

MACE – XCi & HydroMace

The following requirements do not replace the XCi Product Manual or the HydroMace Product Manual. The manual is essential for the successful installation, commissioning, operation, and maintenance of this device, and must always be used.

However, for use of this meter under this module of the standard the following requirements must be met, as a minimum, and have been formulated from recommendations/advice in the manual and where required with input from the manufacturer.

Requirements to be confirmed by validation type	
Existing meter installation – new logger and or new sensor/s installed as direct replacement	Section 2.0, Section 3.0, Section 4.0, Section 5.0, Section 7.0, and Section 9.0
Ongoing (revalidation) or Faulty meter (maintenance) – existing meter installation - new or replacement sensors only and no new logger	Section 2.0, Section 3.0, Section 4.0, Section 5.0, Section 7.0, Section 8.0, and Section 9.0
Ongoing (revalidation) or Faulty meter (maintenance) – existing meter installation - new logger only and no new or replacement sensors Ongoing (revalidation) or Faulty meter (maintenance) – existing meter installation - no new or replacement logger and no new or replacement sensors	Section 4.0, Section 5.0, Section 6.0, Section 7.0, Section 8.0, and Section 9.0

Note: The requirements only reference the XCi but these requirements must also be met with the HydroMace. Where the requirements cannot be met with a HydroMace, this has been noted.

1.0 Key terms

Term	Definition
pressure sensor	A stand-alone third-party sensor/s
XCi	The MACE AgriFlo XCi or FloPro XCi including connected sensors.
Logger	The controller/logger component of the XCi

2.0 Authorised Meter Validator

From 1 December 2022, a CMI must have completed training by MACE for the XCi within the previous 2 years to perform the activities in the following table. The training record/certificate must be provided with the validation certificate where a new sensor is installed.

Activity	CMI	Training by MACE
Installation of new sensors	✓	✓

3.0 Measurement assurance requirement B

New pressure sensors must be calibrated after manufacture and prior to installation, and the manufacturer must certify that the sensor will measure depth within $\pm 0.1\%$ of true value across the depth range.

The new sensor must be provided with a calibration certificate showing:

- date of the calibration test
- the serial number of the reference device
- the sensor type, manufacturer part number, and the serial number for the sensor
- the depth range over which the sensor was tested
- the calibration results confirming $\pm 0.1\%$, or, that the sensor has 'passed' the test.

The new sensor must withstand temperatures from -50°C to $+50^{\circ}\text{C}$ and relative humidity's of 100% (without condensation) in a non-operating condition.

4.0 Installation

4.1 General

The logger must:

- Water damage – be mounted above known flood peak levels. The logger must NOT be submerged.
- Sunlight - be mounted so that the LCD faces in a direction away from direct sunlight (i.e., LCD must face South).
- Cable damage – have all cables appropriately routed through electrical conduit when not enclosed in any mounting pole.
- Insects and moisture – have a non-curing sealing compound (e.g., duct-seal-putty) installed down the first 5 to 10 cm of electrical conduit or the mounting pole where cables are enclosed, to prevent insect/moisture ingress.
- Power – have an alternate DC source of 16-30V DV connected to the logger power regulator to charge the internal battery (i.e., a mains powered trickle charger or a solar panel, where mains power is not available). The cables from the solar panel/charger to the logger must be enclosed in electrical conduit when not enclosed in any mounting pole (also see Insect and moisture requirement above).
- Solar panel - have tri-spikes installed on the top of the solar panel to reduce the accumulation of bird droppings on the front face of the panel; and the solar panel orientated to the North at the appropriate incline angle, and the panel must not be shaded by trees or structures.

4.2 Pressure sensor

The sensor cable must not:

- have any connections between the sensor and the logger (so the sensor cannot be disconnected inadvertently or to facilitate fraud).

The sensor must:

- be installed in a stilling well/pipe.
- connect to the logger, where measurements must be logged
- obtain power from the logger.

5.0 Configuration

5.1 Site ID

Must be the logger serial number.

When a validation certificate is issued for the XCi, it must link:

- the logger serial number (Site ID), to the
- water resource extraction authorisation number(s), to the
- works number(s) for extraction occurring against an authorisation, to the
- latitude and longitude for the meter location
- the serial number(s) for the sensor(s) connected to the logger.

Where the controller card is replaced, the serial number for the new card must be linked to the metering installation with a validation certificate. The new serial number must be permanently recorded inside the logger using a label or tag.

5.2 The XCi channels

The XCi uses channels to enable various measurements to be made and other parameters to be calculated. There are three types of channels:

- Connected sensor channels – these channels output the measured value based on the signal received from physically connected sensors wired to the logger.
- Calculated channels – these channels use the measured values (connected sensor channels) and apply an algorithm(s) to output calculated values.
- System channels – these channels use system values direct from the logger.

5.2.1 XCi – Metering – small concrete rectangular weir measurement structure

CONFIGURATION 3: Measurement of depth of flow over a concrete rectangular weir, with flowrate calculated using a depth to volume algorithm for the weir.

- A pressure sensor signal is converted to a depth output by the logger using a 'depth channel'.
- The depth output is then used to calculate flowrate via a 'flowrate channel' by using a pre-configured algorithm for the structure.

For these existing weirs treat them as a suppressed rectangular weir $\rightarrow Q = 1.84 * L * h^{1.5}$, where:

Q = discharge (kL/second); L = weir width (m); and h1 is the upstream height measured by the pressure sensor (m).

Following are minimum requirements for 'Channels' to be configured and confirmed for the metering installation.

Channels	Channel type	Configuration 3
Depth	Connected sensor	✓
Flowrate (using weir)	Calculated	✓
Total flow	Calculated	✓ The 'non-resettable' check box must be ticked.## The 'total positive flow' check box must be ticked.

Channels	Channel type	Configuration 3
Net flow total	Calculated	✓ The 'non-resettable' check box must be ticked.## The 'all values' check box must be ticked.
Device battery voltage#	System	✓
Device external voltage#	System	✓

Essential meter health elements, i) the logger internal battery and alternate DC power source voltage, making it easier to identify if the meter is/when the meter became faulty.

Essential tamper-evident/prevention elements, i) stopping unauthorised persons from resetting the XCi totals; either inadvertently or to facilitate fraud.

6.0 Pressure sensor check

The sensor 'offset' must be confirmed and checked. The offset is the level that the sensor is positioned relative to the crest of the concrete rectangular weir.

Where the water level is over the sensor, the reading must also be confirmed against another measurement device. For example, a tape or ruler.

Where the water level is not over the sensor, the sensor must be confirmed to be reading correctly against another measurement device. For example, submerging the sensor and confirming the level matches that of a tape or ruler.

Where the sensor fails the check, a new sensor must be installed.

A report on this activity, confirming completion, is to be provided to the relevant person with the validation certificate.

7.0 Output

Where the department requires meter health as an output from the meter:

The logger must have a FloSI card installed. To have a validation certificate issued, where an XCi:

- is installed after this document came into effect - it must have a card installed as part of validation post-installation
- was installed prior to the effect of this document - it must have a FloSI card installed as part of the next process of validation for the XCi.

The FloSI Card provides output from the XCi for interface with third party transmission devices.

A WebComm card may be used where the department confirms this is possible. This card provides cellular output from the XCi to the Department's nominated data platform.

Where the department requires pulse output only:

The logger must have a Pulse I/O card installed. To have a validation certificate issued, where an XCi:

- is installed after this document came into effect - it must have a Pulse I/O card installed as part of the process of validation, post-installation
- was installed prior to the effect of this document - it must have a Pulse I/O card installed as part of the next process of validation for the XCi.

The Pulse I/O card provides output from the XCi for interface with third party transmission devices.

8.0 Maintenance

8.1 Battery replacement

The XCi internal battery must be replaced every 5 years, as a minimum, regardless of perceived battery status.

The logger control panel battery must be replaced when the internal battery is replaced, regardless of perceived battery status.

8.2 Pressure sensor

The pressure sensor must be checked (6.0 Pressure Sensor Check).

Where the sensor fails, a new sensor must be installed.