User Manual

EE741

Inline Flow Sensor for Compressed Air and Gases

YOUR PARTNER IN SENSOR TECHNOLOGY

E+E ELEKTRONIK® Ges.m.b.H.

E+E Elektronik Ges.m.b.H. doesn't accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

The document may contain technical inaccuracies and typographical errors. The content will be revised on a regular basis. These changes will be implemented in later versions. The described products can be improved and changed at any time without prior notice.

EMC note USA (FCC):

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

EMC note Canada (ICES-003):

CAN ICES-3 (A) / NMB-3 (A)

CONTENT

1 General

This user manual serves for ensuring proper handling and optimal functioning of the device. The user manual shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair. The user manual may not be used for the purposes of competition without the written consent of E+E Elektronik® and may not be forwarded to third parties. Copies may be made for internal purposes. All information, technical data and diagrams included in these instructions are based on the information available at the time of writing.

Disclaimer

The manufacturer or his authorized agent can be only be held liable in case of willful or gross negligence. In any case, the scope of liability is limited to the corresponding amount of the order issued to the manufacturer. The manufacturer assumes no liability for damages incurred due to failure to comply with the applicable regulations, operating instructions or the specified operating conditions. Consequential damages are excluded from the liability.

1.1 Explanation of Symbols

This symbol indicates safety information.
It is essential that all safety information is strictly observed. Failure to comply with this information can lead to personal injuries or damage to property. E+E Elektronik® assumes no liability if this happens.

This symbol indicates instructions.
The instructions shall be observed in order to reach optimal performance of the device.

1.2 Safety Instructions

1.2.1 Intended Use

The inline flow sensor (device) is dedicated to the measurement of compressed air and non-corrosive gases in pipelines. Please consult the manufacturer before employing the device in wet or dirty gases.

The inline flow sensor consists of a sensing unit and a gauge mounting block. The sensing unit may only be installed in the appropriate E+E gauge mounting block. It is not permissible to use the sensing unit without a gauge mounting block.

Due to the design the flow sensor is appropriate for operation in pressurized systems up to 16 bar (232 psi) (PN16).

It is not allowed to operate the EE741 in explosion hazard areas. The surrounding area of the sensing unit must not be an explosion-hazard area. When used with flammable gases, explosive atmospheres in the pipeline must be avoided at all times.

Installation, electrical connection, maintenance and commissioning may only be performed by qualified, trained and authorized staff.

Use other than described in the present operation manual may represent a security risk for people and the entire measuring chain and is therefore not permitted. The manufacturer may not be made liable for injuries damages caused by inappropriate or non-intended use or installation.

To prevent safety risks and damages, and assure full functionality of the device, the user shall strictly observe the start-up, inspection and maintenance steps described in this manual. Furthermore, the device may not be manipulated in any other way than described in these operating instructions, and may not be exposed to any excessive mechanical stress.

The flow sensor may be operated only under the ambient conditions as defined in the technical data sheet. Use under other ambient conditions may lead to device malfunctions.

1.2.2 Mounting, Start-Up and Operation

The inline flow sensor has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory after fulfilling all safety criteria.
The manufacturer has taken all precautions to ensure safe operation of the device. The user must ensure that the device is set up and installed in a manner that does not have a negative effect on its safe use.

The user is responsible for observing all applicable safety guidelines, local and international, with respect to safe installation and operation on the device. This operating manual contains information and warnings that must be observed by the user in order to ensure safe operation.

- Mounting, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorized by the plant operator to carry out the mentioned activities.
- The qualified staff must have read and understood this operating manual and must follow the instructions contained within.
- All process and electrical connections shall be thoroughly checked by authorized staff before putting the system into operation.
- Do not install or start start-up a device supposed to be faulty. Make sure that such devices are not accidentally used by marking them clearly as faulty.
- A faulty device may only be investigated and possibly repaired by qualified, trained and authorized staff. If the fault cannot be fixed, the device shall be removed from the system.
- Service operations other than described in this operating manual may only be performed by the manufacturer.

1.3 Environmental Aspects

Products from E+E Elektronik® are developed and manufactured observing of all relevant environmental protection requirements. Please observe local regulations for the device disposal.

For disposal, the individual components of the device must be separated according to local recycling regulations. The electronics shall be disposed of correctly as electronics waste.

2 Scope of Supply

Item 1: EE741:
- EE741 according to ordering guide
- 1 x Allen key
- 1 x USB cable
- User manual
- Two self-adhesive labels for configuration changes (see user guide at www.epluse.com/relabeling)
- Inspection certificate according to DIN EN 10204-3.1

Item 2: Gauge mounting block:
- Gauge mounting block incl. sealing plug

3 Product Description

The EE741 flow sensor operates on the thermal mass flow measurement principle and is suitable for measuring the flow of compressed air and gases in pipelines. It can be used for measuring the consumption of compressed air, nitrogen, argon, oxygen, CO_2 or other non-corrosive and non-flammable gases.

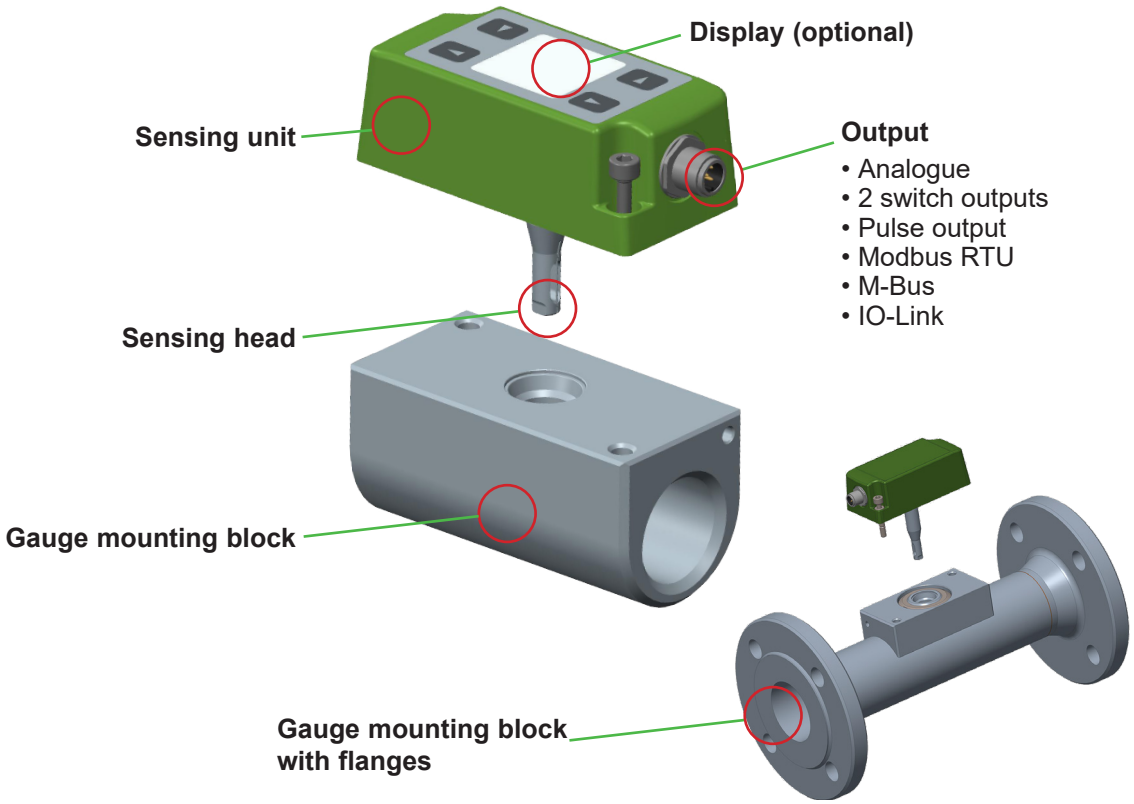
The EE741 measures the volume flow under standard conditions. The standard conditions according to DIN 1343 (1013.25 mbar; 0 °C) are factory-set. Additionally, EE741 measures the mass flow, the standardized flow and the temperature.

Depending on the ordered version, the EE741 is available either as analogue version with analogue output (current), switch output and/or pulse output for consumption metering or as digital version (Modbus RTU, M-Bus or IO-Link).

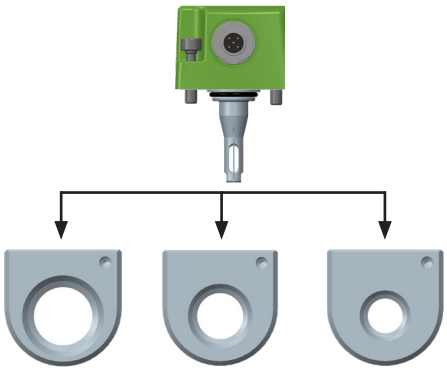
The analogue version has 2 configurable outputs, output 1 as current or switch output, output 2 as switch or pulse output.

The digital version provides Modbus RTU, M-Bus or IO-Link interface by factory.

The EE741 features an integrated consumption meter. The consumption volume can be shown on the display and is retained even if the supply voltage is interrupted.



3.1 Modular Design



One and the same sensing unit can be used for each of three pipe diameters:

EE741: DN15 (1/2") / DN20 (3/4") / DN25 (1")
EE741-N50: DN32 (1-1/4") / DN40 (1-1/2") / DN50 (2")

The pipe diameter is easily changed via the display menu or the EE-PCS Product Configurator Software (available for free download at www.epluse.com/configurator).

In the diameters DN32 (1-1/4") / DN40 (1-1/2") / DN50 (2") the EE741-N50 can be operated optionally with a gauge mounting block with flanges.

Once the gauge mounting block is built into the pipeline, the sensing unit can be installed and removed without disassembling the pipework. As a result, the EE741 is also ideal for temporary measurement at serveral mounting blocks. The sealing plug included in the scope of supply enable the normal operation of the compressed air system when the sensing unit is removed.

3.1.1 Changing the Pipe Diameter

Upon delivery, the factory setting of the sensing unit corresponds to the pipe diameter as ordered. The setting must match the gauge mounting block. For use use with a gauge mounting block of different diameter, the sensing unit setting shall be correspondingly changed, otherwise it would lead to relevant measurement errors.

Fig. 1 Pipe diameter on gauge mounting block

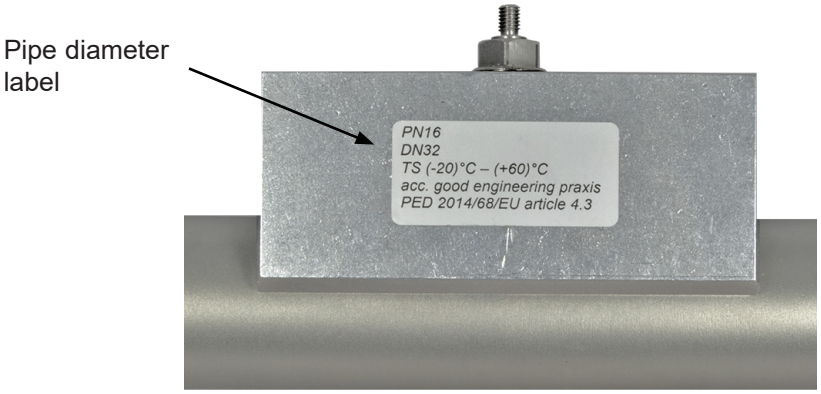


Fig. 2 Pipe diameter on gauge mounting block with flanges

The pipe diameter setting of the sensing unit can be viewed on the status page of the optional display and can be changed using the “Pipe diameter” menu, see chapter 6 Display.
The pipe diameter setting can also be viewed and changed using the EE-PCS Product Configurator Software and via the IO-Link interface.

3.2 Functions

3.2.1 General

Maximum consumption value on the display

The consumption value on the display is limited at 999 999 999.0 m^3. For value above this, the display shows “LCD maximum”, while internally the consumption is metered normally up the maximum value of 3.4 * 10^{38} m^3. Values above 999 999 999.0 m^3 can be read with the EE-PCS Product Configurator Software.

Setting the Standard Conditions

The standard volume flow calculation is based on the standard conditions stored in the EE741 sensing unit. The factory setting for the standard conditions complies with DIN 1343:
P_0 = 1013.25 mbar, t_0 = 0 °C
The standard conditions can be changed via display menu, via EE-PCS Product Configurator Software or via IO-Link.

Low Flow Cut-Off

Very small (insignificant) flow values can be suppressed by setting a shutdown threshold.
Measured values below the shutdown threshold have no effect on the output signal, display and consumption meter.
The minimum shutdown value can be set in m^3/h or ft^3/min.

3.2.2 Analogue Output

Current Output (OUT 1)

The analogue current output (factory setting 4 - 20 mA or 0 - 20 mA) is used for the actual flow or temperature measured values. The analogue output is freely configurable and scalable via the display menu or the EE-PCS Product Configurator Software.

The analogue output features an error message function according to NAMUR NE43. In the event of a faulty sensing head, the output signal will freeze at 21 mA.

Switch (Alarm) Outputs (OUT 1 and OUT 2)

The switch outputs can be set via the display menu or via the EE-PCS Product Configurator Software. One can select between “hysteresis mode” or “window mode” as well as between normally closed (NC) or normally open (NO) contact.

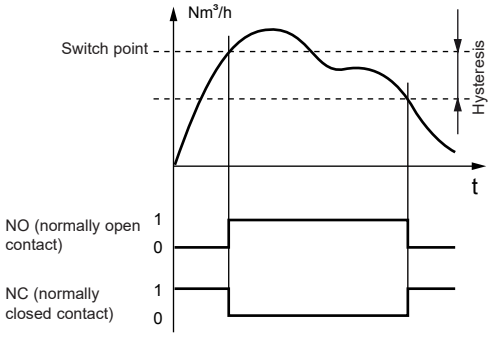


Fig. 3 Hysteresis mode

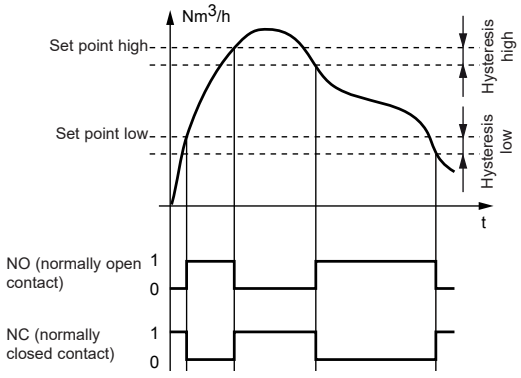


Fig. 4 Window mode

Pulse Output (OUT 2) and Consumption Meter

The EE741 flow sensor features an integrated meter with pulse output, which totalizes the consumption of compressed air or gas.
With the display menu or the EE-PCS Product Configurator Software, the user can set:
- Pulse duration: 0.02...2 s
- Pulse value: 0.1...1 000 m^3

The pulse - pause ratio must be at least 1:2. This means that the time between pulses must be at least twice the pulse duration.

The minimum time between two pulses is 2 s.

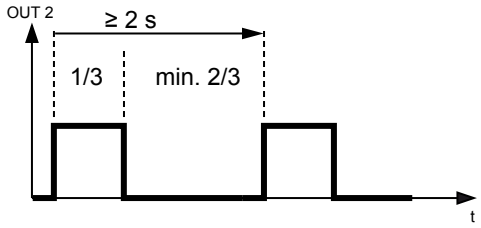


Fig. 5 Pulse-pause ratio

The pulse duration and the pulse value can be calculated with following MIN/MAX-Formula:

Calculating the min. *"pulse value"* or the max. *"pulse duration"*:

IMPW_MIN = NORMV_MAX [m³/h] * IMPL [s] / 1200
IMPL_MAX = IMPW [m³] * 1200 / NORMV_MAX [m³/h]

IMPW	pulse value [m³]
IMPL	pulse duration [s]
IMPW_MIN	min. value for pulse value [m³]
IMPL_MAX	max. pulse duration [s]
NORMV_MAX	max. expected standard volume flow [m³/h]

The totalized consumption is stored every minute and is retained even if the supply voltage is interrupted.
The totalized consumption can be shown on the display. A reset of the consumption meter can be performed via the display menu or the EE-PCS Product Configurator Software.

3.2.3 Digital Interface

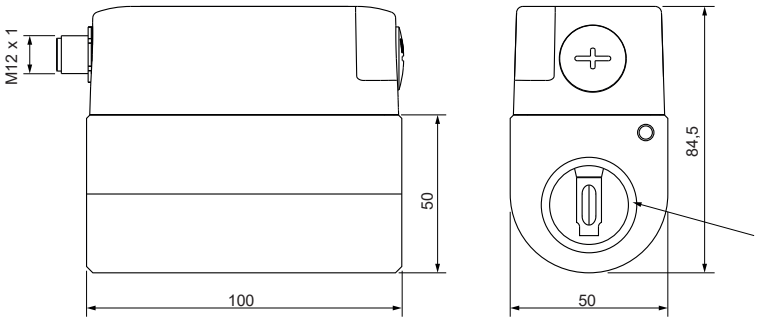
The EE741 is available in three different digital interface versions, with Modbus RTU, M-Bus or IO-Link interface. The Modbus RTU and M-Bus interface parameters can be accessed and changed with the help of the EE-PCS Product Configurator Software.

4 Mechanical Installation

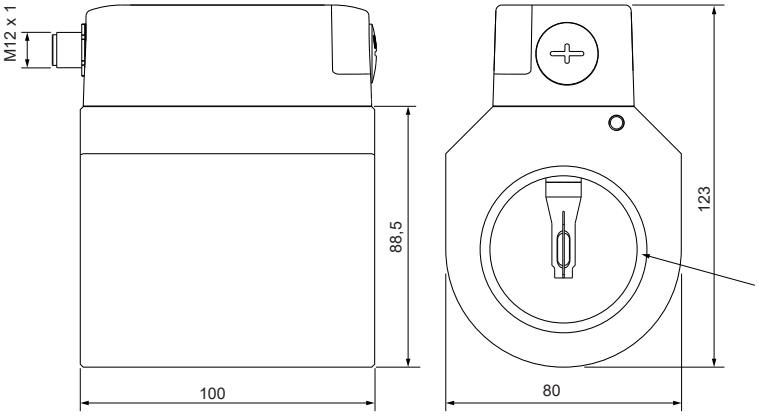
4.1 Installation Dimensions

4.1.1 Installation Dimensions Gauge Mounting Block

EE741:



EE741-N50:

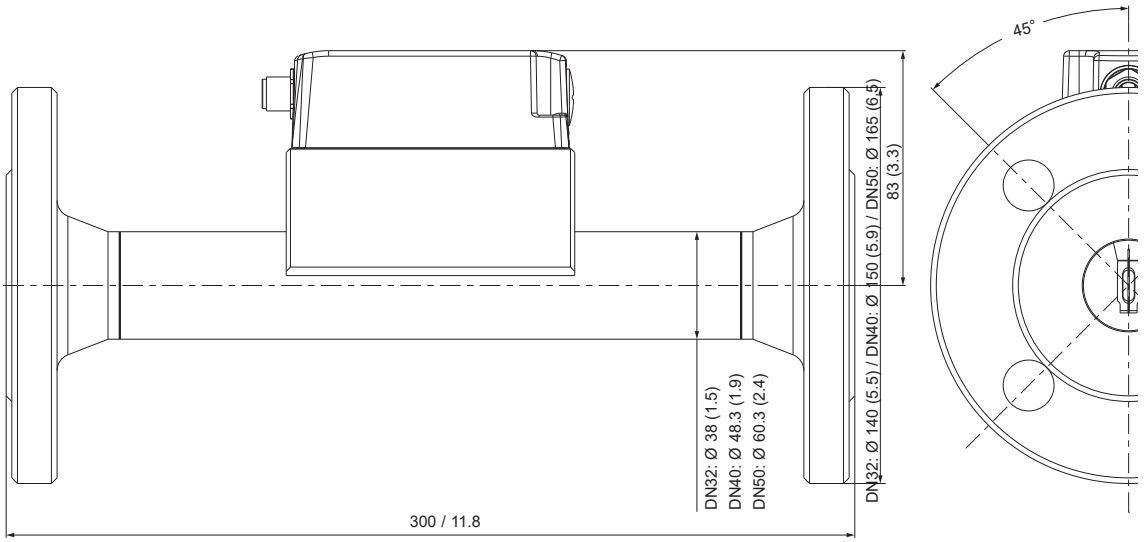


Gauge mounting block	Thread R_p or NPT
DN15	1/2"
DN20	3/4"
DN25	1"
DN32[1)]	1-1/4"
DN40	1-1/2"
DN50	2"

1) only R_p thread

4.1.2 Installation Dimensions Gauge Mounting Block with Flanges

EE741-N50:



4.2 Choosing the Appropriate Mounting Location

- The mounting location site shall be easily accessible and free of vibration.
- A minimum clearance of 150 mm (5.9") shall be observed around the mounting location for installing / removing the sensing unit of the EE741.
- The ambient temperature shall not exceed the specified limits. Consider also the possible heat radiation.
- Air (medium) purity at the mounting location shall comply to ISO 8573-1:2010, at least Class 3.4.4.
- The medium and the ambient conditions at the mounting location shall be non-condensing.
- In compressed air networks, EE741 shall be installed after the air dryer. In the absence of a dryer, EE741 shall be installed after the condensate separator and appropriate filters.
- Observe the flow direction in the pipe.
- Observe the recommended inlet and outlet path length. These are relevant for measurement accuracy as specified in the EE741 data sheet.
- EE741 shall be located as far as possible from flow disturbances, for instance at an appropriate distance before valves.

4.2.1 Process Pressure

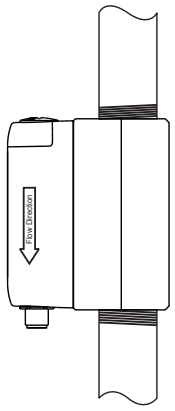
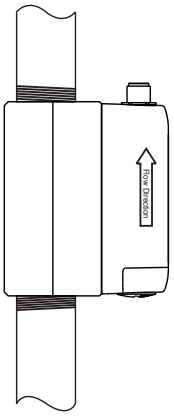
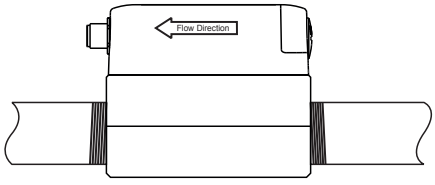
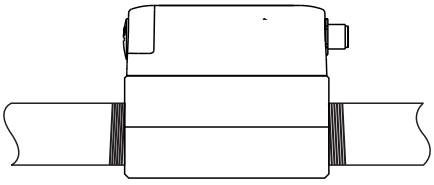
The pressure in the pipeline may not exceed 16 bar (232 psi).

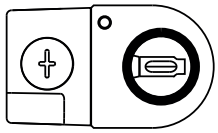
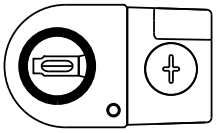
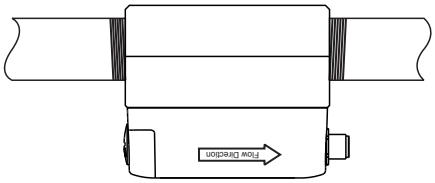
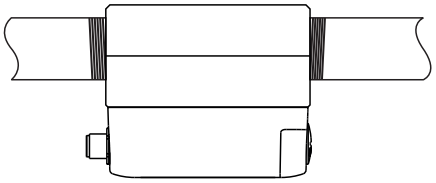
Before mounting or removing the sensing unit, the pipeline must be depressurised.

Due to its measuring principle, the measurement accuracy of the EE741 is quasi-independent of the actual process pressure. Besides, the device is factory adjusted at 7 bar (102 psi) absolute pressure. For normal requirements pressure compensation is not necessary. For best measurement accuracy, the actual working pressure can be set via display menu, via EE-PCS Product Configurator Software or via the IO-Link interface.

4.3 Installation Position

The suitability of the following mounting positions must be taken into account for mounting the EE741 in the gauge mounting block or in the gauge mounting block with flanges.

Vertical mounting		
		+
Horizontal mounting, sensing unit at top		
		+

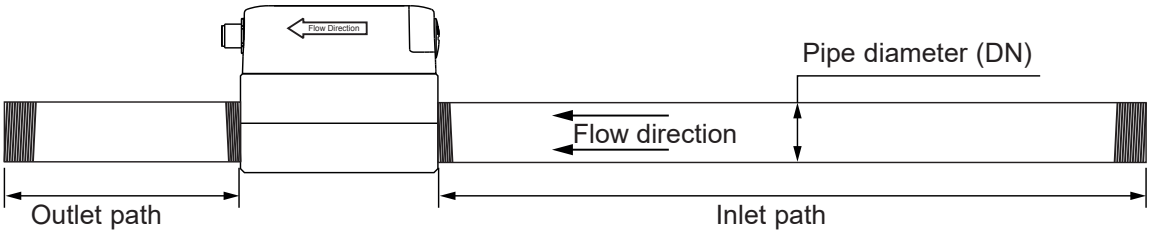
Horizontal mounting, sensing unit horizontal		
		+
Horizontal mounting, sensing unit at bottom		
		-

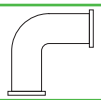
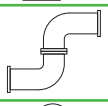
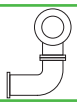
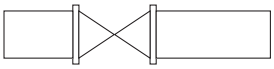
+ ... Recommended installation position
- ..... Not recommended

4.4 Inlet and Outlet Measurement Path

For measurement accuracy according to product specification, the EE741 flow sensor shall be located as far as possible from flow disturbances caused for instance by pipe reductions or expansions, bends, T-pieces, valves or sliders. This can be accomplished by observing a minimum inlet and outlet path length, which depends on both the nature of disturbance and the pipe diameter. This applies to mounting the EE741 in the gauge mounting block as well as in the gauge mounting block with flanges.

- The flow sensort shall be located before valves or sliders.
- With light gases the inlet paths need to be extended.



	Type	(DN = pipe diameter)	
		Inlet path	Outlet path
	Extension	15 x DN	5 x DN
	Reduction	15 x DN	5 x DN
	90° elbow	20 x DN	5 x DN
	Two 90° elbows, on one level	25 x DN	5 x DN
	Two 90° elbows, on two levels, T-piece	30 x DN	5 x DN
	Valve, slider	50 x DN	5 x DN

4.5 Installation of the Gauge Mounting Block

4.5.1 Gauge Mounting Block

The gauge mounting block is symmetrical and can be installed in the pipeline irrespective of the flow direction.

- All connections must be properly sealed and checked for tightness.
- The thread seals shall not impact on the cross section of the pipe or of the block.

4.5.2 Gauge Mounting Block with Flanges

The gauge mounting block with flanges is symmetrical and can be installed in the pipeline irrespective of the flow direction. The entire media contacting surface is of stainless steel 1.4404.

- Both connection surfaces of the flanges are to be connected to the pipe system with suitable seals. (see HA074532, HA074540, HA074550)
- The seals shall not impact the cross section of the pipe or of the block.
- All connections must be properly sealed and checked for tightness before use.

4.5.3 Operating the Pipeline without Sensing Unit

To operate the pipeline without the sensing unit unit, the opening of gauge mounting block which accommodates the sensing head can be closed using the sealing plug included in the scope of supply (Fig. 6). The sealing plug has a Tuflok® coating (http://www.bossard.com) and does not require any additional seal.
Mount the sealing plug with a torque of min. 28 Nm.

Under normal operation with sensing unit installed, the sealing plug shall be placed for safe keeping into the opening at the side of the gauge mounting block (Fig. 7).

Fig. 6 Gauge mounting block with sealing plug

Fig. 7 Sealing plug in park position

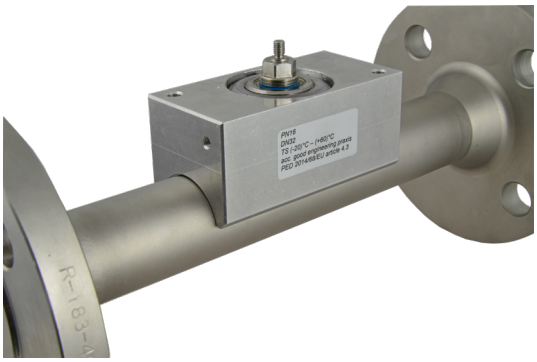


Fig. 8 Gauge mounting block with flanges with sealing plug

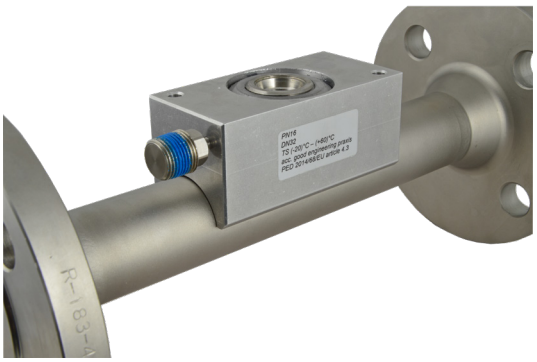


Fig. 9 Gauge mounting block with flanges with sealing plug in park position

4.6 Mounting the Sensing unit Unit into the Gauge Mounting Block

Depressurize the pipeline before mounting or removing the sensing unit unit.

In case the gauge mounting block has been operated without sensing unit, remove the sealing plug with a WAF 13 spanner.

Remove the protective cap from the sensing head (Fig. 10) and insert carefully the sensing head of the sensing unit into the gauge mounting block.

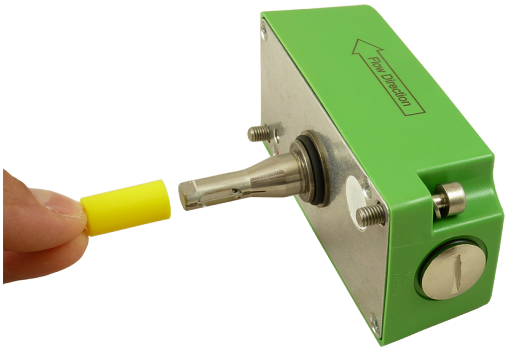


Fig. 10 Remove protective cap

Make sure that the direction arrow on the sensing unit units corresponds to the flow direction in the pipeline. Failure to comply with this may lead to additional measurement error of ±3 % of the measured value.

Complete the mounting by tightening the mounting screws with a max. torque of 6 Nm using the 4 mm hex key included in the scope of supply (Fig. 11).

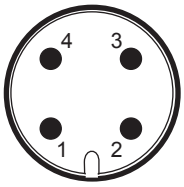
Fig. 11 Tighten mounting screws

5 Electrical Installation

The electrical installation of the EE741 shall be performed by qualified staff only. Observe all applicable national and international requirements for the installation of electrical devices as well as power supply according to EN 50178, SELV, PEL.

5.1 Connection Diagram

Fig. 12 M12 connector



M12 connector on the sensing unit

Analogue/switch/ pulse output	Modbus RTU	M-Bus	IO-Link
1...V+	1...V+	1...V+	1...V+ (L+)
2...Output 1	2...RS485 A (=D+)	2...M-Bus	2...NC
3...GND	3...GND	3...GND	3...GND (L-)
4...Output 2	4...RS485 B (=D-)	4...M-Bus	4...CQ

5.1.1 Switch and Pulse Outputs Internal Circuit

Switch and pulse outputs are NOT potential-free and include internal pull-down resistors (Fig. 13).

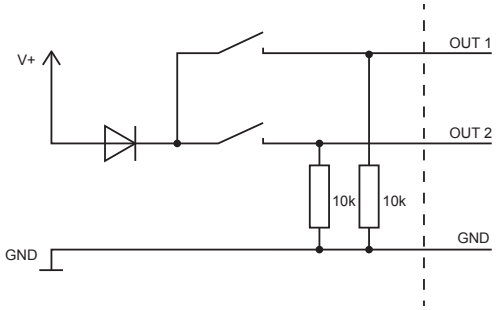


Fig. 13 Switch/pulse output

5.2 Digital Interface

5.2.1 M-Bus (Meter Bus)

The M-Bus (Meter Bus) is a field bus for recording consumption data. Transmission runs serially on a reverse polarity protected two-wire line. The EE741 flow sensor as M-Bus adress requires a separate supply voltage. There is no prescribed specific topology (line or star) for the wiring. Normal phone cable of type J-Y(St)Y Nx2x0.8 mm can be used. The max. cable length per segment (primary addressed) is 250 m (820 ft).

The table below shows the structure of the consumption data sent by the sensing unit:

Header	
68	Start of the telegram
4F 4F	L-field (length)
68	Second starting signal
08	C-field (RSP_UD)
XX	A-field (address)
Start user data	
72	CI-field (variable data structure)
XX XX XX XX	Identification number
A5 16	Manufacturer (0x16A5 … EUE)
01	Version
09	Medium (9 … compressed air)
XX	Access number (consecutive)
00	Status
00 00	Signature
Data record 1: Volume flow	
05	DIF (32 bit real)
3E	VIF (volume flow in m³/h)
XX XX XX XX	Cur. measured value
Data record 2: Temperature	
05	DIF (32 bit real)
5B	VIF (temperature in °C)
XX XX XX XX	Cur. measured value
Data record 3: Mass flow	
05	DIF (32 bit real)
53	VIF (mass flow in kg/h)
XX XX XX XX	Cur. measured value
Data record 4: Consumption meter status	
05	DIF (32 bit real)
16	VIF (volumes in m³)
XX XX XX XX	Cur. consumption value

Data record 5: Flow velocity	
05	DIF (32 bit real)
7F	VIF (manufacturer-specific in m/s)
XX XX XX XX	Cur. measured value
Data record 6: Volume flow	
04	DIF (32 bit integer)
3B	VIF (volume flow in 10^{-3} m³/h)
XX XX XX XX	Cur. measured value
Data record 7: Temperature	
04	DIF (32 bit integer)
59	VIF (temperature in 10^{-2} °C)
XX XX XX XX	Cur. measured value
Data record 8: Mass flow	
04	DIF (32 bit integer)
51	VIF (mass flow in 10^{-2} kg/h)
XX XX XX XX	Cur. measured value
Data record 9: Consumption meter status	
07	DIF (64 bit integer)
13	VIF (volumes in 10^{-3} m³)
XX XX XX XX XX XX XX XX	Cur. consumption value
Data record 10: Flow velocity	
04	DIF (32 bit integer)
7F	VIF (manufacturer-specific in 10^{-2} m/s)
XX XX XX XX	Cur. measured value
End user data	
XX	Checksum
16	End of telegram

Secondary addressing:

In addition to primary addressing, the EE741 flow sensor provides the option of secondary addressing. The secondary address uses the fields of identification number, manufacturer, version and medium. The M-Bus Standard https://m-bus.com/assets/downloads/MBDOC48.PDF describes the exact sequence of the secondary addressing.

M-Bus setup:

	Factory settings	**Adjustable values**
Baud rate	2400	600, 1200, 2400, 4800, 9600
Data bits	8	8
Parity	EVEN	None, odd, even
Stop bits	1	1 or 2
M-Bus address	240	0...254

For several devices on the bus the max. recommended baud rate is 9600.

5.2.2 Modbus RTU

EE741 flow sensor can be operated in a Modbus RTU network with max. 32 devices. Writing 0 into the corresponding register will reset the MIN/MAX values and the consumption meter.

For Modbus protocol settings see Application Note Modbus AN0103 (www.epluse.com/ee741).

Modbus Map:

Register number[1] [DEC]	Register address[2] [HEX]	Measured value	Unit	Type
Read registers (function code 0x03 / 0x04)				
30501	1F4	Temperature	°C	32-bit float
30503	1F6	Temperature	°F	32-bit float
30507	1FA	Standard flow	Nm/s	32-bit float
30509	1FC	Standard flow	SFPM	32-bit float
30511	1FE	Mass flow	kg/h	32-bit float
30513	200	Mass flow	kg/min	32-bit float
30517	204	Standard volume flow	Nm³/h	32-bit float
30519	206	Standard volume flow	Nm³/min	32-bit float
30521	208	Standard volume flow	l/min	32-bit float
30523	20A	Standard volume flow	l/s	32-bit float
30525	20C	Standard volume flow	SCFM	32-bit float
30529	210	Consumption meter status	m³	64-bit-double
30533	214	Consumption meter status	ft³	64-bit-double
31001	3E8	MIN value temperature	°C	32-bit float
31003	3EA	MIN value temperature	°F	32-bit float
31007	3EE	MIN value standard flow	Nm/s	32-bit float
31009	3F0	MIN value standard flow	SFPM	32-bit float
31011	3F2	MIN value mass flow	kg/h	32-bit float
31013	3F4	MIN value mass flow	kg/min	32-bit float
31017	3F8	MIN value standard volume flow	Nm³/h	32-bit float
31019	3FA	MIN value standard volume flow	Nm³/min	32-bit float
31021	3FC	MIN value standard volume flow	l/min	32-bit float
31023	3FE	MIN value standard volume flow	l/s	32-bit float
31025	400	MIN value standard volume flow	SCFM	32-bit float
31501	5DC	MAX value temperature	°C	32-bit float
31503	5DE	MAX value temperature	°F	32-bit float
31507	5E2	MAX value standard flow	Nm/s	32-bit float
31509	5E4	MAX value standard flow	SFPM	32-bit float
31511	5E6	MAX value mass flow	kg/h	32-bit float
31513	5E8	MAX value mass flow	kg/min	32-bit float
31517	5EC	MAX value standard volume flow	Nm³/h	32-bit float
31519	5EE	MAX value standard volume flow	Nm³/min	32-bit float
31521	5F0	MAX value standard volume flow	l/min	32-bit float
31523	5F2	MAX value standard volume flow	l/s	32-bit float
31525	5F4	MAX value standard volume flow	SCFM	32-bit float
Write registers (function code 0x06)				
60001	0	Reset MIN value temperature		16-bit integer
60002	1	Reset MIN value standard flow		16-bit integer
60003	2	Reset MIN value mass flow		16-bit integer
60004	3	Reset MIN value standard volume flow		16-bit integer
60005	4	Reset MAX value temperature		16-bit integer
60006	5	Reset MAX value standard flow		16-bit integer
60007	6	Reset MAX value mass flow		16-bit integer
60008	7	Reset MAX value standard volume flow		16-bit integer
60009	8	Reset consumption meter		16-bit integer

1) Register number starts from 1
2) Register address starts from 0

Modbus setup:

	Factory settings	Adjustable values
Baud rate	9600	9600, 19200, 38400
Data bits	8	8
Parity	EVEN	None, odd, even
Stop bits	1	1 or 2
Modbus address	240	1...247

The recommended baud rate for several devices in the Modbus RTU network is 9600.

Device address, baud rate, parity and stop bits can be set via:
1. EE-PCS, Product Configuration Software and USB configuration interface (see chapter 5.3).
   The EE-PCS can be downloaded free of charge from www.epluse.com/configurator
2. Modbus protocol in the register 60001 (0x00) and 60002 (0x01).
   See Application Note Modbus AN0103 (available at www.epluse.com/ee741)

The serial number as ASCII-code is located at read register address 30001-30008 (16 bits per address). The firmware version is located at register address 30009 (bit 15...8 = major release; bit 7...0 = minor release). The sensor name is located at register address 30010.

Please note: When reading the serial number or the sensor name, it is always necessary to read all 8 registers, even if the desired information requires less.

Please note: For obtaining the correct floating point values, both registers have to be read within the same reading cycle. The measured value can change between two Modbus requests, therefore exponent and mantissa may get inconsistent.

Communication settings (INTEGER 16 bit)		
Parameter	**Register number[1] [DEC]**	**Register address[2] [HEX]**
Write register: function code 0x06		
Modbus address	1	0x00
Modbus protocol settings[3]	2	0x01

1) Register number starts from 1.
2) Register address starts from 0.
3) For Modbus protocol settings see Application Note Modbus AN0103 (available at www.epluse.com/ee741).

INFO (read register)		
Parameter	**Register number[1] [DEC]**	**Register address[2] [HEX]**
Read register: function code 0x03 / 0x04		
Serial number (as ASCII)	1	0x00
Firmware version	9	0x08
Sensor Name	10	0x09

1) Register number starts from 1.
2) Register address starts from 0.

Bus termination resistor:

Bus termination is required for the last flow sensor in a Modbus RTU network. The 120 Ω termination resistor is located behind the blind of the USB port and can be switched on and off (see Fig. 14).

Fig. 14 Bus termination resistor

5.2.3 IO-Link

Communication specification

Manufacturer ID	0563_{hex} / 1379_{dec}
Device IDs	
EE741 DN15 to DN25:	EE741 DN15 to DN25 : 0x074111 475409 d
EE741 DN32 to DN50:	EE741 DN32 to DN50 : 0x074112 475409 d
Bitrate	COM2 (38.4 kBaud)
Minimum cycle time	6.0 ms
SIO mode supported	no
Process data input length	12 bytes
IO-Link Revision	1.1
Required masterport class	A

Structure of process data input

The Process Data Input (the measured data of EE741) is configurable and structured in the following order:

Bit no.	95 64	63 32	31 0
Process data input	Measurand 1	Measurand 2	Measurand 3
Measurand index, factory default acc. to Tab. 2	80 Mass flow m' [kg/h]	83 Standard volume flow V'n [m^3/h]	1 Temperature T [°C]

Tab. 1 Scheme of process data input

Per factory default, the measurands' data type is FLOAT32 (more exactly, 32-bit single precision float). The parameters may freely be selected via IO-Link device parameter, the most usual are pre-selected per default. See Tab. 2 for the supported measurands.

Alternatively, the measured data may be represented as INTEGER32 within the above scheme, the values are scaled with a factor 1 000 in this case.

Please note that the data type selection (FLOAT32 or INTEGER32) applies to the entire 12 byte process data input, i.e., all 3 measureands will have the same data type at the same time.

Measurand description	Formula sign	Unit	Measurand index
Temperature	T	°C	1
		°F	2
		K	4
Standard flow	vn	m/s	22
		ft/min	23
Mass flow	m'	kg/h	80
		kg/min	81
		kg/s	82
Standard volume flow	V'n	m^3/h	83
		m^3/min	84
		SLPM	85
		l/s	86
		SCFM	87
		m^3/s	88
Consumption	Qn	m^3	91
		ft^3	93

Tab. 2 Indices of supported measurands

5.3 USB Configuration Interface

The micro USB port is located behind a blind cover (Fig. 15 and Fig. 16)

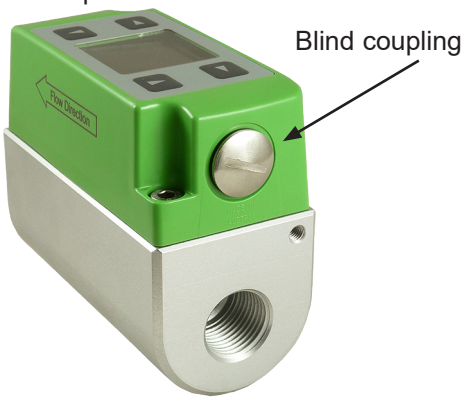


Fig. 15 Remove the blind cover

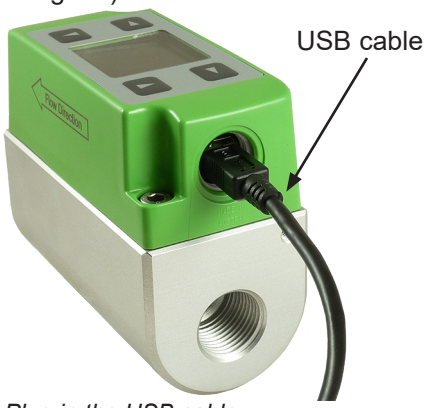


Fig. 16 Plug in the USB cable

For EE741 setup and configuration via USB interface it is necessary to install the EE-PCS Product Configuration Software on a personal computer. EE-PCS is available for free download at www.epluse.com/ee741. When an adjustment is performed using the EE-PCS, a suitable air velocity / temperature reference has to be used.

6 Display

The LCD-display (optional) shows the actual measured values and the overall consumption. The complete EE741 setup and configuration can be performed with the control keys and intuitive, self explanatory menu guidance.

If the settings are changed during operation, it may affect the function of the system. Ensure that it will not result in any system malfunctions.

The display orientation can be changed in 90° steps via the settings menu to match the mounting position of EE741 (Fig. 17 and Fig. 18).

Fig. 17 Horizontal display

Fig. 18 Vertical display

6.1 Measured Value Display

Upon power on the display is in measuring mode and shows the measured values. One can select among six measurands and a status page (Fig. 19 and Fig. 20).

Abbreviations for measurands:

T ... Temperature
V'n ... Standard volume flow
m' ... Mass flow
Qn ... Consumption
vn ... Standard flow

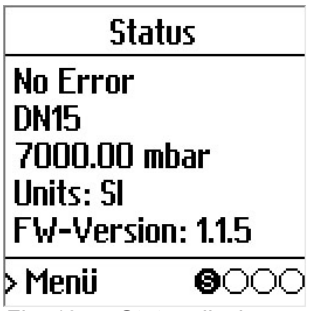


Fig. 19 Status display

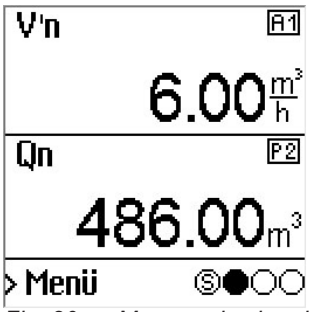


Fig. 20 Measured value display

Explanation of the symbols:

A1 ... Output 1 set to analogue output

P2 ... Output 2 set to pulse output/consumption

S1 ... Output 1 set to switching output; status OFF

S1 ... Output 1 set to switching output; status ON

S2 ... Output 2 set to switching output; status OFF

S2 ... Output 2 set to switching output; status ON

6.2 Display Menu

The display menu can be navigated and settings made using the four control keys allow for easy navigation and intuitive device setup.

... SELECT/SAVE

... BACK/CANCEL

... UP/increase value

... DOWN/decrease value

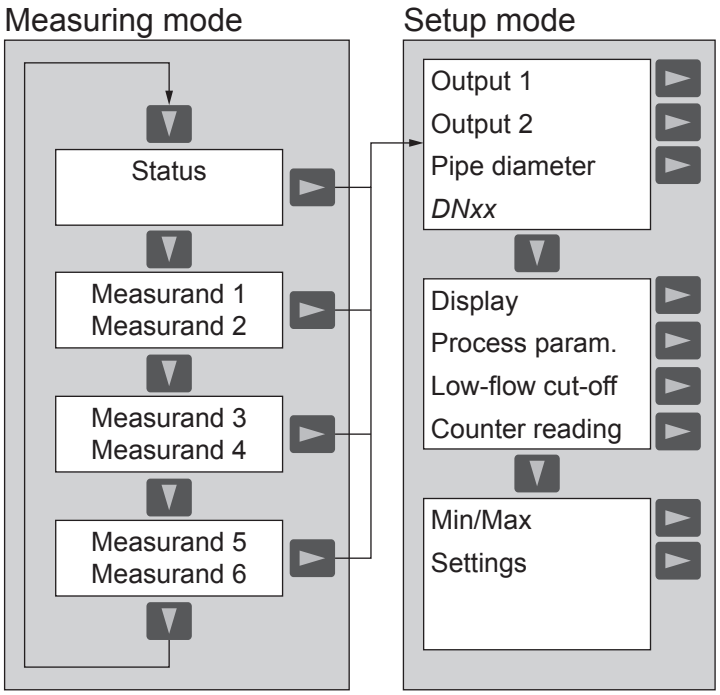


Fig. 21 Display - menu guidance

Output 1

Configuration for output 1: analogue or switch output, measurand, scale and switch setup.

Output 2

Configuration for output 2: switch or pulse output, measurand, switch setup.

Pipe diameter

Set the pipe diameter, see 2.1.1 on page 7

Display

Set the measuring mode and the display orientation.

Process parameter

Set the operating pressure and the standard conditions (see chapter 3.2.1 on page 8).

Low-flow cut-off

Set the cut-off threshold for leak flow volume suppression (see chapter 3.2.1 on page 8).

Counter reading

Display or reset the consumption meter.

Min/Max

Display or delete the min/max memory.

Settings

- Language (English / German)
- Averaging of analogue output signal. Number of samples selectable between 1 and 50. The sampling interval is 0.1 s.
  e.g. < 10 .... response time t_{90} <2 s
  50 .... response time t_{90} 5 s

7 Error Messages

Error messages are available on the status page of the display and at the status LEDs.

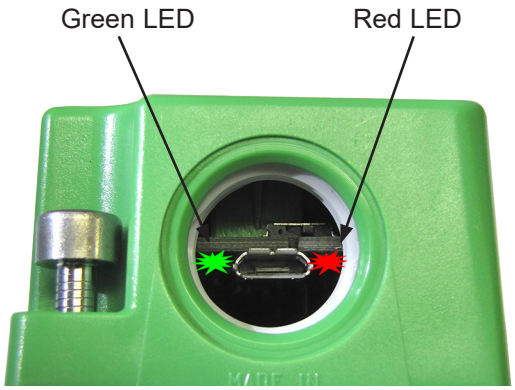


Fig. 22 Status LED - error message

0: no error / green LED flashes

1: EEPROM faulty / green LED flashes, red LED lights up

Cause: The EEprom for storing the consumption meter status and the MIN/MAX values is faulty.
Consequence: The consumption meter status and the MIN/MAX values are no longer available.All current measured values are shown on the display. The analogue, switch and pulse outputs operate normally.
Remedy: Return the device to the manufacturer for service.

2: Display error / green LED flashes, red LED lights up

Cause: The display or the communication with the display is faulty.
Consequence: Analogue, switch and pulse outputs operate normally.
Remedy: Return the device to the manufacturer for service.

4: Sensor fault / green LED flashes, red LED flashes

Cause: The sensing head is faulty.
Consequence: All measurands on the display are frozen at the lowest possible value e.g. -20 °C (-4 °F) or 0 m³/h. The analogue output is frozen at 21 mA (NAMUR NE43).
Remedy: Return the device to the manufacturer for service.

8 Maintenance

It is recommended to calibrate the EE741 flow sensor on a yearly base.

For use with polluted media, the sensing head should be periodically cleaned.

8.1 Removing the Sensing Unit from the Gauge Mounting Block

Depressurize the pipeline before mounting or removing the sensing unit unit.

Ensure that the line is depressurized and release the mounting screws of the sensing unit (Fig. 23 and Fig. 24).

Fig. 23 Unscrew mounting screws

Fig. 24 Remove sensing unit

To operate the pipeline without a sensing unit, see chapter 4.5.3 on page 13.

8.2 Cleaning the Sensing Head

Do not use abrasive cleaning agents and organic solvents containing halogen or acetone.

Clean the sens head by carefully dipping into warm water or isopropanol.
Isopropanol is recommended for contamination with greases or oils.

Do not touch or rub the sensor element within the sensing head.

Allow the sensing head to dry free.

9 Ordering Guide for Accessories

Designation		Order number
Inlet and outlet path BSP thread, stainless steel for gauge mounting block	DN15	HA070215
	DN20	HA070220
	DN25	HA070225
	DN32	HA070232
	DN40	HA070240
	DN50	HA070250
M12 female connector for self assembly, plastic		HA010707
M12 female connector for self assembly, metal		HA010708
Connecting cable, M12x1 socket - free ends, shielded, PUR	1.5 m	HA010819
	5 m	HA010820
	10 m	HA010821
Connecting cable, M12x1 socket - connector, shielded, PUR	2 m	HA010816
	5 m	HA010817
	10 m	HA010818
Sealing plugs for the gauge mounting block (for operating the pipeline without the sensing unit unit)		HA070204
Gasket set for gauge mounting block with flanges DN32		HA074532
Gasket set for gauge mounting block with flanges DN40		HA074540
Gasket set for gauge mounting block with flanges DN50		HA074550
Cable M12x1 female, angled 90°, 4 pins	3 m	HA010824

10 Technical Data

Measurands

Flow

Standard conditions (factory setting)	1013.25 mbar (14.7 psi), 0 °C (32 °F) (configurable)
Measurement range[1] in air	DN15 (1/2"): 0.2...76.3 Nm^3/h (0.12...44.88 SCFM) DN20 (3/4"): 0.4...135.7 Nm^3/h (0.24...79.77 SCFM) DN25 (1"): 0.6...212 Nm^3/h (0.36...124.71 SCFM) DN32 (1-1/4"): 0.9...347.4 Nm^3/h (0.52...202.06 SCFM) DN40 (1-1/2"): 1.4...542.8 Nm^3/h (0.81...315.71 SCFM) DN50 (2"): 2.2...848.2 Nm^3/h (1.22...493.35 SCFM)
Accuracy[2] in air at 7 bar (102 psi) (abs) and 23 °C (73 °F)	± (3 % of measured value + 0.3 % of full scale)
Pressure dependency EE-PCS[3]	Compensated by entering the system pressure using the
Response time t_{90}	< 2 s
Measurement interval	0.1 s

Temperature

Measurement range	-20...60 °C (-4...140 °F)
Accuracy at 20 °C (68 °F) and flow >0.5 Nm/s	± 0.7 °C (1.26 °F)

Outputs

Analogue output (scalable)	0 - 20 mA / 4 - 20 mA R_L < 500 Ω
Switch output	DC PNP, max. 100 mA, V_{drop} < 2.5 V, 10 kΩ pull-down Configurable: N/C or N/O, hysteresis, window
Pulse output	Consumption meter, pulse length 0.02...2 s
Digital output	
RS485	
Protocol	Modbus RTU (EE741 = 1 unit load)
Default settings	Baud rate 9600[4], parity even, 1 stop bit, Modbus address 240
M-BUS	
Default settings	Baud rate 2400[5], parity even, 1 stop bit, Modbus address 240
IO-Link	
Interface specification	IO-Link v1.1, IO-Link device, COM2 (38.4 kBaud)
Service interface	USB

General

Supply voltage	18 - 30 V DC
Current consumption	
with display	I_{max} ≤ 120 mA (P_{max} ≤ 2,5 W)
without display	I_{max} ≤ 60 mA (P_{max} ≤ 1.6 W)
Operating pressure (max.)	16 bar (232 psi) / PN16
Ambient temperature range	
with display	0...50 °C (32...122 °F)
without display	-20...60 °C (-4...140 °F)
Medium and storage temperature range	-20...60 °C (-4...140 °F)
Humidity working range	0…100 %RH, non condensing
Medium	Compressed air or none corrosive gases
Electrical connection	M12x1 plug, 4 poles
Electromagnetic compatibility	EN 61326-1 EN 61326-2-3 Industrial environment FCC Part 15 Class A ICES-003 Class A
Material	
Enclosure sensing unit	Polycarbonate
Sensing head / sensor element	Stainless steel 1.4404 / glass
Gauge mounting block	Aluminium anodised or stainless steel 1.4404
Gauge mounting block with flanges	Entire media contacting surface in stainless steel 1.4404
Enclosure protection rating	IP65

1) See operation manual for factory settings.
2) The tolerance specifications include the uncertainty of the factory calibration with a coverage factor k=2 (2 x standard deviation). The tolerance was calculated in accordance with EA-4/02 following the GUM (Guide to the Expression of Uncertainty in Measurement). Temperature coefficient: ± 0.25 % of measured value / °C deviating from 23 °C (73 °F).
3) The flow meter is factory adjusted at 7 bar (abs, 102 psi). Pressure compensation is valid for v = 10 ... 120 Nm / s. Without entering the system pressure into the EE741, the pressure dependency is +/- 0.5 % of the measured value / bar deviating from 7 bar.
4) Supported baud rates: 600, 1200, 2400, 4800, 9 600, 19 200, 38 400 and 57 600; find more details about communication setting in the User Manual and the Modbus Application Note at www.epluse.com/ee741
5) Supported baud rates: 600, 1200, 2400, 4800 and 9 600; find more details about communication setting in the User Manual

10.1 Factory Settings of the Outputs for DN15 / DN20 / DN25

		Analogue output		Switch output hysteresis mode		Minimum flow shutdown	
	Pipe diameter	from	to	SP	HY	SP	HY
Standard volume flow [Nm³/h]	DN15	0	75	50	5	0.15	0.07
	DN20	0	130	90	9	0.25	0.12
	DN25	0	200	150	15	0.35	0.17
Standard volume flow [Nm³/min]	DN15	0	1.25	0.83	0.08		
	DN20	0	2.15	1.5	0.15		
	DN25	0	3.3	2.5	0.25		
Standard volume flow [l/min]	DN15	0	1250	833	83		
	DN20	0	2150	1500	150		
	DN25	0	3300	2500	250		
Standard volume flow [l/s]	DN15	0	20	14	1.4		
	DN20	0	35	25	2.5		
	DN25	0	55	40	4		
Standard volume flow [SCFM]	DN15	0	44	30	3	0.15	0.07
	DN20	0	76	53	5.3	0.25	0.12
	DN25	0	117	88	8.8	0.35	0.17
Mass flow [kg/h]	DN15	0	97	65	6.5		
	DN20	0	165	115	11.5		
	DN25	0	255	195	19.5		
Mass flow [kg/min]	DN15	0	1.6	1	0.1		
	DN20	0	2.8	2	0.2		
	DN25	0	4.3	3.2	0.32		
Standard flow [Nm/s]	DN15	0	120	80	8		
	DN20	0	120	80	8		
	DN25	0	120	80	8		
Standard flow [SCFM]	DN15	0	23600	15000	1500		
	DN20	0	23600	15000	1500		
	DN25	0	23600	15000	1500		
Temperature [°C]	DN15	-20	60	24	0.5		
	DN20	-20	60	24	0.5		
	DN25	-20	60	24	0.5		
Temperature [°F]	DN15	-4	140	75	1		
	DN20	-4	140	75	1		
	DN25	-4	140	75	1		

Pulse output:

Pulse duration: 0.1 s

Pulse value: 1 m³

Measured value averaging: 10

10.2 Factory settings of the outputs DN32 / DN40 / DN52

		Analogue output		Switch output hysteresis mode		Minimum flow shutdown	
	Pipe diameter	from	to	SP	HY	SP	HY
Standard volume flow [Nm³/h]	DN32	0	300	200	20	0.55	0.25
	DN40	0	500	350	35	0.9	0.45
	DN50	0	800	600	60	1.4	0.7
Standard volume flow [Nm³/min]	DN32	0	5	3.3	0.3		
	DN40	0	8.3	5.8	0.58		
	DN50	0	13.3	10	1		
Standard volume flow [l/min]	DN32	0	5000	3300	330		
	DN40	0	8300	5800	580		
	DN50	0	13300	10000	1000		
Standard volume flow [l/s]	DN32	0	83	56	5.6		
	DN40	0	139	97	9.7		
	DN50	0	222	167	16.7		
Standard volume flow [SCFM]	DN32	0	176	117	11.7	0.55	0.25
	DN40	0	294	200	20	0.9	0.45
	DN50	0	470	350	35	1.4	0.7
Mass flow [kg/h]	DN32	0	390	260	26		
	DN40	0	650	450	45		
	DN50	0	1000	770	77		
Mass flow [kg/min]	DN32	0	6.5	4.3	0.43		
	DN40	0	10.8	7.5	0.75		
	DN50	0	17.2	13	1.3		
Standard flow [Nm/s]	DN32	0	120	80	8		
	DN40	0	120	80	8		
	DN50	0	120	80	8		
Standard flow [SCFM]	DN32	0	23600	15000	1500		
	DN40	0	23600	15000	1500		
	DN50	0	23600	15000	1500		
Temperature [°C]	DN32	-20	60	24	0.5		
	DN40	-20	60	24	0.5		
	DN50	-20	60	24	0.5		
Temperature [°F]	DN32	-4	140	75	1		
	DN40	-4	140	75	1		
	DN50	-4	140	75	1		

10.3 Works Certificate

YOUR PARTNER IN SENSOR TECHNOLOGY
ELEKTRONIK Ges.m.b.H.

WERKSBESCHEINIGUNG NACH DIN EN 10204 - 2.1
Works certificate according to DIN EN 10204 - 2.1

ISO TS16949:2002
ISO 9001:2000

Zertifikat Nr. */ Certificate No:* *A039628T9*

Gegenstand */ Object:* Durchflussmesser / *Flow Meter EE741*

Hiermit bestätigen wir, dass die angeführten E+E Erzeugnisse unter Verwendung einwandfreier Werkstoffe nach dem Stand der Technik gefertigt wurden. Produktion, Kalibrierung und Qualitätsprüfung werden im Rahmen der E+E Qualitätssicherungsmaßnahmen überwacht.

We herewith certify that above listed E+E products are manufactured in compliance with the latest technical standards. All used materials and components have passed the quality assurance system. Manufacturing, calibration and quality testing are performed according to the E+E Quality Assurance System.

Werkstoffe / *Materials*

Messumformer / sensing unit	
Gehäuse / *housing*	Polycarbonate UL94-V0
Dichtung / *sealing*	EPDM
Stecker / connector	Messing vernickelt / *brass nickel plated*
Grundplatte / *mounting plate*	Aluminium / *aluminum*
Messfühler / *sensing probe*	
Sensorkopf / *sensing head*	Edelstahl 1.4404 / *stainless steel AISI 316L*
O-Ring / o-Ring	FKM
Strömungssensor Element / *Flow sensor element*	Glas, polyimide coating
Messblock / *gauge mounting block*	
HA0790xx, HA1790xx	Aluminium eloxiert / *aluminum anodized*
HA0780xx, HA1780xx, HA0810xx, HA1810xx	Edelstahl 1.4404 / *stainless steel AISI 316L*
Dichtstopfen / *sealing plug*	Edelstahl 1.4405 mit TUFLOK Beschichtung / *stainless steel AISI 303 with TUFLOK coating*
Flansch - Messstrecke / *gauge mounting block with flanges*	
HA0745xx	Edelstahl 1.4404 / *stainless steel AISI 316L* Aluminium AlMg4,5Mn / *aluminum AlMg4,5Mn* Stahl verzinkt / *galvanized steel*
Dichtstopfen / *sealing plug*	Edelstahl 1.4405 mit TUFLOK Beschichtung / *stainless steel AISI 303 with TUFLOK coating*

Es wird bestätigt, dass die Lieferung den Vereinbarungen bei der Bestellung entspricht.
We hereby certify that the material described above complies with the terms of the order.

Geprüft / Supervised

E+E Elektronik Ges.m.b.H.
Langwiesen 7
A-4209 Engerwitzdorf
AUSTRIA

Tel.: +43 7235 605-0
Fax. +43 7235 605-8
e-mail: info@epluse.at
www.epluse.com

HEADQUARTERS

E+E Elektronik Ges.m.b.H.
Langwiesen 7
4209 Engerwitzdorf
Austria
Tel.: +43 7235 605-0
E-mail: info@epluse.com
Web: www.epluse.com

SUBSIDIARIES

E+E Elektronik China
18F, Kaidi Financial Building,
No.1088 XiangYin Road
200433 Shanghai
Tel.: +86 21 6117 6129
E-mail: info@epluse.cn

E+E Elektronik France
47 Avenue de l'Europe
92310 Sèvres
Tel.: +33 4 74 72 35 82
E-mail: info@epluse.fr

E+E Elektronik Germany
Obere Zeil 2
61440 Oberursel
Tel.: +49 6171 69411-0
E-mail: info@epluse.de

E+E Elektronik India
801, Sakhi Vihar Road
400072 Mumbai
Tel.: +91 990 440 5400
E-mail: info.in@epluse.com

E+E Elektronik Italy
Via Alghero 17/19
20128 Milano (MI)
Tel.: +39 02 2707 86 36
E-mail: info@epluse.it

E+E Elektronik Korea
Suite 2001, Heungdeok IT
Valley Towerdong, 13,
Heungdeok 1-ro, Giheung-gu
16954 Yongin-si, Gyeonggi-do
Tel.: +82 31 732 6050
E-mail: info@epluse.co.kr

E+E Elektronik USA
333 East State Parkway
Schaumburg, IL 60173
Tel.: +1 847 490 0520
E-mail: office@epluse.com