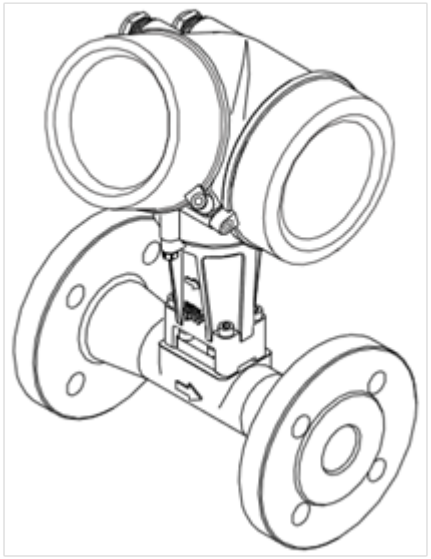
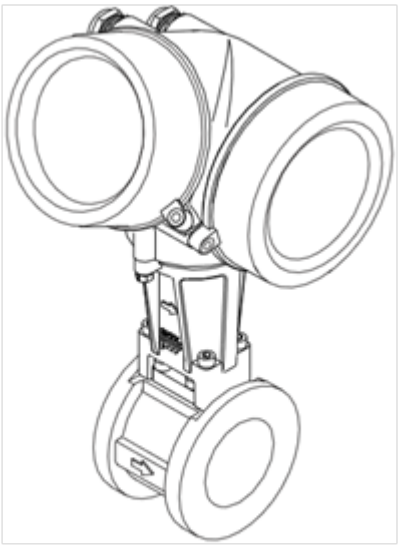
172-65639M-01 (EF200) 13 April 2018

Instruction Manual





Vortex Flowmeter
EF200

Contents

1. Safety Instructions

1.1 Correct Usage

- The EF200 measuring system is used to measure the flow of saturated steam, superheated steam, air and water. Do not use to measure the flow of toxic, flammable or otherwise hazardous fluids. Use this system only as intended.
- The primarily measured variables are volume flow and temperature. From these values, the device can use stored data on density and enthalpy to calculate and output information such as mass flow and heat flow.
- The manufacturer assumes no liability for damage or other accidents caused by incorrect use of the instrument.

1.2 Dangers and Notes

All instruments are designed to meet state-of-the-art safety requirements, have been tested, and have left the factory in a condition in which they are safe to operate. They can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following symbols:


Warning!

Warning!
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.


Caution!

Caution!
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.


Note!

Note!
This symbol contains information on procedures and other facts which do not result in personal injury.

1.3 Operational Safety

- The EF200 measuring system complies with EMC requirements of both IEC/EN 61326 and NAMUR NE 21, and the general safety requirements in accordance with EN 61010-01.
- EF200 fulfills all requirements for IP 66/67 to EN 60529.
- The appropriate error messages are shown on the LCD display.
- On power failure, the configuration data of the measuring system remain in the EEPROM. The totalizer remains on the value last shown.

1.4 Installation, Commissioning and Operation

- Mounting, electrical installation, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the operator of the facility. The specialist must have read and understand this manual before carrying out its instructions.
- The device may only be operated by personnel who are authorized and trained by the operator of the facility. Strict compliance with the instructions in these Operating Instructions is mandatory.
- In the case of corrosive fluids (incl. fluids for cleaning), the user is responsible for verifying the suitability of the material resistance properties of wetted parts, as regards their in-process resistance to corrosion; the manufacturer refuses to accept liability.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams.

Note!
There is no longer any contact protection once the housing cover is removed.


Note!

- Observe all local regulations governing the opening and repair of electrical devices.

1.5 Repairs, Dangerous Chemicals

Warning!
The following procedures must be carried out before an EF200 is sent to TLV for repair:


Warning!

NOTE: References to use with hazardous fluids are for customers having special permission and a signed contract with TLV for hazardous use.

- A note must be enclosed with the instrument, containing a description of the fault, the application and the chemical and physical properties of the fluid being measured.
- Remove all fluid residues that may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.
- No instrument should be returned to TLV without all dangerous material being removed first.

Incomplete cleaning of the device may result in waste disposal requirements or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the operator of the device.

1.6 Technical Improvements

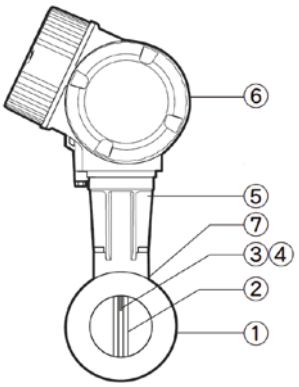
The manufacturer reserves the right to modify technical data without prior notice. Your local TLV Distributor or Sales Office will supply you with all current information and any updates to this manual.

2. System Description

The EF200 vortex flowmeter measures the temperature and volumetric flow of steam, gases and liquids with temperatures in the range of -200 to +400 °C and at nominal pressures of up to 4.96 MPaG (49.6 barg).
EF200 can measure the volumetric flow rate in operation and can be programmed to supply the flow rate in mass, energy or corrected volume units via temperature measurements by the internal temperature sensor.

No.	Description
①	Meter Body
②	Bluff Body
③	DSC Sensor (wetted parts)
④	DSC Sensor (non-wetted parts)
⑤	Housing Support
⑥	Transmitter Housing
⑦	Gasket
Mounting Kit*	
Remote Transmitter Mount**	
Connection Cable (30 m)**	

* Flangeless model only, see 3.5
** Remote version only, see 4.4



2.1 EF200 Measuring System

The measuring system consists of:
- EF200 *remote* or *compact* versions
- EF200 flangeless or flanged connection body

In the *compact version*, the transmitter and sensor form a single mechanical unit; in the *remote version*, they are mounted separate from each other. When the sensor body must be installed in a high or otherwise difficult to reach location, the *remote version* allows more accessible transmitter installation. (See Fig. 1)

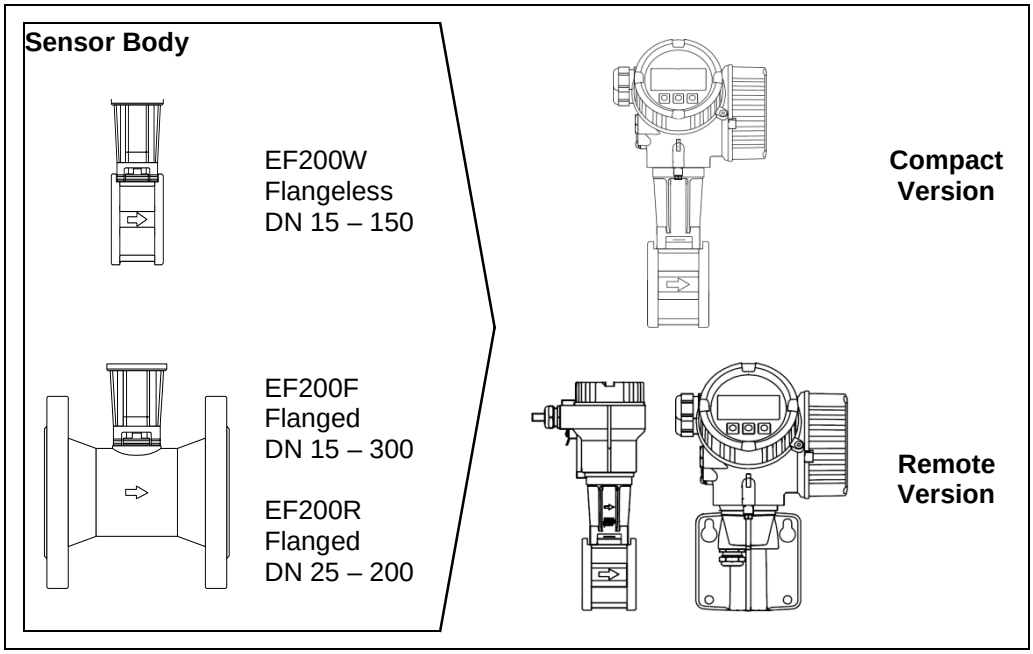
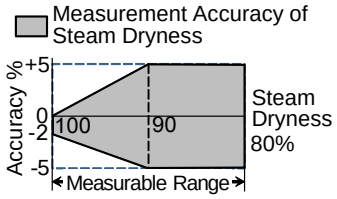


Figure 1
EF200 measuring system

2.2 Steam Dryness Fraction Calculator

EF200F ordered with the “Steam Dryness Fraction Calculator” option is not only capable of flow rate measurement but can also calculate the dryness fraction of steam.

Measurable range: 80 to 100% (See the figure on the right for measurement accuracy)



NOTE: Steam dryness fraction is an indication of steam quality. It shows the ratio of steam by mass in wet saturated steam.

Note!

$$\text{Steam Dryness Fraction (\%)} = \frac{\text{Steam mass flow rate}}{\left(\begin{array}{l}\text{Steam mass flow rate}\\ \text{+ Water mass flow rate}\end{array}\right)} \times 100$$

Caution!
This option cannot be used with EF200W or EF200R.

Caution!

There are a number of points to consider for the Steam Dryness Fraction Calculator. Ensure these are met when installing.

Applicable Models
- EF200F (Flanged) DN 25 – 100

Applicable Operating Conditions
- Pressure: 0.1 to 1.0 MPaG (1.0 to 10 barg)
- Temperature: 120 to 185 °C (Saturation temperature for the pressures above)
- Use at a stable pressure and flow rate.
  Steam pressure is input in fixed values, therefore correct measurement is not possible with large pressure fluctuations.
- Make sure the flow rate falls within the measurable range of flow rates at pressures between 0.1 and 1.0 MPaG (1.0 to 10 barg)
  The measurable ranges for flow rate and for steam dryness fraction are different. Refer to the table below to identify if the Steam Dryness Fraction Calculator option is applicable.

Caution regarding installation of devices equipped with the Steam Dryness Fraction Calculator (see 3.3)
- Ensure the required length of straight piping, without using a flow conditioner
- Install on horizontal piping with the display facing downward

Caution!
- When equipped with the Steam Dryness Fraction Calculator function, the EF200F can be used with steam and water, but cannot be used with air.
- When using the Steam Dryness Fraction Calculator function, the measurement accuracy for steam mass flow rate will decrease from ±2 °C to ±4 °C.

Caution!

Measurable flow rates for saturated steam when used with the optional Steam Dryness Fraction Calculator EF200F (Unit: kg/h)

Size (mm)/DN		25		40		50		80		100		Temp. (°C)
Pressure		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
MPaG	barg											
0.1	1	11	66	27	233	44	349	99	872	171	906	120.4
0.2	2	14	96	35	340	57	510	128	1,272	221	1,323	133.7
0.3	3	19	126	45	445	75	668	167	1,666	289	1,731	143.7
0.4	4	23	156	55	548	92	823	206	2,054	356	2,135	151.9
0.5	5	27	185	66	651	109	978	244	2,438	423	2,534	158.9
0.6	6	31	214	76	753	126	1,131	282	2,820	489	2,931	165.0
0.7	7	35	243	86	855	143	1,283	320	3,200	555	3,326	170.5
0.8	8	39	272	96	956	160	1,435	358	3,579	620	3,720	175.4
0.9	9	43	301	106	1,057	177	1,586	396	3,955	686	4,111	179.9
1.0	10	48	329	116	1,158	194	1,737	434	4,333	751	4,503	184.1

Consult TLV for measurable flow rate data in imperial units.

3. Mounting and Installation

3.1 Transport

- The devices must be transported in the container supplied.
- Devices with nominal diameter 40 to 300 mm (DN 40 to 300) must not be lifted at the transmitter housing (*compact version*) or at the connection housing (*remote version*) when transporting (see Fig. 2). Use carrier slings when transporting and put the slings around both process connections. Avoid chains as these could damage the housing.

Warning!
The center of gravity of the entire measuring device might be higher than the suspension points of the slings. Therefore, when hoisting, make sure that the device does not unintentionally turn or slip, as there is the risk of injury if the device falls.

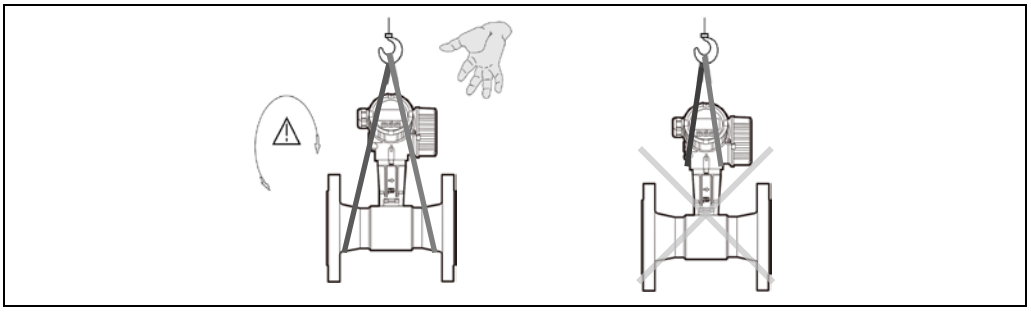


Figure 2 Instructions for transporting sensors of sizes 40 -300 mm

3.2 Degree of Protection

IP66/67 (EN60529)

Caution!
The devices fulfill all the requirements for IP66/67, Type 4X enclosure. Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP66/67, Type 4X enclosure protection is maintained:

- Housing gaskets must be clean and undamaged when inserted in the gasket groove. The gaskets may need to be dried, cleaned or replaced.
- All housing screws and screw caps must be firmly tightened.
- The cables used for connection must be of the specified outside diameters.

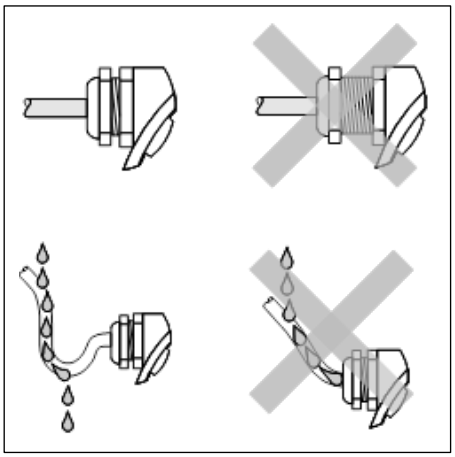


Figure 3 Protection Class IP66/67, Type 4X enclosure

- Firmly tighten the cable entry (see Fig. 3).
- The cables must loop down before they enter the cable entries (“water trap”, Fig. 3). This arrangement prevents moisture penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Replace all unused cable entries with dummy plugs.
- Do not remove the grommet from the cable entry.

Temperature Ranges

- The maximum allowable ambient and process temperatures must be observed (see 6.1.6).
- Ensure both pipeline heat insulation and mounting position conditions are met (see 3.3).

3.3 Installation Conditions

A vortex flowmeter requires a fully developed flow profile as a prerequisite for measuring volume accurately. The following points must therefore be noted when mounting the EF200 in the pipeline.

Pipe Inner Diameter
When ordering, ensure that the nominal diameter and pipe schedule (DIN/ANSI/JIS) are correct, since calibration of the flowmeter and therefore the achievable accuracy of the measuring point are dependent on these specifications.

3.3.1 Upstream and Downstream Sections

To ensure an undisturbed flow profile, the vortex flowmeter should be mounted up- and downstream of any flow disturbances such as pipe elbows, reducers or valves, otherwise the longest possible straight section of piping should be between the disturbance and the flowmeter. The figures on the right show the minimum section of straight piping up- and downstream of the disturbance as multiples of the nominal diameter of the pipe (D, see Fig. 4-1). If two or more flow disturbances are located upstream, the minimum section of straight piping upstream is equal to the sum of each individual disturbance's requirements up to a maximum of 50D.

Example:
For 25 mm diameter piping with one 90° elbow:
20D = 20 × 25 mm = 500 mm, therefore straight piping length must be at least 500 mm.

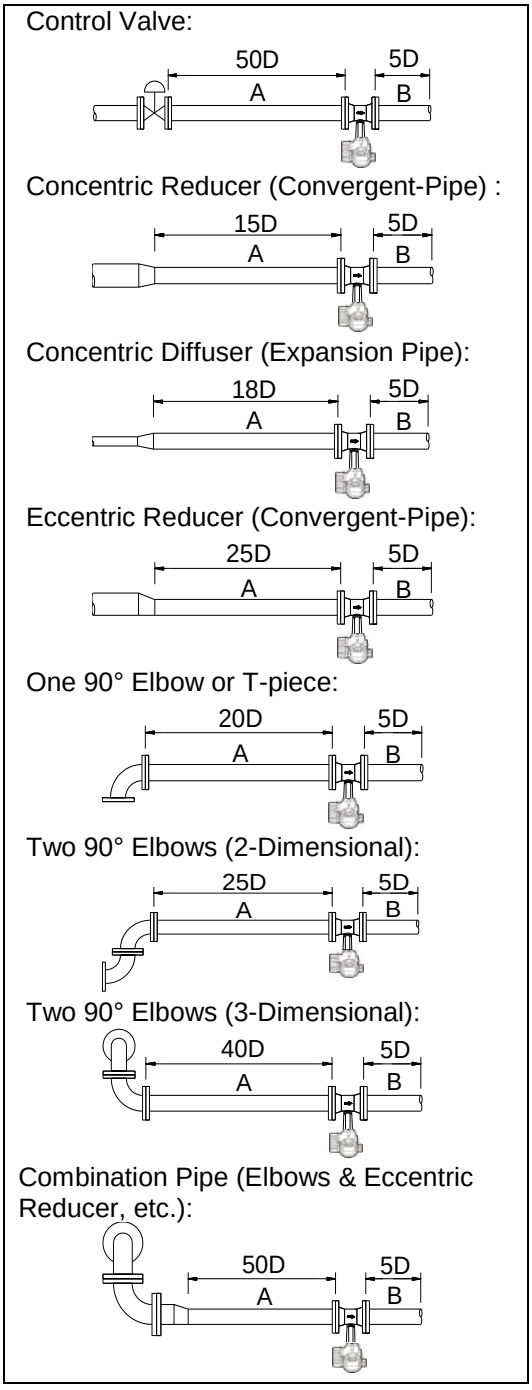
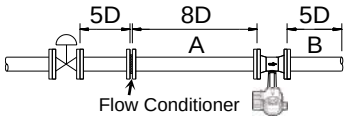


Figure 4-1 Upstream and downstream piping requirements

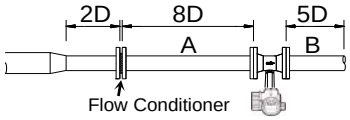
A = Upstream
B = Downstream
D = Nominal Diameter

3.3.2 Flow Conditioner (Rectifier)

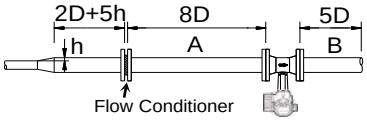
Control Valve and Flow Conditioner:



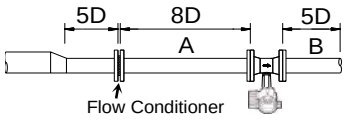
Concentric Reducer and Flow Conditioner:



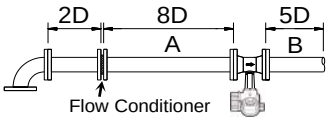
Concentric Diffuser and Flow Conditioner:



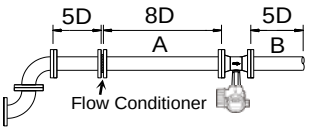
Eccentric Reducer and Flow Conditioner:



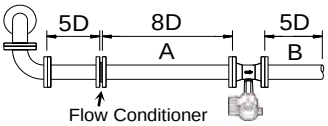
One 90° Elbow or T-piece and Flow Conditioner:



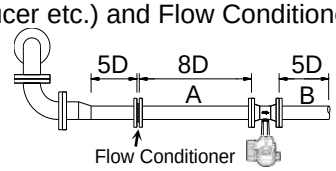
Two 90° Elbows (2-Dimensional) and Flow Conditioner:



Two 90° Elbows (3-Dimensional) and Flow Conditioner:



Combination Pipe (Elbows & Eccentric Reducer etc.) and Flow Conditioner:



With limited space and large pipes, it is not always possible to use the upstream sections shown in Fig. 4-1. In such cases the specially developed perforated plate flow conditioner (see 6.6) can be fitted as shown on the right (see Fig. 4-2). The flow conditioner is held between two piping flanges and centered with the flange bolts. It reduces the length of the upstream section downstream from flow disturbances to 8D while maintaining full measurement accuracy. The total length of straight piping downstream becomes 10D to 13D. Note that a flow conditioner cannot be used in conjunction with the Steam Dryness Fraction Calculator option.

Figure 4-2 Upstream and downstream piping requirements

A = Upstream
B = Downstream
D = Nominal Diameter

3.3.3 Installation Orientation

The EF200 can be mounted in any direction in the piping. An arrow on the meter body shows the direction of flow.

For measuring liquids in vertical pipes, the meter should be installed with an upwards flow direction, position A, to make sure pipes are completely flooded, avoiding partial filling (see Fig. 5).

For horizontal pipelines, positions B, C and D are possible (see Fig. 5). With hot piping (e.g. steam), position C or D must be selected in order to respect the maximum permissible ambient temperature at the electronics.
Do not mount the flangeless model EF200W at sizes of 100 mm or larger in position B for use with fluids at temperatures equal to or greater than 200 °C.

Refer to the Technical Data section for ambient temperatures (see 6.1.6).

Caution!
For use with the Steam Dryness Fraction Calculator option, ensure the flowmeter is mounted in position C.

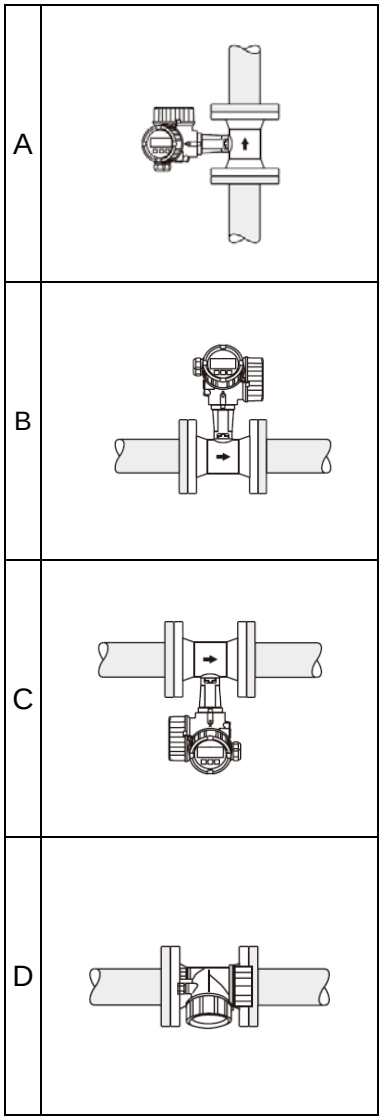


Figure 5
Installation position

3.3.4 Pressure Measurement Points

If a pressure measuring point is installed after the device, ensure that there is a large enough distance between the device and the measuring point so that there are no negative effects on vortex formation in the sensor.
(see Fig. 6)

D = Nominal Diameter

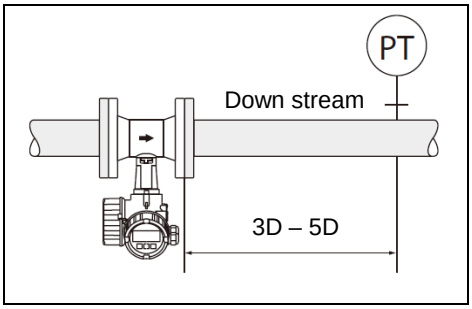


Figure 6
Mounting pressure sensors

3.3.5 Pipeline Heat Insulation

Caution!

Caution!
When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part serves as a radiator and protects the electronics from overheating (or undercooling).

The maximum insulation height permitted is illustrated in Figure 7 (marked “max.” with a limiting line). These apply to both the compact version and the sensor in the remote version, as well as all installation orientations.

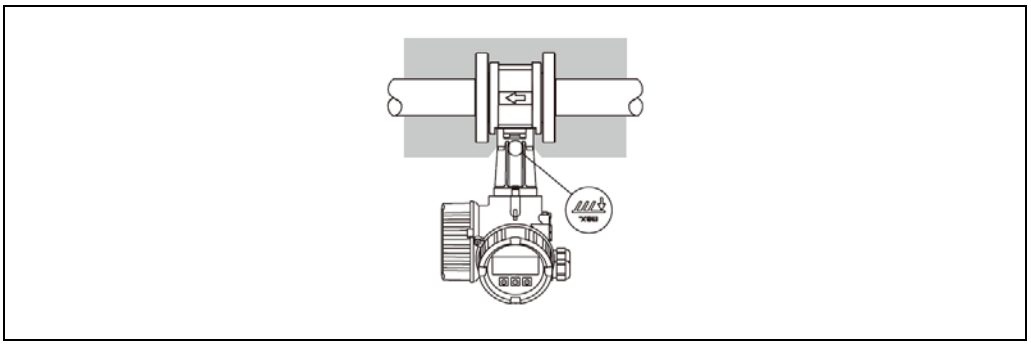


Figure 7
Pipeline insulation flangeless/flanged version

3.3.6 Minimum Maintenance Space

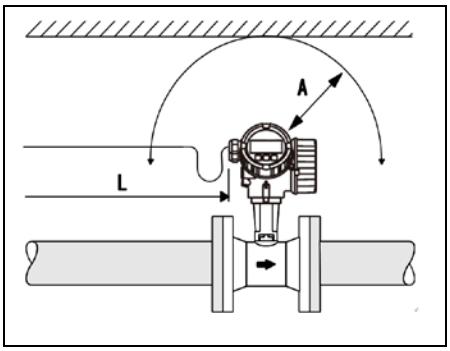


Figure 8
Minimum spacing for mounting and removing the transmitter housing

When servicing, it is necessary to remove the transmitter housing from the housing support.
When installing in the piping, be sure to secure the following cable lengths and minimum maintenance space:

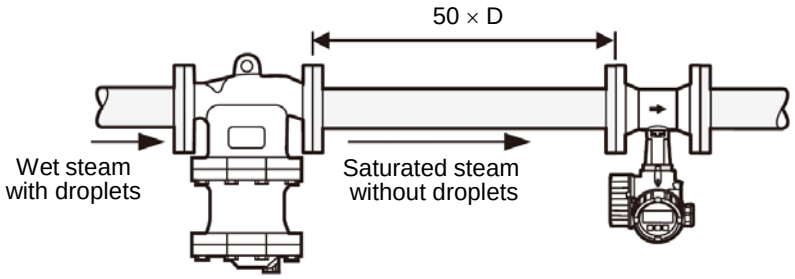
- Minimum maintenance space in all directions: A = 100 mm
- Cable length required: L + 150 mm

Caution!

Caution!
Removing the transmitter from the housing support is to be carried out by qualified TLV appointed service personnel only!

3.3.7 Ensuring accurate measurements

In some cases where steam is mixed with condensate, it may not be possible to obtain accurate flow rate measurements.
To remove these causes for concern about flow rate measurements, it is recommended to install a separator upstream of the flowmeter.



3.3.8 Other Considerations

Vibrations

The correct operation of the measuring system is not influenced by plant vibrations up to 1 g, 10 to 500 Hz. Consequently, the sensors require no special measures for attachment. If higher levels of vibration are expected, be sure to secure piping before and after the flow meter.

Preventing Excessive Flow

Caution!


Caution!

To ensure long service life for the flowmeter, excessive instantaneous/ periodical flow rates should be held below the flow meter's maximum flow rate. Failing to do so might result in damage to the sensor. Special care is necessary for steam at startup when the pressure is low, or when a valve is opened rapidly, such as by a solenoid valve, as excessive instantaneous flow rates often occur.

Pulsating Influences

The ability of the flowmeter to measure correctly may be adversely affected if there are large variations of pressure or pulsating pressure from compressors and/or soot blowers. Use the procedures below to minimize pulsating pressures:

- Move the source of the pulsations to the downstream side of the flowmeter. Alternatively, put as much distance as possible between the source and the flowmeter.
- Install a pulsation dampening device, such as a chamber.
- Close the valves before and after the flowmeter when there is no flow. (This is to prevent false non-zero readings under zero-flow conditions.)

Prevent Mixed Phase Flow

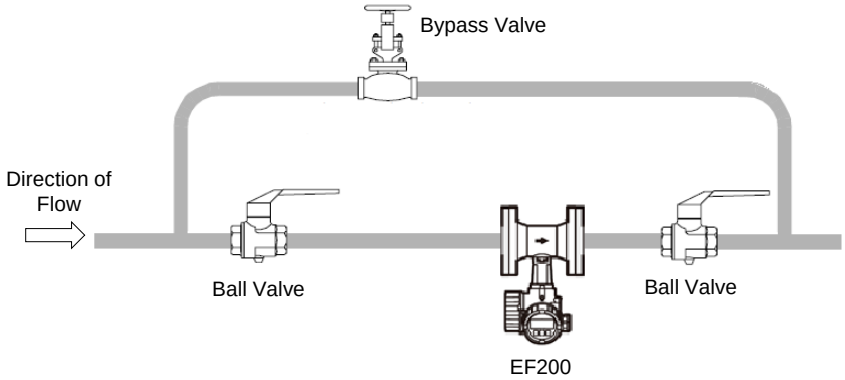
This flowmeter is designed to measure both gases and liquids. However, accurate measurement cannot be guaranteed when gases and liquids are mixed together (i.e. gas-liquid mixed phase flow).

Ensure Pipe is Flooded

When measuring liquids ensure that the pipe is flooded, as this will have an influence on the accuracy of flow rate measurements.

Bypass Lines

The installation of bypass lines can facilitate maintenance and inspections. When installing a bypass line, use upstream and downstream valves of a type that does not disturb the flow profile, and secure sufficient length of straight pipe.



3.4 Mounting the Flowmeter

Warning!

Warning!
Note the following points before installing the flowmeter:

- Remove all packaging used for transport and protective coverings from the flowmeter before installing the flowmeter in the pipeline.
- Ensure that the inner diameters of the gaskets are identical to or larger than those of the meter body and process piping. Gaskets that protrude into the flow affect vortex formation behind the bluff body and lead to inaccurate measurement. Therefore, the gaskets delivered by TLV come with a slightly larger inner diameter than the measuring pipe.
- Confirm the gaskets are not dirty or damaged.
- Ensure that the direction of the arrow on the sensor body matches the flow direction (direction of medium flow in the piping).
- Mount the flowmeter or rotate the transmitter housing so that the cable entries do not face upward.

Mounting EF200 Flangeless Version
Mounting the flangeless body is carried out using a mounting set (see Fig. 9)

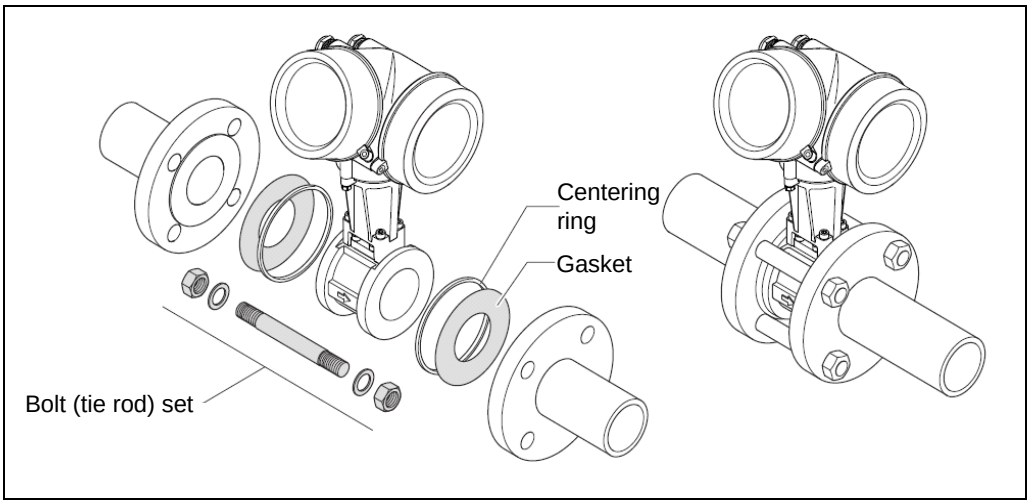


Figure 9
Mounting the EF200 flangeless version

Caution!

Caution!
By tightening the bolts (tie rods) after fitting the centering rings to the flange rims on the meter body, it is possible to align the meter body with the piping and fill the space between the bolts (tie rods) and the meter body. However the centering rings are not secured to the meter body.

3.5 Mounting the Transmitter (Remote Version)

Where the flowmeter body is installed on piping in a high position or in cases where there is poor accessibility to the display, the remote transmitter display may be installed in an easily visible location.
The transmitter can be mounted in the following ways:

- Wall mounting (Fig. 10.A)
- Pipe mounting (with optional pipe mounting kit) (Fig. 10.B)

Caution!
Install the transmitter in a location out of direct sunlight and with an ambient temperature range of -40 to +80 °C. (See 3.7)
However, the display performance of the LCD may be affected or it may be difficult to read the display if the ambient temperature is below -10°C or above +60°C.

Caution!

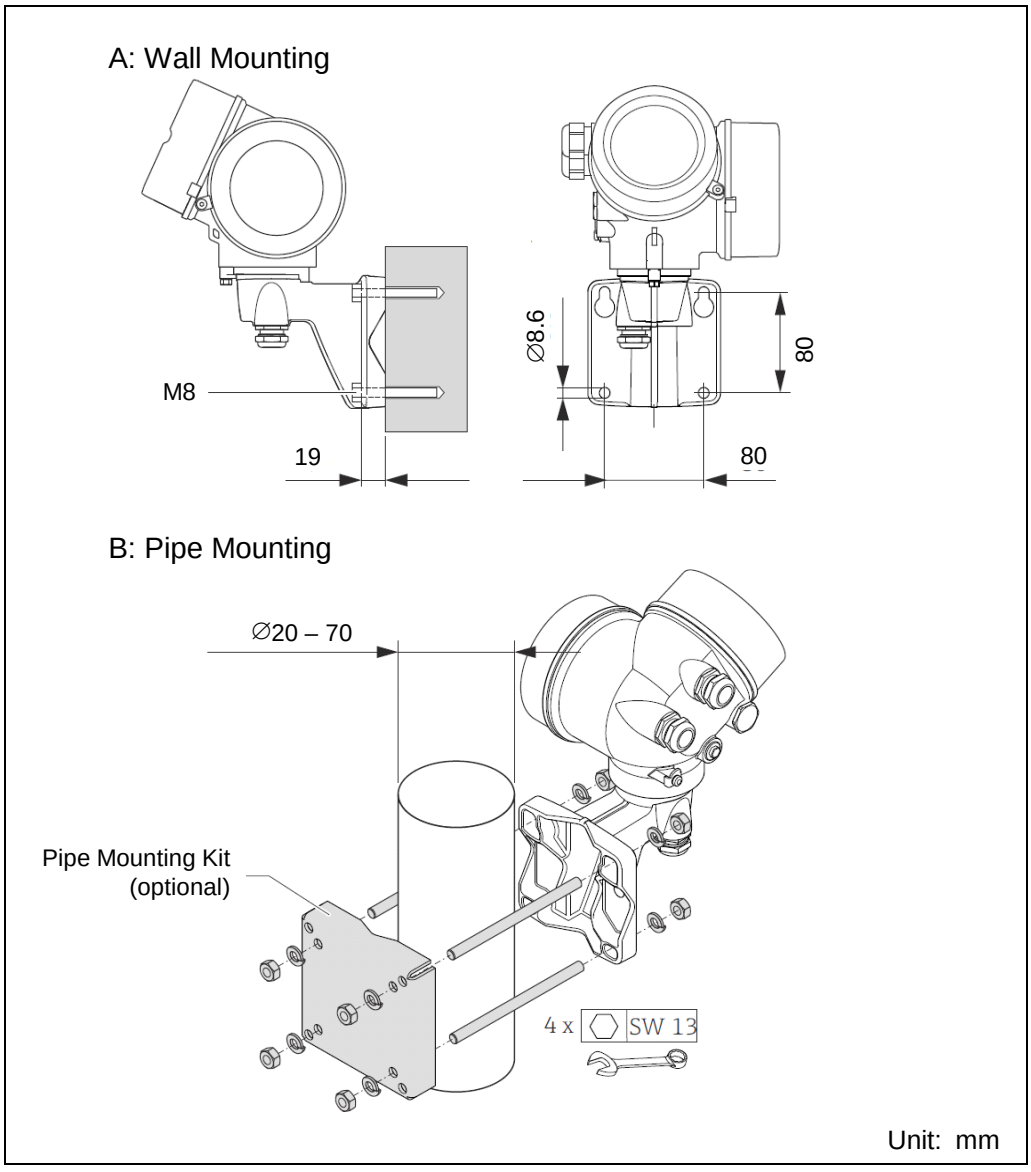


Figure 10
Mounting the transmitter (remote version)

Caution!
Take care not to overtighten the nuts when installing the remote transmitter on piping.
The transmitter housing is constructed from die-cast aluminum, therefore may be damaged. (Recommended torque: 5 N·m)

Caution!

3.6 Transmitter Housing / Display (Mounting/Rotating)

Rotating the Transmitter Housing

The transmitter housing of EF200 can be rotated on the housing support up to 350° clockwise or counterclockwise to reposition the optional local display for easy reading.

This is carried out as follows (see Fig. 11):

1. Loosen the securing screw (minimum one turn).
2. Turn the transmitter housing to the desired position.
3. Fasten the securing screw firmly.

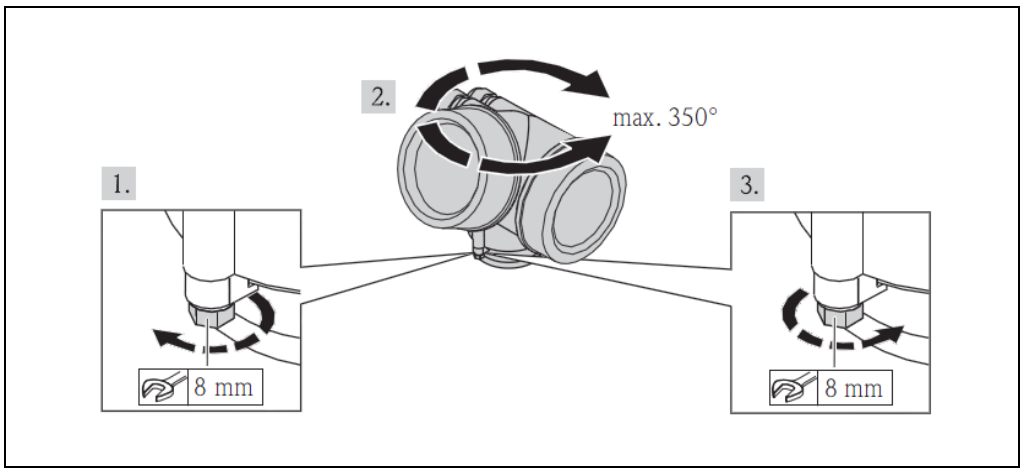


Figure 11
Rotating the transmitter housing

Rotating the Display

The display module can be rotated for easy reading in any position (see Fig. 12).

1. Loosen the securing clamp of the electronics compartment cover using a hex key.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Optional: pull out the display module with a gentle rotational movement.
4. Rotate the display module into the desired position: Max. 8 × 45° in each direction.
5. Without display module pulled out:
   Allow display module to engage at desired position.
6. With display module pulled out:
   Feed the cable into the gap between the housing and main electronics module and plug the display module into the electronics compartment until it engages.
7. Reverse the removal procedure to reassemble the transmitter.

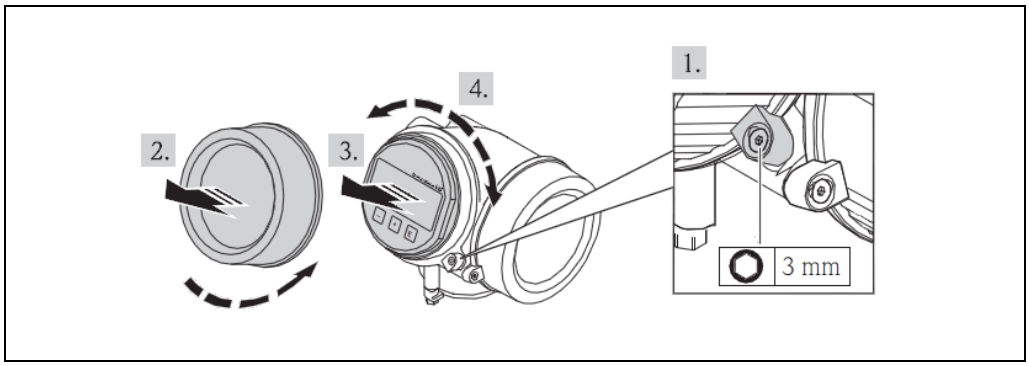


Figure 12
Rotating the local display

3.7 Protect the Transmitter Against Direct Sunlight

Install the transmitter in a location out of direct sunlight if possible. If the transmitter is subjected to direct sunlight, even when ambient temperature is within operational range (80 °C or below), the temperature inside the transmitter may become higher. Additionally, sunlight may promote deterioration of the finish and appearance of the unit.

If installation outdoors in an uncovered location in unavoidable, installing the optional sunshade is recommended. (This is not required when installing compact version with the transmitter oriented downwards.)

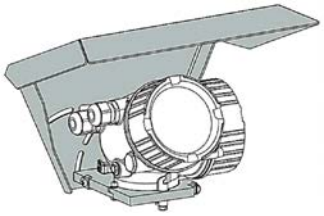


Figure 13
Installing the optional sunshade

4. Electrical Connection

4.1 Connecting the Transmitter

Warning!

Warning!

- Power must be switched off until wiring is completed.

Caution!

Caution!

- All relevant national installation regulations must be observed.
- The power supply is max. 35 V DC.

Procedure (see Fig. 14)

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the cable in accordance with the terminal assignment. For HART communication: when connecting the cable shielding to the ground terminal, observe the grounding concept of the facility.
6. Firmly tighten the cable glands.
7. **Warning!**
   Housing protection class may be void due to insufficient sealing of the housing. Reinsert the screw without using any lubricant. The screw threads on the cover are coated with a dry lubricant.
   Reverse the removal procedure to reassemble the transmitter.

Warning!

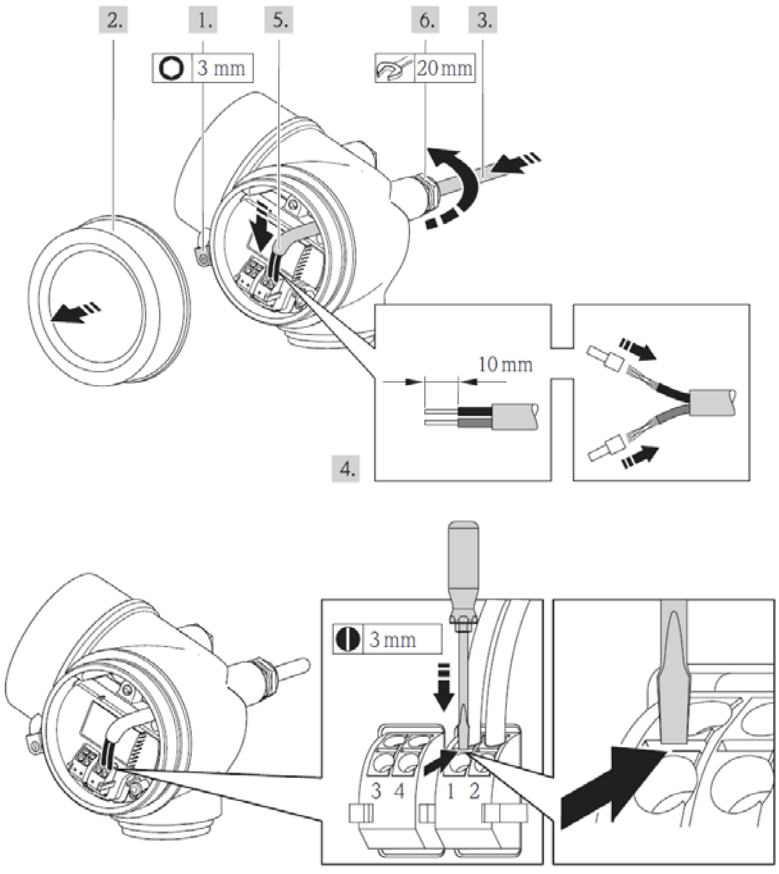


Figure 14
Procedure for connecting the transmitter

To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes while simultaneously pulling the cable end out of the terminal.

4.2 Wiring Diagrams

EF200 Only, Connecting Power Supply

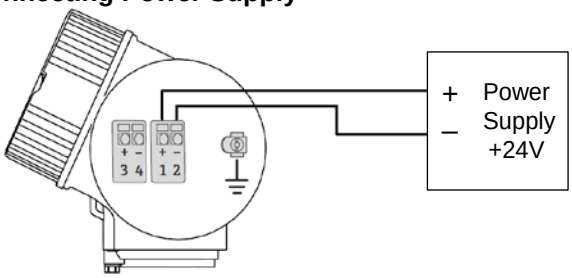


Figure 15
Power Supply DC24V

Frequency (Pulse) Output for an Electronic Counter or PLC

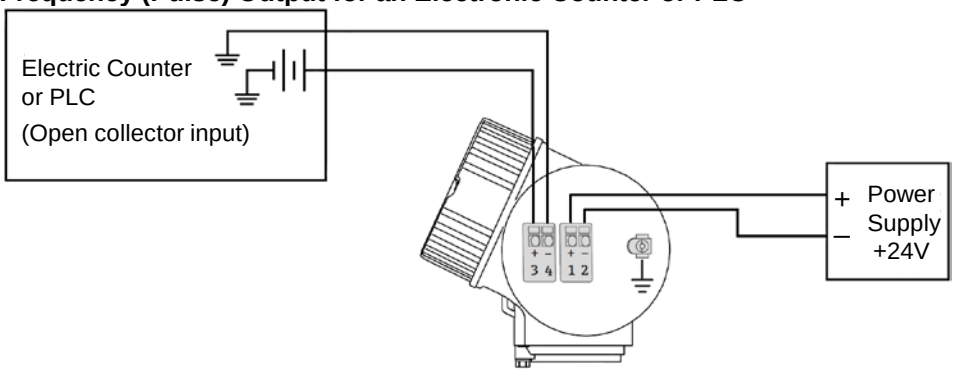


Figure 16
Pulse output to electronic counter or PLC

Caution!
The residual voltage of pulse output is 2 V at load current of 2 mA or less, or 8 V at 10 mA. Make sure to select an electronic counter or PLC conforming to these specifications or an instrument that can be set to “Low” level.

Caution!

Current Output for an Analog Data Receiver

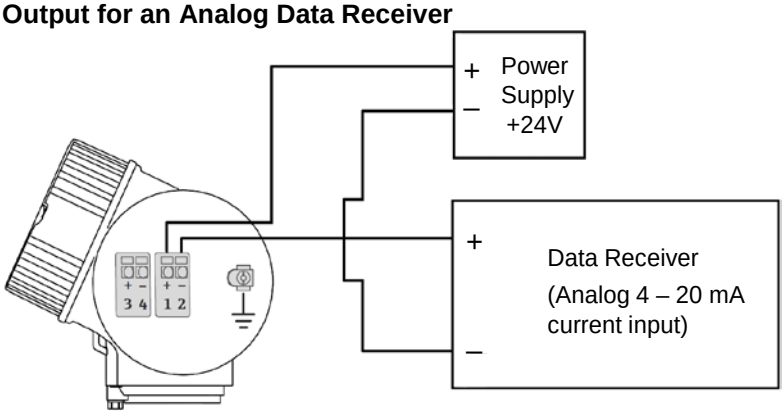


Figure 17
Analog current output connection

NOTE: Shielded cable recommended for current output.

4.3 Connecting to TLV EC351 Flow Computer and Parameter Settings

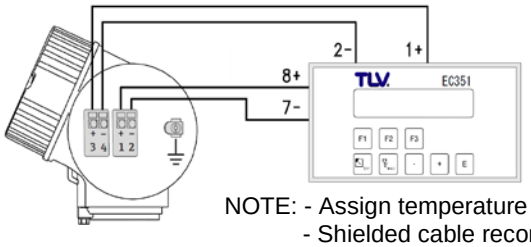


Figure 18
Connecting to TLV flow computer EC351

NOTE: - Assign temperature to the analog output
- Shielded cable recommended for analog output

EF200 Pulse Output Settings

Submenu	Parameter	Selection
Pulse/ frequency/ switch output	Operating mode	Pulse
	Assign pulse output	Volume flow
	Volume unit	L (liter)
	Value per pulse	See Table A
	Pulse width	5 ms

Table A

Size	Value per pulse [dm³/P]		
	EF200W	EF200F	EF200R
15	0.098400	0.068400	–
25	0.448700	0.347799	0.068400
40	1.039101	0.855103	0.347799
50	1.685999	1.425801	0.855103
80	3.793483	3.199488	1.425801
100	6.462871	5.542008	3.199488
150	14.47387	12.60716	5.542008
200	–	24.20136	12.60716
250	–	38.15388	–
300	–	54.73454	–

e.g. When connecting a DN 40 EF200F to EC351, enter a "Value per pulse" of 0.855103

Size	Value per pulse [dm³/P]		
	EF200W	EF200F	EF200R
15	0.098400	0.068400	–
25	0.448700	0.347799	0.068400
40	1.039101	0.855103	0.347799
50	1.685999	1.425801	0.855103
80	3.793483	3.199488	1.425801
100	6.462871	5.542008	3.199488
150	14.47387	12.60716	5.542008
200	–	24.20136	12.60716
250	–	38.15338	–
300	–	54.73454	–

EC351 Flow Rate Input Settings

Function group	Function	Selection
FLOW INPUT	K-FACTOR	See Table B

Table B

Size	K-FACTOR [P/l]		
	EF200W	EF200F	EF200R
15	10.1626	14.61988	–
25	2.22866	2.87522	14.61988
40	0.96237	1.16945	2.87522
50	0.59312	0.70136	1.16945
80	0.26361	0.31255	0.70136
100	0.15473	0.18044	0.31255
150	0.06909	0.07932	0.18044
200	–	0.04132	0.07932
250	–	0.02621	–
300	–	0.01827	–

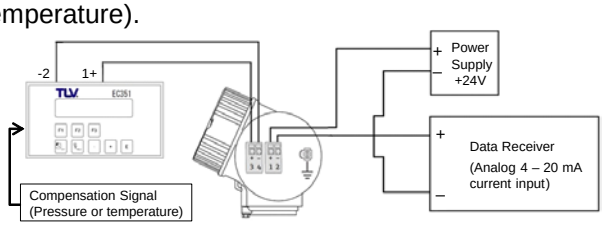
e.g. When connecting a DN 40 EF200F to EC351, enter a "K-FACTOR" of 1.16945

Size	K-FACTOR [P/l]		
	EF200W	EF200F	EF200R
15	10.1626	14.61988	–
25	2.22866	2.87522	14.61988
40	0.96237	1.16945	2.87522
50	0.59312	0.70136	1.16945
80	0.26361	0.31255	0.70136
100	0.15473	0.18044	0.31255
150	0.06909	0.07932	0.18044
200	–	0.04132	0.07932
250	–	0.02621	–
300	–	0.01827	–

Caution!

Caution!

An additional sensor is required to convert steam flow rates to mass flow rates when assigning measurements such as steam dryness fraction calculation to the analog output (except temperature).



4.4 Connecting the Remote Version

Warning!

- Ground the remote version and in doing so connect the sensor and transmitter to the same potential equalization.
- When using the remote version, always make sure that you connect the sensor only to the transmitter with the same serial number. If this is not observed when connecting the devices, incorrect measurements may be displayed.

Connecting the sensor connection housing

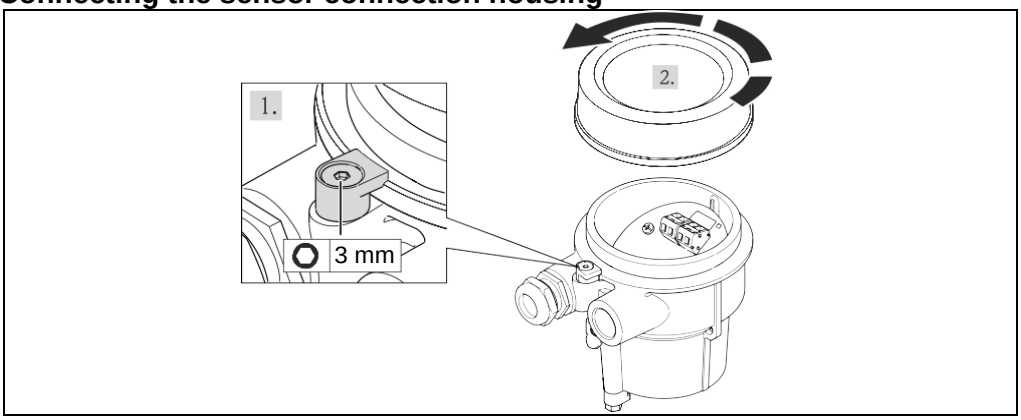


Figure 19
Removing the cover

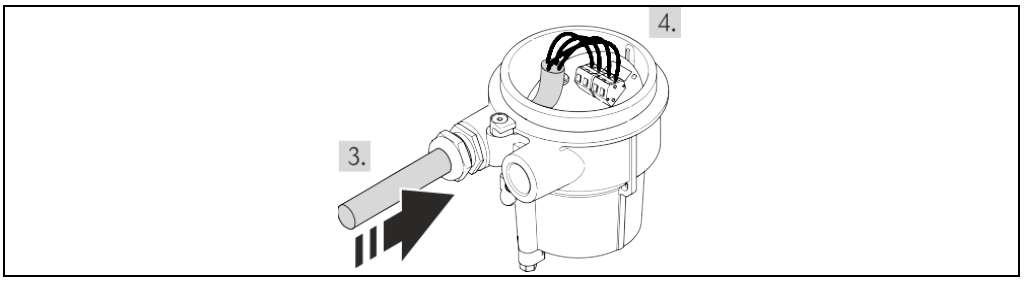


Figure 20
Wiring the remote version

1. Loosen the securing clamp of the transmitter housing.
2. Unscrew the housing cover.
3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).
4. Wire the connecting cable:
   Terminal 1 = brown cable
   Terminal 2 = white cable
   Terminal 3 = yellow cable
   Terminal 4 = green cable
5. Correct the cable shield via the cable strain relief.
6. Screw the housing cover back onto the transmitter housing, then reposition the securing clamp and tighten.

Connecting cables to the transmitter

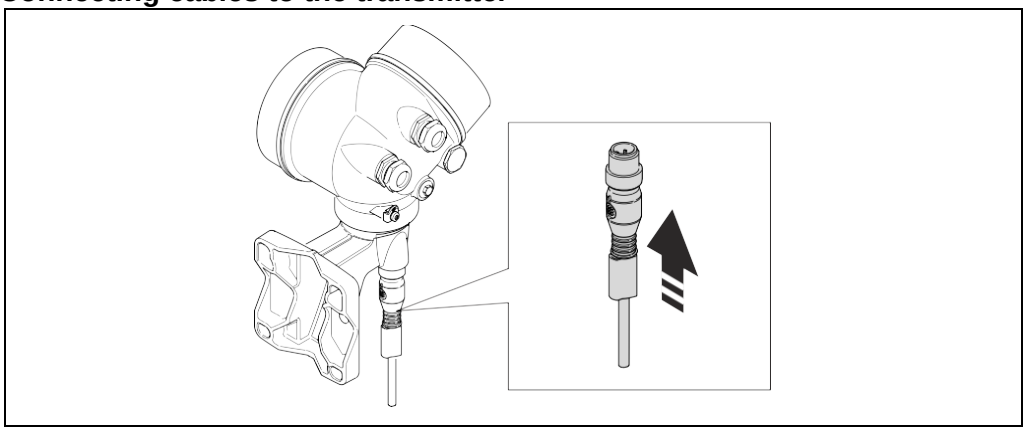


Figure 21
Connecting the remote version

Connecting the signal cable plug to the remote transmitter

Caution!
For non-standard specifications, there may be cases in which the signal cable has no plug and requires terminal connection identical to the sensor housing. Consult TLV for cable connection methods.

Connection Cable Specifications

Cable configuration	$4 \times 2 \times 0.34$ mm^2 (22 AWG) PVC cable with common shield (4 pairs, pair-stranded)
Flame resistance	DIN EN 60332-2-1 compliant
Oil resistance	DIN EN 60811-2-1 compliant
Shielding	Galvanized copper braid, operating density approx. 85%
Cable length	30 m
Operating temperature	When in a fixed position: -50 to +105 °C When cable freely adjustable: -25 to +105 °C

5. Operation

The EF200 has a number of functions that the user can individually set according to process conditions. The display consists of max. of 4 lines; this is where measured values and/or status variables are displayed. You can change the assignment of the display lines to different variables to suit your needs and preferences.

Note!
Due to current use restrictions, the EF200 LCD does not employ a backlight. Lighting is required when reading the display in dark places.


Note!

5.1 Display and Operating Elements

The transmitter is operated locally by using three keys and the local display (see Fig. 22). This enables individual functions to be selected and parameters or values to be entered.
The following is an explanation of the display and operation of each screen mode.

5.1.1 Operating Display

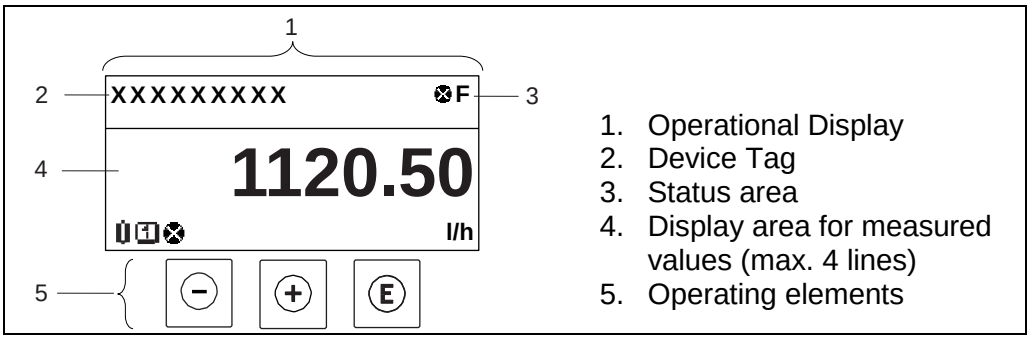


Figure 22
Display and operating elements of the EF200

Status area
The following symbols appear in the status area of the operational display at the top right:
- Status signals
  F: Failure
  C: Function check
  S: Out of specification
  M: Maintenance required
- Diagnostic behavior (see 10.2)
  ⊗ Alarm
  ⚠ Warning
- 🔒 Locking (the device is locked via the hardware)
- ⇆ Communication (communication via remote operation is active)

Display area for measured values
Each measured value in the display area is preceded where necessary by a symbol for measured variables, measurement channel numbers or diagnostic behavior.

Measured Variables

Symbol	Meaning
$\dot{V}$	Volume flow
$\dot{m}$	Mass flow rate
Σ	Totalizer Tip: The measurement channel number indicates which of the three totalizers is displayed.
	Output

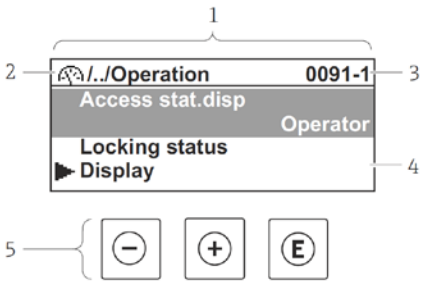
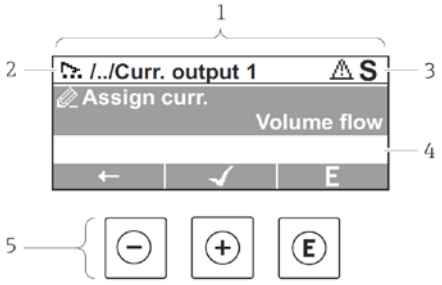
Measurement channel numbers

Symbol	Meaning
1–4	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).	

Diagnostic behavior
The diagnostic behavior (alarm or warning output) pertains to a diagnostic event that is relevant to the displayed measured variable.

5.1.2 Navigation view

Pressing the E key from the operating display or operations such as selecting a specific menu will switch to the Navigation view.

In the submenu	In the wizard
	

1. Navigation view
2. Navigation path to current position
3. Status area
4. Display area for navigation
5. Operating elements

Status area
The following appears in the status area of the navigation view in the top right corner:

- Of the submenu:
  – The direct access code for the parameter you are navigating to (e.g. 0022-1)
  – If a diagnostic event is present, the diagnostic behavior and status signal
- Of the wizard:
  – If a diagnostic event is present, the diagnostic behavior and status signal

Display area

Menus

Symbol	Meaning
	**Operation** Appears: • In the menu next to the "Operation" selection • At the left in the navigation path in the "Operation" menu
	**Setup** Appears: • In the menu next to the "Setup" selection • At the left in the navigation path in the "Setup" menu
	**Diagnostics** Appears: • In the menu next to the "Diagnostic" section • At the left in the navigation path in the "Diagnostic" menu
	**Expert** Appears: • In the menu next to the "Expert" section • At the left in the navigation path in the "Expert" menu NOTE: This menu is for use by TLV technical service personnel only.

Submenus, wizards, parameters

Symbol	Meaning
	Submenu
	Wizard
	Parameters within a wizard

Locking

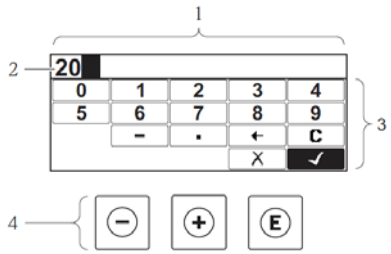
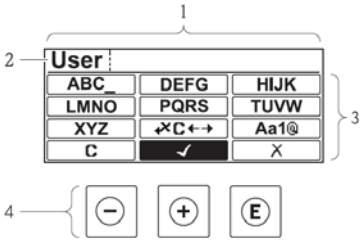
Symbol	Meaning
	**Parameter locked** When displayed in front of a parameter name, indicates that the parameter is locked. There are two methods of locking parameters. • By a user-specific access code • By the hardware write protection switch

Wizard operation

Symbol	Meaning
	Switches to the previous parameter.
	Confirms the parameter value and switches to the next parameter.
	Opens the editing view of the parameter.

5.1.3 Editing view

When changing settings, entering text or access codes, the display will appear as follows.

Numeric editor	Text editor
	

1. Editing view
2. Display area of the entered values
3. Input mask
4. Operating elements

Input mask

The following keys are available in the input mask of the numeric and text editor:

Numeric editor

Key	Function
0 . … 9 –	Inserts the selected number or symbol
✓	Confirms selection
←	Moves the input position one position to the left
X	Exits the input without applying the changes
C	Clears all entered characters

Text editor

Key	Function
Aa1@	Toggle • Between upper-case and lower-case letters • For entering numbers • For entering special characters
ABC_ … XYZ	Selection of letters from A to Z
abc _ … xyz	Selection of letters from a to z
'"^ _ … ~& _	Selection of special characters
✓	Confirms selection
✓C←	Switches to the selection of the correction tools
X	Exits the input without applying the changes
C	Clears all entered characters

Correction keys under ✓C←

Key	Function
C	Clears all entered characters
→	Moves the input position one position to the right
←	Moves the input position one position to the left
⌫	Deletes one character immediately to the left of the input position

5.1.4 Operating elements

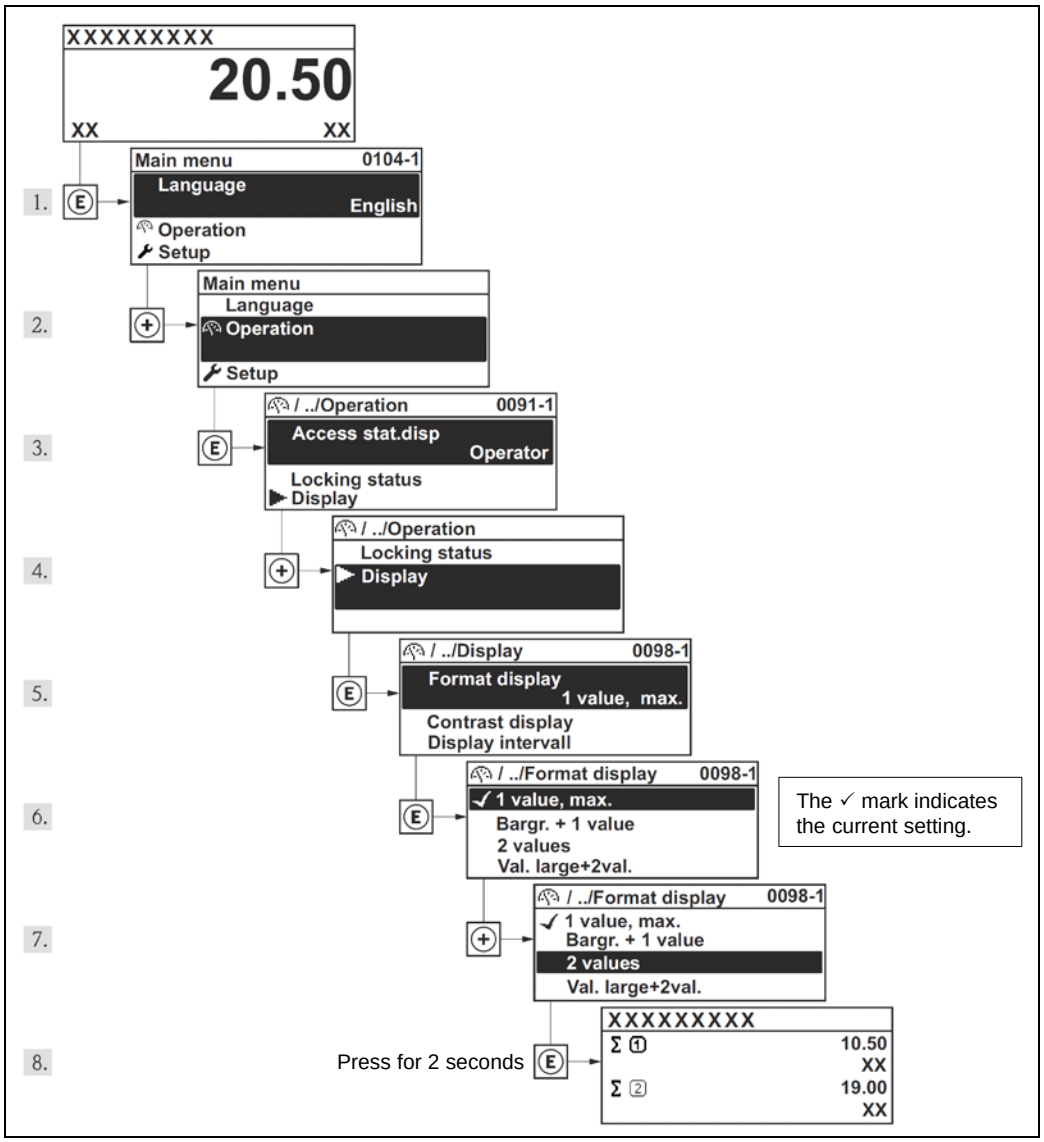
Key	Function
−	**Minus key** • In a menu, submenu Moves the selection bar upwards in a choose list. • With a Wizard Confirms the parameter value and goes to the previous parameter. • With a text and numeric editor In the input mask, moves the selection bar to the left (backwards).
+	**Plus key** • In a menu, submenu Moves the selection bar downwards in a choose list. • With a Wizard Confirms the parameter value and goes to the next parameter. • With a text and numeric editor Moves the selection bar to the right (forwards) in an input screen.
E	**Enter key** • For operational display Pressing the key briefly opens the operating menu. • In a menu, submenu Pressing the key briefly: – Opens the selected menu, submenu or parameter. – Starts the wizard. – If help text is open, closes the help text of the parameter. Pressing the key for 2 seconds for parameter: If present, opens the help text for the function of the parameter. • With a Wizard Opens the editing view of the parameter. • With a text and numeric editor Pressing the key briefly: – Opens the selected group. – Carries out the selected action. Pressing the key for 2 seconds confirms the edited parameter value.
− + +	**Escape key combination (press keys simultaneously)** • In a menu, submenu Pressing the key briefly: – Exits the current menu level and takes you to the next higher level. – If help text is open, closes the help text of the parameter. Pressing the key for 2 seconds returns you to the operational display ("home position"). • With a Wizard Exits the wizard and takes you to the next higher level. • With a text and numeric editor Closes the text or numeric editor without applying changes.
− + E	**Minus/Enter key combination (press the keys simultaneously)** Reduces the contrast (brighter setting).
+ + E	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
− + + + E	**Minus/Plus/Enter key combination (press the keys simultaneously)** For operational display Enables or disables the keypad lock.

5.2 Navigating the Operation Menu (Basic Operation of the Function Matrix)

The operating elements can be used to navigate within the Operation Menu. A symbol is displayed to the left of each of the following functions and appears in the header when navigating the submenu for that function.

- Operation
- Setup
- Diagnostics
- Expert

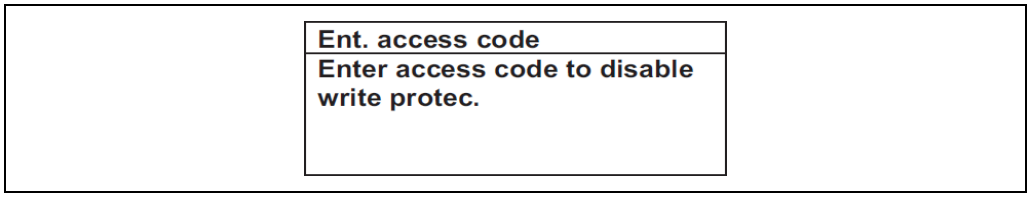
Example: Setting the number of displayed measured values to “2 values”



5.2.1 Calling up help text

For some parameters, help texts exist, which the user can call up from the navigation view. These briefly describe the function of the parameter and thus support fast and reliable commissioning.

Calling up and closing the help text
The user is in the navigation view and the selection bar is on a parameter.
1. Press E for 2 seconds.
   The help text for the selected parameter opens.



2. Press − + + simultaneously.
   The help text is closed.

5.2.2 Disabling write protection via access code

By entering the customer-defined access code, parameters for device settings can be write-protected. (See 8.2.19)

Access codes are not enabled by default.

If the 🔒 symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using the local display.

The locking of the write access via local operation can be disabled by entering the customer-defined access code via the respective access option.
1. After you press E, the input prompt for the access code appears.
2. Enter the access code.
   The 🔒 symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

5.2.3 Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

Switching on the keypad lock
The device is in the measured value display.
Press the −, +, E keys simultaneously.
➥The message **Keylock on** appears on the display: The keypad lock is switched on.

Tip: If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock
The keypad lock is switched on.
Press the −, +, E keys simultaneously.
➥The message **Keylock off** appears on the display: The keypad lock is switched off.

6. Technical Data

6.1 Technical Data at a Glance

6.1.1 Application

The measuring system is used to measure the flow of saturated steam, superheated steam, gases and liquids. The variables volume flow and temperature are measured directly. From these values, the device can used stored data on the density and enthalpy to calculate and output the mass flow and heat flow for example.

6.1.2 Function and System Design

Measuring Principle	Vortex flow measurement on the principle of the Karman vortex street.
Measuring System	The measuring system consists of a transmitter and a sensor. Two versions are available: • Compact version: Transmitter and sensor form a single mechanical unit. • Remote version: Sensor is mounted separate from the transmitter.

6.1.3 Input

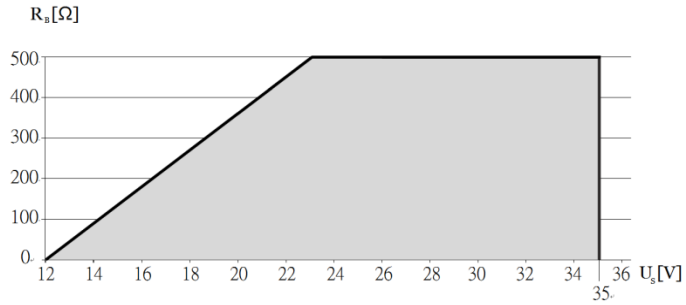
Measured Variable	• Volumetric flow (volume flow) → is proportional to the frequency of vortex shedding after the bluff body. • Temperature → can be output directly and is used to calculate the mass flow for example. The following variables can be output via internal calculation: Corrected volume flow, mass flow, calculated saturated steam pressure, energy flow, heat flow difference, specific volume, degree of superheat.
Measuring Range	The measuring range depends on the fluid and the pipe diameter. **Start of Measuring Range:** Depends on the density and the Reynolds number (Re_{min} = 5,000, Re_{linear} = 20 000). The Reynolds number is dimensionless and indicates the ratio of a fluid's inertial forces to its viscous forces. It is used to characterize the flow. The Reynolds number is calculated as follows: $$\mathrm{Re} = \frac{4 \cdot Q\ [m^3/s] \cdot \rho\ [kg/m^3]}{\pi \cdot di\ [m] \cdot \mu\ [Pa \cdot s]}$$ Re = Reynolds number Q = volume flow di = pipe inner diameter μ = viscosity ρ = density 15 - 300 mm → $v_{min} = \frac{6}{\sqrt{\rho\ [kg/m^3]}}\ [m/s]$ **Full Scale Value:** • Gas, steam: v_{max} = 75 m/s (DN 15: v_{max} = 46 m/s) • Liquids: v_{max} = 9 m/s

6.1.4 Output

<table>
<tr><td>Output Variables</td><td>The following measured variables can generally be output via the outputs:
<table>
<tr><th>Output Method</th><th>Assignable Measured Variables</th></tr>
<tr><td>Current output/
Frequency output</td><td>– Volume flow
– Corrected volume flow
– Mass flow
– Flow velocity
– Temperature
– Calculated saturated steam pressure
– Steam quality (Steam dryness)
– Total mass flow
– Energy flow
– Heat flow difference</td></tr>
<tr><td>Pulse output</td><td>– Volume flow
– Corrected volume flow
– Mass flow
– Total mass flow
– Energy flow
– Heat flow difference</td></tr>
<tr><td>Switch output
(limit)</td><td>– Volume flow
– Corrected volume flow
– Mass flow
– Flow velocity
– Temperature
– Calculated saturated steam pressure
– Steam quality (Steam dryness)
– Total mass flow
– Energy flow
– Heat flow difference
– Reynolds number
– Totalizer 1 to 3</td></tr>
<tr><td>Switch output
(diagnostic behavior)</td><td>– Alarm
– Alarm + warning
– Warning</td></tr>
<tr><td>Switch output
(status)</td><td>Low flow cut off</td></tr>
</table></td></tr>
<tr><td>Output Signal</td><td>Current Output:
• 4 to 20 mA + HART Communication
• Start value, full scale value and time constant (0 to 999.9 seconds) can be set
• Resolution <1μA
• Load 0 to 500 Ω

Pulse/frequency/switch output:
Open collector, passive, no-voltage contact output, galvanically isolated
• Maximum input values = DC 35 V, 50 mA
• Residual voltage: 2 V at load current of 2 mA or less, or 8 V at 10 mA.

The frequency output can be configured as:
• Frequency output: 0 to 1000 Hz
• Pulse output: Pulse width adjustable (5 to 2000 milliseconds); pulse frequency max. 100 Hz
• Switch output:
Binary, conductive or non-conductive
Can be set to status, limit values for all measured variables or diagnostic behavior</td></tr>
<tr><td>Signal on Alarm</td><td>Output behavior for alarm can be configured for current/pulse/frequency/switch output</td></tr>
</table>

Load	 The area marked in gray indicates the permissible load. Depending on the supply voltage (U_S), the maximum load (R_B) including line resistance must be observed to ensure adequate terminal voltage at the device. In doing so, observe the minimum terminal voltage. $R_B \leq (U_S - U_{term.min}) \div 0.022$ A $R_B \leq 500$ Ω R_B :Load U_S :Supply voltage = 13 to 35 V DC
Low Flow Cutoff	Switch points for low flow cut off can be selected as required
Galvanic Isolation	All electrical connections are galvanically isolated themselves.

6.1.5 Power Supply

Electrical Connection	See 4.2
Supply Voltage	13 to 35 V DC
Cable Entry	Power supply cable / signal cable (outputs): • Thread for cable entry: $G^1/_2$
Cable Specification	• Standard installation cable is sufficient • Remote version → See 4.4
Power Supply Failure	• Totalizer stops at the last value determined (can be configured). • All settings are kept in the EEPROM. • Error messages (incl. value of operated hours counter) are stored.
Overvoltage protection (optional)	Input voltage range : Values correspond to supply voltage specifications (The voltage is reduced by the amount of the internal resistance) Resistance per channel : 2 · 0.5 Ω max DC sparkover voltage : 400 to 700 V Trip surge voltage : <800 V Capacitance at 1 MHz : <1.5 pF Nominal discharge current (8/20µs) : 10 kA Temperature range : -40 to +85 °C

6.1.6 Performance Characteristics

Reference operating conditions	Error limits following ISO/DIN 11631: • 20 to 30 °C • 0.2 to 0.4 MPa (2 to 4 bar) • Calibration rig traced to national standards.
Maximum Measured error	• Volume flow (liquid): ±0.75% o.r. for Re > 20,000 ±10% o.r. for 5,000 ≤ Re ≤ 20,000 • Volume flow (gas/steam): ±1% o.r. for Re > 20,000 ±10% o.r. for 5,000 ≤ Re ≤ 20,000 • Temperature ±1 °C (T > 100 °C, saturated steam); Rise time 50% (agitated under water, following IEC 60751): 8 seconds • Mass flow (saturated steam): – For flow velocities v 20 to 50 m/s, T > 150 °C (423 K) ±1.7% o.r. for Re > 20,000 ±10% o.r. for 5,000 ≤ Re ≤ 20,000 – For flow velocities v 10 to 70 m/s, T > 140 °C (413 K) ±2.0% o.r. for Re > 20,000 ±10% o.r. for 5,000 ≤ Re ≤ 20,000 • Mass flow (other fluids): Depends on the pressure value. An individual error observation must be carried out. o.r. = of reading Re = Reynolds number
Repeatability	±0.2% o.r. (of reading)

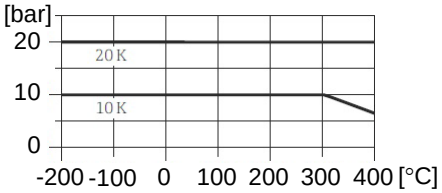
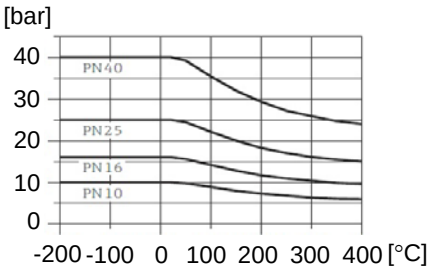
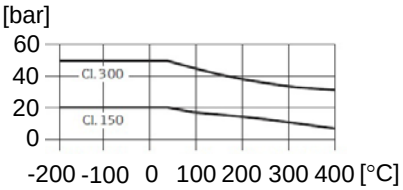
Environment

Ambient Temperature Range	• Compact Version: -40 to +80 °C Display can be read between -20 °C and +60 °C • Remote Version – Sensor: -40 to +80 °C Display can be read between -20 °C and +60 °C **Caution!** When mounting outside, TLV recommends to protect the device from direct sunlight with a sunshade (optional part), especially in warmer climates with high ambient temperatures.
Storage Temperature	-40 to +80 °C
Protection Class	IP 66/67, type 4X enclosure
Vibration Resistance	Acceleration up to 2 g, 10 to 500 Hz, following IEC 60068-2-6
Electromagnetic Compatibility (EMC)	To EN 61326 and NAMUR Recommendation NE 21


Caution!

Process

Medium Temperature Range	• DSC sensor (digital switched capacitor), capacitive sensor: -200 to +400 °C • Gaskets: Graphite: -200 to +400 °C Viton (optional): -15 to +175 °C Kalrez (optional): -20 to +275 °C Gylon (PTFE) (optional): -200 to +260 °C

Pressure-Temperature Curve	Pressure-temperature curve to JIS, stainless steel JIS 10, 20 K  Pressure-temperature curve to EN (DIN), stainless steel EN (DIN) PN 10 to 40  Pressure-temperature curve to ASME B16.5, stainless steel ASME class 150, 300 
Limiting Flow	See flow rate data in section 11.1
Pressure Loss	TLV will calculate and provide pressure loss data on request

6.1.7 Mechanical Construction

Dimensions	See 6.2 to 6.5
Weight	See 6.2 to 6.5
Material	• Transmitter housing: Powder-coated die-cast aluminum (AlSi10Mg) • Meter body: Stainless steel, 1.4408 (CF3M) Compliant to AD2000 (limited to -10 to +400 °C), NACE MR0175-2003 and MR0103-2003 • Flanges: Butt welded flange Stainless steel, 1.4404 (SUS F316, F316L) Compliant to NACE MR0175-2003 and MR0103-2003 • DSC sensor (differential switched capacitor; capacitive sensor): – Wetted parts: Stainless steel 1.4435 (SUS316, 316L), compliant to NACE MR0175-2003 and MR0103-2003 – Non-wetted parts: Stainless steel 1.4301 (SUS304) • Housing support: Stainless steel, 1.4408 (CF3M) • Gasket: Graphite (other materials available)

6.1.8 User Interface

Display Elements	• 4-line display • Format for displaying measured variables and status variables can be individually configured • Permitted ambient temperature for the display: -20 to +60 °C The readability of the display may be impaired at temperatures outside the temperature range.
Operating Elements	Local operation with 3 keys (⊖, ⊕, Ⓔ)
Remote Operation	Can be operated using the following tools. • HART communication

6.2 Remote Transmitter Dimensions

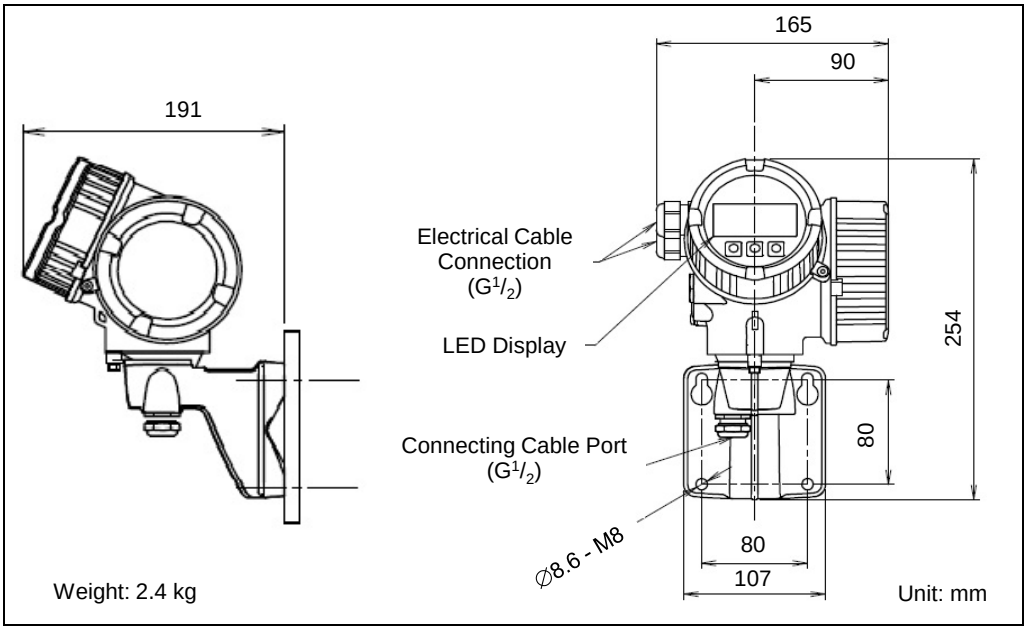


Figure 23 Dimensions of transmitter, remote version

6.3 EF200W Dimensions – Flangeless Connection

The EF200W flangeless model is compatible with the following flange standards:

- ASME B16.5, class 150, 300, Sch.40
- EN 1092-1 (DIN 2501) PN10, 16, 25, 40
- JIS B2220, 10K/20K, Sch.40

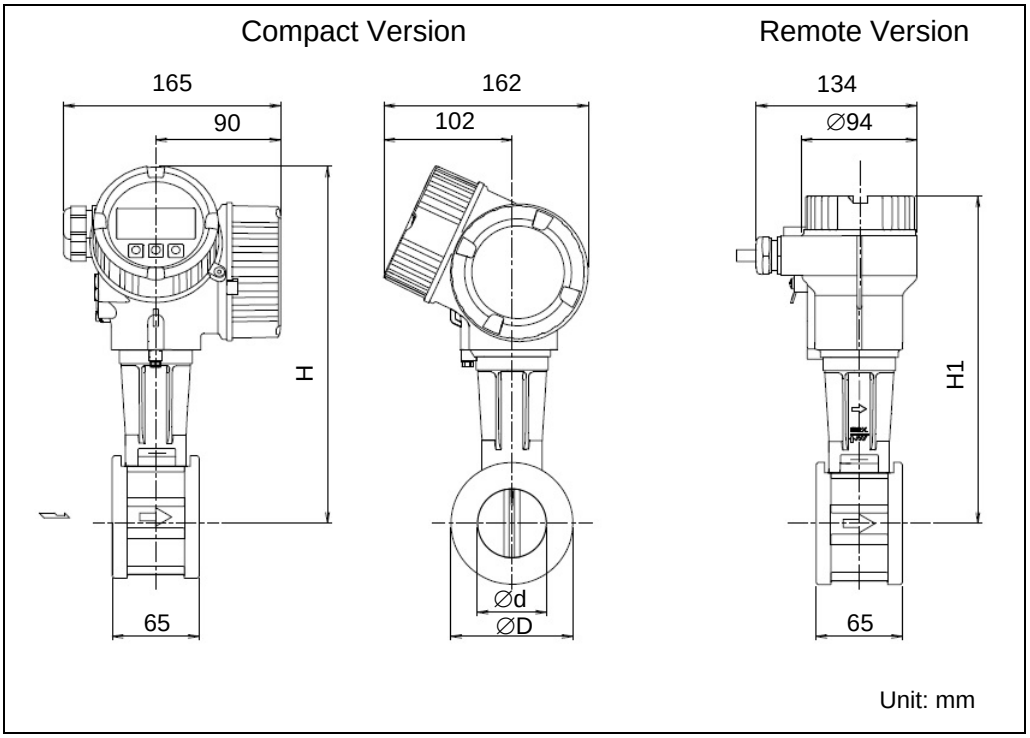


Figure 24
Dimensions of EF200W

Size		d	D	H – Compact	H_1 – Remote	Weight
JIS/DIN	ASME	(mm)	(mm)	(mm)	(mm)	(kg)
15	$^1/_2$”	16.5	45.0	252.5	222.8	3.1
25	1”	27.6	64.0	262.0	232.3	3.3
40	$1^1/_2$”	42.0	82.0	270.5	240.8	3.9
50	2”	53.5	92.0	277.5	247.8	4.2
80	3”	80.3	127.0	291.5	261.8	5.6
100 (DIN)	4”	104.8	157.2	304.0	274.3	6.6
100 (JIS)	–	102.3	157.2	303.2	273.5	6.6
150	6”	156.8	215.9	330.0	300.3	9.1

6.4 EF200F Dimensions – Flanged Connection

The EF200F is available with the following flange standards:

- ASME B16.5, class 150, 300, Sch.40
- RF flanges compliant to EN1092-1 (DIN2501) and EN1092-1 Form B1 (DIN2526 Form C)
- JIS B2238, 10K, 20K, Sch.40

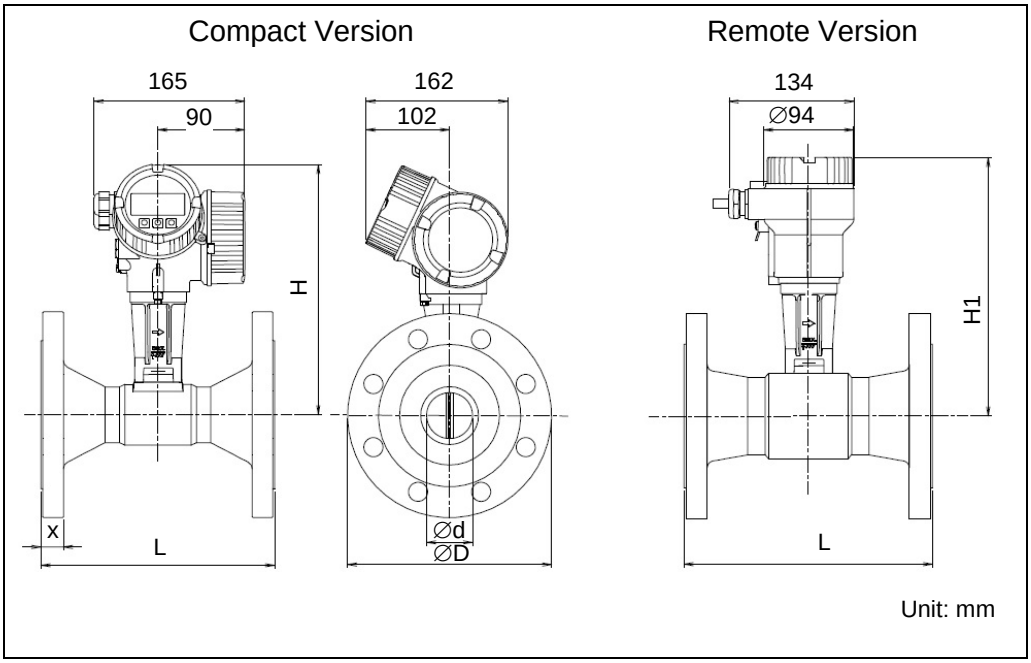


Figure 25
Dimensions of EF200F

EF200F Flanged – ASME B16.5

Size (mm)	ASME Class	d (mm)	D (mm)	L (mm)	x (mm)	H_1 (mm)	H_1 (mm)	Weight (kg)
15	150	15.7	88.9	200	11.2	254.0	224.3	4.5
	300		95		14.2			4.9
25	150	26.7	107.9	200	15.7	260.4	230.7	6.3
	300		123.8		19.1			7.5
40	150	40.9	127	200	17.5	268.5	238.8	7.9
	300		155.6		20.6			10.2
50	150	52.6	152.4	200	19.1	275.3	245.6	10
	300		165		22.4			12
80	150	78.0	190.5	200	23.9	288.2	258.5	16
	300		210		28.4			19
100	150	102.4	228.6	250	24.5	300.1	270.4	21
	300		254		31.8			29
150	150	154.2	279.4	300	25.4	324.8	295.1	33
	300		317.5		36.6			50
200	150	202.7	342.9	300	42.0	353.4	323.7	62
	300		381.0					85
250	150	254.5	406.4	380	48.0	379.3	349.6	89
	300		444.5					125
300	150	304.8	482.6	450	60.0	404.4	374.7	135
	300		520.7					184

EF200F Flanged – EN 1092-1 (DIN 2501)

Size (DN)	PN Rating	d (mm)	D (mm)	L (mm)	x (mm)	H (mm)	H_1 (mm)	Weight (kg)
15	PN10–40	17.3	95.0	200	16	254.0	224.3	5.1
25	PN10–40	28.5	115.0	200	18	260.4	230.7	7.1
40	PN10–40	43.1	150.0	200	18	268.5	238.8	9.1
50	PN10–40	54.4	165.0	200	20	275.3	245.6	11.1
80	PN10–40	82.5	200.0	200	24	288.2	258.5	16.1
100	PN10/16	107.1	220.0	250	20	300.1	270.4	18
	PN25/40		235.0		24			21
150	PN10/16	159.3	285.0	300	22	324.8	295.1	31
	PN25/40		300.0		28			37
200	PN10	207.3	340	300	42	353.4	323.7	56
	PN16	207.3	340		42			55
	PN25	206.5	360		42			65
	PN40	206.5	375		42			72
250	PN10	260.4	395	380	48	379.3	349.6	80
	PN16	260.4	405		48			82
	PN25	258.8	425		48			94
	PN40	258.8	450		48			111
300	PN10	309.7	400	450	51	404.4	374.7	110
	PN16	309.7	460		51			117
	PN25	307.9	485		51			132
	PN40	307.9	515		51			158

EF200F Flanged – JIS B2238

Size (mm)	Press. Rating	d (mm)	D (mm)	L (mm)	x (mm)	H (mm)	H_1 (mm)	Weight (kg)
15	10/20K	16.1	95	200	14	254.0	224.3	4.9
25	10/20K	27.2	125	200	16	260.4	230.7	7.2
40	10/20K	41.2	140	200	18	268.5	238.8	8.5
50	10K	52.7	155	200	16	275.3	245.6	9.4
	20K				18			9.7
80	10K	78.1	185	200	18	288.2	258.5	13
	20K		200		22			15
100	10K	102.3	210	250	18	300.1	270.4	16
	20K		225		24			20
150	10K	151.0	280	300	22	324.8	295.1	30
	20K		305		28			38
200	10K	202.7	330	300	42	353.4	323.7	53
	20K		350					63
250	10K	254.5	400	380	48	379.3	349.6	80
	20K		430					101
300	10K	304.8	445	450	51	404.4	374.7	109
	20K		480					136

6.5 EF200R Dimensions – Flanged Connection

The EF200R is available with the following flange standards:

- ASME B16.5, class 150, 300, Sch.40
- RF flanges compliant to EN1092-1 (DIN2501) and EN1092-1 Form B1 (DIN2526 Form C)
- JIS B2238, 10K, 20K, Sch.40

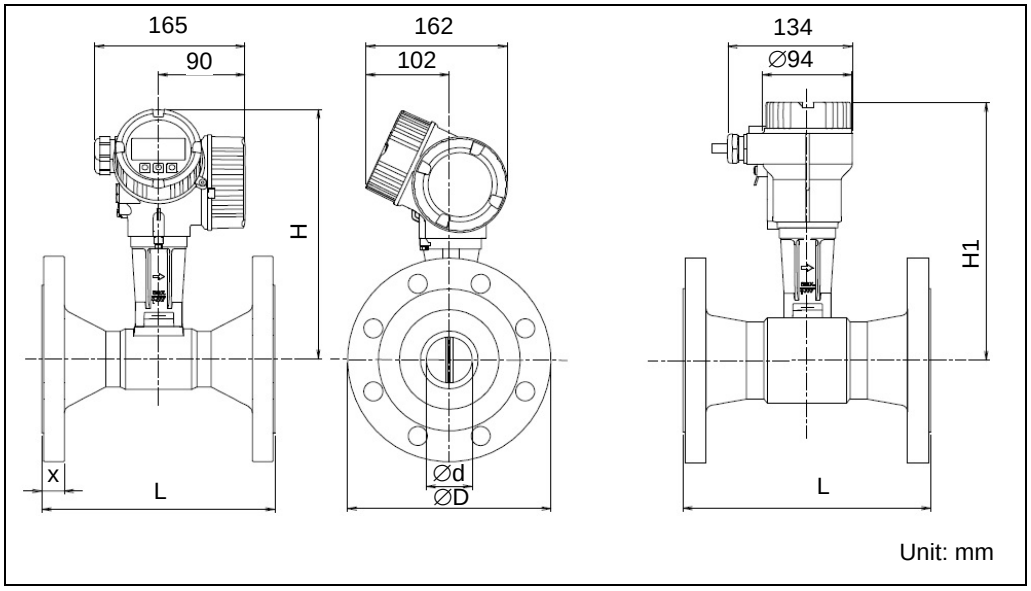


Figure 26
Dimensions of EF200R

EF200R Flanged – ASME B16.5

Size (mm)	ASME Class	d (mm)	D (mm)	L (mm)	x (mm)	H (mm)	H_1 (mm)	Weight (kg)
25	150	22.0	108.0	200	18.0	254.0	224.3	5.3
	300		124.0		22.0			6.5
40	150	30.0	127.0	200	18.0	260.4	230.7	8.9
	300		155.4		25.0			11
50	150	45.0	152.4	200	20.0	268.5	238.8	11
	300		165.1		25.0			13
80	150	56.5	190.5	200	23.9	275.2	245.5	16
	300		209.6		28.9			19
100	150	87	228.6	250	24.5	288.2	258.5	23
	300		254.0		31.8			31
150	150	112	279.4	300	25.5	300.1	270.4	38
	300		317.5		38.5			55
200	150	146.3	279.4	300	25.5	324.8	295.1	53
	300		381.0		41.1			76

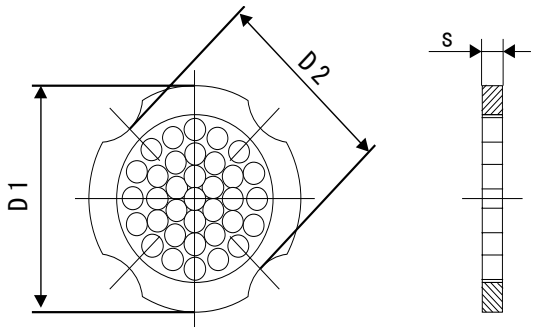
EF200R Flanged – EN 1092-1 (DIN 2501)

Size (DN)	PN Rating	d (mm)	D (mm)	L (mm)	x (mm)	H (mm)	H_1 (mm)	Weight (kg)
25	PN10-40	22.0	115	200	18.0	254	224.3	6.1
40	PN10-40	30.0	150	200	21.0	268.5	238.8	10
50	PN10-40	45.0	165	200	22.0	260.4	230.7	12
80	PN10-40	56.5	200	200	25.0	288.2	258.5	16
100	PN10/16	87.0	220	250	22.0	268.5	238.8	20
	PN25/40		235		26.5			23
150	PN10/16	112.0	285	300	25.0	275.2	245.5	36
	PN25/40		300		31.0			42
200	PN10	146.3	340	300	24.0	324.8	295.1	47
	PN16							46
	PN25		360		30.0			56
	PN40		375		36.5			63

EF200R Flanged – JIS B2238

Size (mm)	Press. Rating	d (mm)	D (mm)	L (mm)	x (mm)	H (mm)	H_1 (mm)	Weight (kg)
25	10/20K	22.0	125	200	18.5	254.0	224.3	6.2
40	10/20K	30.0	140	200	18.5	260.4	230.7	9.5
50	10K	45.0	155	200	20.0	268.5	238.8	10
	20K							11
80	10K	56.5	185	200	22.0	275.2	245.5	13
	20K		200		26.5			15
100	10K	87.0	210	250	22.0	288.2	258.5	18
	20K		225		25.5			22
150	10K	112.0	280	300	31.0	300.1	270.4	35
	20K		305		37.5			43
200	20K	146.3	350	300	31.0	324.8	295.1	54

6.6 Dimensions of Flow Conditioner (optional)



D1 = The flow conditioner is fitted at the outer diameter between the bolts.
D2 = The flow conditioner is fitted at the indentations between the bolts.

Figure 27
Dimensions of flow conditioner (Compliant to EN(DIN)/ASME)
Material: 1.4435 (316L)

Flow Conditioner Dimensions to ASME

Size (mm)	Size (in)	ASME Class	Centering Ø (mm)	D1/D2	s (mm)	Weight (kg)
15	1/2	150	51.1	D1	2.0	0.03
		300	56.5			0.04
25	1	150	69.2	D2	3.5	0.12
		300	74.3	D1		
40	1 1/2	150	88.2	D2	5.3	0.3
		300	97.7			
50	2	150	106.6	D2	6.8	0.5
		300	113	D1		
80	3	150	138.4	D1	10.1	1.2
		300	151.3			1.4
100	4	150	176.5	D2	13.3	2.7
		300	182.6	D1		
150	6	150	223.6	D1	20.0	6.3
		300	252			7.8
200	8	150	274.0	D2	26.3	12.3
		300	309.0	D1		15.8
250	10	150	340.0	D1	33.0	25.7
		300	363.0			27.5
300	12	150	404.0	D1	39.6	36.4
		300	402.0			44.6

Flow Conditioner Dimensions to EN (DIN)

Size (DN)	PN Rating	Centering Ø (mm)	D1/D2	s (mm)	Weight (kg)
15	PN10–40	54.3	D2	2	0.04
25	PN10–40	74.3	D1	3.5	0.12
40	PN10–40	95.3	D1	5.3	0.3
50	PN10–40	110	D2	6.8	0.5
80	PN10–40	145.3	D2	10.1	1.4
100	PN10/16	165.3	D2	13.3	2.4
	PN25/40	171.3	D1		
150	PN10/16	221	D2	20	6.3
	PN25/40	227			7.8
200	PN10	274.0	D1	26.3	11.5
	PN16		D2		12.3
	PN25	280.0	D1		
	PN40	294.0	D2		15.9
250	PN10/16	330.0	D2	33.0	25.7
	PN25	340.0	D1		
	PN40	355.0	D2		27.5
300	PN10/16	380.0	D2	39.6	36.4
	PN25	404.0	D1		
	PN40	420.0			44.7

Flow Conditioner Dimensions to JIS

Size (mm)	Press. Rating	Centering Ø (mm)	D1/D2	s (mm)	Weight (kg)
15	10/20K	60.3	D2	2	0.06
25	10/20K	76.3	D2	3.5	0.14
	30K	81.3	D1		
40	10/20K	91.3	D2	5.3	0.31
50	10/20K	106.6	D2	6.8	0.47
80	10K	136.3	D2	10.1	1.1
	20K	142.3	D1		
100	10K	161.3	D2	13.3	1.8
	20K	167.3	D1		
150	10K	221	D2	20	4.5
	20K	240	D1		5.5
200	10K	271	D2	26.3	9.2
	20K	284	D1		
250	10K	330	D2	33	15.8
	20K	355	D2		19.1
300	10K	380	D2	39.6	26.5
	20K	404	D1		

7. Commissioning

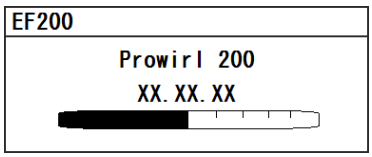
7.1 Function Check

Make sure that all final checks regarding installation and wiring have been completed before you commission the device.

7.2 Commissioning

7.2.1 Switching on the Measuring Device

Once the function checks have been successfully completed, it is time to switch on the supply voltage. After 5 to 10 seconds, the device is ready for operation. The measuring device performs a number of internal test functions after power-on. As this procedure progresses, the following message appears on the local display:



Start-up message:
Displays the current software version

Normal measuring mode commences as soon as start-up completes. Various measured values and/or status variables appear on the display (HOME position).


Note!

Note!
If start-up fails, an appropriate error message is displayed, depending on the cause.

7.2.2 Device Setup

The Setup menu contains all parameters required for standard operation.
The following parameters should be configured at startup time.

Parameter	Menu	Contents	See
System units	"Setup" menu → Advanced setup → System units	Configure units for all parameters	8.2.11
Medium selection	"Setup" menu → Medium selection	Select the medium to be measured and configure settings for related parameters.	8.2.5
Current output	"Setup" menu → Current output 1 to 2	Configure assignment and parameters of current output.	8.2.6
Pulse/frequency/ switch output	"Setup" menu → Pulse/frequency/ switch output	Configure assignment and parameters of pulse/frequency/switch output	8.2.7
Display	"Setup" menu → Display	Configure display settings	8.2.8
Totalizer	"Setup" menu → Advanced setup → Totalizer 1 to 3	Configure assignment and parameters of totalizer	8.2.16


Note!

NOTE:
- TLV will preconfigure the parameters necessary for measurement after determining the customer's specification.
- See 4.3 for more information when using EF200 in combination with TLV EC351 Flow Computer.

8. Device Functions

8.1 Function Matrix

NOTE: See 11.3 for details.

Main Menu	Sub Menu	Description	See
Language		Selects the display language.	8.2.1
Operation	Access status display	Displays the current status.	8.2.2
	Display	Sets parameters for operating the display (e.g. contrast adjustment, etc.)	8.2.3
	Totalizer handling	Sets parameters for operating the totalizer.	8.2.4
Setup	Medium selection	Selects the type of fluid to be measured and relevant details.	8.2.5
	Current output 1	Assigns and sets the current output.	8.2.6
	Pulse/frequency/switch output	Selects and sets the output operating mode (pulse, frequency or switch.)	8.2.7
	Display	Sets parameters for the display.	8.2.8
	Output conditioning	Sets damping output.	8.2.9
	Low flow cut off	Sets parameters for low flow cut off.	8.2.10
	Advanced setup		
	System unit	Sets units to be used.	8.2.11
	Medium properties	Sets the physical characteristics of the fluid to be measured.	8.2.12
	Gas composition	Sets the gas composition etc. when a gas is selected as the fluid to be measured.	8.2.13
	External compensation	Sets information (compensation input) for measurement when required. Also includes settings for Steam Dryness Fraction Calculator	8.2.14
	Sensor adjustment	Sets parameters for the sensor.	8.2.15
	Totalizer 1 to 3	Sets parameters for operating the totalizer.	8.2.16
	Display	Sets parameters for the display.	8.2.17
	Configuration backup display	Saves device data.	8.2.18
	Administration	Manages the access code and resets the device.	8.2.19
Diagnostics	Diagnostic results display	Displays current status, past records, and operation time	8.2.20
	Event logbook	Sets the event message catergory and displays the event list.	8.2.21
	Device information	Displays device-specific information.	8.2.22
	Measured values		
	Process variables	Displays the value currently being measured.	8.2.23
	Totalizer	Displays the current totalizer counter value and overflow.	8.2.23
	Output values	Displays the values of the external output signal.	8.2.24
	Simulation	Simulates various process variables, device alarm mode and signal output without a real flow situation	8.2.25
Expert		For use by TLV technical personnel. TLV does not disclose access codes to users.	8.2.26

8.2.1 Setting the Operating Language

Descriptions of functions: Language	
Language	This function can be used to select the language in which all parameters and messages are displayed. Available languages: English Deutsch Français Español Italiano Nederlands Portuguesa Polski русский язык (Russian) Svenska Türkçe 中文 (Chinese) 日本語 (Japanese) 한국어 (Korean) الْعَرَبِيَة (Arabic) Bahasa Indonesia ภาษาไทย (Thai) tiếng Việt (Vietnamese) čeština (Czech) Factory setting: English

8.2.2 Operation

Descriptions of functions: Operation	
Access status display	This function can be used to confirm the current status. The individual parts of the operating menu are assigned to certain user roles (status) (operator, maintenance and expert). The two user roles “Operator” and “Maintenance” have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access.

User role		Operator	Maintenance
Read access	Without access code (from the factory)	✓	✓
	With access code	✓	✓
Write access	Without access code (from the factory)	✓	✓
	With access code	✕	✓

NOTE: Despite the defined access code, certain parameters can always be modified and thus are excepted from the write protection, as they do not affect the measurement.

If an incorrect access is entered, the user obtains the access rights of the “Operator” role.

NOTE: The “Expert” status is assigned only to TLV technical personnel. TLV does not disclose access codes to users.

<table>
<tr><td>Locking status</td><td>The write protection types that are currently active can be determined.
<table><tr><th>Options</th><th>Description</th></tr><tr><td>None</td><td>The access status displayed in “Access status display” parameter applies.</td></tr><tr><td>Hardware locked</td><td>The DIP switch for hardware locking is activated on the main electronics module. This prevents write access to the parameters.</td></tr><tr><td>Temporarily locked</td><td>Due to internal processing in the device (e.g. up-/downloading of data, reset), write access to the parameters is blocked for a short time. Once the internal processing has been completed, the parameters can be changed once again.</td></tr></table></td></tr>
</table>

8.2.3 Display: Operation → Display

NOTE: See 8.2.8 for advanced display settings.

Descriptions of functions: Display	
Format display	Select how measured values are shown on the display. • 1 value, max. size • 1 bargraph + 1 value • 2 values • 1 value large + 2 values • 4 values Factory setting: 2 values
Contrast display	Set the display contrast. The contrasts increases as the value increases. Setting range: 20 to 80% Factory setting: 25%
Display interval	Set time measured values are shown on display if display alternates between values. Setting range: 1 to 10 seconds Factory setting: 5 seconds

8.2.4 Totalizer handling: Operation → Totalizer handling

NOTE: See 8.2.16 for advanced totalizer settings.

Descriptions of functions: Totalizer handling	
Control Totalizer 1 to 3	Control totalizer value. • Totalize • Reset + hold • Preset + hold • Reset + totalize • Preset + totalize Factory setting: Totalize
Preset value 1 to 3	Specify start value for totalizer. (Signed floating-point number) Factory setting: 0 m^3
Reset all totalizers	Reset all totalizers to 0 and start. • Cancel • Reset + totalize Factory setting: Cancel

8.2.5 Medium selection: Setup → Medium selection

Descriptions of functions: Medium selection	
Select medium	Select medium type. • Gas • Liquid • Steam Factory setting: Depends on customer specifications.
Select gas type	Select measured gas type. NOTE: In the Select medium parameter the Gas option must be selected. • Single gas • Gas mixture • Air • Natural gas • User-specific gas Factory setting: Air
Select liquid type	Select measured liquid type. NOTE: In the Select medium parameter the Liquid option must be selected. • Water • LPG • User-specific liquid Factory setting: Water
Fixed process pressure	Enter fixed value for process pressure. NOTE: The unit is taken from the Pressure unit parameter. Setting range: 0 to 250 bar abs. Factory setting: 0 bar abs.
Enthalpy calculation	Select the norm the enthalpy calculation is based on. NOTE: - In the Select medium parameter the Gas option must be selected - In the Select gas type parameter the Natural gas option must be selected. • AGA5 • ISO 6976 Factory setting: AGA5
Density calculation	Select the norm the density calculation is based on. NOTE: - In the Select medium parameter the Gas option must be selected - In the Select gas type parameter the Natural gas option must be selected. • AGA Nx19 • ISO 12213- 2 • ISO 12213- 3 Factory setting: AGA Nx19
Enthalpy type	Define which kind of enthalpy is used. NOTE: - In the Select gas type parameter, the User-specific gas option is selected, or - In the Select liquid type parameter, the User-specific liquid option is selected. • Heat • Calorific value Factory setting: Heat

8.2.6 Current output: Setup → Current output

Descriptions of functions: Current output	
Assign current output	Select process variable for current output. • Off • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Calculated saturated steam pressure • Steam quality (Steam dryness) • Total mass flow • Energy flow • Heat flow difference Factory setting: Depends on customer specifications.
Select units for assigned process variable	Select units for the process variable assigned to current output. NOTE: See 8.2.11 for details.
Current span	Select current range for process value output and upper/lower level for alarm signal. • 4 to 20 mA NAMUR • 4 to 20 mA US • 4 to 20 mA • Fixed current Factory setting: 4 to 20 mA NAMUR
4 mA value	Enter 4 mA value. (Signed floating-point number) Factory setting: Depends on customer specifications.
20 mA value	Enter 20 mA value. (Signed floating-point number) Factory setting: Depends on customer specifications.
Failure mode	Define output behavior in alarm condition. • Min. • Max. • Last valid value • Actual value • Defined value Factory setting: Max.
Failure current	Enter current output value in alarm condition. Setting range: 3.59 to 22.5 mA Factory setting: 22.5 mA

8.2.7 Pulse/frequency/switch output: Setup → Pulse/frequency/switch output

Descriptions of functions: Pulse/frequency/switch output	
Operating mode	Define the output as a pulse, frequency or switch output. • Pulse • Frequency • Switch Factory setting: Pulse
Assign pulse output	NOTE: This function is available when the operating mode is set to “pulse output”. Select process variable for pulse output. • Off • Volume flow • Corrected volume flow • Mass flow • Total mass flow • Energy flow • Heat flow difference Factory setting: Depends on customer specifications.
Select units for assigned process variable	Select units for the process variable assigned to pulse output. NOTE: See 8.2.11 for details.
Value per pulse	NOTE: This function is available when the operating mode is set to “pulse output”. Enter measured value at which a pulse is output. NOTE: Ensure the value per pulse is set so that the pulse frequency at maximum flow does not exceed 100 Hz. Factory setting: Depends on customer specifications.
Pulse width	NOTE: This function is available when the operating mode is set to “pulse output”. Define time width of the output pulse. Setting range: 5 to 2000 milliseconds Factory setting: Depends on customer specifications.
Failure mode	NOTE: This function is available when the operating mode is set to “pulse output”. Define output behavior in alarm condition. • Actual value • No pulses Factory setting: No pulses
Invert output signal	NOTE: This function is available when the operating mode is set to “pulse output”. Invert the output signal. • No • Yes Factory setting: No

Descriptions of functions: Pulse/frequency/switch output	
Assign frequency output	NOTE: This function is available when the operating mode is set to “frequency output”. Select process variable for frequency output • Off • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Calculated saturated steam pressure • Steam quality (Steam dryness) • Total mass flow • Energy flow • Heat flow difference
Select units for assigned process variable	Select units for the process variable assigned to frequency output. NOTE: See 8.2.11 for details.
Minimum frequency value	NOTE: This function is available when the operating mode is set to “frequency output”. Enter the minimum frequency value. Setting range: 0.0 to 1000.0 Hz Factory setting: 0.0 Hz
Maximum frequency value	NOTE: This function is available when the operating mode is set to “frequency output”. Enter the maximum frequency value. Setting range: 0.0 to 1000.0 Hz Factory setting: 1000.0 Hz
Measuring value at minimum frequency	NOTE: This function is available when the operating mode is set to “frequency output”. Enter measured value for minimum frequency. (Signed floating-point number) Factory setting: 0
Measuring value at maximum frequency	NOTE: This function is available when the operating mode is set to “frequency output”. Enter measured value for maximum frequency. (Signed floating-point number) Factory setting: 0
Failure mode	NOTE: This function is available when the operating mode is set to “frequency output”. Define output behavior in alarm condition. • Actual value • Defined value • 0 Hz Factory setting: 0 Hz
Failure frequency	NOTE: This function is available when the operating mode is set to “frequency output”. Enter frequency output value in alarm condition. Setting range: 0.0 to 1250.0 Hz Factory setting: 0.0 Hz
Invert output signal	NOTE: This function is available when the operating mode is set to “frequency output”. Invert the output signal. • No • Yes Factory setting: No

Descriptions of functions: Pulse/frequency/switch output	
Switch output function	NOTE: This function is available when the operating mode is set to “switch output”. Select function for switch output. • Off • On • Diagnostic behavior • Limit • Status Factory setting: Off
Assign diagnostic behavior	NOTE: This function is available when the operating mode is set to “switch output”. Select diagnostic behavior for switch output. • Alarm • Alarm or warning • Warning Factory setting: Alarm
Assign limit	NOTE: This function is available when the operating mode is set to “switch output”. Select process variable for limit function. • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Calculated saturated steam pressure • Steam quality (Steam dryness) • Total mass flow • Energy flow • Heat flow difference • Reynolds number • Totalizer 1 • Totalizer 2 • Totalizer 3 Factory setting: Volume flow
Assign flow direction check	NOTE: This function is available when the operating mode is set to “switch output”. Select process variable for flow direction monitoring. • Off • Volume flow • Mass flow • Corrected volume flow Factory setting: Volume flow
Assign status	NOTE: This function is available when the operating mode is set to “switch output”. Select device status for switch output. • Low flow cut off Factory setting: Low flow cut off
Select units for assigned process variable	Select units for the process variable assigned to switch output. NOTE: See 8.2.11 for details.
Switch-on value	NOTE: This function is available when the operating mode is set to “switch output”. Enter measured value for the switch-on point. (Signed floating-point number) Factory setting: Depends on customer specifications.
Switch-off value	NOTE: This function is available when the operating mode is set to “switch output”. Enter measured value for the switch-off point. (Signed floating-point number) Factory setting: Depends on customer specifications.

Switch-on delay	NOTE: This function is available when the operating mode is set to “switch output”. Define delay for the switch-on of status output. Factory setting: 0.0 second
Switch-off delay	NOTE: This function is available when the operating mode is set to “switch output”. Define delay for the switch-off of status output. Factory setting: 0.0 second
Failure mode	NOTE: This function is available when the operating mode is set to “switch output”. Define output behavior in alarm condition. • Actual status • Open • Closed Factory setting: Open
Invert output signal	NOTE: This function is available when the operating mode is set to “switch output”. Invert the output signal. • No • Yes Factory setting: No

8.2.8 Display: Setup → Display

NOTE: See 8.2.17 for advanced settings.

Descriptions of functions: Display	
Format display	Select how measured values are shown on the display. • 1 value, max. size • 1 bargraph + 1 value • 2 values • 1 value large + 2 values • 4 values Factory setting: 2 values
Value 1 display	Select the measured value that is shown on the local display. • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Calculated saturated steam pressure • Steam quality (Steam dryness) • Total mass flow • Condensate mass flow • Energy flow • Heat flow difference • Reynolds number • Density • Pressure • Specific volume • Degrees of superheat • Totalizer 1 • Totalizer 2 • Totalizer 3 • Current output 1 Factory setting: Depends on customer specifications.
0% bargraph value 1	Enter 0% value for bar graph display. (Signed floating-point number) Factory setting: 0 m^3/h

100% bargraph value 1	Enter 100% value for bar graph display. (Signed floating-point number) Factory setting: 1 m³/h
Value 2 display	Select the measured value that is shown on the local display. (see Value 1 display) Factory setting: Totalizer 1
Value 3 display	Select the measured value that is shown on the local display. (see Value 1 display) Factory setting: None
0% bargraph value 3	Enter 0% value for bar graph display. (Signed floating-point number) Factory setting: 0
100% bargraph value 3	Enter 100% value for bar graph display. (Signed floating-point number) Factory setting: 0
Value 4 display	Select the measured value that is shown on the local display. (see Value 1 display) Factory setting: None

8.2.9 Output conditioning: Setup → Output conditioning

Descriptions of functions: Output conditioning	
Display damping	Set display reaction time to fluctuations in the measured value. Setting range: 0.0 to 999.9 seconds Factory setting: 5.0 seconds
Damping output 1	Set the reaction time of the output signal of the current output to fluctuations in the measured value. Setting range: 0.0 to 999.9 seconds Factory setting: 1 second
Damping output 2	Set the reaction time of the output signal of the frequency output to fluctuations in the measured value. Setting range: 0.0 to 999.9 seconds Factory setting: 1 second

8.2.10 Low flow cut off: Setup → Low flow cut off

Descriptions of functions: Low flow cut off	
Assign process variable	Select process variable for low flow cut off. • Off • Volume flow • Corrected volume flow • Mass flow • Reynolds number Factory setting: Off
On value low flow cutoff	Enter on value for low flow cut off. (Positive floating-point number) Factory setting: 0
Off value low flow cutoff	Enter off value for low flow cut off. Setting range: 0 to 100.0% Factory setting: 50%

8.2.11 System units: Setup → Advanced setup → System units

NOTE: Depending on operating conditions, some parameters may not be displayed.

Descriptions of functions: System units	
Volume flow unit	Select volume flow unit. The selected unit applies for output, low flow cut off and simulation process variables. • cm^3/s, cm^3/min, cm^3/h, cm^3/d, dm^3/s, dm^3/min, dm^3/h, dm^3/d • m^3/s, m^3/min, m^3/h, m^3/d • ml/s, ml/min, ml/h, ml/d, l/s, l/min, l/h, l/d • hl/s, hl/min, hl/h, hl/d, Ml/s, Ml/min, Ml/h, Ml/d • af/s, af/min, af/h, af/d, ft^3/s, ft^3/min, ft^3/h, ft^3/d • fl oz/s [us], fl oz/min [us], fl oz/h [us], fl oz/d [us] • gal/s [us], gal/min [us], gal/h [us], gal/d [us] • kgal/s [us], kgal/min [us], kgal/h [us], kgal/d [us] • Mgal/s [us], Mgal/min [us], Mgal/h [us], Mgal/d [us] • bbl/s [us;liq.], bbl/min [us;liq.], bbl/h [us;liq.], bbl/d [us;liq.] • bbl/s [us;beer], bbl/min [us; beer], bbl/h [us; beer], bbl/d [us; beer] • bbl/s [us;oil], bbl/min [us; oil], bbl/h [us; oil], bbl/d [us; oil] • bbl/s [us;tank], bbl/min [us; tank], bbl/h [us; tank], bbl/d [us; tank] • gal/s [imp], gal/min [imp], gal/h [imp], gal/d [imp] • Mgal/s [imp], Mgal/min [imp], Mgal/h [imp], Mgal/d [imp] • bbl/s [imp;oil], bbl/min [imp;oil], bbl/h [imp;oil], bbl/d [imp;oil] • User vol./s, User vol./min, User vol./h, User vol./d Factory setting: Depends on customer specifications.
Volume unit	Select volume unit. (The selected unit is taken from volume flow unit parameter) • cm^3, dm^3, m^3, ml, l, hl, Ml Mega, af, ft^3, fl oz [us] • gal [us], kgal [us], Mgal [us], bbl [us; oil] • bbl [us;liq.], bbl [us; beer], bbl [us; tank] • gal [imp], Mgal [imp], bbl [imp; oil], User vol. Factory setting: Depends on customer specifications.
Mass flow unit	Select mass flow unit. The selected unit applies for output, low flow cut off and simulation process variable. • kg/s, kg/min kg/h, kg/d, t/s, t/min, t/h, t/d • oz/s, oz/min, oz/h, oz/d, lb/s, lb/min, lb/h, lb/d • STon/s, STon/min, STon/h, STon/d • User mass/s, User mass/min, User mass/h, User mass/d Factory setting: kg/h
Mass unit	Select mass unit. (The selected unit is taken from mass flow unit parameter.) • g, kg, t, oz, lb, Ston, User mass Factory setting: kg
Corrected volume flow unit	Select corrected volume flow unit. The selected unit applies for output, low flow cut off and simulation process variable. • Nl/s, Nl/min, Nl/h, Nl/d, Nm^3/s, Nm^3/min, Nm^3/h, Nm^3/d • Sm^3/s, Sm^3/min, Sm^3/h, Sm^3/d • Sft^3/s, Sft^3/min, Sft^3/h, Sft^3/d • UserCrVol./s, UserCrVol./min, UserCrVol./h, UserCrVol./d Factory setting: Depends on customer specifications.
Corrected volume unit	Select corrected volume unit. (The selected unit is taken from corrected volume flow unit parameter.) • Nl, Nm^3, Sm^3, Sft^3, UserCrVol Factory setting: Depends on customer specifications.

Pressure unit	Select process pressure unit. The unit is taken from calculated saturated steam pressure, atmospheric pressure, maximum value, fixed process pressure, pressure and reference pressure. • Pa, kPa, MPa, mbar, bar, torr, atm, psi • mmH_2O [4 °C], mmH_2O [68 °F], mmHg [0 °C] • gf/cm^2, kgf/cm^2, inH_2O[4 °C], inH_2O [68 °F], ftH_2O [68 °F], inHg [0 °C] • User pres Factory setting: MPa
Temperature unit	Select temperature unit. The selected unit applies for output, reference temperature and simulation process variable. • °C, °F, K, °R Factory setting: °C
Energy flow unit	Select energy flow unit. The selected unit applies for outputs and low flow cut off and is taken from heat flow difference and energy flow. • kW, MW, GW, kJ/s, kJ/min, kJ/h, kJ/d, MJ/s, MJ/min, MJ/h, MJ/d • GJ/s, GJ/min, GJ/h, GJ/d, kcal/s, kcal/min, kcal/h, kcal/d • Mcal/s, Mcal/min, Mcal/h, Mcal/d, Gcal/s, Gcal/min, Gcal/h, Gcal/d • Btu/s, Btu/min, Btu/h, Btu/day, MBtu/s, MBtu/min, MBtu/h, MBtu/d • MMBtu/s, MMBtu/min, MMBtu/h, MMBtu/d • User en./s, User en./min, User en./h, User en./d Factory setting: kW
Energy unit	Select energy unit. • kWh, MWh, GWh, kJ, MJ, GJ, kcal, Mcal, Gcal • Btu, MBtu, MMBtu, User en Factory setting: kWh
Calorific value unit	Select calorific value unit (see 8.2.12) • Volume: kJ/Nm^3, MJ/Nm^3, kWh/Nm^3, MWh/Nm^3, kJ/Sm^3, MJ/Sm^3, kWh/Sm^3, MWh/Sm^3, Btu/Sm^3, $MBtu/Sm^3$, Btu/Sft^3, $MBtu/Sft^3$, User enth • Mass: kJ/kg, MJ/kg, kWh/kg, MWh/kg, kJ/lb, MJ/lb, kWh/lb, MWh/lb, Btu/lb, MBtu/lb, User enth Factory setting: Depends on customer specifications.
Velocity unit	Select velocity unit. The selected unit is taken from flow velocity and maximum value. • m/s, ft/s Factory setting: m/s
Density unit	Select density unit. The selected unit applies for output and simulation process variable and is taken from density, fixed density and reference density. • g/cm^3, kg/cm^3, kg/l, kg/m^3 • SD4 °C, SD15 °C, SD20 °C, SG4 °C, SG15 °C, SG20 °C, lb/ft3 • lb/gal [us], lb/bbl [us;liq.], lb/bbl [us;beer], lb/bbl [us;oil], lb/bbl [us;tank] • lb/gal [imp], lb/bbl [imp;oil], User dens Factory setting: kg/m^3
Dynamic viscosity unit	Select dynamic viscosity unit. The selected unit is taken from dynamic viscosity. • Pa s, cP, P Factory setting: Pa s
Length unit	Select length unit for nominal diameter. The selected unit is taken from inlet run and mating pipe diameter. • mm, m, in, ft Factory setting: mm

8.2.12 Medium properties:
Setup → Advanced setup → Medium properties

NOTE: Depending on operating conditions, some parameters may not be displayed.

Descriptions of functions: Medium properties	
Enthalpy type	Define which kind of enthalpy is used. • Heat • Calorific value Factory setting: Heat
Calorific value type	Select calculation based on gross calorific value or net calorific value. • Gross calorific value volume • Net calorific value volume • Gross calorific value mass • Net calorific value Mass Factory setting: Gross calorific value mass
Reference combustion temperature	Enter reference combustion temperature to calculate the natural gas energy value. Setting range: −200 to 450 °C Factory setting: 20 °C
Reference density	Enter fixed value for reference density. Setting range: 0.01 to 15 000 kg/m^3 Factory setting: 1 000 kg/m^3
Reference gross calorific value	Enter reference gross calorific value of the natural gas. (Positive floating point number) Factory setting: 50 000 kJ/Nm^3
Reference pressure	Enter reference pressure for the calculation of the reference density. (The unit is taken from the Pressure unit parameter.) Setting range: 0 to 250 bar Factory setting: 1.01325 bar
Reference temperature	Enter reference temperature for calculating the reference density. Setting range: −200 to 450 °C Factory setting: 20 °C
Reference Z-factor	Enter real gas constant Z for gas under reference conditions. Setting range: 0.1 to 2 Factory setting: 1
Linear expansion coefficient	Enter linear, medium-specific expansion coefficient for calculating the reference density. Setting range: 1.0^{-6} to 2.0^{-3} Factory setting: 2.06^{-4}
Relative density	Enter a relative density of the natural gas. Setting range: 0.55 to 0.9 Factory setting: 0.664
Specific heat capacity	Enter the specific heat capacity of the medium. Setting range: 0 to 50 kJ/(kgK) Factory setting: 4.187 kJ/(kgK)
Calorific value	Enter gross calorific value to calculate the energy flow. (Positive floating point number) Factory setting: 50 000 kJ/kg
Z-factor	Enter real gas constant Z for gas under operation conditions. Setting range: 0.1 to 2.0 Factory setting: 1

Dynamic viscosity	Enter the value of dynamic viscosity for a user-specific gas or liquid. (Positive floating point number) Factory setting: Depends on customer specifications.

8.2.13 Gas composition: Setup → Advanced setup →Medium properties → Gas composition

NOTE: Depending on operating conditions, some parameters may not be displayed.

Descriptions of functions: Gas composition	
Gas type	Select measured gas type. • Hydrogen H_2 • Helium He • Neon Ne • Argon Ar • Krypton Kr • Xenon Xe • Nitrogen N_2 • Oxygen O_2 • Chlorine Cl_2 • Ammonia NH_3 • Carbon monoxide CO • Carbon dioxide CO_2 • Sulfur dioxide SO_2 • Hydrogen sulfide H_2S • Hydrogen chloride HCl • Methane CH_4 • Ethane C_2H_6 • Propane C_3H_8 • Butane C_4H_{10} • Ethylene C_2H_4 • Vinyl Chloride C_2H_3Cl Factory setting: Methane CH_4
Gas mixture	Select measured gas mixture. • Hydrogen H_2 • Helium He • Neon Ne • Argon Ar • Krypton Kr • Xenon Xe • Nitrogen N_2 • Oxygen O_2 • Chlorine Cl_2 • Ammonia NH_3 • Carbon monoxide CO • Carbon dioxide CO_2 • Sulfur dioxide SO_2 • Hydrogen sulfide H_2S • Hydrogen chloride HCl • Methane CH_4 • Ethane C_2H_6 • Propane C_3H_8 • Butane C_4H_{10} • Ethylene C_2H_4 • Vinyl Chloride C_2H_3Cl • Others Factory setting: Methane CH_4
Mol% gases	Enter amount of each substance of the gas mixture. Setting range: 0 to 100 % Factory setting: 0%
Relative humidity	Enter humidity content of air in %. Setting range: 0 to 100 % Factory setting: 0%

8.2.14 External compensation: Setup → Advanced setup → External compensation

Descriptions of functions: External compensation	
External value	Assign variable from external device to process variable. • Off • Pressure • Relative pressure • Density • Temperature • 2nd temperature delta heat Factory setting: Off
Atmospheric pressure	Enter atmospheric pressure value to be used for pressure correction. (The unit is taken from the pressure unit parameter.) Setting range: 0 to 250 bar Factory setting: 1.01325 bar

Delta heat calculation	Calculates the transferred heat of a heat exchanger (= delta heat). • Off • Device on cold side • Device on warm Side Factory setting: Device on warm side
Fixed density	Enter fixed value for medium density. (The unit is taken from the density unit parameter.) Setting range: 0.01 to 15 000 kg/m³ Factory setting: 1 000 kg/m³
Fixed temperature	Enter a fixed value for process temperature. (The unit is taken from the temperature unit parameter.) Setting range: –200 to 450 °C Factory setting: 20 °C
2nd temperature delta heat	Enter 2nd temperature value to calculate the delta heat. (The unit is taken from the Temperature unit parameter.) Setting range: –200 to 450 °C Factory setting: 20 °C
Fixed process pressure	Enter fixed value for process pressure. (The unit is taken from the Pressure unit parameter.) Setting range: 0 to 250 bar abs. Factory setting: 0 bar abs.
Steam quality	Select compensation mode for steam quality (steam dryness). • Fixed value • Calculated value Factory setting: Fixed value **Caution!** When using the optional “Steam Dryness Fraction Calculator”, select “Calculated value”.
Steam quality value	Enter fixed value for steam quality (steam dryness). Setting range: 0 to 100 % Factory setting: 100 %


Caution!

8.2.15 Sensor adjustment:
Setup → Advanced setup → Sensor adjustment

Descriptions of functions: Sensor adjustment	
Inlet configuration	Select the configuration of the upstream piping. The upstream straight piping may be reduced to its shortest possible length (10 × nominal diameter). • Off • Single elbow • Double elbow • Double elbow 3D • Reduction NOTE: - An additional measuring uncertainty of ±0.5% o.r. will occur. - This function is only applicable to EF200F, from sizes 15 – 150mm. - Depending on operating conditions, this function may not be selected. (Example: Cannot be used in conjunction with the “Steam Dryness Fraction Calculator” option). Factory setting: Off
Inlet run	Define length of the straight upstream piping. Setting range: 0 to 20 m Factory setting: 0 m

Mating pipe diameter	Enter actual value of the mating pipe to activate the diameter mismatch correction. Setting range: 0 to 1 m Factory setting: 0 m
Installation factor	Enter factor to adjust for installation conditions. (Positive floating point number) Factory setting: 1.0

8.2.16 Totalizer 1 to 3: Setup → Advanced setup → Totalizer 1 to 3

See 8.2.4 'Totalizer handling'

Descriptions of functions: Totalizer 1 to 3	
Assign process variable	Select process variable for totalizer. • Off • Volume flow • Corrected volume flow • Mass flow • Total mass flow • Condensate mass flow • Energy flow • Heat flow difference Factory setting: Depends on customer specifications.
Unit totalizer	Select units for the process variable assigned to totalizer. NOTE: Available units may differ depending on selected process variable. Factory setting: Depends on customer specifications.
Failure mode	Define totalizer behavior in alarm condition. • Stop • Actual value • Last valid value Factory setting: Stop

8.2.17 Display: Setup → Advanced setup → Display

NOTE: Parameters that appear in 8.2.8 have been omitted here.
Parameters that have not been explained in 8.2.8 are described below.

Descriptions of functions: Display	
Decimal places 1 to 4	Select the number of decimal places for the display value. • x • x.x • x.xx • x.xxx • x.xxxx Factory setting: x.xx
Language	Set display language. See 8.2.1 Factory setting: English
Display interval	Set time measured values are shown on display if display alternates between values. Setting range: 1 to 10 seconds Factory setting: 5 seconds
Display damping	Set display reaction time to fluctuations in the measured value. Setting range: 0.0 to 999.9 seconds Factory setting: 5 seconds
Header	Select header contents on local display. • Device tag • Free text Factory setting: Device tag

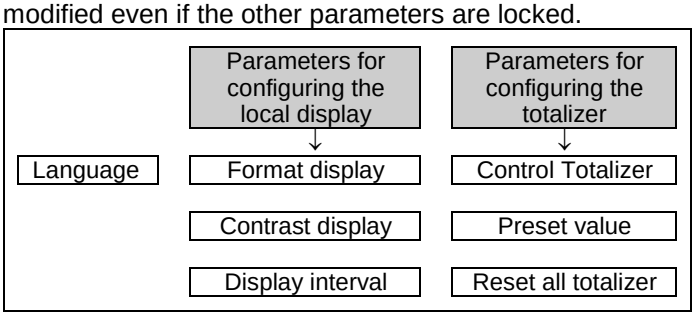
Header text	Enter display header text. Factory setting: ----------
Separator	Select decimal separator for displaying numerical values. • . (Period/Full stop) • , (Comma) Factory setting: . (Period/Full stop)

8.2.18 Configuration backup display: Setup → Advanced setup → Configuration backup display

NOTE: Depending on operating conditions, some parameters may not be displayed.

Descriptions of functions: Configuration backup display	
Operating time	Indicates how long the device has been in operation. Display format: Days (d), hours (h), minutes (m), seconds (s)
Last backup	Indicates when the last data backup was saved to the display module. Display format: Days (d), hours (h), minutes (m), seconds (s)
Configuration management	Select action for managing the device data in the display module. NOTE: It is possible to save the device settings to the display module. This function enables the user to back-up device settings and restore data from back-ups. Settings may be copied to other identically configured flowmeters. • Cancel • Execute backup • Restore • Duplicate • Compare • Clear backup data Factory setting: Cancel
Comparison result	Comparison between present device data and display backup. • Settings identical • Settings not identical • No backup available • Backup settings corrupt • Check not done • Dataset incompatible Factory setting: Check not done

8.2.19 Administration: Setup → Advanced setup → Administration

Descriptions of functions: Administration	
Define access code	With the customer-specific access code, the parameters for the measuring device configuration are write-protected and their values can no longer be changed via local operation. (For disabling write-protection, see 5.2.2) Defining the access code via local display 1. Navigate to the Enter access code parameter. 2. Define a max. 4-digit numeric code as an access code. 3. Enter the access code again to confirm the code. ➥The (🔒) symbol appears in front of all write-protected parameters. NOTE: The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 seconds if the user skips back to the operational display mode from the navigation and editing view. NOTE: • If write access is activated via access code, it can be also be deactivated only via the access code. • The user role with which the user is currently logged on via the local display is indicated by the Access status display parameter. Parameters which can always be modified via the local display. Certain parameters that do not affect the measurement are excepted from write protection via the local display. Despite the defined access code, these parameters can always be modified even if the other parameters are locked. 
Device reset	Restart or reset device manually. NOTE: Using the Device reset parameter it is possible to reset the entire device configuration or some of the configuration to a defined state. • Cancel • To factory defaults • To delivery settings • Restart device Factory setting: Cancel

8.2.20 Diagnostics

Descriptions of functions: Diagnostics	
Actual diagnostics	Displays the current diagnostic event along with the diagnostic information. NOTE: If two or more messages occur simultaneously, the message with the highest priority is shown on the display. Displayed: Symbol for diagnostic behavior, diagnostic code and short message.
Previous diagnostics	Displays the diagnostic event that occurred prior to the current diagnostic event along with the diagnostic information. Displayed: Symbol for diagnostic behavior, diagnostic code and short message.
Operating time from restart	Shows the time the device has been in operation since the last device restart. Display format: Days (d), hours (h), minutes (m), seconds (s)
Operating time	Indicates how long the device has been in operation. Display format: Days (d), hours (h), minutes (m), seconds (s)
Diagnostic list	In the Diagnostic list submenu, up to 5 currently pending diagnostic events can be displayed along with the related diagnostic information. NOTE: If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

8.2.21 Event logbook: Diagnostics → Event logbook

Descriptions of functions: Event logbook	
Filter options	The category of event messages displayed in the event list can be defined. Filter categories • All • Failure (F) • Function check (C) • Out of specification (S) • Maintenance required (M) • Information (I)
Event list	A maximum of 20 event messages can be displayed in chronological order. The event history includes entries for: • Diagnostic events → (see 10.3 for details) • Information events → (see 10.4 for details) In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended: • Event has occurred • Event has ended

8.2.22 Device information: Diagnostics → Device information

Descriptions of functions: Device information	
Device tag	Enter the name for the measuring point. Max. 32 characters. Allowed characters: letters, numbers or special characters (e.g. @, %, /) Factory setting: EF200
Serial number	Displays the serial number of the measuring device. Max. 11-digit character string comprising letters and numbers.
Firmware version	Displays the device firmware version installed. Display format: xx.yy.zz

Device name	Displays the name of the transmitter. (Character string composed of letters, numbers and certain punctuation marks.)
Order code	Displays the device order code. (Character string composed of letters, numbers and certain punctuation marks.)
Extended order code 1 to 3	Displays the extended order code.
ENP version	Displays the version of the electronic nameplate. Display format: xx.yy.zz
Device version	Displays the device revision with which the device is registered with the HART Communication Foundation.
Device ID	Displays the device ID for identifying the device in a HART network. (Positive integer) Display format: 6-digit hexadecimal number
Device type	Displays the device type with which the measuring device is registered with the HART Communication Foundation.
Manufacturer ID	Displays the manufacturer ID with which the measuring device is registered with the HART Communication Foundation.

8.2.23 Measured values: Diagnostics → Measured values

Descriptions of functions: Measured values	
Process variables	Displays the process variables currently being measured. NOTE: Units follow the system unit settings. Displayed process variables: (Depending on operating conditions, some variables may not be displayed) • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Calculated saturated steam pressure • Steam quality (Steam dryness) • Total mass flow • Condensate mass flow • Energy flow • Heat flow difference • Reynolds number • Density • Specific volume • Pressure • Compressibility factor • Degrees of superheat
Totalizer	In the assigned Process variable parameter of Totalizer 1 to 3, the current totalizer counter value and the current totalizer overflow can be displayed. Totalizer value: Current totalizer counter value Totalizer overflow: Current totalizer overflow

8.2.24 Output values: Diagnostics → Measured values → Output values

Descriptions of functions: Output values	
Output current 1	Displays the current value currently calculated for the current output. Display range: 3.59 to 22.5 mA
Measured current 1	Displays the current value currently measured for the current output. Display range: 0 to 30 mA
Terminal voltage 1	Displays the current terminal voltage that is applied at the current output. Display range: 0.0 to 50.0 V
Pulse output	Displays the value currently measured for the pulse output. (Positive floating point number)
Output frequency	Displays the value currently measured for the frequency output. Display range: 0.0 to 1 250.0 Hz
Switch status	Displays the current switch output status (open or closed).

8.2.25 Simulation: Diagnostics → Simulation

NOTE: The "Simulation" submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

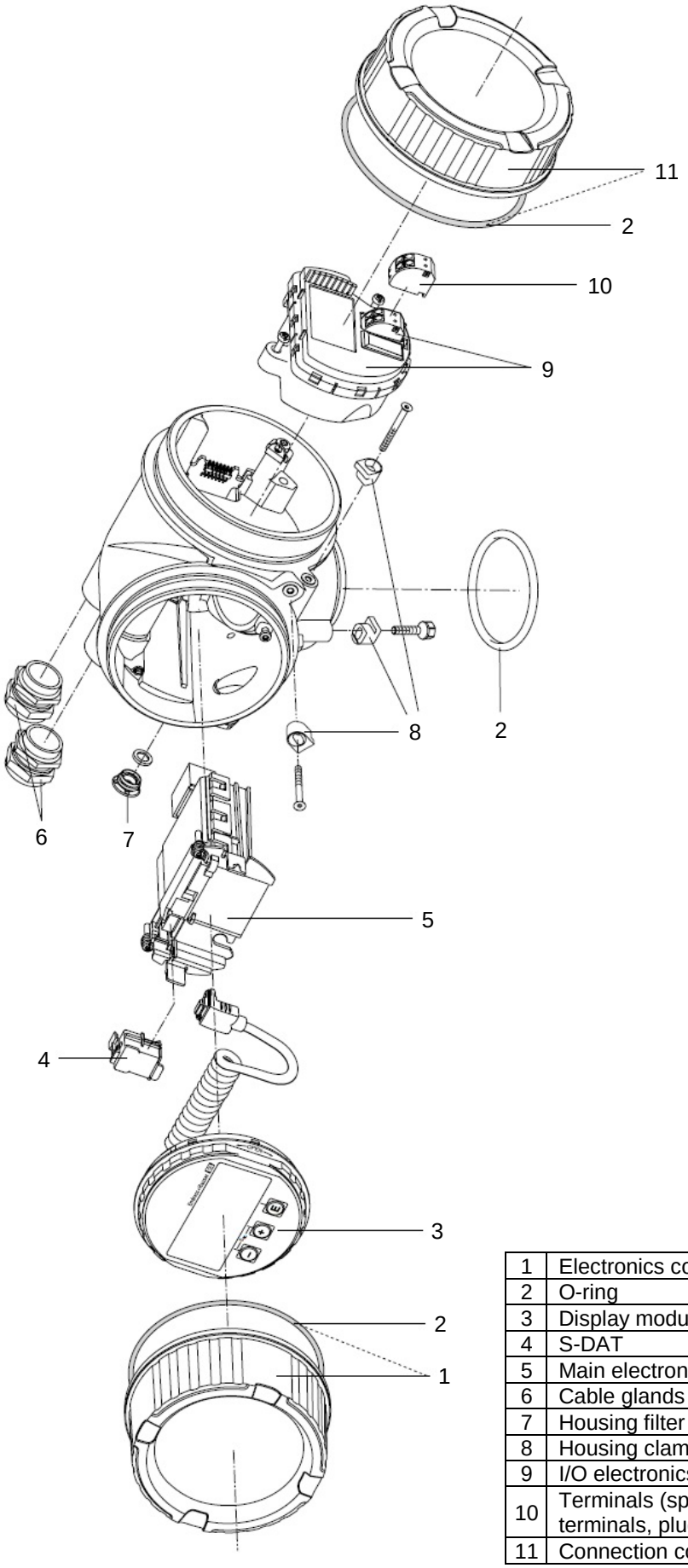
Descriptions of functions: Simulation	
Assign simulation process variable	Select a process variable for the simulation process that is activated. • Off • Volume flow • Corrected volume flow • Mass flow • Flow velocity • Temperature • Calculated saturated steam pressure • Steam quality (Steam dryness) • Total mass flow • Condensate mass flow • Energy flow • Heat flow difference • Reynolds number Factory setting: Off
Value process variable	Enter the simulation value for the selected process variable. (Signed floating point number) Factory setting: 0
Simulation current output 1	Switch simulation of the current output on and off. • Off • On Factory setting: Off
Value current output 1	Enter the current value for simulation. Setting range: 3.59 to 22.5 mA Factory setting: 3.59 mA
Frequency simulation	Switch simulation of the frequency output on and off. • Off • On Factory setting: Off
Frequency value	Enter the frequency value for simulation. Setting range: 0.0 to 1 250.0 Hz Factory setting: 0.0 Hz

Pulse simulation	Switch simulation of the pulse output on and off. • Off • Fixed value • Down-counting value NOTE: If the fixed value option is selected, the Pulse width parameter defines the pulse width of the pulses output. Factory setting: Off
Pulse value	When the down-counting value option is selected in the simulation pulse output parameter, enter the number of pulses for simulation. Setting range: 0 to 65535 Factory setting: 0
Switch output simulation	Switch simulation of switch output on and off. • Off • On Factory setting: Off
Switch status	Select the status of the status output for the simulation. • Open • Closed Factory setting: Open
Simulation device alarm	Switch the device alarm on and off. • Off • On Factory setting: Off
Diagnostic event category	Select the category of the diagnostic event. • Sensor • Electronics • Configuration • Process Factory setting: Process
Simulation diagnostic event	Switch simulation of the diagnostic event on and off. For the simulation, you can choose from the diagnostic events of the category selected in the Diagnostic event category parameter. • Off • Picklist Diagnostic events (see 10.3) (depends on the selected category) Factory setting: Off

8.2.26 Expert

This menu is for use by TLV technical service personnel and does not require operation during standard flow measurement.
In the event that operation of this menu is required, TLV will explain the operation procedure.
Consult TLV for more information if required.

9. Configuration of the Transmitter Housing (Display Unit)



1	Electronics compartment cover
2	O-ring
3	Display module
4	S-DAT
5	Main electronics module
6	Cable glands
7	Housing filter
8	Housing clamp
9	I/O electronics module
10	Terminals (spring loaded terminals, pluggable)
11	Connection compartment cover

10. Diagnostics and troubleshooting

10.1 Troubleshooting

For local display

Problem	Possible causes	Remedy
Local display dark and no output signals	Supply voltage does not match the voltage specified on the nameplate.	Apply the correct supply voltage.
	Supply voltage has incorrect polarity.	Reverse polarity of supply voltage.
	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
	Terminals are not plugged into the I/O electronics module correctly.	Check terminals.
	I/O electronics module is defective.	Order spare part.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	• Set the display brighter by simultaneously pressing ⊕ + Ⓔ. • Set the display darker by simultaneously pressing ⊖ + Ⓔ.
	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
	Display module is defective.	Order spare part.
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured.	1. Press ⊖ + ⊕ for 2 seconds ("home position"). 2. Press Ⓔ. 3. Set the desired language in the Language parameter.
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	• Check the cable and the connector between the main electronics module and display module. • Order spare part.

For output signals

Problem	Possible causes	Remedy
Signal output outside the valid range	Main electronics module is defective.	Order spare part.
Signal output outside the valid current range (<3.6 mA or >22 mA)	I/O electronics module is defective.	Order spare part.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error	Check and correct parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration 2. Observe limit values specified in the "Technical Data".

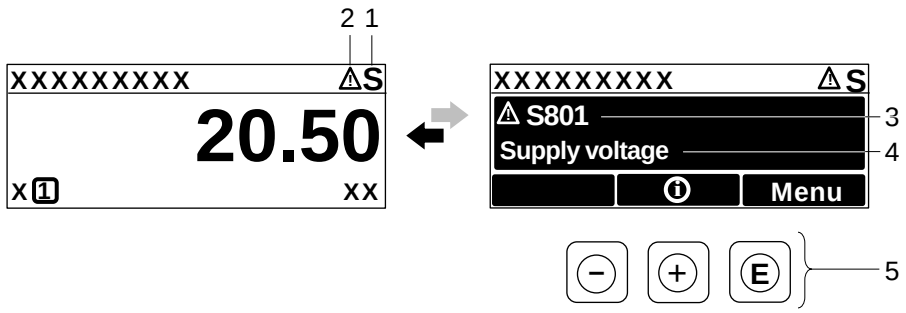
For access

Problem	Possible causes	Remedy
No write access to parameters	Hardware write protection enabled	Set the write protection switch on the main electronics module to the OFF position.
	Current user role has limited access authorization	1. Check user role (→ 8.2.2). 2. Enter correct customer-specific access code (→ 8.2.19)

10.2 Diagnostic message (Error message)

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.

Operational display in alarm condition	Diagnostic message



1. Status signal
2. Diagnostic behavior
3. Diagnostic behavior with diagnostic code
4. Short text
5. Operating elements

NOTE: If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107:

F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device continues to operate: • Outside its technical specification limits (e.g. outside the process temperature range) • Outside of the configuration carried out by the user (e.g. maximum flow in parameter 20 mA value)
M	**Maintenance required** Maintenance is required. The measured value remains valid.

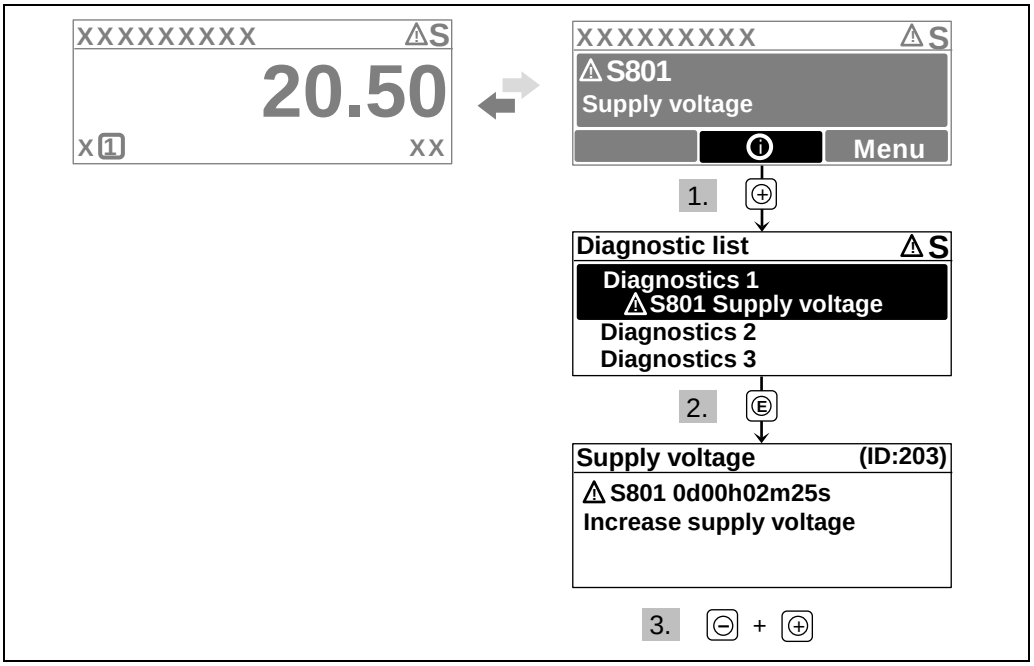
Diagnostic behavior

Symbol	Meaning
⊗	**Alarm** • Measurement is interrupted. • Signal outputs and totalizers assume the defined alarm condition. • A diagnostic message is generated.
⚠	**Warning** Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

Operating elements

Key	Function
⊕	**Plus key** In a menu, submenu Opens the message about the remedial measures.
Ⓔ	**Enter key** In a menu, submenu Opens the operating menu.

Calling up remedial measures for diagnostic events



The user is in the diagnostic message.

1. Press ⊕ (ⓘ symbol).
   ➥ The Diagnostic list submenu opens.
2. Select the desired diagnostic event with ⊕ or ⊖ and press Ⓔ.
   ➥ The message for the remedial measures for the selected diagnostic event opens.
3. Press ⊕ + ⊖ simultaneously.
   ➥ The message for the remedial measures closes.

10.3 Overview of diagnostic information

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
004	Sensor defective	1. Check plug connections 2. Change pre-amplifier 3. Change DSC sensor	**F**	Alarm
022	Temperature sensor defective	1. Check plug connections 2. Change pre-amplifier 3. Change DSC sensor	**F**	Alarm[1)]
046	Sensor limit exceeded	1. Check plug connections 2. Change pre-amplifier 3. Change DSC sensor	**S**	Warning
062	Sensor connection defective	1. Check plug connections 2. Change pre-amplifier 3. Change DSC sensor	**F**	Alarm
082	Data storage	1. Change main electronic module 2. Change sensor	**F**	Alarm
083	Memory content	1. Restart device 2. Restore S-Dat data 3. Change sensor	**F**	Alarm
114	Sensor leaky	Change DSC sensor	**F**	Alarm
122	Temperature sensor defective	1. Check plug connections 2. Change pre-amplifier 3. Change DSC sensor	**M**	Warning[1)]
Diagnostic of electronic				
242	Software incompatible	1. Check software 2. Flash or change main electronics module	**F**	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change I/O or main electronic module	**F**	Alarm
261	Electronic modules	1. Restart device 2. Check electronic modules 3. Change I/O module or main electronics	**F**	Alarm
262	Module connection	1. Check module connections 2. Change electronic modules	**F**	Alarm
270	Main electronic failure	Change main electronic module	**F**	Alarm
271	Main electronic failure	1. Restart device 2. Check main electronic module	**F**	Alarm
272	Main electronic failure	1. Restart device 2. Contact TLV	**F**	Alarm
273	Main electronic failure	1. Emergency operation via display 2. Change main electronics	**F**	Alarm
275	I/O module failure	Change I/O module	**F**	Alarm
276	I/O module failure	1. Restart device 2. Change I/O module	**F**	Alarm
277	Electronic defective	1. Change pre-amplifier 2. Change main electronic module	**F**	Alarm
282	Data storage	1. Restart device 2. Contact TLV	**F**	Alarm
283	Memory content	1. Transfer data or reset device 2. Contact TLV	**F**	Alarm
302	Device verification active	Device verification active, please wait.	**C**	Warning
311	Electronic failure	1. Transfer data or reset device 2. Contact TLV	**F**	Alarm

311	Electronic failure	Maintenance required! 1. Do not perform reset 2. Contact TLV	**M**	Warning
350	Pre-amplifier defective	Change pre-amplifier	**F**	Alarm[1)]
351	Pre-amplifier defective	Change pre-amplifier	**F**	Alarm
370	Pre-amplifier defective	1. Check plug connections 2. Check cable connection of remote version 3. Change pre-amplifier or main electronic module	**F**	Alarm
371	Temperature sensor defective	1. Check plug connections 2. Change pre-amplifier 3. Change DSC sensor	**M**	Warning[1)]
Diagnostic of configuration				
410	Data transfer	1. Check connection 2. Retry data transfer	**F**	Alarm
412	Processing download	Download active, please wait	**C**	Warning
431	Trim 1 to 2	Carry out trim	**C**	Warning
437	Configuration incompatible	1. Restart device 2. Contact TLV	**F**	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	**M**	Warning
441	Current output 1 to 2	1. Check process 2. Check current output settings	**S**	Warning[1)]
442	Frequency output	1. Check process 2. Check frequency output settings	**S**	Warning[1)]
443	Pulse output	1. Check process 2. Check pulse output settings	**S**	Warning[1)]
444	Current input 1	1. Check process 2. Check current input settings	**S**	Warning[1)]
453	Flow override	Deactivate flow override	**C**	Warning
484	Simulation failure mode	Deactivate simulation	**C**	Alarm
485	Simulation measured variable	Deactivate simulation	**C**	Warning
486	Simulation current input 1	Deactivate simulation	**C**	Warning
491	Simulation current output 1 to 2	Deactivate simulation	**C**	Warning
492	Simulation frequency output	Deactivate simulation frequency output	**C**	Warning
493	Simulation pulse output	Deactivate simulation pulse output	**C**	Warning
494	Switch output simulation	Deactivate simulation switch output	**C**	Warning
495	Simulation diagnostic event	Deactivate simulation	**C**	Warning
538	Flow computer configuration incorrect	Check input value (pressure, temperature)	**S**	Warning
539	Flow computer configuration incorrect	1. Check input value (pressure, temperature) 2. Check allowed values of the medium properties	**S**	Alarm
540	Flow computer configuration incorrect	Check entered reference value using the document Operating Instructions	**S**	Warning
570	Inverted data heat	Check configuration of mounting location (parameter Installation direction)	**F**	Alarm

Diagnostic of process				
801	Supply voltage too low	Increase supply voltage	**S**	Warning
803	Current loop	1. Check wiring 2. Change I/O module	**F**	Alarm
828	Ambient temperature too low	Increase ambient temperature of pre-amplifier	**S**	Warning[1)]
829	Ambient temperature too high	Reduce ambient temperature of pre-amplifier	**S**	Warning[1)]
832	Electronic temperature too high	Reduce ambient temperature	**S**	Warning[1)]
833	Electronic temperature too low	Increase ambient temperature	**S**	Warning[1)]
834	Process temperature too high	Reduce process temperature	**S**	Warning[1)]
835	Process temperature too low	Increase process temperature	**S**	Warning[1)]
841	Flow velocity too high	Reduce flow velocity	**S**	Warning[1)]
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	**S**	Warning
844	Sensor range exceeded	Reduce flow velocity	**S**	Warning[1)]
870	Measuring inaccuracy increased	1. Check process 2. Increase flow volume	**S**	Warning[1)]
871	Near steam saturation limit	Check process conditions	**S**	Warning[1)]
872	Wet steam detected	1. Check process 2. Check plant	**S**	Warning[1)]
873	Water detected	Check process (water in piping)	**S**	Warning[1)]
874	X% spec invalid	1. Check pressure, temperature 2. Check flow velocity 3. Check for flow fluctuation	**S**	Warning[1)]
882	Input signal	1. Check input configuration 2. Check external device or process conditions	**F**	Alarm
945	Sensor range exceeded	Check immediately process conditions (pressure-temperature rating)	**S**	Warning[1)]
946	Vibration detected	Check installation	**S**	Warning
947	Vibration exceeded	Check installation	**S**	Alarm[1)]
972	Degrees of superheat limit exceeded	1. Control process conditions 2. Install pressure transmitter or enter correct fixed pressure value	**S**	Warning[1)]

[1)] Diagnostic status is changeable.

Operating conditions for displaying the following diagnostics information:

- Diagnostics information 871: The process temperature is less than 2K from the saturated steam line.
- Diagnostics information 872: The measured steam quality (steam dryness) has dropped below the configured limit value for the steam quality (steam dryness) (limit value: "Expert" menu → System → Diagnostic handling → Diagnostic limits → Steam quality limit).
- Diagnostics information 873: The process temperature is ≤ 0 °C.
- Diagnostics information 874: Steam dryness fraction calculation is outside the specified limits for the following process parameters: pressure, temperature, velocity.
- Diagnostics information 972: The degree of superheat has exceeded the configured limit value (limit value: "Expert" menu → System → Diagnostic handling → Diagnostic limits → Degrees of superheat limit).

10.4 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Info number	Info name
I1000	-------- (Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Trend data deleted
I1110	Write protection switch changed
I1137	Electronic changed
I1151	History reset
I1154	Reset terminal voltage min/max
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1185	Display backup done
I1186	Restore via display done
I1187	Settings downloaded with display
I1188	Display data cleared
I1189	Backup compared
I1227	Sensor emergency mode activated
I1228	Sensor emergency mode failed
I1256	Display: access status changed
I1264	Safety sequence aborted
I1335	Firmware changed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1444	Device verification passed
I1445	Device verification failed
I1459	Failed: I/O module verification
I1461	Failed: Sensor verification
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1552	Failed: Main electronic verification
I1553	Failed: Pre-amplifier verification

11. Flow Rate Data

11.1 Flow Rate for Saturated Steam (kg/h)

1 MPa = 10 bar

EF200W - Flangeless															
Size (DN)	15		25		40		50		80		100		150		Temp (°C)
Press (MPaG)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
0.05	4.4	30	13	140	28	325	46	527	102	1187	174	2023	389	4531	111.6
0.1	5	40	14	183	32	424	52	689	117	1551	199	2643	445	5919	120.4
0.2	6	58	17	267	39	620	63	1006	141	2263	240	3856	537	8636	133.7
0.3	6.9	76	20	350	45	811	72	1316	161	2962	275	5047	614	11303	143.7
0.4	7.6	94	22	432	49	1000	80	1623	179	3652	305	6223	682	13936	151.9
0.5	8.3	112	24	512	54	1187	87	1927	195	4336	332	7388	743	16545	158.9
0.6	8.9	130	25	593	58	1373	94	2229	210	5015	357	8545	799	19136	165.0
0.7	9.5	147	27	673	62	1558	100	2529	224	5691	381	9697	851	21714	170.5
0.8	10	165	28	752	65	1743	105	2828	236	6364	402	10843	900	24282	175.4
0.9	11	182	30	832	68	1927	111	3126	248	7035	423	11987	947	26843	179.9
1.0	11	199	31	911	72	2110	116	3424	260	7705	443	13128	991	29399	184.1
1.1	12	217	33	990	75	2293	121	3721	271	8374	461	14268	1033	31950	188.0
1.2	12	234	34	1069	78	2476	125	4018	282	9042	479	15406	1073	34500	191.6
1.3	13	251	35	1148	80	2659	130	4315	292	9710	497	16544	1112	37048	195.1
1.4	13	269	36	1227	83	2842	134	4612	302	10378	514	17682	1150	39596	198.3
1.5	14	286	37	1306	86	3025	139	4909	311	11046	530	18820	1186	42144	201.4
1.6	14	303	38	1385	88	3208	143	5206	320	11714	546	19958	1221	44694	204.3
1.7	14	321	39	1464	91	3391	147	5503	329	12383	561	21098	1256	47246	207.1
1.8	15	338	40	1543	93	3575	151	5801	338	13053	576	22239	1289	49800	209.8
1.9	15	355	41	1623	95	3758	154	6099	347	13723	591	23381	1322	52357	212.4
2.0	15	373	42	1702	98	3942	158	6397	355	14394	605	24524	1354	54918	214.9
2.5	17	461	47	2102	108	4867	175	7897	394	17768	671	30274	1504	67791	226.1
3.0	18	549	51	2505	118	5802	191	9413	430	21180	734	36087	1642	80810	235.7

EF200F – Flanged (DN 15 – 80)											
Size (DN)	15		25		40		50		80		Temp (°C)
Press (MPaG)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
0.05	3.1	21	10	108	23	267	39	446	86	1001	111.6
0.1	3.5	27	11	142	27	349	44)	583	99	1308	120.4
0.2	4.3	40	13	207	32	510	53	850	119	1909	133.7
0.3	4.9	53	15	271	37	667	61	1113	136	2498	143.7
0.4	5.4	65	17	334	41	823	68	1372	151	3080	151.9
0.5	5.9	78	18	397	44	977	74	1629	165	3657	158.9
0.6	6.3	90	20	459	48	1130	79	1885	177	4230	165
0.7	6.7	102	21	521	51	1282	84	2139	189	4800	170.5
0.8	7.1	114	22	583	54	1434	89	2392	199	5368	175.4
0.9	7.5	126	23	645	56	1585	94	2644	210	5934	179.9
1.0	7.8	138	24	706	59	1736	98	2896	219	6499	184.1
1.1	8.2	150	25	767	61	1887	102	3147	229	7063	188
1.2	8.5	163	26	829	64	2038	106	3398	238	7626	191.6
1.3	8.8	175	27	890	66	2188	110	3649	246	8190	195.1
1.4	9.1	187	28	951	68	2339	114	3900	255	8753	198.3
1.5	9.4	199	29	1012	71	2489	117	4151	263	9316	201.4
1.6	9.7	211	30	1074	73	2640	121	4403	270	9880	204.3
1.7	9.9	223	31	1135	75	2791	124	4654	278	10444	207.1
1.8	11	235	31	1196	77	2942	127	4906	285	11009	209.8
1.9	11	247	32	1258	79	3093	131	5158	293	11574	212.4
2.0	11	259	33	1319	80	3244	134	5410	300	12140	214.9
2.5	12	320	36	1629	89	4005	148	6678	332	14986	226.1
3.0	13	382	39	1942	97	4774	162	7961	363	17864	235.7

EF200F – Flanged (DN 100 – 300)											
Size (DN)	100		150		200		250		300		Temp (°C)
Press (MPaG)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
0.05	149	1735	339	3947	594	6919	933	10872	1321	15393	111.6
0.1	171	2266	388	5156	679	9038	1066	14201	1510	20107	120.4
0.2	206	3307	468	7523	820	13189	1288	20722	1823	29339	133.7
0.3	236	4328	535	9846	938	17261	1474	27120	2086	38398	143.7
0.4	262	5336	594	12140	1041	21282	1636	33438	2316	47342	151.9
0.5	285	6335	648	14412	1135	25266	1783	39697	2524	56205	158.9
0.6	306	7328	696	16669	1220	29223	1917	45915	2714	65007	165
0.7	326	8315	742	18915	1300	33160	2042	52100	2891	73765	170.5
0.8	345	9298	784	21152	1375	37082	2160	58262	3057	82489	175.4
0.9	363	10279	825	23383	1445	40992	2270	64406	3214	91188	179.9
1.0	380	11257	863	25609	1512	44895	2376	70538	3364	99869	184.1
1.1	396	12234	900	27832	1577	48791	2477	76660	3507	108537	188
1.2	411	13211	935	30053	1638	52684	2574	82777	3644	117197	191.6
1.3	426	14186	969	32272	1698	56576	2667	88890	3776	125853	195.1
1.4	441	15162	1001	34492	1755	60466	2757	95003	3904	134508	198.3
1.5	454	16138	1033	36712	1811	64358	2845	101118	4027	143165	201.4
1.6	468	17114	1064	38933	1865	68252	2930	107236	4147	151827	204.3
1.7	481	18092	1094	41156	1917	72149	3012	113358	4264	160495	207.1
1.8	494	19070	1123	43381	1968	76050	3092	119487	4378	169173	209.8
1.9	506	20049	1152	45609	2018	79955	3171	125623	4489	177861	212.4
2.0	519	21030	1179	47840	2067	83866	3247	131768	4597	186561	214.9
2.5	576	25960	1310	59054	2296	103525	3608	162656	5108	230293	226.1
3.0	629	30945	1430	70394	2507	123406	3939	193893	5577	274518	235.7

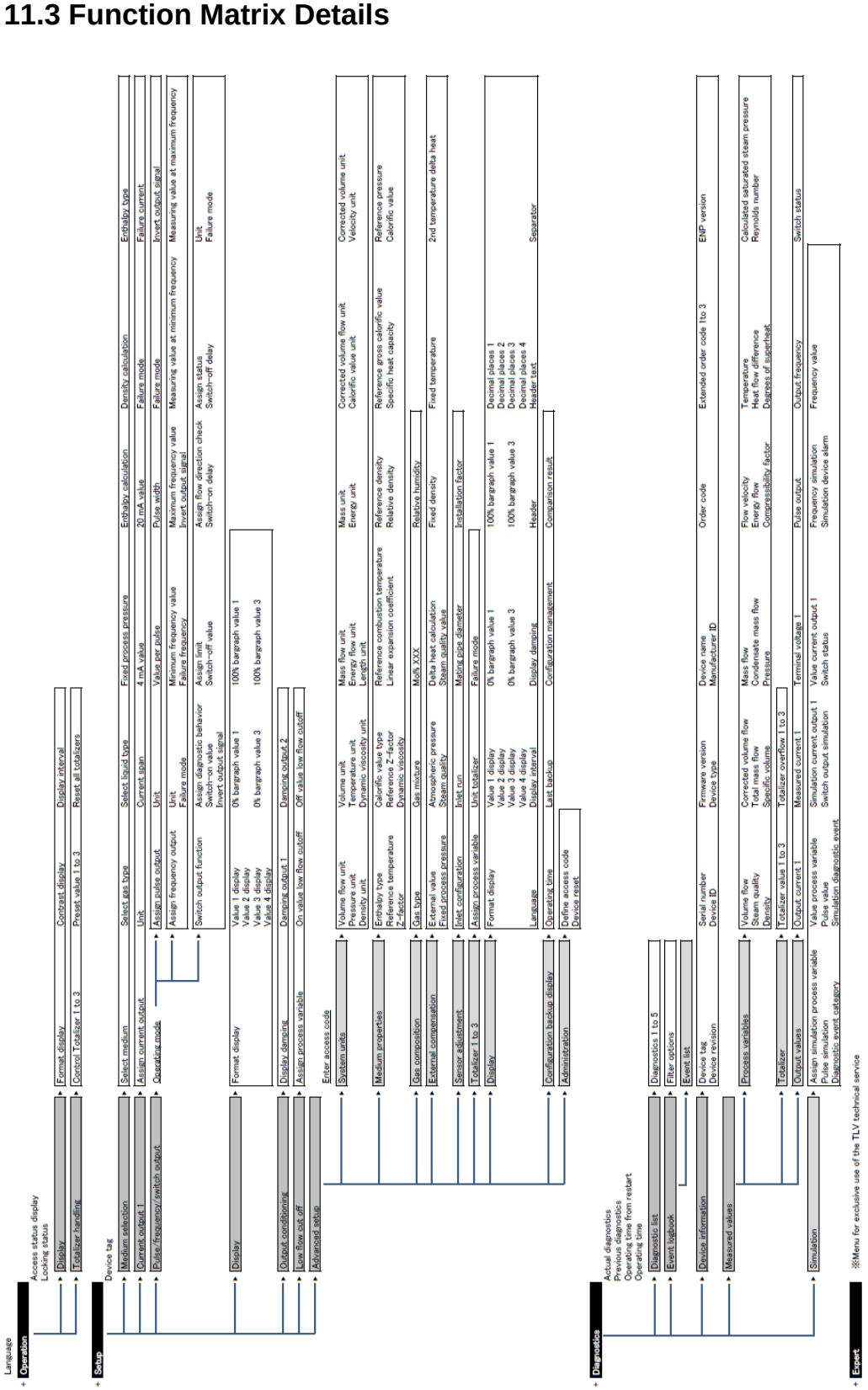
EF200R – Flanged (Reduced Port)															
Size (DN)	25		40		50		80		100		150		200		Temp (°C)
Press (MPaG)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
0.05	3.1	21	10	108	23	267	39	446	86	1001	149	1735	339	3947	111.6
0.1	3.5	27	11	142	27	349	44	583	99	1308	171	2266	387	5156	120.4
0.2	4.3	40	13	207	32	510	53	850	119	1909	206	3307	468	7523	133.7
0.3	4.9	53	15	271	37	667	61	1113	136	2498	236	4328	535	9846	143.7
0.4	5.4	65	17	334	41	823	68	1372	151	3080	262	5336	594	12140	151.9
0.5	5.9	78	18	397	44	977	74	1630	165	3657	285	6335	648	14412	158.9
0.6	6.3	90	20	459	48	1130	79	1885	177	4230	306	7327	696	16669	165.0
0.7	6.7	102	21	521	51	1282	84	2139	189	4800	326	8315	742	18915	170.5
0.8	7.1	114	22	583	54	1434	89	2392	199	5368	345	9298	784	21152	175.4
0.9	7.5	126	23	645	56	1585	94	2644	210	5934	363	10279	825	23383	179.9
1.0	7.8	138	24	706	59	1736	98	2896	219	6499	380	11257	863	25609	184.1
1.1	8.2	150	25	767	61	1887	102	3147	229	7063	396	12234	900	27832	188.0
1.2	8.5	163	26	829	64	2038	106	3398	238	7626	411	13211	935	30053	191.6
1.3	8.8	175	27	890	66	2188	110	3649	246	8190	426	14186	969	32272	195.1
1.4	9.1	187	28	951	68	2339	114	3900	255	8753	441	15162	1001	34492	198.3
1.5	9.4	199	29	1012	71	2489	117	4151	263	9316	454	16138	1033	36712	201.4
1.6	9.7	211	30	1074	73	2640	121	4403	270	9880	468	17114	1064	38933	204.3
1.7	9.9	223	31	1135	75	2791	124	4654	278	10444	481	18091	1094	41156	207.1
1.8	11	235	31	1196	77	2942	127	4906	285	11009	494	19069	1123	43381	209.8
1.9	11	247	32	1258	79	3093	131	5158	293	11574	506	20049	1152	45609	212.4
2.0	11	259	33	1319	80	3244	134	5410	300	12140	519	21030	1179	47840	214.9
2.5	12	320	36	1629	89	4005	148	6678	332	14986	576	25960	1310	59054	226.1
3.0	13	382	39	1942	97	4774	162	7961	363	17864	629	30945	1430	70395	235.7

EF200F with Steam Dryness Fraction Calculator Function											
Size (DN)	25		40		50		80		100		Temp (°C)
Press (MPaG)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
0.1	11	66	27	233	44	349	99	872	171	906	120.4
0.2	14	96	35	340	57	510	128	1272	221	1323	133.7
0.3	19	126	45	445	75	668	167	1666	289	1731	143.7
0.4	23	156	55	548	92	823	206	2054	356	2135	151.9
0.5	27	185	66	651	109	978	244	2438	423	2534	158.9
0.6	31	214	76	753	126	1131	282	2820	489	2931	165
0.7	35	243	86	855	143	1283	320	3200	555	3326	170.5
0.8	39	272	96	956	160	1435	358	3579	620	3720	175.4
0.9	43	301	106	1057	177	1586	396	3955	686	4111	179.9
1.0	48	329	116	1158	194	1737	434	4333	751	4503	184.1

11.2 Flow Rate for Air or Water (m^3/h)

Model	EF200W				EF200F				EF200R			
Fluid	Air (0°C Atmospheric pressure)		Water (20°C)		Air (0°C Atmospheric pressure)		Water (20°C)		Air (0°C Atmospheric pressure)		Water (20°C)	
Size (DN)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
15	4.1	35	0.23	7	2.9	25	0.20	4.9	-	-	-	-
25	11	162	0.41	19	8.8	125	0.35	15	2.9	25	0.16	4.9
40	26	374	0.95	45	22	308	0.78	37	8.8	125	0.32	15
50	43	606	1.54	73	36	513	1.30	62	22	308	0.78	37
80	96	1,365	3.46	164	81	1,151	2.92	138	36	513	1.30	62
100	164	2,326	5.89	279	140	1,995	5.05	239	81	1,151	2.92	138
150	367	5,210	13.2	625	319	4,538	11.49	545	140	1,995	5.05	239
200	-	-	-	-	614	8,713	22.06	1045	319	4,538	11.49	545
250	-	-	-	-	967	13,735	34.78	1648	-	-	-	-
300	-	-	-	-	1,387	19,700	49.89	2364	-	-	-	-

11.3 Function Matrix Details



12. Product Warranty

1. Warranty Period
   One year following product delivery.

2. Warranty Coverage
   TLV CO., LTD. warrants this product to the original purchaser to be free from defective materials and workmanship. Under this warranty, the product will be repaired or replaced at our option, without charge for parts or labor.

3. This product warranty will not apply to cosmetic defects, nor to any product whose exterior has been damaged or defaced; nor does it apply in the following cases:
   1) Malfunctions due to improper installation, use, handling, etc., by other than TLV CO., LTD. authorized service representatives.
   2) Malfunctions due to dirt, scale, rust, etc.
   3) Malfunctions due to improper disassembly and reassembly, or inadequate inspection and maintenance by other than TLV CO., LTD. authorized service representatives.
   4) Malfunctions due to disasters or forces of nature.
   5) Accidents or malfunctions due to any other cause beyond the control of TLV CO., LTD.

4. Under no circumstances will TLV CO., LTD. be liable for consequential economic loss damage or consequential damage to property.

13. Service

For Service or Technical Assistance:
Contact your TLV representative or your TLV office.

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