



MS3500E / MS3510E

High Resolution ER Data Logger

Operator's Manual



Metal Samples

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I. Introduction

A. General Description

The MS3500E/MS3510E is a battery powered, corrosion meter capable of measuring and storing data from all types of electrical resistance (ER) corrosion probes. The instrument is light weight, microprocessor-based, and features a simple, menu-driven interface using a keypad and a graphical LCD display.

Corrosion rate measurements are made using the electrical resistance method. Essentially, the instrument measures the resistance of the probe element which changes over time, as metal loss occurs. The rate of change is directly proportional to corrosion rate. This method finds a wide variety of applications since it can be used in conductive and nonconductive environments such as petroleum, chemical, water, soil, or even atmosphere. The new high-resolution measurement of the MS3500E/MS3510E detects smaller increments of metal loss, providing faster response than traditional ER instruments.

After taking a reading, the instrument displays metal loss in mils. All stored readings are automatically time and date stamped. Readings are stored to non-volatile Flash memory which retains data without the need for a battery backup.

The MS3500E/MS3510E High Resolution ER Data Logger can store more than 100000 readings. Stored data can be downloaded directly to a USB Flash (“jump”) drive or Bluetooth compatible devices via Bluetooth. Data can be opened and charted using the provided CDMS software, or it can be imported into any standard data analysis (spreadsheet) program such as Microsoft Excel. Data can also be reviewed and charted on the instrument’s LCD display for quick reference.

B. Principles of Operation

The MS3500E/MS3510E High Resolution ER Data Logger 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 MS3500E/MS3510E High Resolution ER Data Logger 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 several 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 MS3500E/MS3510E High Resolution ER Data Logger measures an ER probe utilizing a high-resolution, 16-bit measurement. This allows the unit to detect much smaller amounts of metal loss, thus responding faster to corrosion events and upsets. At 16-bit resolution the MS3500E/MS3510E ER Data Logger can measure metal loss amounts as small as 0.004% of the probe life. For highly sensitive probes such as the 5-mil large flush shown above, that results in a detection limit of less than one angstrom.

C. Technical Specifications

Model

MS3500E - Basic Model

MS3510E - Basic Model + 4-20mA Current Loop Output

MS3520E - Basic Model + Bluetooth

Physical Data

Instrument Weight:	11.94 lbs. (5.42 kg)
Total Weight w/ Accessories:	13.64 lbs. (6.19 kg)
Instrument Dimensions:	11.50"H x 8.94"W x 4.00"D (29.21cm x 22.71cm x 10.16cm)
Case Specifications:	NEMA 4X / IP66 - stainless steel
Mounting Specifications:	10.75"H x 6"W (27.31cm x 15.24cm) Bolt Pattern 0.3" (0.76cm) Diameter Bolt Holes
Operating Temperature:	-40° to 158°F (-40° to 70°C)
Storage Temperature:	-40° to 185°F (-40° to 85°C)

Performance Data

Measurement Type:	ER measurement using any standard ER Probe Types Preferred Probe Types: Cylindrical, Flush Compatible probe types: Tube Loop, Wire Loop, Flush, Strip, etc.
Range:	0 - 65,535 probe life units (displayed as 0.00 to 1000.00 PLU's in 0.04 increments)
Resolution:	0.0015% of Probe Life
Repeatability:	± 0.2% of Full Scale
Data Storage:	> 100,000 readings

Electrical Data

Power Requirements:	7.2V lithium Battery pack
Nominal Probe Cable Distance:	30 ft. (10 m)
Download Method:	To certified Bluetooth enabled devices (MS3520E) or directly to USB Flash drive (Certified Data Transfer Unit required for use in hazardous areas)

Hazardous Location Certifications – Intrinsic Safety

See Appendix B

Included Accessories

Meter Prover, Operation Manual, Corrosion Data Management Software

Optional Accessory Items (Ordered Separately)

Certified Flash Drive (required for transferring data in a hazardous area)

II. Start-up and Operation

A. Receiving the MS3500E/MS3510E High Resolution ER Data Logger

Check the MS3500E/MS3510E High Resolution Data Logger for any shipping damage when it is first received. When the unit is unpacked, verify that the following items are included:

- Data Logger
- Battery pack (Shipped Separately)
- Meter Prover
- User's Manual
- Current Loop Cable (MS3510E Model 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. Start-Up

CAUTION: *Using this product in any way other than that specified within this manual may impair the intrinsic safety protection.*

Start-up of the MS3500E/MS3510E Data Logger involves the following steps:

1. Port Details and Probe Connection
2. Current Loop Connection (MS3510E Model Only)
3. Power-Up
4. Setup and Operation

1. Probe Connection

CAUTION: *Using this product in any way other than that specified within this manual may impair the intrinsic safety protection.*

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

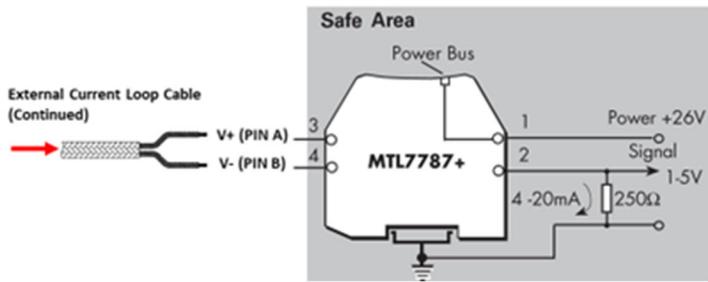
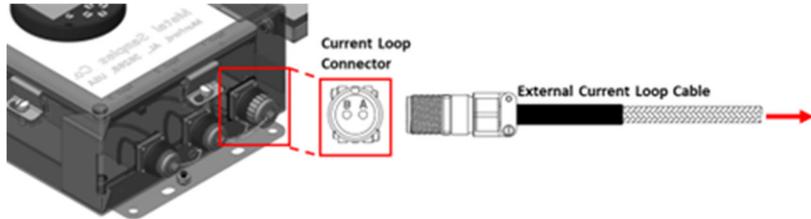
- Do not mount the transmitter in a location that exceeds its operating temperature.
- Avoid mounting the transmitter near sources of strong electrical noise.
- Ensure that there is sufficient clearance for installation and to open the transmitter cover afterwards.

a. Remote Mounting

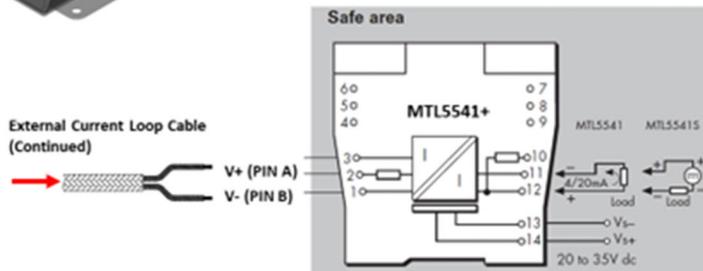
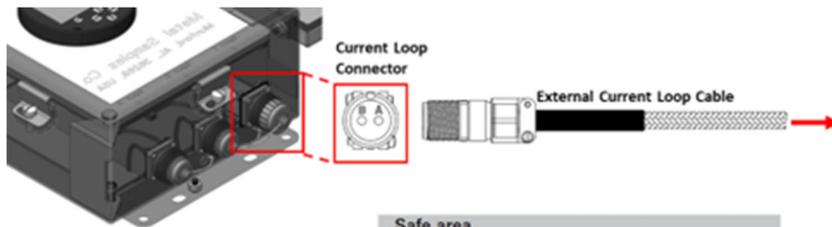
The unit is designed to mount remotely. The data logger is connected to the ER probe via the probe extension cable. When possible, the data logger should be mounted within 10' (3m) of the probe to keep the probe cabling short and minimize signal degradation.

2. Current Loop Connection (for the MS3510E model)

To setup current loop communication, refer to the Control Drawing (Hazardous Area Wiring Diagram), found in Appendix C: Control Drawing on page 36.



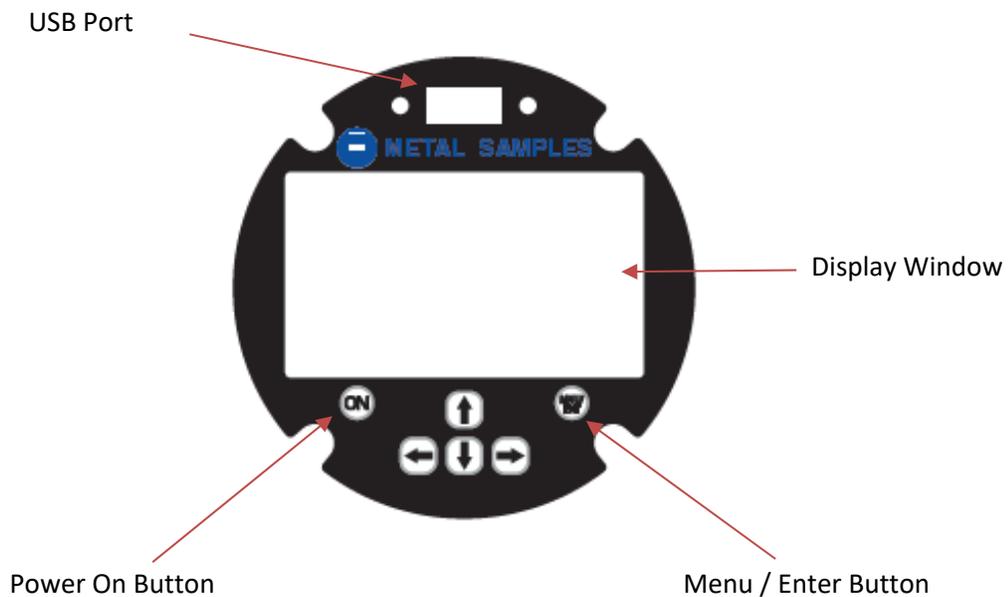
OR



- a. **In the Safe Area only**, connect the external current loop cable (shipped with the instrument) to either:
 - Certified Safety Barrier (EEx ia) IIC Typical of MTL 7787+
 - Certified 4-20mA Repeater Power Supply (EEx ia) IIC Typical of MTL 5541+.
- b. Connect the 2-pin connector from the external current loop cable to the instrument's 4-20mA current loop port.
- c. Current measurements will be explained in the "Comm./Loop" section on Page 19.

3. Power-Up

The unit is supplied with a battery pack in a separate package. Install the battery pack before starting the product. The instrument can be powered up by pressing the 'ON' button on the keypad. The start-up screen with the Metal Samples logo will appear on the screen; the start-up screen confirms the software version currently running and the SD card status. The keypad switch layout is shown below.



a. Safe Area Usage

The MS3500E/MS3510E High Resolution Data Logger is approved for use in hazardous areas but can be used in non-hazardous areas as well.

The cells in the battery pack must be replaced only in a safe area and it should be replaced with batteries of the same make and model.

b. Hazardous Area Usage

Refer to Appendix B for details.

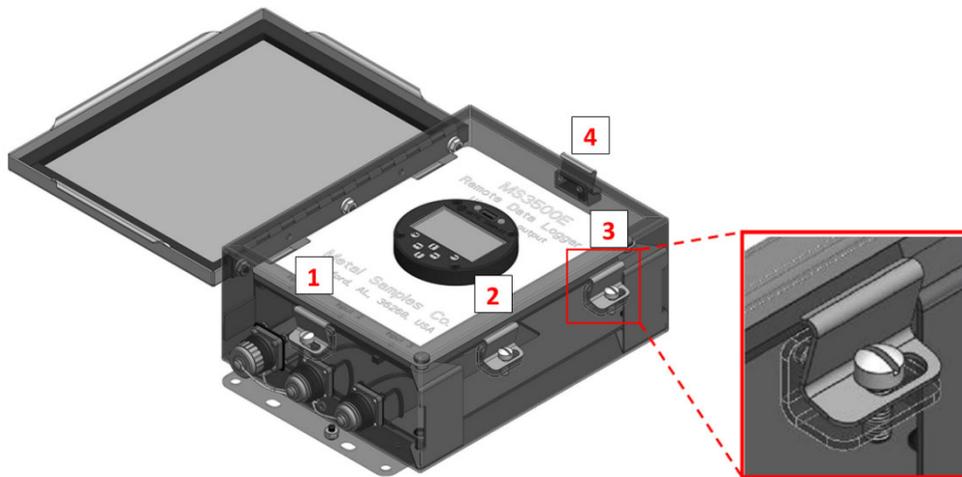
c. Battery Replacement

WARNING:

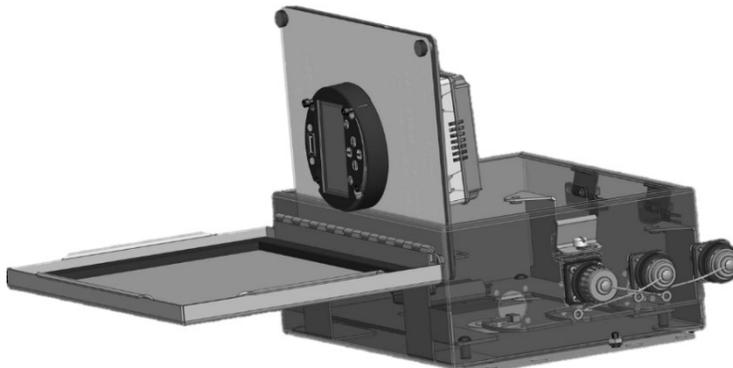
- Do not mix old and new batteries. Equipment is intended for use only with Xeno Energy model XL-205F and Tadiran model TL-5930 cells. Use of any other battery in this device may impair intrinsic safety.
- Do not mix batteries of different types (such as alkaline and lithium.)
- The cover screw is used to prevent unauthorized tampering of the batteries and is required to ensure intrinsic safety.
- Do not over-tighten the cover screw, as this may damage the instrument case.

To remove the battery pack from the Instrument:

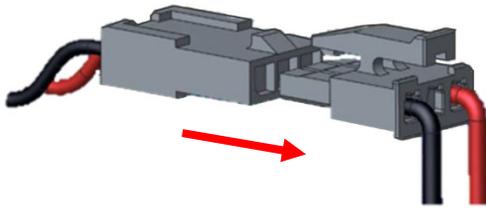
1. Open the front door of the enclosure by unscrewing and unlatching the four latches securing the front door.



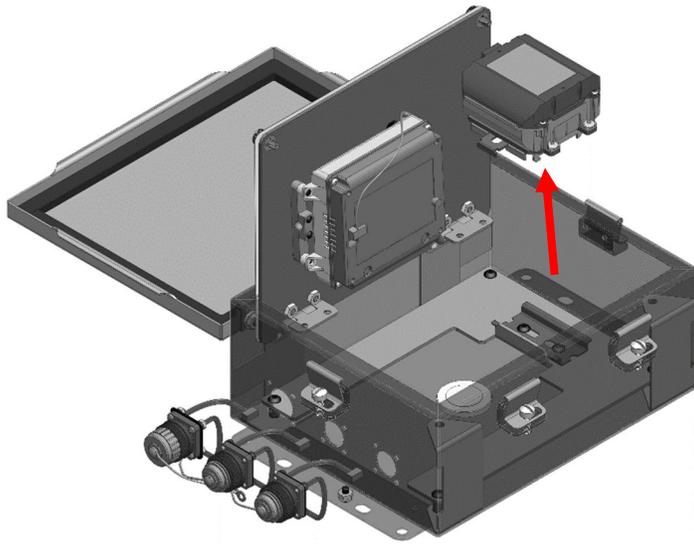
2. Unscrew the two thumb screws securing the front panel. Open the front panel.



3. Disconnect the battery cable connection, by pressing down on the locking tab and pulling.



4. Unlatch and remove the battery holder assembly from the mounting plate DIN rail.

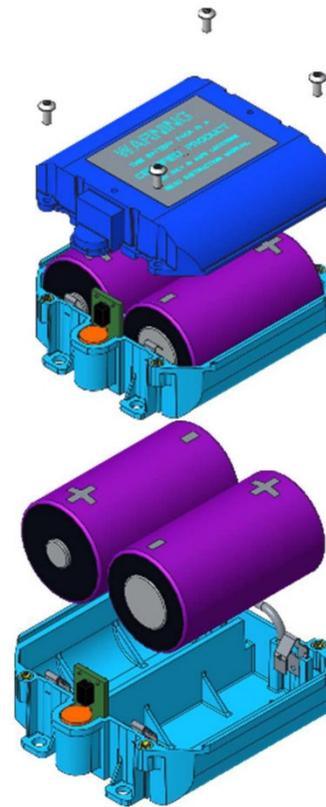


Replace battery cells:

Follow the previous instructions 'To remove the battery pack from the Instrument' and move the battery pack to a safe location.

**WARNING: ENSURE BATTERY PACK IS MOVED TO SAFE LOCATION BEFORE CONTINUING.
FAILING TO DO SO MAY IMPAIR INSTRINSIC SAFETY.**

1. With the battery pack in a SAFE location, remove the 4 Tamper Resistant Torx Screws from the battery pack. Remove the battery pack cover.
2. Remove the battery cells from the pack. Check that new batteries are of the same type as those removed.
3. Insert the new batteries into the pack, ensuring that the direction matches the battery pack.
4. Replace the battery pack cover and screw in the 4 Tamper Resistant Torx Screws until snug.
DO NOT OVERTIGHTEN.



Replace battery Pack:

Follow the instructions to return the battery pack

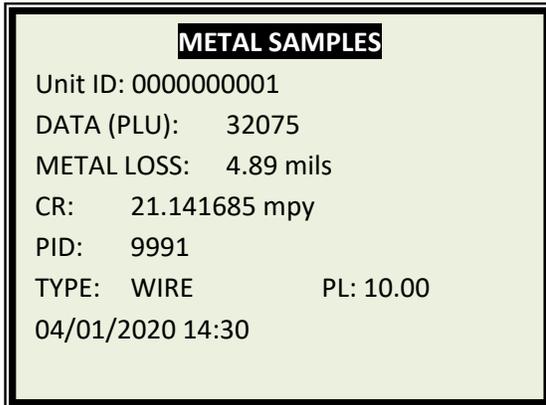
To return the battery pack with replacement:

1. Reinstall the battery pack within the instrument enclosure by latching the battery pack assembly to the mounting plate DIN rail.
2. Reconnect the battery pack cable by pushing the battery cable and the power cable connectors together until they lock.
3. Close the front panel and tighten the 2 thumb screws.
4. Close the enclosure door, latch all 4 of the latches to the door, then tighten the 4 screws to secure the latches.

C. Setup and Operation

MAIN MENU

The MS3500E/MS3510E allows you to measure metal loss and corrosion rate. This section describes the functions that display on the Main Menu:



The Start-Up display shows the data logger's unit ID at the top of the screen.

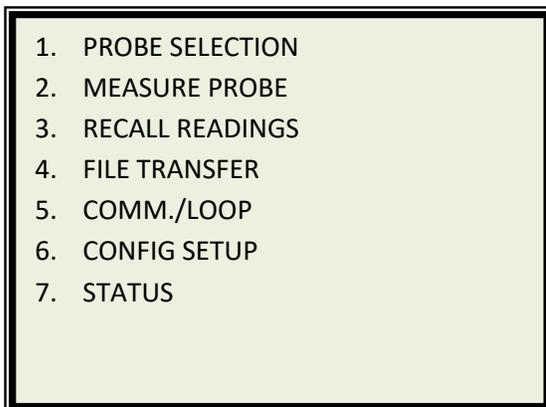
It also shows the recent probe data in probe life units with a range of 0 to 65535, metal loss in mils, and corrosion rate in mils per year.

Probe ID, probe type and probe life also displayed in the bottom of the screen. Current date and time are displayed in the last line.

Press 'MNU/ENT' key on the keypad to display the menu screen.

a. MENU DISPLAY

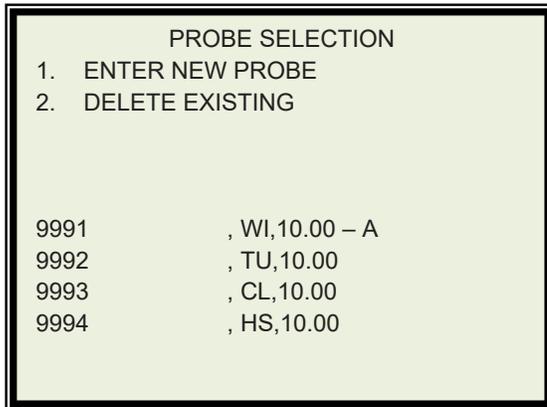
Review this section which describes the functions that display on the Main Menu.



Select the functions by using the UP/DOWN arrow keys to navigate and pressing 'MNU/ENT' key to select an option. Pressing '<->' will return the selection to the previous screen.

1. PROBE SELECTION

Select the 'PROBE SELECTION' option from the main menu to access the probe selection menu. You can enter a new probe, delete a probe, or select an existing probe from this section.



a. ENTER NEW PROBE

To enter the ID of a new probe, navigate to the 'ENTER NEW PROBE' option by using the UP/DOWN arrow keys, and press MNU/ENT key to select the option; the next screen allows you to enter the probe ID number and the probe type.

1. Enter the Probe ID using the Up/Down arrow Keys. (Use the Up/Down arrows to scroll between alphanumeric characters. Use the Right/Left arrows to advance to the next character or go back to the previous character.) When a 7-digit Probe ID is entered the cursor automatically advances to the Probe Type field.
2. Use the Up/Down arrows to select the Probe Type. Use the Right arrow to advance to the Probe Life field.
3. Enter the Probe Life using the up/Down arrow keys.
4. Press ENTER.

```
PROBE ID      : 9991_  
PROBE TYPE    : WIRE  
PROBE LIFE    : 10.0_
```

b. SELECT EXISTING PROBE

The Probe Selection menu displays the four probe IDs currently in memory. Select the probe you wish to take a measurement with by using the UP/DOWN arrow keys and press 'MNU/ENT' key. Current selected probes /active probes will be displayed with an 'A' symbol at the end of the probe ID line.

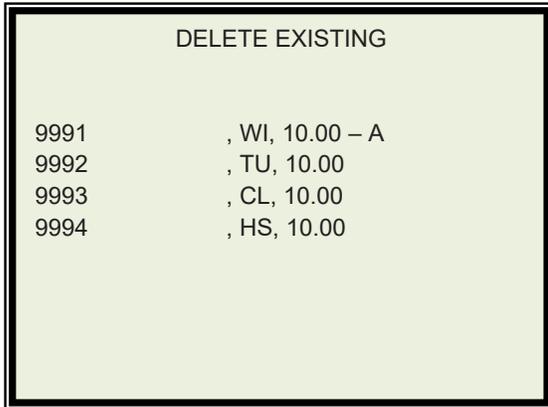
```
                PROBE SELECTION  
3.  ENTER NEW PROBE  
4.  DELETE EXISTING  
  
9991      , WI,10.00 – A  
9992      , TU,10.00  
9993      , CL,10.00  
9994      , HS,10.00
```

c. DELETE EXISTING PROBE

It is occasionally necessary to remove the ID of a probe from memory, for example:

- When the memory bank is full
- When a probe is no longer used

To delete the ID of a probe in memory, select Probe Selection Menu from the Main Menu. Select DELETE EXISTING.



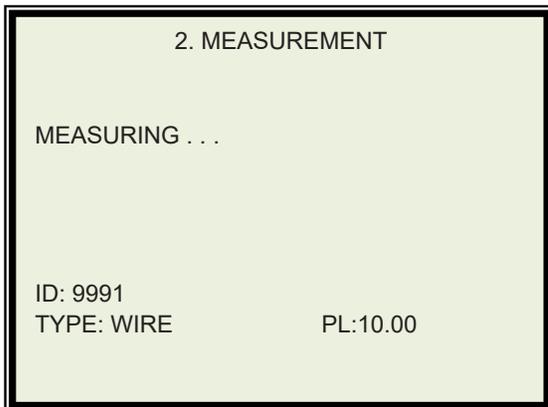
1. Press the Down arrow to select the probe ID which needs to be deleted.
2. Press 'ENT/MNU' key. The selected probe ID will be deleted from memory and the Probe Selection menu.

2. MEASURE PROBE

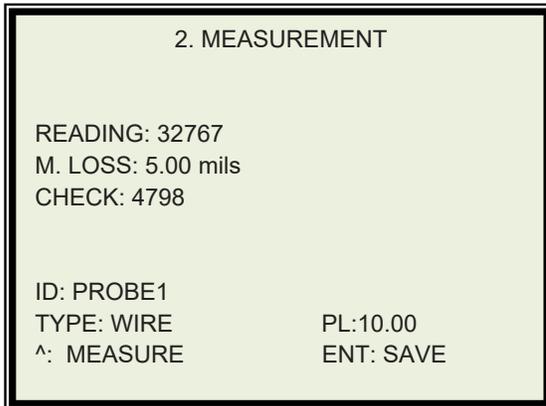
Select a probe before you run the function

To run 'MAKE MEASUREMENT' you must select a probe from memory first. See 'SELECT PROBE' from the Main menu.

To make a measurement manually, select 'MEASURE PROBE' in the Main Menu. Ensure that the probe connected to the data logger is selected as the active probe before using this function. The display changes as below and the data logger measures the probe. The probe ID, probe type, and probe life of the current measuring probe is displayed at the bottom of the screen.



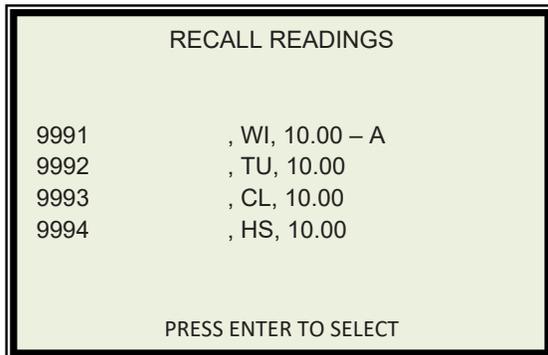
The measured values will be displayed as shown below.



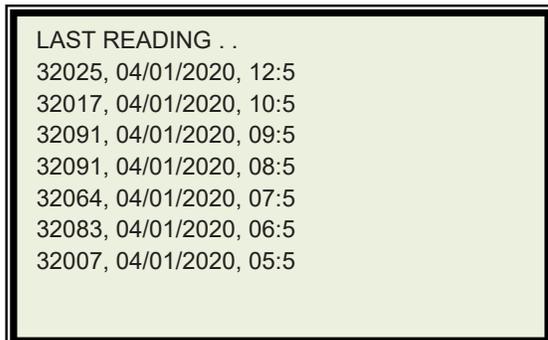
The measured value can be saved by pressing the 'MNU/ENT' key.
Take another measurement by pressing the 'up' arrow key.

3. RECALL READINGS

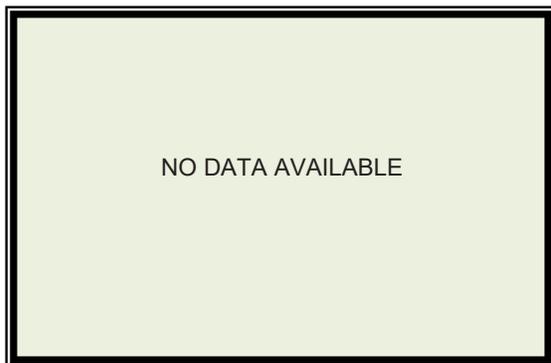
Selecting 'RECALL READINGS' in the main menu will allow you to display the last 7 readings of the probe selected. Use the up/down arrow keys to navigate to the desired probe ID and press the 'MNU/ENT' to select it.



The readings will be displayed as shown below. To exit the menu, press the left arrow key.

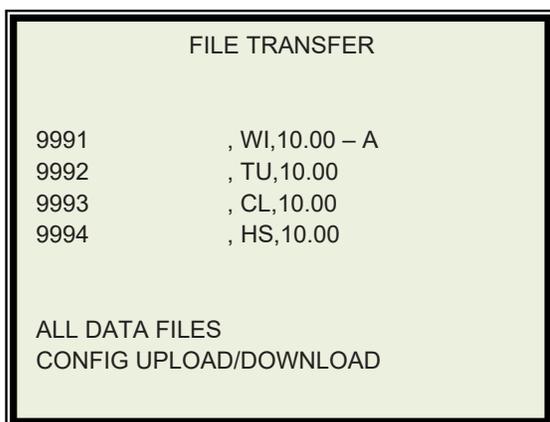


If there are no readings saved for the selected probe this screen will appear. Press the left arrow key to exit.



4. FILE TRANSFER

Selecting 'FILE TRANSFER' from main menu screen will display the file transfer screen as below.



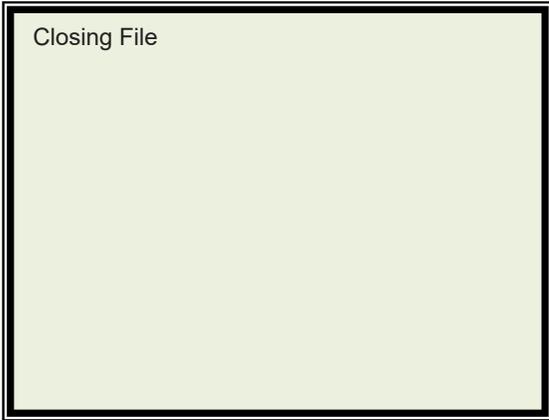
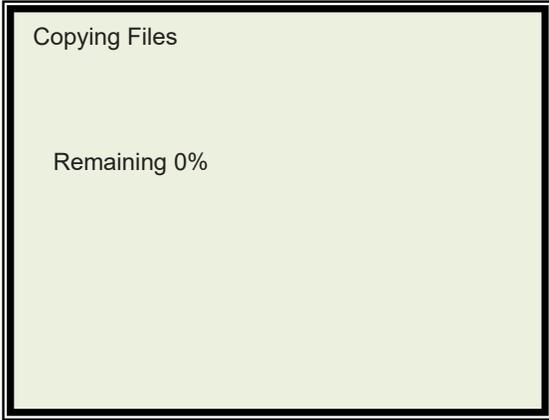
a. MEASUREMENT DATA FILE TRANSFER

To transfer probe readings, insert the USB storage device into the USB port of the data logger. Use the UP/DOWN arrow keys to navigate to the probe ID you wish to transfer or 'ALL FILES' and press 'MNU/ENT' to select it. The data will be transferred to the USB storage device. The following screens show the process of a successful file transfer. For information on potential errors see the Error Messages section on page 25.

ACCESSING USB
Step - 1

FLASH DRIVE FOUND
Step - 2

Checking DIR . . .



b. UPLOAD/DOWNLOAD CONFIG

This function uploads a copy of the unit's current settings to a flash drive in a .txt file. This file may be edited on a computer and then downloaded back onto the unit. Any settings altered in the file will be altered on the unit.

Note: Config Download will delete the data stored on the device. Before using the Config Download feature, upload any data stored on the instrument.

Enter the File Transfer menu and insert the data logger's flash drive into the data logger's USB port. Use the Up/Down arrow keys to highlight the CONFIG UPLOAD option and select it with the 'MNU/ENT' key. The file transfer for Config Upload will have the same sequence as the one for measurement data with an extra step to enter a password for confirmation before the file transfer begins. Use the Up/Down and Left/Right arrows to enter '3333' and press 'MNU/ENT' to confirm.



After completing the file transfer, save the configuration file, named 'CONFIG' to a computer and open it. The information stored in the file will have this format.

```
Pass Word,3333
Interval,2,0001
Display Power Down,02
Active PID,1
Pid1,9991 ,1,1000
Pid2,9992 ,2,1000
Pid3,9993 ,3,1000
Pid4,9994 ,8,1000
Unit_ID,0000000001
```

After saving changes to the configuration file, save the file to a flash drive. Ensure that there are no other files on the flash drive and that the configuration file is not stored in any folders. Power on the data logger, enter the File Transfer menu and insert the data logger's flash drive into the data

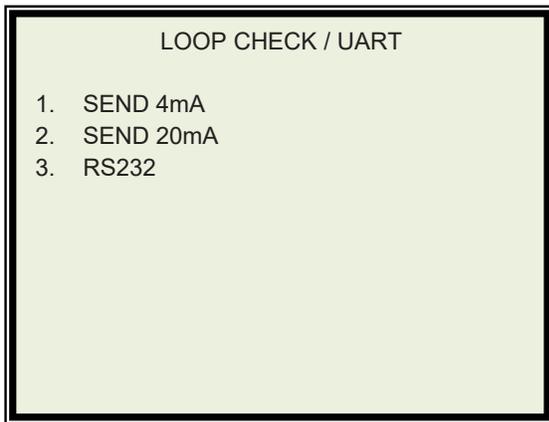
logger's USB port. Use the Up/Down arrow keys to highlight the CONFIG DOWNLOAD option and select it with the 'MNU/ENT' key. The file transfer for Config Download will have the same sequence as the one for measurement data with an extra step to enter a password for confirmation before the file transfer begins. Use the Up/Down and Left/Right arrows to enter '3333' and press 'MNU/ENT' to confirm. After completing the file transfer, the data logger's settings will match those of the configuration file and all data stored on the data logger will be erased.

5. COMM./LOOP

4-20mA Current Loop Output (Model MS3510E)

Prior to using the 'Comm/Loop' function, connect the external current loop cable according to the instructions on Page 5.

Select 'Comm./Loop' from the Main Menu to enter the Loop Check menu.



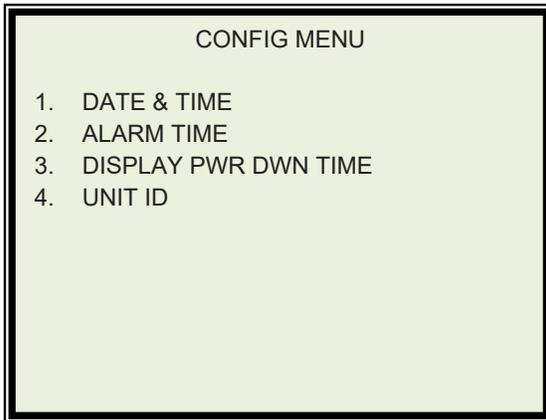
To ensure the current loop measurement is okay:

1. Use the Up/Down arrow keys to highlight the "Send 4mA" option and press the 'MNU/ENT' key. Ensure the loop current measurement is approximately 4mA.
2. Use the Up/Down arrow keys to highlight the "Send 20mA" option and press the 'MNU/ENT' key. Ensure the loop current measurement is approximately 20mA.
3. Ensure the loop current measurement is the correct value when measuring the meter prover:
 - a. Connect the meter prover to the probe connector or probe cable.
 - b. Measure the connected meter prover using the steps described on pages 13-14, after the reading, the current should be:

$$\left(\frac{\text{Reading Value (Written on the Meter Prover)}}{4095.9375} \right) + 4.0$$

6. CONFIG SETUP

Select 'CONFIG SETUP' from Main Menu to set Date & Time, Alarm Time, and other settings. The screen below shows the available settings.

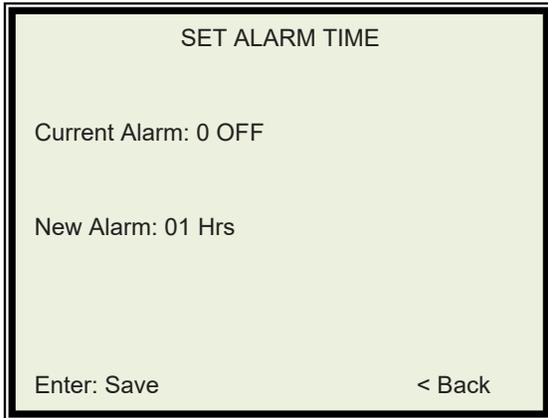


a. DATE & TIME

Selecting 'DATE & TIME' in the config menu will display the date and time setup screen. Enter the current date and time using Up/Down arrows and Left/Right arrows.

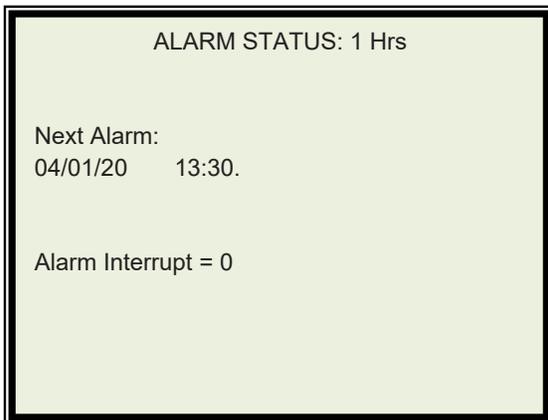


b. ALARM TIME



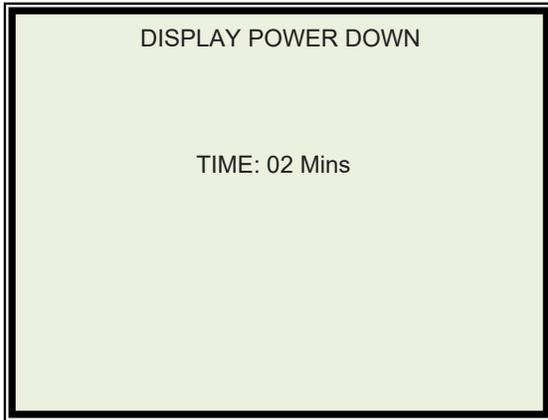
Selecting ALARM TIME will display the set alarm time screen. The current alarm is displayed at the top. Enter the desired alarm interval with the UP/DOWN and LEFT/RIGHT keys. The maximum interval is 99 days and the default minimum interval is 1 hour. The minimum interval can be changed to one minute by enabling “Alarm Mins.” in the Unit ID menu (page 23), then setting the alarm interval to “01 Min”. The unit takes one reading per the interval.

While on the main menu, press the right arrow key to access the Alarm Status screen that shows alarm interval, the time of the next alarm measurement and the number of times the current alarm interval has been interrupted.



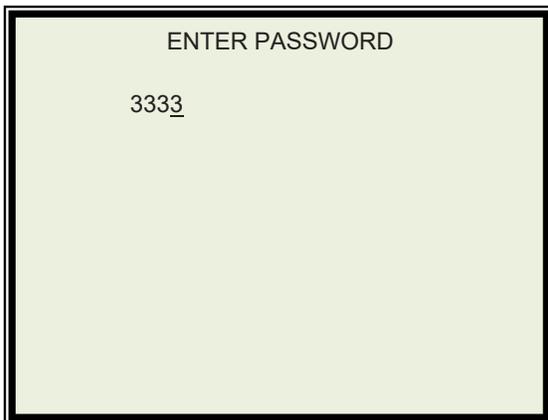
c. DISPLAY POWER DOWN TIME

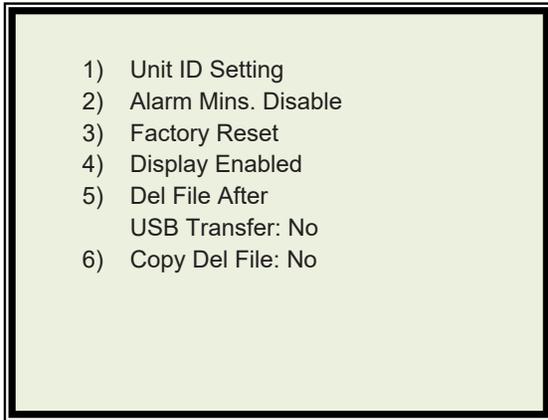
Select the DISPLAY PWR DWN TIME option to display the screen below. Use the UP/DOWN and LEFT/RIGHT arrow keys to set the amount of time the display will remain on without any input.



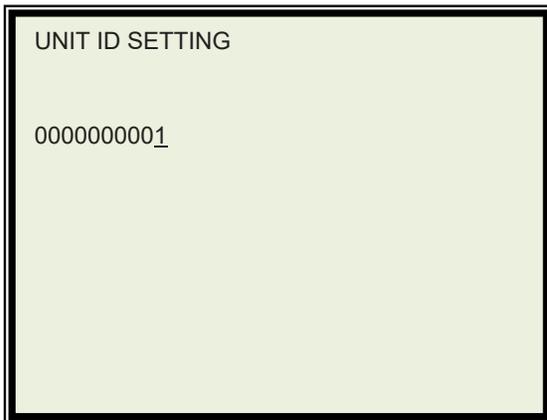
d. UNIT ID

Select the Unit ID option to display the screen below. To access a menu with additional options, use the UP/DOWN and LEFT/RIGHT arrow keys to enter the code '3333' and press the 'MNU/ENT' key.





Use the Up/Down arrow keys to navigate the menu
Select 'Unit ID Setting' to change the data logger's unit ID. Use the UP/DOWN and LEFT/RIGHT to enter the new unit ID and press 'MNU/ENT' to save the new unit ID. The Unit ID Setting screen is shown below.



Use the Left/Right arrow keys to toggle the Alarm Mins. Disable option between Enable/Disable. This will allow the alarm intervals of less than an hour to be used.

Select the Factory Reset option to erase all probe IDs and readings.

Use the Left/Right arrow keys to toggle the Display Enabled option between Enabled/Disabled. This will cause the display to turn off while still allowing the data logger to make alarm measurements and transfer files.

Use the Left/Right arrow keys to toggle the Del File After USB Transfer option between Yes/No. This will cause transferred measurement data to be deleted from the data logger after file transfer.

Use the Left/Right arrow keys to toggle the Copy Del File option between Yes/No. This will copy deleted probe IDs onto the USB device during USB transfer.

7. DISPLAY DISABLED

The display can be disabled in the settings menu described in Section 5d. This function is for use in temperatures under -20°C. It allows the unit to take alarm measurements and transfer data and configuration files with the display off.

After selecting the option to disable the display, the display will automatically turn off while the green LED remains on. Before using any of the unit's functions, power the unit off and on again.

To transfer files the unit must be in file transfer mode. To turn on file transfer mode, hold 'MNU/ENT' for 3 seconds. When the unit is in file transfer mode the red LED will flash 2 times a second. To exit file transfer mode, hold 'MNU/ENT' for 3 seconds again. The red LED will stop flashing.

When the unit is not in file transfer mode, hold the LEFT arrow key for 5 seconds. The green LED will turn off when the unit is powered off.

To temporarily turn the display on hold the UP key for 3 seconds while the unit is not in file transfer mode. To enable the display, enter the settings menu and change the Display Disabled setting to Enabled.

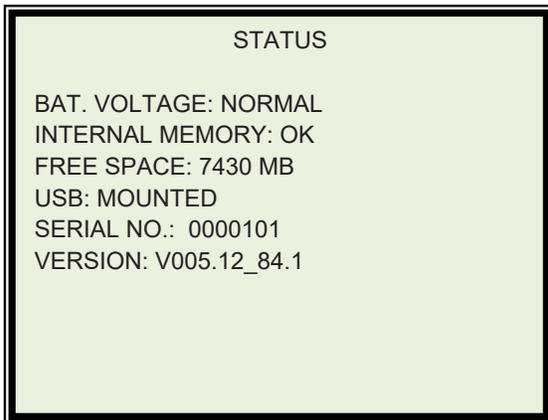
To download the data of the active probe ID, enter file transfer mode, insert a flash drive, then hold the DOWN key for 3 seconds. The green LED will flash once per second during the file transfer. When the green LED stops flashing, the flash drive may be removed.

To download the data of all probe IDs, enter file transfer mode, insert a flash drive, then hold the UP and DOWN keys for 3 seconds. The green LED will flash once per second during the file transfer. When the green LED stops flashing, the flash drive may be removed.

To download the configuration file of the unit onto a flash drive, enter file transfer mode, insert a flash drive, then hold the RIGHT key for 3 seconds. The green LED will flash once per second during the file transfer. When the green LED stops flashing, the flash drive may be removed.

To download a configuration file stored on a flash drive onto the unit, enter file transfer mode, insert the flash drive, then hold the LEFT key for 3 seconds. The green LED will flash once per second during the file transfer. When the green LED stops flashing, the flash drive may be removed.

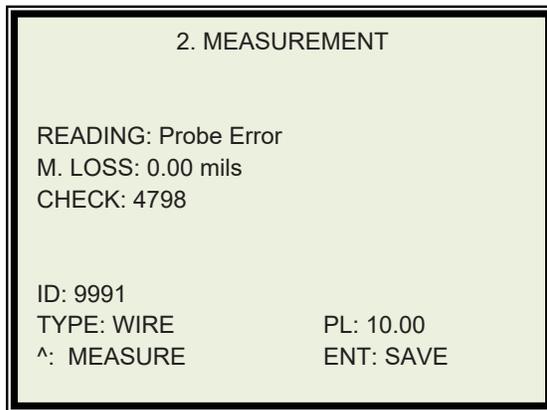
8. STATUS



Current battery status is displayed on the first line.
Internal memory status is displayed on the second line.
Free memory space is displayed on the third line in MB.
USB status is displayed on the fourth line.
Serial number is displayed on the fifth line.
Firmware revision is displayed on the last line.

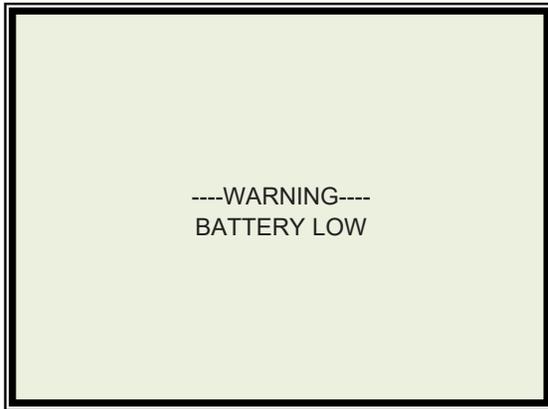
9. ERROR MESSAGES

This error message may appear after taking a measurement.



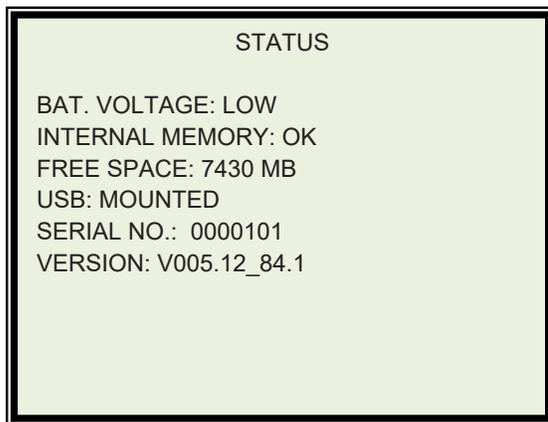
If this message appears, first ensure that the correct probe type was selected in the probe selection menu. If it is not, select the correct probe type before taking another measurement. If the error repeats even if the correct probe is selected, connect the probe to the transmitter directly to the data logger, ensure that the connection between the probe and the data logger is secure and take another measurement. If the error repeats take a measurement with the meter prover that was shipped with the data logger or a different probe. If the error repeats, there may be an issue with the data logger, and you will need to contact Metal Samples' customer support.

This error message may appear when attempting to take a measurement.

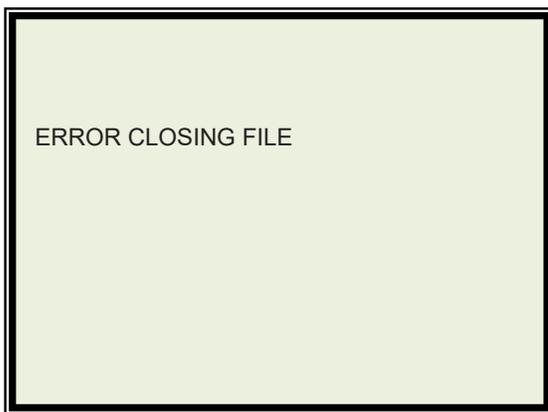
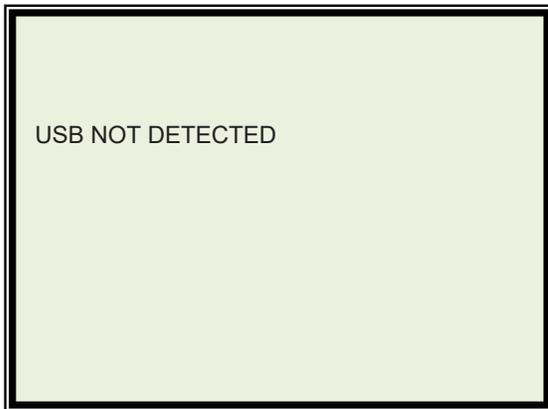
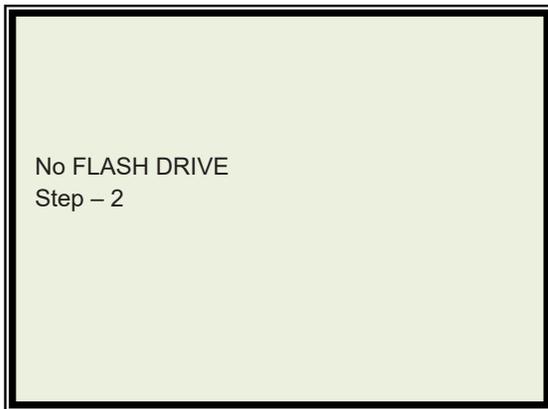


You will need to replace the batteries before attempting another measurement. Instructions for replacing the battery are on page 7 of this instruction manual.

If the battery must be replaced, the battery status is listed as “LOW” in the status menu.



These error messages may appear while attempting a USB transfer.



If these errors occur ensure that you are using the approved Metal Samples flash drive. Remove the flash drive from the USB port of the data logger and inspect both the flash drive and the USB port for damage. If both appear undamaged reinsert the flash drive and attempt another USB transfer. If the USB Transfer still fails, you will need to contact Metal Samples' customer support.

This error message may appear while attempting current loop communication:



If this error occurs, ensure that all of the current loop cable is connected. Ensure that you are using the Metal Samples current loop cable that was shipped with the data logger.

D. Maintenance

Once installed, the MS3500E/MS3510E High Resolution ER Data Logger requires no maintenance. However, it is important to verify the following items periodically to ensure continued safe operation.

CAUTION: Before performing any tests or maintenance on the MS3500E/MS3510E High Resolution ER Data Logger, ensure that all hazardous area requirements are met.

Inspection Item	Frequency
Inspect the enclosure for any signs of damage. Return if necessary.	Annually
Inspect the probe cable / connector for any signs of damage. Replace as necessary.	Annually
Replace the Battery pack	As needed

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

1. Testing the MS3500E/MS3510E High Resolution ER Data Logger with the Meter Prover

A Meter Prover is provided to allow routine checks of the MS3500E/MS3510E High Resolution ER Data Logger. The Meter Prover simulates a Wire Loop type probe at a fixed value. To test the unit with the Meter Prover:

- 1) Connect the Meter Prover to the probe connector.
- 2) Turn on the MS3500 data logger by pressing the 'ON' button
- 3) Select probe type as Wire Loop.
- 4) Select MAKE MEASUREMENT in the main menu.
- 5) Press 'ENT' button to start measuring the probe value. During measurement, the 'MEASURING' message displays on the screen. On completion of the measurement, the display shows the Meter Prover reading. The output should closely match the value printed on the Meter Prover label.

If the Data Logger output matches the Meter Prover value, the instrument can be used for probe measurement by selecting the appropriate probe ID and connecting to the respective probe. If the Data Logger output shows a significant difference compared to the Meter Prover value, further troubleshooting may be required. Refer to page 30 for troubleshooting or contact Metal Samples for further assistance.

E. Troubleshooting

If the MS3500E/MS3510E High Resolution ER Data Logger does not seem to perform as expected, check the following items:

CAUTION: *Before performing any tests or maintenance on the MS3500E/MS3510E High Resolution ER Data Logger, ensure that all hazardous area requirements are met.*

1. Ensure that the probe is operational and is not completely corroded. This can be done in two ways.
 - a. Test the probe with another 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 probe's 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 the battery voltage.
3. Test the MS3500E/MS3510E High Resolution ER Data Logger using the supplied Meter Prover.

These basic checks should indicate the source of any problem (probe, power supply, wiring, etc.). If it is determined that the MS3500E/MS3510E High Resolution ER Data Logger is malfunctioning, or if you need further assistance in troubleshooting, contact Metal Samples Technical Support.

CAUTION: *If the MS3500E/MS3510E High Resolution ER Data Logger transmitter shows any signs of damage, remove it from service immediately and consult the factory.*

III. Service and Warranty Information

A. Warranty

Metal Samples warrants that any part of the model **MS3500E/MS3510E High Resolution ER Data Logger** 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 salesperson 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

Model Number		Serial Number	
RMA Number		Date of Purchase*	

**If known.*

Contact Information for Repair

Contact Name		Company	
Phone Number		E-mail Address	

Return Shipping Information

Recipient Name*		Company*	
Return Address			

**If different than above.*

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

Invoice Instructions (For non-warranty repairs)

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

Appendix B: CERTIFICATION DETAILS

	MS35XX & MS36XX HAZARDOUS AREA CERTIFICATION - INTRINSIC SAFETY DETAILS	Doc.Number	EXDOC-000012
		Revision	0
		Date	6/28/2017
		Page	1 of 2
Worldwide and Europe	Ex ia [ia] IIC T4 Ga -40°C ≤ Ta ≤ +70°C (When used with Tadiran TL-5930 Cells) -40°C ≤ Ta ≤ +50°C When used with Xeno Energy XL-205F Cells ATEX Cert. No: ITS17ATEX201833X IECEX Cert. No: IECEX ETL 17.0020X X – See special Conditions below		
Special Conditions			
	<ol style="list-style-type: none">1. Potential Electro charging Hazard.2. Only Battery packs allowed to replace in Hazardous areas.		
	<u>Hazardous Area Installation</u>		
	CAUTION: This section provides general guidelines for hazardous area wiring. However, regardless of anything stated here, the MS36XXE transmitter must be installed in full compliance with the control drawing provided Annexure-C and all of the local area requirements.		
	<u>Entity Parameters</u>		
	<u>at Probe (common for all models)</u>		
	Uo: 4.94V		
	Io: 0.85A		
	Po: 1.05W		
	Ci: 44.55µF		
	Li: 0µH		
	Co: 1.9µF		
	Lo: 10µH		



MS35XX & MS36XX HAZARDOUS AREA
CERTIFICATION - INTRINSIC SAFETY DETAILS

Doc.Number	EXDOC-000012
Revision	0
Date	6/28/2017
Page	2 of 2

at J2 Connector (Serial output to Certified handheld equipment)

This is applicable to Model number MS3630E and MS3640E

Uo:	4.94V
Io:	20mA
Po:	24.7mW
Ci:	0 μ F
Li:	0 μ H
Co:	100 μ F
Lo:	880.0 μ H

at J3 Connector (4-20 current loop input thru' barrier)

This is applicable to Model number MS3610E and MS3640E

Ui	28V
Ii	93mA
Pi	0.75W
Ci (@28V)	0.054 μ F
Ci: (@4.94V)	5.59 μ F
Li:	0H

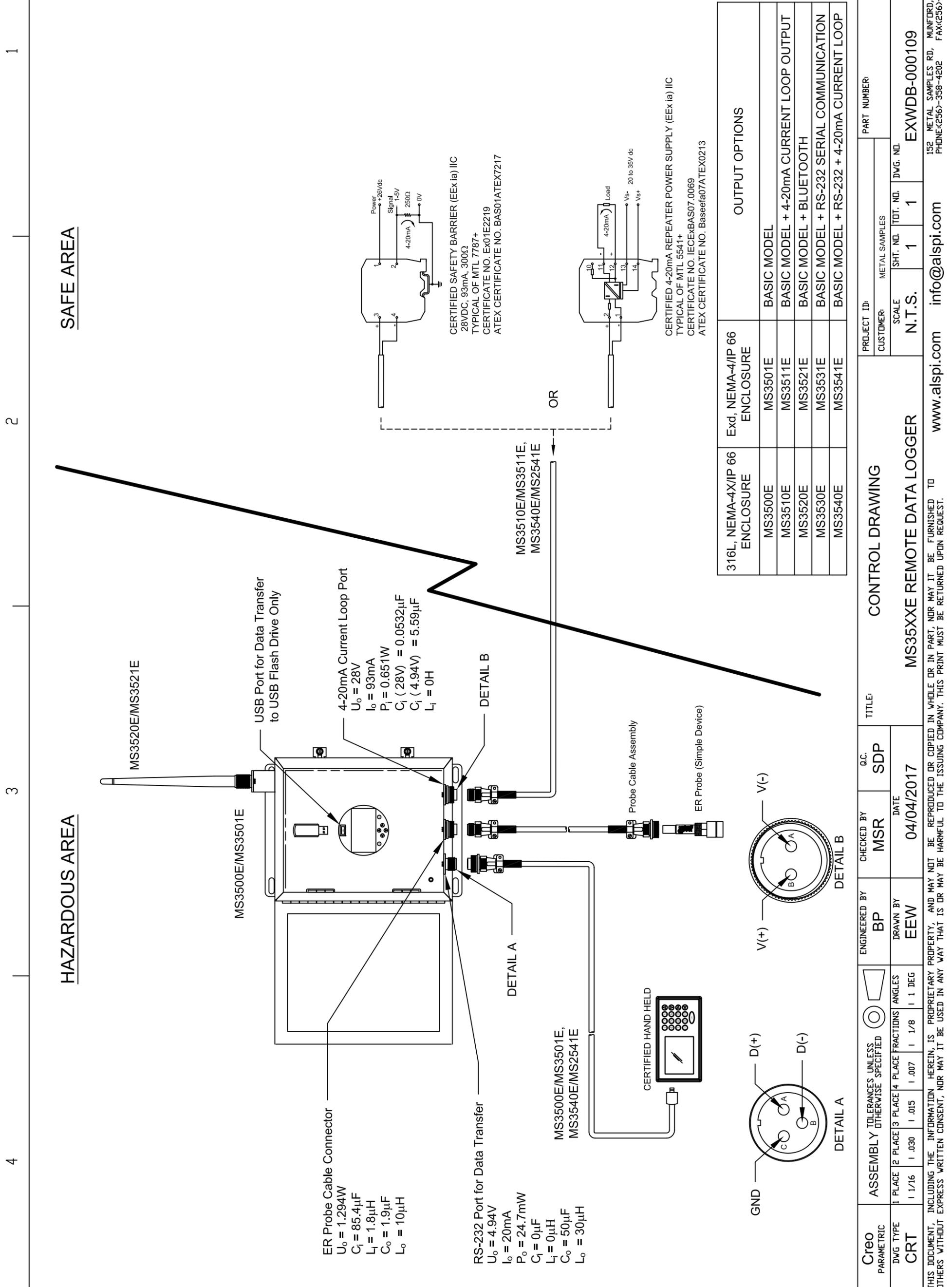
CAUTION:

1. When replacing the battery packs in Hazardous area, discharge the static charge from the body using ground strips or other methods.
2. Use gas analyzers or other type of equipment to ensure the area is non-hazardous before changing the batteries. Cells in the batteries not allowed to replace in hazardous areas.
3. Use only with battery pack part # ET1664 or ET1857.
4. Equipment is intended for use only with Xeno Energy model XL-205F and Tadiran model TL-5930 cells. Use of any other battery in this device may impair intrinsic safety.
5. Do not replace cells in the pack unless area is known to be Non-Hazardous.

Appendix C: Drawings

Control Drawing (Hazardous Area Wiring Diagram)

REV	DATE	DESCRIPTION	BY	CHKD



316L, NEMA-4X/IP 66 ENCLOSURE	Exd, NEMA-4/IP 66 ENCLOSURE	OUTPUT OPTIONS
MS3500E	MS3501E	BASIC MODEL
MS3510E	MS3511E	BASIC MODEL + 4-20mA CURRENT LOOP OUTPUT
MS3520E	MS3521E	BASIC MODEL + BLUETOOTH
MS3530E	MS3531E	BASIC MODEL + RS-232 SERIAL COMMUNICATION
MS3540E	MS3541E	BASIC MODEL + RS-232 + 4-20mA CURRENT LOOP

Creo PARAMETRIC	DWG TYPE	1 PLACE 2	1.1/16	1.030	1.015	1.007	1.1/8	1.1 DEG	ASSEMBLY TOLERANCES UNLESS OTHERWISE SPECIFIED	ENGINEERED BY	BP	CHECKED BY	MSR	DATE	04/04/2017	Q.C.	SDP	TITLE:	CONTROL DRAWING		PROJECT ID:	METAL SAMPLES		PART NUMBER:	EXWDB-000109		REV.	Ø
	CRT	1 PLACE 3	1.1/16	1.030	1.015	1.007	1.1/8	1.1 DEG	OTHERWISE SPECIFIED	DRAWN BY	EEW	DATE	04/04/2017	SCALE	N.T.S.	SHT. NO.	1	TOT. NO.	1	DWG. NO.	EXWDB-000109	SCALE	N.T.S.	SHT. NO.	1	TOT. NO.	1	DWG. NO.

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