Hydro-Control (HC07) Installation Guide

To re-order quote part number:	HD1074
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1 Introduction

1.1 Purpose and scope

This manual is not a user guide. It is designed as a reference guide for engineers designing, installing, or commissioning a Hydro-Control (HC07) system. Before installing this device, the personnel involved must read the Safety Information (HD1100).

This manual complements the Operators Guide (HD1048), which details how to set up and calibrate recipes in the Hydro-Control. It is advisable to read the Operators Guide before reading this manual to understand the choices of operation and consequent design requirements.

The manual is divided into three sections covering the mechanical installation, the electrical installation, and the commissioning of the unit.

Outside the scope of this guide, but covered by separate documentation is:

Warning	Document ref. No.	Document name
	HD1061	HC07 Fan replacement guide
	HD1087	HC07 Battery replacement instructions
	EN0108	HC07 Expansion PCB retrofit guide
	EN0111	HC07 AC IO Board Fuse Replacement Guide
	EN0112	HC07 IO Board Replacement Guide

All above mentioned documents are available on request or on www.Hydronix.com website.

1.2 Responsibilities

The safety of any system incorporating the equipment described in this documentation is the responsibility of the assembler of the system.

Read the safety information guide before attempting to install or use the device. The device must only be used in accordance with the manufacturer's specified intended use.

The products covered by this document must be installed per the manufacturer's instructions and used only within the conditions defined in Section 5 of the Safety Information (HD1100).

All installation work must comply with and meet the relevant local standards of electrical installations. The safety of any system incorporating Hydro-Control is the responsibility of the assembler of the system. If Hydro-Control is used in a manner not specified, the protection provided by this equipment may be impaired.

2 Classifications and Markings

The following approvals and certifications are provided: The Hydro-Control (HC07) has been designed to meet the requirements of UL/IEC 61010-1 Edition 3.1.

Contains FCC ID: 2ABCB-RPIRM0, IC: 20953-RPIRM0

This device complies with part 15 of the FCC Rules. Operation is subject to the following 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.

A full declaration of conformity and other relevant documentation is available by following this QR code.

3 Specifications and Ratings

For more information on specifications and ratings, refer to chapter 1, section 5 of HD1100 Hydro-Control (HC07) Safety Information.

3.1 Lightning Strikes

Consideration should be given to protecting the installation from damage caused by lightning and similar electrical disturbances.

Many installations will be in situations that are particularly prone to damage by lightning, for example:

- Tropical Regions.
- Long cable runs between the sensor and the control panel.
- Tall, electrically conductive constructions (e.g. aggregate bins).

Although the Hydro-Control is fitted with isolation on the sensor input, this will not prevent damage in all cases. Precautions should still be taken to avoid lightning damage in areas with a known risk.

Installing suitable lightning barriers to all conductors in the sensor extension cable is recommended. Ideally, these would be fitted at both ends of this cable to protect the sensor, the Hydro-Control and any other equipment.

Installing the equipment using screened cables is recommended to the specification defined in Chapter 4 Section 6.

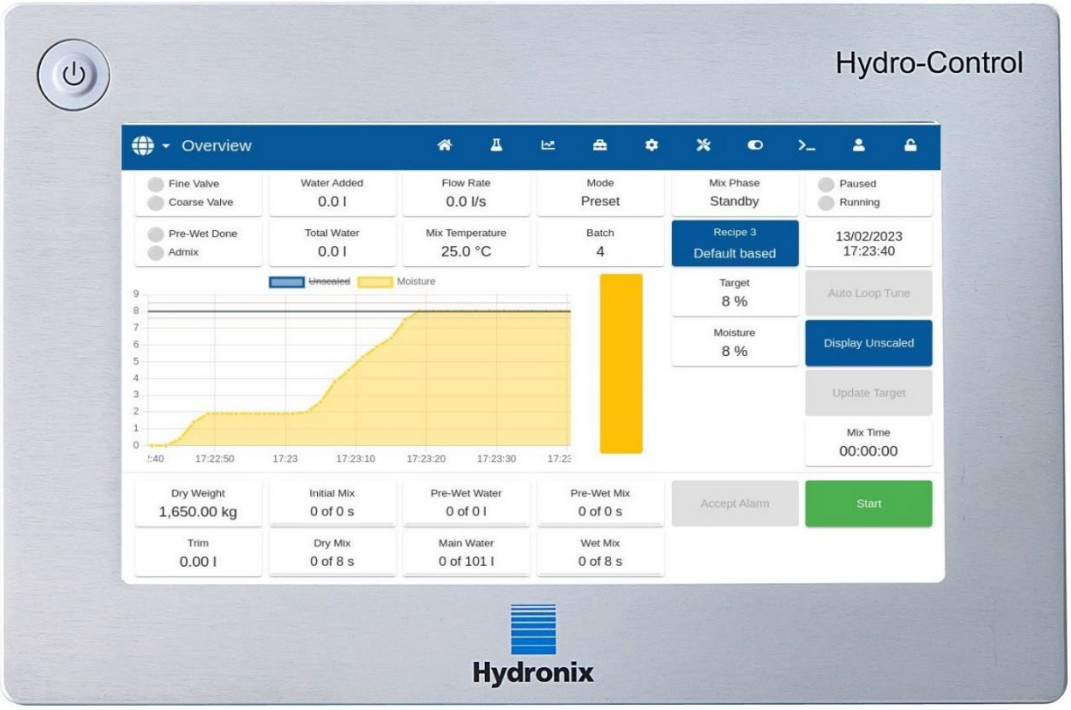


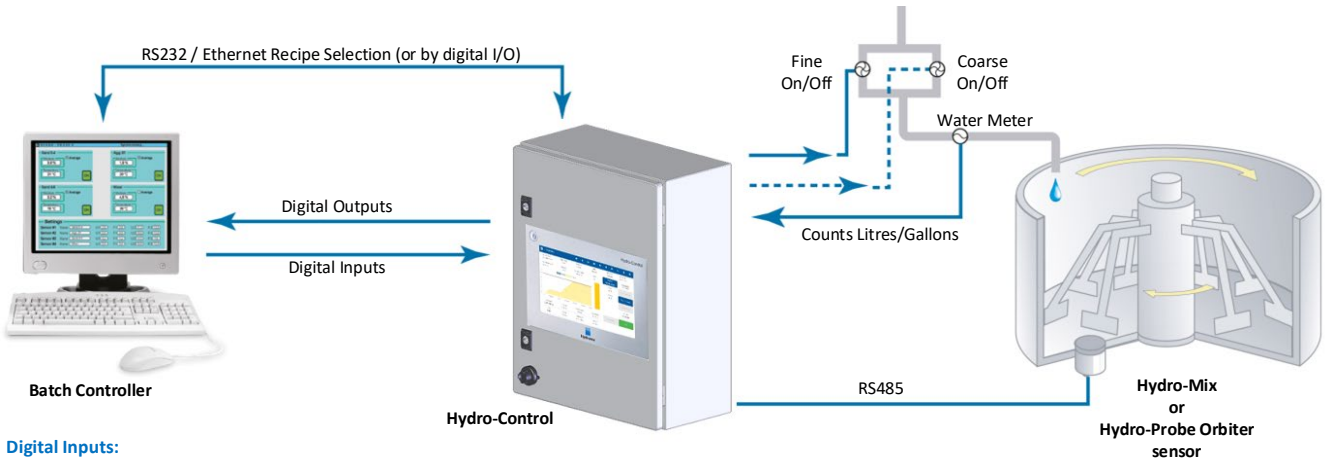
Figure 1: The Hydro-Control screen

1 Introduction to the Hydro-Control

The Hydro-Control (HC07) is a touch-screen computer based on a Linux operating system. It has been designed to work with the Hydronix range of sensors. The unit monitors the moisture level in a process (usually in a mixer) and sends signals to adjust the water flow into the process using water valves.

The moisture level during the process cycle is displayed on the Overview Screen, and there are intuitive and easy-to-use graphical tools for setting up the recipes in the system.

Communication with external systems can be implemented using either the built-in RS232 serial port or the optional Expansion Board. The Expansion Board also provides two analogue inputs and two analogue outputs.



Digital Inputs:
Start/Resume, Cement In, Pause/Reset, Water Meter Pulse Input, Water Tank Full, Optional 8 inputs for recipe selection

Digital Outputs:
Coarse Water (switches on the coarse valve), Fine Water (switches on the fine valve), Admin, Pre-Wet Done, Mix Complete, Alarm, Water Tank Fill

Figure 2: Example implementation of Hydro-Control

2 Packaging and box content

Figure 3: The Hydro-Control

Standard Contents:

1	x	Hydro-Control (HC07) unit
1	x	Antenna Kit
2	x	Top/Bottom fixing brackets
2	x	Side fixing brackets
1	x	QR code label
1	x	Declaration of Conformity
1	x	Safety Information (HD1100)

Additional Contents (If Expansion Board has been factory fitted):

1	x	9 Way Connector for Analogue Inputs/Outputs
1	x	9 Way Connector for Recipe Selection Inputs

Accessories:

Part No.	Description
7010	Hydro-Control (HC07) Expansion board for retrofit*
7015	24V DC I/O Module
7020	110V AC I/O Module
7025	Hydro-Control (HC07) System Card
0175	Panel Mount USB Socket
7030	Hydro-Control (HC07) Replacement Fan
7035	Hydro-Control (HC07) Antenna Kit
7100	Hydro-Control (HC07) Wall Mount Enclosure (IP65)
7200	Hydro-Control (HC07) Control Cabinet**
7050	Hydro-Control (HC06) to (HC07) adapter plate
7060	Hydro-Control (HC06) to (HC07) adapter cable

*required for weighed water, digital recipe selection and Thermo-Tuff temperature input

** Pre-wired for easy connection to field wiring

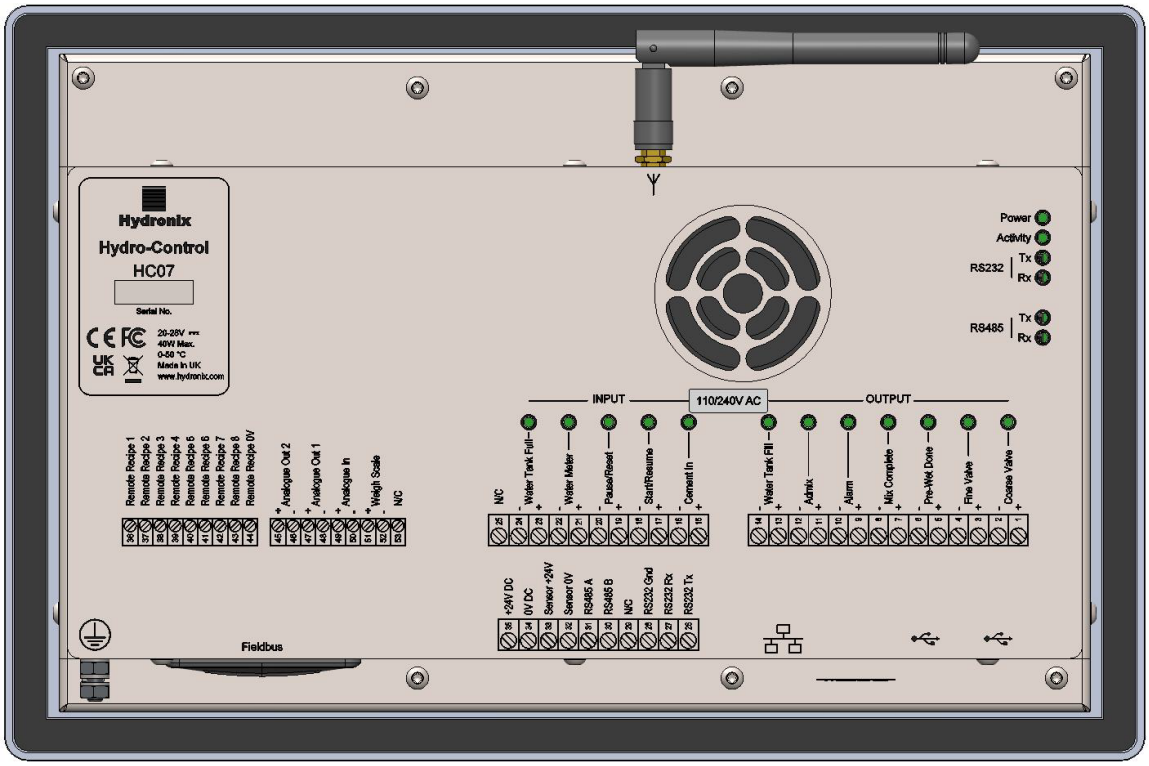


Figure 4: Rear view of the Hydro-Control

1 Weight and Dimensions

Fascia:	290 mm (W) x 192 mm (H); (11.42” (W) x 7.56” (H))
Panel Cut out:	265 mm (W) x 168 mm (H); (10.43” (W) x 6.61” (H))
Min Panel Thickness:	1 mm
Max Panel Thickness:	3 mm
Depth:	81 mm (3.19”)
Depth behind Fascia:	76 mm (2.99”)
Weight:	2.3 Kg (5.07 lb)

NOTE:

I/O connections are made to the base of the unit. Access needs to be allowed for the cables and connectors. USB connections are made underneath the unit. Sufficient space should be left to insert and remove USB cables.

A ground stud is positioned at the bottom left of the unit (viewed from the rear).

2 Mounting and installation

The Hydro-Control is designed to be mounted in a control panel with a maximum thickness of 3mm. The unit is supplied with four mounting brackets one for each side.

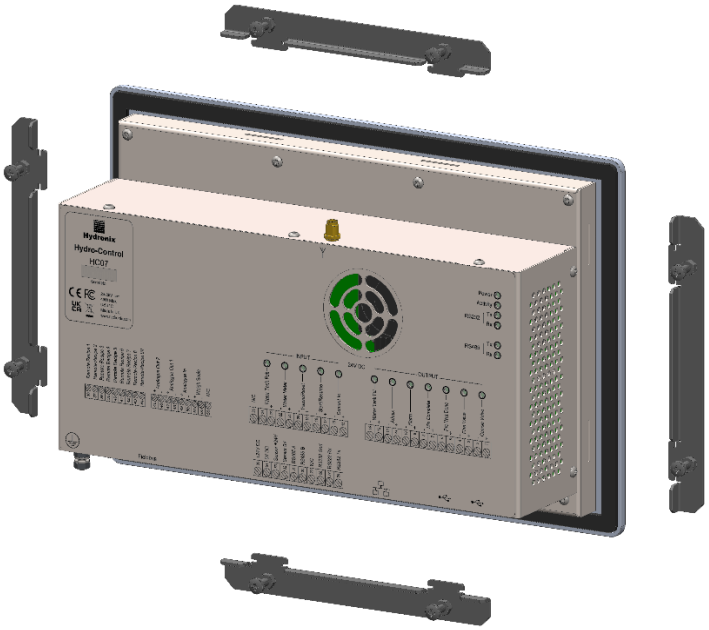


Figure 5: Mounting brackets

2.1 Typical (new) installation

To install the Hydro-Control in a cabinet with no pre-existing cut-out:

- Cut out an aperture in the panel of the correct size. See Figure 6 for a template.
- Remove the mounting brackets from the body of the unit by releasing the screws and then unhooking the brackets.
- Insert the Hydro-Control through the prepared hole.
- Re-fit the mounting brackets to the unit. To install the side mounting brackets, insert into the slot and slide down. For the top and lower brackets insert into the slot and slide right.
- Once the brackets are inserted tighten the screws evenly to pull the fascia towards the control panel.

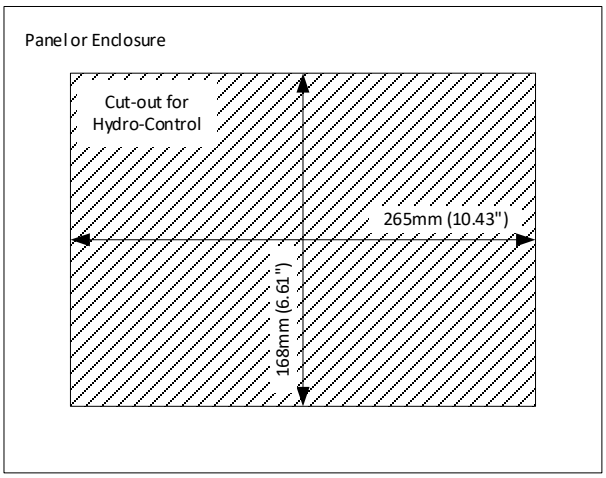


Figure 6: Panel cut-out for the Hydro-Control

2.2 Affixing Hydro-Control (HC07) in a (HC06) cabinet

To install the Hydro-Control in a cabinet that previously housed Hydro-Control VI (HC06):

- Using the Hydro-Control (HC06) to (HC07) adapter plate (part No 7050) as a template, modify the aperture in the panel to the correct size. To do this ensure that the new (HC07) cutout's lower edge is aligned with the existing (HC06) cutout and horizontally centralised.
- Using the adapter plate (part No 7050) as a template, drill plate mounting holes in the (HC06) cabinet and attach the adaptor plate to the cabinet using appropriate M4 fixings.
- Finish installing the (HC07) as per instructions in section 2.1.

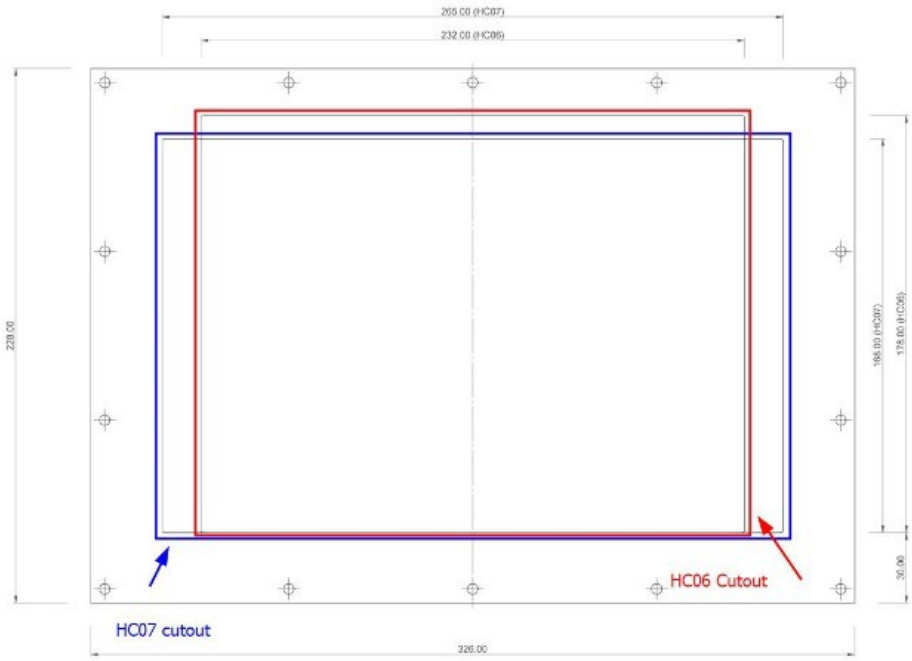


Figure 7: Aligning (HC06) and (HC07) panel cutouts

This chapter explains the configuration of the connectors on the Hydro-Control unit and how the wiring should be designed and installed. These connections will vary depending on the configuration and integration requirements of the system design.

1 Connecting the HC07 to an existing HC06 installation

CAUTION

DO NOT CONNECT existing HC06 wiring to the HC07 device!

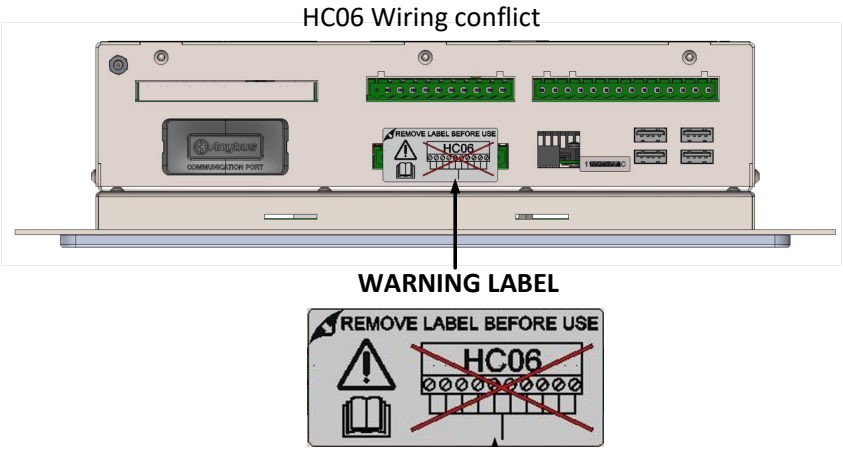


Figure 8: HC06 wiring conflict warning label

1.1 HC06 wiring to HC07 device wiring conflict

The Hydro-Control (HC07) is designed to utilise the same physical 10-pin connector for the power supply and sensor connection as used in HC06 installations. However, **the wiring connections within the 10-pin connector differ between HC06 and HC07 devices**, see Figure 9.

1.2 Wiring differences

Figure 9 depicts the difference in wiring configuration between the HC06 installation wiring and the connections required by HC07.

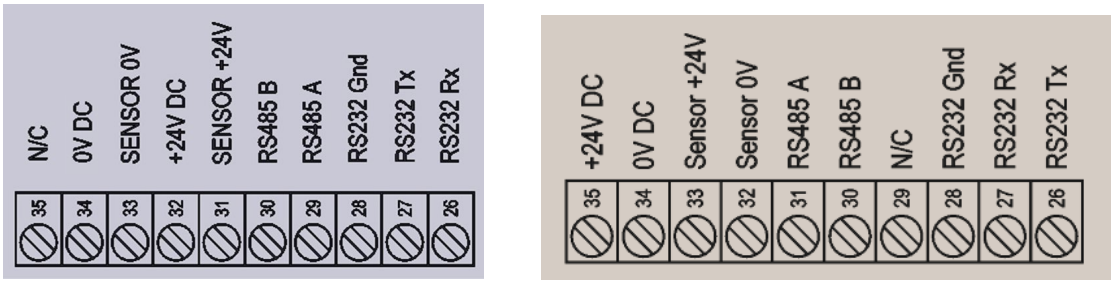


Figure 9: HC06 vs HC07 – 10-pin connector pinout differences

1.3 Making the Correct Connections

The Hydro-Control (HC07) can be connected to an existing HC06 wiring installation in one of two ways:

- Using an HC06-to-HC07 adaptor loom (part No. 7060)
- Re-wiring the HC06 connector to match the HC07 pinout (see Figure 9)

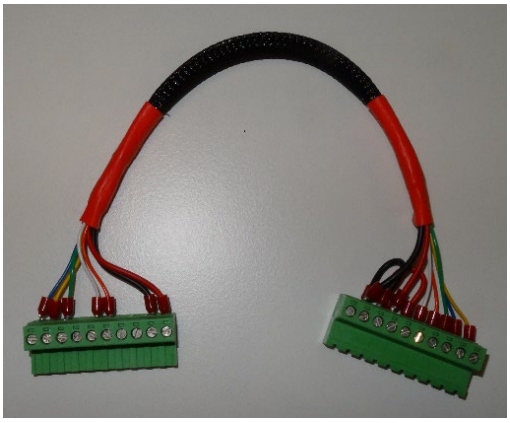


Figure 10: HC06 wiring to HC07 adaptor loom

When the HC06-to-HC07 adaptor loom (part No.7060) is not available, the wiring configuration of the 10-pin terminal block can be changed to match the pinout of the HC07 terminal block wiring, refer to Figure 9.

2 Connector pin assignments

2.1 Output Connector

Pins		Name	Description
+	-		
1	2	Coarse Valve	Controls the larger coarse water addition valve
3	4	Fine Valve	Controls the smaller fine water addition valve
5	6	Pre-Wet Done	Indicates the end of the Pre-Wet phase
7	8	Mix Complete	Indicates the Hydro-Control has completed the mix cycle
9	10	Alarm	Indicates the Hydro-Control is in an alarm state
11	12	Admix	Indicates Admixture should be added. May also be configured to indicate the mix is running or that the Hydro-Control is in a water addition phase
13	14	Water Tank Fill	Indicates that the water tank requires filling on a weighed water system

2.2 Input Connector

Pins		Name	Description
+	-		
15	16	Cement In	Minimum 200ms pulse indicates the cement has been added
17	18	Start/Resume	Minimum 200ms pulse starts or resumes the Hydro-Control water control cycle.
19	20	Pause/Reset	Minimum 200ms pulse pauses or resets the Hydro-Control water control cycle
21	22	Water Meter	Water meter pulse input (see Chapter 4 Section 5.4.3 for signal pulse requirements)
23	24	Water Tank Full	Minimum 200ms pulse indicates the water tank is full
25		N/C	No Connection

2.3 Power and Communications Connector

Pins	Name	Description
26	RS232 Rx	RS232 data transmit line
27	RS232 Tx	RS232 data receive line
28	RS232 Gnd	RS232 ground
29	N/C	N/C
30	RS485 B	RS485 line B for connection to the sensor
31	RS485 A	RS485 line A for connection to the sensor
32	Sensor 0V	0VDC connection for powering the sensor
33	Sensor +24V	+24VDC connection for powering the sensor
34	0V DC	0VDC system power supply input
35	+24V DC	+24VDC system power supply input

2.4 Remote Recipe Connector (on optional Expansion Board)

Pins	Name	Description
36	Remote Recipe 1	Remote recipe selection inputs. These are used to change the recipe in the Hydro-Control via a BCD, binary or digital signal (see section 4.3).
37	Remote Recipe 2	
38	Remote Recipe 3	
39	Remote Recipe 4	
40	Remote Recipe 5	
41	Remote Recipe 6	
42	Remote Recipe 7	
43	Remote Recipe 8	
44	Remote Recipe 0V	Remote recipe selection 0V signal.

2.5 Analogue I/O Connector (on optional Expansion Board)

Pins		Name	Description
+	-		
45	46	Analogue Out 2	Analogue output reserved for future use.
47	48	Analogue Out 1	Analogue output reserved for future use.
49	50	Analogue Input 2	Analogue input for Thermo-Tuff sensor.
51	52	Weigh Scale	Analogue weigh scale input for weighed water system.
53		N/C	

3 Communications

3.1 RS485

The RS485 connection is used for communicating with a Hydronix moisture sensor. It is possible to change operating parameters and sensor diagnostics from the Hydro-Control.

3.2 RS232

The RS232 connection is used for connection to a batch computer or remote operator terminal to permit the remote selection of recipes.

3.3 Ethernet Telnet Port

Enables the same operations available on the RS232 using the Telnet port (port23).

3.4 I/O Module Voltage Options

3.4.1 I/O Module Model (24VDC)

Hydronix Part No.	Description
7015	9 - 28 VDC

3.4.2 I/O Module Model (110VAC)

Hydronix Part No.	Description
7020	110 - 240 VAC

4 Expansion Board (Hydronix Part Number 7010)

The Expansion Board is an optional add-on that can be used to provide additional functionality. The board may be added to the system at any time, enabling the use of the weighed water system and the remote recipe selection inputs.

4.1 Analogue Inputs

The board has two analogue inputs. Input 1 is used for the weigh scale input and it can be set to 4-20mA or 0-20mA (0-20mA setting can be used as use 0-10V signal if a conversion resistor is used). Input 2 is used for connecting Thermo-Tuff temperature sensor.

4.2 Analogue Outputs

The board has two analogue outputs. These are reserved for future use.

4.3 Recipe selection inputs

The board has eight recipe selection inputs to control recipes using discrete, binary or BCD inputs. These are configurable on the 'I/O Settings' page of the 'Hardware' screen (see Figure 69) and can be used to change the current recipe being used by the unit from an external control system or other recipe selection device.

5 I/O Wiring Diagrams

It is recommended that any field wiring is protected by an emergency stop device that can disconnect the devices being controlled from the signal given by the Hydro-Control in the event of a fault.

5.1 Wiring digital inputs

The inputs function in a similar way to the coil side of a normally open relay. To activate an input, apply the correct potential across the terminals. The maximum permissible input voltage for the DC I/O card is 28V DC, and the AC I/O card is 240V AC.

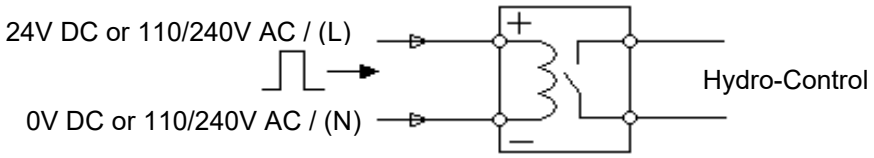


Figure 11: Digital Input Wiring Diagram

5.2 Wiring digital outputs

The outputs function in a similar way to the voltage-free contact side of a normally open relay. The Hydro-Control activates the output by closing the contacts for the output side. The maximum permissible supply voltage and output current values for the DC I/O card are 28VDC / 2A, respectively and for the AC I/O card, are 240V AC / 1A. Note that the AC outputs have a minimum current of 20mA.

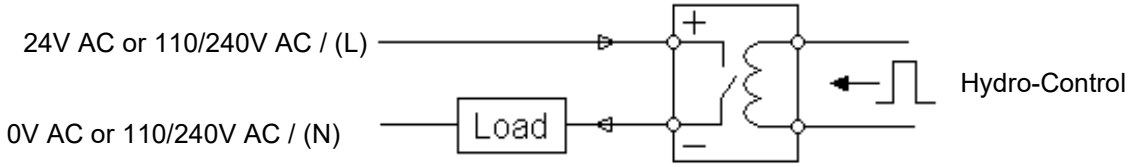


Figure 12: Digital Output Wiring Diagram

5.3 Digital Output Protection – 24V DC I/O Module

When an inductive load is to be connected to any of the digital outputs of the device fitted with the 24V DC I/O Module (a coil such as an inductor, relay coil, motor or solenoid winding), a flywheel diode must be fitted across the load.

The flywheel diode (also known as back EMF diode) will suppress the back EMF voltage spike, which can potentially damage the device's output circuitry. It is recommended to use a general-purpose rectifier diode, such as 1N4007 or equivalent.

The flywheel diode must be connected as shown in Figure 13 (note the reverse orientation of the diode).

Note: The flywheel diode is only required for the DC I/O module; **DO NOT** use with the 110V AC I/O module.

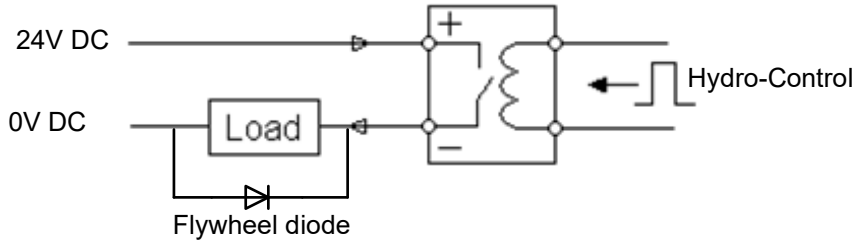


Figure 13: Digital Output Wiring Diagram

5.4 Custom I/O combination

This section shows suggested connections for mixed I/O requirements.

5.4.1 Connecting a DC input signal to the AC input card

When interfacing a DC input signal with the AC I/O card is required, refer to the example of electrical connection shown in Figure 14.

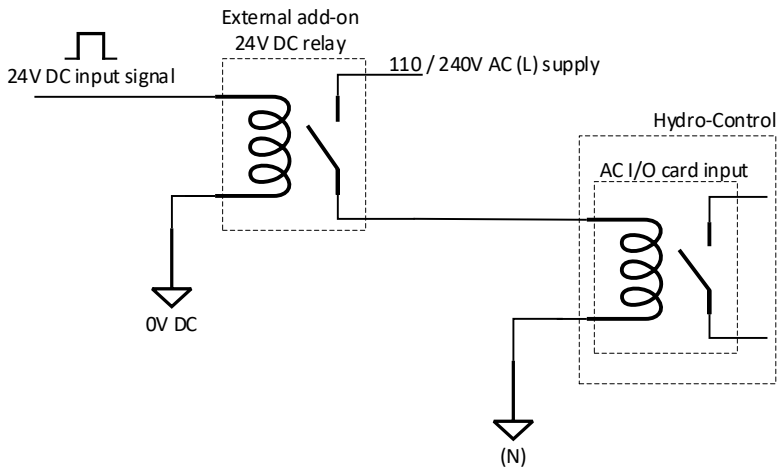


Figure 14: Connecting a DC input signal to an AC input card

5.4.2 Connecting an AC input signal to the DC input card

When interfacing an AC input signal with the DC I/O card is required, refer to the example of electrical connection shown in Figure 15.

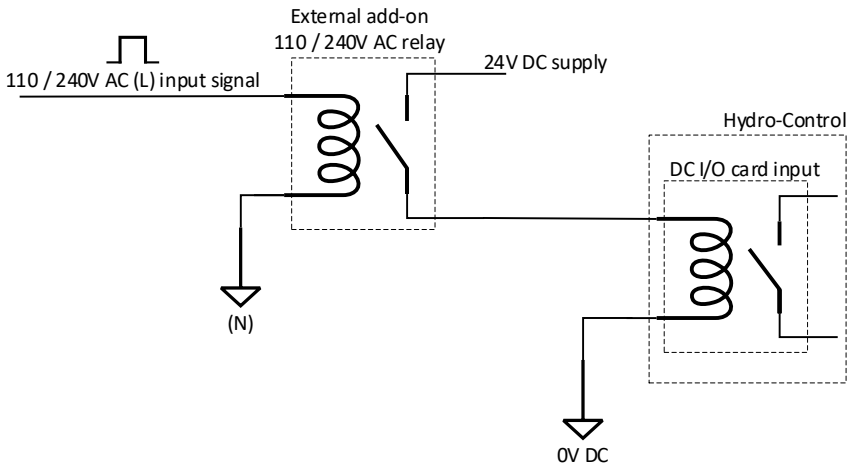


Figure 15: Connecting an AC input signal to a DC input card

5.4.3 Water meter input

It is essential that a solid-state relay capable of sufficient switching times is used for the water meter input.

To connect a 110/220VAC water meter signal to the HC07 DC input card, a solid-state relay capable of switching at 20Hz is required.

To connect a 24VDC water meter signal to the HC07 AC input card, a solid-state relay capable of switching at 20Hz is required.

Water meter pulse timing requirements:

HC07 I/O Card Type	ON Time [ms]	OFF Time [ms]
DC	≥ 20	≥ 20
AC	≥20	≥ 70

5.4.4 Activating an AC device from a DC I/O Module

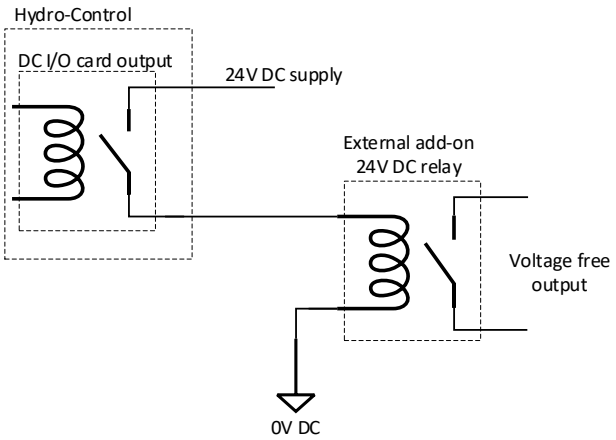


Figure 16: Activating an AC device using DC I/O card output

5.4.5 Activating a DC device from an AC I/O Module

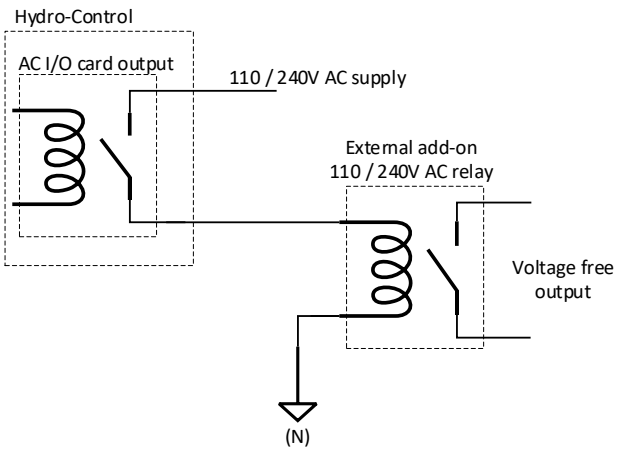


Figure 17: Activating a DC device using AC I/O card output

5.5 Wiring analogue inputs

The 'Analogue Inputs' are current loop inputs and accept a signal of either 0-20mA or 4-20mA. This is configurable on the 'Analogues' page of the 'Hardware' screen (refer to the operator guide). The connection to an Analogue Input is shown in Figure 18.

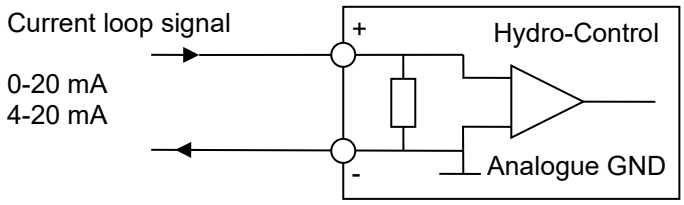


Figure 18: Analogue Input Current Loop Wiring Diagram

The wiring of the device connected to the Analogue Input will depend on whether the device has a self-powered loop or is powered by the loop itself.

Figure 19 shows the wiring diagram for connecting an analogue device that does not have a power source. These sensors are also known as "two-wire sensors".

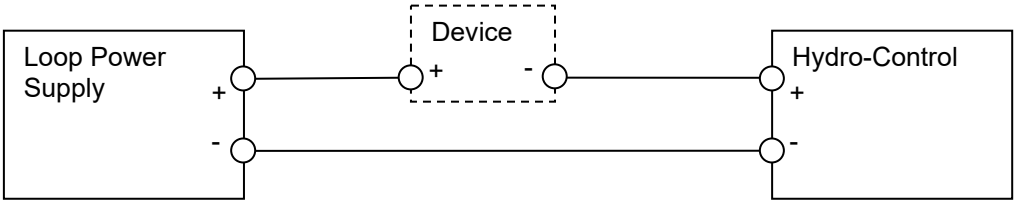


Figure 19: Connecting a loop-powered device

Figure 20 shows the wiring diagram for connecting an analogue device that has a separate power supply which powers the current loop.

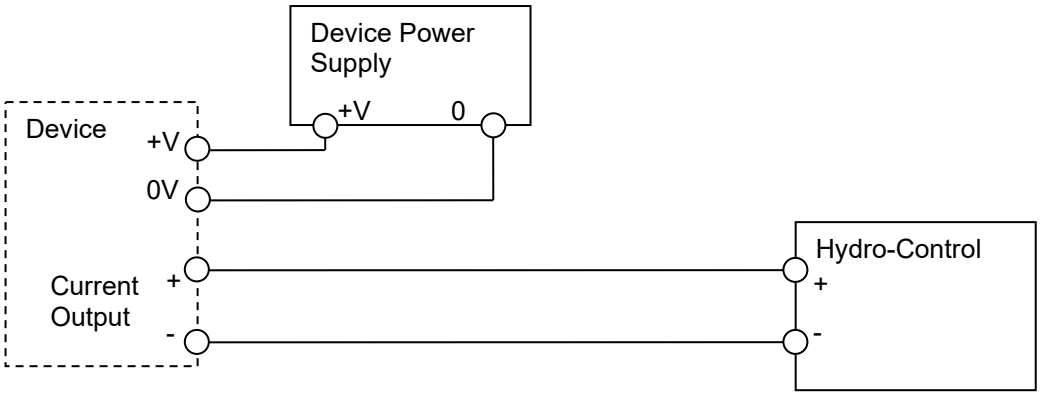


Figure 20: Connecting the current loop of an externally powered device

Figure 21 shows a method for connecting a 0-10V signal to the Hydro-Control. A 375Ω resistor connected in series is required. (The value of 375Ω can be obtained by placing two 750Ω resistors in parallel). It is recommended to use resistors with a tolerance of ±0.1%.

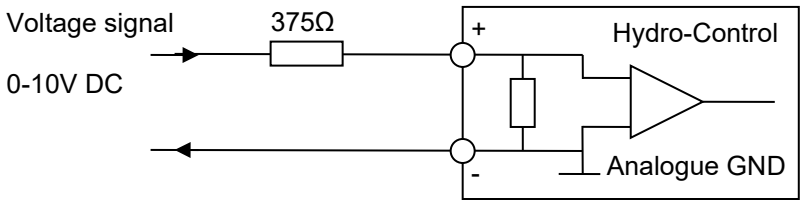


Figure 21: Connecting a voltage signal to the Analogue Input

5.6 Wiring analogue outputs

The analogue outputs from the Hydro-Control are designed as a constant current source. These are designed for future expansion.

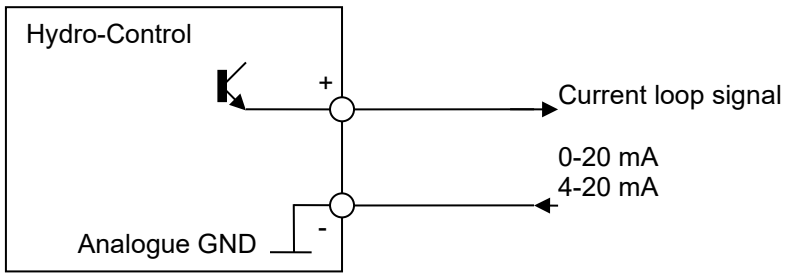


Figure 22: Analogue Output Wiring Diagram

Note that all '-' connections for the analogue inputs and outputs are connected to a common analogue ground.

5.7 Wiring recipe selection inputs

The recipe inputs are 2mA current sinks. They switch on a DC input signal with a nominal voltage of 24V (the DC voltage range is actually 9-28V). There is one common ground for all eight input signals as shown in Figure 23.

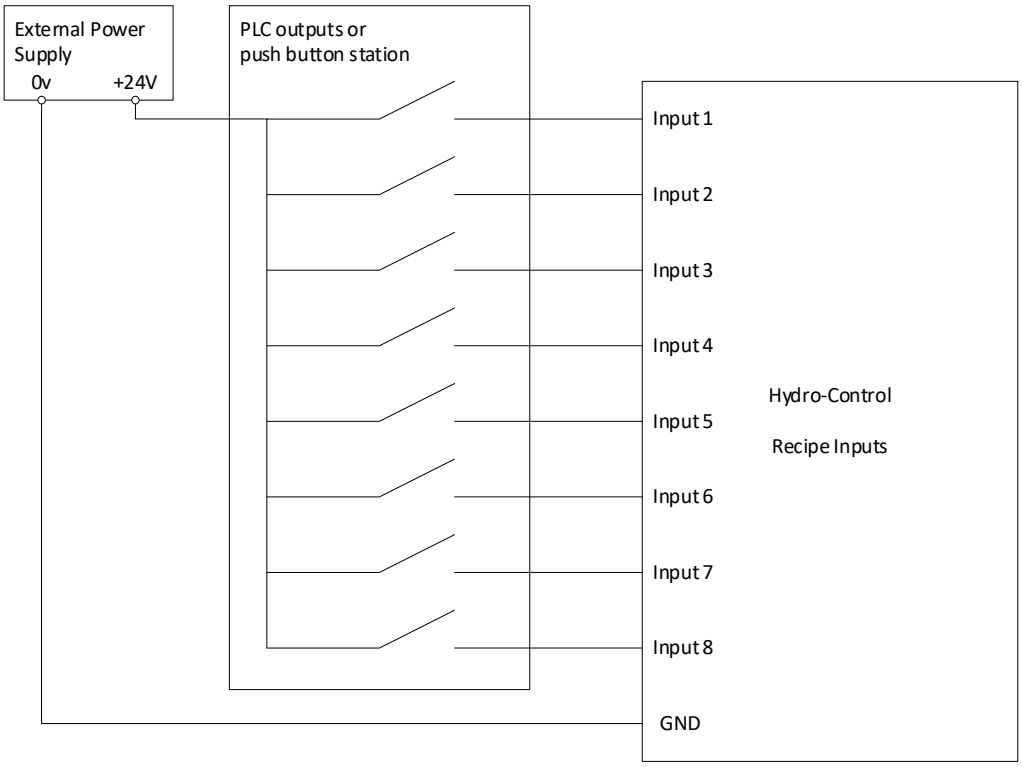


Figure 23: The recipe selection input wiring

6 Cables

6.1 Sensor cable

The sensor must be connected using an extension cable of a suitable length of two twisted pairs (4 cores total) screened (shielded) cable with 22 AWG, 0.35mm^2 conductors. It is recommended that a high-quality cable with a good braid screen and a foil screen is used to minimise the possibility of interference. Recommended cable types are Belden 8302 or Alpha 6373.

For optimum performance (and to comply with relevant safety regulations), all cables, including power and communications cables, must be screened, and the screen must be connected to the Hydro-Control.

The cable from the sensor to the control unit must be distanced from any heavy equipment and associated power cables, particularly the power cable for the mixer. Failure to separate the cables can lead to signal interference.

6.2 Analogue cables

The analogue cables should be of good quality screened cable. They should be distanced from heavy equipment and power cables to avoid signal interference.

7 USB Ports

The Hydro-Control has four USB ports built into the unit to enable the system to backup, restore and upgrade. Each of these can accept a standard USB memory stick.

A panel mount USB socket with an extension cable is available from Hydronix, Part Number 0175. This has a 1.5m cable, and the panel-mounted socket needs a 28mm diameter hole with a 3mm key cut-out. The maximum panel thickness is 5.2mm and a clearance of 22mm is needed behind the panel. Detailed mounting instructions are available from Hydronix.

1 Navigation

The Hydro-Control is a touch screen device. Navigation of the unit is achieved by touching the screen itself to activate relevant features.

To access the device's menu screens, use the buttons marked as 'Menu bar buttons' in Figure 24.

Figure 24: Main menu bar

The menu bar enables access to the following main categories:

Overview

Displays the main Overview Screen to control the mix cycle and view details about the batch and recipe currently in use.

Recipes

Displays the user-defined recipes stored in the system and allows the user to create, edit, and delete recipes.

Mix Log

Displays a list and details of previously run batches. Recipe calibration based on a previous batch can be performed using the submenu of this section.

System Parameters

Enables configuration of the system parameters, including water meter and valve setup, AUTO Mode setup, Auto-Track parameters, and alarm configuration.

Sensor Overview

Displays the sensor configuration screen allowing changes to the filtering and I/O settings.

Settings

Enables configuration of system time and date, units of measurement, IP address settings, and screen brightness. Software upgrade and database backup can be performed using the submenu of this section.

Hardware

Enables configuration of hardware and process-related inputs and outputs, selection of RS232 communication mode and performing I/O tests.

Comms

Displays diagnostic information regarding the RS232 communication.

User Management

Enables creating, modifying, and deleting user accounts. This section manages user restriction levels.

A detailed description of the navigation functions is covered in Chapter 2 of the Operators Guide (HD1048).

2 Basic Tests and Configuration

Once the wiring is completed, the Hydro-Control can be switched on by pressing the power button in the top left corner marked with the symbol .

After successfully starting up the system, it is recommended to commission the system by first testing the sensor communications and I/O using the following instructions. This should be done before setting up the system parameters.

Testing electrical connections made between the Hydro-Control and associated equipment is done using the 'Hardware' screen.

2.1 Sensor Testing

The Hydro-Control uses an RS485 serial interface to communicate with the Hydronix moisture sensor in the mixer. Once the unit has finished loading, it will display the main screen with a message in the centre reading 'Searching'.

During this time, the Alarm output is set to signify a problem to the control system.

Once the unit has searched all the RS485 addresses, it should find the sensor and display its reading in the trend display.

Run through the following procedure to test that the sensor is functioning properly:

1. Press the 'Display Unscaled' button on the Overview screen. This displays the incoming sensor value in terms of the unscaled units (0 in air, 100 in water). This is not a moisture % reading and allows the basic sensor value to be seen.
2. Whilst the mixer is empty (with the sensor in air), the sensor value should read between 0 and 15 (this number will vary depending on differences in the installation).
3. Place a wet cloth over the sensor's ceramic faceplate. The sensor value should rise up to between 70 and 90 (this number will also vary depending on how wet the cloth is, and the speed of the signal change will depend on the filtering settings in the sensor). This test can also be done by placing a hand over the sensor's ceramic face.

Successful completion of the above test confirms that the sensor installation and communications with the Hydro-Control are working. Press 'Display Moisture' to switch back to viewing % moisture values.

Sensor parameters and configuration is described in more detail in Chapter 5 Section 4.

2.2 Testing Digital I/O

The digital inputs and outputs can be tested using the 'Inputs / Outputs' page of the 'Hardware' screen (see Figure 25).

The status of the input signals can be seen on the 'Inputs/Outputs' page of the 'Hardware' screen. Deactivated inputs show as a grey circle and activated inputs show as a red circle. The external control system outputs can be activated and the input to the Hydro-Control checked.

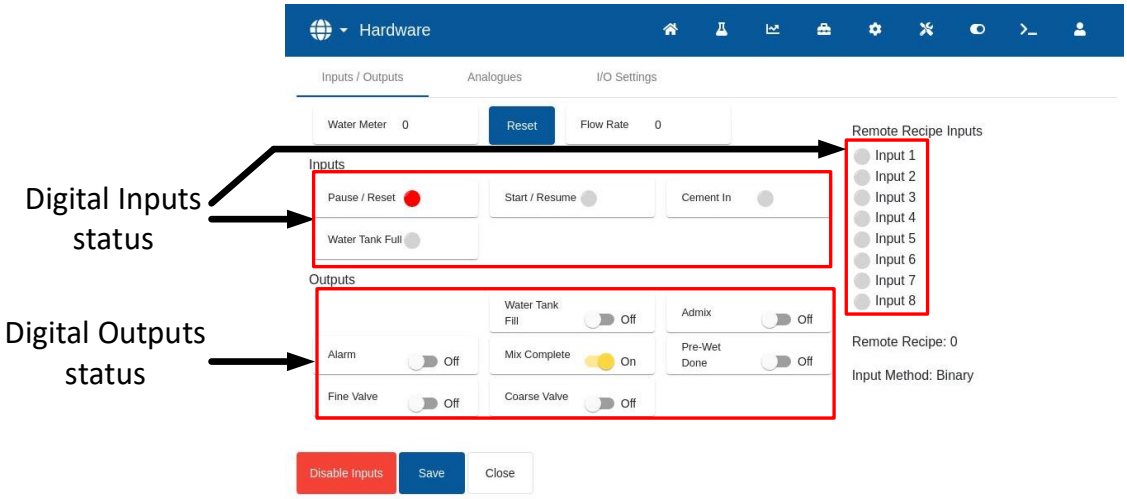


Figure 25: I/O test page

To stop the Hydro-Control from responding to the received inputs (for example, starting a mix when the Start signal is activated), press the 'Disable Inputs' button and then the 'Save' button. Whilst the inputs are disabled, the button is changed to 'Enable Inputs'. Additionally, a red 'Enable Inputs' button on the Overview screen will appear to remind the user that the inputs are currently disabled. Pressing the red button re-enables the inputs and removes the red button from the Overview screen.

Individual outputs can be activated and deactivated by pressing on the toggle switch icon next to each output's name. This allows the link to the external control system input to be checked.

The toggle switch icon is grey when the output is deactivated and yellow when activated.

2.3 Testing Valves and Flow Meter

To test the valves function correctly, follow this procedure:

1. Navigate to the 'Inputs / Outputs' page of the 'Hardware' screen (see Figure 25). Press the 'Reset' button is the 'Water Meter' value is not '0'.
2. Weigh a container and place it underneath the water inlet to collect the dosed water during the testing.
3. Open the Coarse Valve by pressing the toggle switch icon, seen close to the 'Coarse Valve' label, from let to right. This will change from Off (in grey) to On (in Yellow).
4. Check that the valve physically opens, water flows, and the water meter counts up.
5. Close the Coarse Valve by pressing the Coarse Valve icon again. It should change from yellow to grey.
6. Open the Fine Valve by pressing the toggle switch icon, seen close to the 'Fine Valve' label. This will change from Off (in grey) to On (in Yellow).
7. Check that the valve physically opens, water flows, and the water meter counts up.
8. Close the Fine Valve by pressing the Fine Valve icon again. It should change from yellow to grey.
9. Weigh the container and contents to determine how much water has been collected. Record this and the value from the Water Meter reading on the screen.

Use the following equation to determine the water meter flow per pulse for entry into the System Parameters screen:

$$Pulses\ Per\ Litre = {}^{Number\ Of\ Pulses}/_{Number\ Of Litres}$$

NB: Weight of water in kilograms = Volume of water in litres

2.4 Testing Analogue Inputs

The analogue inputs can be tested using the ‘Analogues’ page on the ‘Hardware’ screen (see Figure 26).

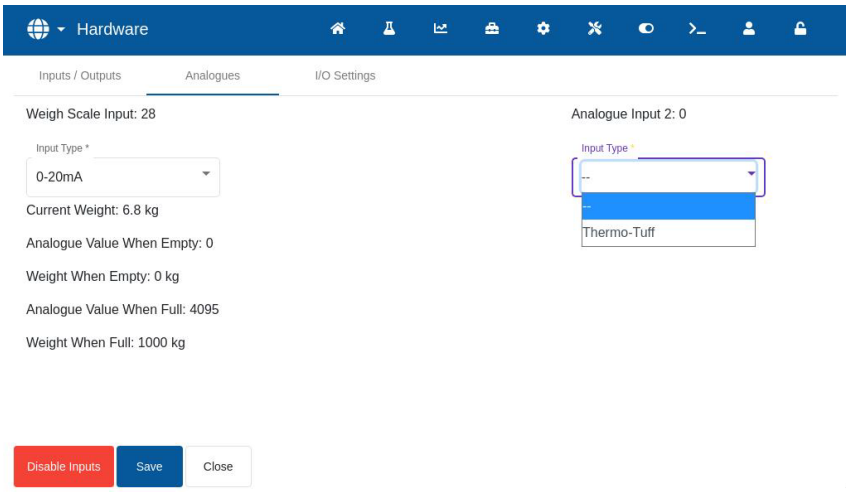


Figure 26: Analogue inputs configuration

The ‘Analogues’ page of the ‘Hardware’ screen, shown in Figure 26, enables the configuration of the Analogue Inputs and Outputs.

The ‘Weigh Scale’ input can be configured to accept either a 0-20mA or 4-20mA signal.

Once the input type has been selected, the input should be set to a known value, and the Weigh Scale Input should be checked. The Weigh Scale Input value displays 0 when at 0 (or 4 mA depending on the Input Type setting) and displays 4095 when the input is at 20mA.

The ‘Analogue Input 2’ (labelled on the device as ‘Analogue In’) is used for connecting Thermo-Tuff temperature sensor. If the temperature sensor is to be used, the ‘Analogue Input 2’ needs to be set accordingly (see Figure 26).

The ‘Analogue Out 1’ and ‘Analogue Out 2’ outputs are intended for future use.

2.5 Configuring the I/O Settings

The remaining I/O can be configured using the I/O Settings page on the ‘Hardware’ screen (see Figure 24 to Figure 29).

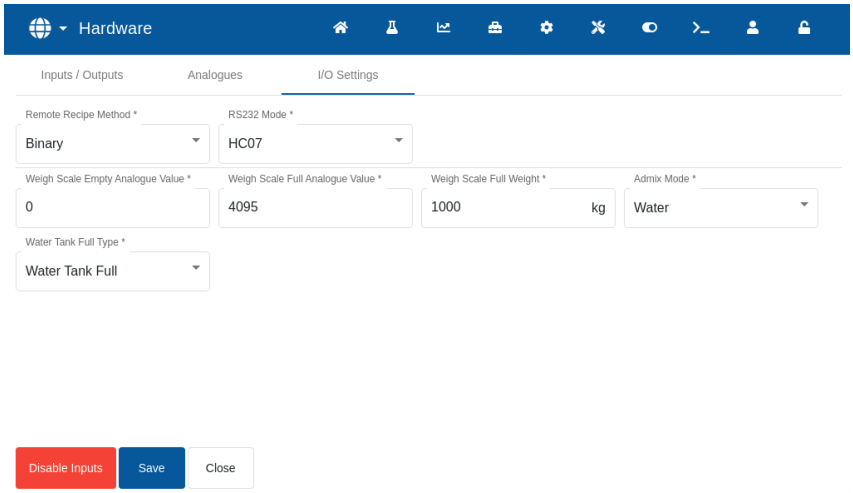


Figure 27: I/O settings page

Remote recipe selection is configured using the drop-down list of the 'Remote Recipe Method' field. Select the desired option, then press the 'Save' button. For more information, see Chapter 6 section 3.2.

Selecting the RS232 communication mode is done using a drop-down list of the 'RS232 Mode' field. Select the desired option, then press the 'Save' button. Configuring the RS232 communication settings is described in more detail in Chapter 7.

Selecting the Admix output mode is done using a drop-down list of the 'Admix Mode' field (Figure 28). Select the desired option, then press the 'Save' button.

The **Admix Signal** is used to control at which point the Admix output is set during the mix cycle. If the parameter is set to All, then the Admix output is set whilst the Hydro-Control is running a mix which is the same function as the Busy Mode parameter 'All' on the Hydro-Control V. Other options are explained in the section on Admix control in Chapter 6.

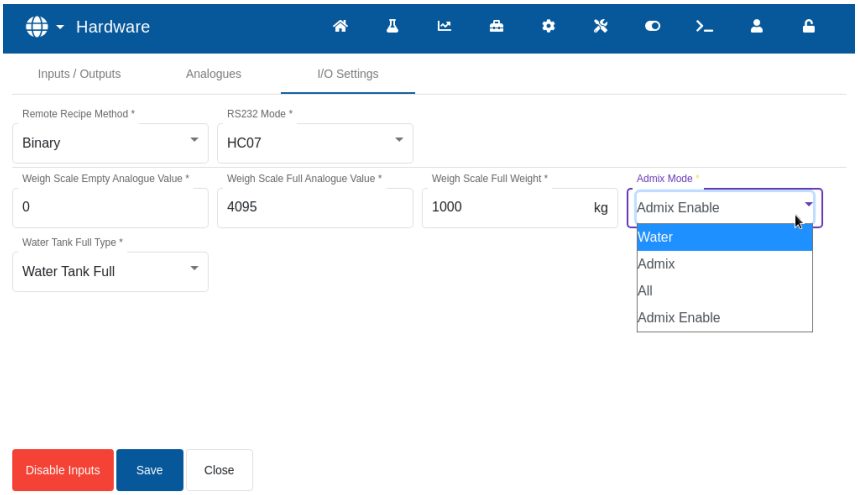


Figure 28: Admix output configuration

Selecting the Water Tank Full input mode is done using a drop-down list of the 'Water Tank Full Type' field (Figure 29). Select the desired option, then press the 'Save' button.

The **Water Tank Full signal** is used to indicate that the water weigh scale is full. If configured, the Water Tank Full signal can also be used to initiate a system shut down. This can be used in conjunction with a UPS. To configure the Shutdown signal, select 'Shutdown' from the selection box.

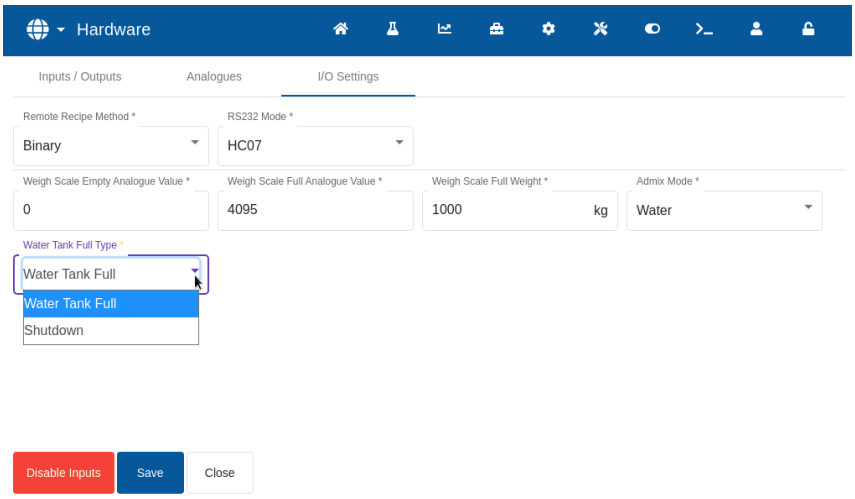


Figure 29: Water Tank Full input configuration

2.6 Setting up weighed water

To use the weighed water functionality, an Expansion Board must be fitted to the Hydro-Control. If this is not available, then the parameters will be greyed out.

The weighed water system is set up using the 'Analogues' page and the 'I/O Settings' page of the 'Hardware' screen. Follow the instructions described below to perform the initial setup and calibrate the input from the weigh scale.

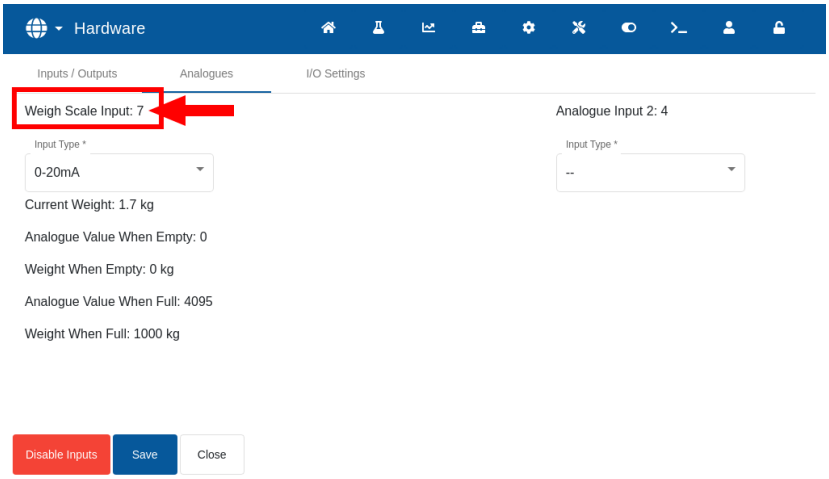


Figure 30: Weighed water configuration – step 1

With the water tank empty, copy the 'Weigh Scale Input' value (the 'Analogues' page, see Figure 30) into the 'Weigh Scale Empty Analogue Value' field (the 'I/O Settings' page, see Figure 31).

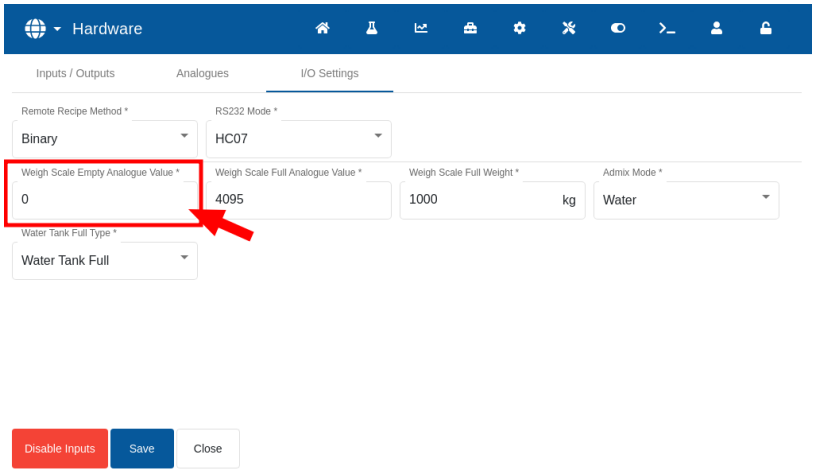


Figure 31: Weighed water configuration – step 2

The Hydro-Control needs now to be set to use weighed water. This is done on the 'Water Setup' page of the 'System Parameters' screen by setting the 'Water Mode' to 'Weighed' (see Figure 32 and Figure 35).

Once this is set, the Hydro-Control will activate the 'Water Tank Fill' output to open the valve to fill the water tank to the high level.

When the tank has reached the high level, this is signalled back to the Hydro-Control with the 'Water Tank Full' input signal. Now the 'Weigh Scale Input' value needs to be copied into the 'Weigh Scale Full Analogue Value' field.

Enter the 'Weigh Scale Full Analogue Value' figure for the water tank and press the 'Save Changes' button.

3 System Parameters

The ‘System Parameters’ screen enables configuration of the system parameters, including water meter and valve setup, AUTO Mode, Auto-Track parameters, and alarm configuration.

This section describes the system parameters functions, their units, range, and the default value.

3.1 General

At the bottom of the System Parameters subpages are two buttons:

- Save – This button saves changes to the system parameters.
- Close – If unsaved changes are detected, the user is given the option to ‘Discard’ and return to the Overview screen or ‘Cancel’ and return to editing system parameters.

3.2 Water Setup

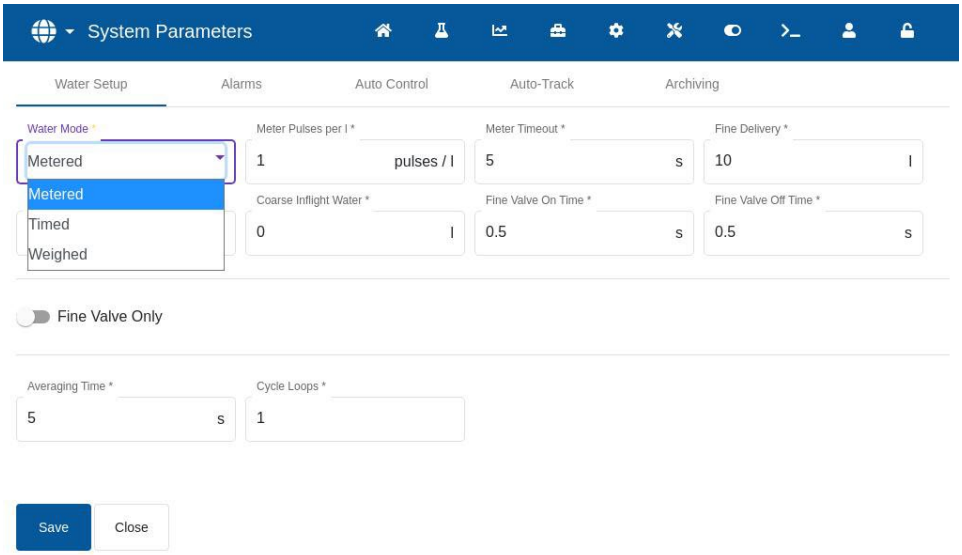


Figure 32: Water addition modes

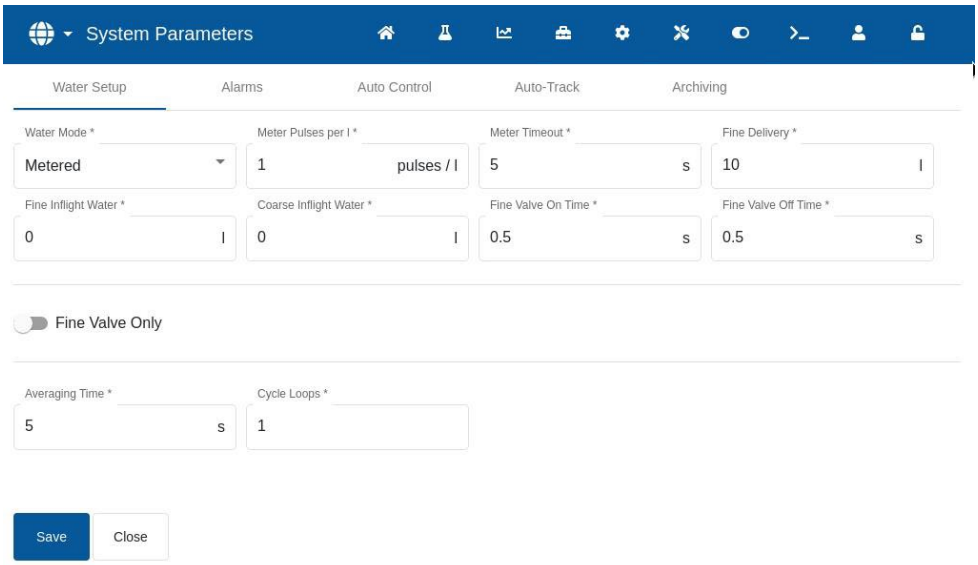


Figure 33: Water setup page - metered

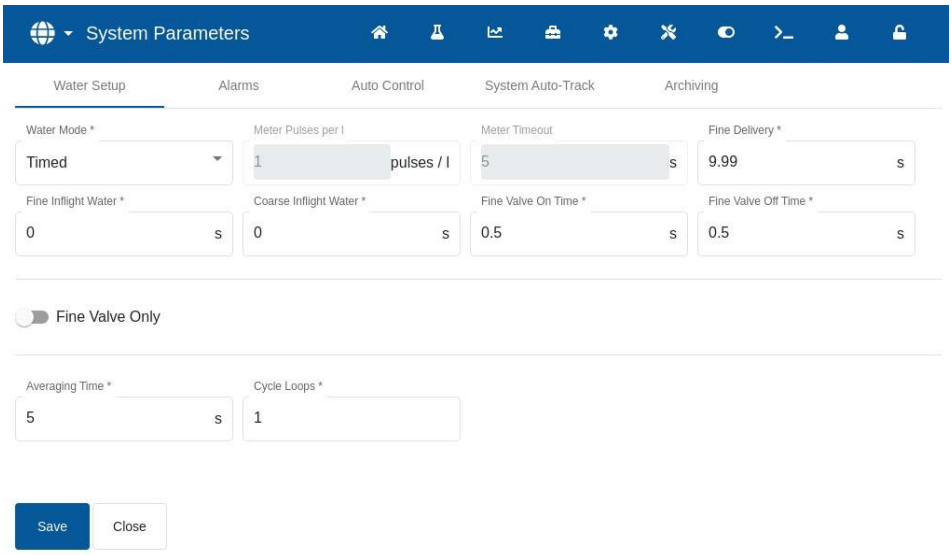


Figure 34: Water setup page – timed

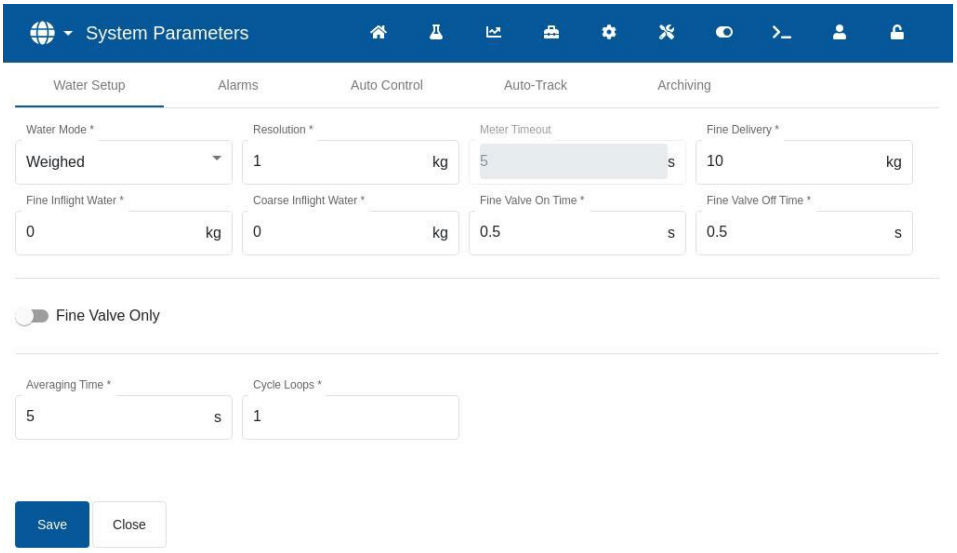


Figure 35: Water setup page - weighed

Each item on the parameters page is described in the following pages. Greyed-out items are not required for the currently selected water mode.

Parameter	Units	Default	Range
Water Mode	None	Metered	Metered/Timed/Weighed
Pulses Per Litre	Pulses Per Litre/Gallon	1	0.1 – 10,000 Pulses per Litre 0 – 2641.7 Pulses per Gallon
Water Meter Timeout	Seconds	5	0 – 100 s
Fine Delivery	Litres/Gallons	10	0 – 100 L 0 – 26.4 Gallons

Fine Inflight Water	Litres/Gallons	0	0 – 100 L 0 – 26.4 Gallons
Coarse Inflight Water	Litres/Gallons	0	0 – 100 L 0 – 26.4 Gallons
Fine Valve On Time	Seconds	0.5	0 – 100 s
Fine Valve Off Time	Seconds	0.5	0 – 100 s
Fine Valve Only	None	No	ON / OFF
Averaging Time	Seconds	5	0 – 100 s
Cycle Loops	None	1	1 – 100
Resolution	Kg/lb	1	0-200

Water Mode controls how the water is measured into the mixer. If using a water meter to measure the water dosed into the mixer, this should be set to 'Metered'. If using a weight measurement system, then the 'Weighed' water mode should be selected. 'Timed' water mode is recommended for use when there are problems with the water measurement device. More information on selecting water modes is available in Chapter 6.

Pulses Per Litre sets the number of pulses received when dosing one litre of water into the mixer in Metered Mode.

Water Meter Timeout is the amount of time after opening the water valve that the system will wait before alarming if it has not received a water meter pulse.

Fine Delivery is the quantity of water at the end of the preset or calculated dose fed using the fine valve only.

Fine Inflight Water is the quantity of water that continues to flow after the fine valve has been closed.

Coarse Inflight Water is the quantity of water that continues to flow after the coarse valve has been closed. This valve is used when the Pre-wet phase is run in preset mode.

Fine Valve On Time is the amount of time it takes to turn on the fine valve. This should be referenced from the valve manufacturer's data sheet.

Fine Valve Off Time is the amount of time it takes to turn off the fine valve. This should be referenced from the valve manufacturer's data sheet.

The valve on/off times are used to set the minimum pulse of the valve during AUTO Mode addition, to prevent the valves from being damaged due to excessive use.

Fine Valve Only sets the system to only dose water using the fine valve. In this mode, it will never activate the coarse valve.

Averaging Time is the amount of time at the end of the dry and wet mix phases that the system will use to take an average moisture reading value.

Cycle Loops is a setting that is used to repeat the wet mix addition and the wet mixing phases. It is generally only useful for linearity testing and so should be left set to 1.

Resolution sets the resolution of the weigh scale value for systems set to use weighed water. This value is not displayed unless the water mode is set to weighed water.

3.3 Alarms

The ‘Alarms’ page of the ‘System Parameters’ screen allows each of the alarms in the system to be disabled. The parameters of this section are detailed in Chapter 10 of the Operators Guide (HD1048).

3.4 Auto Control

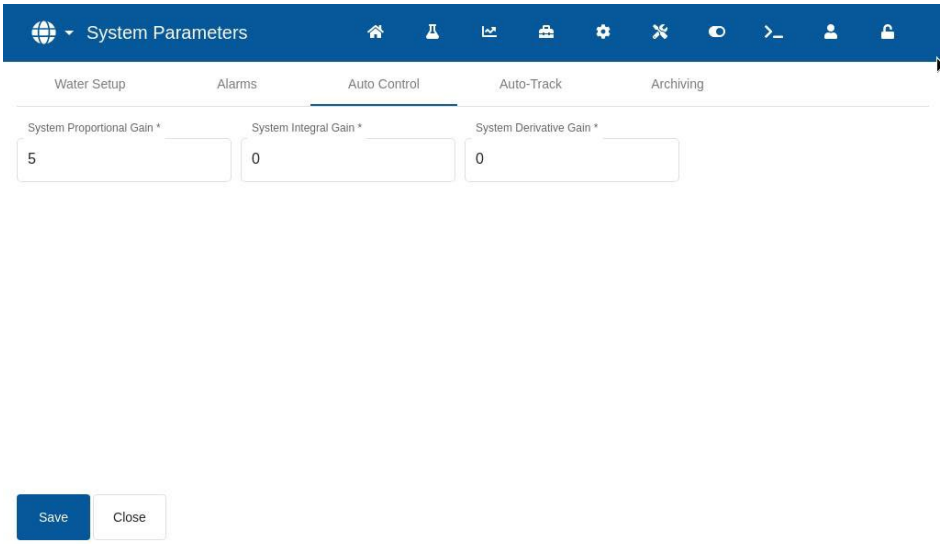


Figure 36: Auto control page

Parameter	Units	Default	Range
System Proportional Gain	None	5	-100 – 100
System Integral Gain	None	0	-100 – 100
System Derivative Gain	None	0	-100 – 100

The **System Proportional, System Integral** and **System Derivative Gain** parameters control the water valves during AUTO Mode. They compare the current sensor value with the target and generate a control signal for the speed of water addition (during the process the speed of water addition is controlled initially by opening the coarse and fine valve fully and, as the error is reduced, by closing the coarse valve and varying the pulse rate of the fine valve). Optimising these parameters is described in the Operators Guide (HD1048) in the chapter ‘Using Moisture Control’.

These system parameters can be over-ridden from within each recipe.

3.5 Auto-Track

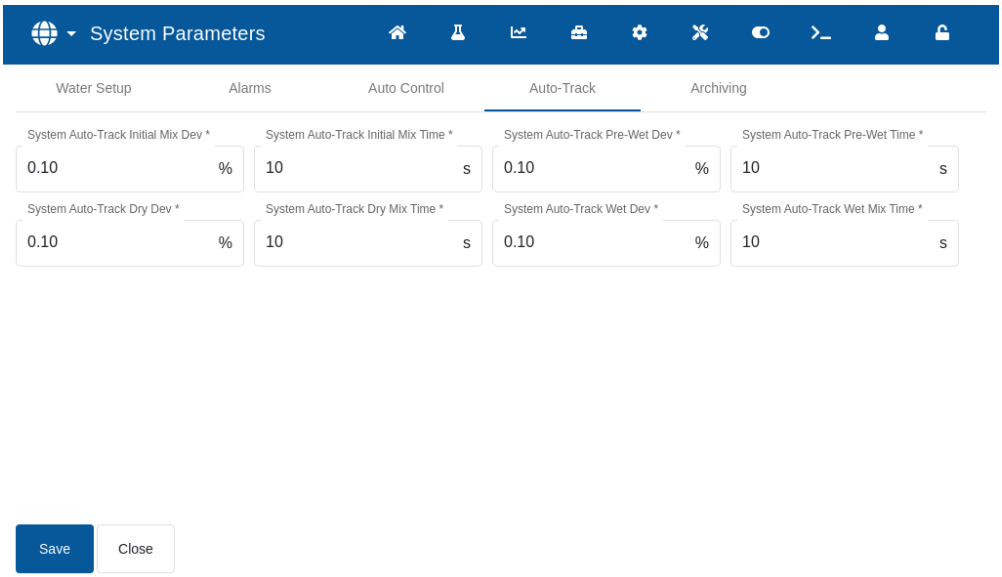


Figure 37: System Parameters - Auto-Track

Parameter	Units	Default	Range
Auto-Track Initial Mix Dev	%	0.1	0 – 100
Auto-Track Initial Mix Time	Seconds	10	0 – 100
Auto-Track Pre-Wet Mix Dev	%	0.1	0 – 100
Auto-Track Pre-Wet Mix Time	Seconds	10	0 – 100
Auto-Track Dry Dev	%	0.1	0 – 100
Auto-Track Dry Mix Time	Seconds	10	0 – 100
Auto-Track Wet Dev	%	0.1	0 – 100
Auto-Track Wet Mix Time	Seconds	10	0 – 100

The **Auto-Track Initial Mix Dev, Auto-Track Initial Mix Time, Auto-Track Pre-Wet Mix Dev, Auto-Track Pre-Wet Mix Time, Auto-Track Dry Dev**, **Auto-Track Dry Mix Time**, **Auto-Track Wet Dev** and **Auto-Track Wet Mix Time** parameters are used by the Auto-Track feature to control when the system finishes the initial, pre-wet, dry and wet mix phases. During the initial, Pre-Wet, dry or wet mix phase, if the variation in the sensor value is less than the specified Mix Deviation for the Mix Time then the mixing phase will continue to the next phase.

For more details regarding the Auto-Track feature, refer to Chapter 6 Section 4.4. These system parameters can be over-ridden from within each recipe.

3.6 Archiving

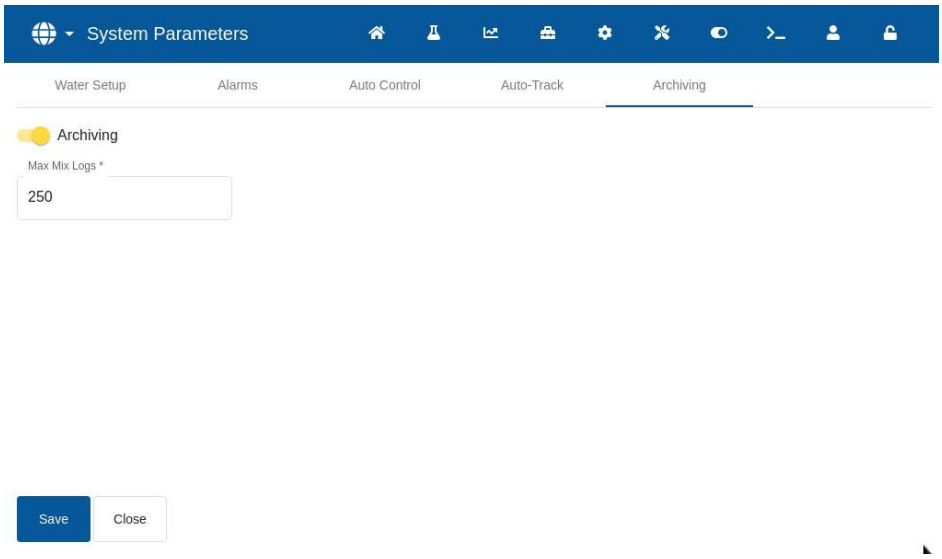


Figure 38: Archiving page

Parameter	Units	Default	Range
Archiving	None	OFF	ON/OFF
Max Mix Logs	None	25	1-1000

The **Archiving** switch, when in the ON state (signified by yellow colour), will enable the Hydro-Control to save all mix log data that exceeds the Max Mix Logs limit to archive files. Once the Max Mix log limit has been reached, any Mix Logs that are removed from the main database are copied to the archive file. If a USB memory stick is inserted into the device, and a Backup is requested, the archive files will be moved to the USB stick. This will enable the user to keep a record of older mix logs.

Switching the archiving feature off will delete the archives saved on the device. Saving the archives onto a USB memory stick prior to deletion is recommended.

Backing up archives is described in more detail in Chapter 11, Section 1.3 of the Operators Guide (HD1048).

The **Max Mix Log** parameter limits the maximum number of mix logs saved to the database.

4 Sensor Overview

With a sensor connected, the measurement parameters and settings can be changed by using the Sensor Overview screen and its subpages. This section of the manual briefly describes the options available in the subpages. For more detailed information on the available parameters, refer to the Sensor Configuration and Calibration Guide (HD0679).

4.1 General

The ‘Sensor Overview’ screen menu is separated into two main sections: ‘Configuration’ and ‘Diagnostics’. These are accessible using the buttons marked ‘1’ and ‘2’, respectively, in Figure 39.

The ‘Configuration’ screen has seven subpages, described in sections 4.2 to 4.9, and the ‘Diagnostics screen has two subpages, described in sections 4.10 and 4.11.

Not all subpages of the ‘Sensor Overview’ screen are available for Plant Operator or Supervisor level user accounts.

At the bottom of the Sensor Overview Configuration subpages are two buttons:

- Save – This button saves changes to the sensor’s internal settings.
- Refresh – Acquires configuration currently saved in the sensor memory.

Note: Any changes to the settings listed on this page must be downloaded into the sensor’s memory by pressing the ‘Save’ button.

If changes are only done in the user interface fields (the ‘Save’ button is not pressed after changes are made), navigating away from the screen or pressing the ‘Refresh’ button will cause the changes to be discarded.

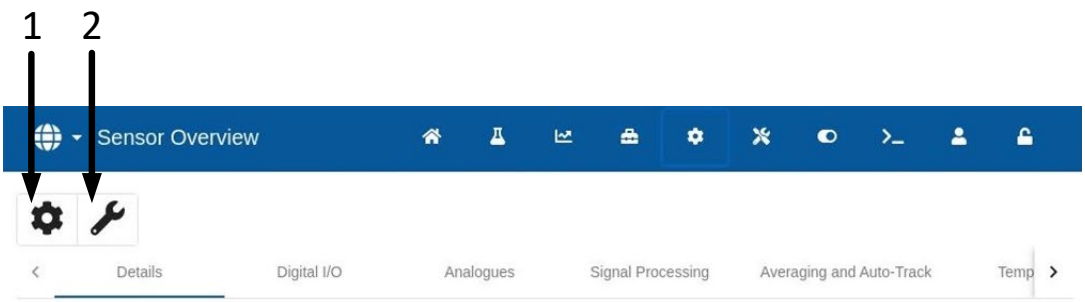


Figure 39: Sensor overview screen navigation

4.2 Details

The top part of this section displays the sensor ID, the current firmware version of the sensor and allows the setting of the sensor's name and address on the RS485 network.

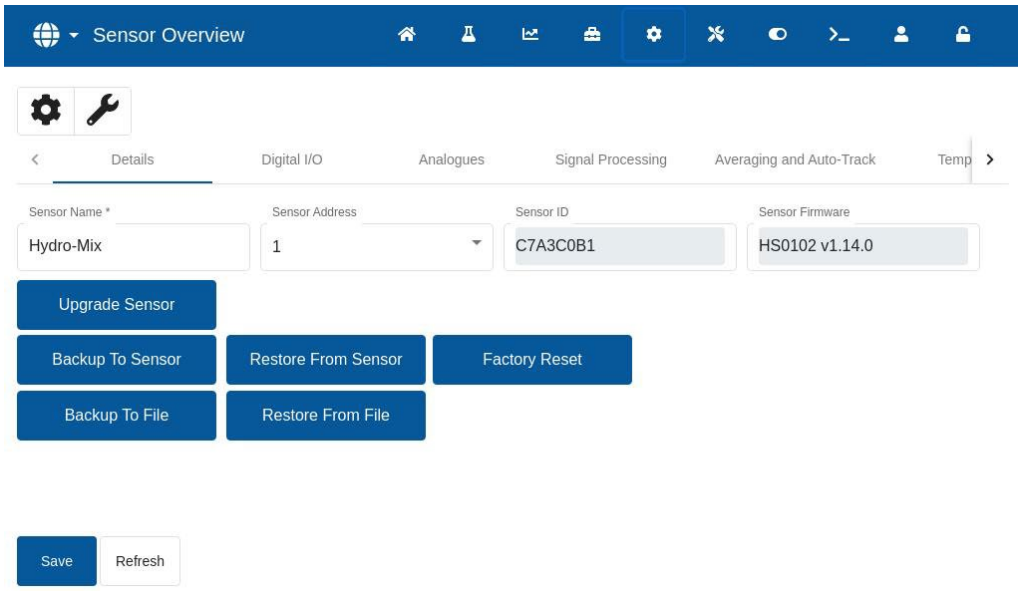


Figure 40: The sensor details page

The bottom part contains buttons that enable access to the following functions:

Upgrade Sensor

The firmware held in the sensor's flash memory may be upgraded from a file (HS0104) available for download from the Hydronix web site. The sensor firmware upgrade feature (accessible by pressing the 'Upgrade Sensor' button) uses a single upgrade file containing the firmware for all Hydronix sensors.

Backup To Sensor and Restore From Sensor

All Hydronix sensors utilising firmware HS0102 and above can store a copy of the sensor configuration settings in the internal memory. This facility enables the user to backup the sensor configuration so it can be restored later if required. This is a secondary internal calibration backup to the factory default settings.

Factory Reset

During manufacture, all factory settings are stored in a reserved memory location to enable the sensor to be restored to default factory settings.

Backup To File and Restore From File

The Backup and Restore From File functions save the sensor's settings to an XML file. Backing up a sensor after commissioning facilitates restoring a sensor if the configuration is changed accidentally. This function also enables the user to keep a record of all settings. To create a backup, Insert a USB flash drive, select 'Backup', and choose a file location. Once a backup has been created, the sensor can be restored using this file. To restore, insert a USB flash drive with a sensor backup file on, click 'Restore' and select the relevant backup file.

4.3 Digital I/O

This section allows the digital input/output options to be configured.

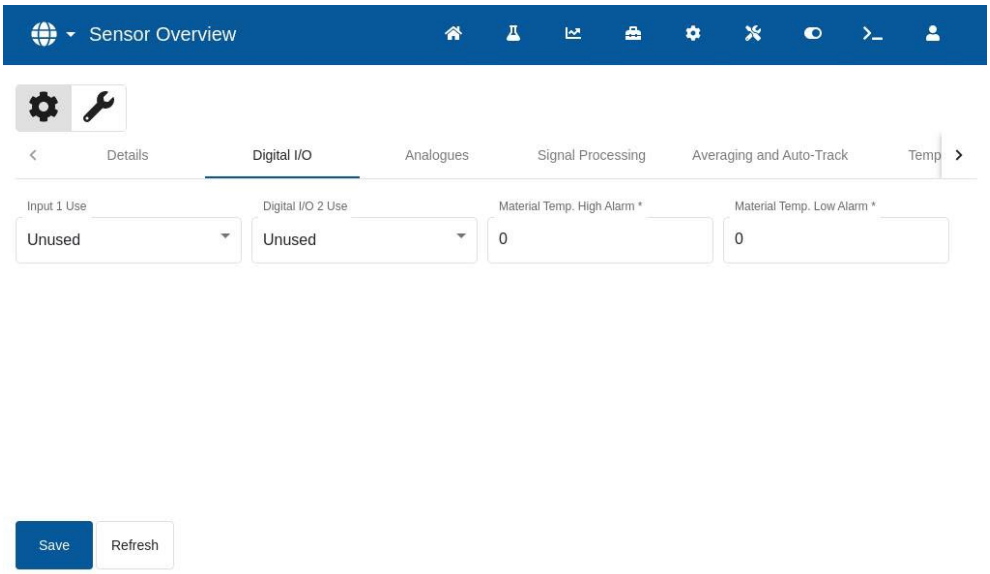


Figure 41: Digital I/O page

4.4 Analogues

This section allows the setup of the analogue outputs of the sensor to be adjusted. As the Hydro-Control communicates with the sensor using the RS485, the analogue outputs can be used independently of the main control itself. As the material calibration is downloaded to the sensor when the recipe is changed, if the analogue output is set to output Filtered Moisture then the analogue output will follow the Hydro-Control moisture value.

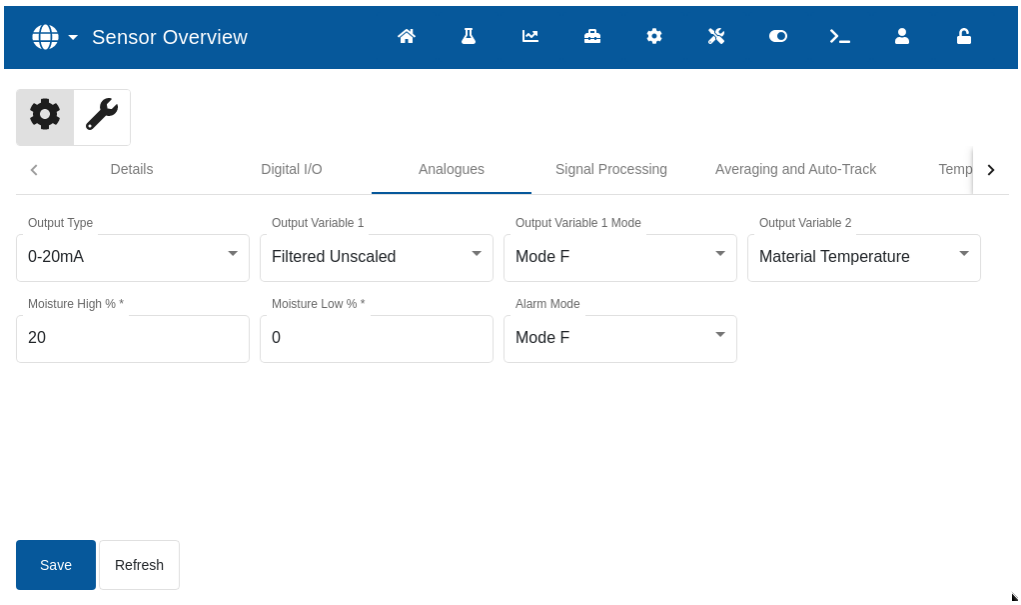


Figure 42: Analogues page

4.5 Signal Processing

This section enables adjusting the sensor's signal processing parameters. It may be necessary to adjust these depending on the mixer being used to improve the stability and response of the sensor reading.

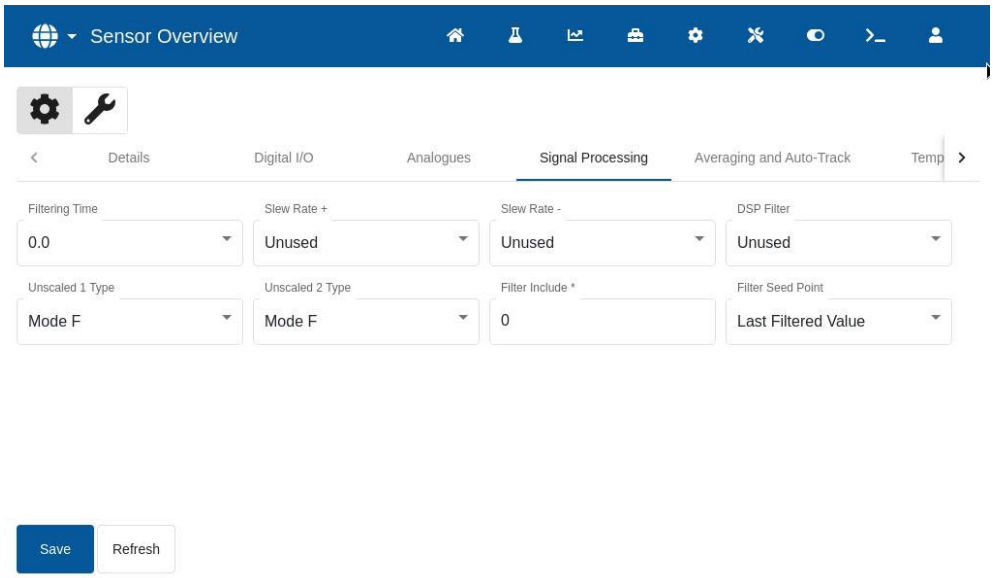


Figure 43: Signal Processing page

4.6 Averaging and Auto-Track

This section configures the Averaging function in the sensor. This is not generally used in mixer applications.

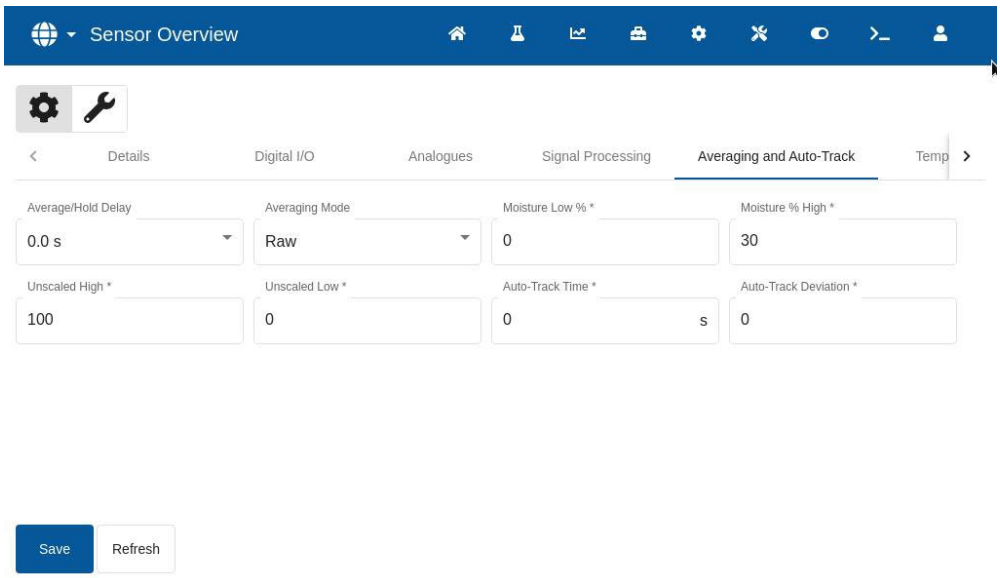


Figure 44: Averaging and Auto-Track

4.7 Temperature Compensation

This section allows the temperature compensation parameters to be changed. Changing these settings when using a Hydro-Probe Orbiter and changing the Orbiter Arm may be necessary. An Engineering Note is included with relevant Orbiter Arms, which details the settings that must be entered. With certain Hydro-Mix sensors, these coefficients are set for each sensor in the factory and should not be changed.

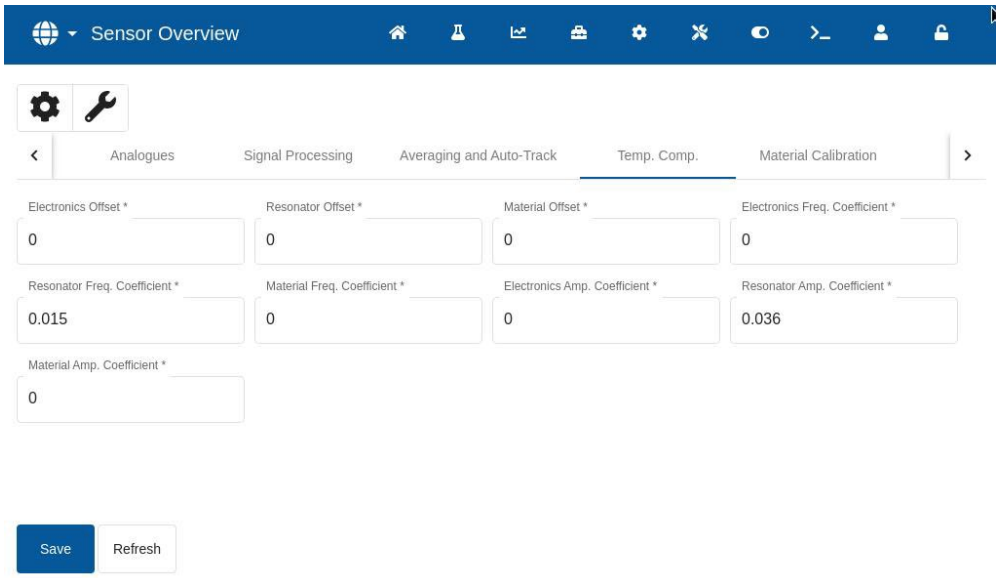


Figure 45: Temperature compensation page

4.8 Material Calibration

This section shows the current material calibration in the sensor. This is updated when the recipe in the Hydro-Control is changed. The current measurement mode selected for the recipe is also displayed (for HS0102 sensors).

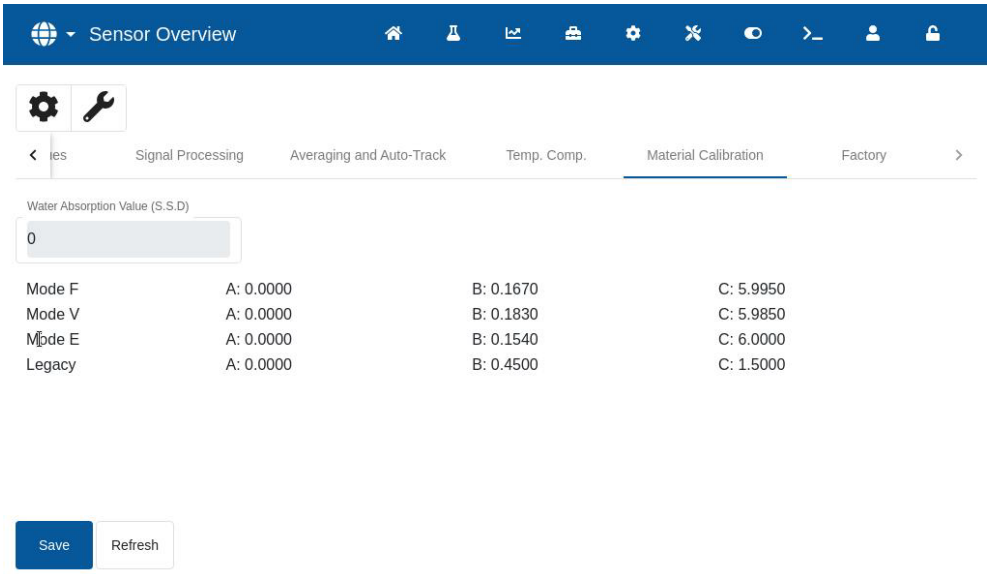


Figure 46: Material Calibration page

4.9 Factory

This page displays the current measurement calibration and enables a new calibration of the sensor to be performed.

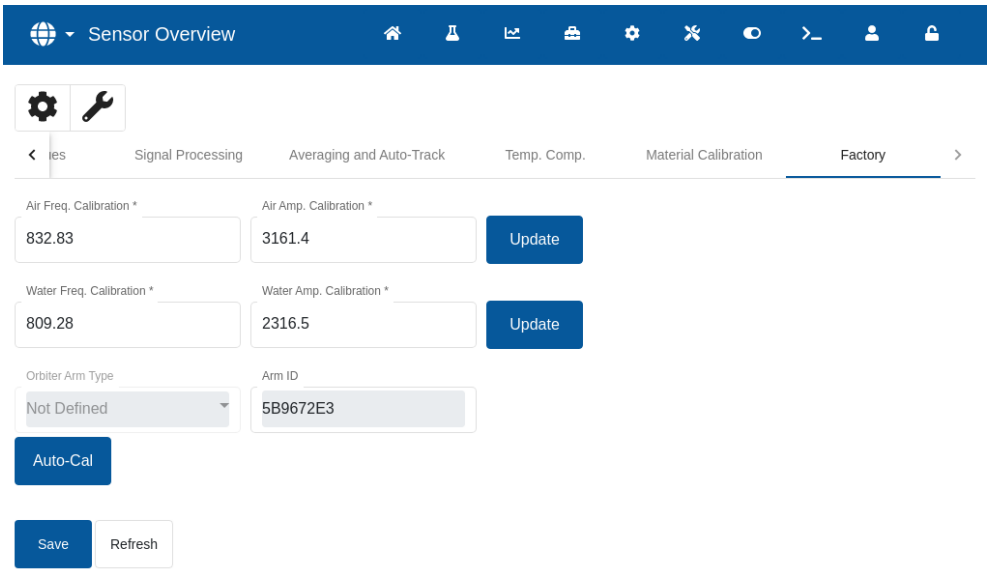


Figure 47: Factory settings page

Air / Water Frequency and Amplitude calibration settings

This section allows the factory calibration of the sensor to be changed. This is necessary if the sensor is a Hydro-Probe Orbiter and the arm is changed or if the sensor is a Hydro-Mix and the ceramic faceplate is replaced.

To set the factory calibration, ensure the sensor faceplate is in air and press the ‘Update’ button next to the air parameters. After a short delay, the new air frequency and amplitude settings will be displayed in the entry boxes. Next, hold the sensor so that the faceplate is immersed in water as per the instructions in the sensor user guide and press the lower ‘Update’ button. The ‘Save’ button must be pressed to download the new calibration data into the sensor.

An alternative method to factory calibration is to use the Auto-Cal function. This can be used to simplify the factory calibration process. After the Auto-Cal is performed, it may be necessary to recalibrate the recipes.

To use the Automatic Calibration function, press the 'Auto-Cal' button and ensure the sensor faceplate is in air. After a short delay the Hydro-Control will display an indication as to whether the Auto-Cal was successful or not.

Orbiter Arm

The ‘Orbiter Arm Type’ and ‘Arm ID’ fields are only available when a Hydro-Probe Orbiter sensor is connected.

4.10 Sensor Diagnostics – Live Data

This screen shows information about the sensor. This can be used to perform basic diagnostic checks to establish if the sensor is operating correctly.

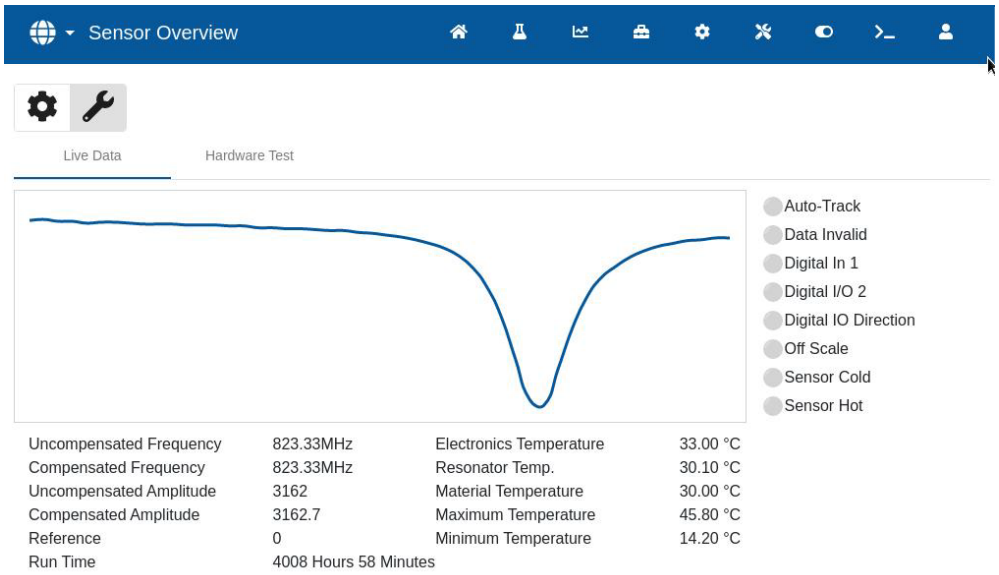


Figure 48: Live Data diagnostics page

4.11 Sensor Diagnostics – Hardware Test

The two analogue outputs are tested by forcing each output to a known value. This is useful for checking connections with external systems. To perform the test a value between ‘0’ and ‘20’ needs to be input into the desired ‘Current Loop’ field and the ‘Start’ button needs to be pressed. The current level of the corresponding output needs to be checked against the input field value to verify that the two match.

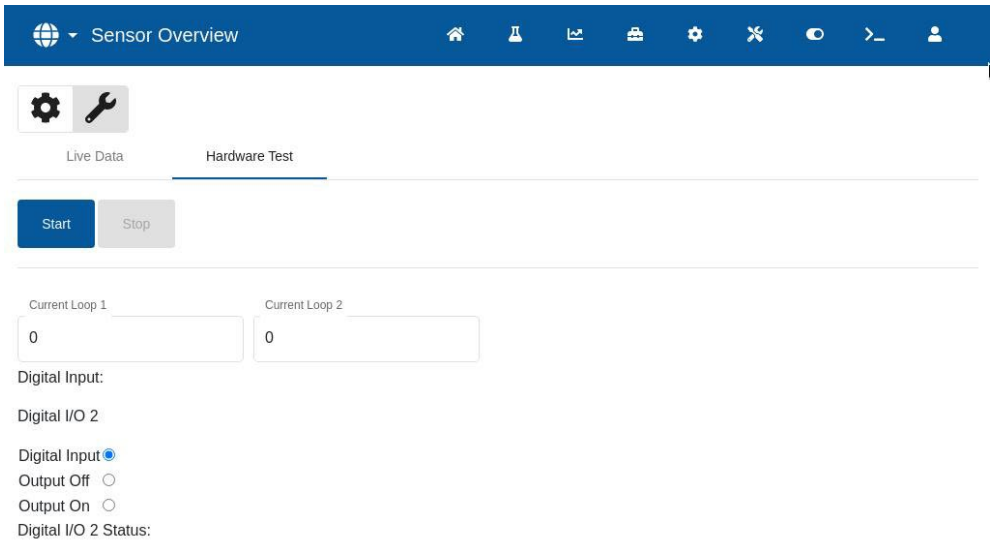


Figure 49: Hardware Test diagnostics page

5 Settings

This section describes the ‘Settings’ screen parameters functions.

5.1 General

At the bottom of the ‘Settings’ screen subpages are two buttons:

- Save – This button saves changes to the system parameters.
- Close – If unsaved changes are detected, the user is given the option to ‘Discard’ and return to the Overview screen or ‘Cancel’ and return to editing system parameters.

5.2 System

A detailed description of the functions available on the ‘System’ page is covered in Chapter 10 of the Operators Guide (HD1048).

5.3 Defaults

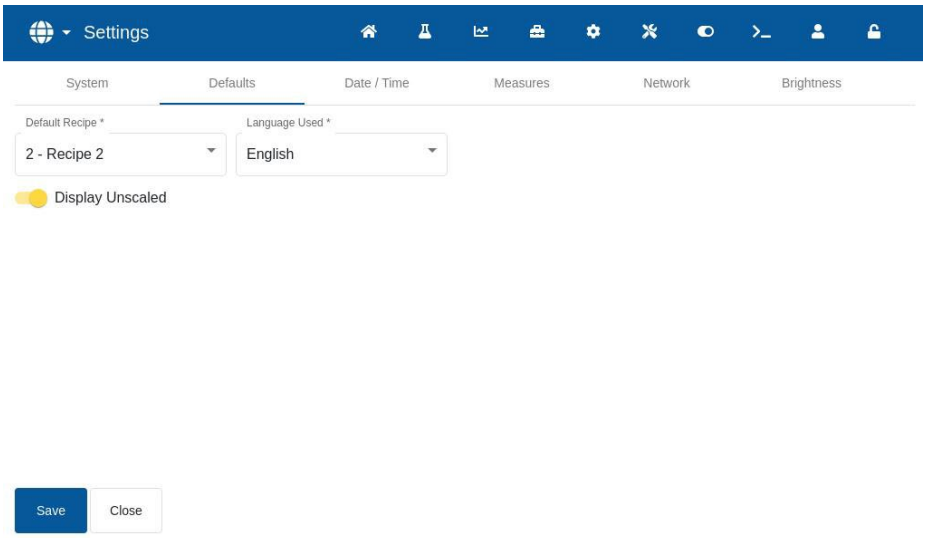


Figure 50: Settings – Defaults page

Settings parameter	Description
Default Recipe	Default recipe name displayed on the Recipes Screen.
Language Used	Sets the menu language.
Display Unscaled	Sets the Unscaled value being displayed by default after powering on or rebooting the Hydro-Control.

5.4 Date/Time

The system 'Date / Time' settings are used to set the clock and the date in the Hydro-Control. The date and time are used to log times against the mix logs.

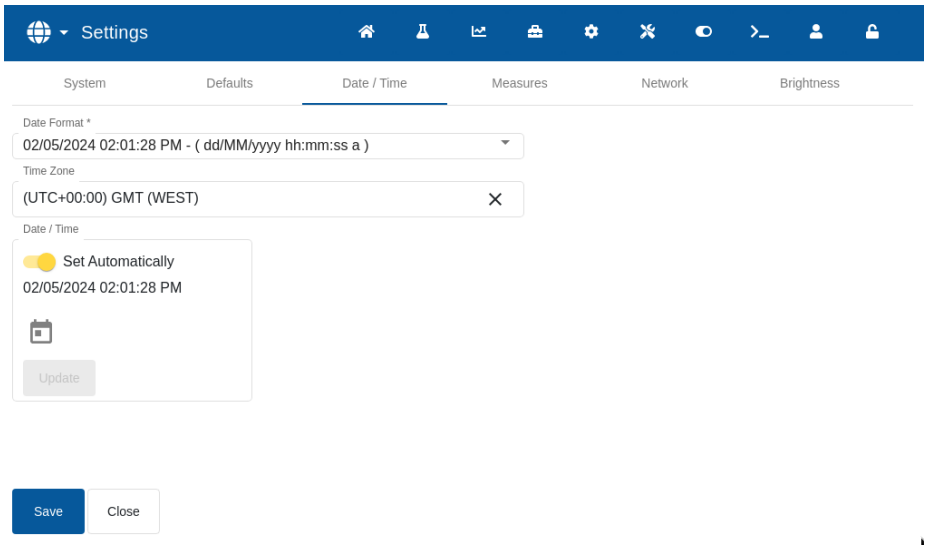


Figure 51: Settings - Date/Time page

Settings parameter	Description
Date Format	Sets the date format.
Time Zone	Sets the time zone.
Date / Time	Sets the current time.

5.4.1 Selecting date format

The device supports four date formats. The desired format can be selected by pressing on the 'Date Format' field. A drop-down list will appear. Press on the preferred format, then press the 'Save' button (refer to Figure 52).

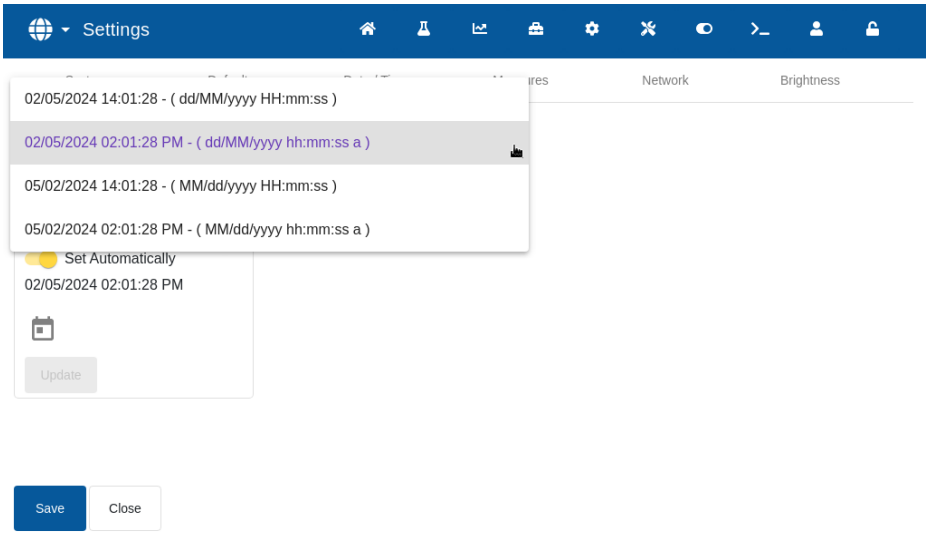


Figure 52: Settings - selecting date format

5.4.2 Selecting Time Zone

To change the current time zone parameter, press on the 'Time Zone' field. Select the desired time zone from the drop-down menu and press the 'Save' button. (refer to Figure 53).

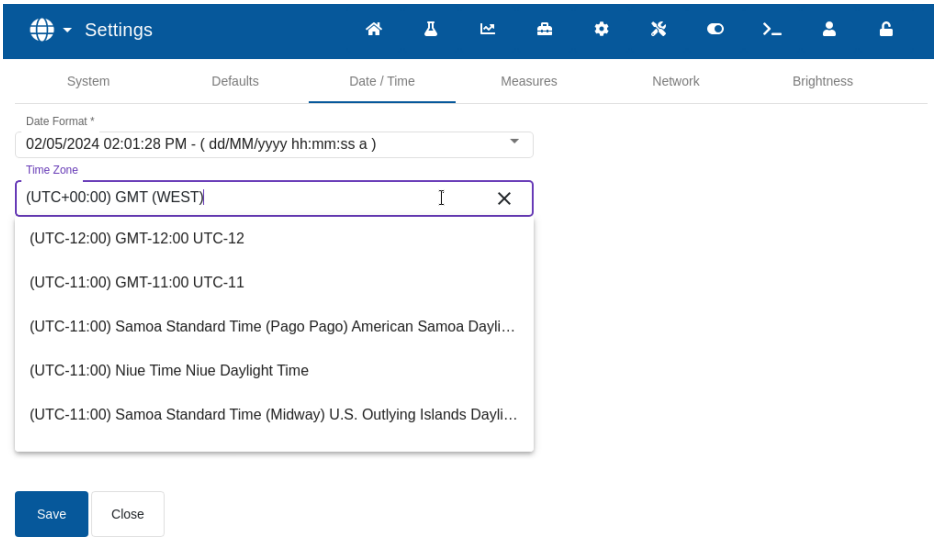


Figure 53: Settings - selecting the time zone

5.4.3 Setting date and time

To allow the device to update its internal time and date settings automatically, the 'Set Automatically' toggle switch needs to be set to on (signified by the switch icon turning yellow, see Figure 54). An internet connection is required for this feature to work. After toggling the 'Set Automatically' switch, press the 'Save' button to retain the new settings.

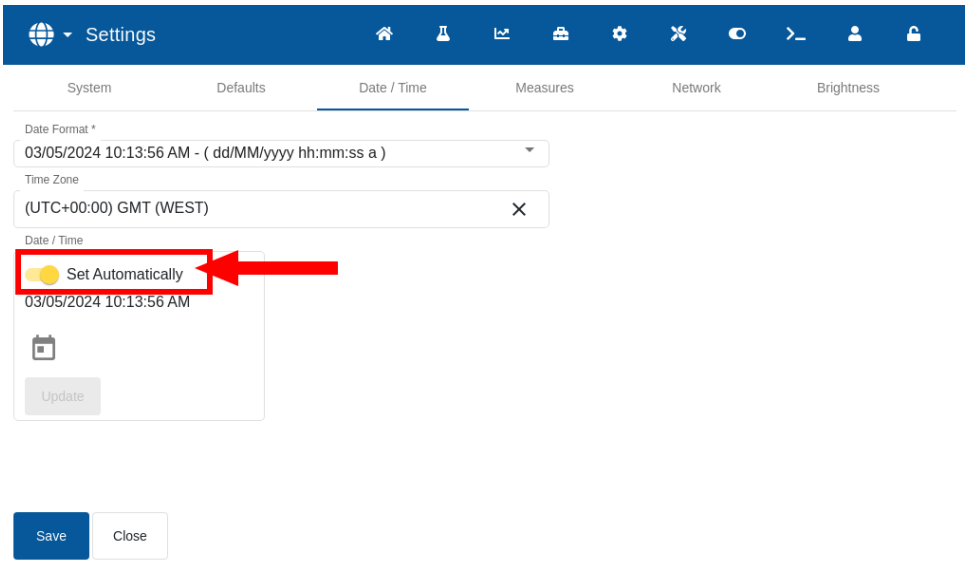


Figure 54: Settings – automatic time and date update

To set the current time and / or date setting manually, switch the ‘Set Automatically’ toggle switch to off (signified by the icon turning grey, see Figure 55). A selection window will pop up from which the time and date can be adjusted. After adjusting the settings, press the ‘Save’ button to confirm the changes.

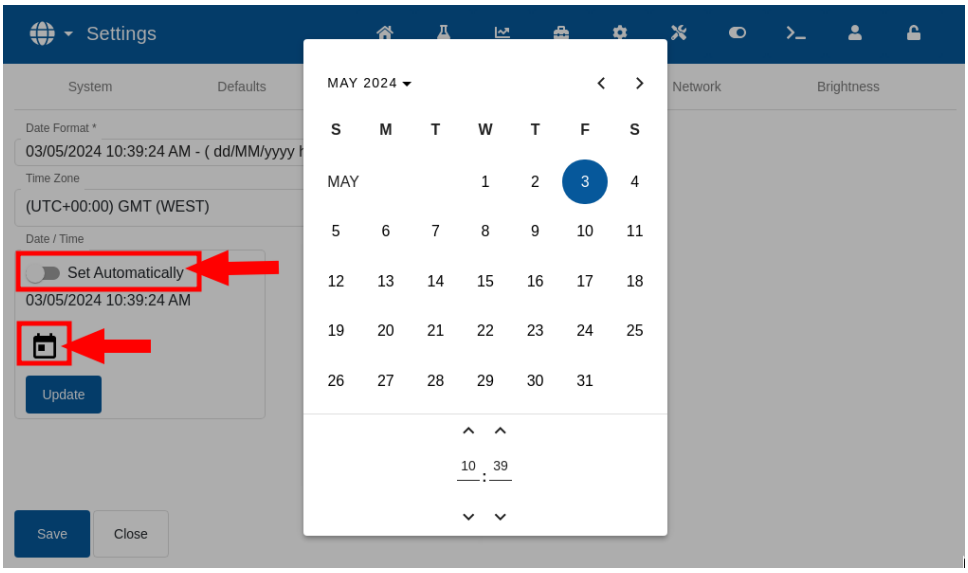


Figure 55: Settings - selecting the date and time manually

5.5 Measures

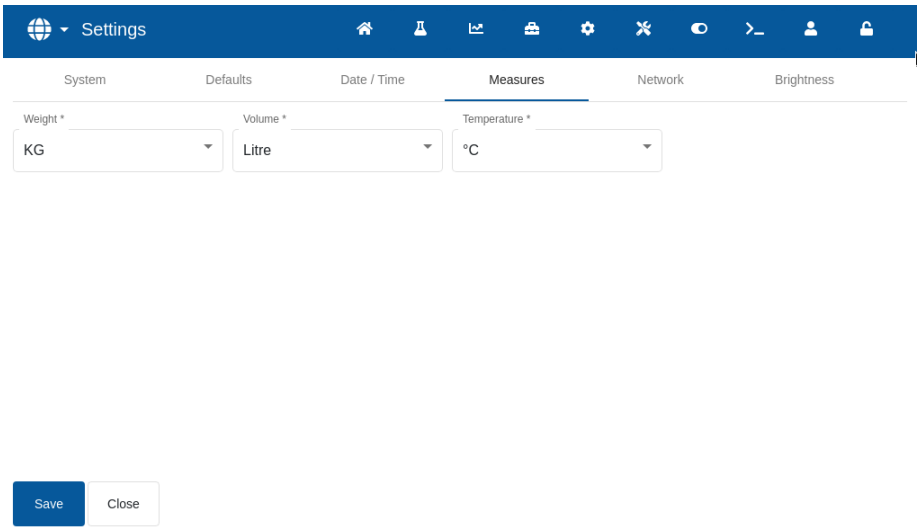


Figure 56: Settings – Measures page

Settings parameter	Description
Weight	Sets unit of measure for weight.
Volume	Sets unit of measure for volume.
Temperature	Sets unit of measure for temperature.

5.6 Network

A detailed description of the functions available on the Network page is covered in Chapter 1 Section 9 of the Safety Information (HD1100).

5.7 Brightness

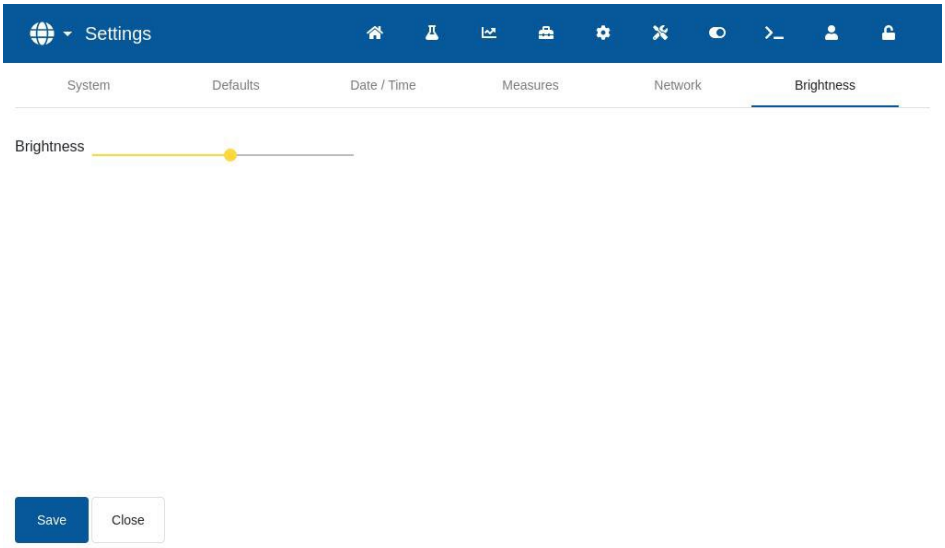


Figure 57: Settings – Brightness page

Settings parameter	Description
Brightness	The slider sets the screen brightness level.

6 Recipe Parameters

This section describes the recipe parameters functions, their units, range and the default value.

Accessing the Recipes screen and it's subpages, as well as selecting, creating and editing recipes, is described in more detail in chapter 6 of the Operators Guide (HD1048).

6.1 Recipe Details

The first screen of the Recipes section stores and displays the recipe details, the water addition and the material addition/mixing times.

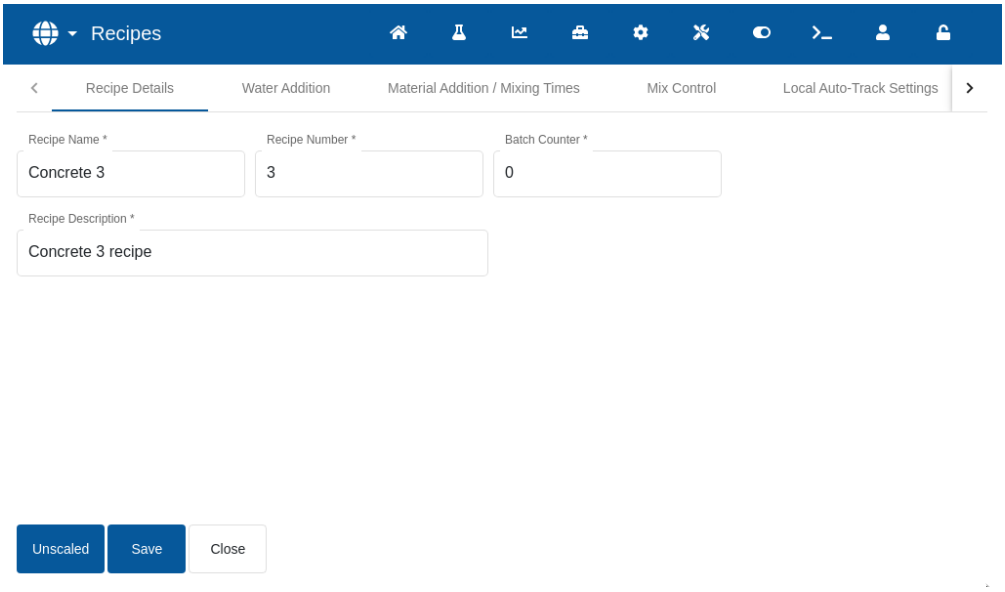


Figure 58: Editing a Recipe – Recipe Details

Parameter	Units	Default	Range
Recipe Name	Free Text Entry		25 characters length
Recipe Number	None	1	1 – 99,999
Batch Counter	None	0	0 – 99,999
Recipe Description	Free Text Entry		25 characters length

The **Recipe Name** is a free text entry field of up to 25 characters that can be used to give a meaningful name to the recipe, which is displayed in the recipe selection box and on the main screen.

The **Recipe Number** parameter is the number of the recipe in the system. Recipes can be selected by number from an external batch control system using the 8 digital recipe inputs (available on the optional Hydro-Control Expansion Board) or using the serial communications protocol. They are also listed in numerical order on the recipe selector available from the start page or the recipe overview screen.

The **Batch Number** parameter is a number that increments after each batch of a recipe is completed. It can be used to trace a batch that has been made.

The **Recipe Description** is a free text entry field of up to 25 characters that can be used to give a meaningful description to the recipe to ease the recipe identification.

6.2 Water Addition

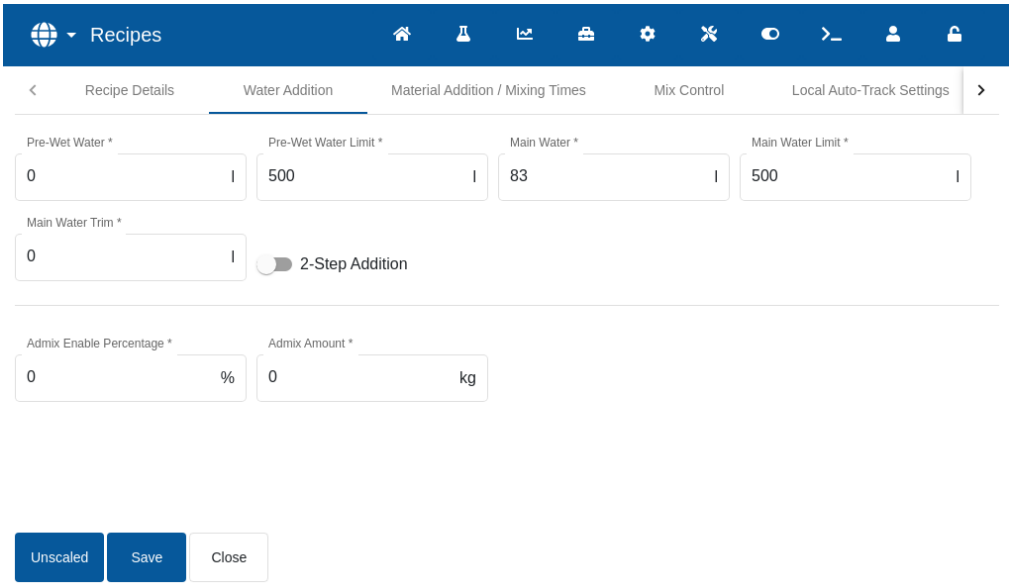


Figure 59: Editing Recipe - Water Addition

Parameter	Units	Default	Range
Pre-Wet Water	Litres/Gallons	0	0 – 999 Litres 0 – 264 Gallons
Pre-Wet Water Limit	Litres/Gallons	500	0 – 999 Litres 0 – 264 Gallons
Main Water	Litres/Gallons	0	0 – 999 Litres 0 – 264 Gallons
Main Water Limit	Litres/Gallons	500	0 – 999 Litres 0 – 264 Gallons
Main Water Trim	Litres/Gallons	0	-999.9 – 999.9 Litres -264 – 264 Gallons
2-Step Addition	None	No	Yes/No
Admix Enable Percentage	%	0	0 – 100 %
Admix Amount	Kg/lbs	0	0 – 999.9 kg 0 – 70547 lbs

The **Pre-Wet Water** parameter sets the quantity of water that should be dosed into the mixer during the pre-wet phase of the mix cycle.

The **Pre-Wet Water Limit** parameter sets the maximum amount of water that will be added, when the system is running with the pre-wet water in AUTO Mode, before the system will alarm.

The **Main Water** parameter sets the quantity of water that is added to the mix during the main water addition phase of the mix cycle when running in preset mode.

If the main water addition phase runs in CALC Mode and the calculated water addition quantity is larger than the **Main Water Limit**, the system will trigger an alarm. If the main water addition phase is being run in AUTO Mode and the amount of water dosed reaches the **Main Water Limit,** then the system will stop adding water and trigger an alarm

The **Main Water Trim** parameter adjusts the target of the recipe so that it can be made temporarily wetter or drier for special mixes.

The **2-Step Addition** option is used in Preset and CALC Mode and changes the Main Water Addition when running in Preset mode for use with certain admixtures. This is discussed in Chapter 6 in the section on Admix control.

The **Admix Enable** parameter is used to set when the Admix output signal is activated during the main water addition. This is defined as a percentage of the total main water quantity. For example, if the main water addition is 70 litres and the Admix Enable is set to 50% the Admix signal will be activated when the added water reaches 35 litres.

The **Admix Amount** parameter is used to set the amount of Admix used in a recipe. This is only used to display in the Mix Log.

6.3 Material Addition/Mixing Times

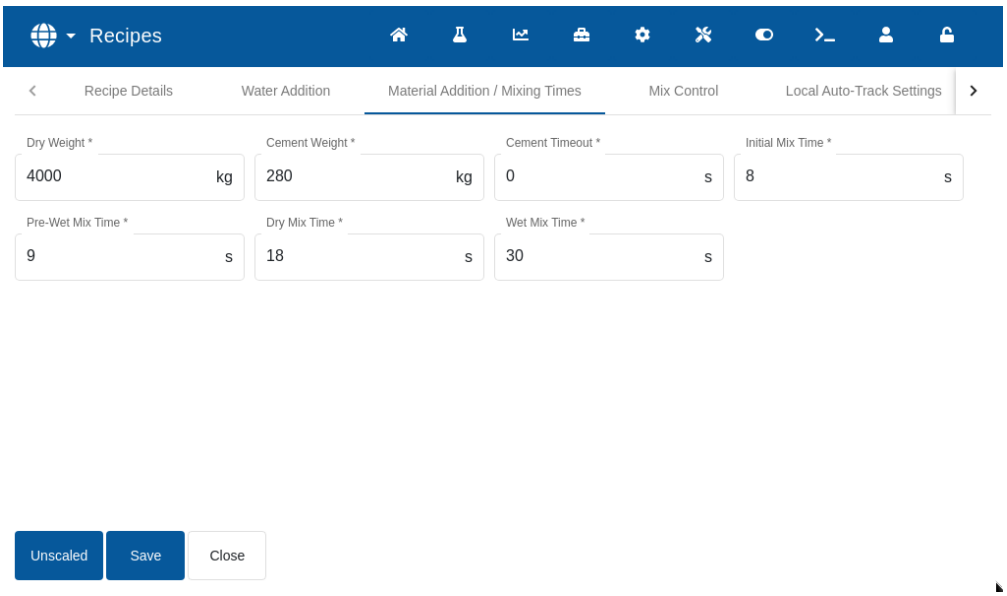


Figure 60: Editing Recipe - Material Addition and Mixing Times

Parameter	Units	Default	Range
Dry Weight	kg/lbs	0	0 – 32000 kg 0 – 70547 lbs
Cement Weight	kg/lbs	0	0 – 32000 kg 0 – 70547 lbs
Cement Timeout	Seconds	0	0 – 999 s
Initial Mix Time	Seconds	0	0 – 999 s
Pre-Wet Mix Time	Seconds	0	0 – 999 s
Dry Mix Time	Seconds	0	0 – 999 s
Wet Mix Time	Seconds	0	0 – 999 s

The **Dry Weight** parameter is the weight of all of the recipe ingredients, as weighed, in their dry state. With aggregates, this should be without free water (the weight at the SSD value). It should include the weight of the cement in the mix. This is used as the basis of the calculation mode.

The **Cement Weight** parameter is the quantity of cement added to the mix. This is used to calculate the Water/Cement ratio in the mix log.

The **Pre-Wet Mix Time** is the time the system will mix for after adding the pre-wet water, before activating the Pre-wet Done output and moving to the next phase.

The **Cement Timeout** parameter defines how long the Hydro-Control will wait after sending the Pre-Wet Done signal for the batch control system to add the cement. If the Cement In signal has not been received by the end of this time, then it will trigger the Cement Timeout Alarm.

The **Initial Mix Time** is the time period that the system will mix prior to the pre-wet water being added. The **Pre-Wet Mix Time** is the time period that the system will mix after the Pre-Wet Water has been added before issuing the pre-wet done signal. The **Dry Mix Time** is the time the system will mix for after the Pre-Wet Done signal (or Cement In signal if used) is raised before moving on to the main water addition. The **Wet Mix Time** is the time the system mixes for after the main water addition before giving a mix complete signal.

If the Auto-Track feature is used then during operation these mix times are doubled and used as maximum mix times for more information on using the auto-track feature see Chapter 6 System Design section 4.4 Auto-Track.

6.4 Mix Control

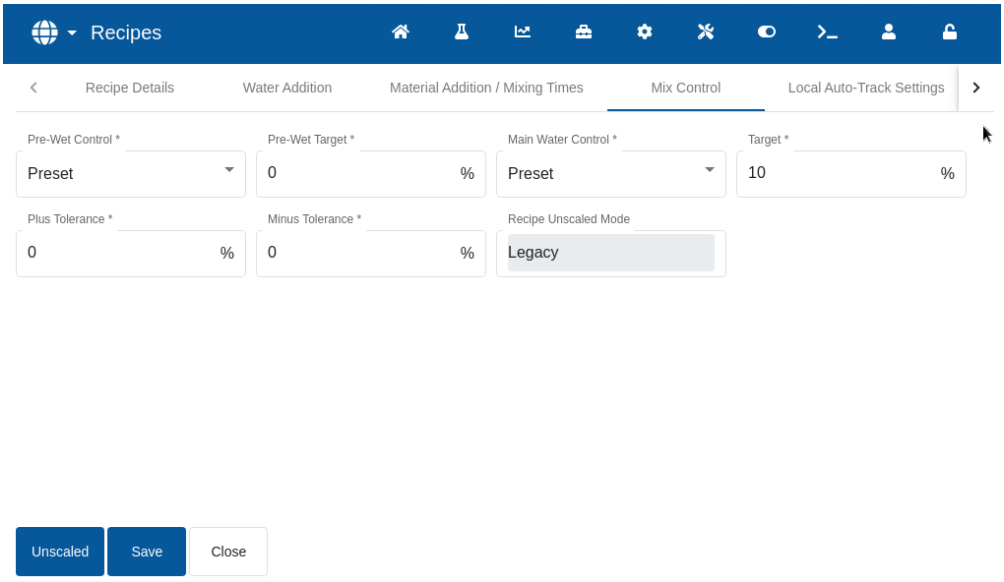


Figure 61: Editing Recipe - Mix Control

Parameter	Units	Default	Range
Pre-Wet Control	None	Preset	Preset/Auto/Calculation
Pre-Wet Target	%	8	-200 – 200
Main Water Control	None	Preset	Preset/Auto/Calculation
Target	%	10	-200 – 200
Plus Tolerance	%	2.75	0 – 99.9
Minus Tolerance	%	2.75	0 – 99.9
Recipe Unscaled Mode	None	Legacy/Mode F	Legacy/Mode F/Mode V/Mode E

The **Pre-Wet Control** changes the method that is used to control the pre-wet water addition. If the method is set to Preset, then a fixed quantity of water is added defined by the parameter **Pre-Wet Water** in the Water Addition section on page 1 of the recipe parameters. If the method is set to Auto, then the water is added in AUTO Mode to reach the target defined as **Pre-Wet Target**.

The **Main Water Control** parameter sets how the main water is added. If this is set to Preset then the system will add the fixed quantity of water defined as the **Main Water** parameter in the Water Addition section on page 1 of the recipe. If the method is set to Auto then the water is added to reach the target defined in **Target**. If the method is set to Calculation then the water is added based on a value calculated using the calibration parameters, the **Target** and the average reading taken during the Dry Mix phase of the mix cycle.

The **Plus Tolerance** and **Minus Tolerance** parameters are used at the end of the Wet Mix phase. If the difference between the average moisture value taken at the end of the wet mix phase and the target value is greater than the Plus Tolerance above the target, or greater than the Minus Tolerance below the target, then the Mix Too Wet or Mix Too Dry alarms are triggered. In AUTO Mode the **Minus Tolerance** is also used as a dead band for the target.

6.5 Local Auto-Track

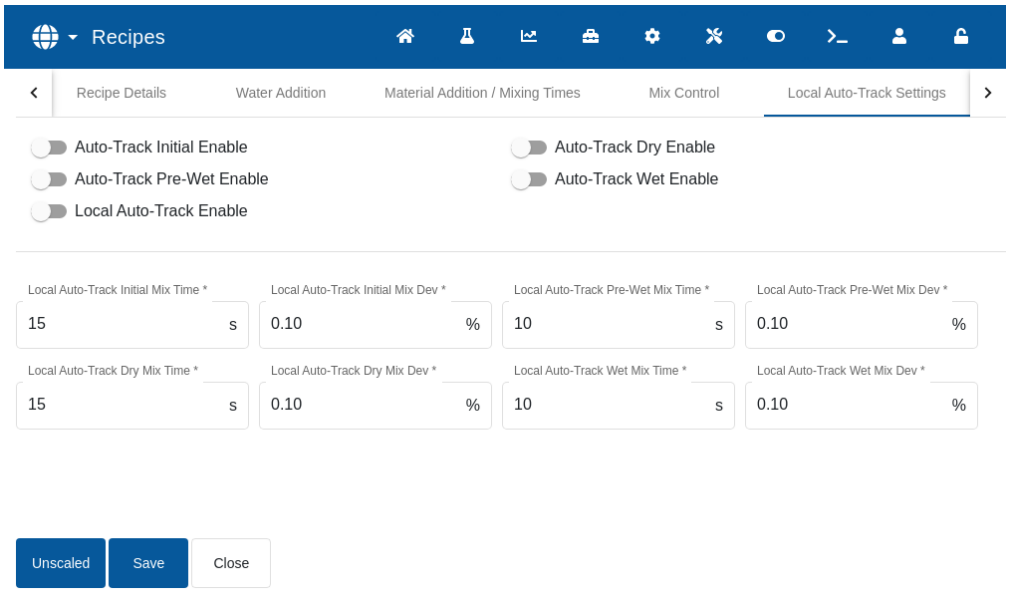


Figure 62: Editing Recipe - local Auto-Track settings

Parameter	Units	Default	Range
Auto-Track Initial Enable	None	No	Yes/No
Auto-Track Pre-Wet Enable	None	No	Yes/No
Local Auto-Track Enable	None	No	Yes/No
Auto-Track Dry Enable	None	No	Yes/No
Auto-Track Wet Enable	None	No	Yes/No
Auto-Track Initial Mix Time	Seconds	10	0 – 100 s
Auto-Track Initial Mix Dev	%	0.1	0 – 100 %
Auto-Track Pre-Wet Mix Time	Seconds	10	0 – 100 s
Auto-Track Pre-Wet Mix Dev	%	0.1	0 – 100 %
Auto-Track Dry Mix Time	Seconds	10	0 – 100 s
Auto-Track Dry Mix Dev	%	0.1	0 – 100 %
Auto-Track Wet Mix Time	Seconds	10	0 – 100 s
Auto-Track Wet Mix Dev	%	0.1	0 – 100 %

Auto-Track is the facility to configure the system to measure the stability or homogeneity of the mix. If the sensor value is within a certain deviation for a set time, this function allows the mix time to finish earlier.

Auto-Track Initial Enable, Auto-Track Pre-Wet Mix Enable, Auto-Track Dry Enable and Auto-Track Wet Enable parameters can be used to set whether the auto track feature is used on any of the mix phases .

If the **Local Auto-Track Enable** option is set to 'Yes' then the Auto-Track parameters defined in the recipe override the parameters set in the System Parameters.

The **Auto-Track Dry Mix Dev**, **Auto-Track Dry Mix Time**, **Auto-Track Wet Mix Dev** and **Auto-Track Wet Mix Time** parameters are used by the Auto-Track feature to control when the system finishes the dry and wet mix phases. During the dry or wet mix phase, if the variation in the sensor value is less than the specified Mix Deviation for the Mix Time then the mixing phase will continue to the next phase.

6.6 Calculation Mode Settings

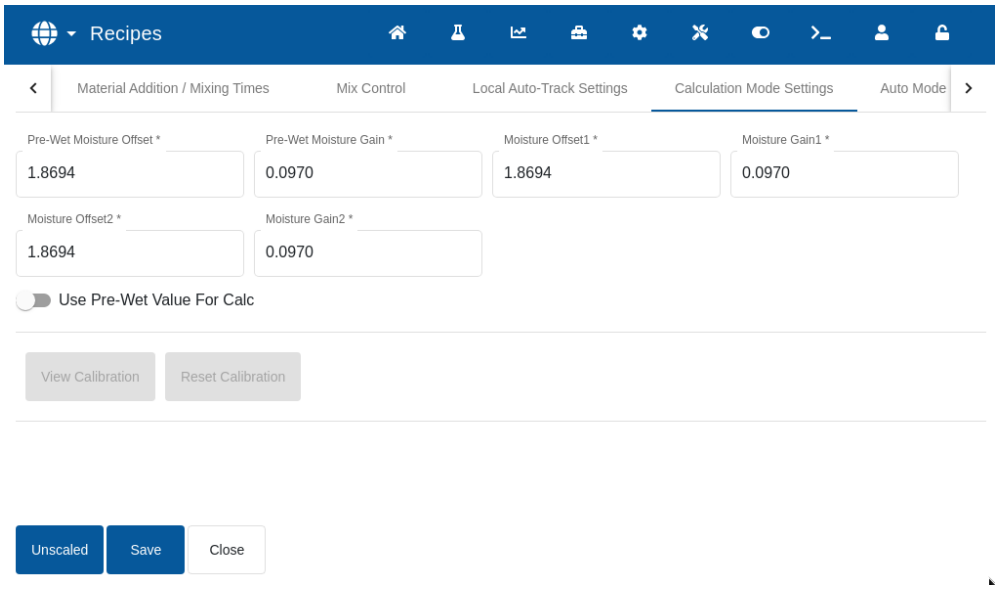


Figure 63: Editing Recipe - Calculation Mode Settings

Parameter	Units	Default	Range
Pre-Wet Moisture Offset	%	-3.6463	-100 – 100 %
Pre-Wet Moisture Gain	%/US	0.1818	0 – 100 %/US
Moisture Offset 1	%	-3.6463	-100 – 100 %
Moisture Gain 1	%/US	0.1818	0 – 100 %/US
Moisture Offset 2	%	-3.6463	-100 – 100 %
Moisture Gain 2	%/US	0.1818	0 – 100 %/US
Use Pre-Wet Value For Calc	None	No	Yes/No

The calculation mode settings are automatically generated the recipe is calibrated from a suitable batch. These should not need to be changed. After the recipe has been calibrated, if the moisture is displayed incorrectly, then the calibration parameters can be reset to their default values by pressing the 'Reset Calibration' button. After resetting the calibration, the recipe will need to be calibrated again.

The calibration process is described in further detail in the Operators Guide (HD1048).

6.7 Auto Mode Settings

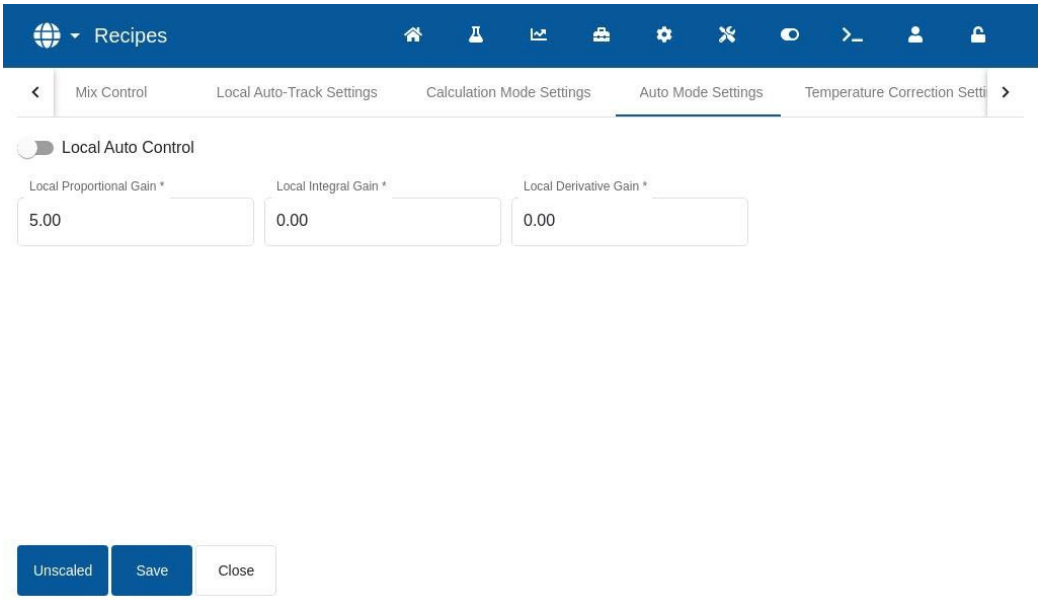


Figure 64: Editing Recipe - Auto Mode Settings

Parameter	Units	Default	Range
Local Auto Control	None	No	Yes/No
Local Proportional Gain	None	5	-100 – 100
Local Integral Gain	None	0	-100 – 100
Local Derivative Gain	None	0	-100 – 100

The **Local Auto Control** parameter sets the recipe to use the local recipe values for the AUTO Mode loop rather than the parameters entered in the System Parameters section.

The **Local Proportional, Local Integral Gain** and **Local Derivative Gain** parameters control the water valves during AUTO Mode. They compare the current sensor value with the target and generate a control signal for the speed of water addition (during the process the speed of water addition is controlled initially by opening the coarse and fine valve fully and, as the error is reduced, by closing the coarse valve and varying the pulse rate of the fine valve). Optimising these parameters is described in the Operators Guide in the chapter 'Using Moisture Control'.

6.8 Temperature Correction Settings

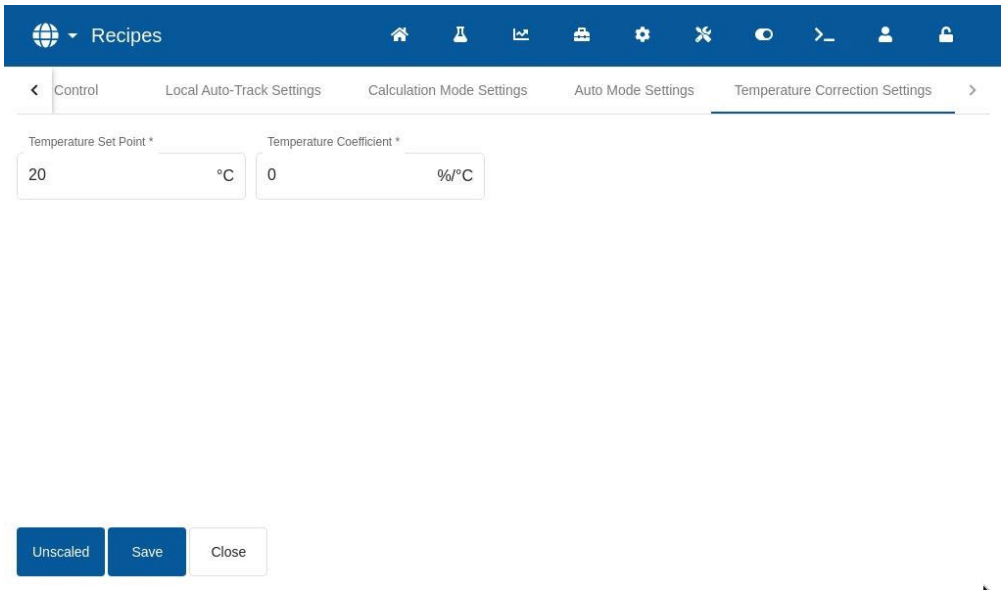


Figure 65: Editing Recipe - Temperature Correction Settings

Parameter	Units	Default	Range
Temperature Set Point	°C	20	0 – 100 °C
Temperature Coefficient	%M/°C	0	-9.9999 – 9.9999

The temperature correction settings are designed to allow system designers to compensate for the effects of hot or cold weather on the reactions in the concrete by changing the target moisture depending on the temperature. To this end, the settings allow the Target to be changed by the **Temperature Coefficient** in proportion to the difference of the current temperature from the **Temperature Set Point**. The equation is:

$$NewTarget = OldTarget + TemperatureCoefficient * (TemperatureSetPoint - CurrentTemperature)$$

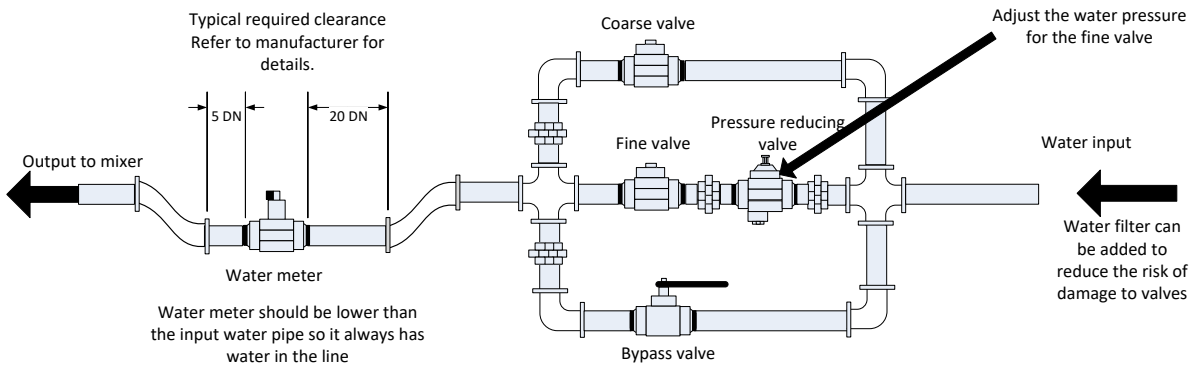
1 Water Valves

1.1 Introduction

While the Hydro-Control can work with a single water control valve, optimum performance will only be achieved with:

- A coarse valve to rapidly bring the moisture level near to target
- A fine valve to trim the moisture level to the target without overshoot

It is essential that the valves are correctly sized and flow rates correctly adjusted with respect to the mixer capacity and efficiency.



This is an example set-up please refer to the manufactures guidelines for specific details.

Figure 66: Typical water valve set-up

1.2 Guidelines for sizing valves and flow rates

Valves should be able to turn on and off rapidly – the combined on/off cycle time for a 50 mm (2”) valve should be no more than 2 seconds and 19 mm (3/4”) valves should have combined on/off cycle time of no more than 1 second. This permits precise water addition.

- **Fine valve flow rate** multiplied by on/off cycle time should be in the range 0.04% to 0.1% moisture increase (e.g. for a 1m^3 *{35ft^3}* mixer, flow rate x on/off time should be in the range 1 to 2.4L *{0.26 to 0.63Gal}*)
- **Coarse valve flow** rate multiplied by on/off cycle time should be in the range 0.25% to 0.5% moisture increase (e.g. for a 1m^3 *{35ft^3}* mixer, flow rate x on/off time should be in the range 6 to 12L *{1.6 to 3.2Gal}*))
- **Valve on/off time** if in doubt, set it to one second, then choose valve sizes to give suitable flow rate according to the chart below

The next two tables show the recommended flow rates for different sizes of mixer.

Mixer Capacity (m^3)	Load (Kg)	Coarse valve			Fine valve		
		Flow rate (L/sec)	On/Off Time (sec)	% Moist Increase	Flow rate (L/sec)	On/Off Time (sec)	% Moist Increase
0.25	550	2	1	0.36	0.4	1	0.07
0.5	1100	4	1	0.36	0.75	1	0.07
1.0	2200	8	1	0.36	1.5	1	0.07
1.5	3300	12	1	0.36	2.25	1	0.07
2.0	4400	15	1	0.34	3	1	0.07

Mixer Capacity (ft^3)	Load (lbs)	Coarse valve			Fine valve		
		Flow rate (Gal/sec)	On/Off Time (sec)	% Moist Increase	Flow rate (Gal/sec)	On/Off Time (sec)	% Moist Increase
10	1400	0.6	1	0.36	0.1	1	0.06
20	2800	1.2	1	0.36	0.25	1	0.07
40	5500	2.4	1	0.36	0.5	1	0.07
60	8300	3.6	1	0.36	0.75	1	0.07
80	11000	4.5	1	0.34	0.9	1	0.07

This table shows example pipe diameters

Flow Rate (L/S)	Pipe diameter (mm)	Pipe diameter (in)
≤0.5	20	¾
≤1	25	1
≤2	40	1 ½

1.3 Water valves installation location

It is recommended that the water valves are installed below the mixer water inlet level. This prevents the inflight water (unmetered water) entering the mixer.

1.4 Example

Metric units:

If a 1m^3 mixer has only a coarse valve and the water flow rate through the valve is 10 L/s with an on/off cycle time of 1 sec, then water can only be added in 10 L steps. With a full load (~ 2200 Kg) then the smallest moisture step is approx. 0.5%, which is too coarse for adequate control.

If the same system was also fitted with a fine valve which had a flow rate of 1 L/sec with an on/off time of 1 sec, then using this valve would permit water addition in steps of approx. 1 L or 0.05% giving good control.

US units:

If a 35ft^3 mixer has only a coarse valve and the water flow rate through the valve is 3 Gal/s with an on/off cycle time of 1 sec, then water can only be added in 3 Gal steps. With a full load (~ 4800 lbs) then the smallest moisture step is approx. 0.5%, which is too coarse for adequate control.

If the same system was also fitted with a fine valve, which had a flow rate of 0.3Gal/sec with an on/off time of 1 sec, then using this valve would permit water addition in steps of approx. 0.3Gal or 0.05% giving good control.

Note that a higher water flow rate should normally allow a shorter mix cycle time for an efficient mixer, provided the valve is fast enough to control the dose (on/off time is short). A slow flow rate and slow valve will provide the same dosing accuracy but will take longer to complete a mix.

It is also possible to add water too fast to a mixer, which creates a large ball of water which moves around the mixer with the raw material rather than being mixed in. To compensate for this, it is recommended to add water using a spray bar arrangement instead of from a single outlet.

1.5 Leaking Water Valve Alarm

If the water flow meter outputs pulses when there are no valves open, this will trigger the Leaking Water Valve Alarm.

2 Flow Measurement

2.1 Flow Meter

The flow meter should be specified to give a pulse rate of between 1 and 10 Hz. For a system that is adding 60 litres in a 30 second dose, this would mean 2 litres per second, so a flow meter giving 2 pulses per litre would be suitable (this would pulse 4 times per second).

2.2 Weighed Water

In Weighed Water Mode, a tank is filled to a known level (the high level point), and held ready for the water addition phase. A weigh cell analogue input is used and the reading is zeroed when the tank reaches the high level point. As the tank empties the weight of water that has been dosed into the system can be read from the change in the input, and this can be used to determine the quantity of water dosed.

2.3 Timed Mode

In Timed Mode, the water is added for a time specified in the recipe. The water pressure must be constant for results in this mode to be repeatable. It is not recommended to design a system to use this mode, but it can be useful to keep a plant running when there is a problem with the flow meter.

3 Retrofitting Systems

The Hydro-Control may easily be retro-fitted to any plant control system to allow an easy upgrade to enable moisture controlled water addition.

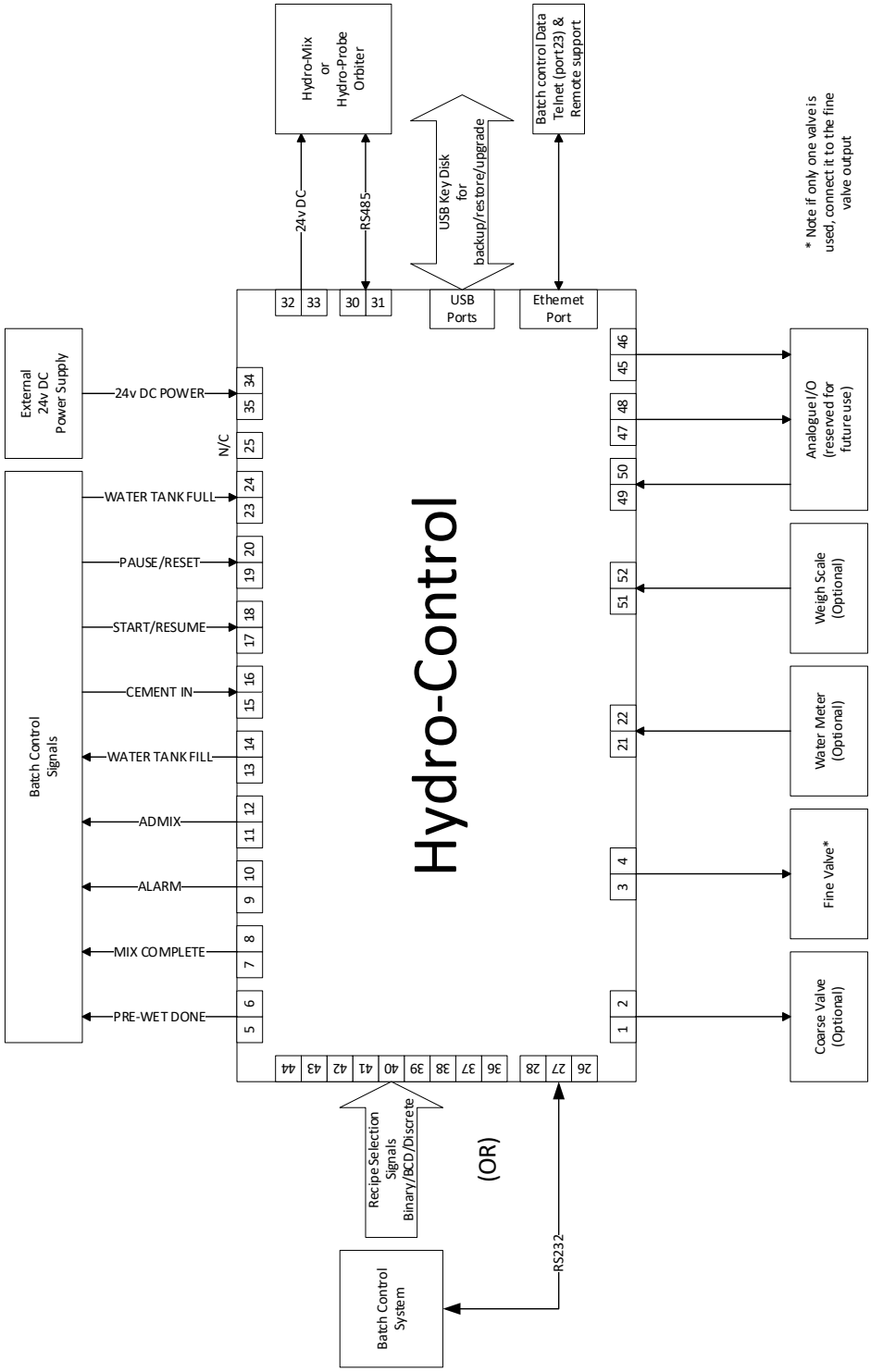


Figure 67: System Block Diagram

3.1 Basic connections

Figure 67 shows the block diagram of a system. Although the simplest configuration requires only the fine valve to be connected, it is recommended that a way of measuring the amount of water dosed into the mixer is also used, either using a flow meter or using a weighed water system. A simple installation is shown in Figure 68, which can control one or two valves and read a water meter.

In installations where the Hydro-Control is integrated with the batch control system, the most important signals to and from the batch controller are the Start/Resume signal (to tell the Hydro-Control that the mixer is ready for the water to be added), the Mix Complete signal (which signals to the batch control system that the Hydro-Control has finished the water addition) and the Reset signal (which is used to set the Hydro-Control back to standby mode). Other signals should be used as needed.

At least 10 seconds should be allowed after sending the Reset signal before sending a Start signal to begin the next batch.

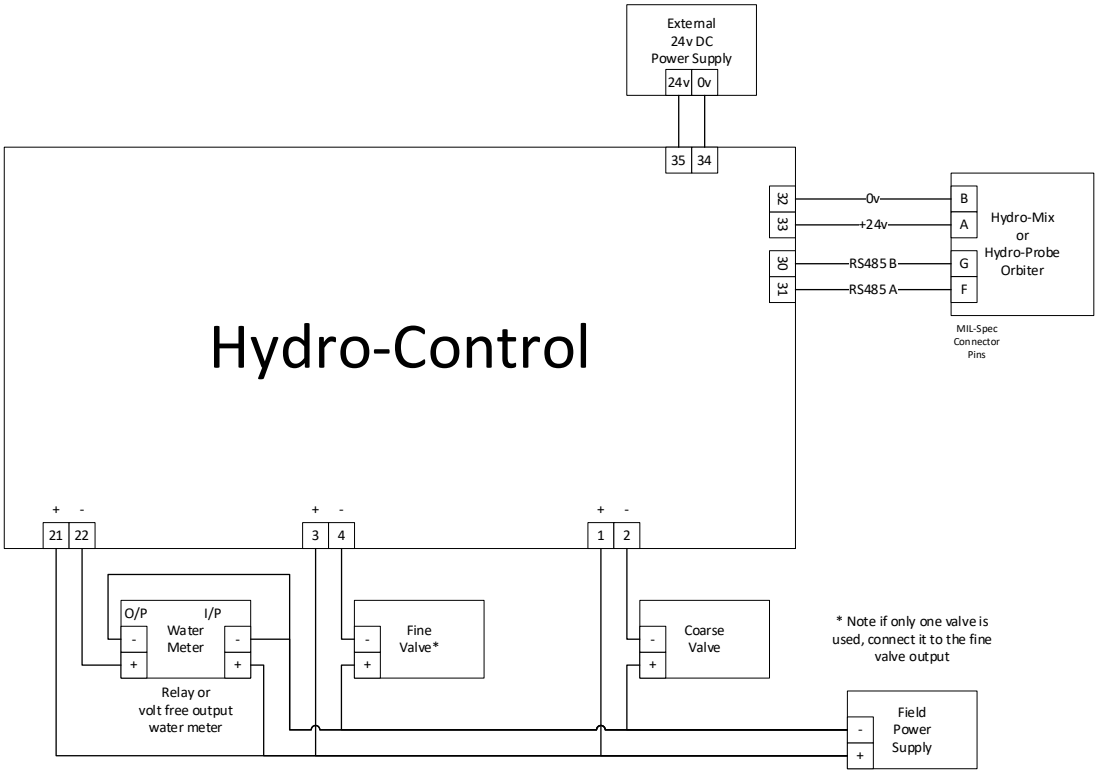


Figure 68: Example Wiring Schematic For Manual Plant Operation

3.2 Remote Recipe Selection

If the recipe design in the mixer changes (for example, if a different mix of aggregates is used, a different type of cement, a different admixture, or a different colour or pigment) then, it is strongly recommended to use different recipes in the Hydro-Control for calibration and control. In a system which is integrated to a batch control system, it is best to make the recipe selection automatic.

Automatic recipe selection can be implemented either by using an RS232 link between the batch system and the Hydro-Control or by using the recipe selection signals that are available if the Expansion Board is fitted.

The Expansion Board has 9 connections (8 input connections with a common ground), and accepts signals in the following formats:

- Binary (maximum of 255 recipes)
- Binary Coded Decimal (BCD) (maximum of 99 recipes)
- Discrete (maximum of 8 recipes)

The 'Remote Recipe Input' option on the 'Hardware' screen needs to correspond the system wiring configuration. To change the setting, select the desired option from the drop-down menu, then press the 'Save' button.

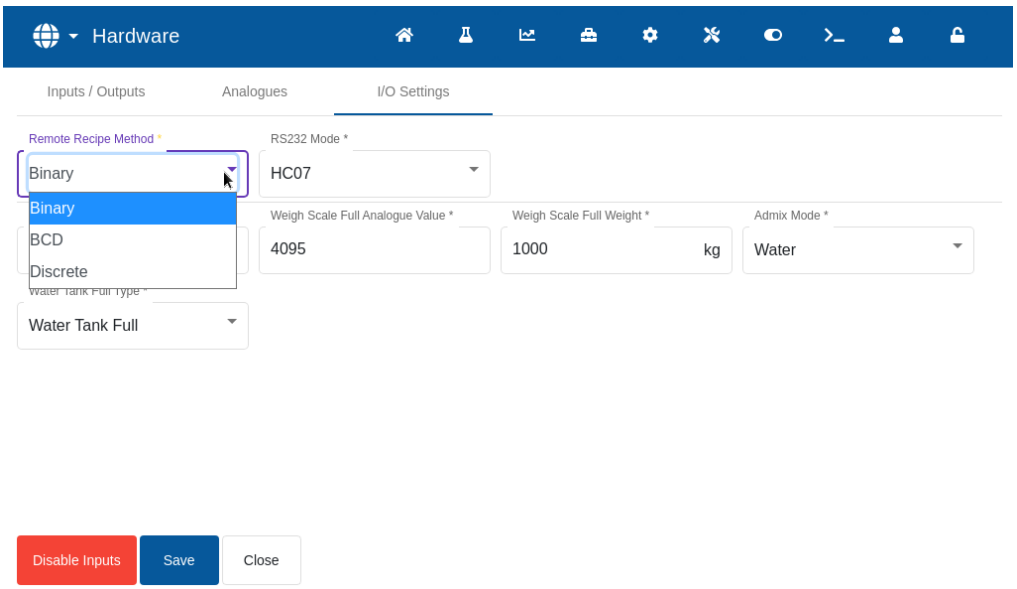


Figure 69: Remote recipe modes

3.3 Upgrading Hydro-Control VI installations

Attention: The Hydro-Control (HC07) must not be connected to the existing HC06 installation before this Installation Guide is read and understood by the personnel carrying out the system upgrade.

The Hydro-Control (HC07) has been designed to be a functional replacement for the Hydro-Control VI. The new device utilises the same input / output set-up and performs tasks that mirror the functionality and configuration of the device it supersedes, the Hydro-Control VI.

However the electrical connections differ between the two devices. For ease of installation, both devices use the same 10-pin main power connector, however the connections within the 10-pin main power connector are different. **Consult Chapter 4 Section 1 to connect the device correctly**.

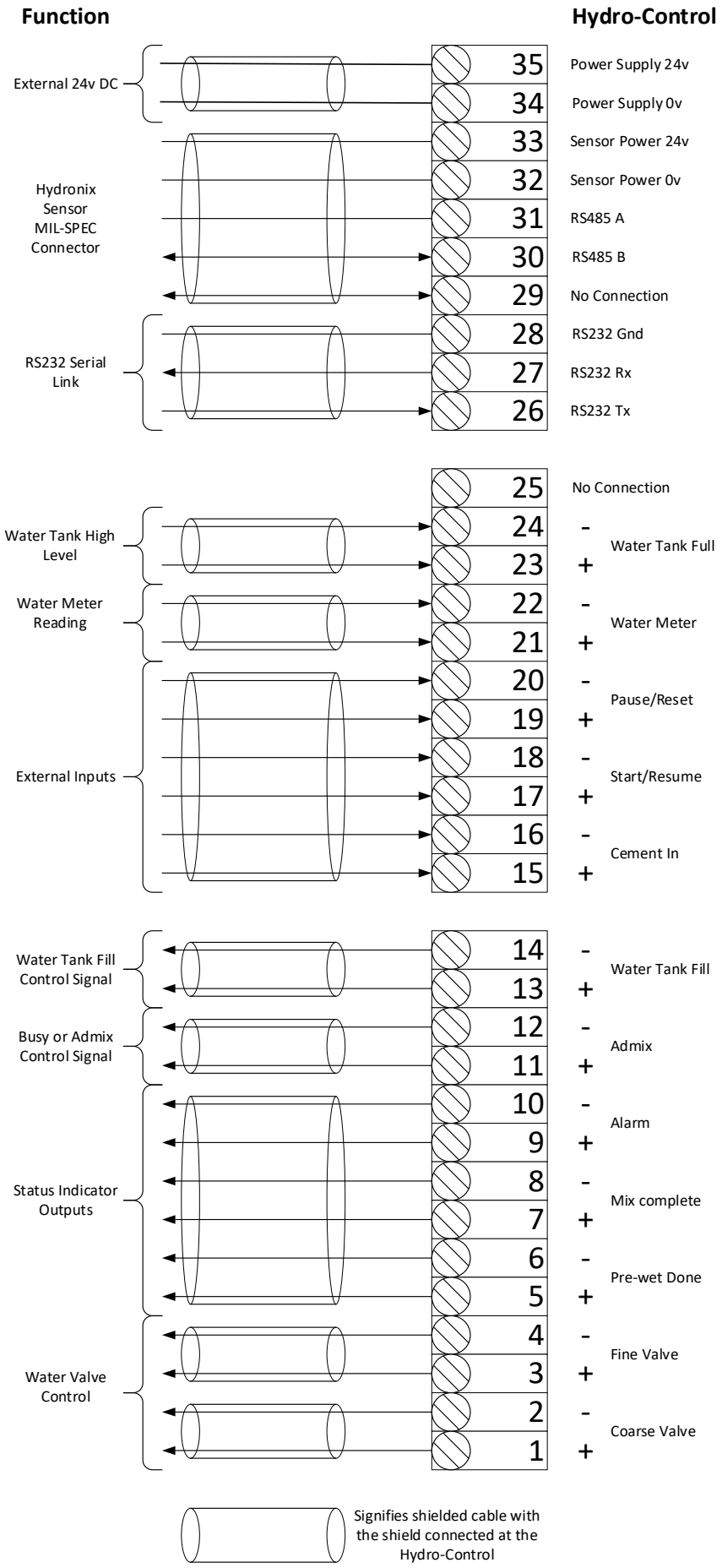


Figure 70: System Interconnections

4 Mix Cycle Design

This section details the design of the mix control sequence which can contain up to three water addition steps along with associated mixing times.

The mix sequence design is usually based on the type of concrete being made, the type of aggregates or the admixture addition recommendations.

4.1 The Complete Mix Cycle

Figure 71 shows a complete mix utilising all the basic mix cycle options. The mixer is loaded and then the start signal is sent to the Hydro-Control. The Hydro-Control will then run the initial mix cycle time and then adds an optional amount of Pre-Wet water which can be used to increase the moisture of the dry materials. Pre-Wet water is useful if lightweight materials or materials with high water absorption values are being used. It is considered best practice to increase the moisture of raw materials above their Saturated Surface Dry (SSD) condition wherever possible before the materials enter the mixer. Using Pre-Wet water can also reduce the amount of dust generated by the process and reduces wear on the mixer motor and gearbox.

The Hydro-Control signals to the batching control system that the Pre-Wet has been completed. The control system then adds the cement and activates the 'Cement In' signal.

The Hydro-Control runs the dry mix time, adds the main water, and runs the wet mix time before activating the 'Mix Complete' output. The batching control system can then discharge the mixer and send back a reset to the Hydro-Control to prepare for the next batch.

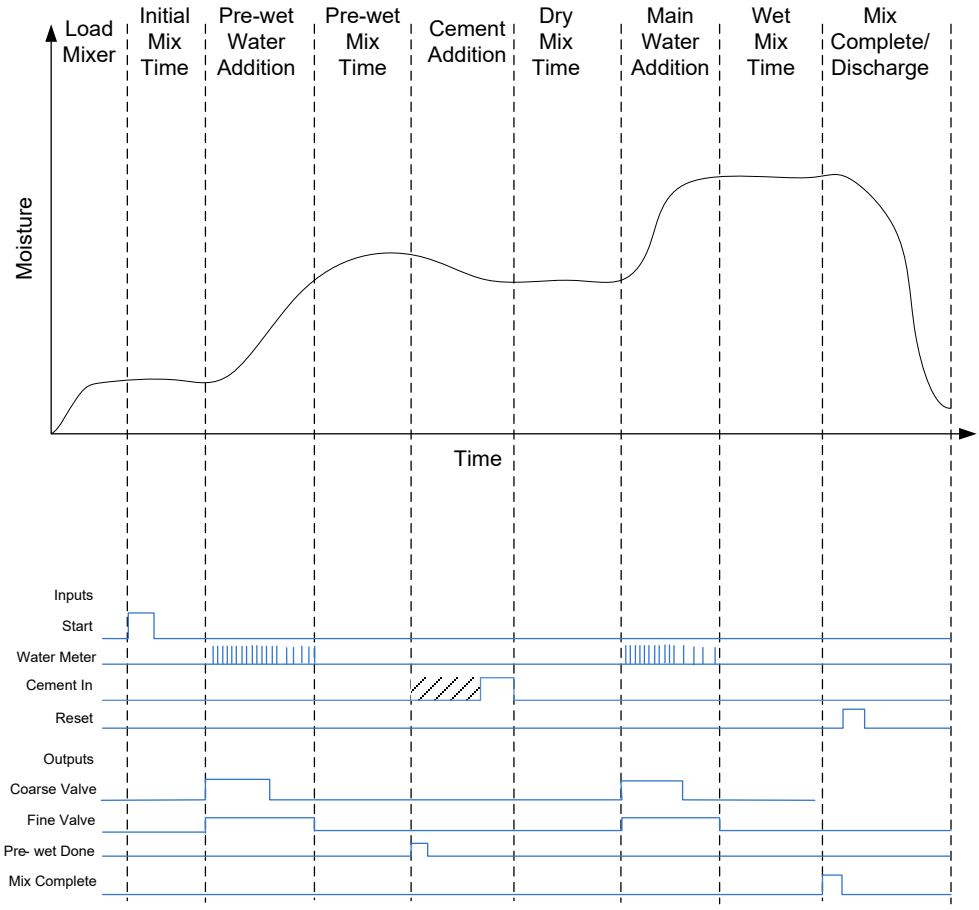


Figure 71: The Complete Mix Cycle

4.2 Simple Mix

A simpler mix control sequence is to load all the raw materials into the mixer at the same time and then perform a dry mix to being to homogenise the materials. The main water is then added, and the wet mix time is run before the 'Mix Complete' output is given to indicate that the control system can empty the mixer. This is shown in Figure 72 with the I/O status.

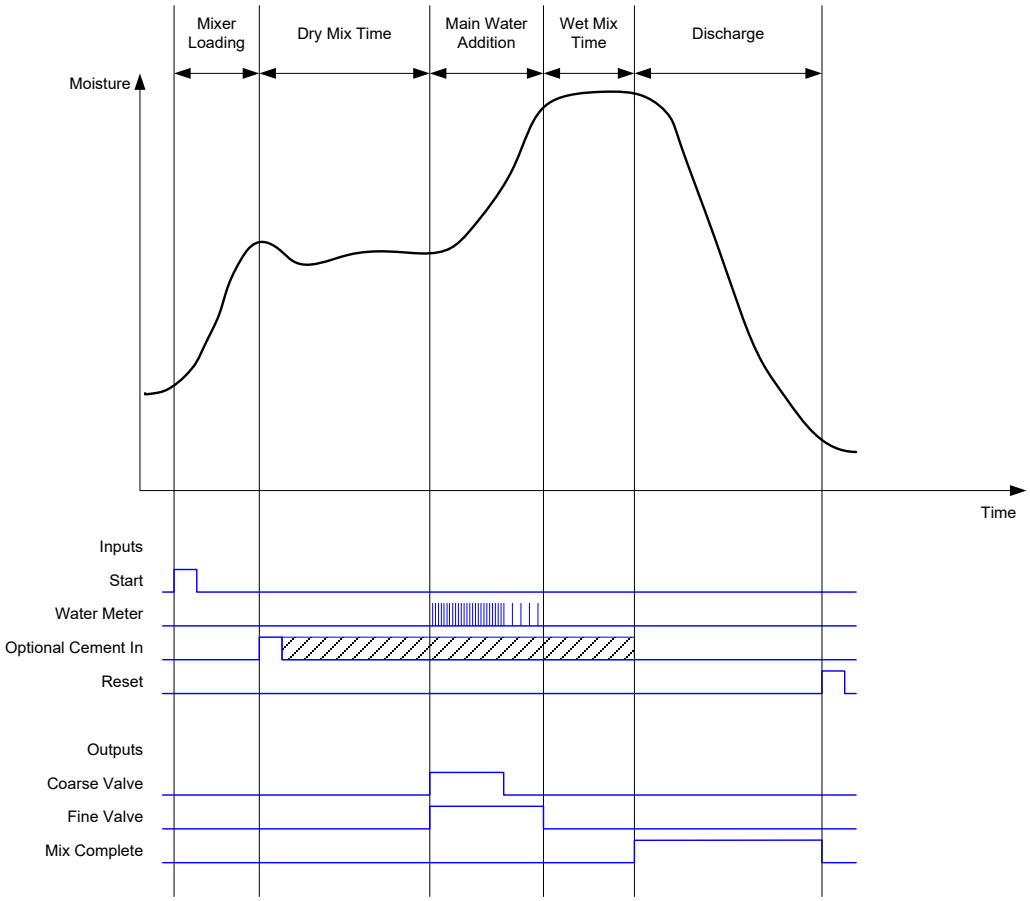


Figure 72: The Mix cycle showing the I/O status

The 'Cement In' signal is optional and may be used to control the timing of the cement addition. The signal requirement can be configured in the recipe database by setting the parameter 'Cement Timeout' to a non-zero value. The system will then wait until the 'Cement In' signal has been received before starting the Dry Mix phase.

A timer is started when the system receives the Start signal and if this reaches the 'Cement Timeout' before the 'Cement In' signal has been received the 'Cement In Alarm' will be triggered unless this has been disabled on the System Parameters page.

4.3 Admix control

The effect that an admixture has on the sensor signal will depend on the admixture itself and the point at which it is added to the mixer. The Hydro-Control has an output for controlling the addition of the admixture that may be configured using the Admix Signal parameter on the second page of the System Parameters.

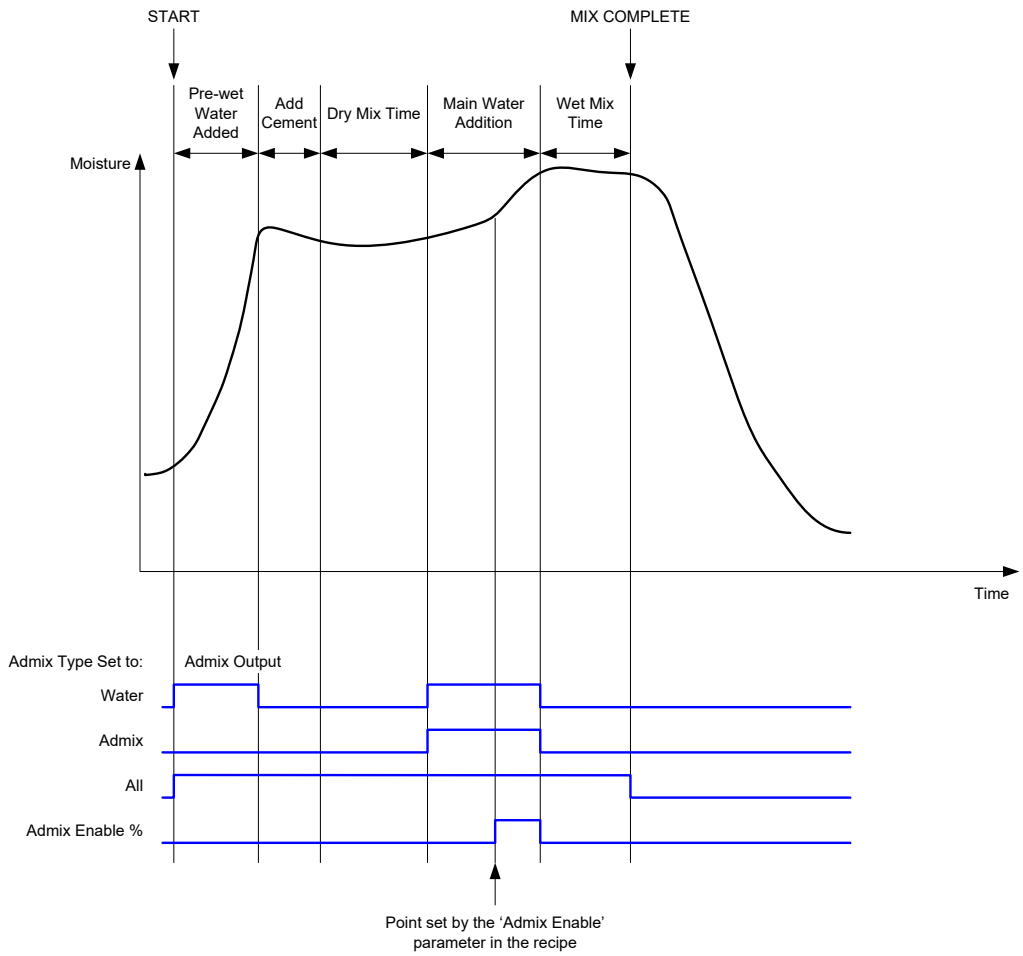


Figure 73: The Admix output signal during a normal mix cycle

When the Admix Signal parameter is set 'Admix Enable %' the Admix output is set high during the Main Water addition when the percentage of the main water dosed reaches the recipe parameter 'Admix Enable'. The total water used to calculate the percentage is the calculated amount (in CALC Mode) or the amount dosed in the previous batch (in AUTO Mode).

This is used to delay the admixture addition until a set amount of water has been dosed. This can be a requirement given by the manufacturer of the admixture.

When the Admix Signal parameter is set to 'Water' the Admix output is set high whenever the water is being added to the mixer.

When the Admix Signal parameter is set to 'Admix' the Admix output is set high during the main water addition phases of the mix cycle. This is to provide backwards compatibility with the Hydro-Control V.

When the admix signal is set to 'All' the Admix output is set high from the time the Hydro-Control receives the Start signal until the time that the Hydro-Control outputs the Mix Complete signal. This is equivalent to the busy output on the Hydro-Control V.

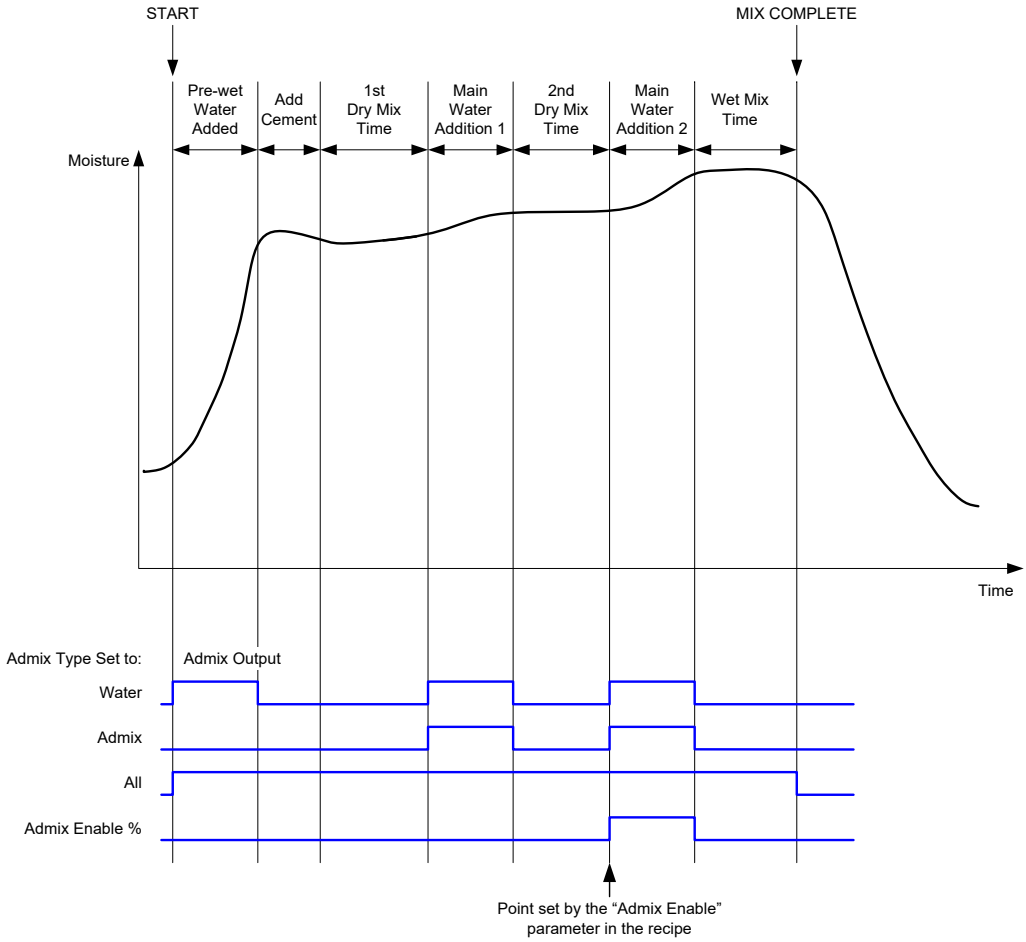


Figure 74: The Admix output signal during a 2-step mix cycle

If the recipe is configured to 2-step addition mode then, when the Main Water addition is added using Preset Mode, the mix cycle will add the Main Water to the mixer in two portions, defined by the Admix Enable parameter in the recipe. After Main Water Addition 1, the Dry Mix phase will be run a second time.

At the end of each of the Dry Mix phases, the system will obtain an average reading of the sensor value as defined by the 'Averaging Time' parameter in the System Parameters.

If this 2-step batch is used to calibrate a recipe, then a second gain and offset value will be calculated for the recipe and this will be used to calculate the moisture whenever the unscaled value rises above the average unscaled vale from the second Dry Mix phase. This will happen in either AUTO or CALC Modes.

This functionality is useful if an admixture is being used which makes a large change to the calibration of the material in the mixer. The 2-step addition mode will rescale the moisture display on the graph on the main screen so that it is more representative of the moisture in the mixer.

4.4 Auto-Track

Auto-Track can be used during any of the mixing phases of the mix cycle to automatically adjust the mix time depending on the homogeneity of the material in the mixer. There are four sets of parameters in the System Parameters page which control when the Auto-Track will finish the mix phases. These can be over-ridden in the Recipe Parameters if needed. In the recipe settings it is possible to select which mixing phases use auto-track and which do not.

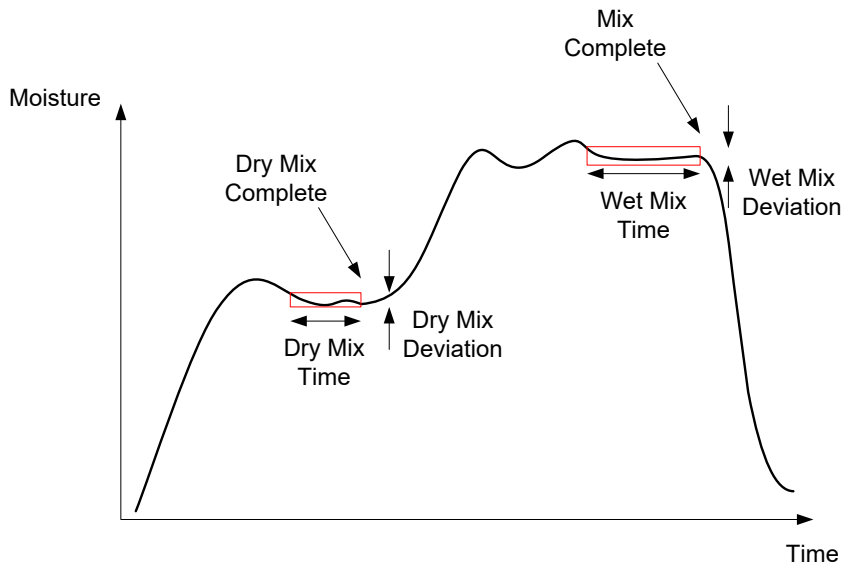


Figure 75: The mix trace showing Auto-Track settings

Figure 75 shows a typical mix trace showing the Auto-Track timing. The Auto-Track monitors the moisture and identifies the stable point for the Dry Mix and the Wet Mix times. It requires the variation in the sensor value to be less than the Mix Deviation parameter for the period of the Mix Time parameter before continuing to the next mixing phase. If the time reaches the recipe Mix Time parameter, an alarm is activated.

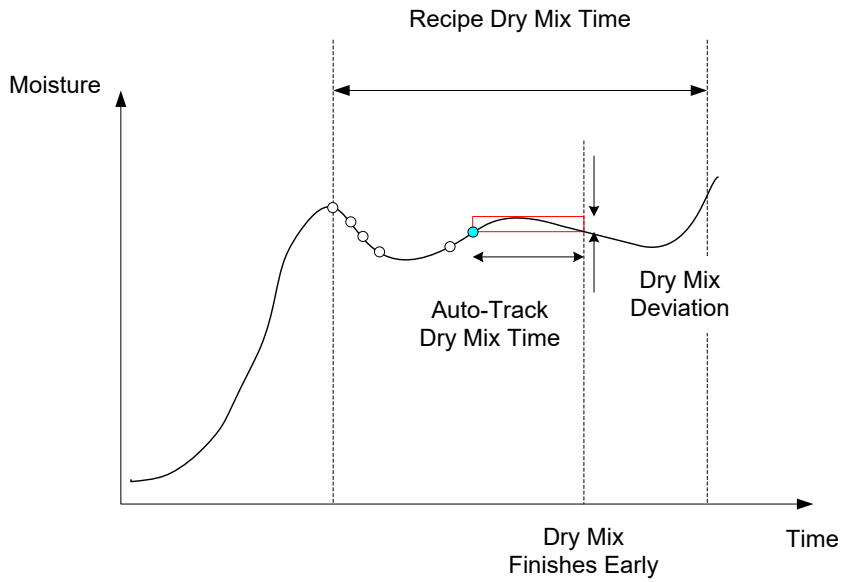


Figure 76: Auto-Track parameter example for the Dry Mix phase

On the overview screen the mix time will appear twice as long as the time set in the recipe.

The auto-track process is as follows:

- Mix until mix phase time is less than the mixing time minus the auto-track time
- Record the sensor value and start auto-track. Two green lines will appear on the graph to indicate the plus and minus tolerance of the auto-track
- If the sensor value moves outside of the recorded sensor value +/- auto-track deviation re-start auto track
- If the sensor reading stays within the auto-track bounds for the auto-track time exit the mix phase
- If the system has not exited the mix phase for twice as long as the mixing time entered into the recipe an alarm is issued allowing the user to select whether to repeat the phase (the mix time is automatically doubled in the recipe) or to exit from the mix phase and continue with the rest of the cycle

4.4.1 Auto-Track with Preset Mode

Auto-Track can be used with Preset mode to ensure that the sensor reading is stable at the end of the dry and wet mixes. When the system is running with Auto-Track, the average taken at the end of each of the mixing phases is the average value during the Auto-Track time and not that defined by the Averaging Time value in the System Parameters. This will ensure that any values used for calibration are representative of the sensor value in the mixer.

4.4.2 Auto-Track with CALC Mode

When Auto-Track is used with CALC Mode, the Auto-Track parameters should be set so that the Dry Mix Deviation gives a stable reading (for example, 0.1%) for the calculation as described in the previous section. The Wet Mix Deviation should be set dependant on the homogeneity of the concrete required.

4.4.3 Auto-Track with AUTO Mode

Auto-Track can be used with AUTO Mode on the dry mix to achieve a degree of homogeneity from which to start adding water. This can be useful if raw materials sometimes vary in moisture causing differences in the initial mixing action (for example, if the cement takes longer to homogenise due to wetter aggregates). During the wet mix the Auto-Track can be used to control the final homogeneity of the mix.

1 Port Settings

1.1 RS232

The RS232 port settings should be set up as follows

- Baud Rate – 9600
- Data Bits – 8
- Parity – None
- Stop Bits – 1
- Handshaking – None

1.2 Ethernet

The Ethernet port can also be configured to utilise the RS232 protocol. The required IP address is displayed on the Settings screen. The connected device should be set to communicate on port 23. If connecting to a Hydro-Control outside the local network, please consult the network administrator to configure port forwarding.

2 RS232 Protocol Configuration

The **RS232 Protocol** parameter sets whether the serial communication protocol used on the Hydro-Control is set to the Hydro-Control (HC07) mode or one of the older devices' mode (Hydro-Control VI, Hydro-Control V or Hydro-Control IV).

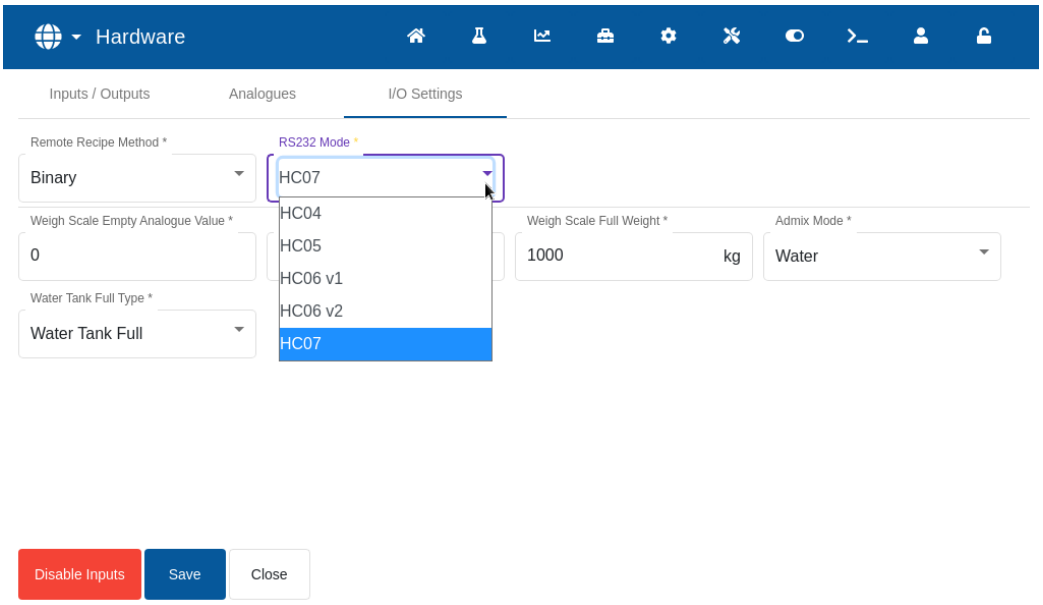


Figure 77: RS232 communication options

If the Hydro-Control (HC07) is replacing an older Hydro-Control device, refer to the table below to configure the serial protocol settings correctly:

Device being replaced	Serial protocol setting to be used
None (new install)	HC07
Hydro-Control VI (HC06 v1 mix log format)	HC06 v1
Hydro-Control VI (HC06 v2 mix log format)	HC06 v2
Hydro-Control V	HC05
Hydro-Control IV	HC04

3 RS232 Commands HC05/HC06/HC07 Formats

All commands must be terminated with an ASCII 13 character (carriage return). Once received the Hydro-Control will try to process the command. The command acknowledgements are listed below. Each will be terminated with an ASCII 13 character.

Some value	The data requested via a valid read command is returned
!	A data write operation was successful
?10	Invalid Command
?11	Parameter 1 out of range
?12	Parameter 2 out of range
?13	Parameter 3 out of range
?14	Command not valid in this mix phase

To prevent accidental changes (such as changing the recipe during the mix) some commands are not valid at certain phases of the mix. These will be noted where appropriate. The following subsections describe the different types of commands that can be used.

3.1 Non-Parameter/Status Commands

These are commands that do not correspond to the current state of the Hydro-Control or any system or recipe parameters. These commands are listed below

Format	Description	Parameter Range	Valid Period	Response
>R1=nn	Selects recipe nn as the next recipe If the requested recipe does not exist in the database a new blank recipe will be created with the selected recipe number	nn = any valid integer	Standby	!
>D1 = nn	Sets the dry weight in kg/lbs of the current recipe to nn	Nn = 1 - 32000	Standby	!
*2	Current Moisture value	N/A	Any	xx.yy
*3	Software Version	N/A	Any	Hydro-Control VI v x.x.x.x
*4	Download Entire Mix Log	N/A	Any	All current mix logs (tab separated values)
*5	Current Temperature in °C or °F	N/A	Any	xx.y
*7	Sensor Unscaled Reading	N/A	Any	xx.yy
*8	Download Last Batch From Mix log	N/A	Any	Last mix log (tab separated values)
*9	Download last batch from mixlog (HC06 v2 format)	N/A	Any	Last mix log (tab separated values)
*10	Current Total water	N/A	Any	xx.y

3.2 Mix Log Formats

The Mix Log format will depend on which mode the RS232 Protocol is set to. This parameter is on page 2 of the System Parameters screen and details of this can be found in Chapter 5.

The data is sent as a list of values separated by the tab character (ASCII Code 9).

3.2.1 Hydro-Control V (HC05) Format

Value	Description
1	Batch/Recipe/Control Method
2	Dry % Moisture
3	Calculated Target % Moisture
4	Wet % Moisture
5	Water/Cement ratio
6	Pre-Wet Water
7	Calculated Water
8	Actual Water
9	Trim Water
10	Mix Time
11	Dry Weight
12	Moisture Gain
13	Moisture Offset
14	Dry Reading Unscaled
15	Calculated Target Unscaled
16	Final Target Unscaled
17	Dry Deviation Unscaled
18	Wet Deviation Unscaled
19	Dry Deviation % Moisture
20	Wet Deviation % Moisture

3.2.2 Hydro-Control VI (HC06) Format v1

Value	Description
1	Batch/Recipe/Control Method
2	Dry % Moisture
3	Dry Reading Unscaled
4	Dry Deviation % Moisture
5	Dry Deviation Unscaled
6	Calculated Target % Moisture
7	Calculated Target Unscaled
8	Wet % Moisture
9	Wet Reading Unscaled
10	Wet Deviation % Moisture
11	Wet Deviation Unscaled
12	Pre-Wet Water
13	Calculated Water
14	Automatic Trim
15	Manual Trim
16	Addition Error
17	Total Water
18	Water/Cement Ratio
19	Dry Mix Time
20	Water Addition Time
21	Wet Mix Time
22	Total Time
23	Dry Weight
24	Cement Weight

25	Moisture Gain 1
26	Moisture Offset 1
27	Moisture Gain 2
28	Moisture Offset 2
29	Calculation Gain
30	Calculation Offset
31	Proportional Gain
32	Derivative Gain
33	Cement In Error
34	Water Meter Fault
35	Leaking Water Valve
36	No Water Required Error
37	Too Much Water Calculated Error
38	Pre-Wet Target Not Reached
37	Mix Too Wet Rejected
40	Mix Too Dry Rejected
41	Mix Too Wet Accepted
42	Mix Too Dry Accepted
43	Water Limit Exceeded
44	Max Dry Mix Time Reached
45	Max Wet Mix Time Reached
46	Mix Aborted
47	Sensor Fault
48	Mixer Blades Worn

3.2.3 Hydro-Control VI (HC06) Format v2

Value	Description
1	Batch/Recipe/Prewet Control Method Control Method
2	Auto-track Initial Enable
3	Auto-track Pre-wet Enable
4	Auto-track Dry Enable
5	Auto-track Wet Enable
6	Initial Mix Value (% Moisture)
7	Initial Mix Value (Unscaled)
8	Initial Mix Deviation (% Moisture)
9	Initial Mix Deviation (Unscaled)
10	Pre-Wet Target Value (%Moisture)
11	Pre-Wet Target Value (Unscaled)
12	Pre-Wet Mix Value (% Moisture)
13	Pre-Wet Mix Value (Unscaled)
14	Pre-Wet Mix Deviation (% Moisture)
15	Pre-Wet Mix Deviation (Unscaled)
16	Dry Mix Value (% Moisture)
17	Dry Mix Value (Unscaled)
18	Dry Mix Deviation (% Moisture)
19	Dry Mix Deviation (Unscaled)
20	Target Value (% Moisture)
21	Target Value (Unscaled)
22	Wet Mix Value (% Moisture)
23	Wet Mix Value (Unscaled)
24	Wet Mix Deviation (% Moisture)

25	Wet Mix Deviation (Unscaled)
26	Pre-Wet Water
27	Calculated Water
28	Auto Trim Water
29	Manual Trim Water
30	Addition Error
31	Total Water
32	Water/Cement Ratio
33	Dry Mix Time
34	Water Addition Time
35	Wet Mix Time
36	Total Time
37	Dry Weight
38	Cement Weight
39	Mix Temperature
40	Pre-Wet Moisture Gain
41	Pre-wet Moisture Offset
42	Moisture Gain 1
43	Moisture Offset 1
44	Moisture Gain 2
45	Moisture Offset 2
46	Calculation Gain
47	Calculation Offset
48	Proportional Gain
49	Integral Gain
50	Derivative Gain

51	Cement In Error
52	Water Meter Fault
53	Leaking Water Valve
54	No Water Required
55	Too Much Water Calculated
56	Pre-wet Target Not Reached
57	Mix Too Wet Rejected
58	Mix Too Dry Rejected
59	Mix Too Wet Accepted
60	Mix Too Dry Accepted
61	Water Limit Exceeded
62	Max Dry Mix Time Reached
63	Max Wet Mix Time Reached
64	Mix Aborted
65	Sensor Fault
66	Mixer Blades Worn

3.3 Reading and writing recipe parameters

The recipe values of each recipe can be set at any time except if the recipe is currently in use. If the recipe is currently in use, then commands to change parameters will be applied to the next mix started.

To read parameters the following format should be used:

- #_R_nn_pp

"_" denotes a space, do not use the underscore character in the RS232 string, "nn" denotes the recipe number and "pp" denotes the parameter to read.

To write a recipe parameter the following format should be used:

- #_W_nn_pp_vv

"_" denotes a space, do not use the underscore character in the RS232 string, "nn" denotes the recipe number, "pp" denotes the parameter to change and "vv" is the value to set it to.

Below is a list of parameters and their respective units. Certain commands have been changed or are no longer used. These are shown for backwards compatibility. Command 40 onwards are new commands for the HC06.

Parameter	Description	Units	RS232 Value	Actual Value
4	First Mix Time	Seconds	10	10
5	Cement Timeout	Seconds	10	10
6	Pre-wet Water	Seconds, Litres, US Gallons, Weight	250	25.0
7	Moisture Target	%	65	6.5
8	Pre-set Water Total (Previously Pre-set Final)	Seconds, Litres, US Gallons, Weight	300	30.0
9	Pre-wet water limit	Seconds, Litres, US Gallons, Weight	1200	120.0
13	Final Mix Time	Seconds	15	15
14	Plus Tolerance	%	10	1.0
15	Minus Tolerance	%	3	0.30
17	NO LONGER USED (was recipe gain)	N/A	N/A	N/A
19	Moisture Offset	None	-36364	-3.6364
20	Moisture Gain	None	1817	0.1817
23	Control method (0= preset, 1 = auto, 2 = calc)	None	N/A	N/A
24	Dry weight	Kg or lbs	2000	2000
25	NO LONGER USED (was Calc %)	N/A	N/A	N/A
26	NO LONGER USED (was calibration water)	N/A	N/A	N/A
27	Water Limit	Seconds, weight, Litres or US Gallons	500	50.0

28	Water Trim	Seconds, weight, Litres or US Gallons	50	5.0
29	Batch Counter	None	3	3
30	Pre-wet Mix (was Pre-wet delay)	Seconds	10	10
31	Pre-wet Target	%	40	4.0
32	Pre-wet mode (0 = auto, 1 = preset)	None	N/A	N/A
33	Cement Weight	Kg or lbs	2000	2000
34	Temperature	°C or °F	250	25.0
35	Temp. Coeff	% /°temp	200	0.2
36	Calibration Type (1= 1 point, 2 = 2 point)	None	N/A	N/A
41	Admix Enable after % water	%	10	1.0
42	Admix amount	US Gallons, Litres	10	10
43	Mix extension enabled (1= true, 0 = false)	N/A	N/A	N/A
44	Mix extension time	Seconds	10	10
45	Local Auto-Track Enabled (1=true, 0 = false)	N/A	N/A	N/A
46	Local Auto-Track time dry mix	Seconds	10	10
47	Local Auto-Track dry mix deviation	%	1	0.1
48	Local Auto-Track time wet mix	Seconds	10	10
49	Local Auto-Track wet mix deviation	%	1	0.1
50	Local Auto-Loop Enable (1= true, 0 = false)	N/A	N/A	N/A

51	Local Recipe Proportional Gain	None	100	1.0
52	Local Recipe Derivative Gain	None	100	1.0
53	Auto-Track Enabled (1= true, 0 = false)	N/A	N/A	N/A
54	Averaging Time	Seconds	10	10
55	Moisture Offset 1	None	-36364	-3.6364
56	Moisture Gain 1	None	1817	0.1817
57	Moisture Offset 2	None	-36364	-3.6364
58	Moisture Gain 2	None	1817	0.1817
59	Recipe Name	None	ABC	ABC
60	Recipe Description	None	ABC	ABC

3.4 Reading and writing system parameters

The system values of each recipe can be set at any time.

To read parameters the following format should be used:

- #_R_nn_pp

"_" denotes a space, do not use the underscore character in the RS232 string, "nn" will always be 0 and "pp" denotes the parameter to read.

To Write a system parameter the following format should be used:

- #_W_nn_pp_vv

"_" denotes a space, do not use the underscore character in the RS232 string, "nn" will always be 0, "pp" denotes the parameter to change and "vv" is the value to set it to.

Below is a list of parameters and their respective units. Certain commands have been changed or are no longer used. These are shown for backwards compatibility.

Parameter	Description	Units	RS232 Value	Actual Value
101	Water mode (0=metered,1=timed,2=weighed)	N/A	N/A	N/A
102	Meter Flow (opposite to HC05)	Pulses per litre	200	0.2
103	Meter Timeout	Seconds	10	10
105	Language (0 = English others to be defined)	N/A	N/A	N/A
129	Fine Delivery	Seconds, weight, Litres or US Gallons	20	20
130	In-flight	Seconds, weight, Litres or US Gallons	10	1.0
131	Averaging Time	Seconds	150	15.0
132	Coarse In-flight	Seconds, weight, Litres or US Gallons	10	1.0
139	Cycle Loops	None	2	2
147	Water valve on time	Seconds	100	1
148	Water valve off time	Seconds	100	1
149	Use Fine Valve Only (1 = true, 0 = false)	N/A	N/A	N/A
151	System Proportional Gain	None	100	1.0

152	System Derivative gain	None	100	1.0
153	System Dry mix Auto-Track Time	Seconds	10	10
154	System Dry mix Auto-Track Deviation	%	10	0.1
155	System Wet mix Auto-Track Time	Seconds	10	10
156	System Wet mix Auto-Track Deviation	%	10	0.1

3.5 Mixer Status Commands

To obtain the status of the system the following command can be given:

- #_M_nn_pp

"_" denotes a space, do not use the underscore character in the RS232 string, nn is always 0 and pp is a parameter as listed below

Parameter	Description	Units	RS232 value	Actual value
6	Current active recipe	None	1	1
12	Total water added last	Seconds, weight, Litres or US Gallons	82.50	82.50
24	Time taken to reach mix complete	Seconds	140	140
25	Status Byte	(see below)	N/A	N/A
26	Moisture Reading At mix complete	%	7.40	7.40
27	Calculated water (will be 0 unless in main water addition phase in CALC Mode)	Seconds, weight, Litres or US Gallons	10	1.0

In the case of the status byte it will return the following values depending on which stage of the mix it is in.

- 1 – Standby
- 2 – Pre-Wet
- 4 – Waiting for cement
- 8 – Dry Mix
- 16 – Main Water Addition

- 32 – Wet Mix
- 64 – Mix Complete
- 128 – Paused

It is also possible to get combinations of status (such as pause and wet mix) in this case 32+128 = 160 would be returned

3.6 Mixer Control Commands

To issue start, pause, resume and reset commands to the unit the following command can be used:

- >C1=nn

Where nn is equal to the command sent

- 01 – start
- 02 – pause
- 03 – resume
- 04 – reset
- 05 – cement in

3.7 IO Status

It is also possible to retrieve the status of the Onboard IO. The following command can be used to do this:

- >S1=n

n can b e 0, 1 or 2. If n = 0 then a status word will be sent where:

- 1 – Cement In
- 2 – Start/Resume
- 4 – Pause/Reset
- 8 – Water Meter
- 16 – Water Tank full
- 32 – Coarse Valve
- 64 – Fine Valve
- 128 – Pre-wet done signal
- 256 – Mix complete signal
- 512 – Alarm signal
- 1024 – Request Admix
- 2048 – Unassigned Output

If nn = 1 then a status byte will be sent for the Expansion Board inputs

- 0 – No Daughterboard
- 1 – Digital input 1
- 2 – Digital input 2
- 4 – Digital input 3
- 8 – Digital input 4
- 16 – Digital input 5
- 32 – Digital input 6
- 64 – Digital input 7
- 128 – Digital input 8

If nn = 2, 4 tab delimited integers will be sent representing the current readings for the 2 analogue inputs and 2 analogue outputs. 4 tab delimited 0's will be sent if no Expansion Board is present.

3.8 Alarm Status

It is possible to find out what type of alarm is currently active this can be achieved by sending the command below:

- >A1

  This will return an integer value based on the type of alarm. Below is a list of integer values for the alarms

- 0 – No alarm
- 1 – Cement in fault
- 2 – Water meter fault
- 3 – Leaking water valve
- 4 – No water required
- 5 – Too much water calculated
- 6 – Pre-wet target no reached (auto-mode)
- 7 – Mix too wet
- 8 – Mix too dry
- 9 – Water limit exceeded
- 10 – Maximum dry mix time reached
- 11 – Maximum wet mix time reached
- 12 – Sensor fault
- 13 – Mixer blades worn
- 14 – Waiting for water tank to fill
- 15 – Over temp
- 16 – Fan stopped

It is also possible to accept all alarms. This can be done using the command

- >A2RS232 Commands HC04 Format

On the second system page the RS232 mode can be set to HC04. This will allow the unit to operate using the Hydro-Control IV communications protocol. Refer to HD044 for a list of the commands used. This functionality is only for backwards compatibility and should not be used for newly designed systems

1 Accessing the Hydro-Control remotely

Setting up a remote connection to the Hydro-Control is described in detail in Chapter 12 of the Hydro-Control (HC07) Operators Guide (HD1048).

1 USB Ports

To perform the backup, restore or upgrade function the user must have access to the Hydro-Control's USB ports.

In case if the access to the device's built-in USB Ports is restricted or obstructed, a suitable USB extension with a panel mounted socket should be installed (Hydronix Part Number 0175).

Figure 78: USB Ports location

2 The Backing up, Restoring and Upgrading functions

Backing up and restoring the database, as well as performing software upgrade of the Hydro-Control is detailed in Chapter 11 of the Operators Guide (HD1048).

Water Setup

Parameter	Units	Default	Commissioned Value
Water Mode	None	Metered	
Pulses Per Litre	Pulses Per Litre/Gallon	1	
Water Meter Timeout	Seconds	5	
Fine Delivery	Litres/Gallons	20	
Fine Valve Inflight	Litres/Gallons	0	
Coarse Valve Inflight	Litres/Gallons	0	
Fine Valve On Time	Seconds	0.5	
Fine Valve Off Time	Seconds	0.5	
Use Fine Valve Only	None	No	
Averaging Time	Seconds	10	
Cycle Loops	None	1	

System Auto Control Setup

Parameter	Units	Default	Commissioned Value
Proportional Gain	None	5	
Integral Gain	None	0	
Derivative Gain	None	0	

System Auto-Track

Parameter	Units	Default	Commissioned Value
Auto-Track Initial Mix Dev	%	0.1	
Auto-Track Initial Mix Time	Seconds	10	
Auto-Track Pre-Wet Mix Dev	%	0.1	
Auto-Track Pre-Wet Mix Time	Seconds	10	
Auto-Track Dry Dev	%	0.1	
Auto-Track Dry Mix Time	Seconds	10	
Auto-Track Wet Dev	%	0.1	
Auto-Track Wet Mix Time	Seconds	10	

General Settings

Parameter	Units	Default	Commissioned Value
Language	None	English	

Remote Communications

Parameter	Units	Default	Commissioned Value
RS232 Protocol	None	HC07	
Admix Signal	None	Admix Enable %	

The following tables list the most common faults found when using the controller. In case of difficulties experienced in diagnosing the problem, please contact Hydronix technical support on +44 (0) 1483 468900 or by email: support@hydronix.com.

Symptom: Displays shows 'Searching For Sensor' - no output from the sensor

Possible explanation	Check	Required result	Action required on failure
No power to sensor.	DC power at rear of Hydro-Control, pins 32(0VDC) +33(24VDC)	+24v DC	Locate fault in power supply/wiring
Sensor has temporarily locked up	Power down and re-power sensor	Sensor functions correctly	Check sensor connector pins
Sensor MIL-Spec connector pins are damaged	Disconnect the sensor cable and check if any pins are damaged.	Pins are bent and can be bent to normal to make electrical contact.	Check sensor configuration by connecting to a PC.
Internal failure or incorrect configuration	Connect the sensor to a PC using the Hydro-Com software and a suitable RS485 converter.	Digital RS485 connection is working.	Digital RS485 connection is not working. Sensor should be returned to Hydronix for repair.

Symptom: Incorrect sensor readings

Possible explanation	Check	Required result	Action required on failure
Sensor Unscaled readings are incorrect	Press the 'Unscaled' button on the 'Overview' screen	Readings should be the following: Sensor exposed to air = close to zero. Hand on sensor = 75-85 US	Contact Hydronix for more details.
Incorrect recipe calibration	Check recipe for parameters 'moisture gain' and 'moisture offset'	Moisture offset = 0 to -5 Moisture gain = 0.12 to 3	Recalibrate recipe as per instructions in the Operators guide (HD1048). The signal trace should be stable at the end of the first and final mix times for increased accuracy.

Symptom: Faulty output

Possible explanation	Check	Required result	Action required on failure
Internal fault / wiring fault	Indicator LED status. Perform test described in section 2.2 of Chapter 5.	On with output activated. Off with output deactivated.	Contact Hydronix.
Internal fault / wiring fault	Output status Perform test described in section 2.2 of Chapter 5.	Activated with LED on. Deactivated with LED off.	Contact Hydronix.

Symptom: Faulty input

Possible explanation	Check	Required result	Action required on failure
Internal fault / wiring	Indicator LED / Hardware screen indicator status	On with input activated. Off with input deactivated.	Contact Hydronix.
Internal fault / wiring	Apply correct voltage across the input terminals and check I/O status. for DC input module, 0v connected to – terminal and 24v connected to + terminal.	When voltage is applied, LED and on-screen indicator turn on. Hydro-Control must be powered for this test	Contact Hydronix.

Symptom: Faulty display contrast

Possible explanation	Check	Required result	Action required
Faulty internal power supply to backlight.	-	-	Contact Hydronix for repair details.
Backlight has failed	-	-	Contact Hydronix for repair details.

Analogue Output

The analogue outputs are continuously variable voltages or currents that can be configured to output the sensor's moisture or unscaled output to a batch control system using an analogue input module.

Automatic Calibration (Auto-Cal)

To simplify fitting a new sensor arm to a Hydro-Probe Orbiter, the sensor can be automatically calibrated. This sets the air and water values for the arm. The sensor face must be clean, dry and obstruction free to run the automatic calibration.

Averaging

During a mix cycle, the Hydro-Control takes an average value at the end of the mix times. The time the averaging is taken over can be defined on the system parameters pages.

Backup/Restore Settings

The mix log and recipe and system parameter databases can be backed up to or restored from a memory stick.

Calibration

The Hydro-Control calculation mode is calibrated by running mixes in pre-set mode and adding fixed quantities of water and changing this quantity depending on the resulting material. When a good mix has been obtained, the recipe can then be calibrated from the mix log.

Dry Mix Time

This is the time taken for the Dry Mix, the first mix that occurs after the pre-wet water has been added. The Dry Mix Time can be short for AUTO Mode but should be longer if using CALC Mode.

If a two step addition is selected, then the dry mix time is done twice, once after any pre-wet water is added and the second after the first main water addition (this is stopped when the water addition gets to the admixture addition point).

Dry Weight Moisture

This is the concrete industry standard measure of moisture content. It is calculated as the percentage of the weight of the moisture in the dry weight of the material. As an example, a 1000kg of completely dry sand with 100kg of water added to it, makes the sand 10% moisture. The sand and water together would weigh 1100kg.

Main Water Addition

This is the water that is added after the dry mix before the wet mix is done.

Material

The material is the physical product that is being measure by the sensor. The material must be flowing and must completely cover the sensor's ceramic faceplate.

Moisture

The water held in and around the material. Moisture is defined as a percentage using the weight of the water and the weight of the material it is with. Although the material weight can either be dry weight or wet weight the standard for the concrete industry is to use the dry weight.

Pre-wet Water

This is the water that is added at the start of the process before the dry mixing commences.

Probe

See Sensor.

RS485

This is the serial communication protocol that the sensors use to communicate digitally with the control system.

RS485 Address

Up to 16 sensors may be connected on a RS485 network and the address uniquely identifies each sensor. The sensors leave the factory set to address 16 by default.

Sensor

The sensor is the physical device that is used to measure the moisture in the material.

Unscaled

This is the raw value of the sensor, which changes linearly with the amount of moisture in the material being measured. The unscaled value is pre-set to read 0 (in air) and 100 (in water).

USB

The Universal Serial Bus is an interface that can be used to attach external devices, such as memory sticks, to the Hydro-Control.

Wet Mix Time

This is the time taken for the wet mix phase. This is the mixing phase that occurs at the end of the batch after the main water has been added. During CALC Mode this is when the water will be mixed to homogeneity and so needs to be set reasonably long. During AUTO Mode this can be shortened depending on the homogeneity required in the final product.

Wet Weight Moisture

This is the moisture content of the material calculated as the percentage of the weight of water in the wet weight of material in the sample.

Document Cross Reference

This section lists all the other documents referred to in this Installation Guide. It is beneficial to have a copy available when reading this guide.

Document Number	Title
HD1048	Hydro-Control (HC07) Operators Guide
HD1100	Hydro-Control (HC07) Safety information
HD0679	Hydronix Moisture Sensor Configuration and Calibration Guide
HD0678	Hydronix Moisture Sensor Electrical Installation Guide
HD0676	Hydro-Mix Mechanical Installation Guide
HD0677	Hydro-Probe Orbiter Installation Guide
HD1061	HC07 Fan replacement guide
HD1087	HC07 Battery replacement instructions
EN0108	HC07 Expansion PCB retrofit guide
EN0111	HC07 AC IO Board Fuse Replacement Guide
EN0112	HC07 IO Board Replacement Guide

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