

Hydrogen

Chlor-Alkali

SOEC

PEM

Fuel Cells

EMobility/
Powertrain

LDPE / EVA

Additive
Manufacturing

Explosion
Protection

19"
Legacy

Portfolio



PEM Electrolyser

Voltage Monitoring



HVT 300-DX

Shunt Current
Monitoring



HVT 300-DV

HVT 300-DX

- SIL 2 rated voltage monitor
- Up to 1000 V
- Redundant design, two processor DuoTec© technology with self-diagnosis
- Flexible software configuration
- Only SIL 2 voltage monitoring transmitter for 1000 V

HVT 300-DV

- SIL 2 rated mV transmitter
- 0 – 70 mV measurement range
- Redundant design, two processor DuoTec© technology with self-diagnosis
- Flexible software configuration
- Only SIL 2 mV transmitter

> Monitoring of operational conditions of electrolyser

> Detect deviations in the process

> Identify need for maintenance

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AVL

SOEC Electrolyser

Voltage Monitoring



HVT 300-DX

Shunt Current
Monitoring



HVT 300-DV

HVT 300-DX

- SIL 2 rated voltage monitor
- Up to 1000 V
- Redundant design, two processor DuoTec© technology with self-diagnosis
- Flexible software configuration
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HVT 300-DV

SIL 2 rated mV transmitter
0 – 70 mV measurement range
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Flexible software configuration
Only SIL 2 mV transmitter

> Monitoring of operational conditions of electrolyser

> Detect deviations in the process

> Identify need for maintenance

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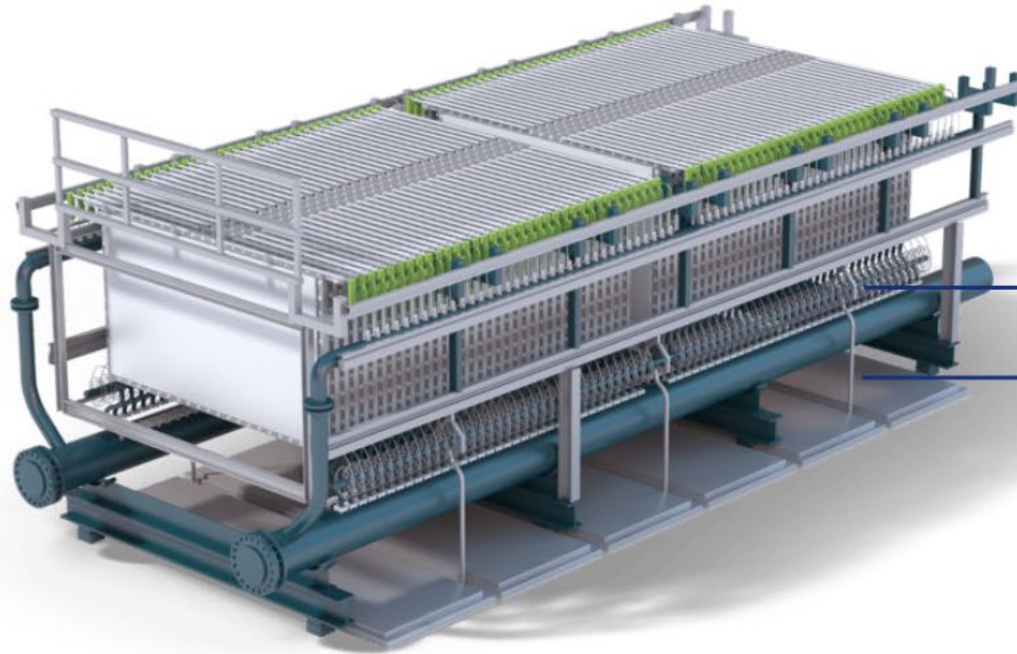
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Chlor Alkali Electrolyser

Voltage Monitoring



HVT 300-DX
HVT 400-DX
HVT 300-DP

Shunt Current Monitoring



HVT 300-DV

HVT 300 & 400-DX/DP

- SIL 2 rated voltage monitor
- Up to 1000 V or 1500 V
- Optional Balance and Symmetry Monitoring (max. +/- 1500 V)
- Redundant design, two processor
- DuoTec© technology with self-diagnosis
- Flexible software configuration
- Only SIL 2 voltage monitoring transmitter for more than 1000 V

HVT 300-DV

- SIL 2 rated mV transmitter
- 0 – 70 mV measurement range
- Redundant design, two processor
- DuoTec© technology with self-diagnosis
- Flexible software configuration
- Only SIL 2 mV transmitter

> Monitoring of operational conditions of electrolyser

> Detect deviations in the process

> Identify need for maintenance

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Fuel Cell

Voltage Monitoring



HVT 300-DX
HVT 400-DX

HVT 300-DX & 400-DX

- SIL 2 rated voltage monitor
- Up to 1000 or 1500 V
- Redundant design, two processor DuoTec© technology with self-diagnosis
- Flexible software configuration
- Only SIL 2 voltage monitoring transmitter for more than 1000 V

> Monitoring of operational conditions across the whole stack

> Detect deviations in the process

> Identify need for maintenance

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PLd Rated High Voltage Test Beds



testFAB 42

Safety rated voltage monitoring



HVT Series – SIL 2 for up to 1500 V

Safe Discharging



HVD Series – Wear-free & safe discharging

HVT 300 & 400-DX

- SIL-2 rated voltage monitor
- Up to 1000 or 1500 V
- Redundant design, two processor, DuoTec technology with self diagnosis
- Flexible software configuration
- Standard for managing high voltage risks at leading eMobility suppliers

HVD 450

- GaN-based solid state contactor
- Wear-free switching and discharging of intermediate circuits (max. 2000 VDC, 10 A) with current and voltage monitoring

> Manage risks related to high voltages in laboratories and production lines

> Safe switching and safe discharging of HV circuits

> Protect employees from electrical shock

> Reduce employees' training requirements for test beds

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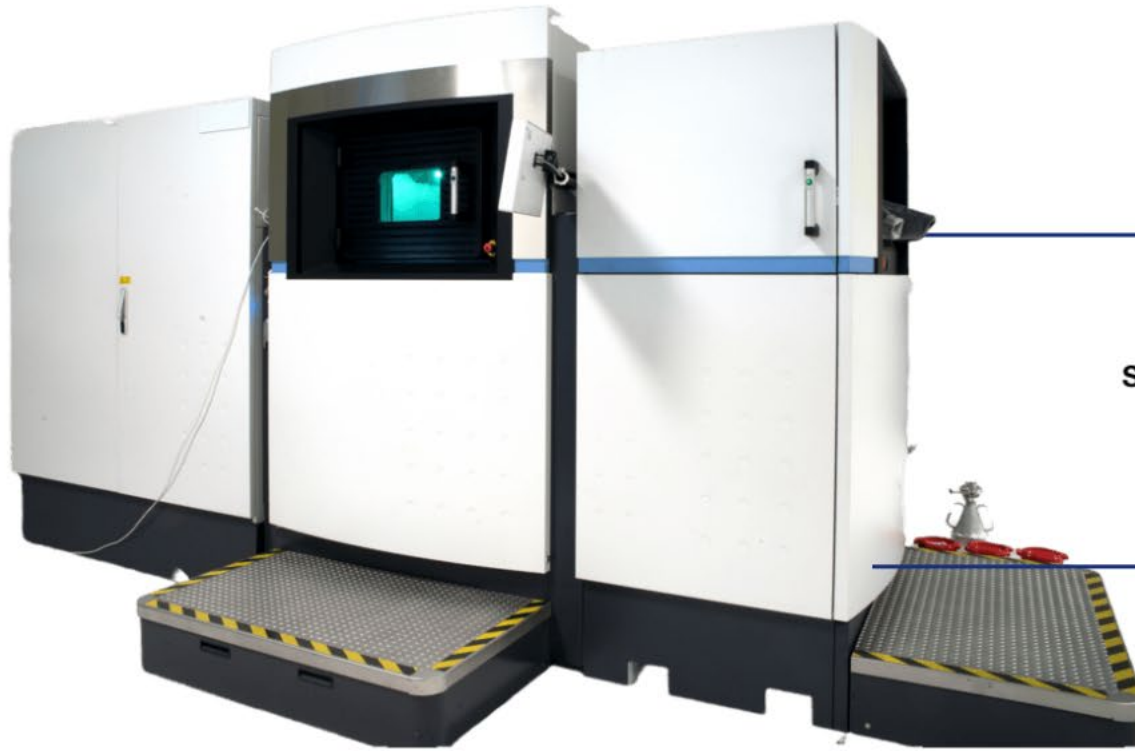
LDPE / EVA

**Additive
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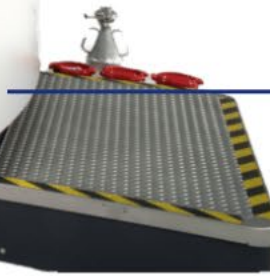
3D Printing / Additive Manufacturing

Safety rated
voltage Monitoring



HVT Series –
SIL 2 voltage monitoring

Oxygen Transmitter



MST 300

HVT 300-DX

- SIL 2 rated voltage monitor
- Up to 1000 or 1500 V
- Redundant design, two processor DuoTec© technology with self-diagnosis
- Flexible software configuration

MST 300

- High Impedance Isolation Amplifier for Oxygen sensors
- 0 ... 1500 mV measurement range
- Input resistance >100 MΩ

> Safety-rated monitoring of laser supply voltage to prevent accidents and injuries

> Safe Oxygen monitoring

HVT 300 & 400 – The only SIL 2 high voltage transmitters

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HVT 300 & 400

- SIL 2 rated voltage monitor
- Up to 1000 or 1500 V
- Redundant design, two processor DuoTec© technology with self-diagnosis
- Flexible software configuration

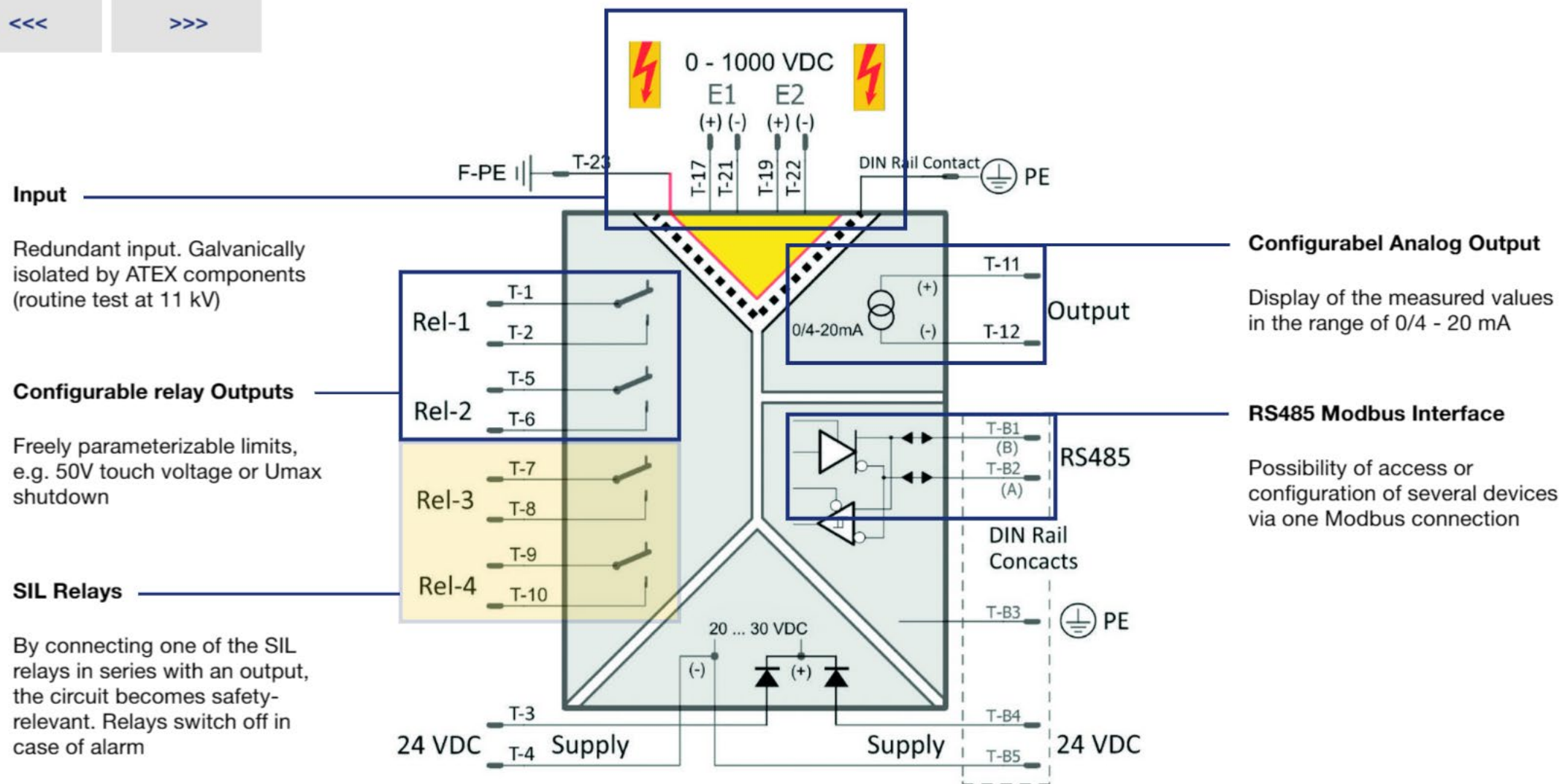
- Variant DX: absolute voltage measurement
- Variant DP: Balance voltage (e.g. symmetry monitoring in electrolysers)



HVT 300 & 400 – The only SIL 2 high voltage transmitters

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Input

The two input channels are constantly compared. The adjustable tolerance defines the maximum deviation. If the deviation exceeds the tolerated threshold, the safety alarm is displayed. In this way, a break in the HV input line can be detected.

Relays

Each relay has two output contacts. One of them is addressed from the terminal, the other is connected to the processor to ensure the correct state.

Processor

Mütec DuoTec® technology is based on two independent processors that constantly monitor each other. If one processor fails, the other reports the error with a safety alarm to put the device in a safe state.

mA Output

The analog output is a voltage controlled current source. The value of the output signal is read back into the controller and compared with the setpoint. If a defined tolerance is exceeded or in case of wire break, the safety alarm is triggered

Supply Voltage

The supply is monitored by a watchdog circuit that triggers a safety alarm in the event of a voltage drop.

Memory

Configuration and parameters are stored in a non-volatile memory and constantly monitored. After each power-up, the parameters are compared with a checksum defined by the user configuration.

HVT 300 & 400

Safety Properties	FMEDA
Category	SIL 2
Device type	Type B
HFT	0
SFF	95 %
DC	90 %
Safe failure rate	331 FIT
Safe detected failure rate	0 FIT
Safe undetected failure rate	331 FIT
Dangerous failure rate	362 FIT
Dangerous detected failure rate	325 FIT
Dangerous undetected failure rate	37 FIT

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HVT 300 & 400 – The only SIL 2 high voltage transmitters

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HVT 400

Technical Data

Certificate	SIL 2 according to IEC 61508
Measurement range	0.. 1500 V AC/DC
Input Resistance	12 M Ω each channel
Analog Output	04... 20 mA
Load	Max. 500 Ω at 22 mA
Accuracy	< 0,5 %
Contact outputs	Normally Open
Switching Power	Max. 37,5 VA / Max. 30 W
Switching Voltage	Max. 125 VAC / 30 V DC
Switching Current	Max. 0,3 A AC / 1 A DC
Contact Material	AG Pd + 10 μ Au
Status LEDs	Power: Green Error / SIL Alarm: Red REL1/REL2: Yellow
USB Interface	USB 2.0
RS485 Interface	Half duplex, no scheduling
Baud rate	9600 bps
Device Address	1-248
Supply	24 VDC (20...30 VDC)
Power Consumption	Max. 1,9 W
Temperature	-10° C...+60° C
Storage / Transport	-20° C...+70° C
Perm. Humidity	10 %...95 % r.H no cond.
Max. operating Altitude	<2000 m above mean sea level
Temperature Coefficient	<0,01 %/K (max) <0,005 %/K (typical)
Galvanic isolation	4,3 kV AC test voltage
Overtoltage category	CAT II: 1500 V Pollution Degree 2
PCB Material	FR4
Housing Material	Polyamide
Protection Class	IP20
Flammability UL94	V0
Mounting type	35 mm DIN rail

HVT 300 & 400 – The only SIL 2 high voltage transmitters

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HVT 300-DX

More Information



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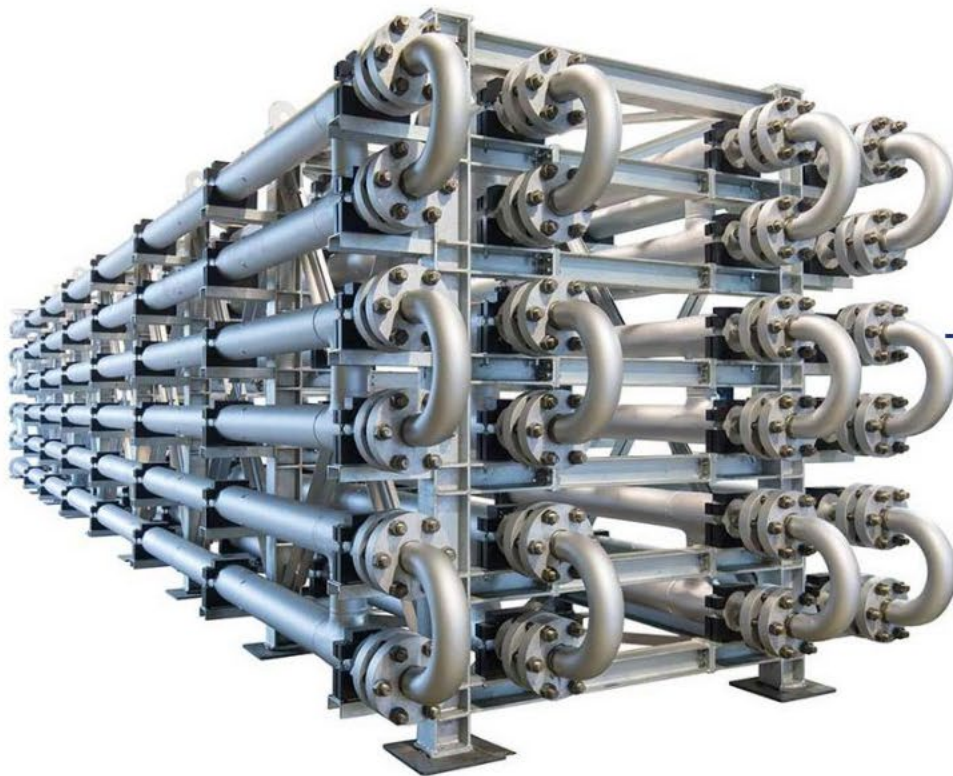
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High Speed Temperature Transmitter



**MTP 300 series –
Temperature Transmission
in less than 4 ms**

High Speed Temperature Transmitter



**MTP 302 – with additional
output for overshoot reactions**

MTP 300

- Worlds fastest temperature transmitter (4 ms)
- Supports all thermocouple types
- High dielectric strength
- SIL2 according to IEC/EN 61505
- ATEX rating up to zone 0
- High safety (4,7 FIT)
- 10-year proof test interval

MTP 302

- Adds additional output with tripled measurement range above trip value
- Information regarding peak temperature, average temperature and cooling allows calculating the overall stress regime on pipes and fittings

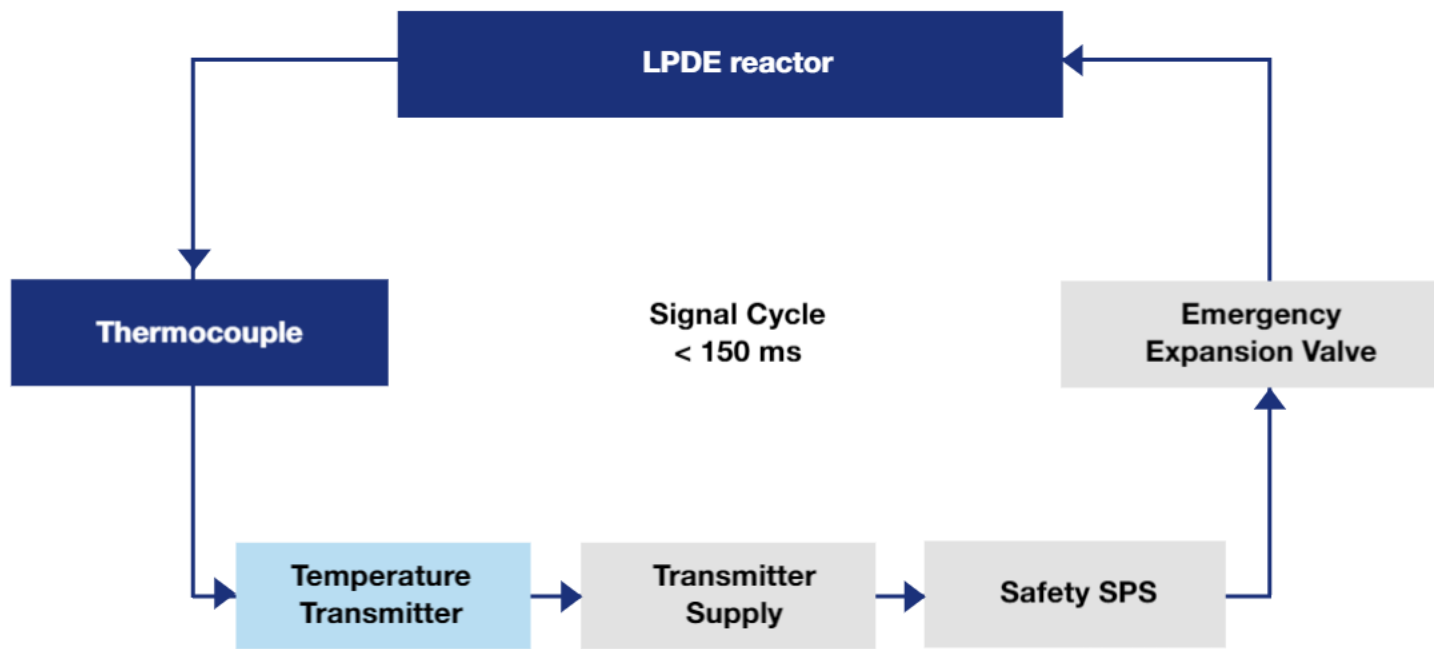
> **Fast triggering of emergency valve
in case of a decomposition**

> **Less stress on the equipment,
faster maintenance and turnaround**



**LDPE & EVA Production -
High Pressure Polymerisation**

- Hydrogen >>>
- Fuel Cells
- EMobility/ Powertrain
- LDPE / EVA**
- Additive Manufacturing
- Explosion Protection
- 19" Legacy
- Portfolio



Zone 0 Safe Zone
Zone 1

LDPE & EVA

- LDPE plants require a safe monitoring of temperature in the reactor due to high process pressure (~3000 bar)
- An increase of temperature needs to be detected and processed quickly, as pressure might otherwise rise to a critical level
- The transmitters trigger the opening of the emergency expansion valves and depressurize the reactor
- Fast reaction is crucial for safe operation and to minimize shut down time and interruptions for LDPE productions

Hydrogen

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Fuel Cells

EMobility/
Powertrain

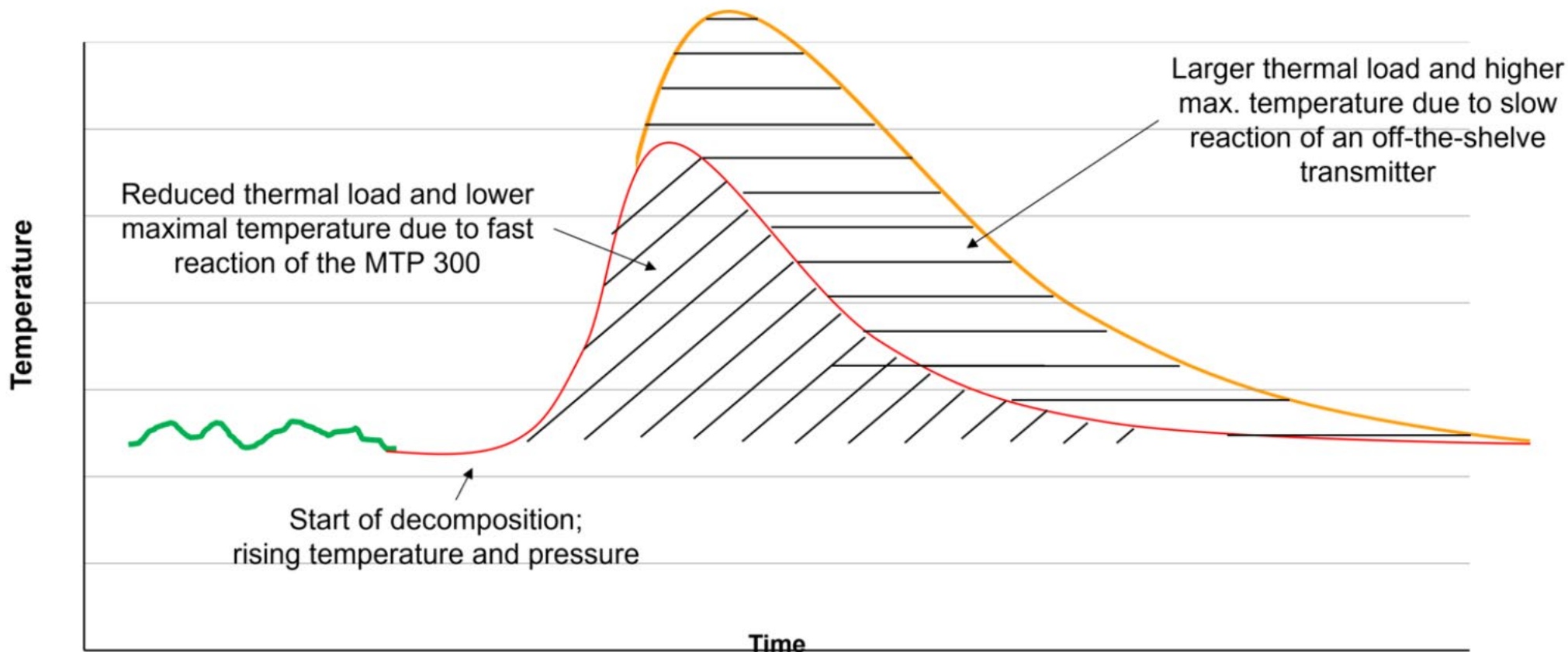
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Fuel Cells

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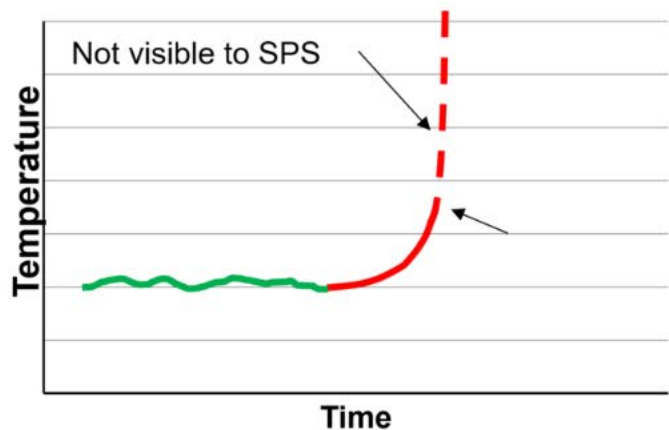
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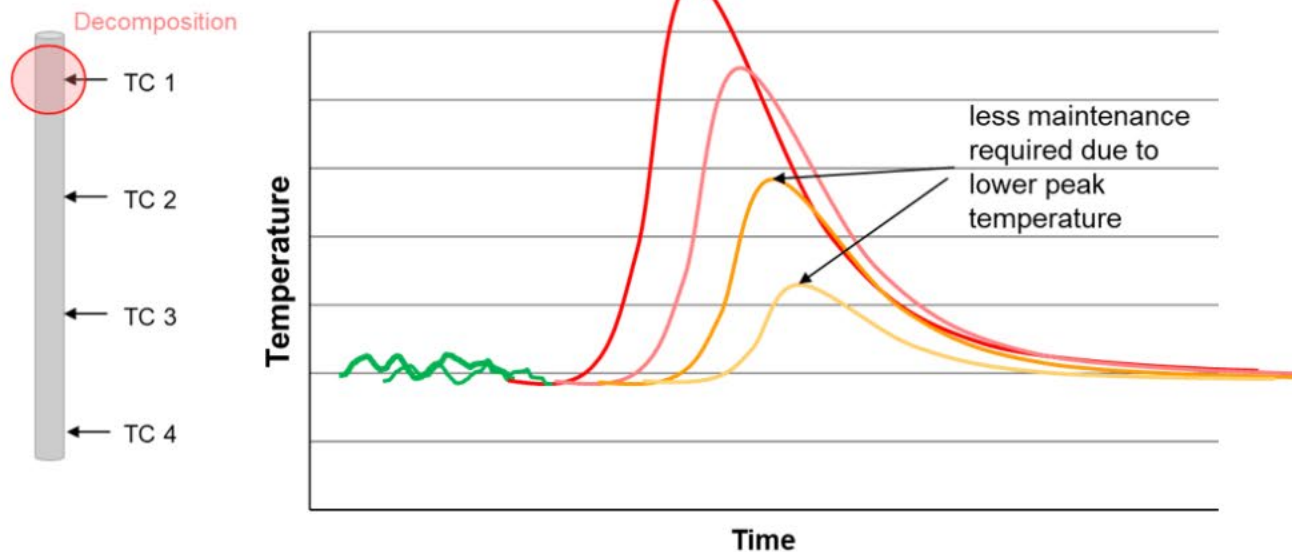
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MTP 302 Benefits

- Additional Output with extended range
- Information on peak and average Temperature in case of decompositions
- Rapid signal processing (3ms)
- SIL2 / ATEX Zone 0
- Based on well-tried safety concept (MTP 300i)
- Developed and already successfully tested in cooperation with industry leaders



Hydrogen

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Fuel Cells

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Powertrain

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MTP 300 & 302

- Worlds fastest temperature transmitters (4 ms)
- SIL2 according to IEC/EN 61508
- ATEX rating up to zone 0
- High safety (4,7 FIT)
- 10-year proof test interval
- Global standard in most LDPE licenses to handle decomposition reactions
- Global standard in gas power plants to control the combustion process in the turbines



Hydrogen

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Fuel Cells

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World fastest reaction time

<35 ms with input filter
<4 ms without input filter

High dielectric strength

Special transducers rated and tested at 11 kV

Extremely low failure rates

Only 4,7 undetected failures in 109 operating hours ($\lambda_{du} = 4,7$ FIT)



Optional redundancy

Two electrically isolated TC-inputs are available to increase the redundancy

External Safety Routines

e.g., Detects wire breaks, loose contacts and defect thermocouples

Internal Self-Diagnosis

e.g., both input channels, memory failure, analog output, range violation

SIL 2 and ATEX / IECEx Zone 0

Intrinsic safety according to IEC61508:2010 SIL2, IEC/EN 60079-11, ATEX [Ex ia] IIC

MTP 300 & 302 – The world fastest temperature transmitters

Hydrogen

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Actively monitored analog output

Loop-powered intrinsically safe output signal with active monitoring

Automatic internal cold junction compensation

Each input features an internal CJC in the range of -10°C... +70°C

Two Channel Structure

Redundant architecture with active wire break detection on both channels

Digital linearisation

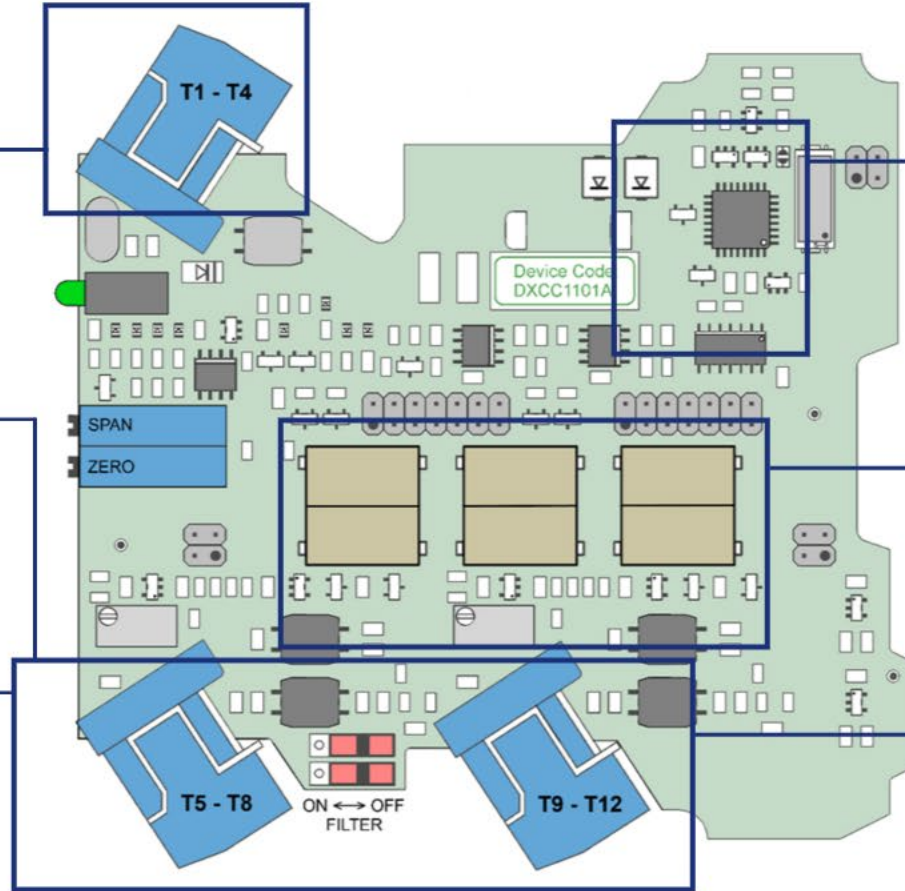
The analog input stage and a customizable linearization controller enable the speed for pre-defined measurement ranges

Strong dielectric barriers

Specifically designed converters ensure galvanic isolation between both inputs and the output

Optional Input filter

In order to diminish EMC interferences, a 2nd order butterworth filter is available with a switch



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Speed

Due to its analog design, the MTP 300 features a high degree of integration. This makes it very fast, but also efficient. It can be loop-powered supplied by a transmitter power supply, which makes the signal chain safer and less complex.

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Processor

Internally, the diagnosis routines monitor the processor clock frequency as well as supply current and voltage. If the deviation exceeds the value of 5 %, the mA value of the output circuit jumps periodically to < 3.6 mA

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Redundant Structure

Two inputs ensure also a short circuit detection due to the comparison of both input channels. In case of a short circuit, the faulty line signals the CJC temperature, while the second channel reads the temperature value. If the deviation is >5%, an internal failure is signalled.

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Output and Supply

In order to supply the device, an intrinsically safe transmitter power supply is required. If the output signal shows a deviation of >5%, the output signal jumps periodically to < 3.6 mA.

Internal Input Monitoring

In order to supply the device, an intrinsically safe transmitter power supply is required. If the output signal shows a deviation of >5%, the output signal jumps periodically to < 3.6 mA.

External Input Monitoring

An external failure (Thermocouple or wire break) leads to a permanent reduction of the mA-value in the supply circuit (< 3.6 mA). This is detected by applying a small current to the TC circuit.

MTP 300 & 302

Safety Properties	FMEDA
Category	SIL 2
Device type	Type B
HFT	0
SFF	93 %
PFD _{avg}	5,63E-5 %
Safe failure rate	78,5 FIT
Safe detected failure rate	0 FIT
Safe undetected failure rate	78,5 FIT
Dangerous failure rate	66 FIT
Dangerous detected failure rate	61,3 FIT
Dangerous undetected failure rate	4,7 FIT

MTP 300 & 302 – The world fastest temperature transmitters

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Technical Data MTP 300

Certificate	SIL 2 according to IEC 61508 ATEX:II 2(1)G Ex ib [ia Ga] IIC T4 Gb
Thermocouple inputs Safety Data	U ₀ = 1 VDC I ₀ = 1.8 mA P ₀ = 0.5 mW C ₀ = 10 µF L ₀ = 100 mH
Analog Output Supply Safety Data	U _i = 28 VDC I _i = 95 mA P _i = 655 mW C _i = 26 nF L _i = negligible
Supply voltage range	12.5V ... 28V
Current range	>3.5 ... <24 mA
Load	70 ... 800 Ω
Cold junction compensation	-10 ... 70°C
Status LEDs	luminosity corresponds to 4 ... 20 mA
Behavior in case of failure	low
Power Consumption	Max. 560 mW, Min. 50 mW
Temperature Storage / Transport	-10°C...+70°C -20°C...+80°C
Perm. Humidity	10%...95% r.H no cond.
Max. operating Altitude	<2000m above mean sea level
Temperature Coefficient	<0,05%/10K (max)
Galvanic isolation EMC	EN 60079-11 EN 61326-3-2
PCB Material	FR4
Housing Material	Polyamide
Protection Class	IP20
Flammability UL94	V0
Mounting type	35mm DIN rail

MTP 300 & 302 – The world fastest temperature transmitters

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More Information



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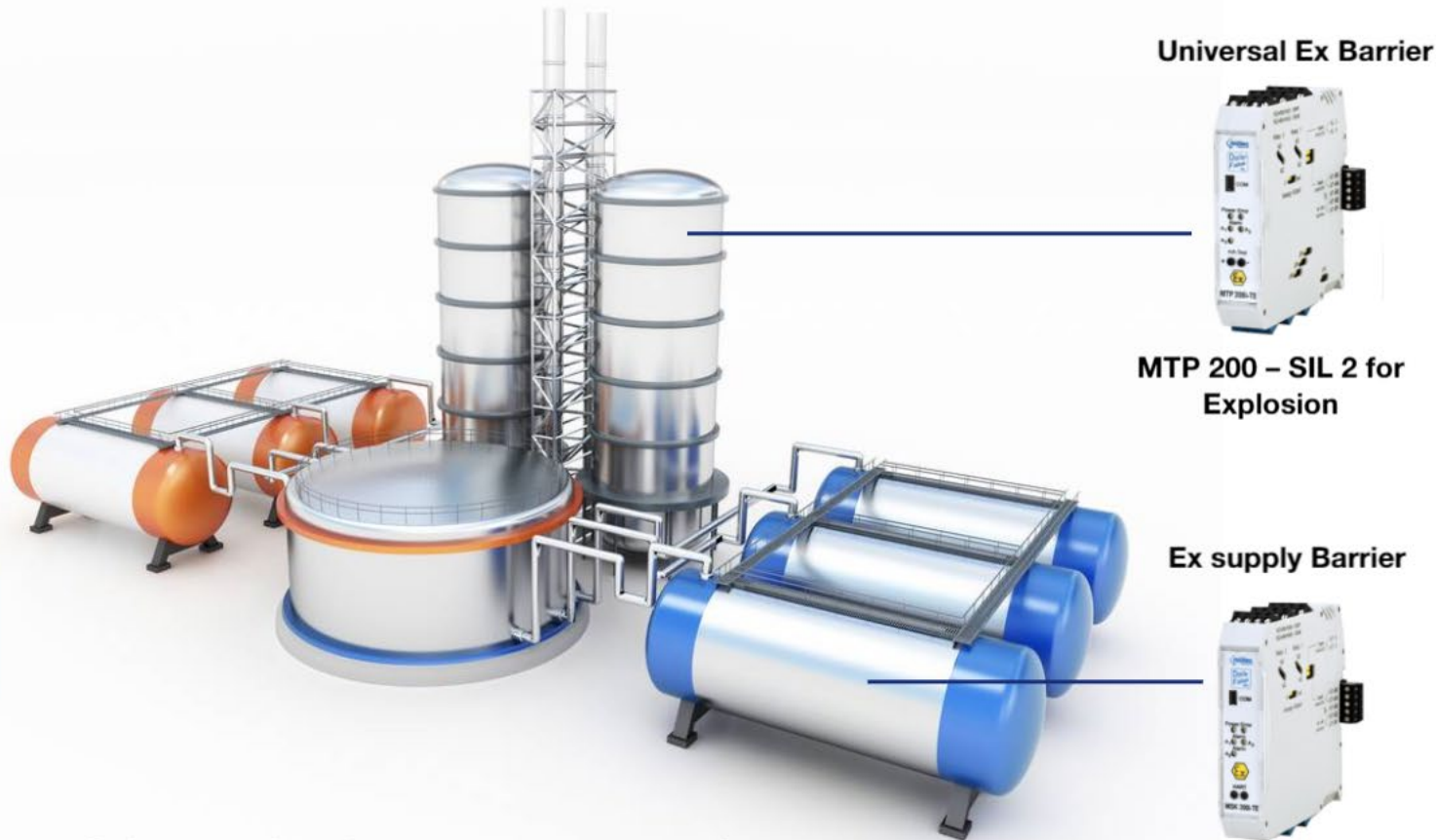
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Safe connection of temperature, pressure and flow sensors in petrochemical plants

MTP & MSK 200-TE

- IEC61508 SIL2 and ATEX [Ex ia] IIC
- Continuous self-monitoring by 2 microprocessors
- Diagnosis manager with error memory
- 1 service alarm
- 4 limit alarms: 2 relays and 2 transistors
- For DIN-Rail or 19"-mounting
- Bus capable (MODBUS RTU)
- High Galvanic isolation
- New: Predictive maintenance by TC-Resistance monitoring



> Flexible ATEX and SIL 2 solution for all applications

> Versatile power supply for Ex zones

> Short lead times

Hydrogen

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MTP 200

- IEC61508 SIL2 and ATEX [Ex ia] IIC
- Continuous self-monitoring by 2 microprocessors
- Diagnosis manager with error memory
- 1 service alarm
- 4 limit alarms: 2 relays and 2 transistors
- Universal inputs (only 2 types for all applications)
- For DIN-Rail or 19"-mounting
- Power supply via DIN-Rail or clamp
- Bus capable (RS 232 and RS 485)
- Galvanic isolation
- New: TC-Resistance monitoring



MTP 200 – Universal Ex Barrier

Hydrogen

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Fuel Cells

Software Configuration

Over RS 232 or RS 485

Multiple Input types

Thermocouple, PT100,
Potentiometer, Voltage, Current

EMobility/
Powertrain

High dielectric strength

Special transducers for the use
in ATEX environments

External Safety Routines

e.g., Detects wire breaks, loose
contacts and defect
thermocouples

LDPE / EVA

DuoTec Technology

Two processors are constantly
monitoring each other

Internal Self-Diagnosis

e.g., both input channels,
memory failure, analog output,
range violation

Additive
Manufacturing

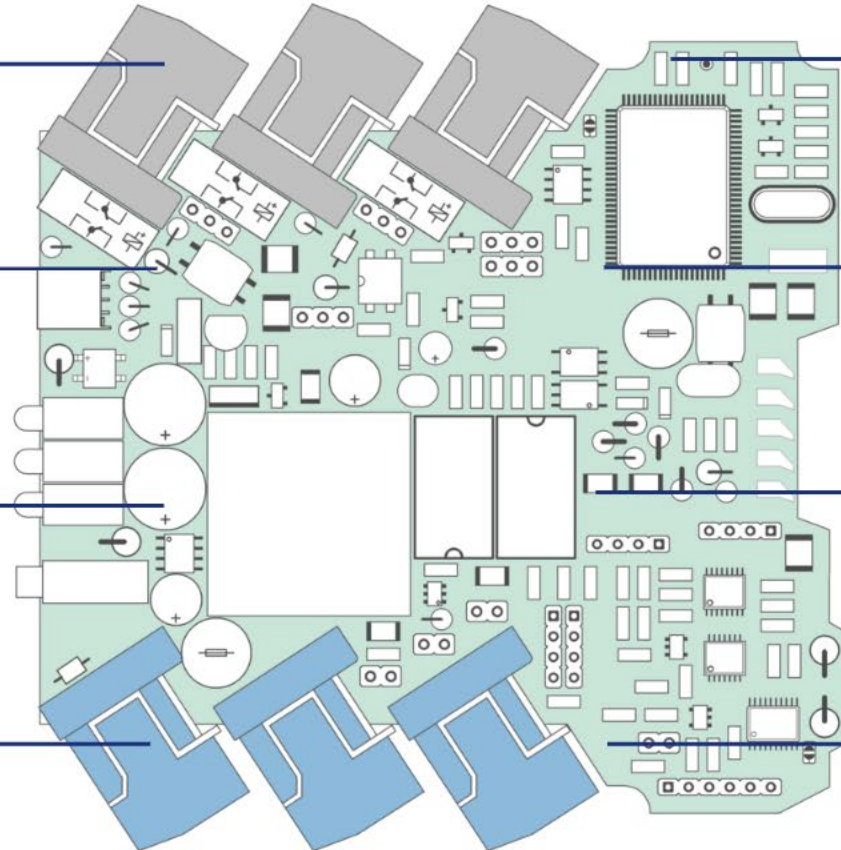
**Explosion
Protection**

SIL 2 and ATEX / IECEx Zone 0

Intrinsic safety according to
IEC61508:2010 SIL2, IEC/EN 60079-
11, ATEX [Ex ia] IIC

Predictive Maintenance

By measuring the resistance, it
is possible to detect defects in
thermocouples



Portfolio

MTP 200 – Universal Ex Barrier

- Hydrogen
- Fuel Cells
- EMobility/
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- LDPE / EVA
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Input

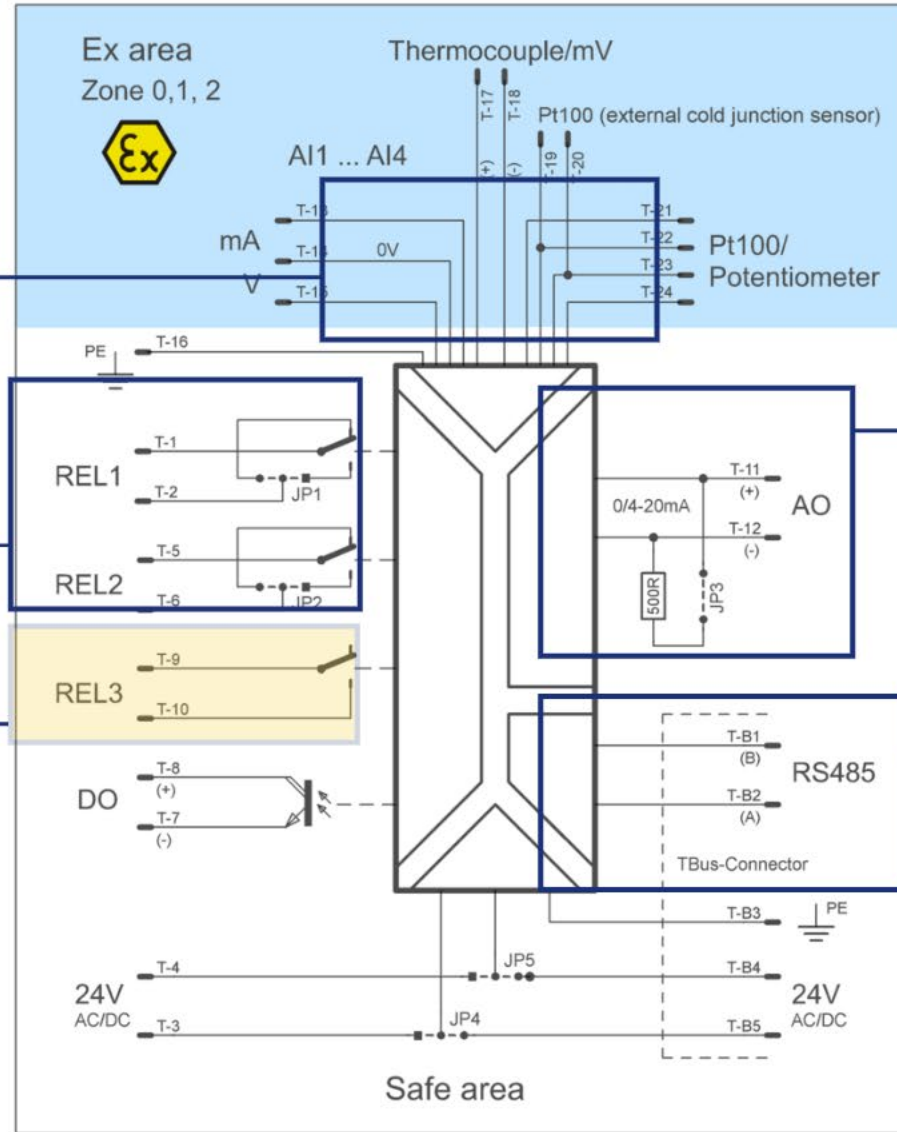
Flexible input signals. Galvanically isolated by ATEX components (routine test at 11 kV).

Configurable relay Outputs

Freely parameterizable limits, e.g. 50V touch voltage or U_{max} shutdown.

SIL Relays

By connecting the SIL relay in series with an output, the circuit becomes safety-relevant. The relay switches off in case of alarm.



Configurable Analog Output

Display of the measured values in the range of 0/4 - 20 mA

RS485 Modbus Interface

Possibility of access or configuration of several devices via one Modbus connection.

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Input

The input channels are constantly monitored. The adjustable tolerance defines the maximum deviation. If the deviation exceeds the tolerated threshold, the safety alarm is displayed. In this way, a break in the HV input line can be detected.

Relays

Each relay has two output contacts. One of them is addressed from the terminal, the other is connected to the processor to ensure the correct state.

Processor

Mütec DuoTec® technology is based on two independent processors that constantly monitor each other. If one processor fails, the other reports the error with a safety alarm to put the device in a safe state.

mA Output

The analog output is a voltage controlled current source. The value of the output signal is read back into the controller and compared with the setpoint. If a defined tolerance is exceeded or in case of wire break, the safety alarm is triggered.

Supply Voltage

The supply is monitored by a watchdog circuit that triggers a safety alarm in the event of a voltage drop.

Memory

Configuration and parameters are stored in a non-volatile memory and constantly monitored. After each power-up, the parameters are compared with a checksum defined by the user configuration.

MTP 200

Safety Properties	FMEDA
Category	SIL 2
Device type	Type B
HFT	0
SFF	90,1 %
DC	76,2 %
Safe failure rate	2025 FIT
Safe detected failure rate	875 FIT
Safe undetected failure rate	1150 FIT
Dangerous failure rate	1457 FIT
Dangerous detected failure rate	1110 FIT
Dangerous undetected failure rate	347 FIT



Explosion Protection

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MSK 200

- IEC61508 SIL2 and ATEX [Ex ia] IIC
- Continuous self-monitoring by 2 microprocessors
- Diagnosis manager with error memory
- 1 service alarm
- 4 limit alarms: 2 relays and 2 transistors
- Universal inputs (only 2 types for all applications)
- For DIN-Rail or 19"-mounting
- Power supply via DIN-Rail or clamp
- Bus capable (RS 232 and RS 485)
- Galvanic isolation
- New: TC-Resistance monitoring



MSK 200 – Intelligent SIL 2 Power Supply

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Software Configuration

Over RS 232 or RS 485

High dielectric strength

Special transducers for the use in ATEX environments

DuoTec Technology

Two processors are constantly monitoring each other

SIL 2 and ATEX / IECEx Zone 0

Intrinsic safety according to IEC61508:2010 SIL2, IEC/EN 60079-11, ATEX [Ex ia] IIC



Multiple Input types

Thermocouple, PT100, Potentiometer, Voltage, Current

External Safety Routines

e.g., Detects wire breaks, loose contacts and defect thermocouples

Internal Self-Diagnosis

e.g., both input channels, memory failure, analog output, range violation

Predictive Maintenance

By measuring the resistance, it is possible to detect defects in thermocouples

MSK 200 – Intelligent SIL 2 Power Supply

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Input

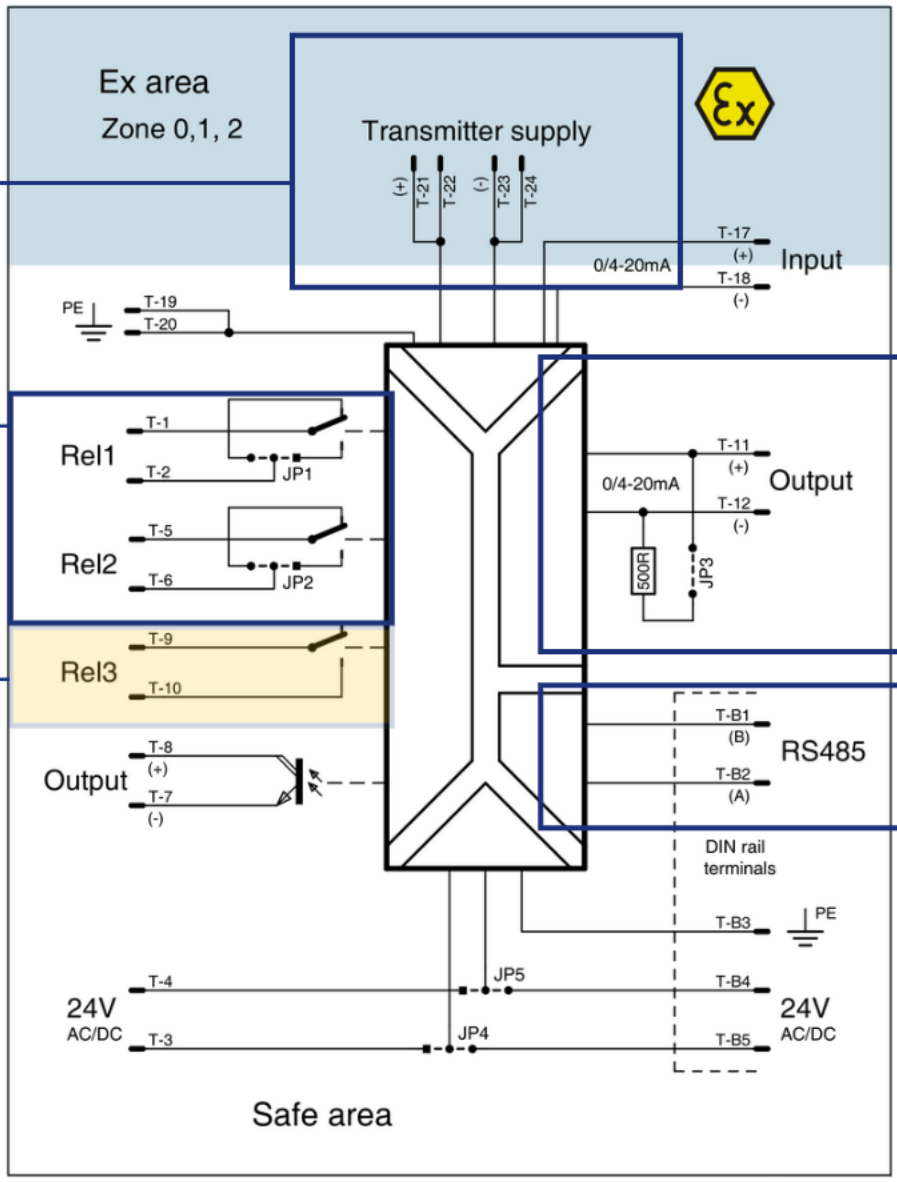
Flexible input signals. Galvanically isolated by ATEX components (routine test at 11 kV).

Configurable relay Outputs

Freely parameterizable limits, e.g. 50V touch voltage or Umax shutdown.

SIL Relays

By connecting the SIL relay in series with an output, the circuit becomes safety-relevant. The relay switches off in case of alarm.



Configurable Analog Output

Display of the measured values in the range of 0/4 - 20 mA

RS485 Modbus Interface

Possibility of access or configuration of several devices via one Modbus connection.

MSK 200 – Intelligent SIL 2 Power Supply

Hydrogen

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Fuel Cells

EMobility/
Powertrain

LDPE / EVA

Additive
Manufacturing

Explosion
Protection

19"
Legacy

Portfolio



Technical Data

Certificate	SIL 2 according to IEC 61508
Measurement range	mA, V, PT100, Potentiometer, TC
Analog Output	0/4 ... 20 mA
Load	Max. 500 Ω at 22 mA
Accuracy	< 0,5%
Contact outputs	Normally Open
Switching Power	Max. 62,5 VA / Max. 30 W
Switching Voltage	Max. 125 VAC / 110 VDC
Switching Current	Max. 1A
Contact Material	AG Pd + 10 μAu
Status LEDs	Power: Green Error / SIL Alarm: Red REL1/REL2: Yellow
Interfaces	RS 232, RS 485
RS485 Interface	Half duplex, no scheduling
Baud rate	9600 bps
Device Address	1-248
Supply	24 VDC (20...30 VDC)
Power Consumption	Max. 1,9 W
Temperature	-10° C ... +60° C
Storage / Transport	-20° C ... +70° C
Perm. Humidity	10 % ... 90 % r.H no cond.
Max. operating Altitude	<2000m above mean sea level
Temperature Coefficient	<0,01 %/K (max.) <0,005%/K (typical)
Galvanic isolation	300 Veff, 2.5 kV test voltage
Oversvoltage category	CAT II: 300 V Pollution Degree 1
PCB Material	FR4
Housing Material	Polyamide
Protection Class	IP20
Flammability UL94	V0
Mounting type	35 mm DIN rail

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More Information



Hydrogen

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Fuel Cells

EMobility/
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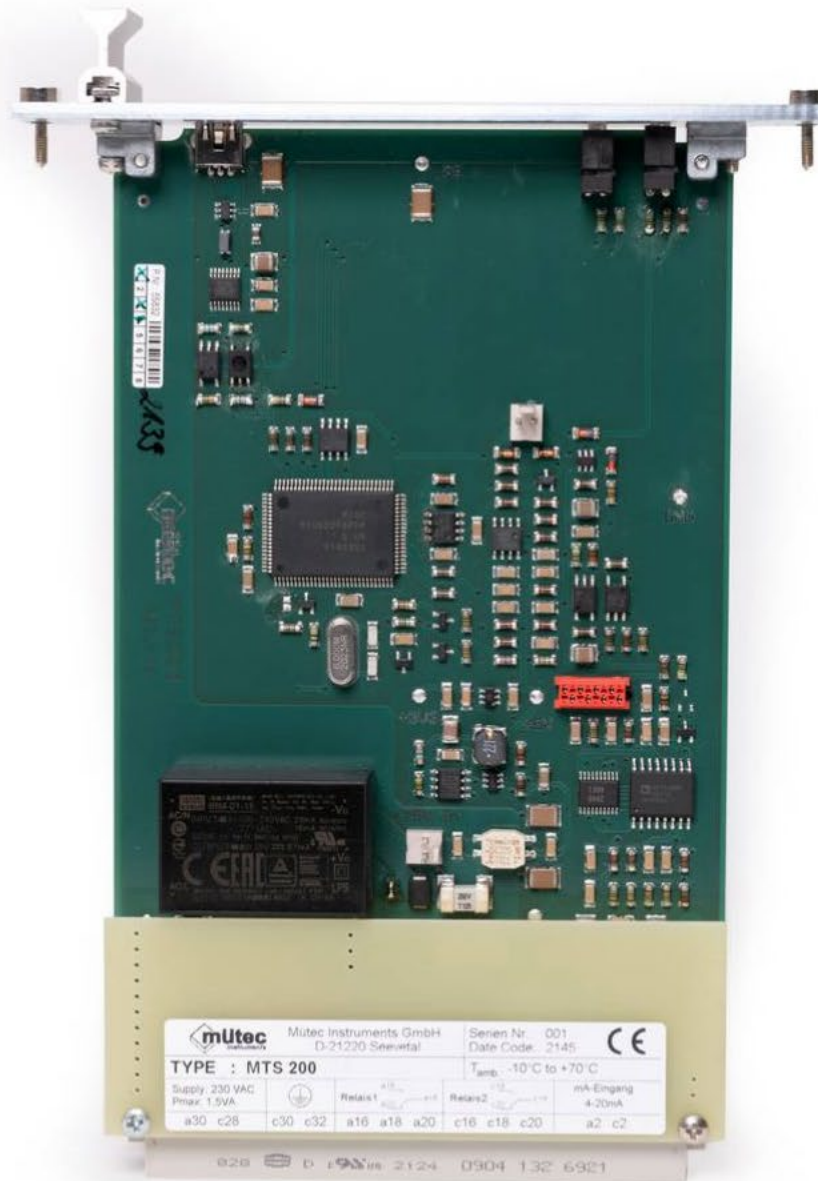
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MTS 200

19" Technology

- Pin Compatible replacements for discontinued 19" cards
- Fast and easy IEC61508 SIL2 and ATEX [Ex ia] IIC re-certifications
- Software implementation (Diagnosis manager with error memory, configurable alarms)
- USB / BUS capable (RS 232 and RS 485)
- Existing MTP / MSK series can be individually modified to suit almost all applications

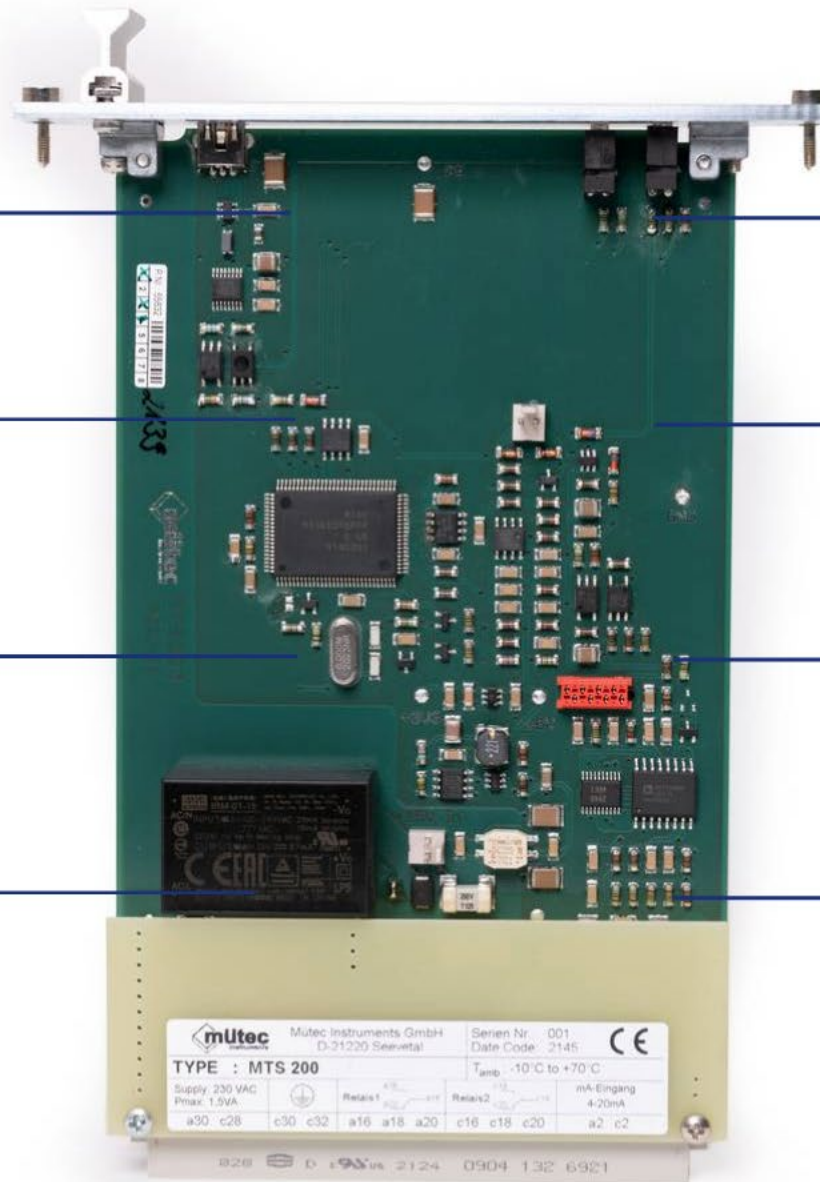


19" Legacy & Customized SIL 2 and ATEX Replacements

- Hydrogen
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Software Configuration

Over RS 232 or RS 485

High dielectric strength

Special transducers for the use in ATEX environments

DuoTec Technology

Two processors are constantly monitoring each other

SIL 2 and ATEX / IECEx Zone 0

Intrinsic safety according to IEC61508:2010 SIL2, IEC/EN 60079-11, ATEX [Ex ia] IIC

Optional redundancy

Thermocouple, PT100, Potentiometer, Voltage, Current

External Safety Routines

e.g., Detects wire breaks, loose contacts and defect thermocouples

Internal Self-Diagnosis

e.g., both input channels, memory failure, analog output, range violation

Predictive Maintenance

By measuring the resistance, it is possible to detect defects in thermocouples

mütec Mütec Instruments GmbH D-21220 Seewetal Serien Nr. 001 Date Code: 2145
TYPE : MTS 200 T_{amb.} -10°C to +70°C
 Supply 230 VAC P_{max.} 1.5VA Relais1 Relais2 mA-Eingang
 a30 c26 c50 c52 a16 a18 a20 c16 c18 c20 a2 c2

028 D 1944 2124 0904 132 6921

A complete portfolio for safety-driven applications

Hydrogen

Fuel Cells

EMobility/
Powertrain

LDPE / EVA

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SIL



HVT 400-DX
Voltage up to 1500 V



HVT 400-DP
Balance Voltage Monitor



HVT 300-DX
Voltage up to 1000 V



HVT 300-DP
Balance Voltage Monitor



HVT 300-DV
Shunt Current Monitor

SIL & ATEX



MTP-300
High Speed
Temperature



MTP-302
High Speed
Temperature



MTP-200
Universal Ex Barrier



MSK-200
Ex Power Supply

None



HVD 450
Electrical discharging



MST 300
Oxygen isolation
amplifier