Hydro-Control VI

Installation Guide

To re-order quote part number:	HD0455
Revision:	1.9.0
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CUSTOMER RESPONSIBILITY

The customer in applying the product described in this documentation accepts that the product is a programmable electronic system which is inherently complex and which may not be completely free of errors. In doing so the customer therefore undertakes responsibility to ensure that the product is properly installed commissioned operated and maintained by competent and suitably trained persons and in accordance with any instructions or safety precautions made available or good engineering practice and to thoroughly verify the use of the product in the particular application.

ERRORS IN DOCUMENTATION

The product described in this documentation is subject to continuous development and improvement. All information of a technical nature and particulars of the product and its use including the information and particulars contained in this documentation are given by Hydronix in good faith.

Hydronix welcomes comments and suggestions relating to the product and this documentation

ACKNOWLEDGEMENTS

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If your feedback is concerning an Atex certified product or associated service it would be very helpful for you to give us your contact details and the model number and serial number of the product if possible. This will enable us to contact you with any relevant safety advice should this be necessary. It is not obligatory to leave your contact details and any information will be treated as confidential.

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Revision history

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1.1.0		November 2010	RS232 Command set added for Hydro-Control Iv.
1.2.0	V1.8.0	March 2011	Remote support setup added
1.3.0	V1.8.0	June 2011	Modification to Hydro-Control V Mix Log table
1.4.0	V2.0.0	December 2011	RS232 HC06 v2 Mixlog table added, additional sections on initial mix time and auto-track functions for initial and pre-wet mix added
1.5.0	V2.0.0	April 2013	Figure 38 added – Typical water valve set up Pipe Diameter table added Figure 42 updated
1.5.1	V2.0.0	June 2013	USB Panel Mount socket added to Box Contents List
1.6.0	V2.3.0.0	Sept 2013	Added *9 and * 10 RS232 Commands
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1.8.1	V2.8.0.0	January 2016	Minor formatting update
1.9.0	V2.15.0.0	March 2020	Reference to HC06 v2 added (no memory cards) Archiving function added Address Updated

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Box Contents

Standard Contents:

1	x	Hydro-Control VI Unit
4	x	Top/Bottom fixing brackets
2	x	Side fixing brackets
1	x	10 Way Connector for Power/Sensor Communications
1	x	11 Way Connector for Digital Inputs
1	x	14 Way Connector for Digital Outputs
1	x	Panel Mount USB Socket Kit
1	x	Hydronix USB Memory Stick with Documentation

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

1	x	8 Way Connector for Analogue Inputs/Outputs
1	x	9 Way Connector for Recipe Selection Inputs

Accessories

Part No.	Description
0116	24v DC Power Supply 30 Watt
0175	Panel Mount USB Socket
0176	Replacement System Card (Not applicable to HC06 v2)
0177	Replacement Data Card (Not applicable to HC06 v2)
0179	Replacement Touch Screen Protective Layer
0180	Hydro-Control VI Expansion Board
0170	Hydro-Control VI Wall Mount Enclosure
0190	Hydro-Control VI Control Cabinet

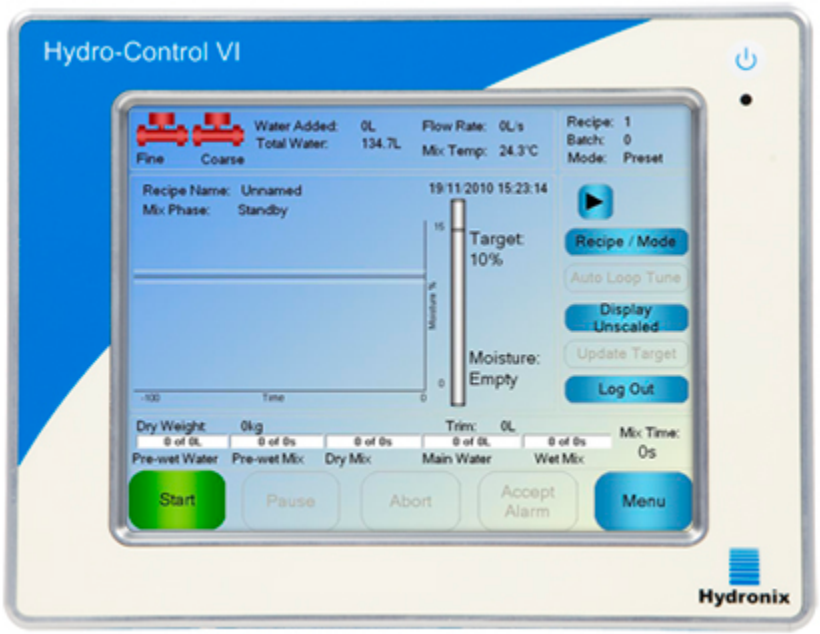


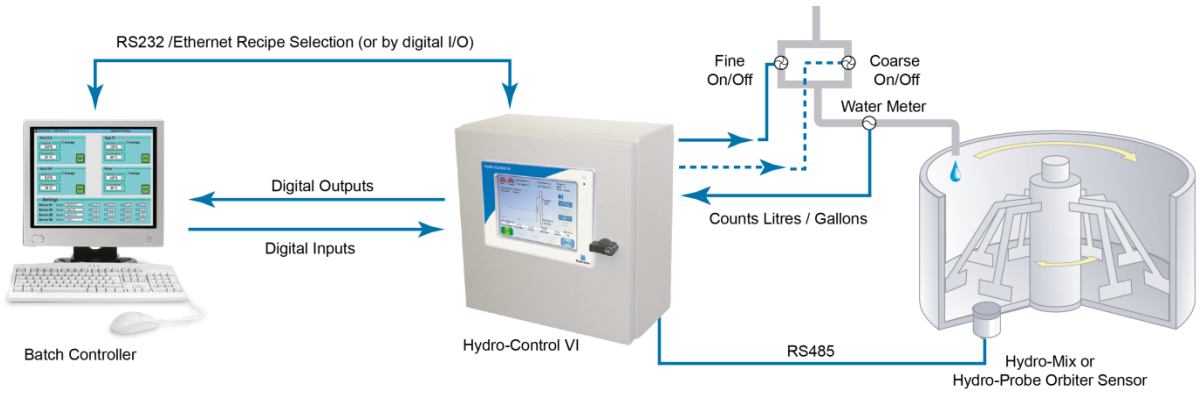
Figure 1: The Hydro-Control VI

1 Introduction to the Hydro-Control VI

The Hydro-Control VI is a touch screen computer based upon the Microsoft Windows XP Embedded operating system that has been designed to work with the Hydronix range of sensors to monitor the level of moisture in a process (usually in a mixer) and send signals to adjust the flow of water into the process using water valves.

The moisture level during the process cycle is displayed on the main 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, Ethernet Telnet port (port23) 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, Prewet Done, Mix Complete, Alarm, Water Tank Fill

2 About this manual

This manual is not a user guide. It is designed as a reference guide for engineers who are designing, installing or commissioning a Hydro-Control VI system.

This manual complements the Operators Guide which details how to setup and calibrate recipes in the Hydro-Control VI. In order to understand the choices of operation and consequent design requirements it is advisable to read the Operators Guide before reading this manual.

The manual is divided into 3 sections covering the mechanical installation, the electrical installation and the commissioning of the unit.

3 Safety

The Hydro-Control VI has been designed to meet the requirements of IEC/EN 61010-1 : 2001 and ANSI/UL 61010-1 Second Edition.

This equipment is designed to be safe under the following conditions.

3.1 Precautions

This unit is suitable for indoor use only.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The final installation should have a means to disconnect the electrical supply to the unit. It should be marked as the disconnecting device and be within easy reach of the operator.

Disconnect all signals from any voltage supply before the unit is opened for any adjustment, maintenance or repair work.

Ensure that only fuses of the correct type and rating are fitted.

Ensure that the Hydro-Control is mounted in an environment that will not cause electrical interference.

3.2 Explanation of Symbols and Markings

It is important to understand the meaning of the various symbols and markings on the Hydro-Control equipment as follows:

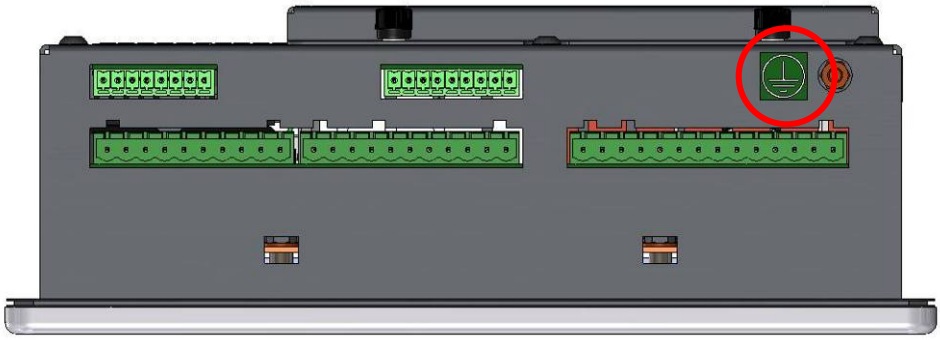


Figure 2: The base of the Hydro-Control VI with the label for the Earth stud in the red circle

The Protective Earth symbol indicates that the earth must be connected to this point.

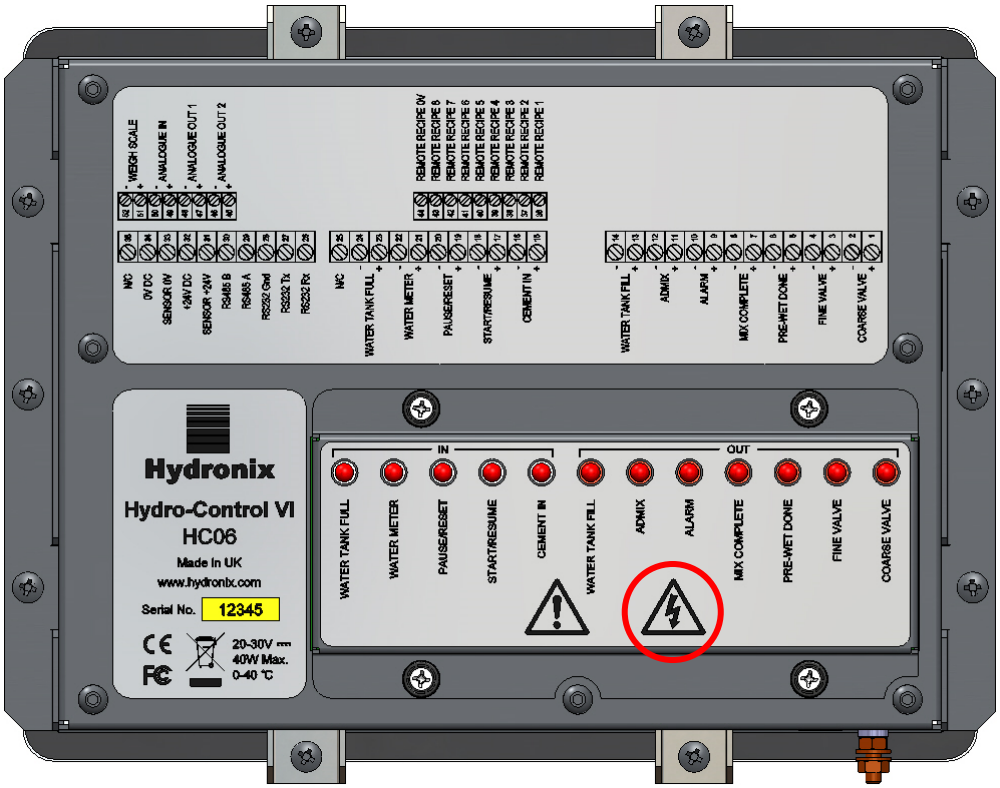
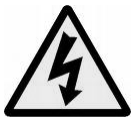


Figure 3: The rear of the Hydro-Control showing the electrical safety symbol in the red circle



Caution – risk of electric shock.

Caution – refer to accompanying documents.

3.3 Clearance Requirements

It is important to ensure that the Hydro-Control has adequate clearance for ventilation and access. The side and top vents should not be restricted and the top access plate for the CompactFlash cards should be easily accessible.

The minimum clearance for the top and sides of the enclosure is 100mm. It may be necessary to allow more space at the top to allow access to the top access plate with a screwdriver.

3.4 IP Rating

When correctly integrated into a suitable enclosure, the front panel and touch screen are designed to be rated to Ingression Protection (IP) rating IP66. This has the American equivalent NEMA 4.

This IP/NEMA rating is only applicable if the unit is installed in accordance with the mechanical mounting procedures in Chapter 2 of this installation guide.

3.5 Environmental Conditions

The range of environmental conditions for which the equipment has been designed are:

- Indoor Use Only
- Altitude up to 2000m
- Temperature 0°C to 40°C (32°F to 104°F)
- Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C
- Pollution Degree 3 (Electrical Equipment in industrial or farming areas, untreated rooms and Boiler rooms)

3.6 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 Optical Isolation on the sensor input, this will not prevent damage in all cases. Precautions should still be taken to avoid damage by lightning in areas where there is a known risk.

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

It is recommended to install the equipment using screened cables to the specification defined in Chapter 3 section 7.

3.7 Cleaning

The front panel of the Hydro-Control should be cleaned with a soft cloth. Abrasive materials and liquids must not be used.

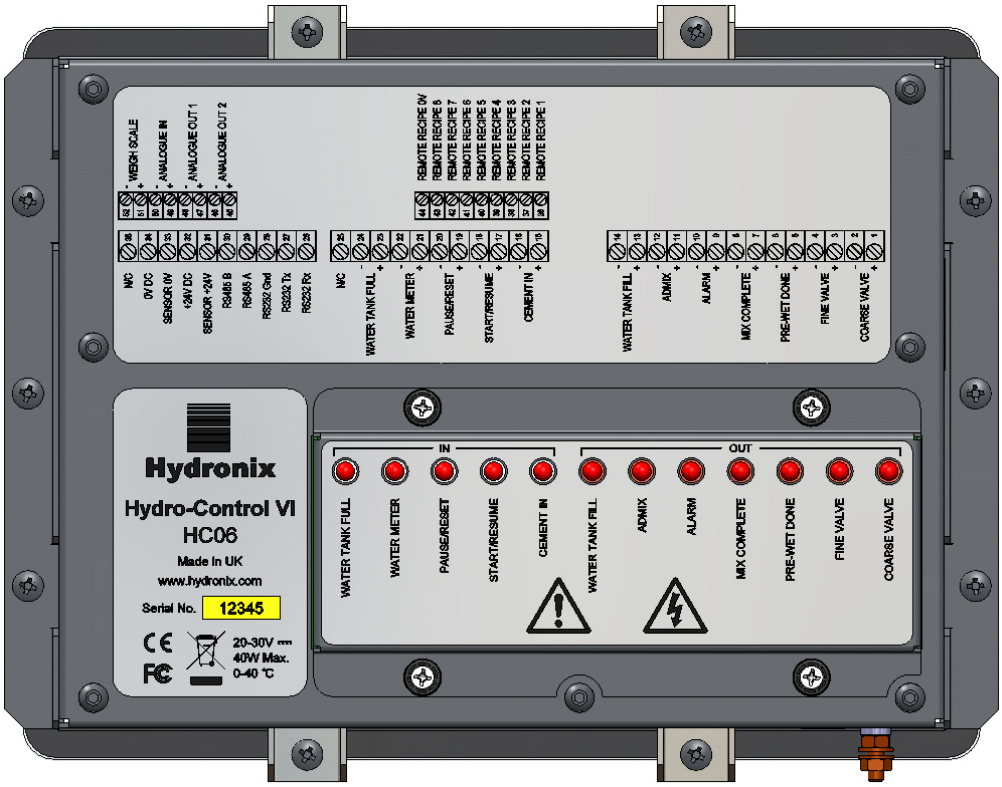


Figure 4: The rear view of the Hydro-Control VI

1 Weight and Dimensions

Fascia:	246 mm (W) x 190 mm (H); (9.69” (W) x 7.48” (H))
Panel Cut out:	232 mm (W) x 178 mm (H); (9.14” (W) x 7.00” (H))
Max Panel Thickness:	8 mm
Depth:	84 mm (3.54”)
Depth behind Fascia:	78 mm (3.31”)
Weight:	3.5 Kg (7.75 lb)

NOTE:

I/O connections are made to the base so access needs to be allowed for the cables and connectors.

Space should be allowed for memory cards (Not applicable to HC06 v2) to be installed through the access plate on the top of the unit.

USB connections are made on the right hand side of the unit (viewed from the rear). Sufficient space should be left to allow insertion and removal of a USB memory stick, if required.

A minimum of 100mm of space should be allowed around the unit for cooling air circulation.

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

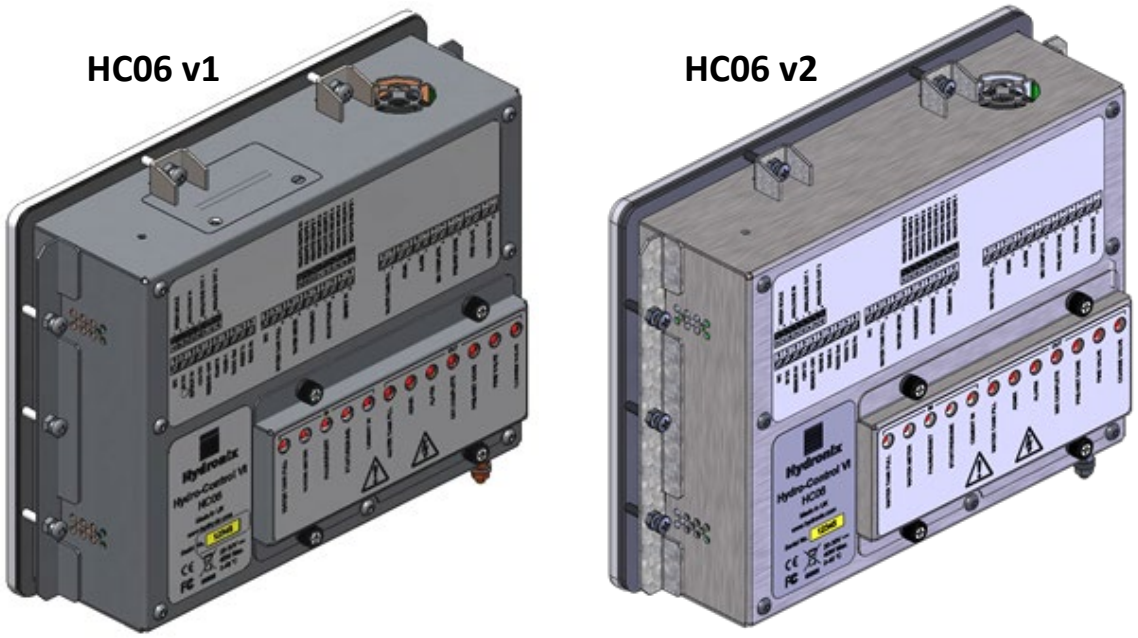


Figure 5: View of the Hydro-Control VI showing the mounting brackets

2 Mounting and installation

The unit should be mounted in a control panel (maximum thickness 8mm) using a bracket on each side, two brackets on the top and two brackets on the bottom. To fit the side brackets, locate the bracket in the slots on the side of the unit and slide it down until the top and bottom of the bracket are level with the case. To fit the top and bottom brackets, insert the bracket into the slot and tighten the bolt.

To install the Hydro-Control

- 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 and tighten the screws evenly to pull the fascia towards the control panel.

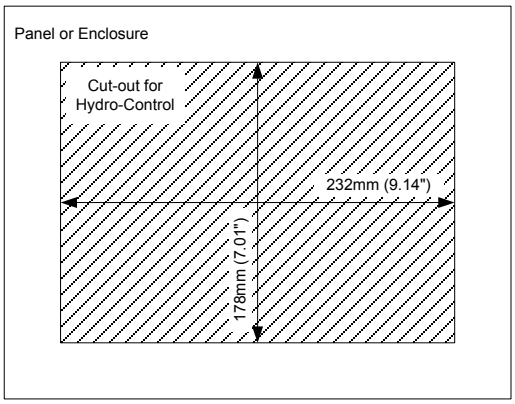


Figure 6: The panel cut-out for the Hydro-Control VI

3 Operating Temperature

The unit has been designed to work in ambient air temperatures inside the cabinet of 0 – 40 °C (32 – 104 °F).

Where ambient temperatures vary from this a temperature regulation system may need to be installed.

4 OPTO modules

The OPTO-22 I/O modules are accessed through the removable panel on the rear of the unit. The panel is held in place by four captive screws. When the screws are released and the panel is removed, the OPTO modules can be individually removed and replaced using their individual retaining screws. All power should be removed, from both the unit and the field wiring, whilst the cover is not in place.

5 Memory Cards

Note: HC06 v2 utilises an internal SSD hard drive and does not contain removable memory cards (Figure 5). The SSD hard drive is not removable, therefore, no user maintenance is possible. Contact support@hydronix.com for assistance in the event of a failure.

There are two memory card slots and these are accessed by removing the mounting bracket on the top left corner of the Hydro-Control (as viewed from the rear). Removing the two small screws opens the access plate over the card sockets (shown in Figure 7).

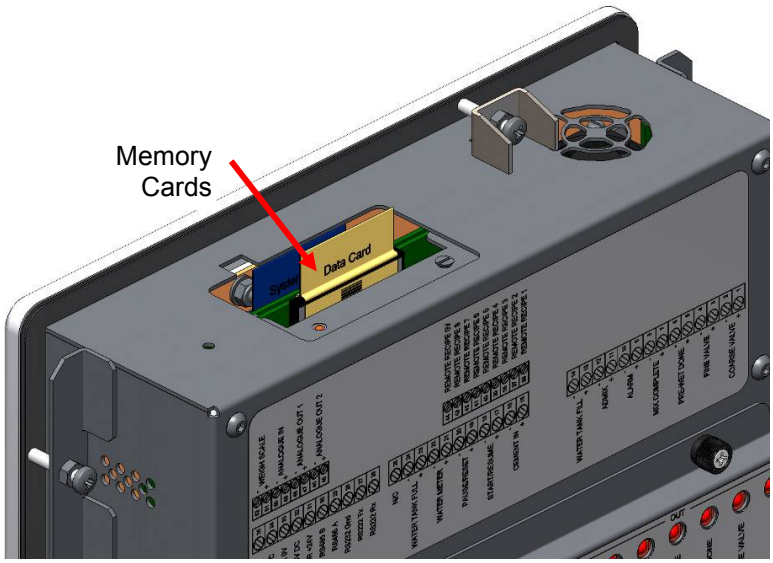


Figure 7: The memory card access port showing the labels of the cards

As shown in Figure 7, the memory cards are mounted so that the System Card is nearest to the front of the unit and the Data Card is nearest to the rear. Both cards are clearly labelled. The System Card is coloured blue and the data card is coloured beige.

The memory cards should always be inserted so that the Hydronix Logo is facing the rear of the unit. The System Card should never be transferred between units.

If needed the System Card can be replaced with Hydronix Part Number 0176. The Card must be replaced with the same colour card as the original factory fitted card.

Over time the memory cards can degrade in performance and so the Data Card should be replaced every five years with Hydronix Part Number 0177.

Use Hydronix original parts to ensure compatibility and continuing reliability of the unit.

6 Touch screen protective layer

The touch screen has a thin sheet of plastic which protects it. The sheet is not glued in place, but held around the edged by the bezel on the front of the Hydro-Control. If the protector gets worn or dirty it can be replaced with Hydronix Part Number 0179.

The touch screen protective layer can be removed by carefully applying pressure to the front of the Hydro-Control and sliding the sheet down slightly. This will expose the corners of the sheet which can then be lifted away from the touch screen. A blunt plastic tool can also be used to help lift the sheet if needed.

To fit a new sheet, remove the sheet from the packaging taking care to keep the sheet clean and dust free. Remove the protective covering from the rear (shiny) surface of the touch screen protector and then carefully fit the new protector over the screen so that the anti-glare (dull) front surface faces away from the touch screen.

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.

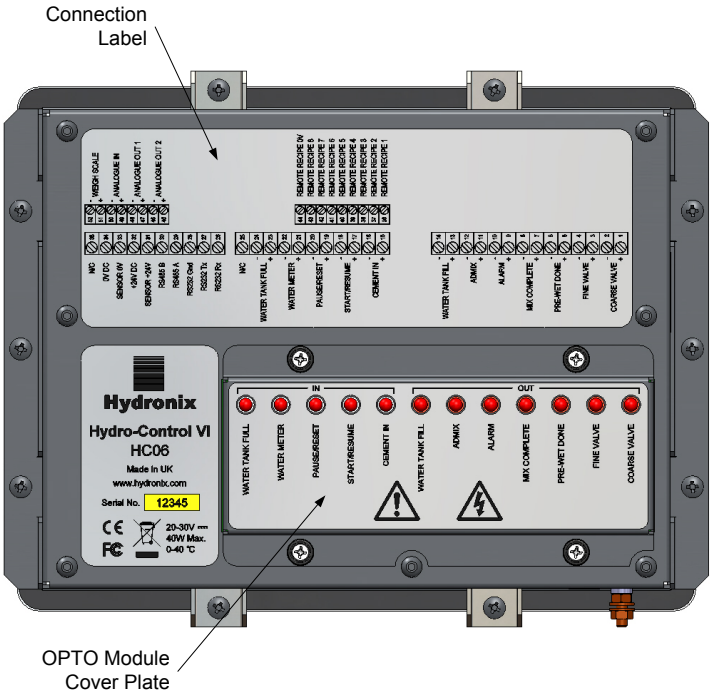


Figure 8: The rear of the Hydro-Control showing two of the connectors at the bottom

The diagram of the Hydro-Control shown in Figure 8 shows the rear of the unit showing the labels detailing the connectors and the OPTO Modules.

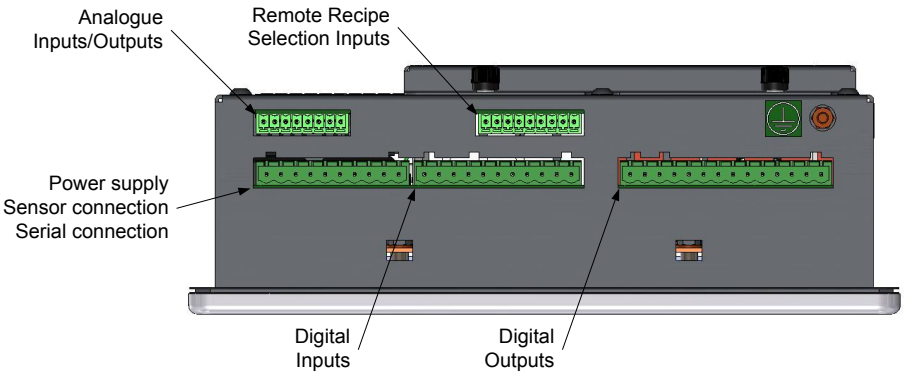


Figure 9: The base of the Hydro-Control showing the connectors

Figure 9 shows the connectors as viewed from the base of the unit.

1 Connector pin assignments

1.1 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	Set to indicate the end of the Pre-wet phase
7	8	Mix Complete	Set indicates the Hydro-Control has finished control
9	10	Alarm	Set indicates the Hydro-Control is in an alarm state
11	12	Admix	Controls the start of the admixture addition
13	14	Water Tank Fill	Controls filling the water tank on a weighed water system

1.2 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	The water meter pulse input
23	24	Water Tank Full	Minimum 200ms pulse set indicates the water tank is full
25		N/C	No Connection

1.3 Power and Communications Connector

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

1.4 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.
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.

1.5 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 In	Analogue input reserved for future use.
51	52	Weigh Scale	Analogue weigh scale input for weighed water system.

2 Power Supply

The unit uses 24v DC, with a nominal power rating of 24W including the sensor.

Minimum supply: **24v DC, 1.25A (30W)**

Recommended supply: **Hydronix part number 0116**

Important: If using 24v DC for inputs/outputs (valves, etc), then this should be powered from a separate power supply to the main unit to reduce the likelihood of interference between the two systems.

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).

4 Interface modules

4.1 OPTO-22 Modules

The Hydro-Control is fitted with plug-in optically isolated input/output modules, manufactured by OPTO-22. A range of different input/output modules is available depending on the voltage required.

Seven output modules and five input modules are provided. The FINE WATER output MUST be connected for the unit to function correctly. All other connections are optional and can be connected as appropriate for each configuration.

4.2 Voltage Options

4.2.1 Digital Input Module Types

Hydronix Part No.	OPTO-22 Part No.	Description
0401	G4IDC5	10 - 32 VDC Standard DC input module
0402	G4IAC5	90 – 140VAC
0403	G4IAC5A	180 – 280VAC

4.2.2 Digital Output Module Types

Hydronix Part No.	OPTO-22 Part No.	Description
0404	G40DC5	5 - 60VDC @ 3A (45ºC), 2A (70ºC).
0405	G40AC5	12 – 140VAC @ 3A (45ºC), 2A (70ºC).
0406	G40AC5A	24 – 280VAC @ 3A (45ºC), 2A (70ºC).

5 Expansion Board (Hydronix Part Number 0180)

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 and enables use of the weighed water system and the remote recipe selection inputs.

5.1 Analogue Inputs

The board has two analogue inputs that can run at 4-20mA or 0-20mA (this can use 0-10v with a conversion resistor as described below). Currently only one input is used for the weigh scale input. The other is reserved for future use.

5.2 Analogue Outputs

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

5.3 Recipe selection inputs

The board has 8 recipe selection inputs to provide recipe control using discrete, binary or BCD inputs. These are configurable in the I/O Setup And Status pages and can be used to change the current recipe being used by the unit from an external control system or other recipe selection device. These replace the Hydro-Control V remote recipe module.

6 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 any problems.

6.1 Wiring digital inputs

This functions in a similar way to the coil side of a normally-open relay. To switch on the relay, apply the correct potential across the terminals.

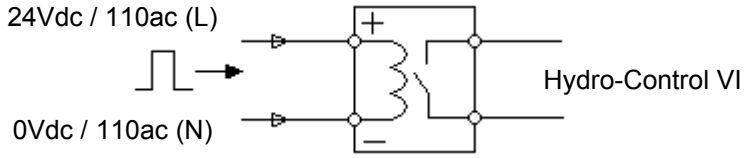


Figure 10: Digital Input Wiring Diagram

6.2 Wiring digital outputs

This functions in a similar way to the voltage free contact side of a normally-open relay. The Hydro-Control switches on the relay therefore closing the contacts for the output side. Note that the AC outputs have a minimum current of 20mA.

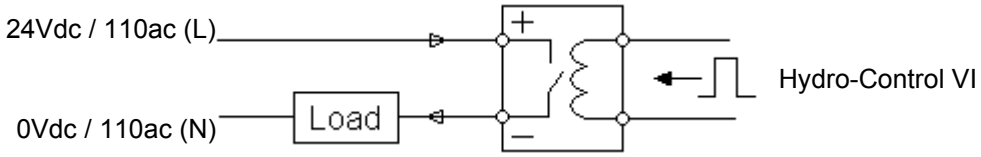


Figure 11: Digital Output Wiring Diagram

6.3 Wiring analogue inputs

The analogue inputs are current loop inputs, taking a signal of either 0-20mA or 4-20mA. This is configurable on page 2 of the I/O Setup and Status pages. The connection to an Analogue Input is shown as in Figure 12.

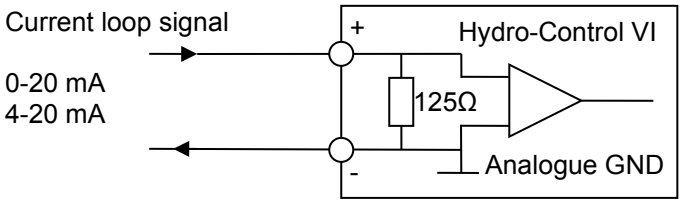


Figure 12: Analogue Input Current Loop Wiring Diagram

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.

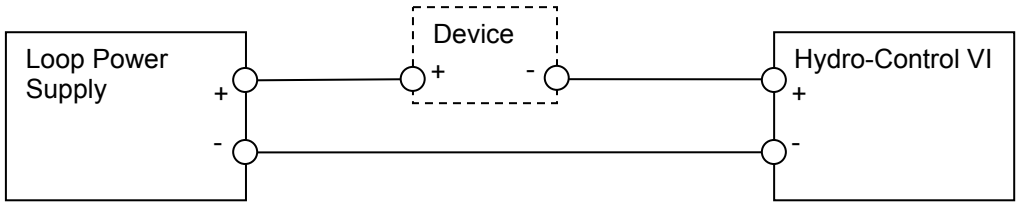


Figure 13: Connecting a loop powered device

Figure 13 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”.

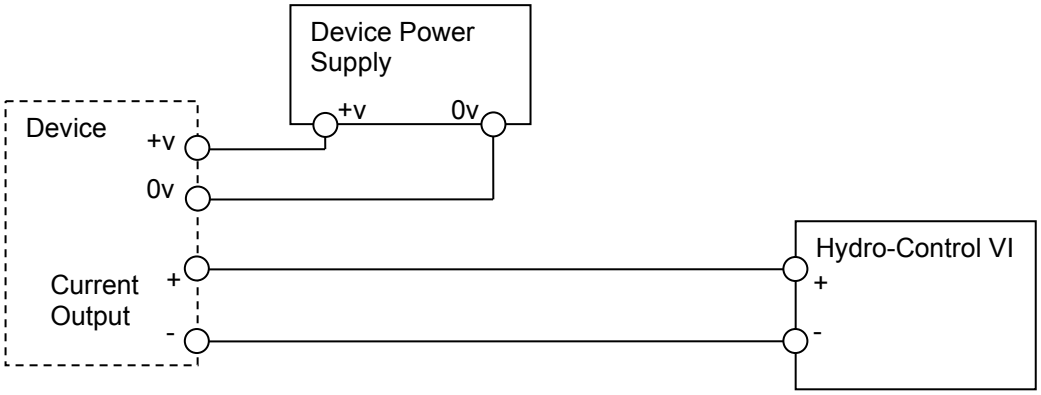


Figure 14: Connecting the current loop of an externally powered device

Figure 14 shows the wiring diagram for connecting an analogue device that has a separate power supply which powers the current loop.

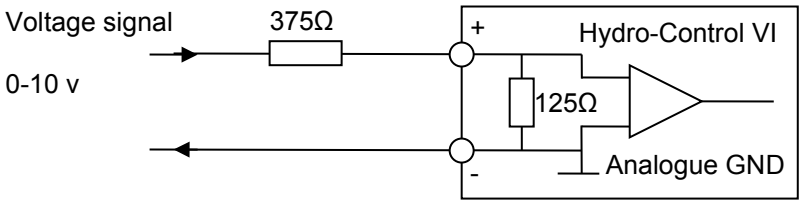


Figure 15: Connecting a voltage signal to the Analogue Input

Figure 15 shows a method for connecting a 0-10v signal into the Hydro-Control. A series resistance of 375Ω resistance is required. This can be obtained by placing two 750Ω resistors in parallel. It is recommended to use resistors with a tolerance of ±0.1%.

6.4 Wiring analogue outputs

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

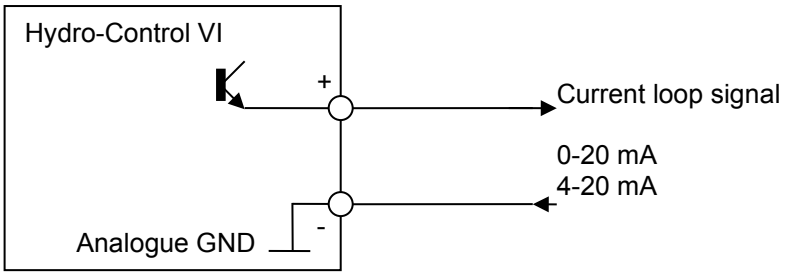


Figure 16: Analogue Output Wiring Diagram

These are designed for future expansion.

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

6.5 Wiring recipe selection inputs

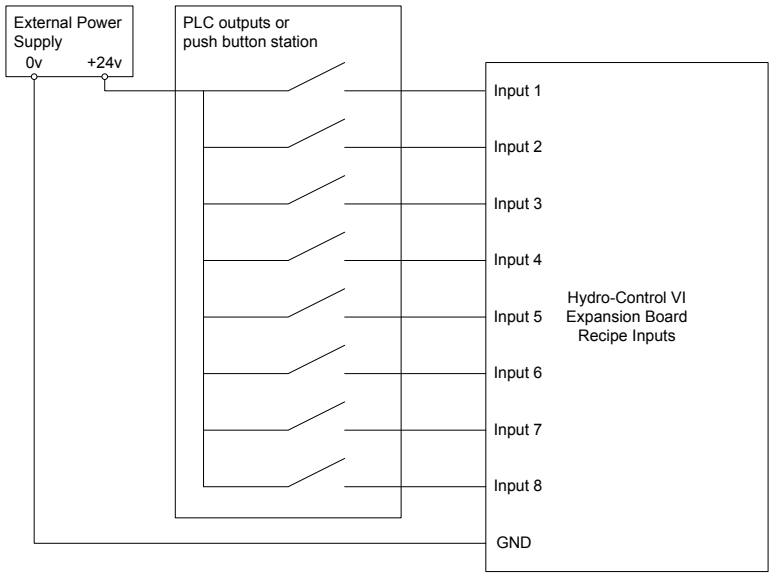


Figure 17: The recipe selection input wiring

The recipe inputs are 2mA current sinks. They switch on a DC input signal with a nominal voltage of 24v (the range of the DC voltage is actually 9-36v). There is one common ground for all eight input signals as shown in Figure 17.

7 Cables

7.1 Sensor cable

The sensor must be connected using an extension cable made up from a suitable length of two pairs twisted (4 cores total) screened (shielded) cable with 22 AWG, 0.35mm^2 conductors. It is recommended that a high quality cable with good braid screen and also a foil screen is used in order 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.

7.2 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.

8 USB Ports

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

A panel mounting 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 Screen Navigation

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

2 Menu Tree

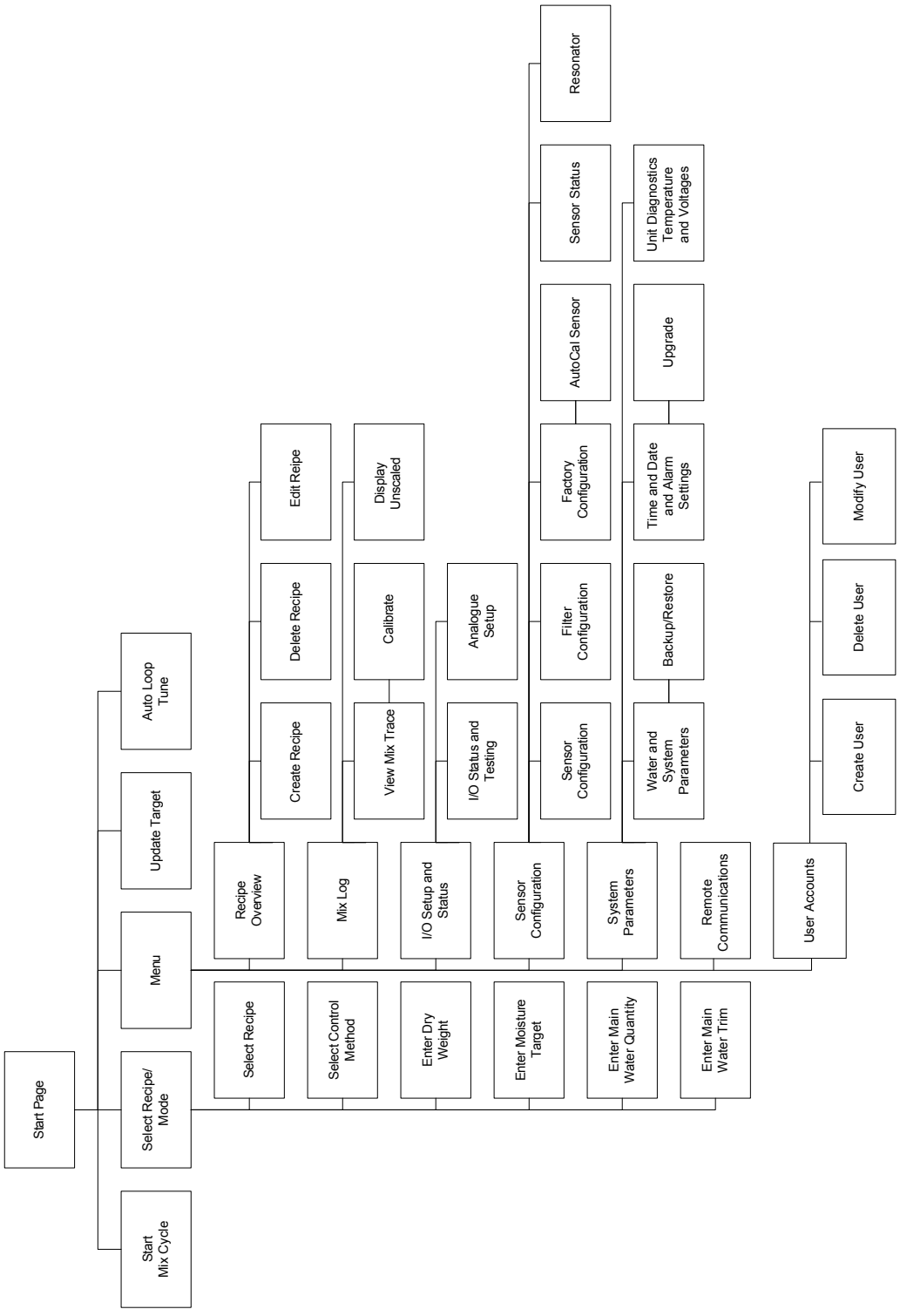


Figure 18: The Menu Structure Of The Hydro-Control VI

3 Basic Tests

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

The unit will run through a self test and boot up the Hydro-Control. A splash screen will be displayed followed by the software version number before displaying the main screen.

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.

3.1 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 banner across the centre reading 'Searching for Sensor on address xx' showing the address of the sensor being requested at that time.

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 the reading from it in the trend display.

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

1. Press the Display Unscaled button 

. 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.

If these tests are completed correctly, then you can be certain that the sensor installation and communications with the Hydro-Control are working. Press Display Moisture 

to switch back to moisture mode.

3.2 Testing the I/O

The I/O Setup And Status screens may be selected by pressing the Menu button 

and then pressing the I/O Setup And Status button 

.

This will display the first I/O Setup And Status page shown in Figure 19, which can be used to test the Digital Inputs and Outputs.

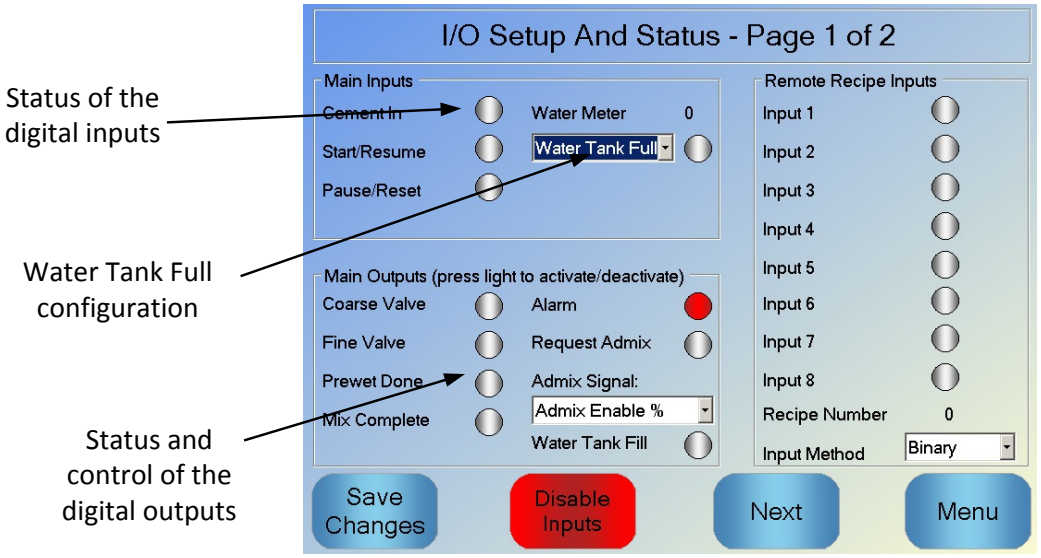


Figure 19: I/O Setup And Status – Page 1

The status of the input signals can be seen at the top and right hand side of the screen with deactivated inputs shown as a grey circle and activated inputs shown as a red circle. The external control system outputs can be activated and the input to the Hydro-Control checked.

To stop the Hydro-Control from responding to the inputs being received (for example, starting a mix when the Start signal is activated) the Disable Inputs button can be pressed. Whilst the inputs are disabled, the button is changed to Enable Inputs. Changing from this screen by pressing the Next or Menu buttons will also re-enable the inputs.

Individual outputs can be activated and deactivated by pressing on the grey circle next to the text which allows the link to the external control system input to be checked. Activated outputs display with a red circle (as seen from the 'Alarm' output which is activated).

The **Admix Signal** is used to control at which point during the mix cycle the Admix output is set. 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 5.

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 19).

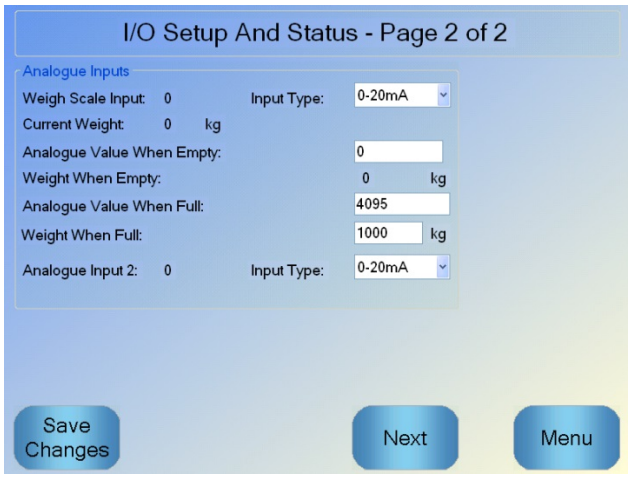


Figure 20: I/O Setup and Status – Page 2

Page 2 of the I/O Setup And Status screens is shown in Figure 20 and allows configuration and display of the Analogue Inputs and Outputs.

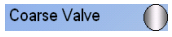
The first Analogue Input is for the Weigh Scale and can be configured as either a 0-20mA or 4-20mA signal.

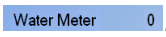
Once the input type has been selected the input should be set to a known value and the Weigh Scale Input should be checked. The Weigh Scale Input value displays 0 when at 0 or 4 mA (depending on the Input Type setting) and displays 4095 when the input is at 20mA.

The second Analogue Input and Analogue Outputs are for future use.

3.3 Valve and flow meter testing

To test the valves function correctly, follow this procedure:

1. Open the first I/O Setup And Status page as in the previous section. When the page is opened, the water meter value is reset to zero.
2. Weigh a container and place it underneath the water inlet to collect the water that is dosed during the testing.
3. Open the Coarse Valve by pressing the icon on the display 

4. Check the valve opens, water flows and the water meter counts up 

.
5. Close the Coarse Valve by pressing the icon again.
6. Open the Fine Valve by pressing the icon on the screen.
7. Check the valve opens, water flows and the water meter counts up.
8. Close the Fine Valve by pressing the icon again.
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.
10. Press Menu 

and then Overview 

to return to the main screen.

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

$$PulsesPerLitre = NoOfPulses / NoOfLitres$$

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

4 Touch screen recalibration

The touch screen should not require calibration unless there are problems when trying to select objects on the screen. In this case the touch screen can be recalibrated as follows:

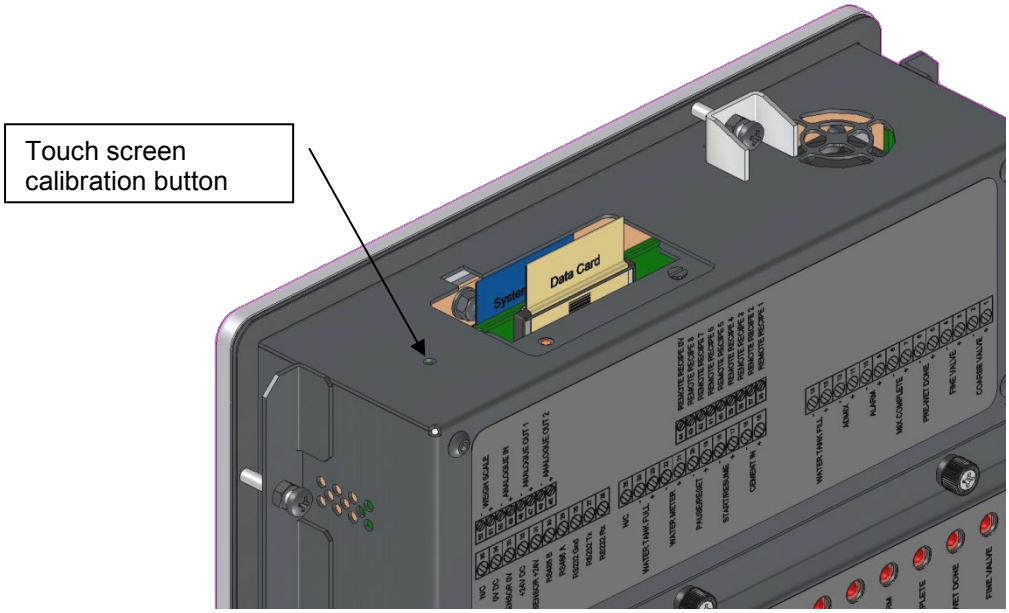


Figure 21: The top of the Hydro-Control showing the recalibration button

The touch screen calibration is started by pressing the recessed button on the top of the unit with a small pointed object.

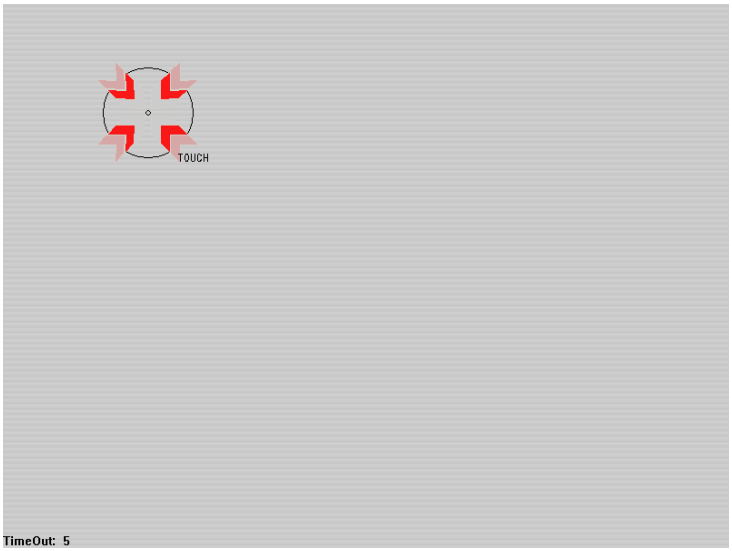


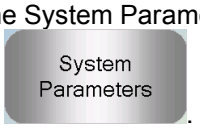
Figure 22: An example of a calibration screen showing the target

After pressing this button the screen will change to a blank display with a small target on it similar to the one shown in Figure 22. Using a small blunt pointed object, touch the screen at the area indicated until prompted to release. This will be repeated a number of times after which the system will display a prompt for the calibration to be accepted. Accept this prompt to continue.

After calibrating the screen the system should be shut down and restarted by pressing the power button briefly and then clicking 'Yes'. If this is not done then the system may not save the screen calibration settings.

5 System Parameters

To access the System Parameters page, press the Menu button 

and then press System Parameters 

.

5.1 The System Parameters – Page 1

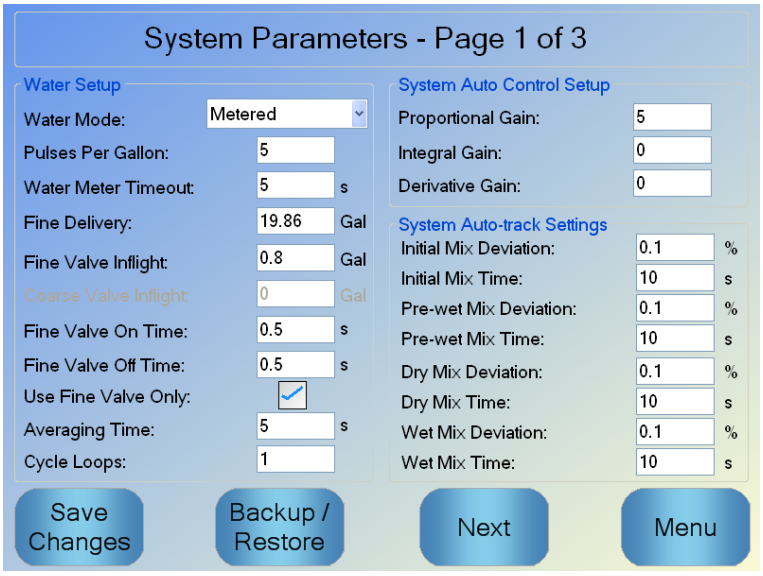


Figure 23: The System Parameters screen

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

Water Setup

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	20	0 – 100 L 0 – 26.4 Gallons
Fine Valve Inflight	Litres/Gallons	0	0 – 100 L 0 – 26.4 Gallons
Coarse Valve Inflight	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
Use Fine Valve Only	None	No	Yes/No
Averaging Time	Seconds	10	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 '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 5.

Pulses Per Litre sets the number of pulses that are 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 that is fed using the fine valve only.

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

Coarse Valve Inflight 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.

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 for taking an average value of the moisture reading.

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.

System Auto Control Setup

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

The **Proportional, Integral** and **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'.

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

System Auto-Track

Parameter	Units	Default	Range
Initial Mix Deviation	%	0.1	0 – 100
Initial Mix Time	Seconds	10	0 – 100
Pre-wet Mix Deviation	%	0.1	0 – 100
Pre-wet Mix Time	Seconds	10	0 – 100
Dry Mix Deviation	%	0.1	0 – 100
Dry Mix Time	Seconds	10	0 – 100
Wet Mix Deviation	%	0.1	0 – 100
Wet Mix Time	Seconds	10	0 – 100

The **Initial Mix Deviation, Initial Mix Time, Pre-wet Mix Deviation, Pre-wet Mix Time, Dry Mix Deviation**, **Dry Mix Time**, **Wet Mix Deviation** and **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.

See the section on Auto-Track on page 66 for more details.

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

5.2 The System Parameters – Page 2

By clicking the Next button 

the following System Parameters page is accessed:

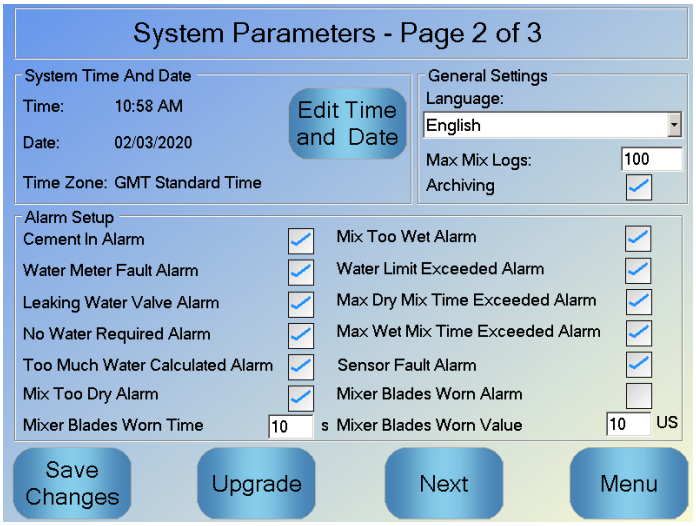


Figure 24: The second System Parameters screen

The System Time and Date settings are used to set the clock in the Hydro-Control. This is used to log times against the mix logs. Pressing the Edit Time and Date button 

displays the following screen allowing the time and date to be set:

Figure 25: Changing the date and time

The time can be entered by selecting the hours (0 – 24) and minutes (0 – 59) boxes. The time zone can be set using the arrows.

General Settings

Parameter	Units	Default	Range
Language	None	English	Multiple Languages
Max Mix Logs	None	100	1-1000
Archiving	None	True	True/False

The **Language** parameter sets the Hydro-Control to display different languages.

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

The **Archiving** parameter, when selected, will enable the HC06 to save all mix log data that exceeds the Max Mix Logs limit to an archive file. 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 HC06, and a Backup is requested, the archive files will be copied to the USB stick. This will enable the user to keep a record of older mix logs.

Alarms Setup

The Alarms Setup section on the System Parameters page allows each of the alarms in the system to be disabled. The alarms are described in the Operators Guide in the chapter 'Alarm Configuration'.

At the end of a batch, if the sensor value has not fallen below the **Mixer Blades Worn Value** by the end of the **Mixer Blades Worn Time**, then the **Mixer Blades Worn Alarm** is activated.

5.3 The System Parameters – Page 3

By clicking the Next button 

the internal temperature and voltage monitoring page is displayed. This is for system information only.

The screen shown in Figure 26 displays the current parameters available from the Hydro-Control and is used for diagnostic monitoring purposes.

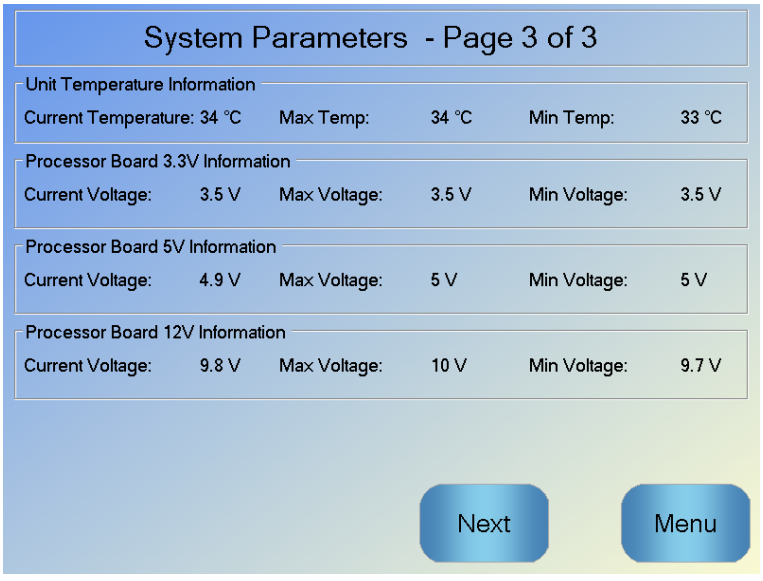


Figure 26: The voltage and temperature monitor screen

5.4 Setting up weighed water

In order 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 from the I/O setup and status page 2. Follow the next instructions to perform the initial setup and calibrate the input from the weigh scale.

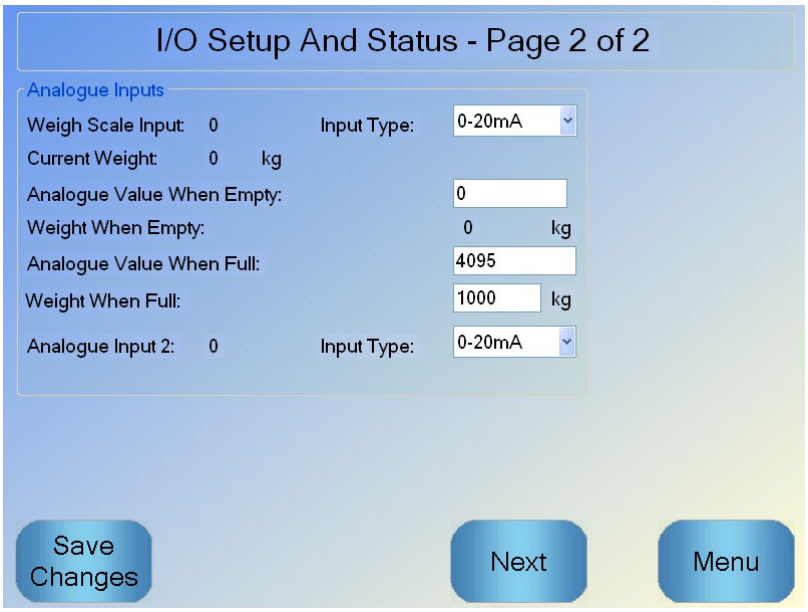


Figure 27: The weighed water setup page

With the water tank empty, copy the 'Weigh Scale Input' shown on the status page (in Figure 27) into the field 'Analogue Value When Empty'.

Now set the Hydro-Control to use weighed water. To do this, go to the first System Parameters page (shown in section 5) and set the system water mode to Weighed. Once you have done this, 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. Go back to the status page (in Figure 27) and copy the number from the 'Weigh Scale Input' into the field 'Analogue Value When Full'.

Now enter the 'Weight When Full' figure for the water tank and press the 'Save Changes' button.

6 Sensor Configuration

With a sensor connected, the measurement parameters and settings can be changed by using the sensor configuration pages which area accessed from the main screen pressing the menu button 

and then the sensor configuration button 

. This section briefly describes the options available in the screens. For more detailed information on the parameters available, refer to the relevant sensor user guide.

6.1 The Sensor Configuration Screen – Page 1

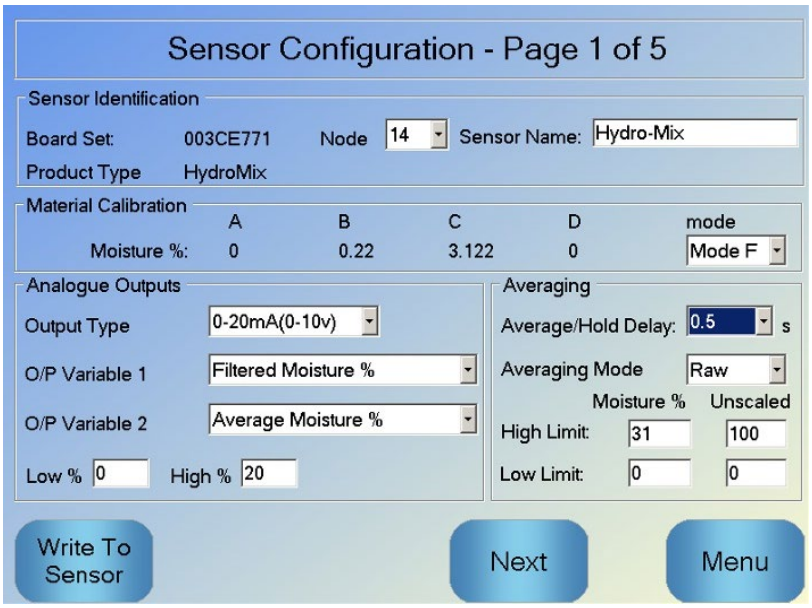


Figure 28: The sensor configuration screen - Page 1

Sensor Identification

This section shows the Board Set identifier, the Node identification number on the RS485 network and allows a sensor name to be set.

Material Calibration

This section shows the current material calibration that has been downloaded to the sensor. This is updated when the recipe in the Hydro-Control VI is changed. The current measurement mode selected for the recipe is also displayed (only with compatible sensors).

Analogue Outputs

This section allows the setup of the Analogue Outputs on the sensor to be adjusted. As the Hydro-Control VI 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 VI moisture value.

Averaging

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

If any settings are changed then they should be downloaded to the sensor using the 'Write To Sensor' button.

6.2 The Sensor Configuration Screen – Page 2

The Next button displays the second screen as shown in Figure 29.

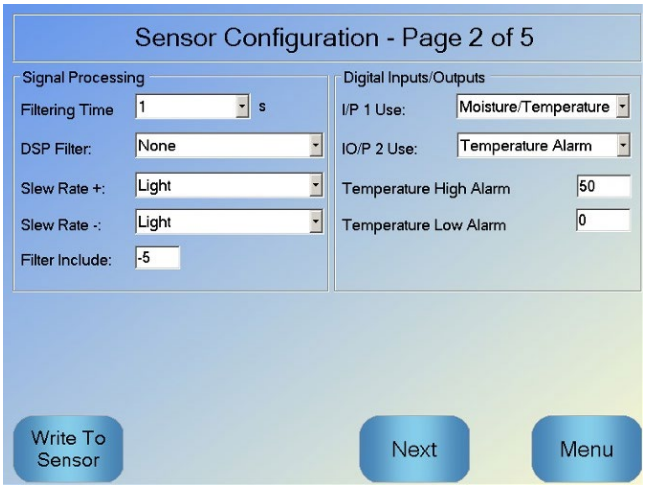


Figure 29: The sensor configuration screen - Page 2

Signal Processing

This section allows the signal processing options in the sensor to be adjusted. It may be necessary to adjust these depending on the mixer being used to improve the stability and response of the sensor reading.

Digital Inputs/Outputs

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

If any settings are changed then they should be downloaded to the sensor using the 'Write To Sensor' button.

6.3 The Sensor Configuration Screen – Page 3

The Next button displays the third screen as shown in Figure 30.

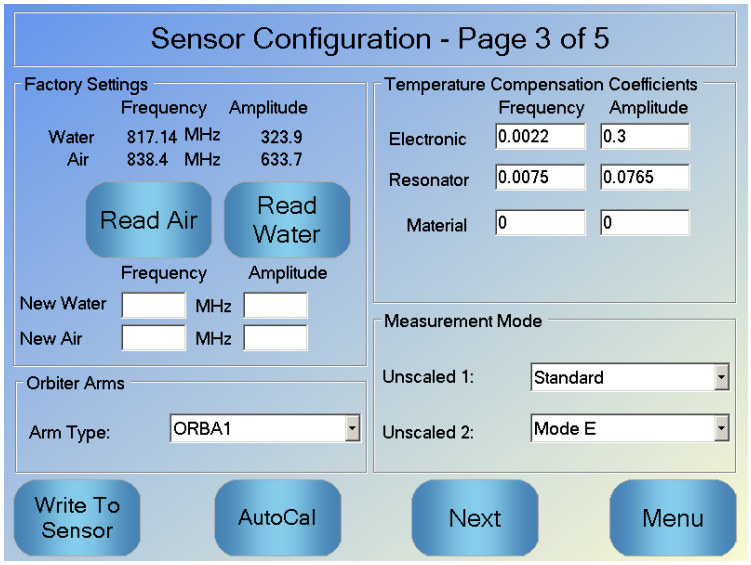


Figure 30: The sensor configuration screen - Page 3

Factory Settings

This section allows the factory calibration of the sensor to be set. 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, make sure the sensor faceplate is in air and then press the 'Read Air' button. 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 'Read Water' button.

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

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

Orbiter Arms

This section allows the Arm Type to be set.

Temperature Compensation Coefficients

This section allows the temperature compensation parameters to be changed. It may be necessary to change these settings when using a Hydro-Probe Orbiter and changing the Orbiter Arm. 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.

Measurement Mode

This allows different measurement modes to be selected.

If any settings are changed then they should be downloaded to the sensor using the 'Write To Sensor' button.

6.4 The Sensor Configuration Screen – Page 4

The Next button displays the fourth screen as shown in Figure 31.

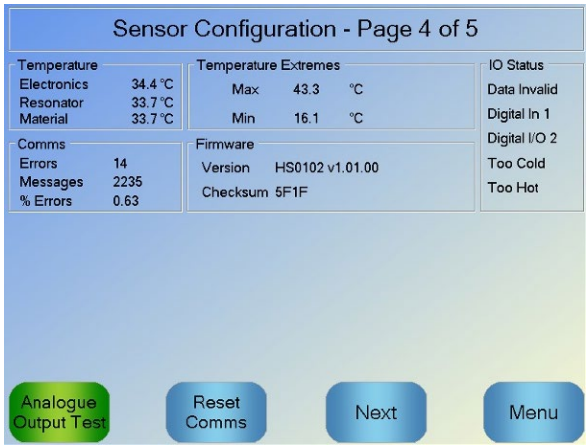


Figure 31: The sensor configuration screen - Page 4

Temperature

This section displays the current temperature readings.

Temperature Extremes

This section displays the maximum and minimum temperatures that the sensor has had whilst being powered up.

Firmware

This section displays the current firmware version number and checksum for diagnostics purposes.

IO Status

This section displays the current state of the digital inputs and outputs and other internal signals.

Comms

This section displays the total communication messages between the Hydro-Control and the sensor along with the error count. The error count can be used to identify communication issues.

Analogue Output Test

If the 'Analogue Output Test' button is pressed then this displays the window, shown in Figure 32, which allows the two analogue outputs to be forced to known values. This is useful for checking connections with external systems.

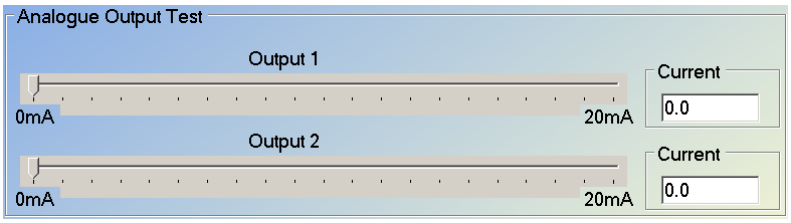


Figure 32: The Analogue Output Test Controls

6.5 The Sensor Configuration Screens – Page 5

The Next button displays the fifth screen as shown in Figure 33.

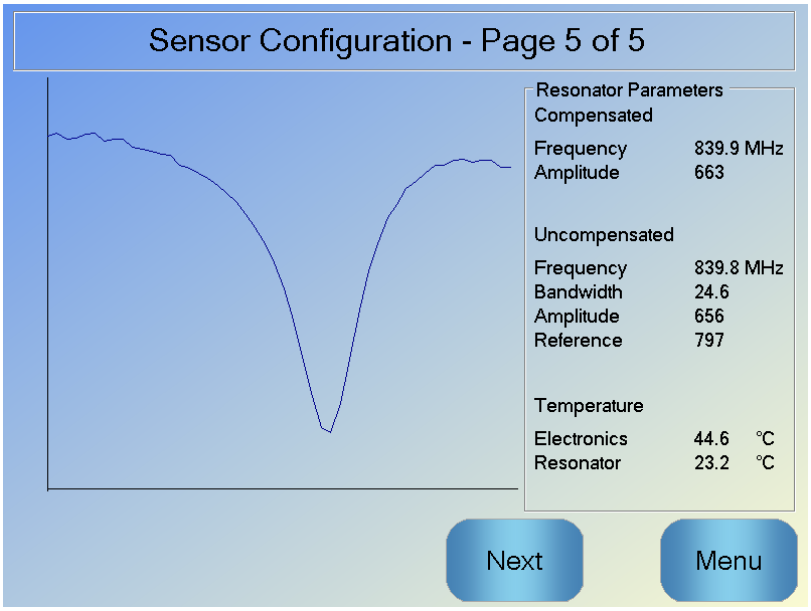


Figure 33: The sensor configuration screen - Page 5

This screen shows information about the sensor reading which can be used for diagnostic purposes.

7 Recipe Parameters

From the main screen, pressing the menu button 

and then the recipe overview button 

will display the Recipe Overview screen.

7.1 The Recipe Overview Screen

Figure 34: The recipe overview screen

This screen lists the currently configured recipes in the Hydro-Control. Selecting one of these by pressing the text in the list box and then pressing the Edit Recipe button displays the recipe editor.

7.2 The Recipe Editor – Page 1

The first screen has the recipe details, the water addition and the material addition/mixing times.

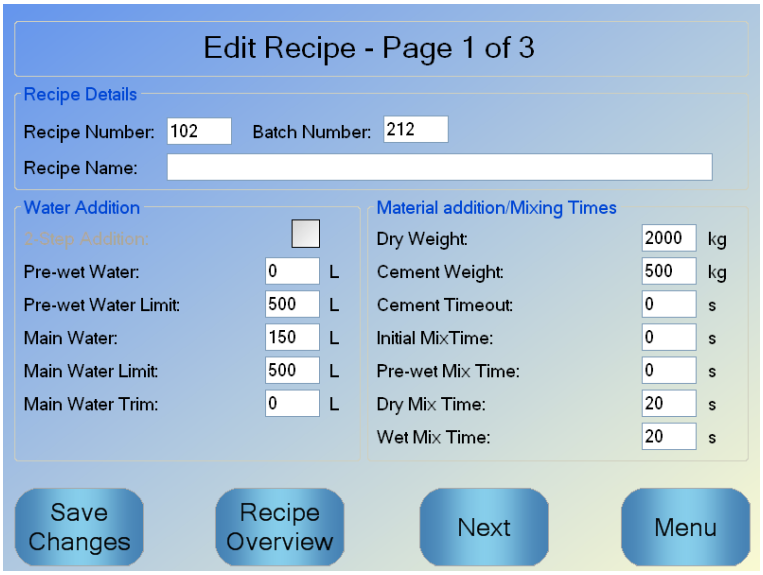


Figure 35: The recipe editor - page 1

Recipe Details

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

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 by using the 8 digital recipe inputs (available on the optional Hydro-Control VI Expansion Board) or by using the serial communications protocol. They are also listed in numerical order on the recipe selector available from the start page, or from 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 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.

Water Addition Parameters

Parameter	Units	Default	Range
2-step Addition	None	No	Yes/No
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

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 5 in the section on Admix control.

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 is being run in CALC Mode and if 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.

Material addition/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 5 System Design section 4.4Auto-Track.

7.3 The Recipe Editor – Page 2

Pressing the Next button 

at the bottom of the screen displays the second page of the recipe editor which has the Mix Control, Local Auto-Track, Admix and Temperature Correction Settings.

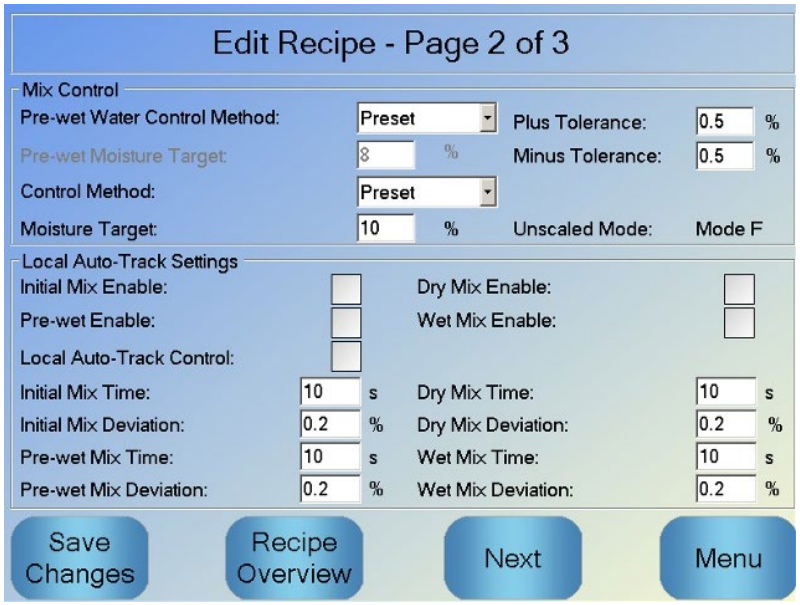


Figure 36: The recipe editor – page 2

Mix Control

Parameter	Units	Default	Range
Pre-wet Water Control Method	None	Preset	Preset/Auto/Calculation
Pre-wet Moisture Target	%	8	0 – 99.9 %
Control Method	None	Preset	Preset/Auto/Calculation
Moisture Target	%	10	0 – 99.9 %
Plus Tolerance	%	2.75	0 – 99.9 %
Minus Tolerance	%	2.75	0 – 99.9 %

The **Pre-wet Control Method** 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 Moisture Target**.

The **Control Method** 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 **Moisture Target**. If the method is set to Calculation then the water is added based on a value calculated using the calibration parameters, the **Moisture 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 deadband for the target.

Local Auto-Track Settings

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.

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

Initial Mix Enable, Pre-wet Mix Enable, Dry Mix Enable and Wet Mix 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 Control** option is set then the Auto-Track parameters defined in the recipe over-ride the parameters set in the System Parameters.

The **Dry Mix Deviation**, **Dry Mix Time**, **Wet Mix Deviation** and **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.

See the section on Auto-Track on page 66 for more details.

Pressing the Next button 

will display the third page of the recipe editor. This has options for the Calculation Mode Settings and AUTO Mode Settings.

Figure 37: The recipe editor – page 3

Calculation Mode Settings

Parameter	Units	Default	Range
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

The calculation mode settings are automatically generated when you calibrate the recipe 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.

Admix Settings

Parameter	Units	Default	Range
Admix Enable	%	0	0 – 100 %
Admix Amount	Kg/lbs	0	0 – 999.9 kg 0 – 70547 lbs

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.

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:

$$NewT\arg et = OldT\arg et + TemperatureCoefficient * (TemperatureSetPo\,\mathrm{int} - CurrentTemperature)$$

AUTO Mode Settings

Parameter	Units	Default	Range
Local Auto Control	None	No	Yes/No
Proportional Gain	None	5	-100 – 100
Integral Gain	None	0	-100 – 100
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 **Proportional, Integral** and **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’.

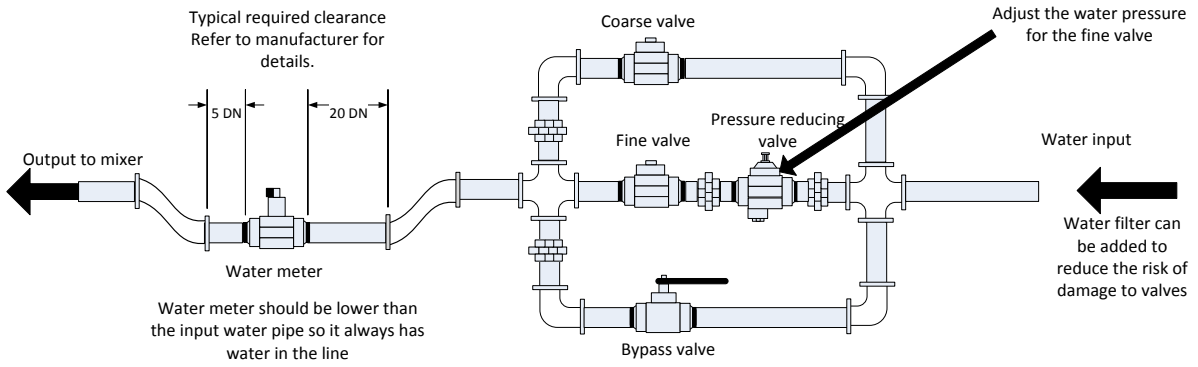
1 Water Valves

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 38: 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 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.

1.4 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.

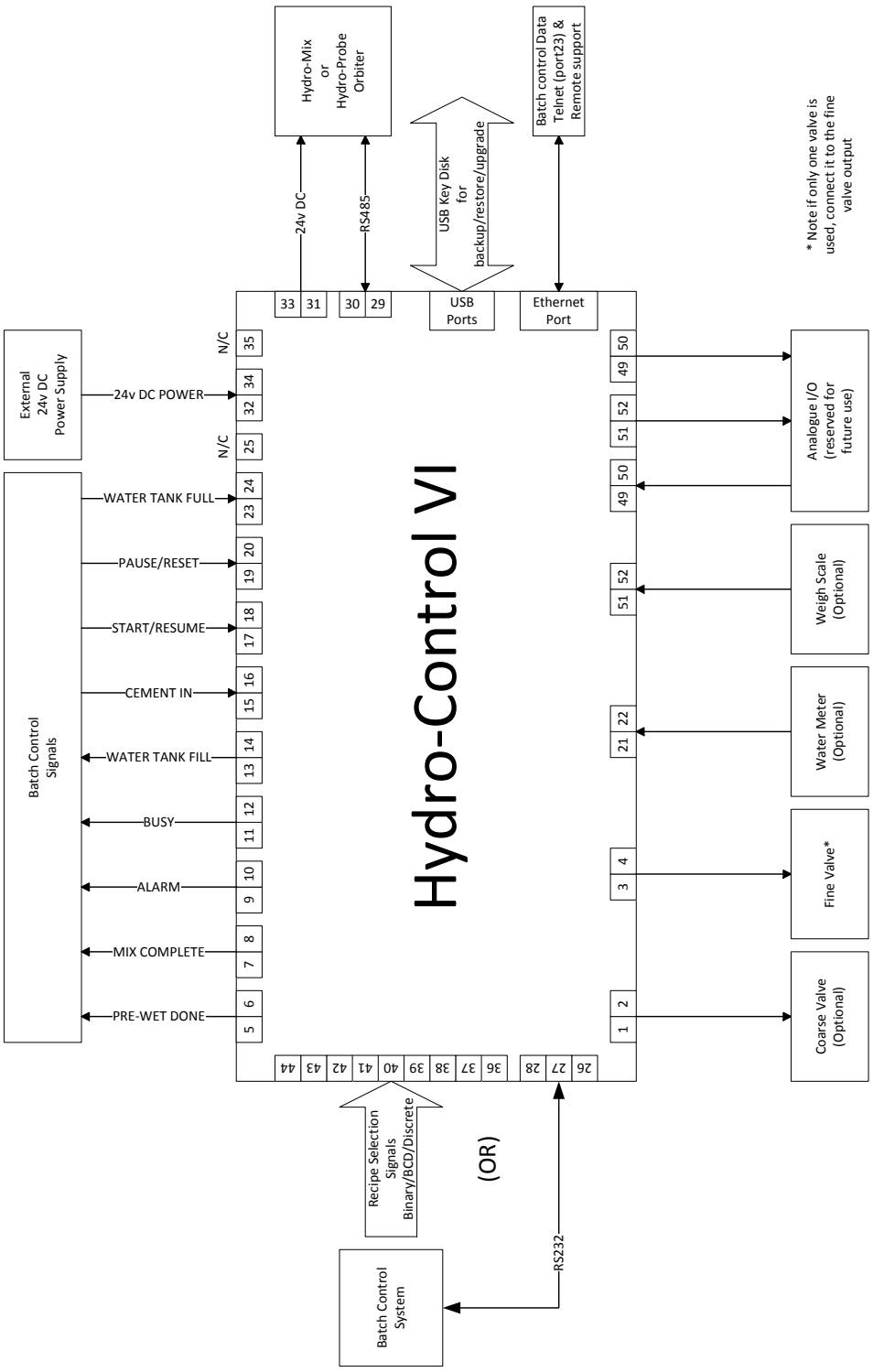


Figure 39: System Block Diagram

3.1 Basic connections

Figure 39 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 40, 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.

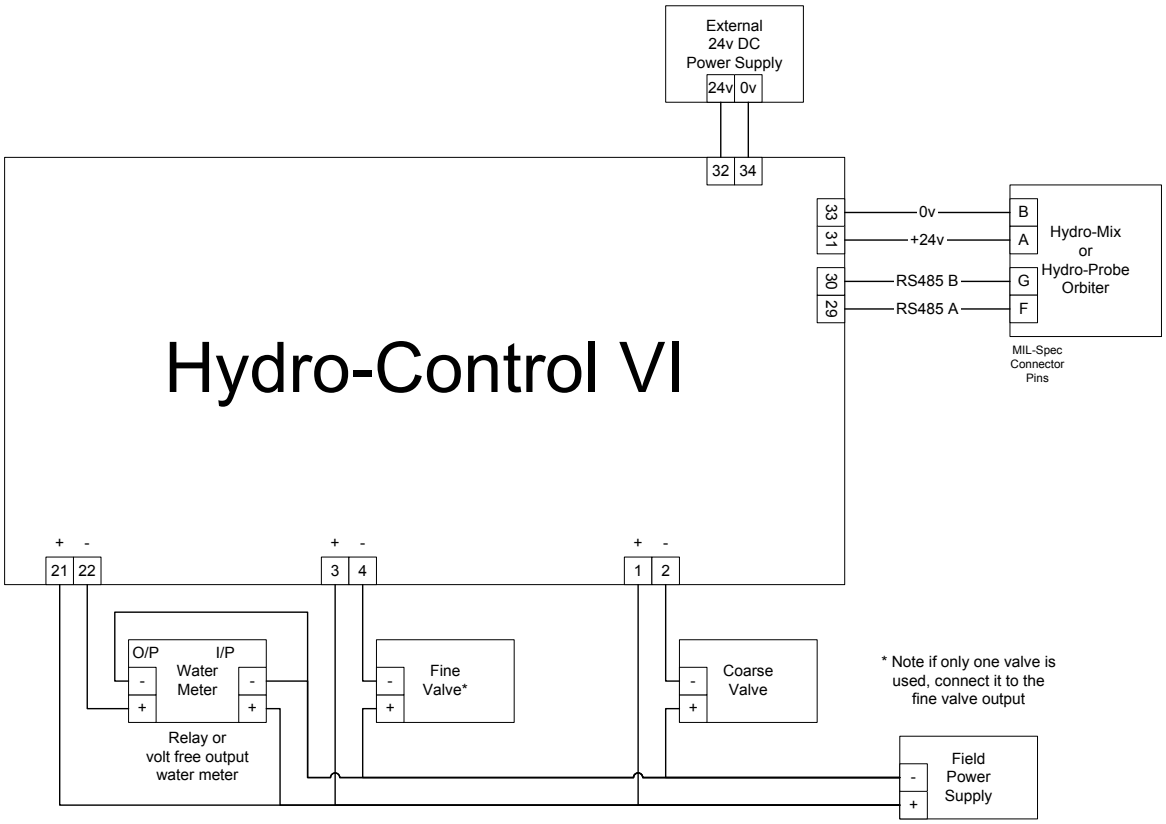


Figure 40: Example Wiring Schematic For Manual Plant Operation

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)

3.3 Upgrading Hydro-Control V installations

The Hydro-Control VI has been designed to be a direct replacement for a Hydro-Control V. The connectors for the I/O will accept the same connectors that the Hydro-Control V uses, with the same pin out. Care should be taken to insert the connectors correctly so that the cut-outs for the connector keys match the connectors themselves.

The Hydro-Control VI Utility is an additional software tool that runs on a PC that can be used to convert a backup from a Hydro-Control V system allowing the recipes and system parameters to be copied to a Hydro-Control VI.

The following points should be noted:

The Busy signal on the Hydro-Control V has been renamed to Admix. The functionality is the same as the Hydro-Control V apart from the addition of 'Admix Enable %'.

Recipe gain for AUTO Mode is no longer supported. The PID parameters should be set conservatively to compensate for smaller batches where moisture will rise faster. A separate recipe with local PID parameters can also be used if faster batch times are required.

There is no longer a calibration mode as the calibration can be more simply performed using a recent batch in the Mix Log as a "template" to set up the calibration points and the target for the recipe.

The AUTO Mode water control loop parameters will need to be commissioned. This is because the setup of the AUTO Mode control loop has been simplified making it much easier to tune correctly to achieve more efficient performance. For a starting point when upgrading a system, divide the Proportional Gain parameter used in the Hydro-Control V by 10 and set the Integral and Derivative Gain parameters to zero.

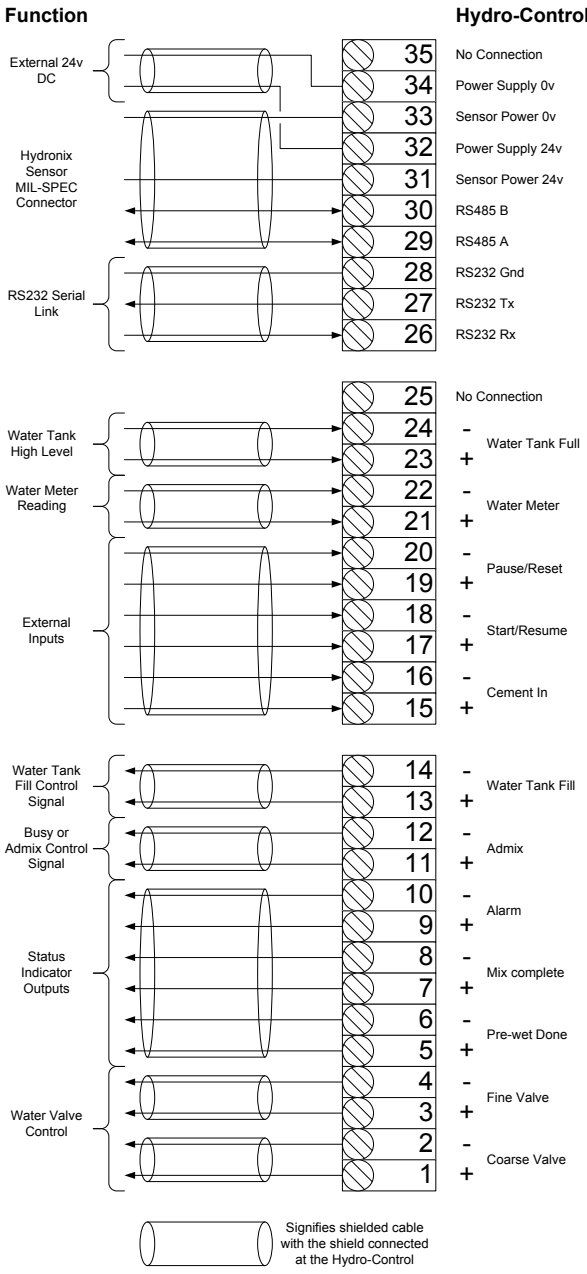


Figure 41: System Interconnections

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 42 shows a complete mix utilising all of 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, then adds the main water, then 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.

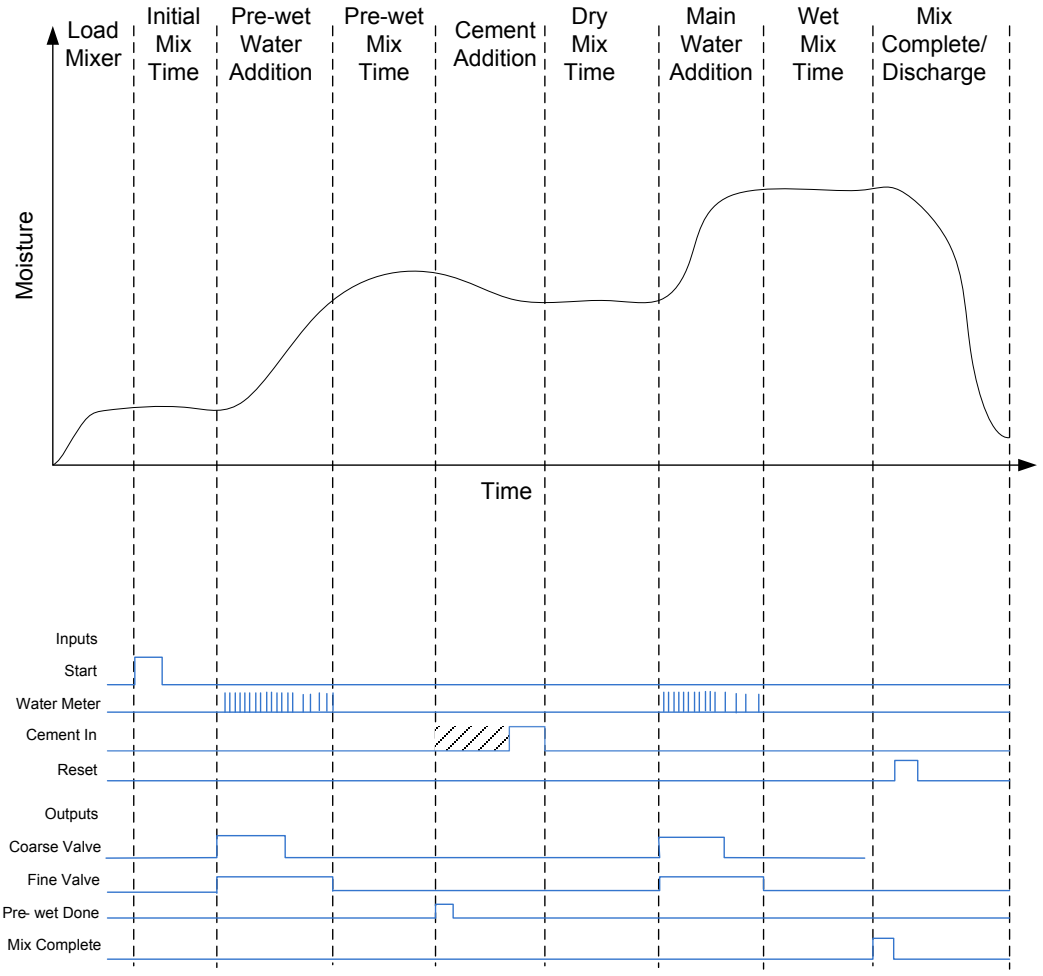


Figure 42: The Complete Mix Cycle

4.2 Simple Mix

A simpler mix control sequence is to load all of 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 43 with the I/O status.

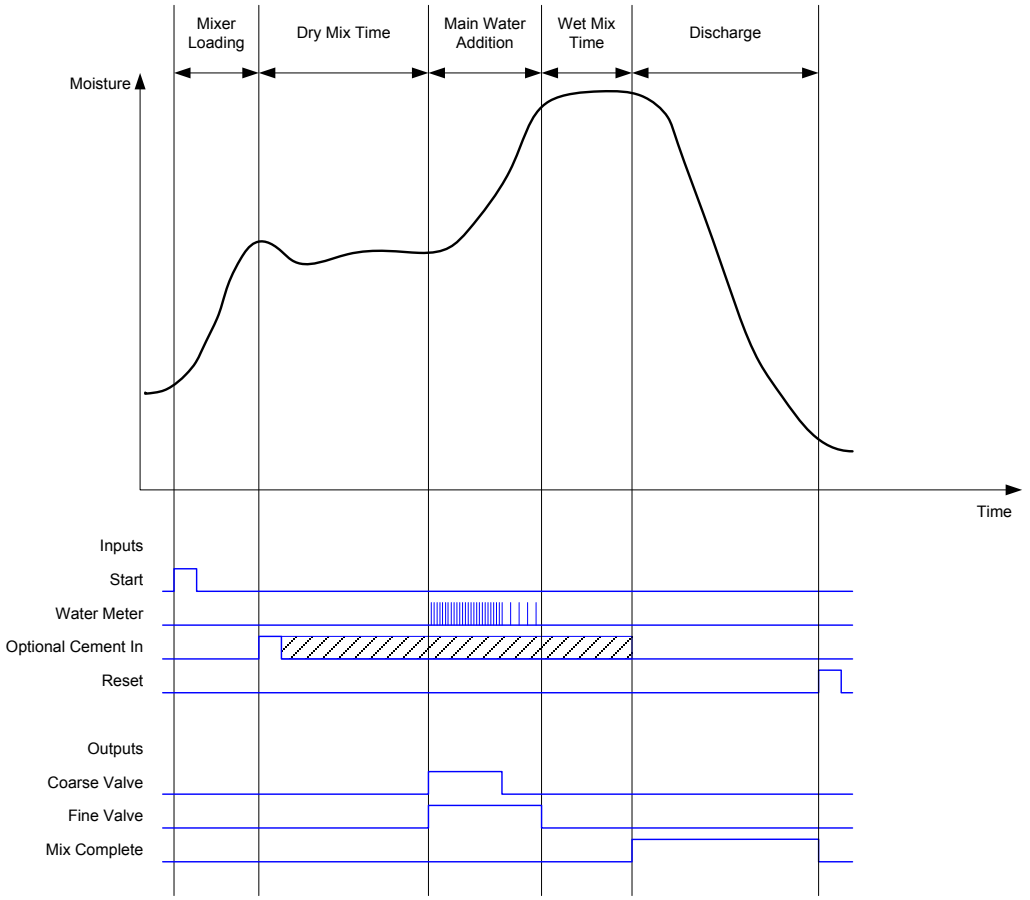


Figure 43: The Mix cycle showing the I/O status

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.

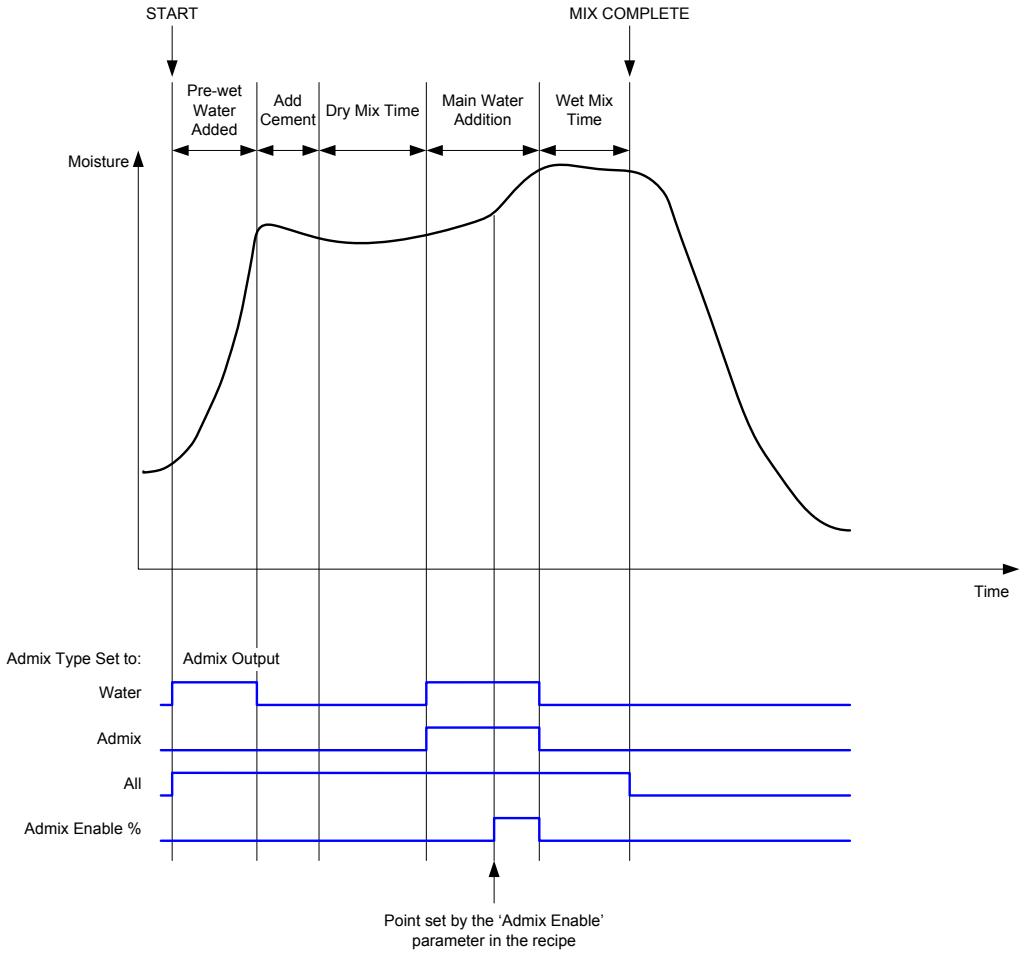


Figure 44: The Admix output signal during a normal mix cycle

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.

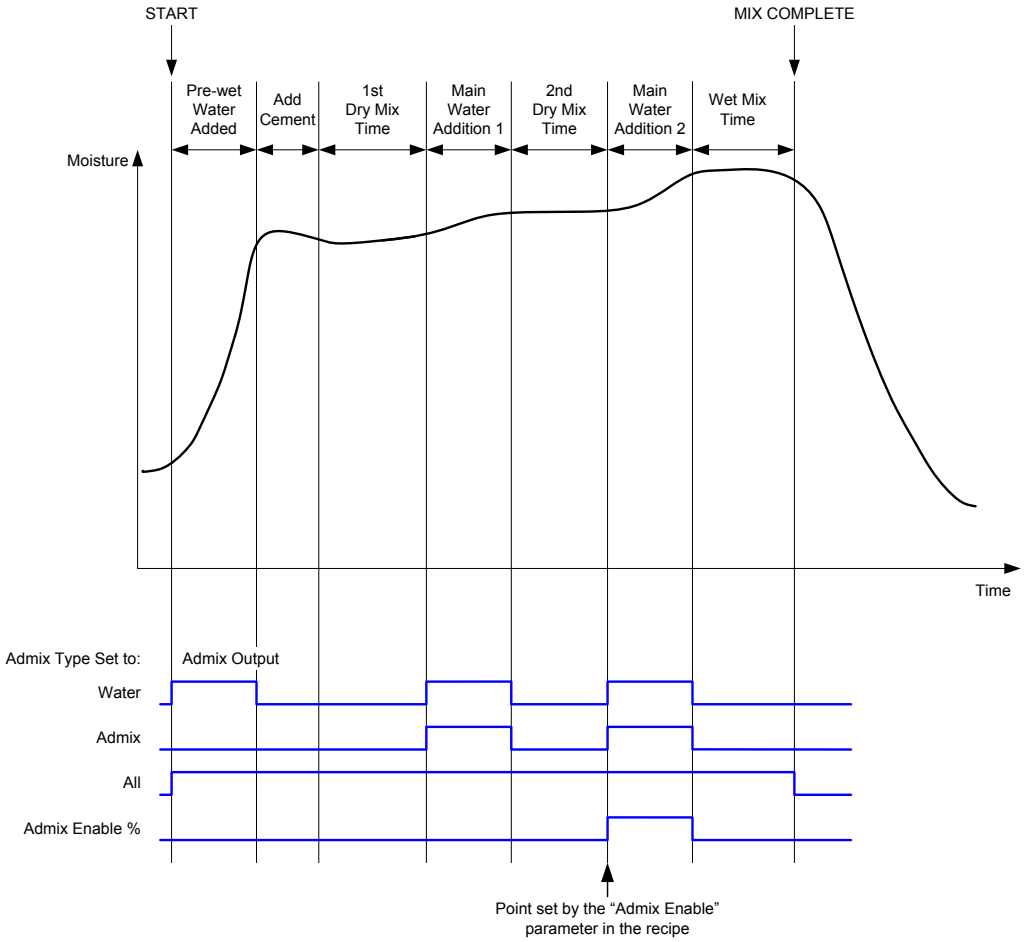


Figure 45: The Admix output signal during a 2-step mix cycle

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.

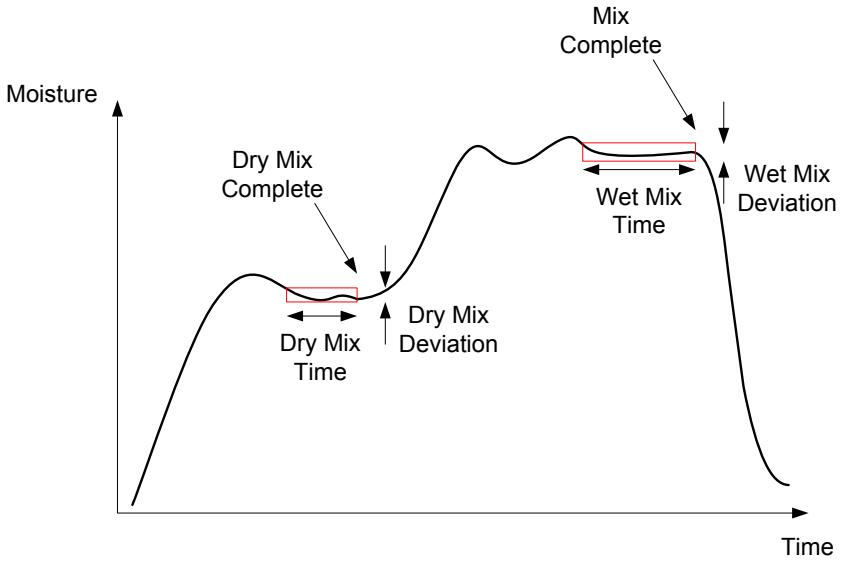


Figure 46: The mix trace showing Auto-Track settings

Figure 46 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 then an alarm is activated.

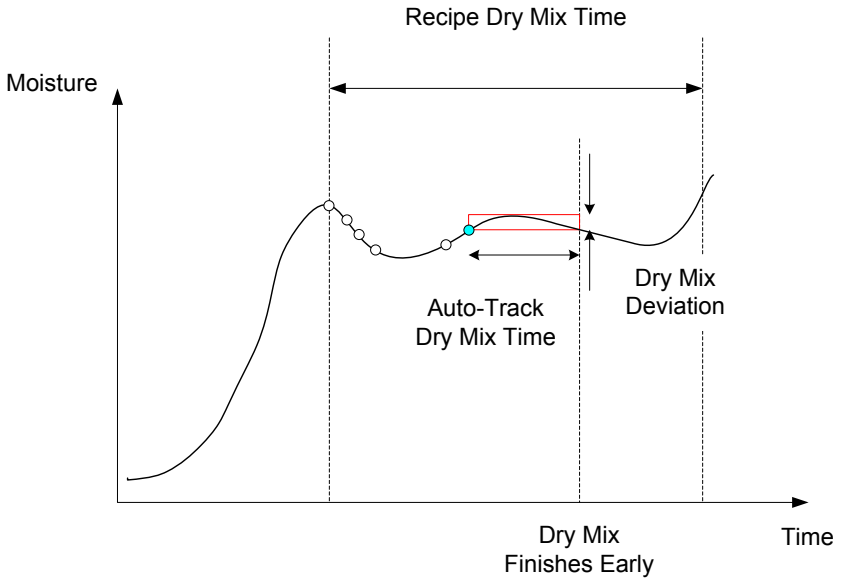


Figure 47: Auto-Track parameter example for the Dry Mix phase

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 the mixing time entered in to the recipe times 2 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 out of 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 the 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 quality 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 in the Remote Communications section and 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 communications protocol used on the Hydro-Control is set to the Hydro-Control VI mode or the older Hydro-Control V or Hydro-Control IV modes. If the Hydro-Control VI is replacing a Hydro-Control V or Hydro-Control IV and the remote communications are in use then this should be set to HC05 or HC04 respectively. HC06 v1 can be selected for systems designed using the HC06 v1 mix log format. HC06 v2 can be used for systems designed using the HC06 v2 mix log format.

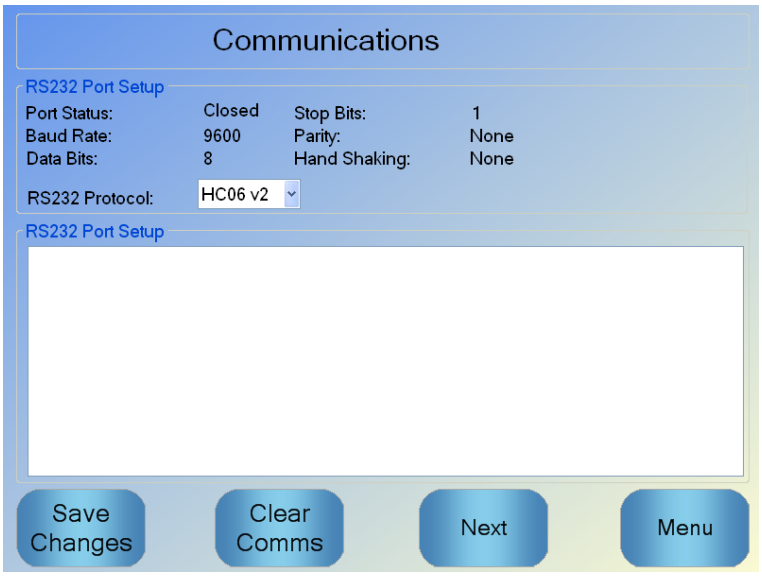


Figure 48 - RS232 Remote Comms screen

Using this screen it is possible to view RS232 commands received by the unit and replies sent from the unit. If a large amount of data is sent out such as the entire mix log for instance it can take some time to update this screen with all the data sent.

3 RS232 Commands HC05/HC06 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.

Code	Meaning
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 4.

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,2=timed,3=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 current 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

Remote support allows a remote connection to the HC06 unit via an Ethernet connection. The remote party, using a standard PC can view, control and change the configuration of the HC06 during its operation, from any location with an internet connection. This facility allows distributors, installers and site managers to offer assistance to operators who may be having difficulties configuring or operating the HC06.

To avoid difficult Ethernet setup configurations, Remote Support uses a connection server at a third party location. The HC06 requires only a basic Ethernet connection to the internet, such as one that would normally allow internet browsing. A connection is established with the third party server and the remote party wishing to control the HC06 also connects to the same server using a simple client software package. Control of the HC06 is then established.

Remote support can be configured to use either the Hydro-Control VI support server provided by Hydronix or another server which an installer or local distributor may choose to set up for themselves.

To access the remote support configuration press Menu followed by Remote Communications. The communications page will now be displayed. Press Next, the Ethernet Comms page is now displayed.

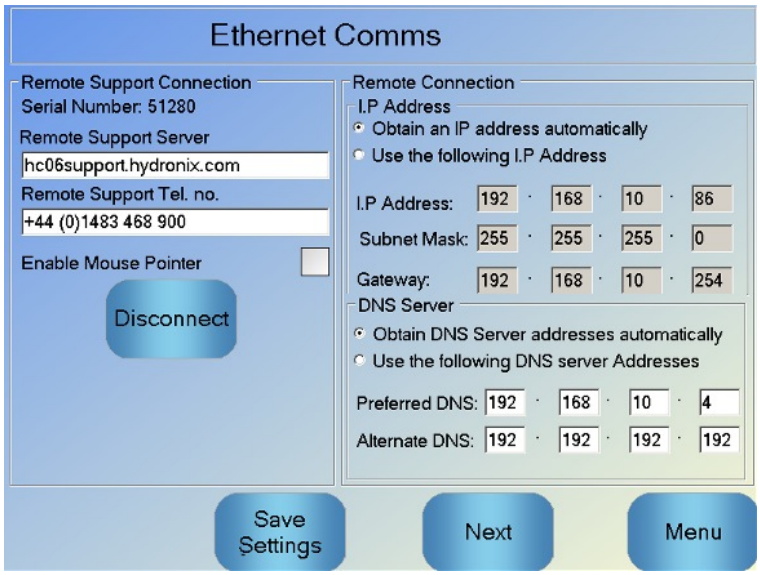


Figure 49 - Ethernet Coms Page

1 Remote support using Hydronix Hydro-Control VI support server

The remote support server by default points at the Hydronix remote support server. This is hc06support.hydronix.com. The installer should change the remote support telephone number to the installers customer support telephone number.

The installers customer support team should install the client software UltraVNC viewer, on customer support PCs. This is available from http://www.uvnc.com/download/index.html or is available from Hydronix on request.

Run the install package selecting to install only the viewer. Run the software.

Please note that this software is only available in limited languages

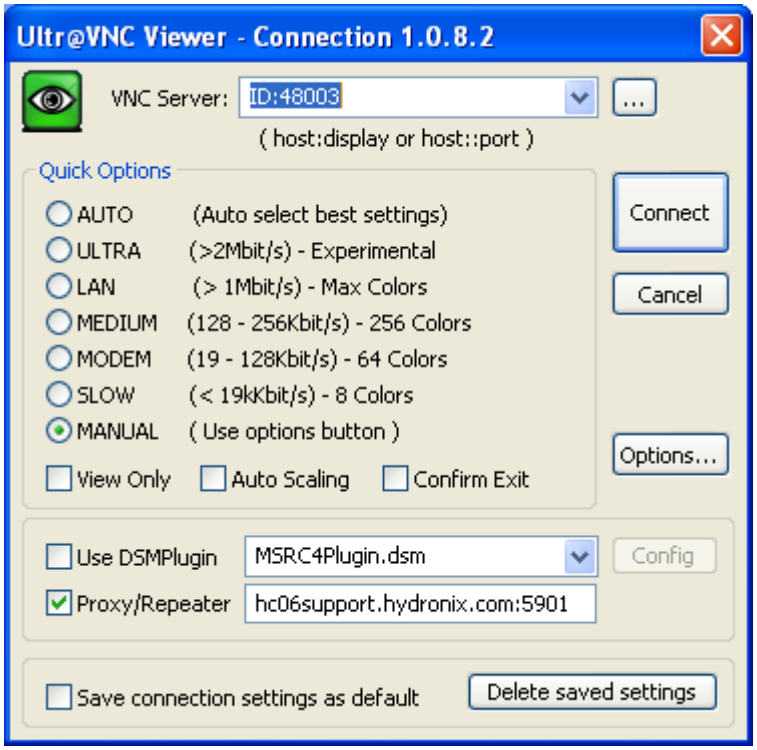


Figure 50 - UltraVNC View software

Make sure Proxy/Repeater is selected and the repeater location is set to hc06Support.hydronix.com:5901. This will connect to the Hydronix Hydro-Control VI support server. This will be different for connection to the custom server and will require the custom server settings.

To connect to a Hydro-Control VI remotely, type in the VNC field “ID:” followed by the serial number of the HC06 unit. This can be seen on the Hydro-Control VI Ethernet Comms screen shown in Figure 49 - Ethernet Coms Page.

Instruct the user to connect the Hydro-Control VI to remote support (see HD0456 Operators guide for more detailed instructions).

Once the user is connected press connect to view the Hydro-Control VI.

2 Remote support using a custom server

To use a custom server it is first necessary to set up a server. The network administrator of the server should allow access through the firewall for ports 5500 and 5901. The ports should be forwarded to the custom support server.

2.1 Setting up the UltraVNC repeater on a server

The repeater is available from http://www.uvnc.com/download/index.html or is available from Hydronix on request. Run the repeater software. The repeater icon will appear in the system tray  . Right click the repeater icon and select settings.

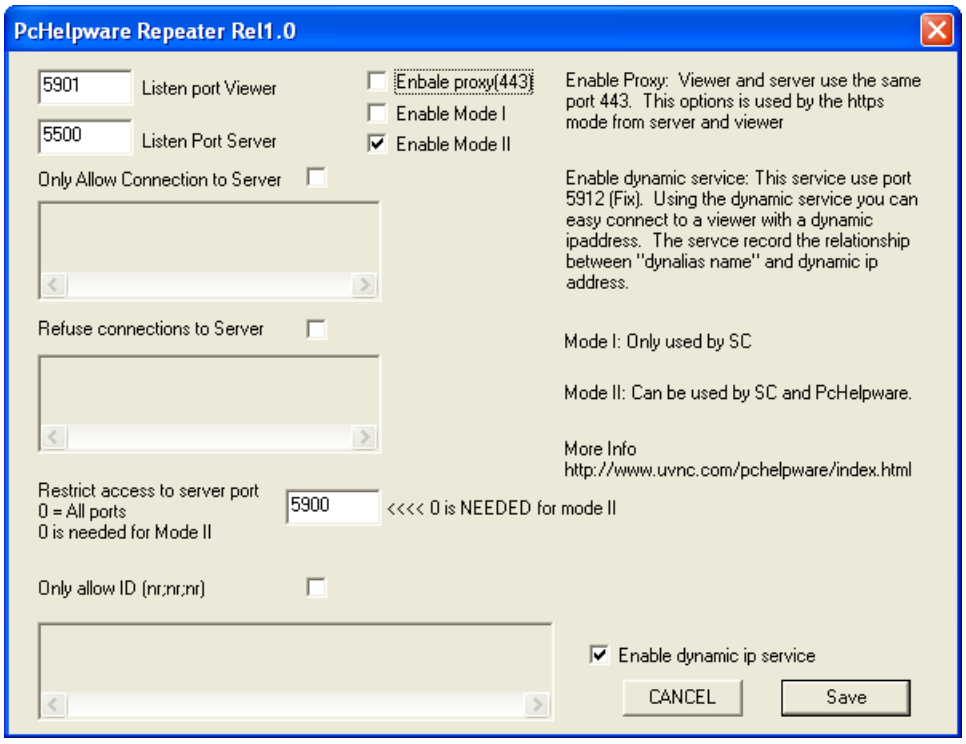


Figure 51 - Repeater Settings

It is safer to disable “proxy(443)” and “Enable Mode II”.

2.2 Setting up the Hydro-Control VI and support PC for a custom server

The Hydro-Control VI remote support server parameter on the Ethernet Comms page (see Figure 49) should be set to the IP address and port number or domain name of the custom server. The Support staff should install UltraVNC viewer and set the proxy/repeater address to the IP address and port number or the domain name of the custom server that the repeater is installed on.

3 Configure the Hydro-Control to use a static IP address

The Hydro-Control can be configured to use either a Static or Automatic IP address (Figure 49). To configure a static IP address select ‘Use the following IP address’ and enter the required address. The DNS server can also be manually set.

Once configured select ‘Save Settings’ to update the Hydro-Control.

To revert back to an automatic IP address select ‘Obtain an IP address automatically’ and save the settings.

1 The System and Data Cards and USB memory stick

The Hydro-Control incorporates a System Card and a Data Card. These cards are accessed via the top access plate. The identification, removal and replacement of these cards is described in Chapter 2.

1.1 The System Card (Hydronix Replacement Part Number 0176)

The System Card holds the main operating files of the Hydro-Control. This is specific to the type of unit and should not be changed between units. (Not applicable to HC06 v2)

1.2 The Data Card (Hydronix Replacement Part Number 0177)

The Data Card holds the mix log database and system settings. With the power supply off, this can be removed and replaced if necessary. (Not applicable to HC06 v2)

1.3 USB Memory Stick

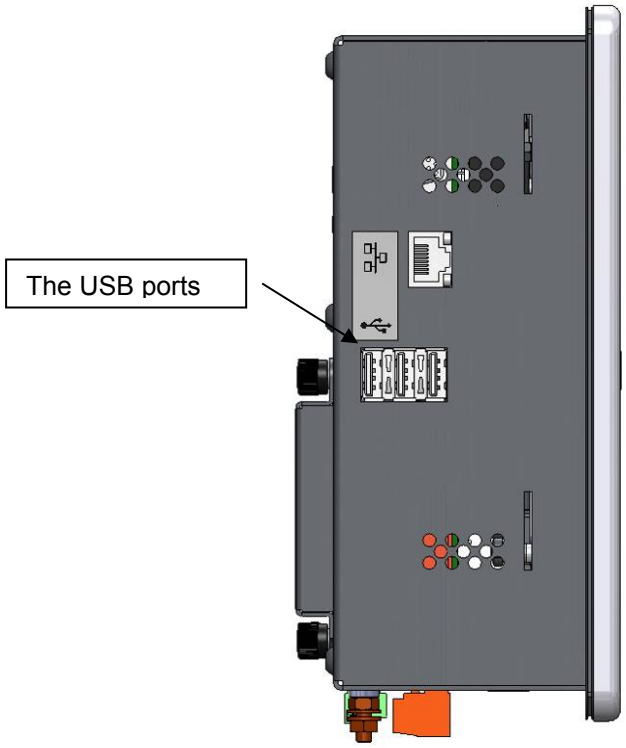


Figure 52: The Hydro-Control VI side view showing the USB ports

There are three USB ports sited on the left hand side when looking at the front of the unit. A Memory Stick may be used for backing up and restoring recipes, system parameters and mix log files.

If the Hydro-Control USB ports are difficult to access then a USB extension with a panel mounted socket is available from Hydronix – Part Number 0175.

The Memory Stick may be inserted and removed with the power supply on. Do not remove the Memory Stick when a backup or restore is in progress.

The backup process copies one file onto the Memory Stick and will overwrite any previous backups made onto that Stick.

2 Backing up and Restoring

2.1 Backup

To backup the Hydro-Control database (System and Recipe Parameters and Mix Log):

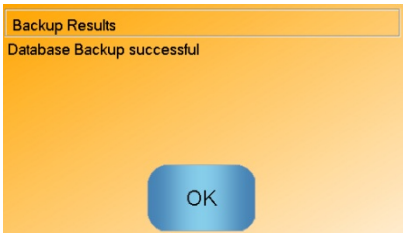
1. Insert a memory stick into one of the USB ports.
2. Press the Menu button 

.
3. Press the System Parameters button 

.
4. Press the Backup/Restore button 

.

5. Press the Backup button.



6. When successful, press OK to return to the parameters screen

2.2 Restore

To restore the Hydro-Control database:

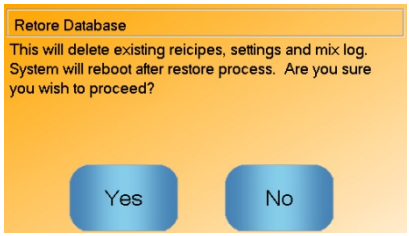
1. Insert a Memory Stick containing a backup of the Hydro-Control into one of the USB ports (The file HC06Database.sdf should be in the root directory of the Memory Stick).
2. Press the Menu button 

.
3. Press the System Parameters button 

.
4. Press the Backup/Restore button 

.

5. Press the Restore button.



6. Press the Yes button to over-write the current database. The Hydro-Control will then restore the recipes, settings and log file from the memory stick file and then reboot. The Memory Stick can be removed at any point after the system has completely restarted and the main screen is shown.

3 Upgrading the Hydro-Control

To upgrade the software in the Hydro-Control, extract the folder containing the software update files from the .ZIP file onto a USB Memory Stick. This should create a folder in the root folder of the Memory Stick called 'DUA' which contains a number of update files as well as a device update file called 'hc06upgrademe.dup'. This is shown in Figure 53.

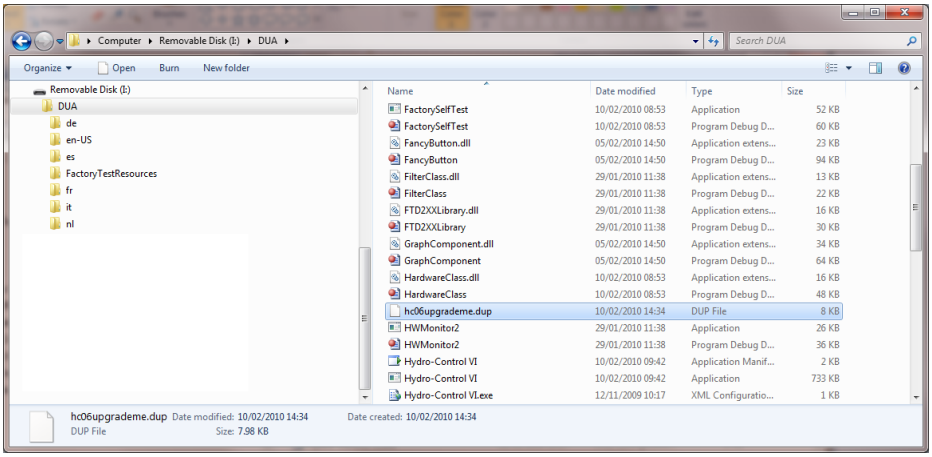
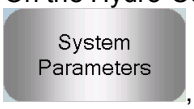


Figure 53: Some of the files on the USB keydisk after extraction

Insert the USB Memory Stick into one of the USB ports on the right hand side of the Hydro-Control (looking at the rear of the unit). The side view of the Hydro-Control is shown in Figure 52.

On the Hydro-Control, press the Menu button 

then press the System Parameters button 

, then press the Next button 

to get to page 2 (shown in Figure 54).

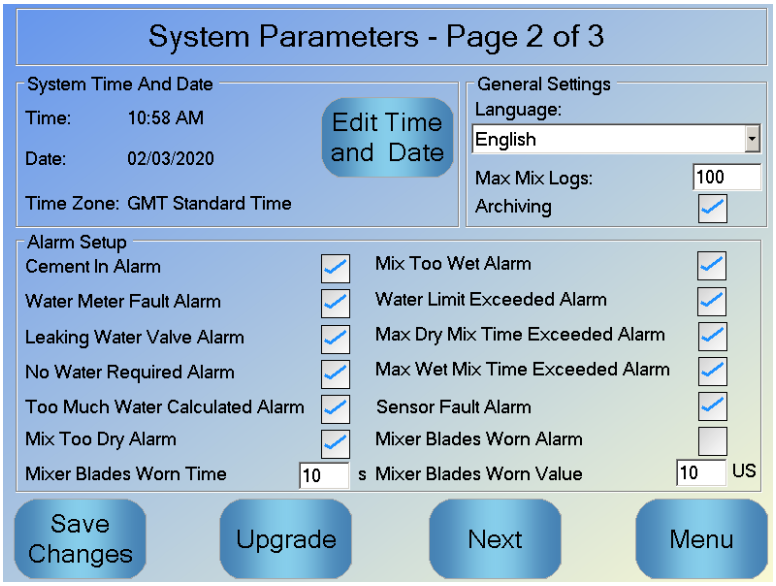


Figure 54: The system parameters page 2 screen

Press the Upgrade button 

and the system will prompt to reboot.

After rebooting the Hydro-Control will automatically update and then reboot and restart itself.

The Memory Stick must not be removed until the upgrade has been completed and the main screen is shown.

DO NOT REMOVE POWER DURING THE UPGRADE PROCEDURE.

Appendix A System Parameters Record

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
Initial Mix Deviation	%	0.1	
Initial Mix Time	Seconds	10	
Pre-wet Mix Deviation	%	0.1	
Pre-wet Mix Time	Seconds	10	
Dry Mix Deviation	%	0.1	
Dry Mix Time	Seconds	10	
Wet Mix Deviation	%	0.1	
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	HC06	
Admix Signal	None	Admix Enable %	

Appendix B Diagnostics

The following tables list the most common faults found when using the controller. If you are unable to diagnose the problem from this information, 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 sensor

Possible explanation	Check	Required result	Action required on failure
No power to sensor.	DC power at rear of Hydro-Control, pins 31 + 33	+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 Display Unscaled on the main screen	Readings should be the following: Sensor exposed to air = close to zero. Hand on sensor = 75-85	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. Moisture signal 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
Incorrect OPTO module used for the output	Voltage range for the output module. As a quick guide, look at the colour of the OPTO module by looking though the holes in the back of the controller.	OPTO module colour: Red: DC module, typically up to 60v DC Black: AC module, typically up to 110v AC	Contact Hydronix for correct OPTO module rating.
Wiring fault	When the OPTO switches on the OPTO LED should light up. Check wiring whilst the OPTO is on.	See User Guide for more details.	Force relay to switch on and check wiring. Go to Menu > I/O Setup and Status. Select output and switch on.
Blown fuse	Remove rear cover and check continuity of the fuse on the specific OPTO module using a meter.	Continuity check ok, zero ohms.	Contact Hydronix for replacement fuse.

Symptom: Faulty input

Possible explanation	Check	Required result	Action required on failure
Incorrect OPTO module used for the input.	Voltage range for the input module. As a quick guide, look at the colour of the OPTO module by looking though the holes in the back of the controller.	OPTO module colour: White: DC module, typically 10-32v DC Black: AC module, typically up to 110v AC	Contact Hydronix for more details.
Wiring fault	When the OPTO switches on the OPTO LED should light up. Apply correct voltage across the input terminals of the OPTO, i.e. for DC input module, 0v connected to – terminal and 24v connected to + terminal.	When voltage is applied, LED turns on. Hydro-Control must be powered for this.	Swap module with the same input range module if one is available, and re-apply power across the terminals.

Symptom: Faulty display contrast

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

Symptom: When power applied display is dark and unit beeps

Possible explanation	Check	Required result	Action required on failure
RAM Self test has failed	Remove power and re-apply	Correct startup	Contact Hydronix for repair details.

Symptom: Blue Screen during power up

Possible explanation	Check	Required result	Action required on failure
Caused by removing power to the Hydro-Control before shutting down the system	Press and hold the power button until the unit powers off and then press it again to restart.	Correct startup	If Blue Screen persists then the System Card will need replacing – Contact Hydronix for further information.

Symptom: Orange dialog 'Write Filter Error'

Possible explanation	Check	Required result	Action required on failure
Caused by the write filter being in the wrong state	Restart the unit and see if the box reappears	Correct startup	Replace System Card with the correct colour Card. The Card colour must be the same as the factory installed System Card.

Appendix C Glossary

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 (AutoCal)

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, if you had 1000kg of completely dry sand and added 100kg of water to it then the sand would be at 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.

Appendix D Document Cross Reference

Document Cross Reference

This section lists all of the other documents that are referred to in this User Guide. You may find it beneficial to have a copy available when reading to this guide.

Document Number	Title
HD0456	Hydro-Control VI Operators Guide
HD0679	Hydronix Moisture Sensor Configuration and Calibration Guide
HD0678	Hydronix Moisture Sensor Electrical Installation Guide
HD0676	Hydro-Mix Installation Guide
HD0677	Hydro-Probe Orbiter Installation Guide
HD0044	Hydro-Control IV Installation and Reference Guide

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