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bürkert
FLUID CONTROL SYSTEMS

Type 8750

Flow controller

Quickstart

English

MAN 1000263177 EN Version: BStatus: RL (released | freigegeben) printed: 22.09.2017

We reserve the right to make technical changes without notice.
Technische Änderungen vorbehalten.
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Operating Instructions 1705/00_EU-EN_00810455 / Original DE

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1 QUICKSTART GUIDE

The quickstart guide contains the most important information and notes regarding the use of the device.

Keep the quickstart guide in a location which is easily accessible to every user and make it available to every new owner of the device.

Important Safety Information.

Read Quickstart carefully and thoroughly. Study in particular the chapters entitled *Basic Safety Instructions* and *Authorized Use*.

▸ Quickstart must be read and understood.

A detailed description of the process controller can be found in the operating instructions for Type 8693.

The operating instructions can be found on the Internet at: www.burkert.com

1.1 Definition of terms / Abbreviation

In these instructions, the term “device” always refers to the flow controller Type 8750.

FMR = Flow controller

2 SYMBOLS

The following symbols are used in these instructions.

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 a serious or fatal injury.

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.

Important tips and recommendations.

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

▸ Indicates an instruction to prevent risks.

→ designates a procedure which you must carry out.

3 AUTHORIZED USE

Non-authorized use of the flow controller Type 8750 may be a hazard to people, nearby equipment and the environment.

- The device is designed as a simple system for determining and controlling the volumetric flow rate of gases.
- Do not expose the device to direct sunlight.
- Do not use the device outdoors.
- Use according to the authorized data, operating conditions, and conditions of use specified in the contract documents and operating instructions. These are described in Chapter "7 Technical data".
- Use the device only in conjunction with third-party devices and components recommended and authorized by Bürkert.
- Correct transportation, storage, and installation, as well as careful use and maintenance are essential for reliable and faultless operation.
- Use the device only as intended.

3.1 Restrictions

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

4 BASIC SAFETY INSTRUCTIONS

These safety instructions do not make allowance for any

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

Risk of injury from high pressure in the equipment/device.

- Before working on equipment or device, switch off the pressure and deaerate/drain lines.

Risk of electric shock.

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

Risk of burns/risk of fire if used during long-term operation through hot device surface.

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

Risk of injury when opening the actuator.

The actuator contains a tensioned spring. If the actuator is opened, there is a risk of injury from the spring jumping out.

- The actuator must not be opened.

Risk of injury from moving parts in the device.

- Do not reach into openings.

General hazardous situations.

- Devices without a separate Ex type label may not be used in a potentially explosive area.
- Only trained technicians may perform installation and maintenance work.
- Ensure that the system cannot be activated unintentionally.
- After an interruption in the power supply or pneumatic supply, ensure that the process is restarted in a defined or controlled manner.
- The device may be operated only when in perfect condition and in consideration of the operating instructions.
- The general rules of technology apply to application planning and operation of the device.
- Do not supply the pilot air port with aggressive or flammable media.
- Do not supply the pilot air port with liquids.
- Do not physically stress the body (e.g. by placing objects on it or standing on it).
- Do not make any internal or external changes on the device.

NOTE!

Electrostatic sensitive components/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, they will be destroyed immediately or will fail after start-up.

- Observe the requirements specified in EN 61340-5-1 to minimize/avoid the possibility of damage caused by a sudden electrostatic discharge.
- Do not touch electronic components while the supply voltage is switched on.

5 GENERAL INFORMATION

5.1 Contact address

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@de.buerkert.com

International

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

And also on the Internet at:

www.burkert.com

5.2 Warranty

The warranty is only valid if the flow controller Type 8750 is used as intended in accordance with the specified application conditions.

5.3 Information on the Internet

Further information on Types 2301 (valve) and 8693 (process controller) can be found on the Internet at: www.burkert.com

6 SYSTEM DESCRIPTION

6.1 General description

The fluid flow rate controller Type 8750 is a complete system for measuring and controlling the volume flow of gases according to the differential pressure principle. The system consists of an ELEMENT control valve Type 2301 with the process controller Type 8693 as well as two pressure sensors of Type 8323. It is supplied as a fully assembled system including special housing.

Options:

- Digital input
- Analog feedback
- 2 digital outputs
- Bus communication (PROFIBUS DP or DeviceNet)

Other:

- The flow controller is supplied with a factory setting.
- The device is operated via 4 function keys and a display.

The pressure drop is measured by the control valve as “measuring orifice”. The measured pressure difference can be used to calculate the nominal volume flow of the medium for a given density and temperature. For this purpose, the flow characteristic of the control valve is saved in the process controller.

6.2 Structure

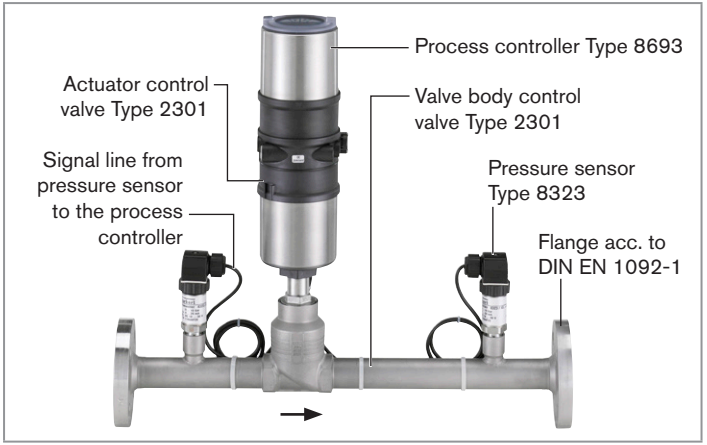


Fig. 1: Structure

6.2.1 Action diagram of the FMR

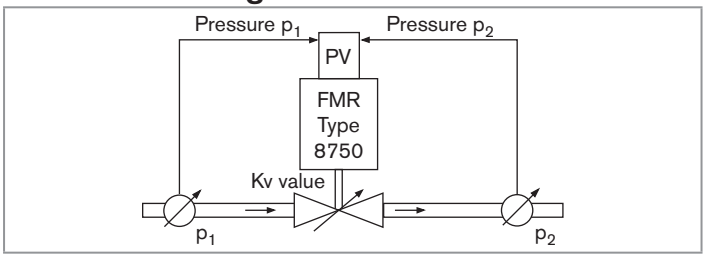


Fig. 2: Action diagram

6.2.2 Influence of the process variables on the flow rate

Pressure drop	Flow rate of gases
subcritical $p_2 > \frac{p_1}{2}$	$Q_N = 514 \cdot k_V \sqrt{\frac{p_1 \cdot \Delta p}{T_1 \cdot p_N}}$
supercritical $p_2 < \frac{p_1}{2}$	$Q_N = 257 \cdot k_V \frac{p_1}{\sqrt{T_1 \cdot p_N}}$

k_V	Flow-rate coefficient	$[m^3/h]$ [1]
Q_N	Standard flow rate	$[m_N^3/h]$ [2]
p_1	Input pressure	[bar] [3]
p_2	Output pressure	[bar] [3]
Δp	Differential pressure $p_1 - p_2$	[bar]
p	Density	$[kg/m^3]$
p_N	Standard density	$[kg/m^3]$
T_1	Medium temperature	[(273+t)K]

[1] measured for water, Δp = 1 bar, above the device

[2] Standard conditions at 1,013 bar[3] and 0 °C (273 K)

[3] Absolute pressure

6.2.3 Electrical interfaces

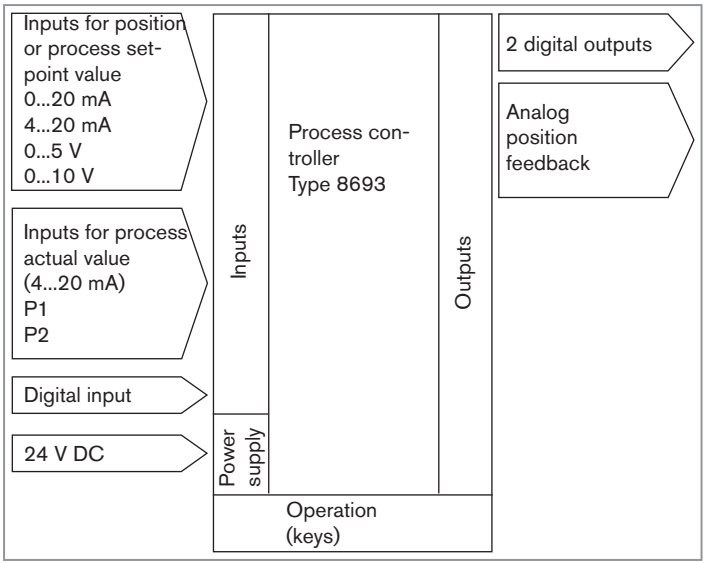


Fig. 3: Interfaces

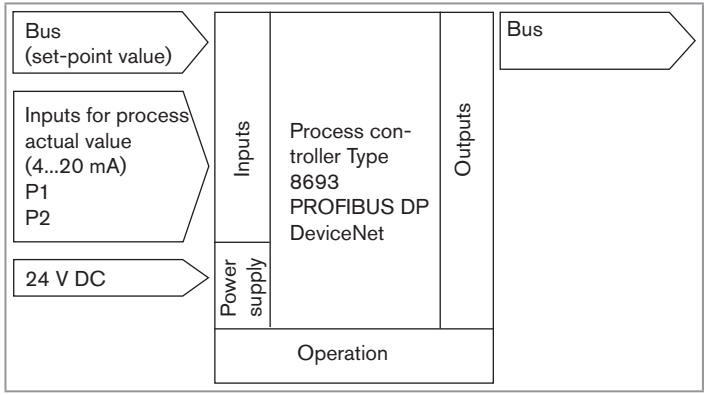


Fig. 4: Interfaces - Bus

7 TECHNICAL DATA

7.1 Conformity

Type 8750 conforms to the EC directives according to the EC Declaration of Conformity.

7.2 Standards

The applied standards which are used to demonstrate compliance with the EC Directives are listed in the EC type test certificate and/or the EC Declaration of Conformity.

7.3 Operating conditions

Ambient temperature 0...+55 °C

Degree of protection: IP65 / IP67 according to EN 60529
(only if cables, plugs and sockets have been connected correctly and in compliance with the exhaust air concept in Chapter "9.3 Pneumatic connection of the process controller")

7.4 Mechanical data

Materials

Valve body	Stainless steel 1.4301 and 1.4404/316L
Actuator	PPS, stainless steel
Process controller	PPS, PC, stainless steel
Seals process controller	EPDM

Other parts which come into contact with media

Graphite seal	Graphite
Packing gland	PTFE rings with silicone grease
Pressure sensor, gasket	PTFE
Seat seal	EPDM
Control cone	Stainless steel 1.4571
Spindle	Stainless steel 1.4404
Dowel pin	Stainless steel A2

Inlet and outlet sections acc. to EN ISO 5167-1

Inlet sections

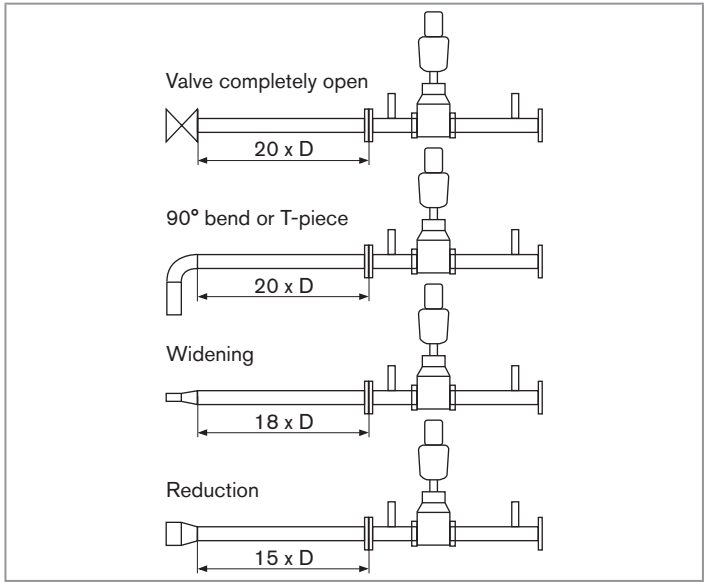


Fig. 5: Inlet sections

Outlet sections already integrated in the system (6 x DN)

Dimensions

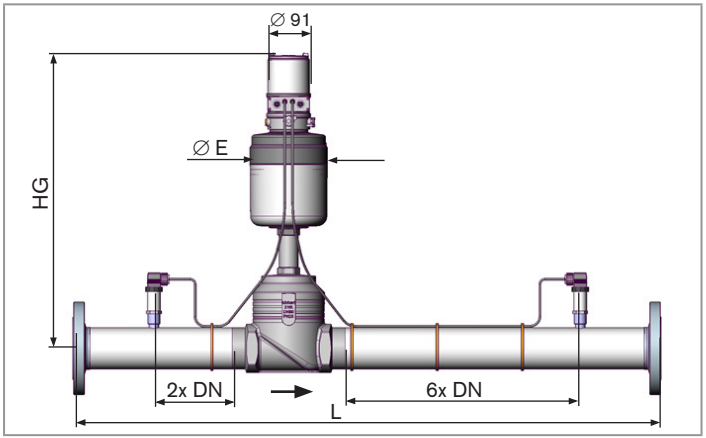


Fig. 6: Dimensions

DN pipe connection [mm]	Actuator size ∅ [mm]	L [mm]	HG [mm]	∅ E [mm]
15	70	330	383	91
25	70	500	392	91
40	90	700	478	120
50	130	800	536	159
65	130	1000	590	159
80	130	1200	598	159
100	130	1400	608	159

Tab. 1: Dimensions

7.5 Type label (Example)

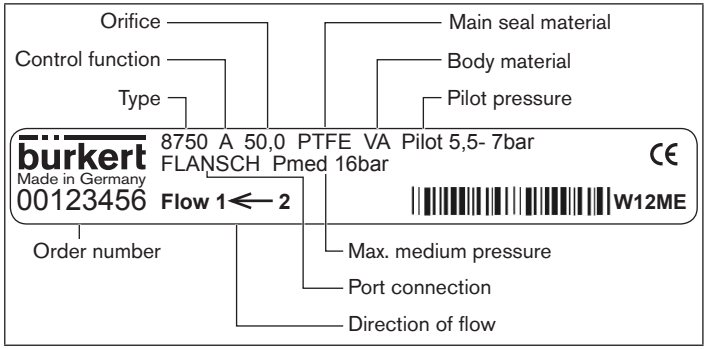


Fig. 7: Type label (Example)

7.6 Fluidic data

Control medium	Air, neutral gases Quality classes in accordance with ISO 8573-1 (5 µm filter recommended)	
Dust content	Quality class 7:	max. particle size 40 µm, max. particle density 10 mg/m³
Water content	Quality class 3:	max. pressure dew point –20 °C or min. 10 °C below the lowest operating temperature
Oil content	Quality class X:	max. 25 mg/m³

Pressure range control medium	5,5...7 bar (DN15...DN50 port connection) 5...6 bar (DN65...DN100 port connection)
Intrinsic air consumption	0 l/min
Connections	threaded connection G1/8
Flow media	air and gases
Ambient temperature	0...+55 °C
Temperature range media	0...+80 °C
Pressure range media	0...16 bar
Pressure measurement range of sensor	0...0,1 bar (overpressure) 0...0,16 bar (overpressure) 0...0,25 bar (overpressure) 0...1 bar (overpressure) 0...2,5 bar (overpressure) 0...6 bar (overpressure) 0...10 bar (overpressure) [standard] 0...16 bar (overpressure) 0...1 bar (abs)
Measurement section	acc. to DIN EN 60534-2-3
Orifice	DN15...DN100 (port connection)
Sensor connections	threaded connection G1/2

7.7 Electrical data

Connections

Operating voltage	circular plug-in connector M12 x 1, 4-pole
Internal system signals	2x circular plug-in connectors M8x1, 4-pole
Input/output signal	circular plug-in connector M12, 8-pole or bus connections
Operating voltage	24 V DC maximum residual ripple 10 %
Power consumption	< 5 W
Set-point value default	0/4...20 mA or 0...5/10 V field bus as option
Display	multifunction display
User interface	4 function keys

Kv value table for FMR versions (specifications for valve stroke and flow rate in %)
The measured set of values for each seat combination is stored in the FMR memory at the factory.

Valve design			Flow rate Kv in [%]																				
			Valve stroke POS [%]																				
DN pipe [mm]	DN seat [mm]	Kvs [m³/h]	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
15	8,0	2,1	0,0	3,3	3,8	4,8	5,2	5,7	6,2	7,6	9,0	11,0	12,9	16,2	20,5	24,8	30,0	37,6	45,2	58,1	76,2	90,5	100,0
	10,0	3,1	0,0	2,9	3,5	4,2	4,8	5,5	6,1	7,7	10,0	12,6	15,8	19,7	24,2	29,7	35,5	44,2	54,8	67,7	80,6	92,6	100,0
	15,0	4,3	0,0	3,3	4,0	4,4	5,1	6,5	8,1	9,8	12,1	15,1	18,6	22,8	27,9	34,4	41,9	51,2	62,8	74,4	86,0	94,4	100,0
25	15,0	5,3	0,0	2,6	3,2	3,6	4,2	5,1	6,6	8,1	9,8	12,1	15,1	18,5	22,6	27,5	34,0	43,0	54,7	66,0	77,4	88,7	100,0
	20,0	7,2	0,0	2,8	3,5	3,9	4,3	5,3	6,5	7,9	9,7	12,2	15,3	18,5	22,2	27,5	34,7	42,8	52,8	63,9	75,0	87,5	100,0
	25,0	12,0	0,0	2,9	3,2	3,9	5,4	6,8	8,3	10,2	12,5	15,0	18,3	22,7	28,3	35,3	42,5	49,6	58,3	67,9	78,3	89,2	100,0
40	25,0	10,3	0,0	3,7	4,7	5,6	6,8	7,9	9,2	11,1	13,6	16,2	19,4	23,6	28,6	34,7	39,8	49,4	55,8	66,8	76,7	88,1	100,0
	32,0	14,4	0,0	3,1	3,8	4,6	5,6	6,5	7,6	9,5	11,8	14,3	17,4	20,8	25,0	30,1	34,4	43,5	49,7	63,0	75,0	87,3	100,0
	40,0	17,5	0,0	3,1	3,8	4,7	5,7	7,0	8,6	10,4	12,9	15,1	18,0	21,5	25,7	31,9	37,1	47,4	54,3	66,7	78,0	88,8	100,0
50	32,0	21,0	0,0	2,3	2,9	3,5	4,3	5,1	6,2	7,9	10,0	12,5	15,2	18,3	21,9	26,7	32,9	43,0	55,2	65,5	76,2	87,4	100,0
	40,0	24,6	0,0	2,4	2,8	3,3	4,1	5,4	6,9	8,5	10,6	13,1	16,3	19,8	24,0	29,8	37,4	47,2	56,9	66,3	76,8	87,8	100,0
	50,0	37,0	0,0	2,4	3,0	3,9	5,1	6,4	7,8	9,8	12,2	15,0	18,4	22,7	28,4	34,9	41,9	50,7	59,5	68,9	79,2	89,2	100,0
65	40,0	29,0	0,0	2,2	2,6	3,2	3,8	4,8	6,2	7,9	9,7	12,1	14,8	18,3	22,4	29,0	35,9	45,2	55,2	65,2	75,9	87,6	100,0
	50,0	45,0	0,0	2,2	2,7	3,3	4,4	5,6	6,9	8,7	10,7	12,4	14,9	18,0	21,6	27,7	35,6	43,6	53,3	65,1	77,8	89,1	100,0
	65,0	65,0	0,0	2,5	3,1	3,8	4,6	5,9	7,7	9,6	12,3	16,2	20,8	26,9	33,8	41,8	50,8	60,0	69,2	77,2	86,2	93,8	100,0
80	50,0	45,0	0,0	2,2	2,7	3,5	4,4	5,6	7,6	9,3	11,8	15,1	18,4	23,5	28,9	34,9	42,2	49,6	57,8	67,3	77,8	88,4	100,0
	65,0	73,0	0,0	2,2	2,7	3,3	4,0	5,4	6,8	8,9	11,2	14,3	17,8	23,7	30,1	38,8	47,9	57,0	65,8	74,5	83,6	91,8	100,0
	80,0	100,0	0,0	2,5	3,4	4,8	6,3	8,5	10,7	13,1	16,0	21,4	27,0	34,5	42,5	50,3	58,0	65,6	73,0	80,0	87,0	93,5	100,0
100	65,0	77,0	0,0	2,8	2,3	3,0	3,6	4,8	6,5	8,4	11,4	15,2	19,5	25,6	32,5	39,7	48,1	56,5	64,9	74,0	83,1	91,4	100,0
	80,0	110,0	0,0	2,0	2,8	4,0	5,4	7,4	9,4	12,4	15,9	21,5	27,3	35,3	43,6	51,8	60,0	67,5	74,5	81,3	88,2	94,2	100,0
	100,0	140,0	0,0	2,7	3,7	4,9	6,8	7,8	10,7	14,3	18,6	25,7	33,2	40,1	48,2	56,3	64,3	72,1	79,3	85,7	91,4	96,1	100,0

Tab. 2: Flow rate Kv

8 CONTROL AND DISPLAY ELEMENTS

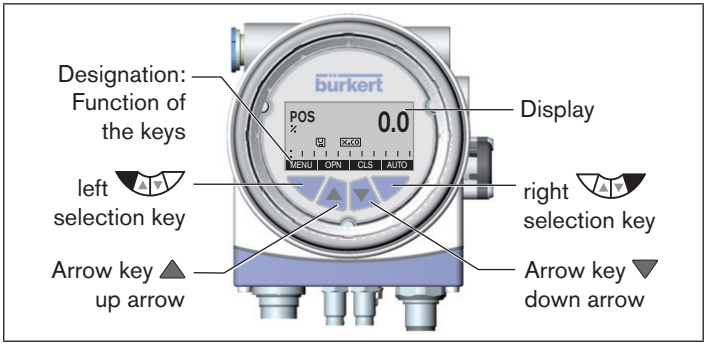


Fig. 8: Description of control elements

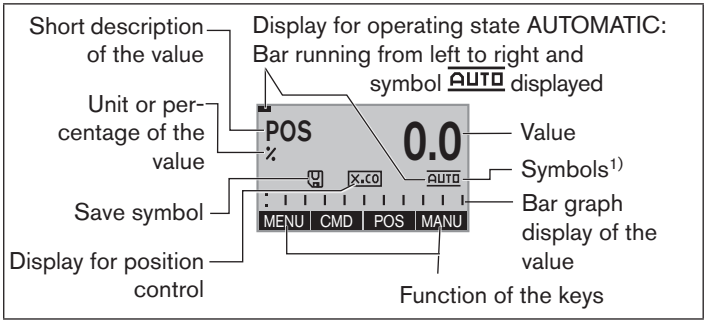


Fig. 9: Description of display

1) *Symbols are displayed according to the activated functions*

8.1 Function of the keys

The functions of the 4 keys differ depending on the operating state (AUTOMATIC or MANUAL) and operating level (process level or setting level).

The function of the keys is displayed in the gray text field which is above the key.

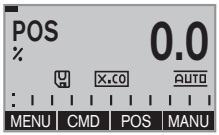
Function of the keys on the process level:			
Key	**Function of the keys**	**Description of the function**	**Operating state**
Arrow key ▲	OPN (OPEN)	Manual opening of the actuator	MANUAL
		Change the displayed value (z.B. *POS-CMD-TEMP-...*)	AUTOMATIC
Arrow key ▼	CLS (CLOSE)	Manual closing of the actuator	MANUAL
		Change the displayed value (e.g. *POS-CMD-TEMP-...*)	AUTOMATIC
Selection key	MENU	Change to the setting level Note: Press key for approx. 3 s.	AUTOMATIC or MANUAL
Selection key	AUTO	Return to AUTOMATIC operating state	MANUAL
	MANU	Change to MANUAL operating state	AUTOMATIC

Function of the keys on the setting level:		
Key	**Function of the keys**	**Description of the function**
Arrow key ▲		Scroll up in the menus
	+	Increase numerical values
Arrow key ▼		Scroll down in the menus
	–	Decrease numerical values
	←	Change by one digit to the left; when entering numerical values
Selection key	EXIT (BACK)	Return to the process level
		Gradually return from a sub-menu option
	ESC	Leave a menu
	STOP	Stop a sequence
Selection key	ENTER SELEC OK INPUT	Select, activate or deactivate a menu option
	EXIT (BACK)	Gradually return from a sub-menu option
	RUN	Start a sequence
	STOP	Stop a sequence

Tab. 3: Function of the keys

8.2 Operating state

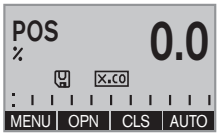
The process controller has 2 operating states:
AUTOMATIC and MANUAL



AUTOMATIC

In the AUTOMATIC operating state, normal controller mode is implemented.

(Bar running along the upper edge of the display and symbol AUTO displayed).



MANUAL

In the MANUAL operating state, the valve can be opened and closed manually via the arrow keys ▲ OPN / ▼ CLS .

8.2.1 Changing the operating state

Use the right selection key to switch between the two operating states AUTOMATIC AUTO and MANUAL MANU.

Switching from AUTOMATIC ⇨ MANUAL	MANU 2)	press
Switching from MANUAL ⇨ AUTOMATIC	AUTO	press

Tab. 4: Changing the operating state

2) *Only possible if POS, CMD, PV (,SP) is displayed.*

8.3 Operating levels

The process controller has 2 operating levels:

- **Process level**

  Display and operation of the current process
  Operating state: AUTOMATIC / MANUAL

- **Setting level**

  Inputting the operating parameters
  Supplementing the menu by optional menu options

8.3.1 Switching between the operating levels

Switching from process level ⇒ setting level	MENU	press for 3 s [3]
Switching from setting level ⇒ process level	EXIT	press

Tab. 5: Changing the operating level

If the device is in the AUTOMATIC operating state when changing to the setting level, the process continues running during the setting.

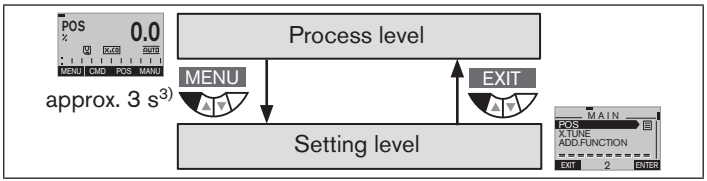
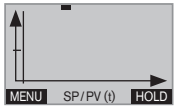
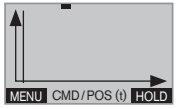
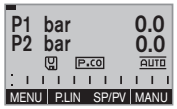
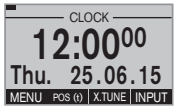
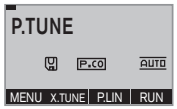


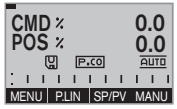
Fig. 10: Operating levels

3) *During these 3 s (countdown), 2 bars converge.*

8.4 Display in AUTOMATIC operating state

Description of the display	set at the factory	Display
Set-point position of the valve actuator (0 – 100 %)	X	POS % 0.0 MENU SP/PV CMD MANU
Nominal position of the valve actuator (0 – 100 %)	X	CMD % 0.0 MENU POS TEMP MANU
Internal temperature in the housing of the device (°C)	–	TEMP °C 0.0 MENU CMD PV
Process actual value	X	PV m3/min 0.0 MENU TEMP SP MANU
Process set-point value	X	SP m3/min 0.0 MENU PV PV (t) INPUT
Simultaneous display of the process set-point value and the process actual value	–	SP m3/min 0.0 PV m3/min 0.0 MENU CMD/POS POS MANU

Description of the display	set at the factory	Display
Graphical display of SP and PV with time axis	–	
Graphical display of POS and CMD with time axis	–	
Value overview Pressure sensor P1 and P2	X	
Time, weekday and date	–	
Automatic adjustment of the process controller	–	
Automatic optimization of the process controller parameters	–	

Description of the display	set at the factory	Display
Automatic linearization of the process characteristics	–	
Simultaneous display of the nominal position and the set-point position of the valve actuator (0–100 %)	–	

Tab. 6: Display in the AUTOMATIC operating state

8.5 Master code

Operation of the device can be locked via a freely selectable user code. In addition, there is a non-changeable master code with which you can perform all operator control actions on the device. This 4-digit master code can be found on the last pages of the printed quickstart guide in the Chapter “Master code”.

If required, cut out the code and keep it separate from this quickstart guide.

9 ASSEMBLY

9.1 Safety instructions

DANGER!

Risk of injury from high pressure in the equipment/device.

- Before working on equipment or device, switch off the pressure and deaerate/drain lines.

Risk of electric shock.

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

WARNING!

Risk of injury from improper assembly.

- Installation must only be carried out by authorized technicians and with the appropriate tools.

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

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

9.2 Before installation

The FMR can be installed in any position, preferably with the process controller face up.

- For trouble-free flow characteristics on the pressure sensor, fit an inlet section upstream of the FMR (dimensions acc. to EN ISO 5167-1, see “Fig. 5: Inlet sections”, page 11)
- Ensure that the pipelines are correctly lined and are not twisted. If necessary, pipelines must be suitably attached or supported.
- Observe flow direction (arrow on valve body).

9.2.1 Installation

→ Clean pipelines and joints (sealing material, swarf, etc.).

→ Connect FMR to pipeline.

9.3 Pneumatic connection of the process controller

DANGER!

Risk of injury from high pressure in the equipment/device.

- Before working on equipment or device, switch off the pressure and deaerate/drain lines.

WARNING!

Risk of injury when opening the actuator.

The actuator contains a tensioned spring. If the actuator is opened, there is a risk of injury from the spring jumping out.

- The actuator must not be opened.

Risk of injury from moving parts in the device.

- Do not reach into openings.

Risk of injury from unsuitable connection hoses.

Hoses which cannot withstand the pressure and temperature range may result in hazardous situations.

- Use only hoses which are authorized for the indicated pressure and temperature range.
- Observe the data sheet specifications from the hose manufacturers.

Procedure:

→ Connect the control medium to the pilot air port (1) (5,6 – 7 bar; air class see chapter "7.6").

→ Fit the exhaust air line or a silencer to the exhaust air port (3).

Important information for the problem-free functioning of the device:

- The installation must not cause back pressure to build up.
- To make the connection, select a hose with sufficient cross section.
- The exhaust air line must be designed in such a way that no water or other liquid can get into the device through the exhaust air port (3).

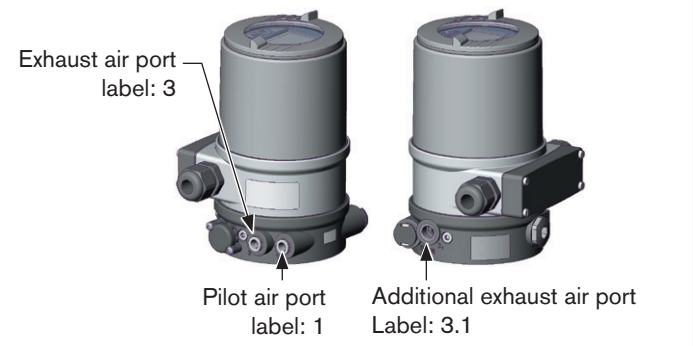


Fig. 11: Pneumatic connection

Caution (exhaust air concept):

In compliance with protection class IP67, an exhaust air line must be installed in the dry area.

Keep the applied control pressure **always** 0.5...1 bar above the pressure which is the minimum required to move the pneumatic actuator to its end position. This ensures that the control behavior is not extremely negatively affected in the upper stroke range on account of too little pressure difference.

During operation, keep the fluctuations of the pilot pressure as low as possible (max. ±10 %). If fluctuations are greater, the control parameters measured with the *X.TUNE* function are not optimum.

10 ELECTRICAL INSTALLATION

DANGER!

Risk of electric shock.

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

WARNING!

Risk of injury from improper installation.

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

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

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

10.1 Electrical installation, 24 V DC with circular plug-in connector (multi-pole variant)

Signal values

Operating voltage	24 V DC
Set-point value (process controller)	4...20 mA (0...20 mA; 0...5 V; 0...10 V)
Actual value	4...20 mA

Procedure:

→ Connect the process controller according to "Fig. 12" and the following tables ("Tab. 7", "Tab. 8", "Tab. 9").

When the operating voltage is applied, the process controller is operating.

→ Now enter the required basic settings and actuate automatic adjustment of the process controller, as described in Chapter "11 Start-up 24 V DC", page 26.

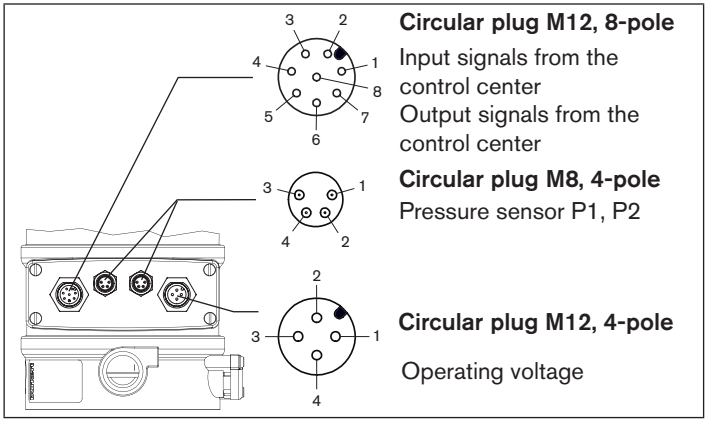


Fig. 12: Connection with 24 V DC circular plug-in connector

4) *The indicated colors refer to the connecting cable available as an accessory (919061 or 919267).*
5) *The indicated colors refer to the connecting cable available as an accessory (918038).*

Circular plug M12, 8-pole

Set-point value, digital input		
Pin	**Wire color[4)]**	**Assignment**
8	red	Set-point value + (0/4 – 20 mA / 0 – 5/10 V)
7	blue	Set-point value GND
1	white	Digital input +
Input/output signals		
Pin	**Wire color[4)]**	**Assignment**
6	pink	Analog position feedback +
5	gray	Analog position feedback GND
4	yellow	Digital output 1
3	green	Digital output 2
2	brown	Digital outputs GND

Tab. 7: Circular plug M12, 8-pole

Circular plug M8, 4-pole (pressure sensor)

Pin	Wire color	Assignment
1	brown	+ 24 V pressure sensor power supply
2	white	4 – 20 mA output from pressure sensor

Tab. 8: Circular plug M8, 4-pole (pressure sensor)

Circular plug M12, 4-pole (operating voltage)

Pin	Wire color[5)]	Assignment	
1	brown	Operating voltage +	24 V DC
3	blue	Operating voltage	GND

Tab. 9: Circular plug M12, 4-pole (operating voltage)

10.2 Electrical installation PROFIBUS DP

Procedure:

→ Connect the process controller according to “Fig. 13” and “Tab. 10”, “Tab. 11”, “Tab. 12”.

The electrical connection module of Type 8693 features a setscrew with nut which is used to connect the Technical Earth (TE) (see “Fig. 13: Connection with PROFIBUS DP”).

→ Connect setscrew (TE connection) to a suitable grounding point. To ensure electromagnetic compatibility (EMC), ensure that the cable is as short as possible (max. 30 cm, Ø 1.5 mm²).

When the operating voltage is applied, the process controller is operating.

→ Now make the required basic settings and actuate automatic adjustment of the process controller, as described in Chapter “13 PROFIBUS DP start-up”, page 38.

The settings in the *BUS.COMM* menu option are described in Chapter “13 PROFIBUS DP start-up”.

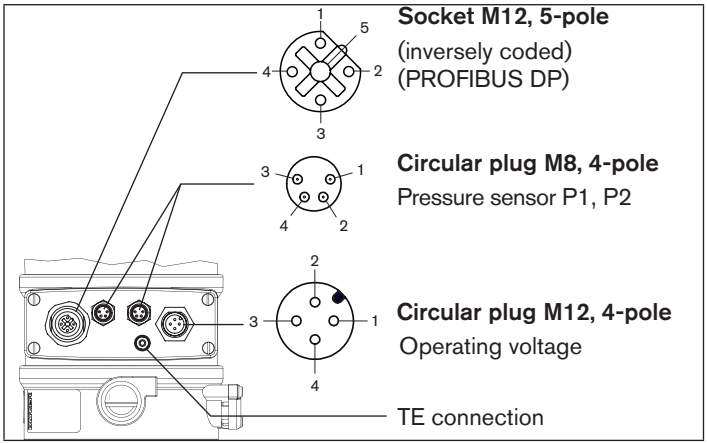


Fig. 13: Connection with PROFIBUS DP

Socket M12, 5-pole (bus connection)

Pin	Signal
1	VP+5
2	RxD/TxD-N
3	DGND
4	RxD/TxD-N
5	Shielding

Tab. 10: Socket M12, 5-pole (bus connection)

Circular plug M8, 4-pole (pressure sensor)

Pin	Wire color	Assignment
1	brown	+ 24 V pressure sensor power supply
2	white	4 – 20 mA output from pressure sensor

Tab. 11: Circular plug M8, 4-pole (pressure sensor)

Circular plug M12, 4-pole (operating voltage)

Pin	Wire color[6)]	Assignment	
1	brown	Operating voltage +	24 V DC
3	blue	Operating voltage	GND

Tab. 12: Circular plug M12, 4-pole (operating voltage)

6) *The indicated colors refer to the connecting cable available as an accessory (918038).*

10.3 Electrical installation DeviceNet

Procedure:

→ Connect the process controller according to “Fig. 14” and “Tab. 13”, “Tab. 14”, “Tab. 15”.

The electrical connection module of Type 8693 features a setscrew with nut which is used to connect the Technical Earth (TE) (see “Fig. 14: Connection with DeviceNet”).

→ Connect setscrew (TE connection) to a suitable grounding point. To ensure electromagnetic compatibility (EMC), ensure that the cable is as short as possible (max. 30 cm, Ø 1.5 mm²).

When the operating voltage is applied, the process controller is operating.

→ Now make the required basic settings and actuate automatic adjustment of the process controller, as described in Chapter “14 DeviceNet start-up”, page 42.

The settings in the *BUS.COMM* menu option are described in Chapter “14 DeviceNet start-up”.

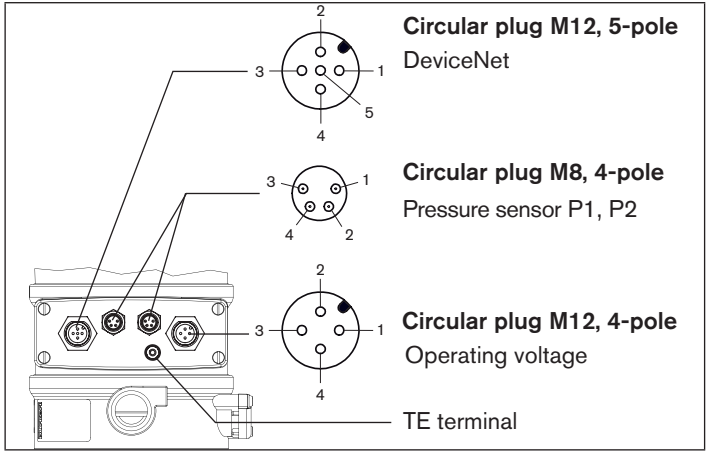


Fig. 14: Connection with DeviceNet

Circular plug M12, 5-pole (bus connection)

Pin	Signal
1	Shielding
2	V+
3	V–
4	CAN H
5	CAN L

Tab. 13: Circular plug M12, 5-pole (bus connection)

Circular plug M8, 4-pole (pressure sensor)

Pin	Wire color	Assignment
1	brown	+ 24 V pressure sensor power supply
2	white	4...20 mA output from pressure sensor

Tab. 14: Circular plug M8, 4-pole (pressure sensor)

Circular plug M12, 4-pole (operating voltage)

Pin	Wire color[7)]	Assignment	
1	brown	Operating voltage +	24 V DC
3	blue	Operating voltage	GND

Tab. 15: Circular plug M12, 4-pole (operating voltage)

7) *The indicated colors refer to the connecting cable available as an accessory (918038).*

11 START-UP 24 V DC

WARNING!

Risk of injury from improper operation.

Improper operation may result in injuries as well as damage to the device and the area around it.

- Before start-up, ensure that the operating personnel are familiar with and completely understand the contents of the operating instructions.
- Observe the safety instructions and intended use.
- Only adequately trained personnel may operate the system/the device.

A detailed description of the start-up and operating procedures for Type 8693 can be found in the operating instructions for Type 8693.

To set up the flow controller, perform the following steps:

- Specify the standard settings of the process controller (input signal (standard signal)).
- Perform the automatic adjustment (*X.TUNE*) of the process controller.
- Add the *F.CONTROL* auxiliary function to the main menu using the configuration menu (*ADD.FUNCTION*) and create settings.

11.1 General procedure for creating settings for the flow controller

Key	Action	Description
MENU	Press for 3 s (countdown in the display)	Switching from process level ⇨ setting level
→ Execute settings.		
EXIT	Press	Switching from setting level ⇨ process level

Tab. 16: General procedure for creating settings

You must exit the main menu by pressing the left selection key EXIT before the modified data is saved to the memory (EEPROM). During the save process, the save symbol is indicated on the display.

11.2 Define basic settings

Setting the input signal

Procedure:

Key	Action	Description
MENU	Press for 3 s (countdown in the display)	Switching from process level ⇨ setting level
▲ / ▼	Select *INPUT*	Selection *INPUT* menu
ENTER	Press	Change to *INPUT* menu
▲ / ▼	Select 4...20 mA, 0...20 mA, 0...10 V or 0...5 V	Select the input signal
SELEC	Press	Specifying the input signal
EXIT	Press	Exit *INPUT* menu
EXIT	Press	Switching from setting level ⇨ process level

Tab. 17: Setting the input signal

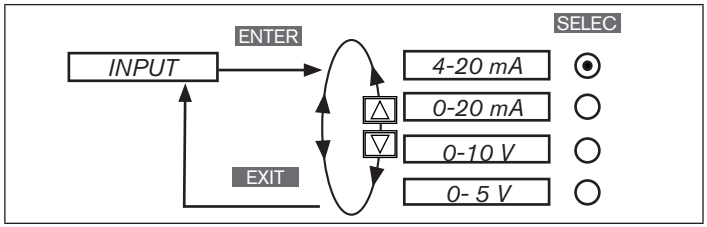


Fig. 15: Operating structure INPUT (select input signal)

You must exit the main menu by pressing the left selection key EXIT before the modified data is saved to the memory (EEPROM). During the save process, the save symbol is indicated on the display.

11.3 Automatic adjustment (*X.TUNE*)

WARNING!

Danger of injury due to the valve position changing when the *X.TUNE* function is run at operating pressure.

- Never run *X.TUNE* while the process is running.
- Secure system against unintentional activation.

NOTE!

An incorrect control pressure or incorrectly connected operating pressure at the valve seat may cause the controller to be wrongly adjusted.

- *X.TUNE* **must always** be run at the control pressure available during subsequent operation (= pneumatic auxiliary energy).
- Run the *X.TUNE* function preferably **without** operating medium pressure to exclude interference caused by flow forces.

The following functions are actuated automatically:

- Adjustment of the sensor signal to the (physical) stroke of the actuating element used.
- Determination of parameters of the PWM signals to control the control valves integrated in Type 8693.
- Setting the controller parameters of the process controller. Optimization occurs according to the criteria of the shortest possible correction time with simultaneous freedom from overshoot.

To stop *X.TUNE*, press the left or right selection key STOP

Procedure:

Taste	Action	Description
MENU	Press ▲▼ for 3 s (countdown in the display)	Switching from process level ⇨ setting level
▲ / ▼	Select *X.TUNE*	Selection *X.TUNE* menu
RUN	Press ▲▼ for 5 s (countdown in the display)	Start of the automatic adjustment *X.TUNE*
		Messages on the progress of the *X.TUNE* on the display: *„TUNE #1....“-„X.TUNE READY“* [8]
EXIT	Press any key	Exit *X.TUNE* menu
EXIT	Press ▲▼	Switching from setting level ⇨ process level

Tab. 18: Setting the input signal

You must exit the main menu by pressing the left selection key ▲▼ EXIT before the modified data is saved to the memory (EEPROM). During the save process, the save symbol is indicated 💾 on the display.

11.4 Configuring the *F.CONTROL* auxiliary function

→ Add the auxiliary function *F.CONTROL* to the main menu using the configuration menu (*ADDFUNCTION*).

Procedure:

Key	Action
MENU	Press ▲▼ for approx. 3 s
▲ / ▼	Select *ADD.FUNCTION*
ENTER	Press ▲▼
▲ / ▼	Select *F.CONTROL*
ENTER	Press ▲▼
EXIT	Press ▲▼
The *F.CONTROL* function is now activated and incorporated into the main menu (MAIN).	

Tab. 19: Incorporating F.CONTROL into the main menu (MAIN)

→ Enter the basic settings for the flow controller under *F.CONTROL*.

8) *„TUNE err/break“ if a fault occurs.*

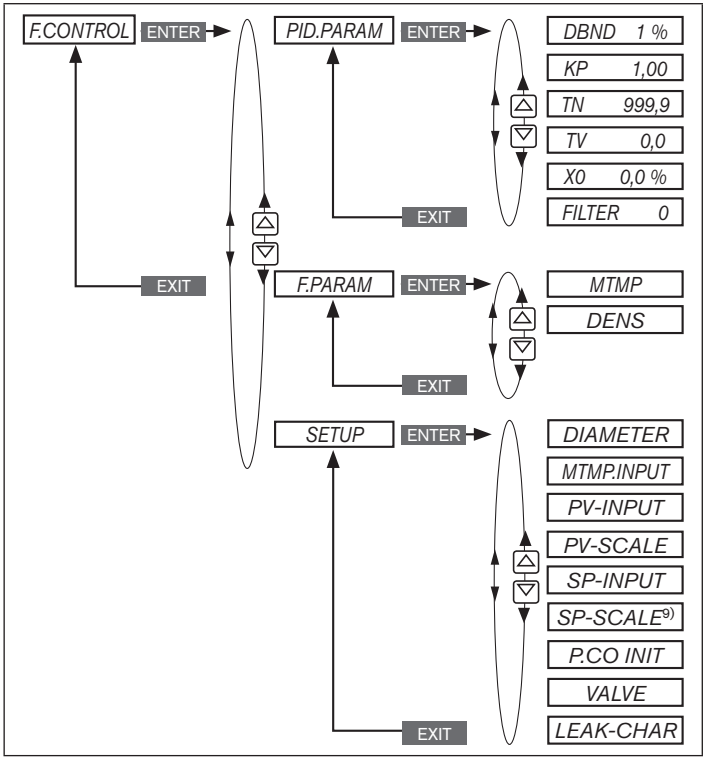


Fig. 16: Operating structure - basic settings for flow controller

9) *The SP SCALE function is indicated only if the external set-point value default (external) menu option is activated under SP INPUT.*

F.CONTROL - Settings:

PID.PARAM	**Parameter settings for the PID process controller**
DBND 0,1 %	Insensitivity area (dead band) of the PID process controller
KP 0,00	Amplification factor of the process controller
TN 0,5	Reset time
TV 0,0	Hold-back time
X0 0,0 %	Working point
FILTER 0	Filtering of the process actual value input
F.PARAM	**Parameter settings for the flow controller**
MTMP	Manually specifying the medium temperature *MTMP.INPUT*: In this case, manual refers to:
DENS	Density: Enter the density of the medium
SETUP	**Setting up the flow controller**
MTMP.INPUT	Specify the medium temperature: can be set either via temperature transmitter or via bus
DIAMETER	Enter the pipe diameter
PV-INPUT	Indication of the signal type for process actual value

PV-SCALE	Scaling the process controller (m³/s or m³/h only)
SP-INPUT	Type of the set-point value default (internal or external)
SP-SCALE[10)]	Scaling the position controller (for external set-point value default only)
P.CO-INIT	Enables a smooth switchover between AUTOMATIC and MANUAL operating state
VALVE	Save a valve-specific Kv characteristic and the Kvs value, customer settings also possible

Tab. 20: Basic settings for the flow controller

The parameter settings for the PID process controller can be created automatically with the help of the *P.TUNE* function (description see “operating instructions for Type 8693”).

10) *The SP SCALE function is indicated only if the external set-point value default (external) menu option is activated under SP INPUT*

11.4.1 Change the process set-point value

Procedure:

1. Set the set-point value default on the setting level:

In the main menu (MAIN), select the *F.CONTROL* function

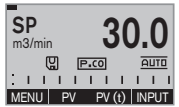
F.CONTROL ENTER → *SETUP* ENTER → *SP-INPUT* *intern* ◉ SELEC

→ Use the EXIT key (press 4 x) to return to the process level.

2. On the process level, manually change the process set-point value:

→ Use the arrow keys ▲ ▼ to select the display for the process set-point value (SP).

→ Press INPUT key.



→ Enter the process set-point value (see image below).

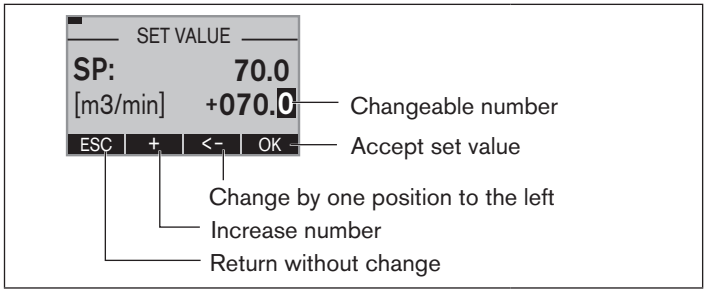


Fig. 17: Enter values

11.5 Leakage air characteristic for FMR (LeakTune)

The function *LEAK.TUNE* enables leakage air compensation which increases the precision of the fluid flow rate control.

Background: When bulk material is conveyed, leakage air occurs on a rotary valve depending on the pressure. The air flow through the controller unit is divided into this leakage air and into the air flow in the conveyor line.

$$Q_{FMR} = Q_{Leakage\ air} + Q_{Conveyor\ line}$$

To obtain leakage air compensation, a leakage air characteristic must be read in once when the conveyor line is closed.

11.5.1 Recording and reading in leakage air characteristic

To determine the leakage air precisely, the system should be started up in normal operation. In doing so, observe the following:

- The conveyor line behind the component, which causes the leakage air, must be closed.
- Material must not be conveyed.

NOTE!

If bulk material is conveyed pneumatically using a rotary valve, ensure that

- the conveyor line behind the rotary valve is closed.
- the rotary valve is empty and is running at nominal speed.
- Measures for sealing the system (e.g. sealing air which flows down into the rotary valve) are implemented.
- the compressor is switched on.

Starting program for automatically recording the leakage air characteristic:

→ Select the menu *LEAK.TUNE* .

→ Press the key RUN for 3 seconds.

The leakage air characteristic will now be automatically recorded and read in.

Display	Description
Countdown 5–0	Countdown from 5 to 0 to start determining the leakage air
Teach-in at work	See program sequence (the individual steps are not shown on the display)
TUNE err/break	Cancel by pressing “STOP”
TUNE ready	The leakage air characteristic was successfully determined.

11.5.2 Program sequence

- The control valve is closed.
- After 10 seconds settling time the primary pressure is recorded on the fluid flow rate controller.

  The scaling of the x axis of the leakage air characteristic is based on this pressure value.

  The upper limit results in the factor 0.85.

  Up to 21 support points are determined.

  Example values: A primary pressure of 2.0 bar results in a characteristic of 0 to 1.7 bar in 85 mbar steps.

- The control valve is slowly opened within a ramp time of 60 seconds.
- Parallel to this the delivery pressure (pressure of the FMR on the output side) is monitored. The delivery pressure and the air flow are saved in the device for each support point of the characteristic.
- Reading in is complete when the control valve is fully open after 60 seconds or when the delivery pressure has prematurely reached the upper limit of the scaling.
- Leakage air compensation is now active. The process value is now based on the difference between the measured air flow and the leakage air calculated from the characteristic:

$$Q_{Conveyor\ line} = Q_{FMR} - Q_{Leakage\ air}$$

12 ADDITIONAL FMR FUNCTIONS

Overview

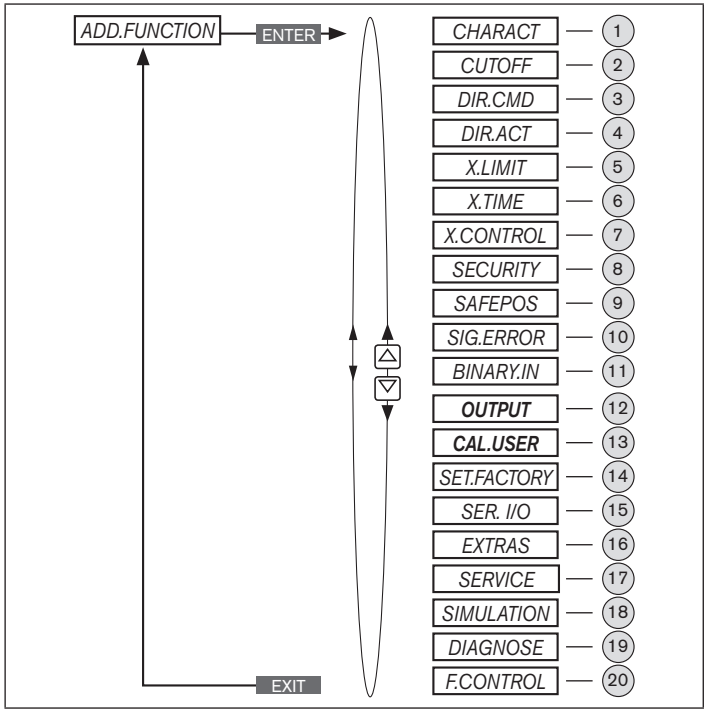


Fig. 18: Overview of FMR auxiliary functions

No	Description
1	Selecting the transfer characteristic between input signal and stroke (correction characteristic)
2	Sealing function for position controller
3	Effective sense of direction between input signal and nominal position
4	Assignment of the aeration state of the actuator chamber to the set-point position
5	Limit the mechanical stroke range
6	Limit the control speed
7	Parameterization of the position controller
8	Code protection for settings
9	Input the safety position
10	Configuration of signal level fault detection
11	Activation of the digital input
12	Configuration of outputs
13	Calibration
14	Reset to factory settings
15	Configuration of serial interface
16	Adjusting the display
17	For internal use only
18	Simulation of set-point value, process valve, process
19	Diagnosis menu (option)
20	Parameterization of the PID process controller

Tab. 21: Description of auxiliary functions

The auxiliary functions listed here can be activated and set in accordance with the control task.

A detailed description of the auxiliary functions and settings can be found in the user instructions for Type 8693 (see www.burkert.com).

The following auxiliary functions differ from Type 8693 and are described in these instructions:

- *CAL.USER* see Chapter “12.2 CAL.USER - Changing the factory calibration”
- *OUTPUT* see Chapter “12.3 OUTPUT - Configuration of the analog output”

12.1 Activating and deactivating auxiliary functions

You can activate the auxiliary functions on the setting level by adding them to the main menu (MAIN). The parameters for the auxiliary functions can then be set.

To deactivate an auxiliary function, remove it from the main menu. The previous settings created using this auxiliary function will then be rendered invalid again as a result.

12.1.1 Including auxiliary functions in the main menu

Procedure:

Key	Action
MENU	Press for approx. 3 s
▲ / ▼	Select *ADD.FUNCTION*
ENTER	Press
▲ / ▼	Select the auxiliary function
ENTER	Press
EXIT	Press
The auxiliary function is now activated and added to the main menu (MAIN).	

Tab. 22: Adding auxiliary functions to the main menu (MAIN)

You must exit the main menu by pressing the left selection key EXIT before the modified data is saved to the memory (EEPROM). During the save process, the save symbol is indicated on the display.

12.2 *CAL.USER* - Changing the factory calibration

→ Add the *CAL.USER* auxiliary function to the main menu using the configuration menu (*ADDFUNCTION*).

→ Enter the settings for the flow controller under *CAL.USER*.

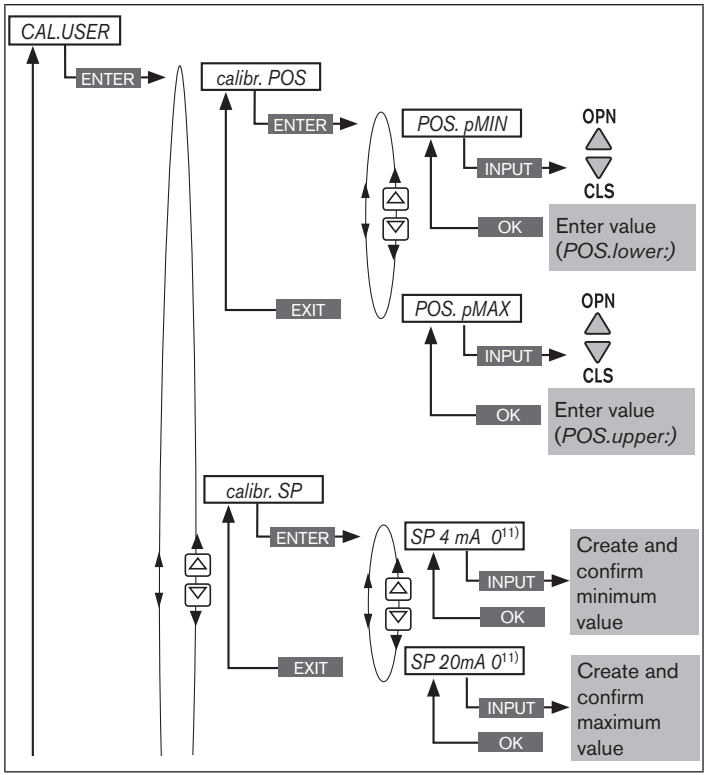


Fig. 19: Operating structure CAL.USER - changing the factory calibration - 1

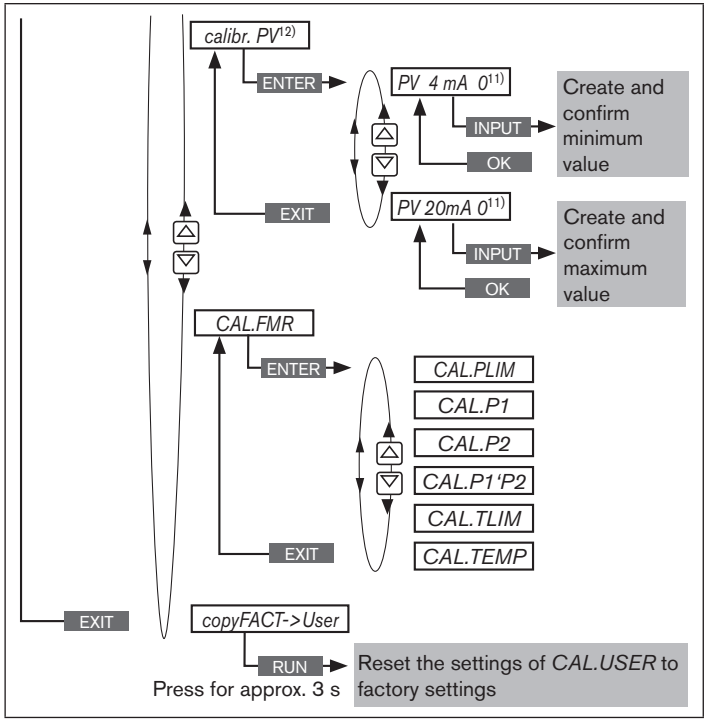


Fig. 20: Operating structure CAL.USER - changing the factory calibration - 2

11) *If you press the key* ESC *the value remains unchanged.*
12) *Visible for certain settings only. The specified input signal type is displayed.*

***CAL.USER* - Settings:**

calibr. POS	**Calibration of the position actual value**
POS. pMIN	Set the minimum position of the valve
POS. pMAX	Set the maximum position of the valve

CAL.FMR	**Calibration of the flow controller**
CAL.PLIM	Measurement range of the pressure sensor
CAL.P1	Calibration of pressure sensor 1
CAL.P2	Calibration of pressure sensor 2
CAL.P1'P2	P1-P2 comparison, increase in accuracy
CAL.TLIM	Measurement range of the temperature transmitter
CAL.TEMP	Calibrating the temperature transmitter

calibr. SP	**Calibrating the process set-point value**
SP 4mA 0	Minimum value of the input signal
SP 20mA 0	Maximum value of the input signal

calibr. PV	**Calibrating the process actual value**
for input signal 4 - 20 mA:	
PV 4mA 0	Minimum value of the input signal
PV 20mA 0	Maximum value of the input signal
for input signal Pt 100:	
0000	Temperature

copyFACT->USER	**Reset to factory settings**

Tab. 23: CAL.USER settings

12.3 *OUTPUT* - Configuration of the analog output

The analog output can send feedback regarding the current position (POS) or the set-point value (CMD), the process actual value (PV), the process set-point value (SP), the pressure at the input (P1), the pressure at the output (P2) or the medium temperature (MTMP) to the control center.

→ Add the auxiliary function *OUTPUT* to the main menu using the configuration menu (*ADDFUNCTION*).

→ Create the settings for the flow controller under *OUT ANALOG*.

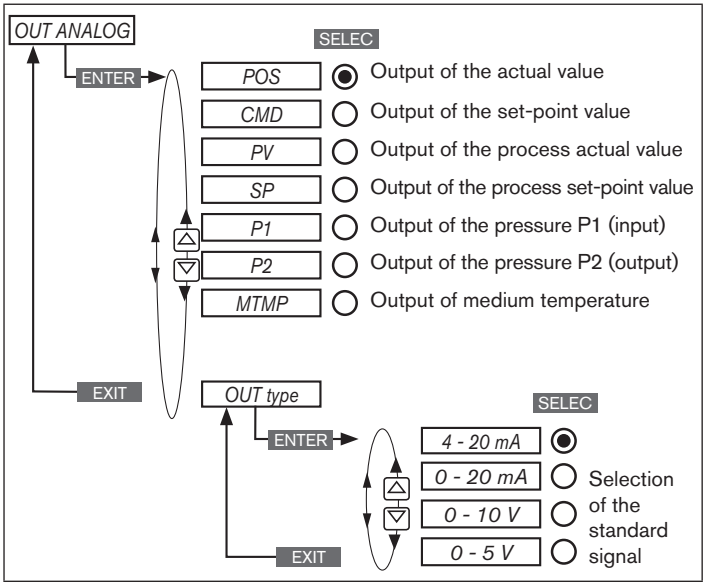


Fig. 21: Operating structure OUT ANALOG - analog output

13 PROFIBUS DP START-UP

Procedure:

- Perform the automatic adjustment (*X.TUNE)* of the process controller.
- Add the *F.CONTROL* auxiliary function to the main menu using the configuration menu (*ADDFUNCTION*) and make settings.
- Make settings in the *BUS.COMM* function.
- Configuration of the process values.

13.1 Settings in *BUS.COMM*

Address X	Enter a device address (value between 0 and 126)
BUS FAIL	Activate or deactivate approach of the safety position
SafePos off ◉	The actuator remains in the position which corresponds to the set-point value last transferred (default setting).
SafePos on ◉	If there is a fault in the bus communication, the behavior of the actuator depends on the activation of the *SAFEPOS* auxiliary function.

SAFEPOS deactivated:
The actuator moves to the safety end position which it would assume if the electrical and pneumatic auxiliary energy failed.
See Chapter “15 Safety end positions”.

SAFEPOS activated:
The actuator moves to the safety position which is specified in the *SAFEPOS* auxiliary function.

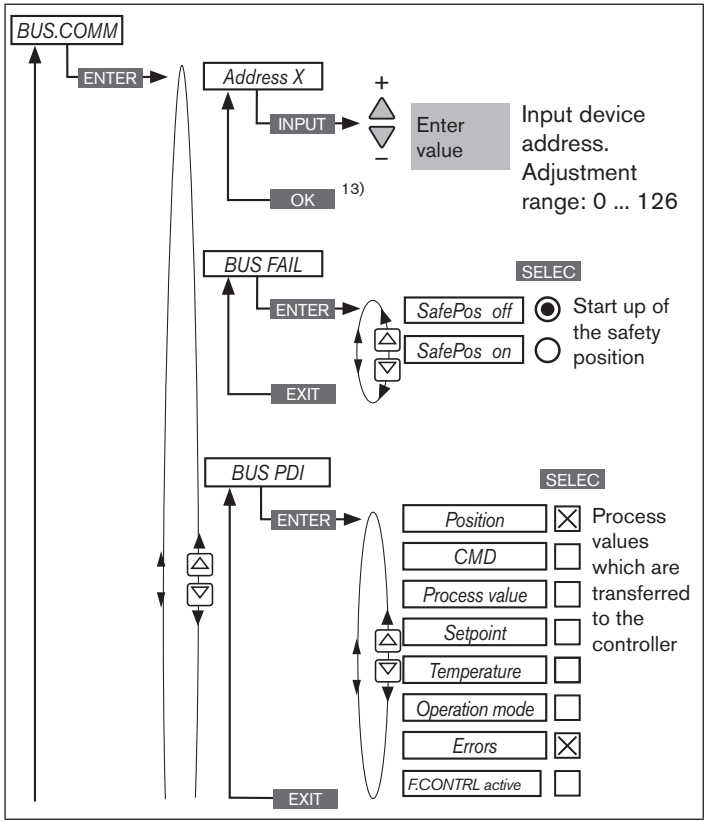


Fig. 22: Operating structure BUS.COMM - 1

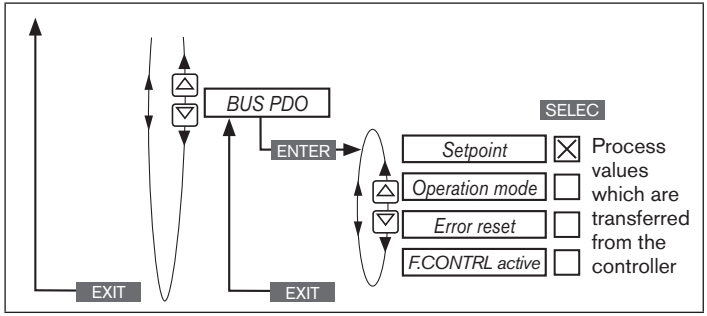


Fig. 23: Operating structure BUS.COMM - 2

13) *If you press the key* ESC*, the value remains unchanged.*

13.2 Configuration of the process values

The following components are required for the configuration:

- Software suitable for the configuration. For example Step7 from Siemens.
- GSD file (Download from the Bürkert homepage)

For more detailed information see supplementary instructions on the Bürkert homepage:

- "Configuration on the PROFIBUS by means of GSD file"

www.burkert.com → Type 8793 → Config. PROFIBUS by GSD file

→ First input the PDI (Process Data Input).

PDI: Process Data Input (from the process controller to the controller)

Name	Description	Identifier
PDI:POS	Actual position (position) Actual value of positioner as ‰. Value range 0 – 1000. Values < 0 or > 1000 are possible if e.g. *X.TUNE* has not run through correctly.	GSD file: *PDI:POS* Identifier (HEX): 41, 40, 00
PDI:CMD	Set-point position (command) Set-point value of positioner as ‰. Value range 0 – 1000.	GSD file: *PDI:CMD* Identifier (HEX): 41, 40, 01
PDI:PV	Process actual value (process value) Actual value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling.	GSD file: *PDI:PV* Identifier (HEX): 41, 40, 02
PDI:SP	Process set-point value (set-point) Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling.	GSD file: *PDI:SP* Identifier (HEX): 41, 40, 03

Name	Description	Identifier
PDI:TEMP	Device temperature (temperature) Temperature of 0.1 °C is measured on the CPU board by the sensor, value range -550 (-55 °C) – +1250 (+125 °C).	GSD file: *PDI:TEMP* Identifier (HEX): 41, 40, 04
PDI:MODE	Operating state (operation mode) Operating state: 0: *AUTO* 1: *MANUAL* 2: *XTUNE* 9: *P.QLIN* 10: *P.TUNE* 12: *BUSSAFEPOS*	GSD file: *PDI:MODE* Identifier (HEX): 41, 00, 05
PDI:ERR	Error Indicates the number of the process value (output) which was not written. The value is retained until it is deleted with *PDO:ERR*. HEX 14 *PDO:CMD / SP* 16 *PDO:MODE*	GSD file: *PDI: ERR* Identifier (HEX): 41, 00, 06

Name	Description	Identifier
PDI:P1	Pressure before the valve 0000-XXXX depending on sensor range	GSD file: *PDI:P1* Identifier (HEX): 41, 40, 07
PDI:P2	Pressure after the valve 0000-XXXX depending on sensor range	GSD file: *PDI:P2* Identifier (HEX): 41, 40, 08
PDI:MTMP	Medium temperature Temperature in °C on 1 °C exactly Value range 0 °C – 150 °C	GSD file: *PDI:MTMP* Identifier (HEX): 41, 40, 09
PDI: PCONact	0: Positioner 1: Process controller	GSD file: *PDI:PCONact* Identifier (HEX): 41, 00, 0A

Tab. 24: Process Data Input, PROFIBUS DP

→ Then input the process data output.

PDO: Process Data Output (from the controller to the process controller)

Name	Description	Identifier
PDO: CMD/SP	Process set-point value (set-point) Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling. If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 14.	GSD file: *PDO:CMD/SP* Identifier (HEX): 81, 40, 14
PDO: MODE	Operating state (operation mode) Value range 0, 1 or 12: Operating state: 0: *AUTO* 1: *MANUAL* 12: *BUSSAFEPOS* If the value is too small or too large, the last valid value is used and is indicated in ERR with HEX 16.	GSD file: *PDO:MODE* Identifier (HEX): 81, 00, 16

Name	Description	Identifier
PDO:ERR	Reset error display If the value > 0, *ERR* is reset.	GSD file: *PDO: ERR* Identifier (HEX): 81, 00, 17
PDO: MTMP	Medium temperature Temperature in °C on 1 °C exactly Value range 0 °C – 150 °C	GSD file: *PDO:MTMP* Identifier (HEX): 81, 40, 18
PDO: CONact	0: Positioner 1: Process controller	GSD file: *PDO:CONact* Identifier (HEX): 81, 00, 19

Tab. 25: Process Data Output, PROFIBUS DP

14 DEVICENET START-UP

Procedure:

- Perform the automatic adjustment (*X.TUNE)* of the process controller.
- Add the *F.CONTROL* auxiliary function to the main menu using the configuration menu (*ADDFUNCTION*) and create settings.
- Make settings in the *BUS.COMM* function.
- Configuration of the process values.

14.1 Settings in *BUS.COMM*

Address X	Enter a device address (value between 0 and 63)
BAUD RATE	Selection of the baud rate

- The baud rate can be changed either by pressing the operator keys on the device or via the bus.
- A change has no effect until a reset (send a reset message to the identity object) or power up is implemented. This means if the changed baud rate attribute is accessed before a reset or power up, the read (changed) value does not agree with the still current baud rate (to be changed) of the network.

Select 125 kbit/s, 250 kbit/s or 500 kbit/s

BUS FAIL	Activate or deactivate approach of the safety position
SafePos off ◉	The actuator remains in the position which corresponds to the set-point value last transferred (default setting).
SafePos on ◉	If there is a fault in the bus communication, the behavior of the actuator depends on the activation of the *SAFEPOS* auxiliary function.

SAFEPOS deactivated: The actuator moves to the safety end position which it would assume if the electrical and pneumatic auxiliary energy failed. See Chapter “15. Safety end positions”.

SAFEPOS activated: The actuator moves to the safety position which is specified in the *SAFEPOS* auxiliary function.

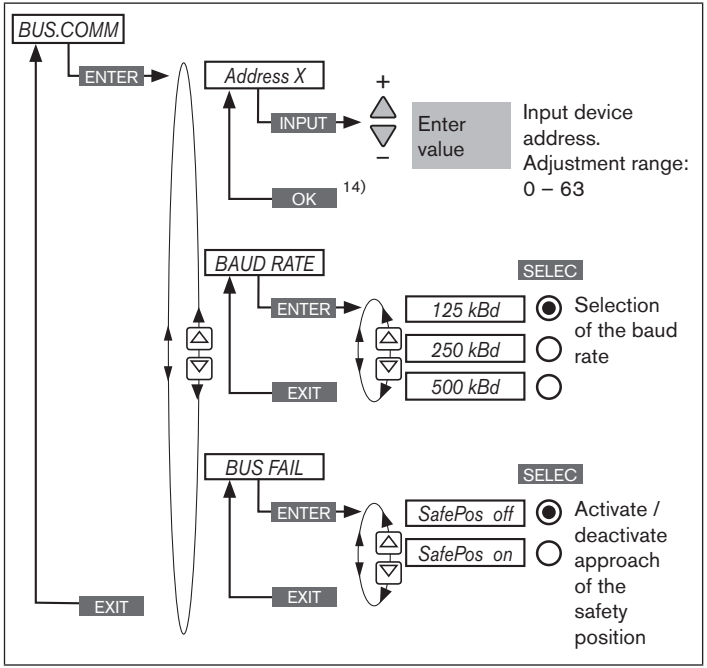


Fig. 24: Operating structure BUS.COMM - DeviceNet

14) *If you press the key* ESC *the value remains unchanged.*

14.2 Configuration of the process data

The following components are required for the configuration:

- Software suitable for the configuration. For example RSNetWorx for DeviceNet (Rev. 4.12.00).
- ESD file (is on the supplied CD).

Transferring process data

The process data is transferred via an I/O connection. 5 static input and 2 static output assemblies can be selected for the transfer. In these assemblies selected attributes are combined in one object.

Selecting the process data

The process data is selected by setting the device parameters during initialization of the I/O connection according to the DeviceNet specification. The following device parameters can be set:

- Active Input Assembly and Active Output Assembly or
- Produced Connection Path and Consumed Connection Path - if supported by the DeviceNet Master/Scanner -.

14.2.1 Static Input Assemblies

Name	Address of data attribute of the assemblies for read access. Class, instance, attributes	Format of the data attribute
POS+ERR (factory setting)	4, 1, 3	Byte 0: POS low Byte 1: POS high Byte 2: ERR
POS+CMD+ ERR	4, 2, 3	Byte 0: POS low Byte 1: POS high Byte 2: CMD low Byte 3: CMD high Byte 4: ERR
PV+ERR	4, 3, 3	Byte 0: PV low Byte 1: PV high Byte 2: ERR
PV+SP+ERR	4, 5, 3	Byte 0: PV low Byte 1: PV high Byte 2: SP low Byte 3: SP high Byte 4: ERR
PV+SP+ CMD+ERR	4, 5, 3	Byte 0: PV low Byte 1: PV high Byte 2: SP low Byte 3: SP high Byte 4: CMD low Byte 5: CMD high Byte 6: ERR

Name	Address of data attribute of the assemblies for read access. Class, instance, attributes	Format of the data attribute
PV+P1+P2+ MTMP+ERR	4, 6, 3	Byte 0: PV low Byte 1: PV high Byte 2: P1 low Byte 3: P1 high Byte 4: P2 low Byte 5: P2 high Byte 6: MTMP low Byte 7: MTMP high Byte 8: ERR
PV+SP+CMD+ P1+P2+ MTMP+ERR	4, 7, 3	Byte 0: PV low Byte 1: PV high Byte 2: SP low Byte 3: SP high Byte 4: CMD low Byte 5: CMD high Byte 6: P1 low Byte 7: P1 high Byte 8: P2 low Byte 9: P2 high Byte 10: MTMP low Byte 11: MTMP high Byte 12: ERR
PV+POS+ ERR+PCON	4, 8, 3	Byte 0: PV low Byte 1: PV high Byte 2: POS low Byte 3: POS high Byte 4: ERR Byte 5: PCON active
PV+POS+ ERR+ PCON+ P1	4, 9, 3	Byte 0: PV low Byte 1: PV high Byte 2: POS low Byte 3: POS high Byte 4: ERR Byte 5: PCON active Byte 6: P1 low Byte 7: P2 low

Tab. 26: Static Input Assemblies, DeviceNet

The addresses indicated in “Tab. 26” can be used as a path statement for the Produced Connection Path attribute of an I/O connection.

This I/O connection can be used to transfer the attributes described in more detail in the following “Tab. 27” as input process data.

Nevertheless, by using this address data, the attributes combined in the assemblies can also be accessed acyclically at any time via Explicit Messages.

Name	Description of the input data attributes	Attribute Address Class, Instance, Attribute; Data type, Length
POS	Actual position Actual value of process controller as ‰. Value range 0 – 1000. However, values <0 or >1000 are also possible if e.g. *X.TUNE* has not run through correctly.	111, 1, 59; INT, 2 byte
CMD	Set-point position Set-point value of positioner as ‰. Value range 0 – 1000.	111, 1, 58; UINT, 2 byte
PV	Process actual value (process value) Actual value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling.	120, 1, 3; INT, 2 byte
SP	Process set-point value Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling.	120, 1, 2; INT, 2 byte
ERR	Error Indicates the number of the process value (output) which was not written. The value is retained until it is deleted with "1" by acyclically writing the "Error" attribute (access via Explicit Message – Set Attribute Single). HEX 0X14 INP 0X15 SP	100, 1, 1; USINT, 1 byte
P1	Pressure before the valve in bar	120, 1, 7; INT, 2 byte
P2	Pressure after the valve in bar	120, 1, 8; INT, 2 byte
MTMP	Medium temperature in °C	120, 1, 9; INT, 2 byte
PCONact	*P.CONTROL* active	120, 1, 10; USINT, 1 byte

Tab. 27: Input data attributes; DeviceNet

14.2.2 Static Output Assemblies

Name	Address of data attribute of the assemblies for read access. Class, instance, attributes	Format of the data attribute
INP (factory setting)	4, 21, 3	Byte 0: INP low Byte 1: INP high
SP	4, 22, 3	Byte 0: SP low Byte 1: SP high
MTMP	4, 23, 3	Byte 0: MTMP low Byte 1: MTMP high
SP+MTMP	4, 24, 3	Byte 0: SP low Byte 1: SP high Byte 2: MTMP low Byte 3: MTMP high
MTMP+SP+ ERR+PCON	4, 25, 3	Byte 0: MTMP low Byte 1: MTMP high Byte 2: SP low Byte 3: SP high Byte 4: ERR Byte 5: PCON active

Tab. 28: Static Output Assemblies, DeviceNet

The addresses indicated in "Tab. 28" can be used as a path statement for the Consumed Connection Path attribute of an I/O connection.

This I/O connection can be used to transfer the attributes described in more detail in the following "Tab. 29" as output process data.

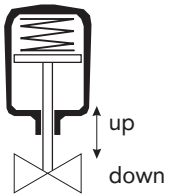
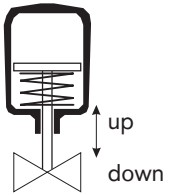
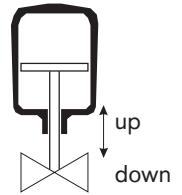
Nevertheless, by using this address data, the attributes combined in the assemblies can also be accessed acyclically at any time via Explicit Messages.

Name	Description of the output data attributes	Attribute Address Class, Instance, Attribute; Data type, Length
INP	Set-point position Set-point value of process controller as ‰. Value range 0 – 1000. In "pure" position controller mode (*F.CONTROL* inactive) the transfer of the INP set-point position is required; as a process controller (*F.CONTROL* active) the transfer of INP is not possible. If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 14.	111, 1, 58; UINT, 2 byte

Name	Description of the output data attributes	Attribute Address Class, Instance, Attribute; Data type, Length
SP	Process set-point value Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling. If the value is too small or too large, the last valid value is used and is indicated in ERR with HEX 15.	120, 1, 2; INT, 2 byte
MTMP	Medium temperature in °C	120, 1, 9; INT, 2 byte
PCONact	*P.CONTROL* active	120, 1, 10; USINT, 1 byte

Tab. 29: Output data attributes; DeviceNet

15 SAFETY END POSITIONS

Actuator system	Designation	Safety end positions after failure of the auxiliary power	
		electrical	pneumatic
	single-acting Control function A	down	pilot-controlled control system: down direct-acting control system: not defined
	single-acting Control function B	up	pilot-controlled control system: up direct-acting control system: not defined
	double-acting Control function I	down / up (depending on the connection of the control cables)	not defined

Tab. 30: Safety end positions

16 ERROR MESSAGES

General error messages (display only for external set-point value and with activated *SIG.ERR*).

Display	Cause	Remedial action
	Minimum input value has been reached.	Do not reduce value further.
	Maximum input value has been reached.	Do not increase value further.
SP error	Signal error set-point value process controller	Check signal
P1 error	Signal error actual value P1 Flow control system	Check signal
P2 error	Signal error actual value P2 Flow control system	Check signal
invalid code	Incorrect access code.	Enter correct access code.
EEPROM fault	EEPROM defective.	Not possible, device defective

Tab. 31: General error messages

Error messages while the *X.TUNE* function is running

Display	Cause	Remedial action
X.TUNE ERROR 1	No compressed air connected.	Connect compressed air.
X.TUNE ERROR 2	Compressed air failure while *X.TUNE* is running	Check compressed air supply.
X.TUNE ERROR 3	Actuator or control system deaeration side leaking	Not possible, device defective.
X.TUNE ERROR 4	Control system aeration side leaking.	Not possible, device defective.
X.TUNE ERROR 6	The end positions for POS-MIN and POS-MAX are too close together.	Check compressed air supply.
X.TUNE ERROR 7	Incorrect assignment POS-MIN and POS-MAX.	To determine POS-MIN and POS-MAX, move the actuator in the direction indicated on the display.

Tab. 32: Error messages during X.TUNE

Error messages while the *P.Q'LIN / P.TUNE* function is running

Display	Cause	Remedial action
P.Q LIN ERROR 1	No compressed air connected. No change to process variable.	Connect compressed air. Check process and, if required, switch on pump or open the shut-off valve. Check process sensor.
P.Q LIN ERROR 2	Support point of the valve stroke was not reached, as ▪ compressed air supply failed during *P.Q'LIN*. ▪ *X.TUNE* was not executed.	 Check compressed air supply. Execute *X.TUNE*.
P.TUNE ERROR 1	No compressed air connected. No change to process variable.	Connect compressed air. Check process and, if required, switch on pump or open the shut-off valve. Check process sensor.

Tab. 33: Error messages during P.Q'LIN / P.TUNE

Error messages while the *LEAK.TUNE* function is running

Display	Cause	Remedial action
P1 error	No primary pressure on the controller unit. The primary pressure is less than 50 mbar.	Switch on compressor before starting to determine the leakage air.
P2 error	No leakage air can be ascertained: The pressure difference between primary pressure and delivery pressure is so low, even when the valve opening is small, that no leakage air can be measured.	The leakage air characteristic must be deactivated, as the precision of the air flow control cannot be increased.
	While the valve was opened, the delivery pressure did not increase. Therefore, no support points could be determined for the characteristic.	Ensure that the conveyor line is closed and that the sealing air is open.
CMD error	Control valve does not close fully. The position <1% is not reached.	Automatically adjust the process controller (X.TUNE) before the LEAK.TUNE.

Tab. 34: Error messages for LEAK.TUNE

16.1 Error messages on field bus devices

Display	Cause	Remedial action
MFI fault Not possible, device defective.	Field bus board defective.	Not possible, device defective.

Tab. 35: Error messages on field bus devices

On PROFIBUS DP

Display	Device state	Remedial action
BUS offline is displayed approx. every 3 seconds	Offline.	Device is not connected to the bus. ▪ Bus connection including plug configuration correct? ▪ Power supply and bus connection of the other nodes correct?
BUS no connection is displayed approx. every 3 seconds	Online, no connection to the master	Device is connected correctly to the bus, the network access procedure has ended without errors, however there is no established connection to the master.

Tab. 36: Error messages PROFIBUS DP

On DeviceNet

Display	Device state	Remedial action
BUS offline is displayed approx. every 3 seconds	Offline.	Device is not connected to the bus, the network access procedure (duplicate MAC-ID test, duration approx. 2 s) has still not ended or device is only active network node ▪ Baud rate correctly set across network? ▪ Bus connection including plug configuration correct? ▪ Power supply and bus connection of the other nodes correct?
BUS no connection is displayed approx. every 3 seconds	Online, no connection to the master	Device is connected correctly to the bus, the network access procedure has ended without errors, however there is no established connection to the master.

BUS timeout is displayed approx. every 3 seconds	I/O connection timeout.	An I/O connection is in the TIME OUT state. → New connection establishment by master; ensure that I/O data is transferred cyclically or, if COS confirmed, that corresponding Acknowledge messages are sent by the master.
BUS critical err is displayed approx. every 3 seconds	Critical bus error.	Other device with the same address in the network or BUS OFF due to communication problems. → Change address of the device and restart device. → Error analysis in the network with a bus monitor.

Tab. 37: Error messages DeviceNet

16.2 Other error messages

Display	Cause	Remedial action
POS = 0 (bei CMD > 0 %) or POS = 100 %, (when CMD < 100 %). PV = 0 (when SP > 0) or PV = PV (when SP > SP).	Sealing function (*CUTOFF*) is unintentionally activated.	Deactivate sealing function.
Applies only to devices with digital output: Digital output does not switch.	Digital output: ▪ Current > 100 mA ▪ Short circuit	Check digital output connection.

Tab. 38: Other error messages

17 ACCESSORIES

Designation	Order no.
M12 connecting cable, 8-pole, 2 m assembled cable	919061
M12 connecting cable, 4-pole, 5 m assembled cable	918038
M8 connecting cable, 4-pole 5 m assembled cable	92903475
USB adapter for connection to a PC in conjunction with an extension cable	227093
Communications software based on FDT/DTM technology	Information at www.burkert.com

Tab. 39: Accessories

18 DISASSEMBLY

DANGER!

Risk of injury from high pressure in the equipment/device.

- Before working on equipment or device, switch off the pressure and deaerate/drain lines.

Risk of electric shock.

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

WARNING!

Risk of injury from improper removal.

- Removal may be carried out by authorized technicians only and with the appropriate tools.

→ Remove electrical connections on the process controller.

→ Release the pneumatic connection on the process controller.

→ Remove FMR from pipeline.

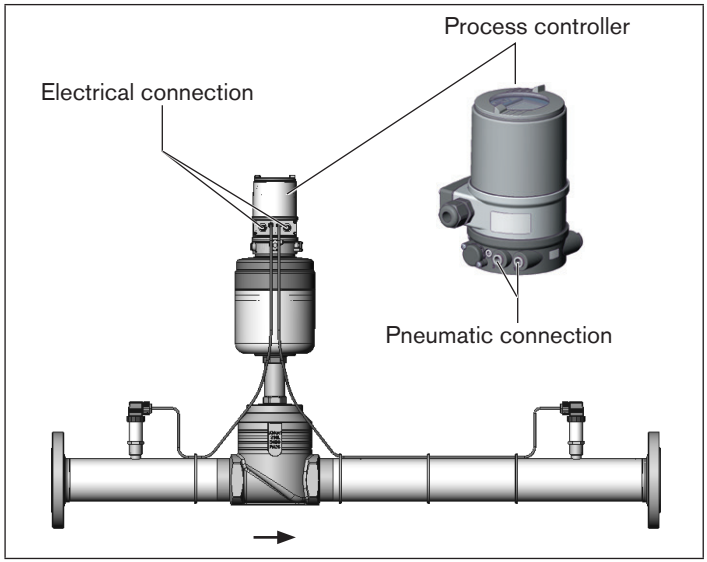


Fig. 25: Disassembly of FMR

19 OPERATING STRUCTURE

The factory presets are highlighted in blue to the right of the menu in the operating structure.

◉ / ☒ Menu options activated or selected at the factory

○ / ☐ Menu options not activated or selected at the factory

2 %, 10 sec Values set at the factory

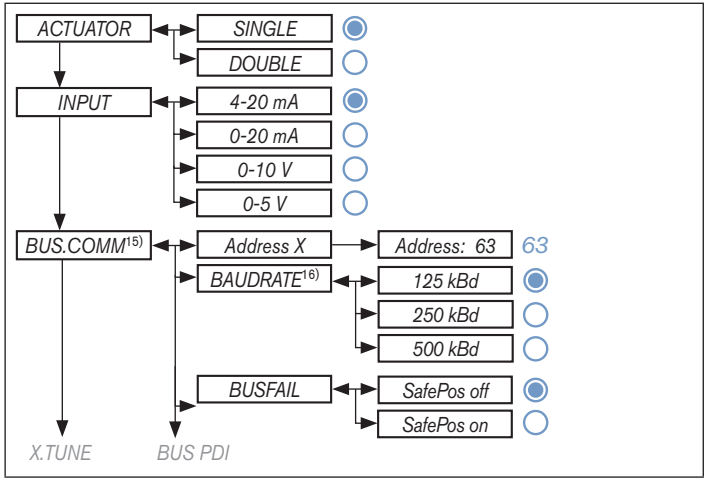


Fig. 26: Operating structure FMR - 1

15) *Only for field bus*
16) *Only DeviceNet*

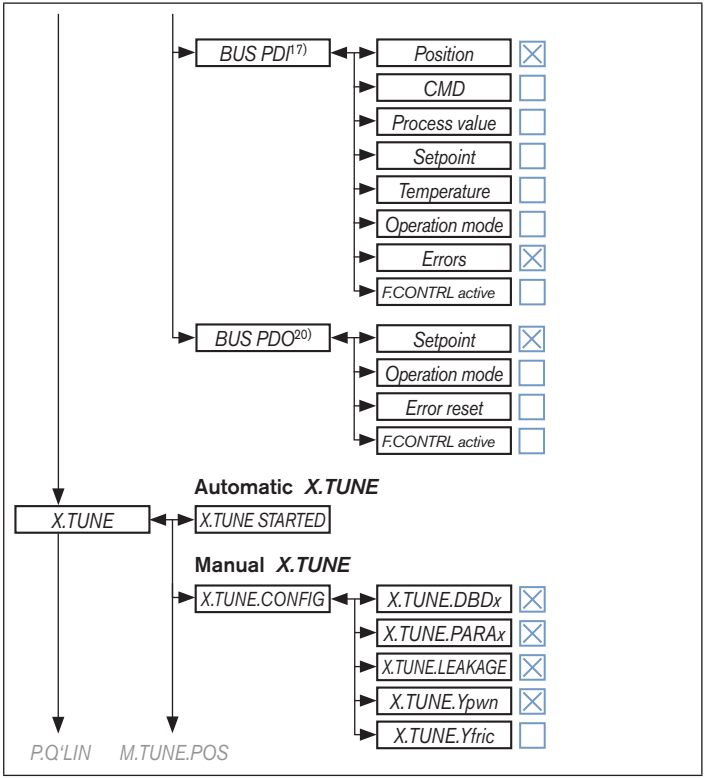


Fig. 27: Operating structure FMR - 2

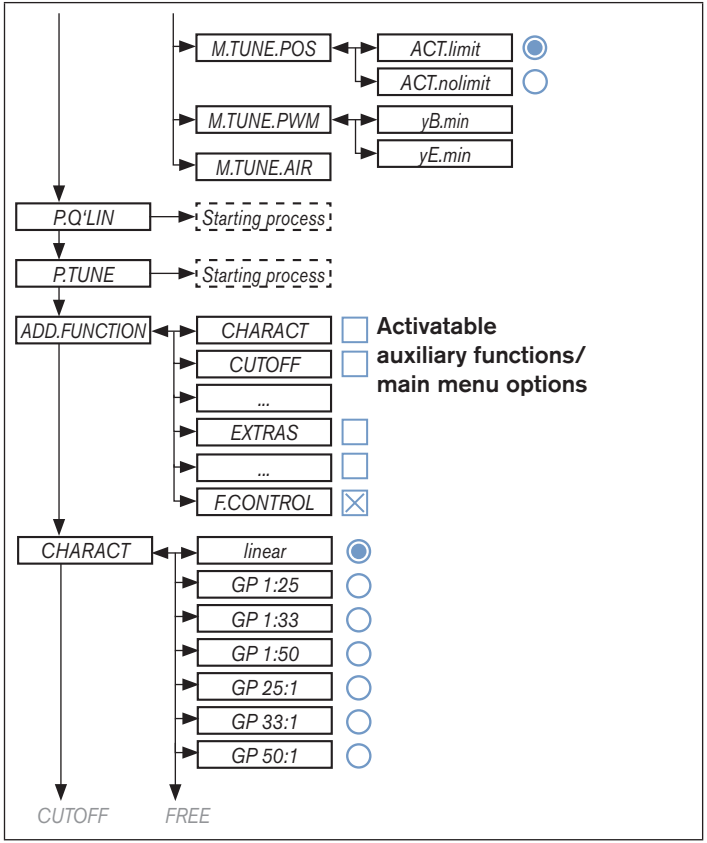


Fig. 28: Operating structure FMR - 3

17) Only PROFIBUS DP

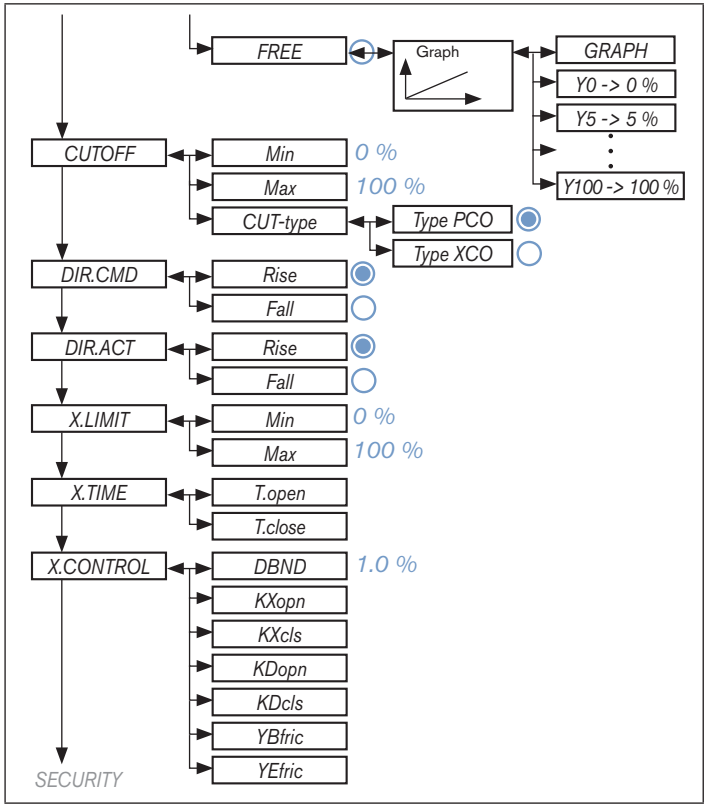


Fig. 29: Operating structure FMR - 4

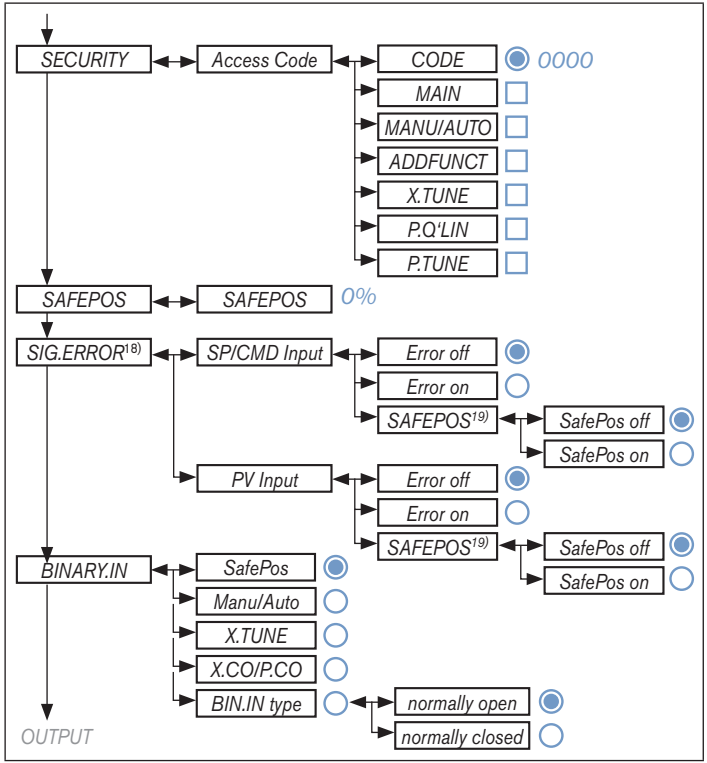


Fig. 30: Operating structure FMR - 5

18) Only for signal type 4-20 mA and Pt 100
19) ‚Error on' must be activated beforehand.

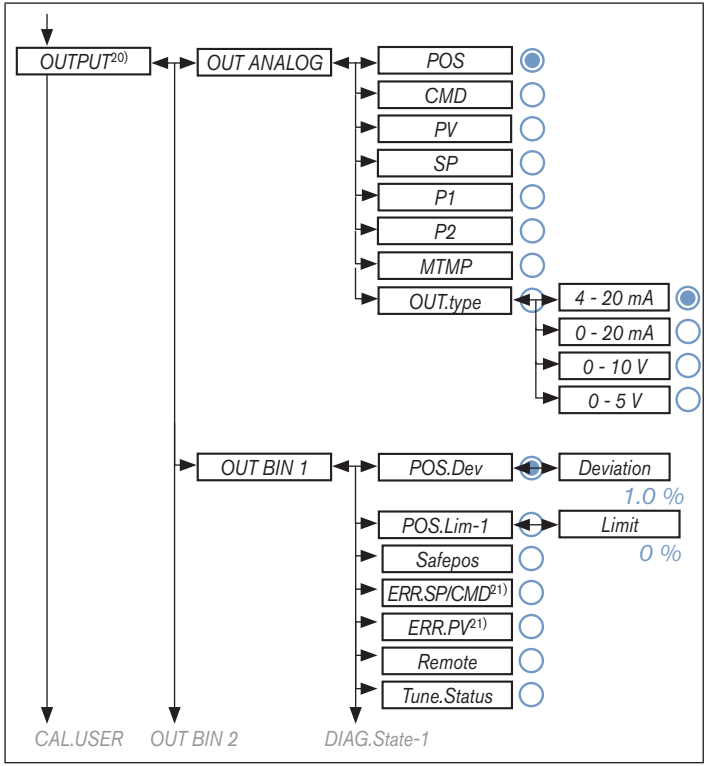


Fig. 31: Operating structure FMR – 6

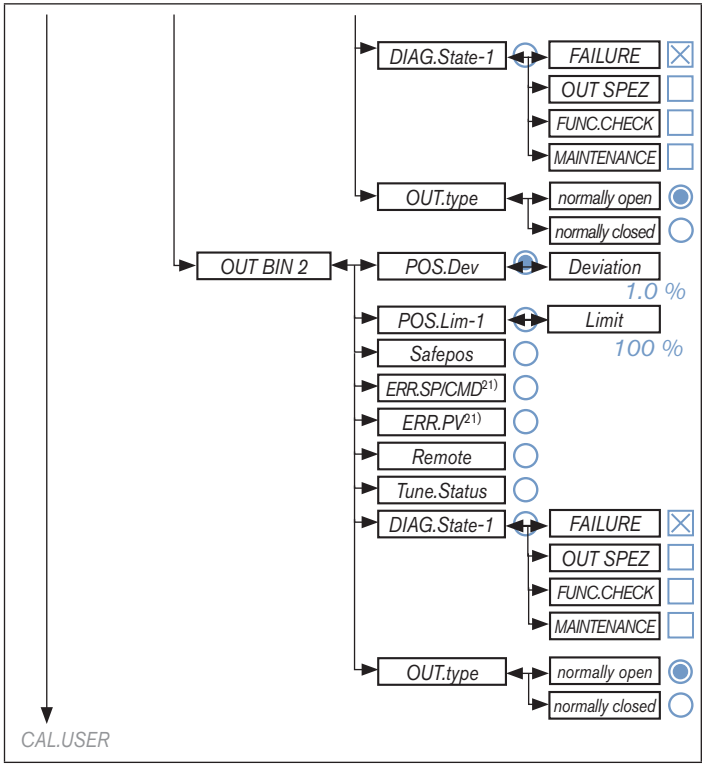


Fig. 32: Operating structure FMR – 7

20) *Optional. The number of outputs varies depending on the version.*

21) *Only if fault detection is activated for the input signal (SIG.ERROR → SP/CMD Input or PV-Input → Error on).*

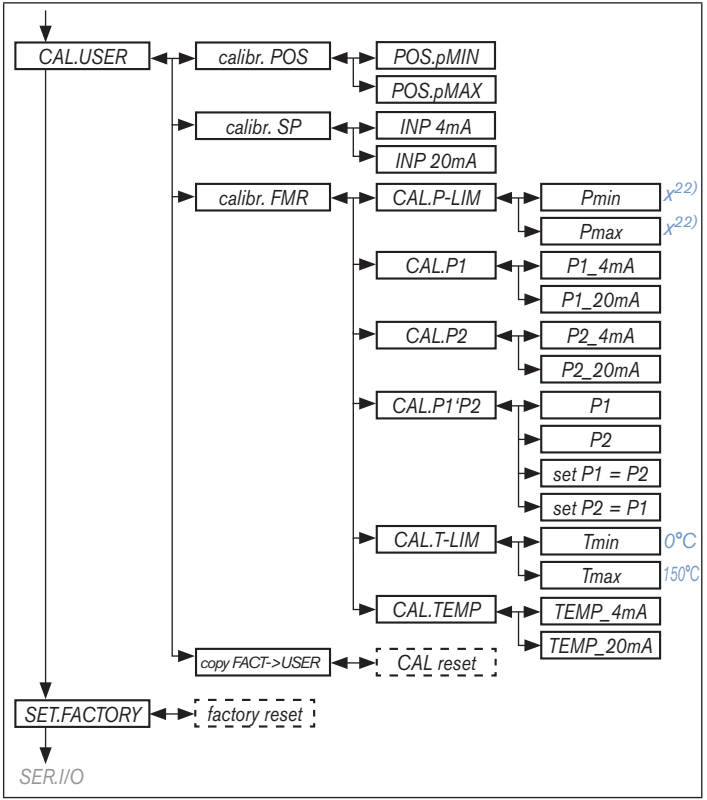


Fig. 33: Operating structure FMR – 8

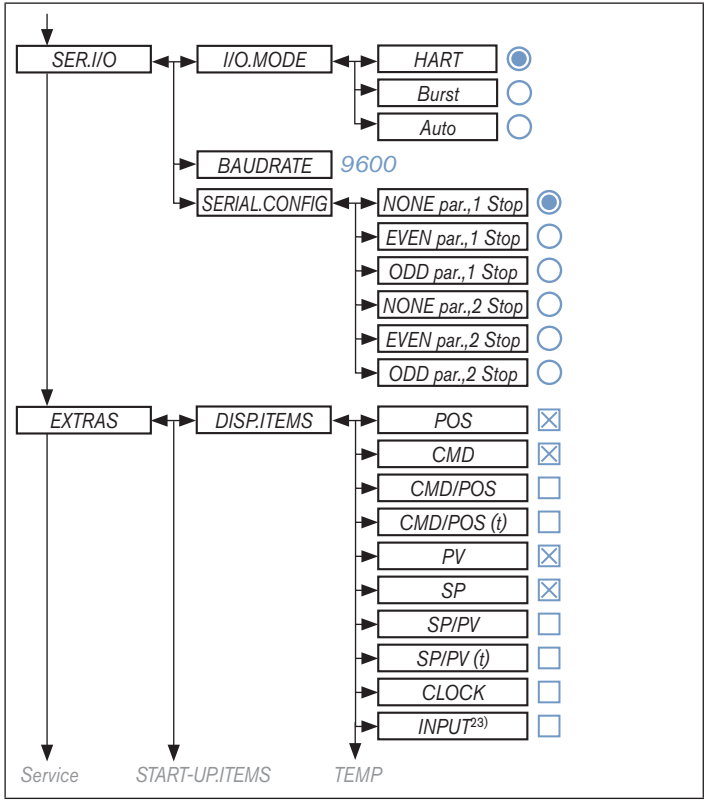


Fig. 34: Operating structure FMR – 9

22) *Value is set by the manufacturer during device-specific calibration.*

23) *Not for field bus*

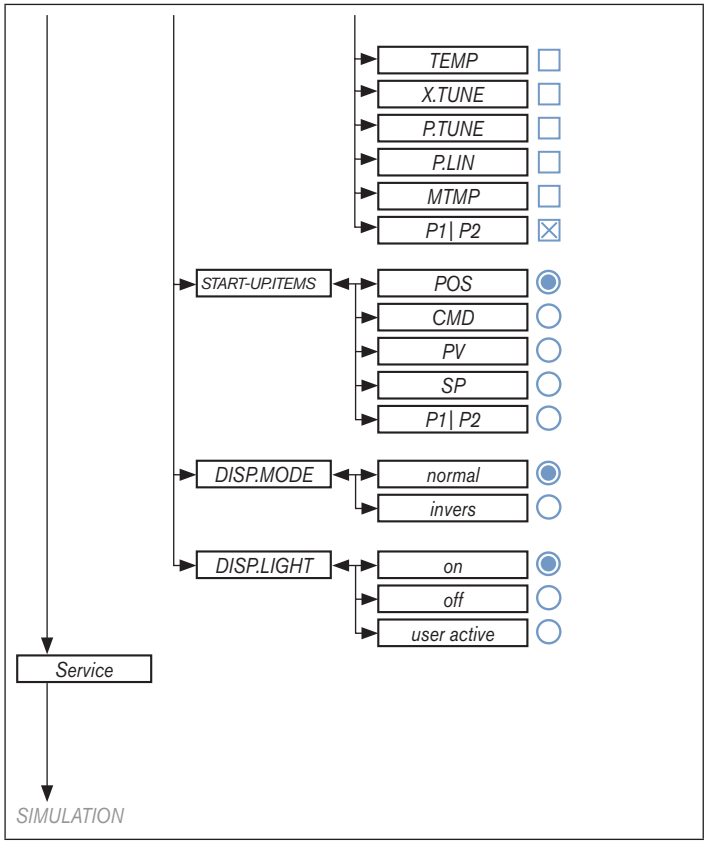


Fig. 35: Operating structure FMR – 10

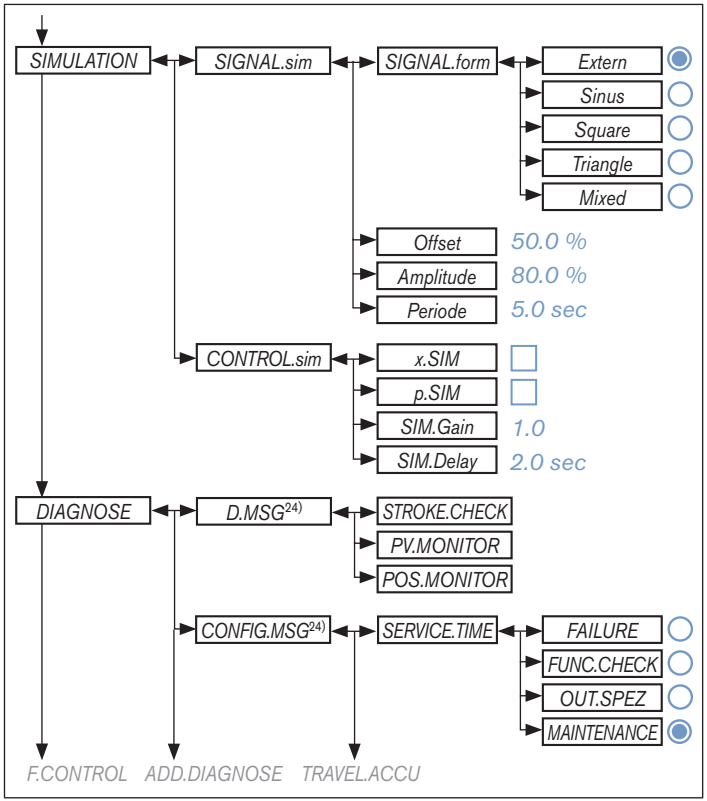


Fig. 36: Operating structure FMR – 11

24) The sub-menu lists only the activated diagnostic functions.

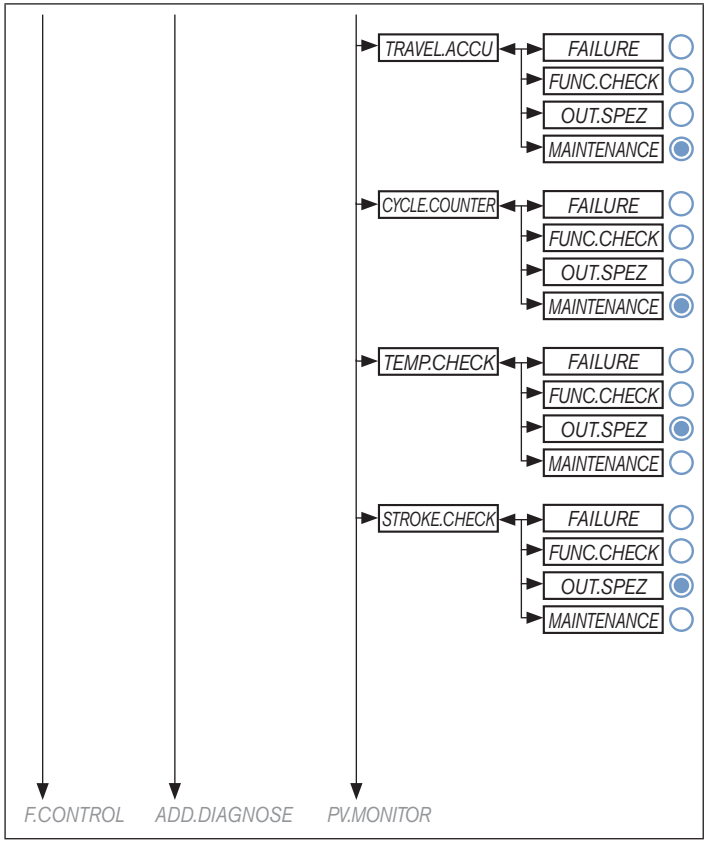


Fig. 37: Operating structure FMR – 12

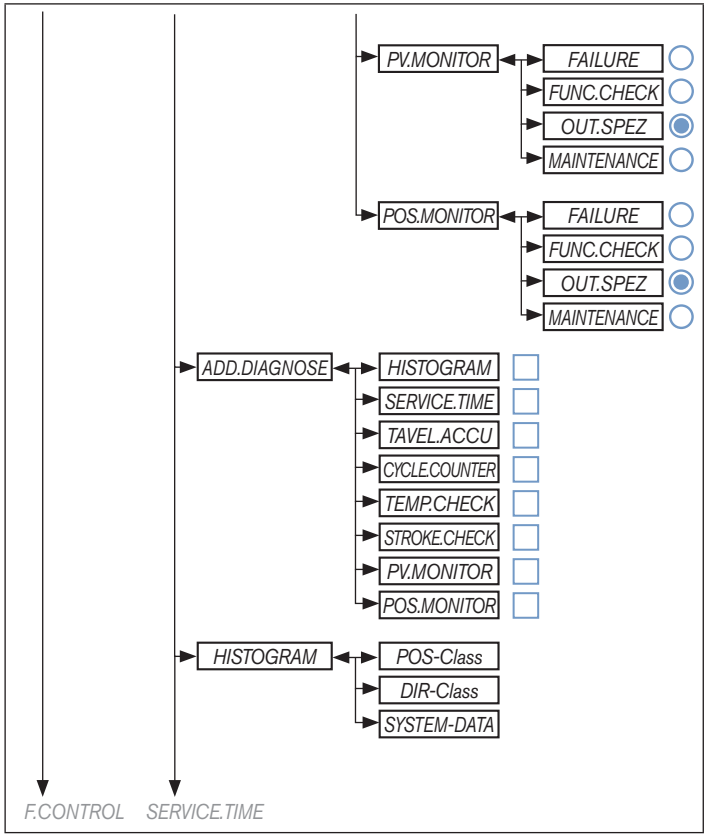


Fig. 38: Operating structure FMR – 13

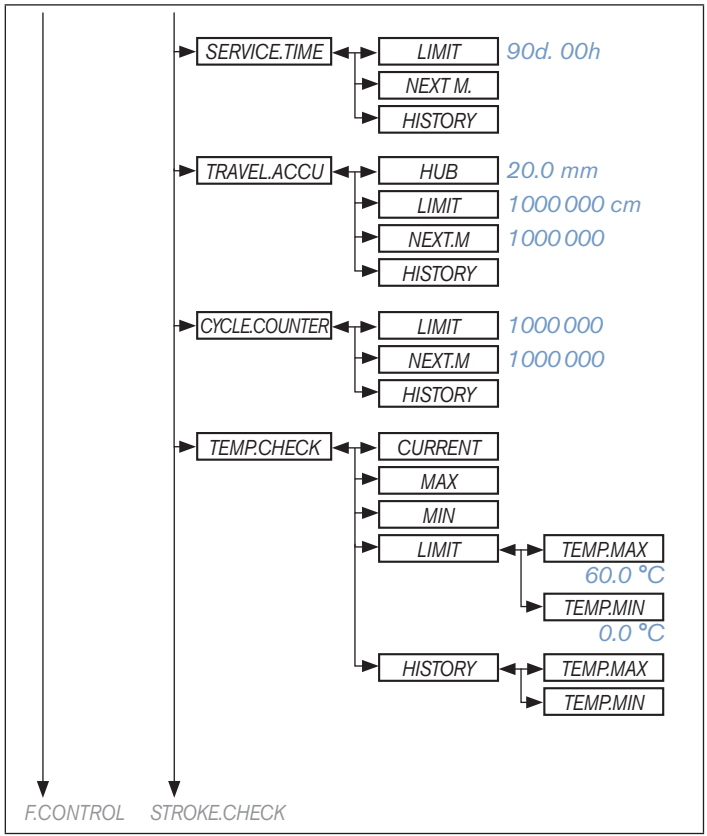


Fig. 39: Operating structure FMR – 14

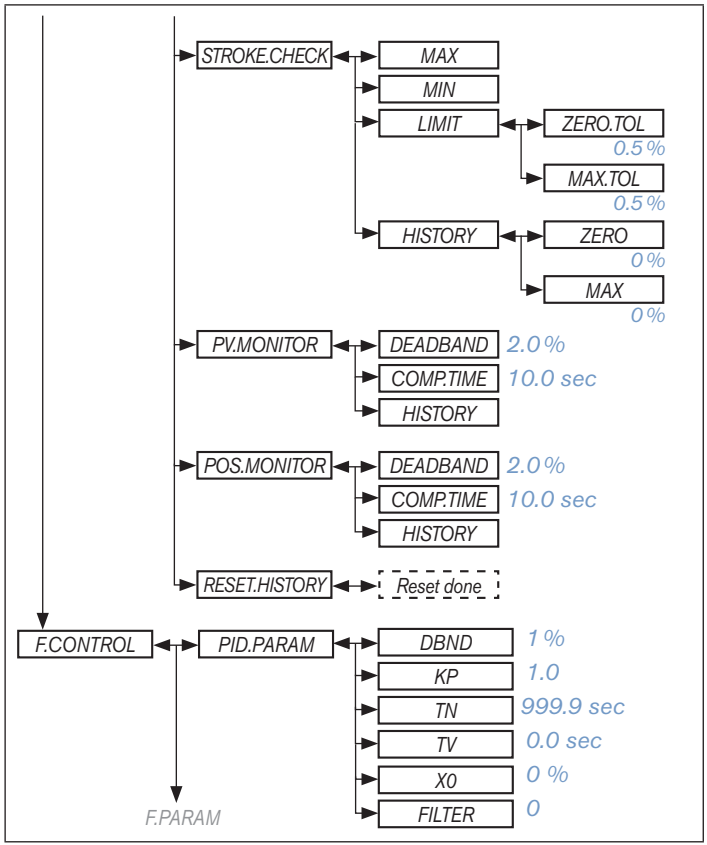


Fig. 40: Operating structure FMR – 15

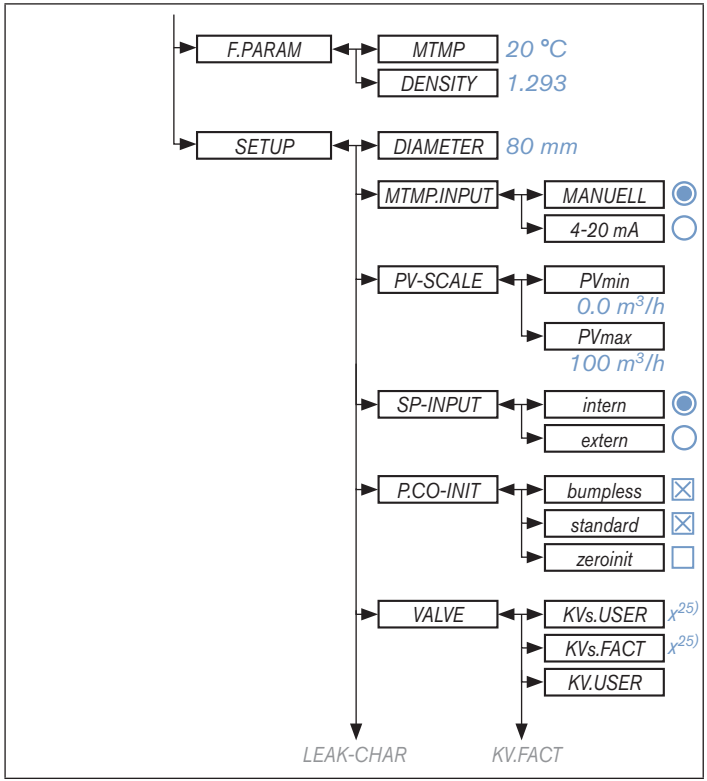


Fig. 41: Operating structure FMR – 16

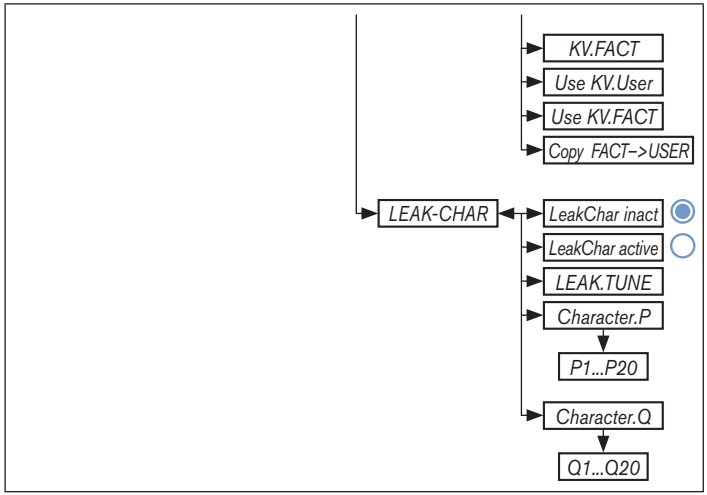


Fig. 42: Operating structure FMR – 17

25) Value is set by the manufacturer during device-specific calibration.

20 TRANSPORT, STORAGE, PACKAGING

NOTE!

Transport damage.

- Inadequately protected devices may be damaged during transportation.
- Protect the device against moisture and dirt in shock-resistant packaging during transportation.
- Prevent the temperature from exceeding or dropping below the permitted storage temperature.
- Protect the electrical interfaces and the pneumatic connections from damage 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 to 55°C.

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

- Dispose of the device and packaging in an environmentally friendly manner.
- Observe applicable disposal and environmental regulations.

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FLUID CONTROL SYSTEMS

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