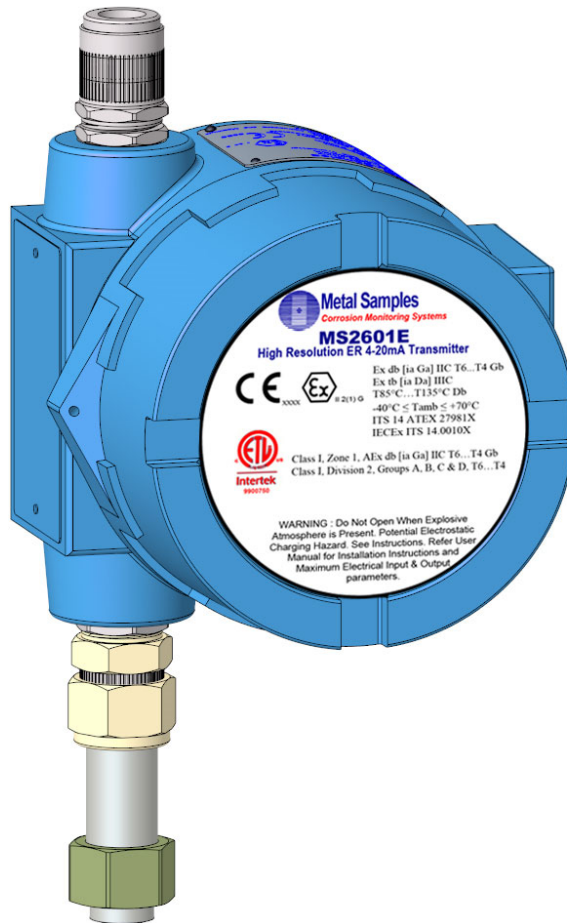


# MS2601E

## High Resolution ER 4-20mA Transmitter

### Operator's Manual



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# Table of Contents

I. Introduction .....	3
A. General Description .....	3
B. Principles of Operation .....	3
C. Technical Specifications .....	5
II. Installation and Operation .....	6
A. Receiving the MS2601E Transmitter .....	6
B. Installation .....	6
1. Physical Mounting and Probe Connection .....	6
a. Direct-Probe Mounting .....	6
b. Remote Mounting .....	7
2. Current Loop Connection .....	7
a. Making Connections .....	8
b. Grounding .....	8
c. Wiring for a Safe Area Installation .....	8
d. Wiring for a Hazardous Area Installation .....	9
3. Setup and Operation .....	11
a. Probe Selection Switches .....	11
b. Testing the Current Loop .....	12
i. Calibration .....	12
ii. Testing loop output zero (4mA) and span (20mA) .....	12
iii. Testing the MS2601E with the Meter Prover .....	12
c. Interpreting Data .....	13
i. Metal Loss .....	13
ii. Calculating Corrosion Rate .....	13
d. Commissioning .....	15
C. Maintenance .....	16
D. Troubleshooting .....	16
III. Service and Warranty Information .....	18
A. Warranty .....	18
B. Obtaining Service and Returning the Instrument for Repair .....	18
C. Instrument Repair Form .....	19
Appendix A – Revision History .....	20
Appendix B – Hazardous Area Certification Details .....	21
Appendix C - Drawings .....	27
Control Drawing (Hazardous Area Wiring Diagram) .....	27



# **I. Introduction**

## **A. General Description**

The MS2601E is a high-resolution meter designed to transmit corrosion (metal loss) data from an Electrical Resistance (ER) probe to a plant control system or other recording device. The MS2601E utilizes traditional 4-20mA current loop communication and is loop-powered with built-in isolator, so it requires only a two-wire interface. This results in a simple and low-cost installation. The use of the 4-20mA protocol also allows the MS2601E to be placed great distances from the control system or recorder while maintaining good noise rejection. Practical current loop distances can be many thousands of feet.

The MS2601E is compatible with all types of Metal Samples ER probes, as well as any standard ER probe from other manufacturers. Unlike competitors' products, the MS2601E Transmitter does not require factory modification to accommodate different probe types. The probe type can be easily changed at any time using the on-board probe selection switches (see page 11.)

The MS2601E is available as direct-mount (standard) or remote-mount. In the direct-mount version the MS2601E is mounted directly to the ER probe. This option offers the simplest installation and minimizes noise problems. The remote-mount option allows the MS2601E to be mounted independently from (but in close proximity to) the ER probe. It is then connected to the probe via a short probe cable. (See page 7 for mounting diagrams and specifications.)

## **B. Principles of Operation**

The MS2601E operates on the Electrical Resistance (ER) technique and is used in conjunction with an ER probe. The ER probe utilizes a resistive sensing element manufactured from the material of interest (or a close approximation) which is exposed to a corroding environment. This is called the Exposed or Corroding Element. The resistance of the Exposed Element is directly related to its thickness, so as the element corrodes the resulting loss of metal causes a proportional increase in the element's resistance. The probe also contains an internal Reference Element which is used to compensate for the influences of temperature on the Exposed Element.

The MS2601E is designed to work with any standard ER probe, but it is recommended that Cylindrical and Large Flush type probes be used to ensure optimum performance. Their physical design places the Reference Element in closer proximity to the Exposed Element compared to other probe types, providing more effective temperature compensation and thus reducing the effects of thermal noise.

Because they are designed to corrode, ER probes are sacrificial in nature. Each ER probe will have a finite life that is based on the element thickness. ER probes are available in a number of geometries and thicknesses designed to suit a wide variety of applications. Table 1 lists the common ER element options available from Metal Samples and the effective life of each.

Element Type		Compatibility	Thickness	Probe Life (Span)
	Tubular Loop	Compatible	4	2
			8	4
	Wire Loop	Compatible	40	10
			80	20
	Flush (Small)	Compatible	4	2
			8	4
			20	10
	Cylindrical	Preferred	10	5
			20	10
			50	25
	Flush (Large)	Preferred	5	2.5
			10	5
			20	10
			40	20

**Table 1.** Standard ER Probe Elements

The MS2601E measures an ER probe utilizing a high-resolution, 16-bit measurement. This allows the MS2601E to detect much smaller amounts of metal loss, thus responding faster to corrosion events and upsets (compared to traditional ER meters.) At 16-bit resolution the MS2601E can measure metal loss amounts as small as 0.0015% of the probe life.

Metal loss readings taken by the MS2601E are converted to a linearized 4-20mA current loop output. The 4-20mA signal can be fed into a plant control system or other devices and scaled accordingly to reflect metal loss. Then corrosion rates can be calculated based on the metal loss data over time. More information on ER probes, their theory, selection, and use can be found on our web site at <http://www.alspi.com/erintro.htm>.

## C. Technical Specifications

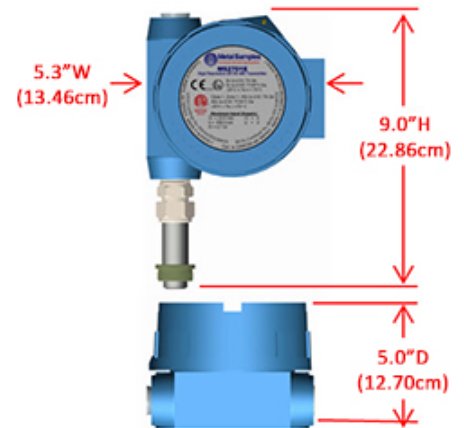
### Model MS2601E - High Resolution ER 4-20mA Transmitter

#### Physical Data

Instrument Weight: 5.25 lb. (2.38 Kg) Total  
Weight w/ Accessories: 7.31 lb. (3.31 Kg)  
Instrument Dimensions: 9.0"H x 5.3"W x 5.0"D  
(22.86cm H x 13.46cm W x 12.70cm D)

Operating Temperature: -40° to 158°F (-40° to 70°C)  
Storage Temperature: -40° to 176°F (-40° to 80°C)

Enclosure Material: Cast Aluminum (Copper-Free)  
Mounting Specifications: Direct probe mount or Remote mount  
(Up to a 2.5" (6.35cm) Dia. pole)



#### Performance Data

Measurement Type: ER measurement using any standard ER probetype  
(Wire Loop, Tube Loop, Cylindrical, Flush, Strip, etc.)  
Range: 0-100% of probe life  
Resolution: 0.0015% of Probe Life (16-bit)  
Cycle Time: 1 Minute

#### Electrical Data

Power Requirements: 11 to 28 VDC  
Nominal Probe Cable Distance: 30 ft (9.1 m)  
Output Specifications: 4-20mA Current Loop Output

#### Hazardous Location Certifications

Europe and Worldwide  
(ATEX and IECEx) II 2(1) G Ex db [ia Ga] IIC T6...T4 Gb  
II 2(1) D Ex tb [ia Da] IIIC T85°C ...T130°C Db  
- 40°C ≤ Tamb ≤ + 70°C  
Ex db [ia Ga] IIC T6...T4 Gb  
Ex tb [ia Da] IIIC T85°C ...T130°C Db  
- 40°C ≤ Tamb ≤ + 70°C

ATEX Certificate No: **ITS14ATEX27981X**  
IECEx Certificate No: **IECEx ITS 14.0010X**

USA and Canada  
(ETL) Class I, Zone 1, AEx db [ia Ga] IIC T6...T4 Gb  
Class I, Division 2, Groups A, B, C & D, T6...T4

#### Hazardous Location Certifications – Enclosure

Case Specifications: Explosion Proof (FM, CSA, UL)  
IP 66, NEMA 4X, 7BCD, 9EFG

#### Included Accessories (Direct-Mount Model)

Meter Prover, Operations Manual

#### Included Accessories (Remote-Mount Model)

Meter Prover, Operations Manual, Probe Cable, Mounting Hardware Kit

## **II. Installation and Operation**

### **A. Receiving the MS2601E Transmitter**

Check the MS2601E Transmitter for any shipping damage when it is first received. When the MS2601E is unpacked, verify that the following items are included:

- MS2601E Transmitter
- Meter Prover
- User's Manual
- Probe Cable & Mounting Hardware (optional, for remote-mount only)

In the event of shipping damage, quantity shortage, or missing items, it is recommended that the event is documented immediately and that digital photographs are taken. Any shortages or missing items should be reported to Metal Samples immediately. In the event of shipping damage, a claim should be opened with the responsible carrier.

### **B. Installation**

---

***Warning:** Do not open when an explosive atmosphere is present. Potential electrostatic charging hazard. See instructions. Refer use manual for installation instructions and maximum electrical input & output parameters.*

***Attention:** ne pas ouvrir en présence d'une atmosphère explosive. Risque potentiel de charge électrostatique. Voir les instructions. Consultez le manuel d'utilisation pour les instructions d'installation et les paramètres d'entrée et de sortie électriques maximum.*

---

Installation of the MS2601E Transmitter involves the following steps:

1. Physical Mounting
2. Electrical Connection
3. Setup and Programming

#### **1. Physical Mounting and Probe Connection**

When selecting a location to mount the MS2601E it is important to consider the surrounding environment. To ensure proper operation:

- Do not mount the MS2601E in a location that exceeds its operating temperature.
- Avoid mounting the MS2601E near sources of strong electrical noise.
- Ensure that there is sufficient clearance for installation and to open the transmitter cover afterwards.

##### **a. Direct-Probe Mounting**

The MS2601E is designed for direct-probe mounting which eliminates the need for additional hardware and transmitter-to-probe cabling. This greatly simplifies installation, reduces costs, and minimizes electrical noise that can be coupled onto probe cabling from nearby electrical equipment.

Before mounting the MS2601E, first ensure that the probe is installed properly and securely. During installation it is important that you do not apply excessive force on the probe or seals, as doing so could break the seal and result in system leakage.

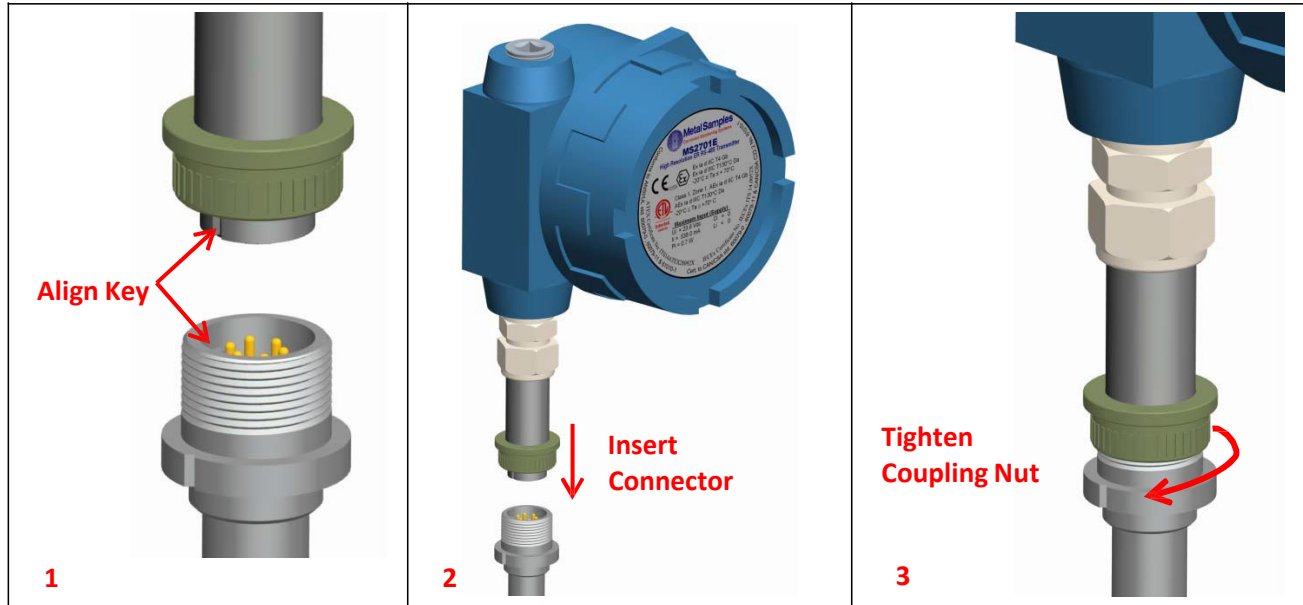


To mount the MS2601E:

1. Align the keyways of the transmitter and probe connectors.
2. Insert the transmitter connector plug fully into the probe connector receptacle.
3. Secure the transmitter to the top of the probe by tightening the coupling nut.

NOTE: Hand-tight is sufficient. Do not over-tighten the coupling nut.

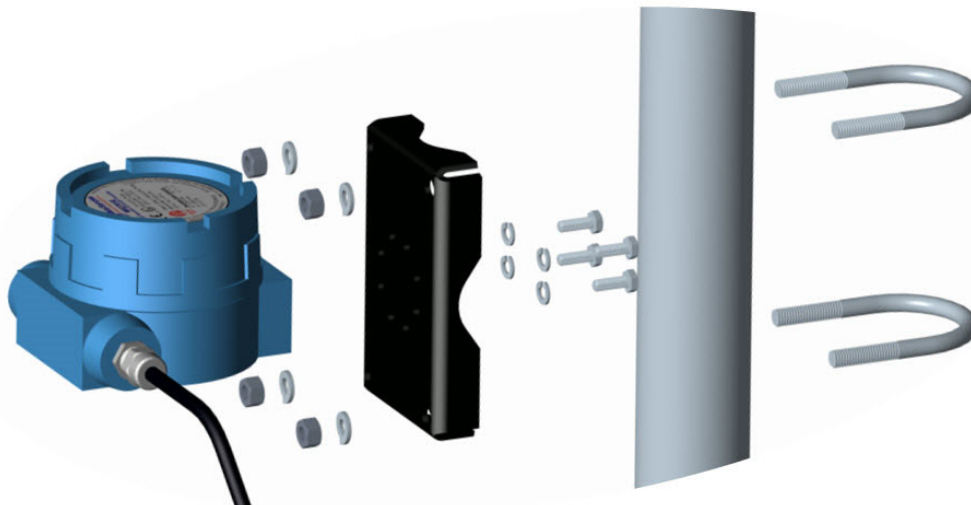
NOTE: Never force the connectors to mate. If there is resistance, stop and check for bent pins on the probe and for foreign material in the female sockets of the transmitter connector. Gently straighten any bent pins and clear any foreign material that may be found.



**Figure 2.** MS2601E Direct Mount Installation

### **b. Remote Mounting**

When it is not practical to direct-probe mount the MS2601E transmitter, the unit can be remote mounted instead. In this case the instrument is mounted to a separate mounting pole using the optional Remote Mounting Hardware Kit. The transmitter is then connected to the ER probe via the probe extension cable.



**Figure 3.** Remote Mount Installation

## 2. Current Loop Connection

### a. Making Connections

The MS2601E current loop connection wiring enters the transmitter through the 1/2" female NPT conduit port shown in Figure 4 below. Please refer control drawing for wiring and Terminal identification.

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**CAUTION:** When used in a hazardous area, the conduit or cable connections must be made in such a way that all hazardous area requirements are met. Cable Glands and blanking plugs must be certified for protection types 'Ex db' or 'tb' and it should be rated for IP66.

**ATTENTION:** Lorsqu'ils sont utilisés dans une zone dangereuse, les connexions des conduits ou des câbles doivent être réalisées de manière à ce que toutes les exigences relatives aux zones dangereuses soient satisfaites. Les presse-étoupes et les obturateurs doivent être certifiés pour les types de protection «Ex db» ou «tb» et doivent être classés IP66.

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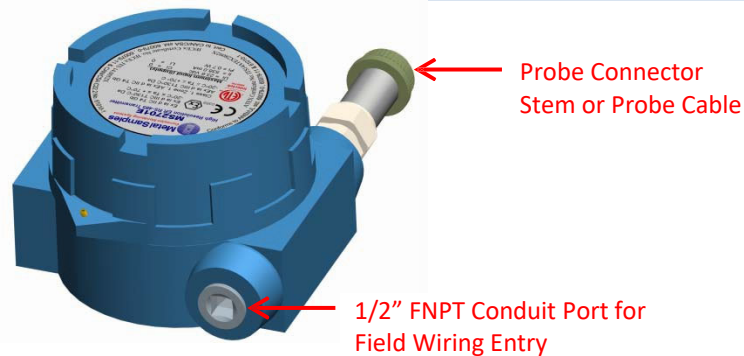


Figure 4. MS2601E current Loop Connector

The maximum permissible length of the current loop wiring between the MS2601E Transmitter and the control system is determined by the control system supply voltage, the electrical resistance of the current loop cable and the load of the control system input. If the Transmitter is to be installed in a safe area, refer to section c. *Wiring for a Safe Area Installation* for details. If the Transmitter is to be installed in a hazardous area, refer to section d. *Wiring for a Hazardous Area Installation*.

### b. Grounding

The MS2601E enclosure is grounded internally through the wiring harness, but an additional, external grounding terminal is provided as well. The enclosure should be grounded properly using the external grounding terminal to ensure safe operation.

### c. Wiring for a Safe Area Installation

For basic safe area wiring information refer to the circuit diagram shown in **Appendix C**. Use the following equation to determine maximum permissible cable length:

$$D = \frac{(V_s - 10)}{(4 * 10^{-5})(R)}$$

Where:

D = Max. cable length in feet.

$V_s$  = Power supply voltage.

R = Cable resistance in ohms per 1000 feet.

Example:

VS = 24 Volts

R = 16.1 (22 AWG cable)

$$D = \frac{(24 - 10)}{(4 * 10^{-5})(16.1)} = 21,739 \text{ Feet}$$

#### d. Wiring for a Hazardous Area Installation

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**CAUTION:** This section provides general guidelines for hazardous area wiring. However, regardless of anything stated here, the MS2601E must be installed in full compliance with the control drawing located in Appendix C and all of the local area requirements.

**ATTENTION:** Cette section fournit des directives générales pour le câblage en zone dangereuse. Cependant, indépendamment de tout ce qui est indiqué ici, le MS2601E doit être installé conformément au schéma de contrôle situé à la Appendix C et à toutes les exigences locales.

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Whenever an electrically driven sensor or measuring device is used in a potentially explosive environment the measuring system must be installed in such a way that electrical energy is either effectively isolated from the explosive environment (via explosive-proof containers, cable conduits, etc.) or the amount of electrical energy produced in the hazardous area must be limited to an permitted level.

Limiting electrical energy is the most practical method of protecting the MS2601E measuring system when the Transmitter is installed in a hazardous area. In the MS2601E system, electrical energy limits are maintained using a power supply with Um of 28V installed in the 4-20 mA current loop per standard practice. The voltage shall be maintained all the time in accordance with the guidance given in IEC 60079-14.

Caution: In general Safety barriers are not necessary but when a safety barrier is used with the MS2601E system, the current loop cable must be connected to the barrier's hazardous area terminals and the barrier output voltage should not exceed 28V at any circumstances. All other connections must be made to the barrier's safe area terminals.

The type of repeater safety barrier employed in the MS2601E system depends on the specific classification of the hazardous environment in question. Metal Samples will provide, upon request, assistance and technical advice in the selection of a repeater safety barrier or its equivalent.

The maximum length of the current loop cable that connects the MS2601E Transmitter to the repeater safety barrier is as follows:

Example:

17.5 Volts

22 AWG Cable = 5,434 feet maximum

16 AWG Cable = 21,788 feet maximum

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**CAUTION:** For hazardous area installations, the maximum inductance and capacitance of the loop wiring between the safety barrier and the transmitter cannot exceed the entity parameters of the selected barrier.

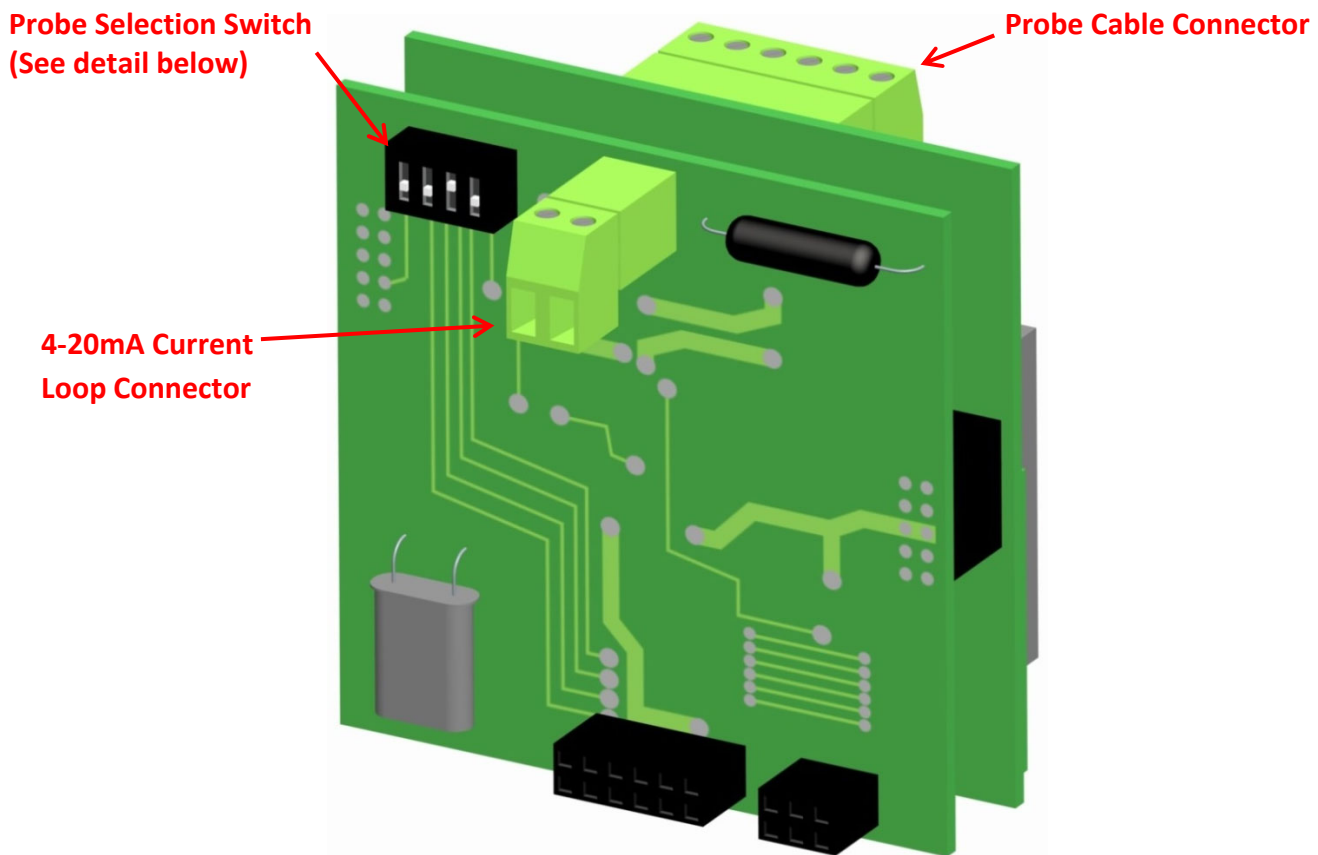
**ATTENTION:** Pour les installations en zone dangereuse, l'inductance et la capacité maximales du câblage de la boucle entre la barrière de sécurité et le transmetteur ne peuvent pas dépasser les paramètres d'entité de la barrière sélectionnée.

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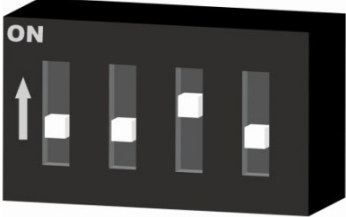
### **3. Setup and Operation**

#### **a. Probe Selection Switches**

Housed within the MS2601E enclosure are probe selection switches which allow the instrument to be set for any standard ER probe type. They also allow the instrument to be placed into several test modes which output fixed values, allowing verification of the current loop connection and DCS program.



**Figure 5.** Connector and Switch Details



	Setting	Switch 1	Switch 2	Switch 3	Switch 4
Operating Positions	Wire Loop	Off (↓)	On (↑)	On (↑)	Off (↓)
	Tube Loop/Flush	On (↑)	Off (↓)	On (↑)	Off (↓)
	Cylindrical*	Off (↓)	Off (↓)	On (↑)	Off (↓)
Test Positions	4mA Output	On (↑)	On (↑)	Off (↓)	Off (↓)
	20mA Output	Off (↓)	On (↑)	Off (↓)	Off (↓)
	4-20mA Sweep	On (↑)	Off (↓)	Off (↓)	Off (↓)

**Table 2.** Probe Switch Settings

\*Cylindrical probe setting is illustrated.

## b. Testing the Current Loop

### i. Calibration

The MS2601E is fully calibrated when shipped from the factory. The calibration settings are fixed to avoid accidental change which could result in erroneous data. In general, no field calibration is required. However, it is important to test the MS2601E upon installation, and during periodic maintenance inspections, to ensure the unit is operating properly. Follow the procedure as below, if calibration becomes absolute necessary.

Note1: Note down the switch settings before proceeding to the below procedure.

- 1) 4.00 mA Calibration
  - a. Power down the instrument
  - b. Turn Off Switch 1 ,2 and 3
  - c. Turn On Switch 4
  - d. Connect meter in series to the instrument to measure current in mA.
  - e. Power-up the instrument
  - f. Check the Loop Current, No calibration necessary if the meter reads 4.00 mA, if not proceed below.
  - g. To increase the loop current in steps of 0.025 mA , toggle the Switch - 2 to Up and Down . Each Toggle will increase loop current by 0.025mA
  - h. To decrease the loop current in steps of 0.025 mA , toggle the Switch - 3 to Up and Down . Each Toggle will decrease loop current by 0.025mA
  - i. Ensure current reading is equal to 4.00 mA.
  - j. Turn Off Swithc-4. Wait for a second
  - k. Turn off the Power.
  
- 2) 20.00 mA Calibration
  - a. Power down the instrument
  - b. Turn Off Switch 2 and 3
  - c. Turn On Switch 1 and 4
  - d. Connect meter in series to the instrument to measure current in mA.
  - e. Power-up the instrument

- f. Check the Loop Current, No calibration necessary if the meter reads 20.00 mA, if not proceed below.
- g. To increase the loop current in steps of 0.025 mA , toggle the Switch - 2 to Up and Down . Each Toggle will increase loop current by 0.025mA
- h. To decrease the loop current in steps of 0.025 mA , toggle the Switch - 3 to Up and Down . Each Toggle will decrease loop current by 0.025mA
- i. Ensure current reading is equal to 20.00 mA.
- j. Turn Off Swithc-4 and wait for a second
- k. Turn off the Power.

Now the new calibration values are registered in the non-volatile memory.

Note2: Set the Switch with respect to the probe connected to the instrument before putting into service.

## **ii. Testing loop output zero (4mA) and span (20mA)**

The MS2601E Probe Selection Switches (page 11) offer three test settings that allow the unit to be placed into various diagnostic modes as follows:

- 1) 4mA Output – Forces a constant 4mA output on the current loop.
- 2) 20mA Output – Forces a constant 20mA output on the current loop.
- 3) 4-20mA Sweep – Causes the output to continually cycle from 4mA up to 20mA.

These test modes can be useful when troubleshooting problems with the current loop wiring and DCS/SCADA system.

## **iii. Testing the MS2601E with the Meter Prover**

A Meter Prover is provided to allow routine checks of the MS2601E. The Meter Prover simulates a Wire Loop type probe at a fixed value. To test the MS2601E with the Meter Prover:

- 1) Disconnect power.
- 2) Disconnect the MS2601E from the probe (or if the MS2601E is remote-mounted, disconnect the probe extension cable from the probe.)
- 3) Connect the Meter Prover to the MS2601E probe connector stem (or to the probe extension cable if the MS2601E is remote-mounted.)
- 4) Loosen the MS2601E Enclosure Lock Screw.
- 5) Unthread and remove the MS2601E cover.
- 6) Change the Probe Selection Switches to the Wire Loop position (see page 11.)
- 7) Reconnect power and allow the instrument to measure for several minutes to stabilize.
- 8) After several minutes observe the transmitter output. The output should closely match the value printed on the Meter Prover label.

If the transmitter output matches the Meter Prover value, you may return the Probe Selection Switches to their previous setting and reconnect the MS2601E to the probe. If the transmitter output shows a significant difference compared to the Meter Prover value, further troubleshooting may be required. Refer to page 16 for troubleshooting or contact the factory for further assistance.

Be sure to reinstall the enclosure cover and tighten the Lock Screw when putting the MS2601E back into service.

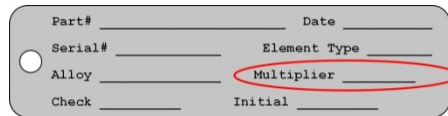
### c. Interpreting Data

#### i. Metal Loss

The MS2601E measures the Metal Loss of an ER probe and converts that value to a linearized 4-20mA current loop output. The 4-20mA output is directly proportional to the cumulative Metal Loss of the ER probe at any given time. The overall span of the 4-20mA output is proportional to the life of the probe in use, so for DCS/SCADA programming the 4-20mA signal can be scaled as follows:

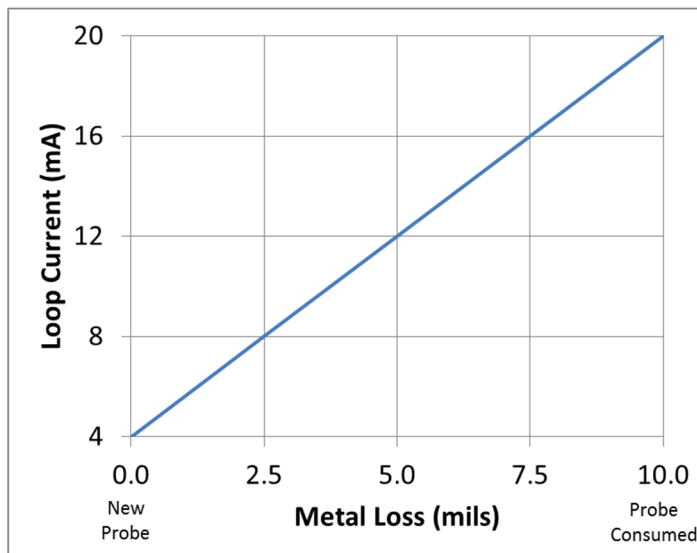
- 4mA = 0 mils (0% Metal Loss)
- 20mA = Probe Life in mils (100% Metal Loss)

The Probe Life can be found in Table 1 and is also listed on the Metal Samples probe tag (as the "Multiplier".)



**Figure 6.** Metal Samples Probe Tag

Figure 7 illustrates the relationship between Loop Current and Metal Loss. In this example a probe with a 10-mil life is assumed. However, the X axis could be changed to represent any Probe Life.



**Figure 7.** Output Relationship

As seen here, the transmitter output begins at 4mA for a new probe (zero Metal Loss) and increases as the probe element corrodes, eventually reaching a maximum of 20mA when the probe sensing element has been completely consumed by corrosion (in this case, 10 mils of Metal Loss.) At this time the probe has reached its end-of-life and must be replaced.

## ii. Calculating Corrosion Rate

As explained previously, ER probes and instruments report *Metal Loss*. However, the value that is of ultimate interest is Corrosion Rate. The Corrosion Rate is essentially Metal Loss over time, so the Corrosion Rate can be calculated using the following formula:

$$\text{Corrosion Rate(mpy)} = \frac{\Delta\text{Loop Current(mA)}}{16} \times \frac{365}{\Delta\text{Time(days)}} \times \text{Probe Life(mils)}$$

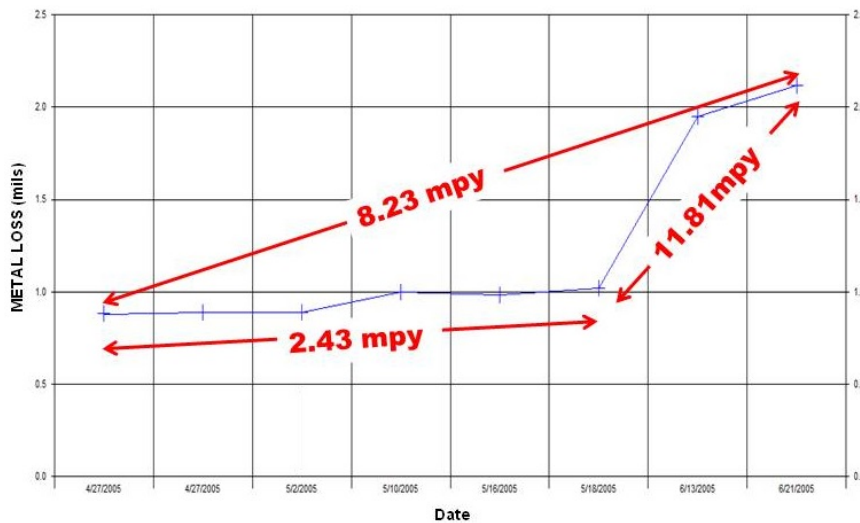
where:

$\Delta\text{Loop Current(mA)}$  is the difference between two readings

$\Delta\text{Time(days)}$  is the time difference between those two readings

It is a common practice to program this formula into the control (DCS/SCADA) system and have it calculate Corrosion Rate on a continual basis from the Metal Loss data. The challenge in doing this is selecting an appropriate time interval. Using an interval that is too short may give erratic results, while selecting an interval that is too long may give results that are insensitive to system upsets. The ideal time period depends on many factors, and will vary from system to system. It may take some trial and error to settle on the best time period for your installation.

In some cases it may be necessary to review the raw Metal Loss data and manually apply the Corrosion Rate formula to periods of interest. For example, look at the graph below and see how much the calculated Corrosion Rate can vary depending on the time period used.



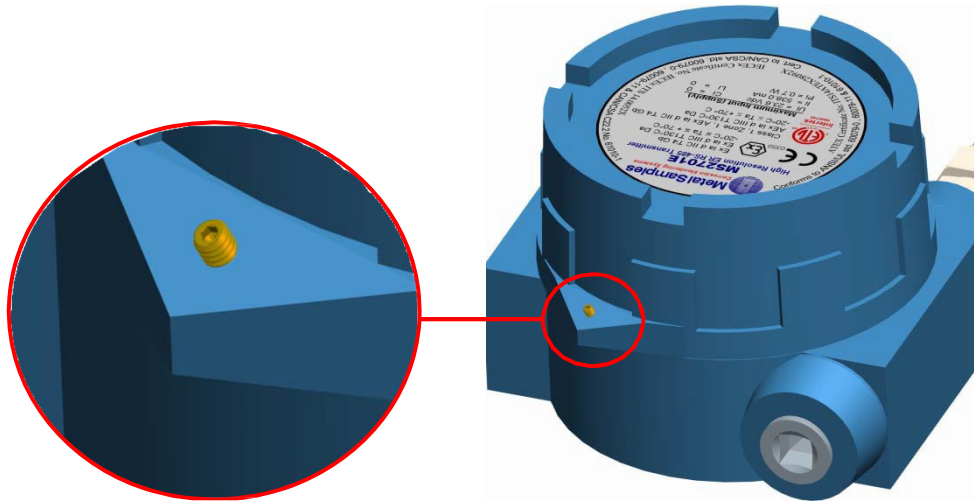
**Figure 8.** Corrosion Rates calculated from Metal Loss data

While each of the results is valid for the selected time period, the one of most interest is the value of 11.81 mpy which represents some type of system upset. When the Corrosion Rate is calculated automatically on a pre-selected time period, there is no guarantee that the selected time period will always coincide with system upsets such as this. That is why manual review and interpretation of Metal Loss data is also helpful.



#### d. Commissioning

Once the MS2601E transmitter has been installed, tested, and properly configured for the probe in use, it can then be closed and put into service. First, perform one last visual inspection to ensure that all electrical connections are secure and that the enclosure o-ring is in place and is in good condition. Then thread the enclosure lid onto the base fully. Once the lid has been threaded into place, tighten the Lock Screw to prevent unauthorized tampering.



**Figure 10.** Enclosure  
Lock Screw

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**CAUTION:** The Lock Screw on the instrument base must be tightened securely to prevent unauthorized personnel from opening the MS2601E transmitter, and ensure that the Flameproof safety is not violated. Only qualified personnel should be allowed to install, operate, and maintain the MS2601E transmitter.

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## C. Maintenance

Once installed, the MS2601E requires little maintenance. However, it is important to verify the following items periodically to ensure continued safe operation.

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**CAUTION:** Before performing any tests or maintenance on the MS2601E, ensure that all hazardous area requirements are met.

---

Inspection Item	Frequency
Inspect the enclosure o-ring for any signs of damage. Replace as necessary.	Annually
Inspect the probe connector o-ring for any signs of damage. Replace as necessary.	Annually
Inspect all electrical connections for signs of corrosion, mechanical damage, or foreign matter that could cause improper operation or cause an electrical short. Clean as necessary.	Annually
Ensure that the locking screw is in place and is secure.	Annually
Inspect the enclosure for any signs of corrosion or paint damage.	Annually
Check for any signs of moisture ingress within the enclosure.	Annually

Contact Metal Samples for replacement parts or if instrument repair is necessary.

## D. Troubleshooting

If the MS2601E does not seem to perform as expected, check the following items:

---

**CAUTION:** Before performing any tests or maintenance on the MS2601E, ensure that all hazardous area requirements are met.

**ATTENTION:** avant d'effectuer des tests ou des opérations de maintenance sur le MS2601E, assurez-vous que toutes les exigences relatives aux zones dangereuses sont respectées.

- 
1. Ensure that the probe is operational and is not completely corroded. This can be done in two ways.
    - a. Test the probe with a portable ER meter if available.
    - b. Test the probe with a portable resistance or continuity meter as follows:
      - i. Connect one test lead to pin 'A' of the probes 6-pin connector.
      - ii. Measure continuity to each of the other pins. There should be continuity (low resistance) to each pin.

NOTE: Continuity on each pin does not ensure that the probe is good. However, if you find an open circuit on any pins then it is almost certain that the probe is bad and should be replaced.

2. Ensure that the Probe Selection Switches are set correctly for the probe being used. Confirm the probe type and refer to Table 2 on page 11 to verify the appropriate switch settings.
3. Perform a visual inspection of the circuit boards to look for any signs of mechanical or electrical damage.
4. Ensure that all electrical cables and wiring are in good condition.
5. Ensure that all electrical contacts are secure and free of corrosion.

6. Ensure that there is adequate supply voltage at the 4-20mA Current Loop Connector.
7. Verify that the supply voltage polarity is correct.
8. If there is insufficient supply voltage on the 4-20mA Current Loop Connector, check the safety barrier (if applicable) for a blown fuse or any other failure.
9. Test the MS2601E using the supplied Meter Prover (see page 12.)
10. Test the MS2601E with a local multi-meter or loop calibrator.

These basic checks should indicate the source of any problem (probe, power supply, wiring, etc...) If it is determined that the MS2601E is malfunctioning, or if you need further assistance in troubleshooting, contact Metal Samples Technical Support.

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**CAUTION:** *If the MS2601E shows any signs of damage remove it from service immediately and consult the factory.*

**ATTENTION:** *Si le MS2601E montre des signes de dommages, mettez-le immédiatement hors service et consultez l'usine.*

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### **III. Service and Warranty Information**

#### **A. Warranty**

Metal Samples warrants that any part of the MS2601E and accessories which proves to be defective in material or workmanship within one year of the date of original shipment to Purchaser will be repaired or replaced, at Metal Samples option, free of charge. This warranty does not cover (1) probe assemblies, (2) items expendable in nature, or (3) items subject to damage from normal wear, misuse or abuse, or failure to follow use and care instructions.

All damaged items are to be shipped at Purchaser's expense to and from Metal Samples which shall have the right to final determination as to the existence and cause of a defect.

The foregoing shall constitute the sole and exclusive remedy of any purchaser of Metal Samples products for breach of warranty and IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS. IN NO EVENT SHALL METAL SAMPLES BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES, OR FOR ANY DELAY IN THE PERFORMANCE OF THIS WARRANTY DUE TO CAUSES BEYOND ITS CONTROL.

The technical information and suggestions contained herein are believed to be reliable, but they are not to be construed as warranties since conditions of use are beyond our control.

#### **B. Obtaining Service and Returning the Instrument for Repair**

If you experience problems with your instrument please contact the factory at 256-358-4202 and ask for customer support for instrumentation. Our customer support department will assist you in troubleshooting your instrument.

Most issues can be resolved over the phone, but in some cases it may be necessary to return your instrument for further evaluation and repair. In this case, please obtain a Return Materials Authorization (RMA) number from the sales person or support technician. This RMA number will ensure that your instrument is routed to the correct department when it is received at the factory.

After receipt of an RMA number you may pack your instrument for return. Be sure to pack your instrument in a sturdy box and to pad it sufficiently to avoid damage during transit. Also be sure to complete the "Instrument Repair Form" on the next page and include a copy with your repair. This will ensure that the repair department has sufficient information regarding the problems you are experiencing with your instrument, as well as the billing, contact, and return shipping details for the repair.

Once you have obtained an RMA number, completed the "Instrument Repair Form", and packed your instrument securely, please ship it prepaid to the following address:

Metal Samples  
152 Metal Samples Road  
Munford, AL 36268  
ATTN: RMA# \_ \_ \_ \_ \_

NOTE: Be sure to list your RMA number in the attention line (shown as blanks in the example above.)

### C. Instrument Repair Form

This form may be photocopied for use when returning an instrument to Metal Samples for repair. Please fill in all known information and enclose a copy of the completed form with the instrument.

#### General Information

<b>Model Number</b>		<b>Serial Number</b>	
<b>RMA Number</b>		<b>Date of Purchase*</b>	

*\*If known.*

#### Contact Information for Repair

<b>Contact Name</b>		<b>Company</b>	
<b>Phone Number</b>		<b>E-mail Address</b>	

#### Return Shipping Information

<b>Recipient Name*</b>		<b>Company*</b>	
<b>Return Address</b>			

*\*If different than above.*

#### Reason for Return. (Provide as much detail as possible. Attach additional pages if required.)

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#### Invoice Instructions (For non-warranty repairs)

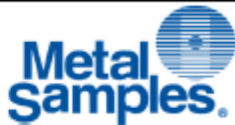
<input type="checkbox"/>	<b>Invoice me for the repair</b> <i>(Requires an open account with Metal samples.)</i>	→	<b>Reference PO#</b>	
<input type="checkbox"/>	<b>Contact me for credit card information</b> <i>(For security purposes, do not list credit card information on this form..)</i>			

**Appendix A: Revision History**

Revision	Date	Changes
A	03/11/16	Initial Release
B	01/16/17	Revisions to Technical Specifications page
C	03/31/20	New Model with Isolator
D	10/23/20	Additional Warnings added

## Appendix B: Hazardous Area Certification Details

	MS26X1E & MS29X1E Hazardous Area Certification Details	Doc.Number	EXDOC-000020
		Revision	0
		Date	04/15/2020
		Page	1 of 3
Worldwide and Europe	Ex db [ia Ga] IIC T6....T4 Gb Ex db [ia] IIC T130°C Da -40°C ≤ Ta ≤ +70°C  ATEX Cert. No: ITS ATEX 27981X IECEx Cert. No: IECEx ETL 17.0020X X – See special Conditions below		
USA AND CANADA	Class I, Zone 1, AEx db [ia Ga] IIC T6...T4 Gb Class I, Division 2, Groups A, B, C & D, T6...T4		
<p><b><u>Hazardous Area Installation</u></b></p> <p><b>CAUTION:</b> This section provides general guidelines for hazardous area wiring. However, regardless of anything stated here, the MS26X1E / MS29X1E ER transmitter must be installed in full compliance with the control drawing provided Annexure-C and all of the local area requirements.</p>			
<p><b><u>Entity Parameters</u></b></p> <p><b><u>at Probe (common for all models)</u></b></p> <p>Uo: 4.94V                  Io: 0.486A                  Po: 0.42W                  Co: 0.4µF                  Lo: 70µH</p>			
<p><b>Special Conditions</b></p> <p>1 All sealing devices including cable glands, blanking elements, thread adapters and stopping plugs are required to be certified to type of protection Ex db or tb as applicable, be suitable for use in an ambient temperature range of -40°C to 70°C, be suitable for use in Group IIC or Group IIIC as applicable and be suitably sized for the cabling which is carried. Installation shall take into account any applicable special conditions for safe use and all relevant installation requirements of IEC 60079-14. No more than one thread adapter may be used on any entry</p>			



MS26X1E & MS29X1E Hazardous Area  
Certification Details

Doc.Number	EXDOC-000020
Revision	0
Date	04/15/2020
Page	2 of 3

- 2 Equipment has been assessed for connection to Um: 28VDC. This voltage shall be maintained in accordance with the guidance given with IEC 60079-14.
- 3 Equipment has been assessed for connection to a simple resistive probe produced from either wiring or a metallic sheet metal mounted onto an epoxy substrate (which has been approximated to tracking). The Temperature Classification in which the equipment may be used is dependent upon the probe connected. The equipment may be used in Temperature Classification T6 providing the following conditions are met as applicable:
  - a) The equipment probe is a simple device produced from wire with a diameter of 0.1mm or higher
  - b) The equipment probe is a simple device produced from tracking with a width of 0.3mm or higher

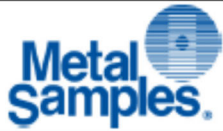
If these parameters cannot be verified, a generic probe may be used with the equipment in Temperature Classification T4 providing it is a simple device produced from wiring or tracking and does not contain any discrete components or resistances.

- 4 Equipment has been assessed for connection to a simple resistive probe produced from either wiring or a metallic sheet metal mounted onto an epoxy substrate (which has been approximated to tracking). The Temperature Classification in which the equipment may be used is dependent upon the probe connected. The equipment may be used in Group III environments with a maximum surface Temperature of T85°C providing the following conditions are met as applicable:
  - a) The equipment probe is a simple device produced from wire with a diameter of 0.1mm or higher
  - b) The equipment probe is a simple device produced from tracking with a width of 0.3mm or higher

If these parameters cannot be verified, a generic probe may be used with the equipment a maximum marked temperature of T135°C providing it is a simple device produced from wiring or tracking and does not contain any discrete components or resistances.

- 5 The resistive probe has been considered as simple apparatus. The probe shall maintain the following minimum parameters in accordance with Clause 5.7 of IEC 60079-11:
  - a) Either the probe circuitry shall maintain a dielectric strength of 500V between its terminals and the equipment frame or the end user shall ensure there is no possibility for different earth potentials within the equipment installation.





MS26X1E & MS29X1E Hazardous Area  
Certification Details

Doc.Number	EXDOC-000020
Revision	0
Date	04/15/2020
Page	3 of 3

- b) Where non-metallic materials are used in the construction of the external enclosure the probe shall be installed in accordance with the guidance for mitigation of electrostatic charging contained within the manufacturer's instruction manual
  
- c) Where metallic materials are used in the construction of the external enclosure it shall be ensured that the materials do not contain more than 7,5 % in total of magnesium, titanium and zirconium.



Détails de la certification MS26X1E et MS29X1E  
pour zones dangereuses

Doc.Number	EXDOC-000024
Revision	0
Date	04/15/2020
Page	1 of 3

**MONDE ET EUROPE**

Ex db [ia Ga] IIC T6...T4 Gb  
Ex db [ia] IIC T130°C Da  
-40°C ≤ Ta ≤ +70°C

ATEX Cert. No: ITS ATEX 27981X  
IECEx Cert. No: IECEx ETL 17.0020X  
X - Voir les conditions particulières ci-dessous

**USA ET CANADA**

Class I, Zone 1, AEx db [ia Ga] IIC T6...T4 Gb  
Class I, Division 2, Groups A, B, C & D, T6...T4

Installation en zone dangereuse

**ATTENTION:** Cette section fournit des directives générales pour le câblage en zone dangereuse.  
Cependant, indépendamment de tout ce qui est indiqué ici, le transmetteur MS26X1E / MS29X1E ER doit être installé en totale conformité avec le schéma de contrôle fourni en Annexe-C et toutes les exigences locales.

Paramètres d'entité

at Probe (commun à tous les modèles)

Uo: 4.94V  
Io: 0.486A  
Po: 0.42W  
Co: 0.4µF  
Lo: 70µH

### Conditions spéciales

- 1 Tous les dispositifs d'étanchéité, y compris les presse-étoupes, les éléments d'obturation, les adaptateurs de filetage et les butées les fiches doivent être certifiées pour le type de protection Ex db ou tb selon le cas, être appropriées pour une utilisation dans une plage de température ambiante de -40 ° C à 70 ° C, convient pour une utilisation en groupe IIC o u Groupe IIIC selon le cas et être dimensionné de manière appropriée pour le câblage qui est transporté. L'installation doit tenir compte de toutes les conditions spéciales applicables pour une utilisation sûre et exigences d'installation pertinentes de la CEI 60079-14. Pas plus d'un adaptateur de fil peut être utilisé sur n'importe quelle entrée
  
- 2 L'équipement a été évalué pour la connexion à Um: 28VDC. Cette tension doit être maintenue conformément aux recommandations de la CEI 60079-14.
  
- 3 L'équipement a été évalué pour la connexion à une simple sonde résistive produite à partir de soit un câblage soit une tôle métallique montée sur un substrat époxy (qui a été approximativement au suivi). La classification de température dans laquelle l'équipement peut être utilisé dépend de la sonde connectée. L'équipement peut être utilisé dans Classification de température T6 à condition que les conditions suivantes soient remplies, le cas échéant:
  - a) La sonde d'équipement est un appareil simple fabriqué à partir de fil avec un diamètre de 0,1 mm ou plus
  - b) La sonde d'équipement est un appareil simple produit à partir d'un suivi d'une largeur de 0,3 mm ou plusSi ces paramètres ne peuvent pas être vérifiés, une sonde générique peut être utilisée avec l'équipement en Classification de température T4 à condition qu'il s'agisse d'un appareil simple sproduit à partir d'un câblageou suivi et ne contient aucun composant discret ou résistance.
  
- 4 L'équipement a été évalué pour la connexion à une simple sonde résistive produite à partir de soit un câblage soit une tôle métallique montée sur un substrat époxy (qui a été approximativement au suivi). La classification de température dans laquelle l'équipement peut être utilisé dépend de la sonde connectée. L'équipement peut être utilisé dans Environnements du groupe III avec une température de surface maximale de T85 ° C assurant la les conditions suivantes sont remplies le cas échéant:
  - a) La sonde d'équipement est un appareil simple fabriqué à partir de fil de diamètre de 0,1 mm ou plus
  - b) La sonde d'équipement est un appareil simple produit à partir d'un suivi d'une largeur de 0,3 mm ou plus

- 5 La sonde résistive a été considérée comme un appareil simple. La sonde doit maintenir le paramètres minimaux suivants conformément à l'article 5.7 de la CEI 60079-11:
- a) Soit le circuit de la sonde doit maintenir une rigidité diélectrique de 500 V entre ses les terminaux et le châssis de l'équipement ou l'utilisateur final doivent s'assurer qu'il n'y a aucune possibilité pour différents potentiels de terre dans l'installation de l'équipement.
  - b) Lorsque des matériaux non métalliques sont utilisés dans la construction de l'enceinte externe la sonde doit être installée conformément aux directives d'atténuation des charge électrostatique contenue dans le manuel d'instructions du fabricant
  - c) Lorsque des matériaux métalliques sont utilisés dans la construction de l'enceinte externe il faut s'assurer que les matériaux ne contiennent pas plus de 7,5% au total de magnésium, titane et zirconium.

## **Appendix C: Drawings**

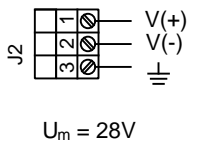
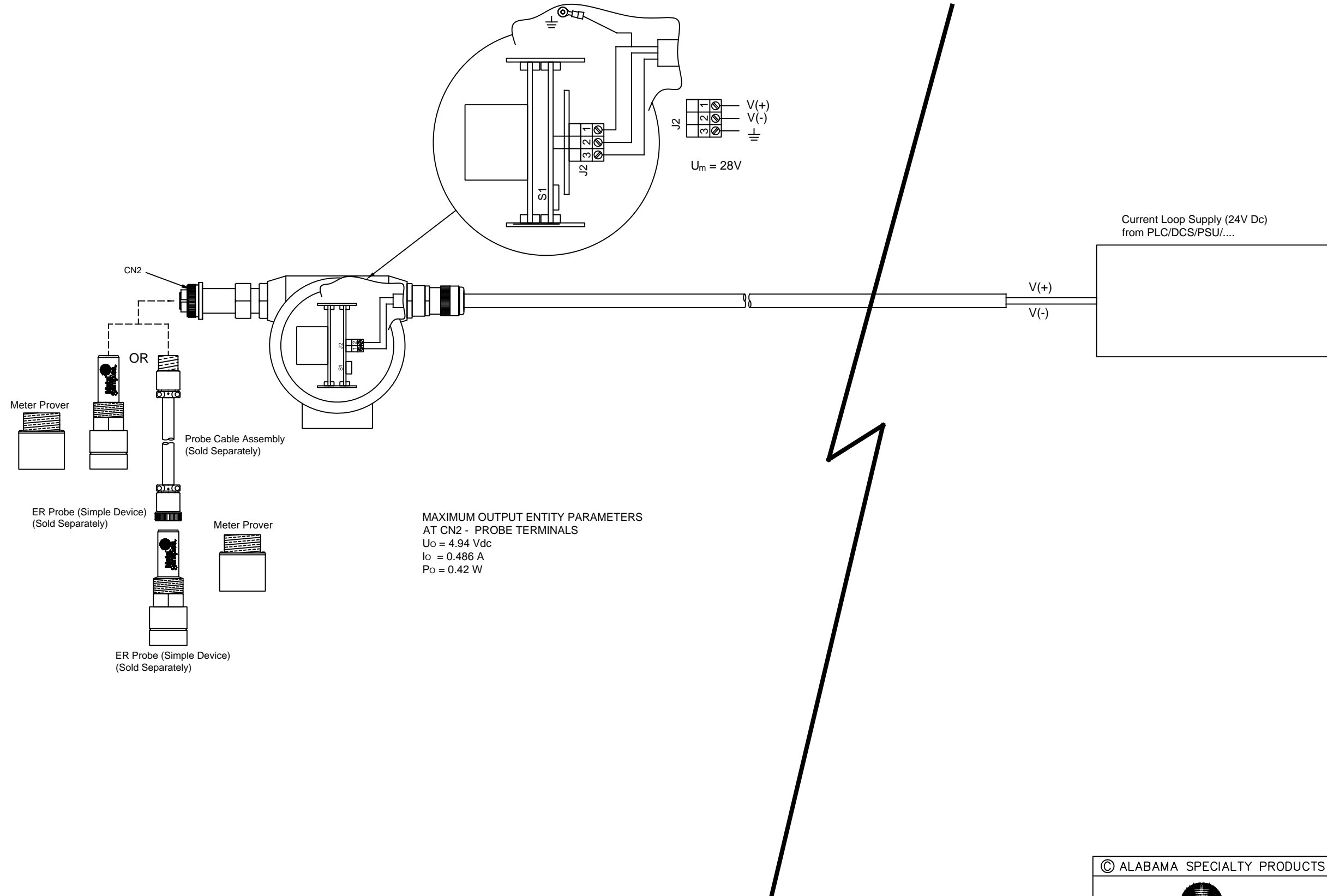
### **A. Wiring Diagrams**

Control Drawing (Hazardous Area Wiring Diagram)

# HAZARDOUS AREA

# SAFE AREA

MS2601E/MS2651E/MS2901E/MS2951E HIGH RESOLUTION ER  
4-20mA TRANSMITTER



MAXIMUM OUTPUT ENTITY PARAMETERS  
AT CN2 - PROBE TERMINALS  
 $U_o = 4.94 \text{ Vdc}$   
 $I_o = 0.486 \text{ A}$   
 $P_o = 0.42 \text{ W}$

REV	DATE	BY	CHKD	REV	DATE	DESCRIPTION
A	08/11/15	BP	BP	EDW	BP	Modified Entity Parameters
D	11/03/15	BP	BP	EDW	BP	PROBE PARAMETERS REMOVED
E	03/11/16	BP	BP	EDW	BP	ADD REPEATER
F	04/15/20	BP	BP	EDW	BP	ADDITIONAL MODELS ADDED

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**Metal Samples**  
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 MUNFORD, AL 36268  
 PHONE: (256)-358-4202  
 FAX: (256)-358-4515  
 A DIVISION OF ALABAMA SPECIALTY PRODUCTS, INC.

ENGINEERED BY BP	DRAWN BY EAN	CHECKED BY SAK	DATE 04/15/20
TITLE Control Drawing MS26X1E / MS29X1E ER Transmitter			
SCALE	SHT. NO. 1	TOT. NO. 1	DWG. NO. EXWDB-000096
			REV. F