure.
- Before any work is done on the system, always switch off the power supply.
- Design the pressure supply with the largest possible volume to prevent a pressure drop when the system is switched on.
- Ensure that the system cannot be activated unintentionally.
- Installation and maintenance work may be carried out only by authorized technicians with the appropriate tools.
- After an interruption in the power supply or pneumatic supply, ensure that the process is restarted in a defined or controlled manner.
- The device may be operated only when in perfect condition and in consideration of the operating instructions.
- The general rules of technology must be observed for application planning and operation of the device.

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NOTE!

Prevent a pressure drop!

To prevent a pressure drop, design the system pressure supply with the largest possible volume.

Electrostatic sensitive components/modules!

The device contains electronic components, which react sensitively to electrostatic discharge (ESD). Contact with electrostatically charged persons or objects is hazardous to these components. In the worst case scenario, they will be destroyed immediately or will fail after start-up.

- Observe the requirements in accordance with EN 61340-5-1 and 5-2 to minimize/avoid the possibility of damage caused by a sudden electrostatic discharge!
- Also, ensure that you do not touch electronic components when the power supply voltage is present!

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4. GENERAL INFORMATION

4.1. Contact addresses

Germany

Bürkert Fluid Control Systems
Sales Center
Christian-Bürkert-Str. 13-17
D-74653 Ingelfingen
Tel. + 49 (0) 7940 - 10 91 111
Fax + 49 (0) 7940 - 10 91 448
E-mail: info@burkert.com

International

Contact addresses can be found on the final pages of the printed operating instructions.

And also on the Internet at:

www.burkert.com

4.2. Warranty

The warranty is only valid if the device is used as intended in accordance with the specified application conditions.

4.3. Information on the Internet

The operating instructions and data sheets for Type 8640 can be found on the Internet at:

www.buerkert.com

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5. PRODUCT DESCRIPTION

5.1. Application area

The valve terminal type 8640 is intended for use in an industrial environment. The valves can be combined very easily and efficiently thanks to the modular design.

DANGER!

Risk of electric shock!

- Before reaching into the device or the equipment, switch off the power supply and secure to prevent reactivation.
- Observe applicable accident prevention and safety regulations for electrical equipment.

5.2. General description

Thanks to its strictly modular construction in terms of the pneumatic and electrical interfaces the type 8640 valve terminal is suitable for a wide range of tasks, including complex ones. By aligning pneumatic modules in sequence with varying numbers of valves it is possible to configure up to 24 valve functions on one valve terminal.

The electrical connection technology can be implemented as required via field bus interfaces, collective sockets (parallel connection technology) or multi-pole interfaces. The valves are designed for various usage scenarios. The body and connection modules are manufactured using high quality plastic (polyamide) and can be connected and released easily thanks to an integrated attachment mechanism.

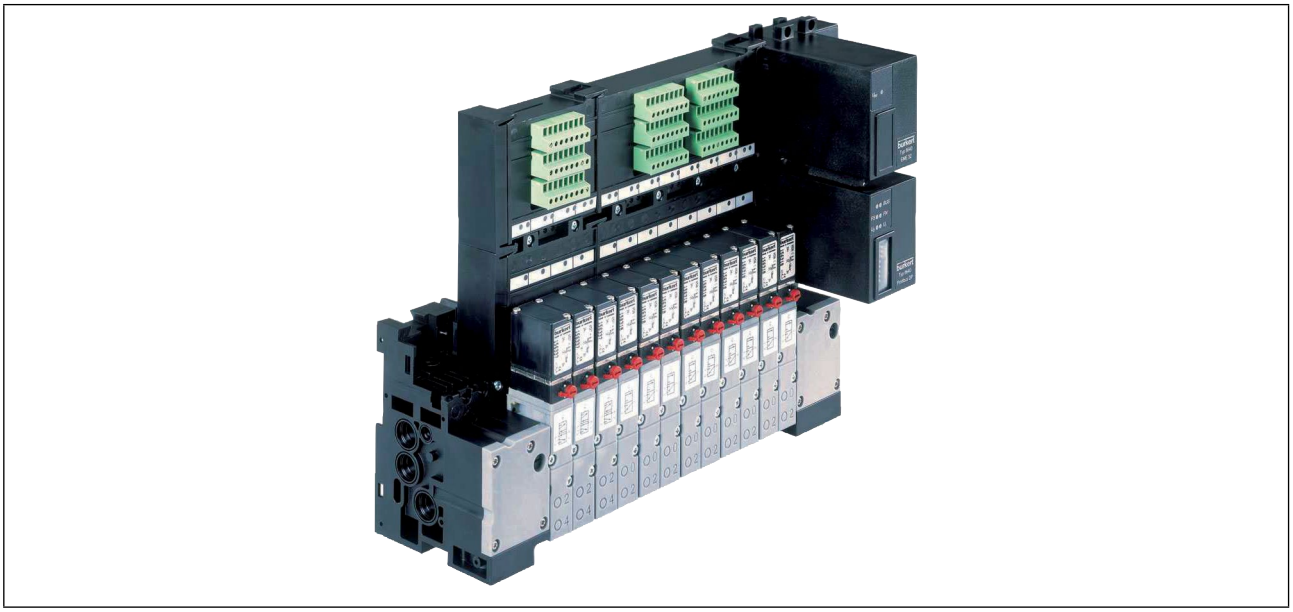

Figure 1: Example of usage for pneumatic modular valve terminal type 8640

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5.3. Structure of the system

Each valve terminal is configured according to customer requirements. To ensure optimal performance for the task in question a large range of electrical and fluid-related components is available.

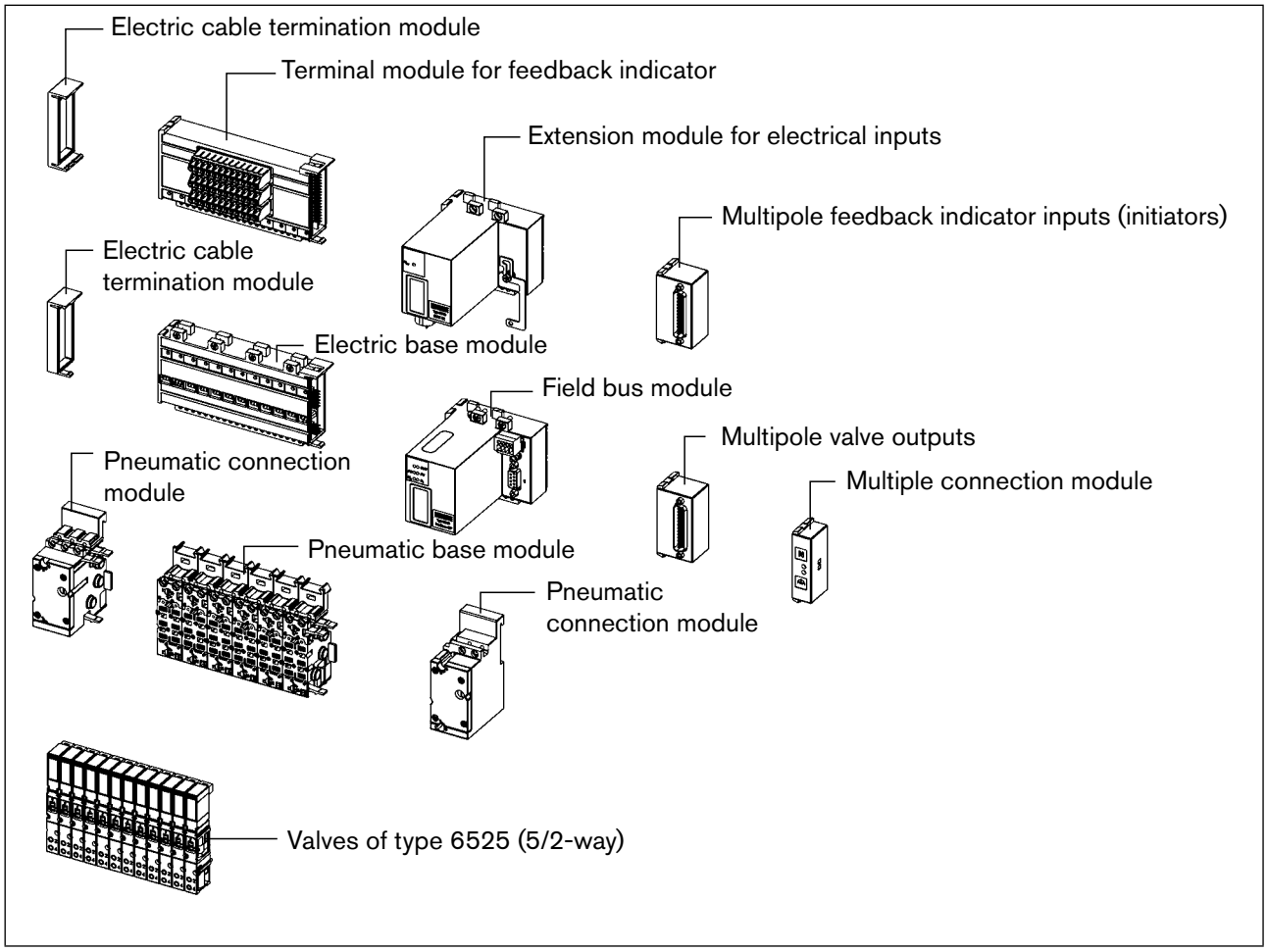

Figure 2: Example for the configuration of the modular electric valve terminal type 8640

5.4. Version REV.2

The hardware and firmware for the device have been revised. The revised version REV.2 is largely compatible with the previous version. Differences to be taken into account by the user are described in these operating instructions.

Devices of version REV.2 are identified by the designation “REV.2” on the type label. Previous device versions display no designation on the type label.

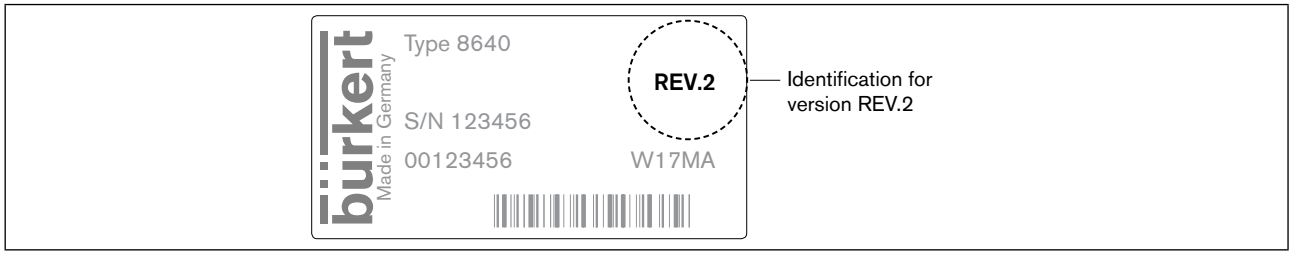

Figure 3: Identification for revised version REV.2

6. TECHNICAL DATA

6.1. Conformity

The device conforms to the EU directives as per the EU Declaration of Conformity (if applicable).

6.2. Standards

The applied standards, which are used to demonstrate conformity with the directives, are listed in the EU type examination certificate and/or the EU Declaration of Conformity (if applicable).

6.3. Operating conditions

Ambient temperature:	0 ... +50 °C
Storage temperature:	-20 ... +60 °C
Nominal operating mode:	Long-term operation (100% ED)
Operating voltage:	24 V / DC ± 10 %, residual ripple for field bus interface 1 Vss
Protection class:	3 in accordance with VDE 0580
Power consumption:	Power consumption is dependent on the type of electrical connection technology.

1. For the collective socket (parallel connection technology), and multi-pole interfaces power consumption is determined by the valve type used, but limited to a total current of 3 A maximum. For a multi-pole solution combined with repeaters there is a further summed current, also limited to a maximum of 3 a.
2. For the field bus interface the total current can be determined according to the equation:

$$I_{total} = I_{base} + (n \times I_{valve}) + (m \times I_{repeater})$$

I_{base}	base current dep. on field bus system PROFIBUS-DP V1 200 mA DeviceNet 200 mA CANopen 200 mA
n	number of valves
m	number of repeaters
I_{valve}	nominal current of valve type
$I_{repeater}$	power consumption of repeater $(m \times I_{repeater})$ = max. 650 mA

NOTE!

Always use safety low voltage according to protection class 3 VDE 0580!

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6.4. General technical data

6.4.1. Add-on dimension 11 mm

Add-on dimension	**11 mm**		
Operating principle Valve	C/D (3/2-way) Type 6524	2xC (2x3/2-way) Type 6524	LN (5/3-way) Type 0460
Operating principle Valve	H (5/2-way) Type 6525		H (5/2-impulse) Type 0460
Flow rate [l/min]	300	300	200
Pressure range [bar]	2.5 ... 7 2,5 ... 10	2.5 ... 7 2,5 ... 10	2.5 ... 7
Power rating [W]	1	2 x 0.25	2 x 0.9
Current before/after power reduction [mA]	43/28	2 x 43/18	2 x 41/-
Valve locations	max. 24	max. 12	max. 12
Repeater	max. 32	max. 32	max. 32
Electrical modules	6-fold*, 8-fold, 12-fold	6-fold*, 8-fold, 12-fold	6-fold*, 8-fold, 12-fold
Pneumatic modules	2-fold, 8-fold	2-fold, 8-fold	2-fold, 8-fold
Protection class in terminal design	IP40 IP20	IP40 IP20	IP40 IP20

* Configuration with 6-fold modules on request

6.4.2. Add-on dimension 16.5 mm and 19 mm

Add-on dimension	**16,5 mm**		**19 mm**	
Operating principle Valve	C/D (3/2-way) Type 6526		C/D (3/2-way) Type 5470	
Operating principle Valve	H (5/2-way) Type 6527		G (4/2-way) Type 5470	
Flow rate [l/min]	700		300	
Pressure range [bar]	2 ... 10		2 ... 8	
Power rating [W]	1	2	1	2
Current before/after power reduction [mA]	42/33	85/52	42/-	84/-
Valve locations	max. 24		max. 24	
Repeater	max. 32		max. 32	
Electrical modules	4-fold, 6-fold, 8-fold		2-fold, 5-fold, 6-fold	
Pneumatic modules	2-fold, 4-fold		2-fold, 3-fold	
Protection class in terminal design	IP54 IP20		IP54 IP20	

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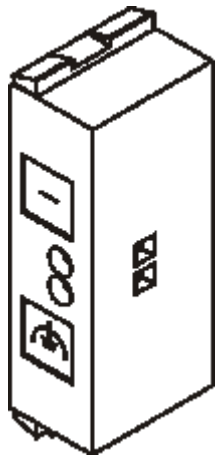
7. MODULES FOR CONVENTIONAL ELECTRICAL CONNECTION TECHNOLOGY

7.4.1. Collective socket module

The collective socket module serves as a central connecting element for ground and functional earth.



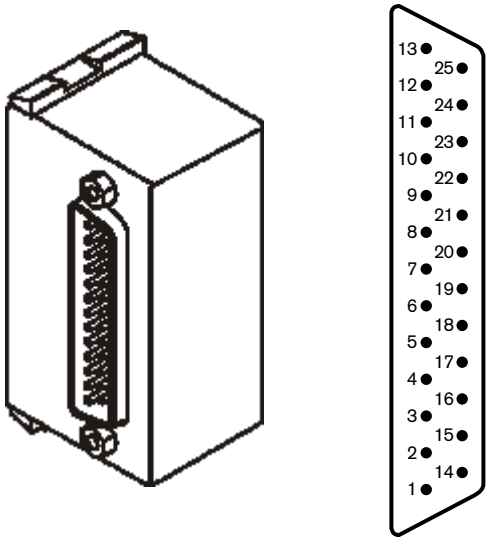
Allocation plan

— Ground

Functional earth

Figure 4: Collective socket module for valve outputs

7.4.2. Multi-pole connection for valve outputs



Pin 1	Valve 1
Pin 2	Valve 2
Pin 3	Valve 3
Pin 4	Valve 4
Pin 5	Valve 5
Pin 6	Valve 6
Pin 7	Valve 7
Pin 8	Valve 8
Pin 9	Valve 9
Pin 10	Valve 10
Pin 11	Valve 11
Pin 12	Valve 12
Pin 13	Valve 13
Pin 14	Valve 14
Pin 15	Valve 15
Pin 16	Valve 16
Pin 17	Valve 17
Pin 18	Valve 18
Pin 19	Valve 19
Pin 20	Valve 20
Pin 21	Valve 21
Pin 22	Valve 22
Pin 23	Valve 23
Pin 24	Valve 24*
Pin 25	Ground

Figure 5: Multi-pole module for valve outputs D-SUB IP54 and allocation of the D-SUB plug

* Multi-pole for manual automation only 23 bit, as Pin 24 used for permanent 24 V.

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Accessories

D-SUB plug	25-pin	IP54 5 m cable	Id.-No. 917 494
D-SUB plug	25-pin	IP54 10 m cable	Id.-No. 917 495

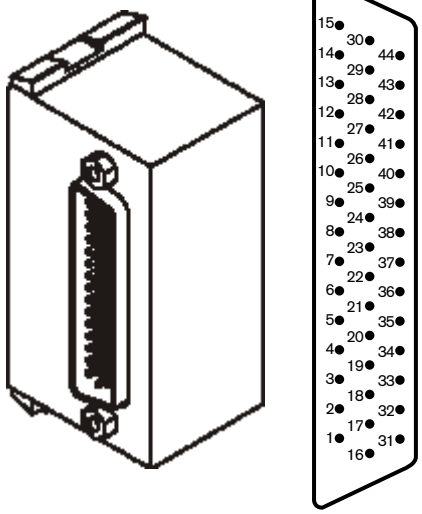
Colour code for D-SUB cable

The wires are soldered 1:1 to the D_SUB plug, i.e. wire 1 ws to Pin 1 D-SUB etc.

Pin/Wire	Wire colour	Code
1	white	ws
2	brown	br
3	green	gn
4	yellow	ge
5	grey	gr
6	pink	rs
7	blue	bl
8	red	rt
9	black	sw
10	violet	vi
11	grey-pink	grrs
12	red-blue	rtbl
13	white-green	wsgn

Pin/Wire	Wire colour	Code
14	brown-green	brgn
15	white-yellow	wsge
16	yellow-brown	gebr
17	white-grey	wsgr
18	grey-brown	grbr
19	white-pink	wsrs
20	pink-brown	rsbr
21	white-blue	wsbl
22	brown-blue	brbl
23	white-red	wsrt
24	brown-red	brrt
25	white-black	wssw

7.4.3. Multi-pole connection with repeater inputs (initiators)



Pin 1	Input 1	Pin 20	Input 20
Pin 2	Input 2	Pin 21	Input 21
Pin 3	Input 3	Pin 22	Input 22
Pin 4	Input 4	Pin 23	Input 23
Pin 5	Input 5	Pin 24	Input 24
Pin 6	Input 6	Pin 25	Input 25
Pin 7	Input 7	Pin 26	Input 26
Pin 8	Input 8	Pin 27	Input 27
Pin 9	Input 9	Pin 28	Input 28
Pin 10	Input 10	Pin 29	Input 29
Pin 11	Input 11	Pin 30	Input 30
Pin 12	Input 12	Pin 31	Input 31
Pin 13	Input 13	Pin 32	Input 32
Pin 14	Input 14	...	
Pin 15	Input 15	Pin 43	24 V
Pin 16	Input 16	Pin 44	Ground
Pin 17	Input 17		
Pin 18	Input 18		
Pin 19	Input 19		

Figure 6: Multi-pole module for repeater inputs D-SUB IP54 and allocation of the D-SUB plug

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Accessories

D-SUB plug	44-pin	IP54 5 m cable	Id.-No. 917 496
D-SUB plug	44-pin	IP54 10 m cable	Id.-No. 917 497

Colour code for D-SUB cable

The wires are soldered 1:1 to the D_SUB plug, i.e. wire 1 ws to Pin 1 D-SUB etc.

Pin/Wire	Wire colour	Code
1	white	ws
2	brown	br
3	green	gn
4	yellow	ge
5	grey	gr
6	pink	rs
7	blue	bl
8	red	rt
9	black	sw
10	violet	vi
11	grey-pink	grrs
12	red-blue	rtbl
13	white-green	wsgn
14	brown-green	brgn
15	white-yellow	wsge
16	yellow-brown	gebr
17	white-grey	wsgr
18	grey-brown	grbr
19	white-pink	wsrs
20	pink-brown	rsbr
21	white-blue	wsbl
22	brown-blue	brbl

Pin/Wire	Wire colour	Code
23	white-red	wsrt
24	brown-red	brrt
25	white-black	wssw
26	brown-black	brsw
27	grey-green	grgn
28	yellow-grey	grgr
29	pink-green	rsgn
30	yellow-pink	gers
31	green-blue	gnbl
32	yellow-blue	gebl
33	green-red	gnrt
34	yellow-red	gert
35	green-black	gnsw
36	yellow-black	gesw
37	grey-blue	grbl
38	pink-blue	rsbl
39	grey-red	grrt
40	pink-red	rsrt
41	grey-black	grsw
42	pink-black	rssw
43	blue-black	blsw
44	red-black	rtsw

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8. FIELD BUS MODULE PROFIBUS DP/V1

8.1. PROFIBUS DP/V1, IP20 - overview

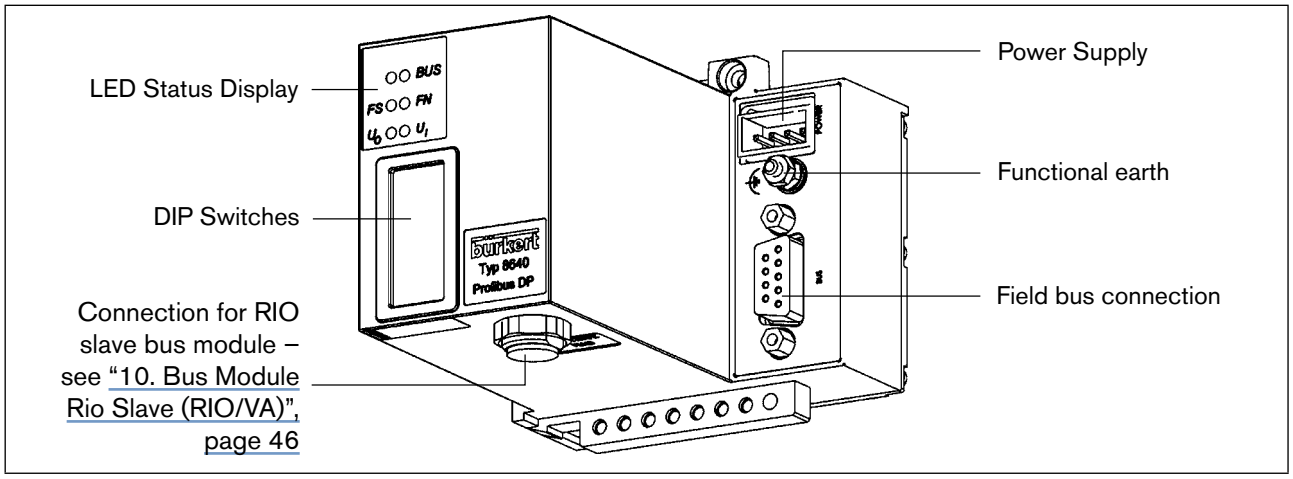

Figure 7: Overview of field bus module PROFIBUS DP IP20

The DIP switches can be operated through the covering film.

8.1.1. Power supply IP20

The 4-pole plug-in connector for the power supply is configured as follows:

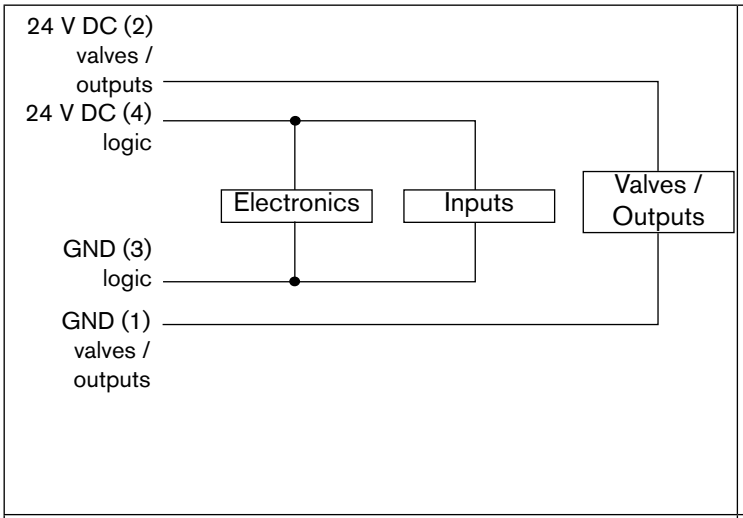

Figure 8: Power supply configuration

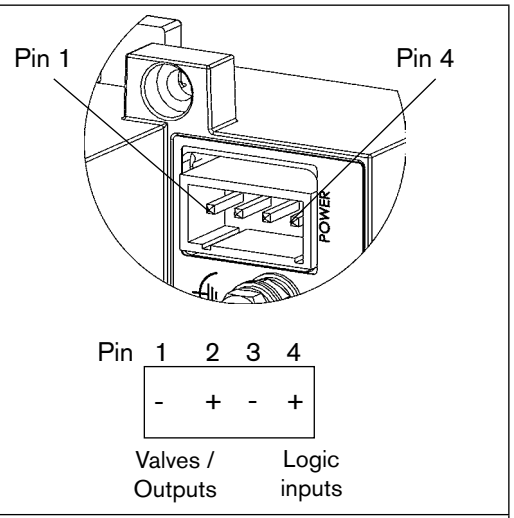

Figure 9: Cutaway POWER connection

Pin 2 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 4 with 1 A.

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NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

Accessories

Plug-in connector (No. 918 226) for power supply (supplied).

8.1.2. IP20 field bus connection

A 9-pole D-SUB connection is used for an IP20 protection class field bus connection. The following shows the wiring layout according to Standard 19245 Part 1.

Pin-No.	Signal name (socket in device, plug on cable)	Description
1	n.c.	-
2	n.c.	-
3	RxD/TxD-P	Receive / Send data P
4	CNTR-P (RTS)	Request to send (repeater control signal)
5	DGND	Data reference potential
6	+5 V	Supply voltage - plus
7	n.c.	-
8	RxD/TxD-N	Receive / Send data N
9	n.c.	-

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8.2. PROFIBUS DP/V1, IP54 - overview

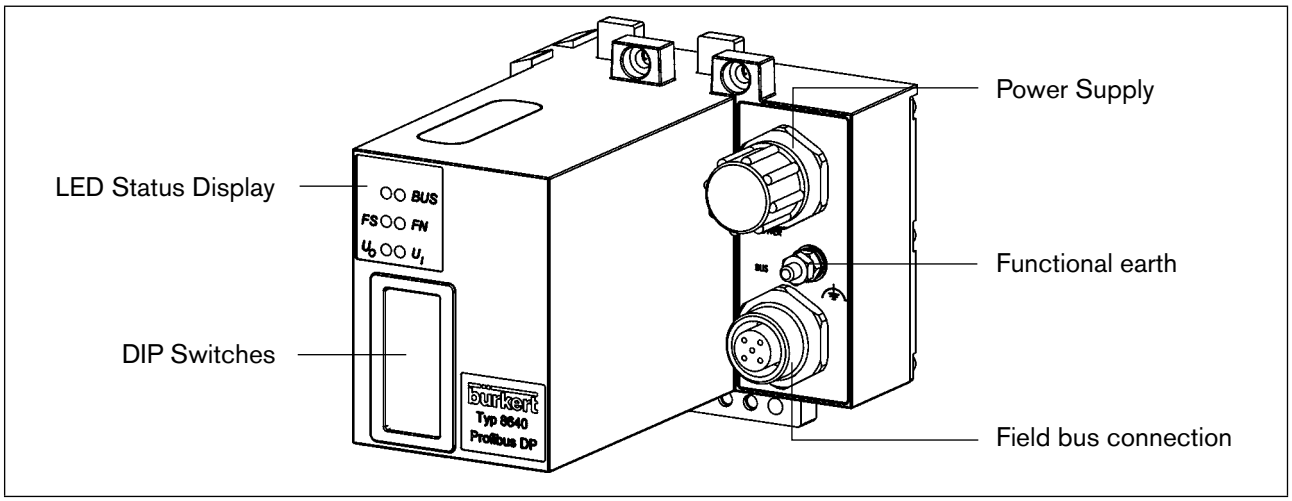

Figure 10: Overview field bus module PROFIBUS-DP IP54

The DIP switches can be operated through the covering film.

8.2.1. Power supply IP54

The 4-pole circular plug-in connector for the power supply is configured as follows:

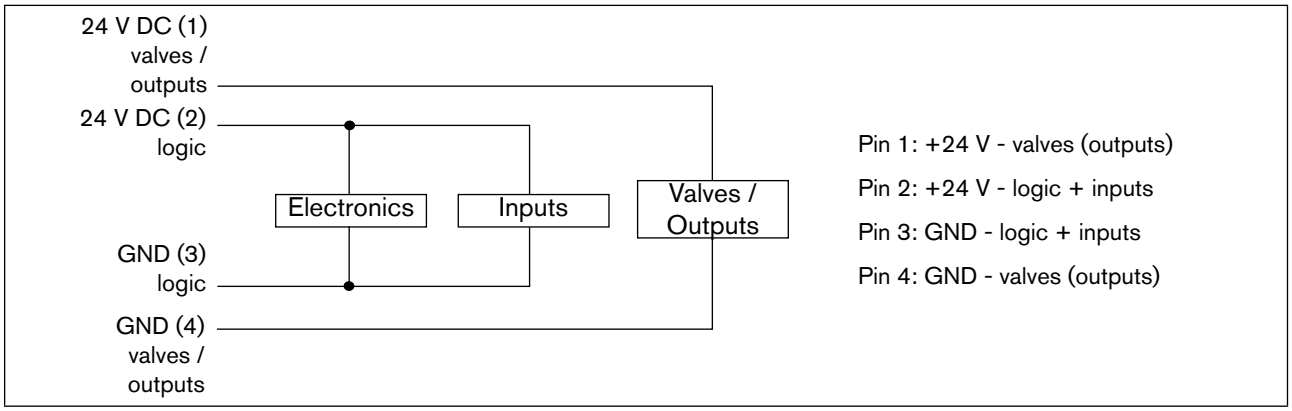

Figure 11: Power supply configuration

Pin 1 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 2 with 1 A.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

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8.2.2. IP54 field bus connection

The M12 plug-in system is used for an IP54 protection class field bus connection. To avoid confusion between the bus and the supply slot the Reserve Key coding is used. Layout for plugs and sockets:

Pin No.	Signal	Description
1	VP	Supply voltage - plus (P5V)
2	RxDx / TxD-N	Receive / Send data N, A connection
3	DGND	Data transmission potential (reference potential to VP)
4	RxDx / TxD-P	Receive / Send data P, B connection
5	Shielding	Shielding / protective earth
Thread	Shielding	Shielding / protective earth

Accessories

PROFIBUS plug-in connector (configurable), socket (Reserve Key coding)	Id.-No. 918 447
PROFIBUS plug-in connector (configurable), plug (Reserve Key coding)	Id.-No. 918 198 for connection without T-piece this ID is needed
PROFIBUS T-piece (12 MBaud)	Id.-No. 902 098
M12 power supply, socket	Id.-No. 902 552
M12 terminal resistance, plug	Id.-No. 902 553

8.3. DIP switch (PROFIBUS address)

→ Set the DIP switch through the film using a screwdriver (the film is very durable).

DIP	Value	Description	Note
1 (above)	1	PROFIBUS address	The PROFIBUS address equals the sum of all the DIP switch values from 1 to 7 in 'ON' setting. 'ON' setting = DIP switch to the right
2	2	PROFIBUS address	
... ...	... ...	PROFIBUS address	
6	32	PROFIBUS address	
7	64	PROFIBUS address	
8 (below)	-	reserved	Switch to 'OFF'

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8.4. LED status display

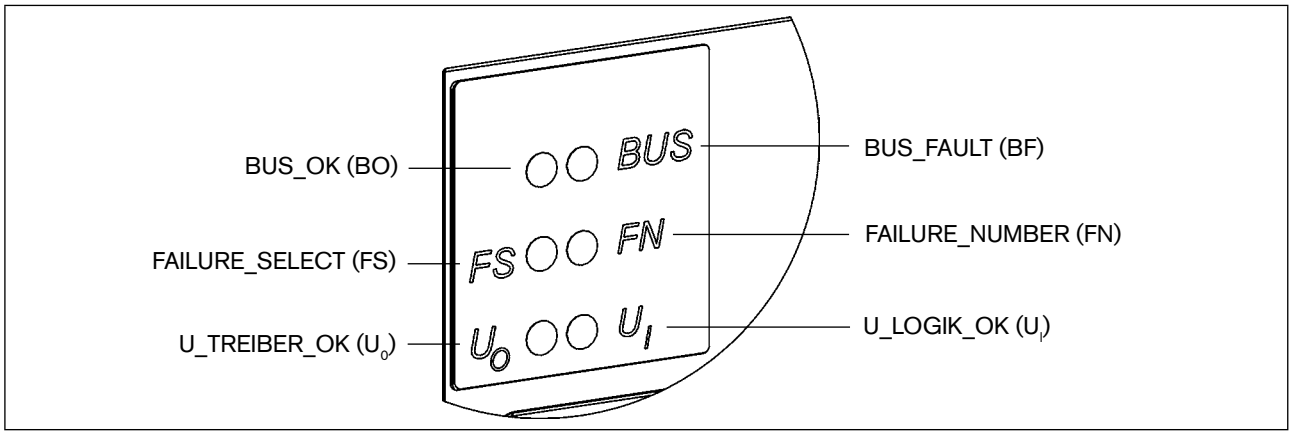

Figure 12: LED state display (detail)

Abbre-viation	Colour	Description	Explanation
BO	green	Bus OK	Bus communication active
BF	red	Bus Fault	Bus fault
FS	yellow	Failure Select	Determines the function of the FN LED: FS lit up: FN displays fault type FS not lit up: FN displays failure number
FN	red	Failure Number	The number of flash impulses indicates the fault type or the failure number depending on whether FS is lit up or not
U_I	green	U LOGIC OK	Voltage for logic supply, inputs and bus interface present
U_0	green	U driver OK	Voltage for outputs present

Normal state

LED	Status	Description
BUS (BO)	ON	Error-free operation of the valve terminal on PROFIBUS DP
BUS (BF)	OFF	
FS	OFF	
FN	OFF	
U_0	ON	
U_L	ON	

bus fault

LED	Status	Description	Fault cause / remedial action
BUS (BO)	OFF	Signal monitoring time on valve terminal elapsed without receipt of signal from master	During operation: → Check master (control) and bus cable During start-up: → Check network configuration on master and station address on terminal
BUS (BF)	ON		
FS	OFF		
FN	OFF		
U_0	ON		
U_L	ON		

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8.4.1. Errors and warnings displayed via FN (Failure Number) and FS (Failure Select) LEDs

The following table contains errors and warning messages displayed via the FN (Failure Number) and FS (Failure Select) LEDs.
The error type is indicated by the number of times FN flashes when FS is set to ON.
The error number is indicated by FN flashing when FS is set to OFF.

Number FN when FS ON error type	Number FN when FS OFF error number	Description	Remedial action
1	Parameterization error (Set_Prm_Telegramm)		
	1	Too many inputs for one valve terminal (bitwise composition)	→ Check user parameters and DIP switch
	2	Too many outputs for one valve terminal (bitwise composition)	→ Check user parameters and DIP switch
	3	Parameterization telegram too long	→ Check user parameters and DIP switch
	4	Parameterization telegram too short	→ Check user parameters and DIP switch
2	Configuration error (Chk_Cfg_Telegramm)		
	1	Too many inputs for one valve terminal	→ Check identification bytes and DIP switch
	2	Too many outputs for one valve terminal	→ Check identification bytes and DIP switch
	3	Too few inputs for one valve terminal (preset in parameterization telegram)	→ Check identification bytes and DIP switch
	4	Too few outputs for one valve terminal (preset in parameterization telegram)	→ Check identification bytes and DIP switch
	5	An identifier has the wrong code	→ Check identification bytes and DIP switch
3	Main terminal error		
	1	No supply voltage for main terminal outputs	→ Check supply voltage
	2	Setting for station address is outside permitted range (0 ... 125)	→ Check PROFIBUS address on main terminal
	3	Error accessing EEPROM	→ Replacement of electronics may be necessary
4	Peripheral terminal error		
	1	No supply voltage for peripheral terminal outputs	→ Check supply voltage
	2	Complete failure of a peripheral terminal	→ Check peripheral terminal RIO bus

After the error has been rectified the valve terminal must be reset by briefly shutting down the supply voltage.

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9. CONFIGURATION AND PARAMETER SETTINGS FOR PROFIBUS DP

The purpose of the bus system is to enable rapid connection of the decentralized periphery (valve terminal) with the central master (control). As well as input and output data, parameter, configuration and diagnostic data is also transmitted.

Many PROFIBUS masters (controls) need a configuration program which lays down the network structure. These programs require the device base data file (GSD file).

9.1. Representation of the PROFIBUS-DP communication process

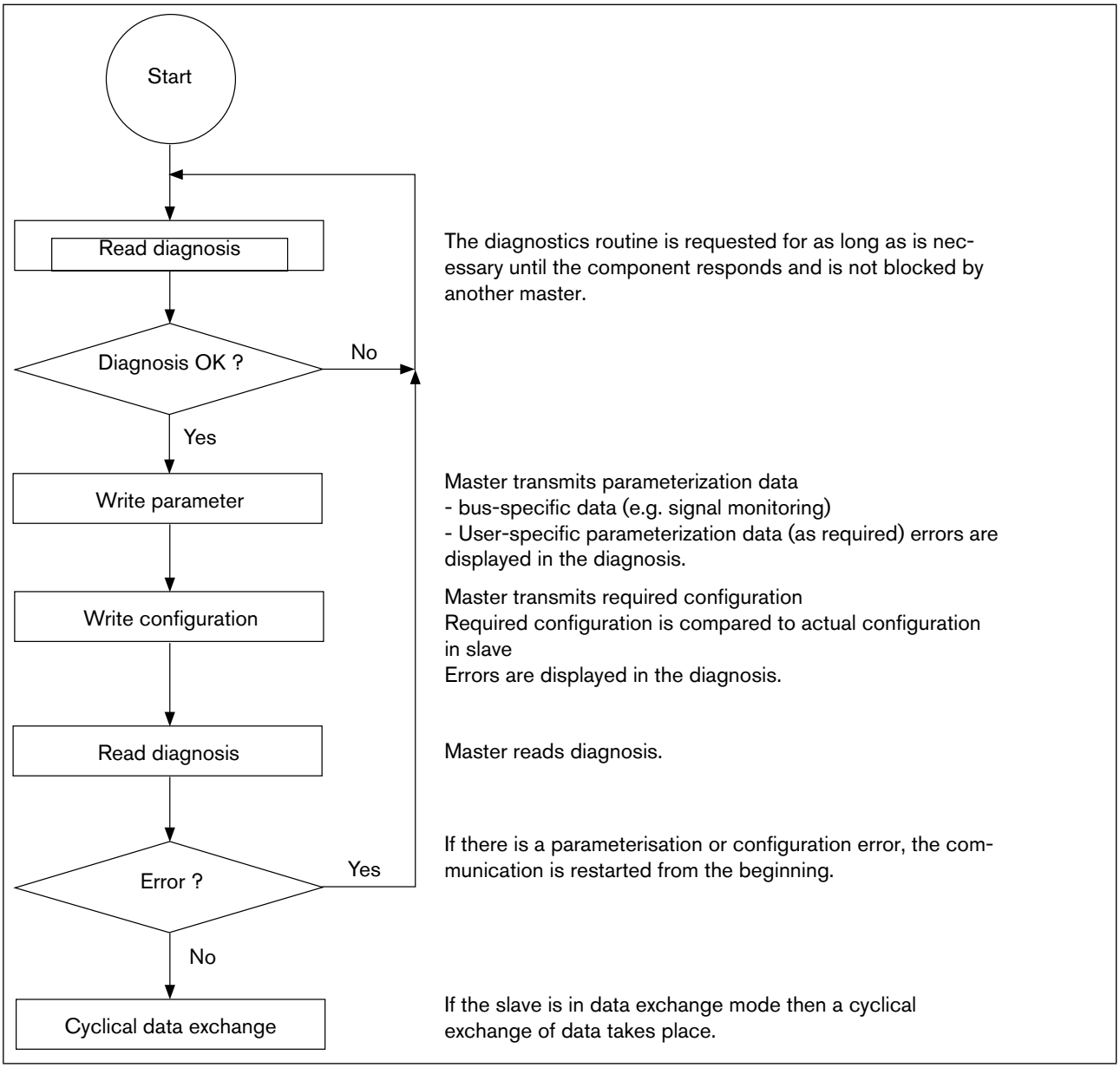

Figure 13: Simplified representation of the PROFIBUS-DP communication process

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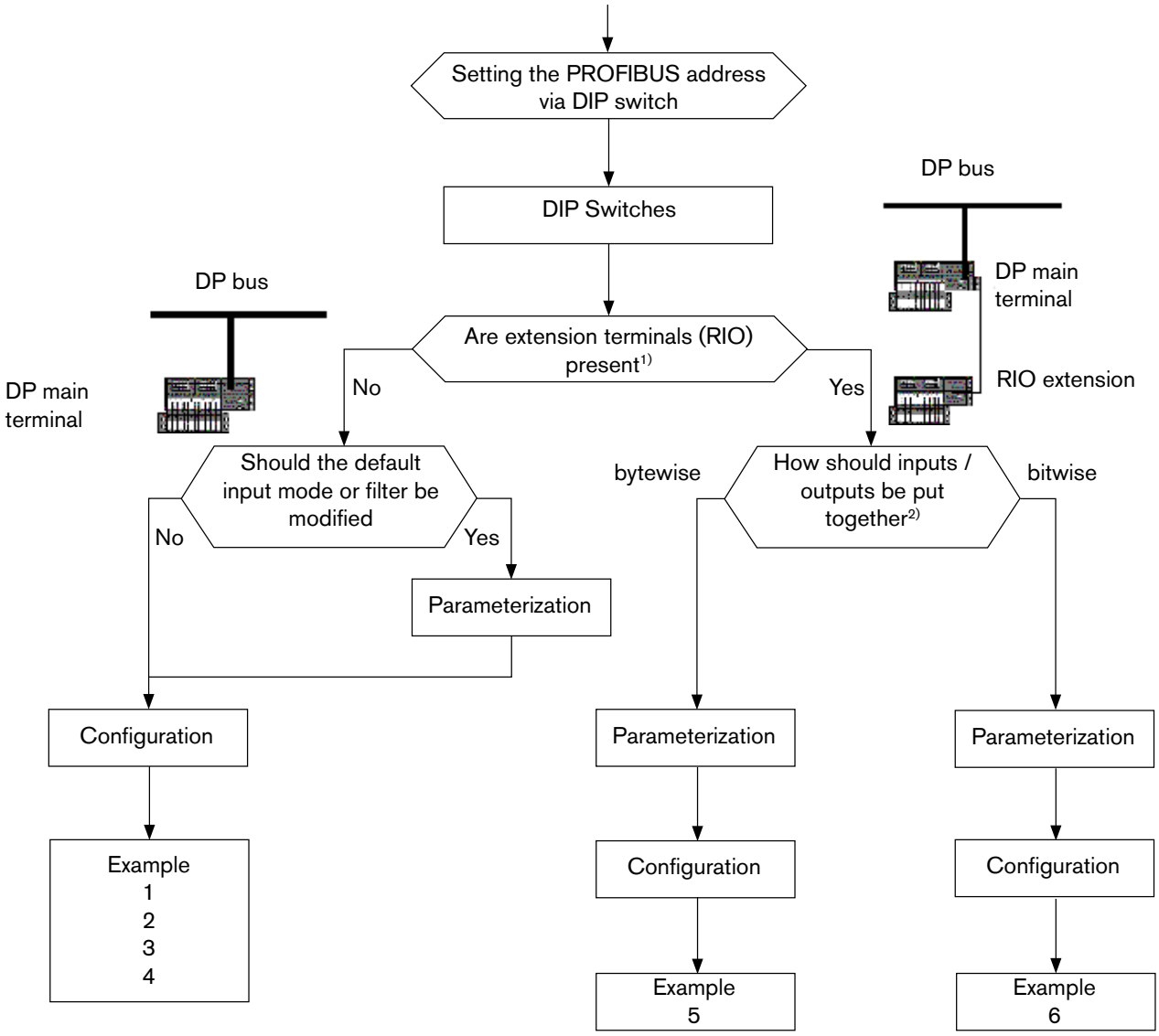
9.2. Start-Up



1) Extension terminals are connected to the valve terminal via the RIO interface

2) Advantage of bitwise distribution:
1. If the number of inputs or outputs does not correspond to the byte pattern then bits remain unused with bytewise configuration. For instance, with a valve terminal with 4 valves and a valve terminal with 10 valves that amounts to 10 bits with bytewise configuration (4+6 bits), because the first valve terminal requires 1 byte and the second one requires 2 bytes. With bitwise distribution the outputs can be combined. This means that only 2 bytes are needed and 2 bits remain unused.
2. The bitwise composition means that the identifiers / slots (assignation in process image) can be selected at will in the configuration program.

Figure 14: Start-Up

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9.2.1. Parameterization without extension terminal (hex parameter / User_Prm_Data)

The default value for the parameterization is:

- Extension terminal none
- Input mode normal inputs
- Filter ON

The parameterization can be used to modify the settings selected for the input mode and the filter.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte	Bus parameters (normal parameters) 7 bytes							
	Lock_Rep	**Unlock_Re**	**Sync_Req**	**Freeze_Req**	**WD_On**	reserved	reserved	reserved
	00 min TSDR and slave spec. data 01 release for other masters 10 lock for other masters 11 release for other masters		Slave being operated in Sync mode	Slave being operated in Freeze mode	Signal monitoring 0: deactivated 1: activated			
2	**WD_Fact_1**		(range 1-255 signal monitoring in [s] = 10 ms x WD_Fact_1 x WD_Fact_2)					
3	**WD_Fact_2**		(range 1-255 signal monitoring in [s] = 10 ms x WD_Fact_1 x WD_Fact_2)					
4	**TSDR**		(time in Tbits in which the slave may respond. At least 11 Tbit; 0 old value remains)					
5	Ident_Number high byte		(manufacturer identification 00 Hex)					
6	Ident_Number low byte		(manufacturer identification 81 Hex)					
7	Group_Ident		(For group generation; each bit represents one group.)					
	User_Parm_Data (DPV1_Status)							
8	DPV1_Status_1							
9	DPV1_Status_2							
10	DPV1_Status_3							
	User_Prm_Data (user parameters)							
11	See table below:							

Byte 11 User_Prm_Data (user parameters)

Input mode	Input filter OFF	Input filter ON
no inputs	04 hex	44 hex
normal inputs	14 hex	54 hex
shifted inputs	24 hex	64 hex
halved inputs	34 hex	74 hex

For a description of the input modes, refer to Section "9.3. Mode inputs"*Mode inputs".*

Many configuration tools do not allow for direct access to bytes 1 to 7. For Siemens (Step 5 and Step 7) the parameters (Hex parameters) start at byte 8.

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9.2.2. Configuration of the valve terminal without extension terminals

The settings of the desired configuration, i.e. setting of various identifiers, is generally done with the help of the GSD file. Up to 7 identifiers (slots) can be assigned.

When the configuration is written, the number of input and output bytes is set in the process image and checked against permitted limits. By using different identifiers the user can assign the input and output bytes in the process image at will.

A valve terminal has a maximum of 32 inputs and a maximum of 24 outputs. This corresponds to a maximum of 4 input bytes and a maximum of 3 output bytes. For this reason never more than the above specified number of input / output bytes may be configured in the process image of a valve terminal- However, taking the limits specified above into account (32 inputs, 24 outputs; 4 input bytes, 3 output bytes) it is possible to configure both less than, but also more than the number of input / output bytes that are actually physically present on the valve terminal.

Example:

Physically present	Configuration	Consequence
16 valves	1 bytes	Only valves 1 to 8 can be addressed
	2 bytes	Valves 1 to 16 can be addressed
	3 bytes	Valves 1 to 16 can be addressed, 1 byte remains unusable in process image
	4 bytes	Configuration errors

Manual configuration

If no GSD file is available the configuration must be performed manually. The following specifications apply. One configuration telegram can contain one or several identifications, whereby the user can make the necessary allocations at will. the identifications have the following structure:

Bit 7	Bit 6	Bit 5 - 4	Bit 3 - 0
Consistency 0 = byte/word 1 = total length	bytes/words 0 = bytes 1 = words (2 bytes)	Input/Output 00 = spec. identifier format 01 = input 10 = output 11 = input/output	Data length (number) 0000 = 1 byte/word ... 0010 = 3 bytes/words ... 1111 = 16 bytes/words

Hex	Decimal	Description
10	016	1 byte input; consistency via byte
11	017	2 bytes input; consistency via byte
12	018	3 bytes input; consistency via byte
13	019	4 bytes input; consistency via byte
20	032	1 byte output; consistency via byte
21	033	2 bytes output; consistency via byte
22	034	3 bytes output; consistency via byte
00	000	Placeholder (empty position)

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Example 1 - valve terminal with 16 valves (outputs) and 32 repeaters (inputs)

- PROFIBUS-DP address 4
- The valves 1-16 are assigned to outputs (PAA) bytes 11-12 in the process image.
- The repeaters 1-32 are assigned to inputs (PAE) bytes 20-23 in the process image.
- Mode: Normal input mode
- Input filter active

DIP Switches

1	2	3	4	5	6	7	8
OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF

User parameter byte 11 User_Prm_Data 54 hex

Configuration:

Byte No. (slot)	1* (0**)	2 (1)
Identification in Hex (Dec)	13 (019)	21 (033)
Process image output (PAA)		11-12
Process image input (PAE)	20-23	

* Standard
** Siemens

Allocation of inputs and outputs to control process image

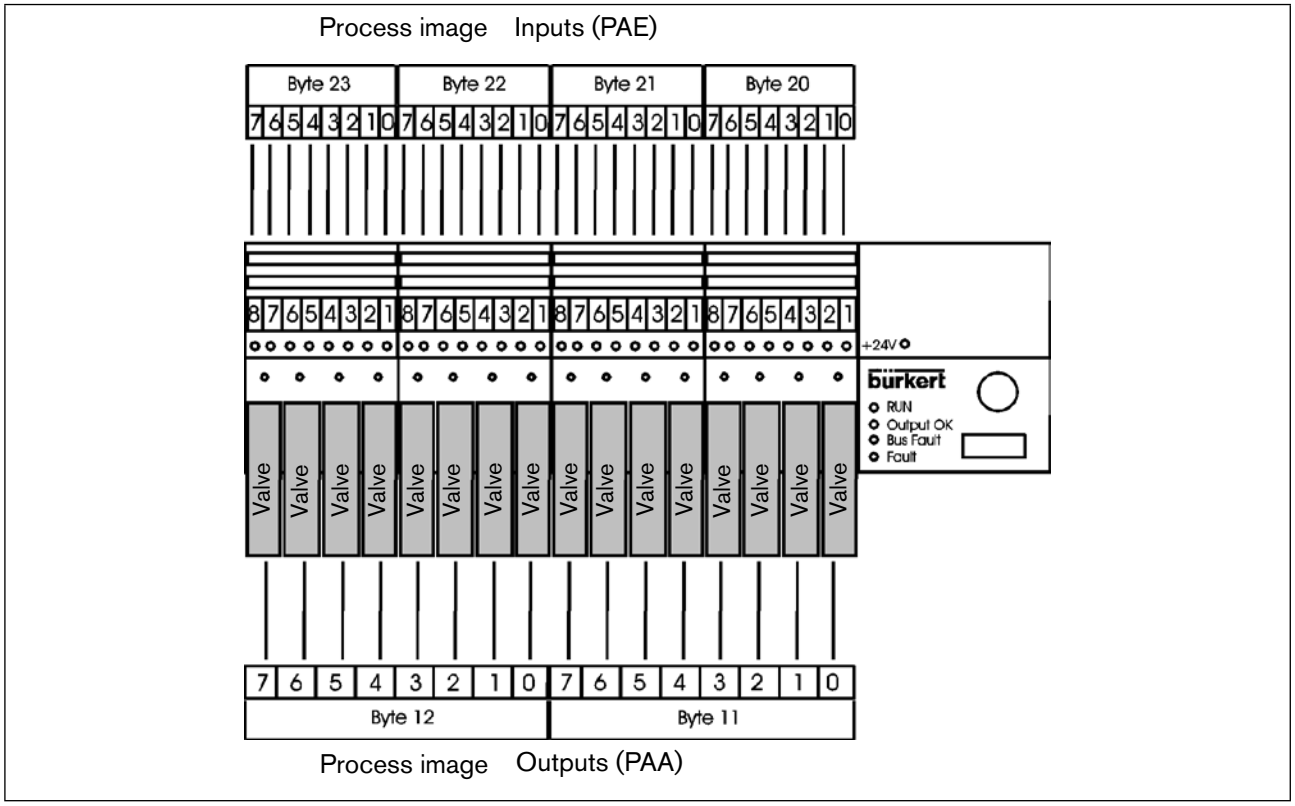

Figure 15: Allocation of inputs and outputs to control process image

Example 2 - valve terminal with 16 valves (outputs) and 32 repeaters (inputs)

- PROFIBUS-DP address 5
- The valves 1-8 are assigned to outputs (PAA) byte 11 in the process image.
- The valves 9-16 are assigned to outputs (PAA) byte 20 in the process image.
- The repeaters 1-8 are assigned to inputs (PAE) byte 10 in the process image.
- The repeaters 9-16 are assigned to inputs (PAE) byte 15 in the process image.
- The repeaters 17-32 are assigned to inputs (PAE) bytes 20-21 in the process image.
- Mode: Normal input mode
- Input filter active

DIP Switches

1	2	3	4	5	6	7	8
ON	OFF	ON	OFF	OFF	OFF	OFF	OFF

User parameter byte 11 User_Prm_Data 54 hex

Configuration:

Byte No. (slot)	1 (0)	2 (1)	3 (2)	4 (3)	5 (4)
Identification in Hex (Dec)	10 (016)	10 (016)	11 (017)	20 (032)	20 (032)
Process image output (PAA)				11	20
Process image input (PAE)	10	15	20-21		

Allocation of inputs and outputs to control process image

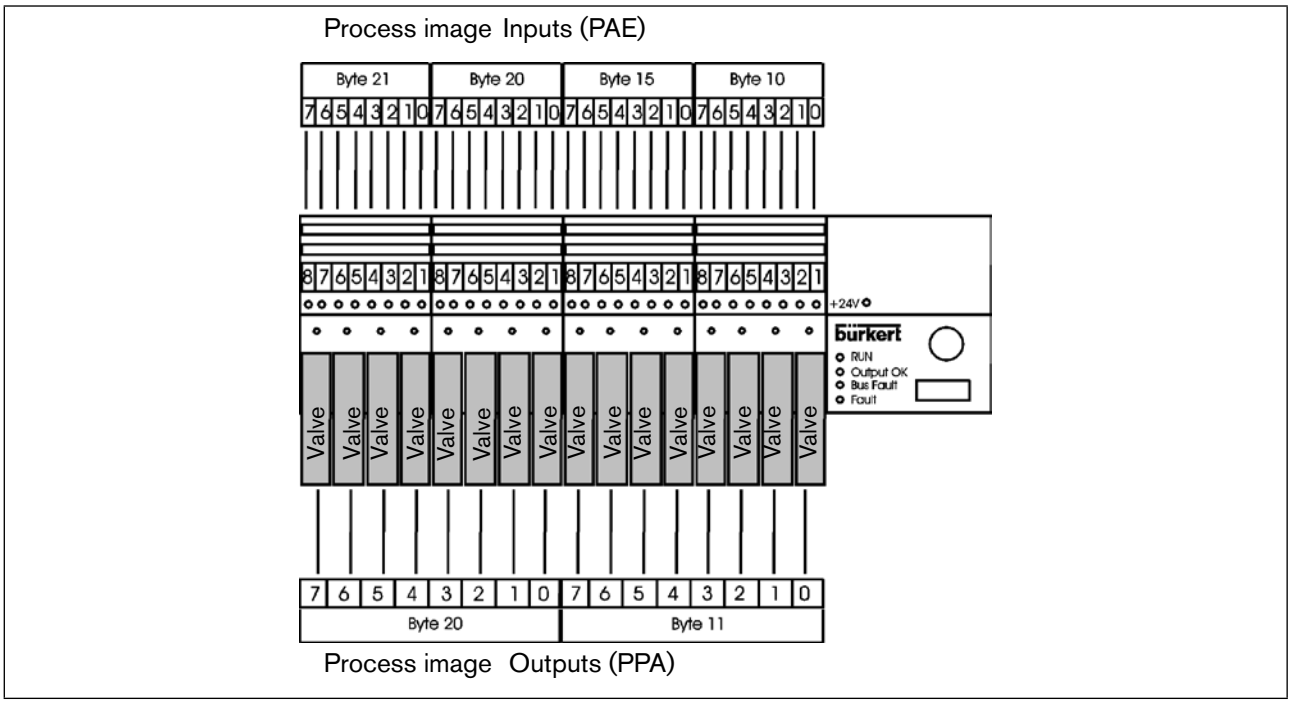

Figure 16: Allocation of inputs and outputs to control process image

Example 3 - valve terminal with 16 valves (outputs) and 32 repeaters (inputs)

- PROFIBUS-DP address 6
- The valves 1-16 are assigned to outputs (PAA) bytes 11+12 in the process image.
- Repeaters 1, 3, 5, ... 15 are assigned to inputs (PAE) byte 10 in the process image.
- Repeaters 2, 4, 6, ... 16 are assigned to inputs (PAE) byte 16 in the process image.
- Repeaters 1, 17, 19, ... 31 are assigned to inputs (PAE) byte 11 in the process image.
- Repeaters 1, 18, 20, ... 32 are assigned to inputs (PAE) byte 17 in the process image.
- Mode: Shifted inputs
- Input filter active

DIP Switches

1	2	3	4	5	6	7	8
OFF	ON	ON	OFF	OFF	OFF	OFF	OFF

User parameter byte 11 User_Prm_Data 64 hex

Configuration:

Byte No. (slot)	1 (0)	2 (1)	3 (2)	4 (3)	5 (4)
Identification in Hex (Dec)	10 (016)	10 (016)	10 (016)	10 (016)	21 (032)
Process image output (PAA)					11-12
Process image input (PAE)	10	16	11	17	

Allocation of inputs and outputs to control process image

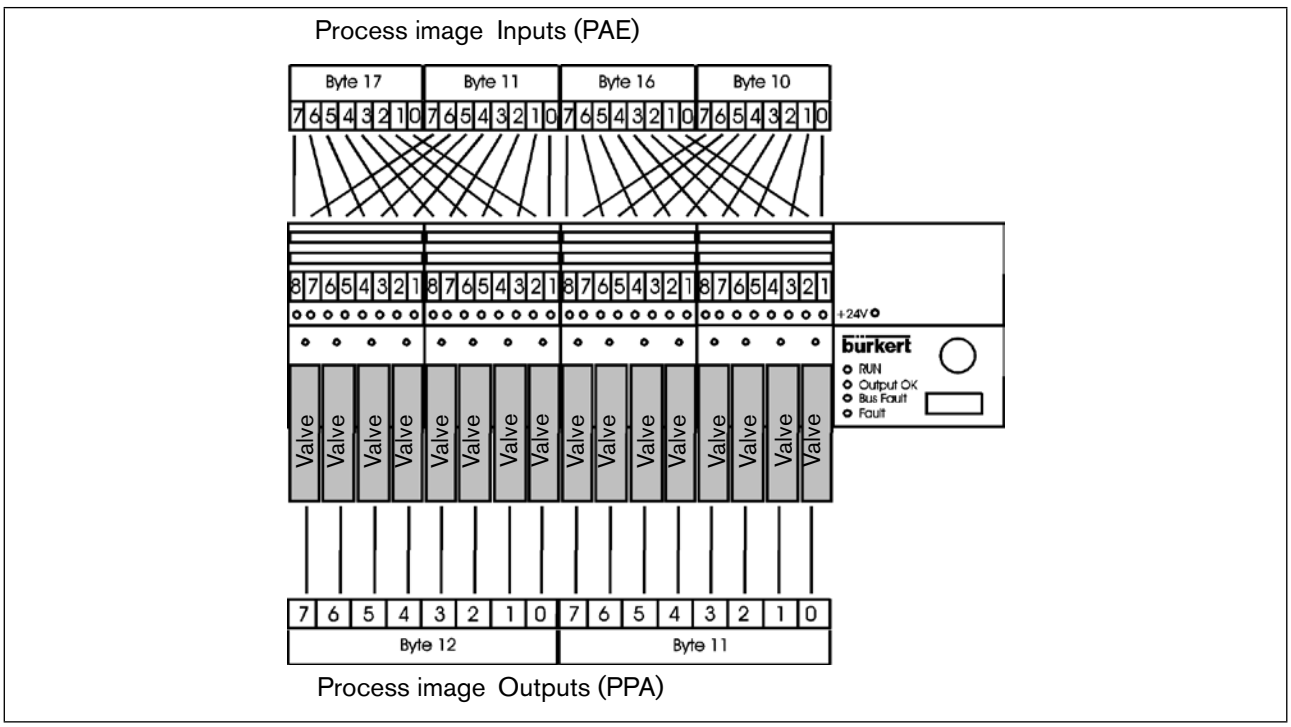

Figure 17: Allocation of inputs and outputs to control process image

Example 4 - valve terminal with 16 valves (outputs) and 32 repeaters (inputs), every second repeat signal not taken into account

- PROFIBUS-DP address 7
- The valves 1-8 are assigned to outputs (PAA) byte 17 in the process image.
- The valves 9-16 are assigned to outputs (PAA) byte 10 in the process image.
- Repeaters 1, 3, 5, ... 15 are assigned to inputs (PAE) byte 18 in the process image.
- Repeaters 1, 17, 19, ... 31 are assigned to inputs (PAE) byte 21 in the process image.
- Mode: Halved inputs
- Input filter active

DIP Switches

1	2	3	4	5	6	7	8
ON	ON	ON	OFF	OFF	OFF	OFF	OFF

User parameter byte 11 User_Prm_Data 74 hex

Configuration:

Byte No. (slot)	1 (0)	2 (1)	3 (2)	4 (3)
Identification in Hex (Dec)	10 (016)	10 (016)	20 (032)	20 (032)
Process image output (PAA)			17	10
Process image input (PAE)	18	21		

Allocation of inputs and outputs to control process image

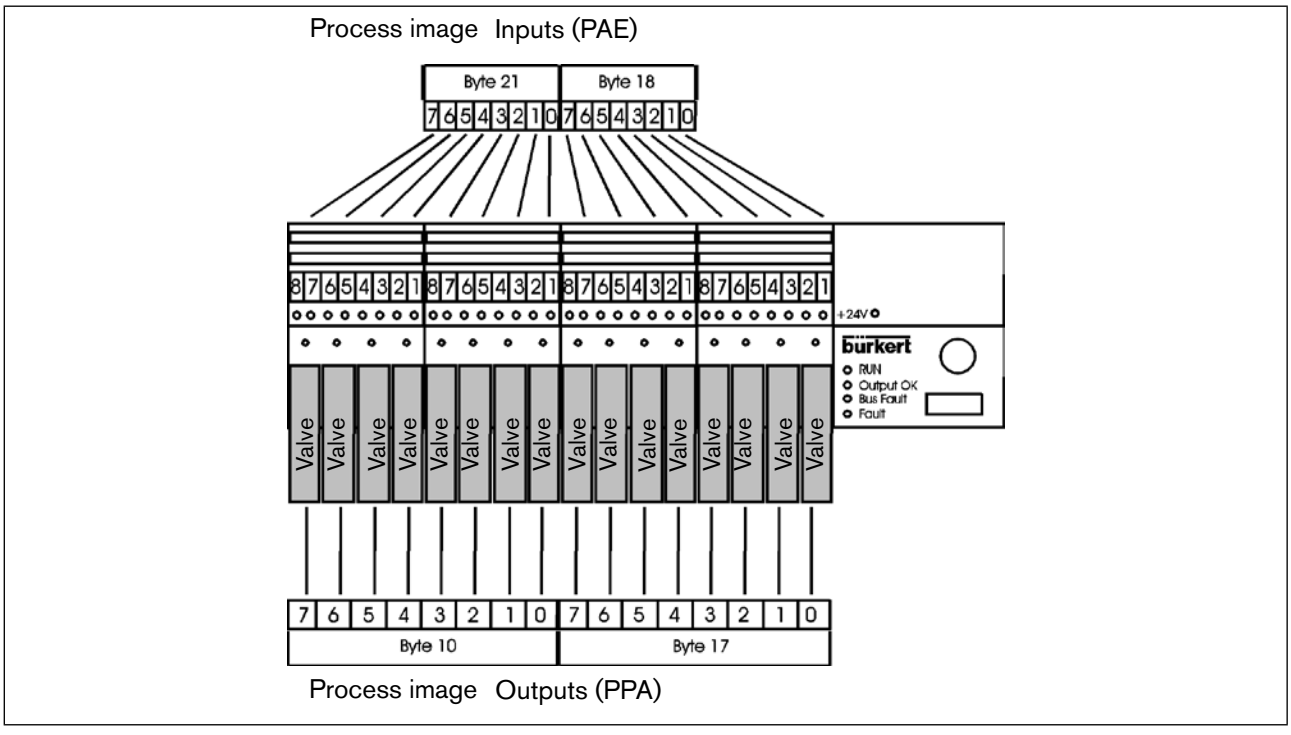

Figure 18: Allocation of inputs and outputs to control process image

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9.2.3. Parameterization of the valve terminal with extension terminal - bytewise composition of the inputs and outputs

The default value for the parameterization of the main terminal is:

- Extension terminal - none (must be adjusted bytewise on RIO)
- Input mode - normal inputs
- Filter - ON

When extension terminals are used the parameterization option extension terminals RIO bytewise must be selected.

The parameterization can be used to modify the settings selected for the input mode and the filter.

Further, you may set the length of the device-related diagnosis, whereby the long diagnosis only makes sense when more than four extension terminals are used. The following settings are permitted in the parameter telegram:

User parameter byte 11 User_Prm_Data

Input mode	Input filter OFF	Input filter ON	Input filter OFF long diagnosis	Input filter ON long diagnosis
no inputs	05 hex	45 hex	85 hex	C5 hex
normal inputs	15 hex	55 hex	95 hex	D5 hex
shifted inputs	25 hex	65 hex	A5 hex	E5 hex
halved inputs	35 hex	75 hex	B5 hex	F5 hex

For a description of the input modes and the input filter refer to Section "9.3 *Input modes".*

9.2.4. Configuration of the valve terminal with extension terminal - bytewise composition of the inputs and outputs

The settings of the desired configuration, i.e. setting of various identifiers, is generally done with the help of the GSD file. Up to 18 identifiers (slots) can be assigned. Each extension terminal starts with a new byte in the process image. For the main terminal and for each extension terminal 2 identifications are used, i.e. for bytewise configuration the identifications for a single valve terminal must be contiguous. Each valve terminal can be configured with 4 input bytes and 3 output bytes.

If there are no inputs / outputs present for a valve terminal, the identification 0 (space) must be entered here.

Manual configuration: If no GSD file is available the configuration must be performed manually. The following specifications apply:

Bit 7	Bit 6	Bit 5-4	Bit 3-0
Consistency 0 = byte/word 1 = total length	**Bytes / Words** 0 = bytes 1 = words (2 bytes)	**Input / Output** 00 = spec. identifier format 01 = input 10 = output 11 = input/output	**Length (amount of data)** 0000 = 1 byte / word ... 0010 = 3 bytes / words ... 1111 = 16 bytes / words

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Examples:

Hex	Decimal	Description
10	016	1 byte input; consistency via byte
11	017	2 bytes input; consistency via byte
12	018	3 bytes input; consistency via byte
13	019	4 bytes input; consistency via byte
20	032	1 byte input; consistency via byte
21	033	2 bytes input; consistency via byte
22	034	3 bytes input; consistency via byte
00	000	Placeholder (empty position)

Configuration

Slot	Function	Valve terminals
1 (0)	Inputs	Main terminal
2 (1)	Outputs	
3 (2)	Inputs	Extension terminal 0 (DIP switch on EI 0 S1=OFF, S2=OFF, S3=OFF)
4 (3)	Outputs	
5 (4)	Inputs	Extension terminal 1 (DIP switch on EI 1 S1=ON, S2=OFF, S3=OFF)
6 (5)	Outputs	
7 (6)	Inputs	Extension terminal 2 (DIP switch on EI 2 S1=OFF, S2=ON, S3=OFF)
8 (7)	Outputs	
9 (8)	Inputs	Extension terminal 3 (DIP switch on EI 3 S1=ON, S2=ON, S3=OFF)
10 (9)	Outputs	
11 (10)	Inputs	Extension terminal 4 (DIP switch on EI 4 S1=OFF, S2=OFF, S3=ON)
12 (11)	Outputs	
13 (12)	Inputs	Extension terminal 5 (DIP switch on EI 5 S1=ON, S2=OFF, S3=ON)
14 (13)	Outputs	
15 (14)	Inputs	Extension terminal 6 (DIP switch on EI 6 S1=OFF, S2=ON, S3=ON)
16 (15)	Outputs	
17 (16)	Inputs	Extension terminal 7 (DIP switch on EI 7 S1=ON, S2=ON, S3=ON)
18 (17)	Outputs	

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Example 5 - main terminal and 3 extension terminals Main terminal with 8 valves (outputs) and 16 repeaters (inputs)

- PROFIBUS-DP address 8
- The valves 1-8 are assigned to outputs (PAA) byte 30 in the process image.
- The repeaters 1-16 are assigned to inputs (PAE) bytes 15+16 in the process image.
- Mode: Normal input mode
- Input filter active
- RIO interface

DIP switch main terminal

1	2	3	4	5	6	7	8
OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF

Extension terminal 0 with 8 valves (outputs) and 16 repeaters (inputs)

- Address 0 (extension terminal 0 always has the address 0)
- The valves 1-8 are assigned to outputs (PAA) byte 12 in the process image.
- The repeaters 1-16 are assigned to inputs (PAE) bytes 20+21 in the process image.
- Mode: Normal input mode
- Input filter active

DIP switch extension terminal 0

1	2	3	4	5	6	7	8	9	10	11	12
OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

Extension terminal 1 with 8 valves (outputs) and 16 repeaters (inputs)

- Address 1 (extension terminal 1 always has the address 1)
- The valves 1-8 are assigned to outputs (PAA) byte 15 in the process image.
- The repeaters 1-16 are assigned to inputs (PAE) bytes 17+18 in the process image.
- Mode: Normal input mode
- Input filter active

DIP switch extension terminal 1

1	2	3	4	5	6	7	8	9	10	11	12
ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

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Extension terminal 2 with 8 valves (outputs) and 16 repeaters (inputs)

- Address 2 (extension terminal 2 always has the address 2)
- The valves 1-8 are assigned to outputs (PAA) byte 16 in the process image.
- The repeaters 1-16 are assigned to inputs (PAE) bytes 22+23 in the process image.
- Mode: Normal input mode
- Input filter active

DIP switch extension terminal 2

1	2	3	4	5	6	7	8	9	10	11	12
OFF	ON	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

User parameter byte 11 User_Prm_Data 55 hex

Configuration

Byte No. (slot)	1* (0)**	2 (1)	3 (2)	4 (3)	5 (4)	6 (5)	7 (6)	8 (7)
Identification in Hex (Dec)	11 (017)	20 (032)	11 (017)	20 (032)	11 (017)	20 (032)	11 (017)	20 (032)
Process image output (PAA)		30		12		15		16
Process image input (PAE)	15+16		20+21		17+18		22+23	
	Main terminal		Extension terminal 0		Extension terminal 1		Extension terminal 2	

* Standard

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Allocation of inputs and outputs to control process image

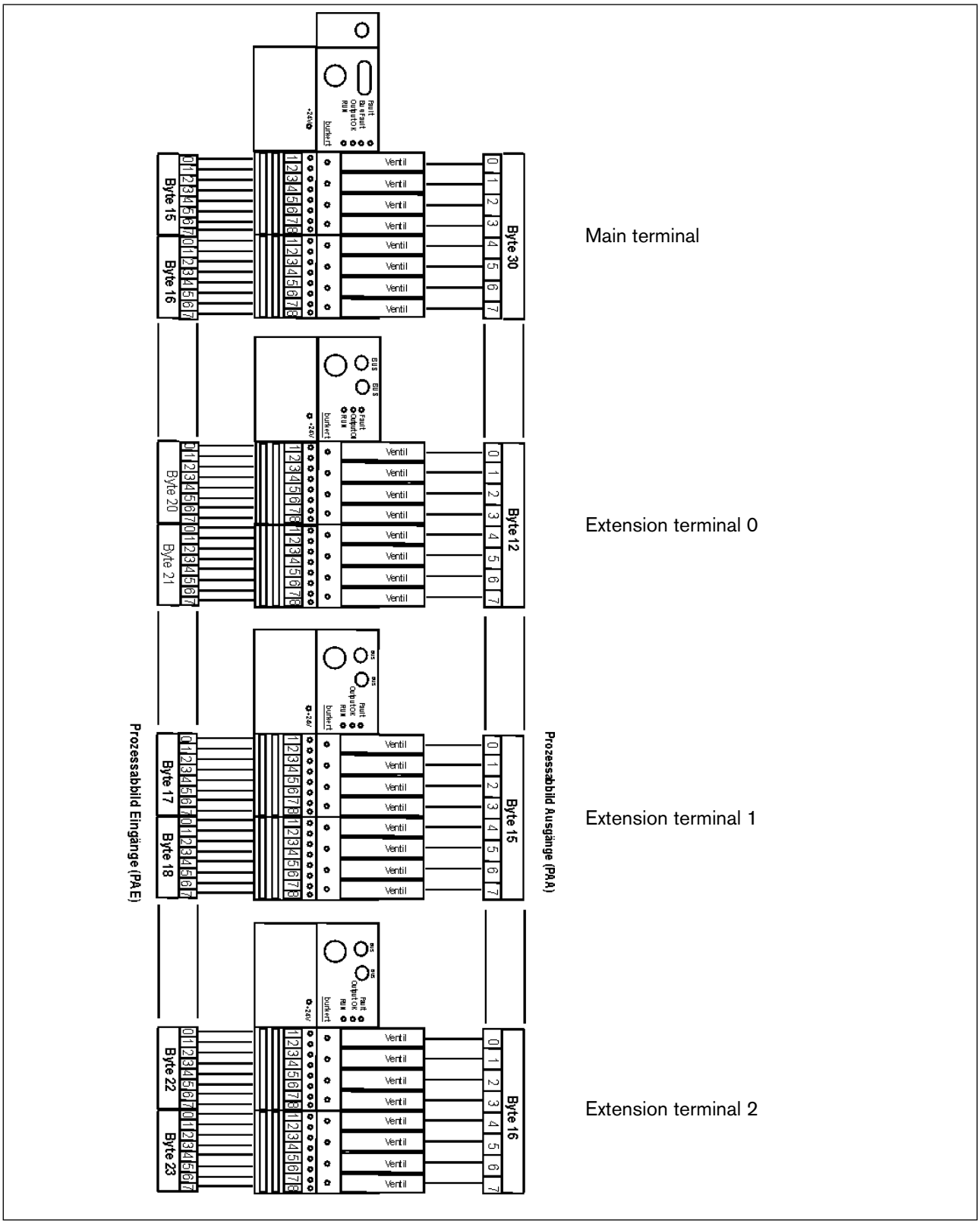

Figure 19: Allocation of inputs and outputs to control process image

9.2.5. Parameterization (Hex parameter* / User_Prm_Data**) of the valve terminal with extension terminal - bitwise composition of the inputs and outputs

With bitwise composition of the inputs and outputs it is necessary to transmit user data (Hex parameters) via the parameterization. The minimum information required in addition to the settings consists of the number of inputs present on the main terminal, on the extension terminal 0, etc.

The default value for the parameterization of the main terminal is

- Extension terminal - none (must be adjusted bitwise on RIO)
- Input mode - normal inputs
- Filter - ON

When extension terminals are used the parameterization option extension terminals RIO bitwise must be selected.

The parameterization can be used to modify the settings selected for the input mode and the filter.

Further, you may set the length of the device-related diagnosis, whereby the long diagnosis only makes sense when more than four extension terminals are used.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte	Bus parameters (normal parameters) 7 bytes							
1	Lock_Rep 00 min TSDR and slave spec. data 01 release for other masters 10 lock for other masters 11 release for other masters	Unlock_Re	Sync_Req Slave being operated in Sync mode	Freeze_Req Slave being operated in Freeze mode	WD_ON Signal monitoring 0: deactivated 1: activated	reserved	reserved	reserved
2	WD_Fact_1		(range 1-255 signal monitoring in [s] = 10 ms x WD_Fact_1 x WD_Fact_2)					
3	WD_Fact_2		(range 1-255 signal monitoring in [s] = 10 ms x WD_Fact_1 x WD_Fact_2)					
4	TSDR		(time in Tbits in which the slave may respond. At least 11 Tbit; 0 old value remains)					
5	Ident_Number high byte		(manufacturer identification 00 Hex)					
6	Ident_Number low byte		(manufacturer identification 81 Hex)					
7	Group_Ident		(For group generation; each bit represents one group.)					

* Siemens

** Standard

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The following settings are permitted in the parameter telegram:

Byte No.	Description	
8 (0)	DPV1_Status_1	
9 (1)	DPV1_Status_2	
10 (2)	DPV1_Status_3	
11 (3)	Input mode / Input filter / Diagnosis length	See table below
12 (4)	Number of bits inputs main terminal	
13 (5)	Number of bits outputs main terminal	
14 (6)	Number of bits inputs extension terminal 0	DIP switch on EI 0: S1=OFF, S2=OFF, S3=OFF
15 (7)	Number of bits outputs extension terminal 0	
16 (8)	Number of bits inputs extension terminal 1	DIP switch on EI 1: S1=ON, S2=OFF, S3=OFF
17 (9)	Number of bits outputs extension terminal 1	
18 (10)	Number of bits inputs extension terminal 2	DIP switch on EI 2: S1=OFF, S2=ON, S3=OFF
19 (11)	Number of bits outputs extension terminal 2	
20 (12)	Number of bits inputs extension terminal 3	DIP switch on EI 3: S1=ON, S2=ON, S3=OFF
21 (13)	Number of bits outputs extension terminal 3	
22 (14)	Number of bits inputs extension terminal 4	DIP switch on EI 4: S1=OFF, S2=OFF, S3=ON
23 (15)	Number of bits outputs extension terminal 4	
24 (16)	Number of bits inputs extension terminal 5	DIP switch on EI 5: S1=ON, S2=OFF, S3=ON
25 (17)	Number of bits outputs extension terminal 5	
26 (18)	Number of bits inputs extension terminal 6	DIP switch on EI 6: S1=OFF, S2=ON, S3=ON
27 (19)	Number of bits outputs extension terminal 6	
28 (20)	Number of bits inputs extension terminal 7	DIP switch on EI 7: S1=ON, S2=ON, S3=ON
29 (21)	Number of bits outputs extension terminal 7	

Byte 11 (3)

Input mode	Input filter OFF	Input filter ON	Input filter OFF long diagnosis	Input filter ON long diagnosis
no inputs	03 hex	43 hex	83 hex	C3 hex
normal inputs	13 hex	53 hex	93 hex	D3 hex
shifted inputs	23 hex	63 hex	A3 hex	E3 hex
halved inputs	33 hex	73 hex	B3 hex	F3 hex

For a description of the input modes and the input filter refer to Section “9.3. Mode inputs”.

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9.2.6. Configuration of the valve terminal with extension terminal - bitwise composition of the inputs and outputs

The settings of the desired configuration, i.e. setting of various identifiers, is generally done with the help of the GSD file.

By using different identifiers the user can assign the input and output bytes in the process image at will. The identifiers are independent of the individual valve terminals.

The inputs / outputs are composed to one bitstream each in accordance with the parameterization from the main terminal and the extension terminals. The bytes can be distributed in the process image on the basis of the identifiers.

Example with inputs: (Z - Assignment; K - Identifier)

Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Z	Main terminal				Extension terminal 0												Extension terminal 1						U	U
K	24DE (12hex)																							
or																								
Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Z	Main terminal				Extension terminal 0												Extension terminal 1						U	U
K	8DE (10 hex)								16DE (11 hex)															
or																								
Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Z	Main terminal				Extension terminal 0												Extension terminal 1						U	U
K	16DE (11 hex)																8DE (10 hex)							
or																								
Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Z	Main terminal				Extension terminal 0												Extension terminal 1						U	U
K	8DE (10 hex)								8DE (10 hex)								8DE (10 hex)							

Main terminal	4 bit inputs
Extension terminal 0	12 bit inputs
Extension terminal 1	6 bit inputs
U	unused bit

Manual configuration

If no GSD file is available the configuration must be performed manually. The following specifications apply. One configuration telegram can contain one or several identifications, whereby the user can make the necessary allocations at will. the identifications have the following structure:

Bit 7	Bit 6	Bit 5 - 4	Bit 3 - 0
Consistency 0 = byte/word 1 = total length	Bytes / Word 0 = bytes 1 = words (2 bytes)	Input / Output 00 = spec. identifier format 01 = input 10 = output 11 = input/output	Length (amount of data) 0000 = 1 byte / word ... 0010 = 3 bytes / words ... 1111 = 16 bytes / words

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Example 6 - main terminal with 3 extension terminals Main terminal with 3 valves (outputs) and 3 repeaters (inputs), every second repeat signal not taken into account

- PROFIBUS-DP address 9
- Mode: halved inputs
- Input filter active
- RIO interface

DIP switch main terminal

1	2	3	4	5	6	7	8
ON	OFF	OFF	ON	OFF	OFF	OFF	OFF

Extension terminal 0 with 4 valves (outputs) and no repeaters

- Address 0 (extension terminal 0 always has the address 0)

DIP switch extension terminal 0

1	2	3	4	5	6	7	8	9	10	11	12
OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF

Extension terminal 1 with 2 valves (outputs) and 4 repeaters (inputs)

- Address 1 (extension terminal 1 always has the address 1)
- Mode: normal input mode
- Input filter active

DIP switch extension terminal 1

1	2	3	4	5	6	7	8	9	10	11	12
ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

Extension terminal 2 with 3 valves (outputs) and 6 repeaters (inputs), every second repeat signal remains unprocessed

- Address 2 (extension terminal 2 always has the address 2)
- Mode: halved inputs
- Input filter active

DIP switch extension terminal 2

1	2	3	4	5	6	7	8	9	10	11	12
OFF	ON	OFF	ON	OFF	OFF	ON	OFF	ON	ON	ON	OFF

Parameter diagram

Here only the user parameters (User_Prm_Data) without the 3 DPV1 status bytes are shown. Counting in brackets starting at zero (most configuration programs only show user parameters). Value in Hex format.

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Byte No.	11 (3)	12 (4)	13 (5)	14 (6)	15 (7)	16 (8)	17 (9)	18 (10)	19 (11)
Value (HEX)	73	03	03	00	04	04	02	03	03
Mean-ing	Parame-ter type	Input	Output	Input	Output	Input	Output	Input	Output
		Main terminal		Extension terminal 0		Extension terminal 1		Extension terminal 2	

Configuration

Byte No. (slot)	1 (0)	2 (1)	3 (2)	4 (3)
Identification in Hex (Dec)	10 (016)	10 (016)	20 (032)	20 (032)
Process image output (PPA)			11	14
Process image input (PAE)	15	20		

Allocation of inputs and outputs to control process image

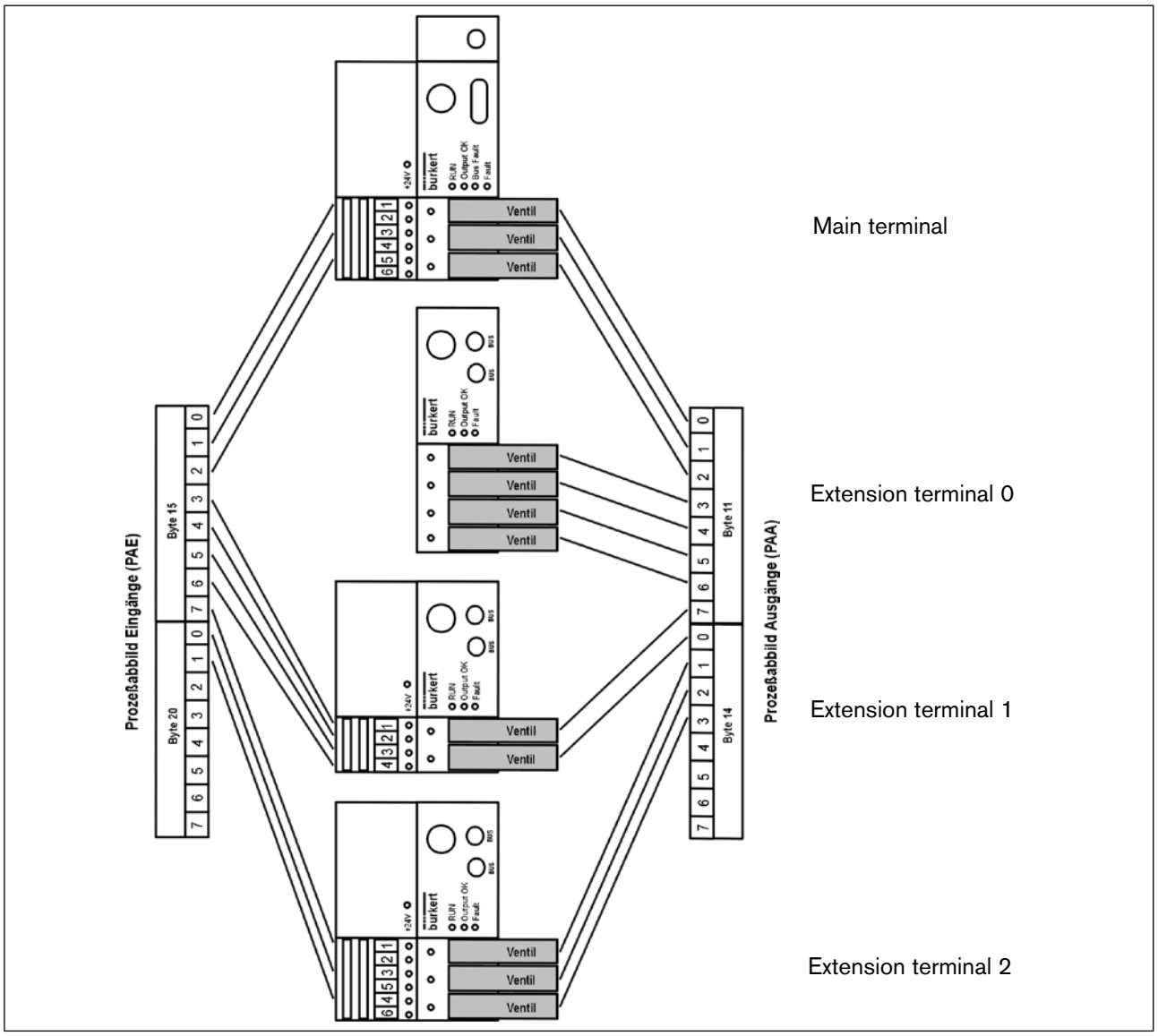

Figure 20: Allocation of inputs and outputs to control process image

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9.3. Mode inputs

With the help of the input modes the inputs (repeaters) can be assigned diversely in the process image of the outputs (PAE). The mode selection takes place in the parameter telegram.

9.3.1. Normal mode

In normal mode all outputs are read in from right to left.

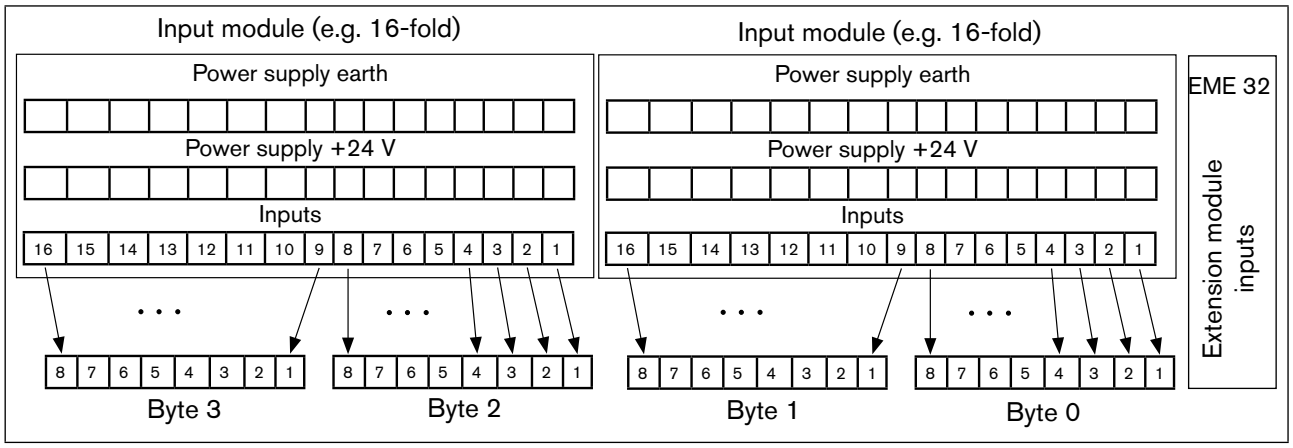

Figure 21: Normal mode

9.3.2. Shifted inputs mode

In shifted inputs mode the first 16 inputs are placed alternatingly in byte 0 and byte 1 of the transmission log. The same procedure is carried out for the following 16 inputs with byte 2 and byte 3.

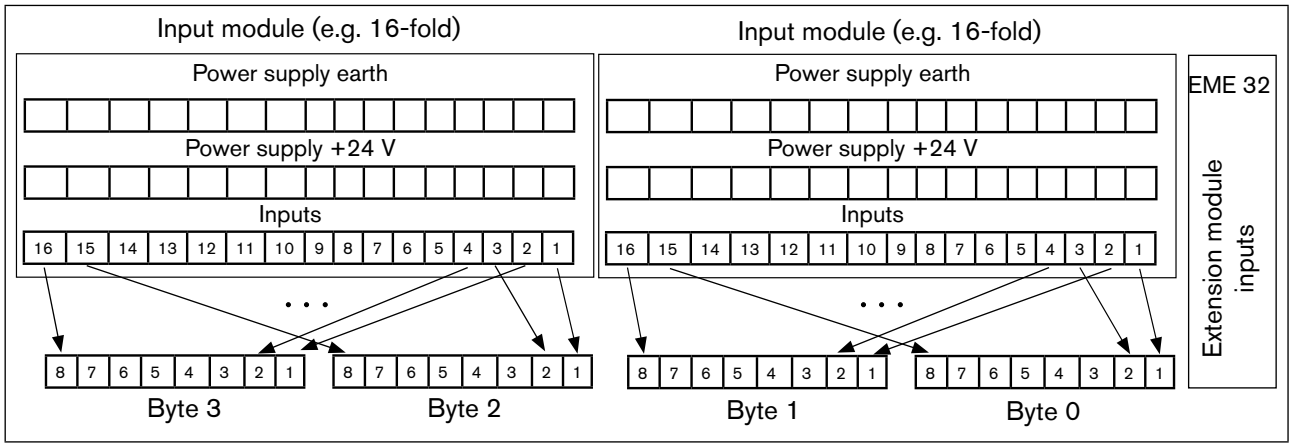

Figure 22: Shifted inputs mode

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9.3.3. Halved inputs mode

In halved inputs mode every second input is skipped. Only the inputs 1, 3, 5, ... are transmitted, so for 32 physically existing inputs only 2 bytes are needed.

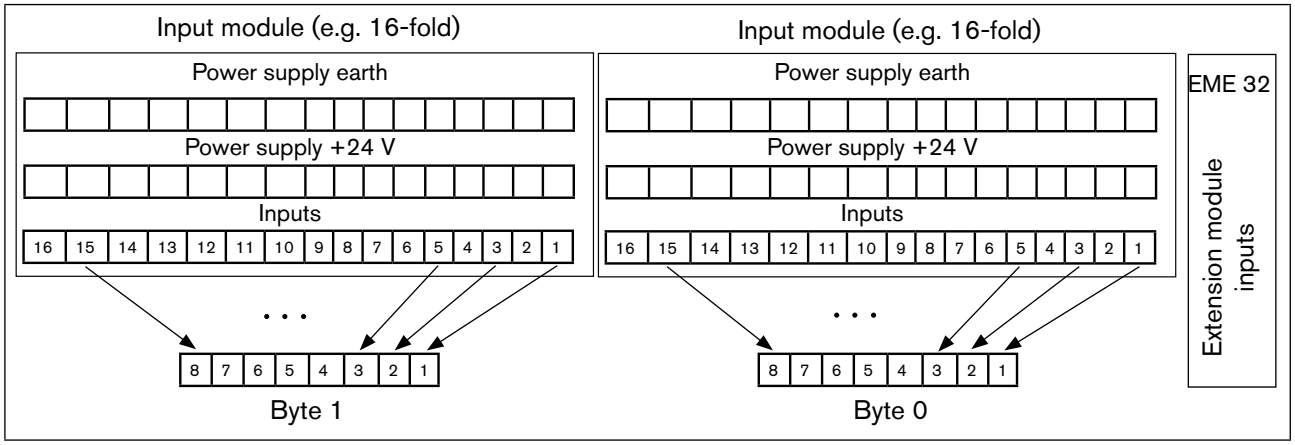

Figure 23: Halved inputs mode

9.4. Input filter

The input filter suppresses disturbances which affect the input modules. Therefore the activation of this input filter is always recommended.

When the filter is activated only signals are recognized which have a duration of ≥ 2 ms. The regulations contained in EMC legislation require that the input filter be activated.

9.5. Special parameterization functions

Parameter 0x0E : Delete EEPROM

In order to delete a default setting stored in the EEPROM for the configuration the code 0x0E (14 decimal) must be transmitted as user data (Hex parameter).

Parameter 0x0F: Modification of the default setting for the configuration

If the default values are used in configuring the valve terminal, then the maximum values, i.e. 4 bytes inputs and 3 bytes outputs, are set and added to the process image.

In order to select another default setting the following user data (Hex parameters) must be set.

Byte No.	Description
0	0 x 0F; parameter for the modified default setting
1	Number of identifiers to follow (max. 7)
2	Identifier 1
3	Identifier 2
...	
8	Identifier 7

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The following identifiers are allowed:

Hex	Decimal	Description
10	016	1 byte input; consistency via byte
11	017	2 bytes input; consistency via byte
12	018	3 bytes input; consistency via byte
13	019	4 bytes input; consistency via byte
20	032	1 byte output; consistency via byte
21	033	2 bytes output; consistency via byte
22	034	3 bytes output; consistency via byte
00	000	Placeholder

9.6. Diagnosis

During system start-up or on error the master reads the diagnosis from the slave. Most controls makes some of the this data available.

The device-related diagnostics file (Ext_Diag_Data) contains the following data:

- Essential DIP switch positions,
- Error number of the parameterization and configuration errors,
- Output voltage error,
- Information concerning the failure of an extension terminal,
- Details of the configuration of the extension terminal.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte	Standard diagnosis 6 bytes							
1 (0)	**Master-Look** Parameterized from other master	**Prm_Fault** Parameter error	**Invalid_ Slave_ Response** Terminal sets 0	**Not_Sup-ported** Function is not supported	**Ext._Diag** Diagnostic entry present	**Cfg._Fault** Configu-ration error	**Station_Not_ Ready** Not ready for data exchange	**Station_Non_ Existent** Terminal sets 0
2 (1)	**Deactivated** Terminal sets 0	**Not_Present** Terminal sets 0	**Sync_Mode** Sync command received (outputs are issued and frozen)	**Freeze_Mode** Freeze command received (outputs are read in and frozen)	**WD_On** Watchdog on	**always = 1**	**Stat_Diag** Static diagnosis	**Prm_Req** Slave must be re-param-eterized and configured
3 (2)	**Ext_Diag_** Overflow, more diag-nostics data present than can be sent	**reserved**	**reserved**	**reserved**	**reserved**	**reserved**	**reserved**	**reserved**
4 (3)	**Master_ADD**		(Address of the master which parameterized the terminal - no master: FF Hex)					
5 (4)	**Ident_Number high byte**		(manufacturer identification 00 Hex)					
6 (5)	**Ident_Number low byte**		(manufacturer identification 81 Hex)					

	Ext_Diag_Data (device-related diagnosis 10 or 14 bytes)							
7 (6)	Header byte (Length of the device-related diagnosis 10 or 14 bytes)							
	Diagnosis of the main terminal (HI)							
8 (7)	0	0	0	0	0	0	0	HI: 24 V out
	Parameterization and configuration error (see Section "9.7. Configuration and parameterization errors")							
9 (8)	Configuration error number				Parameterization error number			
	Diagnosis of extension terminal (EI)							
10 (9)	EI7: 24V out	EI6: 24V out	EI5: 24V out	EI4: 24V out	EI3: 24V out	EI2: 24V out	EI1: 24V out	EI0: 24V out
11 (10)	EI7: NOK	EI6: NOK	EI5: NOK	EI4: NOK	EI3: NOK	EI2: NOK	EI1: NOK	EI0: NOK
12 (11)	EI7: Config	EI6: Config	EI5: Config	EI4: Config	EI3: Config	EI2: Config	EI1: Config	EI0: Config
	Switch positions of extension terminal (EI)							
13 (12)	EI0: DIP -8	EI0: DIP -7	EI0: DIP -6	EI0: DIP -5	EI0: DIP -4	EI0: DIP -11	EI0: DIP -10	EI0: DIP -9
14 (13)	EI1: DIP -8	EI1: DIP -7	EI1: DIP -6	EI1: DIP -5	EI1: DIP -4	EI1: DIP -11	EI1: DIP -10	EI1: DIP -9
15 (14)	EI2: DIP -8	EI2: DIP -7	EI2: DIP -6	EI2: DIP -5	EI2: DIP -4	EI2: DIP -11	EI2: DIP -10	EI2: DIP -9
16 (15)	EI3: DIP -8	EI3: DIP -7	EI3: DIP -6	EI3: DIP -5	EI3: DIP -4	EI3: DIP -11	EI3: DIP -10	EI3: DIP -9
	Only for 14 byte user diagnosis							
17 (16)	EI4: DIP -8	EI4: DIP -7	EI4: DIP -6	EI4: DIP -5	EI4: DIP -4	EI4: DIP -11	EI4: DIP -10	EI4: DIP -9
18 (17)	EI5: DIP -8	EI5: DIP -7	EI5: DIP -6	EI5: DIP -5	EI5: DIP -4	EI5: DIP -11	EI5: DIP -10	EI5: DIP -9
19 (18)	EI6: DIP -8	EI6: DIP -7	EI6: DIP -6	EI6: DIP -5	EI6: DIP -4	EI6: DIP -11	EI6: DIP -10	EI6: DIP -9
20 (19)	EI7: DIP -8	EI7: DIP -7	EI7: DIP -6	EI7: DIP -5	EI7: DIP -4	EI7: DIP -11	EI7: DIP -10	EI7: DIP -9

HI main terminal on PROFIBUS-DP

EIn Extension terminal n on RIO bus (n = 0 to 7),
Example: EI0: DIP-4 extension terminal with address 0 switch 4

DIP-n DIP switch number of the corresponding extension terminal (to the right on bus module)
0:= OFF; 1:=ON

24 V Out 24 V output control voltage not present on corresponding valve terminal
0:=no error; 1:=error

NOK No signal from corresponding extension terminal on RIO bus
0:=no error; 1:=error

Config The corresponding extension terminal was configured by the master
0:=not configured; 1:=configured

9.7. Configuration and parameterization errors

	Configuration error number		Parameterization error number
1	Too many inputs (> 32) for one terminal	1	Too many inputs (> 32) for one terminal entered
2	Too many outputs (> 24) for one terminal	2	Too many outputs (> 24) for one terminal entered
3	Too few inputs for all terminals (preset in parameterization telegram)	3	Parameterization telegram too long
4	Too few outputs for all terminals (preset in parameterization telegram)	4	Too few outputs for all terminals
5	Wrong configuration byte	5	

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10. BUS MODULE RIO SLAVE (RIO/VA)

The bus module RIO slave (internal bus extension via CAN bus) requires a valve terminal 8640 with corresponding RIO connection, e.g. PROFIBUS module DP/V1 or a bus module RIO slave already connected.

NOTE!

The PROFIBUS module DP/V1 with RIO connection and the Profinet IO, Ethernet/IP and Modbus TCP modules support up to 8 RIO slave modules which are connected in series.

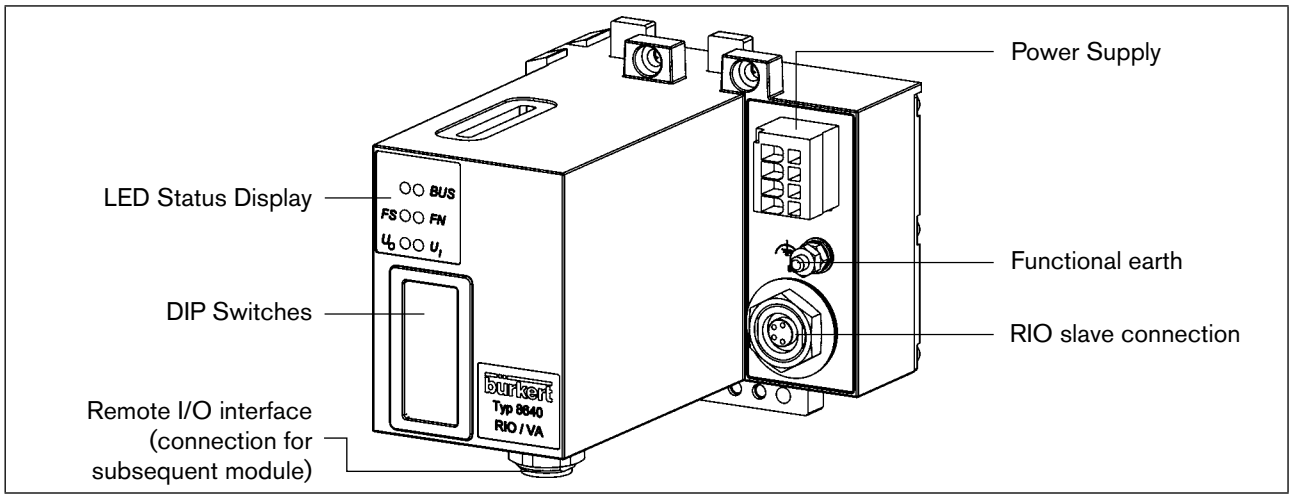

Figure 24: Overview of bus module RIO slave

Appropriate connection cables are required for the connection (see Accessories).

The DIP switches can be operated through the covering film!

Accessories

Connection cable remote I/O interface to RIO slave	1 m (1.09 yd)	Order number 917 498
Connection cable remote I/O interface to RIO slave	2 m (2.19 yd)	Order number 917 499

Plug-in connector for power supply (included in delivery).

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10.1. Power supply (Power) RIO slave

The 4-pole plug-in connector for the power supply is configured as follows:

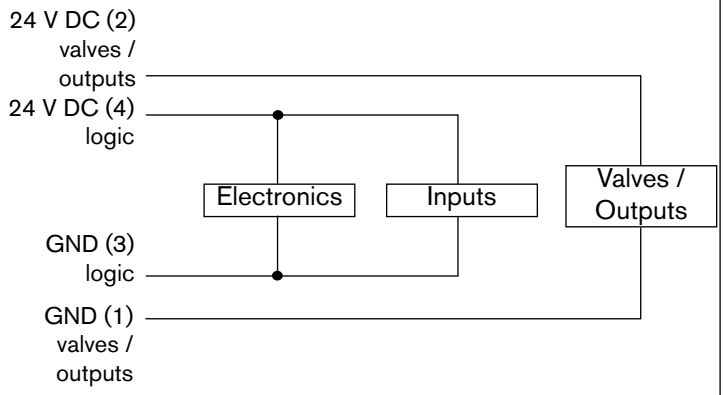

Figure 25: Power supply configuration

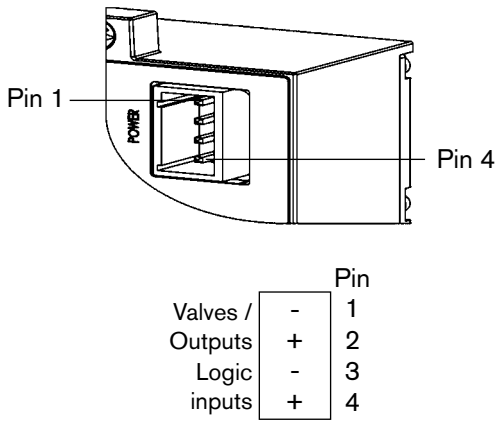

Figure 26: Cutaway POWER connection

Pin 2 of the power supply must be supplied with a 3 A medium time-lag fuse; Pin 4 with 1 A.

The power supply on the RIO slave must be applied no later than 1 second later than on valve island Type 8640 to ensure that it is detected by the valve island and data can be exchanged. Subsequent connection of an RIO slave therefore requires a restart of the valve island!

Version REV.2: If no slave is detected after this time, the RIO interface is switched to an internal service protocol.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

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10.2. Field bus connection RIO slave

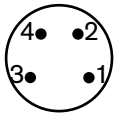
4-pole connections M 8 are used for the internal field bus.

NOTE!

The assignment of both bus connectors is identical. The length of the individual connection cables must be less than 3 m for EMC reasons.

Pin No.	Signal name Incoming interface (BUS IN) (Socket in the device, plug on the cable)	Signal name Outgoing interface (BUS OUT) (Socket in the device, plug on the cable)
1	CAN HIGH	CAN HIGH
2	CAN LOW	CAN LOW
3	not used	not used
4	not used	not used

Pin assignment



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10.3. LED Status Display

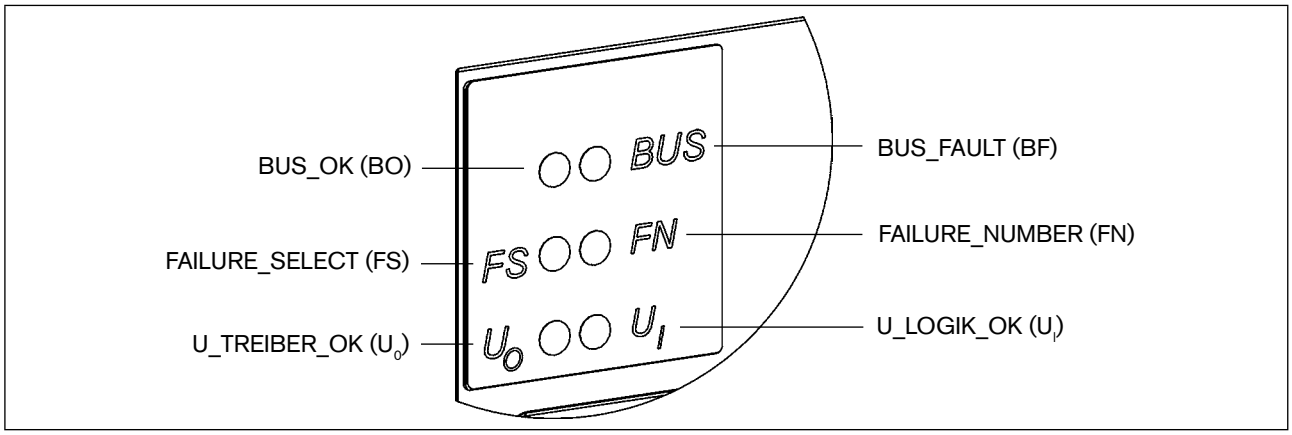

Figure 27: LED status display (detail)

Abbreviation	Color	Description	Explanation
BO	green	Bus OK	Internal bus communication active
BF	red	Bus Fault	Internal bus fault
FS	yellow	Failure Select	Determines the function of the FN LED: FS lit up: FN displays fault type FS not lit up: FN displays failure number
FN	red	Failure Number	The number of flash impulses indicates the fault type or the failure number depending on whether FS is lit up or not
U_I	green	U LOGIC OK	Power supply for logic supply, inputs and bus interface present
U_0	green	U driver OK	Supply voltage for outputs present

10.3.1. Normal state

LED	Status	Description
BUS (BO) BUS (BF) FS FN U_0 U_I	ON OFF OFF OFF ON ON	Trouble-free operation of the peripheral terminal

10.3.2. Bus fault

LED	Status	Description	Fault cause / remedial action
BUS (BO) BUS (BF) FS FN U_0 U_I	OFF FLASHES OFF OFF ON ON	Signal monitoring time on the valve terminal has elapsed without it activating the main terminal	In operation: Check main terminal (control) and bus cable. During start up: Check network configuration on the master and station address on the terminal

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10.3.3. Output voltage not available

LED	Status	Description
U_0 FS FN	OFF FS and FN indicate fault type 4 and failure number 1	Check supply voltage

10.4. DIP switch settings

NOTE!

Set the DIP switches through the film using a screwdriver (the film is very durable).

1	2	3	4	5	6	7	8
Address on the internal RIO bus			Mode inputs		Reserve always OFF		Terminating resistors

Changes made to the switch positions only take effect after the field bus module has been reset.

10.4.1. Address on the internal RIO bus: DIP switches 1 to 3

Each peripheral terminal has a unique address. This address is set on the valve terminal via DIP switches 1 to 3.

DIP 1	DIP 2	DIP 3	Address	Peripheral terminal
OFF	OFF	OFF	0	0
ON	OFF	OFF	1	1
OFF	ON	OFF	2	2
ON	**ON**	**OFF**	**3**	**3**
OFF	OFF	ON	4	4
ON	OFF	ON	5	5
OFF	ON	ON	6	6
ON	ON	ON	7	7

10.4.2. Mode inputs: DIP switches 4 and 5

NOTE!

The input modes allow the entries (feedback indicator) to be assigned in different ways in the process image of the inputs (PAE).

	DIP 4	DIP 5
No entries available	OFF	OFF
Normal mode	ON	OFF
Mode: shifted inputs	OFF	ON
Mode: halved inputs	ON	ON

CAUTION!

If there are no inputs available, both switches must be set to OFF.

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Normal mode

In normal mode all outputs are read in from right to left.

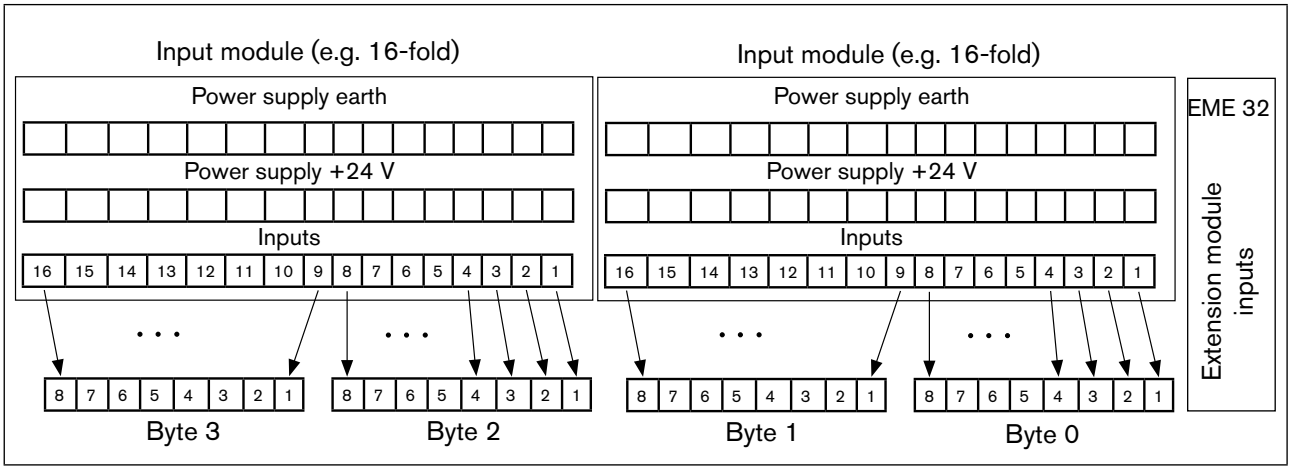

Figure 28: Normal mode

Shifted inputs mode

In shifted inputs mode the first 16 inputs are placed alternatingly in byte 0 and byte 1 of the transmission log. The same procedure is carried out for the following 16 inputs with byte 2 and byte 3.

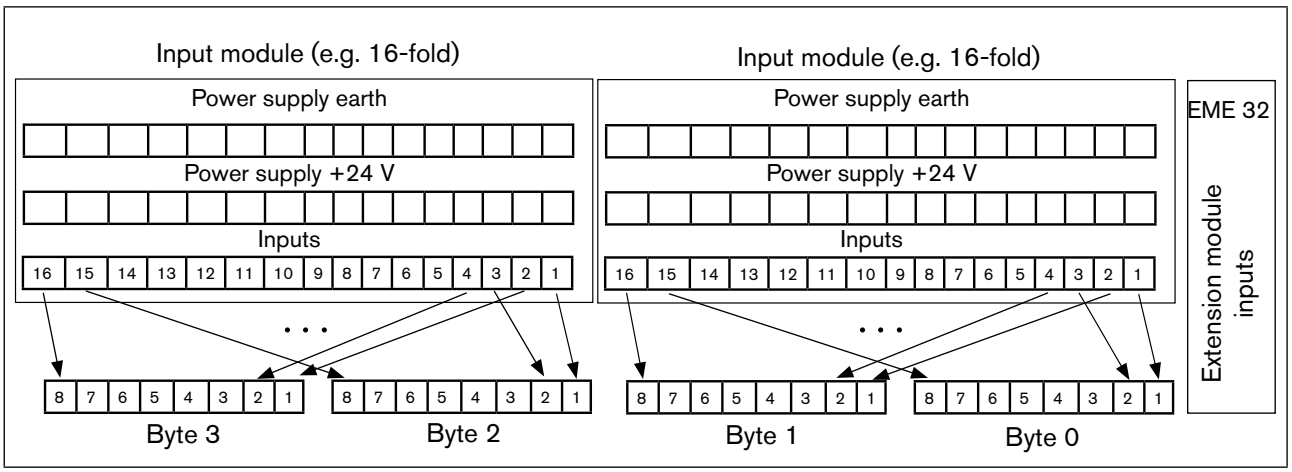

Figure 29: Shifted inputs mode

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Halved inputs mode

In halved inputs mode every second input is skipped. Only the inputs 1, 3, 5, ... are transmitted, so for 32 physically existing inputs only 2 bytes are needed.

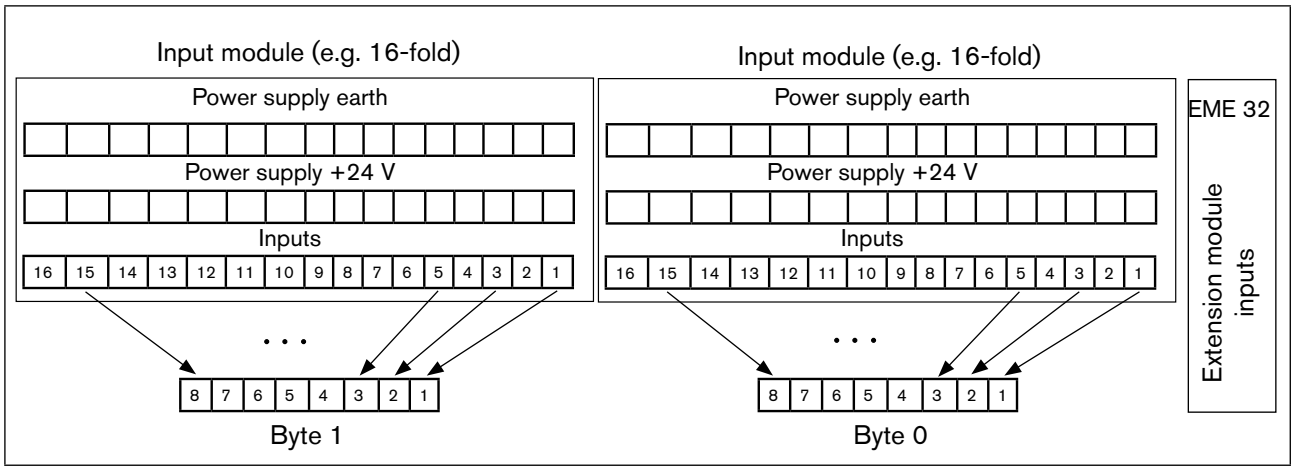

Figure 30: Halved inputs mode

10.4.3. Terminating resistors: DIP switch 8

In the case of the remote I/O interface both ends of the two-wire line of the field bus must be terminated with resistors. If the last subscriber is a valve terminal, the terminating resistors can be activated by DIP switch 8.

NOTE!

The high data transfer rates used in the field bus technology may cause interfering signal reflections at the ends of the field bus line. These may result in data errors. Connected terminating resistors will eliminate these reflections.

	DIP 8
Terminating resistors deactivated	OFF
Terminating resistors activated	ON

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11. FIELDBUS MODULE DEVICENET

The DeviceNet is a field bus system which is based on the CAN protocol (Controller Area Network). It enables actuators and sensors (slaves) to be networked with higher-level controllers (master). In the DeviceNet the valve terminal is a slave device according to the Predefined master/slave Connection Set stipulated in the DeviceNet specification. Polled I/O, Bit Strobed I/O and Change of State (COS) are supported as an I/O connection variant.

11.1. DeviceNet, IP20 - overview

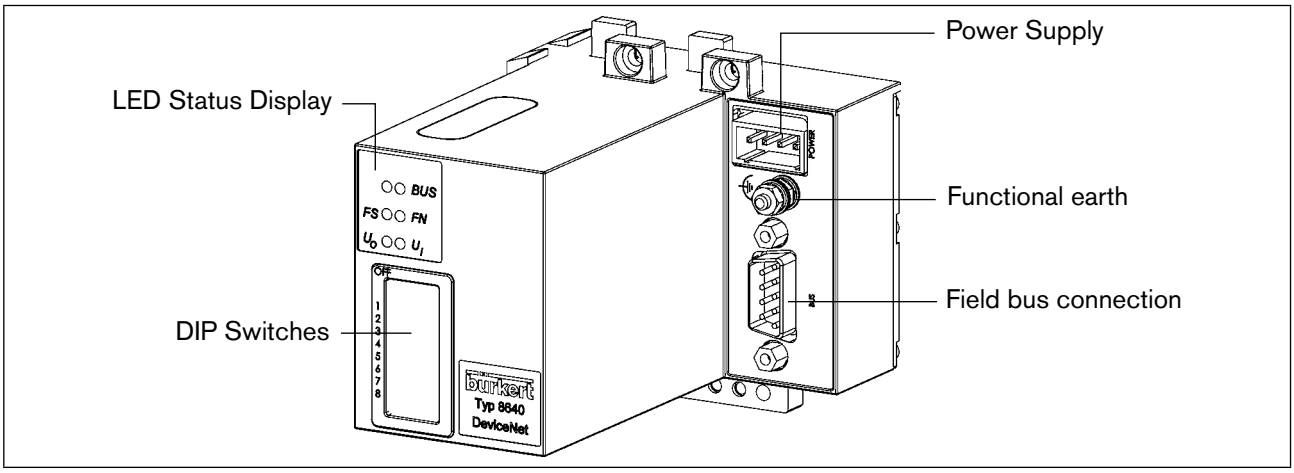

Figure 31: Overview fieldbus module DeviceNet IP20

The DIP switches can be operated through the covering film.

11.1.1. Power supply IP20

The 4-pole plug-in connector for the power supply is configured as follows:

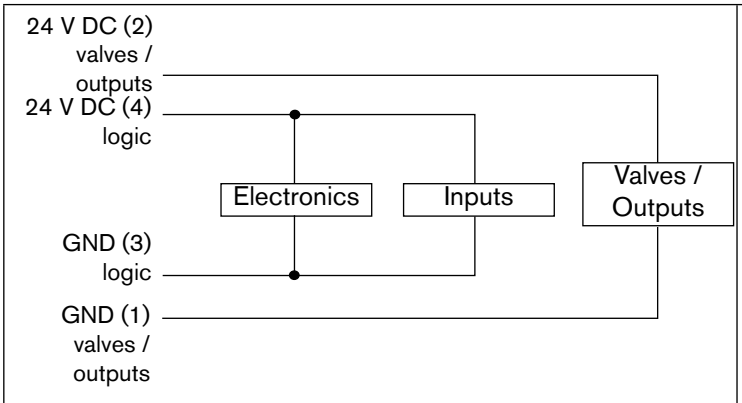

Figure 32: Power supply configuration

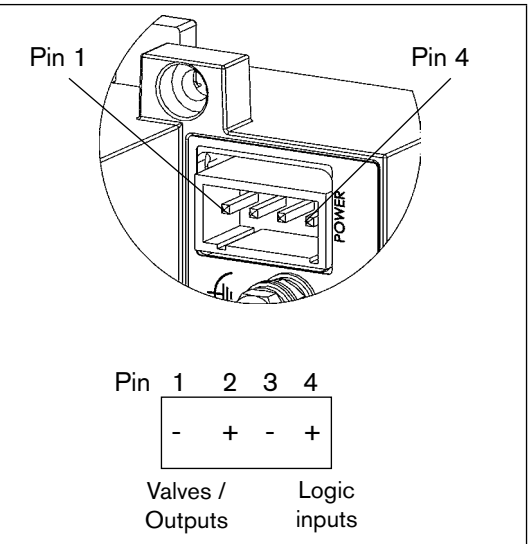

Figure 33: Cutaway POWER connection

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Pin 2 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 4 with 1 A.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

11.1.2. IP20 field bus connection

For connecting the field bus a 9-pole D-SUB connection is used with the following pin assignment (plug in device, socket on cable).

Pin No.	Signal name
1	not used
2	CAN LOW
3	GND
4	not used
5	not used
6	not used
7	CAN HIGH
8	not used
9	not used

11.1.3. IP20 terminating circuit

When installing a DeviceNet system, ensure that the terminating circuit of the data lines is correct. The circuit prevents the occurrence of interference caused by signal reflection in the data lines. The trunk line must be terminated at both ends with resistors of 120 Ω each and 1/4 W power loss.

For the IP20 variant a terminal resistance of 120 Ohm between the two bus connections CAN High and CAN Low can be added using a bridge in the 9-pole D-SUB field bus connection between pin 4 and pin 8.

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11.2. DeviceNet, IP54 - overview

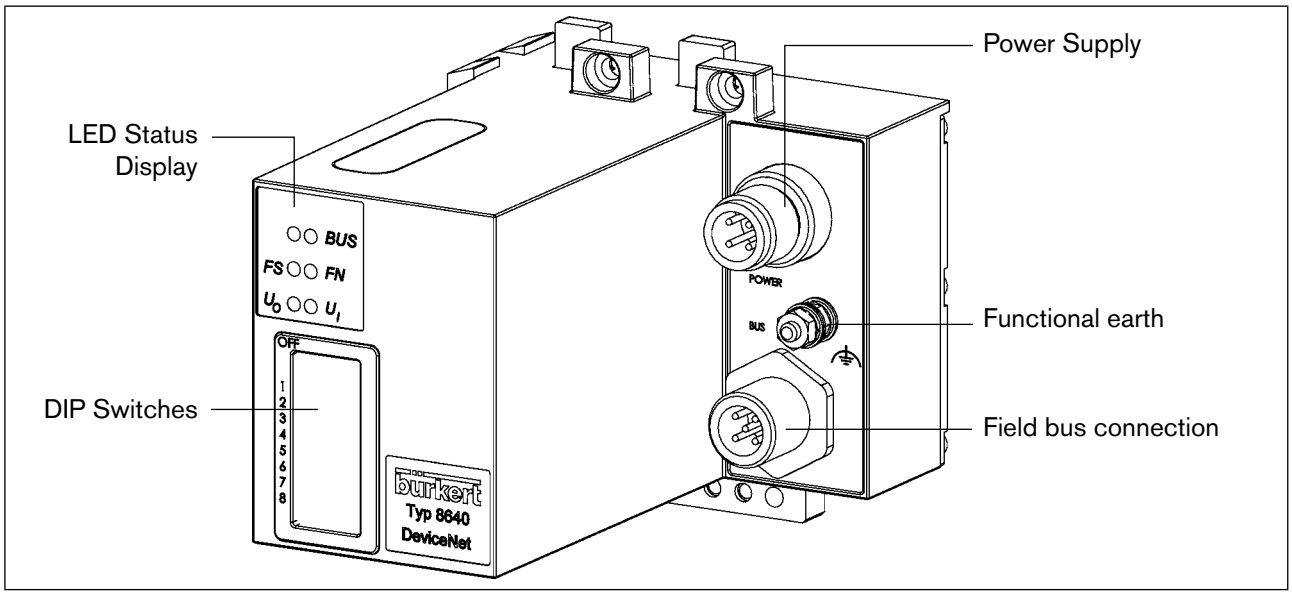

Figure 34: Overview field bus module DeviceNet IP54

11.2.1. Power supply IP54

The 4-pole circular plug-in connector for the power supply is configured as follows:

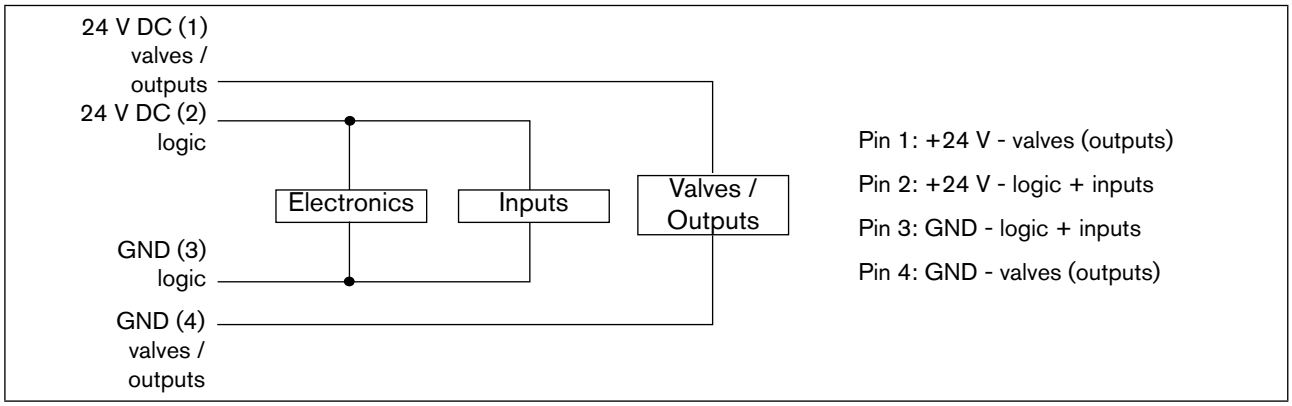

Figure 35: Power supply configuration

Pin 2 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 4 with 1 A.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

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11.2.2. IP54 field bus connection

For the field bus connection the 5-pole M12 Micro-Style plug-in connector (plug) as specified by the DeviceNet is used with the following pin assignment.

Pin No.	Signal name
1	Drain (shielding)
2	not used
3	GND
4	CAN HIGH
5	CAN LOW

The bus drivers are supplied internally via a voltage source which is galvanically isolated from the supply voltage. For this reason it is not necessary for separate voltage to be supplied from the bus via pin 2 and pin 3.

Accessories

DeviceNet, configurable M12 plug-in connector, 5-pole, straight coupling	Id.-No. 917 116
DeviceNet, configurable M12 plug-in connector, 5-pole, straight plug	Id.-No. 902 627
Power supply, configurable M12 plug-in connector, 4-pole, straight coupling	Id.-No. 902 552
Terminal resistance, M12 plug, 5-pole	Id.-No. 902 628
Y-piece, M12, 5-pole	Id.-No. 788 643

11.2.3. IP54 terminating circuit

When installing a DeviceNet system, ensure that the terminating circuit of the data lines is correct. The circuit prevents the occurrence of interference caused by signal reflection in the data lines. The trunk line must be terminated at both ends with resistors of 120 Ω each and 1/4 W power loss.

11.3. Position of the DIP switches

The DIP switches are used to make field bus module settings.

NOTE!

Changes made to the switch settings only take effect after the field bus module has been reset. Set the DIP switch through the film using a screwdriver (the film is very durable).

'ON' setting = DIP switch to the right

1 (above)	2	3	4	5	6	7	8 (below)
Field bus module address						Baud rate	

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11.3.1. Field bus module address: DIP switches 1 to 6

The address of the field bus module can be set on DIP switches 1 ... 6 in the range 0 ... 63.

DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6	Address
OFF	OFF	OFF	OFF	OFF	OFF	0
ON	OFF	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	OFF	3
						...
ON	ON	ON	ON	ON	ON	63

The baud rate can be set on DIP switches 7 and 8:

DIP 7	DIP 8	Baud rate
OFF	OFF	125 kbaud
ON	OFF	250 kbaud
OFF	ON	500 kbaud

11.4. LED status display

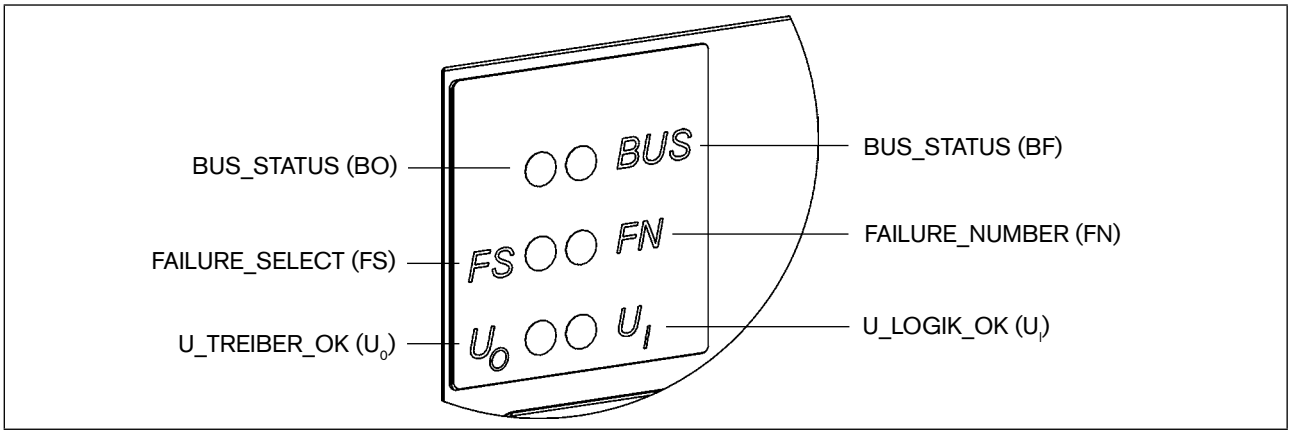

Figure 36: LED state display (detail)

Abbre-viation	Colour	Description	Explanation
BO	green	Bus status	See state of bus status LEDs
BF	red	Bus status	See state of bus status LEDs
FS	yellow	Failure Select	Determines the function of the FN LED: FS lit up: FN displays fault type FS not lit up: FN displays failure number
FN	red	Failure Number	The number of flash impulses indicates the fault type or the failure number depending on whether FS is lit up or not
U_I	green	U LOGIC OK	Voltage for logic supply, inputs and bus interface present
U_0	green	U driver OK	Voltage for outputs present

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State of bus status LEDs

LED	Device state	Explanation	Troubleshooting
not lit up	no voltage / offline	Device is not supplied with voltage Device has still not ended Duplicate MAN ID Test (test lasts approx. 2 sec) Device cannot end Duplicate MAC ID Test.	→ Connect other devices, if the device is the only network participant → Replace device → Check baud rate → Check bus connection
Green	online, communication master	Normal operating state with established connection to the master	
Flashes green	online, not communication master	Normal operating state with established connection to the master	
Flashes red	Connection time-out	One or more I/O connections are in time-out state.	
Red	Critical fault	Another device with the same MAC ID address is in the circuit. No bus connection due to communication problems	→ Check baud rate → Replace device

After voltage is supplied the following function test of the bus status LEDs is carried out:

- BO LED lights up briefly (green, approx. 1/4 sec.)
- BF LED lights up briefly (red, approx. 1/4 sec.)
- LEDs off

No output voltage present:

LED	Status	Remedial action
U_0 FS FN	OFF FS and FN display fault type 3 and fault number 1.	Check supply voltage

EEPROM access fault

LED	Status	Remedial action
FS FN	FS and FN display fault type 5 and fault number 1.	Error accessing EEPROM during start-up; flashing sequence only appears once. Device operating with default parameters. Replacement of electronics may be necessary.

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11.5. Applications object

Object	Class	Instance	Attribute	Access	Length (byte)	Range	Default	Brief description
Assembly	4	1	3	Get	4	0 ... 0 x FF / per byte	-	4 byte inputs
				Set	3	0 ... 0 x FF / per byte	0 x 00	3 byte outputs (valves)
Value Outputs	9	1 ... 3	3	Get / Set	1	0 ... 0 x FF	0 x 00	Valve values
Fault Action	9	1 ... 3	5	Get / Set	1	0 ... 0 x FF	0 x FF	Action on fault or offline per output 0: Fault Value (Def in Fault Value Attr 6) 1: Hold last state
Fault Value	9	1 ... 3	6	Get / Set	1	0 ... 0 x FF	0 x 00	
Factory ID	101	1	1	Get	4			Bürkert ident-number
Factory Serial	101	1	2	Get	4			Bürkert ident-number
Input mode	150	1	1	Get / Set	1	0 ... 3	0: without EME 1: with EME	0: no inputs 1: normal inputs 2: shifted inputs 3: halved inputs
Input filter	150	1	2	Get / Set	1	0 ... 1	1	0: Filter OFF 1: Filter ON

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12. CONFIGURATION AND PARAMETER SETTINGS FOR DEVICENET

12.1. Configuration of process data

To transmit process data via an I/O connection, there is one static input and one static output assembly available. These assemblies contain selected attributes combined into one object so that process data can be transmitted collectively via an I/O connection.

The process data can be accessed either cyclically in the connection variants 'polled I/O' and 'bitstrobed I/O' with 'change of state' when the input values vary, or acyclically via Explicit Messages. The access path for acyclical access is: class 4
instance 1
attribute 3

The output data can be read in acyclically via the Get_Attribute-Single service or written to acyclically via the Set_Attribute_Single service.

4 data bytes for inputs (sensors or initiators)

3 data bytes for outputs (actuators or valves)

12.2. Configuration of the safety position of solenoid valves if bus error

If a bus error occurs, the bus status LED may assume the "Green flashing", "Red flashing" or "Red" status. (For a description see "Status of the Bus Status LED")

The objects Fault Action and Fault Value can be used to configure the solenoid valves in the event of a bus error.

If a bus fault occurs, the configuration data of the solenoid valves can be accessed acyclically via Explicit Messages.

The service Get_Attribute_Single is available for read access to the configuration data and the service Set_Attribute_Single is available for write access to the configuration data.

Object Fault Action (class 9 / instance 1-3 / attribute 5):

Determines the reaction of the outputs when a bus error occurs. Here, each output byte has an instance assigned to it (in groups of 8 in each case).

	Description
1_{bin}	On error the output retains its current state.
0_{bin}	On error the output is switched to the state laid down in the object Fault Value at the appropriate position.

Object Fault Value (class 9 / instance 1-3 / attribute 6):

Determines the state of the outputs when a bus error occurs. Prerequisite: Appropriate setting in Object Fault Action. Here, each output byte has an instance assigned to it (in groups of 8 in each case).

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12.3. Mode inputs

With the help of the input modes the inputs (repeaters) can be assigned diversely in the process image of the outputs (PAE). The mode selection takes place in the input mode object.

Object Input Mode (class 150 / instance 1 / attribute 1):

Value	Description
0	no inputs present
1	normal inputs

Value	Description
2	shifted inputs
3	halved inputs

12.3.1. Normal mode

In normal mode all outputs are read in from right to left.

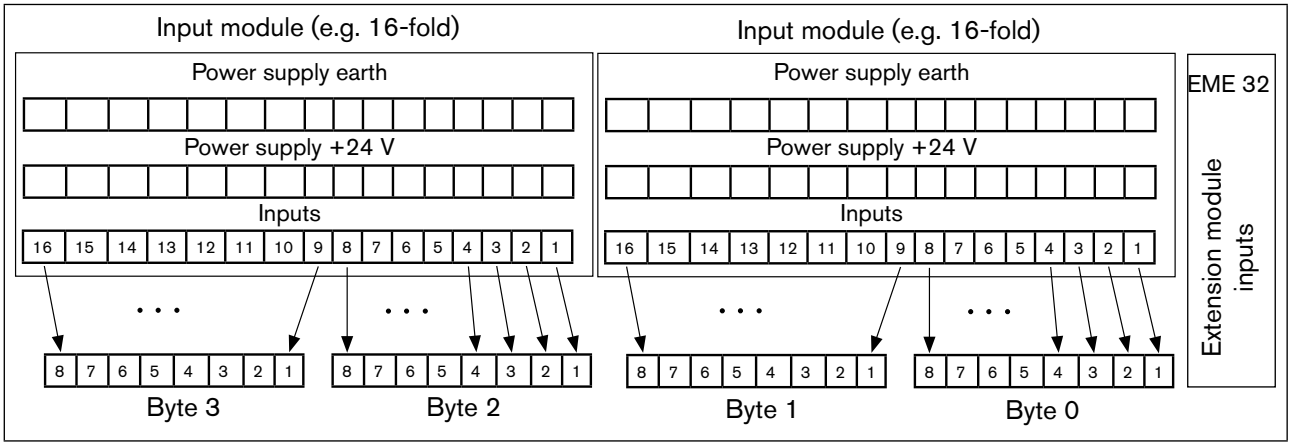

Figure 37: Normal mode

12.3.2. Shifted inputs mode

In shifted inputs mode the first 16 inputs are placed alternatingly in byte 0 and byte 1 of the transmission log. The same procedure is carried out for the following 16 inputs with byte 2 and byte 3.

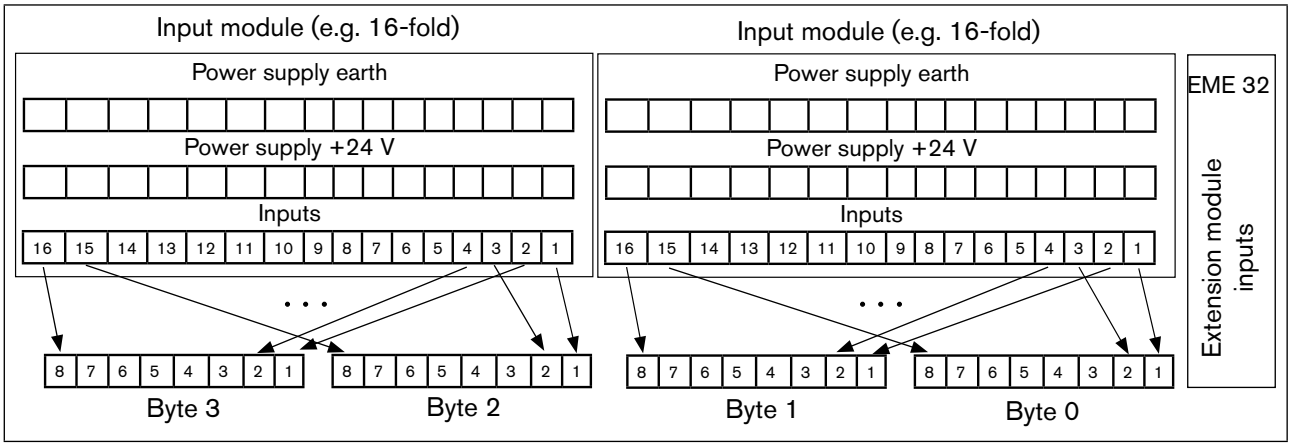

Figure 38: Shifted inputs mode

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12.3.3. Halved inputs mode

In halved inputs mode every second input is skipped. Only the inputs 1, 3, 5, ... are transmitted, so for 32 physically existing inputs only 2 bytes are needed.

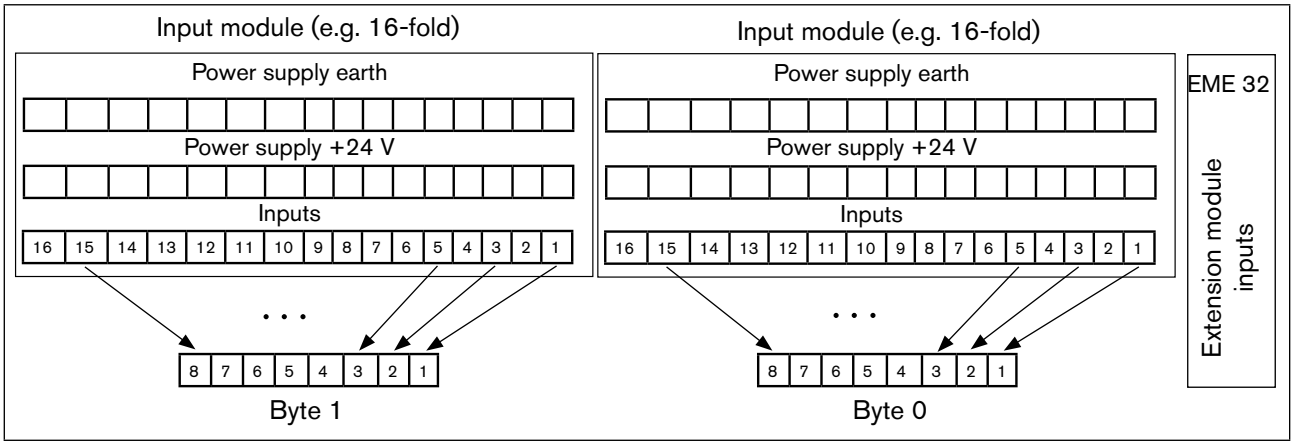

Figure 39: Halved inputs mode

12.4. Input filter

The input filter suppresses disturbances which affect the input modules. Therefore the activation of this input filter is always recommended.

When the filter is activated only signals are recognized which have a duration of ≥ 2 ms. The regulations contained in EMC legislation require that the input filter be activated.

13. FIELDBUS MODULE CANOPEN

13.1. CANopen, IP20 - overview

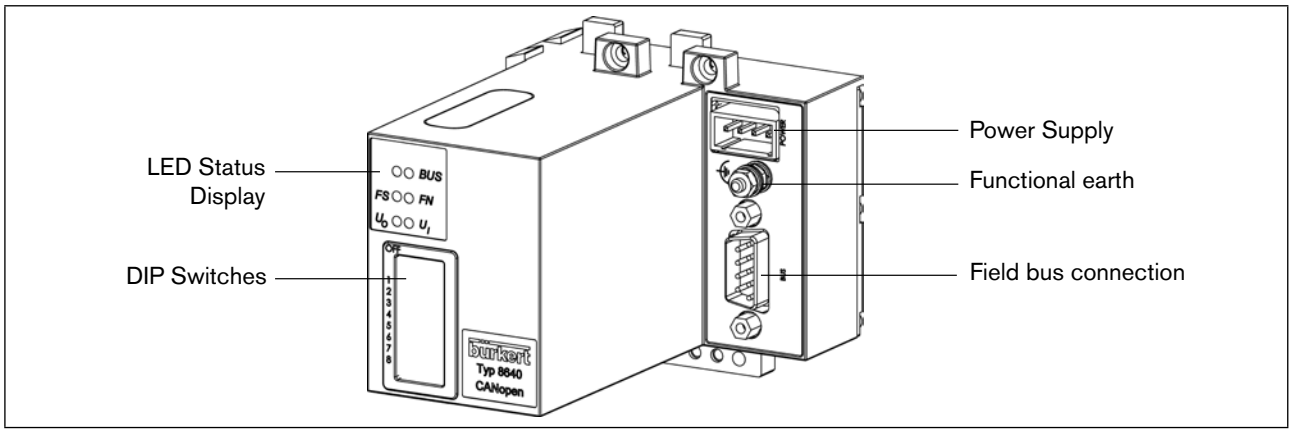

Figure 40: Overview fieldbus module CANopen, IP20

The DIP switches can be operated through the covering film.

13.1.1. Power supply IP20

The 4-pole plug-in connector for the power supply is configured as follows:

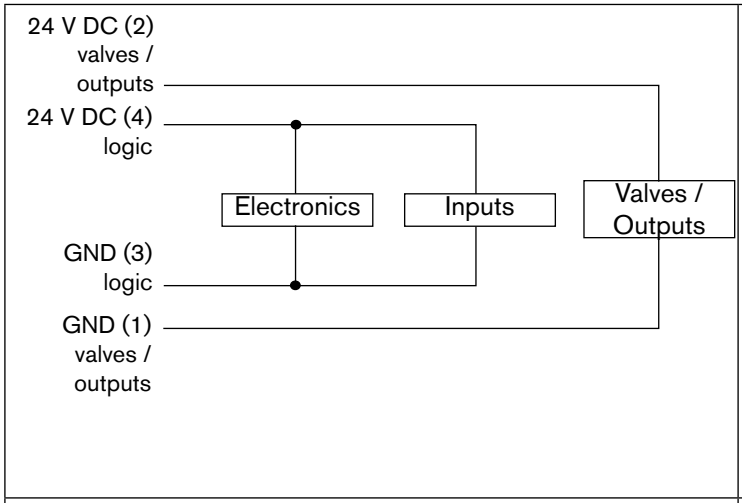

Figure 41: Power supply configuration

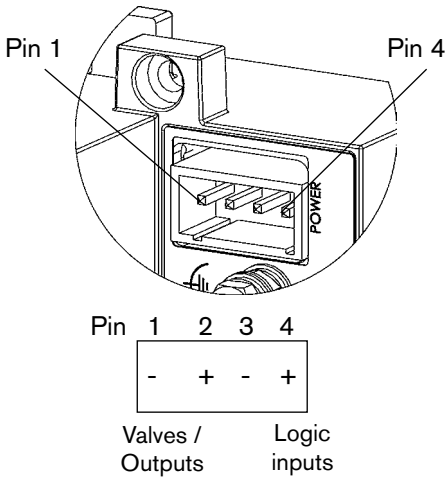

Figure 42: Cutaway POWER connection

Pin 2 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 4 with 1 A.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

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13.1.2. IP20 field bus connection

For connecting the field bus a 9-pole D-SUB connection is used with the following pin assignment (plug in device, socket on cable).

Pin No.	Signal name
1	not used
2	CAN LOW
3	GND
4	not used
5	not used

Pin No.	Signal name
6	not used
7	CAN HIGH
8	not used
9	not used

13.1.3. IP20 terminating circuit

When installing a CANopen system, ensure that the terminating circuit of the data lines is correct. The circuit prevents the occurrence of interference caused by signal reflection in the data lines. The trunk line must be terminated at both ends with resistors of 120 Ω each and 1/4 W power loss.

For the IP20 variant a terminal resistance of 120 Ohm between the two bus connections CAN High and CAN Low can be added using a bridge in the 9-pole D-SUB field bus connection between pin 4 and pin 8.

13.2. CANopen, IP54 - overview

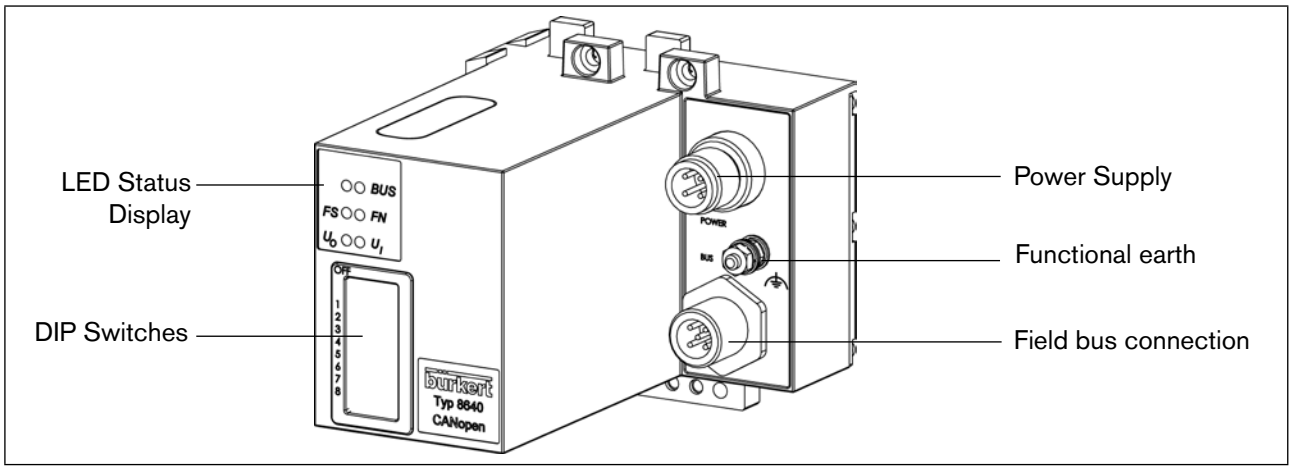

Figure 43: Overview field bus module CANopen IP54

The DIP switches can be operated through the covering film.

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13.2.1. Power supply IP54

The 4-pole circular plug-in connector for the power supply is configured as follows:

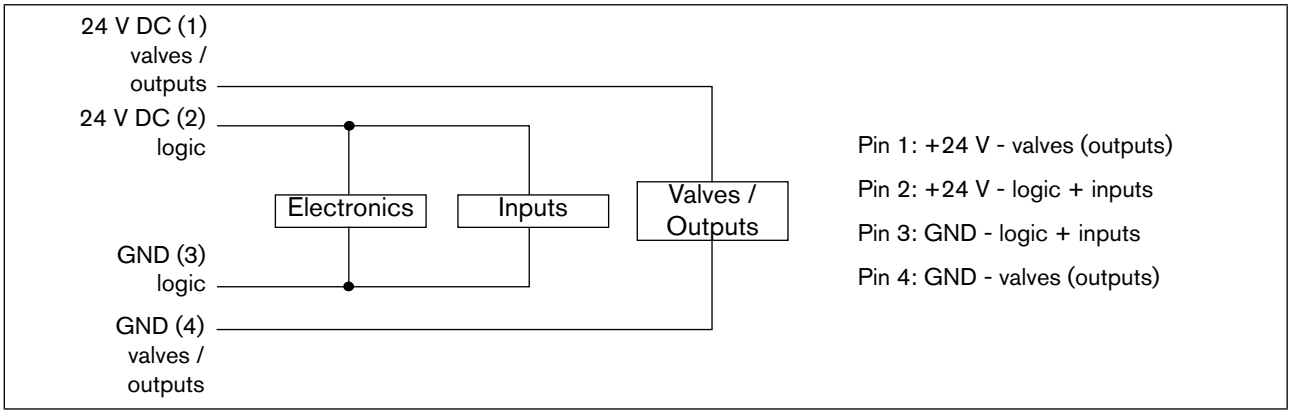

Figure 44: Power supply configuration

Pin 1 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 2 with 1 A.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

13.2.2. IP54 field bus connection

For the field bus connection the 5-pole M12 Micro-Style plug-in connector (plug) as specified by CANopen is used with the following pin assignment.

Pin No.	Signal name
1	Drain (shielding)
2	not used
3	GND
4	CAN HIGH
5	CAN LOW

The bus drivers are supplied internally via a voltage source which is galvanically isolated from the supply voltage. For this reason it is not necessary for separate voltage to be supplied from the bus via pin 2 and pin 3.

Accessories

CANopen, configurable M12 plug-in connector, 5-pole, straight coupling	Id.-No. 917 116
CANopen, configurable M12 plug-in connector, 5-pole, straight plug	Id.-No. 902 627
Power supply, configurable M12 plug-in connector, 4-pole, straight coupling	Id.-No. 902 552
Terminal resistance, M12 plug, 5-pole	Id.-No. 902 628
Y-piece, M12, 5-pole	Id.-No. 778 643

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13.2.3. IP54 terminating circuit

When installing a CANopen system, ensure that the terminating circuit of the data lines is correct. The circuit prevents the occurrence of interference caused by signal reflection in the data lines. The trunk line must be terminated at both ends with resistors of 120 Ω each and 1/4 W power loss.

13.3. Position of the DIP switches

The DIP switches are used to make field bus module settings.

NOTE!

Changes made to the switch settings only take effect after the field bus module has been reset. Set the DIP switch through the film using a screwdriver (the film is very durable).

'ON' setting = DIP switch to the right

1 (above)	2	3	4	5	6	7	8 (below)
Field bus module address						Baud rate	

13.3.1. Field bus module address: DIP switches 1 to 6

The address of the field bus module can be set on DIP switches 1 ... 6 in the range 0 ... 63.

If an address between 63 and 127 is needed, this can be set via the object Index 3000 / Subindex 0. Then the address is stored on an EEPROM (non-volatile) and is activated when:

- All DIP switches from 1 to 6 are set to 'ON' (address 63).
- A restart is carried out.

DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6	Address
ON	OFF	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	OFF	3
						...
ON	ON	ON	ON	ON	ON	63

The baud rate can be set on DIP switches 7 and 8:

DIP 7	DIP 8	Baud rate
OFF	OFF	20 kB
ON	OFF	125 kbaud
OFF	ON	250 kbaud
ON	ON	500 kbaud

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13.4. LED status display

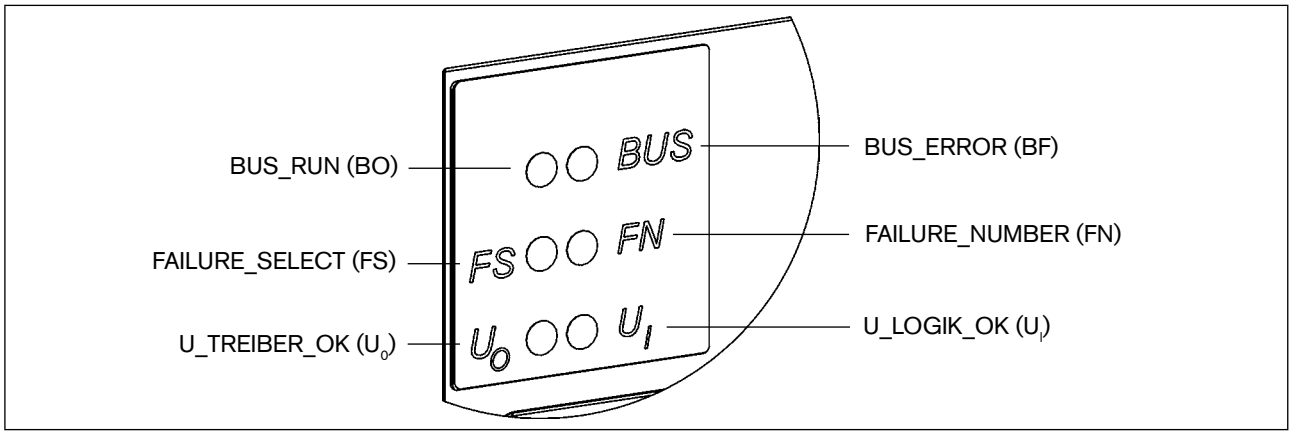
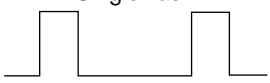
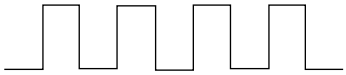


Figure 45: LED state display (detail)

Abbre-viation	Colour	Description	Explanation
BO	green	BUS RUN	See CANopen RUN LED
BF	red	BUS ERROR	See CANopen ERROR LED
FS	yellow	FAILURE SELECT	Determines the function of the FN LED: FS lit up: FN displays fault type FS not lit up: FN displays failure number
FN	red	FAILURE NUMBER	The number of flash impulses indicates the fault type or the failure number depending on whether FS is lit up or not
U_I	green	U LOGIC OK	Voltage for logic supply, inputs and bus interface present
U_0	green	U driver OK	Voltage for outputs present

CANopen RUN LED

CAN RUN LED	Device state	Description
Single flash 	STOPPED	Field bus module is in STOPPED state
Flashing on and off 	PRE-OPERATIONAL	Field bus module is in PRE-OPERATIONAL state
ON	OPERATIONAL	Field bus module is in OPERATIONAL state

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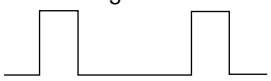
CANopen ERROR LED

CAN ERROR LED	Device state	Description	Remedial action
OFF	Not an error	Device operational	
Single flash 	Warning Limit	Field bus module has detected a certain number of transmission errors (Warning Limit).	Check cable connections and terminal resistances. Perhaps reduce baud rate or bus cable length.
Double flash 	Guard Event triggered.	No Guarding telegram has been received within the preset time (time-out).	Check whether master sends Guarding telegram within preset time.
ON	Bus OFF	Field bus module has disconnected from bus on account of large number of detected transmission errors (Bus OFF).	Check cable connections and terminal resistances. Perhaps reduce baud rate or bus cable length. Restart field bus module.

13.4.1. Errors and warnings displayed via FN (Failure Number) and FS (Failure Select) LEDs

The following table contains errors and warning messages displayed via the FN (Failure Number) and FS (Failure Select) LEDs.
The error type is indicated by the number of times FN flashes when FS is set to ON.
The error number is indicated by FN flashing when FS is set to OFF.

Number FN when FS ON error type	Number FN when FS OFF error number	Description	Remedial action
3	Main terminal error		
	1	No supply voltage for main terminal outputs	Check supply voltage
	2	Setting for station address is outside permitted range (1 ... 127)	Check bus address on main terminal.
5	EEPROM fault		
	1	Error on accessing EEPROM during start-up; flashing sequence is only displayed once. Device operates with default parameters (see Object Table)	Replacement of electronics may be necessary.

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14. CONFIGURATION AND PARAMETER SETTINGS FOR CANOPEN

14.1. Description of the CANopen field bus node

The valve terminal is a 'Pre-defined Device' according to CANopen Standard V4.10. 'Device Profile 401 (I/O – Modules) V1.4' applies to its functions and objects.

The terms 'address' and 'Node ID' are synonymous in this description.

The following IDs are used:

Object	Identifier
NMT	0 hex
SYNC	80 hex
EMERGENCY	80 hex + address
1 st TPDO	180 hex + address
1 st RPDO	200 hex + address
TSDO	580 hex + address
RSDO	600 hex + address
GUARDING	700 hex + address

14.2. Object overview

The valve terminal supports the following objects:

Index (hex)	Sub-indices (hex)	Name	Access		
			read	write	constant
1000	0	Device type	x		
1001	0	Error register (bits 0 & 2 used)	x		
1005	0	COB - ID SYNC	x	x	
1008	0	Manufacturer device name			x
1009	0	Manufacturer hardware version			x
100A	0	Manufacturer software version			x
100B	0	(reserved for compatibility reasons)			
100C	0	Guard time	x	x	
100D	0	Life time factor	x	x	
100E	0	(reserved for compatibility reasons)			
1014	0	COB - ID EMCY	x	x	
1015	0	Inhibit time emergency	x	x	
1018	0-4	Identity object			x

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1200	0-3	1 st Server SDO parameter	x	(x)	
1400	0-2	1 st receive PDO parameter	x	(x)	
1600	0-3	1 st receive PDO mapping	x	(x)	
1800	0-3, 5	1 st transmit PDO parameter	x	(x)	
1A00	0-4	1 st transmit PDO mapping	x	(x)	
3000	0	Address via EEPROM	x	x	
6000	0-4	Read state 8 input lines	x		
6003	0	Input filter	x	x	
601F	0	Input mode	x	x	
6200	0-3	Write state 8 output lines	x	(x)	
6206	0-3	Fault mode 8 output lines	x	(x)	
6207	0-3	Fault state 8 output lines	x	(x)	

x - the characteristic applies

(x) - the characteristic may apply depending on Sub-Index

14.3. Detailed description of the supported objects

Object 1000 $_{hex}$ **Device type**
Describes the device type and the profile used
Length 32 bits
Value 401D $_{hex}$

Object 1001 $_{hex}$ **Error register**
Register for device errors, part of the Emergency Object.
Length 8 bits

Register position	Fault description
Bit 0	General error
Bit 2	No supply voltage for valves
Bit 1; bits 3 -7	not used

Object 1005 $_{hex}$ **COB - ID SYNC**
Defines the COB - ID of the SYNC object and the generation of SYNC telegrams. Default value 0080 $_{hex}$.

Object 1008 $_{hex}$ **Manufacturer device name**
Device name as given by manufacturer

Object 1009 $_{hex}$ **Manufacturer hardware version**
Manufacturer's device hardware version

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Object 100A $_{hex}$ **Manufacturer software version**
Manufacturer's software version

Object 100C $_{hex}$ **Guard time**
Guard time value in ms. Yields 'life-time' for the Guarding log when multiplied by the 'life-time factor'. The value '0' means that the object is not used.
Length 16 bits
Default value 500 ms

Object 100D $_{hex}$ **Life-time factor**
Life-time factor' value For description, see Object 100Chex 'Guard time'.
Length 8 bits
Default value 3

Object 1014 $_{hex}$ **COB - ID Emergency**
Defines the COB - ID of the Emergency Object.
Length 32 bits
Default value (80 $_{hex}$ + address)

Object 1015 $_{hex}$ **Inhibit Time EMCY**
'Inhibit Time EMCY' value in 0.1 ms. This is where the 'Inhibit Time' for Emergency Telegrams can be set. The value '0' means that the object is not used.
Length 16 bits
Default value 0 $_{hex}$

Object 1018 $_{hex}$ **Identity Object**

Sub-Index	Description	Length
00 hex	Number of object entries	8 bits
01 hex	Vendor ID	32 bits
02 hex	Product Code	32 bits
03 hex	Revision Number	32 bits
04 hex	Serial Number	32 bits

Object 1200 $_{hex}$ **Server SDO parameter**

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Highest supported sub-index	02 hex	x	-
01 hex	COB - ID for this SDO	600 hex + address	x	x
02 hex	Product Code for this SDO	580 hex + address	x	x

Object 1400 $_{hex}$ **Receive PDO communication parameter**
Parameterizes the first Receive PDO

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Highest supported sub-index	02 hex	x	-
01 hex	COB - ID used by the PDO	200 hex + address	x	x
02 hex	Transmission Type; values 00 hex - FF hex	FF hex	x	x

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Object 1600 $_{hex}$ Receive PDO mapping
Mapping of the first Receive PDO.

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Number of mapped objects of the PDO	03 hex	x	-
01 hex	PDO - Mapping for the next object	(6200 / 01) hex	x	x
02 hex		(6200 / 02) hex	x	x
03 hex		(6200 / 03) hex	x	x

Meaning of (6200 / 02) hex:
Object 6200 hex
Sub-Index 02 hex

Object 1800 $_{hex}$ Transmit PDO communication parameter

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Highest supported sub-index	05 hex	x	-
01 hex	COB - ID used by the PDO	180 hex + address	x	x
02 hex	Transmission Type; values 00 hex - FF hex	FF hex	x	x
03 hex	'Inhibit time' (in 0.1 ms)	00 hex	x	x
05 hex	'Event timer' (in ms)	00 hex	x	x

Object 1A00 $_{hex}$ Transmit PDO mapping
Mapping of the first Receive PDO.

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Number of mapped objects of the PDO	04 hex	x	-
01 hex	PDO - Mapping for the next object	(6000 / 01) hex	x	x
02 hex		(6000 / 02) hex	x	x
03 hex		(6000 / 03) hex	x	x
04 hex		(6000 / 04) hex	x	x

Meaning of (6000 / 01) hex:
Object 6000 hex
Sub-Index 01 hex

Object 3000 $_{hex}$ Node ID via EEPROM
If an address between 63 and 127 is needed (1 - 62 are possible via DIP switch), then this can be set via the Object Index 3000 / Sub-Index 0. Then the address is stored on a non-volatile EEPROM.
This address is activated when:
All DIP switches from 1 to 6 are set to ON (address 63).
A restart is carried out.
Length 8 bits
Default value 3F $_{hex}$

Object 6000 $_{hex}$ Read state 8 Input Lines
The states of the inputs configured on the valve terminal are transmitted.

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Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Number of object entries (here 4: 01 hex - 04 hex)		x	-
01 hex	State of the first group of inputs	00 hex - FF hex	x	
02 hex	State of the second group of inputs	00 hex - FF hex	x	
03 hex	State of the third group of inputs	00 hex - FF hex	x	
04 hex	State of the fourth group of inputs	00 hex - FF hex	x	

14.4. Input filter

Object 6003 $_{hex}$ Input filter
The input filter suppresses disturbances which affect the input modules. Therefore the activation of this input filter is always recommended.

When the filter is activated only signals are recognized which have a duration of ≥ 2 ms. The regulations contained in EMC legislation require that the input filter be activated.

Length 8 bits
Default value 01 $_{hex}$

0 = input filter deactivated
1 = input filter activated

14.5. Mode inputs

Object 601F $_{hex}$ Mode inputs
The input modes can be used to achieve different assignments of the inputs (repeaters) to the process image of the inputs (PAE).
Length 8 bits
Default value without EME 00$_{hex}$
with EME 01 $_{hex}$

14.5.1. Normal mode

In normal mode all outputs are read in from right to left.

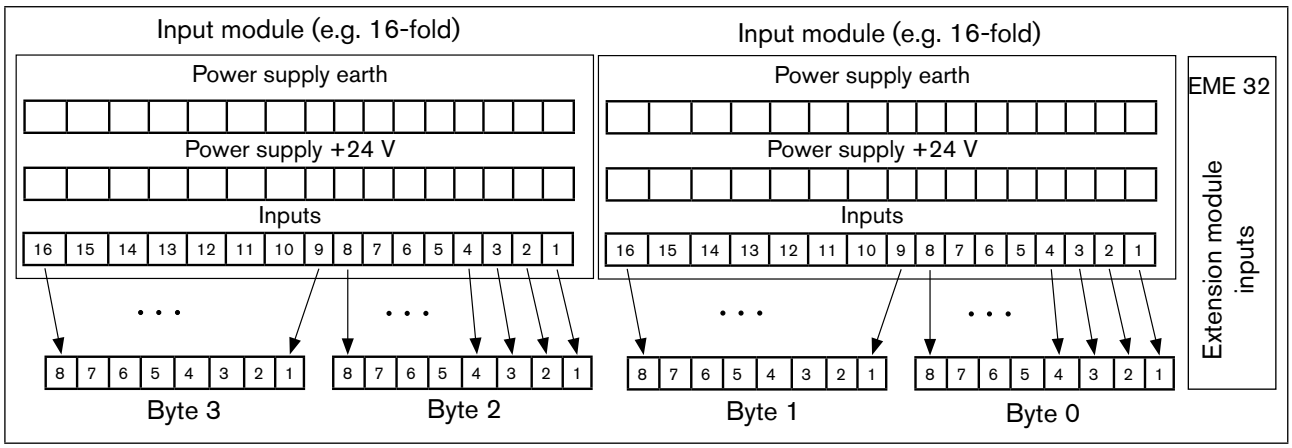

Figure 46: Normal mode

14.5.2. Shifted inputs mode

In shifted inputs mode the first 16 inputs are placed alternatingly in byte 0 and byte 1 of the transmission log. The same procedure is carried out for the following 16 inputs with byte 2 and byte 3.

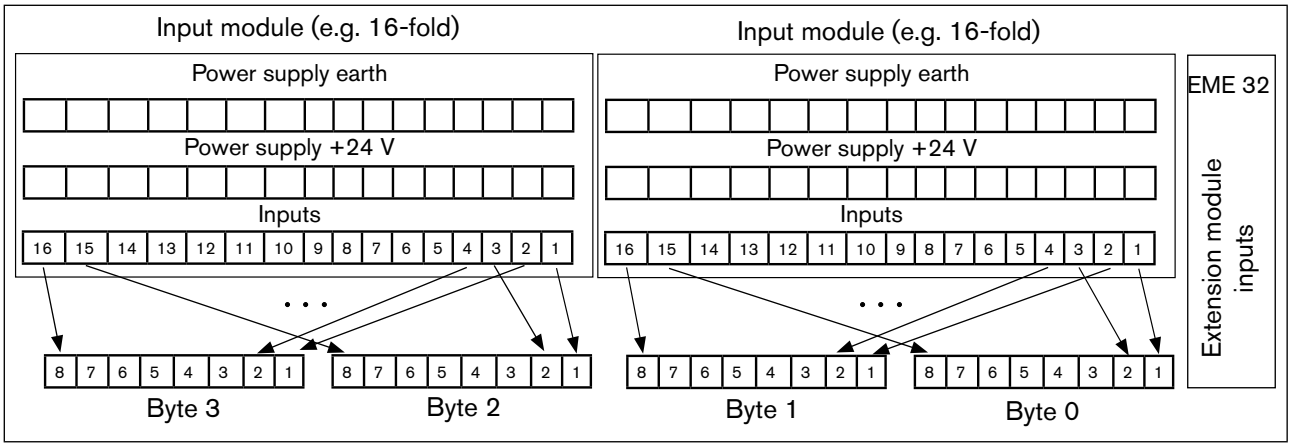

Figure 47: Shifted inputs mode

14.5.3. Halved inputs mode

In halved inputs mode every second input is skipped. Only the inputs 1,3,5, ... are transmitted, so for 32 physically existing inputs only 2 bytes are needed.

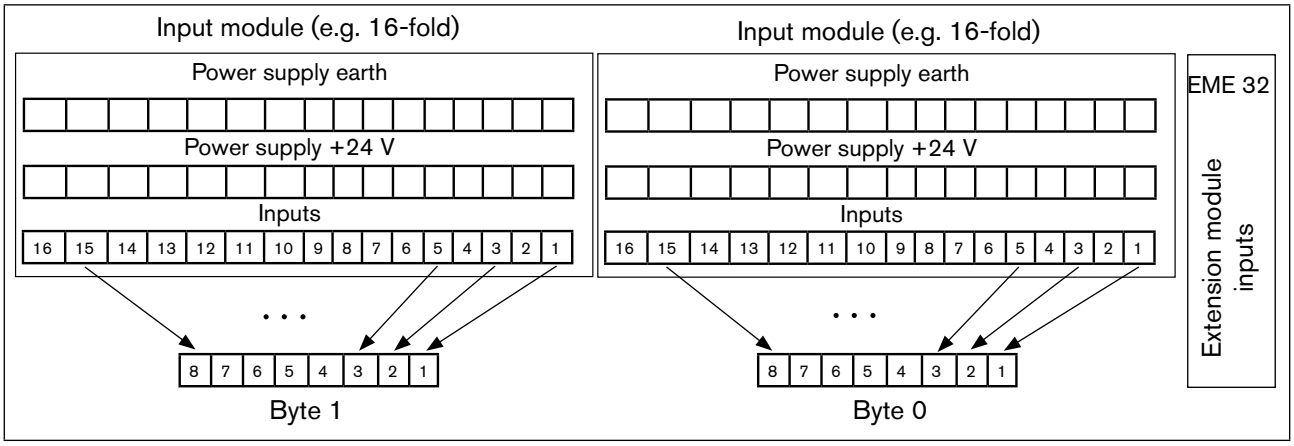

Figure 48: Halved inputs mode

14.6. Outputs

Object 6200 $_{hex}$ Write state 8 Outputs Lines
Places the outputs in groups of 8 each.

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Number of object entries (here 3: 01 - 03 hex)		x	-
01 hex	State of the first group of outputs (valves 1-8)	00 hex - FF hex	x	x
02 hex	State of the second group of outputs (valves 9-16)	00 hex - FF hex	x	x
03 hex	State of the third group of outputs (valves 17-24)	00 hex - FF hex	x	x

Object 6206 $_{hex}$ Fault mode 8 Output Lines
Determines the reaction of the outputs when an error occurs (in groups of 8 each).
Meaning:
1 bin - On error, the output retains its current state;
0 bin - On error, the output is switched to the state laid down in Object 6207 hex at the appropriate position.

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Number of object entries (here 3: 01 - 03 hex)		x	-
01 hex	State of the first group of outputs	00 hex - FF hex	x	x
02 hex	State of the second group of outputs	00 hex - FF hex	x	x
03 hex	State of the third group of outputs	00 hex - FF hex	x	x

Object 6207 $_{hex}$ Fault state 8 Output Lines
Determines the reaction of the outputs when an error occurs (in groups of 8 each). Prerequisite: Appropriate setting in Object 6206 hex.

Sub-Index	Table of Contents	Default	Access	
			read	write
00 hex	Number of object entries (here 3: 01 - 03 hex)		x	-
01 hex	State of the first group of outputs on error	00 hex - FF hex	x	x
02 hex	State of the second group of outputs on error	00 hex - FF hex	x	x
03 hex	State of the third group of outputs on error	00 hex - FF hex	x	x

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14.7. Example for start-up

CANopen command sequence to put the Type 8640 valve terminal into 'Operational State', set outputs and read in inputs.

- On entering 'Pre-Operational' state (following Power On or Network Reset) the slave sends the boot-up message once with content 0. In this state the BUS LED flashes green.

  SLAVE
  Identifier = 700 hex + set address (e.g.: 701 hex for address 1)
  Length = 1
  Data = 00, xx, xx, xx, xx, xx, xx, xx

- Switch all nodes in network to 'Operational' state

  MASTER
  Identifier = 0
  Length = 2
  Data = 01, 00, xx, xx, xx, xx, xx, xx

In 'Operational' state the BUS LED lights up green all the time. On entering 'Operational' state the state of the inputs is transmitted once.

SLAVE
Identifier = 180 hex + set address (e.g.: 181 hex for address 1)
Length = 4
Data = yy, yy, yy, yy, xx, xx, xx, xx
(yy: State of the inputs e.g.: 00 10 00 00, when input 9 is set)

The message is sent even if no inputs are activated. In this case the content of the 4 data bytes is 00 hex in each case.

SLAVE
Identifier = 180 hex + set address (e.g.: 181 hex for address 1)
Length = 4
Data = 00, 00, 00,00, xx, xx, xx, xx

- Set outputs

  MASTER
  Identifier = 200 hex + set address (e.g.: 201 hex for address 1)
  Length = 3
  Data = yy, yy, yy, xx, xx, xx, xx, xx (yy: Initial value e.g.: 55 for every second output)

- Read in inputs - the state of the inputs is transmitted according to event (depending on configuration; cf. Object 1800 hex); Message is sent every time the output state changes.

  SLAVE
  Identifier = 180 hex + set address (e.g.: 181 hex for address 1)
  Length = 4
  Data = yy, yy, yy, yy, xx, xx, xx, xx
  (yy: State of the inputs e.g.: 01 00 00 00, when input 1 is set)

- Reset nodes to the 'Pre-Operational' state

  MASTER
  Identifier = 0
  Length = 2
  Data = 80, 00, xx, xx, xx, xx, xx, xx

The node is reset to the 'Pre-Operational' state. In this case the boot-up message is no longer sent (see point 1).

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- Reset nodes

  MASTER
  Identifier = 0
  Length = 2
  Data = 81, 00, xx, xx, xx, xx, xx, xx

This command resets the node to the 'System Init' state. After this the node automatically goes on to the 'Pre-Operational' state, from which it can then be switched to the 'Operational' state.

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15. FIELD BUS MODULES PROFINET IO, ETHERNET/IP AND MODBUS TCP

15.1. PROFINET IO, EtherNet/IP and MODBUS TCP, IP20 - overview

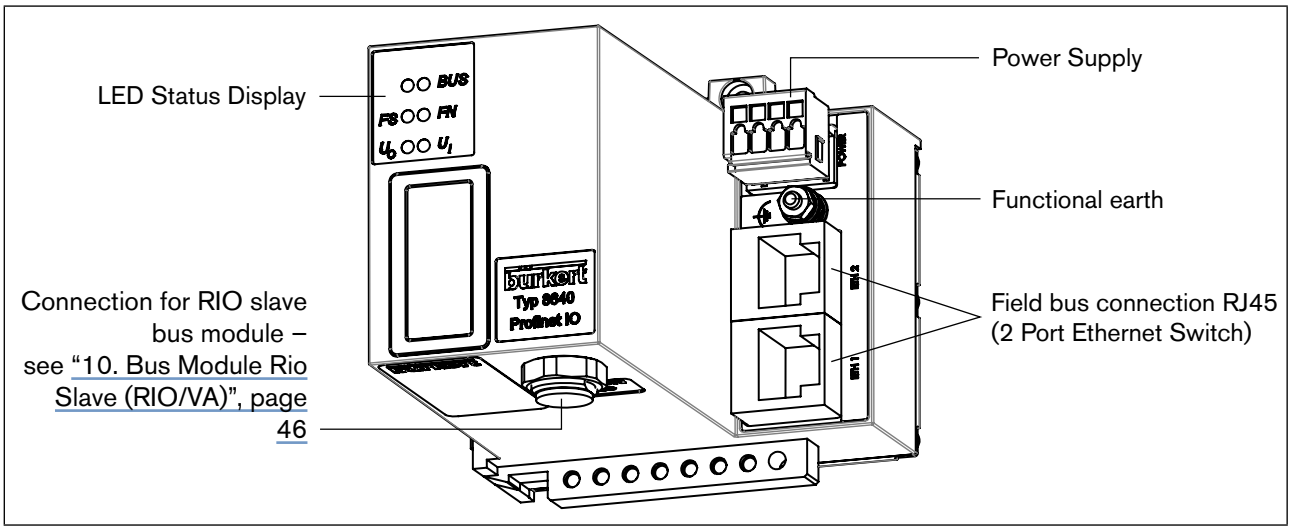

Figure 49: Overview of field bus modules PROFINET IO, EtherNet/IP, MODBUS TCP

15.1.1. Power supply IP20

The 4-pole plug-in connector for the power supply is configured as follows:

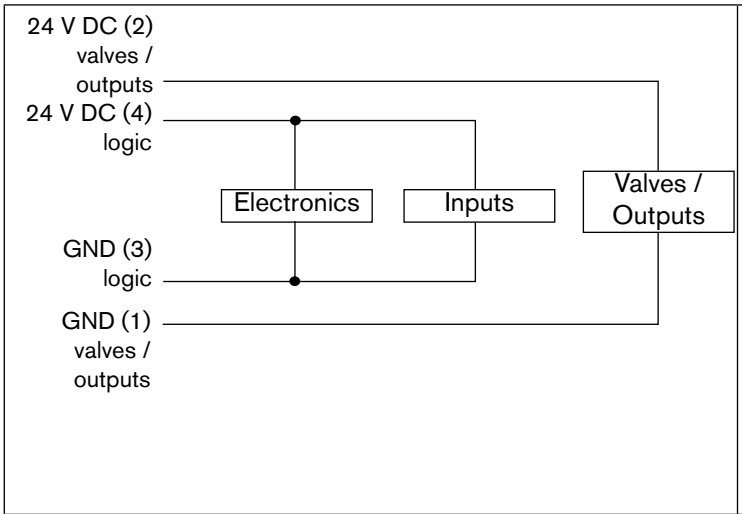

Figure 50: Power supply configuration

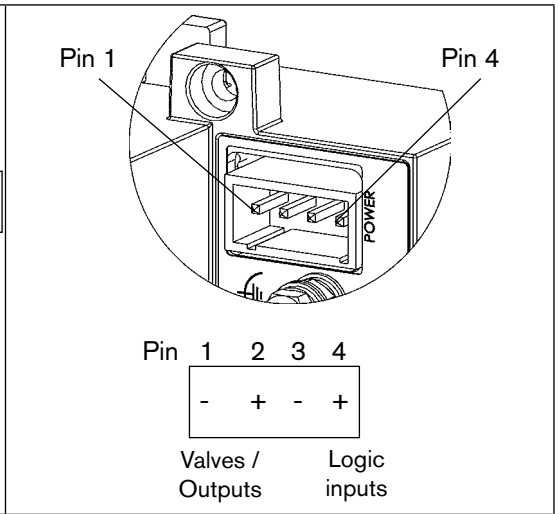

Figure 51: Cutaway POWER connection

Pin 2 of the power supply must be supplied with a 4 A medium time-lag fuse; Pin 4 with 1 A.

NOTE!

To ensure electromagnetic compatibility (EMC) connect the screw terminal FE (functional earth) to earth potential using a short cable (30 cm).

Accessories

Plug-in connector (No. 918 226) for power supply (supplied).

15.1.2. IP20 field bus connection

RJ45 connections are used for an IP20 protection class field bus connection. The assignment is described in the following.

Pin-No.:	1	2	3	4	5	6	7	8
Signal name (socket in device, plug on cable) :	TX+	TX–	RX+	n.c.	n.c.	RX–	n.c.	n.c.

Figure 52: Assignment of RJ45 connection

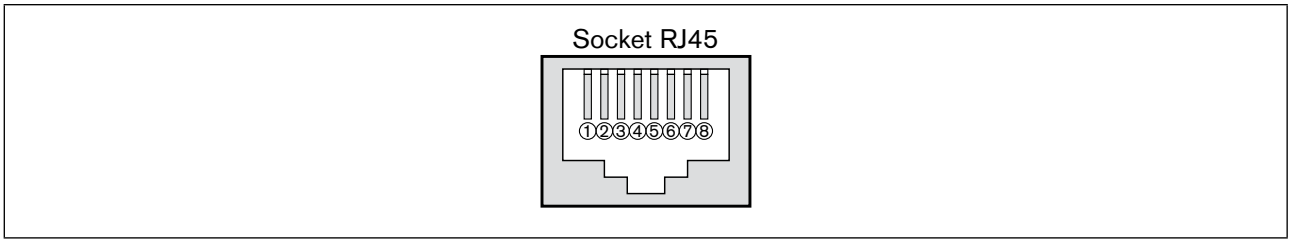

Figure 53: Illustration of RJ45 port

NOTE!

To ensure electromagnetic compatibility (EMC), a shielded Ethernet cable must be used.

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15.2. LED status display

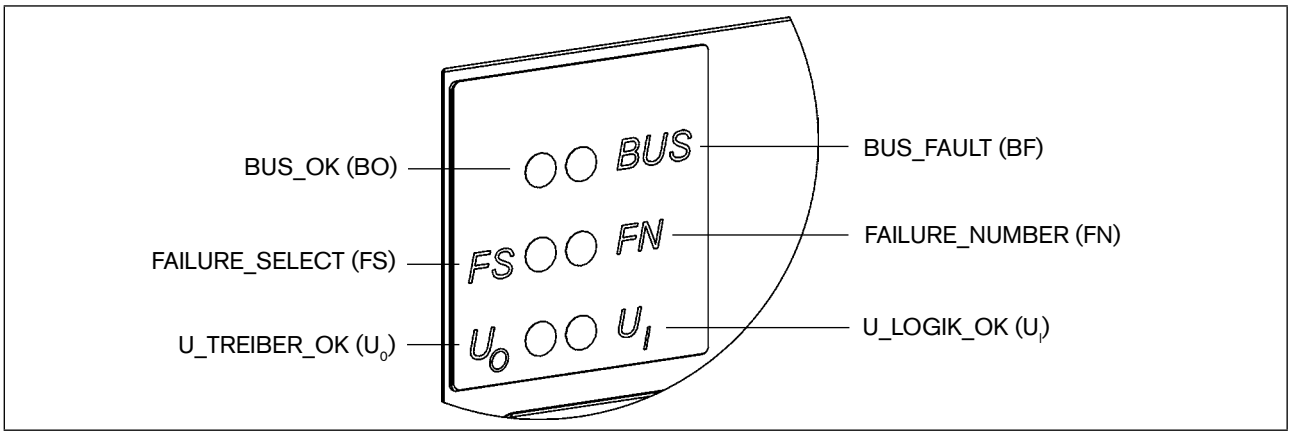

Figure 54: LED state display (detail)

Abbre-viation	Colour	Description	Explanation
BO	green	Bus OK	Bus communication active
BF	red	Bus Fault	Bus fault
FS	yellow	Failure Select	Determines the function of the FN LED: FS lit up: FN displays fault type FS not lit up: FN displays failure number
FN	red	Failure Number	The number of flash impulses indicates the fault type or the failure number depending on whether FS is lit up or not
U_I	green	U LOGIC OK	Voltage for logic supply, inputs and bus interface present
U_0	green	U driver OK	Voltage for outputs present

Normal state

LED	Status	Description
BUS (BO)	ON	Error-free operation of the valve terminal on network
BUS (BF)	OFF	
FS	OFF	
FN	OFF	
U_0	ON	
U_L	ON	

bus fault

LED	Status	Description	Fault cause / remedial action
BUS (BO)	OFF	Signal monitoring time on valve terminal elapsed without receipt of signal from master	During operation: → Check master (control) and bus cable During start-up: → Check network configuration on master
BUS (BF)	ON		
FS	OFF		
FN	OFF		
U_0	ON		
U_L	ON		

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15.2.1. Errors and warnings displayed via FN (Failure Number) and FS (Failure Select) LEDs

The following table contains errors and warning messages displayed via the FN (Failure Number) and FS (Failure Select) LEDs.
The error type is indicated by the number of times FN flashes when FS is set to ON.
The error number is indicated by FN flashing when FS is set to OFF.

Number FN when FS ON error type	Number FN when FS OFF error number	Description	Remedial action
3	Main terminal error		
	1	No supply voltage for main terminal outputs	→ Check supply voltage
	3	Error accessing EEPROM	→ Replacement of electronics may be necessary
4	Peripheral terminal error		
	1	No supply voltage for peripheral terminal outputs	→ Check supply voltage
	2	Complete failure of a peripheral terminal	→ Check peripheral terminal RIO bus

As soon as the configuration is correct and a master control system is connected, the bus LED switches from red to green. Differences from the planned Profinet configuration can be found in the ModulDiffBlock. There are no configuration or parameter-setting telegrams for any other bus systems.

After the error has been rectified the valve terminal must be reset by briefly shutting down the supply voltage.

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15.3. Mode inputs

With the help of the input modes the inputs (repeaters) can be assigned diversely in the process image of the outputs (PAE). The mode selection takes place in the input mode object.

15.3.1. Normal mode

In normal mode all outputs are read in from right to left.

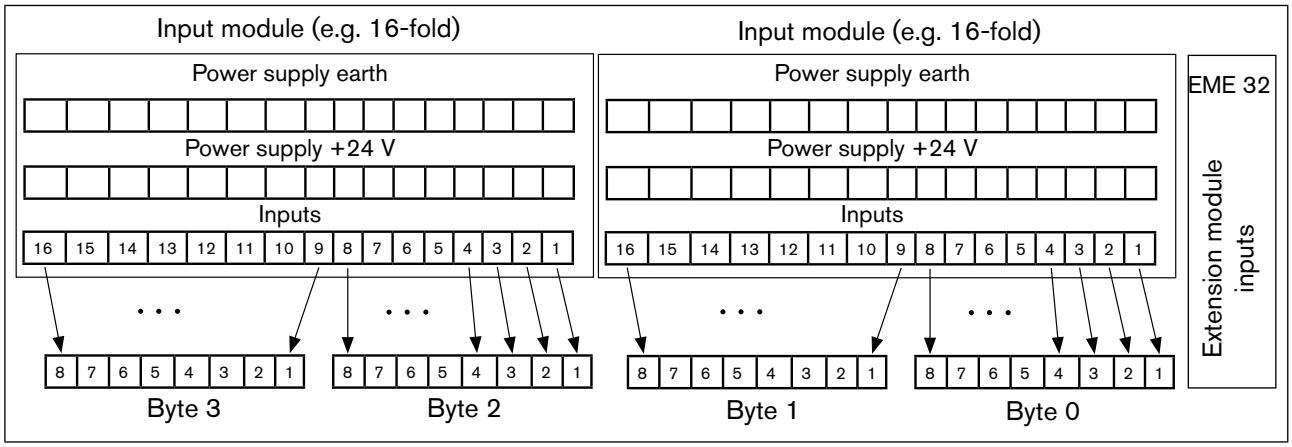

Figure 55: Normal mode

15.3.2. Shifted inputs mode

In shifted inputs mode the first 16 inputs are placed alternatingly in byte 0 and byte 1 of the transmission log. The same procedure is carried out for the following 16 inputs with byte 2 and byte 3.

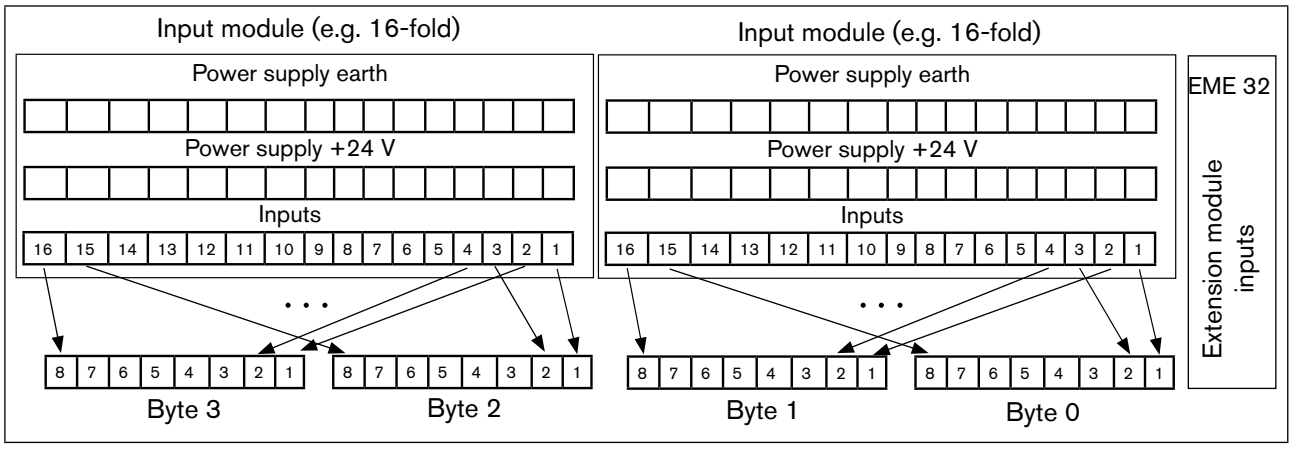

Figure 56: Shifted inputs mode

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15.3.3. Halved inputs mode

In halved inputs mode every second input is skipped. Only the inputs 1, 3, 5, ... are transmitted, so for 32 physically existing inputs only 2 bytes are needed.

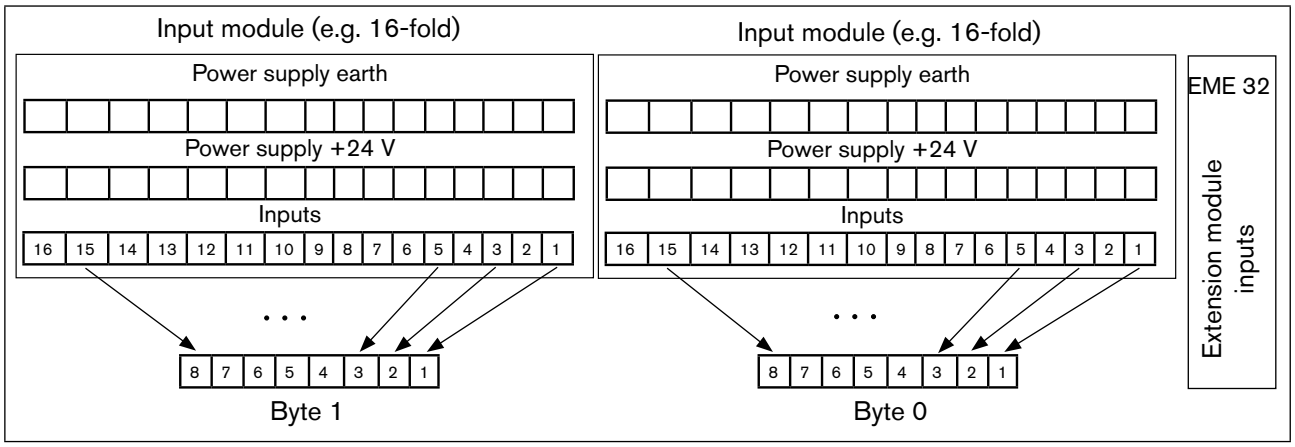

Figure 57: Halved inputs mode

15.4. Input filter

The input filter suppresses disturbances which affect the input modules. Therefore the activation of this input filter is always recommended.

When the filter is activated only signals are recognized which have a duration of ≥ 2 ms. The regulations contained in EMC legislation require that the input filter be activated.

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15.5. Fault Action and Fault Value

These settings define the state the valves are to assume in case of fault (bus interruption). The values must be entered as decimal numbers for groups of 8 at a time (byte-wise).

15.5.1. Fault Action

For Fault Action the meanings are as follows:

0: In case of fault the output assumes the value defined by Fault Value.

1: In case of fault the output retains its current state.

Examples

Valves 1–4 are to assume Fault Value; valves 5–8 retain their current state:

Binary: 1 1 1 1 0 0 0 0 => Decimal: 240

Valves 1, 3, 5, 7 are to assume Fault Value; valves 2, 4, 6, 8 retain their current state:

Binary: 1 0 1 0 1 0 1 0 => Decimal: 170

15.5.2. Fault Value

For Fault Value the meanings are as follows:

0: In case of fault the output is not actuated.

1: In case of fault the output is actuated.

Example

Valves 1, 3, 5, 7 are to be actuated; valves 2, 4, 6, 8 are not actuated:

Binary: 0 1 0 1 0 1 0 1 => Decimal: 85

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15.6. Webserver

Before the Ethernet participant 8640 can be incorporated into the Ethernet network, it must be configured using a web server. For this purpose, the network card of the PC that is to be used for this purpose must first be configured.

Configuring multiple Ethernet participants
If multiple Ethernet participants are configured, **they should be connected** to the network one after the other and renamed (IP address and device name) because all Ethernet participants have the same IP address (192.168.0.100) by default.

15.6.1. Configuring the PC network card

→ Set the IP address for the network card of the PC.
IP address: **192.168.0.xxx**

→ For xxx, enter any numerical value other than 100
(100 is occupied by the IP address of the Ethernet participant by default).

→ Connect the PC with a network cable to the Ethernet participant.

15.6.2. Accessing the web server

→ To connect to the Ethernet participant, open an Internet browser.

→ Enter the IP address of the Ethernet participant into the address bar of the Internet browser in order to access the device (default IP **192.168.0.100**).
On EtherNet/IP devices, the IP address is assigned by a DHCP server. If no address is assigned via DHCP within 1 minute, the device uses the default IP 192.168.0.100.

✔ The user interface of the web server is displayed.

Representation of a user interface of the web server:

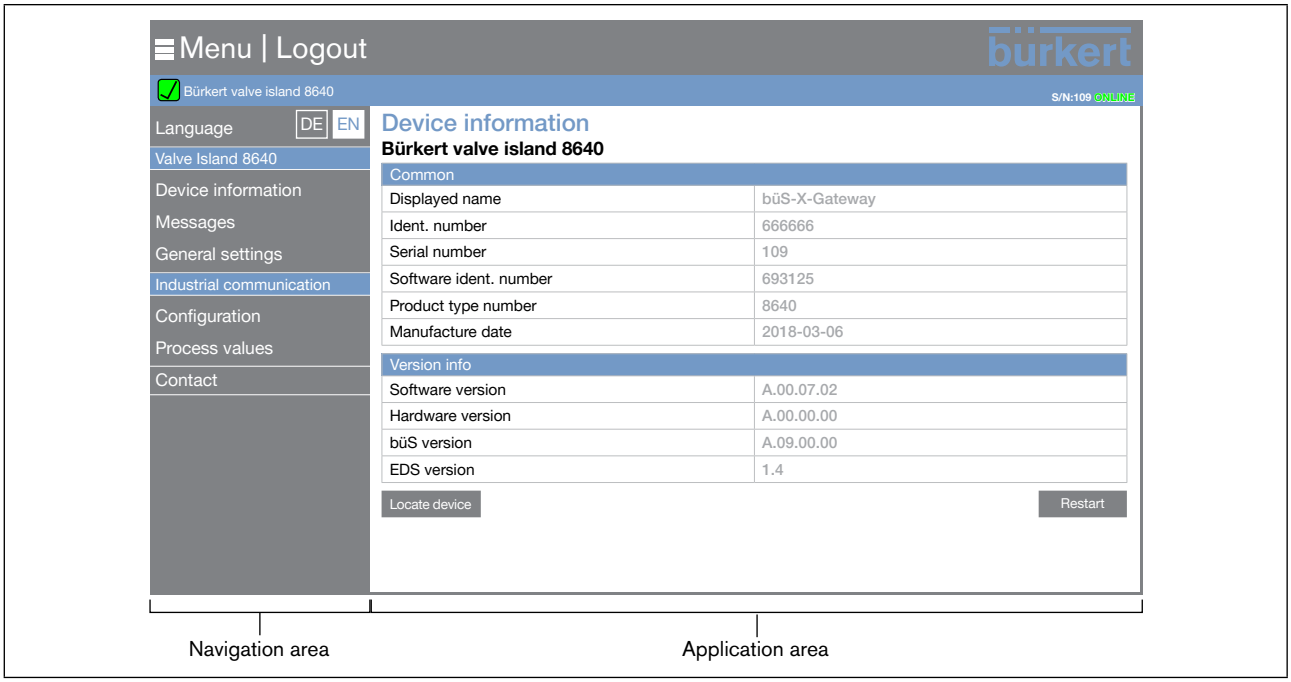

Figure 58: Overview of web server user interface

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15.6.3. Executing a login

To change device parameters, you need to log in.

→ To log in, select the **Login** command in the top left part of the web server window.

→ Enter your user name and password.

User name: **admin**
User password: **admin**

→ Confirm your entries using the **Login** button.

Once you have logged in, you can adjust the device parameters.

15.6.4. Adjusting device parameters

→ In the navigation area, select **Configuration** to display the “Industrial communication” application area.

→ Adjust the device parameters in the application area. The device name assigned here (DNS compatible name) is used later during project planning (e.g. under STEP 7).

→ Confirm changes with **Apply** to save the changes in the device.

→ For the changes to become effective, select **Restart**.

15.6.5. Localising Ethernet participants in the field

→ In the navigation area, select **Device information** to display the “Device information” application area.

→ In the application area, press the **Locate device** button.

✔ The LEDs FN (Failure Number) and FS (Failure Select) of the device in question flash 3 x briefly.

15.6.6. Displaying process values of the Ethernet participant

→ In the navigation area, select **Process values** to display the “Process values“ application area.

✔ All process values of the Ethernet participant are displayed in the application area.

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16. CONFIGURATION AND PARAMETER SETTINGS FOR PROFINET IO

16.1. Hardware configuration by GSDML based on the example of Siemens STEP 7

To configure the network master a software program such as Siemens STEP 7 is required.

Siemens's SIMATIC S7-300 CPU 315-2 PN/DP was used for the example configuration procedure.

Before accessing PROFINET IO slave 8640 the relevant GSDML must be imported into the hardware catalog of the tool. For details on how to do this refer to the software manual.

16.1.1. Configuration: Main terminal with 0 up to 8 RIO modules

Depending on the number of connected Rio modules, the right Device Access Point (DAP) must be selected from the hardware catalog in the right-hand screen pane (see “Figure 59”). It can be dragged and dropped onto the PROFINET network.

The default device name is "Valvelsland". As PROFINET IO slave 8640 has the same name by default, a connection can be made without making any further changes. As soon as multiple devices have been configured, their device names must match the configured names. The device names can be assigned as described in chapter “Adjusting device parameters” by way of the Web server or with STEP 7 (double-click on DAP and change device name).

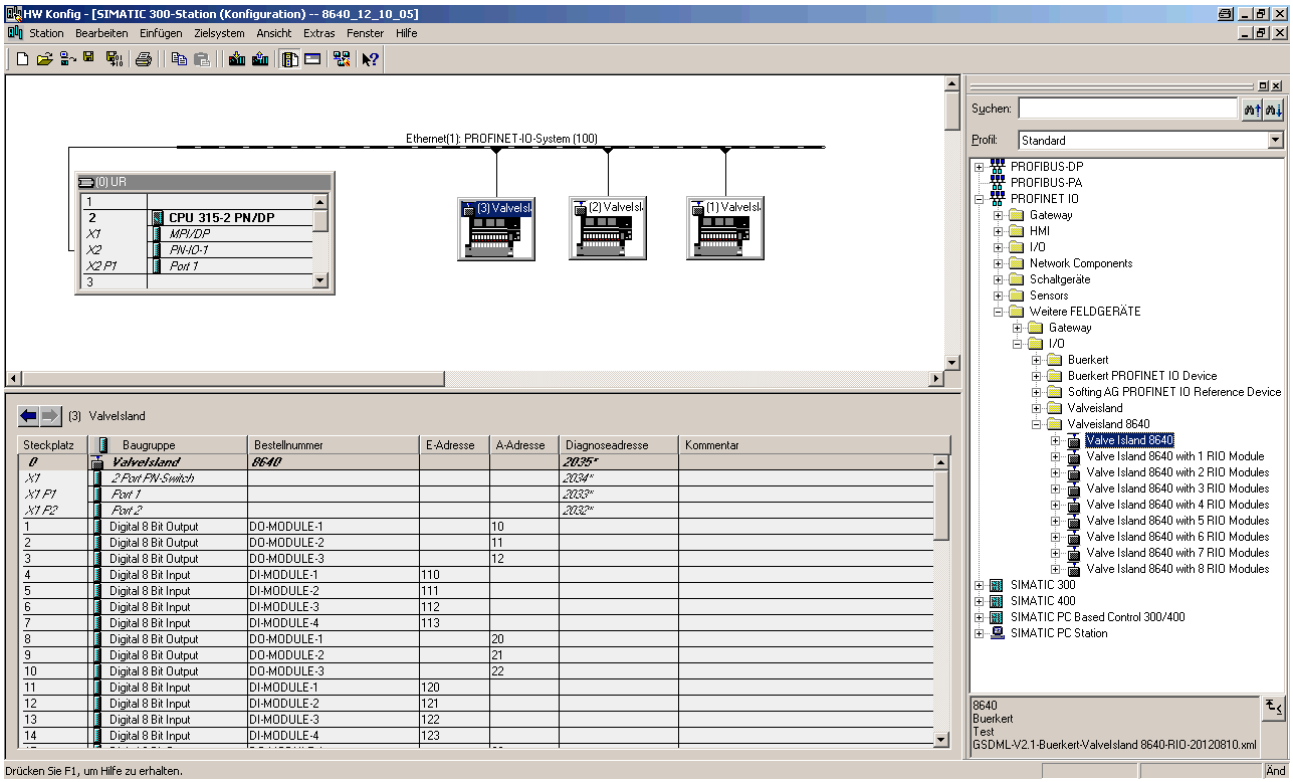

Figure 59: Konfiguration

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The main terminal is assigned to the first 7 slots with 3 output modules (slots 1–3) and 4 input modules (slots 4–7). Each slot contains 8 bits and so can serve 8 valves or 8 inputs:

Output modules		
Slot 1	Slot 2	Slot 3
Valve 1–8	Valve 9-16	Valve 17-24

Input modules			
Slot 4	Slot 5	Slot 6	Slot 7
Input 1–8	Input 9-16	Input 17-24	Input 25-32

The RIO nodes follow then in chronological order. 7 slots per node are assigned by default.

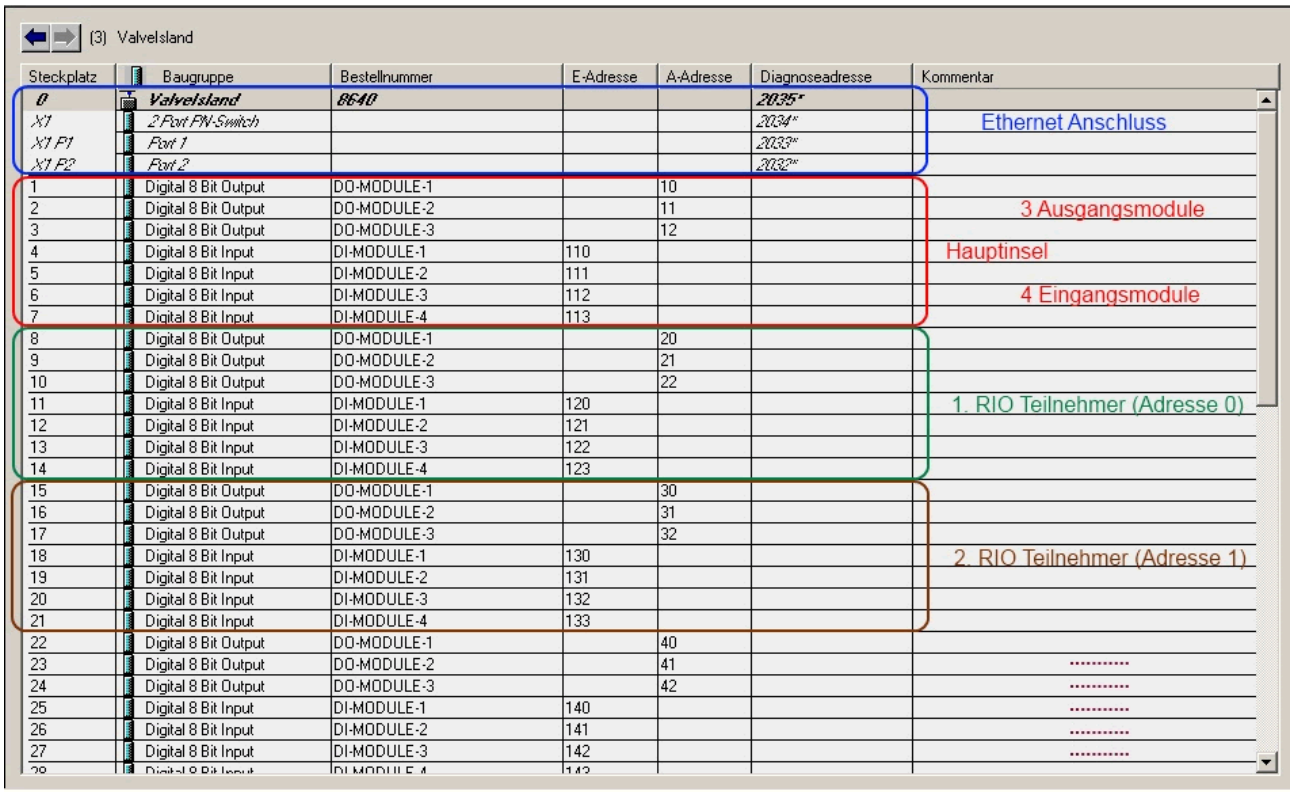

Figure 60: Example of slot assignment of a main terminal 8640 with 2 nodes

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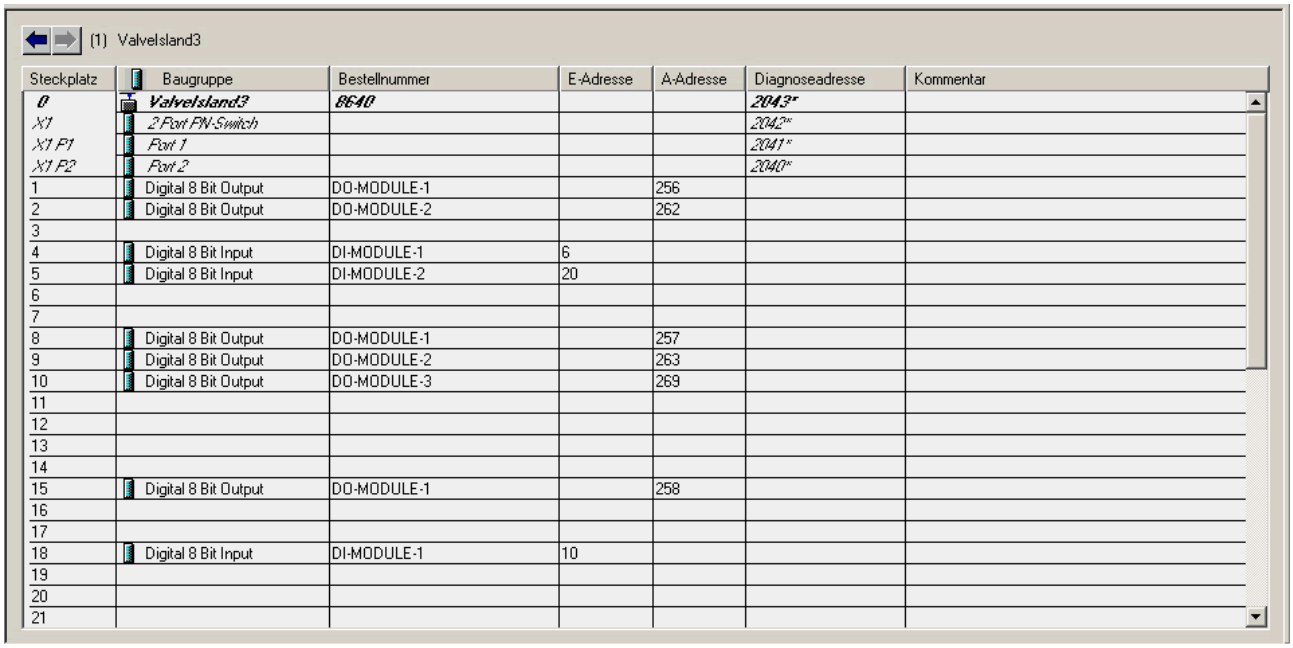
If the RIO node does not need all 7 slots because its configuration is lower (e.g. 16 valves and 0 inputs), the modules in those slots can be removed so as to save on addresses. Those slots then remain vacant.

The following example shows a main terminal and 2 RIO nodes with the following configurations:

Main terminal	RIO node 1	RIO node 2
16 valves	24 valves	8 valves
16 inputs	0 inputs	8 inputs



Steckplatz	Baugruppe	Bestellnummer	E-Adresse	A-Adresse	Diagnoseadresse	Kommentar
0	*ValveIsland3*	*8640*			*2043*	
X1	*2 Port FN-Switch*				*2042*	
X1 P1	*Port 1*				*2041*	
X1 P2	*Port 2*				*2040*	
1	Digital 8 Bit Output	DO-MODULE-1		256		
2	Digital 8 Bit Output	DO-MODULE-2		262		
3						
4	Digital 8 Bit Input	DI-MODULE-1	6			
5	Digital 8 Bit Input	DI-MODULE-2	20			
6						
7						
8	Digital 8 Bit Output	DO-MODULE-1		257		
9	Digital 8 Bit Output	DO-MODULE-2		263		
10	Digital 8 Bit Output	DO-MODULE-3		269		
11						
12						
13						
14						
15	Digital 8 Bit Output	DO-MODULE-1		258		
16						
17						
18	Digital 8 Bit Input	DI-MODULE-1	10			
19						
20						
21						

Figure 61: Example of slot assignment with low configuration

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16.2. Parameter settings for the PROFINET IO slave

The parameters for the PROFINET IO slave can be set either via the user interface of the project configuration software (such as STEP7) or by acyclic object access.

16.2.1. Parameter setting based on the example of STEP7

Double-click on the "HeadUnit" (slot 0) to open a new window and access the parameters.

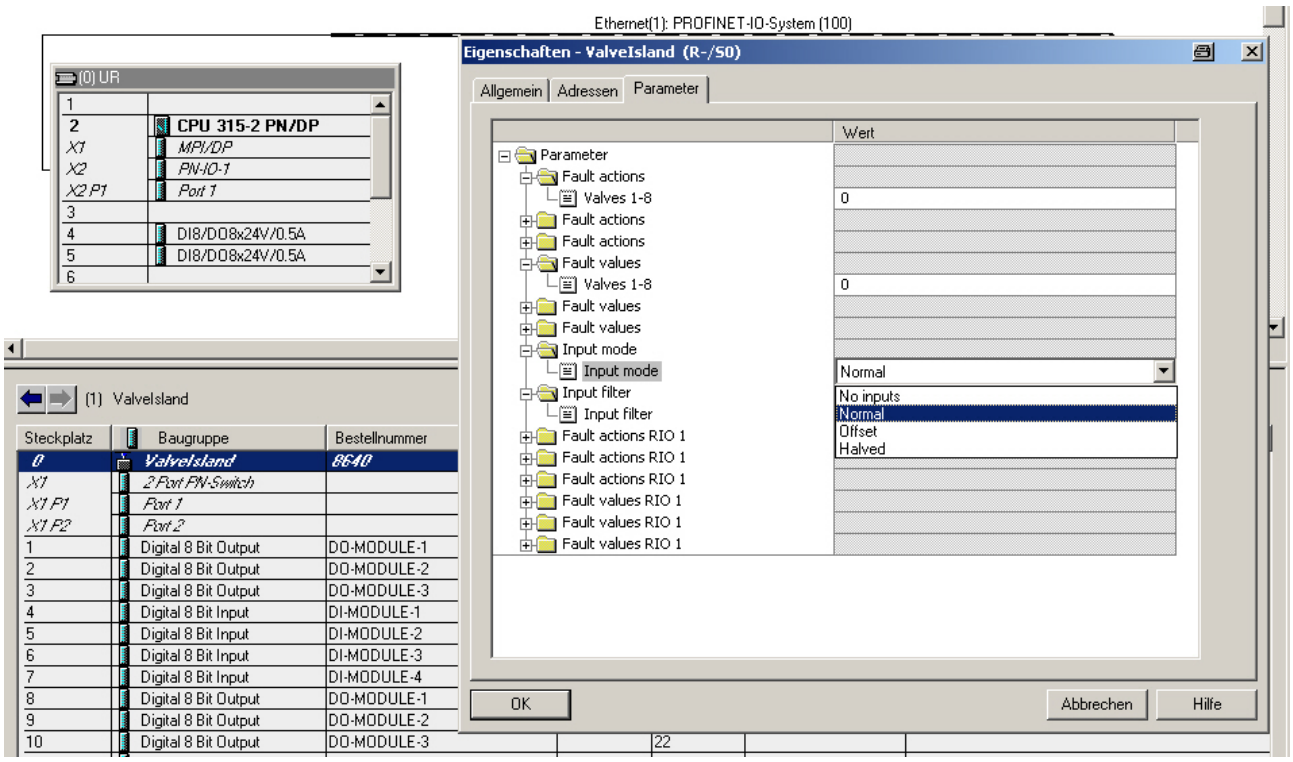

Figure 62: Parameter settings for the PROFINET IO slave via STEP7

16.2.2. Parameter setting by acyclic object access

The following table lists the data for the acyclic parameter change.

	Value	Slot hex	Subslot hex	Index hex	Index dec
Main terminal	Faultaction	0x00	0x01	0x02	2
	Faultaction	0x00	0x01	0x03	3
	Faultaction	0x00	0x01	0x04	4
	Faultvalue	0x00	0x01	0x05	5
	Faultvalue	0x00	0x01	0x06	6
	Faultvalue	0x00	0x01	0x07	7
	Identification number	0x00	0x01	0x08	8
	Serial number	0x00	0x01	0x09	9
	Input mode	0x00	0x01	0xA	10
	Input filter	0x00	0x01	0xB	11
RIO 1	Faultaction	0x00	0x01	0x12	18
	Faultaction	0x00	0x01	0x13	19
	Faultaction	0x00	0x01	0x14	20
	Faultvalue	0x00	0x01	0x15	21
	Faultvalue	0x00	0x01	0x16	22
	Faultvalue	0x00	0x01	0x17	23
RIO 2	Faultaction	0x00	0x01	0x22	34
	Faultaction	0x00	0x01	0x23	35
	Faultaction	0x00	0x01	0x24	36
	Faultvalue	0x00	0x01	0x25	37
	Faultvalue	0x00	0x01	0x26	38
	Faultvalue	0x00	0x01	0x27	39
RIO 3	Faultaction	0x00	0x01	0x32	50
	Faultaction	0x00	0x01	0x33	51
	Faultaction	0x00	0x01	0x34	52
	Faultvalue	0x00	0x01	0x35	53
	Faultvalue	0x00	0x01	0x36	54
	Faultvalue	0x00	0x01	0x37	55
⋮					
RIO 8	…	…	…	…	…

Figure 63: Acyclic object access data

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17. CONFIGURATION AND PARAMETER SETTINGS FOR ETHERNET/IP

The data exchange between the EtherNet/IP master and the valve terminal is object-oriented. Each node in the network is represented as a collection of objects.

The Assembly object defines the object assembly for data transfer. The Assembly object can be used to map data (such as I/O data) into blocks and transmit it via a single message connection. This mapping means fewer network access operations are needed.

A distinction is made between input and output assemblies. An input assembly reads data from the application over the network and produces data on the network.

An output assembly writes data to the application over the network and consumes data from the network.

Various assembly instances are preprogrammed in the field bus coupler/controller (static assembly). After power-up the assembly object maps data from the process image. As soon as a connection has been made, the master is able to address the data with "Class", "Instance" and "Attribute" and access it, and read and/or write it via I/O connections.

The data mapping depends on the selected assembly instance of the static assembly.

17.1. Addressing

The IP address is assigned – as usual for Ethernet IP – via a DHCP server. If no assignment occurs within 1 minute via DHCP, the device uses the Fallback IP address 192.168.0.100.

17.2. EDS file

The Electronic Data Sheets (EDS) file contains the identifying data of the field bus coupler/controller and details of its communications capabilities.

The EDS file needed for EtherNet/IP operation is installed from the project configuration software.

Downloading the EDS file
You will find the EDS file on the Internet, Type 8640 (Search by Type: 8640), at: www.buerkert.com

For information on installing the EDS file refer to your configuration software documentation.

17.3. Object model

For network communications EtherNet/IP uses an object model in which all the functions and data of a device are described. Each node in the network is represented as a collection of objects.

The object model includes terms which are defined as follows:

Object:

An object is an abstract representation of individual linked components within a device. It is identified by its data or attributes, by its externally provided functions or services, and by its defined behavior.

Class:

A class describes a series of objects which all represent the same kind of system component. A class is a generalization of an object. All objects in a class are identical in terms of form and behavior, though they may comprise differing attribute values.

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Instance:

A specific characteristic of an object is described as an instance. The designations “Object”, “Instance” and “Object instance” all refer to a specific instance.

If a class has different instances, services, behavior and attributes are the same. However, they may have different variable values.

Example: An instance of the object class “Vehicle” is for example car.

Attributes:

Attributes help describe the functions of an object.

Example: For a valve output, attributes can be used to define the value, the behavior in the event of a fault and a safety position.

Service:

Service designates a function which is supported by an object. A group of common services is defined as CIP. Services are for example the reading and writing of values.

Class overview:

The CIP classes are listed in the ODVA's CIP Specification (volume 1, "Common Industrial Protocol"). This specifies their attributes, regardless of the physical interface (e.g. Ethernet, CAN).

The physical interface is described in another specification ("EtherNet/IP Adaption of CIP"). It describes the adaption of EtherNet/IP to CIP.

Overview of CIP common classes

Class	Name
01 hex	Identity
02 hex	Message Router
04 hex	Assembly
05 hex	Connection
06 hex	Connection Manager
F4 hex	Port Class Object
F5 hex	TCP/IP Interface Object
F6 hex	Ethernet Link Object

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17.4. Configuring process data

The valve island Type 8640 has been revised. This revised version REV.2 is compatible with the previous version, but only for the main terminal with up to 4 RIOs. If 5 or more RIOs are used or if downward compatibility was deactivated using the “DownwardsCompatibility” object (see section “17.5.1”, page 5), new description files (EDS file) are provided for the open loop control of version REV.2 devices.

Transmitting process data via an I/O connection
One static input assembly and a static output assembly are available for selection. These assemblies contain selected attributes combined into one object to be transmitted collectively as process data.

Access to process data can be cyclic or acyclic:

Acyclic access takes place via “Explicit Messages”. The access path for acyclic access is:

class 4

instance “X” (for X, refer to the tables below)

attribute 3

The *Get_Attribute-Single* service can provide acyclic read access to the input data and the *Set_Attribute_Single* service can provide acyclic write access to the output data.

The number of respective data bytes for inputs (sensors or proximity switches) and for outputs (actuators or valves) are in the following tables to be referred.

Previous device versions (see section “5.4”, page 12).

Terminal	Object	Class	Instance	Attribute	Access	Length (byte)	Range	Default
Main terminal	Assembly	4	100	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
Main terminal	Assembly	4	101	3	Get	4	0 ... 0 x FF per byte	4 byte inputs
RIO 1	Assembly	4	102	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
RIO 1	Assembly	4	103	3	Get	4	0 ... 0 x FF per byte	4 byte inputs
⋮								
RIO 8	Assembly	4	116	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
RIO 8	Assembly	4	117	3	Get	4	0 ... 0 x FF per byte	4 byte inputs

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Device version REV.2 with up to 4 RIO slaves and “downward compatible = on”:

Terminal	Object	Class	Instance	Attribute	Access	Length (byte)	Range	Default
Main terminal	Assembly	4	100	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
Main terminal	Assembly	4	101	3	Get	4	0 ... 0 x FF per byte	4 byte inputs
RIO 1	Assembly	4	102	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
RIO 1	Assembly	4	103	3	Get	4	0 ... 0 x FF per byte	4 byte inputs
⋮								
RIO 4	Assembly	4	108	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
RIO 4	Assembly	4	109	3	Get	4	0 ... 0 x FF per byte	4 byte inputs

Device version REV.2 with 5 or more RIO slaves or “downward compatible = off”:

Terminal	Object	Class	Instance	Attribute	Access	Length (byte)	Range	Default
Main terminal	Assembly	4	100	3	Set	3	0 ... 0 x FF per byte	3 byte outputs (valves)
Main terminal	Assembly	4	101	3	Get	4	0 ... 0 x FF per byte	4 byte inputs
RIO 1	Assembly	4	102	3	Set	6	0 ... 0 x FF per byte	6 byte outputs (valves)
RIO 1	Assembly	4	103	3	Get	8	0 ... 0 x FF per byte	8 byte inputs
⋮								
RIO 8	Assembly	4	108	3	Set	6	0 ... 0 x FF per byte	6 byte outputs (valves)
RIO 8	Assembly	4	109	3	Get	8	0 ... 0 x FF per byte	8 byte inputs

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17.5. Applications object

The valve island Type 8640 has been revised. This revised version REV.2 is compatible with the previous version, but only for the main terminal with up to 4 RIOs. If 5 or more RIOs are used or if downward compatibility was deactivated using the “DownwardsCompatibility” object, new description files (EDS file) are provided for the open loop control of version REV.2 devices.

During parameterisation, the usable objects may differ. The objects that must be used depend on the following factors:

- **Device version**

  Previous device version (without specification of a revision number on the type label)
  or
  Device version REV.2 (with identical information on the type label)

- **Number of RIOs used for the main terminal**

  Main terminal + 1...4 RIOs
  Main terminal + 1...8 RIOs

- **Setting the acyclic object “Downwards Compatibility”**

Overview of objects to be used:

Number of RIOs	Previous device version	Device version REV.2, downward compatible “on”	Device version REV.2, downward compatible “off”
Main terminal + 1...4 RIOs	see “Table 2: Previous version objects”	see “Table 2: Previous version objects”	see “Table 3: Version REV.2 objects”
Main terminal + 5...8 RIOs		see “Table 3: Version REV.2 objects”	

17.5.1. Object “Downwards Compatibility”

Object	Class	Instance	Attribute	Access	Length [byte]	Area	Default	Summary description
Downwards Compatibility	152	1	1	Get/Set	1	0 ... 1	*1*	Switching compatibility to old versions (old EDS file), only possible for less than 5 RIO nodes 0: not compatible -> new EDS file 1: compatible -> old EDS file

Table 1: Downwards Compatibility object

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17.5.2. Previous version objects

The prevision device versions can be parameterised using the following objects:

Object	Class	Instance	Attribute	Zugriff	Länge [Byte]	Bereich	Default	Kurzbeschreibung
Inputs*	8	1 ... 36	3	Get/Set	1	0 ... 0xFF		Reads inputs via *Assembly* or *Class 8*
Valves*	9	1 ... 27	3	Get/Set	1	0 ... 0xFF		Switches valves via *Assembly* or *Class 9*
Fault Action*	9	1 ... 27	5	Get/Set	1	0 ... 0xFF	0x00	Action in case of fault or offline per output 0: Fault Value (Default in Fault Value attribute 6) 1: Hold last state
Fault Value*	9	1 ... 27	6	Get/Set	1	0 ... 0xFF		
Factory ID	150	1	1	Get	4			Bürkert ident number
Factory Serial	150	1	2	Get	4			Bürkert serial number
Input mode	151	1	1	Get/Set	1	0 ... 3	0: without EME 1: with EME	0: no inputs 1: normal inputs 2: shifted inputs 3: halved inputs
Input filter	151	1	2	Get/Set	1	0 ... 1	1	0: Filter Off 1: Filter On

Table 2: Previous version objects

In the Fault Action and Fault Value configuration the Instance of each subsequent RIO node starts with the offset of 3 (3 x 8 = 24 valves per island possible).

Example:

Fault Action RIO 1 --> Instance 4…6

Fault Value RIO 2 --> Instance 7…9

*) The maximum possible instance depends on the number of connected RIO nodes.
Example 4 RIOs:
Inputs: Instance 1…20
Valves: Instance 1…15
Fault Action: Instance 1…15
Fault value: Instance 1…15

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17.5.3. Version REV.2 objects

The devices of version REV.2 can be parameterised using the following objects:

Object	Class	Instance	Attribute	Access	Length [byte]	Area	Default	Summary description
Inputs Main terminal 1st–4th Byte	101	1 ... 4	3	Get	1	0 ... 0xFF		Reads inputs via *Assembly* or *Class 101*
Outputs Main terminal 1st–3rd Byte	100	1 ... 3	3	Get/Set	1	0 ... 0xFF		Switches valves via *Assembly* or *Class 100*
Inputs RIO 1 1st–4th Byte RIO 2 1st–4th Byte	103	1 ... 8	3	Get	1	0 ... 0xFF		Reads inputs via *Assembly* or *Class 103*
Outputs RIO 1 1st–3rd Byte RIO 2 1st–3rd Byte	102	1 ... 6	3	Get/Set	1	0 ... 0xFF		Switches valves via *Assembly* or *Class 102*
Inputs RIO 3 1st–4th Byte RIO 4 1st–4th Byte	105	1 ... 8	3	Get	1	0 ... 0xFF		Reads inputs via *Assembly* or *Class 105*
Outputs RIO 3 1st–3rd Byte RIO 4 1st–3rd Byte	104	1 ... 6	3	Get/Set	1	0 ... 0xFF		Switches valves via *Assembly* or *Class 104*
Inputs RIO 5 1st–4th Byte RIO 6 1st–4th Byte	107	1 ... 8	3	Get	1	0 ... 0xFF		Reads inputs via *Assembly* or *Class 107*
Outputs RIO 5 1st–3th Byte RIO 6 1st–3rd Byte	106	1 ... 6	3	Get/Set	1	0 ... 0xFF		Switches valves via *Assembly* or *Class 106*
Inputs RIO 7 1st–4th Byte RIO 8 1st–4th Byte	109	1 ... 8	3	Get	1	0 ... 0xFF		Reads inputs via *Assembly* or *Class 109*

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Object	Class	Instance	Attribute	Access	Length [byte]	Area	Default	Summary description
Outputs RIO 7 1st–3rd Byte RIO 8 1st–3rd Byte	108	1 ... 6	3	Get/Set	1	0 ... 0xFF		Switches valves via *Assembly* or *Class 108*
Fault Action	9	1 ... 27	5	Get/Set	1	0 ... 0xFF	0x00	Action in case of fault or offline per output 0: Fault Value (Default in Fault Value attribute 6) 1: Hold last state
Fault Value	9	1 ... 27	6	Get/Set	1	0 ... 0xFF		
Factory ID	150	1	1	Get	4			Bürkert ident. number
Factory Serial	150	1	2	Get	4			Bürkert serial number
Input mode	151	1	1	Get/Set	1	0 ... 3	0: without EME 1: with EME	0: no inputs 1: normal inputs 2: shifted inputs 3: halved inputs
Input filter	151	1	2	Get/Set	1	0 ... 1	1	0: Filter Off 1: Filter On

Table 3: Version REV.2 objects

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18. CONFIGURATION AND PARAMETER SETTINGS FOR MODBUS TCP

18.1. Modbus application protocol

The application protocol is organized independently of the transfer medium used, and follows the client-server principle. When the request telegram is sent the client initiates a service call which the server answers with a response telegram. The request and response telegrams contain parameters and/or data. The differences between the standard Modbus telegram and the Modbus-TCP telegram are shown in the following graphic.

Whereas in standard Modbus communication the slave address and a CRC checksum are transmitted in addition to the command code and data, in the case of Modbus TCP these functions are handled by the underlaid TCP protocol.

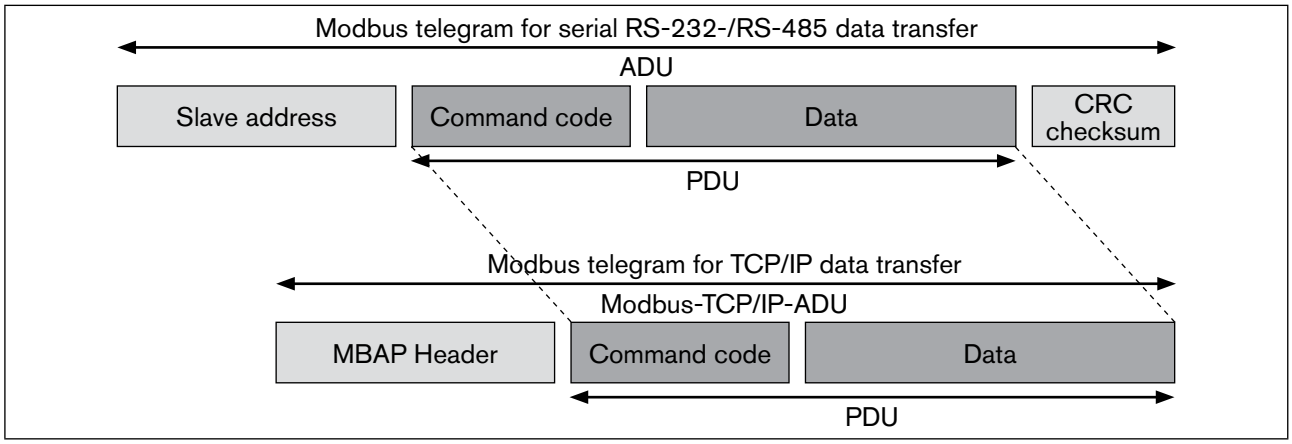

Figure 64: Differences between the standard Modbus telegram and the Modbus-TCP telegram

In the following the interactions between the client and server are described based on the example of a "Read Discrete Input" command:

The client uses this command to request reading of the server's digital inputs. The command code and the parameters are sent to the server in the request telegram:

Example of request telegram

Function code	1 bytes	2
Start address	2 bytes	0 - 65535
Number of inputs	2 bytes	1 - 2000

If the server has received the read command correctly, the desired input data is transmitted to the client in the response telegram.

Example of response telegram

Function code	1 bytes
Number of	1 bytes
Input values	N bytes

N corresponds to the number of inputs divided by 8. If the division remainder is greater than 0, N is increased by 1 and the remaining bits are transferred in the last byte. Unneeded bits are filled out with zeros. If the server is unable to deliver the requested data, instead of the response telegram it sends an error telegram to the client.

In addition to the "Read Discrete Input" service, Modbus defines a large number of other standard commands listed in the specification. Additionally, function codes 65–72 and 100–110 can be used for custom user-defined services. An overview of some unified (Public) Modbus services is provided in the following table:

Method	Data type	Service	Code	Access
Bit-wise	Inputs	Read Discrete Input	02	Read
Bit-wise	Outputs/Coils	Read Coils	01	Read
Bit-wise	Outputs/Coils	Write Single Coil	05	Write
Word-wise	Inputs	Read Input Register	04	Read
Word-wise	Outputs/Coils	Write Single Register	06	Write
Word-wise	Outputs/Coils	Write Multiple Register	16	Write

18.2. Modbus data model

The data model is simply structured and differentiates between four basic types:

- Discrete Inputs
- Coils (outputs)
- Input Register (input data)
- Holding Register (output data)

The definition and naming indicates the origins of the Modbus protocol. In present-day Modbus implementations these basic definitions are applied very generously to the wide-ranging data types of modern automation devices. The meanings and data addresses in each individual case must be specified by the manufacturer in the device manual. Electronic device data sheets and cross-manufacturer engineering tools as in the case of modern-day field bus systems do not (as yet) exist in the Modbus environment.

18.3. Mapping to TCP/IP

For data transfer in Ethernet-TCP/IP networks Modbus TCP uses the Transport Control Protocol (TCP) to transmit the Modbus application protocol. In this, the parameters and data are embedded in the user data container of a TCP telegram according to the encapsulation principle. During encapsulation (embedding), the client generates a Modbus Application Header (MBAP) which enables the server to unambiguously interpret the received Modbus parameters and commands. Only one Modbus application telegram may be embedded in one TCP/IP telegram.

18.4. Connection-oriented structure

Before user data can be transferred via Modbus TCP, a TCP/IP connection must first be established between the client and server. Port number 502 is reserved for Modbus TCP on the server side. The connection is typically made automatically via the TCP/IP socket interface by the protocol software, which means it is fully transparent for the application process. Once the TCP/IP connection between the client and server has been established, the client and server can transfer as much user data as often as they want via that connection. The client and server can set up multiple TCP/IP connections simultaneously. The maximum number depends on the capacity of the TCP/IP interface. In cyclic transfer of input and output data the connection between the client and server is maintained continuously. For demand-based data transfer for parameters or diagnostic messages, the connection can be cut when the data transfer is finished and re-established the next time communication is required.

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18.5. 8640 objects

18.5.1. Valves

Method	Data type	Service	Code	Access
Bit-wise	Outputs/Coils	Write Single Coil	05*	Write
Bit-wise	Outputs/Coils	Write Multiple Coil	15	Write
Word-wise	Outputs	Write Single Register	06	Write

*) Code 05 is no longer supported in version REV.2

Access bit-wise (multiple access possible):

Each access addresses 1 valve. This results in an address offset of 1 per valve and an address offset of 24 per RIO participant.

Start address valves: 0x001

Main terminal: 1-24

RIO 1 25-48

…

RIO 8 193-216

Access word-wise (only 1 byte is valid):

Each access addresses 8 valves. This results in an address offset of 1 per 8 valves and an address offset of 3 per RIO participant.

Main terminal: 1-3

RIO 1 4-6

…

RIO 8 25-27

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18.5.2. Inputs

Method	Data type	Service	Code	Access
Bit-wise	Inputs/Coils	Read Coils	01	Read
Bit-wise	Inputs/Coils	Read Discrete Input	02	Read
Word-wise	Inputs	Read Holding Register	03	Read

Access bit-wise (multiple access possible):

Each access addresses 1 input. This results in an address offset of 1 per input and an address offset of 32 per RIO participant.

Start address inputs: 0x001

Main terminal: 257-288

RIO 1 289-320

…

RIO 8 513-544

Access word-wise (only 1 byte is valid):

Each access addresses 8 inputs. This results in an address offset of 1 per 8 inputs and an address offset of 4 per RIO participant.

Main terminal: 257-260

RIO 1 261-264

…

RIO 8 289-292

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18.5.3. Configuration data

Method	Data type	Service	Code	Access
Word-wise	Outputs	Write Single Register	06	Write
Word-wise	Inputs	Read Holding Register	03	Read

Access word-wise (only 1 byte is valid):

Each access addresses 8 valves. This results in an address offset of 1 per 8 valves and an address offset of 3 per RIO participant.

Start address Fault action: 0x201

Main terminal: 513-515

RIO 1 516-518

…

RIO 8 537-539

Start address Fault value: 0x301

Main terminal: 769-571

RIO 1 772-774

…

RIO 8 793-795

Service Parameter

Method	Data type	Service	Code	Access
Word-wise	Outputs	Write Single Register	06	Write
Word-wise	Inputs	Read Holding Register	03	Read
Word-wise	Outputs/Coils	Write Multiple Register	16	Write

Start Device Parameter: 0x401

Object	Length	Data type	Start address
Identification number	Previous version: 6 bytes	Previous version: String	0x401
	Version REV.2: 4 bytes	Version REV.2: UINT32	
Serial number	4 bytes	UINT32	0x404
Input mode	1 bytes	UINT8 (only 1 byte is valid)	0x406
Input filter	1 bytes	UINT8 (only 1 byte is valid)	0x407

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19. ELECTRICAL BASE MODULE OUTPUT

19.1. Collective socket

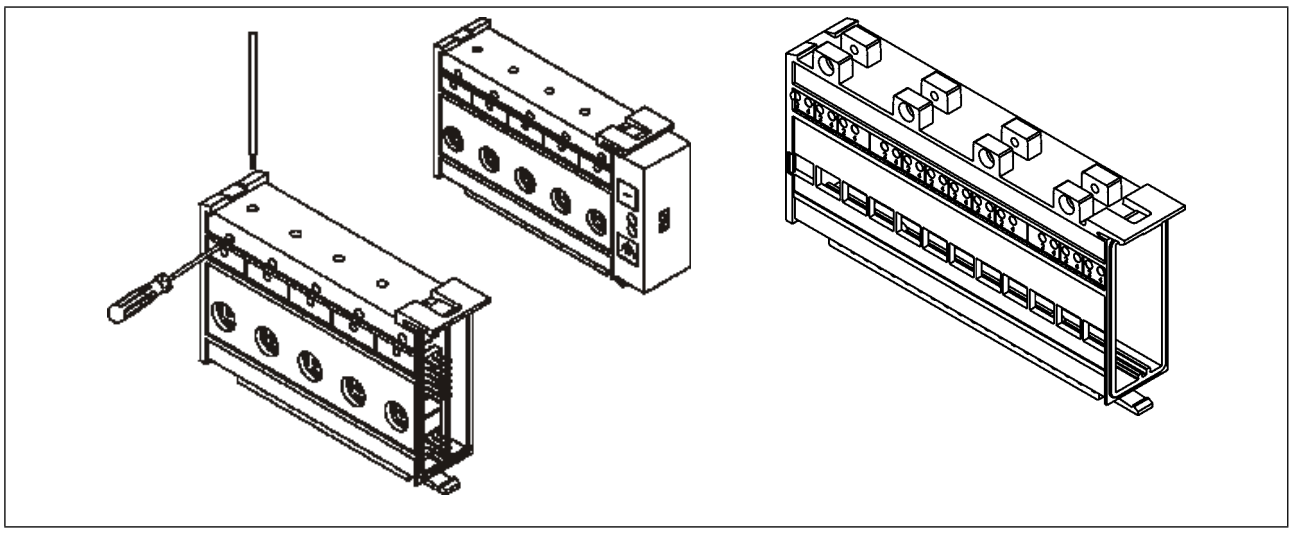
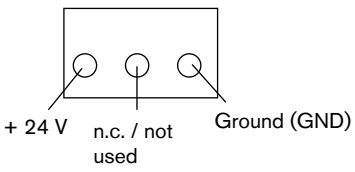


Figure 65: Collective socket

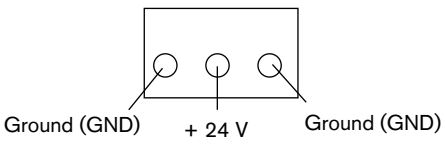
Electrical base module collective socket only in connect with the collective socket module for valve outputs (see module for the conventional electrical connection technology “Collective socket module”).

19.1.1. Allocation plan

Valve types 6510, 6511, 6524, 6525:



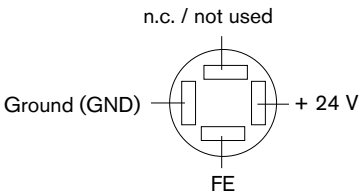
Valve types 0460, 6524 (2 x 2/3-way valve):



NOTE!

For the valve types 6524 (2 x 3/2-way valve) and 0460 the outputs are negative switched: GND are switched; 24 V are applied.

Valve types 0460, 5470, 6512, 6513, 6516, 6517, 6526 and 6527:



NOTE!

The outputs are positive switched: 24 V are switched; GND is applied.

19.2. Valve outputs

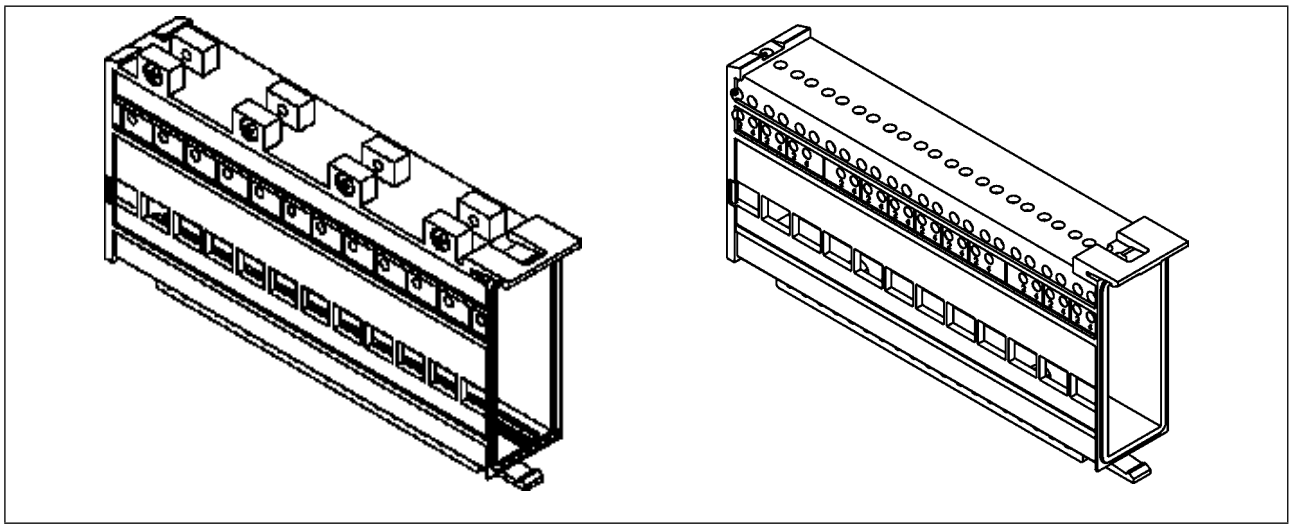


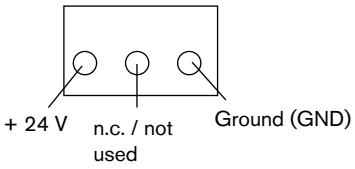
Figure 66: Electrical base module for valve outputs

NOTE!

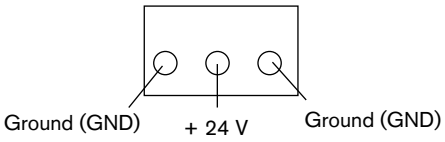
The electrical base modules contain the connections for the valve control.

19.2.1. Allocation plan

Valve types 6510, 6511, 6524, 6525:



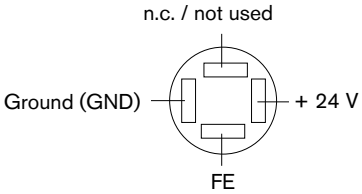
Valve types 0460, 6524 (2 x 2/3-way valve):



NOTE!

For the valve types 6524 (2 x 3/2-way valve) and 0460 the outputs are negative switched: GND are switched; 24 V are applied.

Valve types 0460, 5470, 6512, 6513, 6516, 6517, 6526 and 6527:



NOTE!

The outputs are positive switched: 24 V are switched; GND is applied.

19.3. Valve outputs with manual / automatic switching

Using this module, the connected valves can be switched to manual or automatic as required.

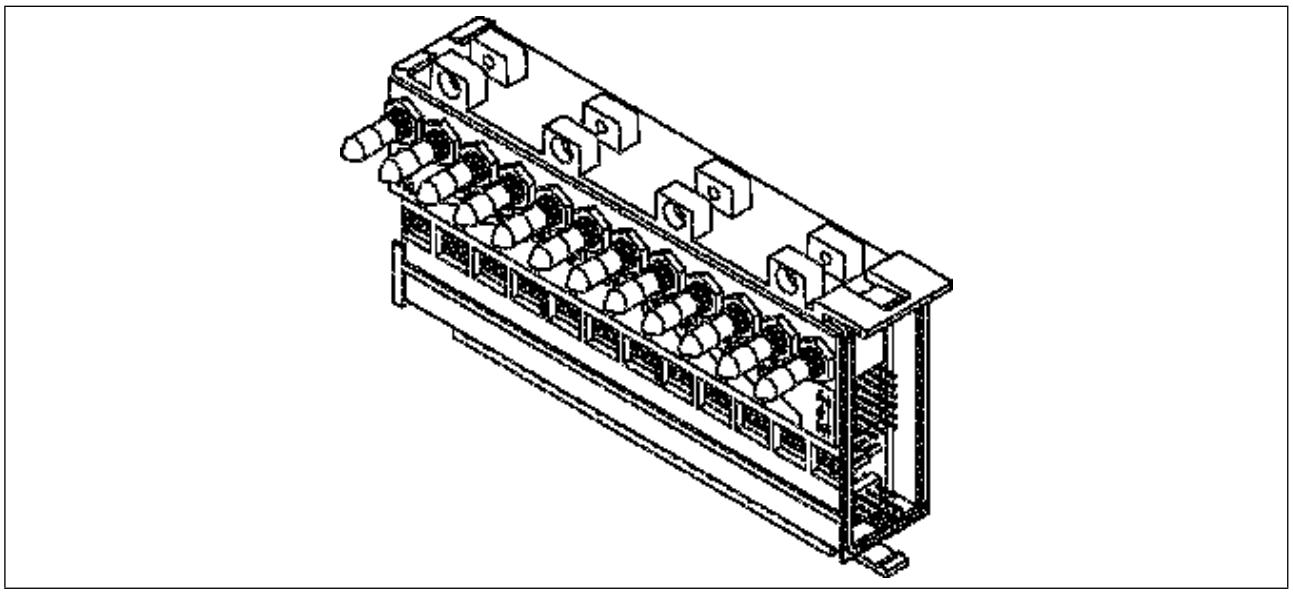


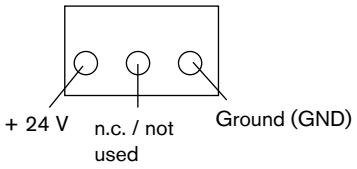
Figure 67: Electrical base module for valve outputs with manual / automatic switching (12-fold)

NOTE!

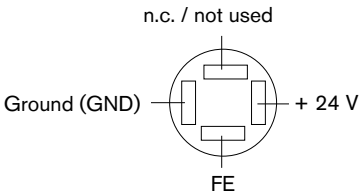
Locked switches! The manual / automatic switches have a mechanical locking mechanism. Before being deployed, the lever must be pulled out of the lock position!

19.3.1. Allocation plan

Valve types 6510, 6511, 6524, 6525:



Valve types 0460, 5470, 6512, 6513, 6516, 6517, 6526 and 6527:



NOTE!

The outputs are positive switched: 24 V are switched; GND is applied.

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19.3.2. Switching functions of the electrical base module with manual / automatic switching.

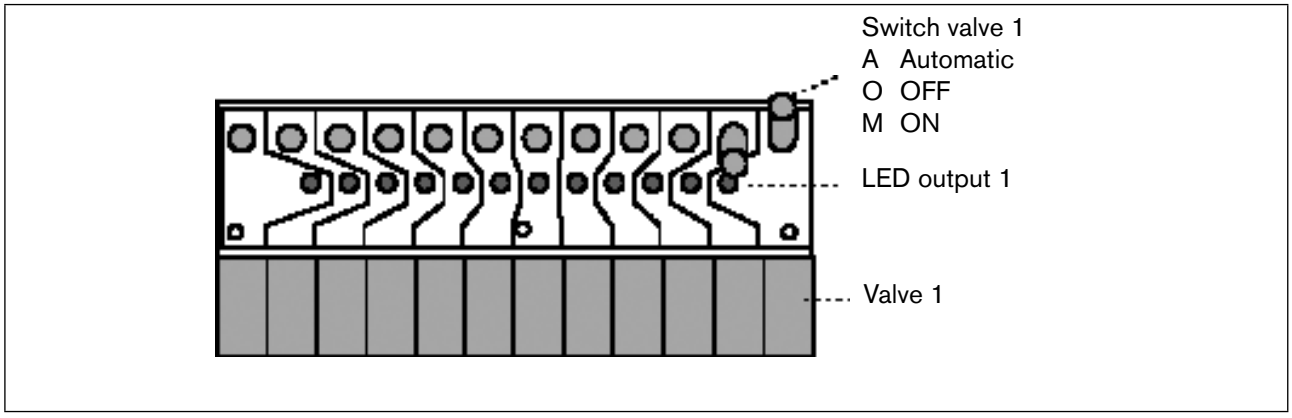

Figure 68: Module description for electrical base module with manual / automatic switching using example: Module EGM / HA-10-12

19.3.3. Switching functions

Switch position	Function	Description
up	Automatic	Bus operation; incoming control signal switches valve
centre	Valve OFF	Valve is always closed
down	Valve ON	Valve is always open

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19.4. Valve outputs with external switch-off

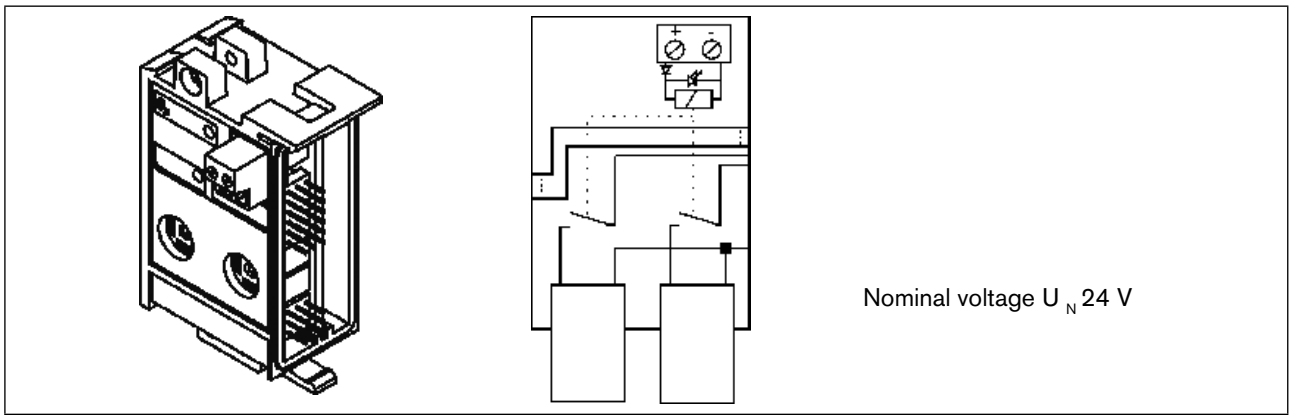
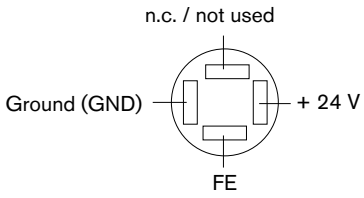


Figure 69: Valve outputs with external switch-off - circuit diagram of the valve outputs

19.4.1. Allocation plan

Valve types 5470, 6512, 6513, 6516, 6517, 6526, 6527:



NOTE!

The outputs are positive switched: 24 V are switched; GND is applied.

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20. ELECTRICAL BASE MODULE INPUT

20.1. Terminal inputs for repeaters (initiators)

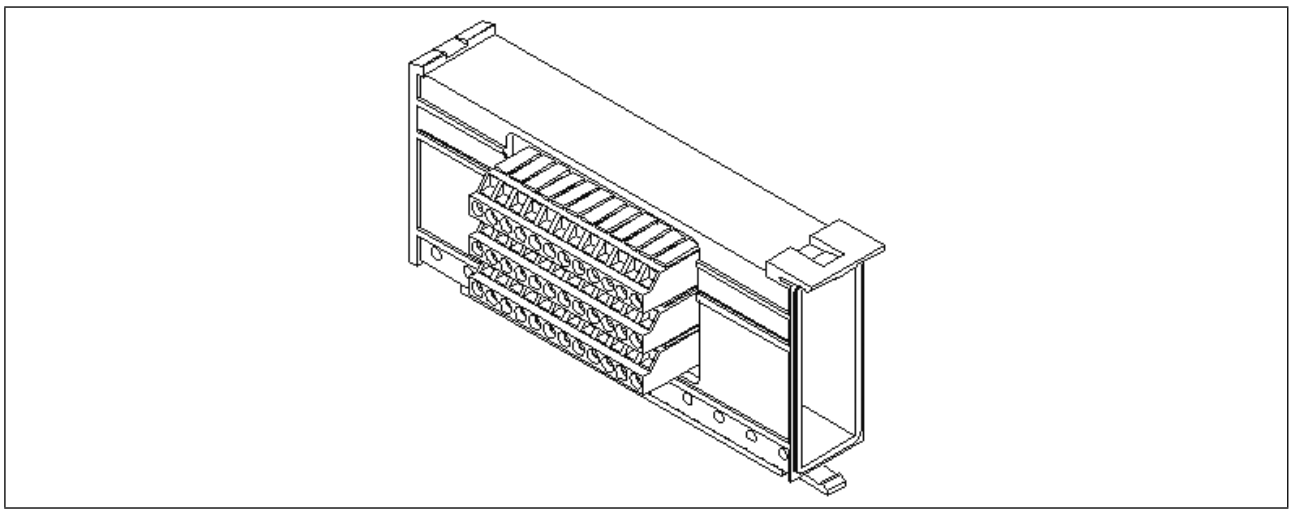
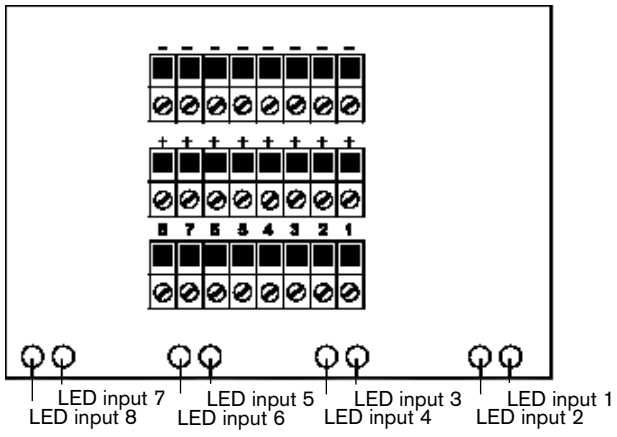


Figure 70: Electrical base module for repeater inputs (initiators) for terminals (IP20)

20.1.1. Terminal assignment



Input voltage	+ 24 V
Signal	
0 (logical)	0 to 5 V
1 (logical)	12 to 30 V
Input current for 1-signal:	≤ 10 mA

Figure 71: Terminal assignment

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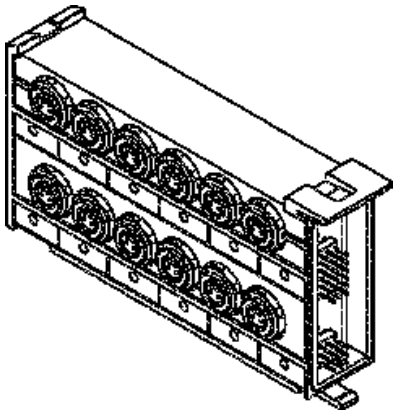
20.2. Plug inputs (M8 circular plugs) for repeaters (initiators)

Electrical base module for repeater inputs (initiators) for terminals (IP20)



Input voltage	+ 24 V
Signal	
0 (logical)	0 to 5 V
1 (logical)	13 to 30 V
Input current for 1-signal:	≤ 10 mA

Figure 72: Electrical base module for repeater inputs

20.2.1. Inputs of the module EGM-SE-19-10

10 inputs (circular plugs) for return signal; one LED per input

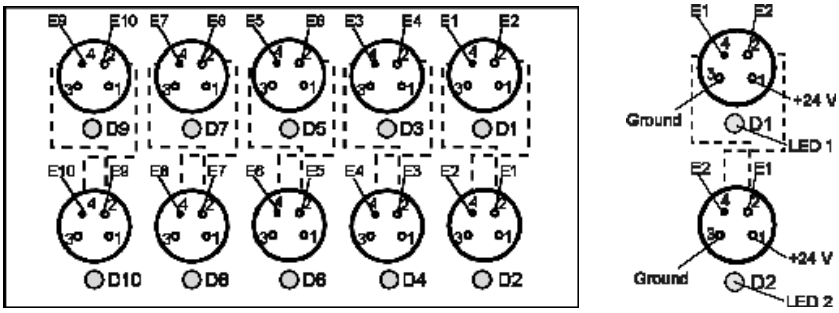


Figure 73: Plug configuration of the EGM-SE modules except EGM-SE-19-4

NOTE!

The internal connection between two plugs one above the other serves to conduct two return signals via one plug.

20.2.2. Inputs of the module EGM-SE-19-4

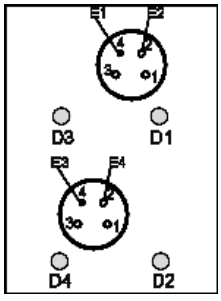


Figure 74: Plug configuration of the module EGM-SE-19-4

21. PNEUMATIC BASE MODULE

21.1. General description

The pneumatic base module features the working connections for the following applications. Several modules can be placed in rows by connecting them. The seal on the outside is retained. The P-connection can be sealed by using a bulkhead. This allows movement in one valve block with different operating pressures.

Variants

The variant versions differ in add-on dimension, number of valve locations, wiring diagram of the valves, version of the working connections and optional use of non-return valves Not all conceivable variants have been implemented.

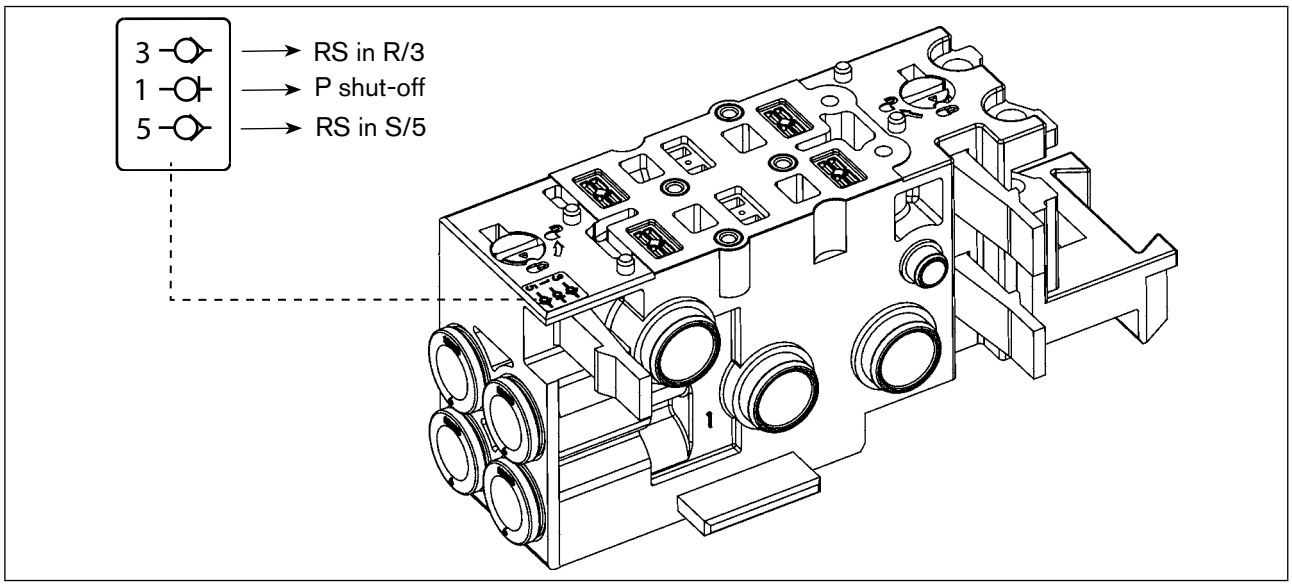


Figure 75: Example of a pneumatic base module (Type MP11 / 2-fold)

Add-on dimension

Larger valves also require wider base modules. This allows a higher flow rate to be implemented. Currently the following add-on dimensions are available:

Variants	Add-on dimension mm	2-fold mono	2-fold 2 x mono	2-fold bistable	3-fold mono	4-fold mono	8-fold mono	8-fold 2 x mono
MP11	11	X*	X*	X	-	-	X*	X*
MP12	16.5	X	-	X	X	X	-	-

* Also with P shut-off

Number of valve locations per module

As module optimization is based on low granularity, cost savings, structure of valve discs and utilization of the electronics, it is useful to have modules with a varying number of valve locations.

Type of working connections

Whether quick plug-in connections or thread - you as the customer decide which is the optimum variant for you.

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Non-return valve for the vent connections

As certain applications require a functionality with non-return valves, there are also appropriate types for this purpose:

- Without non-return valve,
- Non-return valve in R+S,
- An integrated P shut-off is also available for the modules MP11.

MP11	MP12
D6	D8
-	G 1/8"
D 1/4"	NPT 1/8 "
-	D6*
M7	-
-	M7*
-	D 1/4"*

* Special design 3-fold module with 10 mm valves

21.2. Pneumatic base module with integrated P shut-off

General Description

The P shut-off can be integrated in the module for the pneumatic base modules MP11, 2-fold and 8-fold versions. This option allows a defective valve to be changed under pressure without having to depressurize the complete valve cluster or system. When the valve is changed by a mechanism, the open cross section is reduced until only a slight residual leakage occurs.

Features and restrictions

If the P shut-off is used, there are some restrictions with respect to the operating data of the complete system:

- The flow rate of the valves Type 6524 / 6525 is reduced to approx. 60%*.
- The operating pressure range must be between 5 and 7 bar if the P shut-off is used, otherwise there may be problems with the P shut-off.
- As the pressure supply for the pilot valves is not shut off if valves are used with external control assist air, the P shut-off can be used only in conjunction with the valves with internal control air within the restricted pressure range.
- The P shut-off can be combined with the integrated non-return valves.

NOTE!

If using the P shut-off base modules, ensure that the pressure supply of the valve clusters is designed with a correspondingly large volume (minimum hose diameter 8/6 mm).

* Mean value from measurements

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Procedure when replacing a valve

CAUTION!

- Only one valve may be removed at the same time.
- During removal, observe that only the P channel is shut off! This means that a pressure on the working outputs A or B is released when the valve is removed. This also means that a connected actuator is also depressurized and a movement may be triggered as a result.
- If there is a larger volume on the actuator side, attach a shut-off option for the working connections to prevent the actuator from moving.

When the valve is removed, a relatively large amount of air is initially blown into the open for functional reasons, as the P shut-off cannot close until the required pressure difference is reached. However, as the automatic shut-off reduces the exhaust air significantly, only a residual leakage remains when the P shut-off is closed.

→ When installing the valve, ensure that the seal is inserted correctly.

→ Install the valve at the tightening torques indicated in the operating instructions.

→ When installing the valve, ensure that the working connections are also pressurized in the corresponding rest position of the valve until it is switched over. The pressurization may cause a connected actuator to move.

→ Ensure that these movements of the actuator do not cause any damage or unwanted actions in the system.

CAUTION!

Danger from loose deposits or components!

When releasing a valve under pressure with P shut-off deposits or aged constituents could be ejected.

- Use a suitable pair of protective glasses when replacing valves.

Before changing the valve, we recommend bringing the system into an electrically safe basic state.

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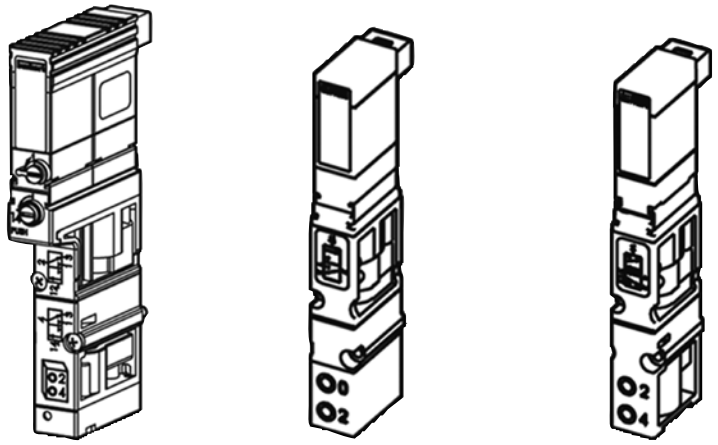
22. VALVES

22.1. General description

Automation systems are being used increasingly in all areas in which open and closed loop tasks are to be managed. The valves form the interface between electronics and pneumatics. The valves consist of a pilot control solenoid valve and a pneumatic valve. Pilot valve and valve body are clamped or bolted to each other. The active principle allows high pressures to be switched at low power consumption and short switching times.

The valves operate maintenance-free.

Ex license II 3 G Ex nA II T4 for Types 6524 / 6525 and Types 6526 / 6527



Type 6524 (2 x 3/2-way) | Type 6524 | Type 6525

Figure 76: Example of a valve: Types 6524 (2 x 3/2-way), 6524 and 6525

Variants

Valve	Operating principle	Operation	Width	Type
3/2-way	C (NC)	Internal control air	10	6524
	D (NO)			
	C (NC)	Control assist air (External)		
	D (NO)			
	C - Vacuum (NC)			
2 x 3/2-way	2 x C (NC)	Internal control air		
	2 x C (NC)	Control assist air (External)		

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Valve	Operating principle	Operation	Width	Type
3/2-way	C (NC)	Internal control air	16	6526
	D (NO)			
	C (NC)	Control assist air (External)		
	D (NO)			
	C - Vacuum (NC)			
5/2-way	H	Internal control air	10	6525
		Control assist air (External)		
		Internal control air	16	6527
		Control assist air (External)		
5/3-way	L Lock middle position	Internal control air	10	0460
	N Deaerated			
	L Lock middle position		16	0461
	N Deaerated			
5/2-way Impulse	H	Internal control air	10	0460
			16	0461

NOTE!

Valves with control assist air.

If valves are used with control assist air, the exhaust air escapes from the pilot valve into the environment. Valves with control assist air cannot be combined on the valve cluster with valves with internal control air, as the connection X is used differently.

Valve 6524 and 6525

The assembly of the Type 8640 with valves 6524 and 6525 is authorized for use in Zone 2 in accordance with II 3 G Ex nA II T4 with the number PTB 02 ATEX 2048.

Restrictions for use in Zone 2

CAUTION!

For valve types 6526 and 6527 the valve switch-off time restriction $T_{OFF} \geq 0.2$ s must be observed for use in Zone 2 with temperature class T4 under the following conditions:

- at quick switch-on cycles (valve switch-on time $T_{ON} < 3$ s),
- maximum ambient temperature of +55° C,
- maximum permitted overvoltage of $U_{Nominal}$ + 10 %.

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Valve switching time

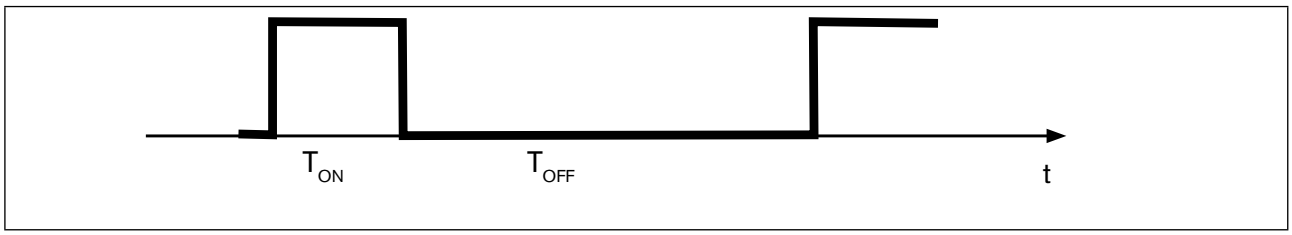

Figure 77: Valve switching time

If the valve is switched on for longer than 3 seconds, there are no restrictions for the duration until the valve is switched on again.

For exact specification see data sheet of the particular valves.

22.1.1. Fluid connection

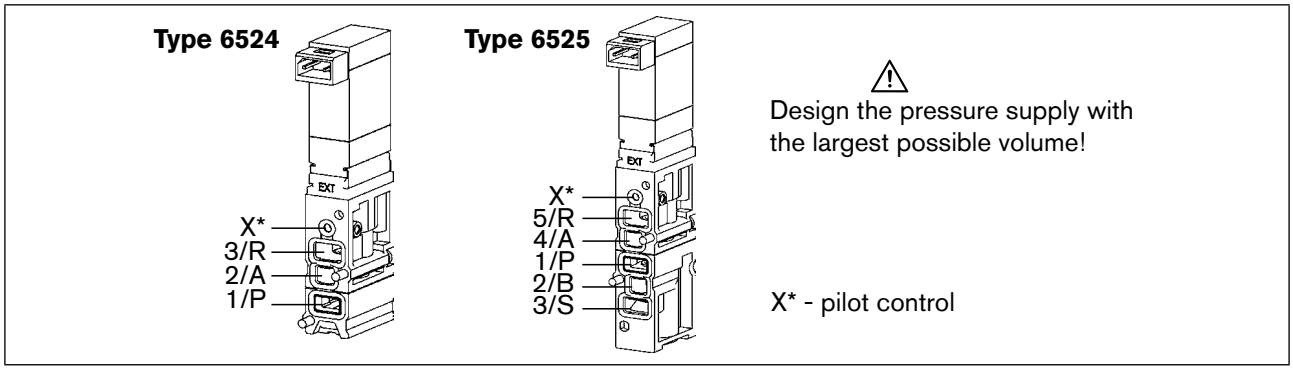

Figure 78: Fluid connection. Types 6524 and 6525

22.1.2. Fluid and electrical connection

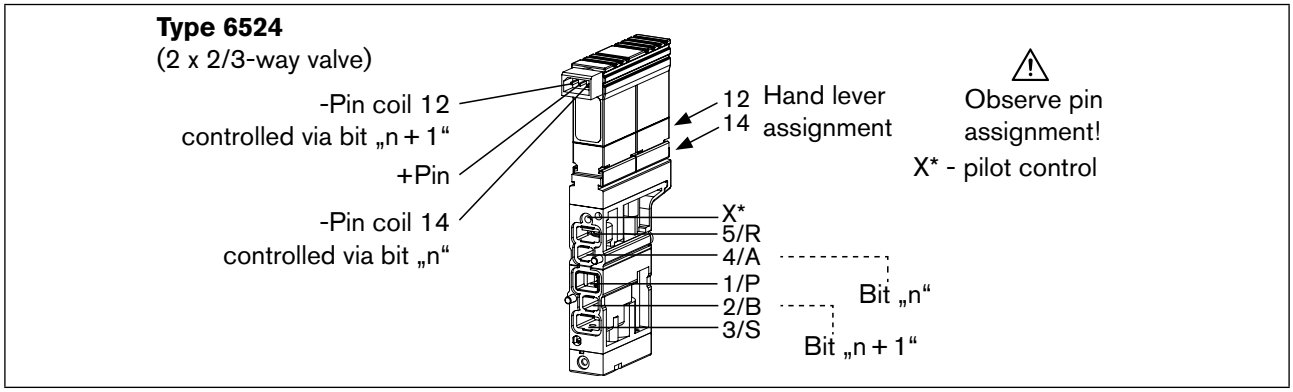

Figure 79: Fluid and electrical connection. Type 6524

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23. INSTALLATION OF AIRLINE QUICK

23.1. Safety instructions

DANGER!

Risk of injury from high pressure in the equipment!

- Before loosening lines or valves, turn off the pressure and vent the lines.

Risk of injury due to electrical shock!

- Before reaching into the device or the equipment, switch off the power supply and secure to prevent reactivation!
- Observe applicable accident prevention and safety regulations for electrical equipment!

WARNING!

Risk of injury from improper assembly!

- Installation may only be carried out by authorized technicians with the appropriate tools!

Risk of injury from unintentional activation of the system and uncontrolled restart!

- Secure system from unintentional activation.
- Following assembly, ensure a controlled restart.

CAUTION!

Escape of medium and malfunction!

If the seals are not seated correctly, leaks and malfunctions may occur due to pressure losses.

- Ensure that the seals are seated correctly in the area of the electronics and pneumatics.

Short-circuit, malfunction!

The electrical connection requires exact contacting.

- Do not bend contacts.
- If connections are damaged or bent, replace the affected components.
- Do not switch on the system unless the components are in perfect condition.

NOTE!

Prevent a pressure drop!

To prevent a pressure drop, design the system pressure supply with the largest possible volume.

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23.2. Installation on standard rail

DANGER!

Risk of electric shock!

- Before reaching into the device or the equipment, switch off the power supply and secure to prevent reactivation!

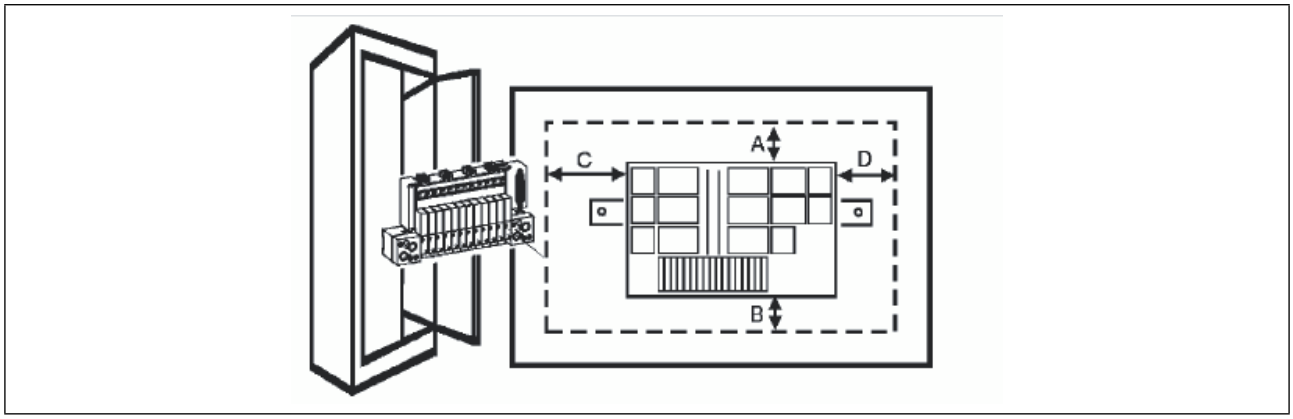

Figure 80: Installation of a valve block into a control cabinet

→ Fasten the standard rail firmly in the control cabinet.

→ Establish a short, wide PE connection between the standard rail and the control cabinet.

The valve terminal must be freely accessible from above. Ensure good heat dissipation!

Recommended distance when installing in a control cabinet:

A	30 mm	**C**	30 mm
B	30 mm	**D**	60 mm

23.3. Installation of AirLINE Quick

To install AirLINE Quick, a notch must be first of all provided on the base or the wall of the control cabinet, e.g. through lasing or punching.

For the dimensions of the relevant flange image, refer to chapter “23.4. Dimensions of the flange images for AirLINE Quick”.

The distances to the left, right, front and top depend on the selected valve terminal configuration.

Recommended distance in the control cabinet to the valve terminal:

left	right	front	top
30 mm	60 mm	30 mm	50 mm

NOTE!

The opening on the control cabinet must be burr-free to prevent damage to the seal of the AirLINE Quick adapter.

→ Without damaging the seal of the AirLINE Quick adapter, insert it into the groove of the flange opening.

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→ Place the valve terminal in the control cabinet on the prepared notch.

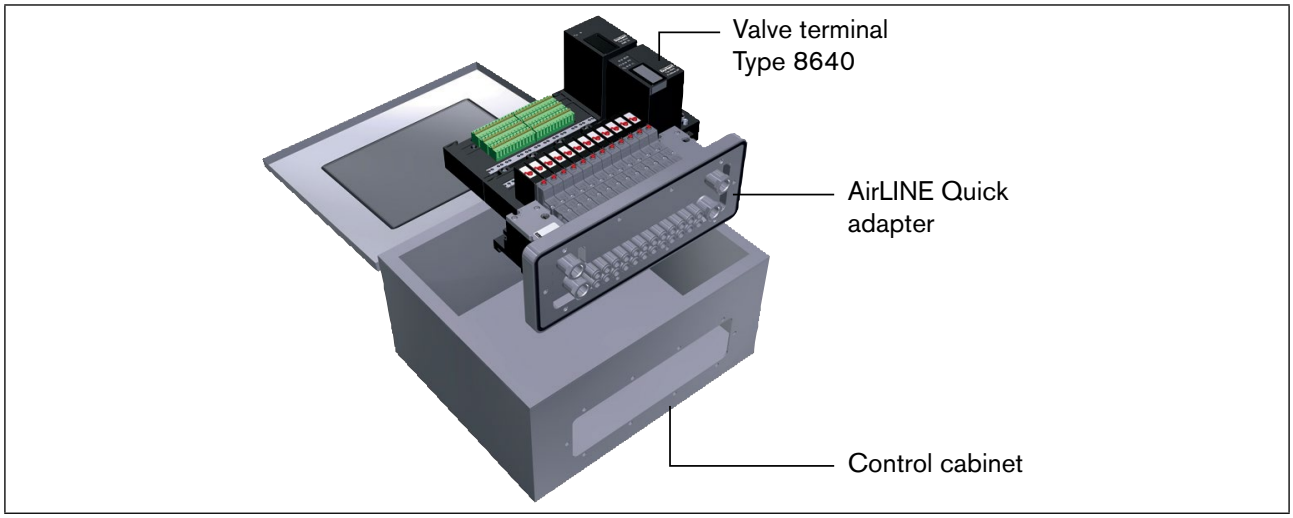

Figure 81: Placing the valve terminal in the control cabinet

NOTE!

The seal of the AirLINE Quick adapter must be placed into the groove without being damaged before installing the adapter on the control cabinet base.

→ From outside attach the stability plate to prevent distortion and secure with screws M 5 x 10 from the enclosed fastening set.

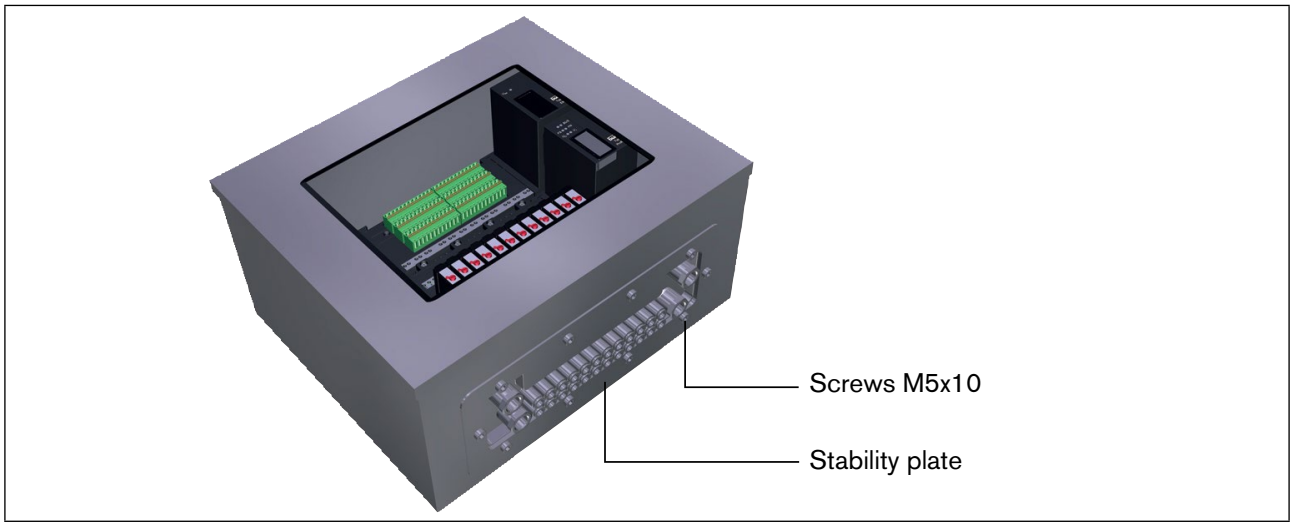

Figure 82: Attaching the stability plate

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23.4. Dimensions of the flange images for AirLINE Quick

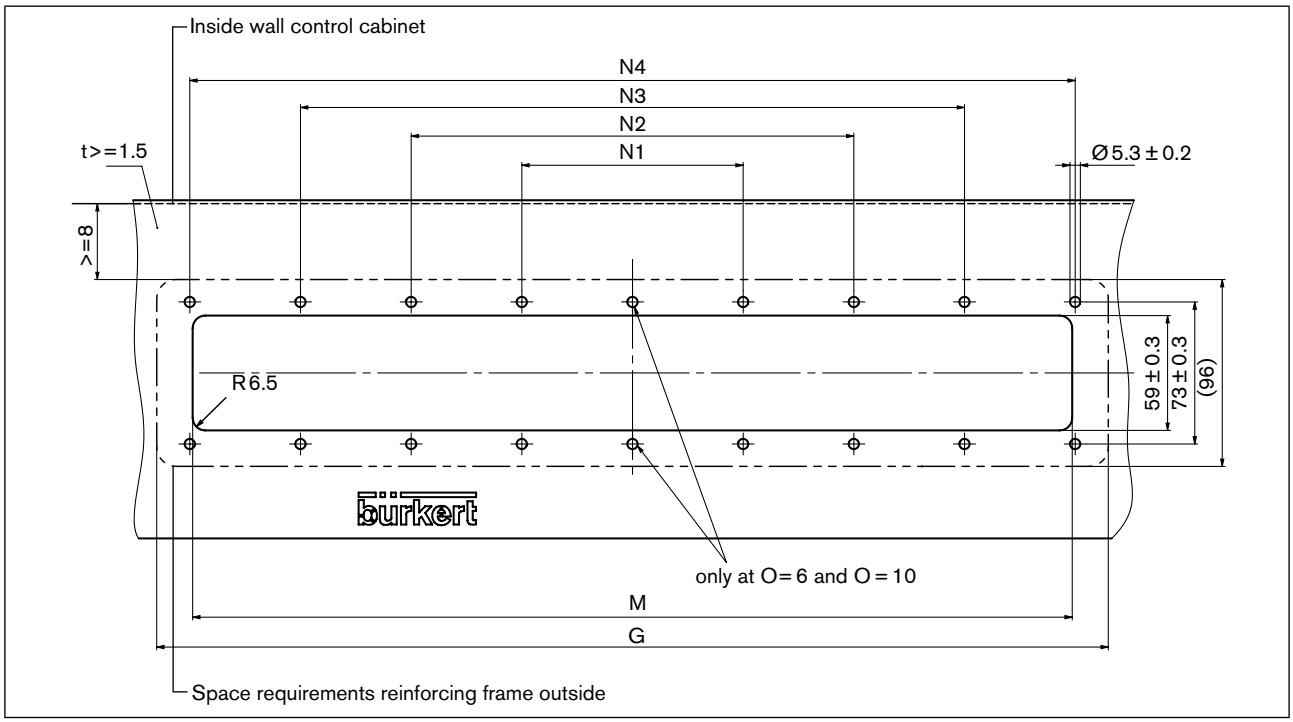

Figure 83: Dimensions of the flange images for AirLINE Quick – for dimensions see "Table 4".

	Version				
	4-fold	**8-fold**	**12-fold**	**16-fold**	**24-fold**
Feature	–	–	–	–	on request
M	111 ± 0.4	155 ± 0.4	199 ± 0.4	243 ± 0.4	331 ± 0.4
N1	114 ± 0.4	54 ± 0.3	68 ± 0.3	123 ± 0.4	66 ± 0.3
N2	–	158 ± 0.4	202 ± 0.4	246 ± 0.4	200 ± 0.4
N3	–	–	–	–	334 ± 0.4
N4	–	–	–	–	–
O (Number of bores)	6	8	8	10	12
G	148	192	236	280	368

Table 4: Dimensions of the flange images for AirLINE Quick.

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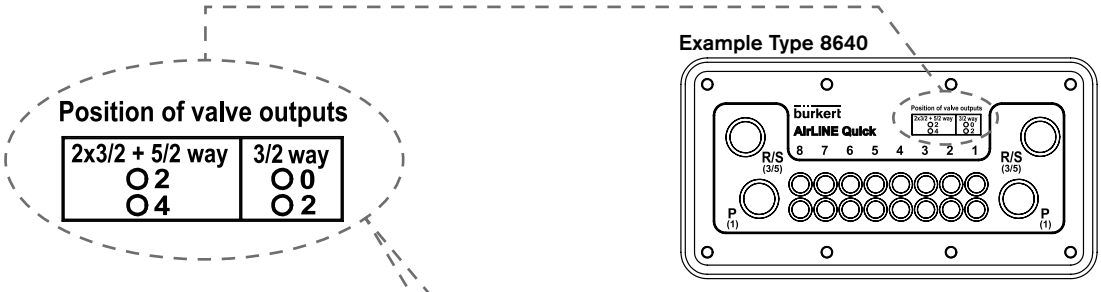
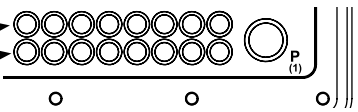
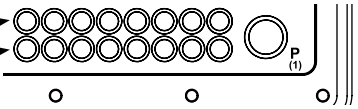
23.4.1. Assignment of the pneumatic connections for AirLINE Quick



Valve type		Pneumatic Connection: Valve output	Pneumatic Connection: AirLINE Quick
	2x3/2-way / Type 6524	2x3/2 + 5/2 way 2 4	
	5/2-way / Type 6525		
	3/2-way / Type 6524	3/2 way 0 2	

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24. PACKAGING, TRANSPORT

NOTE!

Transport damages!

Inadequately protected equipment may be damaged during transport.

- During transportation protect the device against wet and dirt in shock-resistant packaging.
- Avoid exceeding or dropping below the permitted storage temperature.

25. STORAGE

NOTE!

Incorrect storage may damage the device.

- Store the device in a dry and dust-free location!
- Storage temperature: -20 … +60 °C.

26. DISPOSAL

→ Dispose of the device and packaging in an environmentally friendly manner.

NOTE!

Damage to the environment caused by device components contaminated with media.

- Observe applicable disposal regulations and environmental regulations.

Observe national waste disposal regulations.

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