Abriox

Remote monitoring & control for pipelines

MERLIN

CP Monitor & Bond Monitor Installation Instructions

V28

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2. SAFETY INFORMATION

Please ensure you are familiar with the Electrical Safety Regulations of your Company and observe them at all times.

2.1 General Safety Summary

This manual contains information and warnings that must be observed to keep the MERLIN CP Monitor and MERLIN BOND Monitor (hereafter referred to as MERLIN) in a safe condition and ensure safe operation. To use the MERLIN correctly and safely, read and follow all precautions given. Please ensure you fully understand all instructions throughout this manual that relate to specific measurement functions. In addition, please follow all generally accepted safety practices and procedures required when working with and around electricity.

2.2 Safety and Electrical Symbols

The table below lists safety and electrical symbols that appear on the MERLIN and within this document.

Symbol	Description
CAT IV	Installation Category (Overvoltage Category) IV
	Risk of danger. Important information. See Installation Instructions
	Hazardous voltage. Voltage > 30V AC (42.4V peak) or 60V DC might be present

2.3 Maximum Input Voltage for Channels 1 and 2

Channels 1 and 2 of the MERLIN have a maximum input voltage range of ±70V AC (RMS).

2.4 Maximum Input Voltage for Channel 3

Channel 3 of the MERLIN provides readings up to 100mV AC and ±100mV DC. The channel itself should not be exposed to voltages greater than ±4V peak. Voltages greater than this will cause the channel input protection to activate which can only protect the MERLIN for a limited period of time.

2.5 Danger of Electric Shock

When using the MERLIN to monitor voltages over 30V AC or 60V DC care should be taken as there is a danger of electric shock.

2.6 Channel Input Protection

All of the input channels have CAT IV surge protection for their rated input voltage ranges.

2.7 Battery Replacement

The battery pack is specific to the product and can be replaced. Please contact Abriox to order replacements.

2.8 Disclaimer

If this equipment is used in a manner not specified by Abriox, the protection provided by the equipment may be impaired. Please ensure you follow all guidance for safe and correct use of your equipment.

3. COMPLIANCE

This product is CE marked which means that Abriox declares that the product or equipment complies with all applicable European Directives. A copy of the Certificate of Conformity can be obtained from Abriox.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

Do not make any changes or modifications to the equipment unless otherwise specified in the manual. If such changes or modifications should be made, you could be required to stop operation of the equipment.



This symbol indicates that this product is not to be disposed of with your household waste, according to the WEEE Directive (2002/96/EC) and your national law. This product should be handed over to a designated collection point, e.g., on an authorised one-for-one basis when you buy a new similar product or to an authorised collection site for recycling waste electrical and electronic equipment (EEE). Improper handling of this type of waste could have a possible negative impact on the environment and human health due to potentially hazardous substances that are generally associated with EEE. At the same time, your cooperation in the correct disposal of this product will contribute to the effective usage of natural resources. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, waste authority, approved WEEE scheme or your household waste disposal service.

4. SOFTWARE COMPATIBILITY

Native coupon measurements require iCPSM V3.18 or CPSM V3.26 or newer. Earlier versions of the software are not compatible and do not support the features offered by these models.

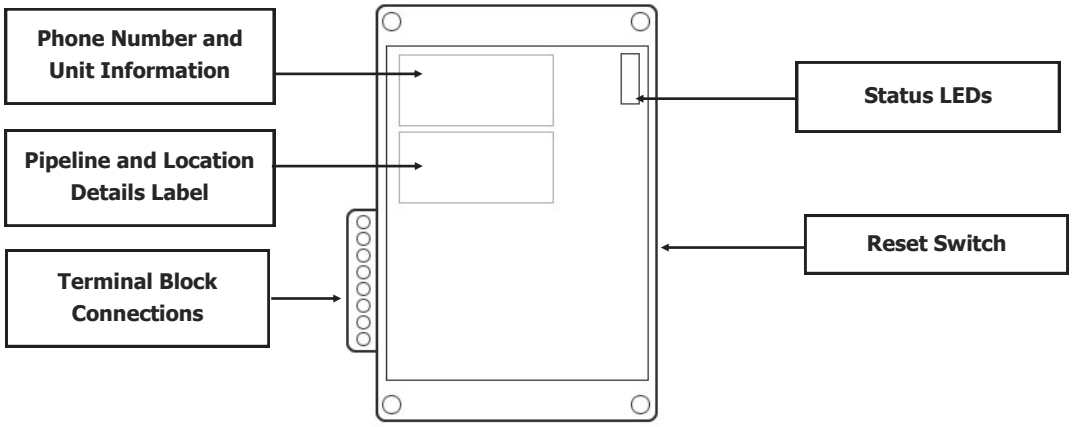
5. INTRODUCTION

The MERLIN is a small, compact Remote Monitoring Unit (RMU) housed within the test post that collects Cathodic Protection (CP) data.

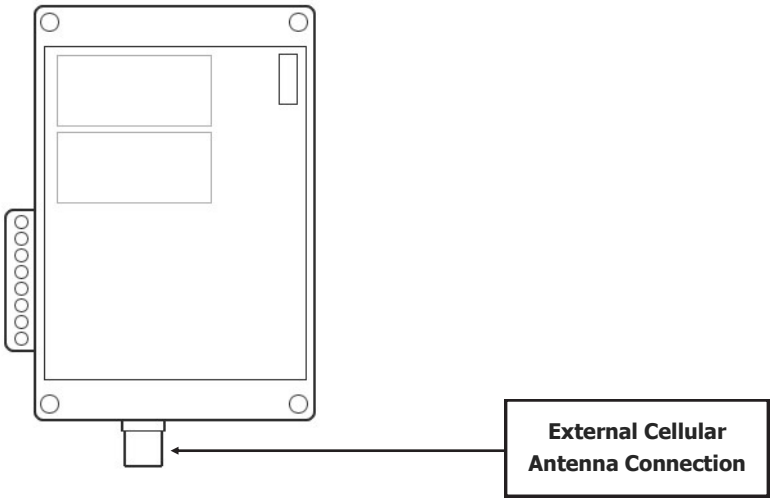
MERLIN checks the measurements against specified alert criteria and reports immediately if an alarm threshold is exceeded. MERLIN can be deployed anywhere on the pipeline network where it is important to record ON/OFF pipe-to-soil potentials, native coupon potentials, bond monitoring or interfering currents. Alternatively it may simply be that certain measurement points on the pipeline create risks to CP technicians, such as at busy road or rail crossings, or are difficult to access, such as on private land.

All data is automatically transmitted in a management report to the system HQ (using the cellular/mobile network) where it is accessed online using Abriox's iCPSM software, or at a PC using CPSM software.

5.1 Front View of the MERLIN (no external antenna)



5.2 Front View of the MERLIN (with external antenna)



Note

Only certain models will offer external antenna connections. Contact Abriox for further information on the available options.

6. BEFORE GOING TO SITE

6.1 Check the HQ(s)

If you are using the web-based iCPSM system, make sure you have noted the phone number of your iCSPM HQ as detailed on your iCPSM Licence Certificate.

If you are using the PC-based CPSM system, make sure you have noted the phone number of your HQ(s) and confirm the software is installed and running*.

Note

*It is vital the CPSM system is installed and running prior to going to site otherwise the installation will fail.

6.2 Check the Test Post/Bond Box is Suitably Prepared

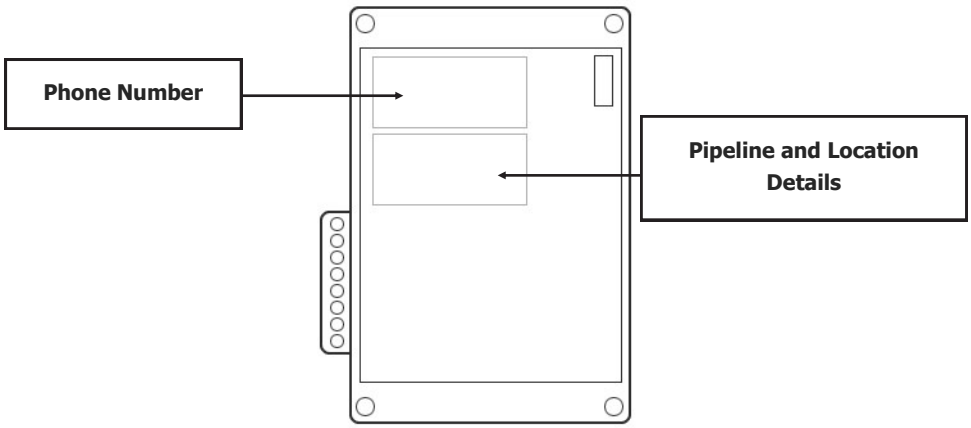
Check the test post/bond box to be monitored has a permanent reference cell and a coupon (if required).

6.3 Check and Designate the MERLIN

Check that MERLIN has a SIM card installed and the phone number is written or printed on the label on the front of the MERLIN. In most cases this will have been completed during production, unless you have opted to source and install your own SIM cards.

Write the Pipeline name (up to 30 characters) and the Location name (up to 50 characters) on the MERLIN front label with a marker pen or using a label maker. You can have multiple MERLINs with the same Pipeline name but each MERLIN must have its own unique Location name. See Appendix A for further information on naming conventions.

Remember – you will have to text these details to the MERLIN so, to avoid mistakes, do not make them longer than necessary.



Note

Do not exceed the character limitation for Pipeline (up to 30 characters) and Location (up to 50 characters) as the system will shorten the names and they will not install as you had intended.

6.4 Equipment Check

Make sure you have the following equipment prior to going to site.

Item	Description
Current Shunt	An appropriate current shunt for the coupon current (if this is to be monitored), 20A 200mV is recommended for 1cm coupons or 200mA 200mV is recommended for 25cm coupons. However, the choice of shunt will be dependent on the current to be measured and taking some alternative value shunts is always recommended. MERLIN has an input range of 0 to 100mV AC and ±100mV DC on its current shunt input.
Magnet	A strong magnet to activate the MERLIN on site
Tool Kit	Tool kit for the installation on site
Documents	Installation instructions (this document), Quick Start Guide
Multimeter	Multimeter to check the voltage and current readings on site
Cell/Mobile Phone	Used for setting up the MERLIN. See the next section for messages you can store in your phone before going to site to make installation easier

6.5 Setting Up Your Cell/Mobile Phone

If you store the text messages required for installation prior to going on site, it will be easier and save time in the field. Write the messages on your cell/mobile phone and save them as a Draft, Template or Outgoing Message.

You must use the international format for all cellular/mobile communications i.e. +44 for UK, then the phone number without the leading zero.

Commands to save:

- **CMD:READ**
  Instructs the MERLIN to take an immediate reading.

- **CMD:CONFIG HQ1:**+441234567891 **HQ2:**+441234567892
  Configures the HQ number(s) which the MERLIN will report to (where the numbers in light grey are the respective telephone numbers of your iCPSM/CPSM HQs). If you only have a single HQ you can set HQ2 to OFF (**HQ2:OFF**).

- **CMD:INSTALL PIPE:PIPELINE NAME LOC:TR NAME**
  Installs the MERLIN in the iCPSM/CPSM software database with the given Pipeline and Location names.

You can use the **CMD:READ** and **CMD:CONFIG** commands for all the MERLIN monitors you are going to install. You will need a separate **CMD:INSTALL** for each MERLIN to give it its own unique Location name. See Appendix A for further information on naming conventions.

Note

You will need to set the phone's SMS message validity to 1 hour to prevent an SMS message getting stuck. For example, if an install message gets stuck in the network and arrives 3 days late, the MERLIN clock will be set 3 days slow. Setting the message validity to 1 hour stops this happening.

7. ON SITE

Please ensure you are familiar with the Electrical Safety Regulations of your company and observe them at all times.

7.1 The Install Process

A. Unscrew and remove the face plate from the post
B. House the MERLIN (see section 7.2)
C. Connect the MERLIN (see section 7.3)
D. Fit any accessories (see section 7.4)
E. Activate the MERLIN (see section 7.5)
F. Take a reading (see section 7.6)
G. Compare the readings with a multimeter (see section 7.7)
H. Configure the HQ(s) (see section 7.8)
I. Name the MERLIN (see section 7.9)
J. Finish on site (see section 7.10)
K. Post site configuration (see section 8)

7.2 House the MERLIN

The MERLIN is designed for installation inside a M28 concrete or plastic post and should ideally be located at the top of the post in order to get the very best cellular reception. Ensure there is enough room to fit the MERLIN. Dimensions for the MERLIN are detailed in section 10.

7.3 Connect the MERLIN

The MERLIN has 8 connections, these are labelled A to H and are briefly described on the front label of the MERLIN.

The connections correspond with the labelled terminal block and are explained in greater detail in the following sections. See section 9 for installation examples.

Wire up the terminal block as follows:

Terminal	Channel	Description
A	Relay Connection A	Internal Relay
B	Relay Connection B	
C	Channel 1 –ve	Potential Measurement
D	Channel 1 +ve	
E	Channel 2 –ve	Potential Measurement
F	Channel 2 +ve	
G	Channel 3 –ve	Millivolts (for current measurement across shunt)
H	Channel 3 +ve	

Where channels are not used, connect together. Connections are explained in greater detail in the following sections.

7.3.1 Internal Relay Connections

These are the connection to the internal relay contacts of the MERLIN. The relay contacts are rated at maximum 1A at 30V DC. The relay contacts are normally closed but open 100ms before an OFF Potential measurement is taken. After measurement is taken (another 100ms) the contacts are closed. These connections are intended to be used so that an instant OFF measurement can be taken at the coupon.

Note
If a coupon is not being used these connections can be left unconnected.

7.3.2 Channel 1 Potential Connections

Connect the –ve to the reference cell. Connect the +ve to the pipe.

On a 4 channel installation, channel 1 is intended to be connected to the coupon (and reference cell) via the MERLIN's internal relay. This allows an instant OFF measurement to be taken at the coupon.

Note
If channel 1 is not required, link both wires together.

7.3.3 Channel 2 Potential Connections

Connect the –ve to the reference cell. Connect the +ve to the pipe.

On a 2 or 3 channel installation, channel 2 is intended to be connected to the coupon (and reference cell) via the MERLIN's internal relay. This allows an instant OFF measurement to be taken at the coupon.

Alternatively channel 2 can be used to monitor:

- A foreign pipe
- The other side of an isolation joint
- A sleeve
- Another metal structure

Note
If channel 2 is not required, link both wires together.

7.3.4 Channel 3 Current Shunt Connections

The MERLIN current shunt input channel can read 0 to ±100mV. The shunt can be used to measure the bond current, anode current or coupon current.

Note
If channel 3 is not required, link both wires together.

7.4 Fit any Accessories

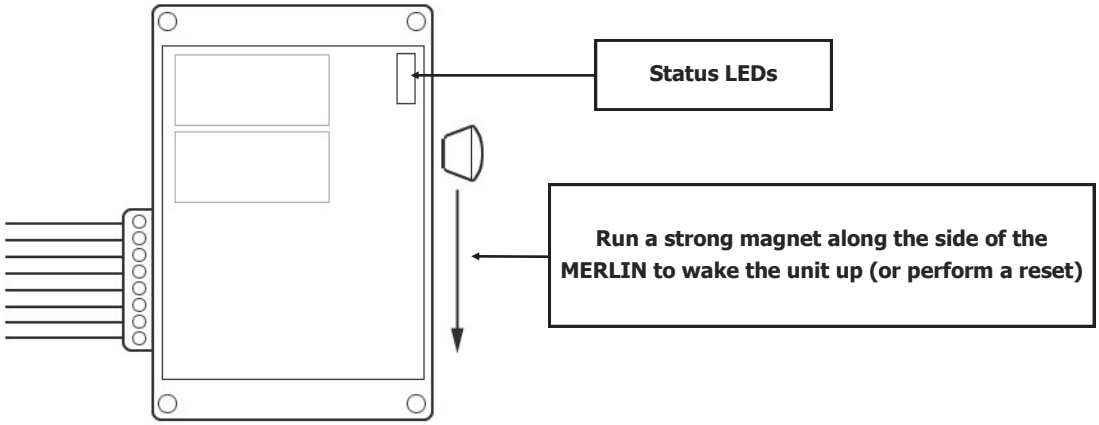
When fitting the external antenna, ensure it is mounted outside any metal enclosures and ideally as high up as possible in order to gain the best cellular signal.

Note

Only MERLINs with an external cellular antenna connector can use an external cellular antenna.

7.5 Activate the MERLIN

Activate the MERLIN by running a strong magnet along the reset switch located on the side of the unit (as indicated on the MERLIN front label). The green status LED will flash twice to show that the MERLIN is waking up.



After approximately 30 - 90 seconds, the green LED should start flashing once every 2 seconds, this confirms the MERLIN has logged onto the cellular network. You may now continue to take a read, configure the HQ(s) and finalise the installation by giving the MERLIN a Pipeline Name and Location (see the next sections for further details on each step).

MERLIN will continue to listen for text messages for 20 minutes after waking up or after a reset. During this time the green LED will flash once every 2 seconds. After the 20 minutes have expired, the MERLIN will enter a low power mode and the LED will stop flashing (or flash once every 10 seconds).

If you have not completed the installation within the 20 minute window, send a **CMD:EXTEND** command to the MERLIN before the 20 minutes is up to add another 10 minutes to the time the MERLIN is awake.

Note

If the green LED is double-flashing every 2 seconds, then the MERLIN is running but cannot log onto the cellular network. Please refer to the LED Descriptions in Appendix B for full details of the Status LEDs.

7.6 Take a Reading

Retrieve the pre-stored **CMD:READ** text from your cell/mobile phone and send (or forward) it to the phone number on the front of the MERLIN.

This will instruct the MERLIN to take a reading on all channels and send the results back to your phone (within approximately 60 - 90 seconds).

Slightly different responses are sent by the MERLIN depending on the model and installation.

Example:

Message Sent: **CMD:READ**

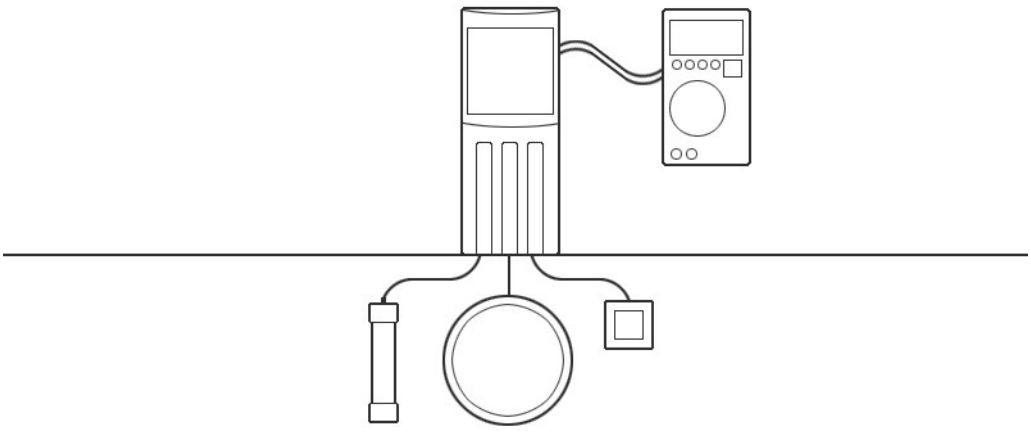
Reply: **CPM:020 UNIT:20000001 POST 1DC:-1000mV 1AC:300mV 2DC:-900mV 2AC:200mV 3DC:10.00mV 3AC:0.40mV**

The reply may consist of:

Message Text	Description
CPM:020	System response code
UNIT:20000001	The serial number of the MERLIN
POST	Type of MERLIN (POST or TR)
1DC:	Channel 1 DC reading
1AC:	Channel 1 AC reading
2DC:	Channel 2 DC reading
2AC:	Channel 2 AC reading
3DC:	Channel 3 DC reading
3AC:	Channel 3 AC reading

7.7 Compare the Readings with a Multimeter

Once all connections have been made, take a reading on the terminals using a multimeter. The values can be compared against the response to the **CMD:READ** command as described in section 7.6.



If any the readings are inconsistent with the multimeter, check the wiring and the condition of the reference cell.

7.8 Configure the HQ(s)

Retrieve the pre-stored **CMD:CONFIG** text from your cell/mobile phone and send (or forward) it to the phone number on the front of the MERLIN.

This command configures the HQ number(s) which the MERLIN will report to. Once the MERLIN has received the message it will reply back to your phone advising its current configuration (within approximately 60 - 90 seconds).

Wait for the reply and confirm that the HQ number(s) given in the response are correct.

If you have only a single HQ you can set HQ2 to OFF (**HQ2:OFF**). See examples below.

Example (Single HQ):

Message Sent: **CMD:CONFIG HQ1:+441234567891 HQ2:OFF**

Reply: **CPM:009 UNIT:20000001 MTIME:05:00 RDAY:TUE RTIME:12:30 RETRY:1 RETRY-HRS:6 ACK:MSG LED:ON HQ1:+441234567891 HQ2:OFF**

Example (2 HQs):

Message Sent: **CMD:CONFIG HQ1:+441234567891 HQ2:+441234567892**

Reply: **CPM:009 UNIT:20000001 MTIME:05:00 RDAY:TUE RTIME:12:30 RETRY:1 RETRY-HRS:6 ACK:MSG LED:ON HQ1:+441234567891 HQ2:+441234567892**

Message Text	Description
CPM:009	System response code
UNIT:20000001	The serial number of the MERLIN
MTIME:05:00	Shows the daily measurement time HH:MM
RDAY:TUE	Shows the reporting day of the week
RTIME:12:30	Shows the reporting time of day HH:MM
RETRY:1	Shows the number of report retries: 0, 1, 2
RETRY-HRS:6	Shows the interval between report retries
ACK:MSG	Shows the type of acknowledge the MERLIN should request: SMS (MSG) or a Delivery Report (REP)
LED:ON	The LEDs on the MERLIN can be set to: OFF, ON or DIS (Discreet)
HQ1:+441234567891	HQ 1 phone number
HQ2:+441234567892	HQ 2 phone number (this should be set to OFF if there is no second HQ)

The reply will consist of:

Note

One or more parameters may be changed with a single text message. If a command is sent without any parameters, the reply still contains all current configuration settings. For further information on all text based user commands, please refer to the MERLIN Commands document. Once the MERLIN has been installed in the iCPSM/CPSM database, full configuration can be done via the software.

7.9 Name the MERLIN

Retrieve the pre-stored **CMD:INSTALL** text from your phone and edit the Pipeline name and Location name. Send (or forward) it to the phone number on the front of the MERLIN. This installs the MERLIN in the iCPSM/CPSM software database with the assigned Pipeline and Location names. Wait for the "**Installed Successfully**" reply from the HQ(s) - this could take a minute or two.

Example:

Message Sent: **CMD:INSTALL PIPE:PIPELINE NORTH LOC:MAIN TR FENTON**

Reply: **PIPELINE NORTH/MAIN TR FENTON INSTALLED SUCCESSFULLY**

You can have multiple MERLINs with the same Pipeline name but each MERLIN must have its own unique Location name. See Appendix A for further information on naming conventions.

Note

The **pipe:** and **loc:** text are not case sensitive and will be converted to uppercase by the system. The names can include spaces, punctuation and numbers but not "**loc:**" or "**pipe:**".

The MERLIN system will accept the following characters:

! " # % & ' ( ) * + , - . / : ; < = > ?

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

The MERLIN system will not recognise the following characters:

@ £ $ _ ^ { } \ [~] | € ¡ ¿

7.10 Finish On Site

If you haven't already, to aid maintenance, write the Pipeline name and Location name on the front of the MERLIN in the labelled boxes.

Fit the MERLIN into position inside the post cavity. Carefully feed any excess cables back down into the post. Replace the face plate and secure.

The MERLIN is now installed and you can leave site.

8. POST SITE CONFIGURATION

Once the physical installation has been completed, it's time to configure the MERLIN in your chosen software (iCPSM or CPSM).

You will need to configure the following: **Shunt Values** and **Alarm Thresholds** (specify the high and low values that trigger an alarm).

Further configuration options and system features are available via the software.

8.1 iCPSM Users

For users who choose the online client iCPSM - simply go to **www.icpsm.com** in your chosen browser and log in with your Abriox issued Username and Password.

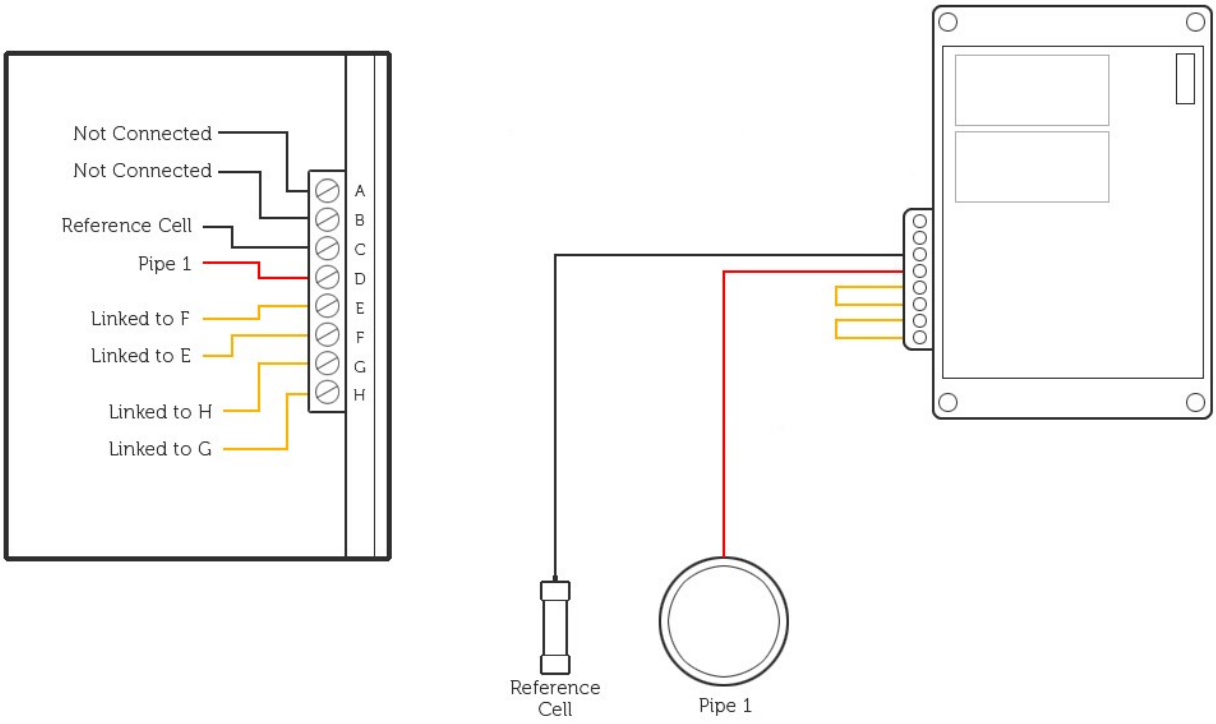
8.2 CPSM Users

Launch CPSM by double clicking the icon from the task bar.

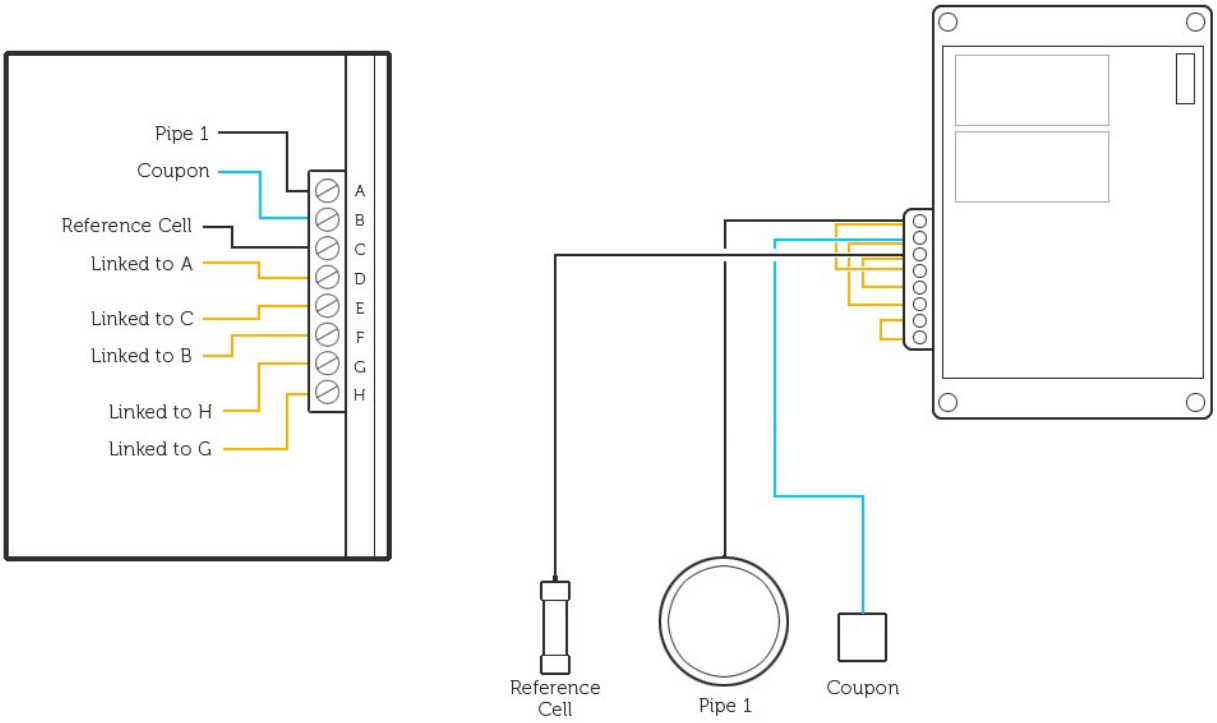
9. INSTALLATION EXAMPLES

The following examples are shown only as a guide.

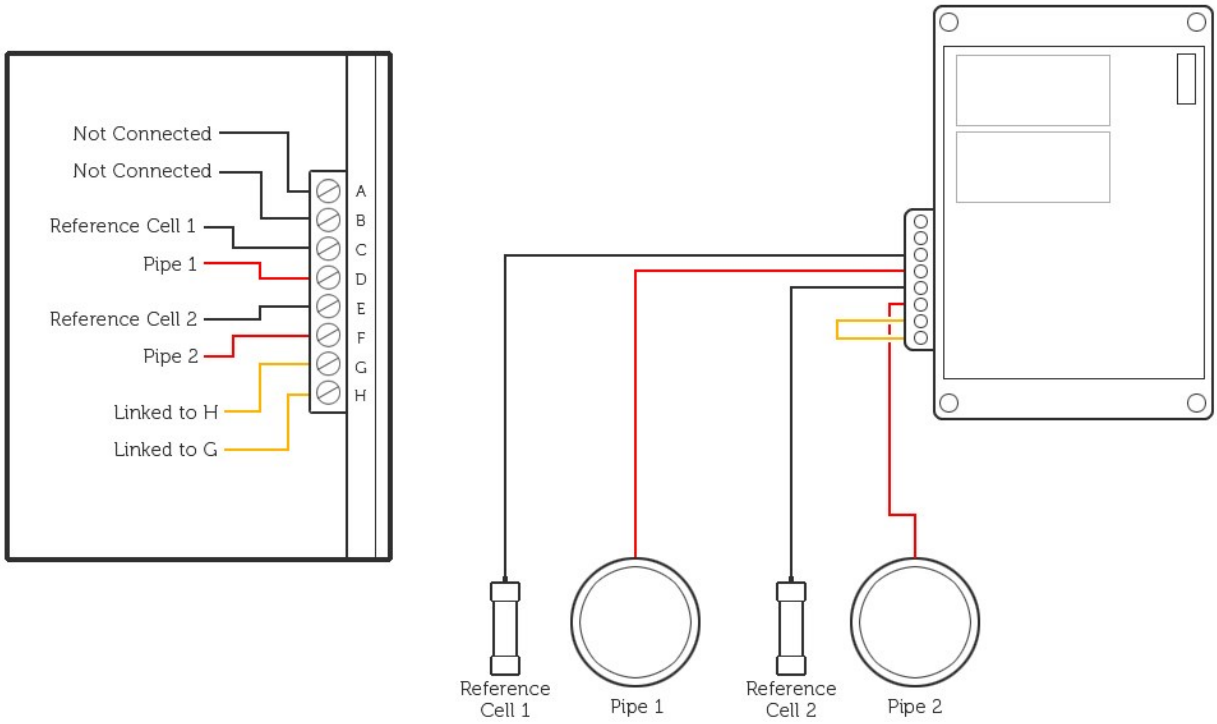
9.1 1 Channel Installation (Single ON Potential)



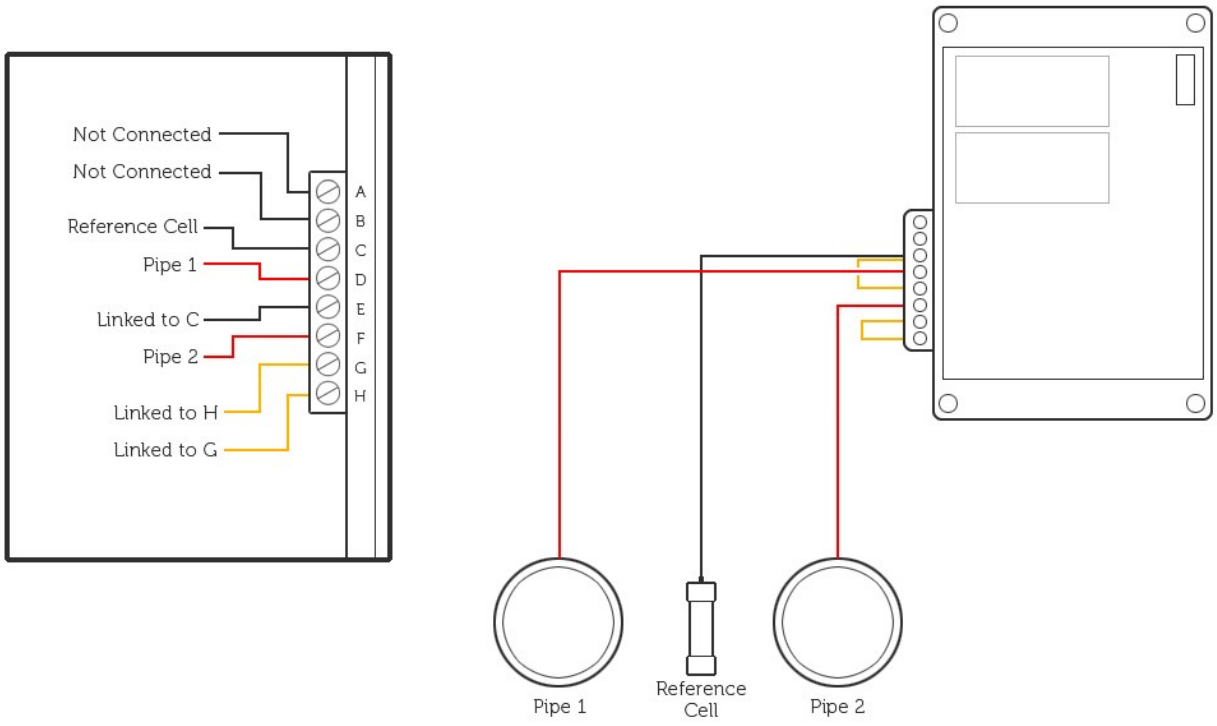
9.2 2 Channel Installation (OFF Potential) - with Coupon but no Current Shunt



9.3 2 Channel Installation (2 ON Potentials) - with a Foreign Pipe and 2 Reference Cells

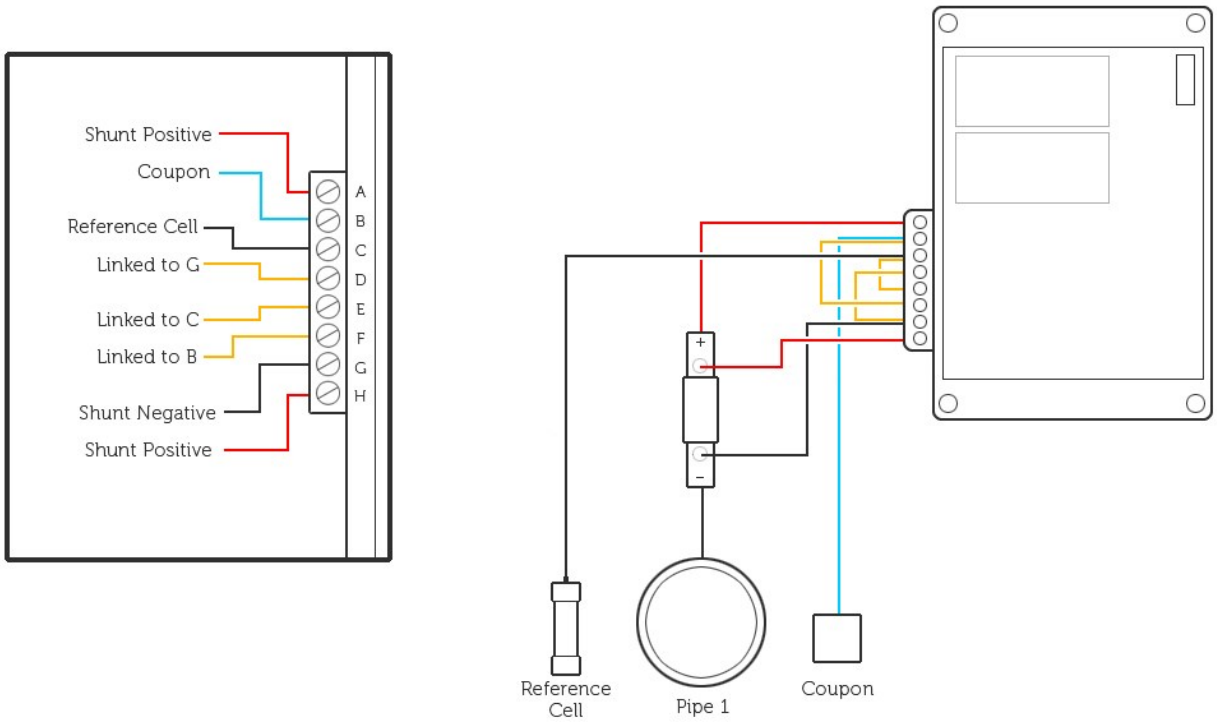


9.4 2 Channel Installation (2 ON Potentials) - with a Foreign Pipe and 1 Reference Cell

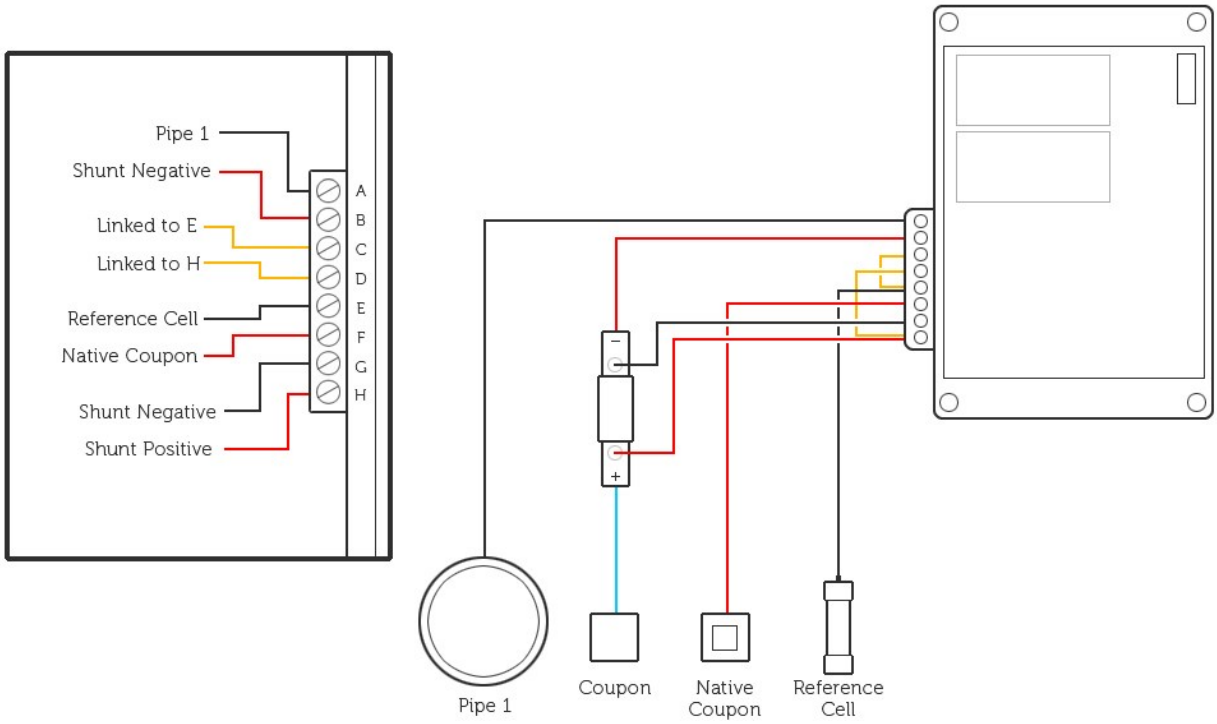


9.5 3 Channel Installation with Coupon

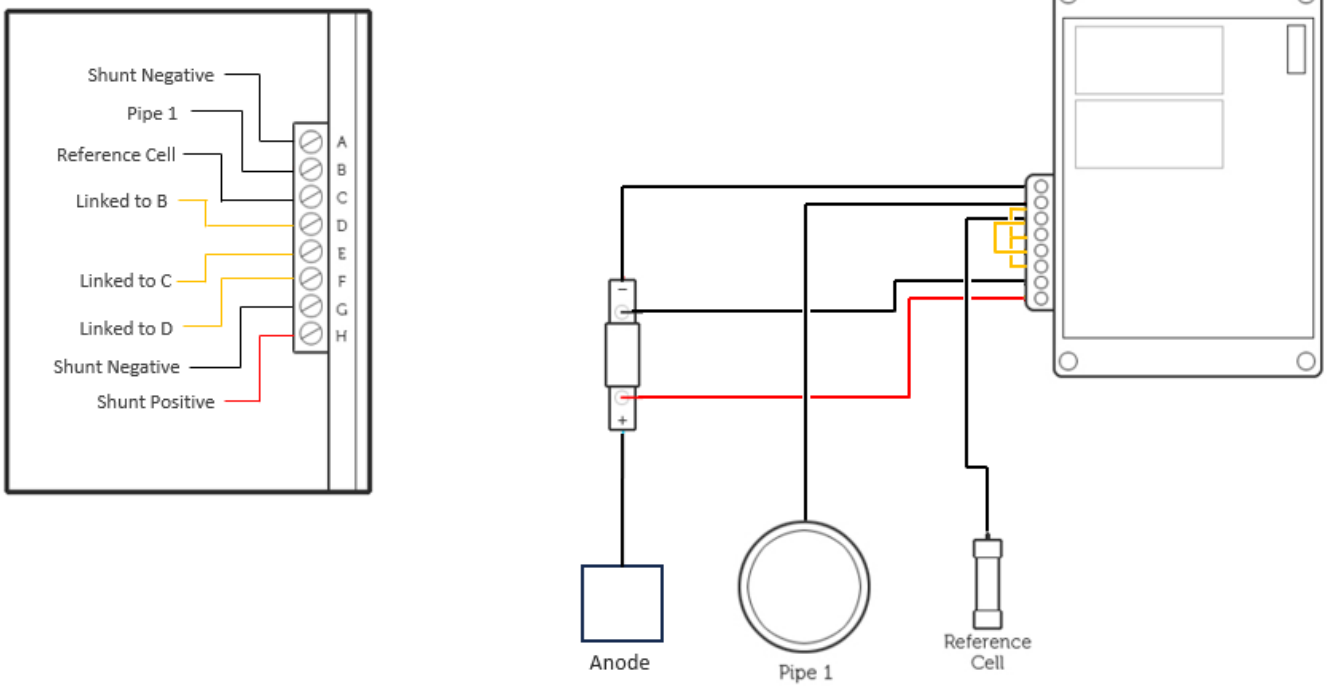
Wiring loom for this configuration can be supplied pre-assembled from Abriox



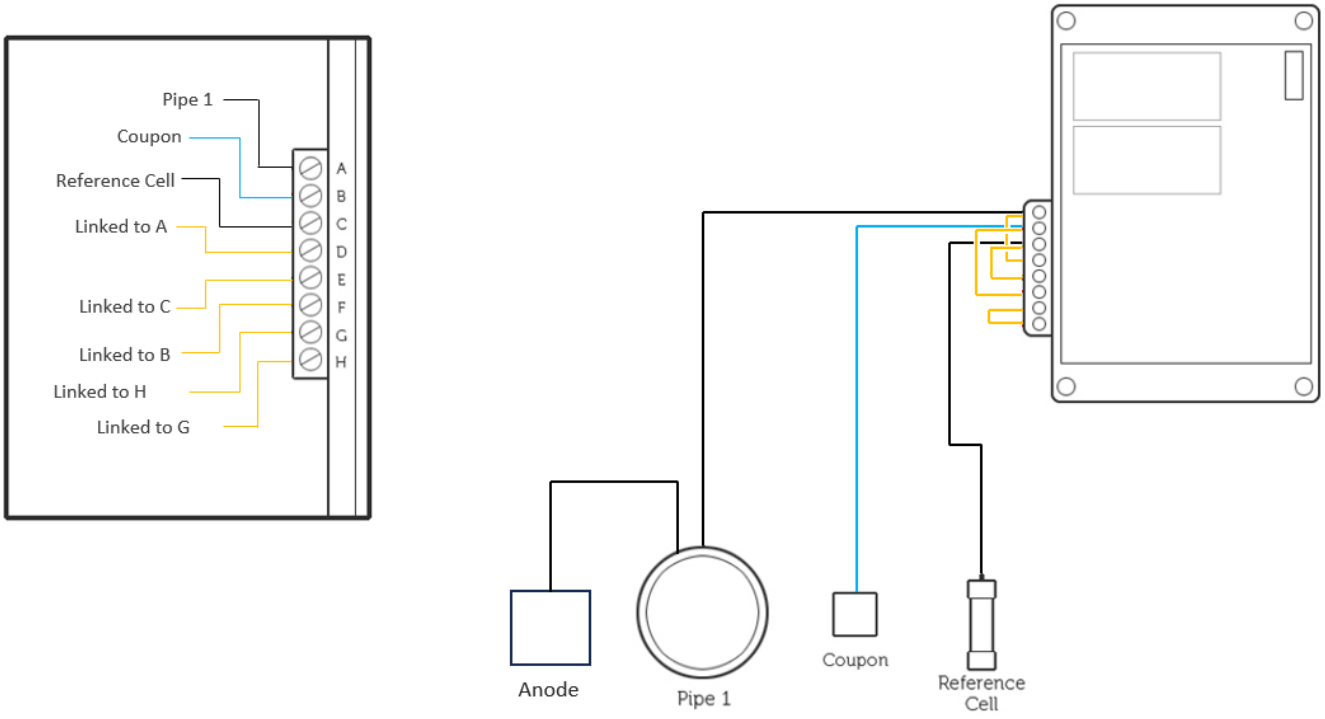
9.6 4 Channel Installation with Native Coupon



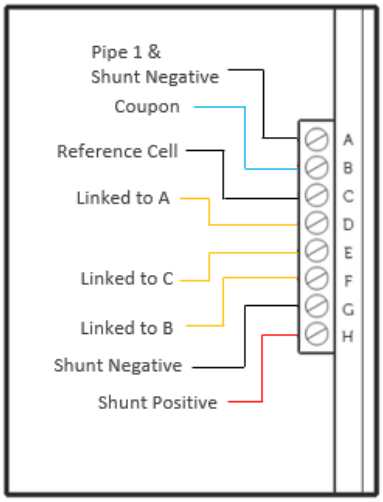
9.7 3 Channel Installation using Sacrificial Anode with Shunt and without Coupon

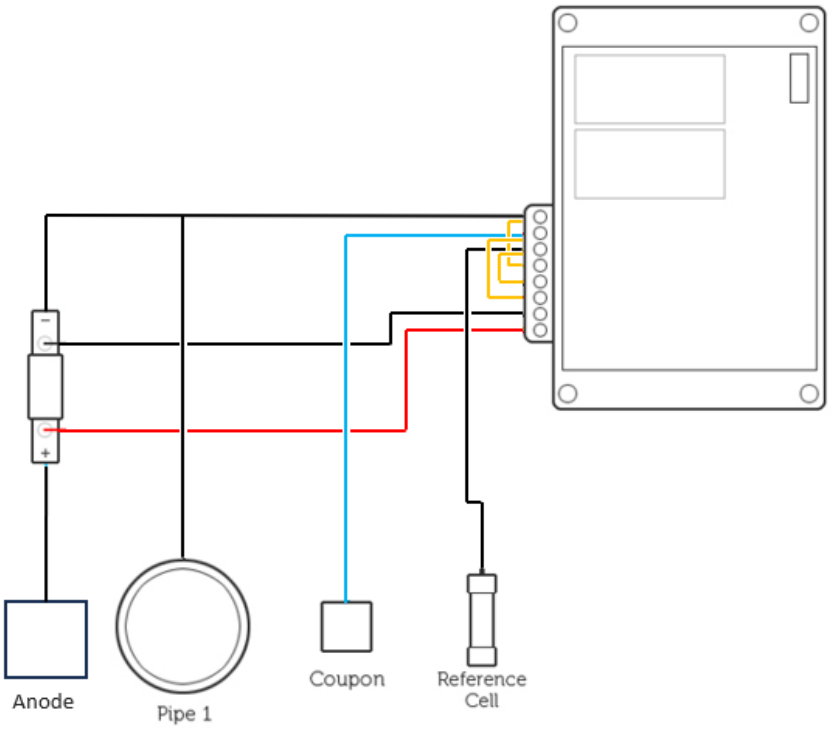


9.8 2 Channel Installation using Sacrificial Anode with Coupon and without Shunt

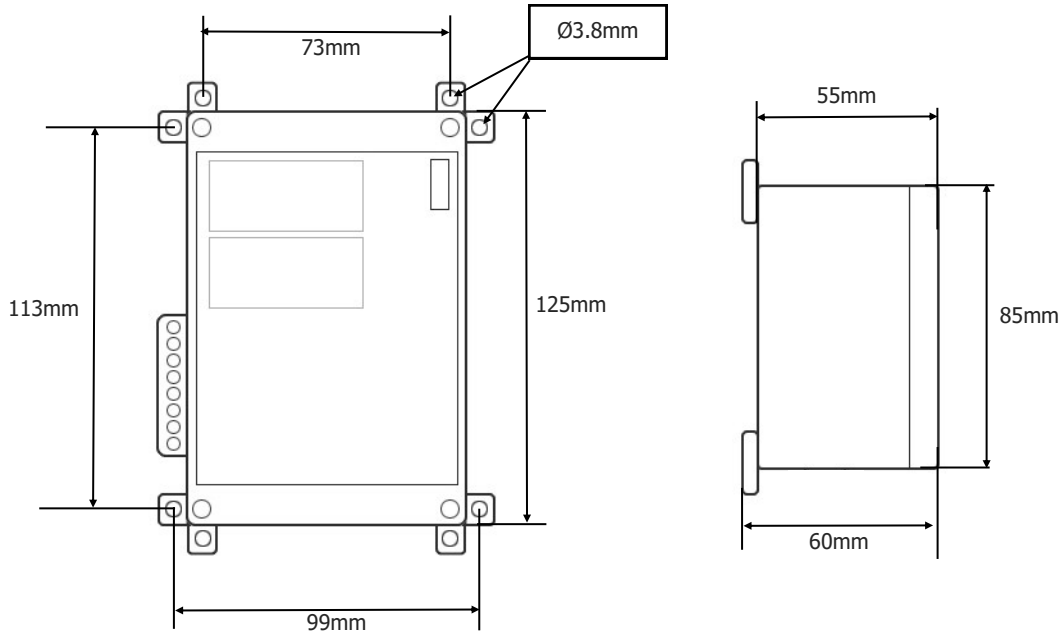


9.9 3 Channel Installation using Sacrificial Anode with Coupon and Shunt





10. DIMENSIONS



11. NOTES

Use this space to write your own notes, tips and cheats to aid future installations (extra space for creating notes is available on pages 22 and 23).

12. APPENDIX A - NAMING CONVENTIONS

When naming and installing MERLIN units, it is important to give them a unique location reference. The term 'location reference' is the combination of the 'Pipe' and 'Location' (PIPE: and LOC:) names given to a MERLIN.

All location references must be unique i.e. you can not have multiple MERLINs with the same Pipe and Location names.

Example 1 - Correct Method

MERLIN A **PIPE:WEST**
LOC:POST A

MERLIN B **PIPE:WEST**
LOC:POST B

In example 1 above, both MERLINs have been installed on the same Pipeline (**PIPE:WEST**) but have been given unique Location names (**LOC:POST A** and **LOC:POST B**). This is the correct method of naming.

Example 2 - Incorrect Method

MERLIN A **PIPE:EAST**
LOC:POST A

MERLIN B **PIPE:EAST**
LOC:POST A

In example 2 above, both MERLINs have been installed on the same Pipeline (**PIPE:EAST**) but have been given the same Location names (**LOC:POST A**), this will cause data confusion and the system will fail.

The only way you can ever use the same Location name is if the MERLINs reside on separate pipes or are assigned a different Pipeline name, see example 3 below.

Example 3

MERLIN A **PIPE:NORTH**
LOC:POST D

MERLIN B **PIPE:SOUTH**
LOC:POST D

In example 3 above, the MERLINs have been installed on different pipelines (**PIPE:NORTH** and **PIPE:SOUTH**) but have been given the same Location names (**LOC:POST D**). Even though the units have the same Location name (**LOC:POST D**), as they reside on separate pipes the 'location references' are unique.

13. APPENDIX B - LED DESCRIPTIONS

The Status LEDs on the MERLIN describe the current status and can indicate any problems.


Indicates Activity


Indicates an Error

During Normal Operation

LED Colour	Sequence	Description
	Double flash	Start of reset (magnet swipe).
	Single flash every 2 seconds	Unit is awake and active. Unit will respond to SMS. Battery is OK.
	Double flash every 2 seconds	Unit is awake and active but not 100% logged onto the cellular network. Unit may respond to SMS. Battery is OK.
	Single flash every 10 seconds	Unit is snoozing between measurements and reporting. Unit will not respond to SMS. Battery is OK.
	Single flash every 2 seconds	Unit is awake and active. Unit will respond to SMS. Battery is low.
	Double flash every 2 seconds	Unit is awake and active but not 100% logged onto the cellular network. Unit may respond to SMS. Battery is low.
	Single flash every 10 seconds	Unit is snoozing between measurements and reporting. Unit will not respond to SMS. Battery is low.
	No flashes	Unit is busy initialising cellular communications or sending/receiving an SMS message. Can take up to 3 minutes.

Possible Error Codes (given after unit reset - error code presented within 3 minutes of reset)

	3 flashes	No cellular network. Unit will keep trying to log on. Try relocating the unit or use an external antenna.
	4 flashes	No SIM card detected. Check SIM card is installed and seated correctly. Check SIM card works by installing it in a phone and checking SMS (text) is working.
	5 flashes	SIM card error. Check SIM card is installed and seated correctly. Check SIM card works by installing it in a phone and checking SMS (text) is working.
	6 flashes	PIN error. SIM card has PIN code enabled. Fit SIM card in a phone and disable the PIN code.
	7 flashes	Setting error. Unit has suffered internal error, please return to Abriox.
	8 flashes	No modem. Unit has not detected modem, please return to Abriox.

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