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Technical Information
Liquiphant Density and Density Computer FML621

Vibronic

Density computer for liquids
Also for use in hazardous areas

Application

The density measuring line can be used in liquid media. It is used for the following purposes:
- To density measurement
- To intelligent medium detection
- To calculate the reference density
- To calculate the concentration of a liquid
- To convert values to different units such as °Brix, °Baumé, °API etc.

Your benefits

- Measurement used directly in tanks or pipes without the need for additional pipework
- Integration of existing temperature measurements for temperature compensation
- Additional calculations, such as the concentration of a product, can be performed in the Density Computer FML621

Endress+Hauser
People for Process Automation

Table of contents

Important document information

Notes on safety conventions and icons

Safety symbols

DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

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

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

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

Electrical symbols

Symbol	Meaning
⎓	Direct current
~	Alternating current
⎓ ~	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⊜	**Protective Earth (PE)** A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protective earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

Symbols for certain types of information

Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
EX	**Hazardous area** Indicates a hazardous area.
EX	**Safe area (non-hazardous area)** Indicates the non-hazardous area.

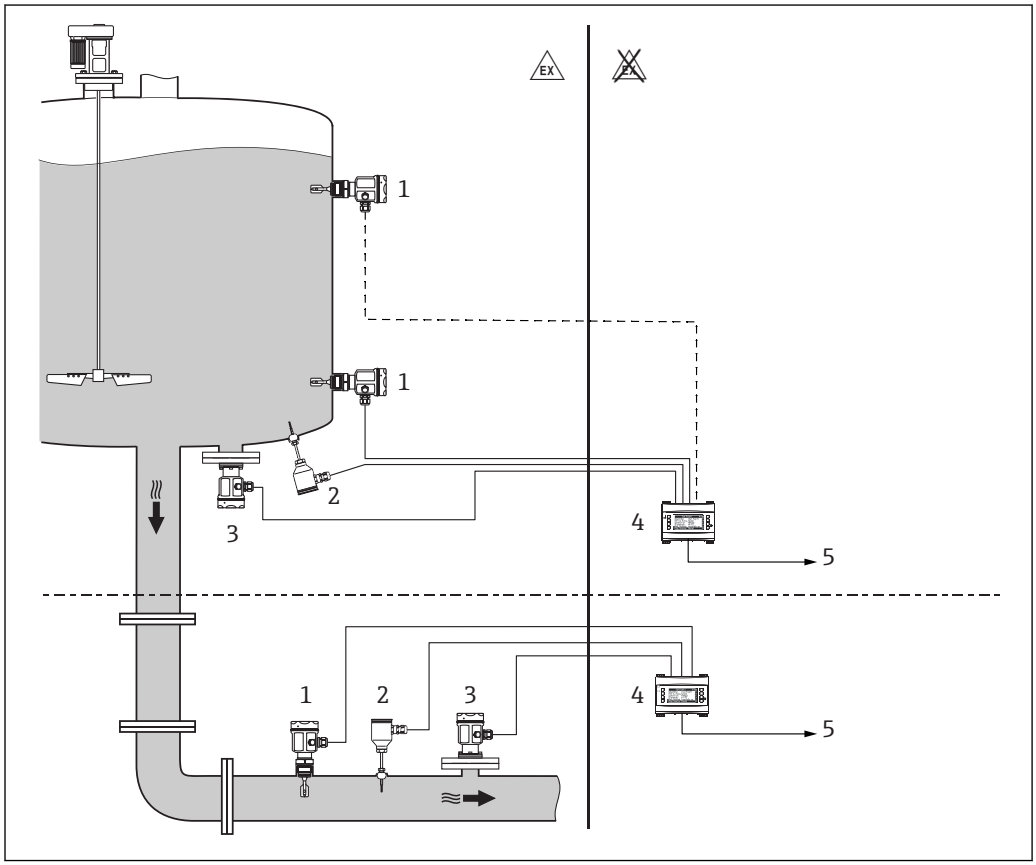
Symbols at the device

Symbol	Meaning
⚠→📖	**Safety instructions** Observe the safety instructions contained in the associated Operating Instructions.
	Temperature resistance of the connection cables Specifies the minimum value of the temperature resistance of the connection cables.

Application

Density measurement

The Liquiphant FTL51B with electronic insert FEL60D measures the density of a liquid medium in pipes and tanks. The device is suitable for all Newtonian - ideal viscous - fluids. The device is also suitable for use in hazardous areas.



1 Density measurement with FML621

1 Liquiphant FTL51B sensor with electronic insert FEL60D - pulse output
2 Temperature sensor - e.g. 4 to 20 mA output
3 Pressure transmitter 4 to 20 mA output required for pressure changes >6 bar
4 Liquiphant Density Computer FML621 with display and operating unit
5 PLC

The measurement can be affected by:
- air bubbles at the sensor
- unit not fully covered by the medium
- solid media buildup on the sensor
- high fluid velocity in pipes
- severe turbulence in the pipe due to inlet and outlet runs that are too short (→ 29)
- corrosion of the fork
- non-Newtonian - non-ideal viscous - behavior of the fluids

Application examples: basic unit

1 density measuring line pressure and temperature-compensated

- **Product structure:** FML621-xxxAAAxxxx
- **Number of inputs:** 4x pulse input for 0 to 20 mA or 4 to 20 mA
- **Number of outputs:** 1x relay SPST, 2x 0 to 20 mA or 4 to 20 mA
- **Comment:**
  - 1 Liquiphant with FEL60D
  - 1 temperature transmitter 4 to 20 mA
  - 1 pressure transmitter 4 to 20 mA
  - 1 output: density 4 to 20 mA
  - 1 output: temperature 4 to 20 mA

2 density measuring lines temperature-compensated

- **Product structure:** FML621-xxxAAAxxxx
- **Number of inputs:** 4x pulse input for 0 to 20 mA or 4 to 20 mA
- **Number of outputs:** 1x relay SPST, 2x 0 to 20 mA or 4 to 20 mA
- **Comment:**
  - 2 Liquiphant with FEL60D
  - 2 temperature transmitter 4 to 20 mA
  - 1 output: density 4 to 20 mA
  - 1 output: temperature 4 to 20 mA

Application examples: Basic unit + 2 extension cards

3 density measuring lines, 2x temperature-compensated, 1x pressure, and temperature compensated

- **Product structure:** FML621-xxxBBAxxxx
- **Number of inputs:** 8x pulse input for 0 to 20 mA or 4 to 20 mA
- **Number of outputs:** 5x relay SPST, 6x 0 to 20 mA or 4 to 20 mA
- **Comment:**
  - 3 Liquiphant with FEL60D
  - 3 temperature transmitter 4 to 20 mA
  - 1 pressure transmitter 4 to 20 mA
  - 3 outputs: density 4 to 20 mA
  - 3 outputs: temperature 4 to 20 mA
  - 1 relay for medium detection

Application examples: medium detection

Distinguish between 2 media

- **Product structure:** FML621-xxxAAAxxxx Basic unit
- **Use of inputs:**
  - 1x FEL60D
  - 1x temperature 4 to 20 mA
- **Information content:**
  - 1 output: density 4 to 20 mA
  - 1 output: temperature 4 to 20 mA
  - 1 relay
- **Comment:** The medium detection can refer to concentrations or phase transitions

Distinguish between 3 media

- **Product structure:** FML621-xxxBAAxxxx Basic unit with additional relay card
- **Use of inputs:**
  - 1x FEL60D
  - 1x temperature 4 to 20 mA
- **Information content:**
  - 1 output: density 4 to 20 mA
  - 1 output: temperature 4 to 20 mA
  - 1 relay: display product 1
  - 1 relay: display product 2
  - 1 relay: display product 3
- **Comment:** The relays can activate subsequent processes by triggering actuators

Application examples: density

Density measurement or concentration calculation with pump protection

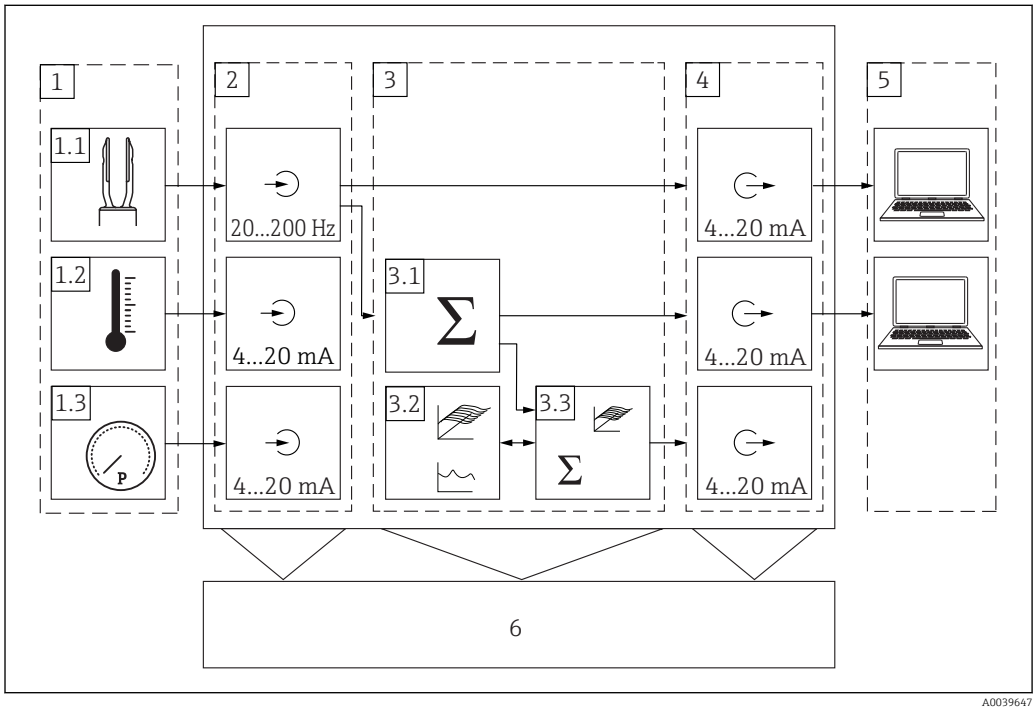
- **Product structure:** FML621-xxxBAAxxxx Basic unit
- **Use of inputs:**
  - 1x FEL60D
  - 1x temperature 4 to 20 mA
- **Information content:**
  - 1 output: density 4 to 20 mA
  - 1 output: temperature 4 to 20 mA
  - 1 relay to switch off the pump
- **Comment:** In addition to determine the density and the concentration, a pump protection can also be implemented by setting the appropriate switching frequency.

Function and system design

Measuring principle

A piezoelectric drive excites the tuning fork of the Liquiphant Density to its resonance frequency. If the density of the liquid medium changes, then the resonance frequency of the tuning fork also changes. The density of the medium has a direct impact on the resonance frequency of the tuning fork. By storing specific medium properties and mathematic relations in the system, the exact concentration of the medium can be calculated.

System design



2 FML621 modular schema

1 External sensors
1.1 Liquiphant Density FTL51B
1.2 Temperature sensor
1.3 Presure sensor
2 Input modules
3 Calculation module
31. Maths e.g. density
3.2 2D/3D curve
3.3 Maths e.g. concentration, 3D linearization
4 Output modules
5 Information processing - control room
6 Display

Specific density applications

Available software modules calculate the density from the frequency, temperature and pressure input variables.

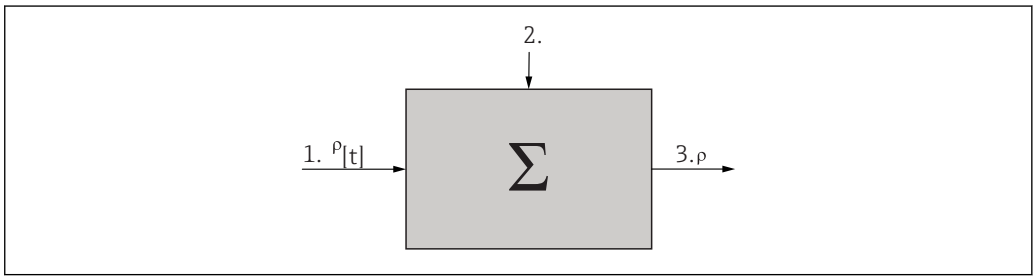
Operating principle

The vibrating frequency of the tuning fork is reduced when the fors is completely covered with liquid. The corresponding density of the medium can be calculated using other information, such as the temperature and pressure. If the value by which the density has changed is known, the concentration of the medium can be determined using a function stored in the system. This value can be determined empirically or be based on existing tables. The tables for converting density to concentration must be provided by the customer.

Additional software modules can calculate the density at the reference temperature, compute the concentrations or detect media.

Reference density

In this module, the system refers back to a reference temperature, such as 15 °C (59 °F) or 20 °C (68 °F). It must be known how the density of the medium changes at different temperatures.



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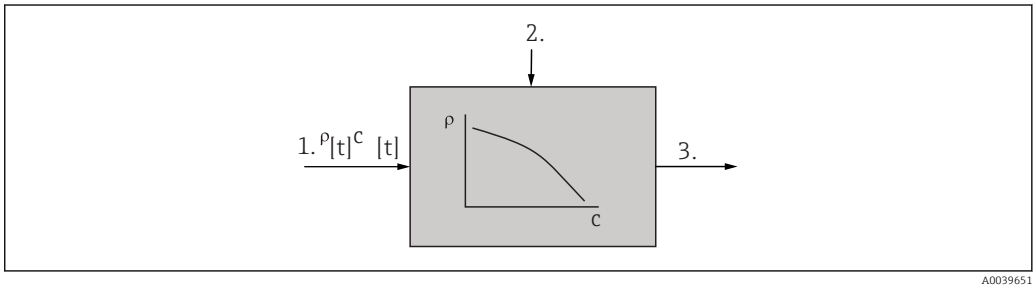
1 Input data: Table ρ [t]
2 Measured liquid medium: temperature and density
3 Output: Calculated density ρ [standard]

Concentration

Using density and concentration curves already available or determined empirically, the concentration can be determined when substances are continuously dissolved in a medium.



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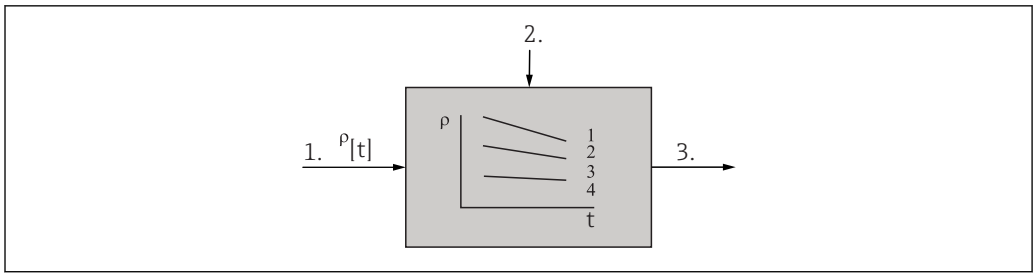
1 Input data: Table ρ, c [t]
2 Measured liquid medium: temperature and density
3 Output: Calculated concentration

Medium detection

To be able to distinguish between two media, the density function - as a function of the temperature - can be stored for several media. In this way, the system can distinguish between two media.



1 Input data: Tables ρ [t] for two liquid mediums
2 Measured liquid medium: temperature and density
3 Output: Analog output device

Measuring system

The FML621 supplies power directly to two-wire transmitters which are connected. Intrinsically safe inputs and transmitter power supply units for current cards are optionally available for hazardous applications. The inputs, outputs, limit values and display are configured, and the device is commissioned and serviced, via 8 soft keys, with the backlit dot-matrix display, using an RS232 or RS485 interface or PC software ReadWin® 2000. The device can be extended using additional extension cards.

The change of the background color signals the alarms or violations of the values. The background color is configurable.

To use the telealarm function, we recommend common industrial modems that have an RS232 interface. The measured values and events or alarms are coded in accordance with the serial protocol and transmitted. The type of the protocol can be requested.

The number of inputs, outputs, relays, and transmitter power supply units contained in the basic unit can be individually extended using a maximum of three plug-in cards.

Modularity

Measuring the density of a liquid medium. Liquiphant with electronic insert FEL60D and Density Computer FML621. Also for hazardous areas. Up to five density measuring lines can be operated using Density Computer FML621. All slots must be fitted with plug-in cards.

The Liquiphant set mesures density of a liquid medium also in hazardous area. The Density Computer FML621 operates up to 5 measuring lines. All slots must be fitted with plug-in cards.

Density Computer FML621 specification

- **Input**
  - FEL60D sensor
  - 0 to 20 mA or 4 to 20 mA pulse inputs
  - 0 to 18 digital inputs
  - 4 to 10 relays inputs
  - sensors (mA, mV, V, TC, RTD)
- **Output**
  - 2 to 8 analog outputs 0 to 20 mA or 4 to 20 mA
  - 2 to 8 pulse outputs - active or passive
  - 1 to 19 relays SPST, AC or DC
- **Communication**
  - Ethernet IP
  - PSTN or GSM modem
  - Serial bus RS232, RS485
  - ProfiBus® via coupler
  - ReadWin® 2000 PC software
- **Power supply mode**
  - 4-10 devices, max. current consumption 30 mA
  - 1 device, max. current consumption 80 mA
- **Internal memory**
  512 kB
- **Calculating functions**
  - predefined
  - editable

Design

Information on the mechanical construction of Liquiphant M sensors is provided in the Technical Information. The document numbers for downloading the documents on the Internet www.endress.com are listed on → 37.

Density Computer FML621

Liquiphant Density FTL51B
Compact version or with extension pipe and with AlloyC22 for use in aggressive liquids

Electronic insert for density measurement

Liquiphant Density with electronic insert FEL60D.

For Density Computer FML621, two-wire pulse output.

Current pulses superimposed on the power supply along the two-wire cabling.

Input

Measured variable

Input: voltage
- analog
- digital

Input: current
- analog
- PFM
- pulse

Only Endress+Hauser flow sensors can be connected to the PFM input.

Not suitable for level and pressure measuring instruments.

Input signal

Any measured variable like flow, level, pressure, temperature or density is implemented as an analog signal.

Measuring range

Current
- 0 to 20 mA or 4 to 20 mA +10 % overrange
- max. input current: 150 mA
- input impedance: <10 Ω
- accuracy 0.1 % of full scale value
- temperature drift: 0.04 % / K (0.022 % / °F)
- signal damping low filter 1st order, filter constant adjustable 0 to 99 s
- resolution: 13 bit

Current (U-I-TC card)
- 0 to 20 mA or 4 to 20 mA +10 % overrange
- max. input current: 80 mA
- input impedance: =10 Ω
- accuracy: 0.1 % of full scale value
- temperature drift: 0.01 % / K 0.01 % / K (0.0056 % / °F)

PFM/pulse input
- frequency range: 0.01 to 18 kHz
- signal level - with approx.: 1.3 kΩ dropping resistor at max. 24 V voltage level:
  - low: 2 to 7 mA
  - high: 13 to 19 mA
- measurement method: period length or frequency measurement
- temperature drift: 0.01 % over entire temperature range

Voltage (digital input)
- voltage level:
  - low: –3 to 5 V
  - high: 12 to 30 V (as per IEC 61131-2)
- input current typically: 3 mA with overload and reverse polarity protection
- sampling frequency:
  - 4x 4 Hz
  - 2x 20 kHz or 2x 4 Hz

Voltage (analog input)

- voltage: 0 to 10 V_{rms}, 0 to 5 V, ±10 V, inaccuracy ±0.1 % of measuring range, input impedance >400 kΩ
- voltage: 0 to 100 mV, 0 to 1 V, ±1 V, ±100 mV, measured error ±0.1 % of measuring range, input impedance >1 MΩ
- temperature drift: 0.01 % / K (0.0056 % / °F)

Resistance thermometer Pt100 as per ITS 90
- measuring range: −200 to 800 °C (−328 to 1 472 °F)
- accuracy: - 4-wire connection 0.03 % of full scale value
- type of connection: 3-wire or 4-wire system
- measuring current: 500 µA
- resolution: 16 bit
- temperature drift: 0.01 % / K (0.0056 % / °F)

Resistance thermometer Pt500 as per ITS 90
- measuring range: −200 to 250 °C (−328 to 482 °F)
- accuracy: - 4-wire connection 0.1 % of full scale value
- type of connection: 3-wire or 4-wire system
- measuring current: 500 µA
- resolution: 16 bit
- temperature drift: 0.01 % / K (0.0056 % / °F)

Resistance thermometer Pt1000 as per ITS 90
- measuring range: −200 to 250 °C (−328 to 482 °F)
- accuracy: - 4-wire connection 0.08 % of full scale value
- type of connection: 3-wire or 4-wire system
- measuring current: 500 µA
- resolution: 16 bit
- temperature drift: 0.01 % / K (0.0056 % / °F)

Thermocouples (TC)
- J (Fe-CuNi), IEC 584
  - measuring range: −210 to 999.9 °C (−346 to 1 832 °F)
  - accuracy: ± (0.15 % oMR +0.5 K) as of −100 °C
    ± (0.15 % oMR +0.9 °F) as of −148 °F
- K (NiCr-Ni), IEC 584
  - measuring range: −200 to 1 372 °C (−328 to 2 502 °F)
  - accuracy: ± (0.15 % oMR +0.5 K) as of −130 °C
    ± (0.15 % oMR +0.9 °F) as of −202 °F
- T (Cu-CuNi), IEC 584
  - measuring range: −270 to 400 °C (−454 to 752 °F)
  - accuracy: ± (0.15 % oMR +0.5 K) as of −200 °C
    ± (0.15 % oMR +0.9 °F) as of −382 °F
- N (NiCrSi-NiSi), IEC 584
  - measuring range: −270 to 1 300 °C (−454 to 1 386 °F)
  - accuracy: ± (0.15 % oMR +0.5 K) as of −100 °C
    ± (0.15 % oMR +0.9 °F) as of −148 °F
- B (Pt30Rh-Pt6Rh), IEC 584
  - measuring range: 0 to 1 820 °C (32 to 3 308 °F)
  - accuracy: ± (0.15 % oMR +1.5 K) as of 600 °C
    ± (0.15 % oMR +2.7 °F) as of 1 112 °F
- D (W3Re/W25Re), ASTME 998
  - measuring range: 0 to 2 315 °C (32 to 4 199 °F)
  - accuracy: ± (0.15 % oMR +1.5 K) as of 500 °C
    ± (0.15 % oMR +2.7 °F) as of 932 °F
- C (W5Re/W26Re), ASTME 998
  - measuring range: 0 to 2 315 °C (32 to 4 199 °F)
  - accuracy: ± (0.15 % oMR +1.5 K) as of 500 °C
    ± (0.15 % oMR +2.7 °F) as of 932 °F
- L (Fe-CuNi), DIN 43710, GOST
  - measuring range: −200 to 900 °C (−346 to 1 652 °F)
  - accuracy: ± (0.15 % oMR +0.5 K) as of −100 °C
    ± (0.15 % oMR +0.9 °F) as of −148 °F

- U (Cu-CuNi), DIN 43710
  - measuring range: −200 to 900 °C (−346 to 1 652 °F)
  - accuracy: ± (0.15 % oMR +0.5 K) as of −100 °C
    ± (0.15 % oMR +0.9 °F) as of −148 °F
- S (Pt10Rh-Pt), IEC 584
  - measuring range: 0 to 1 768 °C (32 to 3 214 °F)
  - accuracy: ± (0.15 % oMR +3.5 K) for 0 to 100 °C
    ± (0.15 % oMR +1.5 K) as of 100 to 1 768 °C
    ± (0.15 % oMR +6.3 °F) for 0 to 212 °F
    ± (0.15 % oMR +2.7 °F) for 212 to 2 314 °F
- R (Pt13Rh-Pt), IEC 584
  - measuring range: 0 to 1 768 °C (32 to 3 214 °F)
  - accuracy: ± (0.15 % oMR +3.5 K) for 0 to 100 °C
    ± (0.15 % oMR +1.5 K) as of 100 to 1 768 °C
    ± (0.15 % oMR +6.3 °F) for 0 to 212 °F
    ± (0.15 % oMR +2.7 °F) for 212 to 2 314 °F

Galvanic isolation

The inputs are galvanically isolated between the individual extension cards and the basic unit (→ 11).

With digital inputs, every terminal block is galvanically isolated from each other.

Output

Output

Output signal

Current, pulse, transmitter power supply (MUS) and switching output.

Galvanic isolation

- the signal inputs and outputs are galvanically isolated towards the supply voltage
  testing voltage: 2.3 kV
- all the signal inputs and outputs are galvanically isolated from one another
  testing voltage: 500 V

The specified isolation voltage is the AC testing voltage U_{eff}, which is applied between the connections. Basis for assessment: IEC 61010-1, protection class II, overvoltage category II.

Measured variables

Current
- 0 to 20 mA or 4 to 20 mA +10 % overrange, invertible
- max. loop current: 22 mA - short-circuit current
- load max.: 750 Ω at 20 mA
- accuracy: 0.1 % of full scale value
- temperature drift: 0.1 % /10 K (0.056 % / 10 °F) ambient temperature
- output ripple: <10 mV at 500 Ω for frequencies <50 kHz
- resolution: 13 bit
- error signals: 3.6 mA or 21 mA limit as per NAMUR NE 43 - adjustable

Pulse
- basic unit:
  - frequency range: up to 12.5 kHz
  - voltage level: 0 to 1 V low, 12 to 28 V high
  - load min.: 1 kΩ
  - pulse width: 0.04 to 1 000 ms
- extension cards - digital passive, open collector:
  - frequency range: up to 12.5 kHz
  - I_{max} = 200 mA
  - U_{max} = 24 V±15 %
  - $U_{low/max}$ = 1.3 V at 200 mA
  - pulse width: 0.04 to 1 000 ms

Number
- number:
  - 2x 0 to 20 mA or 4 to 20 mA / pulse - in basic unit
  - ethernet option: no current output present in the basic unit
- max. number:
  - 8x 0 to 20 mA or 4 to 20 mA / pulse - depends on the number of extension cards
  - 6x digital passive - depends on the number of extension cards

Signal sources
all available multifunctional inputs and results from mathematic calculations can be freely allocated to the outputs.

Switching output

Function
Limit relay switches in the operating modes: minimum or maximum safety, gradient, alarm, frequency or pulse, device error.

Switch behavior
Binary, switches when the limit value is reached - potential-free NO contact.

Relay switching capacity
Max. 250 V_{AC} 3 A / 30 V_{DC} 3 A

Do not combine line voltage and protective extra low voltage for extension card relays.

Switching frequency
Maximum 5 Hz

Threshold
Freely programmable

Hysteresis
0 to 99 %

Signal source
All available inputs and calculated variables can be allocated freely to the switching outputs.

Number of switching cycles
> 100,000

Scan rate
500 ms

Number
- 1 relay - in the basic unit
- Maximum number: 19 relays - depend on the number and type of extension cards

Transmitter power supply and an external power supply

The transmitter power supply unit (MUS), terminals 81/82 or 81/83 - the optional power extension cards 181/182 or 181/183
- maximum output voltage: 24 V_{DC} ±15 %
- impedance: <345 Ω
- maximum loop current: 22 mA (at U_{out} >16 V)

FML621 technical data:
- HART® communication is not impaired
- number: 4 MUS in the basic unit
- maximum number: 10 - depends on the number and type of extension cards

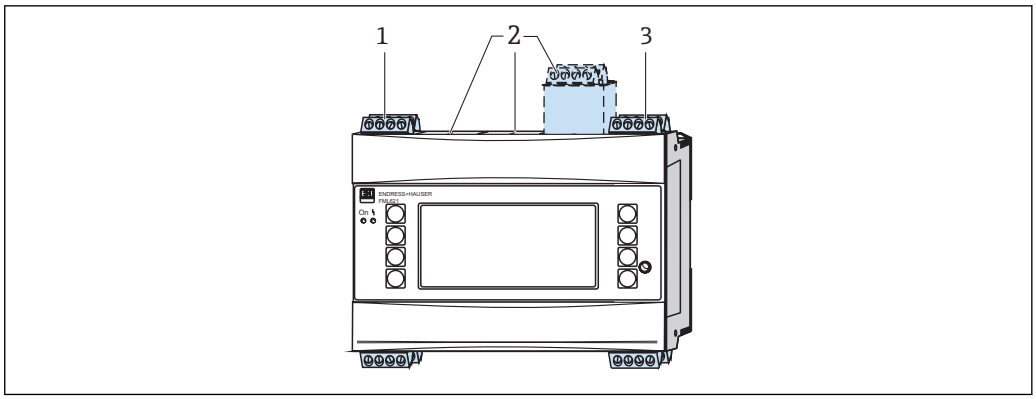
Additional power supply terminals 91/92:
- supply voltage: 24 V_{DC}±5 %
- current max.: 80 mA, short-circuit proof
- number: 1
- source resistance: <10 Ω

Electrical connection

Slots and block circuit diagram

CAUTION

Destruction of electronic components.
- ▶ Do not install or wire the device when it is connected to the power supply.



3 Base unit with extension cards.

1 Slot with extension card A
2 Slots B, C, D
3 Slot with extension card E

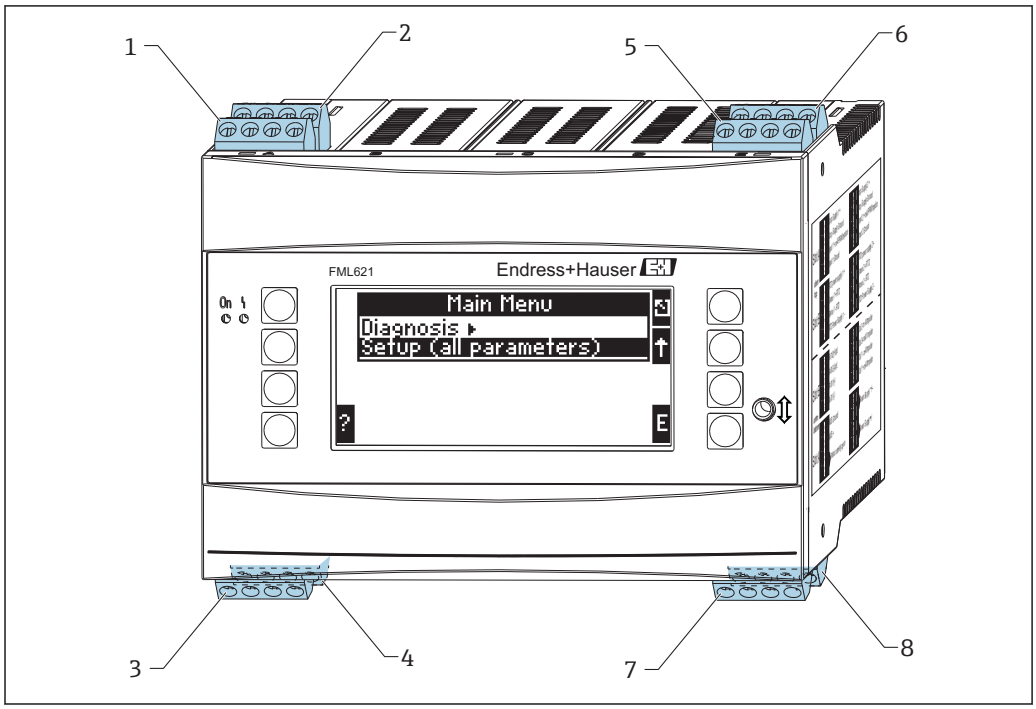
Slots specification

- Slot A
  - input: 2x density sensors, 0 to 20 mA or 4 to 20 mA
  - output: 2x 0 to 20 mA or 4 to 20 mA
- Slots B, C, D
  - input: max. 10 analog devices or 18 digital devices
  - output: max. 8 analog devices or 6 digital devices or 19 relays SPST
- Slot E
  - input: 2x density sensors, 0 to 20 mA or 4 to 20 mA
  - output: relay SPST

The extension cards mounted in the A and E slots are integral parts of the basic unit.

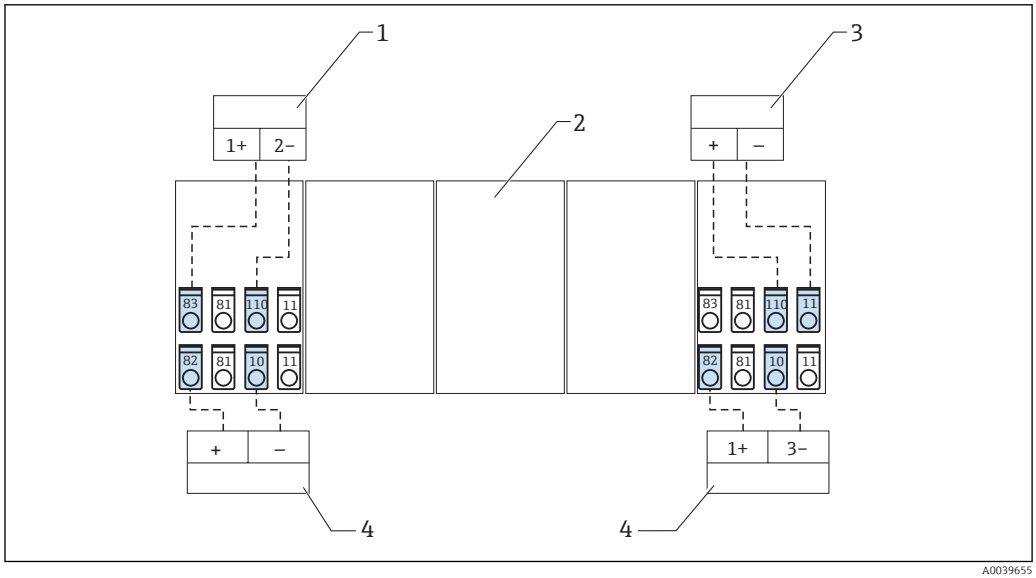
The slots B, C and D can be expanded with additional extension cards.

Terminal assignment



4 *Slot assignment*

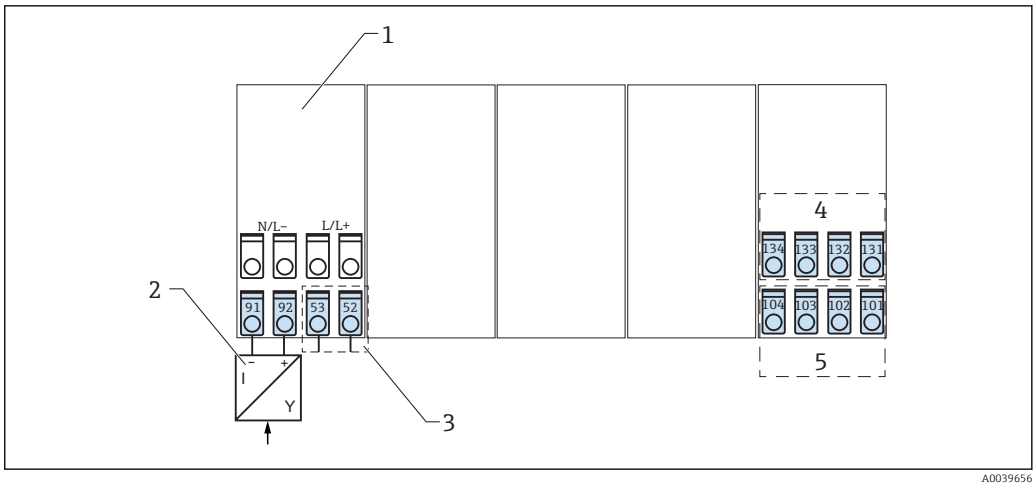
1 *Slot A I - input*
2 *Slot A II - input*
3 *Slot A III - output*
4 *Slot A IV - output*
5 *Slot E I - input*
6 *Slot E II - input*
7 *Slot E III - output*
8 *Slot E IV - output*



5 *Connection overview - inputs*

1 *Passive sensor - pressure measuring*
2 *Slot for the additional extension card*
3 *Active sensor*
4 *Passive sensor*

Active sensor: passing on temperature information from a PLC can be taken as an example for connecting an active sensor.



6 *Connection overview - outputs*

1 *Extension card*
2 *Power supply for sensors*
3 *Relay contact*
4 *Pulse and current outputs - active*
5 *Bus interfaces*

With the Ethernet option, the current output or pulse output is not available at slot **E**.

Slot A I
Input: current or PFM or pulse input 1
- terminal 10: 0 to 20 mA or 4 to 20 mA, PFM, pulse input 1
- terminal 11: ground for 0 to 20 mA or 4 to 20 mA, PFM, pulse input
- terminal 81: sensor power supply ground 1
- terminal 82: 24 V sensor power supply 1

Slot A II
Input: current or PFM or pulse input 2
- terminal 110: 0 to 20 mA or 4 to 20 mA, PFM, pulse input 2
- terminal 11: ground for 0 to 20 mA or 4 to 20 mA, PFM, pulse input
- terminal 81: sensor power supply ground 2
- terminal 83: 24 V sensor power supply 2

Slot A III
Output: relay or additional sensor power supply
- terminal 52: relay Common (COM)
- terminal 53: relay Normally Open (NO)
- terminal 91: sensor power supply ground
- terminal 93: +24 V sensor power supply

Slot A IV
Output: power supply
- terminal L/L+: **L** for AC, **L+** for DC
- terminal N/L-: **N** for AC, **L-** for DC

The inputs in the same slot are not galvanically isolated. There is a separation voltage of 500 V between the inputs and outputs in various slots. Terminals with the same second digit are jumpered internally, e.g. the terminals 11 and 81.

Connecting the power supply

WARNING

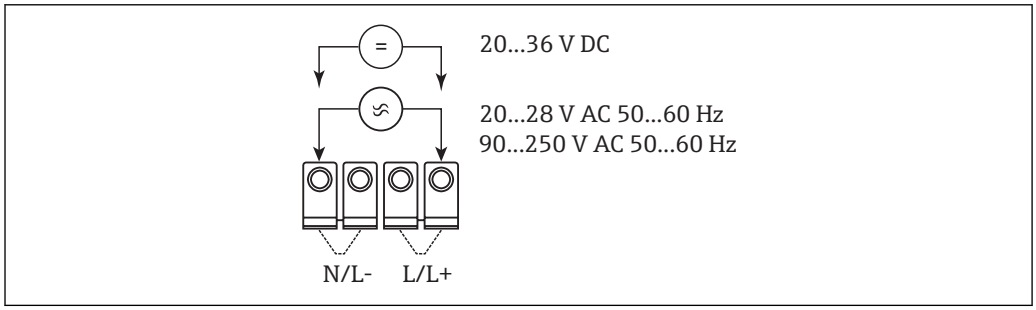
Destruction of electronic components.
- ▶ Check the power supply voltage is the same as indicated on the label plate of the device.

DANGER

High risk of body injuries and damage of the electronic components by the invalid supply voltage.
- ▶ For the version of the device, supplied 90 to 250 V voltage, install a switch marked as a separator in the power supply circuit of the device in an easily accessible location.

⚠ WARNING

Lack of protection of the device's power supply circuit.
Destruction of electronic components.
► Protect the power supply circuit with a 10 A fuse when the device is supplied with 90 to 250 V.



7 *Power supply connection*

Connecting density sensor

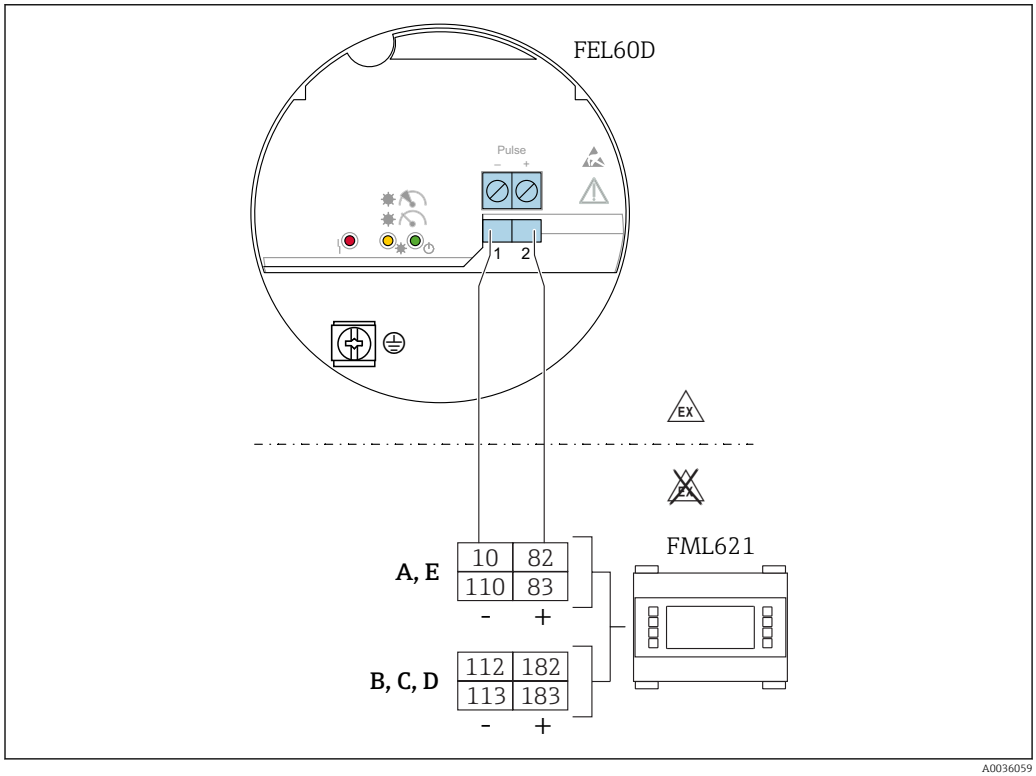
Liquiphant Density with electronic insert FEL60D

⚠ CAUTION

Operation with other switching units is not permitted.
Destruction of electronic components.
► FEL60D cannot be installed in devices that were originally used as a point level switch.

Two-wire connection at Density Computer FML621

The output signal is based on pulse technology. With the aid of this signal, the fork frequency is constantly forwarded to the switching unit.



8 *Connection schema the FEL60D module to Density Computer FML621*

Pulse signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz.

Calibration and adjustment

In the Liquiphant modular system, the option of an extended calibration is also provided in addition to the electronics on special calibration, density H_2O (→ 36).

The three types of adjustment are implemented:

Standard adjustment - see: TI01403F, ordering information for additional fittings, basic version A
Two fork parameters are determined at the factory to describe the sensor characteristics and are provided in the adjustment report with the product. These parameters must be transmitted to the Density Computer FML621.

Special adjustment - see: TI01403F, ordering information for additional fittings, special adjustment, density H_2O (K) or special adjustment, density H_2O with 3.1 certificate (L)
Three fork parameters are determined at the factory to describe the sensor characteristics and are provided in the adjustment report with the product. These parameters must be transmitted to the Density Computer FML621.
This type of adjustment achieves an even greater level of accuracy (→ 27).

Field adjustment
During field adjustment, the density value determined by the customer is used for wet adjustment .

More information on Liquiphant is provided in the following "Technical Information" document:

Liquiphant FTL60D - for standard applications: TI01403F

All of the required parameters of the Liquiphant Density are documented in **Adjustment report** and **Sensor adjustments**.

The documents are included in the delivery.

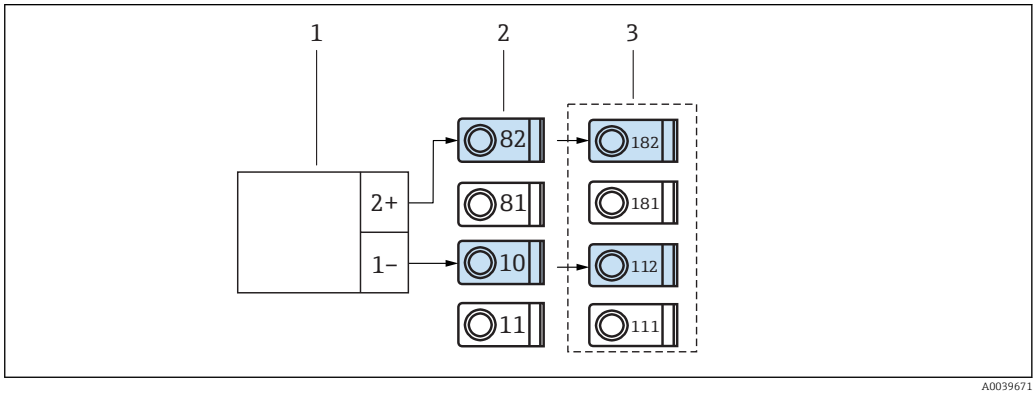
E+H - specific devices

The basic version of **Density Computer FML621** is fitted with slots **A** and **E**.

The device can be extended to the slots B, C and D.

The maximum cable length is 1 000 m (3 280.8 ft). The cable must be shielded for EMC requirements. The maximum power supply per core is 25 W.

Density sensor with a pulse output

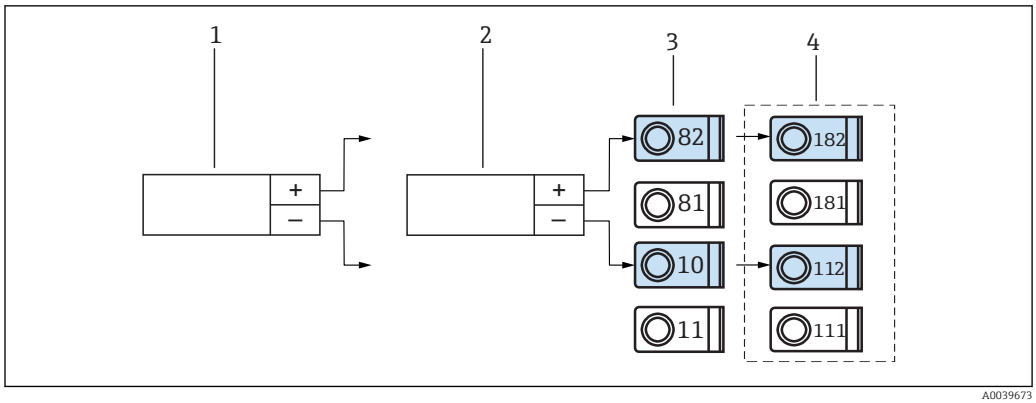


9 *Connection of the density sensor with a pulse output*

1 Density sensor
2 Slot A I
3 Additional Slot B I

Temperature sensor via temperature head transmitter

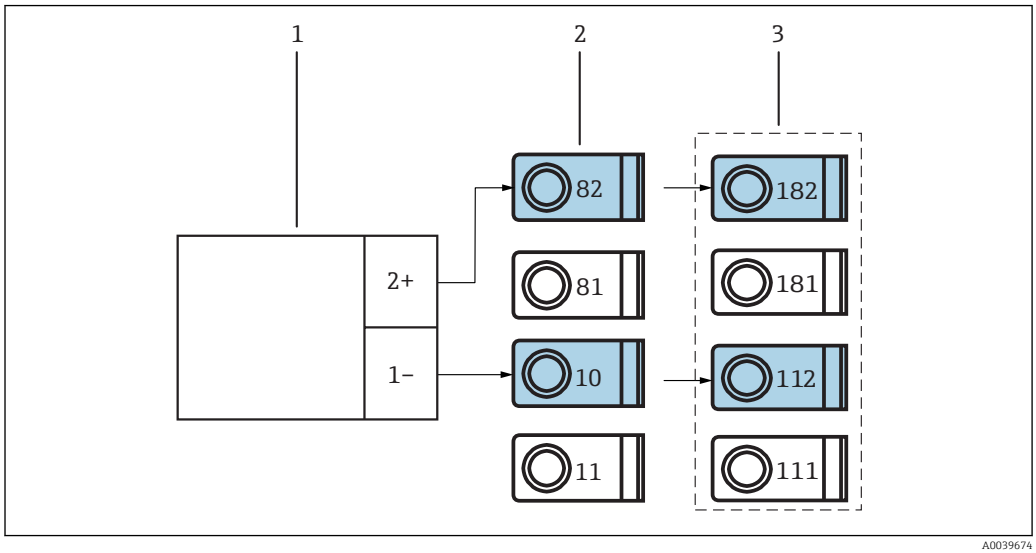
Connection of PT100, PT500 and PT1000 sensors is possible only via an extension card.



10 *Connection of the temperature sensor via the temperature head transmitter*

1 *TMT180 temperature sensor*
2 *TMT181 temperature head transmitter*
3 *Slot A I*
4 *Additional Slot B I*

Pressure sensor with passive current output

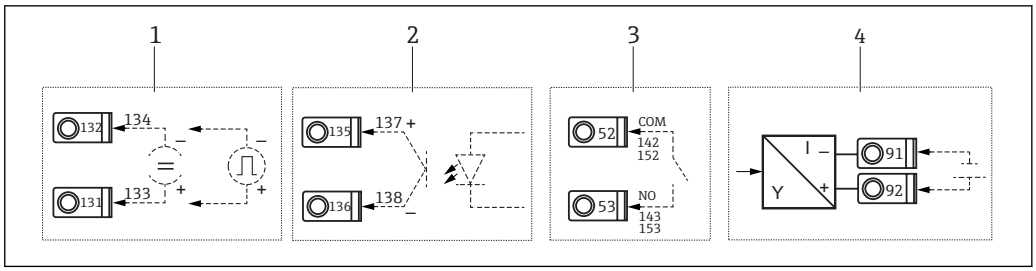


11 *Connection of the pressure sensor with passive current output*

1 *Cerabar S/M*
2 *Slot A I*
3 *Additional Slot B I*

Connecting outputs

The device has two galvanically isolated outputs or Ethernet connection, which can be configured as an analog output or active pulse output. In addition, an output for connecting a relay and the option of transmitter power supply are available for each device. The number of outputs increases according to the installed additional extension cards (→ 20).



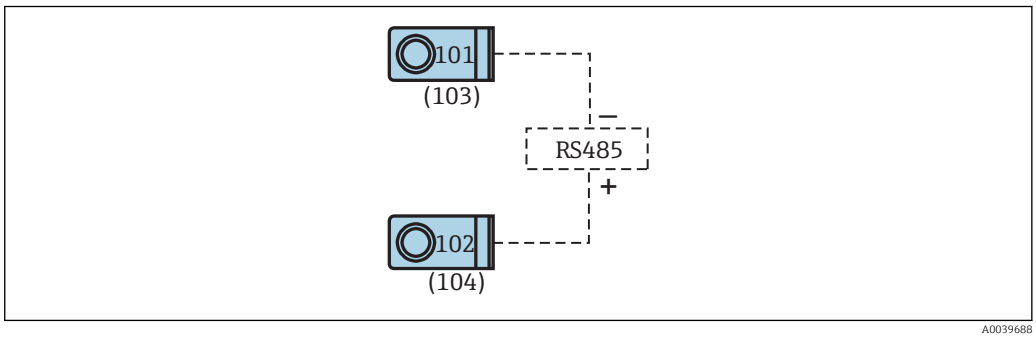
12 *Connecting outputs*

1 *Active pulse and current outputs*
2 *Passive pulse output with the open collector*
3 *Relay output (NO), e.g. slot A III*
4 *Transmitter power supply (MUS) output*

Interface connection

The bus interfaces:

- RS232
  The RS232 interface is connected via an interface cable and a jack socket on the front of the housing.
- RS485
- PROFIBUS®
  Optional connection of the Density Computer FML621 to PROFIBUS DP via the serial RS485 interface with the external module HMS AnyBus Communicator for PROFIBUS (→ 36).
- Optional interfaces:
  - additional RS485
  - Ethernet



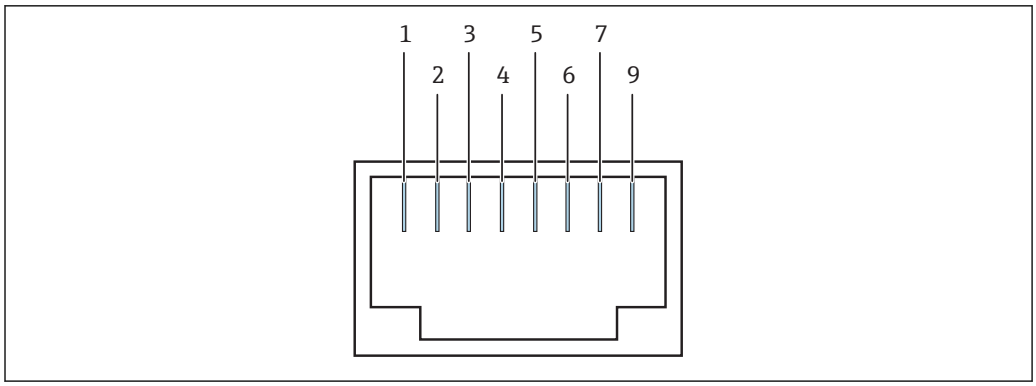
13 *Interface connection*

Ethernet option

Ethernet connection

An IEEE 802.3 compatible connection is available on a shielded RJ45 plug connector on the device underside as the network connection. This can be used to connect the device to devices in the office environment with a hub or switch. The office equipment standard EN 60950 must be taken into consideration for safe distances between equipment. The assignment corresponds to an MDI-interface (AT&T258) conforming to standards so that a shielded 1:1 cable with a maximum length of 100 m (328 ft) can be used. The Ethernet interface is designed as a 10 and 100-BASE-T. Direct connection to a PC is possible with a crossover cable. Half-duplex and full-duplex data transmission is supported.

If the FML621 has an Ethernet interface, no analog outputs are available on the base unit via slot E!



14 *RJ45 socket*

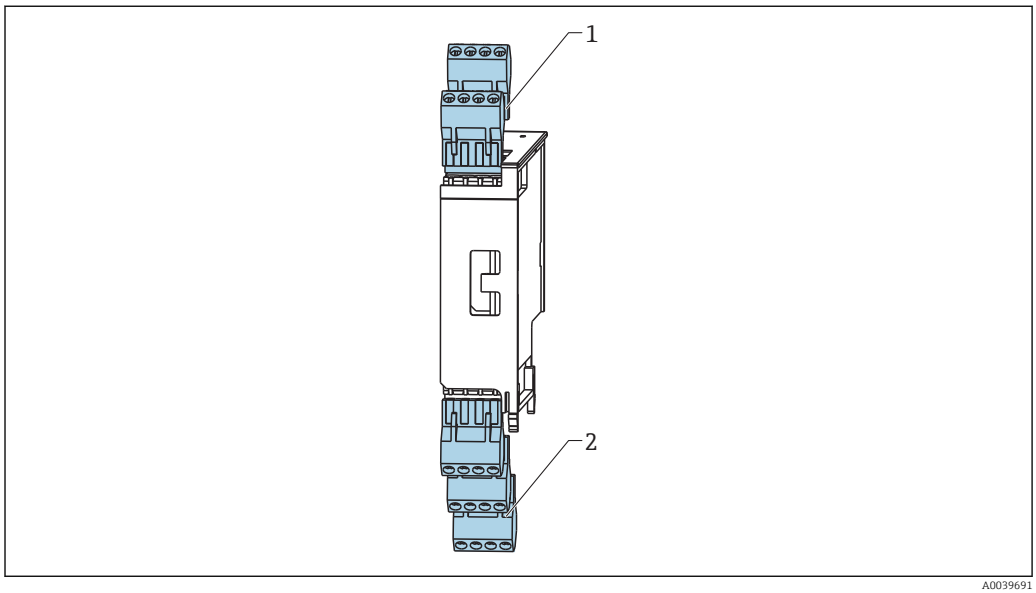
1 *Tx+*
2 *Tx-*
3 *Rx+*
4 *Not connected*
5 *Not connected*
6 *Rx-*
7 *Not connected*
8 *Not connected*

LED indicators

Two LEDs are located under the connector indicate the status of the Ethernet interface.

- yellow LED - link signal
  lits when the device is connected to a network
- green LED - Tx/Rx
  - flashes when the device is sending or receiving data
  - lits constantly when the device is not sending or receiving data

The extension cards



15 *Extension card with terminals*

1 *Input slots (I, II)*
2 *Outputs: (III, IV, V)*

Terminal assignment of "Universal extension card (FML621A-UA)" with intrinsically safe inputs (FML621A-UB)

Slot B I, C I, D I
Input: current or PFM or pulse input 1
- terminal 182: 24 V sensor power supply 1
- terminal 112: 0 to 20 mA or 4 to 20 mA, PFM, pulse input 1
- terminal 111: ground for 0 to 20 mA or 4 to 20 mA, PFM, pulse input
- terminal 181: sensor power supply ground 1

Slot B II, C II, D II
Input: current or PFM or pulse input 2
- terminal 183: 24 V sensor power supply 2
- terminal 181: sensor power supply ground 2
- terminal 113: 0 to 20 mA or 4 to 20 mA, PFM, pulse input 2
- terminal 111: ground for 0 to 20 mA or 4 to 20 mA, PFM, pulse input

Slot B III, C III, D III
- Output: relay 1
  - terminal 142: relay Common (COM)
  - terminal 143: relay Normally Open (NO)
- Output: relay 2
  - terminal 152: relay Common (COM)
  - terminal 153: relay Normally Open (NO)

Slot B IV, CIV, D IV
Output: Current or pulse output - active
- terminal 131: + 0 to 20 mA or 4 to 20 mA pulse output 1
- terminal 132: - 0 to 20 mA or 4 to 20 mA pulse output 1
- terminal 133: + 0 to 20 mA or 4 to 20 mA pulse output 2
- terminal 134: - 0 to 20 mA or 4 to 20 mA pulse output 2

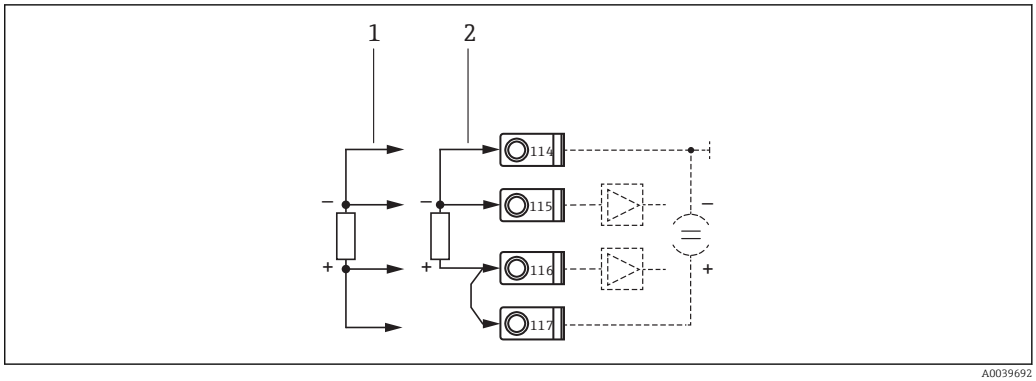
Slot B V, C V, D V
Output: Current or pulse output - passive
- terminal 135: + pulse output 3 - open collector
- terminal 136: - pulse output 3
- terminal 137: + pulse output 4 - open collector
- terminal 138: - pulse output 4

Terminal assignment of "Temperature extension card (FML621A-TA)" with intrinsically safe inputs (FML621A-TB)

Temperature sensors

Connection for Pt100, Pt500 and Pt1000.

Terminals 116 and 117 must be jumpered when connecting 3-wire sensors.



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16 Temperature sensor connection, optional temperature extension card e.g. in slot B (slot B I)

1 4-wire input
2 3-wire input

Slot B I, C I, D I
Input: RTD input 1
- terminal 117: + RTD power supply 1
- terminal 116: + RTD sensor 1
- terminal 115: - RTD sensor 1
- terminal 114: - RTD power supply 1

Slot B II, C II, D II
Input: RTD input 2
- terminal 121: + RTD power supply 1
- terminal 120: + RTD sensor 1
- terminal 119: - RTD sensor 1
- terminal 118: - RTD power supply 1

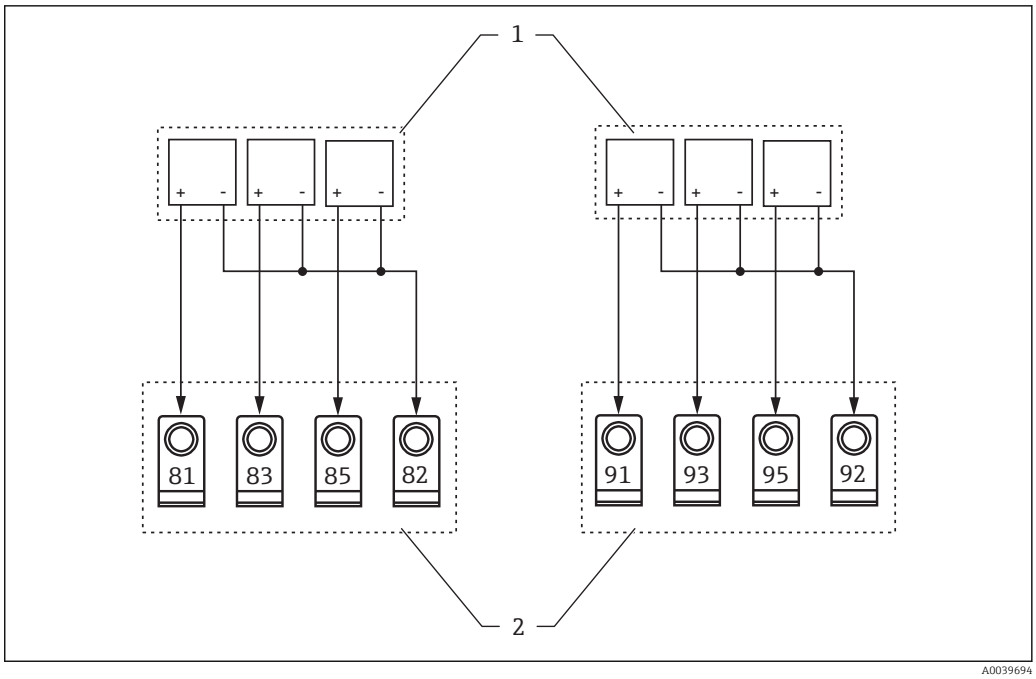
Slot B III, C III, D III
- output: Relay 1
  - terminal 142: relay 1 Common (COM)
  - terminal 143: relay 1 Normally Open (NO)
- output: Relay 2
  - terminal 152: relay 2 Common (COM)
  - terminal 153: relay 21 Normally Open (NO)

Slot B IV, C IV, D IV
- output: current or pulse 1 - active
  - terminal 131: + 0 to 20 mA or 4 to 20 mA
  - terminal 132: - 0 to 20 mA or 4 to 20 mA
- output: current or pulse 2 - active
  - terminal 133: + 0 to 20 mA or 4 to 20 mA
  - terminal 134: - 0 to 20 mA or 4 to 20 mA

Slot B V, C V, D V
- output: Passive pulse output
  - terminal 135: + pulse output 3 - open collector
  - terminal 136: - pulse output 3
- output: Passive pulse output
  - terminal 137: + pulse output 4 - open collector
  - terminal 138: - pulse output 4

Terminal assignment of "Digital extension card (FML621A-DA)" with intrinsically safe inputs (FML621A-DB)

The digital card has 6 intrinsically safe inputs. Terminals E1 and E4 can be defined as pulse inputs.



17 *Connecting the digital input*

1 Digital input device
2 Terminals

The current, PFM, pulse inputs or the RTD inputs in the same slot are not galvanically isolated. There is a separation voltage of 500 V between the aforementioned inputs and outputs in various slots.

Terminals with the same second digit are jumpered internally.

Slots B I, C I, D I
Digital inputs E1 to 3
- terminal 81: E1 20 kHz or 4 Hz as pulse input
- terminal 83: E2 4 Hz
- terminal 85: E3 4 Hz
- terminal 82: Signal ground E1 to 3

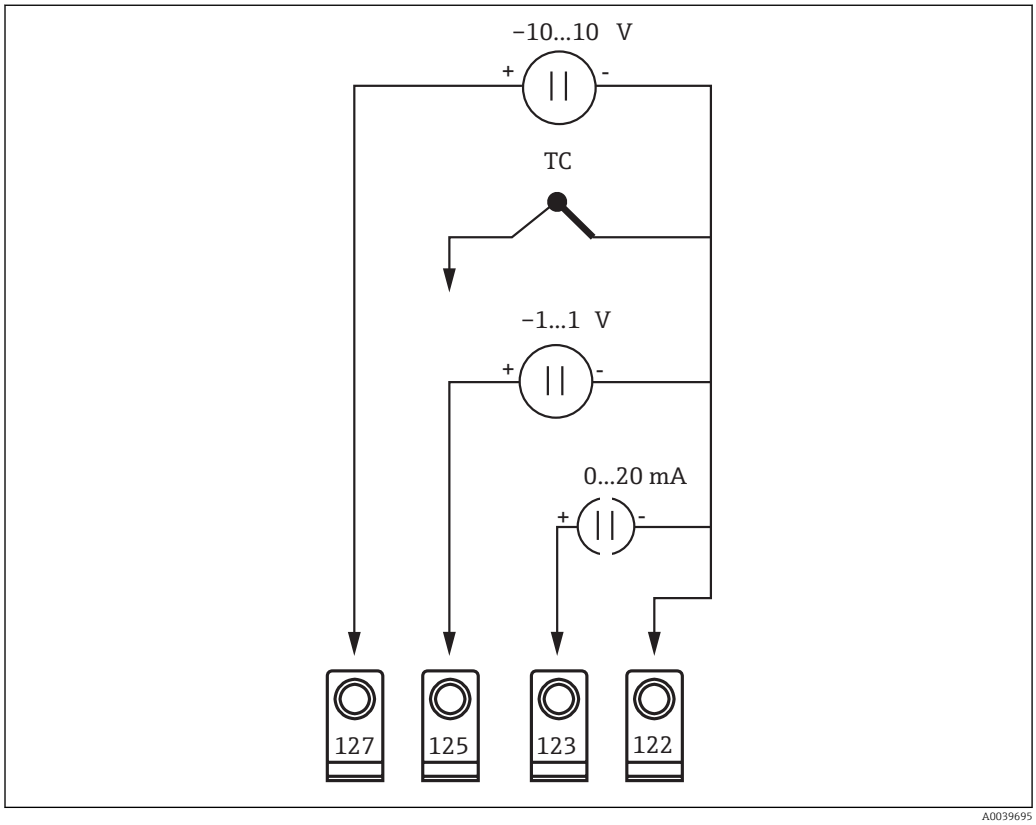
Slots B II, C II, D II
Digital inputs E4 to 6
- terminal 91: E4 20 kHz or 4 Hz as pulse input
- terminal 93: E5 4 Hz
- terminal 95: E6 4 Hz
- terminal 92: Signal ground E4 to 6

Slots B III, C III, D III
- output: Relay 1
  - terminal 142: relay 1 Common (COM)
  - terminal 143: relay 1 Normally Open (NO)
- output: Relay 2
  - terminal 152: relay 2 Common (COM)
  - terminal 153: relay 2 Normally Open (NO)

Slots B IV, C IV, D IV
- output: Relay 3
  - terminal 145: relay 3 Common (COM)
  - terminal 146: relay 3 Normally Open (NO)
- output: Relay 4
  - terminal 155: relay 4 Common (COM)
  - terminal 156: relay 4 Normally Open (NO)

Slots B V, C V, D V
- output: Relay 5
  - terminal 242: relay 5 Common (COM)
  - terminal 243: relay 5 Normally Open (NO)
- output: Relay 6
  - terminal 252: relay 6 Common (COM)
  - terminal 253: relay 6 Normally Open (NO)

Terminal assignment of "U-I-TC extension card (FML621A-CA)" with intrinsically safe inputs (FML621A-CB)



18 U-I-TC card

The card supports 2 input channels.

Channel 1 is supported by terminals 122, 123, 125 and 127.

Channel 2 is supported by terminals 222, 223, 225 and 227.

Slots B I, C I, D I
U-I-TC Input 1
- terminal 127: −10 to +10 V input
- terminal 125: −1 to +1 TC input
- terminal 123: 0 to 20 mA input
- terminal 122: Signal ground input

Slots B II, C II, D II
U-I-TC Input 2
- terminal 227: −10 to +10 V input
- terminal 225: −1 to +1 TC input
- terminal 223: 0 to 20 mA input
- terminal 222: Signal ground input

Slots B III, C III, D III
- output: Relay 1
  - terminal 142: relay 1 Common (COM)
  - terminal 143: relay 1 Normally Open (NO)
- output: Relay 2
  - terminal 152: relay 2 Common (COM)
  - terminal 153: relay 2 Normally Open (NO)

Slots B IV, C IV, D IV
- output: Current or pulse output 1 - active
  - terminal 131: + 0 to 20 mA or 4 to 20 mAor pulse output 1
  - terminal 132: - 0 to 20 mA or 4 to 20 mA or pulse output 1
- output: Current or pulse output 2 - active
  - terminal 133: + 0 to 20 mA or 4 to 20 mA or pulse output 2
  - terminal 134: - 0 to 20 mA or 4 to 20 mA or pulse output 2

Slot B V, C V, D V
- output: Passive pulse output
  - terminal 135: + pulse output 3 - open collector
  - terminal 136: - pulse output 3
- output: Passive pulse output
  - terminal 137: + pulse output 4 - open collector
  - terminal 138: - pulse output 4

Connecting remote display unit and the operating unit

Functional description

Remember!
- connect the remote display unit to use all functions of the operation unit
- operation only with ReadWin® 2000 is not permitted
- connect only one display or operation unit to the top-hat rail device

The remote display is an innovative addition to the powerful FML621 top-hat rail device. The user has the opportunity to optimally install the arithmetic unit to suit the installation and mount the display and operating unit in a user-friendly way at easily accessible locations. The display can be connected to both a top-hat rail device without, as well as a top-hat rail device with, an integrated display or operating unit. A 4-pin cable is supplied to connect the remote display with the basic unit; other components are not necessary.

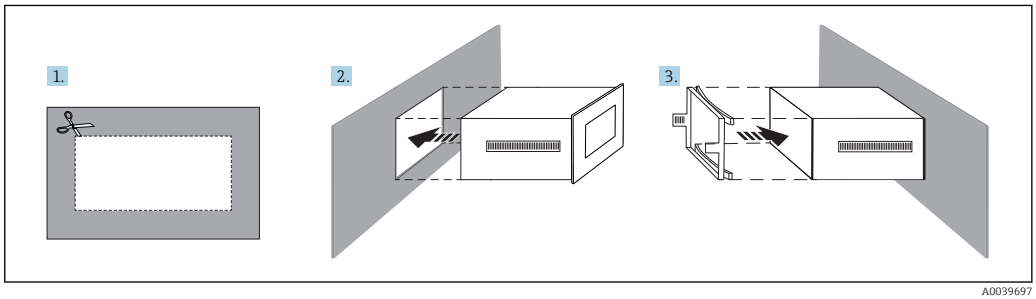
Installation of the remote display unit or operating unit

The place where the display unit is mounted must be free from vibrations.

The permitted ambient temperature during operation is –20 to +60 °C (–4 to 140 °F).

Protect the device from exposure to high temperature or heat.

Installation of the display unit



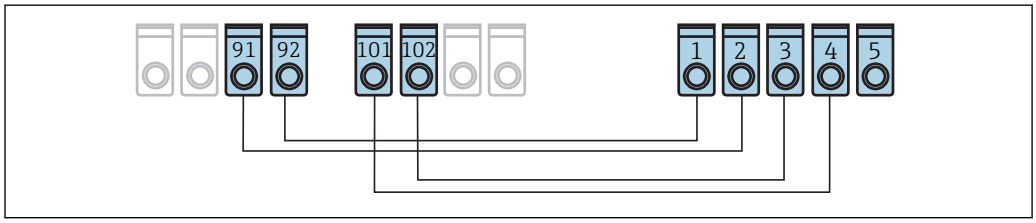
19 *Installation of the display unit*

1 *The display unit*

1. Cut out a hole of dimensions: 138 mm (5.43 in) x 68 mm (2.68 in).
2. Push the device with the sealing ring through the hole from the front.
3. Push the secure frame over the rear of the housing against the panel until the retaining clips engage.
   ↳ The display unit is mounted.

Wiring

The remote display unit and operating unit are connected directly to the basic unit with the supplied cable.



20 Wire connections between remote display unit and base unit.

1 Terminal GDN - remote display unit
2 Terminal 24 V_{DC} - remote display unit
3 Terminal + Rx Tx - remote display unit
4 Terminal - Rx Tx - remote display unit
5 Terminal PE - remote display unit
91 Terminal GND - Slot A III - base unit
92 Terminal 24 V_{DC} - Slot A III - base unit
101 Terminal - Rx Tx - Slot E III - base unit
102 Terminal + Rx Tx - Slot E III - base unit

Post-connection check

After completing the electrical installation of the device, carry out the following checks:

❑ Do a visual inspection thath the cable is not damaged.

Contact E+H Service directly when the device is incomplete or damaged.

❑ Check the power supply voltage. The voltage must be same as shown on the name plate.

The power supply voltage parameters are:

90 to 250 V_{AC} 50 to 60 Hz

20 to 28 V_{AC} 50 to 60 Hz

18 to 36 V_{DC}

❑ Check the power supply and signal cables are connected correctly.

Compare the wiring diagram with the connections in the terminals.

❑ Check the terminals coding.

❑ Check that the terminal slot is firmed correctly.

❑ Check that the cables are not tensioned.

Power supply

Supply voltage

- low voltage power unit: 90 to 230 V_{AC} 50 to 60 Hz
- extra-low voltage power unit: 20 to 36 V_{DC} or 20 to 28 V_{AC} 50 to 60 Hz

Power consumption

8 to 38 VA - depending to version and wiring.

Connection data interface

RS232
- connection: jack socket 3.5 mm (0.14 in), front
- transmission protocol: ReadWin® 2000
- transmission rate: max. 57 600 baud

RS485
- connection: plug-in terminals 101 and 102
- transmission protocol:
  - serial: ReadWin® 2000
  - parallel: open standard
- transmission rate: max. 57 600 baud

Optional: additional RS485 interface
- connection: plug-in terminals 103 and 104
- transmission protocol and transmission rate as standard interface RS485

Optional: Ethernet interface
- Ethernet interface: 10/100 BaseT
- connector type: RJ45
- connection via shielded cable
- issuing of IP address via setup menu in the device

Connection by interface with devices is possible only in office environment.

Safety distances: office device standard IEC 60950-1 must be taken into consideration.

Connection to a PC is possible via "crossover" cable.

Reference operating conditions

FML621 reference operating conditions
- power supply: 207 to 250 V_{AC} ±10 %, 50 Hz, ±0.5 Hz
- warm-up period: >30 min
- ambient temperature: 25 °C (77 °F), ±5 °C (±9 °F)
- air humidity: 39 % ±10 % r.h.

Reference operating conditions for special calibration and Liquiphant M Density
- medium: water H_2O
- medium temperature: 0 to 80 °C (32 to 176 °F), liquid not moved
- ambient temperature: 24 °C (75 °F) ±5 °C (±9 °F)
- humidity: max. 90 %
- warm-up period: >30 min

Performance characteristics

The accuracy described here refers to the entire density measuring line.

General measuring conditions for accuracy data
- measuring range: 300 to 2 000 kg/m³ (18.7 to 124.9 lb/ft³)
- distance between paddle and container wall and surface of liquid: > 50 mm (1.97 in)
- temperature sensor measured error: < 1 K
- maximum viscosity: 350 mPa·s (3.5 P)
- maximum flow velocity: 2 m/s (6.56 ft/s)
  - laminar flow, bubble-free (→ 29)
  - construction-specific measures like bypass or pipe enlargement for reduction must be put in place for higher flow velocities
- process temperature: 0 to +80 °C (32 to 176 °F) - validity of accuracy data
- power supply in accordance with specification FML621
- information in accordance with DIN EN 61298-2
- process pressure: −1 to 25 bar (−14.5 to 362.5 psi)

Maximum measured error

1 g/cm³ = 1 SGU (Specific Gravity Unit)
- standard adjustment: ±0.02 g/cm³ (±1.2 % of the span 1.7 g/cm³, under general measuring conditions)
- special adjustment: ±0.005 g/cm³ (±0.3 % of the span 1.7 g/cm³, under reference operating conditions)
- field adjustment: ±0.002 g/cm³ (in operating point)

Non-repeatability - reproducibility

1 g/cm³ = 1 SGU (Specific Gravity Unit)
- standard adjustment: ±0.002 g/cm³ (under general measuring conditions)
- special adjustment: ±0.0007 g/cm³ (under reference operating conditions)
- field adjustment: ±0.002 g/cm³ (in operating point)

Factors influencing accuracy data

- clean the sensor (CIP or SIP) at process temperatures of up to 140 °C (284 °F) over a long period
- all information on the accuracy of measuring viscosity of liquids refers to Newtonian liquids
- it is not possible to perform density measurement in liquids: gel, viscoelastic gel, non-Newtonian elastic, pseudoelastic and plastic-viscous liquids.

- long-term drift typ.: 0.02 kg/m³ (0.001 lb/ft³) per day
- temperature coefficient typ.: ±0.2 kg/m³ (±0.01 lb/ft³) per 10 K
- fluid velocity in pipes: >2 m/s (6.56 ft/s)
- buildup at the fork
- air bubbles in the case of vacuum applications
- incomplete coverage of the fork
- for pressure changes >6 bar (87 psi), a pressure measurement is required for compensation
- for temperature changes >1 K, a temperature measurement is required for compensation
- mechanical stress, e.g. deformation on the fork tines can impact accuracy and must be avoided
- the device subjected to mechanical stress must be replaced

Cyclic field adjustment can take place depending on the accuracy required.

FML621 installation instructions

Mounting location

Mount the device in a cabinet on top-hat rail IEC 60715.

Orientation

No restrictions.

Environment

Ambient temperature range

CAUTION

Extension cards generate extra heat.
Destruction of electronic components.
▶ Install an additional ventilation with a minimum air flow rate of 0.5 m/s (1.64 ft/s).

Temperature range: –20 to 50 °C (–4 to 122 °F).

Storage temperature

–30 to 70 °C (–22 to 158 °F)

Climate class

As per IEC 60654-1 Class B2 / EN 1434 Class "C" - no condensation permitted.

Electrical safety

As per IEC 61010-1: environment <2 000 m (6 560 ft) height above sea level.

Degree of protection

- basic unit: IP 20
- remote operating and display unit: front IP 65

Electromagnetic compatibility

Interference emission
IEC 61326 Class A

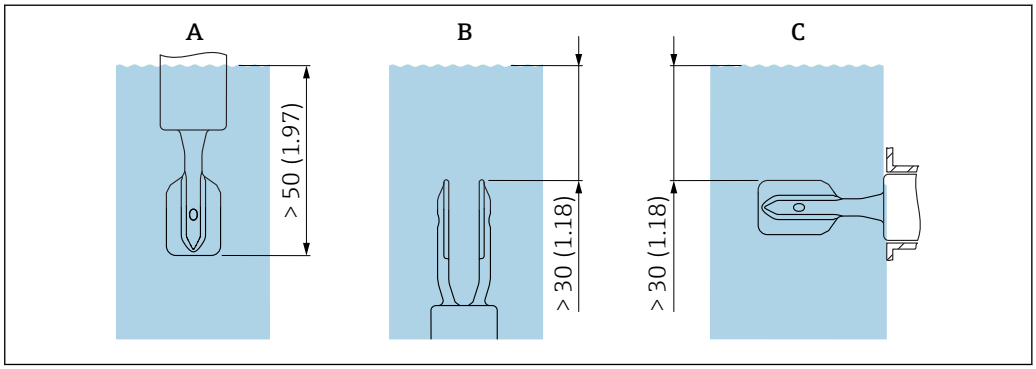
Interference immunity
- power failure: 20 ms, no influence
- starting current limitation: I_{max}/I_n <50 % (T 50 % ≤ 50 ms)
- electromagnetic fields: 10 V/m (3.048 V/ft) as per IEC 61000-4-3
- conducted HF: 0.15 to 80 Hz, 10 V10 V to IEC 61000-4-3
- electrostatic discharge: 6 kV contact, indirect as per IEC 61000-4-2
  - burst - power supply: 2 kV as per IEC 61000-4-4
  - burst - signal: 1 kV/2 kV as per IEC 61000-4-4
  - surge - power supply AC: 1 kV/2 kV as per IEC 61000-4-5
  - surge - power supply DC: 1 kV/2 kV as per IEC 61000-4-5
  - surge - signal: 0.5 kV/1 kV as per IEC 61000-4-5

Installation conditions for Liquiphant

The following information is supplemented by additional documentation on Liquiphant (→ 37).

Orientation

The mounting location must be selected such that the fork tines and the diaphragm are always immersed in the medium.



21 *Unit of measurement mm (in)*

A Top installation
B Bottom installation
C Side installation

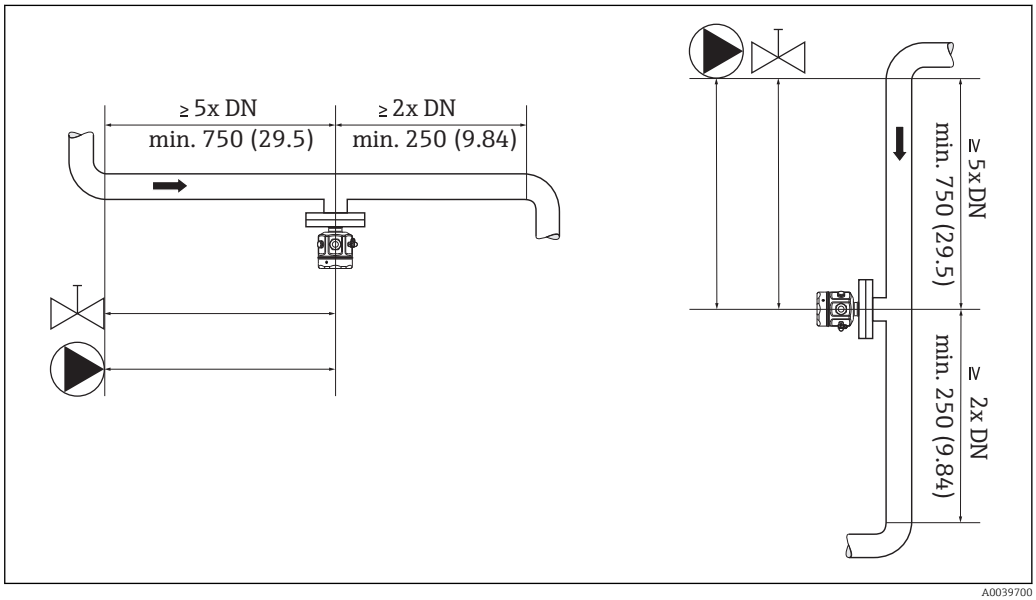
Inlet and outlet run

Inlet run

Install the sensor as far as possible from fittings such as: valves, T-sections, elbows, flange elbows, etc.

Compliance with the following requirements for the inlet run is necessary in order to ensure measuring accuracy:

Inlet run: ≥5x ND (nominal diameter) - min. 750 mm (29.5 in)



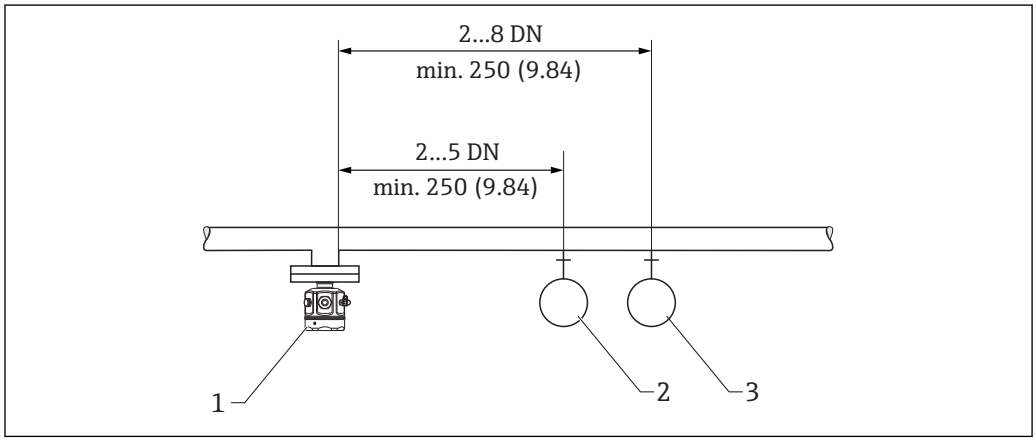
22 *Inlet run installation*

Outlet run

Compliance with the following requirements for the outlet run is necessary in order to ensure measuring accuracy:

Outlet run: ≥2x ND (nominal diameter) - min. 250 mm (9.84 in)

Pressure and temperature sensor must be installed downstream from the flow direction of the Liquiphant Density. When installing pressure and temperature measuring points downstream of the measuring device, make sure the distance between the measuring point and the measuring device is sufficient.



23 Outlet run installation

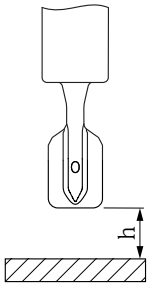
1 Liquiphant sensor
2 Pressure measuring point
3 Temperature measuring point

Mounting location and correction factor

The Liquiphant can be installed in containers, tanks or pipes.

Correction factor "r"

The vibrating fork tines of the Liquiphant Density device need free space to vibrate. The medium has to flow around the fork tines. The measurement result is affected if the distance between the fork tines and the tank or pipe wall is very small. The measurement error can be balanced by entering a correction factor "r".



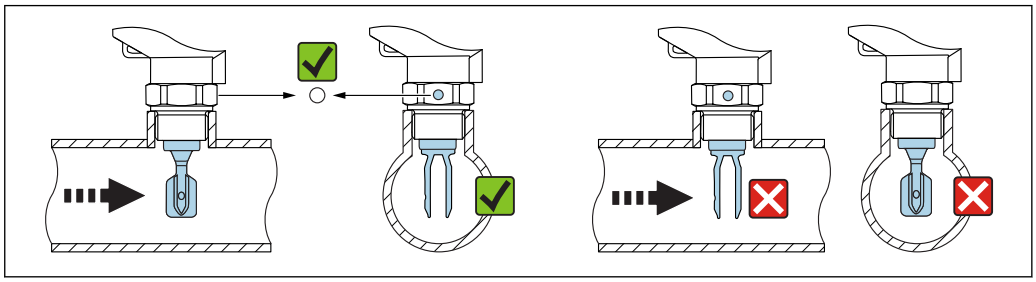
Unit of measurement mm (in)

	h	r
	12 mm (0.47 in)	1,0026
	14 mm (0.55 in)	1,0016
	16 mm (0.63 in)	1,0011
	18 mm (0.71 in)	1,0008
	20 mm (0.79 in)	1,0006
	22 mm (0.87 in)	1,0005
	24 mm (0.94 in)	1,0004
	26 mm (1.02 in)	1,0004
	28 mm (1.10 in)	1,0004
	30 mm (1.18 in)	1,0003
	32 mm (1.26 in)	1,0003
	34 mm (1.34 in)	1,0002
	36 mm (1.42 in)	1,0001
	38 mm (1.50 in)	1,0001
	40 mm (1.57 in)	1,0001

In pipe internal fittings, the fork tines of the Liquiphant must be aligned with the direction of flow. Otherwise, the measurement result can be distorted by vortexes and eddies.

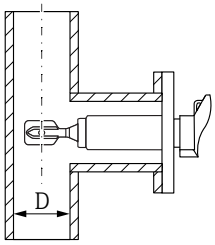
- A mark on the process connection indicates the position of the fork tines.
  Threaded connection = dot on the hexagon head; flange = two lines on the flange.
- The flow velocity of the medium may not exceed 2 m/s (6.56 ft/s) during the operation

In tanks with an agitator, the Liquiphant must be aligned in the direction of flow. Otherwise, the measurement result can be distorted by vortexes and eddies.



A0034851

24 Fork position and marking



A0039707

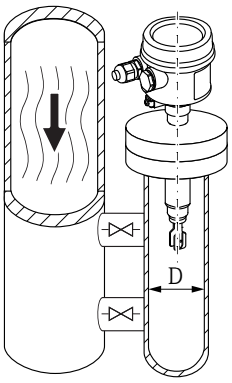
Unit of measurement mm (in)

D	r
<44 mm (1.73 in)	-
44 mm (1.73 in)	1,0225
46 mm (1.81 in)	1,0167
48 mm (1.89 in)	1,0125
50 mm (1.97 in)	1,0096
52 mm (2.05 in)	1,0075
54 mm (2.13 in)	1,0061
56 mm (2.20 in)	1,0051
58 mm (2.28 in)	1,0044
60 mm (2.36 in)	1,0039
62 mm (2.44 in)	1,0035
64 mm (2.52 in)	1,0032
66 mm (2.60 in)	1,0028
68 mm (2.68 in)	1,0025
70 mm (2.76 in)	1,0022
72 mm (2.83 in)	1,0020
74 mm (2.91 in)	1,0017
76 mm (2.99 in)	1,0015
78 mm (3.07 in)	1,0012
80 mm (3.15 in)	1,0009
82 mm (3.23 in)	1,0007
84 mm (3.31 in)	1,0005
86 mm (3.39 in)	1,0004
88 mm (3.46 in)	1,0003
90 mm (3.54 in)	1,0002
92 mm (3.62 in)	1,0002
94 mm (3.70 in)	1,0001
96 mm (3.78 in)	1,0001
98 mm (3.86 in)	1,0001

	D	r
	100 mm (3.94 in)	1,0001
	>100 mm (3.94 in)	1,0000

Pipe nominal diameters with internal measurements <44 mm (1.73 in) is not permitted!

If the flow in the pipes is strong, 2 to 5 m/s (6.56 to 16.4 ft/s), or in the event of turbulent surfaces in tanks, construction specific measures for the reduction of the turbulence at the sensor must be put in place. The Liquiphant Density can be installed in a bypass or in a pipe with a larger diameter for this purpose.

	D	r
 A0039689 *Unit of measurement mm (in)*	<44 mm (1.73 in)	-
	44 mm (1.73 in)	1,0191
	46 mm (1.81 in)	1,0162
	48 mm (1.89 in)	1,0137
	50 mm (1.97 in)	1,0116
	52 mm (2.05 in)	1,0098
	54 mm (2.13 in)	1,0083
	56 mm (2.20 in)	1,0070
	58 mm (2.28 in)	1,0059
	60 mm (2.36 in)	1,0050
	62 mm (2.44 in)	1,0042
	64 mm (2.52 in)	1,0035
	66 mm (2.60 in)	1,0030
	68 mm (2.68 in)	1,0025
	70 mm (2.76 in)	1,0021
	72 mm (2.83 in)	1,0017
	74 mm (2.91 in)	1,0014
	76 mm (2.99 in)	1,0012
	78 mm (3.07 in)	1,0010
	80 mm (3.15 in)	1,0008
	82 mm (3.23 in)	1,0006
	84 mm (3.31 in)	1,0005
	86 mm (3.39 in)	1,0004
	88 mm (3.46 in)	1,0003
	90 mm (3.54 in)	1,0003
	92 mm (3.62 in)	1,0002
	94 mm (3.70 in)	1,0002
	96 mm (3.78 in)	1,0001
	98 mm (3.86 in)	1,0001
	100 mm (3.94 in)	1,0001
	>100 mm (3.94 in)	1,0000

Ambient conditions for Liquiphant Density

Ambient temperature range

−40 to 70 °C (−40 to 158 °F)

For further information on use in hazardous areas (ATEX) (→ 37).

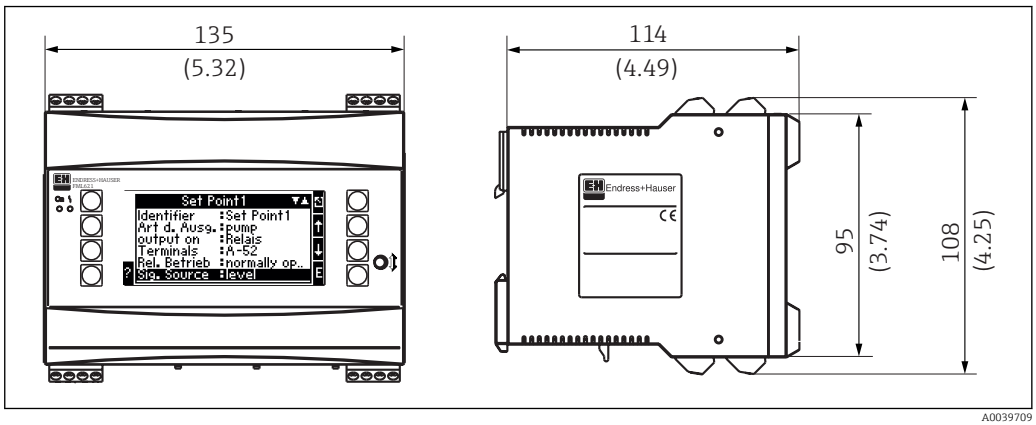
Mechanical construction

Terminals

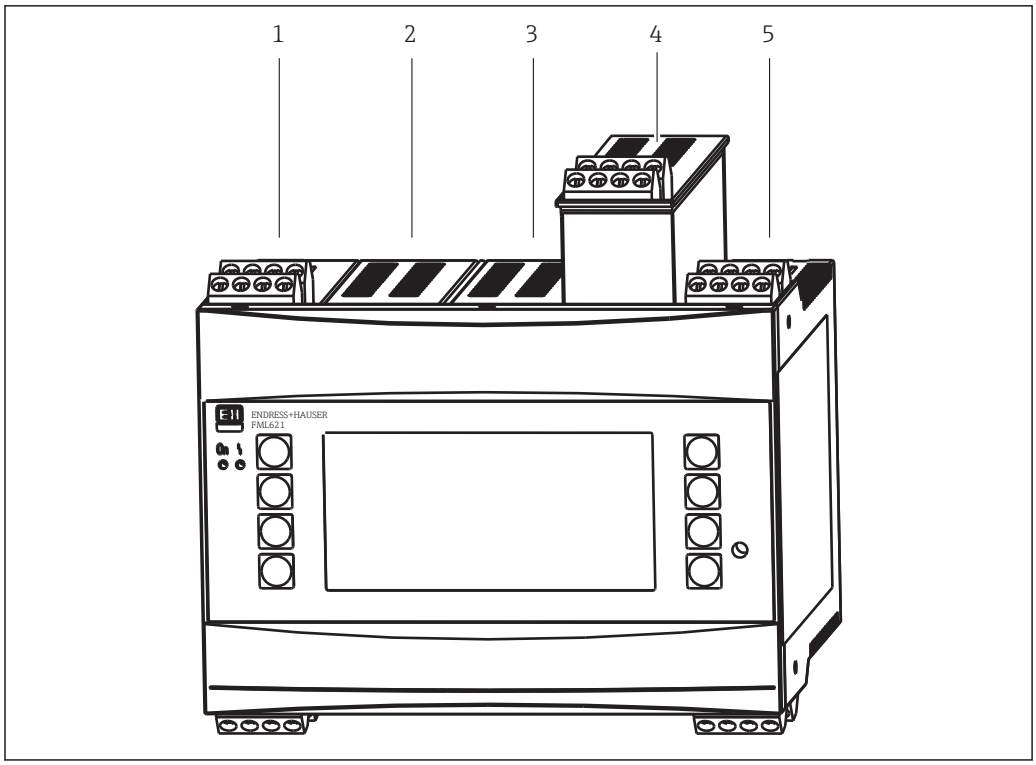
Pluggable screw terminals - power supply terminal coded. The clamping area 1.5 mm² (16 AWG) solid, 1 mm² (18 AWG) flexible with ferrules - applies to all connections.

Design

Dimensions



25 Housing for top-hat rail as per IEC 60715



26 *The device with additional extension cards*

1 *Slot A*
2 *Slot B - an extension card*
3 *Slot C - an extension card*
4 *Slot D - an extension card*
5 *Slot E*

Weight

Basic unit:
500 g (17.6 oz). Weight with all additional extension cards.

Remote operating unit:
300 g (10.6 oz).

Material

Housing:
Polycarbonate plastic, UL 94V0.

Display and operating elements

- an operating and display unit is absolutely essential for field adjustment.
- an operating and display unit can also be used for commissioning Density Computer FML621.
- the operating and display unit can also be used for a number of devices.

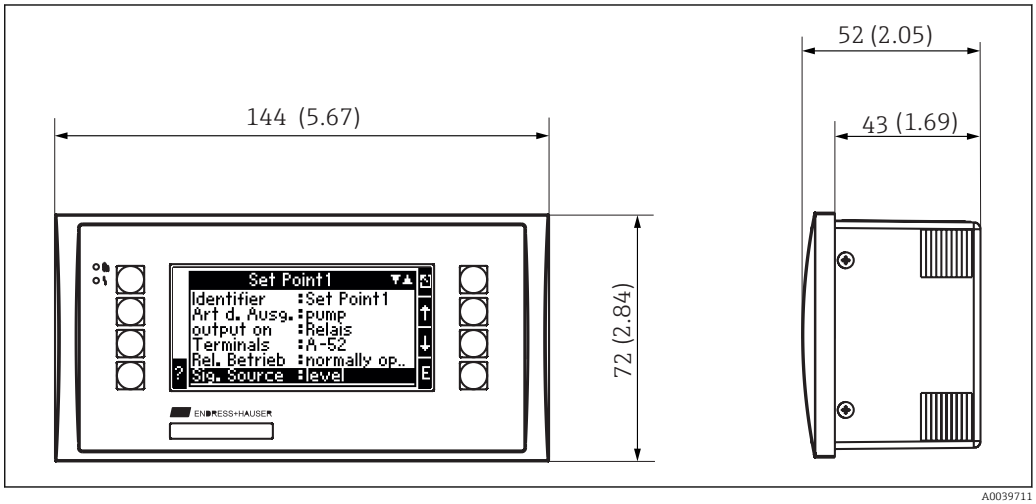
Display elements

Display
160x80 DOT matrix LCD with blue background lighting. The background light color changes to red in the event of an error. The background color is configurable.

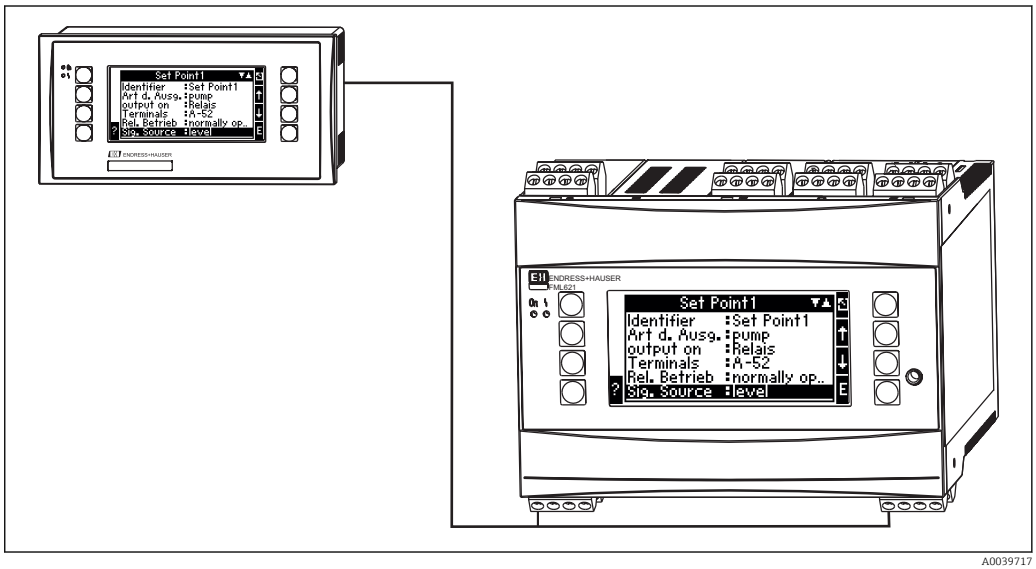
LED status display
- operation: 1x green 2 mm (0.08 in)
- fault message: 1x red 2 mm (0.08 in)

Operating and display unit - optional or as accessory

- an operating and display unit can be additionally connected to the device in the panel mounting housing with dimensions:
  - W: 144 mm (5.67 in)
  - H: 72 mm (2.83 in)
  - D: 43 mm (1.69 in)
- the connection to the integrated RS484 interface is made using the connecting cable, length = 3 m (9.84 ft) is included in the accessories kit
- parallel operation of the operating and display unit with a device-internal display in the FML621 is possible



27 *Operating and display unit for panel mounting*



28 *Operating and display unit in panel mounting housing*

1 Operating or display unit
2 Base unit

Operating elements

Eight front-panel soft keys interact with the display. The key functions are shown on the display.

Remote operation

- RS232 interface via mini jack socket 3.5 mm (0.14 in), configuration using PC and software ReadWin® 2000 PC
- RS485 interface

Real time clock

- deviation: 30 min per year
- power reserve: 14 days

Certificates and approvals

CE mark

The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

Ex approval

Available Ex approvals: see Product Configurator

All explosion protection data are given in a separate documentation available on demand.

Other standards and guidelines

IEC 60529
Degrees of protection provided by enclosures (IP code)

IEC 61010
Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures

EN 61326 series
EMC product family standard for electrical equipment for measurement, control and laboratory use

NAMUR
User association of automation technology in process industries

Ordering information

Detailed ordering information is available from the following sources:

- in the *Product Configurator* on the Endress+Hauser website: www.endress.com -> Click *Corporate* -> Select your country -> Click *Products* -> Select the product using the filters and search field -> Open product page -> The *Configure* button to the right of the product image opens the Product Configurator.
- from your Endress+Hauser Sales Center: www.addresses.endress.com.

Product Configurator - the tool for individual product configuration

- up-to-the-minute configuration data
- depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- automatic verification of exclusion criteria
- automatic creation of the order code and its breakdown in PDF or Excel output format
- ability to order directly in the Endress+Hauser Online Shop

Accessories

General

RXU10-A1
Cable set for FML621 for connecting to a PC or modem

FML621A-AA
Remote display for panel mounting:
- W: 144 mm (5.67 in)
- H: 72 mm (2.83 in)
- D: 43 mm (1.69 in)

RMS621A-P1
PROFIBUS Interface

51004148
Adhesive label, printed, max. 2x 16 characters

51002393
Metal plate for TAG number

51010487
Plate, paper, TAG 3x 16 characters

Extension cards

The device can be extended with a maximum of 3 universal or digital or current or Pt100 cards.

FML621A-DA
Digital
- 6x digital input
- 6x relay output
- kit including terminals and fixing frame

FML621A-DB
Digital, ATEX approved
- 6x digital input
- 6x relay output
- kit including terminals

FML621A-CA
2x U, I, TC
- 2x 0 to 20 mA or 4 to 20 mA per pulse
- 2x digital
- 2x relay SPST

FML621A-CB
Multifunction, 2x U, I, TC ATEX
- 2x 0 to 20 mA or 4 to 20 mA per pulse
- 2x digital
- 2x relay SPST

FML621A-TA
Temperature (Pt100/Pt500/Pt1000)
complete, including terminals and fixing frame

FML621A-TB
Temperature, ATEX approved (Pt100/PT500/PT1000)
complete, including terminals

FML621A-UA
Universal - PFM or pulse or analog or transmitter power supply unit
complete, incl. terminals and fixing frame

FML621A-UB
Universal ATEX approved - PFM or pulse or analog or transmitter power supply unit
complete, including terminals

Documentation

The following documentation types are available in the Downloads of the Endress+Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

Operating Instructions (BA)

Your reference guide
These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

www.addresses.endress.com

Endress+Hauser

People for Process Automation