

MT5000

Guided Wave Radar Level Transmitter

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

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 reuse 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, particularly 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.

**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.

i

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).

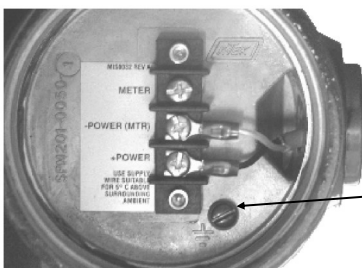


Figure 2-12 — Ground connection on transmitter housing

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 / 1.6mm2 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 flame-proof 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.




3.0 Explosive atmosphere markings

3.1 ATEX / 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

ATEX IS markings :

 II 1 GD Ex ia IIB / IIC T4 Ga
Ex ia III C T80°C Da
 II 3/1 GD Ex ic / ia IIB / IIC T4 Gc / Ga
Ex ic / ia III C T80°C Dc / Da
 II 3 GD Ex ic IIB / IIC T4 Gc
Ex ic III C T80°C Dc
-40°C ≤ Ta ≤ 66°C

ITS17ATEX201813X (ia - ic/ia)
ITS17ATEX201814X (ic - Cat.3)

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 ATEX / 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

ATEX XP markings :

 II 1/2 G Ex ia/db IIC T6 Ga/Gb
 II 1 D Ex ia ta IIIC T80°C Da
-40°C ≤ Ta ≤ 66°C
ITS17ATEX101814X

Enclosure protection rating :
Type 4X / IP66/IP67

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.

3.0 Explosive atmosphere markings

3.3 FM / US HazLoc ratings

Factory Mutual Research Corporation

MT50xx, MT51xx and MT52xx— HART & Fieldbus interconnection :



XP-IS / I / 1 / ABCD / T6 Ta = 77°C
DIP / II, III / 1 / EFG / T6 Ta = 77°C
IS / I / 1 / ABCD / T4 Ta = 77°C - ELE1034, Entity, Type 4X
NI / I / 2 / ABCD / T4 Ta = 77°C
S / II, III / 2 / FG / T4 Ta = 77°C
ANI / I / 2 / ABCD / T4 - ELE1034, Entity, Type 4X

MT50xx, MT51xx and MT52xx— Modbus interconnection (FM Only):



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

Conditions of Certification

(a) Special Conditions for safe use

- For guidance on Intrinsically Safe U.S. installations, see ANSI/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.

4.0 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 overfill 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. 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 1.5×10^{-3} .

7) MT5000 transmitters may only be used in a SIS when they are fitted with a 4-20 mA output HART Protocol /M7A or M7B and are 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 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.

4.3 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">• 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.• ** This tests for possible low current related failures.• *** If the two-point calibration is performed with electrical instrumentation, this proof test will not detect any failures of the sensor.	

4.4 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.

4.4.1 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.

4.4.2 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.

4.4.3 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.

4.4.3.1 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.

4.4.3.2 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.

4.4.3.3 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-of-age or electronics replacement.

4.5 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.

4.6 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.

5.0 Declaration of Conformity (page 1 of 2)



EU DECLARATION OF CONFORMITY

We: ABB Inc.
3400 Rue Pierre-Ardouin
Québec, QC G1P 0B2, CANADA

declare under our sole responsibility that the products **MT5000, MT5100 & MT5200 Guided Wave Radar in all communication configurations (4-20mA, HART, Foundation Fieldbus, MODBUS)** conform to the following European directives and international standards:

EMC Electromagnetic Compatibility Directive, 2014/30/EU, Annex II and 2004/108/EC, Annex II:

Intertek Testing Services NA, Inc. Report: 101628139ATL-003

Standards: IEC 61326-1 Edition 2.0 2012-07 ; IEC 61000-4-2 Edition 2.0 2008-12;
IEC 61000-4-3, Edition 3.2 2010-04 ; IEC 61000-4-4, Edition 3.0 2012-04;
IEC 61000-4-5, Edition 3.0 2014-05 ; IEC 61000-4-6, Edition 4.0 2013-10
IEC 61000-4-8, Edition 2.0 2009-09


BICON EMC Laboratories Report: KTE-20070403-K1

Standards: EN61326-1 A1/A2/A3, EN61000-4-2, EN61000-4-3,
EN61000-4-4, EN61000-4-5, EN61000-4-6

ATEX Directive 2014/34/EU

EC Type Examination Certification Notified Body: 0359, Intertek Testing and Certification LTD.

Intrinsic Safety Certificate: ITS17ATEX201813X
Standards: EN60079-0:2012; EN60079-11:2012; EN60079-26:2015
Marking:  II 1 GD Ex ia IIB / IIC T4 Ga
Ex ia III C T80°C Da
 II 3/1 GD Ex ic / ia IIB / IIC T4 Gc / Ga
Ex ic / ia III C T80°C Dc / Da
-40°C ≤ Ta ≤ 66°C

Flameproof Certificate & Protection by
Enclosure Certificate: ITS17ATEX101814X
Standards: EN60079-0:2012; EN60079-1:2007; EN60079-26:2007
EN60079-31:2009
Marking:  II 1/2 G Ex ia/db IIC T6 Ga/Gb
II 1 D Ex ia ta IIIC T80°C Da
-40°C ≤ Ta ≤ 66°C


Intrinsic Safety Type Certificate: ITS17ATEX201814X
Standards: EN60079-0:2012; EN60079-11:2012
Marking:  II 3 GD Ex ic IIB / IIC T4 Gc
Ex ic III C T80°C Dc
-40°C ≤ Ta ≤ 66°C

ABB Inc.

5.0 Declaration of Conformity (page 2 of 2)



Production Quality Assurance Notified Body: 0344, DEKRA Certification B.V. Arnhem, NL.

QAN Certificate: DEKRA 12ATEXQ0030 Issue 2

PED Pressure Equipment Directive (2014/68/EU):


Sound Engineering Practice according to Article 4.3 of the Directive

The products described in this Declaration of Conformity comply with the applicable European directives and relevant sections of the applicable international standards. The signatures on this document authorizes the distinctive European mark to be applied to the equipment described. A technical construction file is available for inspection by designated bodies upon request. The applicable EHSRs of Annex II of the ATEX Directive 2014/34/EU have been met.

ATTENTION!

The attention of the specifier, purchaser, installer, servicer, or user is drawn to the following special measures and limitations, which must be observed when the product is installed or taken into service to maintain compliance with the above directives:


- 1) Details of these special measures and limitations are also contained in the product manuals and must be followed for safe use, installation, operation and maintenance.**
- 2) It is incumbent upon the End User or any of the other entities mentioned herein to make sure the installation is made in accordance to local and regional regulations and electric codes.**
- 3) It is incumbent upon the End User or any of the other entities mentioned herein to make sure the disposal, decontamination and/or decommissioning is performed in accordance to WEEE Directive 2012/19/EU.**



Marc Corriveau
General Manager

2017-04-05

Date



Andreas Strauch
ATEX Officer

2017-04-05

Date



Louise Martel
Quality Manager

2017-04-05

Date

ABB Inc.

3400 Rue Pierre-Ardouin
Québec, QC G1P 0B2, CANADA

Telephone: 1-418-877-2944
Fax: 1-418-877-2834

Internet: www.abb.com/level
CERT0154/3BOM000142D0760 Rev. A

6.0 Certificate for SIL 3 Capable (page 1 of 2)



The manufacturer
may use the mark:



Revision 1.1 May16, 2017
Surveillance Audit Due
May 1, 2018



ANSI Accredited Program
ISO/IEC 17065
PRODUCT CERTIFICATION BODY
#1004

Certificate / Certificat Zertifikat / 合格証

ABB 1612118 C001

exida hereby confirms that the:

MT5000, MT5100, and MT5200 Series Guided Wave Radar Level Transmitters

ABB, Inc.
Québec City, Québec - CA

Has been assessed per the relevant requirements of:

IEC 61508 : 2010 Parts 1-7

and meets requirements providing a level of integrity to:

Systematic Capability: SC 3 (SIL 3 Capable)

Random Capability: Type B Element

SIL 2 @ HFT=0; SIL 3 @ HFT = 1; Route 2_H

**PFD_{AVG} and Architecture Constraints
must be verified for each application**

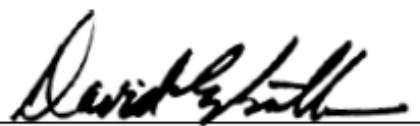
Safety Function:

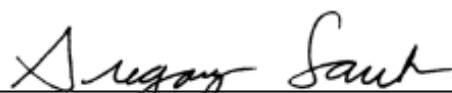
The MT5000, MT5100, and MT5200 Series Transmitter will measure Level within the stated safety accuracy.

Application Restrictions:

The unit must be properly designed into a Safety Instrumented Function per the Safety Manual requirements.




Evaluating Assessor


Certifying Assessor

6.0 Certificate for SIL 3 Capable (page 2 of 2)

MT5000, MT5100 and MT5200 Series Transmitters



80 N Main St
Sellersville, PA 18980

T-002, V4R1

Certificate / Certificat / Zertifikat / 合格証

ABB 1612118 C001

Systematic Capability: SC 3 (SIL 3 Capable)

Random Capability: Type B Element

SIL 2 @ HFT=0; SIL 3 @ HFT = 1; Route 2_H

**PFD_{AVG} and Architecture Constraints
must be verified for each application**

Systematic Capability:

The product has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer.

A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than stated.

Random Capability:

The SIL limit imposed by the Architectural Constraints must be met for each element. This device meets *exida* criteria for Route 2_H.

IEC 61508 Failure Rates in FIT¹

Device	λ_{SD}	λ_{SU}	λ_{DO}	λ_{DU}
MT5000, MT5100 and MT5200 Series Level Transmitters	0	0	438	60

¹ FIT = 1 failure / 10⁹ hours

SIL Verification:

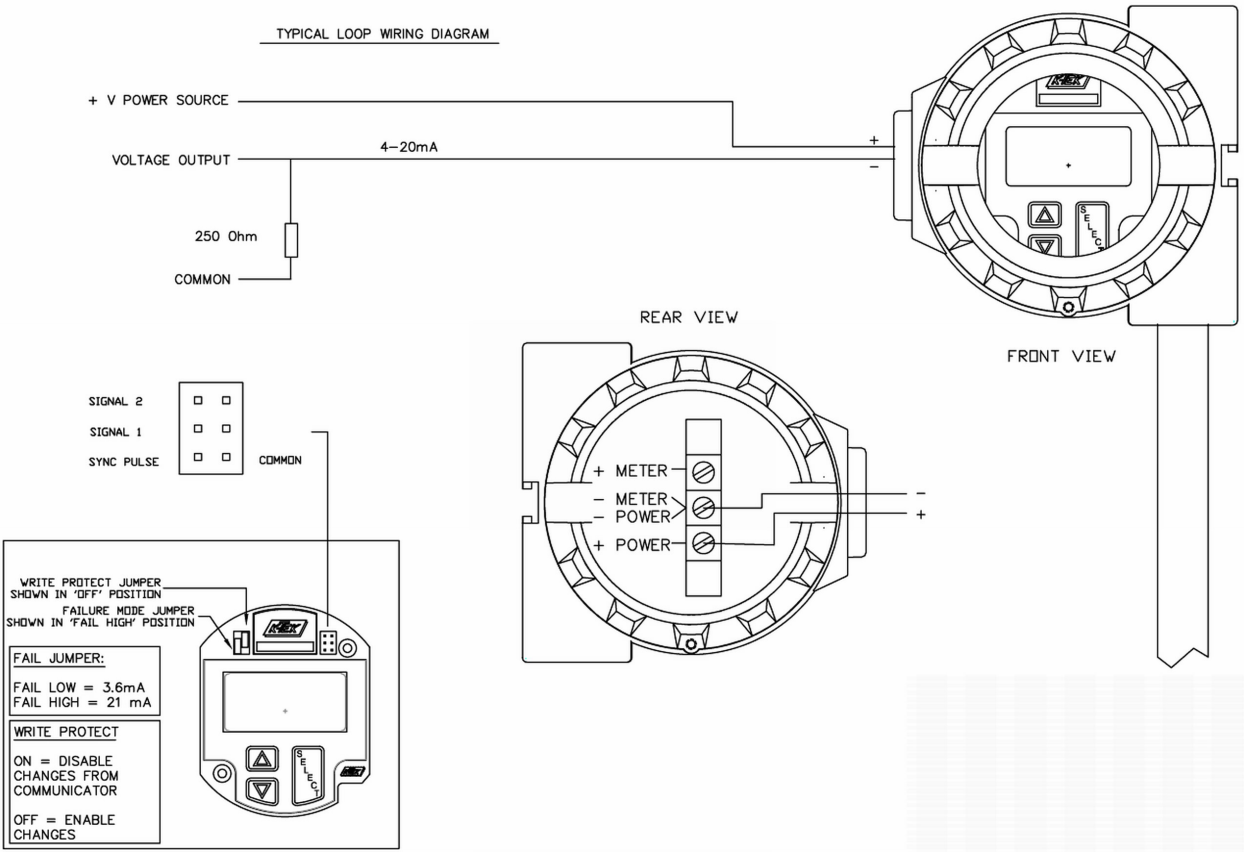
The Safety Integrity Level (SIL) of an entire Safety Instrumented Function (SIF) must be verified via a calculation of PFD_{avg} considering redundant architectures, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each element must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements.

The following documents are a mandatory part of certification:

Assessment Report: ABB 10/02-051 R001 V3R2

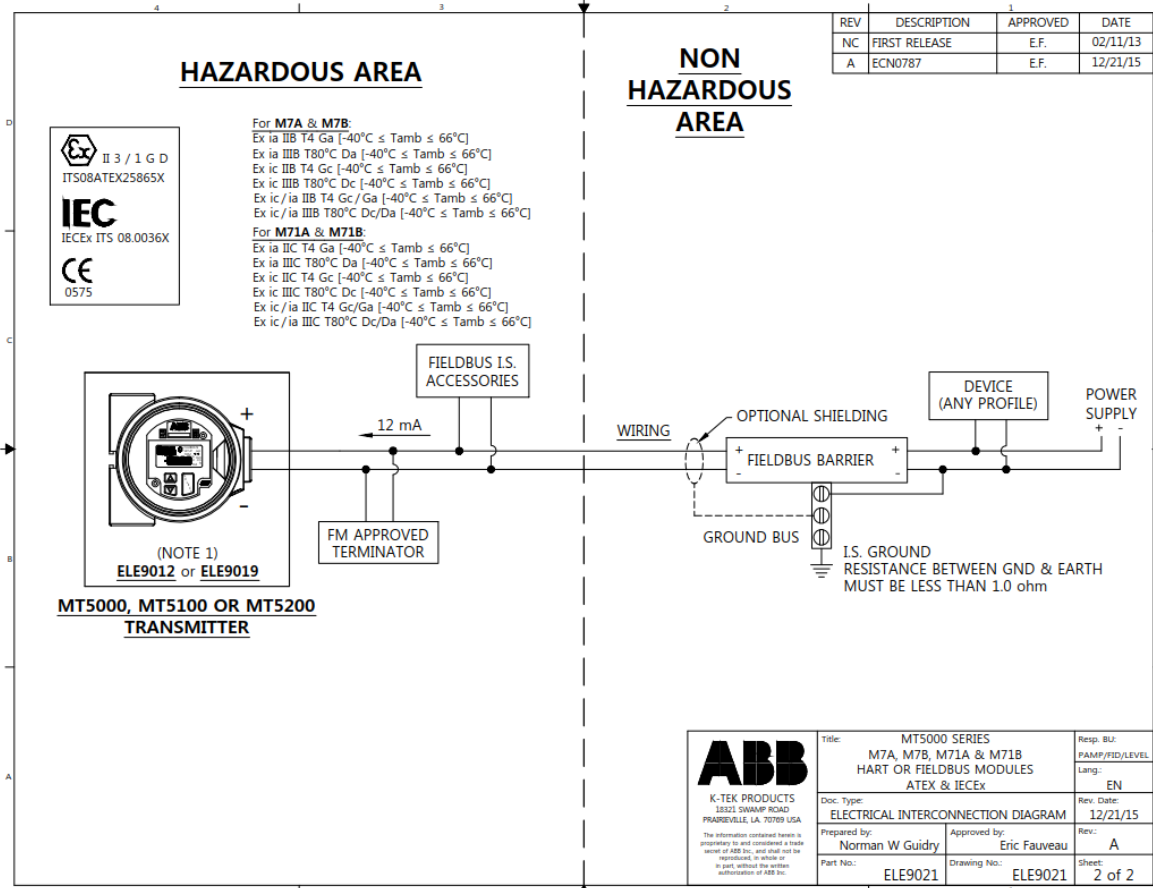
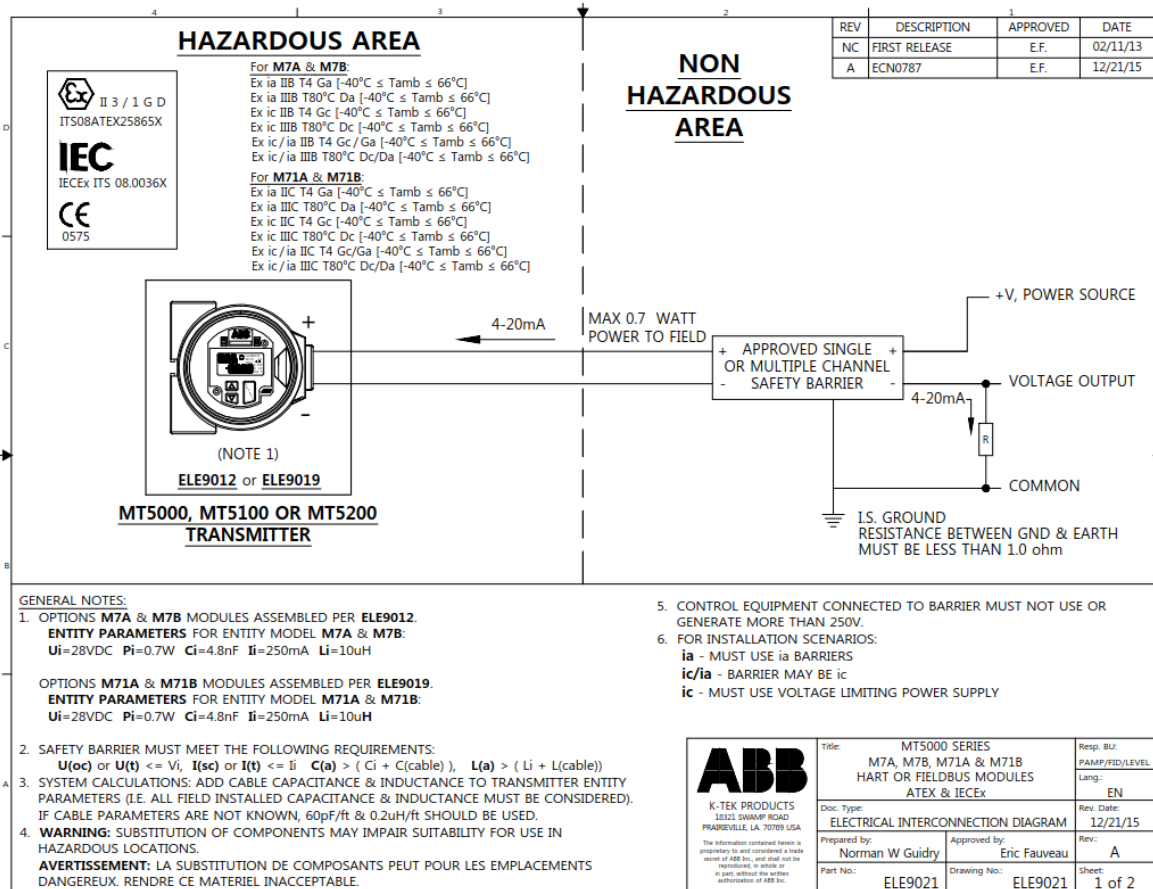
Safety Manual: OI_MT5000-EN_H

7.0 Typical Wiring Drawing



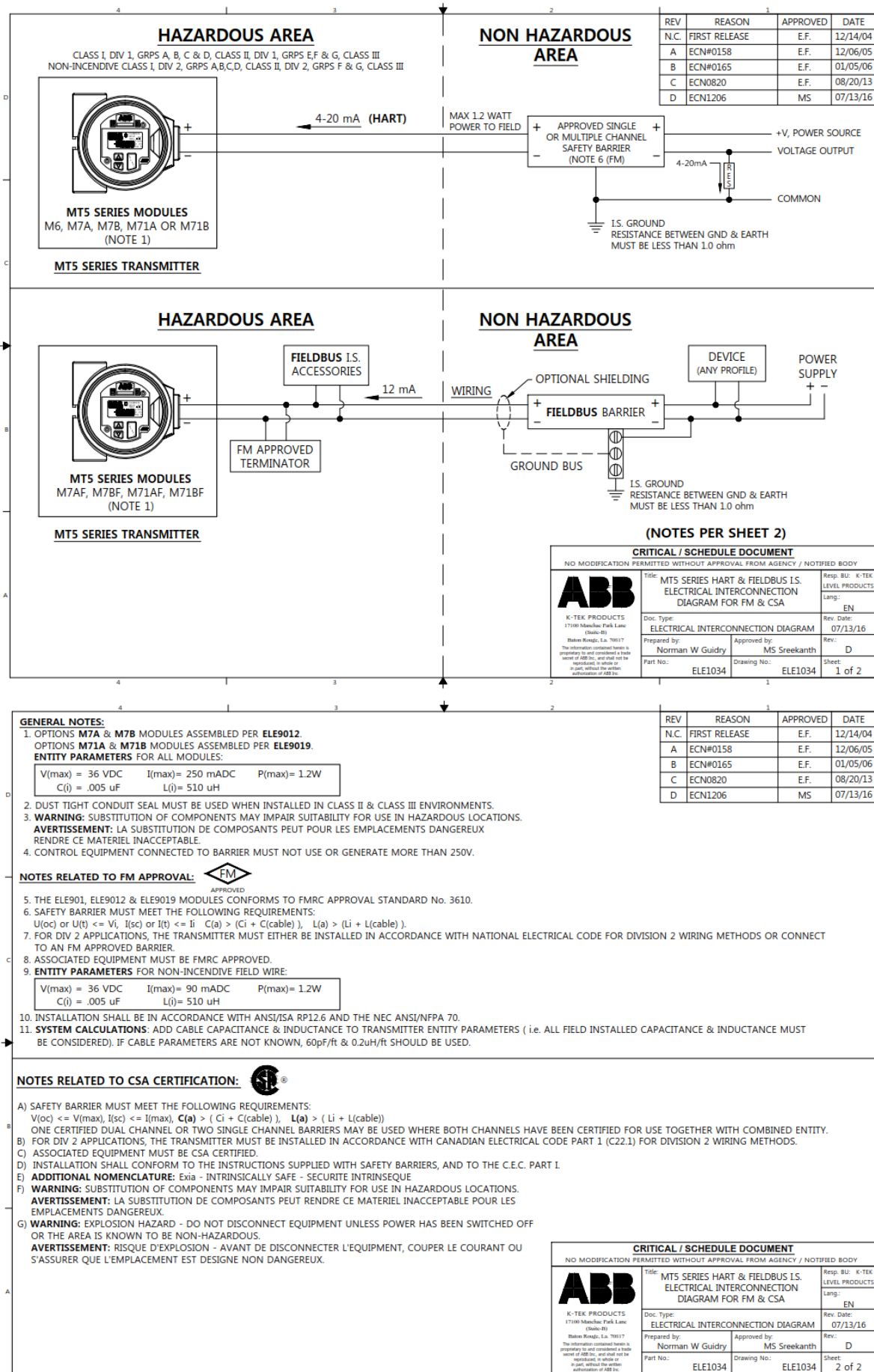
8.0 Installation Drawings for Intrinsic Safety & Standard Wiring

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



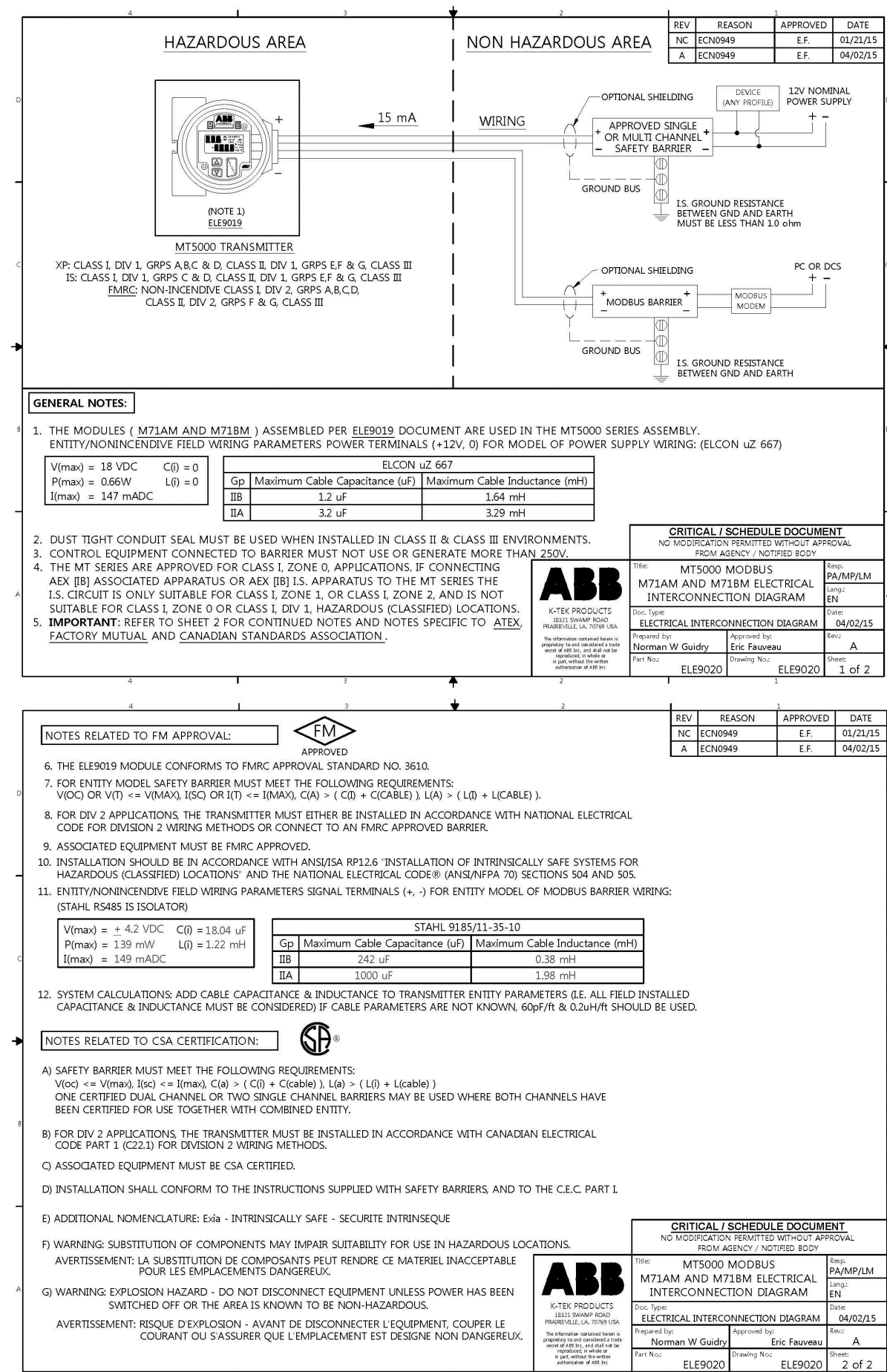
8.0 Installation Drawings for Intrinsic Safety & Standard Wiring

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



8.0 Installation Drawings for Intrinsic Safety & Standard Wiring

Reference ABB drawing ELE9020 MT5000 Series, FM & CSA MODBUS Electrical Interconnection Diagram.



NOTES RELATED TO FM APPROVAL:

APPROVED

6. THE ELE9019 MODULE CONFORMS TO FMRC APPROVAL STANDARD NO. 3610.

7. FOR ENTITY MODEL SAFETY BARRIER MUST MEET THE FOLLOWING REQUIREMENTS:
 $V(OC) \text{ OR } V(T) \leq V(MAX)$, $I(SC) \text{ OR } I(T) \leq I(MAX)$, $C(A) > (C(I) + C(CABLE))$, $L(A) > (L(I) + L(CABLE))$.

8. FOR DIV 2 APPLICATIONS, THE TRANSMITTER MUST EITHER BE INSTALLED IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE FOR DIVISION 2 WIRING METHODS OR CONNECT TO AN FMRC APPROVED BARRIER.

9. ASSOCIATED EQUIPMENT MUST BE FMRC APPROVED.

10. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP12.6 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE® (ANSI/NFPA 70) SECTIONS 504 AND 505.

11. ENTITY/NONINCENDIVE FIELD WIRING PARAMETERS SIGNAL TERMINALS (+, -) FOR ENTITY MODEL OF MODBUS BARRIER WIRING: (STAHL RS485 IS ISOLATOR)

STAHL 9185/11-35-10		
Gp	Maximum Cable Capacitance (uF)	Maximum Cable Inductance (mH)
IIB	242 uF	0.38 mH
IIA	1000 uF	1.98 mH

- SYSTEM CALCULATIONS: ADD CABLE CAPACITANCE & INDUCTANCE TO TRANSMITTER ENTITY PARAMETERS (I.E. ALL FIELD INSTALLED CAPACITANCE & INDUCTANCE MUST BE CONSIDERED) IF CABLE PARAMETERS ARE NOT KNOWN, 60pF/ft & 0.2uH/ft SHOULD BE USED.

NOTES RELATED TO CSA CERTIFICATION:

A) SAFETY BARRIER MUST MEET THE FOLLOWING REQUIREMENTS:
 $V(OC) \leq V(MAX)$, $I(SC) \leq I(MAX)$, $C(A) > (C(I) + C(CABLE))$, $L(A) > (L(I) + L(CABLE))$
 ONE CERTIFIED DUAL CHANNEL OR TWO SINGLE CHANNEL BARRIERS MAY BE USED WHERE BOTH CHANNELS HAVE BEEN CERTIFIED FOR USE TOGETHER WITH COMBINED ENTITY.

B) FOR DIV 2 APPLICATIONS, THE TRANSMITTER MUST BE INSTALLED IN ACCORDANCE WITH CANADIAN ELECTRICAL CODE PART 1 (C22.1) FOR DIVISION 2 WIRING METHODS.

C) ASSOCIATED EQUIPMENT MUST BE CSA CERTIFIED.

D) INSTALLATION SHALL CONFORM TO THE INSTRUCTIONS SUPPLIED WITH SAFETY BARRIERS, AND TO THE C.E.C. PART I.

E) ADDITIONAL NOMENCLATURE: Exia - INTRINSICALLY SAFE - SECURITE INTRINSEQUE

F) WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.
 AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DANGEREUX.

G) WARNING: EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
 AVERTISSEMENT: RISQUE D'EXPLOSION - AVANT DE DISCONNECTER L'EQUIPMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNÉ NON DANGEREUX.

K-TEK PRODUCTS
18321 SWANAMP ROAD
PRAIRIEVILLE, LA 70769 USA

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CRITICAL / SCHEDULE DOCUMENT			
NO MODIFICATION PERMITTED WITHOUT APPROVAL FROM AGENCY / NOTIFIED BODY			
Title:	MT5000 MODBUS M71AM AND M71BM ELECTRICAL INTERCONNECTION DIAGRAM		Resp. PA/MP/LM
Doc. Type:	ELECTRICAL INTERCONNECTION DIAGRAM		Lang: EN
Prepared by:	Norman W Guidry	Approved by:	Eric Fauveau
Part No:	ELE9020	Drawing No:	ELE9020
		Rev:	A
		Sheet:	2 of 2

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SM/MT5000 series -EN Rev. A 11.2017

