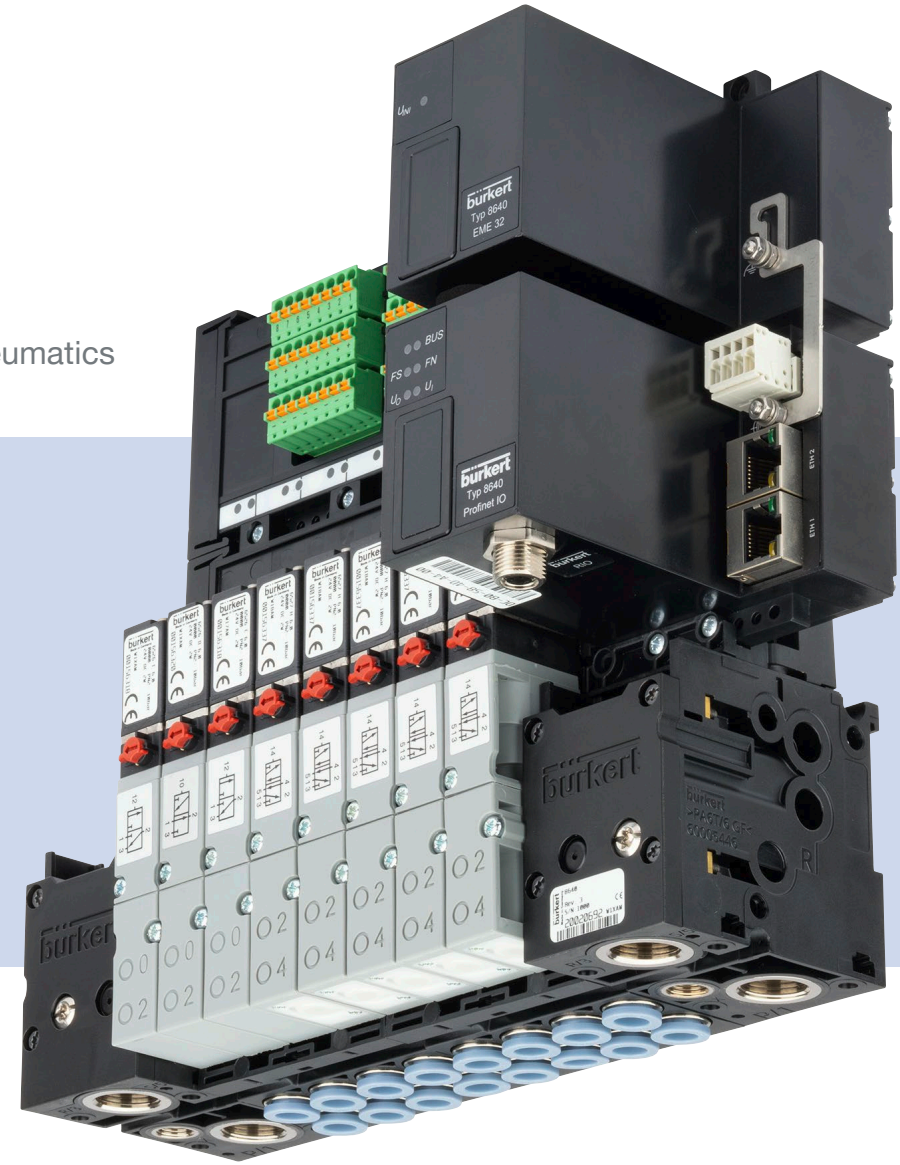
bürkert
FLUID CONTROL SYSTEMS

MAN 1000010102 EN Version: V Status: RL (released | freigegeben) printed: 22.04.2025

Type 8640
AirLINE

Modular valve island for pneumatics
Width per valve 11/16 mm



Operating Instructions

These operating instructions apply to device variants REV.1, REV.2 and REV.3.

You can find information on differentiating characteristics between device variants REV.1, REV.2 and REV.3 in chapter *“5.5 Information on compatibility and revision status”, page 15*

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Operating Instructions 2504/27_EUen_00800665 / Original DE

Valve island 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.

▸ Designates instructions to avoid danger.

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1.2 Definition of terms

Term	in these instructions, refers to
Device, valve island	Valve island Type 8640
Actuator	Pneumatic consumer controlled by the valve island
Plant	Machine with pneumatic consumers actuated by the valve island

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2 INTENDED USE

The valve island Type 8640 has been designed to control pneumatic consumers in automation systems. The valve island must only be used for controlling suitable pneumatic consumers.

- Use the device only as intended. Non-intended use of the device may be dangerous to people, nearby equipment and the environment.
- In explosion hazardous areas, only use devices that are approved for these areas. These devices are identified by additional approval data on the type label. When used in explosion hazardous areas, always observe the specifications on the type label and the “Additional information for use in the Ex area” included in the scope of delivery.
- Device must not be used outdoors unprotected.
- When using the device, observe the authorised data, operating and deployment conditions specified in the contract documents and in the operating instructions. These are described in Chapter “Technical data”.
- Use the device only in conjunction with third-party devices and components recommended or approved by Bürkert.
- Correct transport, storage and installation as well as careful use and maintenance are essential for safe and faultless operation.
- Use the device only when it is in perfect condition.

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3 BASIC SAFETY INSTRUCTIONS

These safety instructions do not take account of any

- contingencies or events which may occur during installation, operation and maintenance of the devices;
- local safety regulations that are within the operator's scope of responsibility, including those relating to the installation personnel.

Risk of injury from high pressure, escaping medium and uncontrolled movement of the actuators.

- ▸ Secure the actuators against shifting before working on the device or plant.
- ▸ Switch off the pressure before working on the device or system. Vent or empty the lines.

Risk of injury from electric shock.

- ▸ Switch off the power supply before working on the device or system. Secure it against reactivation.
- ▸ Observe any applicable accident prevention and safety regulations for electrical devices.

Risk of burns/fire due to hot device surface if device operated continuously.

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

Risk of injury due to improper installation and maintenance.

- ▸ Only allow trained technicians to perform installation and maintenance work.
- ▸ Perform installation and maintenance work using suitable tools only.

Risk of injury due to unintentional activation of the device and system and uncontrolled restart.

- ▸ Secure the device and system against unintentional activation.
- ▸ Ensure that the system only starts up in a controlled manner.

Risk of injury due to allergic reaction to lubricants.

- ▸ Avoid skin contact with lubricants.
- ▸ Wear protective gloves.

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General hazardous situations.

To prevent injuries, observe the following:

- Do not feed any aggressive or combustible media into the media connections of the system.
- Do not subject the housing to mechanical load (e.g. by placing objects on it or standing on it).
- Note that pipes and valves must not be released in pressurised systems.
- Always switch off the power before working on the system.
- Make the pressure supply as large as possible to avoid pressure drops during switching.
- The system cannot be activated unintentionally.
- Installation and maintenance tasks may only be performed by authorised technicians with the appropriate tools.
- Only restart the process in a controlled manner following disruptions.
  Observe sequence!
  1. Apply electrical supply.
  2. Charge the device with medium.
- Operate the device only when it is in perfect condition and in accordance with the operating instructions.
- Observe the general rules of technology.

NOTE!

Prevent a pressure drop!

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

Electrostatic sensitive components and modules.

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

- To minimize or eliminate the risk of damage resulting from sudden electrostatic discharges, ensure compliance with the requirements of EN 61340-5-1.
- Do not touch electronic components while the supply voltage is switched on!

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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 quickstart.

And also on the Internet at: country.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: country.burkert.com

4.4 Standards and directives

The device complies with the valid EU harmonisation legislation.

The harmonised standards that have been applied for the conformity assessment procedure are listed in the current version of the EU Declaration of Conformity.

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5 PRODUCT DESCRIPTION

5.1 Application area

The valve island 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 injury from electric shock.

- Switch off the power supply before working on the device or system. Secure it against reactivation.
- Observe any applicable accident prevention and safety regulations for electrical devices.

5.2 General description

Thanks to its strictly modular construction in terms of the pneumatic and electrical interfaces the type 8640 valve island 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 island.

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.

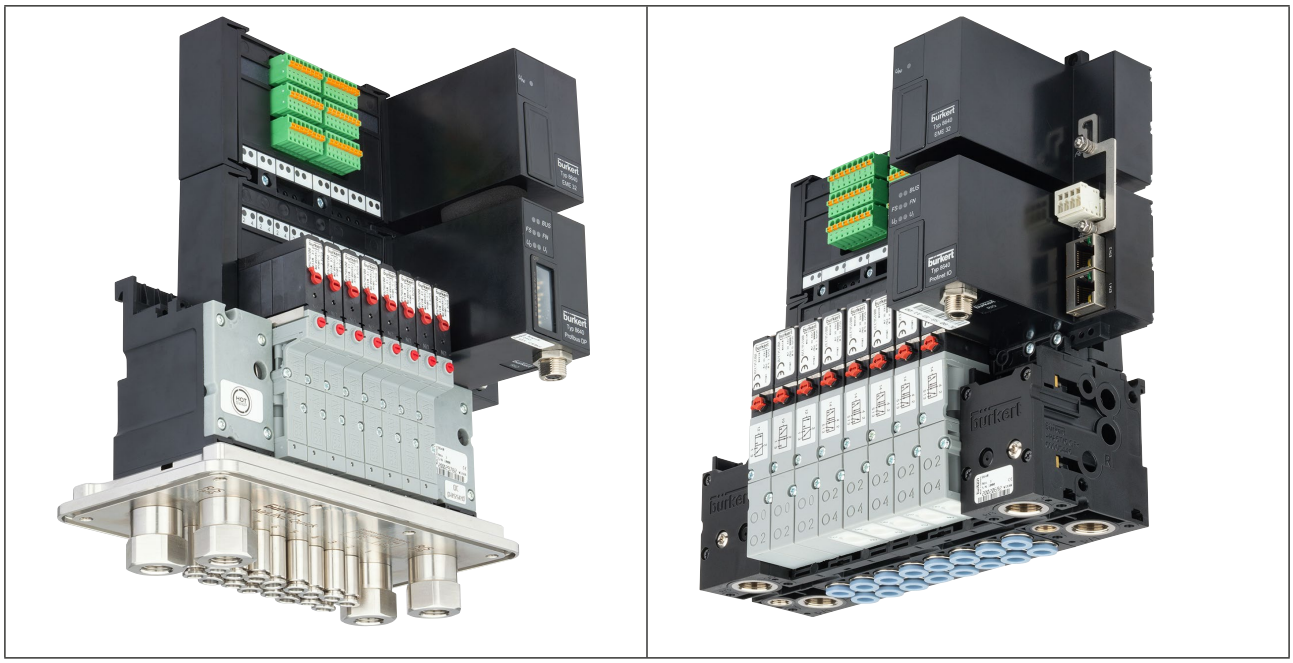

Fig. 1: Type 8640 valve island for pneumatics;
left: Example of a valve island with valves, width per valve 11 mm and AirLINE Quick;
right: example of a valve island with valves, width per valve 16 mm

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5.3 System construction

The valve island is configured customer-specifically. A wide range of electrical and fluidic components is available for optimum adaptation to the tasks.

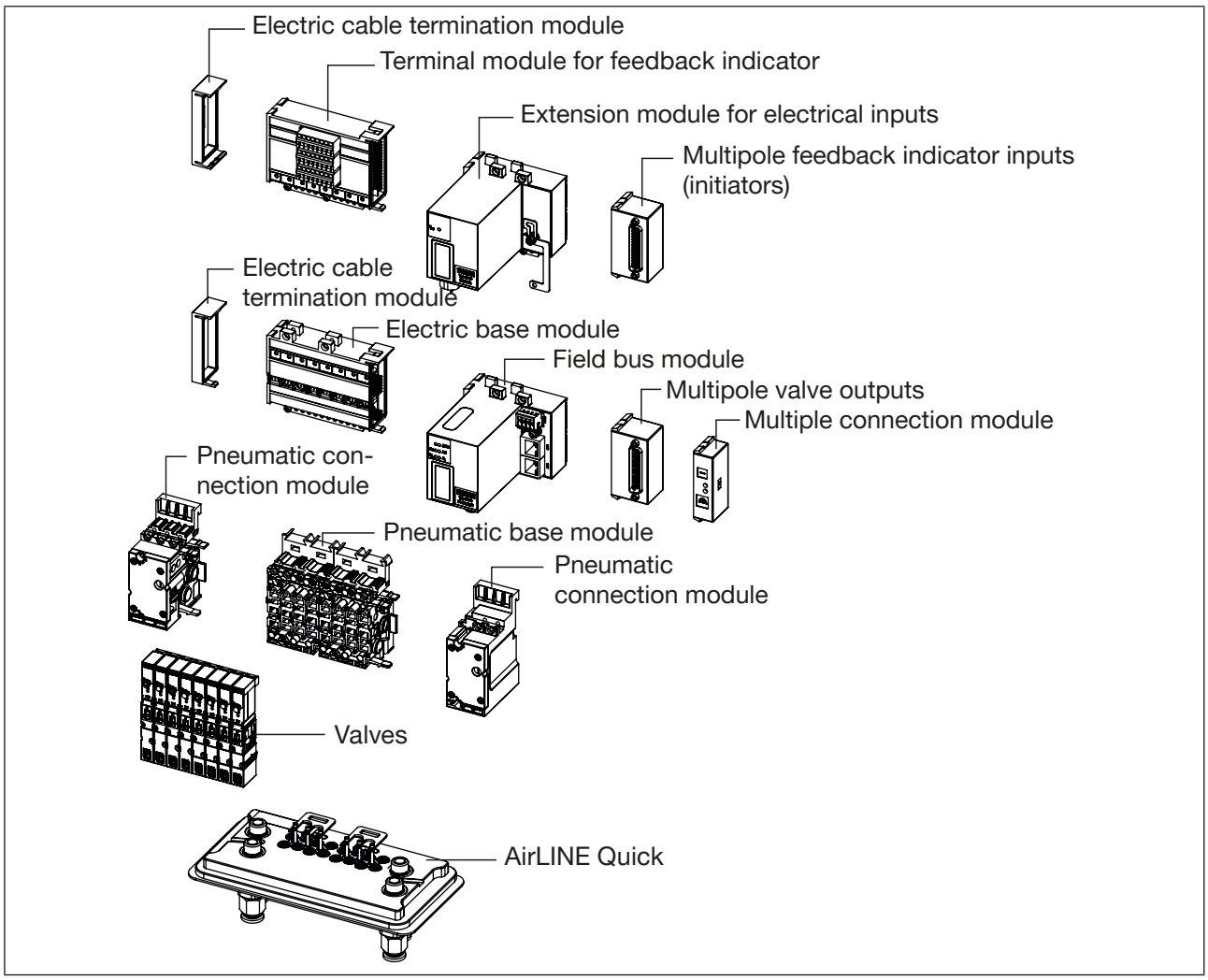

Fig. 2: Example of a configuration of the valve island type 8640, width per valve 11 mm

Further information and technical details on the electrical and fluidic components:

Electrical modules
Chapter “7 Modules for conventional electrical connection technology”
Chapter “17 Electrical base module output”
Chapter “18 Electrical base module input”

Fieldbus technology
Chapter “8 Field bus module PROFIBUS DP/V1” and all subsequent chapters up to
Chapter “16 Configuration and parameter settings for Modbus TCP”

Pneumatic modules
Chapter “19 Pneumatic modules”

Valves
Chapter “20 Valves”

AirLINE Quick
Chapter “21 Installation and commissioning of the valve island in the control cabinet”

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5.4 Location and description of the type labels

5.4.1 Valve island type label

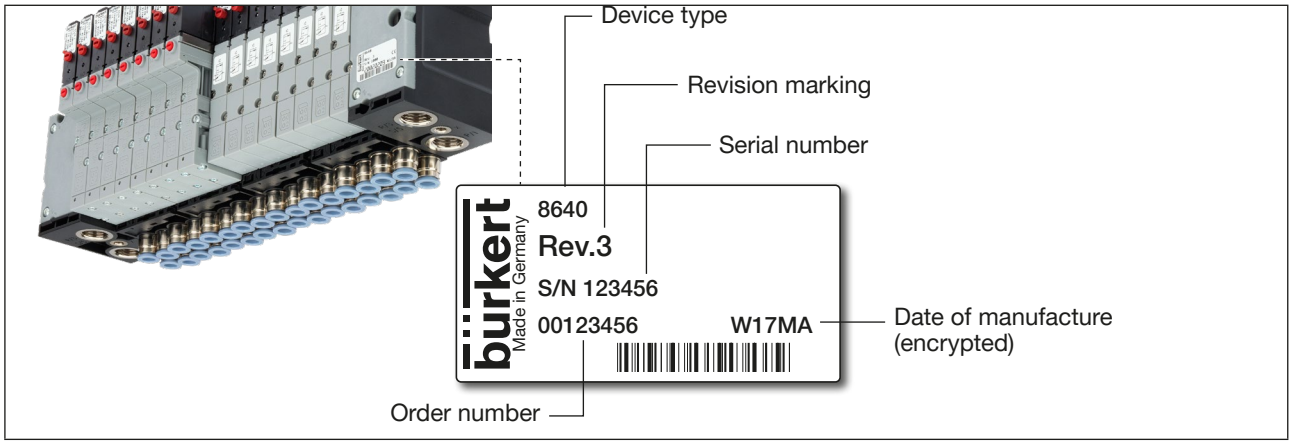

Fig. 3: Location and description of the type label (example)

5.4.2 Valve type label

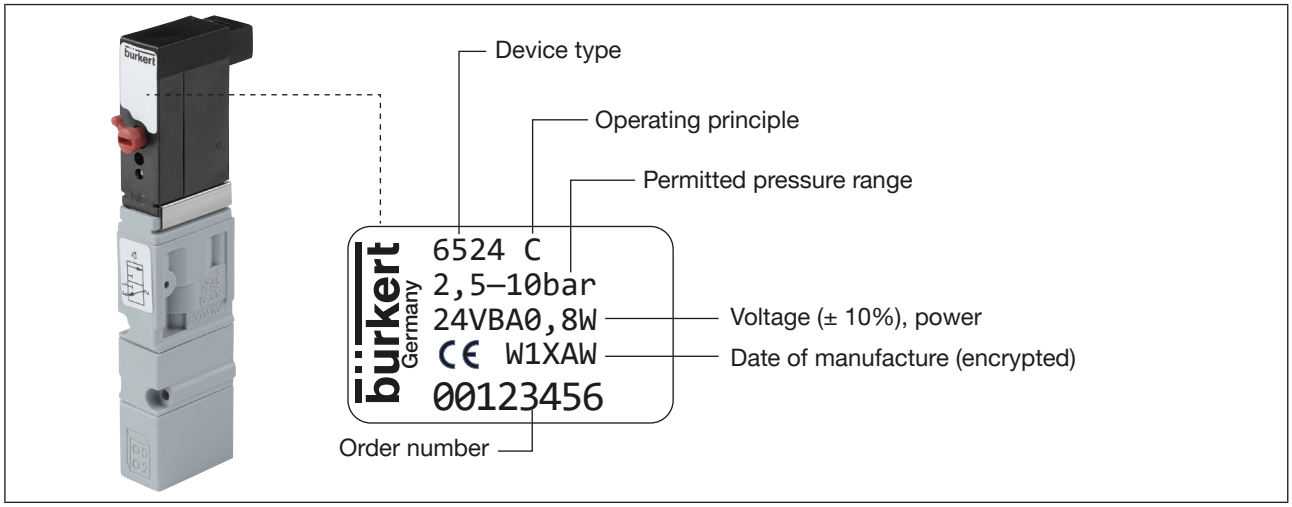

Fig. 4: Location and description of the type label (example Type 6524)

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5.5 Information on compatibility and revision status

5.5.1 Overview of revision levels

Valve island width per valve 11 mm

REV.1	REV.2	REV.3
• Electronic modules REV.1	• Electronic modules REV.2	• Electronic modules REV.2
• Pneumatic base modules REV.1	• Pneumatic base modules REV.1	• Pneumatic base modules REV.2
• Connection modules REV.1	• Connection modules REV.1	• Connection modules REV.2
• Solenoid valve Types 6524 and 6525 REV.1: 1 flange pattern for double valves Type 6524 2x3/2-way 1 flange pattern for single valves Type 6524 3/2-way Type 6525 5/2-way	• Solenoid valve Types 6524 and 6525 REV.1: 1 flange pattern for double valves Type 6524 2x3/2-way 1 flange pattern for single valves Type 6524 3/2-way Type 6525 5/2-way	• Solenoid valve Types 6524 and 6525 REV.2: 1 flange pattern for double valves and single valves Type 6524 2x3/2-way Type 6524 3/2-way Type 6525 5/2-way
• Solenoid valve type 0460: 1 flange pattern for pulse valves and bistable valves: Type 0460 5/2-way Type 0460 5/3-way	• Solenoid valve type 0460: 1 flange pattern for pulse valves and bistable valves: Type 0460 5/2-way Type 0460 5/3-way	• Solenoid valve type 0460: 1 flange pattern for pulse valves and bistable valves: Type 0460 5/2-way Type 0460 5/3-way
• AirLINE Quick REV.1	• AirLINE Quick REV.1	• AirLINE Quick REV.2

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Valve island width per valve 16 mm

REV.1

- **Electronic modules REV.1**
- **Pneumatic base modules REV.1**
- **Connection modules REV.1**
- **Solenoid valve Types 6526, 6527 and 0461:**

  1 flange pattern for single valves:
  Type 6526 3/2-way
  Type 6527 5/2-way

  1 flange pattern for pulse valves and bistable valves
  Type 0461 5/2-way
  Type 0461 5/3-way

REV.2

- **Electronic modules REV.2**
- Pneumatic base modules REV.1
- Connection modules REV.1
- Solenoid valve Types 6526, 6527 and 0461:

  1 flange pattern for single valves:
  Type 6526 3/2-way
  Type 6527 5/2-way

  1 flange pattern for pulse valves and bistable valves
  Type 0461 5/2-way
  Type 0461 5/3-way

REV.3

- Electronic modules REV.2
- **Pneumatic base modules REV.2**
- **Connection modules REV.2**
- Solenoid valve Types 6526 and 6527:

  1 flange pattern for single valves:
  Type 6526 3/2-way
  Type 6527 5/2-way

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5.5.2 Information on Revision 2 (REV.2)

The electronic modules have been revised in terms of hardware and firmware. The revised revision 2 (REV.2) is largely compatible with the previous version. Differences to be taken into account by the user are described in the following chapters:

"15.4 Configuring process data", page 89

"15.5 Applications object", page 91

"16.5 8640 objects", page 96

5.5.3 Information on revision 3 (REV.3)

The individual valves of the types 6524 and 6525, the pneumatic basic and connection modules as well as the control cabinet base adaptation AirLINE Quick have been revised due to various optimisations. Compatibilities must therefore be taken into account in the following cases:

- Valve replacement (see chapter "20.1.4 Exchange valves type 6524 and type 6525", page 111)
- Expansion, repair or conversion of valve blocks

Revision 3 (REV.3) only affects pneumatic components of the 8640 valve block. Not affected by the revision:

– Electrical data

– Configuration

– External dimensions

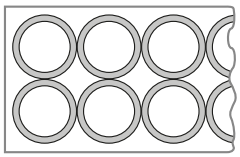
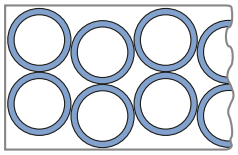
See also for further information

"19.1 Pneumatic connection modules", page 106

"19.2 Pneumatic base modules", page 107

"20.1 Valves type 6524 and type 6525 for valve islands width per valve 11 mm", page 108

5.5.4 Distinguishing features between valve islands REV.1, REV.2 and REV.3

Feature	REV.1	REV.2	REV.3
Colour of release rings (push-in connectors)	black		blue
Channel arrangement of the working connections	 parallel		 undulating
Note on the type label of the valve island	 without note „REV."	 with note „REV.2"	 with note „REV.3"

6 TECHNICAL DATA

6.1 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 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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6.2 General technical data

6.2.1 Width per valve 11 mm

Width per valve	11 mm		
Operating principle Valve	C/D (3/2-way) Type 6524	2xC (2x3/2-way) Type 6524	L/N (5/3-way) Type 0460
Operating principle Valve	H (5/2-way) Type 6525		Z (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[1)], 8-fold, 12-fold	6-fold[1)], 8-fold, 12-fold	6-fold[1)], 8-fold, 12-fold
Pneumatic modules REV.1	2-fold, 8-fold	2-fold, 8-fold	2-fold
Pneumatic modules REV.2	4-fold	4-fold	4-fold
Protection class in terminal design	IP40 IP20	IP40 IP20	IP40 IP20

6.2.2 Width per valve 16.5 mm

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

1) *6-fold only for REV.1 and REV.2*

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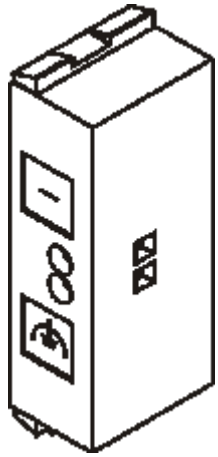
7 MODULES FOR CONVENTIONAL ELECTRICAL CONNECTION TECHNOLOGY

7.2.1 Collective socket module

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



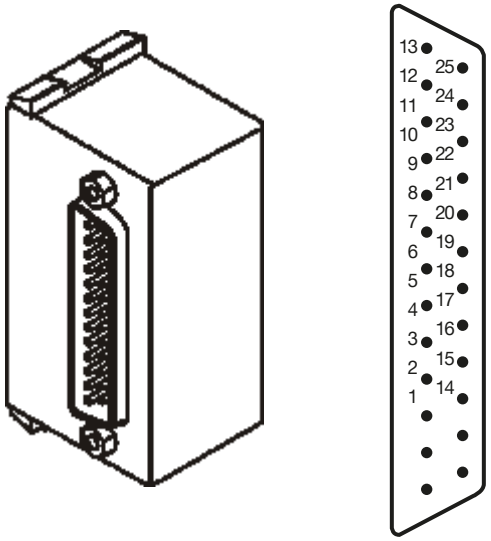
Allocation plan

— Ground

Functional earth

Fig. 5: Collective socket module for valve outputs

7.2.2 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

Fig. 6: 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

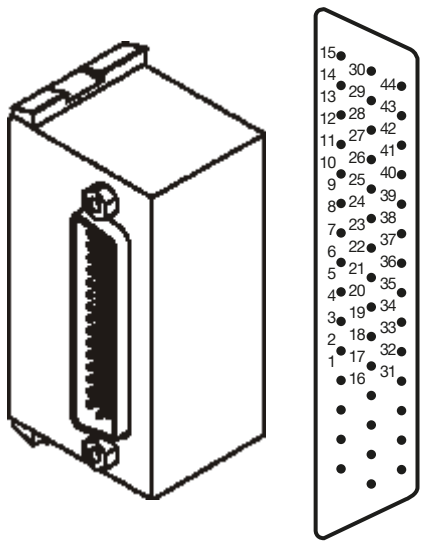
Colour code for D-SUB cable

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

7.2.3 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		

Fig. 7: 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

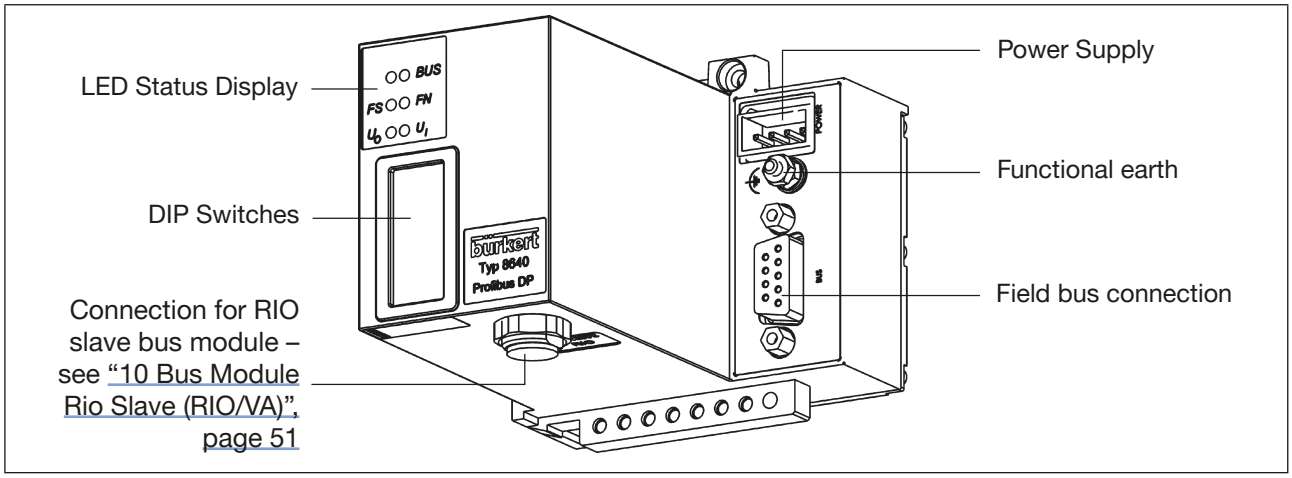

Fig. 8: Overview of field bus module PROFIBUS DP IP20

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:

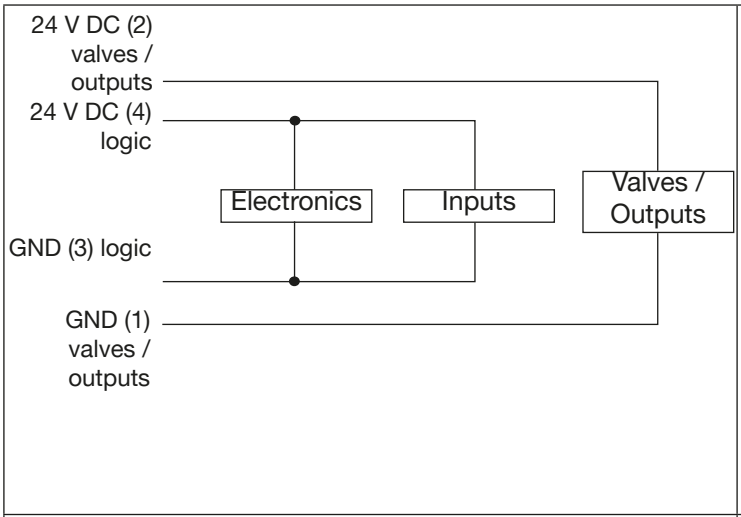

Fig. 9: Power supply configuration

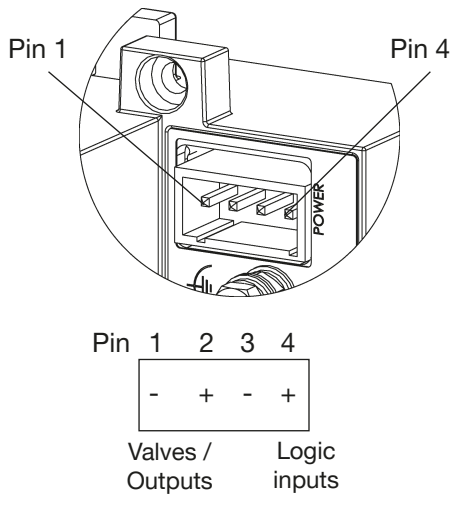

Fig. 10: Cutaway POWER connection

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

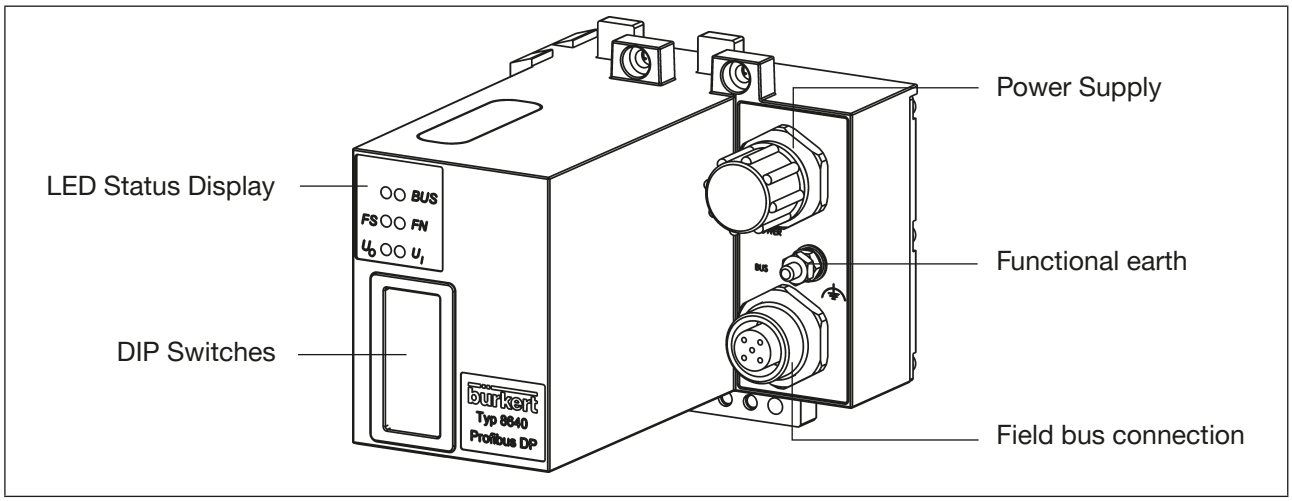

Fig. 11: Overview field bus module PROFIBUS-DP IP54

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:

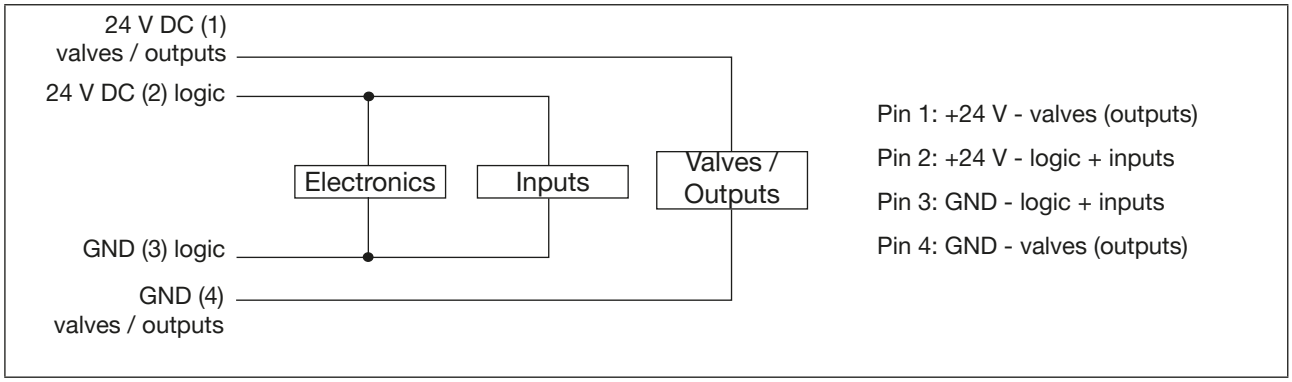

Fig. 12: Power supply configuration

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

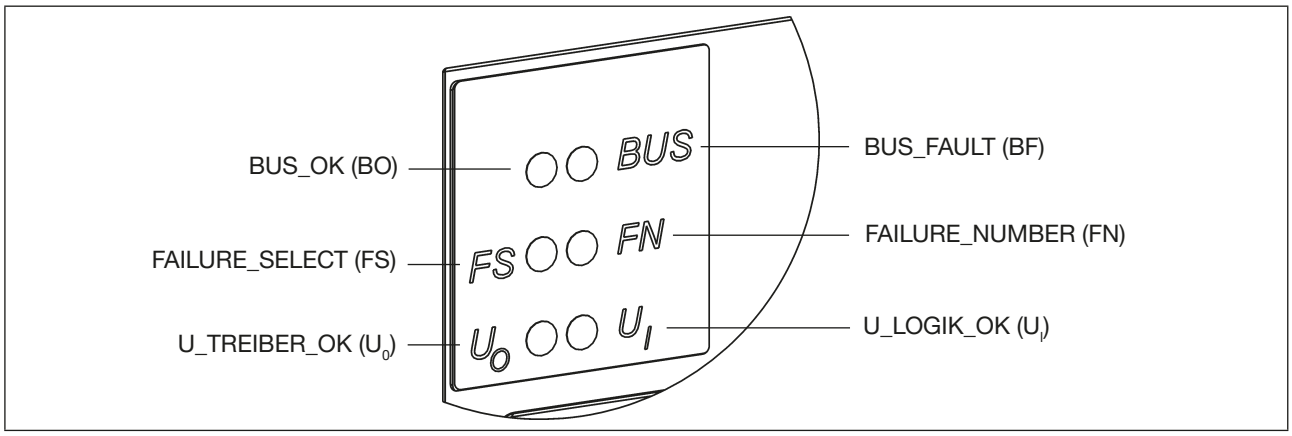

Fig. 13: LED state display (detail)

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 island 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 island 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 island (bitwise composition)	→ Check user parameters and DIP switch
	2	Too many outputs for one valve island (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 island	→ Check identification bytes and DIP switch
	2	Too many outputs for one valve island	→ Check identification bytes and DIP switch
	3	Too few inputs for one valve island (preset in parameterization telegram)	→ Check identification bytes and DIP switch
	4	Too few outputs for one valve island (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 island 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 island) 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

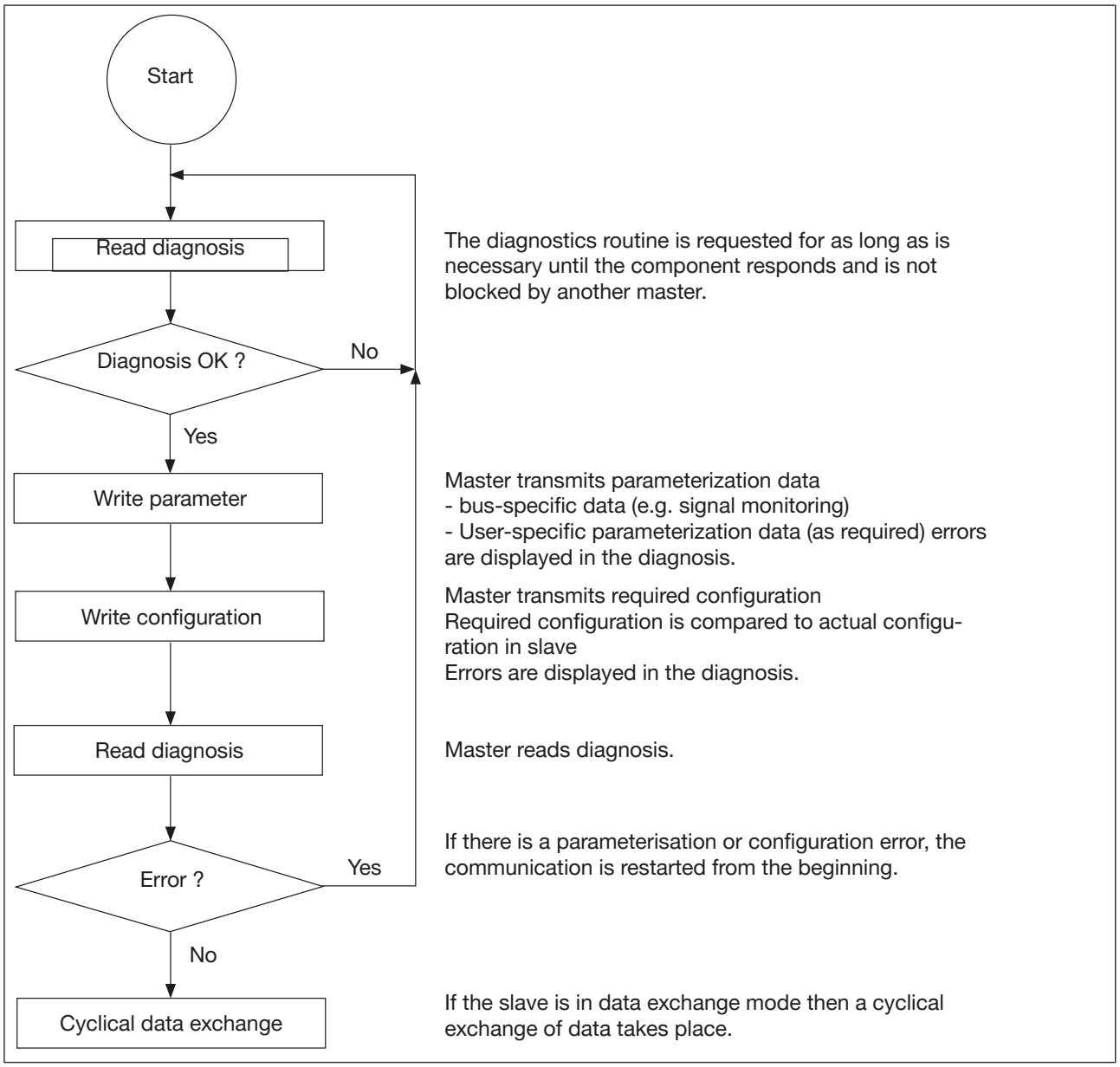

Fig. 14: Simplified representation of the PROFIBUS-DP communication process

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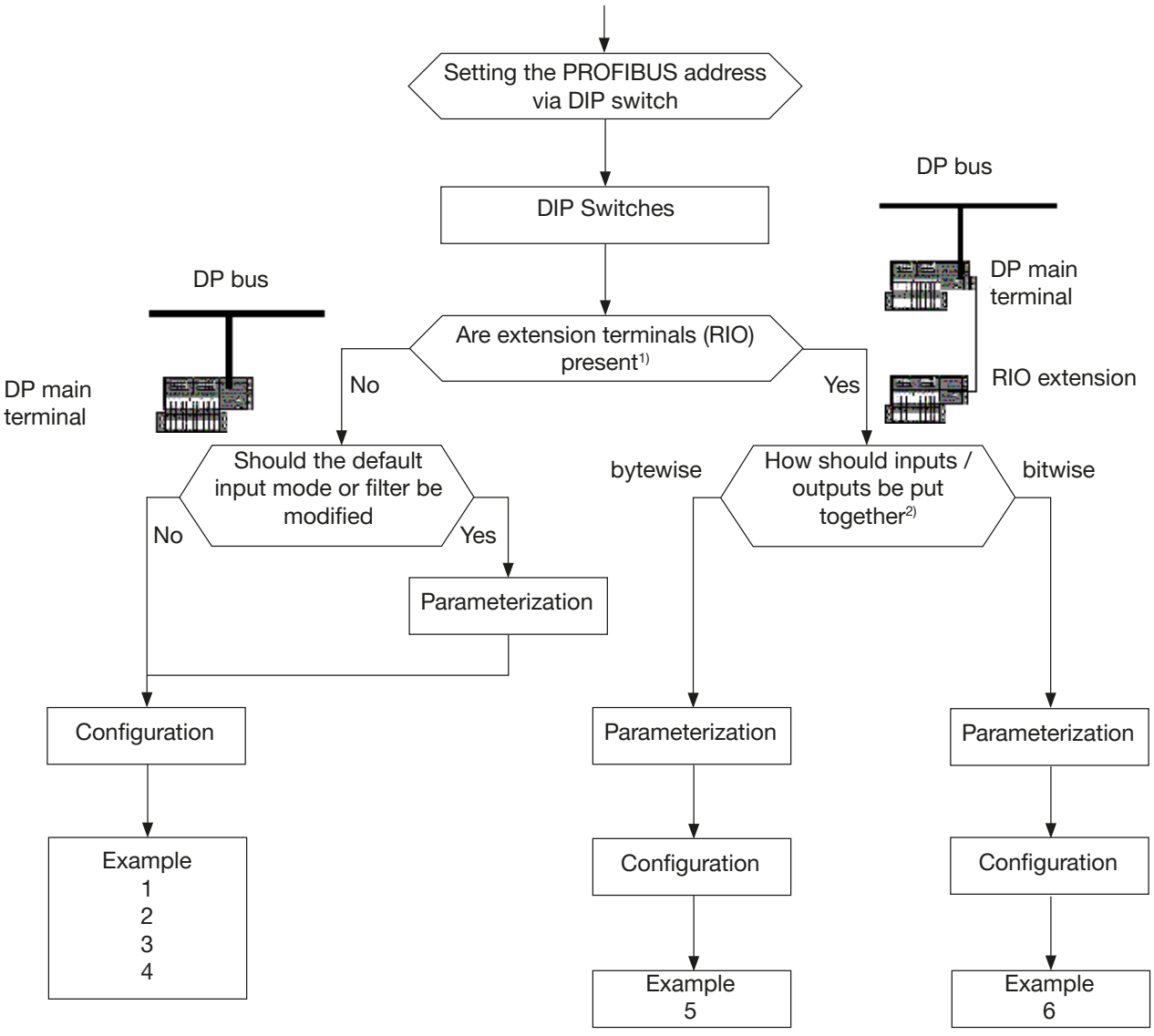
9.2 Start-Up



1) Extension terminals are connected to the valve island 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 island with 4 valves and a valve island with 10 valves that amounts to 10 bits with bytewise configuration (4+6 bits), because the first valve island 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.

Fig. 15: 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 island 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 island 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 island- 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 island.

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 island 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

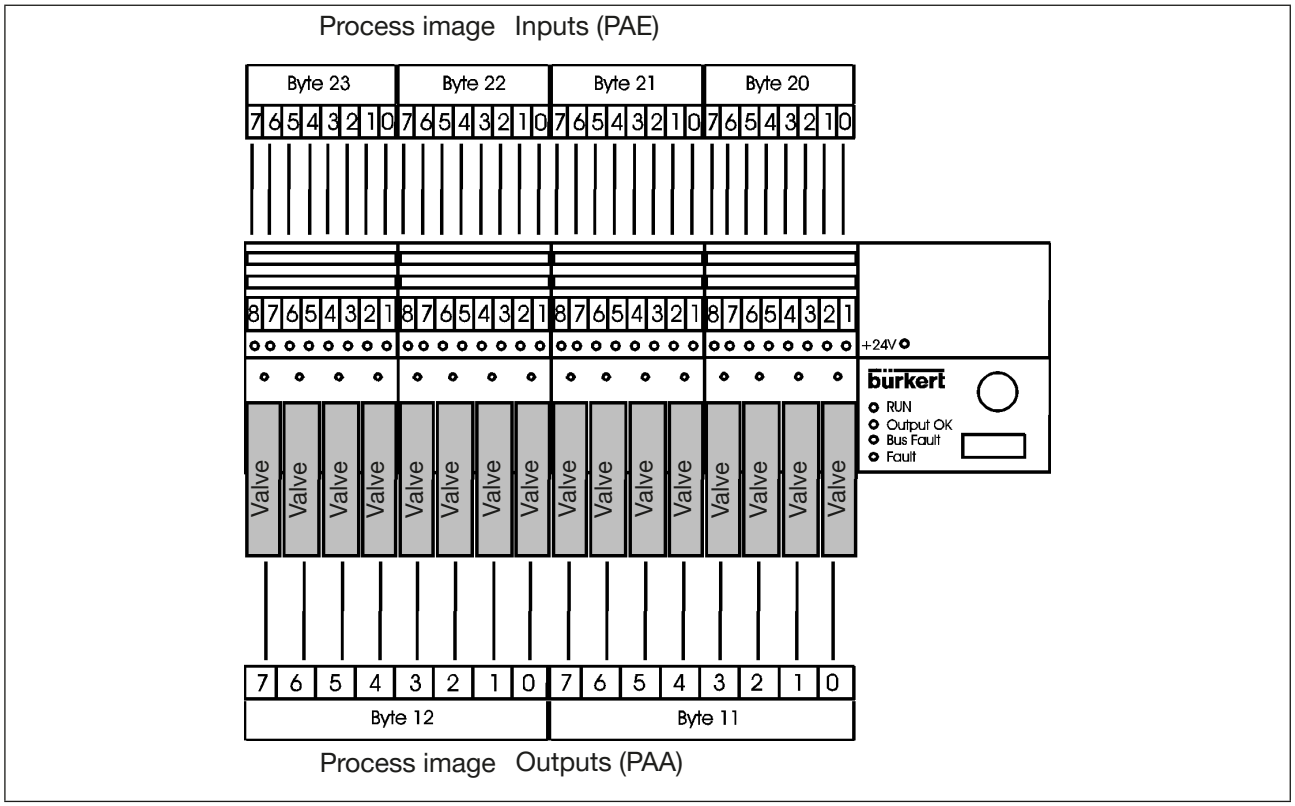

Fig. 16: Allocation of inputs and outputs to control process image

Example 2 - valve island 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

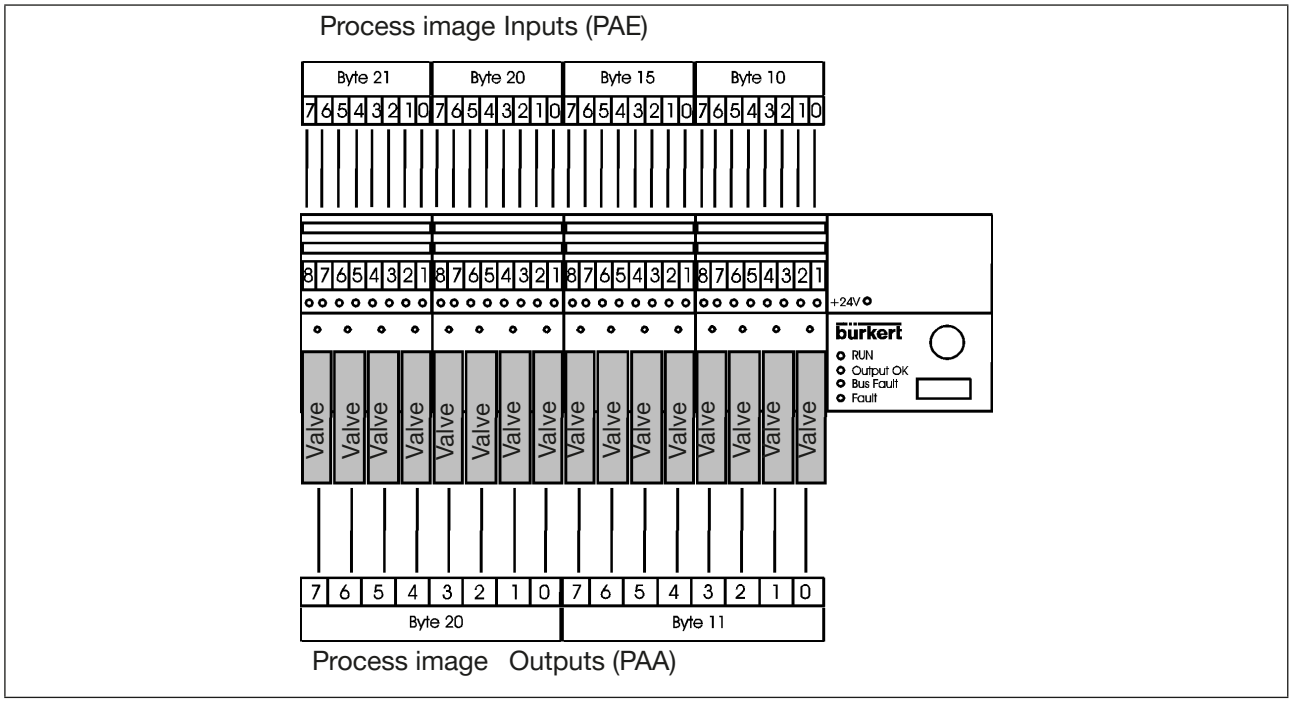

Fig. 17: Allocation of inputs and outputs to control process image

Example 3 - valve island 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

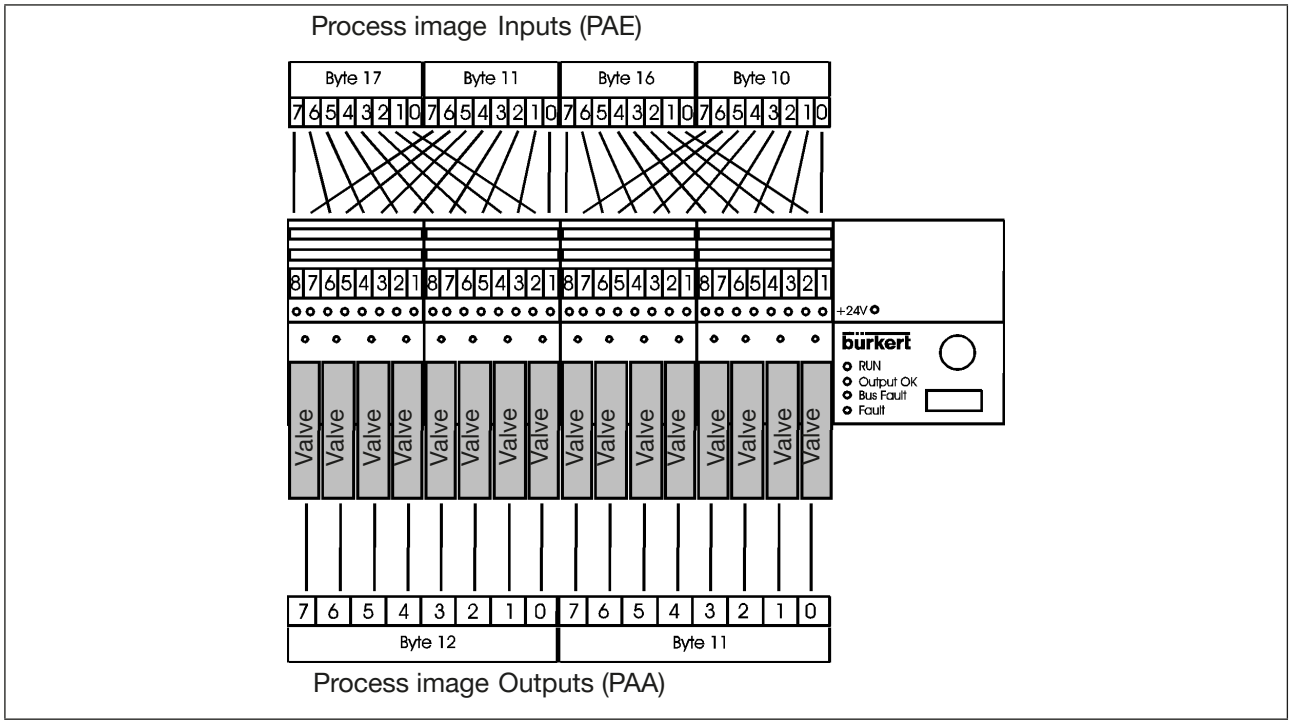

Fig. 18: Allocation of inputs and outputs to control process image

Example 4 - valve island 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

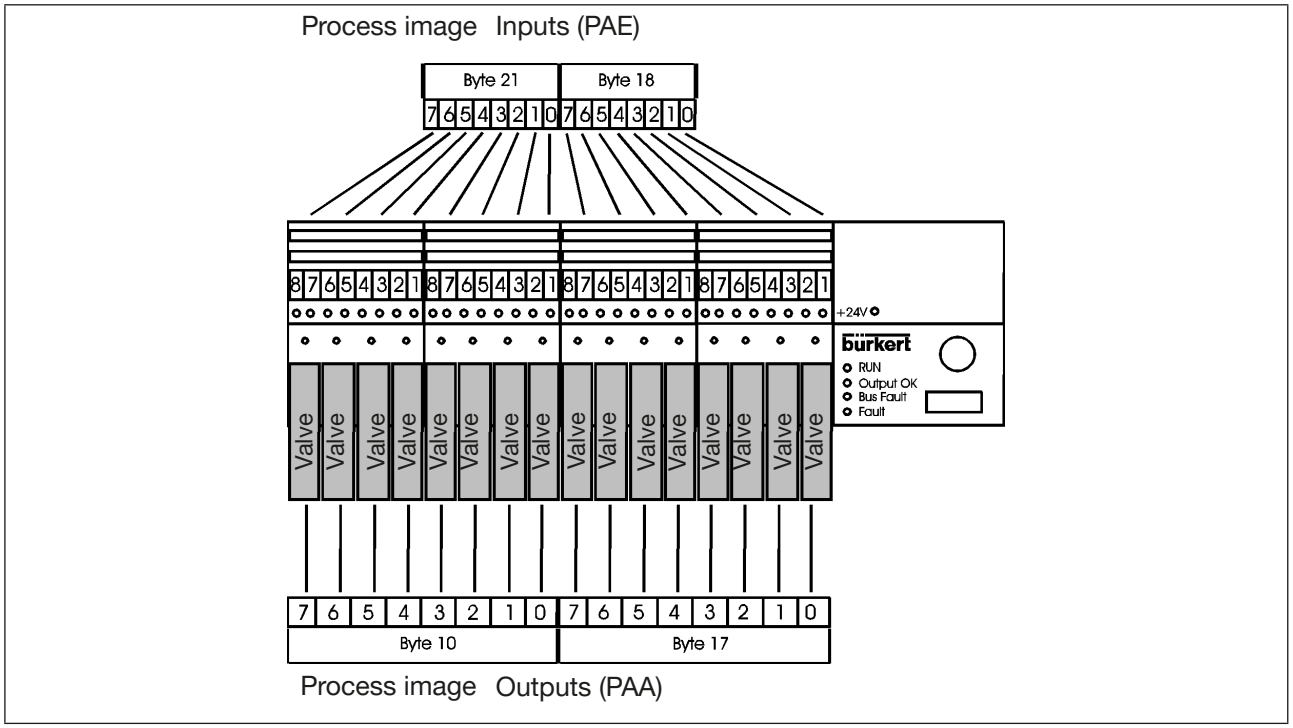

Fig. 19: Allocation of inputs and outputs to control process image

9.2.3 Parameterization of the valve island 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 island 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 island must be contiguous. Each valve island can be configured with 4 input bytes and 3 output bytes.

If there are no inputs / outputs present for a valve island, 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 islands
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

** Siemens

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Allocation of inputs and outputs to control process image

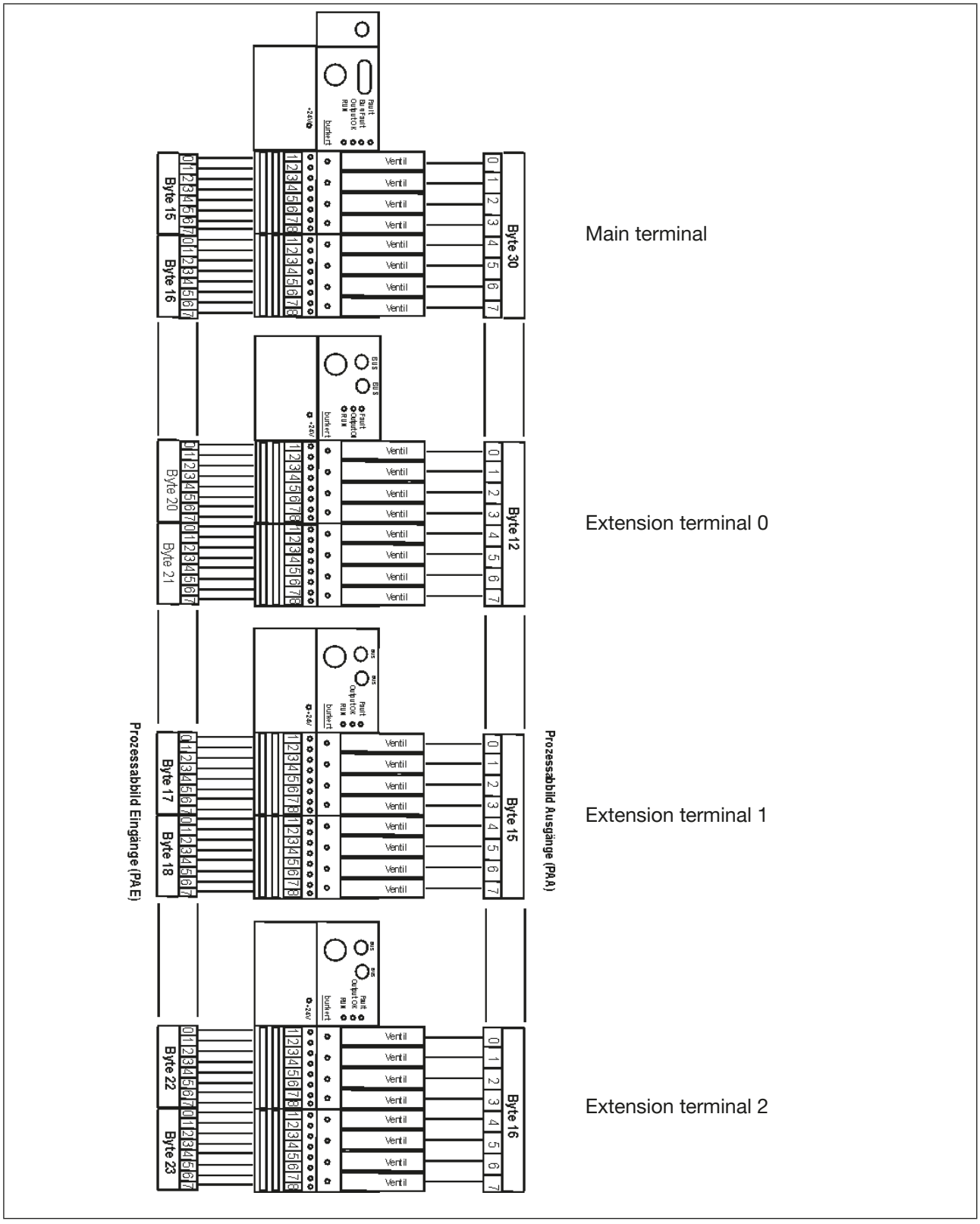

Fig. 20: Allocation of inputs and outputs to control process image

9.2.5 Parameterization (Hex parameter* / User_Prm_Data**) of the valve island 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 island 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 islands.

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.

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

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Meaning	Parameter 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 (PAA)			11	14
Process image input (PAE)	15	20		

Allocation of inputs and outputs to control process image

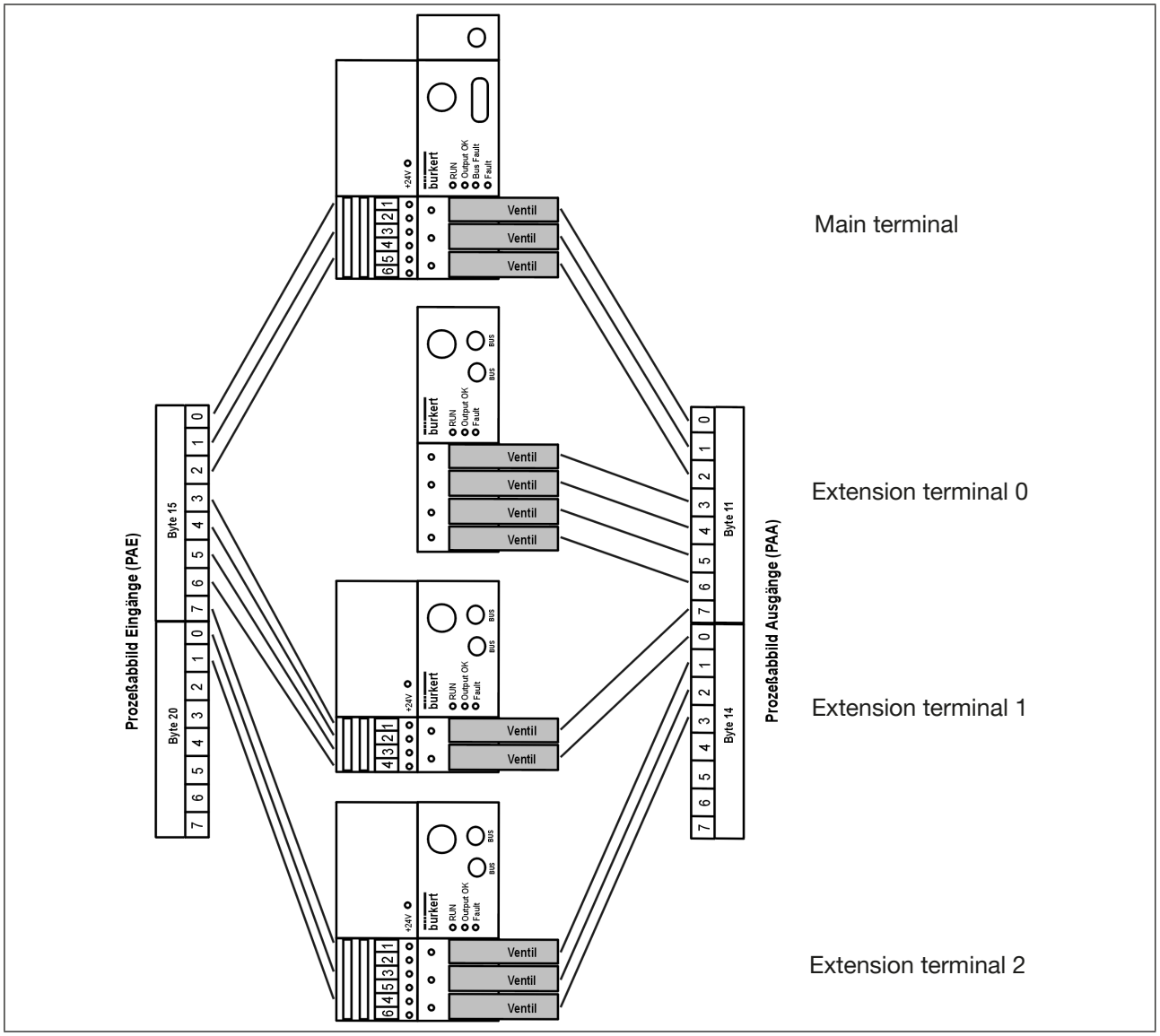

Fig. 21: Allocation of inputs and outputs to control process image

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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.

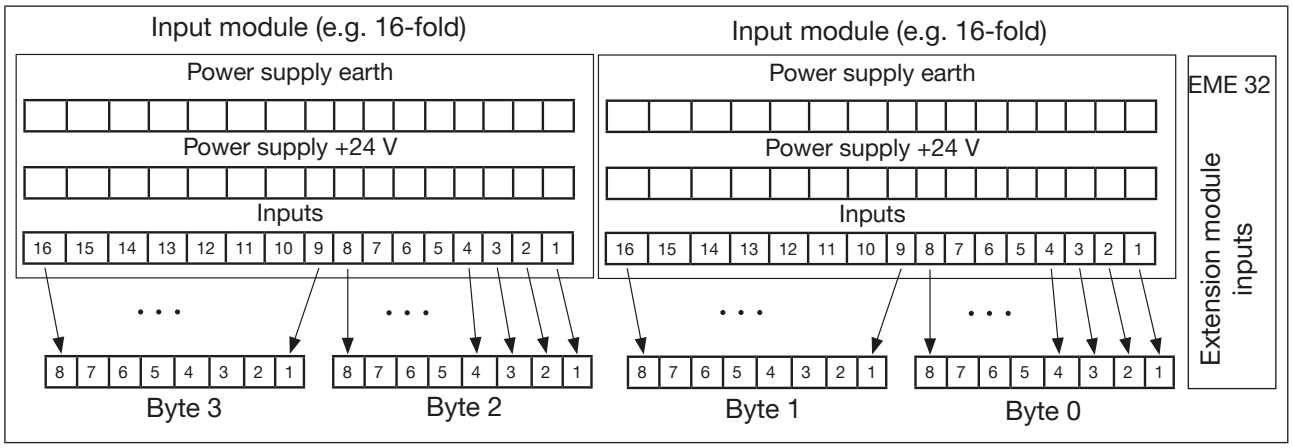

Fig. 22: Normal mode

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.

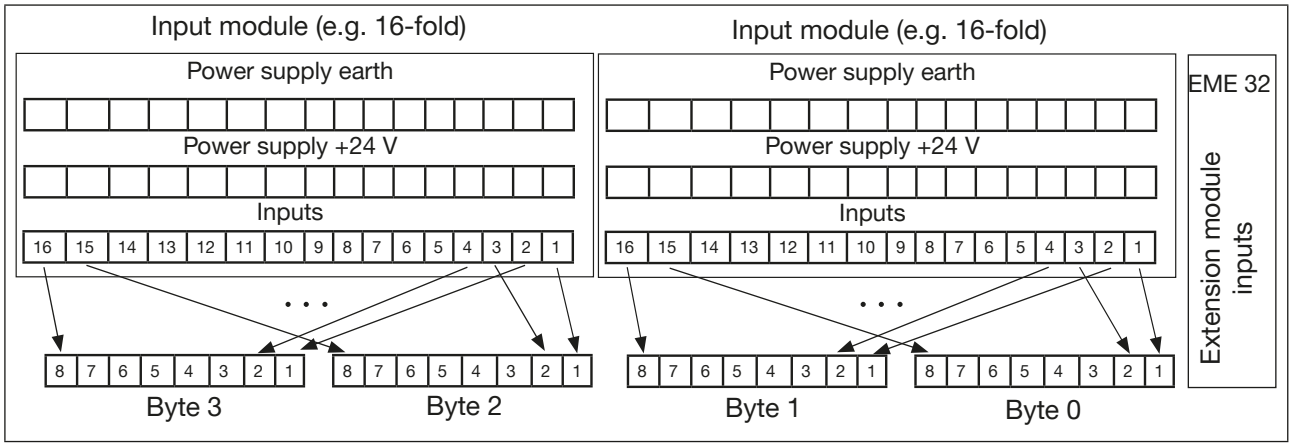

Fig. 23: Shifted inputs mode

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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.

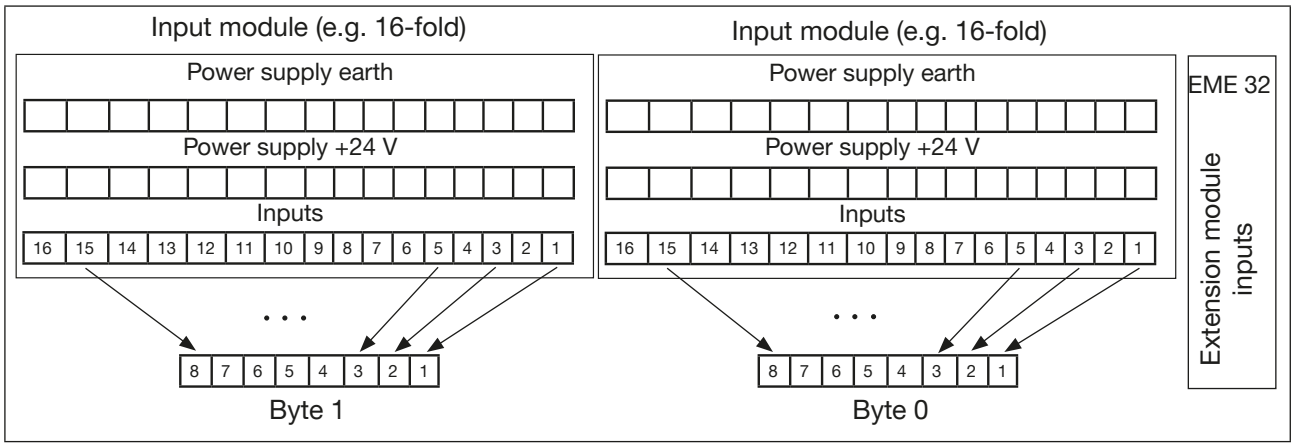

Fig. 24: Halved inputs mode

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 island, 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)							

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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 island
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 island 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.

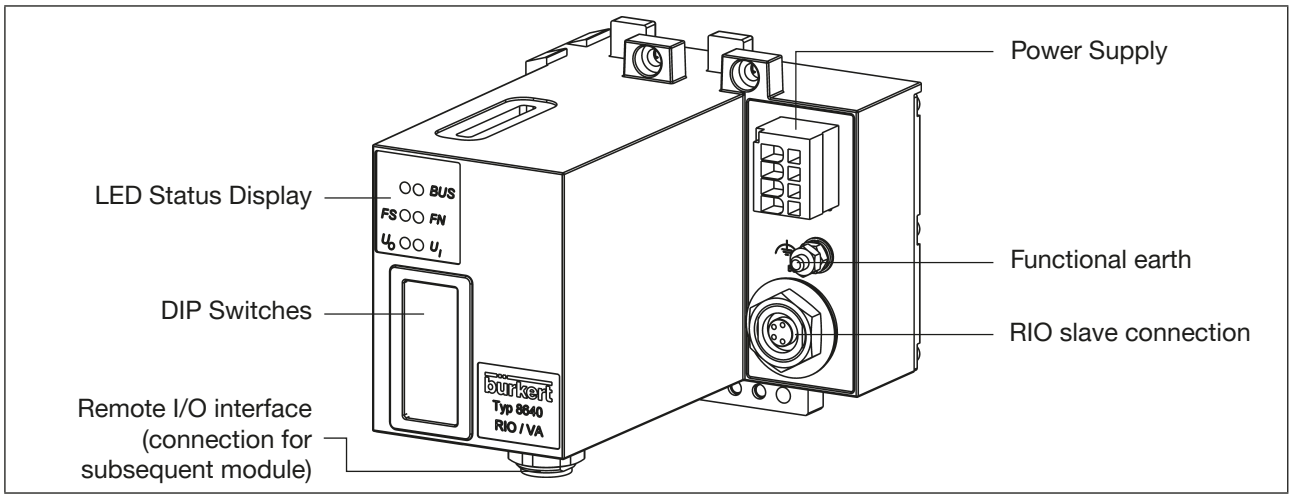

Fig. 25: Overview of bus module RIO slave

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:

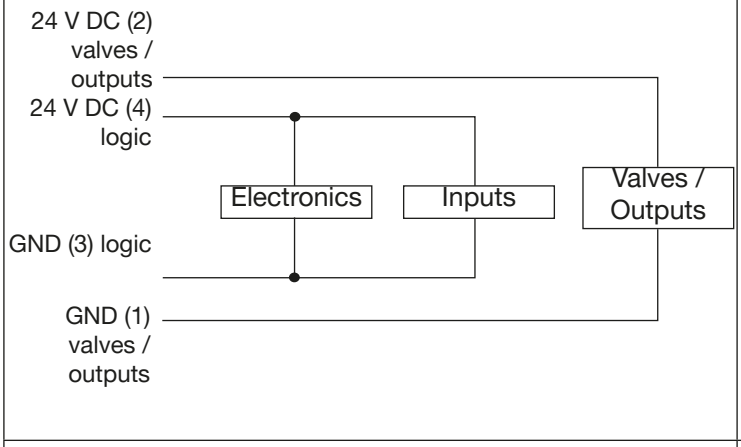

Fig. 26: Power supply configuration

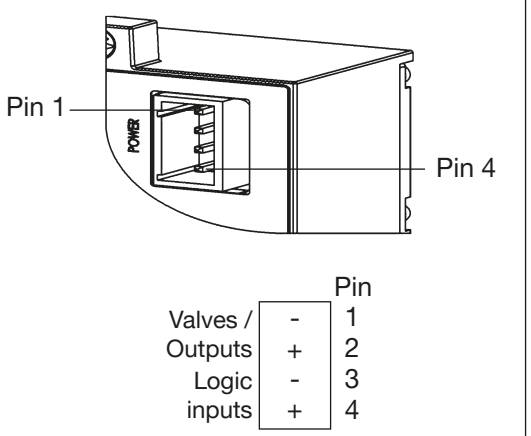

Fig. 27: Cutaway POWER connection

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!

Revision 2 (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

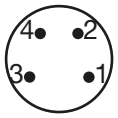
4-pole connections M 8 are used for the internal field bus.

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

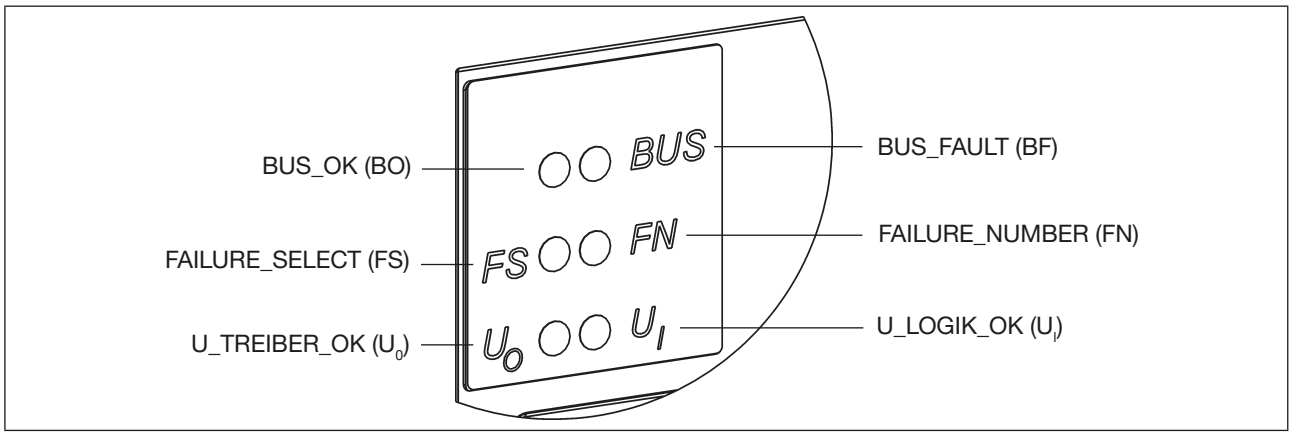

Fig. 28: LED status display (detail)

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 island 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 island 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.

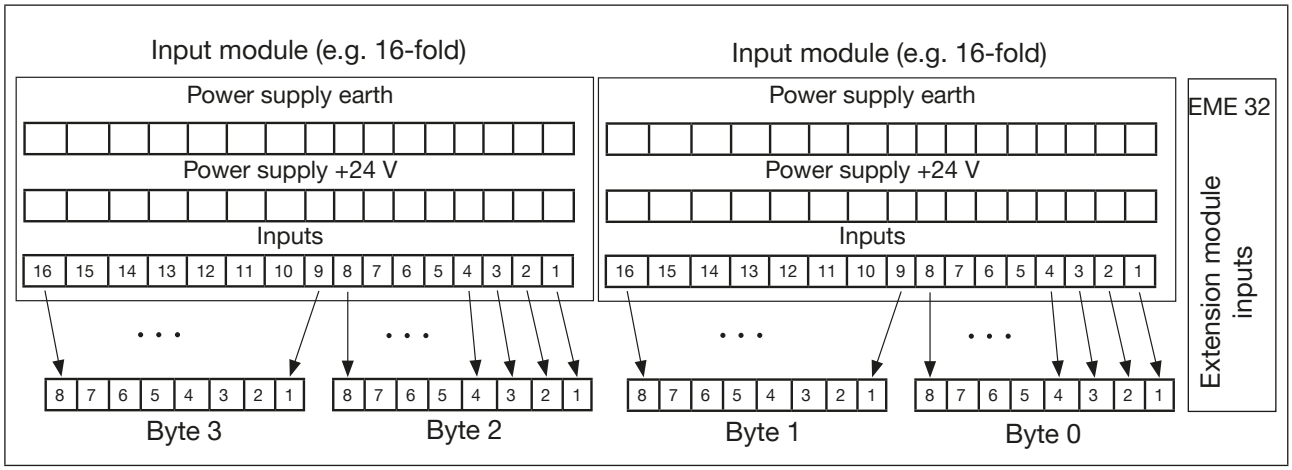

Fig. 29: Normal mode

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.

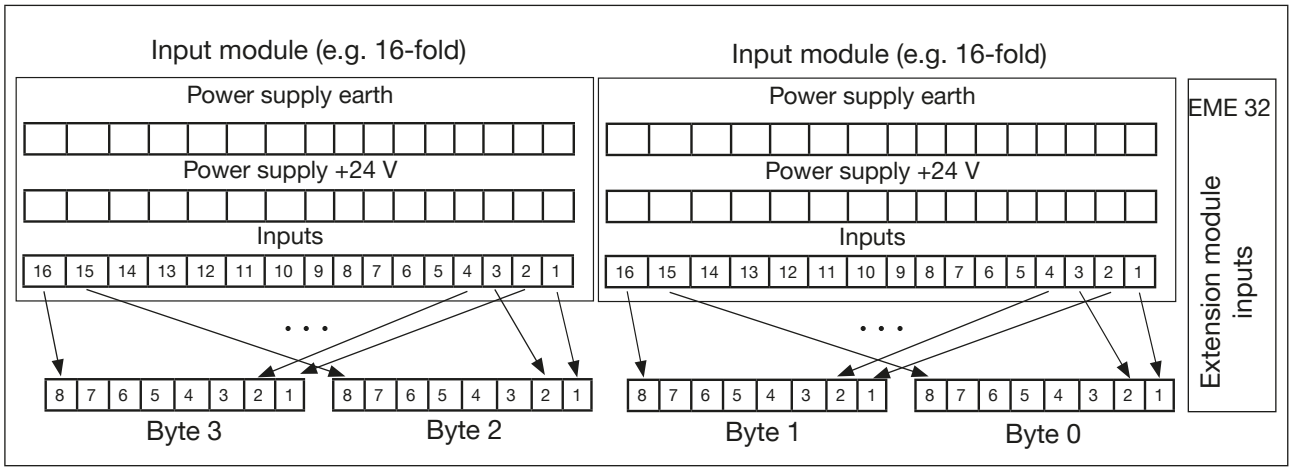

Fig. 30: Shifted inputs mode

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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.

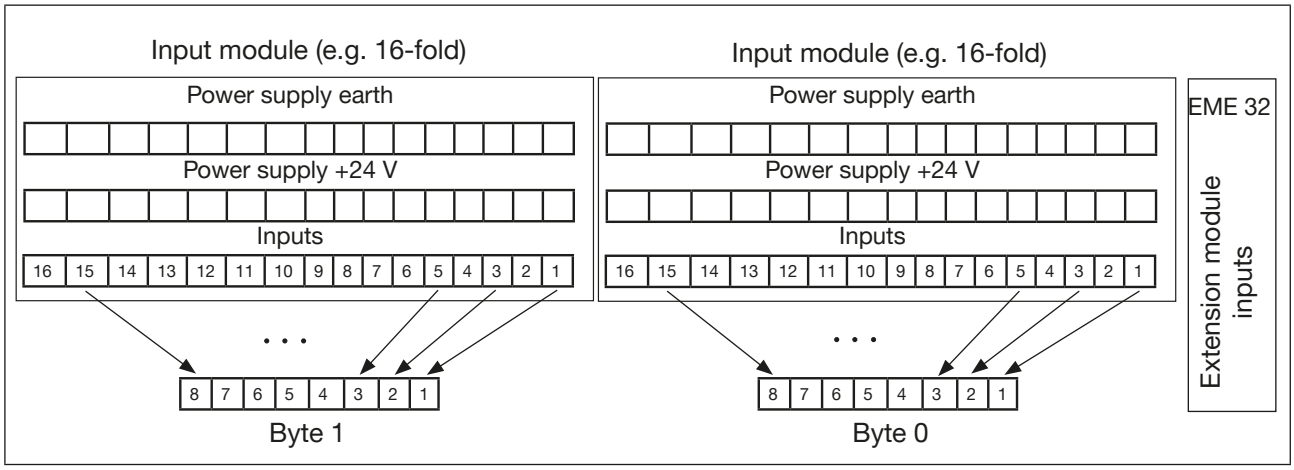

Fig. 31: Halved inputs mode

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 island, 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 CANOPEN

11.1 CANopen, IP20 - overview

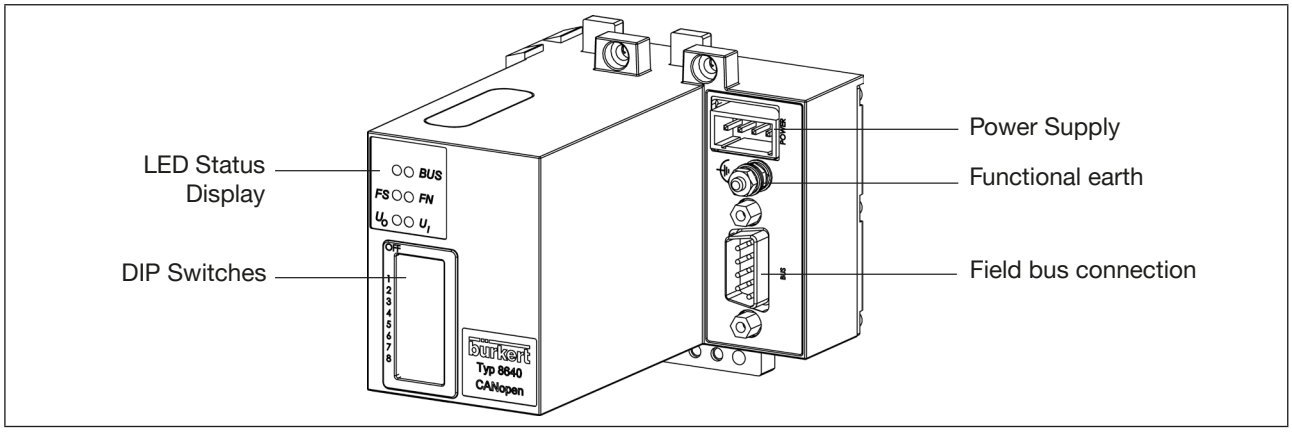

Fig. 32: Overview fieldbus module CANopen, IP20

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:

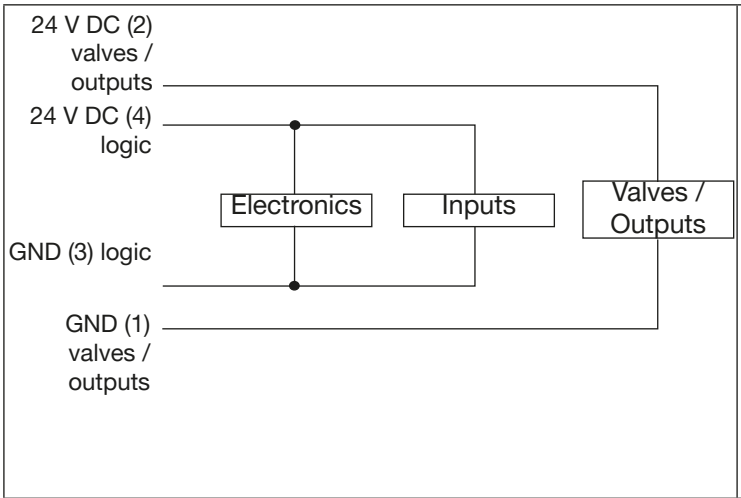

Fig. 33: Power supply configuration

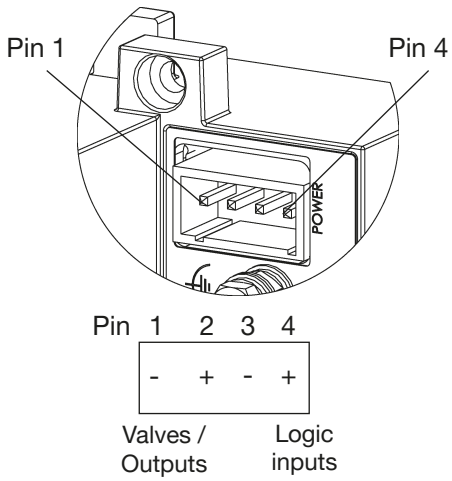

Fig. 34: Cutaway POWER connection

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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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

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

11.1.3 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.

11.2 CANopen, IP54 - overview

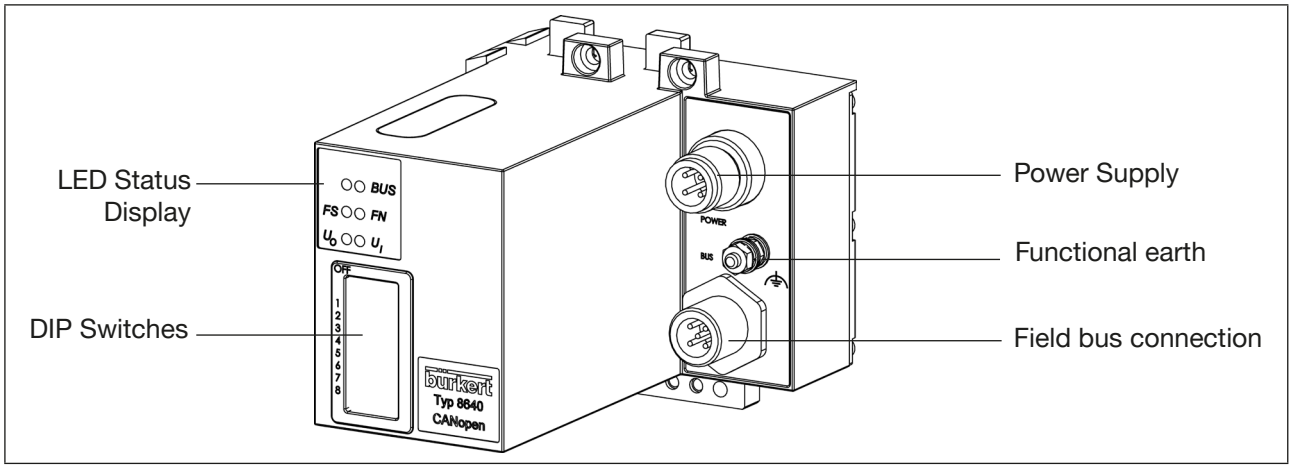

Fig. 35: Overview field bus module CANopen IP54

The DIP switches can be operated through the covering film.

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11.2.1 Power supply IP54

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

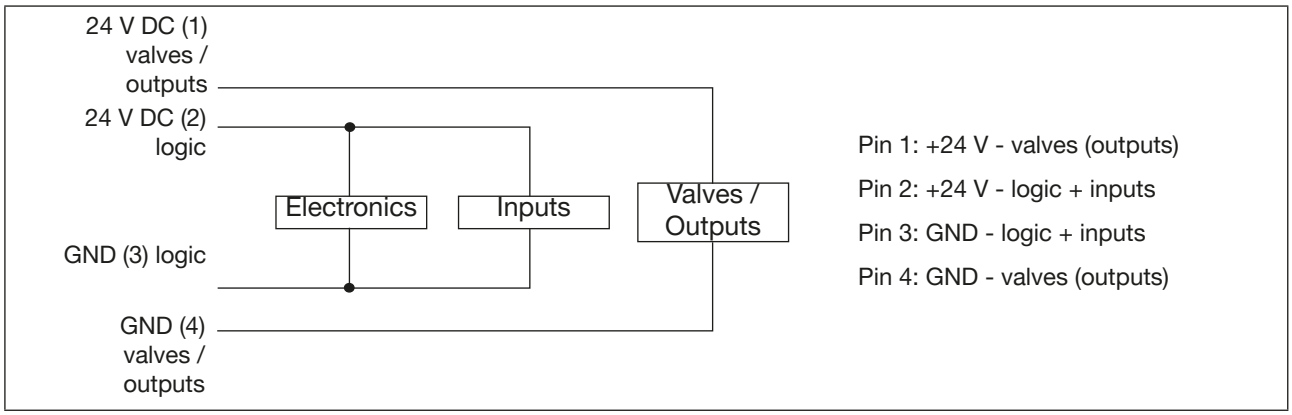

Fig. 36: Power supply configuration

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).

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 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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11.2.3 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.

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	

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.

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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11.4 LED status display

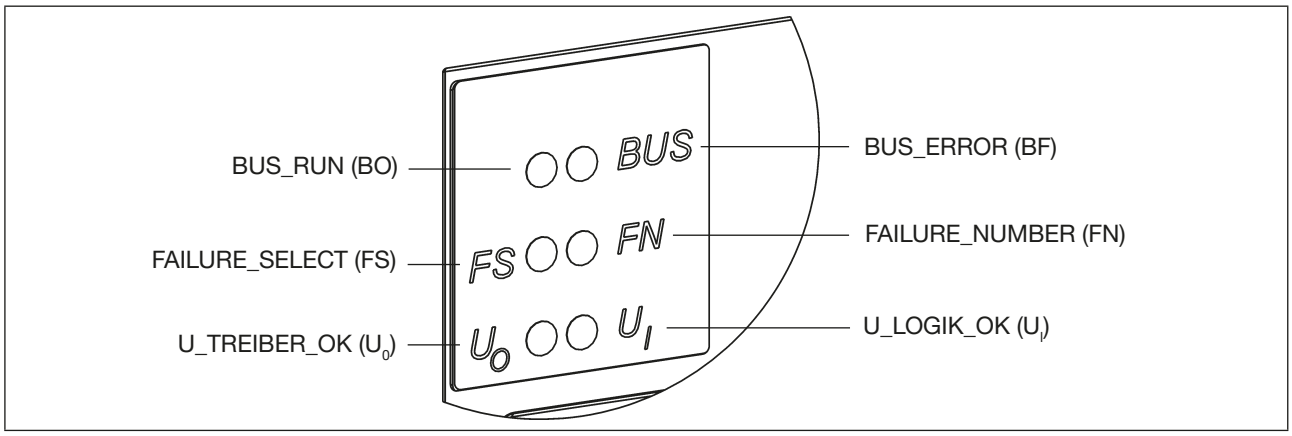
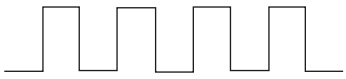


Fig. 37: LED state display (detail)

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.

11.4.1 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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12 CONFIGURATION AND PARAMETER SETTINGS FOR CANOPEN

12.1 Description of the CANopen field bus node

The valve island 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

12.2 Object overview

The valve island 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
1200	0-3	1 st Server SDO parameter	x	(x)	

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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

12.3 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

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

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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 $_{hex}$

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

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	

12.4 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

12.5 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 $_{hex}$

12.5.1 Normal mode

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

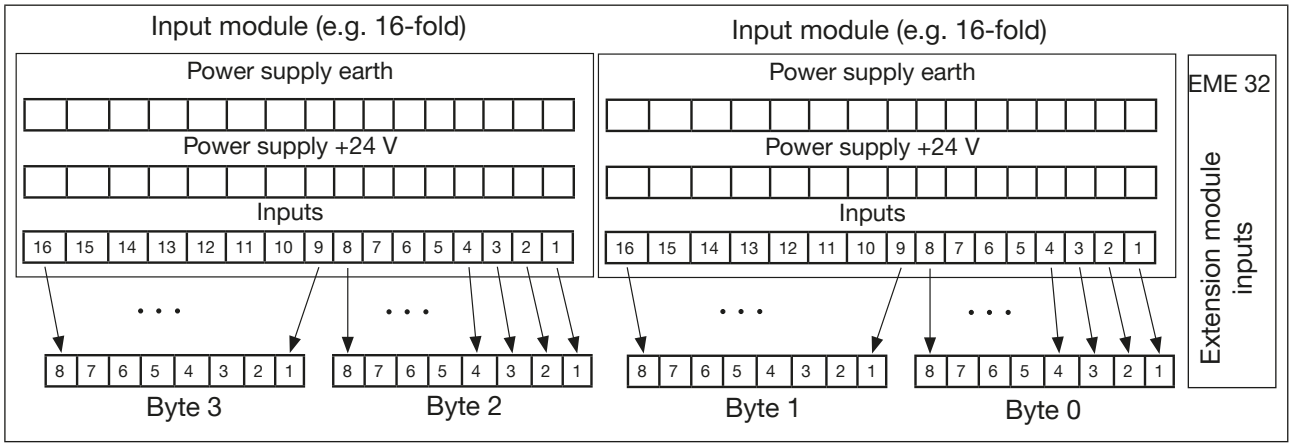

Fig. 38: Normal mode

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12.5.2 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.

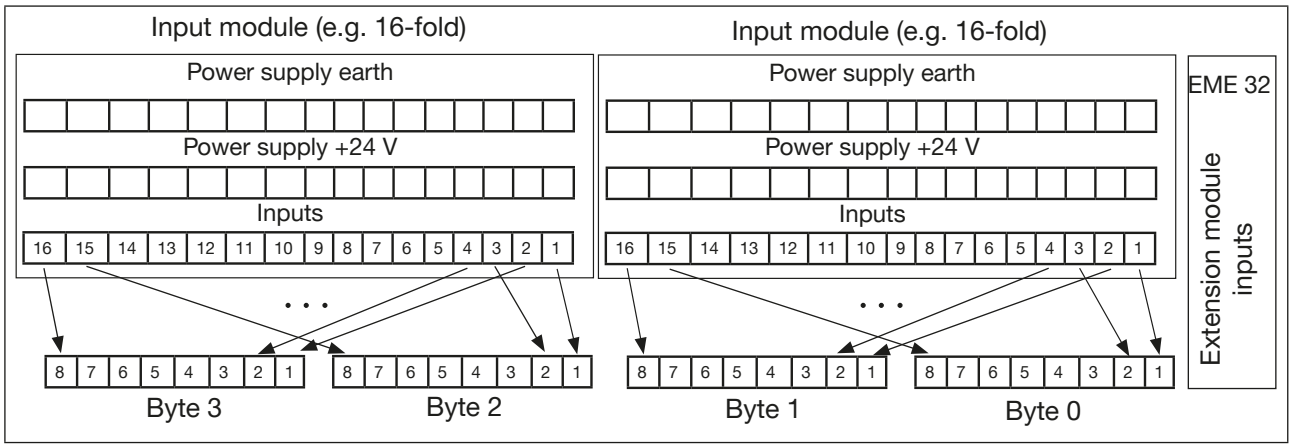

Fig. 39: Shifted inputs mode

12.5.3 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.

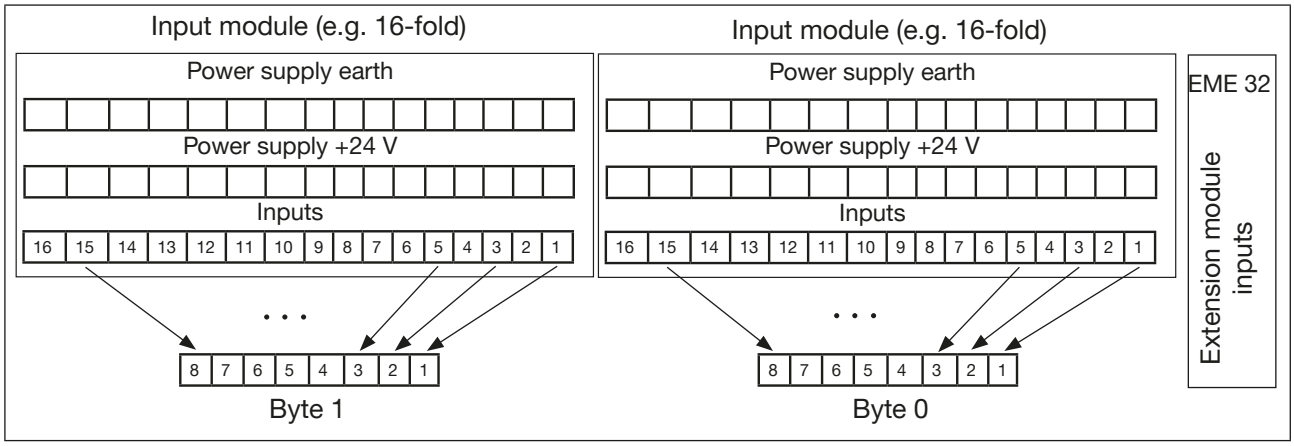

Fig. 40: Halved inputs mode

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12.6 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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12.7 Example for start-up

CANopen command sequence to put the Type 8640 valve island 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

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

- 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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13 FIELD BUS MODULES PROFINET IO, ETHERNET/IP AND MODBUS TCP

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

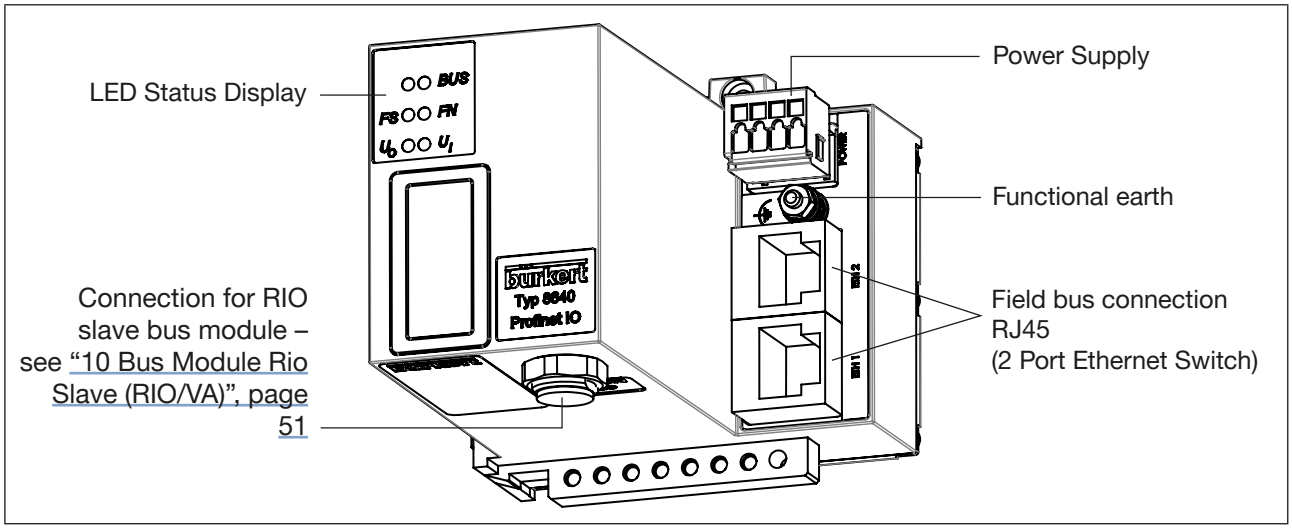

Fig. 41: Overview of field bus modules PROFINET IO, EtherNet/IP, MODBUS TCP

13.1.1 Power supply IP20

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

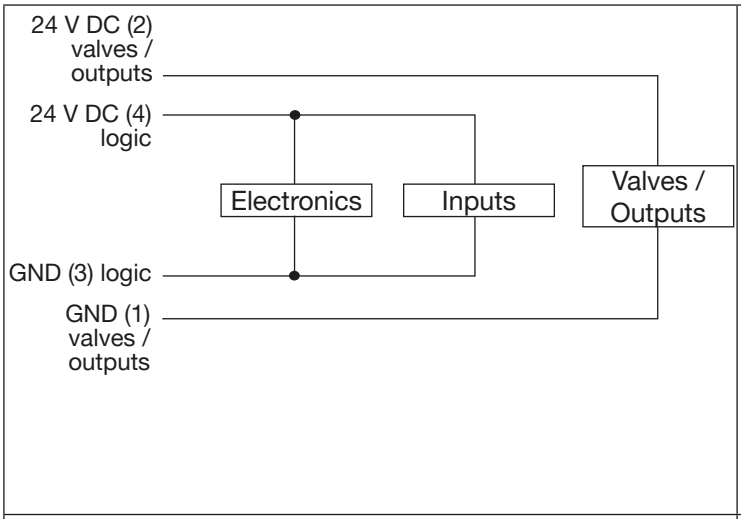

Fig. 42: Power supply configuration

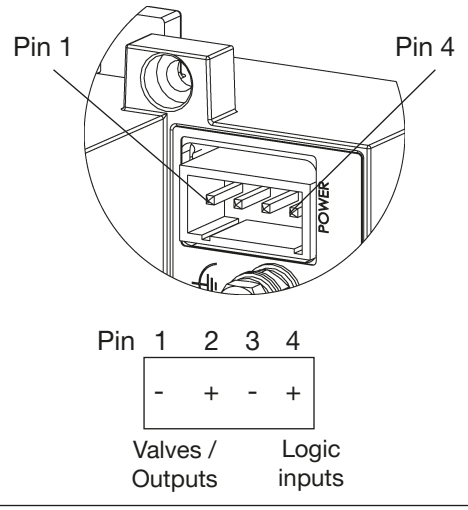

Fig. 43: Cutaway POWER connection

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).

13.1.2 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.

Fig. 44: Assignment of RJ45 connection

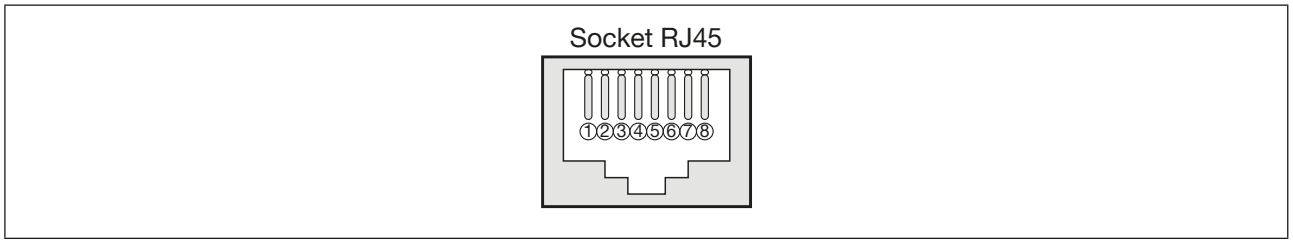

Fig. 45: Illustration of RJ45 port

NOTE!

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

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13.2 LED status display

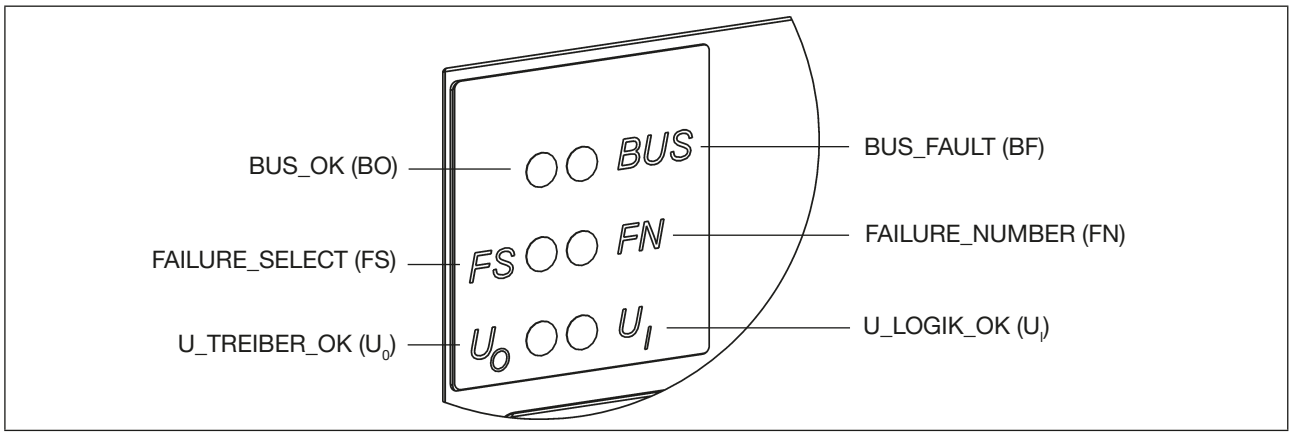

Fig. 46: LED state display (detail)

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 island 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 island 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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13.2.1 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 island must be reset by briefly shutting down the supply voltage.

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13.3 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.

13.3.1 Normal mode

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

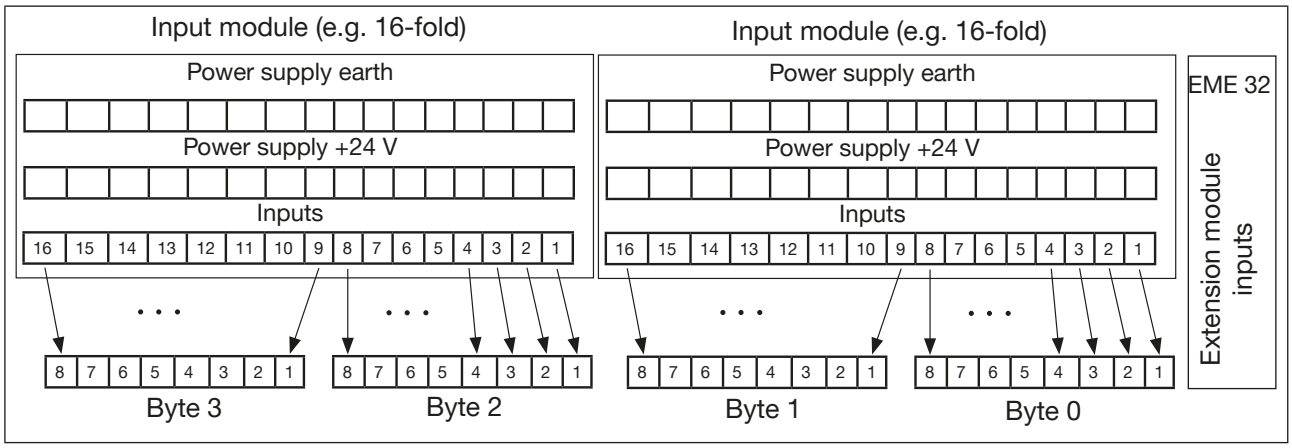

Fig. 47: Normal mode

13.3.2 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.

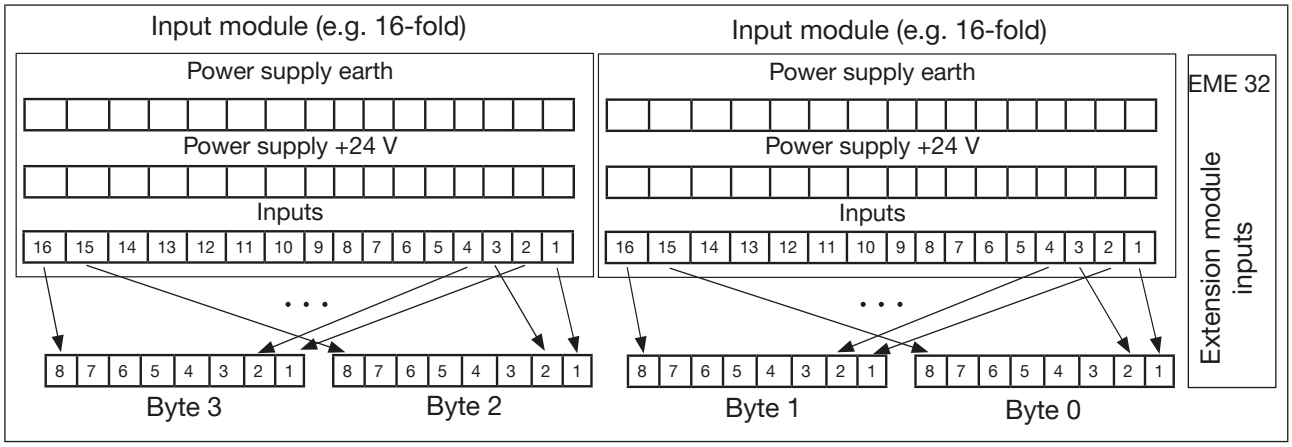

Fig. 48: Shifted inputs mode

13.3.3 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.

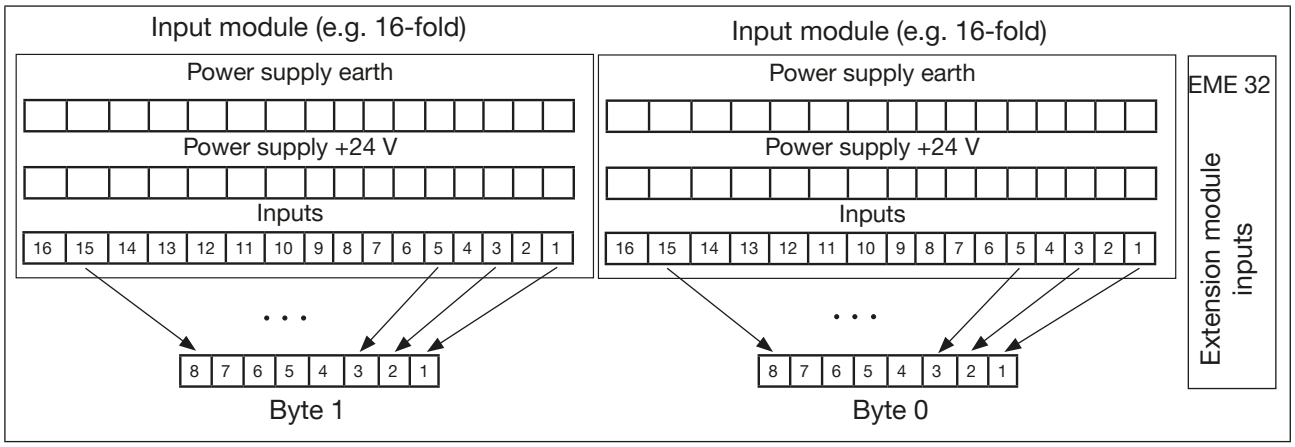

Fig. 49: Halved inputs mode

13.4 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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13.5 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).

13.5.1 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

13.5.2 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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13.6 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.

13.6.1 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.

13.6.2 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:

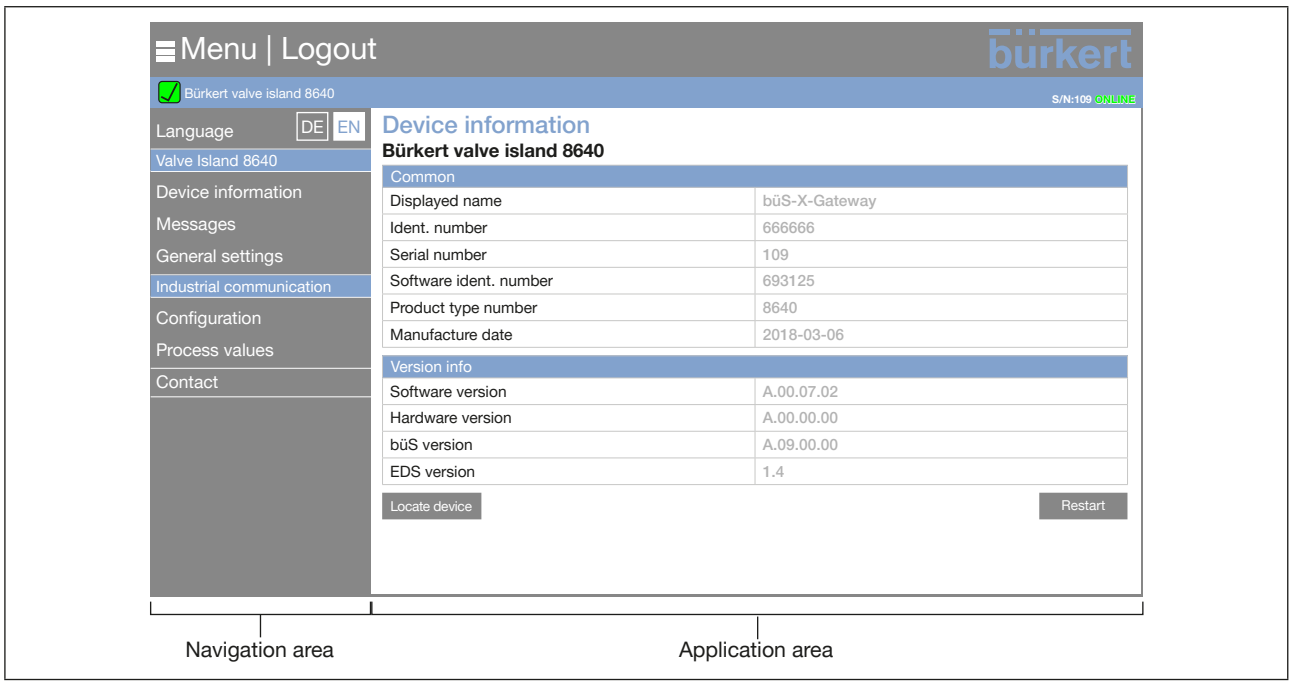

Fig. 50: Overview of web server user interface

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13.6.3 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.

13.6.4 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**.

13.6.5 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.

13.6.6 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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14 CONFIGURATION AND PARAMETER SETTINGS FOR PROFINET IO

14.1 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.

14.1.1 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 “Fig. 51”). It can be dragged and dropped onto the PROFINET network.

The default device name is "ValveIsland". 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).

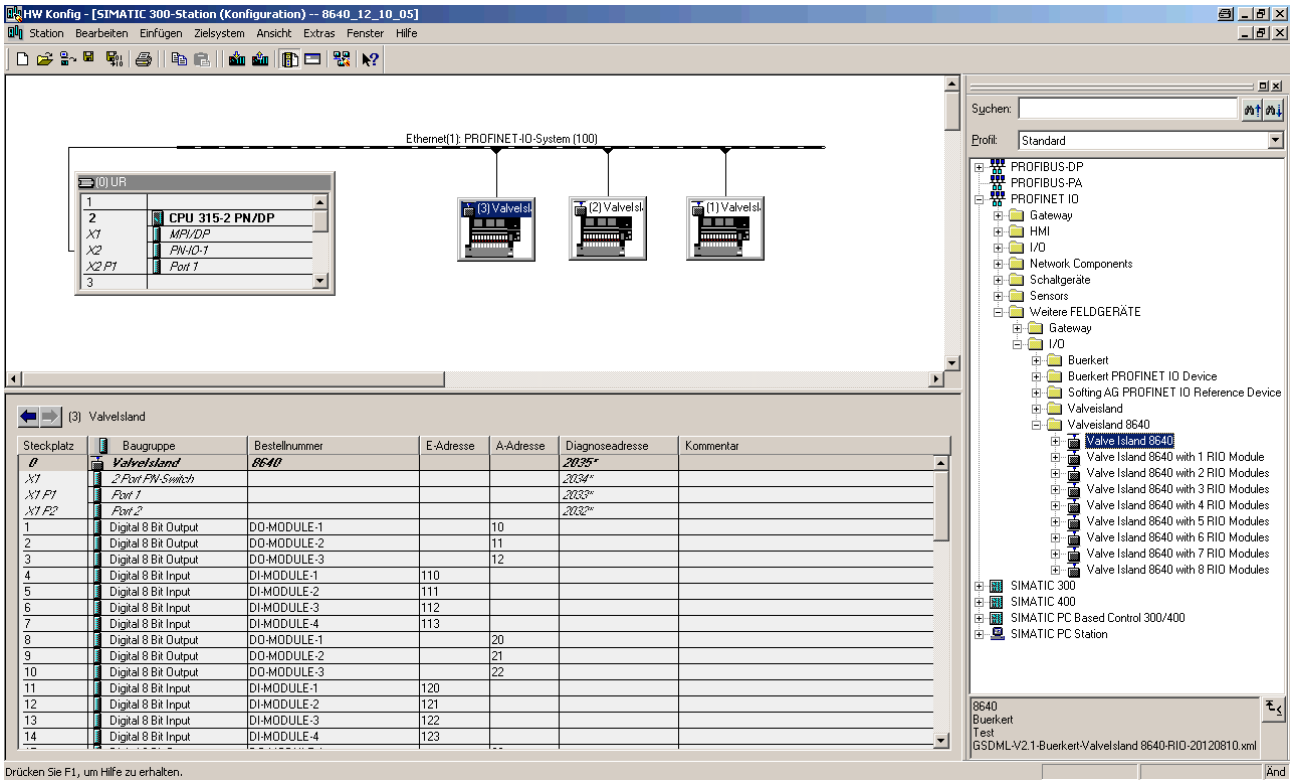

Fig. 51: Konfiguration

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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.

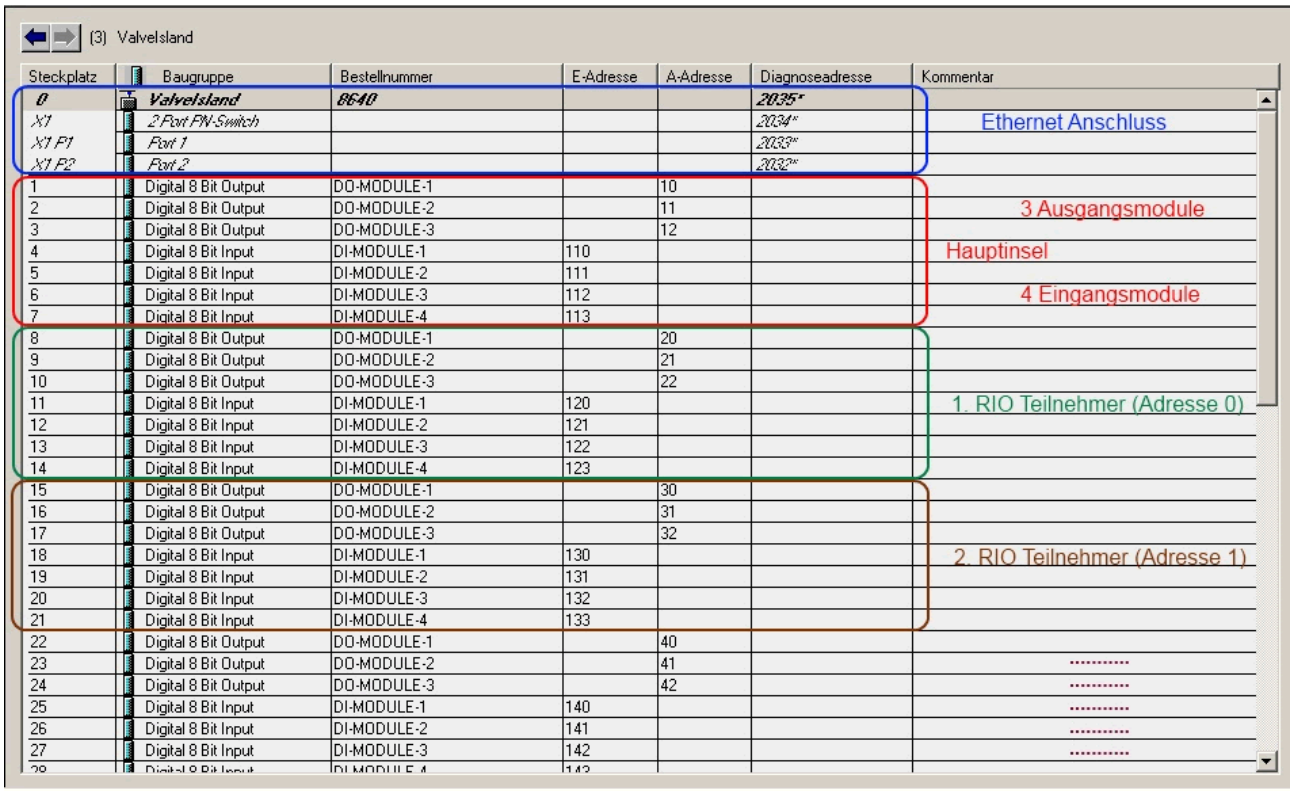

Fig. 52: Example of slot assignment of a main terminal 8640 with 2 nodes

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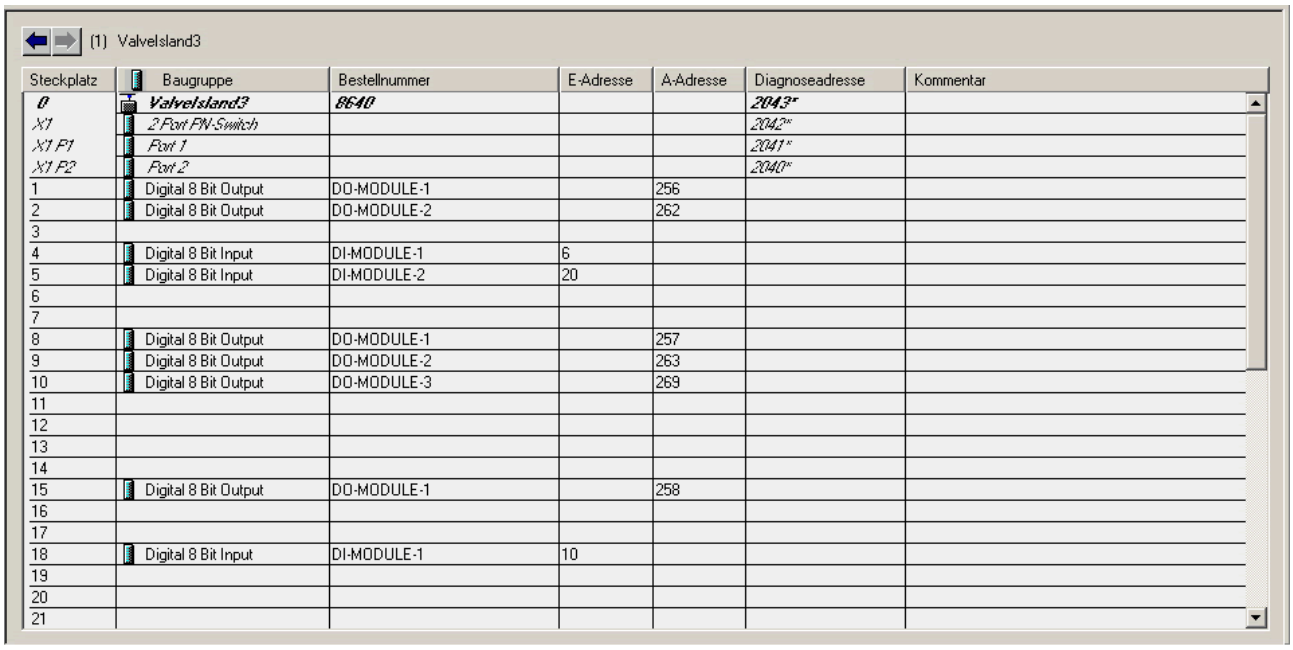
If the RIO node does not need all 7 slots because its configuration is lower (e.g. 16 valves and 0 inputs), the modules in those slots can be removed so as to save on addresses. Those slots then remain vacant.

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	*Valvelsland3*	*8640*			*2043**	
X1	*2 Port PN-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						

Fig. 53: Example of slot assignment with low configuration

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14.2 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.

14.2.1 Parameter setting based on the example of STEP7

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

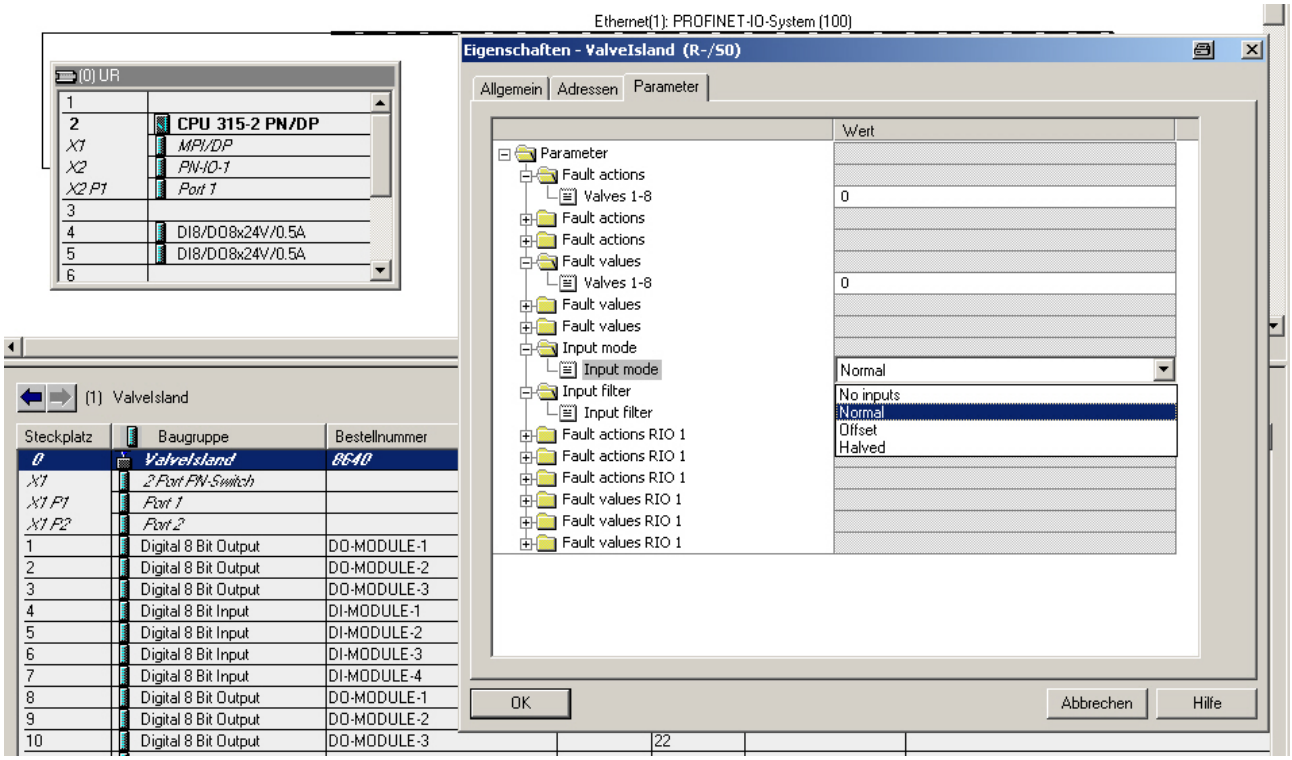

Fig. 54: Parameter settings for the PROFINET IO slave via STEP7

14.2.2 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	…	…	…	…	…

Fig. 55: Acyclic object access data

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15 CONFIGURATION AND PARAMETER SETTINGS FOR ETHERNET/IP

The data exchange between the EtherNet/IP master and the valve island 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.

15.1 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.

15.2 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: country.burkert.com

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

15.3 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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15.4 Configuring process data

The valve island Type 8640 has been revised. This revised Revision 2 (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 Revision 2 (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 “5.5.2”, page 17).

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 Revision 2 (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 Revision 2 (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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15.5 Applications object

The valve island Type 8640 has been revised. This revised Revision 2 (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 Revision 2 (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 Revision 2 (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 Revision 2 (REV.2), downward compatible “on”	Device Revision 2 (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: Revision 2 (REV.2) objects”
Main terminal + 5...8 RIOs		see “Table 3: Revision 2 (REV.2) objects”	

15.5.1 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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15.5.2 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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15.5.3 Revision 2 (REV.2) objects

The devices of Revision 2 (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*
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: Revision 2 (REV.2) objects

16 CONFIGURATION AND PARAMETER SETTINGS FOR MODBUS TCP

16.1 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.

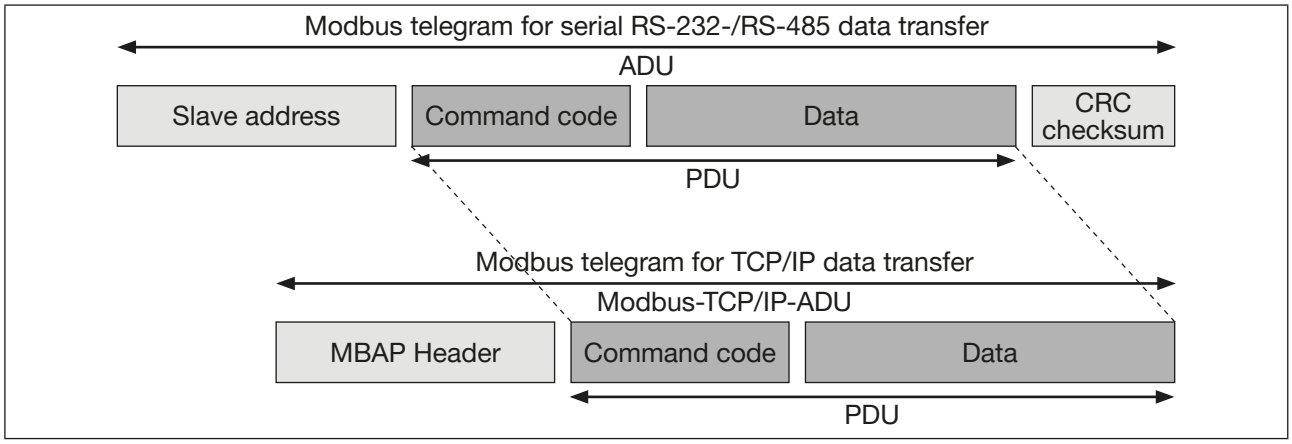

Fig. 56: Differences between the standard Modbus telegram and the Modbus-TCP telegram

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.

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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

16.2 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.

16.3 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.

16.4 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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16.5 8640 objects

16.5.1 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 Revision 2 (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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16.5.2 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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16.5.3 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
	Revision 2 (REV.2): 4 bytes	Revision 2 (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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17 ELECTRICAL BASE MODULE OUTPUT

17.1 Collective socket

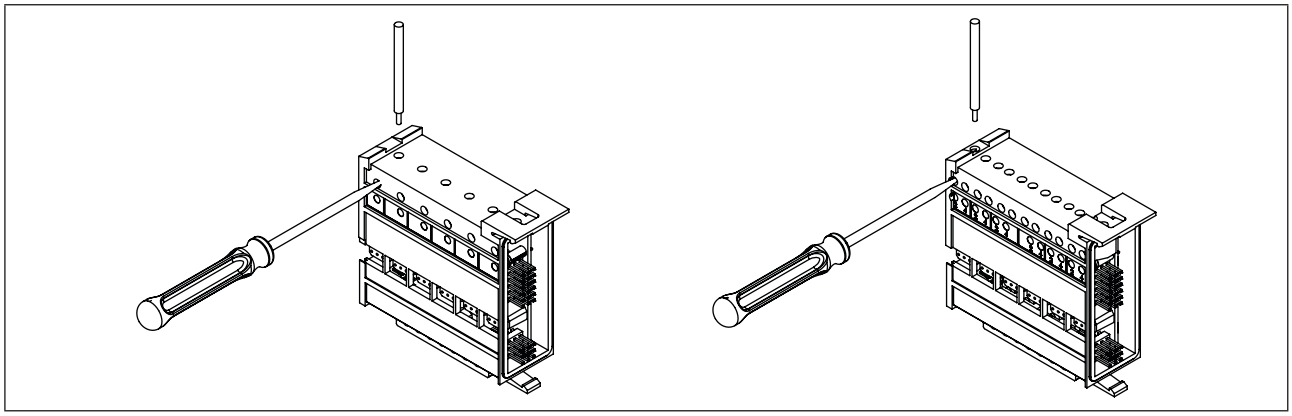
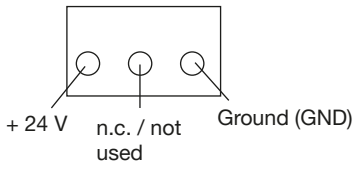


Fig. 57: Collective socket

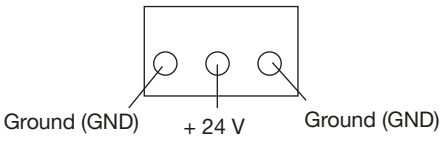
Electrical base module collective socket only in connect with the collective socket module for valve outputs (see module for the conventional electrical connection technology “Collective socket module”).

17.1.1 Allocation plan

For valve types 6524, 6525:



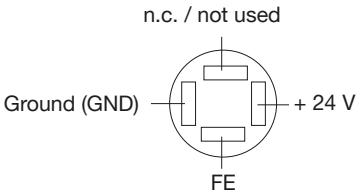
For valve types 0460, 6524 (2 x 2/3-way valve):



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.

For valve types 0460, 6526 and 6527:



NOTE!

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

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17.2 Valve outputs

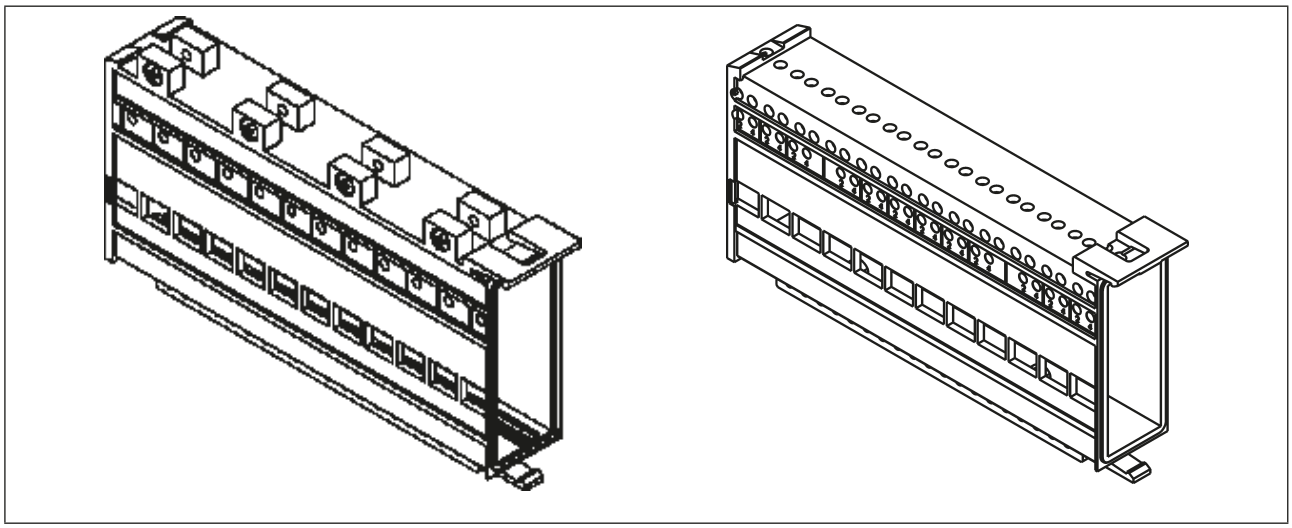


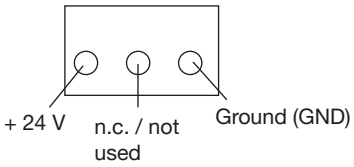
Fig. 58: Electrical base module for valve outputs

NOTE!

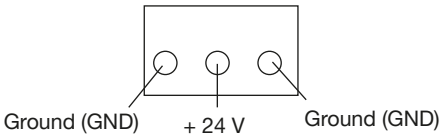
The electrical base modules contain the connections for the valve control.

17.2.1 Allocation plan

For valve types 6524, 6525:



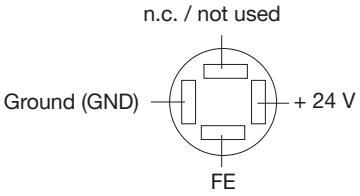
For valve types 0460, 6524 (2 x 2/3-way valve):



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.

For valve types 0460, 6526 and 6527:



NOTE!

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

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17.3 Valve outputs with manual / automatic switching

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

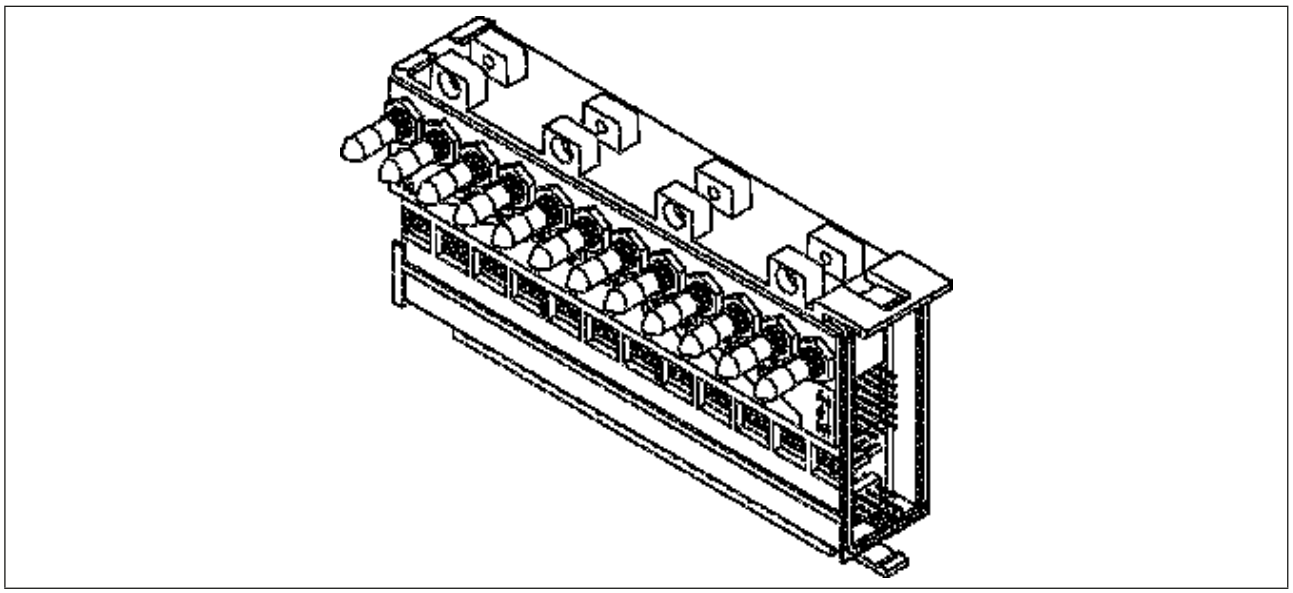


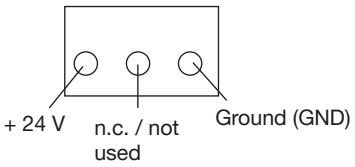
Fig. 59: Electrical base module for valve outputs with manual / automatic switching (12-fold)

NOTE!

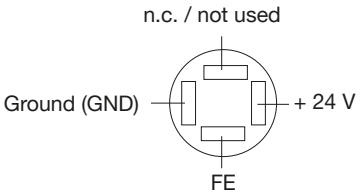
Locked switches! The manual / automatic switches have a mechanical locking mechanism. Before being deployed, the lever must be pulled out of the lock position!

17.3.1 Allocation plan

For valve types 6524, 6525:



For valve types 0460, 6526 and 6527:



NOTE!

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

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

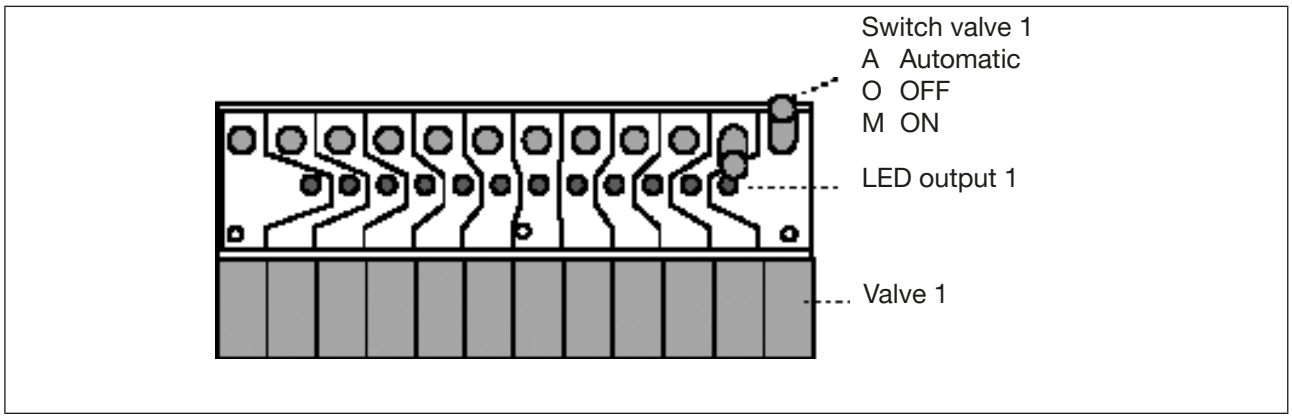

Fig. 60: Module description for electrical base module with manual / automatic switching using example: Module EGM / HA-10-12

17.3.3 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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17.4 Valve outputs with external switch-off

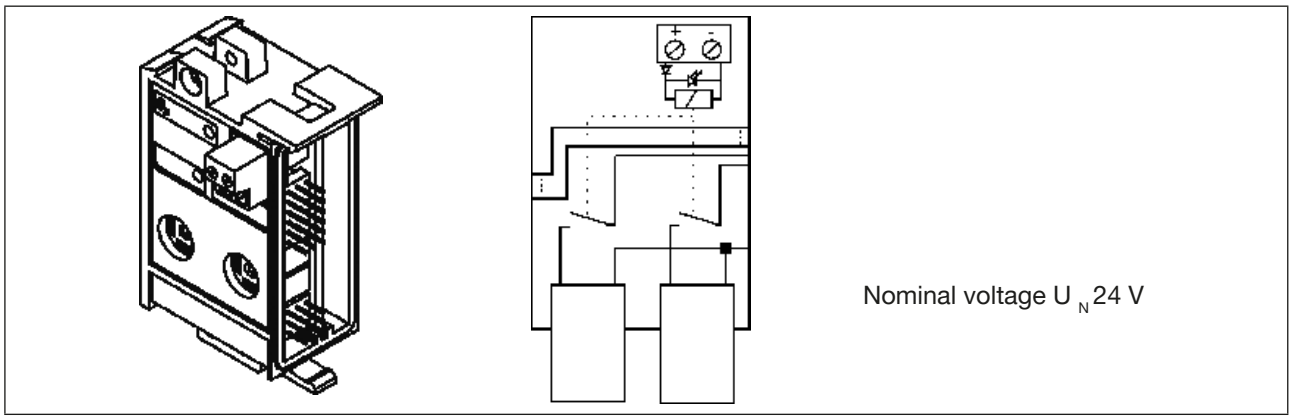
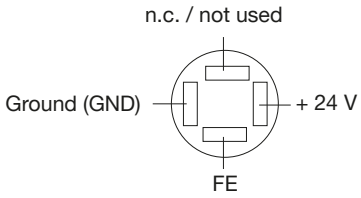


Fig. 61: Valve outputs with external switch-off - circuit diagram of the valve outputs

17.4.1 Allocation plan

For valve types 6526, 6527:



NOTE!

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

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18 ELECTRICAL BASE MODULE INPUT

18.1 Terminal inputs for repeaters (initiators)

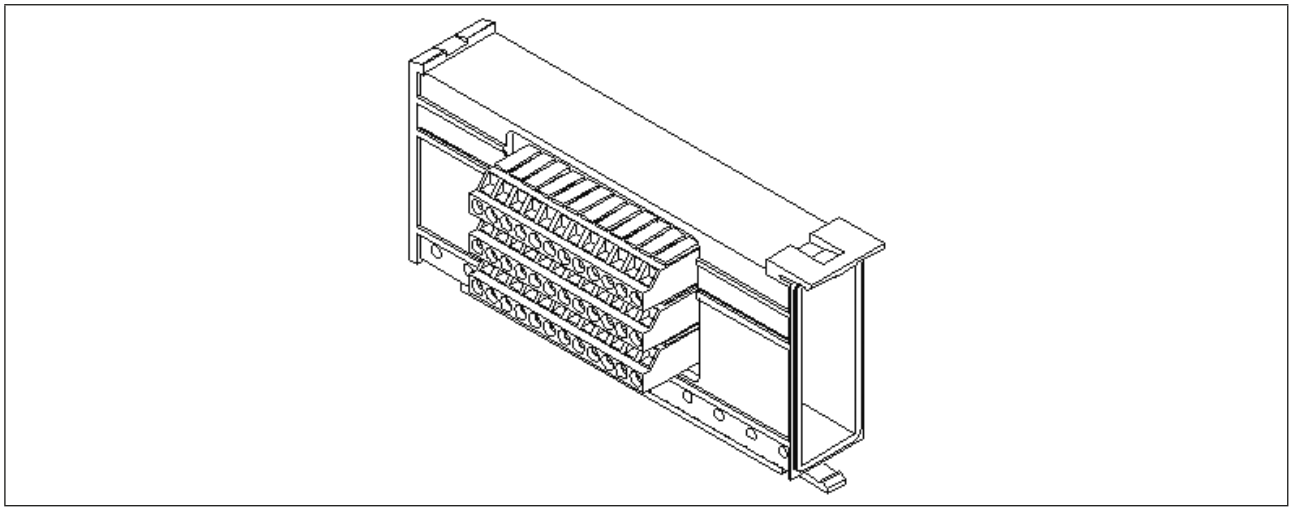
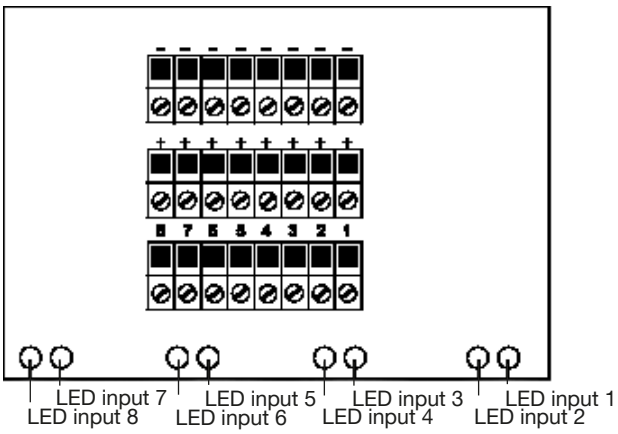


Fig. 62: Electrical base module for repeater inputs (initiators) for terminals (IP20)

18.1.1 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

Fig. 63: Terminal assignment

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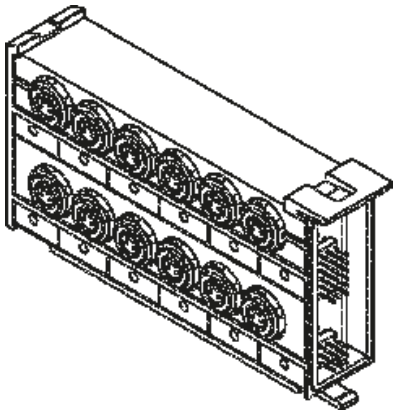
18.2 Plug inputs (M8 circular plugs) for repeaters (initiators)

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

Fig. 64: Electrical base module for repeater inputs

18.2.1 Inputs of the module EGM-SE-19-10

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

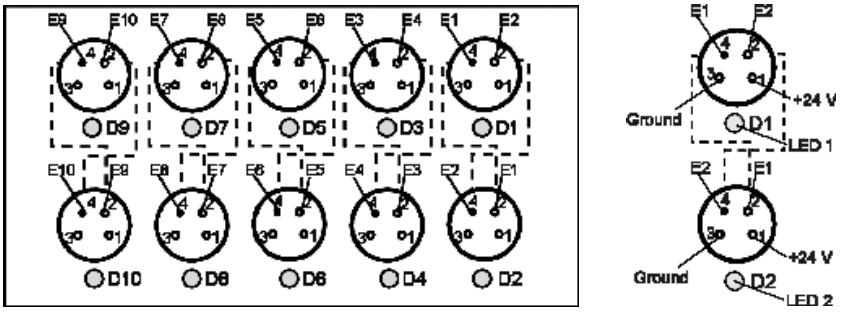


Fig. 65: Plug configuration of the EGM-SE modules except EGM-SE-19-4

NOTE!

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

18.2.2 Inputs of the module EGM-SE-19-4

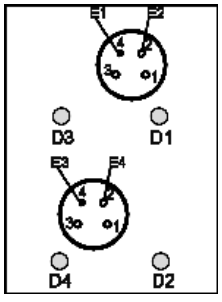


Fig. 66: Plug configuration of the module EGM-SE-19-4

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19 PNEUMATIC MODULES

19.1 Pneumatic connection modules

The valve block is pneumatically supplied and vented via the connection modules. In addition, the valve block is attached to the standard rail via the connection modules.

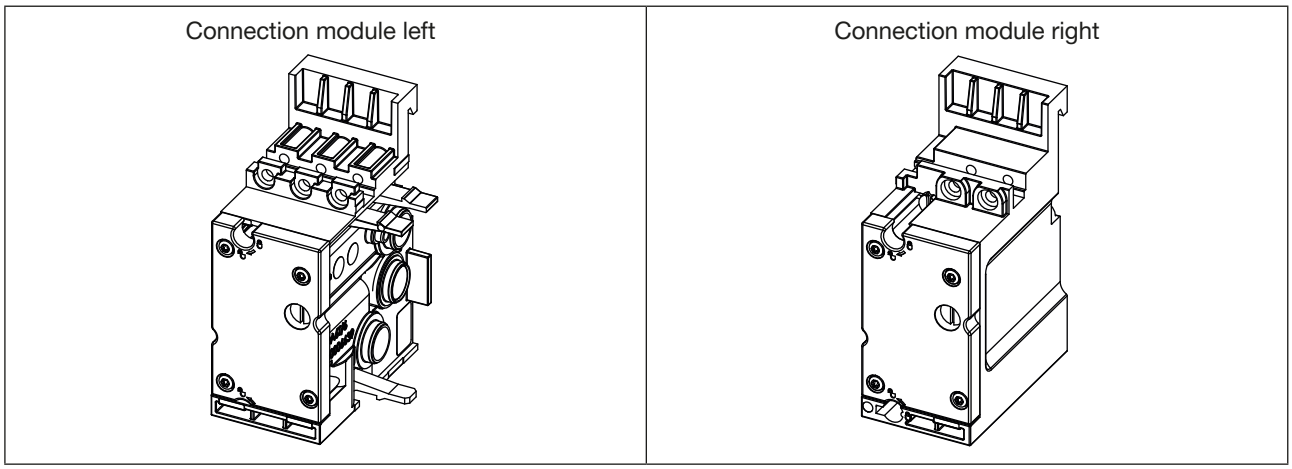

Fig. 67: Connection modules, width per valve 11 mm (shown: REV.2 – only detail differences to REV.1)

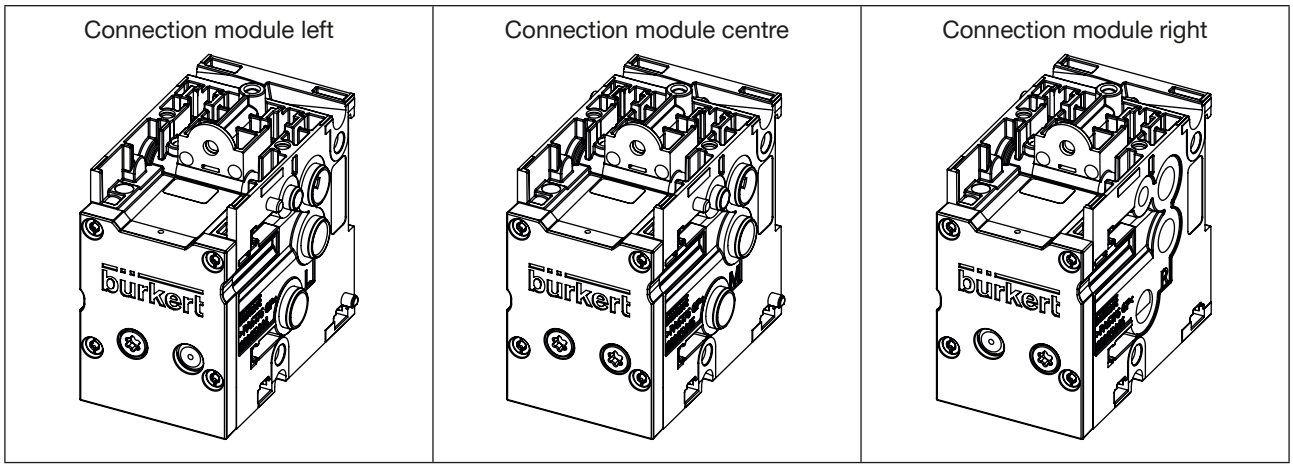

Fig. 68: Connection modules, width per valve 16 mm (shown: REV.2 – only detail differences to REV.1)

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19.2 Pneumatic base modules

The pneumatic base module is part of the valve unit. It supports the valves, is used for pneumatic supply and venting of the valves and provides the pneumatic working outputs. Various port and equipment options are available (see data sheet).

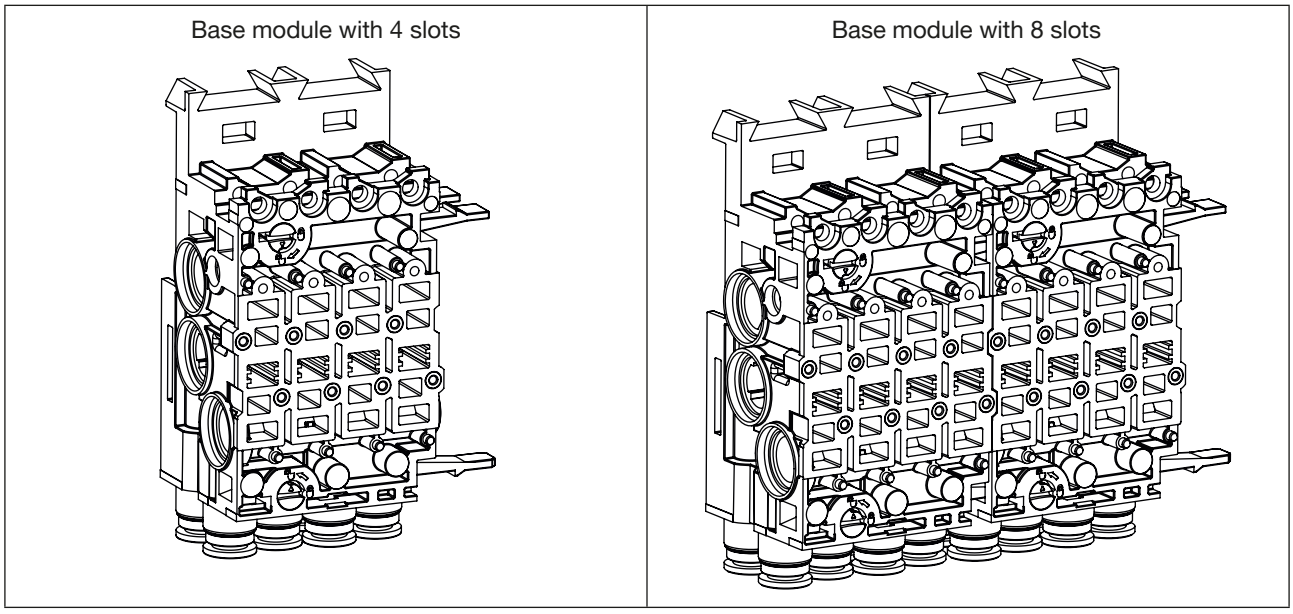

Fig. 69: Base modules, width per valve 11 mm (shown: REV.2 – only detail differences to REV.1)

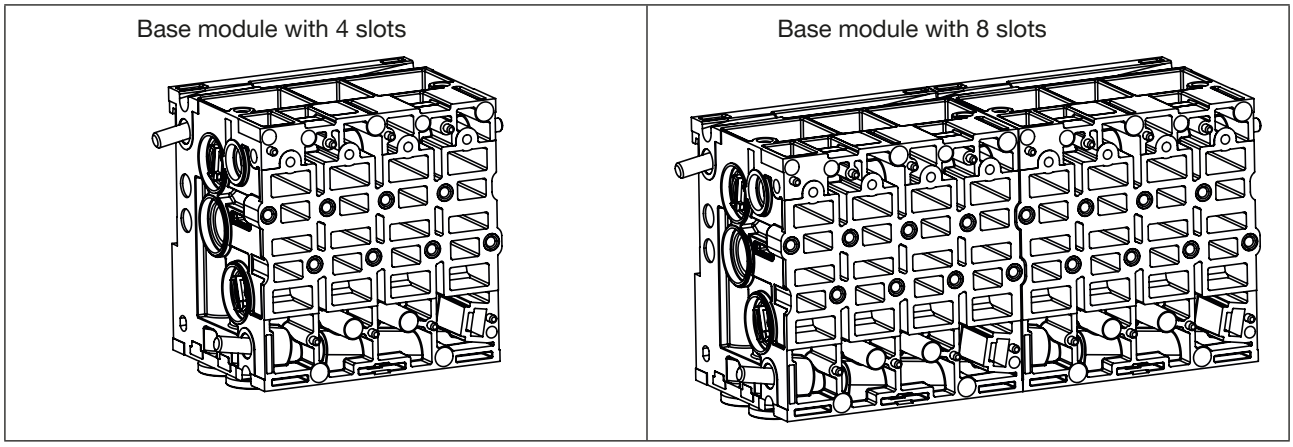

Fig. 70: Base modules, width per valve 16 mm (shown: REV.2 – only detail differences to REV.1)

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20 VALVES

20.1 Valves type 6524 and type 6525 for valve islands width per valve 11 mm

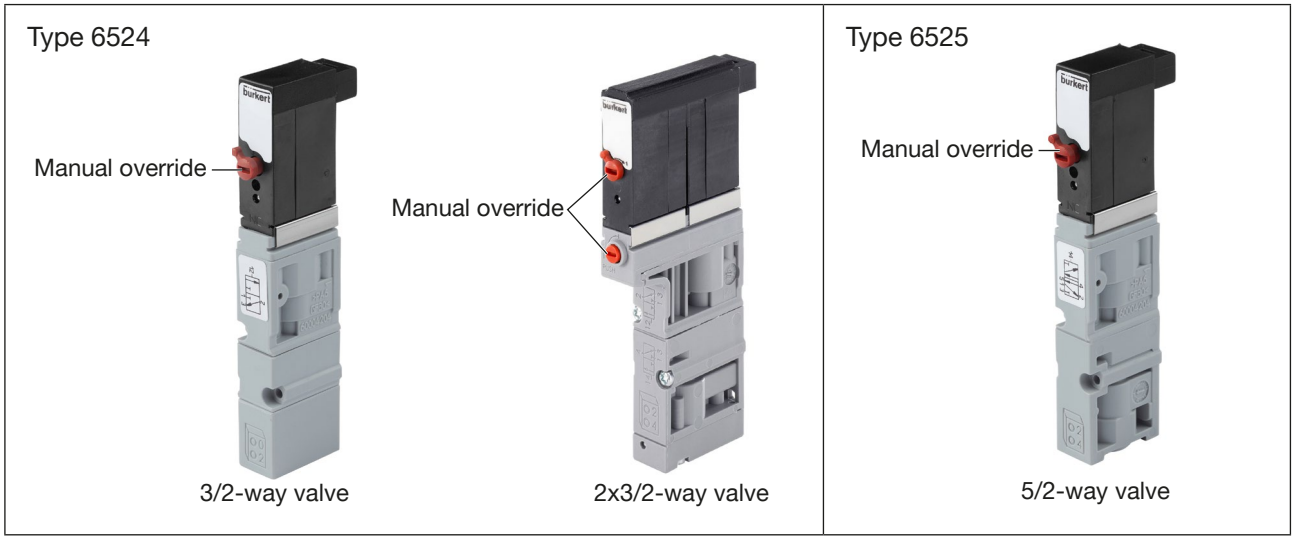

Fig. 71: Valves type 6524 (3/2-way and 2x3/2-way valve) and type 6525 (5/2-way valve)

Type 6524 is a 3/2-way valve or a 2x3/2-way valve. Type 6525 is a 5/2-way valve. The valves consist of a flipper solenoid valve as a pilot control and a pneumatic seat valve as an amplifier. They are monostable and equipped with manual override as standard.

Types 6524 and 6525 are suitable for individual mounting or block mounting and are used to control pneumatic actuators primarily in valve blocks or valve islands. They allow switching of high pressures with low power consumption and short switching times.

2x3/2-way variant

In this variant, type 6524 contains two independently operating 3/2-way valves. This makes the valve block extremely compact.

Channel-by-channel safety-related shut-off

Optionally, the valves of types 6524 and 6525 can be equipped with a 2nd connection (pressed-on cable). Safety-related shut-off is therefore possible for each channel individually. The valve variants are without manual override.

Bürkert has tested the function with a cable length of up to 2 m and the switching contact in the same control cabinet with regard to EMC conformity and voltage drop. The standard local requirements must be observed when wiring.

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20.1.1 Fluidic connection single valves

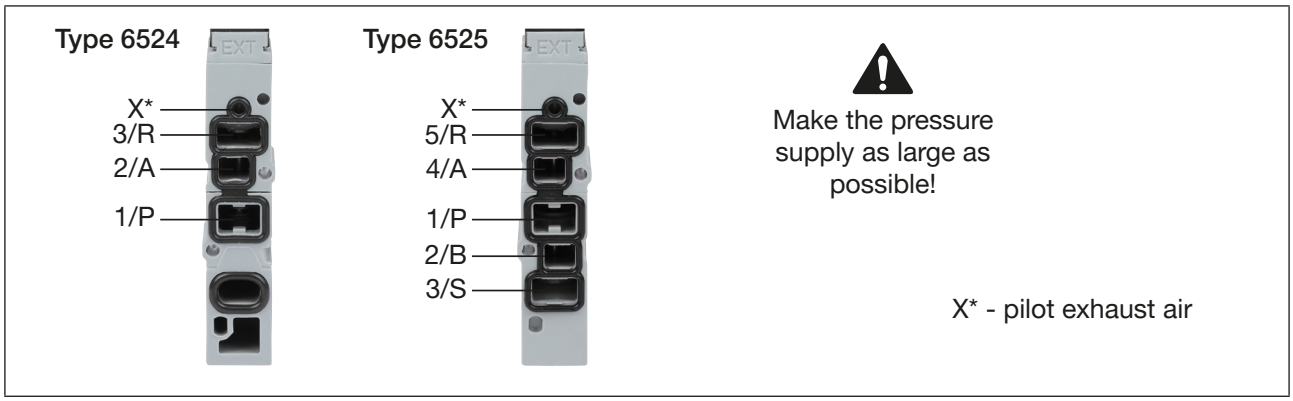

Fig. 72: Fluid connection single valves type 6524 and type 6525

20.1.2 Fluidic and electrical connection double valves

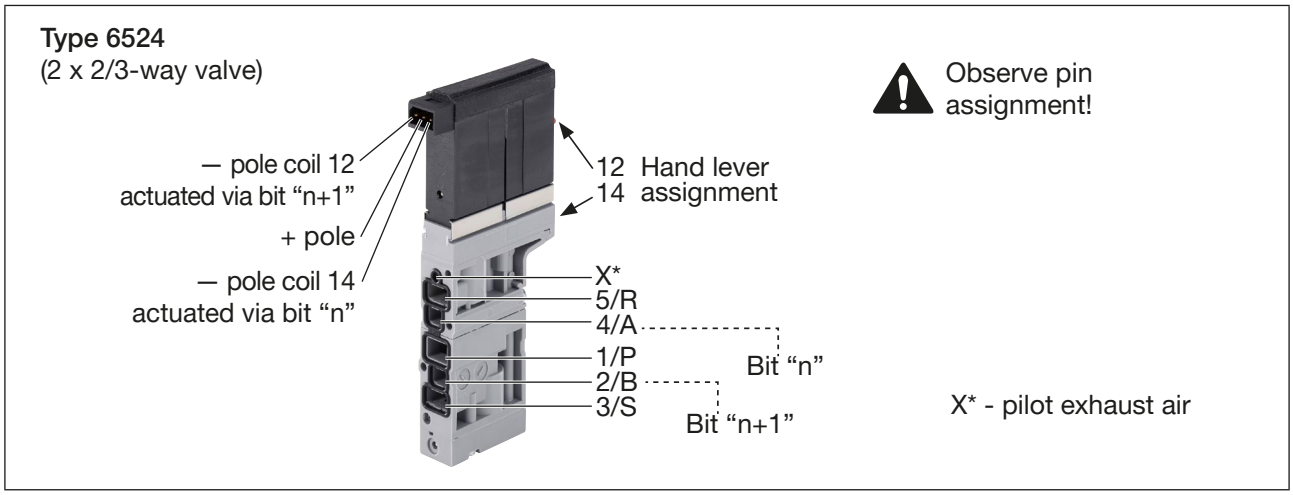

Fig. 73: Fluidic and electrical connection type 6524 2x3/2-way valve

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20.1.3 Manual override

NOTE

Damage to the manual override.

To avoid damage to the manual override, observe the following:

Manual override “A”:
- Press (push function) or turn (lock function).

Manual override “B”:
- Turn only (lock function).

Manual override “C”:
- Press (push function), turn **while pressed** (lock function).

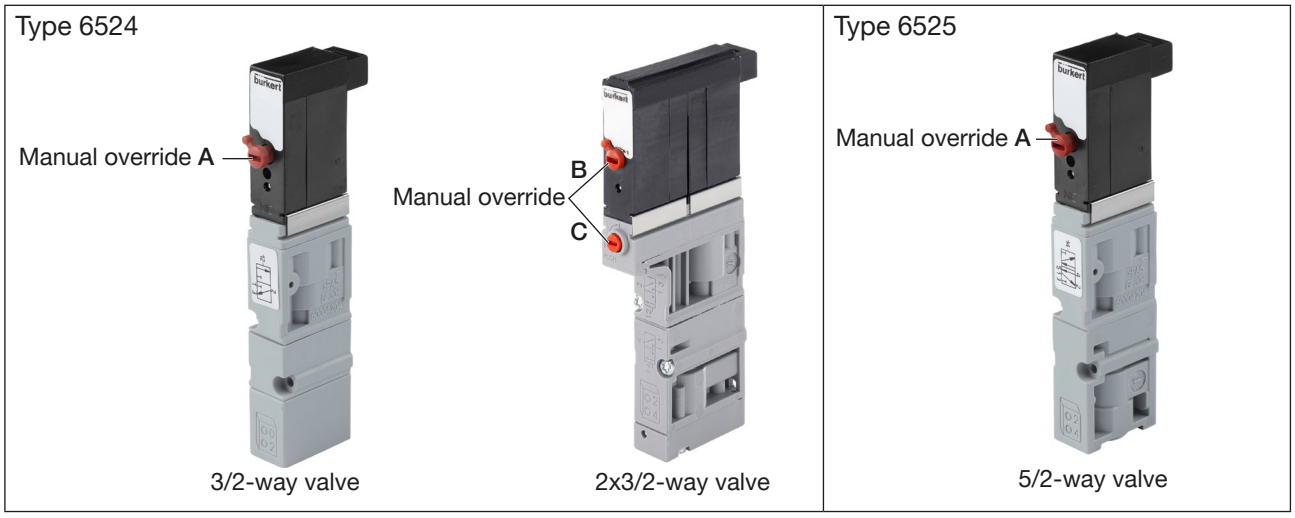

Fig. 74: Valves Type 6524 (3/2-way and 2x3/2-way valve) and Type 6525 (5/2-way valve)

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20.1.4 Exchange valves type 6524 and type 6525

DANGER

Risk of injury due to pressure change.

Actuators can change their position when the pressure changes and lead to injuries and material damage.

▶ Secure the actuators against shifting before working on the device or plant.

Risk of injury due to high pressure with pneumatic base modules without P shutoff.

Suddenly escaping pressure medium can strongly accelerate parts (hoses, small parts ...) and thus cause injuries and material damage.

▶ Switch off the pressure before working on the device or system. Vent or drain the lines.

Risk of injury when the pressure changes in pneumatic base modules with P shutoff.

When the valve is dismantled, only the P channel is shut off. This relieves the pressure present at the working outlets A or B. An actuator connected to it will therefore also be depressurised, which can trigger a movement of the actuator.

▶ Secure the actuators against shifting before working on the device or plant.

Risk of deposits or components coming loose.

When releasing a valve under pressure with P shutoff, deposits or aged components may come loose.

▶ Use suitable safety glasses when replacing valves.

CAUTION

Risk of malfunction of the valve block.

Single valves REV.1 and REV.2 are not compatible.

▶ Replace single valves REV.1 only with single valves REV.1.

▶ Replace single valves REV.2 only with single valves REV.2.

For distinguishing features of the individual valves, see chapter “20.1.5”, page 112

Pneumatic base modules with P shutoff:

For pneumatic base modules equipped with a P shutoff (marked on the module, see below), a valve can also be replaced if supply pressure is available.

When the valve is dismantled, a relatively large amount of air is initially blown out into the open air until the required pressure difference is reached. The automatic shut-off reduces the residual leakage to a minimum and the remaining valves of the valve block can continue to operate.

It is recommended not to remove several valves from the base pneumatic module at the same time.

→ Loosen the fastening screws of the valve with a screwdriver.

→ Pull the valve with flange seal off the valve block.

→ Fit the new valve with the neatly inserted flange seals onto the valve slot.

→ Tighten the fastening screws crosswise, observing the tightening torque (see “Fig. 75”, page 112).

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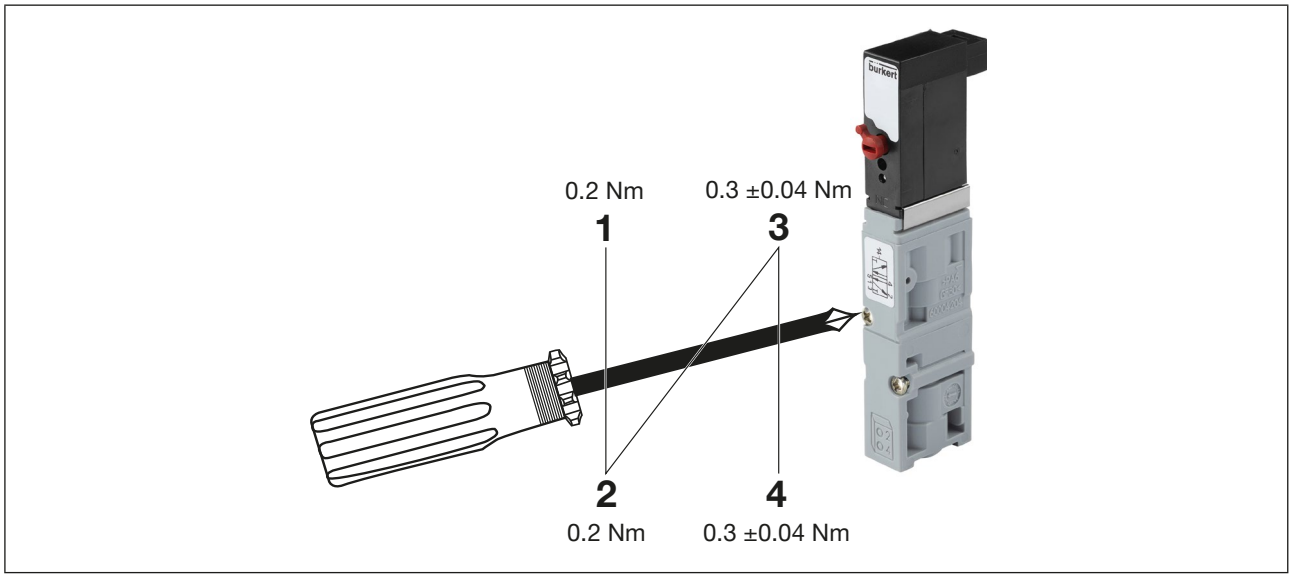

Fig. 75: Tightening the screws for valve replacement type 6524 and type 6525

20.1.5 Valves type 6524 and type 6525: Distinguishing features between REV.1 and REV.2

REV.1:
The single valves of type 6524 3/2-way and type 6525 5/2-way have the same flange pattern as the pneumatic base module.

This single valve flange pattern differs from that of the double valve type 6524 2x3/2-way.

REV.2:
Compared to the REV.1, the flange patterns of the valves have been standardised towards the pneumatic base modules. The single valves 3/2-way and 5/2-way as well as the double valves 2x3/2-way now have the same/unified pneumatic flange pattern.

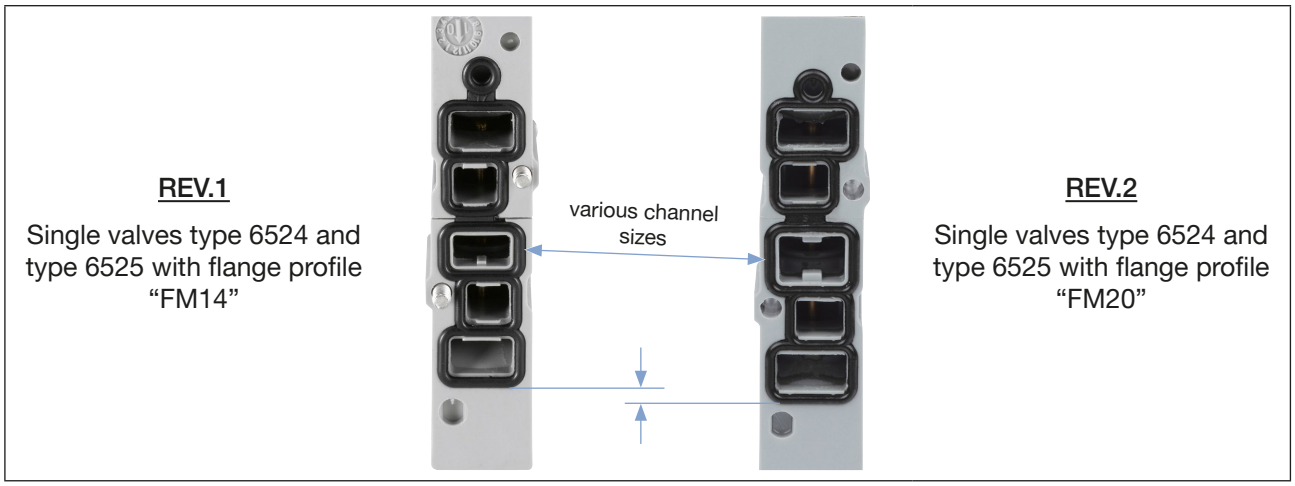

Fig. 76: Variations in flange profiles of single valves type 6524 and type 6525

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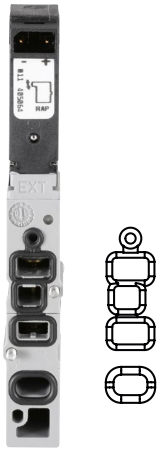
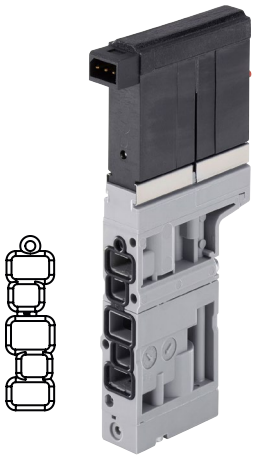
REV.1		REV.2		REV.1 and REV.2
				
Type 6524 with flange pattern FM14	Type 6525 with flange pattern FM14	Type 6524 with flange pattern FM20	Type 6525 with flange pattern FM20	Type 6524 double valve with flange pattern FM20

Fig. 77: The pneumatic valves of the REV.1 and REV.2 can be visually differentiated using the fluidic flange images.

20.2 Valves type 0460 for valve islands width per valve 11 mm

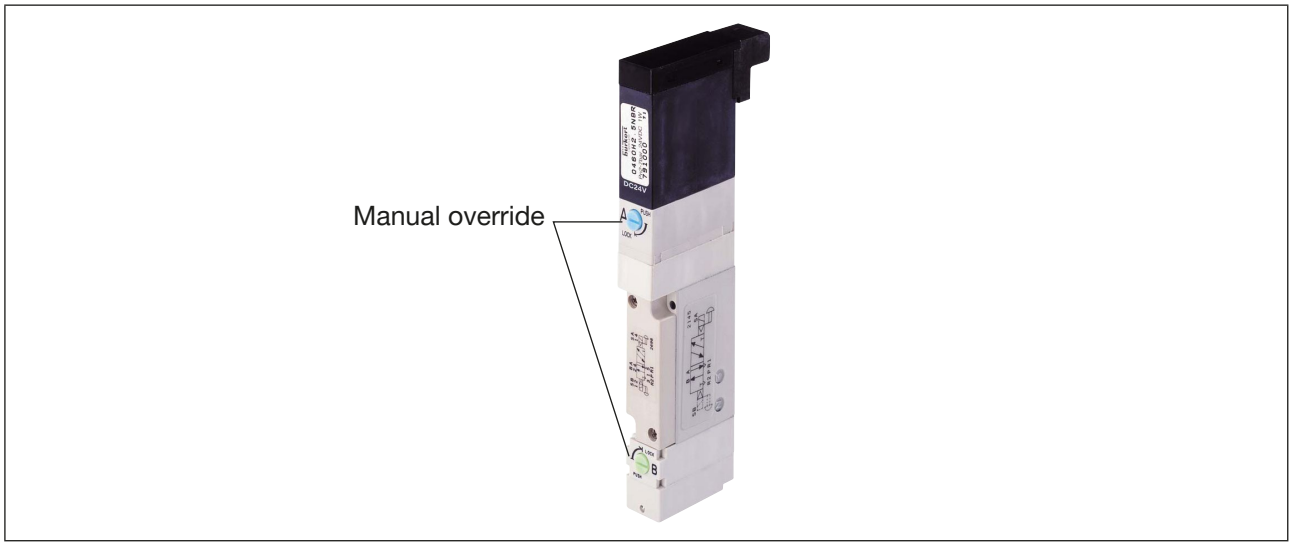


Fig. 78: Valve type 0460, width per valve 11 mm

Valve type 0460 consists of 2 pilot solenoid valves and a pneumatic slide valve. The principle allows the switching of high pressures together with low power consumption and fast switching times. The valves offer the functions 5/2-way impulse and 5/3-way and are equipped with manual overrides as standard.

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20.3 Valves type 6526 and type 6527 for valve islands width per valve 16 mm

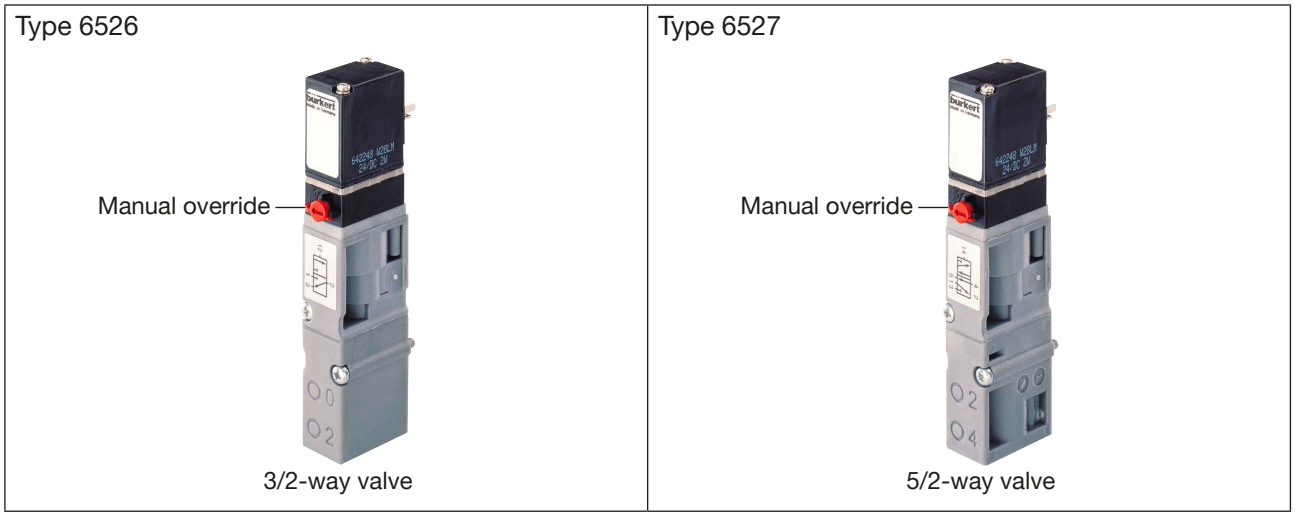

Fig. 79: Valves type 6526 (3/2-way valve) and type 6527 (5/2-way valve)

Type 6526 is a 3/2-way valve, type 6527 is a 5/2-way valve. The valves consist of a flipper solenoid valve as a pilot control and a pneumatic seat valve as an amplifier. They are monostable and equipped with manual override as standard.

Types 6526 and 6527 are suitable for individual mounting or block mounting and are used to control pneumatic actuators primarily in valve blocks or valve islands. They allow switching of high pressures with low power consumption and short switching times.

20.3.1 Fluidic connection

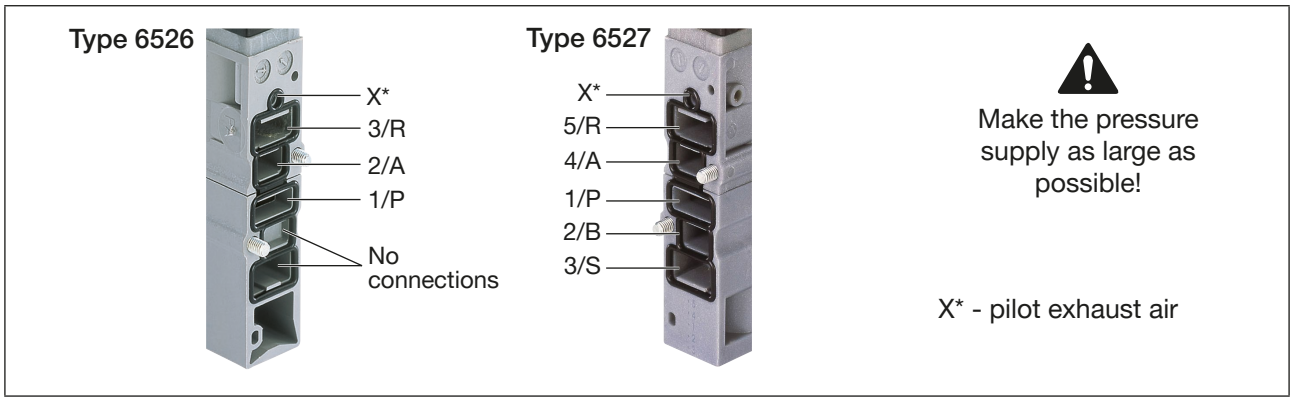

Fig. 80: Fluid port type 6524 and type 6525

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20.3.2 Exchange valves type 6526 and type 6527

DANGER

Risk of injury due to pressure change.

Actuators can change their position when the pressure changes and lead to injuries and material damage.

► Secure the actuators against shifting before working on the device or plant.

Risk of injury from high pressure

Suddenly escaping pressure medium can strongly accelerate parts (hoses, small parts ...) and thus cause injuries and material damage.

► Switch off the pressure before working on the device or system. Vent or drain the lines.

Risk of deposits or components coming loose.

When loosening a valve under pressure, deposits or aged components may come loose.

► Use suitable safety glasses when replacing valves.

→ Loosen the fastening screws of the valve with a screwdriver.

→ Pull the valve with flange seal off the valve block.

→ Fit the new valve with the neatly inserted flange seals onto the valve slot.

→ Tighten the fastening screws crosswise, observing the tightening torque (see “Fig. 81”).

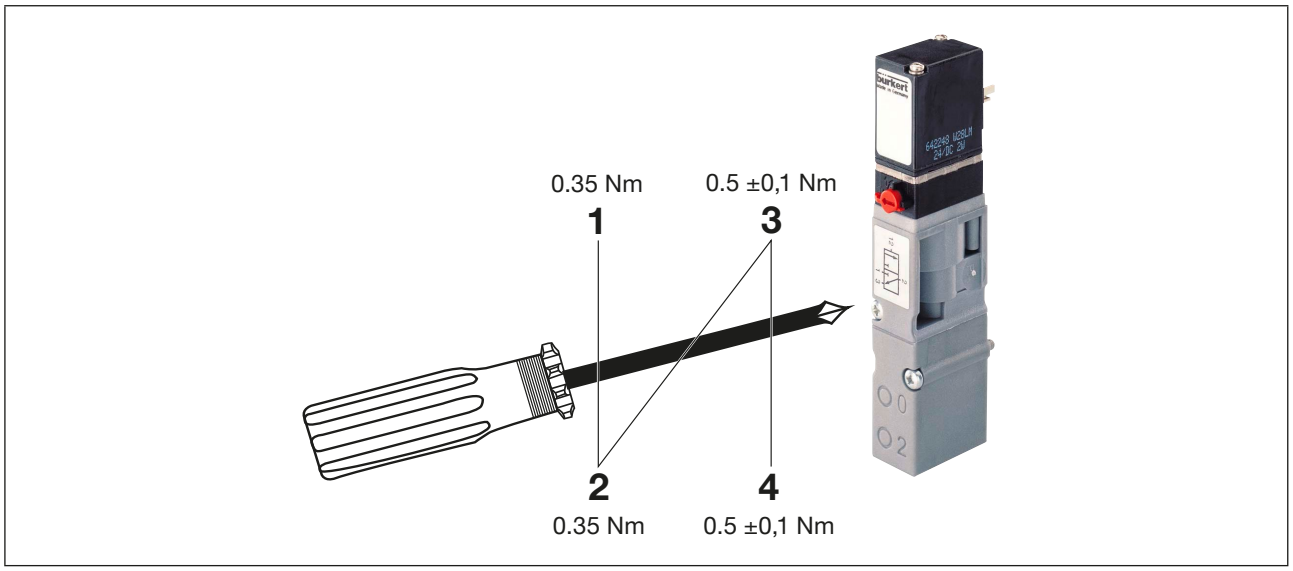

Fig. 81: Tightening the screws when replacing valves type 6526 and type 6527

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21 INSTALLATION AND COMMISSIONING OF THE VALVE ISLAND IN THE CONTROL CABINET

21.1 Safety instructions

DANGER

Risk of explosion.

For systems in the explosion hazardous area, which are installed in a control cabinet, ensure the following:

- ▶ The control cabinet must be approved for use in explosion-proof areas.
- ▶ The control cabinet must be dimensioned in such a way that the resulting heat loss can be discharged to the outside using suitable means.
- ▶ The internal temperature of the control cabinet must not exceed the maximum permitted ambient temperature for the device.

Risk of injury from electric shock.

- ▶ Switch off the power supply before working on the device or system.
- ▶ Secure against reactivation.

WARNING

Risk of injury due to improper installation.

- ▶ Only trained specialist personnel may carry out assembly and disassembly work.
- ▶ Only carry out assembly work using suitable tools.

CAUTION

Risk of injury due to falling heavy equipment.

During transportation or installation work, heavy equipment may fall and cause injuries.

- ▶ Heavy equipment must only be transported, installed and removed with the help of a second person and using suitable aids.

The valve block is not firmly connected to the standard rail before tightening the fastening screws.

- ▶ Make sure that the valve block cannot fall during the entire installation.

Risk of injury due to sharp edges.

Sharp edges can cause cuts.

- ▶ Wear suitable protective gloves.

Valve island type 8640 is supplied as a fully assembled device. Modifications are only permitted to be carried out by Bürkert.

The valves are excluded from this and may be exchanged by the user for valves of the same version.

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21.2 Removing the transport lock from the valve block

The valve block is mounted on a standard rail for transport safety. It must be removed from the standard rail for installation in the control cabinet.

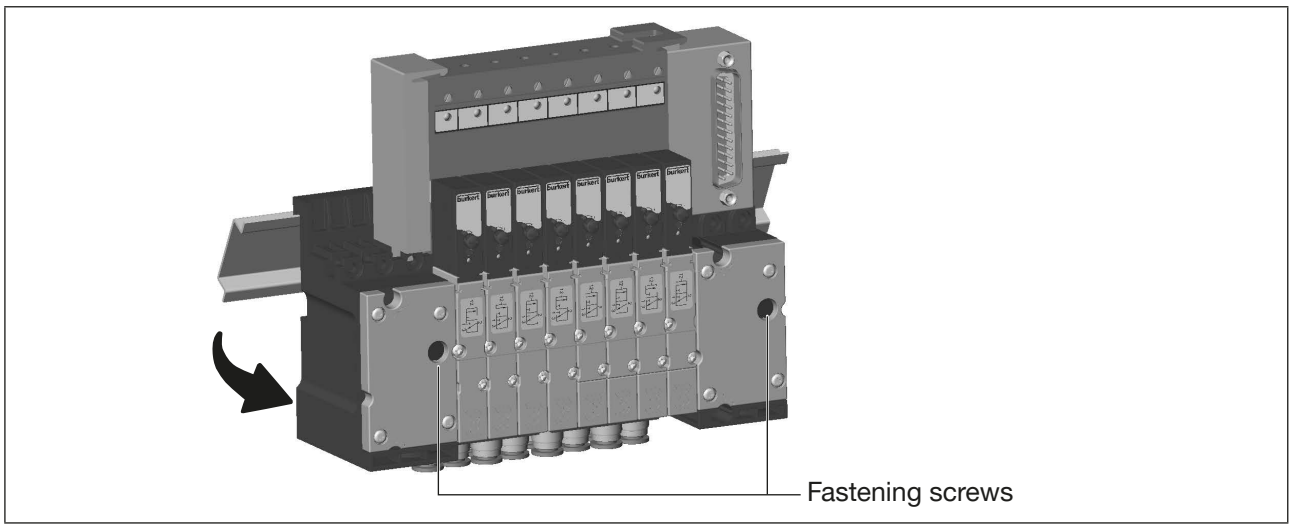

Fig. 82: Removing the valve block from the standard rail

→ Carefully turn the fastening screws **anticlockwise** until they stop.

→ Tilt the valve block slightly upwards and lift it off the standard rail.

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21.3 Installation on standard rail

CAUTION

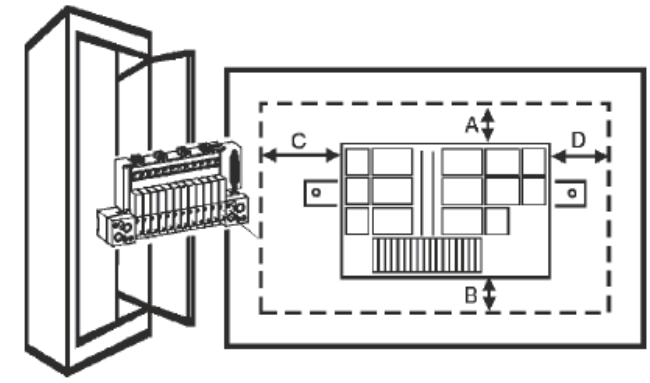
- ► To ensure the best possible EMC protection, ground the standard rail with low impedance.
- ► Before mounting in the control cabinet, check whether the standard rail is firmly anchored in the control cabinet.

The valve block must be freely accessible from above. When installing the standard rail in the control cabinet, take into account that the valve block requires a **minimum distance of 3 cm from the upper edge of the control cabinet** (“Fig. 12).

The minimum distance is required for

— installation and removal of the device on the standard rail,

— avoiding heat build-up due to the waste heat from the device.



Recommended distance when installing in the control cabinet:

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

Fig. 83: Installation of the valve block in a control cabinet

CAUTION

Risk of injury due to falling heavy equipment.

The valve block is not firmly connected to the standard rail before tightening the fastening screws.

- ► Make sure that the valve block cannot fall during the entire installation.

→ Check whether all fastening screws of the valve block (see “Fig. 82”) are at the stop when turning anticlockwise.

→ Place the valve block slightly tilted upwards on the standard rail in the desired position and swing it onto the standard rail. **Hold the valve block when the installation position is not horizontal!**

→ Tighten the fastening screws clockwise (tightening torque approx. 1.8 Nm).

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21.4 Mounting with AirLINE Quick (only valve islands, width per valve 11 mm)

DANGER

Risk of explosion in the Ex area.

- When used in Ex areas, observe the information in the "*Operating instructions for the Ex areas type MP18*". These operating instructions are included in the scope of delivery of the Ex variant of the AirLINE Quick control cabinet base adaption.

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 “21.4.1 Dimensions of the flange images for AirLINE Quick”.

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

Recommended distance in the control cabinet to the valve island:

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.

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

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

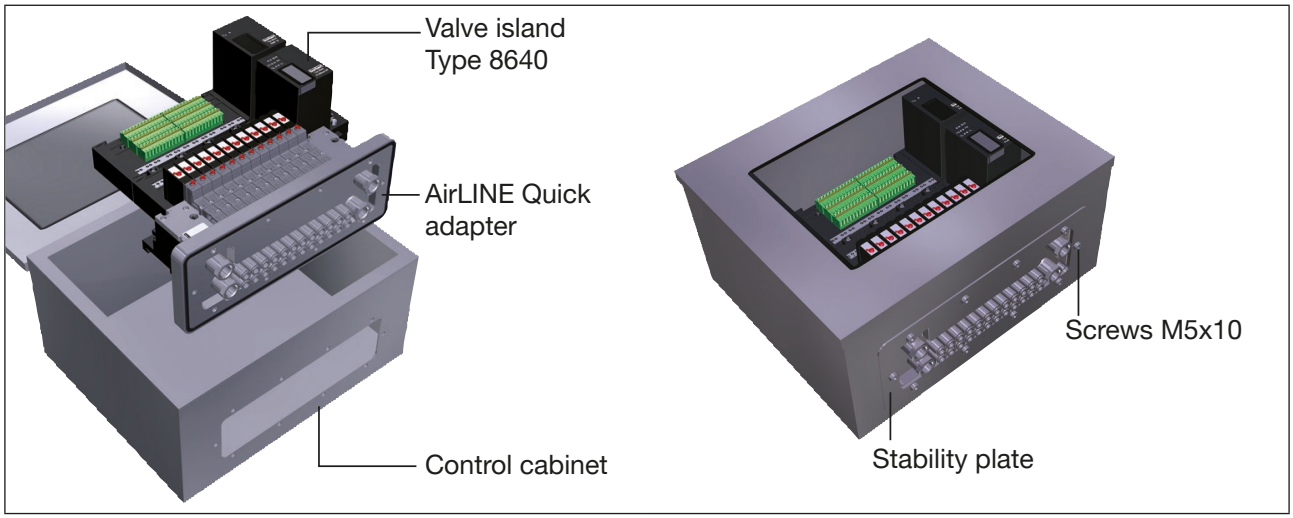

Fig. 84: Placing the valve island in the control cabinet and attaching the stability plate

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21.4.1 Dimensions of the flange images for AirLINE Quick

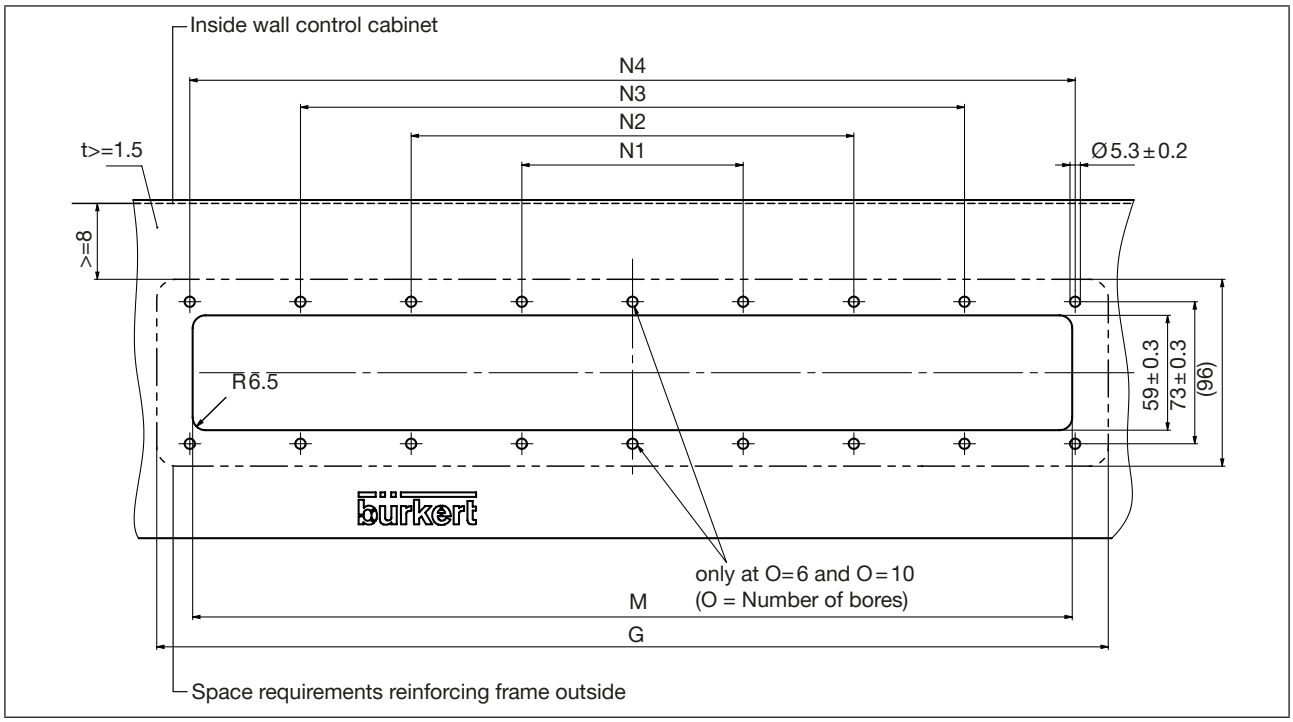

Fig. 85: Dimensions of the flange images for AirLINE Quick – for dimensions see "Table 4".

	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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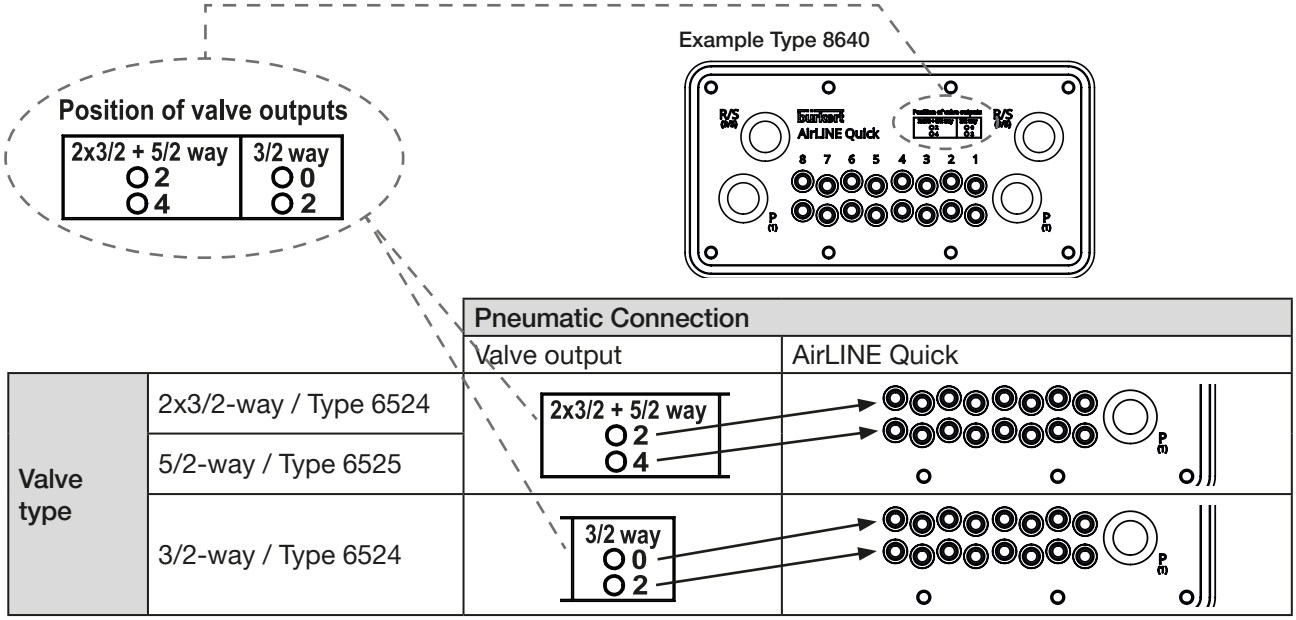
21.4.2 Assignment of the pneumatic connections for AirLINE Quick



21.5 Connection assignment

21.5.1 Pneumatic installation of the connection modules

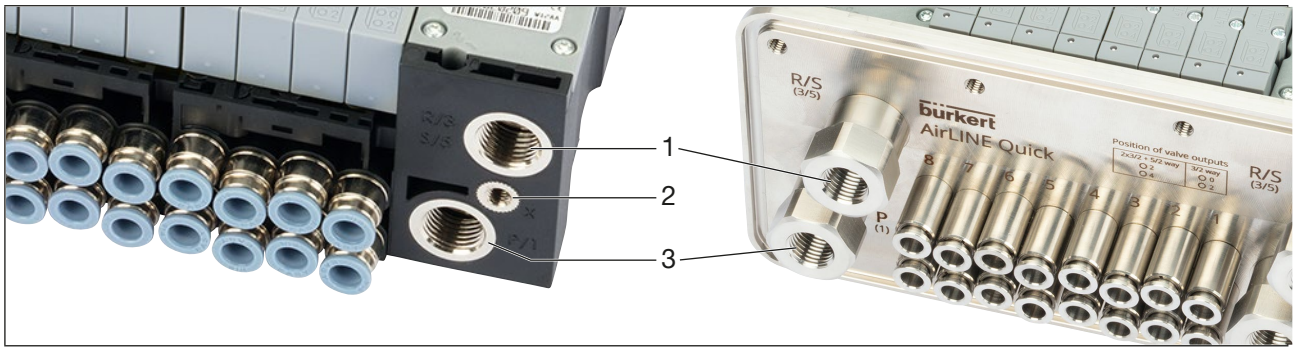


Fig. 86: Pneumatic installation of connection modules

Position	Identification	Function	Connection type
1	R/3 S/5	Exhaust air	G1/4
2	X	Activation EXT: auxiliary control air INT: pilot control exhaust air	M5
3	P/1	Pressure supply	G1/4

Observe chapter “21.6 Tightening torques for port connections”, page 125 when screwing into the port connections.

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21.5.2 Pneumatic installation of the pneumatic base modules

NOTE

For 3/2-way valves, the upper connections remain free.

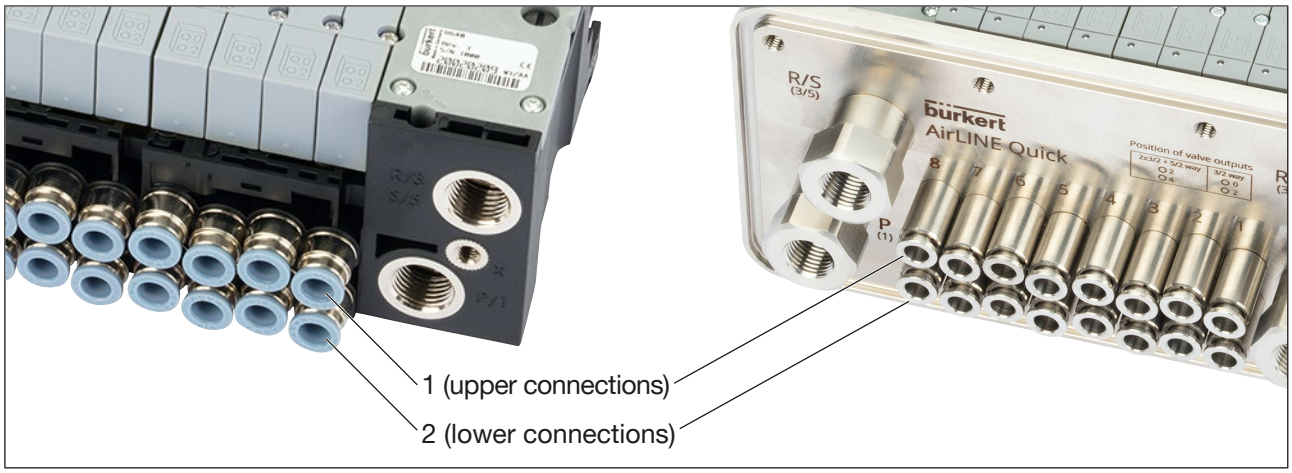
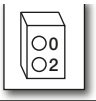


Fig. 87: Pneumatic installation of pneumatic base modules

Position	3/2-way valve Type 6524	5/2-way valve Type 6525	2x3/2-way valve Type 6524	Valve Type 0460
1 (upper connections)	Not used	2	2	2
2 (lower connections)	2	4	4	4

Table 5: Configuration of the working connections of the pneumatic base modules

Configuration of the working connections is displayed on the housing for Type 6524 and Type 6525 valves.

3/2-way valve Type 6524	5/2-way valve Type 6525	2x3/2-way valve Type 6524
		

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21.5.3 Allocation of the pneumatic working ports to the control electronics

Pin assignment for 3/2-way valve (Type 6524/6526) and 5/2-way valve (Type 6525/6527)

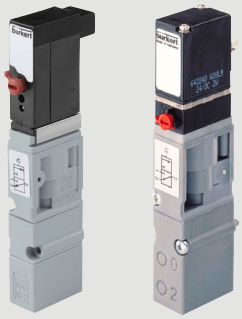
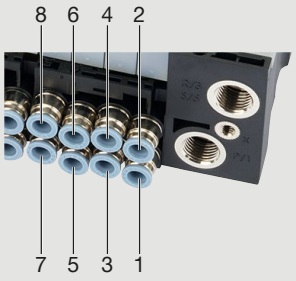
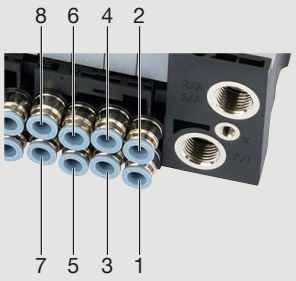
Valve position		VP n	VP 4	VP 3	VP 2	VP 1
Collective port	Port No. at collective port module	n	4	3	2	1
Multi-pin	Pin No.	Pin num.	Pin 4	Pin 3	Pin 2	Pin 1
Fieldbus	Bit No.	Bit ...	Bit 3	Bit 2	Bit 1	Bit 0
Pin assignment for single valve Type 6524/Type 6526 	Working port 	...	7	5	3	1
Identification of ports on island 3/2-way (illustration on valve) 6524/6526		○0 Upper port not used ○2 Lower port pressurised				
Pin assignment for single valve Type 6525/Type 6527 	Working port 	...	8 7	6 5	4 3	2 1
Identification of ports on island 5/2-way (illustration on valve) 6525/6527		○2 Upper port pressurised ○4 Lower port ventilation				

Table 6: Allocation of the pneumatic working ports to the control electronics of single valve

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Pin assignment for 2 x 3/2-way valve (Type 6524)

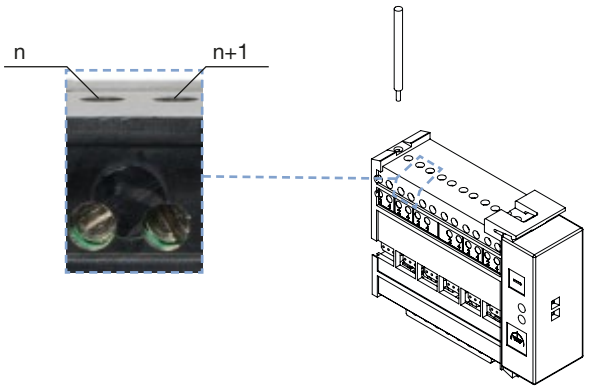
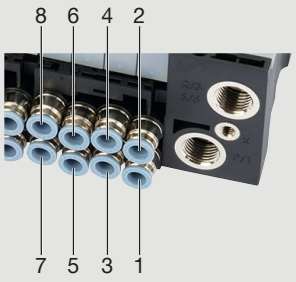
	Valve position	VP n	VP 4	VP 3	VP 2	VP 1
Collective port	Port No. at collective port module	n...n+1	7...8	5...6	3...4	1...2
	Port at collective port module					
	Identification of switching state					
Multi-pin	Pin No.	Pin n+1 Pin num.	Pin 8 Pin 7	Pin 6 Pin 5	Pin 3 Pin 4	Pin 2 Pin 1
Fieldbus	Bit No.	Bit ...	Bit 7 Bit 6	Bit 5 Bit 4	Bit 3 Bit 2	Bit 1 Bit 0
Pin assignment for 2 x 3/2-way valve Type 6524 	Working port 	...	8 7	6 5	4 3	2 1
Identification of ports on island 2 x 3/2-way (illustration on valve) 6524		○2 ○4 Depending on the switching state of the valve, the upper and/or lower port is pressurised				

Table 7: Allocation of the pneumatic working ports to the control electronics of the double valve

21.6 Tightening torques for port connections

Observe the following tightening torques when screwing into the port connections. The specified tightening torque may vary depending on the sealing system.

Port size	Marking/function	Recommended tightening torque [Nm]	Maximum tightening torque [Nm]
G3/8	P, R/S connection (connection modules 16 mm)	6…9	40
G1/4	P, R/S connection (connection modules 11 mm)	4…7	20
G1/8	Auxiliary pilot air (connection modules 16 mm)	3…6	10
M5	Auxiliary pilot air (connection modules 11 mm)	1…1,2	3
M7 (D6, D1/4)	AirLINE Quick push-in connector	1.75…2.25	4

For an illustration of the connections, see “Fig. 86”, page 121 and “Fig. 87”, page 122.

21.7 Recommended action for push-in connectors

Our push-in connectors meet the requirements specified in the ISO 14743:2020 standard. However, if you encounter leakage or retention problems when installing pneumatic hoses in the push-in connectors, you can take the following measures:

Use suitable materials

→ Ensure that the appropriate combination of hose material (polyamide or polyurethane) and push-in connector is used, as different materials require different holding forces.

Check the hose size

→ Ensure that the outer diameter of the hose matches the specification of the push-in connector. Hoses that are too small or too large may not sit correctly in the push-in connector.

According to ISO 14743:2020, depending on the outer diameter (OD) of the hose, the tolerances must not exceed the following values:

Material	Hose OD [mm]	Permitted deviation OD [mm]
Polyamide (PA)	3…10	±0.08
	12…16	±0.1
Polyurethane (PU)	3…8	±0.1
	10…16	±0.15

Check the hose for damage

→ Check the hose for visible damage such as cracks, kinks or wear. Such defects can prevent the hose from seating properly in the push-in connector.

Cut the hose correctly

→ Cut the hose straight. Cutting it diagonally adversely affects the holding force. If the hose is not seated evenly in the push-in connector, the holding force is reduced and the seal between the push-in connector and hose is no longer sufficient. Furthermore, the pressure will be distributed unevenly in the system, which can cause the hose to slip or be pulled out of the push-in connector under pressure.

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Insert the hose correctly

→ Press the hose into the push-in connector with sufficient force. The hose must be inserted deep enough into the push-in connector so that it is held correctly by the claws.

Check the push-in connector system

→ Ensure that the push-in connector system is designed for the corresponding operating conditions. The push-in connectors must function reliably at pressures from –0.09 MPa (–0.9 bar) to 1.6 MPa (16 bar) and be designed for temperatures from –20 °C to +80 °C. Even if the operating conditions for push-in connectors are specified in accordance with ISO 14743:2020, the specific operating conditions of the product used (e.g. those of a valve island) must be taken into account.

Check the holding capacity of the push-in connector

→ When installing the hose, make sure that it is firmly seated in the push-in connector and can reliably withstand the specified minimum tensile forces to ensure a secure connection. It is recommended not to increase the load beyond what is necessary, as excessive tensile force can impair the function and safety of the connection.

For orientation: depending on body weight and fitness, an average person can apply forces of around 300 to 500 N when pulling.

Hose OD, D, mm	3	4	6	8	10	12	14	16
Hose OD, D, in (mm)	1/8 (3.17)	5/32 (4)	1/4 (6.35)	5/16 (8)	3/8 (9.52)	1/2 (12.7)	–	5/8 (16)
Minimum tensile force for polyamide hose (PA), N	60	70	120	170	250	300	300	350
Minimum tensile force for polyure-thane hose (PU), N	25	50	100	150	200	200	250	300

Table 8: Minimum tensile force for the tensile test (DIN ISO 14743:2020)

If the problem persists despite the measures taken, it is possible to use support sleeves (ID 20099400). These sleeves help to increase the stability and tightness of hoses in push-in connectors. This is particularly important when softer or more flexible hoses such as polyurethane (PU) ones are used.

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22 ACCESSORIES, REPLACEMENT PARTS

CAUTION

Risk of injury and/or damage due to incorrect parts.

Incorrect accessories and unsuitable spare parts may cause injuries and damage the device and the area around it

► Use only original accessories and original spare parts from Bürkert.

22.1 Accessories, spare parts for width per valve 11 mm

Different flange patterns of the single valve types 6524/6525 REV.1 and 6524/6525 REV.2!

The single valves (3/2-way valve Type 6524 and 5/2-way valve Type 6525) were optimised. The channel cross-sections and thus the flange pattern of these valves were revised, among other things.
Valves REV.1 and valves REV.2 are therefore different.

When replacing single valves, observe the following:

- The different design of the mechanical interface eliminates the accidental installation of incompatible valves.
- It is not possible to switch between REV.1 and REV.2 single valves (type 6524/6525).
- **With regard to spare parts, it must be ensured that the matching version of the valve is used.**

This does not apply to the double valve (2x 3/2-way valve type 6524).

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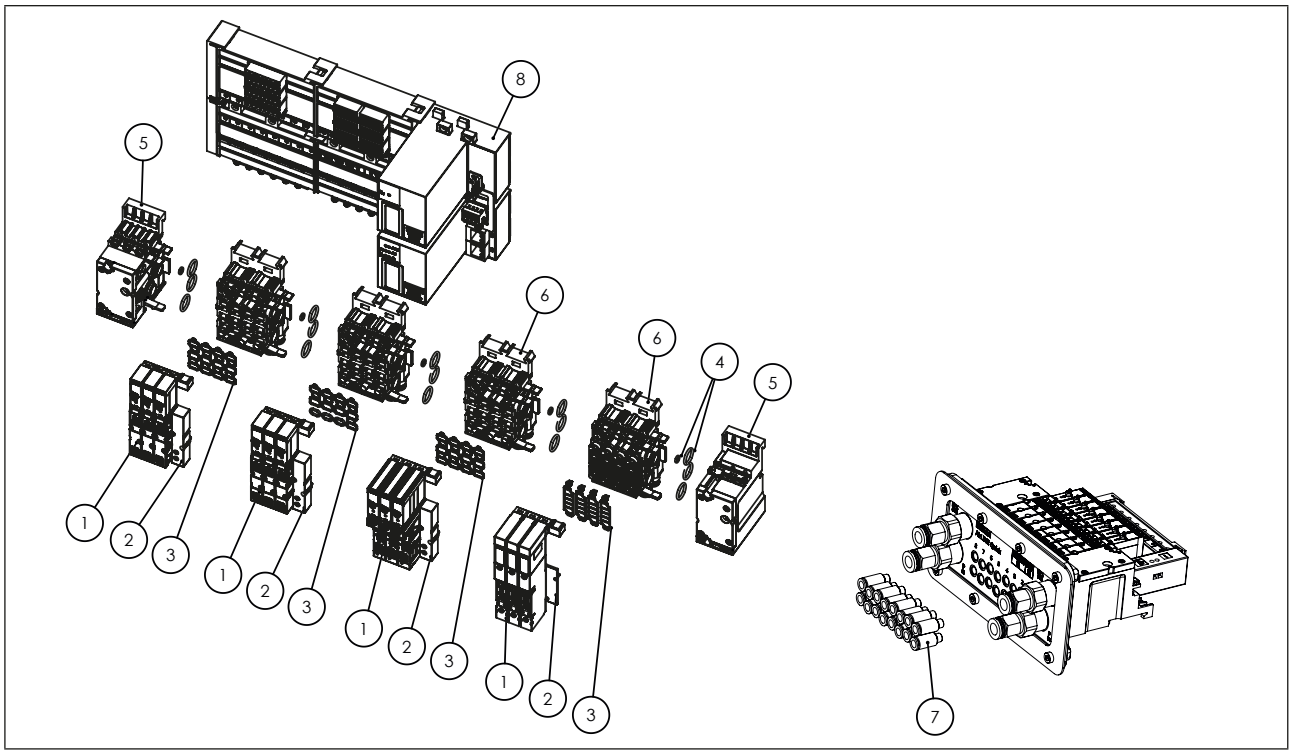

Item	Designation	Contents	Order no.
1	Type 6524, 6525, 0460 solenoid valves (REV.1/REV.2 see Chapter “5.5 Information on compatibility and revision status”, page 15)		see data sheet
2	Cover plate for solenoid valves type 6524/6525 (REV.1)	1 cover plate	650373
	Cover plate for solenoid valves type 6524/6525 (REV.2)		661092
	Cover plate for solenoid valves type 6524 2x3/2-way		661092
3	Sets of profile seals for solenoid valves		
	Type 6524 2x3/2-way	12 seals	2001 6305
	Type 6525 REV.1	12 seals	2002 4334
	Type 6525 REV.2	12 seals	2001 6305
	Type 6524 3/2-way REV.1	12 seals	2002 4333
	Type 6524 3/2-way REV.2	12 seals	2002 4336
	Type 0460	12 seals	2002 4330
4	Set seals modules	12 seals	2002 4339
5	Pneumatic connection modules		On request
6	Pneumatic base modules		On request
7	Set of push-in connectors Ø 6mm brass	8 Push-in connectors	2002 4340
7	Set of push-in connectors Ø 6mm VA	8 Push-in connectors	2002 4341
8	Electronic modules		On request

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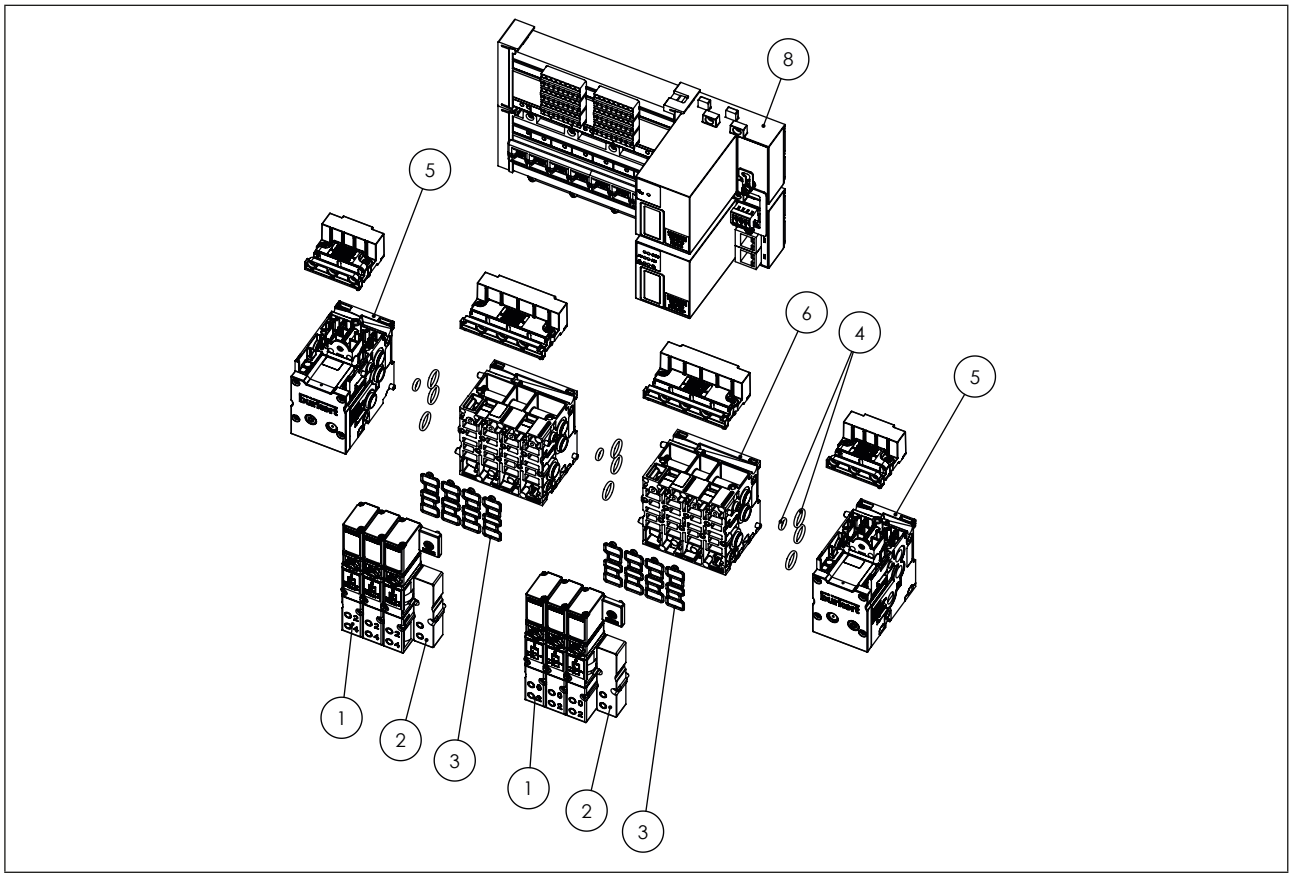
22.2 Accessories, spare parts for 16 mm width per valve 16 mm



Item	Designation	Contents	Order no.
1	Type 6526, 6527 pilot valves		see data sheet
2	Cover plates		see data sheet
3	Sets of profile seals for pilot valves		
	Type 6526/6527	12 seals	2001 6307
4	Set seals modules	12 seals	2001 6310
5	Pneumatic connection modules		On request
6	Pneumatic base modules		On request
8	Electronic modules		On request

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23 PACKAGING, TRANSPORT, STORAGE

WARNING

Risk of injury due to improper behaviour during transport.

- ▶ Only have transport carried out by trained specialists.

During transportation or installation work, heavy equipment may fall and cause injuries.

- ▶ Transport, install and dismantle a heavy device only with the aid of a second person and using suitable equipment.

CAUTION

Damage in transit

Inadequately protected devices may be damaged during transport.

- ▶ Protect the device against moisture and dirt in shock-resistant packaging during transportation.
- ▶ Avoid exceeding or dropping below the permitted storage temperature.
- ▶ Protect the electrical interfaces and pneumatic connections from damage and dirt by placing protective caps on them.

Incorrect storage may damage the device.

- ▶ Store the device in a dry and dust-free location.

Storage temperature –20...+60 °C.

24 ENVIRONMENTALLY FRIENDLY DISPOSAL

- ▶ Follow national regulations regarding disposal and the environment.
- ▶ Collect electrical and electronic devices separately and dispose of them as special waste.

Further information country.burkert.com.

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