

# MT5000

## Guided Wave Radar Level Transmitter

State-of-the-art loop  
powered, 4-20 mA output  
guided wave radar  
transmitter for liquid level  
applications  
K-TEK Products



### Introduction

This safety manual provides the following information:

- Overview
- Electrical installation and ratings
- Explosive atmosphere markings
- Special conditions of use
- Routine & maintenance tests
- Installation drawings
- EU declaration of conformity
- Certification for SIL 3 Capable

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# 1 General

## 1.1 Introduction

This MT5000 series is comprised of the MT5000, MT5100 and MT5200 models. This manual provides an overview of the safety aspects that must be observed for the installation and operation of the device.

## 1.2 Product description

The MT-series of level transmitters is a modular range of field mounted, microprocessor-based electronic transmitters, utilizing guided wave radar technology. Accurate and reliable measurement of liquid, solids and slurry level is provided in even the most difficult and hazardous industrial environments. The MT-series can be configured to provide specific industrial output signals, according to 4–20 mA with HART digital communication as well as FOUNDATION Fieldbus protocol. The MT-series consists of three models: MT5000 (total level measurement), MT5100 (total level and interface measurement) and MT5200 (total level measurement with ULD mode for low dielectric applications).

## 1.3 General safety information

The device is constructed in accordance with international and local regulations and is deemed to be operationally safe. Additionally, the device is tested and shipped from the factory in perfect working condition. The information contained within this safety manual, as well as all applicable documentation and certification, must be observed and adhered to in order to maintain the factory-deployed condition throughout the MT-series period of operation.

Full compliance with the general safety requirements must be observed during handling, installation, maintenance or operation of the device. In addition to providing general information, the individual sections within this manual contain descriptions, processes and/or procedural instructions with specific safety information for that corresponding action.

Only by observing all of the safety information can the user minimize the risk of hazards to personnel and/or the environment. The provided instructions are intended as an overview only and do not contain detailed information on all available models or every conceivable scenario that may arise during setup, operation and/or maintenance work. This document shall be used in conjunction with the operation/instructions manuals.

For additional information, or in the event of specific issues not covered within these operating instructions, please contact the manufacturer. ABB declares the contents of this manual are not part of any prior or existing agreements, commitments or legal relationships and are not intended to amend those that are already in place.

In addition, the user must observe all relevant safety regulations regarding the installation and operation of electrical systems and the relevant standards, regulations and guidelines concerning explosion protection.

## 1.4 Information on WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product/solution is not subject to the WEEE Directive 2002/96/EC or corresponding national laws (e.g., the ElektroG-Electrical and Electronic Equipment Act-Germany). Dispose of the product/solution at a specialized recycling facility. Municipal garbage collection points should not be used for this purpose.

According to WEEE Directive 2002/96/EC, only products that are used in private applications may be disposed of at municipal

garbage facilities. Proper disposal prevents negative effects on both individuals and the environment and also supports the re-use of valuable raw materials. ABB can accept and dispose of returns for a fee.

## 1.5 Pressure Equipment Directive (PED) (97/23/CE)

This product conforms to the EC directives listed in the device-specific EC declaration of conformity. It is designed in accordance with safe engineering practices to meet state of the art safety requirements, has been tested and left the factory in a condition in which they are safe to operate.

## 1.6 Use of instruction



**DANGER** - Serious damage to health / risk to life  
This symbol in conjunction with the signal word "DANGER" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.



**WARNING** - Bodily injury  
This symbol in conjunction with the signal word "WARNING" indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.



**CAUTION** - Minor Injuries  
This symbol in conjunction with the signal word "CAUTION" indicates a potentially dangerous situation. Failure to observe this safety information may result in minor or moderate injury. This symbol may also be used for property damage warnings.



**NOTICE** - Property Damage  
This symbol indicates a potentially damaging situation. Failure to observe this safety information may result in damage to or destruction of the product and / or other system components.



**IMPORTANT (NOTE)**  
This symbol indicates operator tips, useful information or important information about the product or its further uses. The signal word "IMPORTANT (NOTE)" does not indicate a dangerous or harmful situation.

# 2 Installation in Hazardous Locations

## 2.1 Explosives atmospheres installation

For installation requirements in Explosives Atmospheres applications refer to IEC 60079-14 and any local Safety or Electric Code regulations mandatory in your area.

For specific conditions for safe use refer to section 3.0 of this manual.



**WARNING** - Bodily injury. The device can be operated at high levels of pressure and with aggressive media. As a result, serious injury or significant property damage may occur if this device is operated incorrectly.



#### CAUTION - Minor injuries

Only qualified and authorized personnel are to be tasked with the installation, electrical connection, commissioning and maintenance of the transmitter. Qualified personnel are those individuals who have experience in the installation, electrical connection, commissioning and operation of the transmitter or similar devices and hold the necessary qualifications. These qualifications include:

- Training or instruction – authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures and aggressive media
- Training or instruction in accordance with safety engineering standards regarding maintenance and use of adequate safety systems.

For reasons of safety, ABB recommends that only sufficiently insulated tools, conforming to IEC EN 60900, be used.

Since the transmitter may form a link within a safety chain, it is recommended that the device be replaced immediately if defects are detected. In the event of use in a hazardous area, only non-sparking tools shall be used.

### 2.2 Safety information for electrical installation



#### WARNING – Bodily Injury.

Electrical connections may only be established by authorized personnel in accordance with the electrical circuit diagrams. The electrical connection information in the manual must be observed; otherwise, the application protection type may be affected. Ground the measurement system according to requirements.

### 2.3 Safety information for inspection and maintenance

Corrective maintenance work may be performed only by trained personnel.

Before removing the device, depressurize the vessel and any adjacent lines or containers.

Check whether hazardous materials have been used as measured materials before opening the device. Residual amounts of hazardous substances may still be present in the device and could escape when the device is removed from the vessel

Within the scope of operator responsibility, check the following as part of a regular inspection:

- Pressure-bearing walls/lining of the level device
- Measurement-related function
- Leak-tightness
- Wear (corrosion)

### 2.4 Operator liability

In instances where corrosive and / or abrasive materials are being measured, the user must check the level of resistance of all parts that are coming into contact with these materials. ABB offers guidance in the selection of material but does not accept liability in performing this service. The user must strictly observe the applicable national regulations with regards to installing, functional testing, repairing and maintaining electrical devices.

### 2.5 Qualified personnel

Installing, commissioning and maintaining the device may be performed only by trained personnel who are authorized by the plant operator. These trained personnel must have read and understood this manual and must comply with its instructions

### 2.6 Mounting

Read the following installation instructions carefully before proceeding. Failure to observe the warnings and instructions may cause a malfunction or personal hazard. Before installing the transmitter, ensure the device design meets the requirements of the measurement point from both a measure technology and safety point of view.

This applies in respect to:

- Explosion-protection certification
- Measuring range
- Pressure
- Temperature
- Operating voltage

Check the suitability of the materials in regards to their resistance to the media. This applies to the:

- Gasket
- Process connection and seals
- Probe
- End connection

In addition, the relevant directives, regulations, standards and accident prevention regulations must be observed. Measurement accuracy is largely dependent on the correct installation of the level transmitter and, if applicable, mounting arrangement. In instances where it is possible, the measuring setup should be free from critical ambient conditions such as large variations in temperature, vibrations or shocks.

### 2.7 Certification nameplates

Please refer to the 3.0 of this manual for details.

#### **i** IMPORTANT

Read this manual thoroughly before using this equipment. If you do not understand the content of this manual, contact ABB service personnel.

## 2.8 IP Protection and designation

The housing for the MT-series transmitters is certified as conforming to protection type IP67 (according to IEC 60529) or Type 4X (according to NEMA 250).

## 2.9 Cable connection

The electrical connection is established via a cable entry, ½-4 NPT thread, or by M20 adapter.

### IMPORTANT NOTE

With Category 3 transmitters for use in “Zone 2”, a qualified cable gland for this type of protection must be installed by the customer (see the Hazardous Area Consideration section). For transmitters with a flame-proof enclosure (Ex d) type of protection, the housing cover must be secured using the locking screw. The screw plug that may have been supplied with the transmitter must be sealed at the plant using Molykote DX. The installer assumes responsibility for any other type of sealing medium used. Increased force is required to unscrew the housing cover after an interval of several weeks. This is not caused by the threads but is due to the type of gasket.



### CAUTION

The cable entry device shall comply with the requirements of EN 60079-0 and maintain IP 54 or better as required by the installation conditions.

- Field wiring should be rated at least 10°C above the maximum ambient temperature



### WARNING – Bodily Injury.

General risks. Cable, cable gland and unused port plug must be in accordance with the intended type of protection (for example, intrinsically safe and explosion-proof) and the degree of protection (for example, IP6x according to IEC EN 60529 or NEMA 4x). See also the addendum for Ex Safety Aspects and IP Protection. In particular, for explosion-proof installation, remove the red, temporary plastic cap and plug the unused opening with a plug certified for explosion containment.

## 2.10 Grounding

A terminal is available on both the outside of the housing and in the plug for grounding (PE) the transmitter. Both terminals are electrically connected to one another (see Figure 2-12).

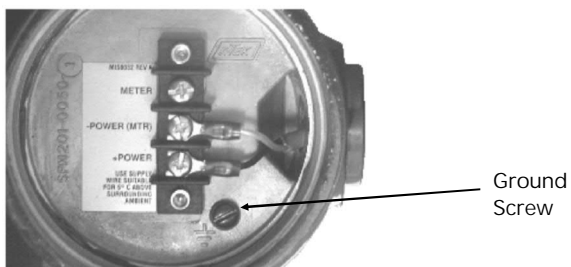


Figure 2-12 — Ground connection on transmitter housing

## 2.11 Protective grounding

All transmitters are supplied with an external ground connection for protective grounding. Wire this ground connection to a suitable earth ground. For a transmitter measuring loop, an earth ground should maintain a resistance of 5 ohms or less. Use a heavy-duty conductor, at least 15 AWG / 1.6mm<sup>2</sup> Ø.



### WARNING – General Risks.

A protective grounding connection is absolutely necessary to ensure personnel protection, to protect against surge (in case of installation of this option) and to prevent explosions in potentially explosive environments.

## 2.12 General guidelines



### WARNING

Make sure all circuits are de-energized prior to installation.

- The MT-series has been evaluated as an Installation (Over-voltage) Category 1/Pollution Degree 2 apparatus, per IEC 61010
- The maximum altitude of operation is 6560 feet (2000 meters).
- The MT-series is designed with both internal and external protective earth (ground) terminals.
- All field wiring connected to the MT-series transmitters must comply with National Electric Code or any other applicable regional electric codes.

## 2.13 Flame-proof/explosion-proof installations

### 2.13.1 Installation requirements

The MT-series of level transmitters is designed for use in Division 1 or at the boundary of a Zone 0 and Zone 1 hazardous area.



### CAUTION

The flameproof joints of the equipment are not intended to be repaired. Consult the manufacturer if repair of the flameproof joints is necessary.

Cable or conduit entries must be fitted with a suitably certified cable entry device, with or without the use of a suitably approved thread adaptor. Where conduit is used in the installation, a conduit seal is not required immediately after the end-user field wiring entrance.



### CAUTION

The cable entry device shall comply with the requirements of EN 60079-0 and maintain IP 54 or better as required by the installation conditions.

- Field wiring should be rated at least 10°C above the maximum ambient temperature

Installation and use of apparatus in hazardous locations shall be in accordance with an IEC 60079-14 or applicable regional standards.



### CAUTION

The housing cover can only be removed when the unit is installed in a non-hazardous area, when installed with intrinsic safety barrier, or when power is removed from the transmitter.

## 3 Explosive atmosphere markings

### 3.1 IECEx IS ratings

IECEx IS markings :

Ex ia IIB/IIC T4 Ga

Ex ia III C T80°C Da

Ex ic/ia IIB/IIC T4 Gc/Ga

Ex ic/ia III C T80°C Dc/Da

Ex ic IIB/IIC T4 Gc

Ex ic III C T80°C Dc

-40°C ≤ Ta ≤ 66°C

IECEx ETL 17.0016X/00

#### Conditions of Certification

##### (a) Special Conditions for safe use

- When EPL Ga or Da is required (for example in Zone 0 or Zone 20 hazardous areas), parts of the equipment containing light metals (Aluminum, Magnesium, Titanium and Zirconium) shall be protected from impact so that impact or friction sparks cannot occur, taking into account rare malfunction.
- Where EPL Da is required, the equipment housing shall not be subjected to uncontrolled dust layers.
- For Group IIC models equipped with Fieldbus communication, for connection to a FISCO trunk, an additional current limiting assembly, ABB part number 010-1000-2, shall be fitted to the input terminals. Refer to ABB Instruction document.
- The cable entry device shall comply with the requirements of IEC 60079-0 and maintain IP 54 or better.

##### (b). Conditions of Manufacture

- Equipment with "ic / ia" intrinsic safety shall be fitted with the MT Series Hermetic Seal Adapter.

### 3.2 IECEx Flameproof ratings

IECEx XP markings :

Ex ia/db IIC T6 Ga/Gb

Ex ia ta IIIC T80°C Da

-40°C ≤ Ta ≤ 66°C

IECEx ETL 17.0017X/00

#### Conditions of Certification

##### (a). Special Conditions for safe use

- When EPL Ga or Da is required (for example in Zone 0 or Zone 20 hazardous areas), parts of the equipment containing light metals (Aluminum, Titanium and Zirconium) shall be protected from impact so that impact or friction sparks cannot occur, taking into account rare malfunction.
- Where EPL Da is required, the equipment housing shall not be subjected to uncontrolled dust layers.
- The cable entry device shall be appropriately IECEx certified and maintain the appropriate level of ingress protection in order to maintain the required ingress protection rating according to the installation conditions.
- Flamepath joints are not intended to be repaired.

##### (b). Conditions of Manufacture

- The probe coupler shall be pressure tested at a pressure of at least 328 psi for at least 10 seconds. There shall be no leakage or permanent deformation.

### 3.3 FM / US HazLoc ratings

#### Factory Mutual Research Corporation

MT50xx, MT51xx and MT52xx f/b abcdefghiFMjk :  
XP-IS / I / 1 / ABCD / T6 Ta = 77°C;  
DIP / II,III / 1 / EFG / T6 Ta = 77°C; Type 4X  
IS / I / 1 / CD / T4 Ta = 77°C – ELE9020; Entity;  
Type 4X  
NI / I / 2 / ABCD / T4 Ta = 77°C;  
S / II,III / 2 / FG / T4 Ta = 77°C; Type 4X  
ANI / I / 2 / ABCD / T4 – ELE9020; Entity; Type 4X



MT51xx and MT52xx f/b abcdefghiFMjk :  
XP-IS / I / 1 / ABCD / T6 Ta = 77°C  
DIP / II, III / 1 / EFG / T6 Ta = 77°C - ELE1034  
IS / I / 1 / ABCD / T4 Ta = 77°C - ELE1034  
NI / I / 2 / ABCD / T4 Ta = 77°C  
S / II,III / 2 / FG / T4 Ta = 77°C  
ANI / I / 2 / ABCD / T4 - ELE1034 Type 4X



#### Conditions of Certification

##### (a) Special Conditions for safe use

- For guidance on Intrinsically Safe U.S. installations, see AN-SI/ISA-RP12.06.01, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
- Installations shall comply with the manufacturer's instructions, according to drawing ELE1034 or ELE9020 as applicable.
- Tampering and replacement with non-factory components may adversely affect the safe use of the system.
- Installations in the US shall comply with the relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®)).

##### (b). Conditions of Manufacture

- The manufacturer shall supply copies of Control Drawing ELE1034 & ELE9020 with each transmitter. The manufacturer shall make additional copies available upon request.
- The manufacturer shall make any Special Conditions of Use available to the user of the Product.
- The manufacturer shall carry out verifications or tests necessary to ensure that the electrical equipment produced complies with the documentation.

### 3.4 CSA / Canadian HazLoc ratings

#### Canadian Standards Association

Model MT5000/5100/5200 Radar Level Transmitter  
"[Ex ia] Associated Equipment"  
« Explosion-proof with intrinsically safe antenna rod »  
XP CL I, DIV 1, GP ABCD;  
CL II, DIV 1, GP EFG; CL 3 - T6  
CL I, DIV 2, GP ABCD;  
CL II, DIV 2, GP EFG - T5  
Maximum ambient = 77°C.  
MWP = 5000 psi max.  
Enclosure Type 4X. Single Seal.



"[Ex ia] INTRINSICALLY SAFE"  
« Intrinsically Safe Entity, when installed per ELE1034 »  
IS CL I, DIV 1, GP CD;  
CL II, DIV 1, GP EFG - T4  
Maximum ambient = 77°C.  
MWP = 5000 psi max.  
Enclosure Type 4X. Single Seal.



#### Conditions of Certification

##### (a) Special Conditions for safe use

- For explosion-proof and Division 2 models with the symbol "[Ex ia]" and the words "Associated Equipment", always open circuit before removing covers.
- For Intrinsically Safe models with the symbol "[Ex ia]" and the words "INTRINSICALLY SAFE", installations shall comply with the installation instructions, according to drawing ELE1034.
- Caution: substitution of components may impair suitability for use as I.S. or Div. 2.
- Caution: do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous
- Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code® (CEC).

##### (b). Conditions of Manufacture

- The manufacturer shall supply copies of Control Drawing ELE1034 with each transmitter. The manufacturer shall make additional copies available upon request.
- The manufacturer shall make any Special Conditions of Use available to the user of the Product.
- The manufacturer shall carry out verifications or tests necessary to ensure that the electrical equipment produced complies with the documentation.

## 4 Safety information for inspection and maintenance

Corrective maintenance work may be performed only by trained personnel.

The MT5000 will operate normally without the need for periodic maintenance or inspection. If the transmitter meets or exceeds the requirements of the application, the transmitter can be expected to provide reliable level indication for a minimum of 10 years.

If the MT5000 transmitter is being used as part of a Safety Implemented System (SIS), periodic testing will be required to proof the transmitter and detect any potential failure which is defined as Dangerous Undetectable in normal operation. Proof testing must be performed at regular intervals (2 years) and the results of this testing must be documented. Should the transmitter exhibit a fault during normal operation, it will be necessary to perform the proof testing regardless of schedule. As part of the testing documentation, all parameters included in the menu structure of the transmitter (see page 10) as well as the configuration of the module jumpers (see page 9) must be recorded. The transmitter is capable of supplying (1) 4-20mA output. If a transmitter is equipped with more than one indication, only the process variable selected by the PV= menu option will be considered as a safety function as this selected variable will be the basis for the 4-20mA output. The MT5000 transmitter may only be used in a safety-related system when the mode of that system is low demand. As a device, the MT5000 transmitter will be used to provide a level measurement to prevent overflow and dry run of a vessel.

If a transmitter fails an inspection or assistance is required for inspection or troubleshooting, contact the Service Department at ABB via e-mail at [service@ca.abb.com](mailto:service@ca.abb.com). The Service Department will answer questions, provide additional assistance, and issue Return Authorization Numbers for equipment in need of repair.

**CAUTION:** In the event a guided wave radar transmitter has suffered a failure in any component which is exposed to the process, any other guided wave radar transmitter installed in the same or similar process should be inspected for the same failure regardless of its maintenance schedule. These Common Cause Failures include: 1) Damage to the high frequency coupler, 2) damage to the electronics module, 3) deformation of the sensor probe due to process agitation.

Notes on usage in Safety Instrumented Systems:

- 1) The MT5000 performs internal diagnostics at a maximum interval of 15 minutes.
- 2) The MT5000 will provide annunciation of a diagnostic failure in less than 15 minutes of the occurrence.
- 3) The failure of any internal diagnostics will result in notification of the fault by setting of diagnostic bits in HART protocol output.
- 4) All MT5000 FMEDA analysis is based on using a safety accuracy of 2%.
- 5) The internal diagnostics are designed to achieve a Safe Failure Fraction of 90% minimum.

6) The target average probability of failure on demand is less than  $1.5 \times 10^{-3}$ .

7) MT5000 transmitters are qualified for use in a SIS only when the output used for the safety function is the 4–20 mA output.

8) If MT5000 transmitters equipped with HART are used in a SIS, they must be fitted with a 4–20 mA output HART Protocol/M7A or M7B and running software version 090414.00.001 Electronic Module or higher.

### 4.1 Personnel Qualifications

Safety Inspection, Maintenance and Troubleshooting should only be performed by qualified personnel. These qualifications include a knowledge of the information in this instruction manual, knowledge of the product and its operating principles, knowledge of the application in which the transmitter is being applied, and general experience as an Instrument Technician.

Before, during and after performing Safety Inspection, Maintenance or Troubleshooting it will be necessary to observe and adhere to any safety standards, practices or requirements defined in the policies of the end user.

### 4.2 MT5X00 Alarm Levels and Dangerous Undetected Failure Rates Calculation

The MT5X00 Dangerous Undetected (DU) failure rates calculation are based on the choice of either 3.61 mA or 21 mA alarm current levels, depending on the user's preference. The value should be selected on the basis of which reflects the direction the output signal would tend toward when a trip is required.

### 4.3 Alarm Levels to be Programmed in Logic Solver

It is strongly recommended to the user that the Safety PLC software should be configured to detect fail-low (e.g.  $\leq 4$  mA) and fail-high (e.g.  $\geq 20$  mA) inputs as an alarm value and possibly as requiring a trip, in addition to the explicit use of 3.61 mA or 21 mA (the selected output value when the diagnostics detect a failure). This precaution allows the user's PLC to detect failures such as open and short circuits that cannot be detected by the MT5000 diagnostics. The corresponding failure rates this detects are 68 FITs and 73 FITs respectively.

### 4.4 Use of Critically Restricted (CR) Mode for Safety Instrumented Systems Applications

The HART version of the MT5100 has an operation mode for level and interface measurements which is named the Critically Restricted mode. This mode is only accessible through a HART command on the MT5100 in the "Extended Setup/Advanced Setup/CR Read Mode" menu.

The Critically Restricted (CR) mode shall not be used in a Safety Instrumented System.

### 4.5 Required Tools

The following tools may be required to perform inspection, maintenance or troubleshooting of the MT5000 transmitter.

- Crescent Wrenches or box end wrenches
- Screwdrivers
- Hex Key Wrenches
- Calibrated Digital Multi-meter
- Tape Measure



In instances where corrosive and / or abrasive materials are being measured, the user must check the level of resistance of all parts that are coming into contact with these materials. ABB offers guidance in the selection of material but does not accept liability in performing this service. The user must strictly observe the applicable national regulations with regards to installing, functional testing, repairing and maintaining electrical devices.

#### 4.6 Suggested Proof Test

The suggested proof test consists of minimum and maximum current capability test followed by a two-point calibration of the transmitter, see the suggested proof test Table. This test will detect > 99% of possible DU failures in the device.

MT5000 Suggested Proof Test Table	
1.	Bypass the safety function in the control system and take appropriate action to avoid a false trip.
2.	Use HART communications to retrieve any diagnostics and take appropriate action.
3.	Send a HART command to the transmitter to go to the high alarm current output and verify that the analog current reaches that value.*
4.	Send a HART command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value.**
5.	Perform a two-point calibration*** of the transmitter over the full working range.
6.	Remove the bypass and otherwise restore normal operation.
Notes: <ul style="list-style-type: none"> <li>• This tests for compliance voltage problems such as a low loop power supply voltage or increased wiring resistance. This also tests for other possible features.</li> <li>• ** This tests for possible low current related failures.</li> <li>• *** If the two-point calibration is performed with electrical instrumentation, this proof test will not detect any failures of the sensor.</li> </ul>	

#### 4.7 Safety Inspection & Test

An MT5000 transmitter can be divided into three major components, the sensor, the transmitter, and the output. All of these components and their subcomponents should be evaluated during each periodic inspection. This inspection (and possible repair) should take less than 4 hours if the proper tools are made available. Prior to inspection, the transmitter should be removed from service following end user specified procedures regarding lockout, tag out, wiring and cleaning. Once removed from service, the MT5000 transmitter should be laid on a flat even surface.

##### 4.7.1 Sensor Inspection

The rod or cable assembly should not be damaged or corroded in any way. Additionally, it should not be touching any of the surrounding tank or chamber surfaces in the measurement range.

##### 4.7.2 Transmitter Testing

The transmitter of the MT5000 is designed to return a level indication and an output based on a dielectric constant change between the upper fluid or vapor and the lower fluid. If the transmitter is equipped with an LCD the level and output will be displayed on the front of the electronics module.

- 1) Apply power to the transmitter using the typical power setup for the particular option.
- 2) Move a high dielectric object such as a metal target plate up and down the sensor.
- 3) Monitor the indication of the level on the LCD to make sure the indication corresponds to the target position.
- 4) Make sure the transmitter responds with an Alarm Indication (based on the jumper position) and a corresponding level indication based on your setup (HIGH = 21.00 mA, LOW = 3.61 mA)

Note: It is possible for the MT5000 to continue providing a 4-20mA output if the LCD display is not functioning properly. If the LCD indicator on an electronics module fails to operate, it is recommended that the electronics module be replaced at the earliest convenience. It will not be necessary however to shut down a transmitter or remove it from service based on an LCD failure.

##### 4.7.3 Output Checkout

The MT5000 can be equipped to provide level indication through the 4-20mA output, HART communications and Foundation Fieldbus. Only transmitters that are specified to output 4-20mA may be used in a Safety Implemented System. The HART communication capability of the 4-20mA transmitter will only be used for configuration and proof testing.

###### 4.7.3.1 Analog 4-20mA Output

The current output of the MT5000 transmitter update at least every 110 milliseconds and be filtered through the user adjusted Damping. The maximum response time to a process change will be less than 110 milliseconds or the value of the Damping, whichever is greater.

1. Apply power to the transmitter using the typical loop wiring diagram.
2. Connect a multi-meter (set to read milliamps) to the transmitter using the Meter  connections on the terminal strip.
3. Move a high dielectric object such as a target plate along the length of the probe and monitor the milliamp output on multi-meter.
4. The output should indicate the target position based on the calibration range of the transmitter.

###### 4.7.3.2 HART Output

1. Apply power to the transmitter using the typical loop wiring diagram.
2. Connect a HART handheld device across a 250 ohm resistor in series with the loop.
3. Move the target along the length of the probe and monitor the PV indication on the handheld device.
4. The output should indicate the target position based on the calibration range of the transmitter.

Note: A HART handheld device will communicate with the MT transmitter. The Device Descriptors are available on the ABB website. If the output of the transmitter becomes latched, the HART handheld will respond with a warning that the Process Variable is out of range. To overcome the error, press OK when prompted to ignore the next 50 occurrences.

#### 4.7.3.3 4–20mA Loop Check

##### Without HART

LOOP TEST is a function designed to simulate transmitter output at various levels and confirm readings from a separate location. The LOOP TEST may be performed at any mA OUTPUT between 3.61 and 21.00. To perform a LOOP TEST: 1. Press and hold the SELECT button for 2 seconds. 2. Scroll UP or DOWN to select each digit for the desired mA OUTPUT. 3. Press the SELECT button to set the digit and move to the next digit in sequence. 4. After the last digit is set the mA OUTPUT will change to the desired level. (Another mA OUTPUT may be selected by repeating steps 1 through 4.) 5. Scroll DOWN to END MENU. (The mA OUTPUT will return to normal operation after pushing the DOWN arrow) 6. Pressing the SELECT button now will return you to the main screen.

##### With HART communications

With the transmitter installed, wired and powered in its field location and power supplied to the loop, connect a HART handheld device to the loop across a 250 ohm resistor. Using the Loop Test feature of the HART handheld, drive the output of the transmitter to 4mA and 20mA. Confirm the proper reading at the indication or control side of the loop.

Minor adjustments to the output of the transmitter may be made using the DAC Trim (Digital/Analog Convertor) feature.

During normal operation, it is not necessary to perform maintenance on the MT5000 transmitter. Routine calibration of the transmitter is not necessary. The MT5000 contains an EPROM which will store calibration in case of an out-age or electronics replacement.

#### 4.8 Verify Proper Power-up of the Transmitter

Use a mA meter to measure the output current. When power is applied, the output should go to 4.00 mA for at least 1 second, and then to either the measured level or an alarm condition output. If this does not happen, the transmitter may not be receiving enough power, or the main electronic is defective. Excessive current above 21 mA is also an indication of improper power-up or defective electronics.

#### 4.9 Module Replacement or Upgrade

The MT5000 transmitter is equipped with modular electronics which may be removed from the housing. An EPROM located in the transmitter housing will maintain the settings of the transmitter if the electronics are removed. This allows the replacement of failed electronic modules and upgrading of electronics or transmitter software without losing calibration and setup configuration.

Before removing the electronics module for replacement or upgrade, the MT5000 transmitter should be taken out of service. To remove the electronics module, simply loosen the 2 mounting screws, unplugging the module from the housing and replace it with the new module.

The software revision of a transmitter can be identified by a tag on the back of the electronics module. The date code of the software revision will appear as a series of numbers such as MT 090414.00.001. The type of module will be identified on the same tag with a code such as M7A-MT5 or M7B-MT5.

#### 4.10 Retirement Date for MT5X00 as a Functional Safety Device

MT5X00 instruments shall not be used in a Safety Instrumented Function (SIF) after December 31<sup>st</sup>, 2022. After this date, MT5X00 instruments can only be used in applications where IEC 61508 functional safety rating is not required.

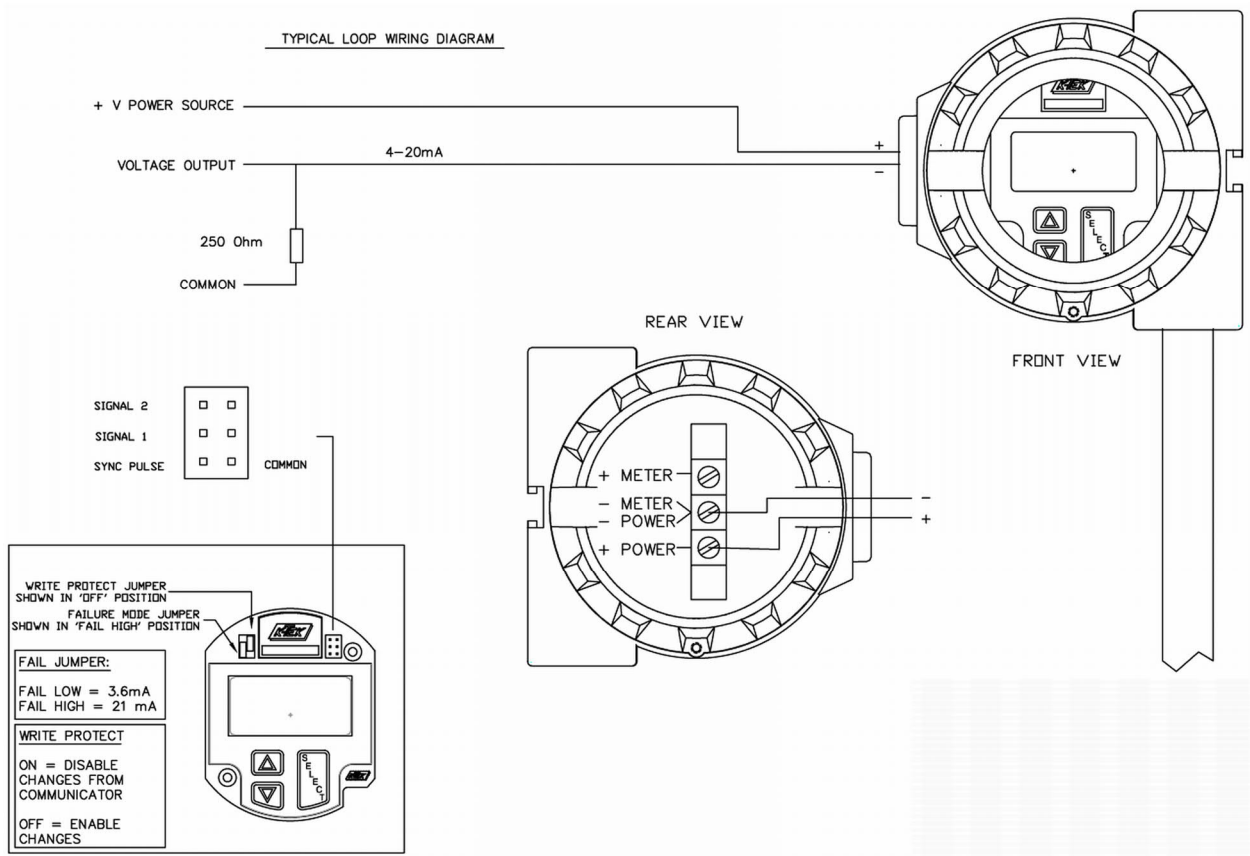
## 6 Certificate for SIL 3 Capable

**i** IMPORTANT NOTE

The user is responsible of verifying that current failure rates shown on the certificate meet the Safety Instrumented Function (SIF).

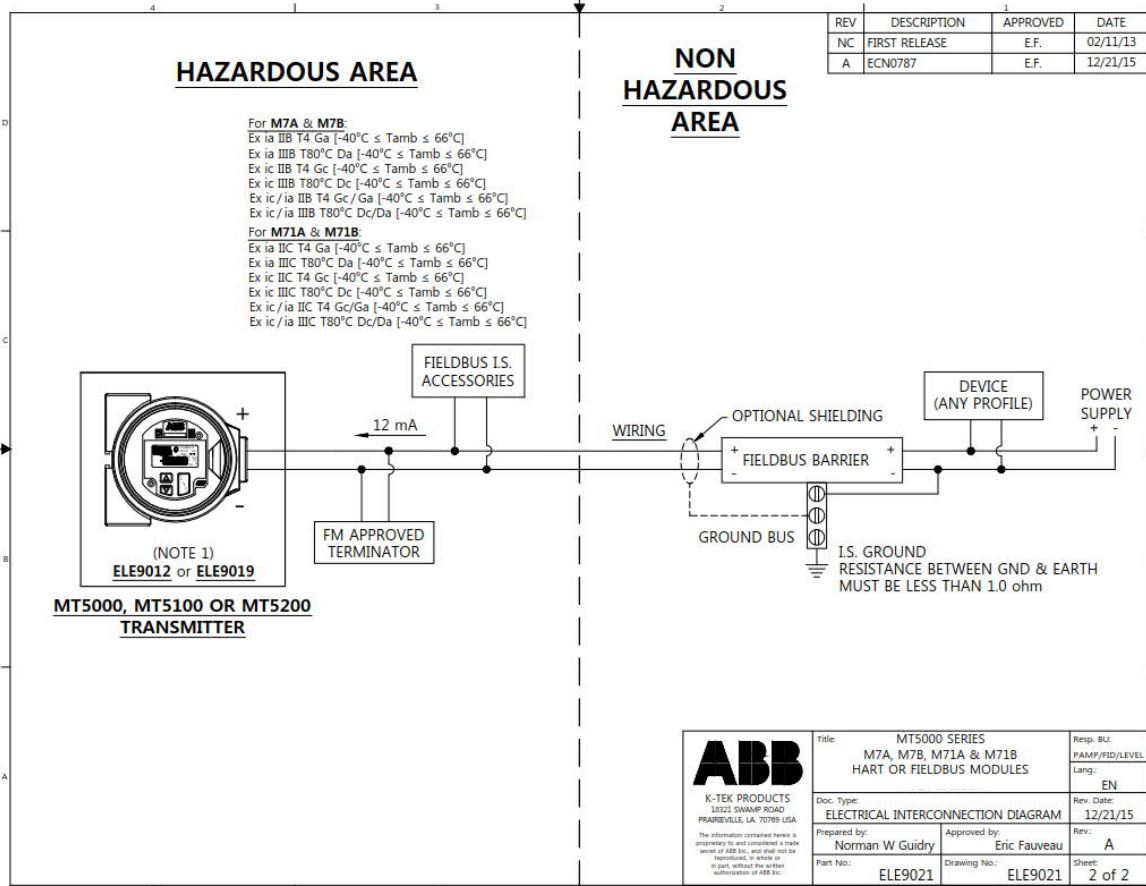
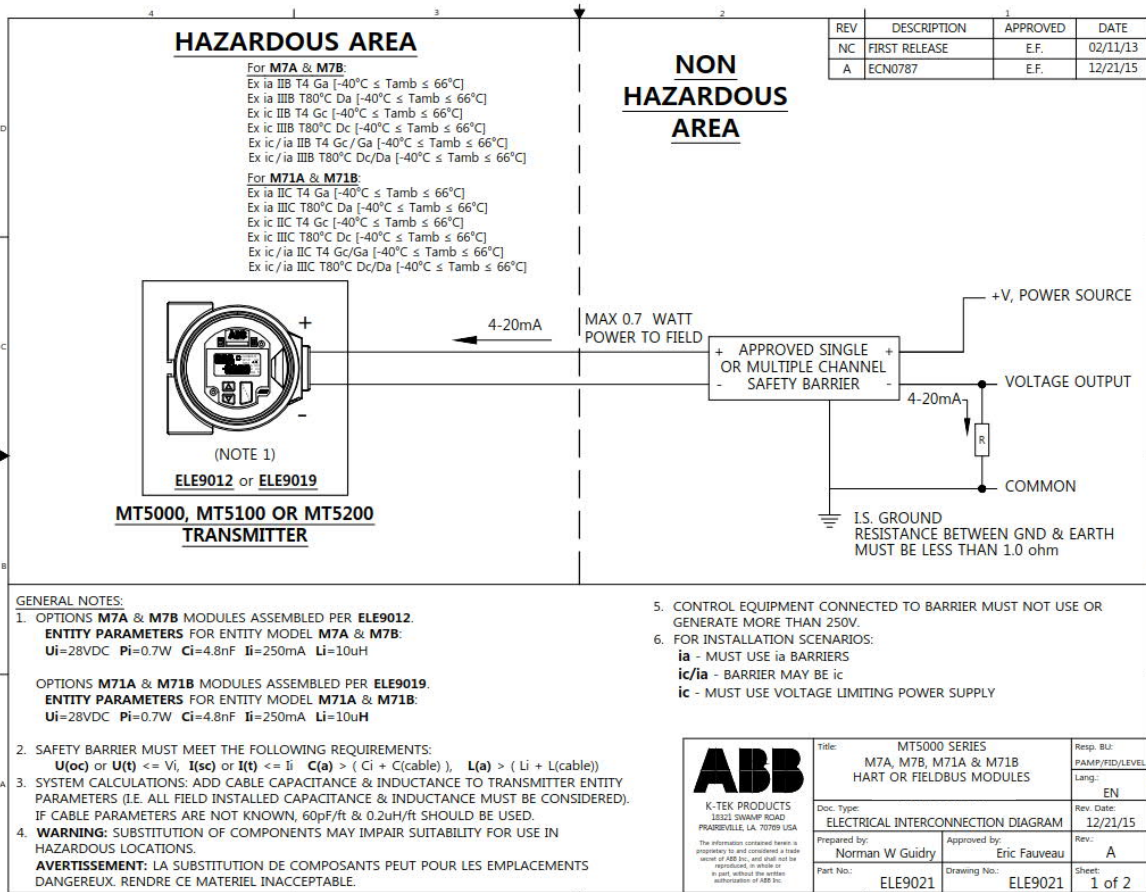
The latest version of this certificate can be found on the web site at <https://library.abb.com/> and searching for certificate [Exida \(SIL\) ABB 16-12-C118 C001 MT5000 Series](#)

# 7 Typical Wiring Drawing



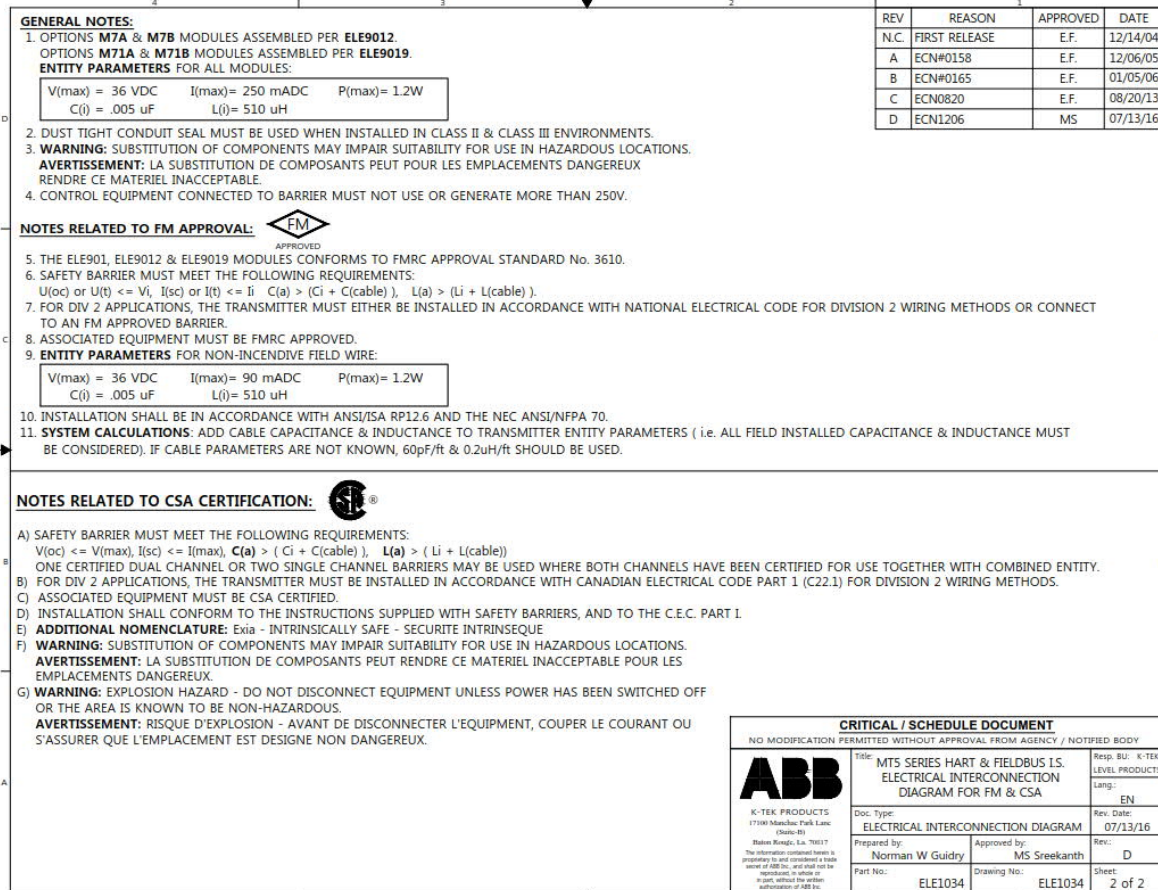
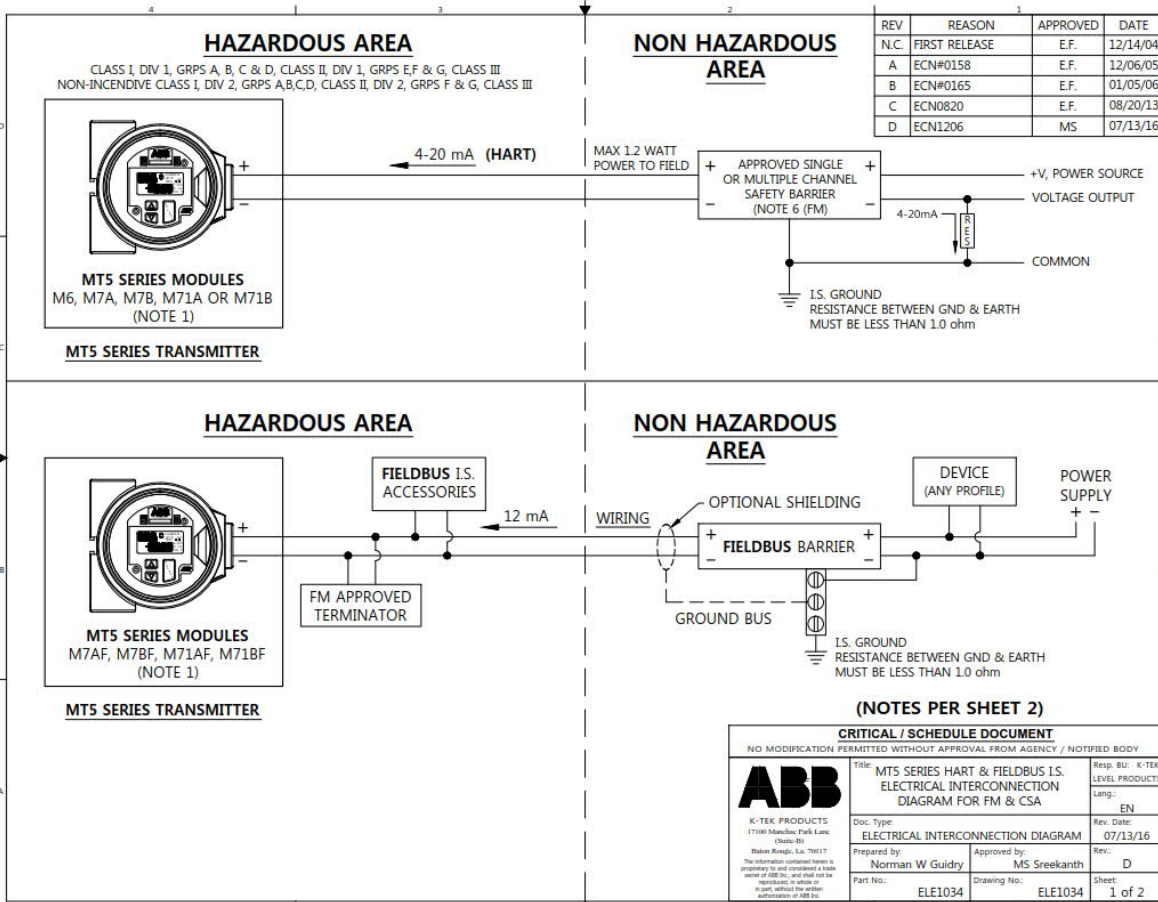
# 8 Installation Drawings for Intrinsic Safety & Standard Wiring

Reference ABB drawing ELE9021 MT5000 Series, Intrinsically Safe Electrical Interconnection Diagram.



# 8 Installation Drawings for Intrinsic Safety & Standard Wiring

Reference ABB drawing ELE1034 MT5000 Series, FM & CSA Intrinsically Safe Electrical Interconnection Diagram.



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