Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Liquiphant M Density and Density Computer FML621

Density computer for liquids.
Also for use in hazardous areas.

Sensor versions with electronic insert FEL50D

FTL50:
Compact design, ideal for mounting in pipes and for installation in areas difficult to access

FTL51:
With extension pipe up to 3 m

Highly corrosion-resistant Alloy C4 (2.4610) is available for the tuning fork and process connection for applications in very aggressive liquids.

FTL50H, FTL51H:
With polished tuning fork and easy-to-clean process connections and housings for food and pharmaceutical applications.

FTL51C:
All the wetted parts are available with a wide range of coatings, such as enamel, PFA and ECTFE, and are thus suitable for use in very aggressive liquids.

International approvals certify use in hazardous areas.

Applications

The density measuring line can be used in liquid media. It is used for the following purposes:
- Density measurement
- 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.

In conjunction with Liquiphant M Density with electronic insert FEL50D, the Density Computer FML621 returns a continuous density measured value. Furthermore, values can be converted to Baumé, °Brix etc.
Additional software modules, such as determining the reference density, intelligent medium differentiation and concentration identification, support the user in monitoring the quality for example.
The tables for converting density to concentration must be provided by the customer.

Your benefits

- Measurement used directly in tanks or pipes without the need for additional pipework
- Large number of process connections to choose from: universal usage
- Integration of existing temperature measurements for temperature compensation
- No mechanically moving parts: no maintenance, no wear, long operating life
- Pump protection can be provided with the same process connection
- Additional calculations, such as the concentration of a product, can be performed in the Density Computer FML621
- The integrated data logger supports users with data during operation and servicing
- Hygiene-compliant solutions with EHEDG and 3A approvals

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People for Process Automation

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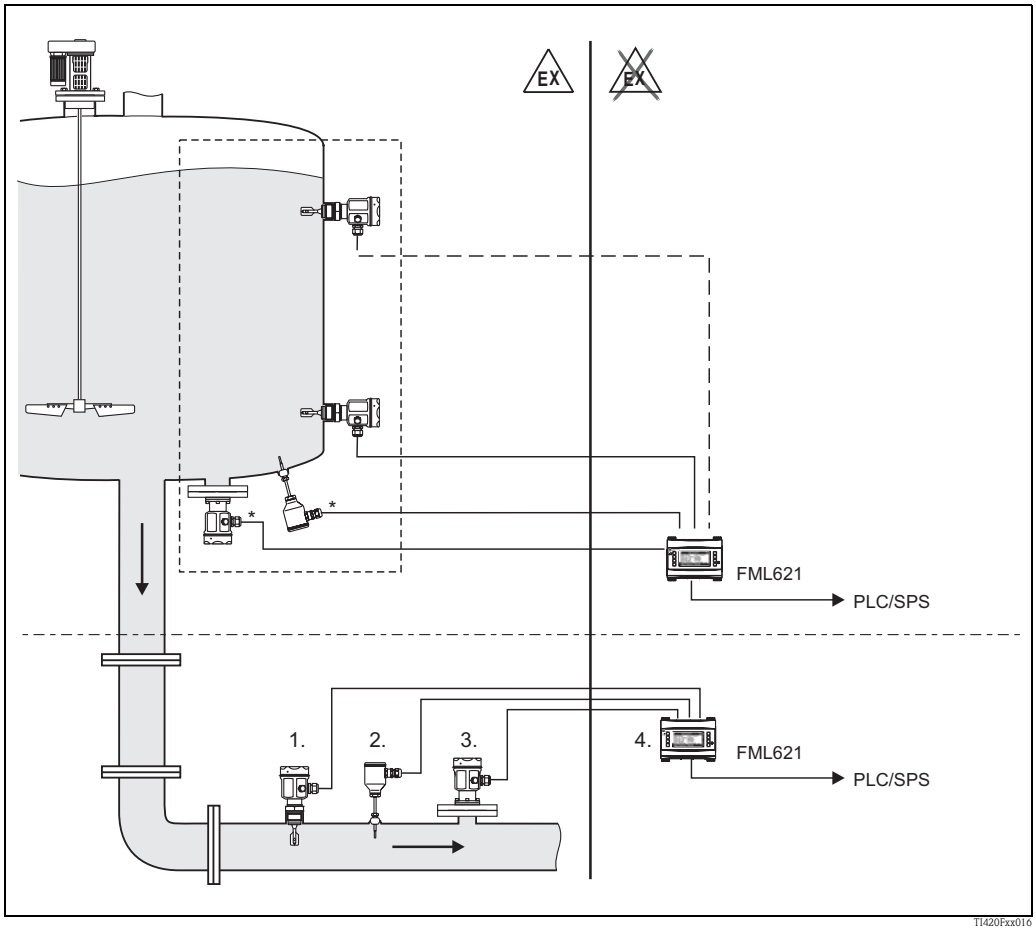
Application

Density measurement

Measuring the density of a liquid medium in pipes and tanks. Also suitable for use in hazardous areas, and preferably for applications in the chemical and food industry.



** Pressure and temperature information required depending on the application.*
1. Liquiphant M sensor with electronic insert FEL50D (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

Note!
The measurement can be affected by:
- Air bubbles at the sensor
- Unit not fully covered by medium
- Solid media buildup on sensor
- High fluid velocity in pipes
- Severe turbulence in the pipe due to inlet and outlet runs that are too short (see Installation conditions)
- Corrosion of the fork

Application examples

Basic unit:

Application	Product structure	Number of inputs	Number of outputs	Comment
1 density measuring line Pressure and temperature-compensated	FML621-xxxAAAxxxx	4x pulse input / 0/4 to 20 mA	1x relay SPST, 2x 0/4 to 20 mA	1 Liquiphant M with FEL50D 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	FML621-xxxAAAxxxx	4x pulse input / 0/4 to 20 mA	1x relay SPST, 2x 0/4 to 20 mA	2 Liquiphant M with FEL50D 2 temperature transmitter 4 to 20 mA 1 output: density 4 to 20 mA 1 output: temperature 4 to 20 mA

Basic unit + 2 extension cards:

Application	Product structure	Number of inputs	Number of outputs	Comment
3 density measuring lines 2x temperature-compensated 1x pressure and temperature-compensated	FML621-xxxBBAxxxx	8x pulse input / 0/4 to 20 mA	5x relay SPST, 6x 0/4 to 20 mA	3 Liquiphant M with FEL50D 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

Medium detection (e.g. with relay):

Application	Product structure	Use of inputs	Information content	Comment
Distinguish between 2 media	FML621-xxxAAAxxxx Basic unit	1x FEL50D 1x temperature 4 to 20 mA	1 output: density 4 to 20 mA 1 output: temperature 4 to 20 mA 1 relay to switch the storage tank, for example	The medium detection can refer to concentrations or phase transitions.
Distinguish between 3 media	FML621-xxxBAAxxxx Basic unit with additional relay card	1x FEL50D 1x temperature 4 to 20 mA	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	The relays can activate subsequent processes by triggering actuators.

Density:

Application	Product structure	Use of inputs	Information content	Comment
Density measurement or concentration calculation with pump protection	FML621-xxxAAAxxxx Basic unit	1x FEL50D 1x temperature 4 to 20 mA	1 output: density 4 to 20 mA 1 output: concentration 4 to 20 mA 1 relay to switch off the pump	In addition to determining the density and concentration, pump protection can also be implemented by setting the appropriate switching frequency.

Density in conjunction with other measuring principles:

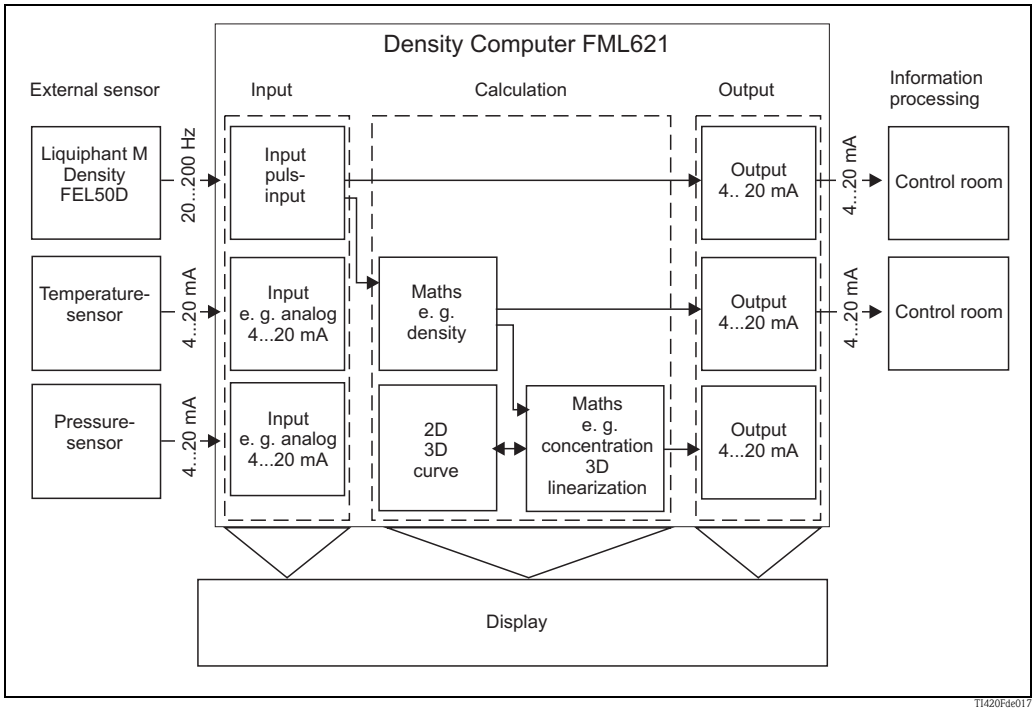
Application	Product structure	Use of inputs	Information content	Comment
Determining the mass of the tank contents and monitoring the validity of the measurement	FML621-xxxBAAxxxx Basic unit with additional extension card Analog	1x FEL50D 1x temperature 4 to 20 mA 1x Micropilot FMR240	1 output: mass 1 output: density 4 to 20 mA 1 output: level 4 to 20 mA Depending on the level information, 1 relay reports whether the measurement is valid	Thanks to the integrated mathematics function, the density measurement can calculate the mass of the medium with the level information.

Function and system design

Measuring principle

A piezoelectric drive excites the tuning fork of the Liquiphant M Density to its resonance frequency. If the density of the liquid medium changes, 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, for example, can be calculated.

System design



Specific density applications

Software modules are available which can calculate the density from the frequency, temperature and pressure input variables.

Operating principle

The vibrating frequency of the tuning fork is reduced when completely covered with liquid.
The corresponding density of the medium can be calculated using other information, such as the temperature and pressure (optional). 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 reference temperature, compute the concentrations or detect media.

Reference density

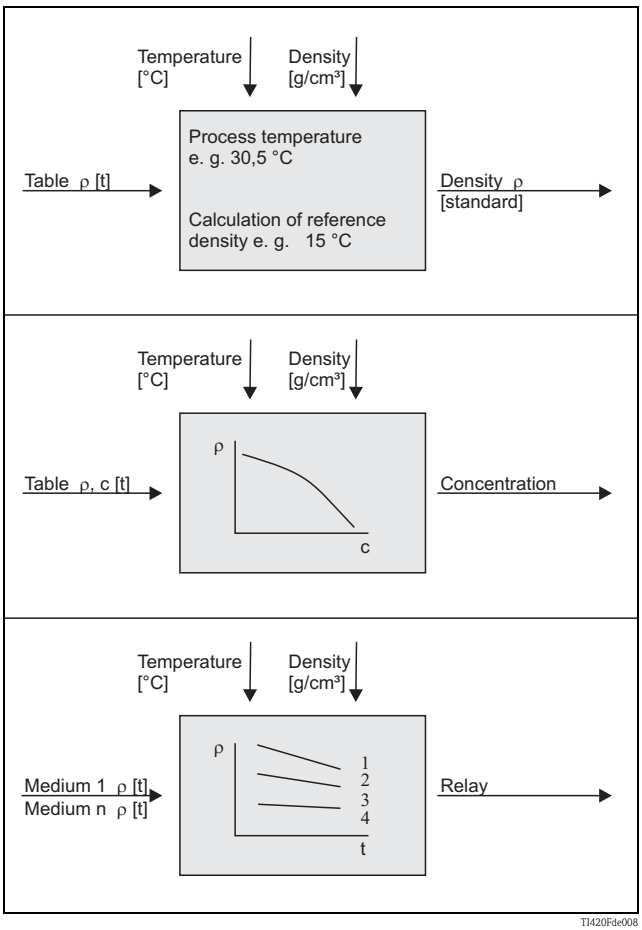
In this module, the system refers back to a reference temperature, such as 15 °C or 20 °C.
It must be known how the density of the medium changes at different temperatures.

Concentration

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

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 or two different concentrations.



Measuring system

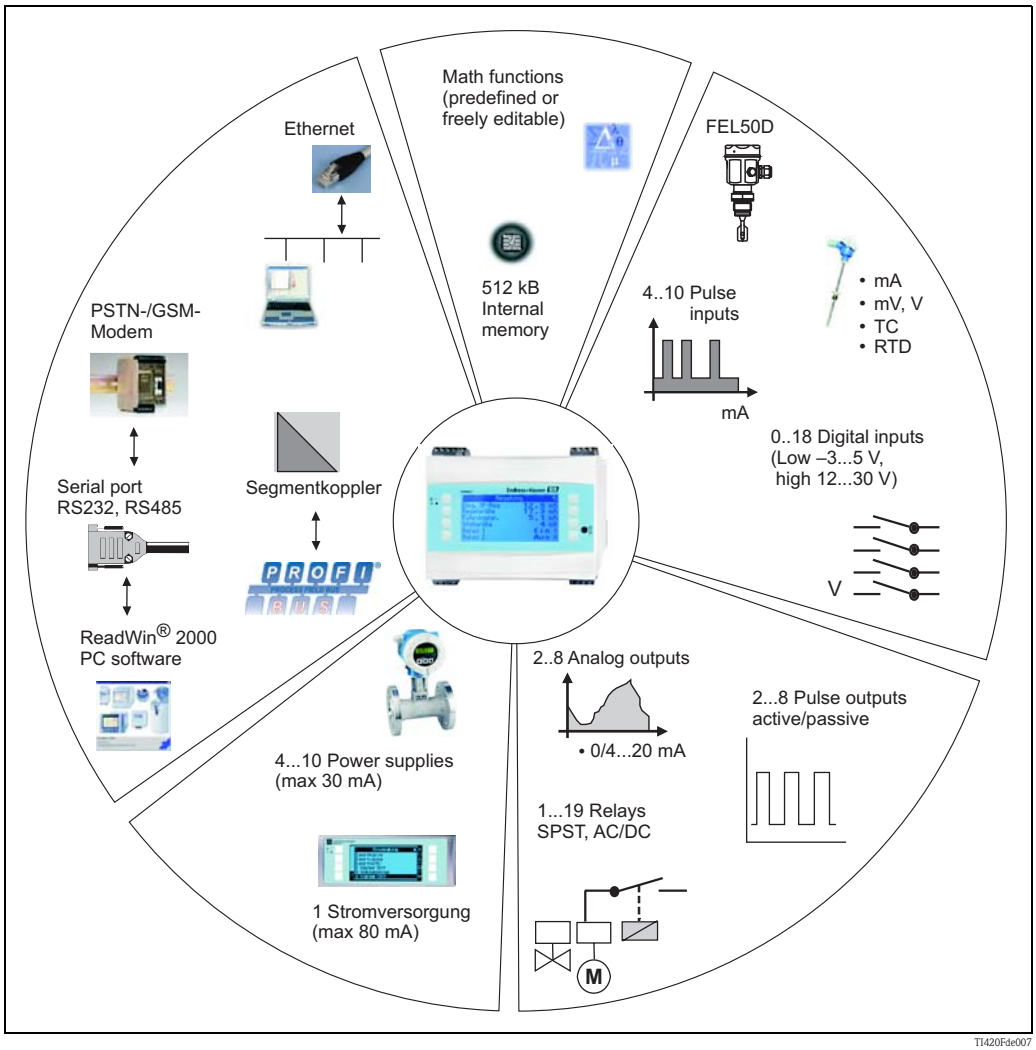
The FML621 supplies power directly to two-wire transmitters connected. Intrinsically safe inputs and transmitter power supply units (for current cards) are optionally available for Ex-applications.
The inputs, outputs, limit values and display are configured, and the device is commissioned and serviced, via 8 soft keys with the backlit dot-matrix display, using an RS232/RS485 interface or PC software ReadWin® 2000. Online Help facilitates local operation.

The configurable change in color of the background illumination signals limit value violations or faults. The function of the device can be extended at any time using extension cards. This also applies to use in the hazardous area.
To use the telealarm function, we recommend common industrial modems that have an RS232 interface. The measured values and events/alarms are coded in accordance with the serial protocol and then transmitted (protocol can be requested).

Note!
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 M with electronic insert FEL50D 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.



Design

Note!
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 (at www.endress.com) are listed on → Page 36.

Density Computer FML621

Liquiphant M Density FTL50
Compact; and with AlloyC4 for use in aggressive liquids

Liquiphant M Density FTL51
With extension pipe; and with AlloyC4 for use in aggressive liquids

Liquiphant M Density FTL50H
Compact; with polished tuning fork and hygienic process connections

Liquiphant M Density FTL51H
With extension pipe; with polished tuning fork and hygienic process connections

Liquiphant M Density FTL51C
With extension pipe; and with various coatings for use in aggressive liquids

Electronic insert (Liquiphant M) for density measurement

Liquiphant M Density FEL50D
For Density Computer FML621; two-wire pulse output;
Current pulses superimposed on the power supply along the two-wire cabling.

Input

Input

Measured variable

Voltage (analog and digital input), current (analog input), PFM, pulse input

Note!
Only Endress+Hauser flow sensors can be connected to the PFM input.
Not suitable for level and pressure measuring instruments.

Input signal

Any measured variables (e.g. flow, level, pressure, temperature, density), implemented as an analog signal.

Measuring range

Measured variable	Input		
Current	■ 0/4 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)	■ 0/4 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 (0.0056 %/ °F)		
PFM/pulse input	■ Frequency range 0.01 to 18 kHz ■ Signal level – low: 2 to 7 mA; – high: 13 to 19 mA ■ Measurement method: period length/frequency measurement ■ Accuracy 0.01% of measured value ■ Temperature drift 0.01% over entire temperature range ■ Signal level 2 to 7 mA low; 13 to 19 mA high with approx. 1.3 kΩ dropping resistor at max. 24 V voltage level		
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: – 4 x 4 Hz – 2 x 20 kHz or 2 x 4 Hz		
Voltage (analog input)	■ Voltage: 0 to 10 V, 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 (RTD) as per ITS 90	Identifier	Measuring range	Accuracy (4-wire connection)
	Pt100	–200 to 800 °C (–328 to 1472 °F)	0.03% of full scale value
	Pt500	–200 to 250 °C (–328 to 482 °F)	0.1% of full scale value
	Pt1000	–200 to 250 °C (–328 to 482 °F)	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)		

Measured variable	Input		
Thermocouples (TC)	Type	Measuring range	Accuracy
	J (Fe-CuNi), IEC 584	–210 to 999.9 °C (–346 to 1832 °F)	± (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	–200 to 1372 °C (–328 to 2502 °F)	± (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	–270 to 400 °C (–454 to 752 °F)	± (0.15% oMR +0.5 K) as of –200 °C ± (0.15% oMR +0.9 °F) as of –328 °F
	N (NiCrSi-NiSi), IEC 584	–270 to 1300 °C (–454 to 1386 °F)	± (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	0 to 1820 °C (32 to 3308 °F)	± (0.15% oMR +1.5 K) as of 600 °C ± (0.15% oMR +2.7 °F) as of 1112 °F
	D (W3Re/W25Re), ASTME 998	0 to 2315 °C (32 to 4199 °F)	± (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	0 to 2315 °C (32 to 4199 °F)	± (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	–200 to 900 °C (–346 to 1652 °F)	± (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	–200 to 600 °C (–328 to 1112 °F)	± (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	0 to 1768 °C (32 to 3214 °F)	± (0.15% oMR +3.5 K) for 0 to 100 °C ± (0.15% oMR +1.5 K) for 100 to 1768 °C ± (0.15% oMR +6.3 °F) for 0 to 212 °F ± (0.15% oMR +2.7 °F) for 212 to 3214 °F
	R (Pt13Rh-Pt), IEC 584	–50 to 1768 °C (–58 to 3214 °F)	± (0.15% oMR +3.5 K) for 0 to 100 °C ± (0.15% oMR +1.5 K) for 100 to 1768 °C ± (0.15% oMR +6.3 °F) for 0 to 212 °F ± (0.15% oMR +2.7 °F) for 212 to 3214 °F
	Internal temperature compensation error: ≤ 3 °C (5.4 °F) Temperature drift: 0.01% / K (0.0056% / °F)		

Galvanic isolation

The inputs are galvanically isolated between the individual extension cards and the basic unit (see also 'Galvanic isolation' under Output.)

Note!
With digital inputs, every terminal block is galvanically isolated from one another.

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).

Note!
The specified insulation 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 variable	Output
Current	■ 0/4 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 1000 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 1000 ms
Number	Number: ■ 2 x 0/4 to 20 mA/pulse (in basic unit) ■ With Ethernet option: no current output present in the basic unit Max. number: ■ 8 x 0/4 to 20 mA/pulse (depends on the number of extension cards) ■ 6 x digital passive (depends on the number of extension cards)
Signal sources	All available multifunctional inputs (current, PFM or pulse inputs) and results from mathematic calculations can be freely allocated to the outputs.

Switching output

Function

Limit relay switches in the operating modes: minimum/maximum safety, gradient, alarm, frequency/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

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

Switching frequency

Max. 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

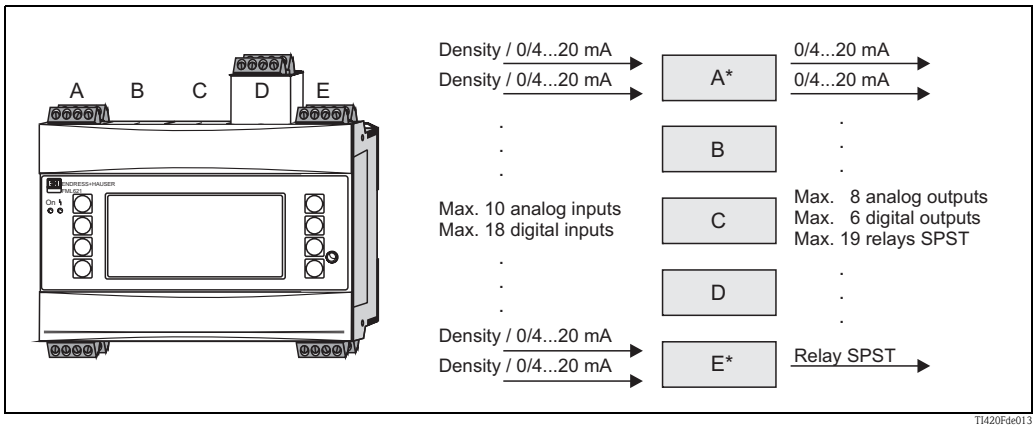
1 relay (in the basic unit)
Max. number: 19 relays (depends on the number and type of extension cards)

Transmitter power supply and external power supply

- Transmitter power supply unit (MUS), terminals 81/82 or 81/83 (optional power extension cards 181/182 or 181/183):
  Max. output voltage 24 V DC ±15%
  Impedance < 345 Ω
  Max. loop current 22 mA (at U_{out} > 16 V)
- FML621 technical data:
  HART® communication is not impaired
  Number: 4 MUS in the basic unit
  Max. number: 10 (depends on the number and type of extension cards)
- Additional power supply (e.g. external display), 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/block circuit diagram

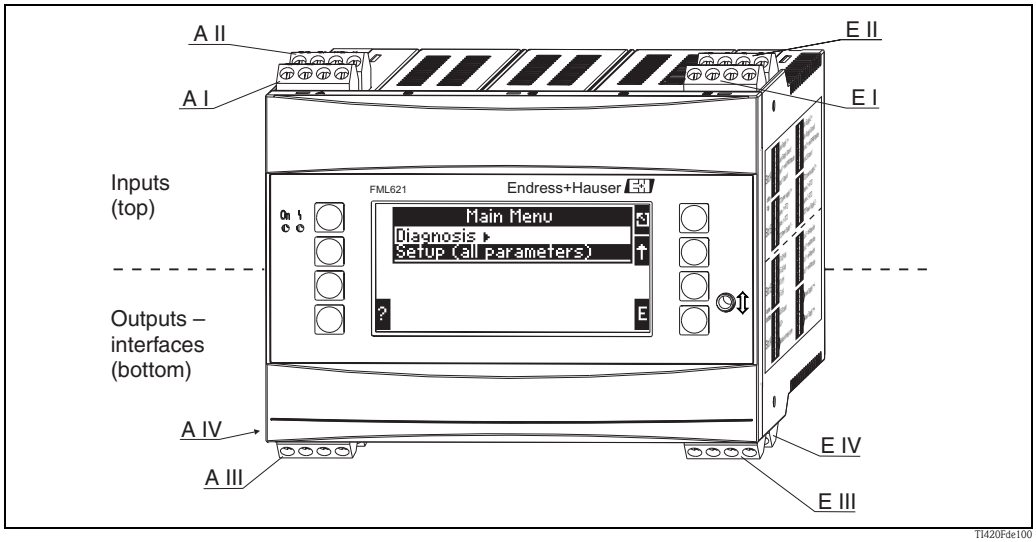


Device with extension cards (available as an option or as an accessory)
- Slots A and E are integral parts of the basic unit
- Slots B, C and D can be expanded with extension cards

** IO card available in the basic unit*

Caution!
Do not install or wire the device when it is connected to the power supply. Not conforming with this can lead to the destruction of electronic components.

Terminal assignment



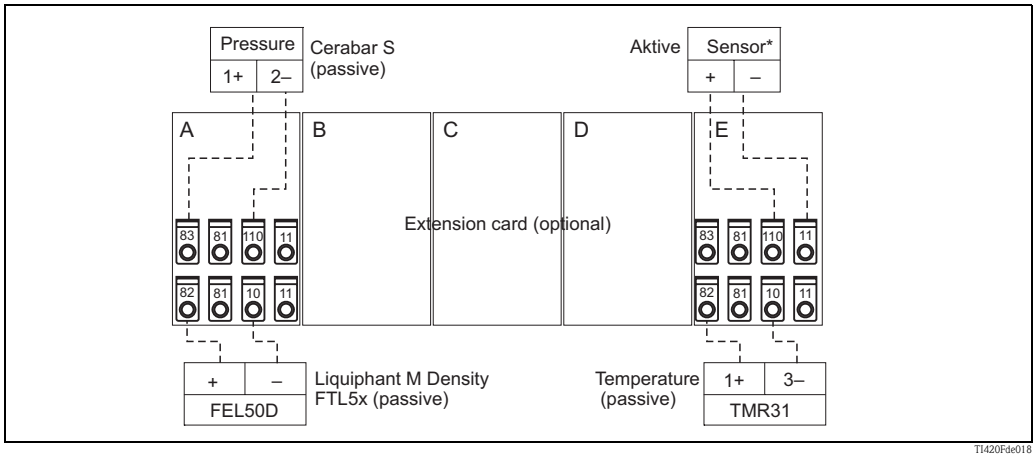
Slot assignment (basic unit)

Terminal (item no.)	Terminal assignment	Slot	Input
10	+ 0/4 to 20 mA/PFM/pulse input 1	A top, front (**A I**)	Current/PFM/pulse input 1
11	Ground for 0/4 to 20 mA/PFM/pulse input		
81	Sensor power supply ground 1		
82	24 V sensor power supply 1		
110	+ 0/4 to 20 mA/PFM/pulse input 2	A top, rear (**A II**)	Current/PFM/pulse input 2
11	Ground for 0/4 to 20 mA/PFM/pulse input		
81	Sensor power supply ground 2		
83	24 V sensor power supply 2		

Terminal (item no.)	Terminal assignment	Slot	Input
10	+ 0/4 to 20 mA/PFM/pulse input 1	E top, front (**E I**)	Current/PFM/pulse input 1
11	Ground for 0/4 to 20 mA/PFM/pulse input		
81	Sensor power supply ground 1		
82	24 V sensor power supply 1		
110	+ 0/4 to 20 mA/PFM/pulse input 2	E top, rear (**E II**)	Current/PFM/pulse input 2
11	Ground for 0/4 to 20 mA/PFM/pulse input		
81	Sensor power supply ground 2		
83	24 V sensor power supply 2		
Terminal (item no.)	**Terminal assignment**	**Slot**	**Output - interface**
101	- RxTx 1	E bottom, front (**E III**)	RS485
102	+ RxTx 1		
103	- RxTx 2		RS485 (optional)
104	+ RxTx 2		
131	+ 0/4 to 20 mA/pulse output 1	E bottom, rear (**E IV**)	Current/pulse output 1
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2
134	- 0/4 to 20 mA/pulse output 2		Note! Ethernet, if the Ethernet option has been ordered.
52	Relay Common (COM)	A bottom, front (**A III**)	Relay 1
53	Relay Normally Open (NO)		
91	Sensor power supply ground		Additional sensor power supply
92	+ 24 V sensor power supply		
L/L+	L for AC L+ for DC	A bottom, rear (**A IV**) Power supply	
N/L-	N for AC L- for DC		

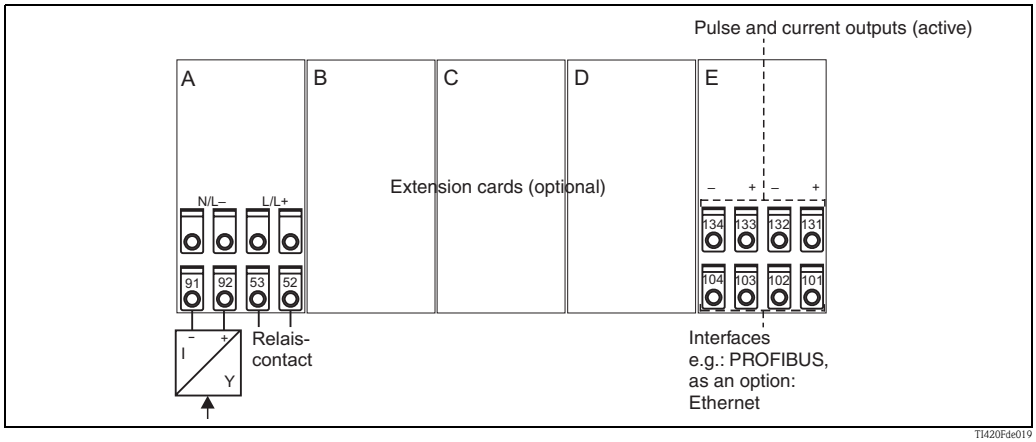
Note!
The inputs in the same slot are not galvanically isolated. There is a separation voltage of 500 V between the aforementioned inputs and outputs in various slots. Terminals with the same second digit are jumpered internally (Terminals 11 and 81).

Connection overview, top (inputs)



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

Connection overview, bottom (outputs, interfaces)

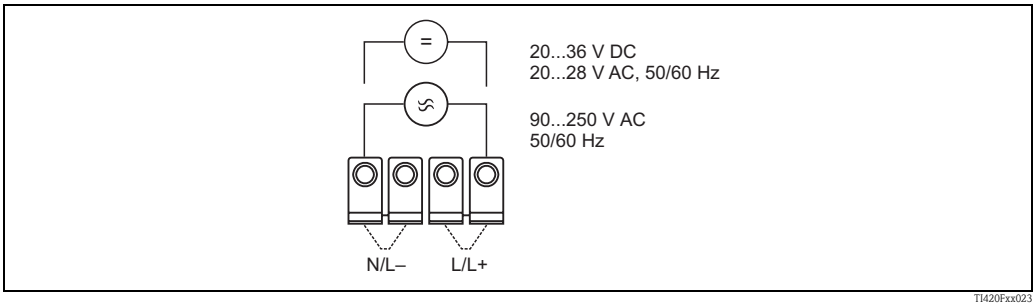


** Active sensor: passing on temperature information from a PLC can be taken as an example for connecting an active sensor.*

Note!
With the Ethernet option, no current output and no pulse output is available at slot E!

Connecting the power supply

Caution!
- Before wiring the device, ensure that the supply voltage corresponds to the specification on the nameplate.
- For the 90 to 250 V AC version (power supply connection), a switch marked as a separator, as well as a fuse (rated current = 10 A), must be fitted in the supply line near the device (easy to reach).



Power supply connection

Connecting external sensors

Note!
Active and passive sensors with analog, PFM or pulse signals can be connected to the device.

Passive sensors

Connection diagram for sensors to which power is supplied via the sensor power supply integrated in the device, e.g. Liquiphant M FEL50D, temperature sensor 4 to 20 mA.

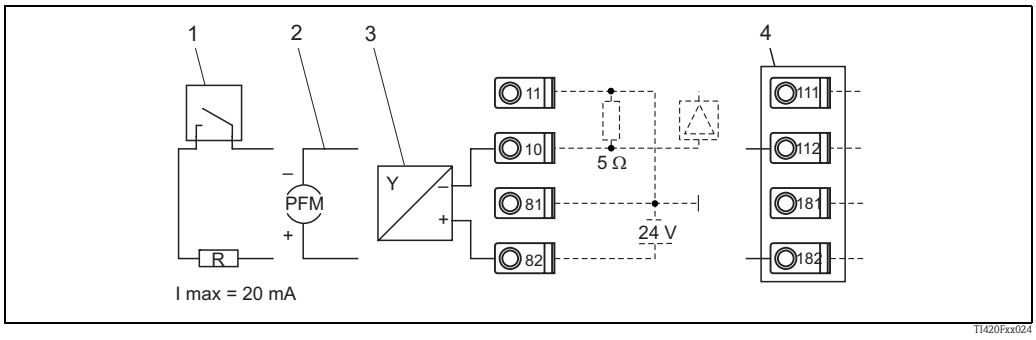
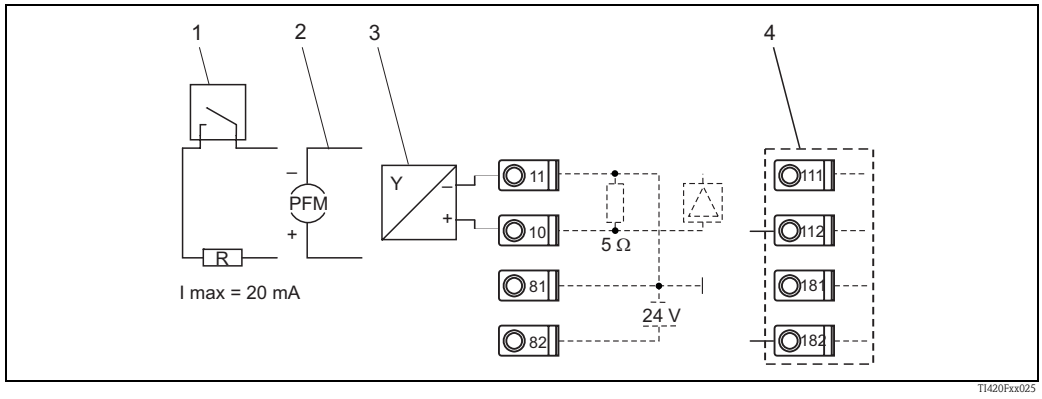


Fig. 1: Connecting a passive sensor, e.g. to input 1 (slot A I).

Item 1: pulse signal, e.g. Liquiphant M (FEL50D)
Item 2: PFM signal
Item 3: 2-wire transmitter (4 to 20 mA), passive
Item 4: optional Universal extension card in slot B (slot B I)

Active sensors

Connection diagram for an active sensor (i.e. external power supply).



Connecting an active sensor, e.g. to input 1 (Slot A I).

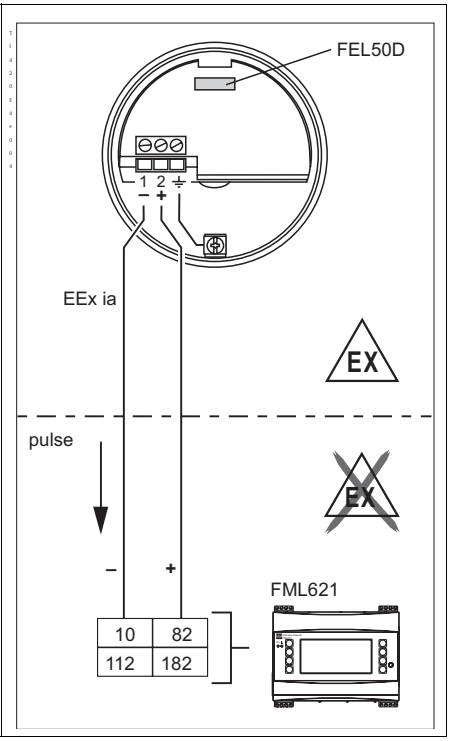
Item 1: pulse signal, e.g. Liquiphant M (FEL50D)
Item 2: PFM signal
Item 3: 2-wire transmitter (4 to 20 mA), active
Item 4: optional Universal extension card in slot B (slot B I)

Liquiphant M Density with electronic insert FEL50D

Two-wire connection at Density Computer FML621
For connecting to 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.

Caution!
Operation with other switching units,
such as FTL325P, is not permitted.
This electronic insert cannot be installed in devices that were originally used as a limit switch.



Signal on alarm

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

Calibration

In the Liquiphant M modular system, the option of an extended calibration is also provided in addition to the electronics (special calibration, density H_2O) (see feature 60: "Accessories").

There are three types of calibration:

Standard calibration (see TI328F, 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 calibration report with the product. These parameters must be transmitted to the Density Computer FML621.

Special calibration (see TI328F, ordering information for additional fittings, special calibration, density H_2O (K) or special calibration, 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 calibration report with the product. These parameters must be transmitted to the Density Computer FML621.
  This type of calibration achieves an even greater level of accuracy (see also "Performance characteristics").

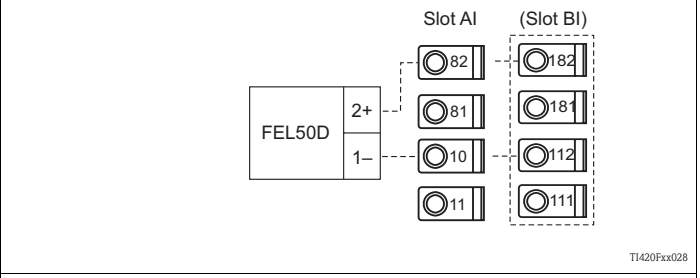
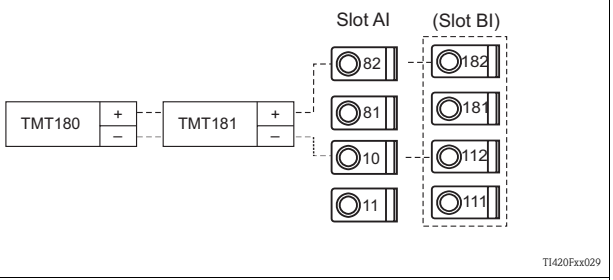
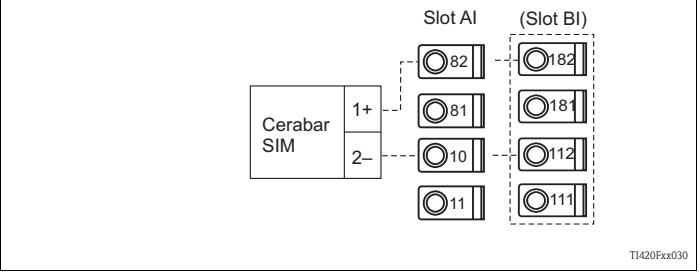
Field calibration
- During field calibration, the density value determined by the customer for wet calibration is used.

Note!
More information on Liquiphant M is provided in the following documents (Technical Information):
- Liquiphant M FTL50, FTL51 (for standard applications): TI328F/00
- Liquiphant M FTL50H, FTL51H (for hygiene applications): TI328F/00
- Liquiphant M FTL51C (with highly corrosion-resistant coating): TI347F/00

Note!
All of the required parameters of the Liquiphant M Density are documented in the calibration report and sensor adjustments.
Both documents are included in the scope of delivery.

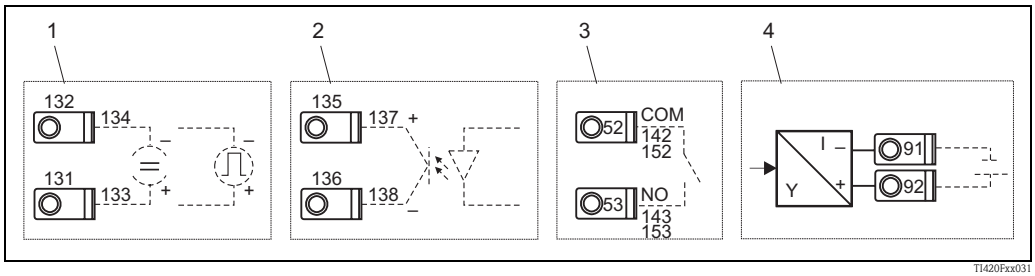
E+H-specific devices

Note!
In the basic version, Density Computer FML621 is fitted with slot A and E. The unit can be optionally extended to include slots B, C, D.

Density sensors with a pulse output	
Temperature sensor via temperature head transmitter (4 to 20 mA)	
Pressure sensor with passive current output (4 to 20 mA)	

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 accordingly when the extension cards are installed (see 'Connecting extension cards').

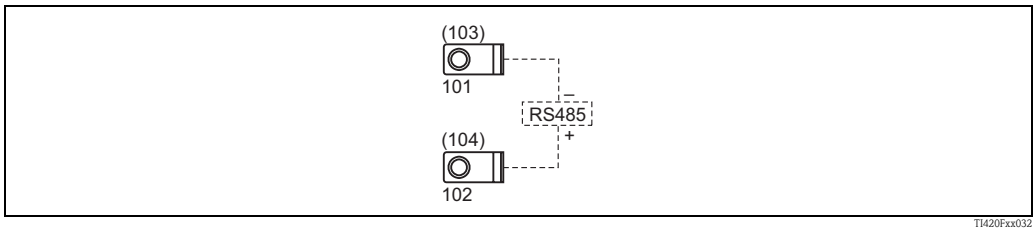


Connecting outputs

Item 1: pulse and current outputs (active)
Item 2: passive pulse output (open collector)
Item 3: relay output (NO), e.g. slot A III (slot BIII, CIII, DIII on optional extension card)
Item 4: transmitter power supply (MUS) output

Interface connection

- **RS232 connection:** The RS232 is contacted by means of the interface cable and the jack socket on the front of the housing.
- **RS485 connection**
- **Optional: additional RS485 interface**
- **PROFIBUS connection:**
  Optional connection of the Density Computer FML621 to PROFIBUS DP via the serial RS485 interface with the external module HMS AnyBus Communicator for PROFIBUS (see "Accessories").
- **Optional: Ethernet connection**



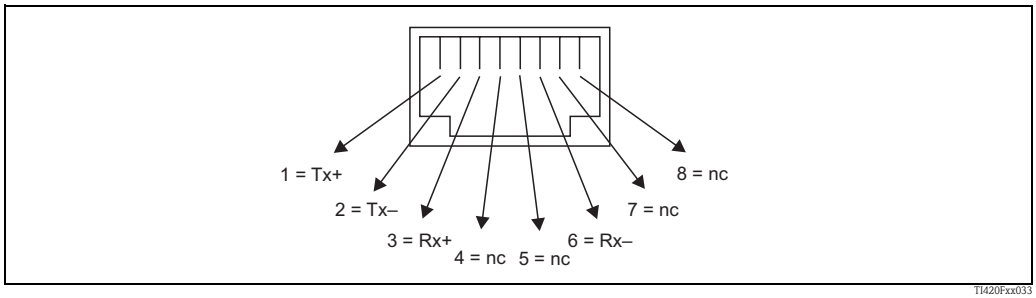
Interface connection

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 meters (328 ft) can be used here. 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.

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



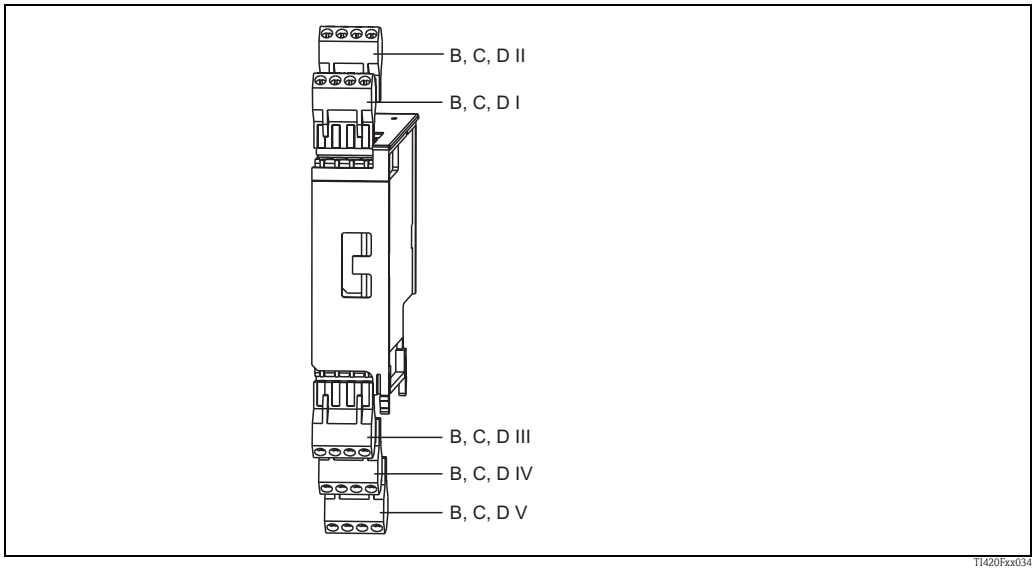
RJ45 socket (assignment AT&T256)

Meaning of the LEDs

Two light-emitting diodes are located under the Ethernet connection (on the device underside) which indicate the status of the Ethernet interface.

- **Yellow LED**: link signal; is lit when the device is connected to a network.
  If this LED is not lit, communication is not possible.
- **Green LED**: Tx/Rx; flashes irregularly when the device is sending or receiving data. Otherwise it is lit constantly.

Connecting extension cards



Extension card with terminals

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

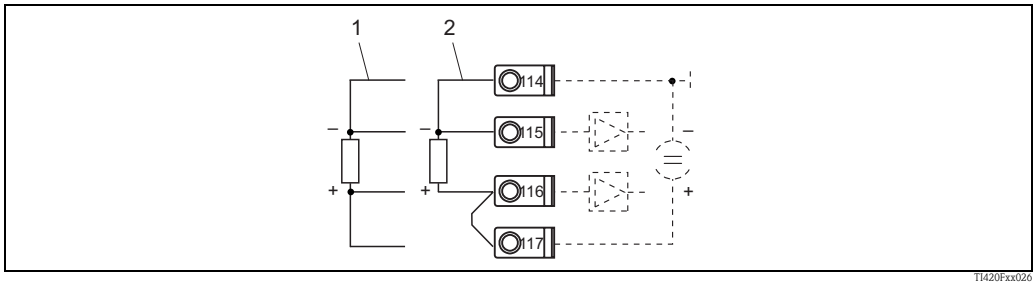
Terminal (item no.)	Terminal assignment	Slot	Input and output
182	24 V sensor power supply 1	B, C, D top, front (**B I, C I, D I**)	Current/PFM/pulse input 1
181	Sensor power supply ground 1		
112	+ 0/4 to 20 mA/PFM/pulse input 1		
111	Ground for 0/4 to 20 mA/PFM/pulse input		
183	24 V sensor power supply 2	B, C, D top, rear (**B II, C II, D II**)	Current/PFM/pulse input 2
181	Sensor power supply ground 2		
113	+ 0/4 to 20 mA/PFM/pulse input 2		
111	Ground for 0/4 to 20 mA/PFM/pulse input		
142	Relay 1 Common (COM)	B, C, D bottom, front (**B III, C III, D III**)	Relay 1
143	Relay 1 Normally Open (NO)		
152	Relay 2 Common (COM)		Relay 2
153	Relay 2 Normally Open (NO)		
131	+ 0/4 to 20 mA/pulse output 1	B, C, D bottom, center (**B IV, C IV, D IV**)	Current/pulse output 1 active
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2 active
134	- 0/4 to 20 mA/pulse output 2		
135	+ pulse output 3 (open collector)	B, C, D bottom, rear (**B V, C V, D V**)	Passive pulse output
136	- pulse output 3		
137	+ pulse output 4 (open collector)		Passive pulse output
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

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



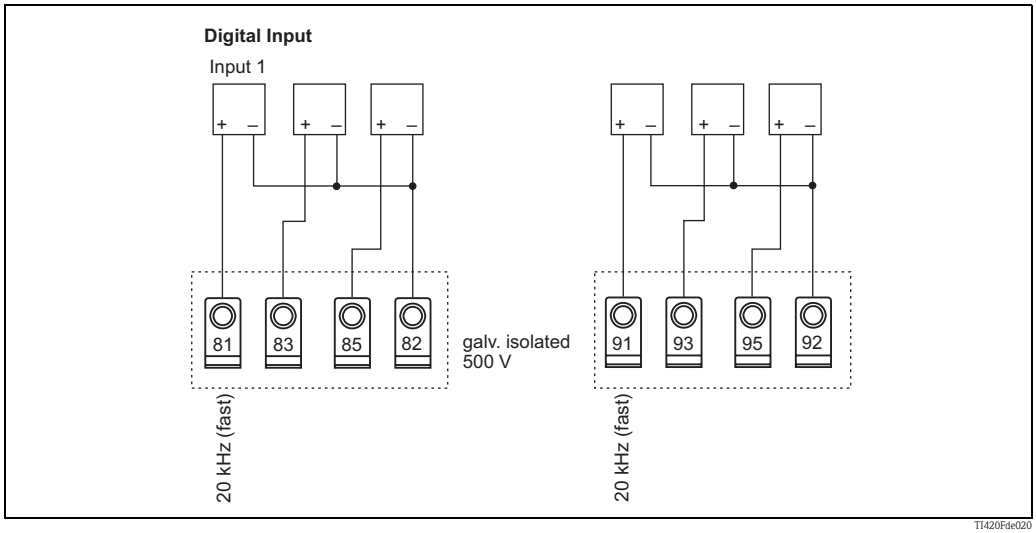
Temperature sensor connection, optional temperature extension card e.g. in slot B (slot B I)

Item 1: 4-wire input
Item 2: 3-wire input

Terminal (item no.)	Terminal assignment	Slot	Input and output
117	+ RTD power supply 1	B, C, D top, front (**B I, C I, D I**)	RTD input 1
116	+ RTD sensor 1		
115	- RTD sensor 1		
114	- RTD power supply 1		
121	+ RTD power supply 2	B, C, D top, rear (**B II, C II, D II**)	RTD input 2
120	+ RTD sensor 2		
119	- RTD sensor 2		
118	- RTD power supply 2		
142	Relay 1 Common (COM)	B, C, D bottom, front (**B III, C III, D III**)	Relay 1
143	Relay 1 Normally Open (NO)		
152	Relay 2 Common (COM)		Relay 2
153	Relay 2 Normally Open (NO)		
131	+ 0/4 to 20 mA/pulse output 1	B, C, D bottom, center (**B IV, C IV, D IV**)	Current/pulse output 1 active
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2 active
134	- 0/4 to 20 mA/pulse output 2		
135	+ pulse output 3 (open collector)	B, C, D bottom, rear (**B V, C V, D V**)	Passive pulse output
136	- pulse output 3		
137	+ pulse output 4 (open collector)		Passive pulse output
138	- pulse output 4		

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

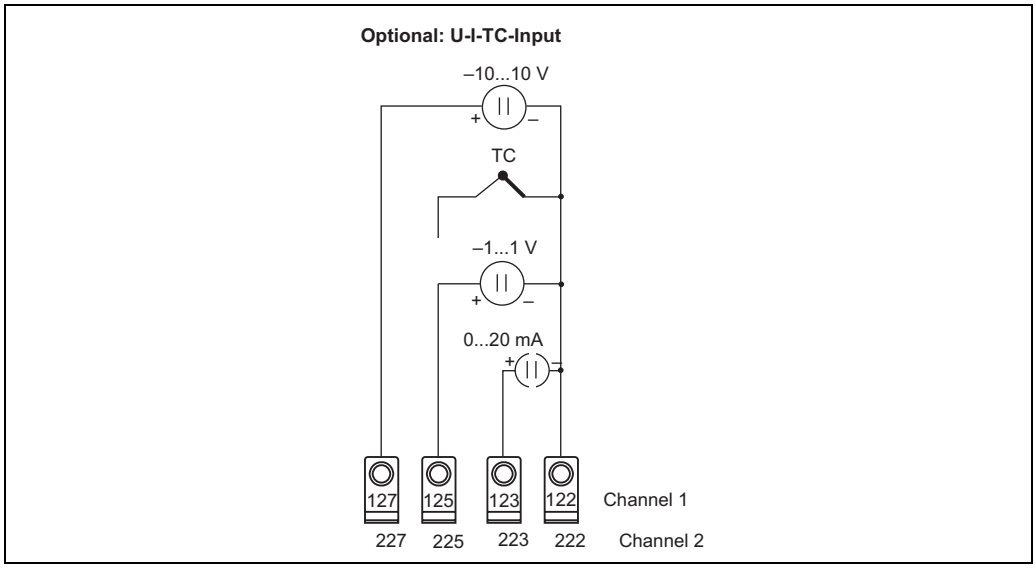
Note!
- The digital card has six intrinsically safe inputs. Two of these inputs (terminal assignment E1 and E4) can be defined as pulse inputs.



Terminal (item no.)	Terminal assignment	Slot	Input and output
81	E1 (20 kHz or 4 Hz as pulse input)	B, C, D top, front (**B I, C I, D I**)	Digital inputs E1 to 3
83	E2 (4 Hz)		
85	E3 (4 Hz)		
82	Signal ground E1 to 3		
91	E4 (20 kHz or 4 Hz as pulse input)	B, C, D top, rear (**B II, C II, D II**)	Digital inputs E4 to 6
93	E5 (4 Hz)		
95	E6 (4 Hz)		
92	Signal ground E4 to 6		
142	Relay 1 Common (COM)	B, C, D bottom, front (**B III, C III, D III**)	Relay 1
143	Relay 1 Normally Open (NO)		
152	Relay 2 Common (COM)		Relay 2
153	Relay 2 Normally Open (NO)		
145	Relay 3 Common (COM)	B, C, D bottom, center (**B IV, C IV, D IV**)	Relay 3
146	Relay 3 Normally Open (NO)		
155	Relay 4 Common (COM)		Relay 4
156	Relay 4 Normally Open (NO)		
242	Relay 5 Common (COM)	B, C, D bottom, rear (**B V, C V, D V**)	Relay 5
243	Relay 5 Normally Open (NO)		
252	Relay 6 Common (COM)		Relay 6
253	Relay 6 Normally Open (NO)		

Note!
- 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. (Terminals 111 and 181).

U-I-TC card (input)



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

Terminal (item no.)	Terminal assignment	Slot	Input and output
127	–10 to +10 V input 1	B, C, D top, front (**B I, C I, D I**)	U-I-TC Input 1
125	–1 to +1 V, TC input 1		
123	0 to 20 mA Input 1		
122	Signal ground input 1		
227	–10 to +10 V input 2	B, C, D top, rear (**B II, C II, D II**)	U-I-TC Input 2
225	–1 to +1 V, TC input 2		
223	0 to 20 mA Input 2		
222	Signal ground input 2		
142	Relay 1 Common (COM)	B, C, D bottom, front (**B III, C III, D III**)	Relay 1
143	Relay 1 Normally Open (NO)		
152	Relay 2 Common (COM)		Relay 2
153	Relay 2 Normally Open (NO)		
131	+ 0/4 to 20 mA/pulse output 1	B, C, D bottom, center (**B IV, C IV, D IV**)	Current/pulse output 1 active
132	- 0/4 to 20 mA/pulse output 1		
133	+ 0/4 to 20 mA/pulse output 2		Current/pulse output 2 active
134	- 0/4 to 20 mA/pulse output 2		
135	+ pulse output 3 (open collector)	B, C, D bottom, rear (**B V, C V, D V**)	Passive pulse output
136	- pulse output 3		
137	+ pulse output 4 (open collector)		Passive pulse output
138	- pulse output 4		

Connecting remote display/ operating unit

Functional description

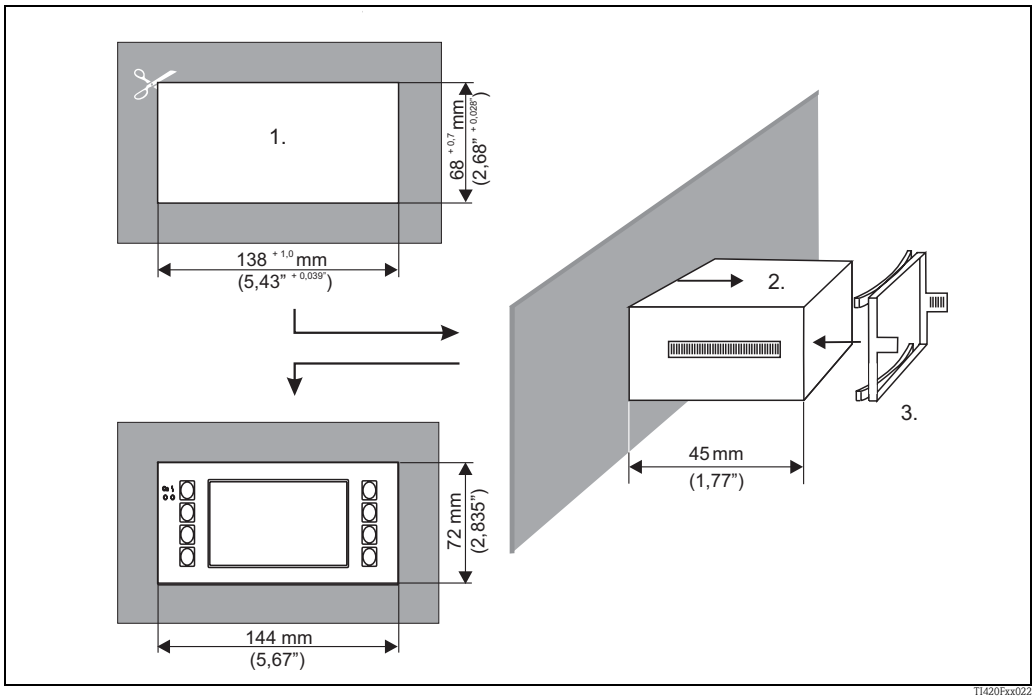
Note!
- A display/operating unit is absolutely essential to be able to use all instrument functions. Operation solely with ReadWin is not permitted.
- Only one display/operating element can be attached to a top-hat rail device and vice versa (point-to-point).

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/operating unit. A 4-pin cable is supplied to connect the remote display with the basic unit; other components are not necessary.

Installation/dimensions

Mounting instructions:
- The mounting location must be free from vibrations.
- The permitted ambient temperature during operation is –20 to +60°C.
- Protect the device against the effects of heat.

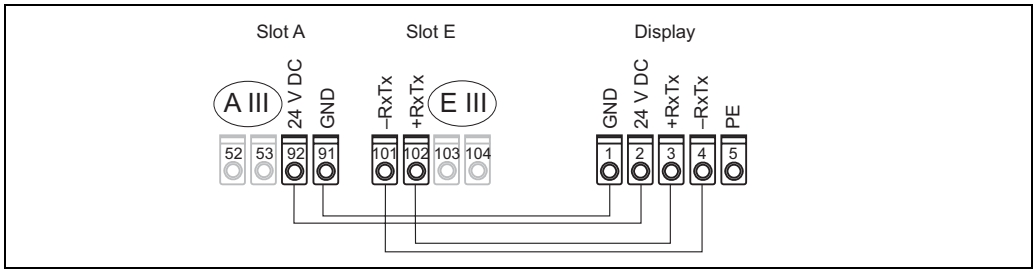
Procedure for panel mounting:
1. Provide a panel cutout of 138+1.0 x 68+0.7 mm (as per DIN 43700), the installation depth is 45 mm.
2. Push the device with the sealing ring through the panel cutout from the front.
3. Hold the device horizontal and, applying uniform pressure, push the securing frame over the rear of the housing against the panel until the retaining clips engage. Make sure the securing frame is seated symmetrically.



Panel mounting

Wiring

Terminal plan of remote display/operating unit:



The remote display/operating unit is connected directly to the basic unit with the cable supplied.

Power supply

Supply voltage

- Low voltage power unit: 90 to 250 V AC 50/60 Hz
- Extra-low voltage power unit: 20 to 36 V DC or 20 to 28 V AC 50/60 Hz

Power consumption

8 to 38 VA (depending on version and wiring)

Connection data interface

RS232
- Connection: jack socket 3.5 mm, front
- Transmission protocol: ReadWin® 2000
- Transmission rate: max. 57,600 baud

RS485
- Connection: plug-in terminals 101/102 (in the basic unit)
- Transmission protocol: (serial: ReadWin® 2000; parallel: open standard)
- Transmission rate: max. 57,600 baud

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

Optional: Ethernet interface
- Ethernet interface 10/10 0BaseT, connector type RJ45, connection via shielded cable, issuing of IP address via Setup menu in the device. Connection by means of interface with devices in office environment. Safety distances: office device standard IEC 60950-1 must be taken into consideration. Connection to a PC: possible by means of a "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 ±5 °C (77 °F ±9 °F)
- Air humidity 39 % ±10 % r.h.

Reference operating conditions, (special calibration, Liquiphant M Density)

- Medium: water (H_2O)
- Medium temperature: 0 to 80 °C (liquid not moved)
- Ambient temperature: 24 °C ±5 °C
- Humidity: max. 90 %
- Warm-up period: > 30 min

Performance characteristics

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

General measuring conditions for accuracy data

- Span (measuring range): 0.3 to 2.0 g/cm³
- Distance between paddle and container wall and surface of liquid: > 50 mm (see Page 30 "Mounting location")
- Temperature sensor measured error: < 1 °C
- Maximum viscosity: 350 mPa*s (exception: maximum 50 mPa*s for FTL51C)
- Maximum flow velocity: 2 m/s
  - Laminar flow, bubble-free, see installation instructions
  - Construction-specific measures (e.g. bypass or pipe enlargement) for reduction must be put in place for higher flow velocities.
- Process temperature: 0 to +80 °C (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 absolute pressure

Maximum measured error

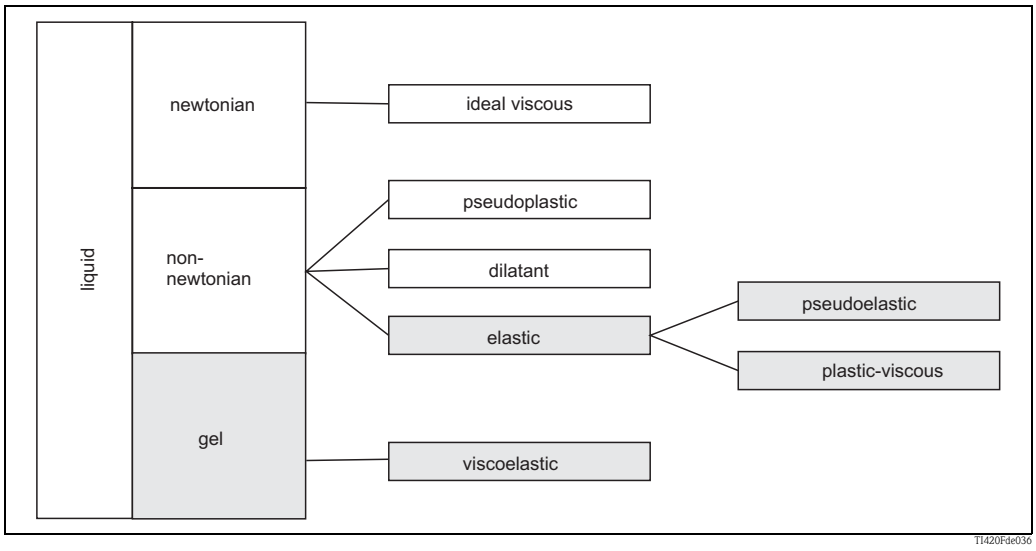
- Standard calibration: ±0.02 g/cm³ (±1.2% of the span (1.7 g/cm³), under general measuring conditions)
- Special calibration: ±0.005 g/cm³ (±0.3% of the span (1.7 g/cm³), under reference operating conditions)
- Field calibration: ±0.002 g/cm³ (in operating point)

Non-repeatability (reproducibility)

- Standard calibration: ±0.002 g/cm³ (under general measuring conditions)
- Special calibration: ±0.0007 g/cm³ (under reference operating conditions)
- Field calibration: ±0.002 g/cm³ (in operating point)

Factors influencing accuracy data

Note!
- Cleaning of the sensor (CIP or SIP) is possible at process temperatures of up to 140°C over a long period.
- Viscosity of liquid:
  All accuracy data refer to Newtonian (purely viscous) liquids.
  Field calibration is recommended for elastic, structurally elastic, purely plastic and viscous-elastic liquids.



- Long-term drift typ. ±0.00002 g/cm³ per day
- Temperature coefficient typ. ±0.0002 g/cm³ per 10 °C
- Fluid velocity in pipes > 2 m/s
- Buildup at the fork
- Air bubbles in the case of vacuum applications
- Incomplete coverage of the fork
- For pressure changes > 6 bar, a pressure measurement is required for compensation
- For temperatures > 1°C, a temperature measurement is required for compensation

- Mechanical stress (e.g. deformation) on the fork tines can impact accuracy and must be avoided. If a device has been subjected to mechanical stress, it must be replaced.

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

FML621 installation instructions

Mounting location	In cabinet on top-hat rail IEC 60715
Orientation	No restrictions

Environment

Ambient temperature range	–20 to 50 °C (–4 to 122 °F) Caution! When using extension cards, venting with an air current of at least 0.5 m/s is necessary.
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 < 2000 m (6560 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: $I_{max}/I_n \leq 50$ % (T50 % ≤ 50 ms) ■ Electromagnetic fields: 10 V/m as per IEC 61000-4-3 ■ Conducted HF: 0.15 to 80 MHz, 10 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): 500 V/1 kV as per IEC 61000-4-5

Installation conditions for Liquiphant M Density

Note!
The following information is supplemented by additional documentation on Liquiphant M (see → Page 36 "Documentation").

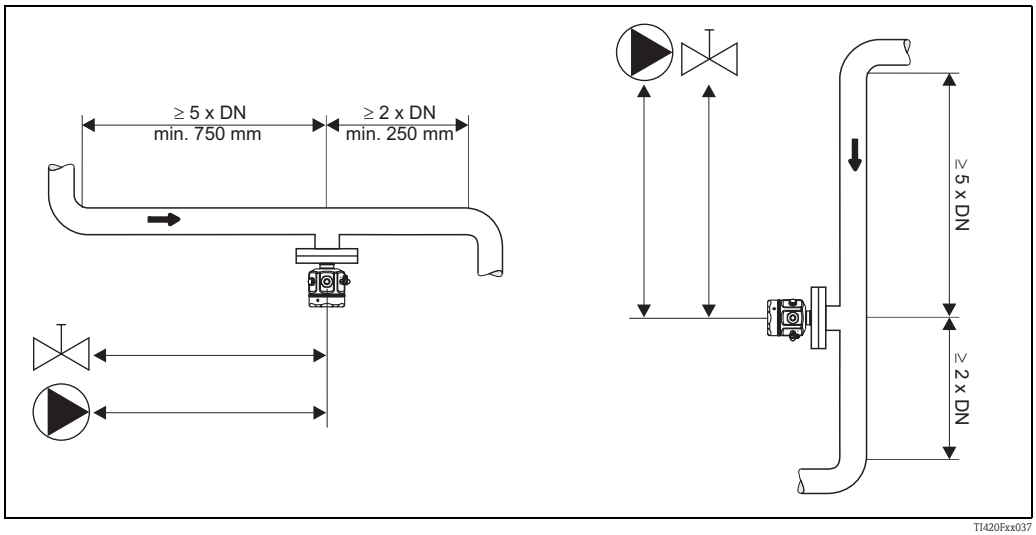
Orientation

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

Note!
To avoid air pockets in the pipes or nozzles, appropriate bleeding must take place in line with the mounting location.

Inlet and outlet run

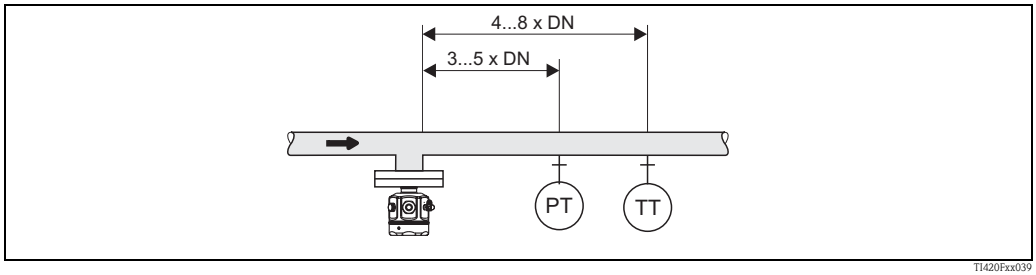
Install the sensor as far as possible from fittings such as valves, T-sections, elbows, flange elbows etc. Compliance with the following requirements for the inlet and outlet runs is necessary in order to ensure measuring accuracy:
- Inlet run: ≥ 5 * DN (nominal diameter) minimum 750 mm
- Outlet run: ≥ 2 * DN (nominal diameter) minimum 250 mm



TI420Fxx037

Outlet runs for pressure and temperature measuring points

Pressure and temperature sensors must be installed downstream of the Liquiphant M Density (from the flow direction). 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.



TI420Fxx039

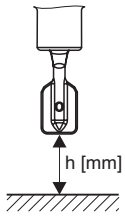
PT = Pressure measuring point
TT = Temperature measuring point

Mounting location and correction factor (correction r)

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

Note!
The following general conditions must be observed when selecting the correct mounting location:

- The vibrating tines of the Liquiphant M Density unit need room to vibrate at the mounting location. Even with this small deflection, the medium is displaced or medium has to flow around the fork. If the distance between the fork tines and the tank or pipe wall is very short, the measurement result is affected. This can be balanced by entering a correction factor (correction r).

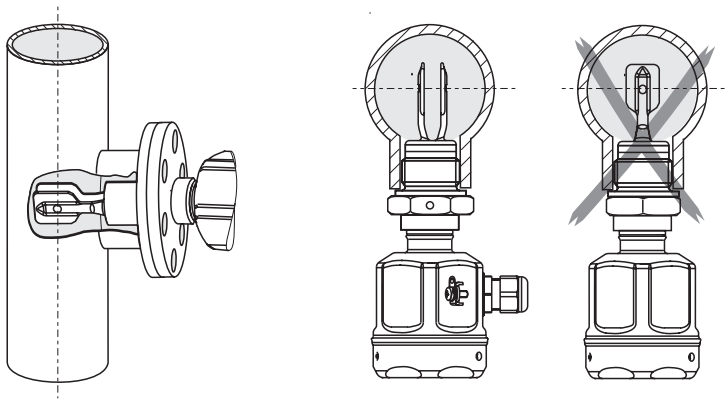


h [mm]	*
12	1,0026
14	1,0016
16	1,0011
18	1,0008
20	1,0006
22	1,0005
24	1,0004
26	1,0004
28	1,0004
30	1,0003
32	1,0003
34	1,0002
36	1,0001
38	1,0001
40	1,0000

TI420Fxx040

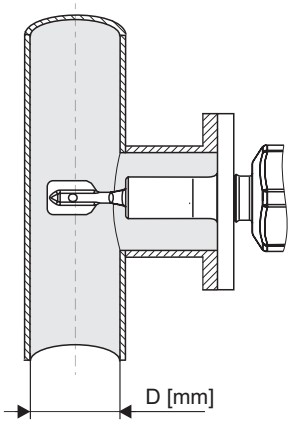
** Correction factor (correction r) with a distance of 12 to 40 mm between the tip of the fork tine and the tank floor, for example.*

- In pipe internal fittings, the fork tines of the Liquiphant M 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 during 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.



TI420Fxx041

Fork tine alignment in direction of flow (note the mark on the Liquiphant M Density)



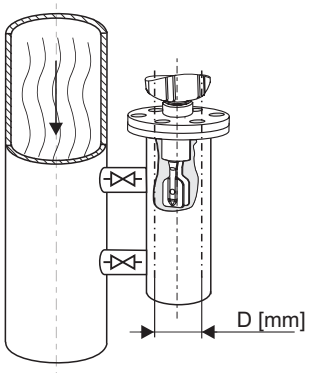
D [mm]	*
<44	–
44	1,0225
46	1,0167
48	1,0125
50	1,0096
52	1,0075
54	1,0061
56	1,0051
58	1,0044
60	1,0039
62	1,0035
64	1,0032
66	1,0028
68	1,0025
70	1,0022
72	1,0020
74	1,0017
76	1,0015
78	1,0012
80	1,0009
82	1,0007
84	1,0005
86	1,0004
88	1,0003
90	1,0002
92	1,0002
94	1,0001
96	1,0001
98	1,0001
100	1,0001
>100	1,0000

TI420Fxx042

** Correction factor (correction r) with sensor immersed laterally. The mark on the fork should match the pipe axis.*

Note!
Pipe nominal diameters with internal measurements < 44 mm are not permitted!

If the flow in the pipes is strong (> 2 to < 5 m/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 M Density could be installed e.g. in a bypass or in a pipe with a larger diameter for this purpose.



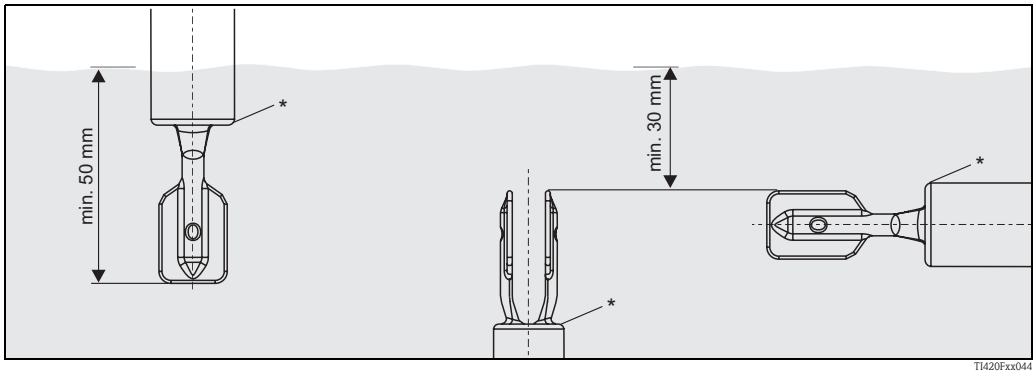
D [mm]	*
<44	–
44	1,0191
46	1,0162
48	1,0137
50	1,0116
52	1,0098
54	1,0083
56	1,0070
58	1,0059
60	1,0050
62	1,0042
64	1,0035
66	1,0030
68	1,0025
70	1,0021
72	1,0017
74	1,0014
76	1,0012
78	1,0010
80	1,0008
82	1,0006
84	1,0005
86	1,0004
88	1,0003
90	1,0003
92	1,0002
94	1,0002
96	1,0001
98	1,0001
100	1,0001
>100	1,0000

TI420Fxx043

** Correction factor (correction r) for pipe nominal diameters between DN50 and DN100. A correction for pipe nominal diameters > DN100 is not necessary.*

Mounting location

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



The fork tines and the diaphragm (*) must be completely covered by medium.

Ambient conditions for Liquiphant M Density

Note!
It must be ensured that the sensor is fully covered constantly during measurement.

Ambient temperature range –40 to +70°C (–40 to 158°F), at Ex –40 to +60 °C (–40 to 140 °F)

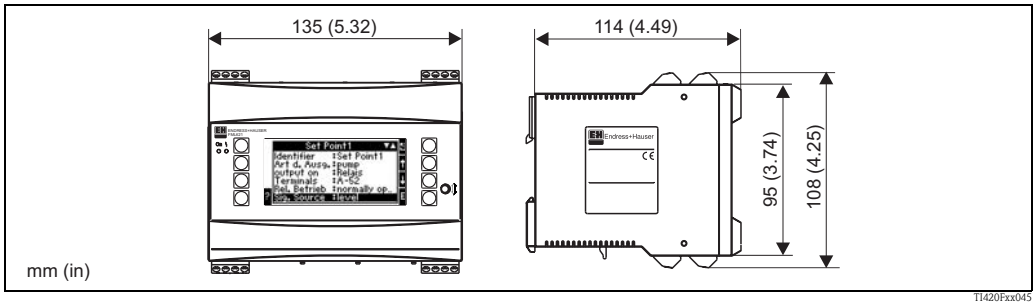
Note!
For further information on use in hazardous areas (ATEX), please refer to Section: → Page 37.

Mechanical construction

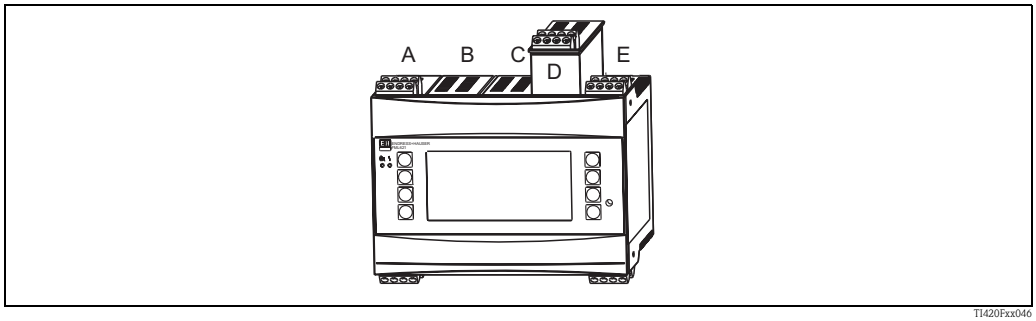
Terminals

Pluggable screw terminals (power supply terminal coded); clamping area 1.5 mm^2 (16 AWG) solid, 1.0 mm^2 (18 AWG) flexible with ferrules (applies to all connections).

Design, dimensions



Housing for top-hat rail as per IEC 60715



Device with extension cards (available optionally or as accessory)
– Slots A and E are integral components of the basic unit
– Slots B, C and D can be expanded with extension cards

Weight

- Basic unit: 500 g (17.6 oz) (in maximum configuration with extension cards)
- Remote operating unit: 300 g (10.6 oz)

Material

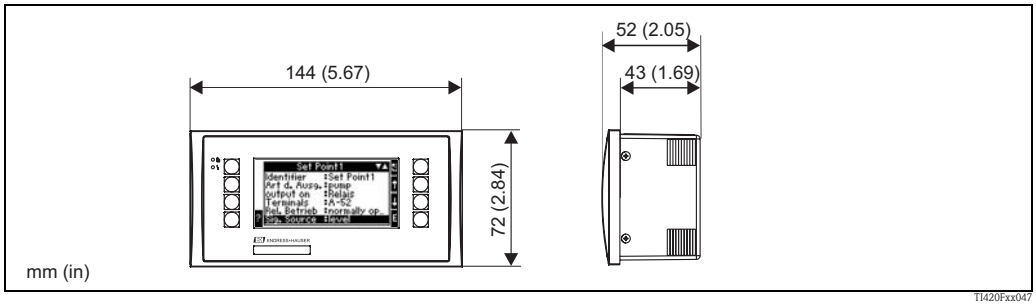
Housing: polycarbonate plastic, UL 94V0

Display and operating elements

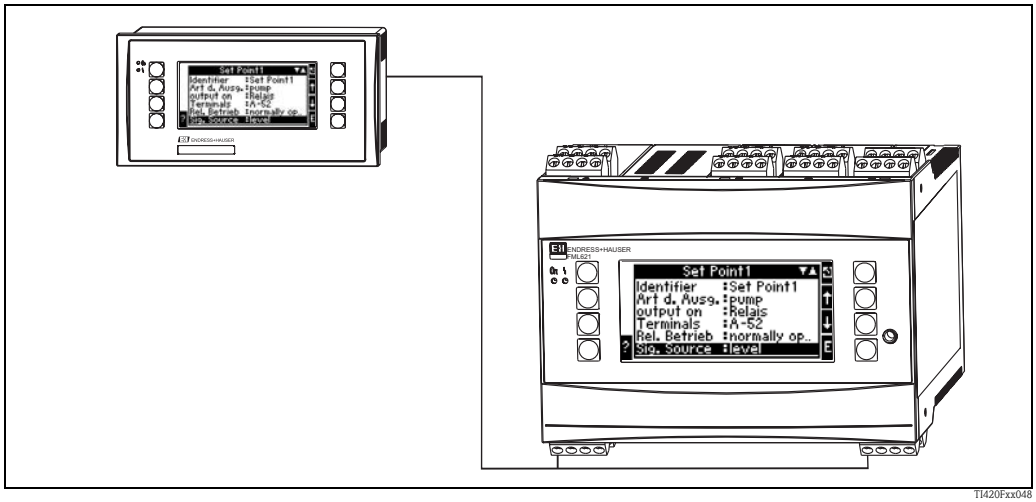
Note!
- An operating and display unit is absolutely essential for field calibration.
- An operating and display unit can also be used for commissioning Density Computer FML621. If necessary, the operating and display unit can also be used for a number of devices.

Display elements

- Display (optional):
  160 x 80 DOT matrix LCD with blue background lighting, color change to red in event of error (configurable)
- LED status display:
  Operation: 1 x green (2 mm (0.08"))
  Fault message: 1 x red (2 mm (0.08"))
- 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 (dimensions WxHxD = 144 x 72 x 43 mm (5.67" x 2.83" x 1.69")). The connection to the integrated RS484 interface is made using the connecting cable (l = 3 m (9.8 ft)), which is included in the accessories kit. Parallel operation of the operating and display unit with a device-internal display in the FML621 is possible.



Operating and display unit for panel mounting (available optionally or as accessory)



Operating and display unit in panel mounting housing

Operating elements

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

Remote operation

RS232 interface (jack socket on front panel 3.5 mm (0.14 in)): configuration via PC with ReadWin® 2000 PC operating software.
RS485 interface

Real time clock

- Deviation: 30 min per year
- Power reserve: 14 days

Certificates and approvals

Certificates and approvals

CE mark

The measuring system meets the legal requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Other standards and guidelines

- IEC 60529:
  Degrees of protection through housing (IP code)
- IEC 61010:
  Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures
- EN 61326 (IEC 1326):
  Electromagnetic compatibility (EMC requirements)
- NAMUR NE 21, NE 43
  Association for Standards for Control and Regulation in the Chemical Industry

Ordering information

Note!
Versions that mutually exclude one another are not marked.

Density Computer FML621 product structure

10	Approval:		
A	Non-hazardous area		
B	ATEX II (1) GD	(EEx ia) IIC	
C	FM	IS, Class I, II, III	Division 1, Group A-G
D	CSA	IS, Class I, II, III	Division 1, Group A-G

20	Display; operation:	
1	Not selected;	No keys
2	Alphanumeric;	8 keys
3	Separate	Panel 72 x 144 mm, 1 x RS485
4	Separate	Panel 72 x 144 mm, 2 x RS485

30	Power supply:
1	90 to 250 V AC
2	20 to 36 V DC, 20 to 28 V AC

40	Slot B:
A	Unused
B	Input: 2 x FEL50D / 0/4 to 20 mA + transmitter power supply Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST
D	Input: 2 x digital 20 kHz, 4 x digital 4 Hz Output: 6 x relay SPST
E	Input: 2 x U, I, TC Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST
G	Input: Ex i, 2 x FEL50D / 0/4 to 20 mA + transmitter power supply Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
H	Input: Ex i, 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
I	Input: Ex i, 4 x digital Output: 6 x relay SPST
J	Input: Ex i, 2 x U, I, TC Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST

50	Slot C:
A	Unused
B	Input: 2 x FEL50D / 0/4 to 20 mA + transmitter power supply Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST
D	Input: 2 x digital 20 kHz, 4 x digital 4 Hz Output: 6 x relay SPST
E	Input: 2 x U, I, TC Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST
G	Input: Ex i, 2 x FEL50D / 0/4 to 20 mA + transmitter power supply Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
H	Input: Ex i, 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
I	Input: Ex i, 4 x digital Output: 6 x relay SPST
J	Input: Ex i, 2 x U, I, TC Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST

60	Slot D:
A	Unused
B	Input: 2 x FEL50D / 0/4 to 20 mA + transmitter power supply Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
C	Input: 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST
D	Input: 2 x digital 20 kHz, 4 x digital 4 Hz Output: 6 x relay SPST
E	Input: 2 x U, I, TC Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST

60	**Slot D:**	
	G	Input: Ex i, 2 x FEL50D / 0/4 to 20 mA + transmitter power supply Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
	H	Input: Ex i, 2 x Pt100/500/1000 Output: 2 x 0/4 to 20 mA, 2 x digital, 2 x relay SPST
	I	Input: Ex i, 4 x digital Output: 6 x relay SPST
	J	Input: Ex i, 2 x U, I, TC Output: 2 x 0/4 to 20 mA, pulse, 2 x digital, 2 x relay SPST

70	**Software:**	
	AA	Mathematics, density module
	AB	Mathematics, density module and telealarm
	YY	Special version

80	**Operating language:**	
	A	German
	B	English
	C	French
	D	Italian
	E	Spanish
	F	Dutch

90	**Communication:**	
	1	1 x RS232, 1 x RS485
	2	1 x RS232, 1 x RS485 + cable
	3	1 x RS232 + Profibus DP slave module
	4	1 x RS232 + cable + Profibus DP, external slave module
	5	1 x RS232 + 2 x RS485
	6	1 x RS232 + 2 x RS485 + cable
	C	1 x RS232 + Profibus DP slave module + Ethernet
	D	1 x RS232 + Profibus DP slave module + Ethernet + cable
	E	1 x RS232 + 2 x RS485 + Ethernet
	F	1 x RS232 + 2 x RS485 + cable + Ethernet

100	**Additional fittings:**	
	1	Not selected
	2	Factory calibration certificate

FML621 -	complete product designation

Accessories

General

Identifier	Order code
Cable set for FML621 for connecting to a PC or modem	RXU10-A1
Remote display for panel mounting 144 x 72 x 43 mm	FML621A-AA
Protective housing IP 66 for top-hat rail devices	52010132
PROFIBUS Interface	RMS621A-P1
Adhesive label, printed (max. 2 x 16 char.)	51004148
Metal plate for TAG number	51002393
Plate, paper, TAG 3x16 characters	51010487

Extension cards

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

Identifier	Order code
Digital 6 x dig. in, 6 x rel. out, cpl. including terminals + fixing frame	FML621A-DA
Digital, ATEX approved 6 x dig. in, 6 x rel. out, cpl. including terminals	FML621A-DB
2 x U, I, TC outp. 2 x 0/4-20 mA/pul., 2 x dig., 2 x rel. SPST	FML621A-CA
Multifunction, 2 x U, I, TC ATEX outp. 2 x 0/4 mA/pul., 2 x dig., 2 x rel. SPST	FML621A-CB
Temperature (Pt100/Pt500/Pt1000) complete, including terminals + fixing frame	FML621A-TA
Temperature, ATEX approved (Pt100/PT500/PT1000) complete, including terminals	FML621A-TB
Universal (PFM/pulse/analog/transmitter power supply unit) complete, incl. terminals + fixing frame	FML621A-UA
Universal ATEX approved (PFM/pulse/analog/transmitter power supply unit) complete, incl. terminals	FML621A-UB

Documentation

Note!
This supplementary documentation can be found on our product pages on www.endress.com

Brochures

Innovation brochure on Liquiphant M Density
IN017F/00 (pending)

Technical Information

Liquiphant M Density and Density Computer FML621
TI420F/00

Liquiphant M FTL50, FTL51 (for standard and hygiene applications)
TI328F/00

Liquiphant M FTL51C (with highly corrosion-resistant coating)
TI347F/00

Operating Instructions	Density Computer FML621 BA335F/00 Liquiphant M Density FTL50, FTL51 with FEL50D KA284F/00 Liquiphant M Density FTL50(H), FTL51(H) with FEL50D KA285F/00 Liquiphant M Density FTL51C with FEL50D KA286F/00
Certificates	FM ZD041F/00 CSA ZD042F/00/en
Safety instructions (ATEX)	Density Computer FML621 CE ⟨Ex⟩ II (1) GD, (EEx ia) IIC (PTB 04 ATEX 2019) XA038R/09/a3 Liquiphant M FTL50(H), FTL51(H), FTL51C, FTL70, FTL71 CE ⟨Ex⟩ II 1/2 G, EEx d IIC/B (KEMA 99 ATEX 1157) XA031F/00/a3 Liquiphant M FTL50(H), FTL51(H), FTL51C, FTL70, FTL71 CE ⟨Ex⟩ II 1/2 G, EEx ia/ib IIC/B (KEMA 99 ATEX 0523) XA063F/00/a3 Liquiphant M FTL50(H), FTL51(H), FTL51C CE ⟨Ex⟩ II 1 G, EEx ia IIC/B (KEMA 99 ATEX 5172 X) XA064F/00/a3 Liquiphant M FTL50(H), FTL51(H), FTL51C, FTL70, FTL71 CE ⟨Ex⟩ II 1/2 G, EEx de IIC/B (KEMA 00 ATEX 2035) XA108F/00/a3 Liquiphant M FTL51C CE ⟨Ex⟩ II 1/2 G, EEx ia/ib IIC (KEMA 00 ATEX 1071 X) XA113F/00/a3 Liquiphant M FTL51C CE ⟨Ex⟩ II 1/2 G, EEx d IIC (KEMA 00 ATEX 2093 X) XA114F/00/a3 Liquiphant M FTL51C CE ⟨Ex⟩ II 1/2 G, EEx de IIC (KEMA 00 ATEX 2092 X) XA115F/00/a3 Liquiphant M FTL50(H), FTL51(H), FTL51C, FTL70, FTL71 CE ⟨Ex⟩ II 3 G, EEx nA/nC II (EG 01 007-a) XA182F/00/a3

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