



AQUAMONIX
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Technical Bulletin Series
**Magnetic Flow
Meters**

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FLOW METER FIELD VERIFICATION PROCEDURES

Introduction

This document describes the process of verifying the flow meter in the field.

Three tests are described:

- Meter test 1: Coil Resistance
- Meter test 2: Electrode and Cable Integrity
- Meter test 3: Coil and Cable integrity (megger / insulation tester)

WARNING

For any test equipment used to verify a flow meter, always observe correct safety precautions contained within the device operating instructions.

Equipment

Multimeter: Aquamonix recommend a calibrated digital multimeter such as the Fluke 79 or equivalent. The maximum period between calibration cycles for the instrument is 12 months.

NOTE, analogue multimeters may produce misleading results.

Insulation Tester: Aquamonix recommends an analogue instrument, equivalent to Kyoritsu model 3132A. Only utilise an instrument which has been approved to Australian safety standards.

Note that there are no components within the flow tube that require maintenance.



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Meter Test 1: Coil Resistance

Unplug all flow meter cables from the transmitter before beginning. Serious damage will be caused to the electronic components if not disconnected before proceeding with this test.

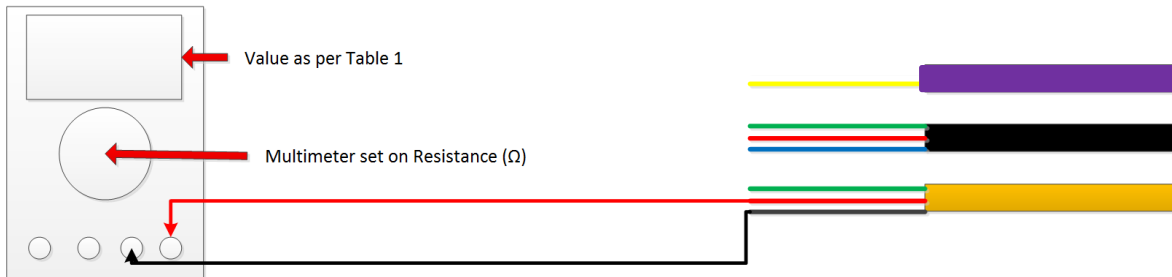


Figure 1: Wiring diagram for testing the coil resistance using a multimeter

Procedure:

- Remove the RED and BLACK wires of the orange circular (coil) cable from the connector.
- Set multimeter to ohms (Ω)
- Connect multimeter to the RED and BLACK wires as shown in figures 1.
Record the reading as per Figure 2.

The measured value should be within the nominal high and low ranges as shown in Table1, dependent upon temperature, equipment calibration and other sources of uncertainty.

If the figure is out of this range, please consult Aquamonix prior to any decommissioning decisions being made on this reading.



Figure 2: Recording the coil resistance using the RED and BLACK wires of the orange cable.



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Flow Tube Series	Nominal Bore	Nominal Coil Resistance in Ω	
		Approx Low Range	Approx High Range
IR2020 (ABS)	All sizes	65	120
IR2060 (Steel)	All sizes	67	120
IR2030 (Stainless Steel)	All sizes	70	120
EM2020 (ABS)	All sizes	35	65
EM2060 (Steel)	All sizes	25	65

Table 1: Nominal coil resistance values for Aquamonix flowmeters

Meter Test 2: Electrode and Cable Integrity

This test checks the resistance between the electrodes. If the current path is open circuit, it may be possible there is an absence of water in the pipe. The resistance path between the electrode wires should not be open or short circuit, in the event water is present in the pipe and in contact with the electrodes.

Note: the result of the test is influenced by presence or absence of water, as well as level of moisture inside the pipe.

Cable and meter capacitance will affect the resistance measurement as can be seen from a rising resistance value while measuring electrode resistance. In some circumstances a charge may exist which will initially give a high resistance reading (in the megohm range). To remove this charge the electrodes are shorted to ground (green wire) for approximately 30 seconds prior to taking resistance readings.

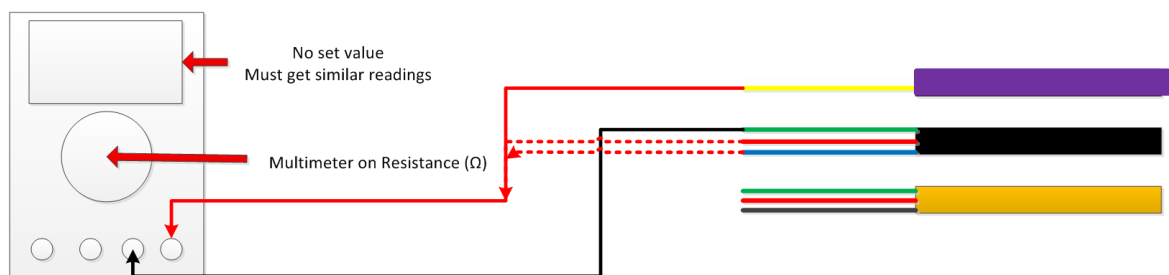


Figure 3: Wiring diagram for testing the electrode resistance using a multimeter

Procedure:

- Unplug all flow meter cables from the transmitter before beginning. Serious damage will be caused to the electronic components if not disconnected before proceeding with this test
- Ensure the meter is full of water (flowing or static)
- Power down the i500 & remove the RED, BLUE, YELLOW and GREEN wires from the signal cables connector
- Set multimeter to ohms (Ω)
- Short the RED & GREEN wires together for approx. 30S. Connect the multimeter to the RED and GREEN wires (as shown in the top photo) and record the initial reading in ohms (Ω)



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- The initial resistance reading should fall in the kilo ohm range & rise in value
- Short the BLUE & GREEN wires together for approx. 30S. Connect the multimeter to the BLUE and GREEN wires (as shown in the top photo) and record the initial reading in ohms (Ω)
- The initial resistance reading should fall in the kilo ohm range & rise in value
- Short the YELLOW & GREEN wires together for approx. 30S. Connect the multimeter to the YELLOW and GREEN wires (as shown in the top photo) and record the initial reading in ohms (Ω)
- The initial resistance reading should fall in the kilo ohm range & rise in value



Figure 4: Recording the resistance between BLUE and GREEN wires.

ADDITIONAL NOTES

1. If there is no water in the flowmeter, then all electrode resistance readings should measure open circuit (high resistance – meg ohms). If moisture exists in the flowmeter, then you may get readings in the high kilo ohm to low meg ohm range. Provided there is no low resistance path to ground, then these results are normal.
2. You can confirm integrity of electrodes & cabling by performing a continuity check. To do this you will need to gain access to inside of the flowmeter.
 - Remove the RED / BLUE / GREEN & YELLOW wires from the i500 signal cable connector & join all wires together
 - Set your multimeter to ohms (Ω)
 - At the flowmeter, place one of the multimeter probes onto an earth point on the flowmeter (2060 & 1060 meters use the earth bolt, on 2030 meters use the outside skin of the flowmeter body)
 - Place the other multimeter probe onto one of the electrodes. You should record a resistance of less than 1.5 ohms
 - Repeat the process checking all electrodes to earth measure less than 1.5 ohms



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- Make sure you have good contact between multimeter probes & electrodes by scratching the surface of the electrode with the probe and repeating the measurement several times.
- 3. If you suspect an electrode / wire is faulty, this can be proved by substituting the faulty electrode with another working electrode. The following procedure describes the process:
 - Ensure the PNF (Yellow wire) electrode measures correctly & the PNF function has been disabled in the i500 transmitter
 - Remove the suspect wire from the connector (example, if Blue measures high then remove the Blue wire)
 - Place the yellow wire where the suspect wire has been removed (e.g. Blue position)
 - Put flow through the meter & confirm all errors clear from the i500 screen and a flowrate is recorded. (The flowrate will be wrong, the actual value is not important, we just need to see flow)

Meter Test 3: Coil and Cable Integrity (“Megger Test”)

This procedure describes the process of testing the flowmeter connections using an insulation tester (megger). The megger test is intended as a sanity check which verifies the insulation of the meter is intact. **Note that it is not to be used as a definitive meter pass/fail test on its own.**

Insulation resistance may deteriorate with ageing of the flowmeter. This on its own does not mean the flowmeter has failed. Decommissioning of the meter would only occur when other meter factors are taken into account.

The insulation resistance measurement will be affected by capacitance across cabling, the flowmeter and the source resistance of the IR meter. When taking IR readings sufficient time must be allowed for the reading to stabilise. To maintain consistency of measurements, Aquamonix recommends measurements are taken with an analogue meter after a period of 5 seconds.

Test Objective:

Megger testing can be useful in troubleshooting issues with an electromagnetic flowmeter installation. The test is designed to determine the electrical resistance between isolated points on the meter. The megger test can sometimes indicate the following effects:

- Cable damage – cuts, ingress, compression. A crushed or water damaged cable may exhibit low resistance or a short circuit.
- Cracked or damaged flow tubes - If a flow tube has been installed in a location with significant bending loads or in a site where the pipework does not match the installation requirements, the meter can break, especially if there is significant thermal variation. In these types of installations, water ingress can occur and the meter can sometimes show reduced insulation properties.
- External moisture ingress - If a flow tube has been damaged or cracked externally, there may exist a moisture path from outside the shroud to the meter internals. In this scenario the insulating properties may be affected over time.
- Age – older meters may show either a lower or higher resistance than when first installed.



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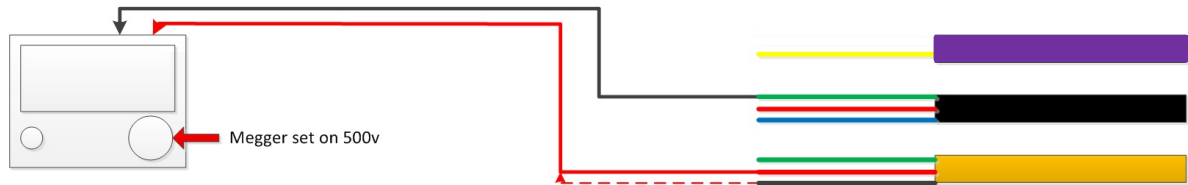


Figure 5: Wiring diagram for testing the coil insulation resistance using a megger tester.

Procedure:

The value should always be read using an analogue instrument equivalent to Kyoritsu model 3132A.

CAUTION: Disconnect all flow meter cables from the transmitter before commencing this test. Serious damage will be caused to the electronic components if not disconnected before proceeding with this test.

- Remove the RED and BLACK wires from the orange coil cable
- Remove the GREEN signal wire from the black signal cable
- Connect megger to RED and GREEN wire
- Set megger to 500 volt range and press button
- Allow 5 seconds for the value to stabilise. Record reading.
- Release button and disconnect leads.

A failed meter will most likely show extremely low resistance or short circuit. Most meters will register an insulation value above 100 mega ohms. Again, this value depends upon environmental factors such as temperature, age and nominal size of the flowmeter.

If the figure is out of this range, please consult Aquamonix prior to any decommissioning decisions being made on this reading.



Figure 6: Megger testing from coil to earth in 500V range using approved equipment



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Electrode Megger Tests:

Additionally, a megger test may be performed on the electrodes and cable. To perform this test, the meter liner must be free of grime and moisture.

Megger testing of the electrodes must be performed using the **250V** range on the megger.

Megger between each electrode wire (Blue, Red & Yellow) to the green earth wire. Results should be the same as for the coil megger test.

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