



# Universal analog measuring unit

MAT 41xx/42xx mipromex®



- Universal application for measured value measurement in function of the product
- Evaluation for impedance probes
- for up to two measuring points
- Menu-guided in 3 languages
- DIN rail or wall mounting

## Use

Universal measuring unit for level, product recognition or monitoring in production operation. The mipromex® is used for easy layer detection in liquid-liquid separations, as occurring in petrochemical storage tanks. The layer detection is visualised via the current output and the valve can be controlled with the relay or a low-level indication can be issued.



## Overview

- MAT 41xx 1 measuring circuit with one analogue output and one limit value output (OC/Relay)
- MAT 41xx/2xx 2 measuring circuits, equipped with one analogue output each (not isolated from one another) and one limit value output each (OC/Relay). The 2nd Measuring circuit can be activated with activation code, at a cost.
- MAT 42xx 2 measuring circuits with one analogue output each (not isolated from one another)\*
- MAT 424x 2 measuring circuits with one analogue output each (isolated from one another)\*
- MAT 4xx1 Special software with dynamic measured value processing, signal spreading (4...20 mA) in 1% increments, drift compensation
- Menu-guided parameterisation in selectable languages: D / F / E
- Device data and item/TAG no. storage
- Measured value processing in microprocessor technology
- Film keypad with graphic display
- 19" plug-in cartridge 3 HE/12 TE (European format)
- Supply 24 V AC 50/60 Hz/ DC independent of polarity
- Analogue output 4 - 20 mA with galvanic isolation max. load 750 Ohm active (non-Ex)
- Fault message programmable on analogue output
- Fault indication Time/Date
- 1 limit value output per measuring circuit
- Output and limit value mA simulation
- 1. Measurement input for MTI probe connection, max. cable length: approx. 200 m (<120 nF)
- 256 kB Flash Firmware V1.17

Ex version: Gas II (2) G [Ex ia Gb] IIC  
Staub II (2) D [Ex ia Db] IIIC;

SEV 09 ATEX 0132; EMC STS 024 CE 1254

programmable % start and end value. Parameter entries are menu-guided and type-dependent. A parameter set can be stored and reloaded.

One further relay changeover switch or optocoupler transistor output (OC) with FSL and FSH function available per measuring circuit, as well as adjustable on/off time delay. Error messages are visualised with time, date and error type.

## Measuring circuit

A measuring probe with MTI transmitter module in the probe head is connected to the mipromex® MAT by means of a shielded 2-core cable. A potential equalisation line must be installed between the earthing of the plant room and the control room.

## Measuring principle

Impedance measurement; dependent on electrical conductivity and dielectric constant.

## Wiring

2-core cable 0.75 mm<sup>2</sup> twisted CY/EIG cable length up to (200 m) or max. C= 120 nF / R = 30 Ohm line impedance

## Connection

all bar and pipe impedance probes with MTI on-site transmitter module

## Basic function

The pulse signal transmitted from the MTI transmitter module is converted into an offset-compensated, filtered pulse value and, in function of the entered measuring span for the data display, converted into a 4-20 mA signal. The indication on the graphic display visualises the pulse, % value or the mA output signal, as well as the limit value outputs.

The pulse signal is converted into a 0–100% value.

The 4–20 mA analogue output can be spread by means of

## Function

The electrode system of a bar/pipe probe, surrounded by product, changes the impedance in function of the dielectric properties and conductivity of organic products and aqueous solutions. The measured impedance sum signal is converted directly by the MTI transmitter module into a normed signal and is transmitted as pulse packages to the analogue transmitter mipromex® MAT.

The measured values in the normed signal range of 0–3700 pulses are product-specific and vary in function of product mixes, fill level height or immersion depth. The physical measured impedance value of a product at a given immersion depth is thus displayed as a numeric value, which is designated as a pulse count.

## Level measurement

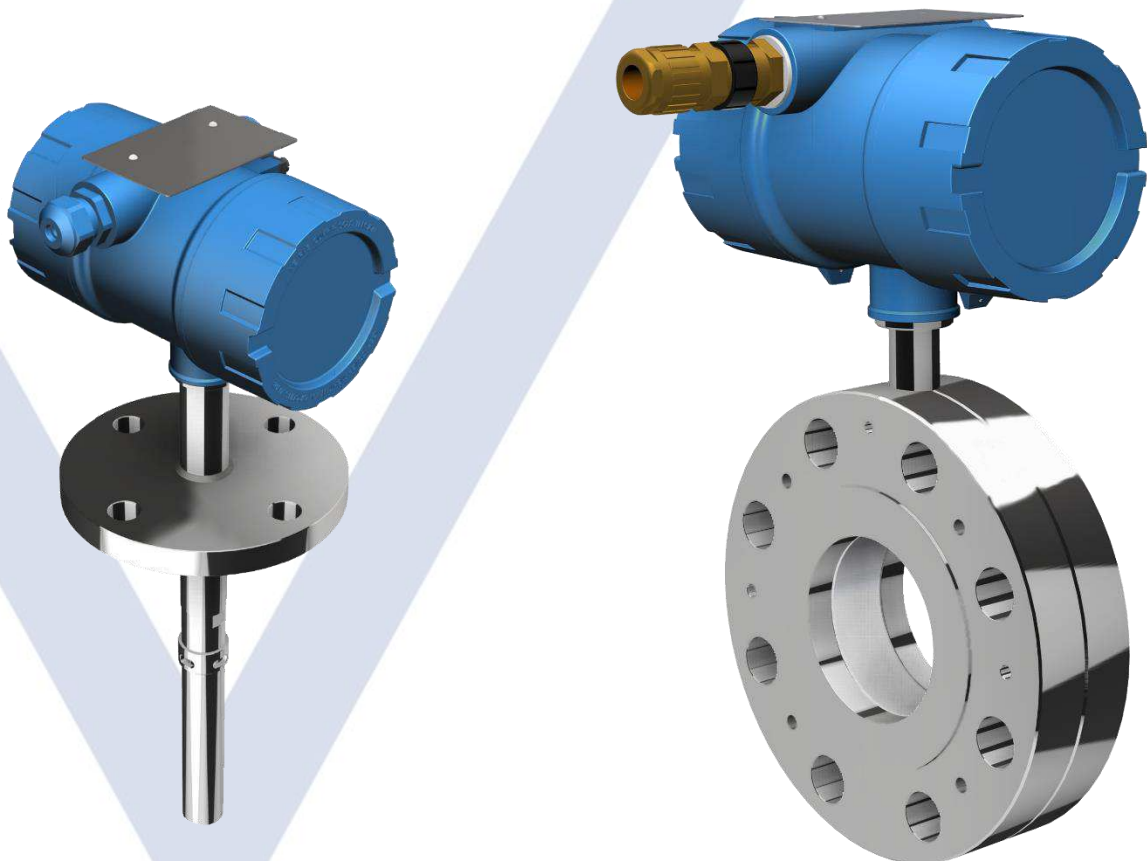
The measured value change in function of the liquid fill level results, via the measuring span calculation, in the fill level indication as a percentage. The measuring span (MS) results from the product-specific measured value with 100% wetted measuring electrode. Display 0–100%.

## Product monitoring

The measured value monitoring detects the product change as well as the low-level indication with the highest precision. The measured value of the product is measured with a pipe or bar probe, which is used in the discharge line after the bottom valve of a storage tank to strip water.

## Quality monitoring

The measured value monitoring detects the product change and can thus monitor the quality of various materials as a sum signal. It is a prerequisite that measurement can be done at a stable temperature.



## Connection circuit board for 19" rack, Monorack

Cage Clamp® terminals for 0.08–2.5 mm<sup>2</sup> cable cross section, stripping length 5–6 mm / 0.22 in (without cable end sleeve), are mounted using a special tensioning tool.

### Colour coding:

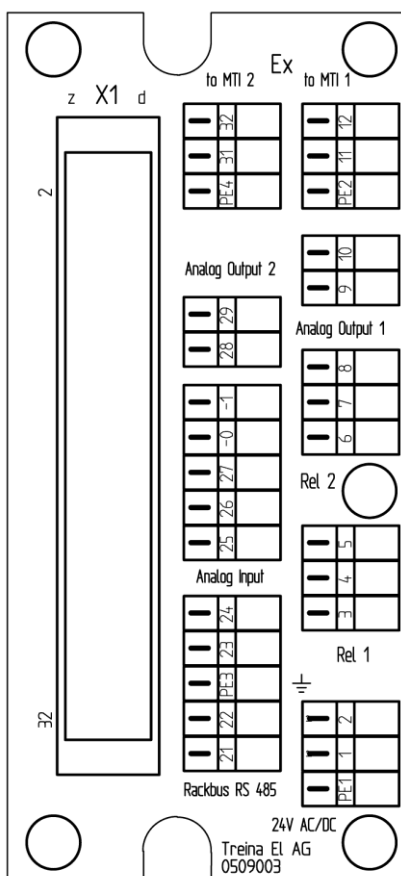
The fail-safe field circuit is connected to the **blue** terminals. It may be guided into the hazardous area with connecting cables as per DIN EN 60079-14.

The **black/orange** terminals are polarity-dependent current inputs or outputs.

**Dimension:** H x W x D 137 x 77 x 210 mm / for Eurocard 3 HE/12TE Depth 60 mm

**Connection to:** mipromex® microprocessor device

**Article no.:** 02.03.18.011



### PE1 earthing

1. supply 24 V AC/DC 50/60 Hz (polarity independent)
2. supply 24 V AC/DC 50/60 Hz (polarity independent)

FI32: d/z6

FI32: z30

FI32: d30

Relais	Optokoppler	
3. 1 NO	output E-	FI32: z24
4. 1 COM	output C+	FI32: d24
5. 1 NC	-	FI32: z22
6. 2 NO	output E-	FI32: z16
7. 2 COM	output C+	FI32: d16
8. 2 NC	-	FI32: z14
9. MK1 analog output 1 -		FI32: d14
10. MK1 analog output 1 +		FI32: z12
11. MK1 MTI 1 K1		FI32: z2
12. MK1 MTI 1 K2		FI32: d2
21. rackbus RS 485 A		FI32: z32
22. rackbus RS 485 B		FI32: d32
23. analog input -		FI32: d18
24. analog input +		FI32: d12
25. digital input 3 (+24 V)		FI32: d10
26. digital input 2 (+24 V)		FI32: z10
27. digital input 1 (+24 V)		FI32: d8
-0 digital input D1-3 (0 V)		FI32: z8
-1 digital input D1-3 (0 V)		FI32: z8
28. MK2 analog output 2 -		FI32: d22
29. MK2 analog output 2 +		FI32: z20

31. MK2 MTI 2 K1

FI32: z4

32. MK2 MTI 2 K2

FI32: d4

## Mounting/Installation:

The 19" cartridge is used in a MRM Monorack for DIN rail or wall mounting.

The connection board with FI32 female multi-point connector can also be installed in table-tops or 19" racks. For Ex applications, the connection boards are different (female multi-point connectors are coded).



# Connections to FI32 female multi-point connector MAT 411x

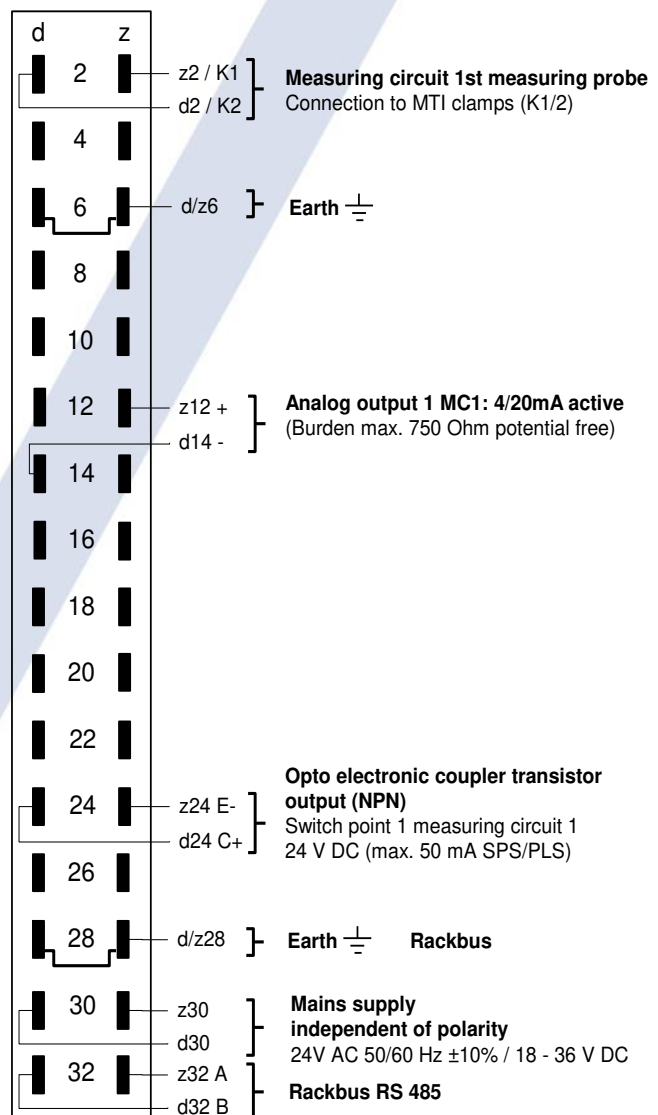
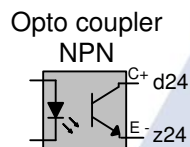
Microprocessor device with one measuring circuit input | Connections to FI32 female multi-point connector

## Electrical data

Euro plug-in print pin assignment 24 V version

Switchpoint 1 for measuring circuit 1 FSL (Fail Safe Lo) L Alarm  
Relay de-energised (Measured value < Limit value)  
Switchpoint 2 for measuring circuit 1 FSH (Fail Safe Hi) H Alarm  
=> for dynamic batch separation, **FS setting** is inactive  
Relay de-energised (Measured value > Limit value)

Technical error Switching levels of analogue output as per parameterisation  
Optocoupler transistor output NPN 1 disabled  
Fault message programmable in 0.1 mA increments; 0.5–3.9 / 20.1–22 mA





# Connections to FI32 female multi-point connector MAT 419x

Microprocessor device with one measuring circuit input | Connections to FI32 female multi-point connector

## Electrical data

Euro plug-in print pin assignment 24 V version

Switchpoint 1 for measuring circuit 1 FSL (Fail Safe Lo) L Alarm

Relay de-energised (Measured value < Limit value)

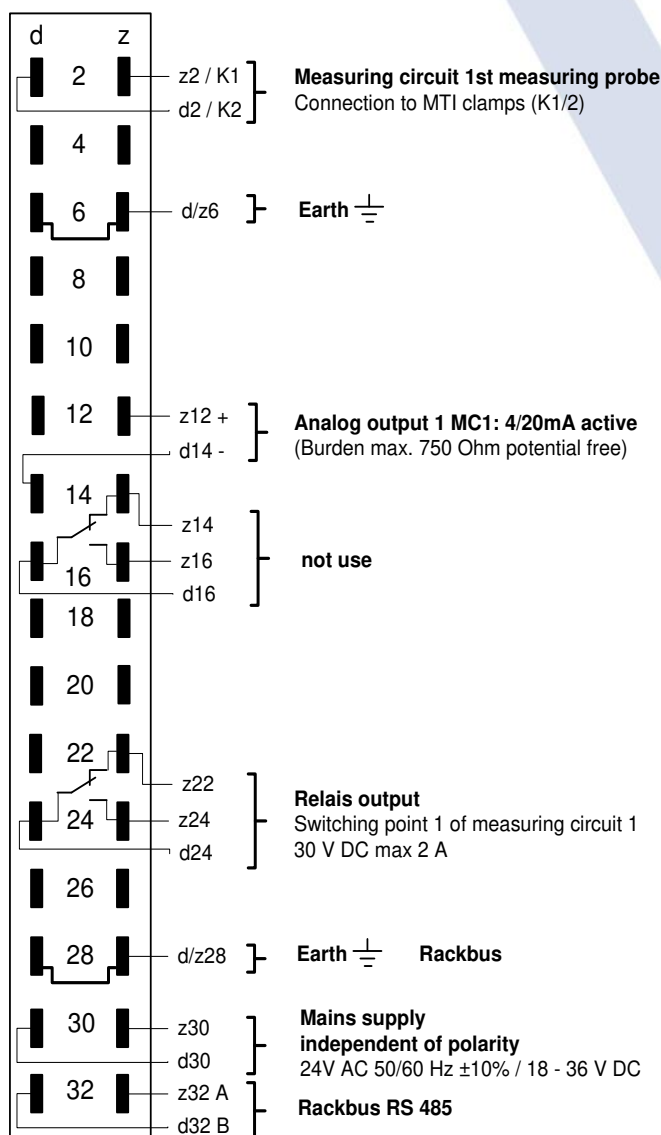
Switchpoint 2 for measuring circuit 1 FSH (Fail Safe Hi) H Alarm

=> for dynamic batch separation, FS setting is inactive

Relay de-energised (Measured value > Limit value)

Technical fault switching levels analogue output as per parameterisation relay de-energised

Fault message programmable in 0.1 mA increments; 0.5–3.9 / 20.1–22 mA



# Connections to FI32 female multi-point connector MAT 422x/424x

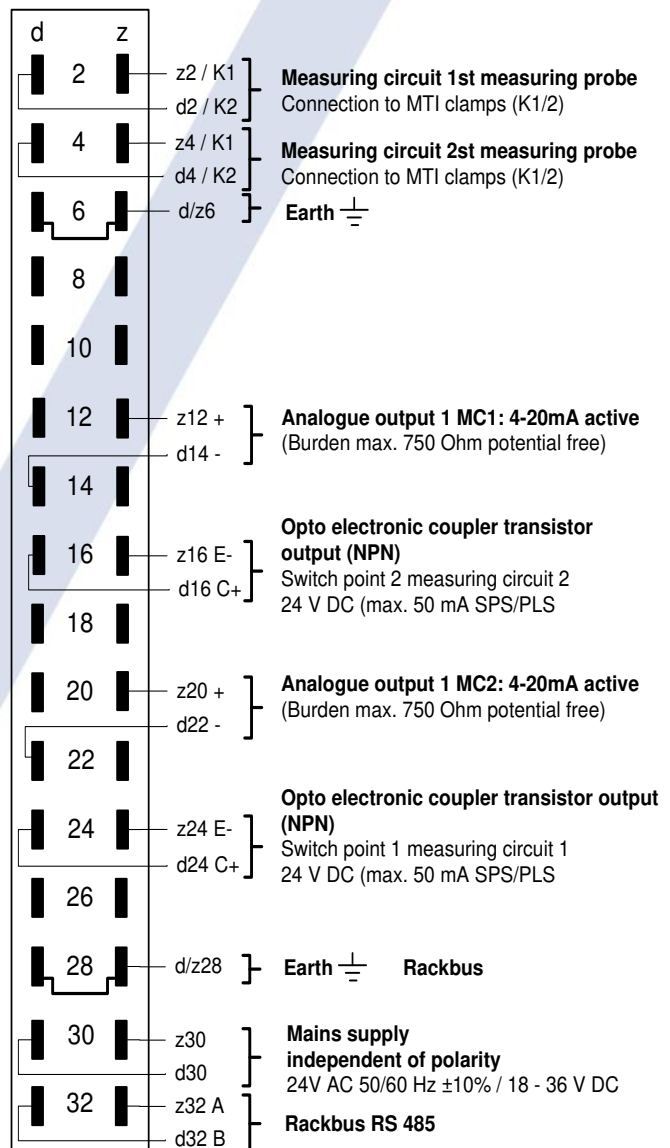
Microprocessor device with two measuring circuit inputs | Connections to FI32 female multi-point connector

## Electrical data

Euro plug-in print pin assignment 24 V version

Switchpoint 1 for measuring circuit 1 FSL (Fail Safe Lo) L Alarm  
Relay de-energised (Measured value < Limit value)  
Switchpoint 2 for measuring circuit 1 FSH (Fail Safe Hi) H Alarm  
=> for dynamic batch separation, **FS setting** is inactive  
Relay de-energised (Measured value > Limit value)

Technical error Switching levels of analogue output as per parameterisation  
Optocoupler transistor output NPN 1 disabled  
Fault message programmable in 0.1 mA increments; 0.5–3.9 / 20.1–22 mA



# Connections to FI32 female multi-point connector MAT 426x

Microprocessor device with two measuring circuit inputs | Connections to FI32 female multi-point connector

## Electrical data

Euro plug-in print pin assignment 24 V version

Switchpoint 1 for measuring circuit 1 FSL (Fail Safe Lo) L Alarm

Relay de-energised (Measured value < Limit value)

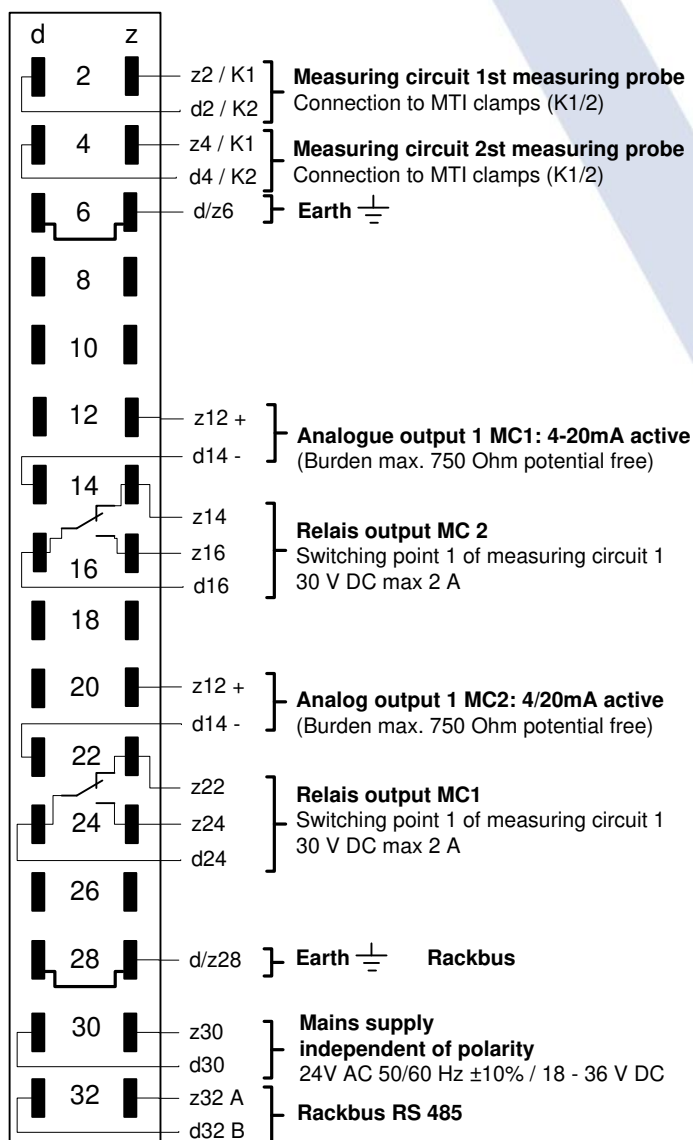
Switchpoint 2 for measuring circuit 1 FSH (Fail Safe Hi) H Alarm

=> for dynamic batch separation, **FS setting** is inactive

Relay de-energised (Measured value > Limit value)

Technical fault switching levels analogue output as per parameterisation relay de-energised

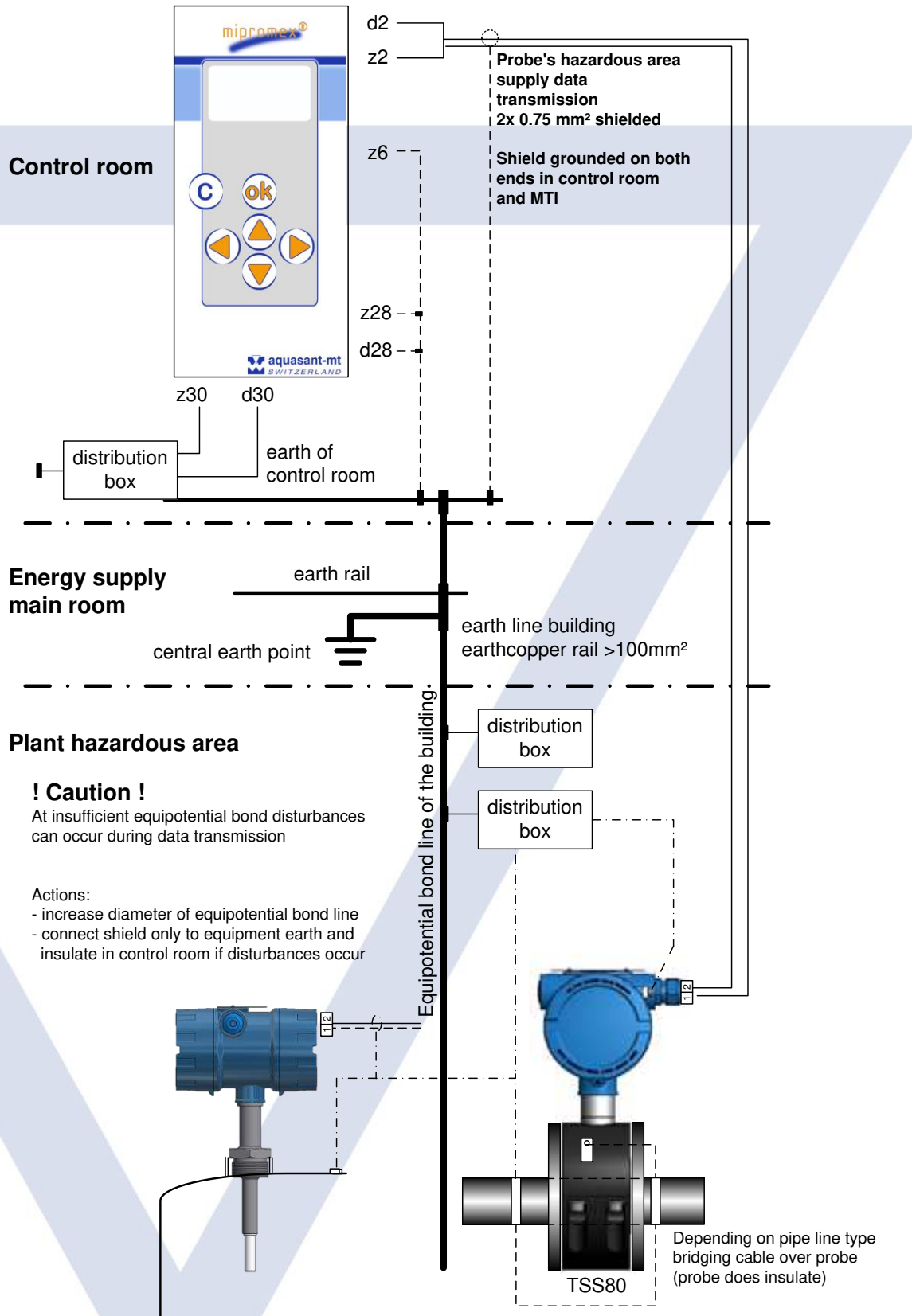
Fault message programmable in 0.1 mA increments; 0.5–3.9 / 20.1–22 mA





# Earthing for microprocessor devices and probes

Earth-related measuring must be earthed in accordance with Ex regulations.



## Technical data

### Design type

Plug-in electronics with square stainless cover in protective housing, with HF connection

19" plug-in module with aluminium-steel housing; IP 20

### Mounting

MR 7 19" rack; 3 HE (European format)

MRM II monorack; plastic housing for DIN rail or wall mounting. Front panel mounting with BOPLA housing.

Compact or table-top for laboratory

### Function

- Analogue transmitter with fail-safe hazardous area supply for a MTI xx measurement transducer. Conversion of a digital measuring signal into an analogue signal with measuring range spread
- Fault message programmable on analogue output 0.5-4.0 mA/20.0-22.0 mA
- Menu-guided multilingual device communication
- Commissioning procedure
- 1 analogue 4-20 mA and limit value optocoupler transistor output NPN or relay per channel

### Operation/Display

Front panel with film keypad with graphic LCD display, backlit, 6 push buttons for entering calibration data and parameters

### Data backup in case of mains failure

Battery buffer max. 10 years. Parameter storage in case of battery failure

### Dimensions

Heights 3 HE; width 12 TE

Front panel: Height x Width 128 x 61 mm

Plug-in module: Height x Width x Depth 100 x 60 x 160 mm

7 plug-in modules can be mounted per 19" rack

### Weight

MAT 4110: 690 g | MAT 4220: 705 g

### Supply voltage

24 V DC/AC 50/60 Hz (22-26 VAC) / (18-36 VDC), independent of polarity

### Start-up current

Short-time (1 ms) approx. 1 A

### Power consumption

MAT 4110 approx. 3.4 VA (I = 140 mA) | MAT 4220: approx. 4 VA (I = 200 mA)

### Fuses

8.5 x 8.5 mm miniature fuse MST 400 mA

### Hazardous area supply/Signal transmission

[Ex ia] IIC, modulated pulse supply signal

Open circuit voltage  $U_0 \leq 18.9$  V

Short-circuit current  $I_0 \leq 49$  mA

Power  $P_0 \leq 231$  mW output characteristic linear

Ex d ia, modulated pulse supply signal

Open circuit voltage  $U \leq 19.3$  V

Short-circuit current  $I \leq 75$  mA

### Signal wiring circuit Ex ia IIC

Max. external inductance  $L_0 \leq 10$  mH

Max outer capacity  $C_0 \leq 180$  nF



### Signal transmission

1 or 2 measuring circuits, modulated pulse supply signal

### Signal line short-circuit

max. current consumption MAT 4110/4130: 160 mA

MAT 4220/4260: 280 mA

### Ambient temperature

0 °C ... +45 °C

### Storage temperature

-20 °C ... +45 °C, ideally +20 °C

### Measuring range / Data display, processing

0 – 3700 pulses / Transmission of MTI 400 ms, internal processing mipromex 20 ms, approx. 3 measurements/second

### Switching hysteresis

1 pulse corresponds to 0.028 pF for measuring range 100 pF

### Connection

FI male plug 32 poles, coding possible (Ex version)

### Optocoupler transistor output NPN

1 potential-free NPN optocoupler transistor output

Limit values min./max. limit value

Min. or max. safety selectable

### Switching voltage limit value – output

30 V DC

### Continuous current limit value – output

Optocoupler transistor 50 mA

Relay 2 A

### Breaking capacity limit value – output

Optocoupler transistor 150 mW

Relay 60 W

### Analog output

active 4-20 mA output, max. load 750  $\Omega$ , non-Ex, with potential separation, technical failure 0.5-4 / 20-22 mA adjustable

### Interface

RS 232 / RS 485 (only for firmware update)

### Monitoring

Self-monitoring measuring system: defective probe, short-circuit/interrupted Ex supply (wire break protection); measuring range; mains failure and mipromex<sup>®</sup> malfunctions

### Testing



gas II (2) G [Ex ia Gb] IIC

dust II (2) D [Ex ia Db] IIIC

II (2) G / II (2) D (Probe [Ex d ia] IIC)

RL 2014/34/EU

Test report no.: 08-IK-0396.01 with extension 1

Device also available without hazardous area protection mipromex<sup>®</sup> must be installed outside the hazardous area.

### Fail-safe hazardous area connection:

MTI transmitter module ... In protective housing or S\*\*; K\*\*; F\*\* bar probes

EMC-tested, STS 024 Report No. 990102WS

complies with EN 1127-1 : 20011

EN 61000-6-2 2005 EN 6100-6-4 : 2007

EN 60079-0 : 2012 EN 60079-11 : 2012



## Fault messages

Error messages are visualised on the display with time, date and error type.

Fault messages can be programmed on the analogue signal in the ranges of 0.5 – 4.0 mA and 20.0 – 22.0 mA, in increments of 0.1 mA.

In the event of a fault, the limit value outputs are de-energised.

### Technical error:

All mipromex® microprocessor devices are equipped with a diagnostic system, which facilitates the error search and helps to rectify faults more quickly.

mipromex® technical errors which require the device to be sent to aquasant® for repair:

- ▼ Flash memory checksum verification failed

**In the case of repeated errors, send device in for repair!**

- ▼ Flash memory failed

**Flash is defective; send device in for repair!**

- ▼ Low battery: Battery is drained and must be replaced

**Battery change; send device in for repair!**

- ▼ Program memory check failed

**Microprocessor card is defective; send device in for repair!**

### Data error:

- ▼ Measured value undershot: mA output changes to the value programmed in menu item 8.3! Relays drop out.  
Possible cause: Cable break, misaligned on-site MTI electronic unit

- ▼ Measured value exceeded: mA output changes to the value programmed in menu item 8.3! Relays drop out.  
Possible cause: Measured value is greater than 3750 pulses, misaligned on-site MTI electronic unit

