

Hydro-Control V Operators Guide

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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.

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ACKNOWLEDGEMENTS

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Revision history

Revision No.	Date	Description of change	Hydro-Control V version
1.0.0	May 2007	Original version	5.00
1.0.1	July 2007	Guide Re-indexed	5.00

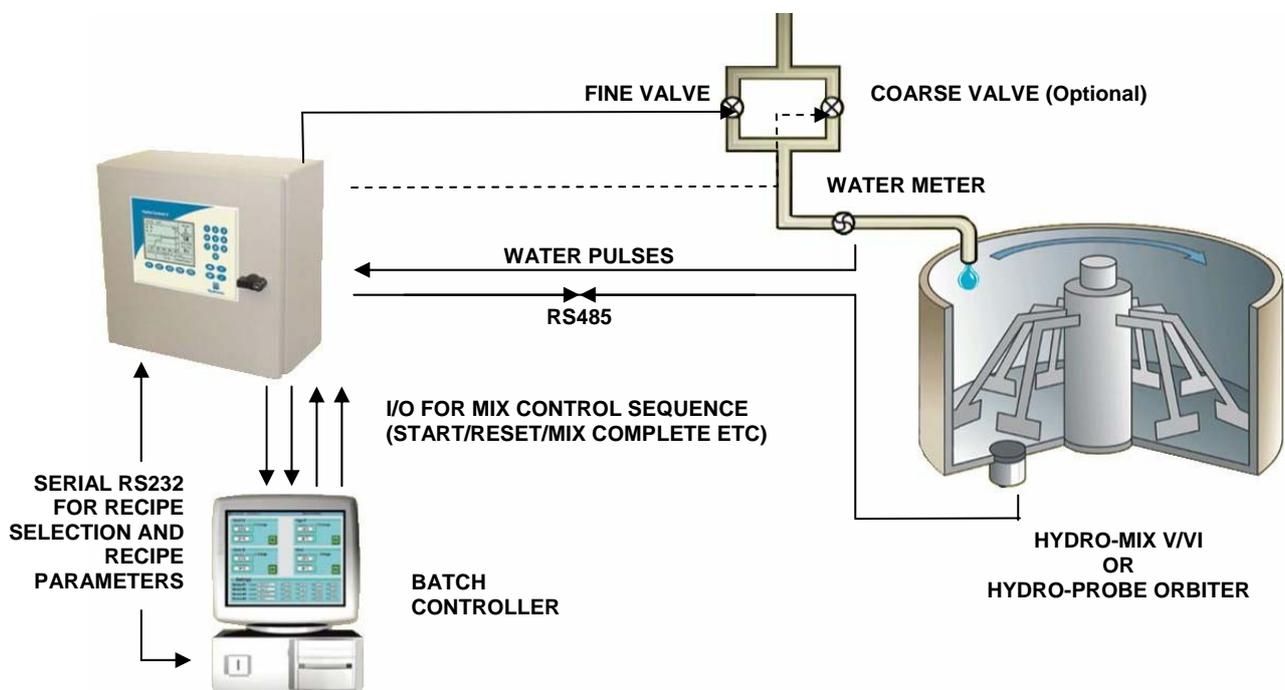
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The Hydro Control V system from Hydronix is used in the concrete industry for controlling the mix cycle to provide precisely the correct addition of water in the shortest possible mixing time.

Using the reading from a single Hydronix microwave sensor inside the mixer, the Hydro Control V accurately monitors the moisture throughout the mix cycle in both wet and dry mix periods. The correct amount of water is added based on known recipes in order to achieve the required target for the percentage moisture.

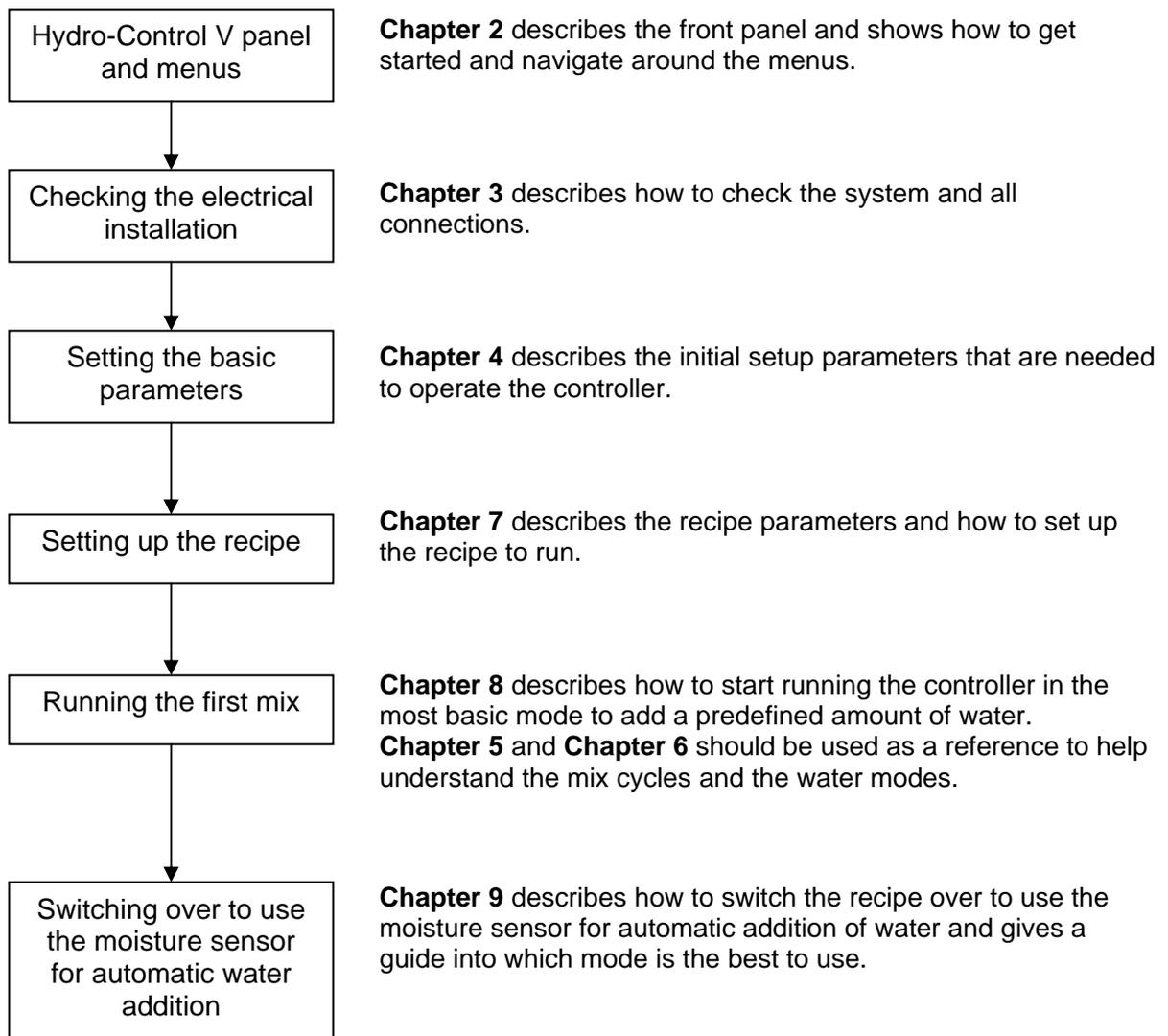
The graphical display provides a wide range of information via a series of menus including mixing cycle status, recipe information and sensor signal trend. The Hydro Control V can also be connected to a batch controller via an RS232 serial link as shown in a typical installation below.



About this manual

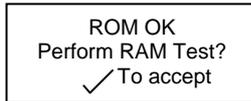
This manual assumes that the unit has already been installed but that the user has had no previous experience of operating this type of device. Full information for the Hydro-Control V is contained in the User Guide HD0193.

This manual describes how a user can setup the system, run mixes manually and then optimise the controller to run with automatic moisture control. Each chapter describes each part of the sequence as shown below.



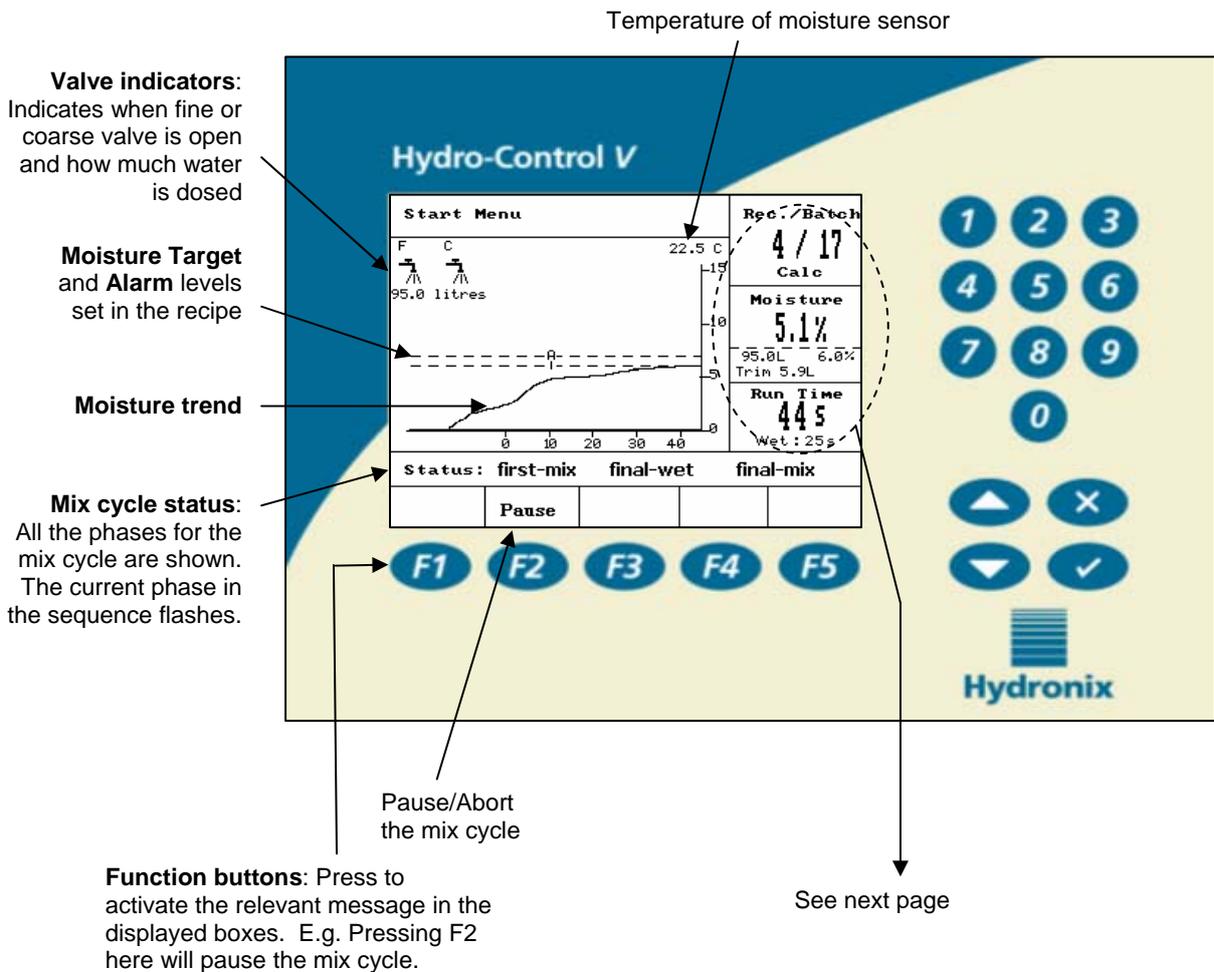
Switching On

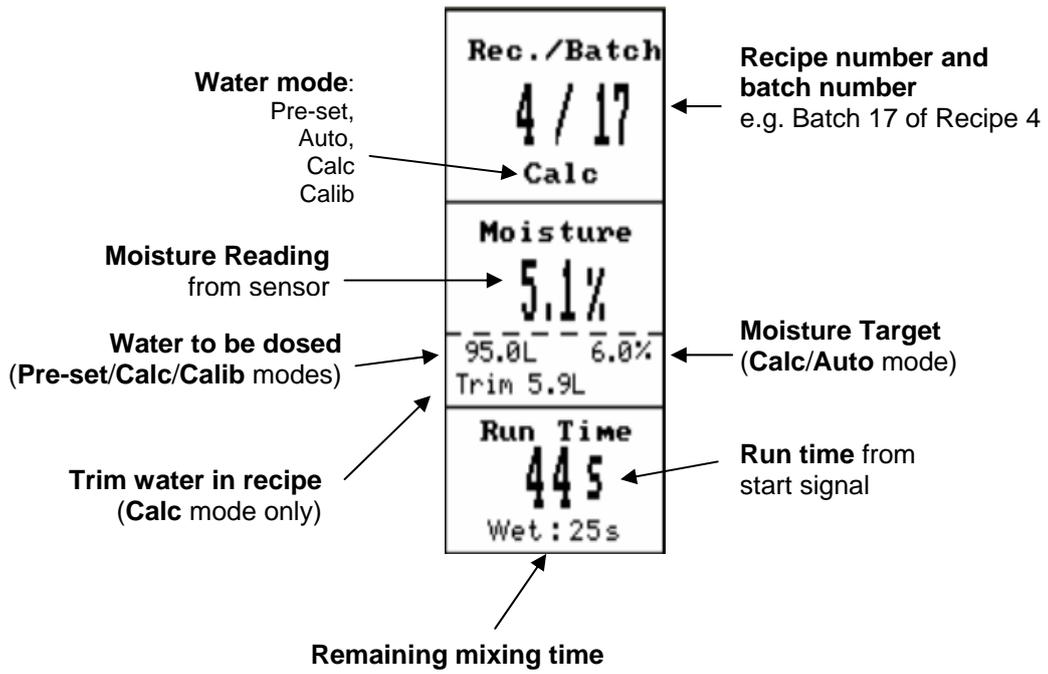
When the Hydro-Control V is first switched on by applying power (there is no on/off switch), the following is displayed for approximately 3 seconds. This enables the RAM of the controller to be checked.



Under normal circumstances this can be left and the controller will show the start page as shown below. If problems with the RAM are suspected then pressing the will start a RAM checking procedure which takes 60 seconds.

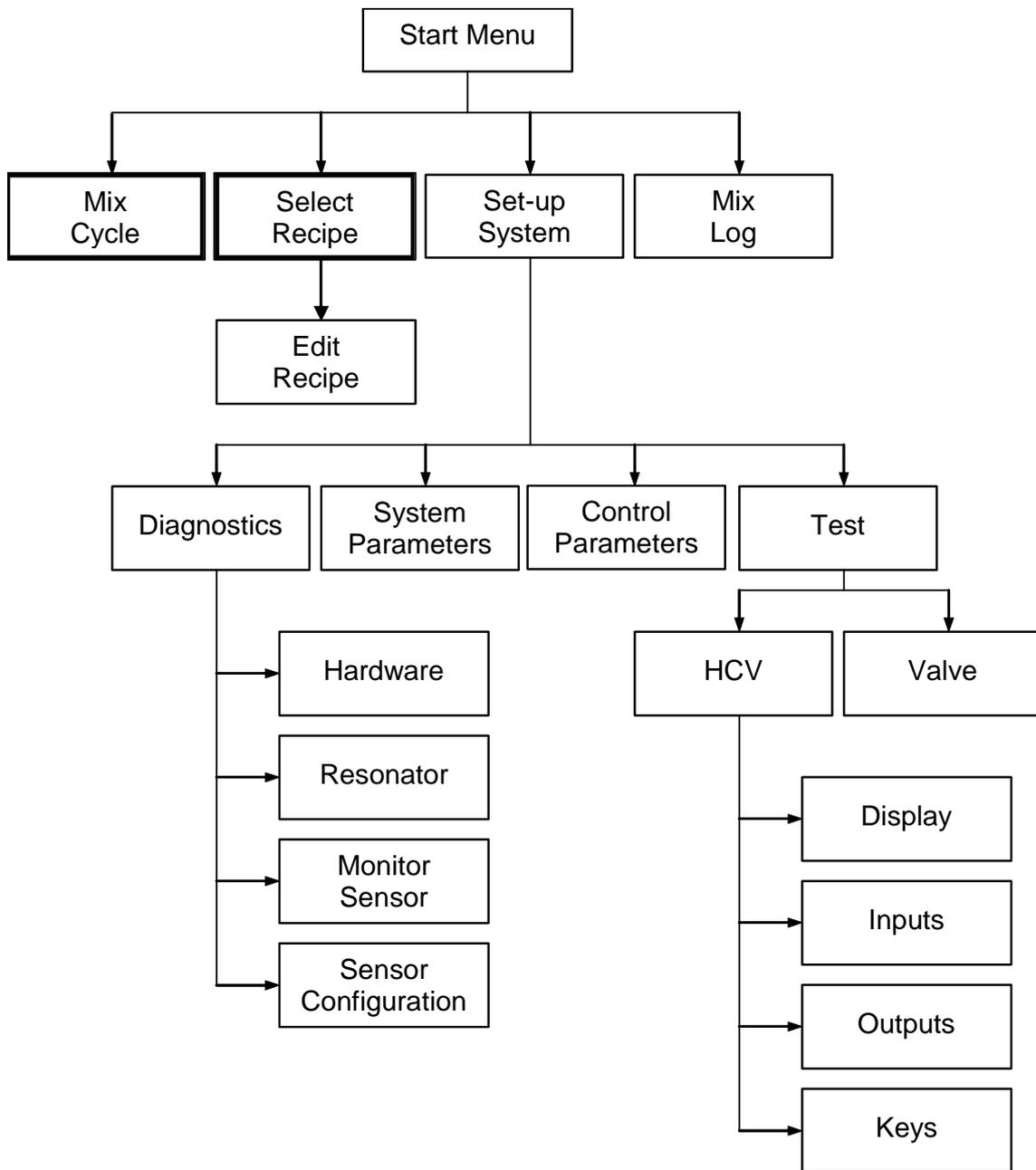
Description of Front Panel





Menu Layout

In routine operation the user can operate the system using just the two highlighted menus shown below, the 'Mix Cycle' and 'Select Recipe'. However additional 'Set up' and 'Diagnostic' menus are available which are password protected (see Appendix A) to permit flexibility and complete control.



This chapter is to assist with any problems that might arise with the connections to the Hydro-Control V. The Hydro-Control V has the following connections:

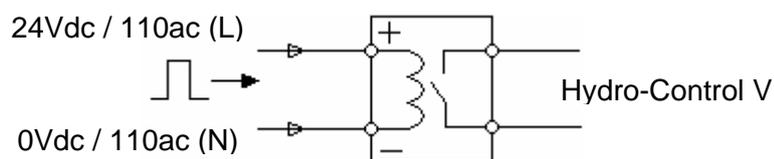
- **RS485 port:** Digital connection for communicating moisture, temperature and diagnostics information from the Hydronix moisture sensor to the controller.
- **RS232 port (optional):** Serial port used to change the recipe number in use and also send recipe and control parameters to/from a batch controller or PC.
- **6 Outputs:** Switched contacts used for batch automation and switching up to two water valves.
- **4 Inputs:** Switch inputs for water counts and batch automation.

Power Supply

The Hydro-Control V should be powered by a stable 24Vdc source capable of supplying a minimum of 1Amp (1Amp is required for the sensor for initial start up). Any ancillary equipment that uses 24Vdc should be powered by a separate 24V power supply as opposed to using the 24V supply powering the controller. This helps to avoid spikes/power dips on a common supply which may reset the controller and make it inoperable.

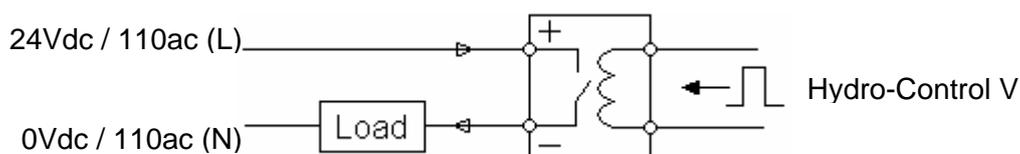
Wiring Inputs

This can be thought of as the coil side of a normally-open relay. To switch on the relay, apply the correct potential across the terminals.



Wiring outputs

This can be thought of as the voltage free contact side of a normally-open relay. The Hydro-Control V switches on the relay therefore closing the contacts for the output side.



Testing Inputs and Outputs

The Hydro-Control V has a test facility to enable the user to manually switch any of the six outputs. A similar facility is available to check the status of any inputs. Both these facilities are available in the advanced menu which is accessed from the main start page by:

'More' (F5) → 'Setup' (F1) → enter password (see Appendix A) → 'Test' (F4) → 'HCV' (F4)

The input test page displays the 4 inputs as shown below. When the input is triggered, the LED on the opto module should be illuminated and the status of that input in the list should toggle.

Input	Rec./Batch
Cement In OFF	1 / 15
Start/Resume OFF	Calc
Pause/Reset ON	Moisture
Water Meter 0	--.--
	Run Time
	-- 5
Status:	
	Back

The output test page, shown below, displays the 6 outputs. Any of the outputs can be turned on or off by pressing **F1** or **F2** respectively.

Output	Rec./Batch
Coarse Valve OFF	1 / 15
Fine Valve OFF	Calc
Prewet done OFF	Moisture
Mix Complete OFF	--.--
Alarm ON	Run Time
Busy OFF	-- 5
Status:	
ON OFF	Back

Note that the 'Alarm' output in this menu is dependant upon whether a sensor is connected. If a sensor is connected the Alarm output will remain OFF, if no sensor is connected it will stay ON.

Checking the valves and water meter

The valves can be switched on in the valve test page, accessed from the start page by pressing:

'More' (F5) → 'Setup' (F1) → enter password (see Appendix A) → 'Test' (F4) → 'Valves' (F4).

This will bring up the following page which enables you to turn on either the fine or coarse valve. With the water meter connected and correctly configured (see chapter 4), the quantity of water dosed will be shown along with the time the valve was open. This can then be used to calculate the water flow rates through each valve if required.

Checking valves				Rec./Batch							
<table border="1" style="margin: auto;"> <tr> <td style="text-align: center;">F</td> <td style="text-align: center;">C</td> </tr> <tr> <td style="text-align: center;">  </td> <td style="text-align: center;">  </td> </tr> <tr> <td colspan="2" style="text-align: center;"> 0.0 litres 0.0 seconds </td> </tr> </table>				F	C			0.0 litres 0.0 seconds		1 / 3 Pre-set	
				F	C						
											
0.0 litres 0.0 seconds											
Moisture											
---.---											
Run Time											
-- 5											
Status:											
Reset	Fine		Coarse	Back							

Before setting up a recipe to start making a mix, the controller has to be setup so that it will dose the correct quantity of water. The setup parameters are located in two menus, 'System' and 'Control'. These are both accessed from the start page as follows:

Accessing the System / Control Menu

Task	Action												
From start page, enter the setup menu	Press 'More' F5 Press 'System' F1												
Enter password to access system menus <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">Setup System</td> <td style="width: 30%;">Rec./Batch 1 / 3</td> </tr> <tr> <td>Hydro-Control V v5.00</td> <td>Pre-set</td> </tr> <tr> <td> </td> <td>Moisture ---</td> </tr> <tr> <td>Password:</td> <td>Run Time -- 5</td> </tr> <tr> <td colspan="2">Status:</td> </tr> <tr> <td>System</td> <td>Back</td> </tr> </table>	Setup System	Rec./Batch 1 / 3	Hydro-Control V v5.00	Pre-set		Moisture ---	Password:	Run Time -- 5	Status:		System	Back	Passwords are listed in Appendix A in this manual. Type the password using the keypad
Setup System	Rec./Batch 1 / 3												
Hydro-Control V v5.00	Pre-set												
	Moisture ---												
Password:	Run Time -- 5												
Status:													
System	Back												

System Menu

Edit System	Rec./Batch 1 / 3
Water mode : Metric	Auto
Meter flow/pulse : 1.000000	Moisture
Meter timeout : 5	Run Time -- 5
Language : English	
Busy mode : Water	
Max. recipes : 10	
Default recipe...	
Status:	
Inc	Dec
	Back

Control Menu

Edit Control	Rec./Batch 1 / 3
Gain : 40	Auto
Upper control thr.: 70	Moisture
Lower control thr.: 25	Run Time -- 5
Valve onoff time : 1.0	
Fine delivery : 20.0	
In-flight -lits : 0.0	
Averaging Time : 10	
Mix Extension : 30	
Access mode : Unlock	
More..	
Status:	
Inc	Dec
	Back

Basic water parameters

There are two parameters that need to be entered for water to be dosed accurately.

Water meter pulse/flow

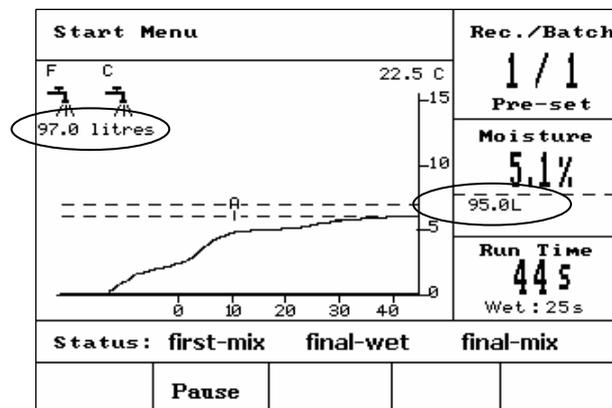
The most important parameter for metered flow is the flow per pulse, located in the System Menu. This is determined by the water meter and so the correct value will need to be entered onto the system parameter 'Meter flow/pulse'.

The value entered is the amount of water represented by one pulse. For example a water meter that gives 10 pulses/litre would need a meter flow/pulse of 0.1 litres, therefore typing 100000 would correctly set this parameter 0.100000.

Setting the in-flight

The in-flight water can be set in the control menu. This water is the quantity that continues to flow after the valves have been switched off. It is the water left in the pipes and the further away the water meter is from the outlet, the higher the in-flight. In general this will be less than 2 litres, but is dependant on the size of the pipes and the water pressure. Setting the in-flight quantity will enable the controller to compensate for this amount by shutting off the valves earlier so that the final water target is reached.

The in-flight water can be found once a recipe has been setup and experimented with. It is easy to determine because all water has to go through the water meter, hence dosing a set quantity of water and then comparing with the actual quantity dosed will give the in-flight water. Both the actual and target water are shown on the screen during a mix cycle. For example as shown below, 95 litres was the target water set in the recipe, but the total water dosed was 97 litres. This would show us that in this case the in-flight is 2 litres.



Description of System Parameters

Parameter	Description
Water mode	Determines the units of the controller, there are three options: <ul style="list-style-type: none"> ○ Metric: litres, kg and deg C ○ US: US Gallons, Lbs, deg F ○ Timed: Use this if there is no water meter connected. Valves are open for a specified length of time as opposed to a pulsed input.
Meter flow/pulse	The quantity of water represented by one pulse of the water meter.
Meter timeout	The maximum waiting time for a pulse when the valves are open before alarming.
Language	Defines the language used in the controller.
Busy mode	Defines how the Busy opto output will be used. There are three options: <ul style="list-style-type: none"> ○ Water: The output is high during any water addition phase ○ Admix: The output goes high only in the final wet phase and therefore can be used to trigger any admixtures ○ All: The output is high for the complete cycle.
Max recipes	Defines the number of recipes available in the recipe menu, maximum 99.

Description of Control Parameters

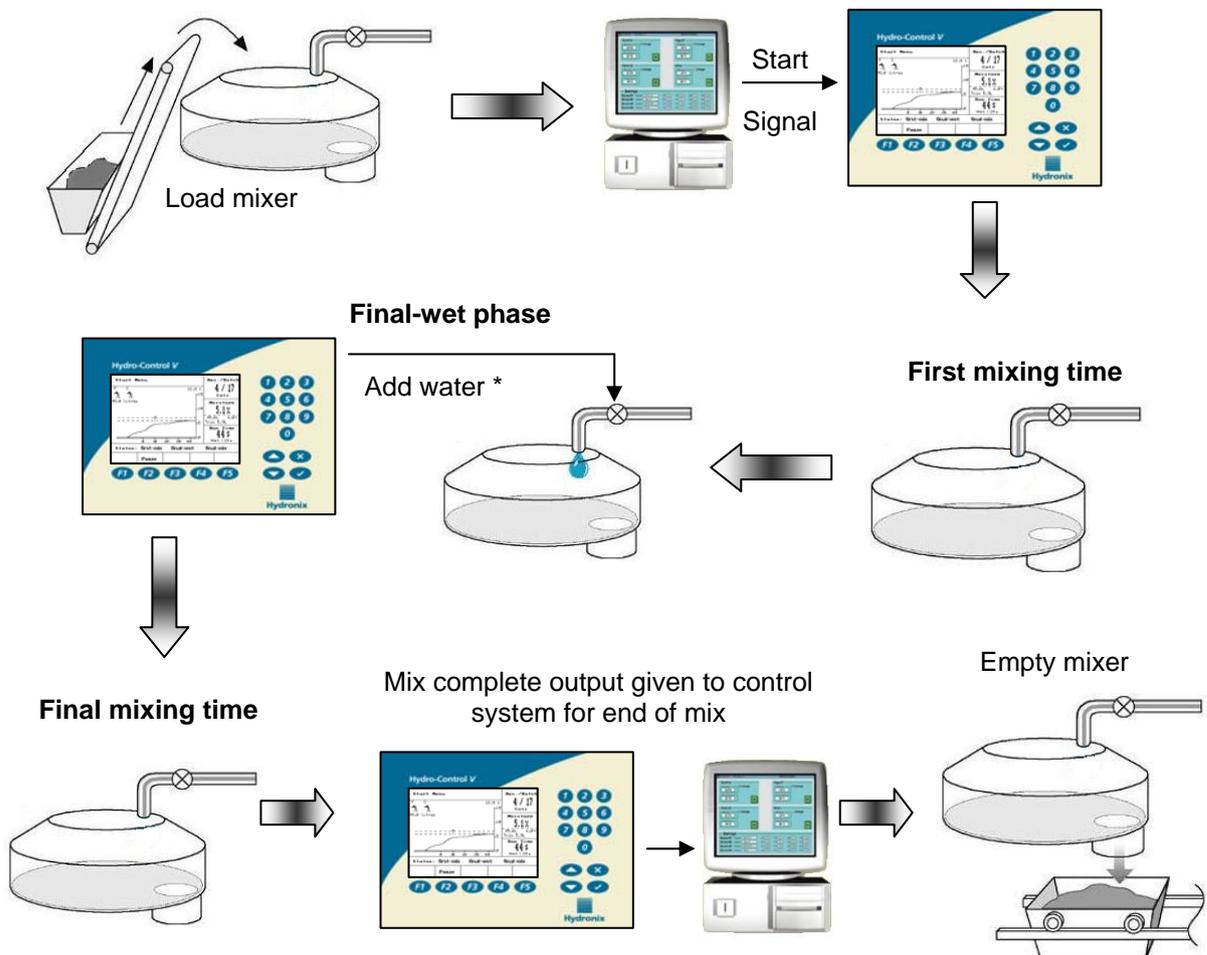
Parameter	Description	Applicable water mode/s
Gain	Defines the speed of the auto mode algorithm and is directly related to the speed at which the moisture changes when water is added. Slower acting mixers will have lower values, the higher the value the higher the rate at which water will enter the mixer.	Auto
Upper Control Threshold	Controls the point when the water valves change from always on, to pulsing. A lower value will keep the valves in the always on state for longer and therefore switch to pulsing much closer to the moisture target. Values of 50-70 are typical for most applications if the gain is set correctly.	Auto
Lower Control Threshold	Determines the rate of pulsing, hence the minimum flow rate, when the moisture is very close to the moisture target. This is used to prevent the water flow being too slow towards the end of the water addition. A lower value reduces the rate of pulsing near the moisture target. Values of 10-25 are typical for most applications if the gain is set correctly.	Auto
Valve on/off Time	Sets the minimum time to open the valve, and therefore controls the minimum quantity of water that can be dosed. e.g. if the water flows at 4 L/s, then setting this parameter to 1 second will mean that the smallest amount of water to enter the mixer in Auto mode is 4 Litres.	Auto
Fine delivery	Sets the final quantity of water that is added only using the fine valve e.g. Fine delivery = 10 litres, if 50 litres is to be dosed Therefore 40 litres will be dosed using both valves, then coarse valve will switch off and last 10 litres will be dosed using fine valve only	Pre, Calc, Calib
In-Flight	Sets the quantity of water that continues to flow into the mixer once the valves have switched off.	Pre, Calc, Calib
Averaging time	Sets the time period at the end of the first mix and final mix times where the moisture are averaged.	All
Mix extension	Defines how long to extend the final mixing time to ensure the readings are stable.	Calib
Access mode	When set to lock, prevents editing of the recipe parameters and allows the user to only change between the current mode and preset.	-
Valve – Pre-wet	Select the valve/s to use for the pre-wet water addition	All
Valve – Final-wet	Select the valve/s to use for the final-wet water addition	All

Understanding the mix cycle is important so that it can be optimised correctly to make the control of moisture accurate and repeatable. This chapter helps to define the phases of a mix cycle so that users can setup recipes.

Simplest Mix Cycle – No Pre-Wet

The simplest cycle is illustrated below. Once material is loaded, it is mixed for a set time, water is added, and then it's mixed for a further set time, then it is unloaded.

The Hydro-Control V starts its cycle when the 'Start' signal is received. The first phase of the cycle is the first mix time, set in the recipe. After this period, water is added, after which the final mixing time commences, also set in the recipe. At the end of the final mix time the cycle is finished and the 'mix complete' signal is set high, used by the control system to unload the mixer. The moisture through the different phases is shown opposite.



* Water can be added in a variety of ways, discussed in more detail in Chapter 10

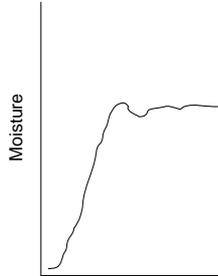
Load mixer

Moisture increases from mixer empty reading



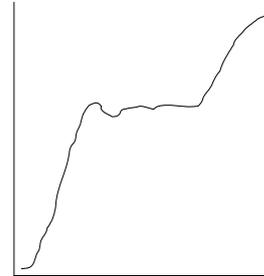
First mixing time

As materials start to mix the moisture begins to stabilise. A stable moisture reading indicates that all the materials are mixed thoroughly. This is called a homogeneous mix.



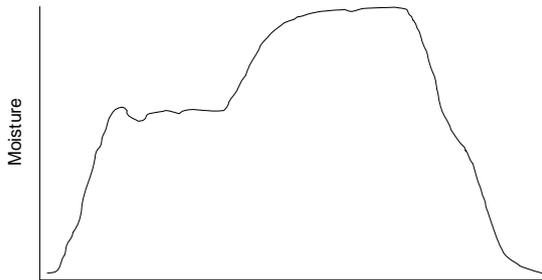
Final-wet phase

As water is added the moisture levels increase



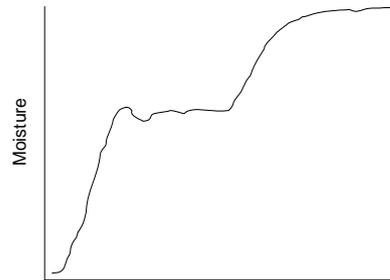
Empty mixer

As the mixer is discharged the moisture reduces back to the mixer empty reading



Final mixing time

As the water gets mixed the moisture levels begin to stabilise. A stable moisture reading indicates that all of the water is mixed thoroughly. This is called a homogeneous mix.



Mix Cycle using Pre-Wet water

Pre-Wet water is a quantity of water used at the beginning of the cycle. It is normally a fixed amount set in the recipe, i.e. number of gallons or litres, but can also be a set moisture target that should be reached at the beginning.

Why use Pre-Wet?

Pre-Wet water may be used for a few reasons. For example:

- Reduce cycle times, especially true for large batches requiring large quantities of water. The Pre-Wet water (typically 2/3 of the total water) can be dosed at the same time as the aggregates are loaded into the mixer, meaning that the water will be mixed into the material quicker. The moisture sensor is then used to accurately dose the remaining 1/3 water on top of the mix, to reach a repeatable moisture target.
- Aid the mixing efficiency when using certain admixtures, so that when the chemicals/dyes are added they are not being added to dry material.
- Wet the aggregates before adding the cement to the mixer. This might be necessary for a number of reasons, for example to aid the mixing of cement into the material (preventing 'balling up') or perhaps the particular colour admixture needs to be added to a wet mix before the cement is added. Another benefit of adding Pre-Wet before the cement is to loosen the material and reduce the mixing power, useful in mixers that are not capable of mixing all dry materials together.
- Wet the aggregates to bring them above their absorption value (SSD), typical for lightweight or synthetic aggregates.

Example case: If the water needed to produce a repeatable concrete mix varies between 55 and 68 litres (depending on the time of year and incoming aggregates), then the recipe could be setup to put 40 litres of Pre-Wet water. The remainder can be topped up in the final-wet phase.

Additional I/O for Pre-Wet water

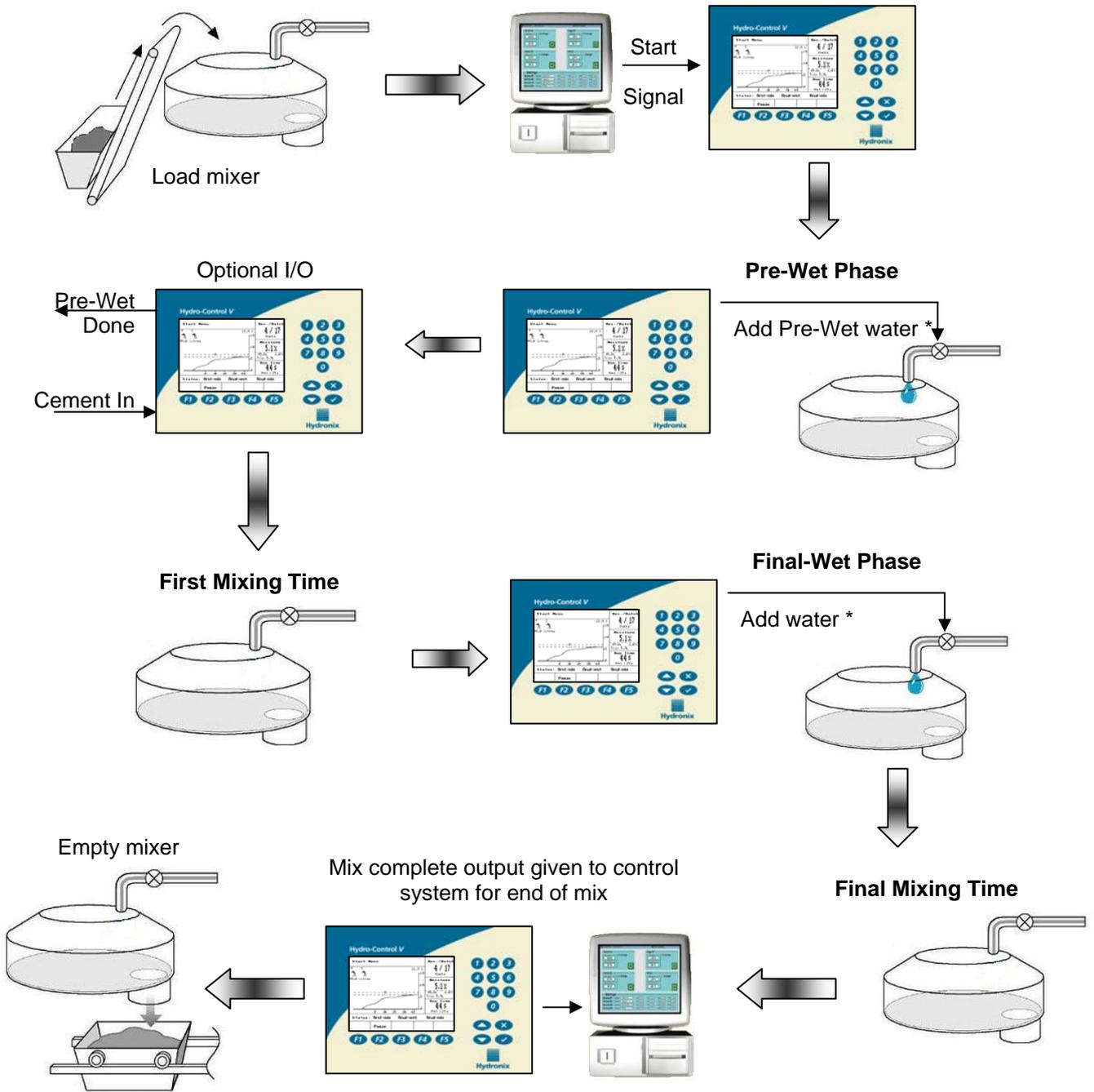
When Pre-Wetting the aggregates before the cement is loaded, it may be necessary to know when the Pre-Wet water is finished. The cement can then be loaded. For this, the Hydro-Control V has an output called 'Pre-Wet Done' which switches at the end of the Pre-Wet phase in the cycle. This can be used by the control system to charge the cement.

To continue on in this cycle, it may be necessary to know that the cement has finished dispensing. For this the Hydro-Control V has an input called 'Cement In'. After the 'Pre-Wet Done' output is given, the controller waits for the 'Cement In'. Once this is received the cycle can continue onto the next phase, the first mixing time.

The wait period is determined by the 'Cement timeout' time in the recipe. If the 'Cement In' input is not used then this time **must** be set to zero, otherwise it will count down and then the alarm will be given that no input was received. In this case the Pre-Wet Done output will still trigger but only for a short period of time.

The mix cycle when using Pre-Wet water is illustrated on the next page.

The Hydro-Control V starts its cycle when the 'Start' signal is received. The first phase is the addition of the Pre-Wet water. The 'Pre-Wet done' output then goes high and the controller waits for the 'Cement In' input. The next phase is the first mix time, set in the recipe. After this period, water is added, after which the final mixing time commences, also set in the recipe. At the end of the final mix time the cycle is finished and the 'mix complete' signal is raised, used by the control system to unload the mixer. The moisture through the different phases is shown on the next page.



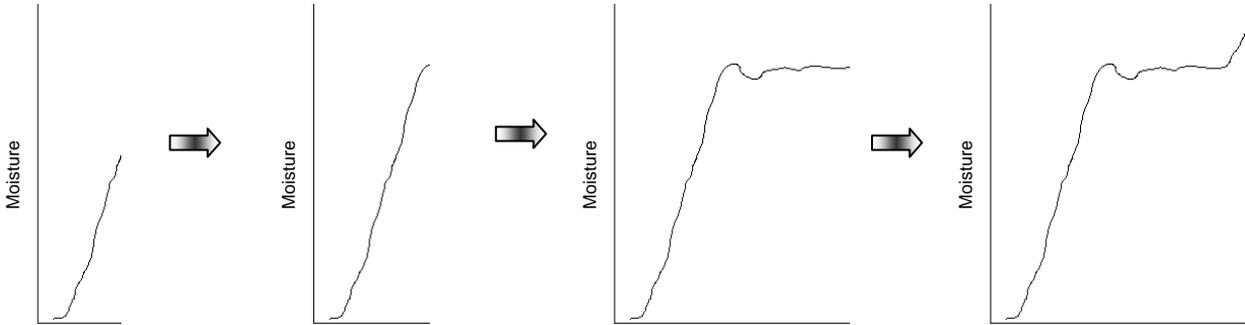
* Water can be added in a variety of ways, discussed in more detail in Chapter 10

Load mixer
Moisture increases from mixer empty reading

Pre-Wet Phase
As water is added the moisture further increases.

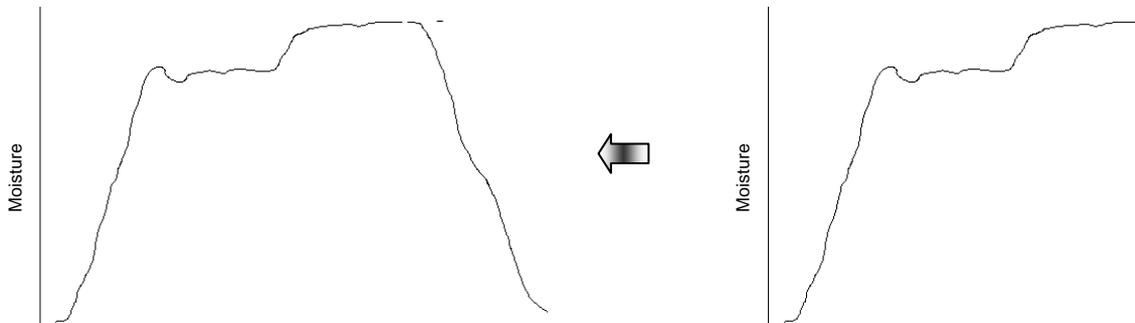
First mixing time
As materials start to mix the moisture begins to stabilise. A stable moisture reading indicates that all the materials are mixed thoroughly. This is called a homogeneous mix.

Final-Wet Phase
As water is added the moisture increases



Empty mixer
As the mixer is discharged the moisture reduces back to the mixer empty reading

Final mixing time
As the water gets mixed the moisture begins to stabilise. A stable moisture reading indicates that all the water is mixed thoroughly. This is called a homogeneous mix.



There are three ways in which the Hydro-Control V can dose water: Preset Mode, Auto Mode and Calc Mode. These 'modes' are described below.

Preset Mode

This is the basic operating mode, which simply adds a fixed amount of water (in litres or gallons) set in the recipe. This is the mode to start using when first setting up a recipe.

No moisture signal is required so this is also the mode to use when either the sensor is not used or faulty.

Auto Mode

This mode, also called a progressive feed method, uses a PID algorithm to add water to the mixer until the moisture target is achieved. The algorithm uses the current moisture reading and the target. The further away the current reading is away from the target, the faster water is dosed. As the reading gets closer to the target water is added more slowly, by pulsing the valves, in order to accurately hit the target.

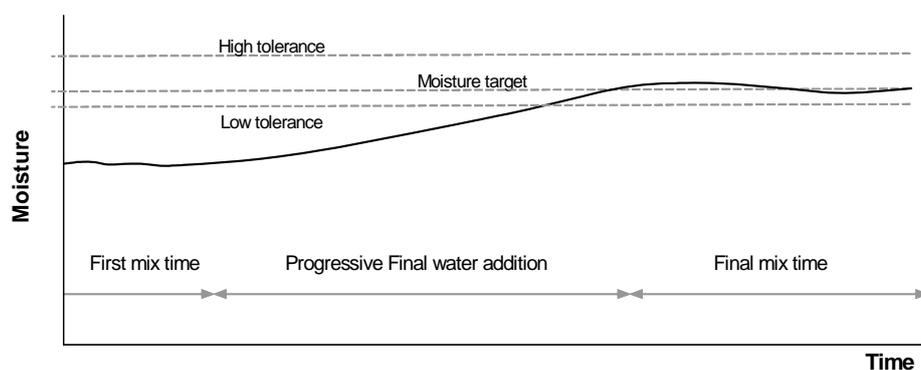
As with all batch cycles, it is important to ensure the mix is homogeneous at the end of the mix, and so sufficient time should be allowed to let the moisture stabilise before discharging.

Advantages:

- As the control only relies on the current reading and moisture target, no calibration of the recipe is required.
- A short first mixing time can be used, for example 10 seconds.
- Batch size independent therefore the control will work even if there are changes in the batch size. However for large changes in batch size, i.e. half batches, it is recommended to use a separate recipe with the 'Recipe gain' (see setting up a recipe section) altered.

Disadvantages:

- The speed of water addition is related to the mixer's mixing efficiency. In order for the sensor to quickly 'see' the water that is being dosed, the water has to be mixed in quickly. This is not always the case in some mixers and therefore it can take a long time for total water addition.
- The progressive algorithm needs to be 'tuned' to the system so that the flow of water into the mixer is matched to how quickly the sensor can read the moisture (i.e. related to the mixer's mixing efficiency).



Calc Mode

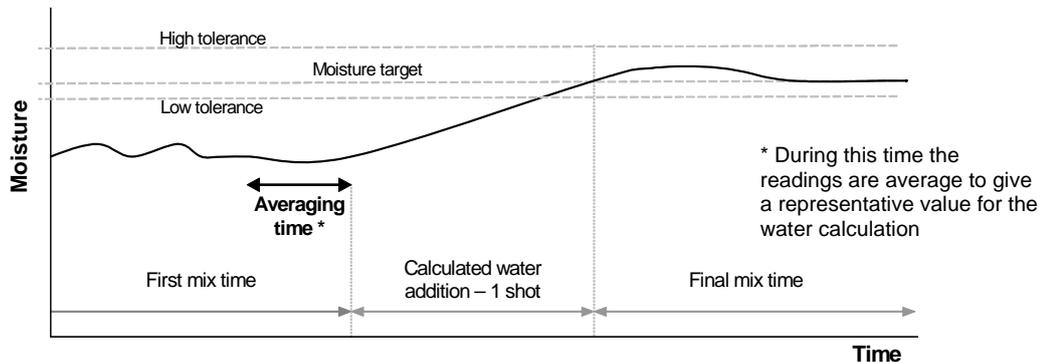
This mode makes a reading at the end of the First mix, then uses this along with the 'Dry weight' parameter from the recipe and the calculation target, to make a calculation of how much water is needed. To achieve the correct calculation, each recipe must be calibrated.

Advantages:

- No tuning of the system necessary
- For mixers with very slow mixing action, this may be the only option.
- The calculated water is dosed in one shot making the final-wet phase quicker than Auto mode.

Disadvantages:

- The dry reading used for the calculation must be very stable which usually requires the first mix time to be longer than is necessary for Auto mode control.
- The water calculation is batch size dependant therefore if the dry weight of material does vary significantly then the recipe will need to be updated with live batch weights, either by manually editing the recipe or sending the value to the recipe using the Hydro-Control V's RS232 port.
- If significant changes are made to the recipe then it will need to be recalibrated.



As with all batch cycles, it is important to ensure the mix is homogeneous at the end of the mix, and so sufficient time should be allowed to let the moisture stabilise before discharging.

Reducing the final mix time.

If cycle times need to be reduced then the only time that can be reduced is the final mix time. The first mix time needs to be long enough to have a stable reading for an accurate water calculation, and so this cannot be reduced. However, any mix used for calibration should have sufficiently long mixing times for both the first and final mix.

Reducing the final mix time will not make any difference to the accuracy, although users should be aware that it may compromise the homogeneity of the mix. One thing that may need to be altered in the recipe is the tolerance band, set with the 'plus tolerance %' and 'minus tolerance %' parameters. These two parameters define a band around the moisture target. If the moisture is outside these levels at the end of the cycle it will alarm. Therefore reducing the final mix time may mean that the moisture might not have reached the target value, in which case the 'minus tolerance %' should be increased to avoid excessive alarming.

In this chapter the descriptions of all the recipes parameters are listed. Also described is how to enter the recipe menus, copy recipes and edit parameters.

Accessing the recipe menu

Task	Action																																																																													
From start page, enter the recipe menu	Press 																																																																													
<p>Select recipe to edit</p> <table border="1" data-bbox="220 730 730 1111"> <thead> <tr> <th colspan="5">Select Recipe</th> <th>Rec./Batch</th> </tr> <tr> <th>No.</th> <th>Pre Wet</th> <th>Mix s</th> <th>Final Wet%</th> <th>Wet Mix s</th> <th>1 / 0</th> </tr> </thead> <tbody> <tr> <td>>01P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td>Pre-set</td> </tr> <tr> <td>02P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td>Moisture</td> </tr> <tr> <td>03P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td>---</td> </tr> <tr> <td>04P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td>Run Time</td> </tr> <tr> <td>05P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td>-- 5</td> </tr> <tr> <td>06P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td></td> </tr> <tr> <td>07P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td></td> </tr> <tr> <td>08P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td></td> </tr> <tr> <td>09P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td></td> </tr> <tr> <td>10P</td> <td>0.0</td> <td>20</td> <td>6.5</td> <td>30</td> <td></td> </tr> </tbody> </table> <p>Status: Select</p> <table border="1" data-bbox="225 1066 730 1111"> <tr> <td>Defs</td> <td>Copy</td> <td></td> <td>Edit</td> <td>Back</td> </tr> </table>	Select Recipe					Rec./Batch	No.	Pre Wet	Mix s	Final Wet%	Wet Mix s	1 / 0	>01P	0.0	20	6.5	30	Pre-set	02P	0.0	20	6.5	30	Moisture	03P	0.0	20	6.5	30	---	04P	0.0	20	6.5	30	Run Time	05P	0.0	20	6.5	30	-- 5	06P	0.0	20	6.5	30		07P	0.0	20	6.5	30		08P	0.0	20	6.5	30		09P	0.0	20	6.5	30		10P	0.0	20	6.5	30		Defs	Copy		Edit	Back	<p>Scroll using  </p> <p>or type the number of the recipe</p> <p>e.g.  followed by  for recipe 3</p> <p>Then edit recipe by pressing </p>
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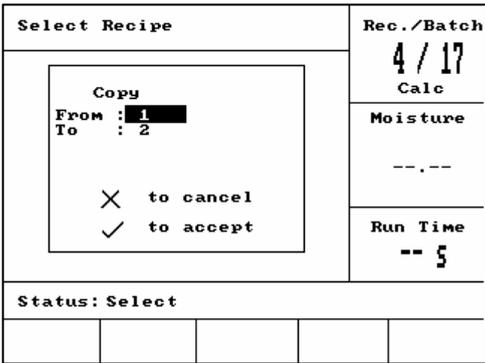
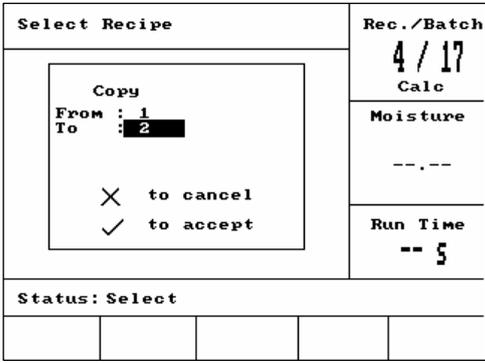
Recipe parameter descriptions

Parameter	Description	Applicable water mode/s
Pre-wet water (Litres/Gal)	If the Pre-Wet mode is set to Pre-Set , this is the quantity of water to add during the Pre-Wet phase of the mix cycle.	Pre-set
Pre-wet target (%)	If the Pre-Wet mode is set to Auto , this is the moisture value to be reached during the Pre-Wet phase of the mix cycle.	Auto
Pre-wet mode	The Hydro-Control V can operate in two Pre-Wet water modes: <ul style="list-style-type: none"> ○ Pre-Set (Pre): The quantity of water defined by Pre-Wet water is added. ○ Auto (Auto): The sensor readings are used to add water up to the Pre-Wet target using Auto mode control. 	
Pre-wet delay (seconds)	The time after adding the Pre-Wet water before continuing the mix cycle. Delays the Pre-Wet done signal, allowing any Pre-Wet water to be mixed before cement is added.	
First mix time (seconds)	The mixing time after any Pre-Wet water and after the cement and aggregates have all loaded. At the end of this time the main water is added.	
Cement timeout (seconds)	This timeout is only used when using any Pre-Wet water. It is the maximum time the system will wait for CEMENT IN signal before beginning First Mix Time . If the CEMENT IN signal is not received in this time the system will automatically pause the mix cycle and output ALARM . If no CEMENT IN signal is to be used after a Pre-Wet phase set this parameter to zero.	
Moisture target (%)	If the Control method is set to Calc or Auto , this is the moisture value to be reached during the Final-Wet phase.	Auto, Calc
Preset final (Litres/Gal)	If the Control method is set to Pre-Set , this is the quantity of water to add during the Final-Wet phase of the mix cycle.	Pre-set
Final mix time (seconds)	The mixing time that follows the addition of the final water. After this time the mix cycle is finished.	
Control Method	The Hydro-Control V can operate in one of four control modes: <ul style="list-style-type: none"> ○ Pre-Set (Pre): The quantity of water to be added as defined by Pre-Set Final. ○ Auto (Auto): The sensor moisture reading is used to add water up to the Moisture Target using Auto Mode control. ○ Calculation (Calc): The sensor moisture reading is used to calculate and add the required quantity of water to reach the Moisture Target. This mode will be disabled if no value of 'Dry weight' has been entered or if there is no water meter present. ○ Calibration (Calib): Mix cycle used to calibrate a recipe for Calc mode. On completion of this cycle the recipe automatically switches to 'Calc' mode. 	
Plus tolerance %	Level above Moisture Target at which the system will pause and output ALARM . This is checked at the end of the mix cycle, and disabled after mix complete.	Auto, Calc

Parameter	Description	Applicable water mode/s						
Recipe gain	<p>A tuning factor for the control algorithm to provide accurate control for smaller batch sizes. For a normal batch size this will be 1.0. For reduced batch sizes it will be a number between 0.0 and 1.0, for example:</p> <table style="margin-left: 40px;"> <tr> <td>$\frac{3}{4}$ Batch</td> <td>Recipe Gain = 0.75</td> </tr> <tr> <td>$\frac{1}{2}$ Batch</td> <td>Recipe Gain = 0.5</td> </tr> <tr> <td>$\frac{1}{4}$ Batch</td> <td>Recipe Gain = 0.25</td> </tr> </table> <p>In the case where an Auto-mode Pre-Wet is followed by a Calc mode Final Wet the Recipe Gain can be increased up to a maximum value of 10.0 to improve the speed of the Pre-Wet water addition.</p>	$\frac{3}{4}$ Batch	Recipe Gain = 0.75	$\frac{1}{2}$ Batch	Recipe Gain = 0.5	$\frac{1}{4}$ Batch	Recipe Gain = 0.25	Auto
$\frac{3}{4}$ Batch	Recipe Gain = 0.75							
$\frac{1}{2}$ Batch	Recipe Gain = 0.5							
$\frac{1}{4}$ Batch	Recipe Gain = 0.25							
Minus tolerance %	<p>Level below Moisture Target at which the system will sound and output ALARM. This is checked at the end of the mix cycle, and disabled after mix complete.</p> <p>In Auto mode if the moisture % falls below this tolerance during the Final Mix Time the cycle will revert to Final Wet phase and add more water in an attempt to reach the Moisture Target.</p>	Auto, Calc						
Dry weight (Kg/Lbs)	<p>The total dry weight of the mix including all sand, aggregates and cement.</p> <p>This must be entered before Calc or Calib mode can be selected.</p>	Calc, Calib						
Calib. Water (Litres/Gal)	<p>Defines the amount of water used for calibrating the recipe in the final wet phase of a Calib mix cycle.</p> <p>See Calibration section for more information.</p>	Calib						
Water limit (Litres/Gal)	The maximum amount of water that would ever need to be added for this recipe.	All						
Batch counter	A batch number to identify a mix in the mix log							
Moisture offset	Factor used to convert sensor units into moisture units, recalculated when the recipe is calibrated.							
Moisture gain	Factor used to convert sensor units into moisture units, recalculated when the recipe is calibrated.							
Water trim (Litres/Gal)	An amount of water added or removed from the final water of a Calc mode mix cycle.	Calc						
Cement weight (Kg/Lbs)	The weight of cement in the mix. Only used for calculating the water/cement ratio which is displayed in the Mix Log .							
Temperature (deg °C/ deg °F)	The base temperature used for temperature compensation in either degrees Centigrade (Metric Mode) or degrees Fahrenheit (US Mode).	Auto, Calc						
Temp. Coeff	The compensation factor used for temperature compensation in % moisture per degrees temperature (°C or °F). If no compensation is required this should be set to 0.000.	Auto, Calc						
Calibration Type	Determines whether the calibration will be a 1-point or 2-point calibration mix cycle (when calibrating with admix), see Advanced section for more information.	Calib						

Copying a recipe

The simplest method of creating a new recipe similar to an existing recipe, is to use the copy function.

Task	Action
From start page, enter the recipe menu	Press 
Select 'Copy'	Press 
<p>Select source recipe</p> 	<p>Type the number of the recipe</p> <p>e.g.  followed by  for recipe 1</p> <p>Press  to accept</p>
<p>Select destination recipe</p> 	<p>Type the number of the recipe</p> <p>e.g.  followed by  for recipe 2.</p> <p>Press  to accept</p>

In order to use the sensor for moisture control, the recipe must be 'trained' to know the required moisture level it must achieve. In order to do this two things need to be established, the water required and the mixing times.

Establishing the correct water for the correct consistency

To get the mix to the right consistency (slump, workability) the correct water will need to be added, but without knowing how much to add it may take a few batches to get this right. This would be best done using Preset mode, as a quantity can be easily changed in the recipe on a batch by batch basis. The trim function may also be used to open the valves to dose more water until a point where the mix consistency is correct.

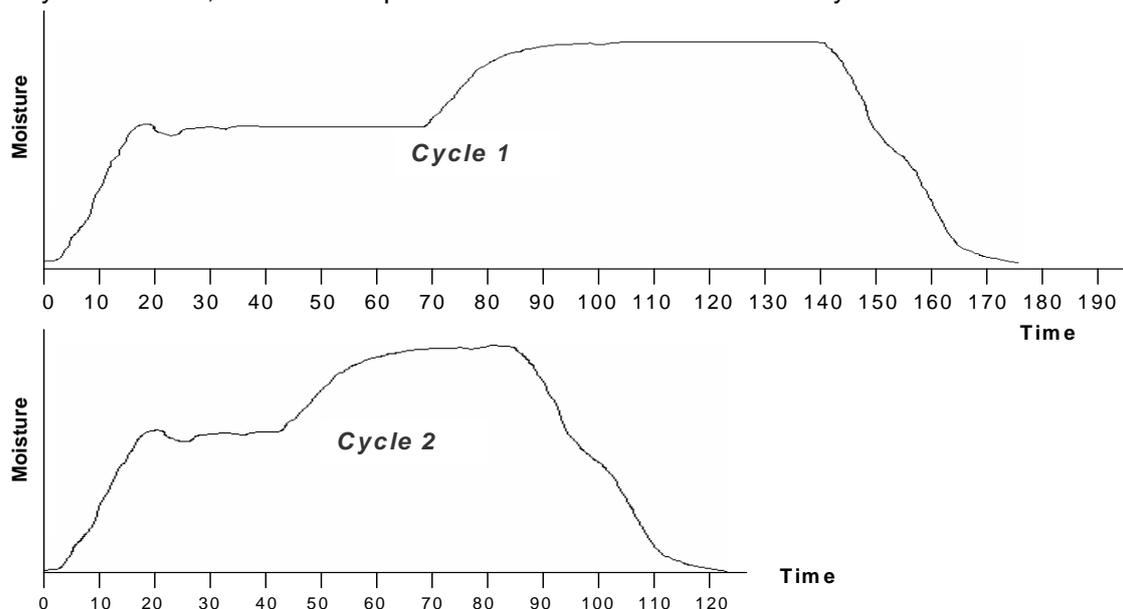
Appropriate mixing times to make a homogeneous mix

The first and final mixing times will ultimately affect how well the materials are mixed. Users need to be aware that when these times are forced low, as the case may be in high production environments, it can have a detrimental affect on the homogeneity of the mix.

The sensor shows the moisture as the materials are mixed and hence it will show when the mix is homogeneous because at this point, the moisture will stabilise. This is important especially in a calculation (**Calc**) mode because the moisture level needs to be stable for making a good water calculation.

The mixing times can only be determined empirically as there are many factors that affect how long it takes to mix all the ingredients in the mixer. The best way to establish suitable first mix and final mix times is to extend them to begin with, and then shorten once you know how long the signal has been stable for, for both the first and final mix times.

Example: Recipe is setup with: First mix time = 60 seconds, Final mix time = 60 seconds. First batch produces mix trace as shown below in cycle 1. From this it can be shown that both mix times can be reduced by 30 seconds, which would produce the mix trace as shown in cycle 2.

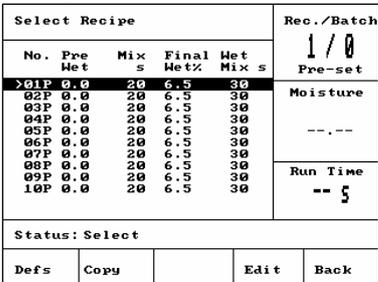
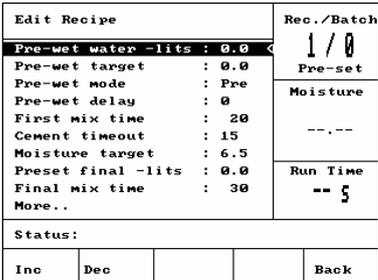


Running the 1st mix.

The sequence would consist of the following:

- i) Setting the recipe for water and mixing times
- ii) Start mix cycle
- iii) Near the end of the mix, pause the cycle to manually check on the consistency
- iv) Add more water if necessary using manual trim
- v) Resume the mix cycle, final mix time will continue until it reaches Mix Complete
- vi) Update recipe with water entered for that mix

i) Setting the recipe parameters for water and mixing times.

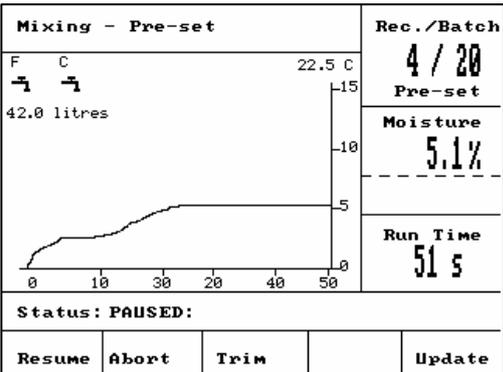
Task	Action
From start page, enter the recipe menu	Press 
Select recipe to edit 	Scroll using   or type the number of the recipe e.g.  followed by  for recipe 3 Then edit recipe by pressing 
Select recipe parameter to edit 	Scroll using  
Edit First Mix Time	Set a long time to begin with, e.g. 70sec. This can then be reduced later.
Edit Pre-Set Final –lits (litres)	Set a quantity of water that will be less than is necessary, the rest can be manually trimmed; too much water is more difficult to deal with compared with not enough! E.g. if total water required is approximately 80 litres then set this to 70 litres.
Edit Final Mix Time	Set a long time to begin with, e.g. 70sec. This can then be reduced later.
Edit Water Limit –lits (litres)	Ensure the water limit is set to an appropriate quantity for that recipe. e.g. if the recipe never requires more than 20L then leaving the water limit at the default value of 120L is not recommended.

In addition to the above parameters, set these if using Pre-Wet Water	
Edit Pre-Wet Water –lits (litres)	Depending on the need for Pre-Wet water (see section x), set a suitable quantity of water.
Edit Cement Timeout	If using the Cement In input, leave this at the default of 15 seconds. If not using the Cement In input then set this to zero.
Update recipe	Press F5 to exit, then  to update recipe

ii) Starting the mix cycle.

Task	Action
Only start a mix cycle when the Hydro-Control V is on the start page	
Start the mix cycle	Press F1 to manually start Or start the cycle using the input signal from the batch controller.

iii) Pause the mix cycle

Task	Action
Wait until the controller has added the water entered in the recipe.	
In the final mix time, pause the cycle.	Press F2 to manually pause 

iv) Trimming the water manually to reach final consistency

Task	Action
Monitor consistency of mix	If possible, observe the mix in the mixer through the inspection hatch to see if more water is needed
Add water (if needed)	Press 'Trim' F3 to manually open the fine valve. Monitor the water quantity at the top left hand corner of the display to ensure the correct amount is being dosed.

v) Resume the mix cycle

Task	Action
Resume cycle	Press 'Resume' F1 to resume. Final mix time will resume and cycle will reach Mix Complete

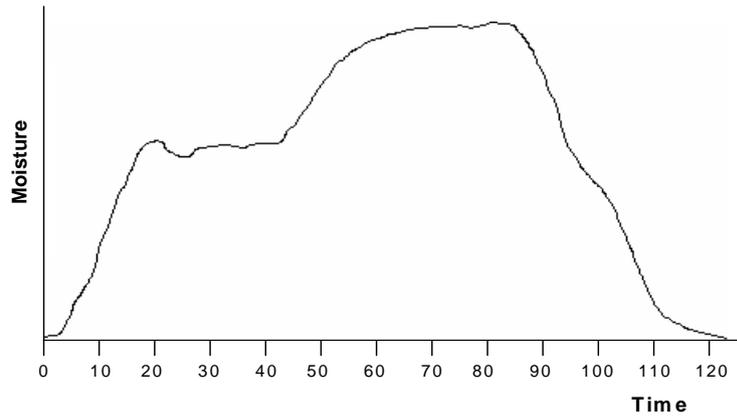
vi) Update Recipe with water

If additional water was manually added by trimming, it is easy to update the recipe with the total water dosed without having to go into the recipe and manually update the **Pre-set Final** water quantity.

Task	Action
Before resetting mix, update Pre-set Final parameter in that recipe with the water entered.	Press F5 to update recipe. Press ✓ to update recipe

Running further mixes

Run at least two more mixes to establish the correct water and mixing times. Any admixtures should be dosed at the same time during the cycle so that the sequence is all the same. The moisture curve should look as shown below, although the times may vary depending on the mixer etc.



Once the mixes are consistent, the recipe can be switched over to use the sensor for controlling the water.

Selecting the best mode – AUTO or CALC?

The best mode for moisture control using the Hydro-Control V will be different from application to application. To begin with it is important that all users understand the differences between AUTO and CALC by reading Chapter 6. In order to answer which mode is better, some questions need to be answered, for example:

- *Do the batch sizes vary significantly from one batch to another?*

If yes then AUTO mode will work fine without the need to update the dry weight parameter in the recipe before a batch is made. To use CALC mode the recipe would have to be updated on a batch by batch basis, either by sending the dry weight parameter to the controller using the RS232 port on the Hydro-Control V, or by manually editing the recipe

- *Is the water supply pressure constant?*

If no, then AUTO will not work well due to changes in speed of water addition when the water pressure changes, and so CALC mode will need to be used.

- *Are mixing times critical?*

If yes then it is more likely that CALC mode will be quicker to use than AUTO mode.

- *Can you achieve a stable reading in the first mix time?*

If no then it is unlikely that CALC mode will give the desired accuracy because the most critical time in the cycle is at the end of the first mix time where stability will give a better water calculation to add in one shot. AUTO mode does not need a stable signal because water is continually added until the target is reached.

Calibrating a recipe for AUTO mode

It is not necessary to calibrate a recipe when using AUTO mode. The only parameter that is required for the controller to add the correct quantity of water for each mix is the 'Moisture Target %'.

However the AUTO mode may need to be optimised so that the mode is tuned to the system. This is covered in more detail at the end of this chapter.

Calibrating a recipe for CALC mode

As described, when planning to use CALC mode the recipe must first be calibrated. Recipe calibration is the process of calculating some suitable coefficients in the recipe, the 'moisture gain' and 'moisture offset'.

To calibrate the recipe there are two ways, either from a good mix recorded in the mix log, or by running a Calib Mode mix cycle. In Calc mode it is essential to have stability at the end of the dry mix time only, whereas to calibrate the cycle stability it is essential at both the dry **and** the wet part of the cycle. This is true if calibrating from the mix log or running a CALIB cycle.

Calibrating from the Mix Log

Calibration from the mix log is useful when a good batch has been made which you want to use as the basis for all the mixes. It saves having to run a further mix to calibrate using Calib mode.

As with all calibrations, it is essential to ensure that the moisture at the end of the first mix and the final mix times are stable, and so this should be checked before any calibration is carried out. Look at the deviations for both the first **and** final mix times. see Chapter 10 for more information on using the mix log. These should be as close to zero as possible, always less than 3 unscaled units and ideally less than 0.5 unscaled units.

Task	Action
Enter mix log	From Start page, Press 'More'  and then press 
Select the recipe that provided a good mix in the mix log.	Scroll using  
Select the 2 nd menu	Press 'More' 
Select to calibrate from the mix record.	Press 'Calib' 

Enter dry weight (only shown if no dry weight has been already entered in the recipe)

Mix Log		Rec./Batch 6 / 1
<div style="border: 1px solid black; padding: 5px; text-align: center;"> Enter Dry Weight 1000 <input type="checkbox"/> to save </div>		Pre-set
		Moisture ---.---
		Run Time -- 5
Status:		

Use keypad to type dry weight and press the  to accept.

Type reference moisture for final target

Mix Log		Rec./Batch 6 / 1
<div style="border: 1px solid black; padding: 5px; text-align: center;"> Select final moisture % = 5.5 <input type="checkbox"/> to cancel <input checked="" type="checkbox"/> to save </div>		Pre-set
		Moisture ---.---
		Run Time -- 5
Status:		

This final moisture is for display purposes only. It is an arbitrary reference that the recipe will use as the target. If however true moisture is required to be displayed, then enter in the true value determined by drying a sample of the mix at the end of the cycle.

Enter a trim (if required)

Mix Log		Rec./Batch 6 / 1
<div style="border: 1px solid black; padding: 5px; text-align: center;"> Trim Water For Good Mix = -2.5 <input type="checkbox"/> to cancel <input checked="" type="checkbox"/> to save </div>		Pre-set
		Moisture ---.---
		Run Time -- 5
Status:		
+/-		

This can be used to input a theoretical trim on a particular mix. This might be useful if this batch was a little too wet or too dry. Adding or subtracting a trim here will then adjust the calibration as if the batch was made with a different quantity of water.

For example a batch is made with 30 litres. This is a little too wet by only about 2 litres. Therefore using a trim of -2 litres would calculate the calibration as if 28 litres was used.

Update new calibration to recipe	Press  at the end of the sequence update. The recipe will automatically switch to run in 'Calc' mode.
----------------------------------	--

Calibrating using CALIB mode.

This section describes a single point calibration cycle only. For more information on 2-point calibration please see section Calibration with Admix in Chapter 11.

The Calib mode cycle is identical to a Pre-Set mode cycle with only one exception, the final mix time is extended by a time set in the parameter 'Mix Extension time' located in the Control menu. By default this is 30 seconds. This may be required in order to guarantee the moisture is stable for the calculations. If the final mix time is already long enough in CALC mode to achieve a stable reading, then the mix extension time can be reduced to zero. If however the final mixing time is very short because the cycles need to be as short as possible, then the mix extension time will extend the cycle and improve the accuracy of the calibration.

Task	Action
From start page, enter the recipe menu	Press 'Recipe' 
Select recipe to run	Scroll using   or type the number of the recipe e.g.  followed by  for recipe 3
Exit recipe menu back to start screen	Press 
Select Calib mode	Press  until 'Calib' is displayed.  Note that Calib mode cannot be selected unless the dry weight is entered into the recipe.

<p>Start the mix cycle</p>	<p>Press F1 to manually start</p> <p>Or start the cycle using the input signal from the batch controller.</p>
<p>The calibration water to be dosed is displayed. Ensure the correct water is displayed or enter the correct quantity.</p>	<p>Type the water required in the cycle using the keypad</p> <p>e.g. 3 , 0 and 0 for 30.0 Litres</p> <div data-bbox="804 607 1264 949" data-label="Image"> </div> <p>Press ✓ to accept and run the cycle.</p>
<p>Cycle will run through as in Pre-set mode and dose the water set as above. Final mix time will be extended by the time set in the 'Mix extension time' parameter.</p>	
<p>At the end of the cycle, enter the final target.</p>	<div data-bbox="791 1137 1289 1505" data-label="Image"> </div> <p>This final moisture is for display purposes only. It is an arbitrary reference that the recipe will use as the target. If however true moisture is required to be displayed, then enter in the true value determined by drying a sample of the mix at the end of the cycle.</p> <p>Press ✓ to accept and run the cycle.</p>
<p>Cycle is finished. The recipe is now calibrated and that recipe will automatically switch over to run in Calc mode, as shown under the recipe number on the top right hand corner of the screen.</p>	

Optimising the Auto mode cycle

In order to use Auto mode the control algorithm needs to be tuned to the system so that the controller achieves the correct dosage of water in the quickest time. This is because the mixing action and the rate of change of moisture in the mix will change from application to application.

A useful trick

The most common problem with moisture measurement in mixers is speed of detection, i.e. the moisture response. This is mostly related to how well the materials are mixed together which is a combination of the mixer and the materials used. Adding to this however, the sensor has to filter out all of the irregularities in the moisture signal so that the sensor can output a usable signal, which slows the response. As the level of filtering inside the sensor can be adjusted, it may be possible to increase the response by reducing the level of filtering as much as reasonably practical. This will only work in Auto mode because speeding up the response will degrade the signal, but unlike Calc mode which needs a stable signal to make its water calculation, Auto will continually add water until the final target is reached. The Hydro-Control V can be used to change the filtering parameters for the sensor. To change the sensors filtering do the following.

Changing Sensor configuration

Task	Action																																	
From start page, enter the setup menu	Press 'More' F5 Press 'System' F1																																	
Enter password to access system menus <table border="1" data-bbox="247 1146 699 1482"> <tr> <td colspan="2">Setup System</td> <td>Rec./Batch</td> </tr> <tr> <td colspan="2">Hydro-Control V v5.00</td> <td>1 / 3</td> </tr> <tr> <td colspan="2">Password:</td> <td>Pre-set</td> </tr> <tr> <td colspan="2"></td> <td>Moisture</td> </tr> <tr> <td colspan="2"></td> <td>---.---</td> </tr> <tr> <td colspan="2"></td> <td>Run Time</td> </tr> <tr> <td colspan="2"></td> <td>-- 5</td> </tr> <tr> <td colspan="3">Status:</td> </tr> <tr> <td>System</td> <td></td> <td>Back</td> </tr> </table>	Setup System		Rec./Batch	Hydro-Control V v5.00		1 / 3	Password:		Pre-set			Moisture			---.---			Run Time			-- 5	Status:			System		Back	Passwords are listed in Appendix A in this manual. Type the password using the keypad						
Setup System		Rec./Batch																																
Hydro-Control V v5.00		1 / 3																																
Password:		Pre-set																																
		Moisture																																
		---.---																																
		Run Time																																
		-- 5																																
Status:																																		
System		Back																																
Enter sensor configuration menu <table border="1" data-bbox="247 1612 705 1955"> <tr> <td colspan="2">Sensor Configuration</td> <td>Rec./Batch</td> </tr> <tr> <td colspan="2">O/P type : 0-20mA</td> <td>1 / 3</td> </tr> <tr> <td colspan="2">O/P variable : fil u/s</td> <td>Pre-set</td> </tr> <tr> <td colspan="2">I/P 1 : None</td> <td>Moisture</td> </tr> <tr> <td colspan="2">I/P 2 : None</td> <td>---.---</td> </tr> <tr> <td colspan="2">Ave/hold delay : 0.0 s</td> <td>Run Time</td> </tr> <tr> <td colspan="2">Filtering time : 1.0 s</td> <td>-- 5</td> </tr> <tr> <td colspan="2">Slew rate + : None</td> <td></td> </tr> <tr> <td colspan="2">Slew rate - : None</td> <td></td> </tr> <tr> <td colspan="3">Status:</td> </tr> <tr> <td>Inc</td> <td>Dec</td> <td>Calib Back</td> </tr> </table>	Sensor Configuration		Rec./Batch	O/P type : 0-20mA		1 / 3	O/P variable : fil u/s		Pre-set	I/P 1 : None		Moisture	I/P 2 : None		---.---	Ave/hold delay : 0.0 s		Run Time	Filtering time : 1.0 s		-- 5	Slew rate + : None			Slew rate - : None			Status:			Inc	Dec	Calib Back	Press 'Diag' F2 Press 'Conf' F4 Sensor configuration menu will be shown as below.
Sensor Configuration		Rec./Batch																																
O/P type : 0-20mA		1 / 3																																
O/P variable : fil u/s		Pre-set																																
I/P 1 : None		Moisture																																
I/P 2 : None		---.---																																
Ave/hold delay : 0.0 s		Run Time																																
Filtering time : 1.0 s		-- 5																																
Slew rate + : None																																		
Slew rate - : None																																		
Status:																																		
Inc	Dec	Calib Back																																

<p>Change filter configuration from default of:</p> <p>Filtering time = 7.5 seconds Slew rate + = Light Slew rate - = Light</p> <p>To:</p> <p>Filtering time = 2.5 seconds Slew rate + = Light Slew rate - = Light</p>	<p>Scroll using  </p> <p>To change values press 'Inc'  or 'Dec' </p>
--	---

The above filter will result in a less stable signal. If for any reason this produces more difficult moisture control then the filter should be reverted back to the default filter settings.

Optimising Auto mode parameters

Optimisation of the Auto mode is a balance between the four Auto mode parameters, **Gain, Upper Control Threshold, Lower Control Threshold** and the **Valve on/off time**. Of these parameters the main one is the gain, which can be thought of as the speed. If the system is too quick and overshoots then it must be slowed down, lower the gain and try again. If the same happens then the gain should be further decreased.

Care and attention should be given to ensure that the system does not overshoot on water, if such a case is likely to happen then the cycle should be paused, trimmed to achieve the correct consistency and then aborted. The auto mode parameters can then be adjusted and further mixes made.

As a quick start guide to optimising the Auto mode, do the following changes to the **Gain** and **Lower control threshold**. It may take several batches to get it working but this should work for most applications.

1. Adjust the gain until the water is dosed at a reasonable rate without reaching the moisture target too quickly and excessively overshooting.

It is better to start at a low value and increase as opposed to starting high and decrease, because if the gain is too low this will just make the cycle time longer than necessary. If the gain is too high then too much water may be added.

Start at a value of 10 and work up until the cycle is reached at the maximum rate without excessive overshoot, i.e. only a few litres. If this is still too quick then decrease the gain. If however the appropriate gain is found to be 5 or lower, then ultimately this will result in very long cycle times and possibly progressive feed is not the correct mode for the application and

Calc mode should be used.

2. Reduce the lower control threshold so that moisture target is reached without overshoot.

The **Mix Log** contains information on the last 99 mix cycles. As a diagnostic and history tool, it has the following uses:

- o Clearly shows sensor readings over repeat batches therefore indicating consistency.
- o Can be downloaded from the controller using the RS232 port, for quality assurance and record purposes – see user guide HD0193 for serial commands.
- o Can be used to calibrate recipes from a previous good mix.
- o Shows the moisture stability and hence indicates homogeneity for both dry and wet mix times.

The mix log can be accessed from the start page by pressing 'More' **F5** and then 'Log' **F2**

Mix Log					Rec./Batch
No.	Dry %	Calc %	Final %	W/C	1 / 3
00/01P	2.5	-	2.5	0.00	Pre-set
35/05C	3.9	9.5	6.7	0.00	Moisture
35/05C	3.9	9.6	6.8	0.00	
38/05C	0.8	20.9	3.1	0.00	---
39/05C	0.8	20.9	4.0	0.00	
38/05C	0.8	6.7	7.3	0.00	
01/10P	-	-	-	0.00	Run Time
00/01P	-	-	-	0.00	
01/01P	-	-	-	0.00	-- 5
02/01P	-	-	-	0.00	
Status:					
US	Water	Mix	More..	Back	

On entering the **Mix Log** the most recent mix cycle is displayed at the bottom. Previous mix cycles may be viewed by using the up  and down  keys

Displayed information

Each record (from start to mix complete) contains the following information:

- o Sensor unscaled readings recorded at the end of dry mix and wet mix times
- o Sensor deviation (variation) recorded at the end of dry mix and wet mix times
- o Moisture readings recorded at the end of dry mix and wet mix times
- o Moisture deviation (variation) recorded at the end of dry mix and wet mix times
- o Water cement ratio**
- o Actual water entered into the mix
- o Target water entered into the mix
- o Total time of mix
- o Weight of mix
- o Gain and offset parameters taken from the recipe

** The water cement ratio calculated will only be a true value if the cement weight is entered into the recipe, **and** the recipe is calibrated to true moisture of the mix. To set the system up so that the displayed moisture is true moisture a sample of the material must be taken at the end of the mix cycle and the true moisture determined. The moisture value determined from the sample can then be entered as the target moisture at the end of the calibration sequence.

Calibrating from the mix log

See Chapter 9 for more details.

Knowing if the mixes are consistent

The mix log is a very useful tool for determining if the mixes are consistent. The best measurements to observe are the sensor unscaled readings. These readings are raw readings taken from the sensor and are therefore independent on any conversions to moisture.

To check consistency look at the unscaled deviations page in the mix log. Once in the mix log, do the following:

- Press 'US' **F1** . This will show all readings in unscaled instead of moisture.
- Press 'More' **F4** . This will show the second menu.
- Press 'Dev' **F4** . This shows the sensor readings for the dry mix and the wet mix phases, along with the deviations. The deviations readings relate to how stable the sensor readings are towards the end of the mixing phases. Both deviation readings should be as close to zero as possible, especially if using to calibrate the mix.

Mix Log				Rec./Batch
No.	Dry	Dry Dev	Final	Wet Dev
36/01C	32.1	0.0	58.3	0.0
37/01C	32.1	0.0	58.3	0.0
38/01C	32.1	0.0	58.4	0.0
39/01C	32.1	0.0	58.3	0.0
40/01C	32.1	0.0	58.3	0.0
41/01C	32.1	0.0	58.4	0.0
42/01C	32.1	0.0	58.3	0.0
43/01C	32.1	0.0	58.3	0.0
44/01C	32.1	0.0	58.4	0.0
45/01C	32.1	0.0	58.3	0.0
Status:				
Calib	Dev	Reset		Back

This page will look similar to as shown above. The four columns show:

- Dry reading (reading at the end of the first mix time)
- Dry deviation (variation of readings at the end of the first mix time)
- Wet reading (reading at the end of the final mix time)
- Wet deviation (variation of readings at the end of the final mix time)

Calibrating using Admixtures

In general, any admixtures dosed should be added to the mix after the water starts so that it is not added on top of the dry material, and should be dosed with the water to aid dispersion into the mix. Following these two guidelines can help the mixing action, improve mix quality and reduce mix cycle times.

The effect of admixtures on the mix varies from admixture to admixture. Unlike water which can be measured linearly by the sensor, admixtures can produce some differing measurement effects. As a result there may be instances when running in Calc mode where the controller is not repeatable and accurate. In such cases Calc mode can be improved by calibrating the recipe omitting the admixture with one shot of the main water, and then adding the admixture along with a second shot of water. This will increase the accuracy because the controller is calibrating to water only. This is called a two stage calibration.

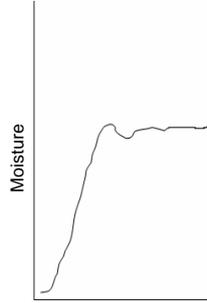
Admixtures can be added by the controller using a generic relay output called 'Busy'. This can be configured in the system menu for a number of different uses (see Chapter 10), but setting this to 'Admix' will make the output high only in the second stage of the water addition in calib mode. In normal calc mode this output goes high along with the water valves so that admixtures (whether connected directly or through a PLC) can be dosed.

The 2-stage calib mode cycle is shown overleaf. As shown the water is split into 2 parts as selected by the user. After the first shot the final mix time commences. The cycle is then repeated with the second shot of the water being dosed and the final mix time.

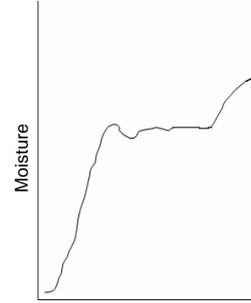
Load mixer
Moisture increases from mixer empty reading



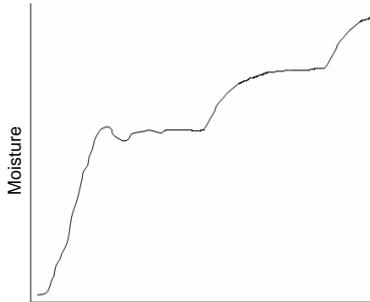
First mixing time
As materials start to mix the moisture begins to stabilise. A stable moisture reading indicates that all the materials are mixed thoroughly, called a homogeneous mix.



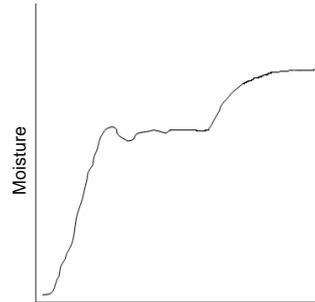
Final-wet phase Addition 1
As water is added the moisture increases



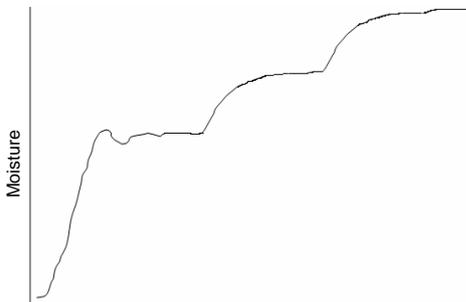
Final-wet phase Addition 2
Water is added the moisture increases. Busy output goes high to add admixtures



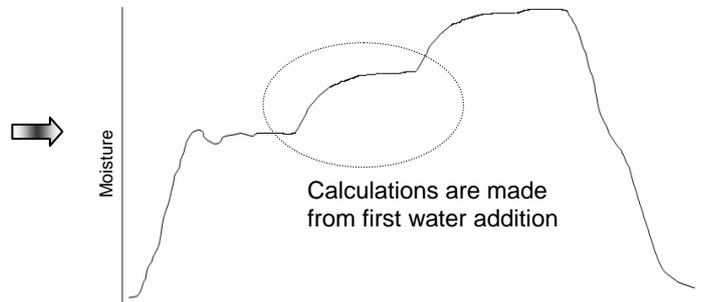
Final mixing time
As the water gets mixed the moisture begins to stabilise.



Final mixing time
As the water gets mixed the moisture begins to stabilise.

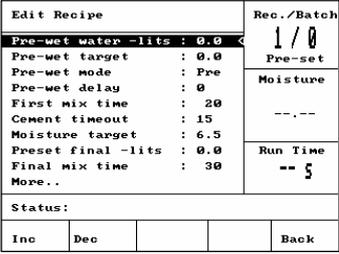


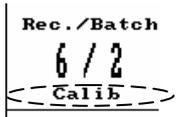
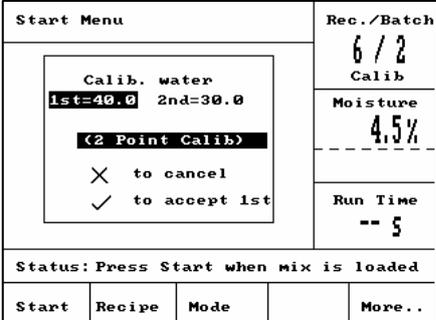
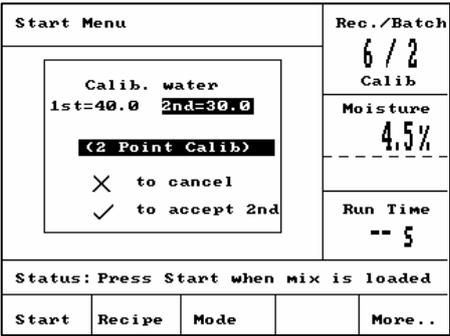
Empty mixer
As the mixer is discharged the moisture reduces back to the mixer empty reading



Performing a two stage calibration

The only way to perform a two stage calibration is to run a cycle in Calib mode, however before running this the recipe parameter 'calibration type' must be changed to '2 Point'.

Task	Action
From start page, enter the recipe menu	Press 'Recipe' 
Select recipe to run	Scroll using   or type the number of the recipe e.g.  followed by  for recipe 3 Then edit recipe by pressing 
Select recipe parameter to edit	Scroll using  
	
Edit First mix time	Set a long time to begin with, e.g. 70sec. This can then be reduced later.
Edit Final mix time	Set a long time to begin with, e.g. 70sec. This can then be reduced later.
Edit Dry Weight of mix	Enter the total dry weight on the materials, cement and aggregates.
Edit Water limit –lits (litres)	Ensure the water limit is set to an appropriate quantity for that recipe, e.g. if the recipe never requires more than 20L then leaving the water limit at the default value of 120L is not recommended.
Edit Calibration Mode	Change to 2 Point
In addition to the above parameters, set these if using Pre-Wet Water	
Edit Pre-Wet water –lits (litres)	Depending on the need for Pre-Wet water (see section x), set a suitable quantity of water.
Edit Cement timeout	If using the Cement In input, leave this at the default of 15 seconds. If not using the Cement In input then set this to zero.
Update recipe	Press  to exit Press  to update recipe
Exit recipe menu back to start screen	Press 

<p>Select Calib mode</p>	<p>Press F3 until 'Calib' is displayed.</p>  <p>Note that Calib mode cannot be selected unless the dry weight is entered into the recipe.</p>
<p>Start the mix cycle</p>	<p>Press F1 to manually start</p> <p>Or start the cycle using the input signal from the batch controller.</p>
<p>The calibration water to be dosed is displayed. Ensure the correct water is displayed for the 1st shot of water. Change this value if necessary.</p>	<p>Type the water required in the cycle using the keypad e.g. 4, 0 and 0 for 40.0 Litres</p>  <p>Press ✓ to accept the first shot quantity.</p>
<p>The calibration water to be dosed is displayed. Ensure the correct water is displayed for the 2nd shot of water. Change this value if necessary.</p>	<p>Type the water required in the cycle using the keypad e.g. 3, 0 and 0 for 30.0 Litres</p>  <p>Press ✓ to accept the second shot quantity and run the cycle.</p>
<p>Cycle will run through as in Pre-set mode but with two main water additions. Final mix times will be extended by the time set in the 'Mix extension time' parameter.</p>	

Note: After the first water addition, the moisture display may jump to a different level. This is normal due to some internal calculations during the cycle.

At the end of the cycle, enter the final target.

Mixing - Calibration (x2)	Rec./Batch
	1 / 6
	Calib
Select final moisture % = 7.6	Moisture 6.3 %
X to cancel	70.0L
✓ to save	Run Time 136 s
Status:	

This final moisture is for display purposes only. It is an arbitrary reference that the recipe will use as the target. If however true moisture is required to be displayed, enter in the true value determined by drying a sample of the mix at the end of the cycle.

Press  to accept and run the cycle.

The cycle is finished. The recipe is now calibrated and that recipe will automatically switch over to run in **Calc** mode, as shown under the recipe number on the top right hand corner of the screen.

Q: I have tested the current loop output and it works but the HC05 always says 'Polling', why is this?

A: This message indicates that there is a problem with the communication between the Hydro-Control V and the sensor. The first thing to check is cabling between the sensor and the controller. Try switching off power, this would reset the sensor and the controller. If the problems still exist, see Chapter 14 for more details

Q: I ordered AC modules instead of DC modules, so I added my own relay to switch over from AC in the Hydro-Control V to DC. Why can't I get the Hydro-Control AC outputs to work?

A: It is possible that the AC outputs are not working because there is not enough load on the opto switch. In this case the AC output will be connected to the coil of the relay. Therefore the load on this switching voltage is determined by the resistance of the coil only which may not be high enough. The minimum load current so that the opto will switch is 20mA. Try adding a resistor in line with the coil to provide some extra switching current.

Q: I think one of the I/O modules is faulty, how do I replace them?

A: If you suspect a faulty opto module, swap over an identical opto from a working input or output which you know works. This will tell you if the original opto was faulty. If you need a replacement then either contact Hydronix or source them from a local OPTO 22 supplier. See Chapter 14 for more details.

Q: Can I adjust the contrast like the Hydro-Control IV?

A: There is no way of adjusting the contrast of the display on a Hydro-Control V. If either the backlight or the contrast is faulty, then the unit will need to be repaired by Hydronix.

Q: We had a lightning strike and now the unit doesn't work properly, can I do any onsite repairs?

A: It is not possible to do any repairs onsite, and any attempts of onsite repairs will invalidate any warranty outstanding. In such cases the equipment should be sent back to Hydronix for repair.

Q: I ordered a 110Vac unit but the label on the back shows a 24Vdc power input. Is this labelling a mistake, should I just wire 110Vac to power the unit instead?

A: The 110Vac refers to the operating voltage of the input and outputs modules only. This should be matched to the operating voltage of ancillary equipment like valves and switches etc. All Hydro-Control V's are 24V dc powered.

Q: The LCD screen has lines running through it. Can I replace the screen without sending the unit back to Hydronix?

A: It is not possible to repair damaged screens onsite. The controller should be sent back to Hydronix for repair by a qualified technician.

Q: How do I know what version I have?

A: The firmware version running on the Hydro-Control can be checked in two ways. Either switch off the controller and turn it back on - the version number is displayed on start up, or alternatively from the start page, press 'More' (F5) → 'Setup' (F1). The version number will then be displayed.

Q: Somebody else has used the unit and now I can only select 10 recipes but I need 50. Can't the HC05 store up to 99?

A: The maximum possible number of recipes that the controller can hold is 99. However the number of displayed recipes can be limited by setting the parameter 'max recipes' located in the system menu. See Chapter 8 for more details.

Q: I just changed the sensing arm on my Hydro-Probe Orbiter. Do I need to recalibrate anything?

A: It will be necessary to calibrate the new sensing arm to the sensor electronics, so that the sensor reads the same as it did with the old arm. We call this calibration process 'Autocal', the details of which are included in the fitting instructions that accompany a replacement sensing arm.
It should not be necessary to recalibrate recipes, assuming that the sensing arm is fitted at the same angle and height as the old arm.

Q: What happens if I change the gain and offset in the recipe manually?

A: The moisture displayed is a number that is calculated from the sensors unscaled readings, the recipe gain and recipe offset. If the gain and offset are changed, then this will affect the displayed moisture.

Q: Can I still run in calculation mode without recalibrating if I change my recipe design?

A: Any changes in the mix design should run with their own recipe, and hence their own calibration. This might include changes in pigment (colour), ratios of aggregates, cement supplier or type of admixture.
If the mix design is the same but the quantity changes, then the recipe can be run as long it is updated with batch weights between batches.

Q: How does the temperature compensation work and how does it benefit me?

A: Temperature compensation is a recipe dependant function which changes the moisture target with respect to the temperature of the mix. This is designed to maintain consistency of the mix which is largely dependant on temperature, the higher the temperature the stiffer the mix, hence generally more water is added to increase the slump. The temperature compensation works by entering two parameters:

- (i) Temperature Coefficient – this is the change in moisture per degrees (0°C or 0°F). This must be determined experimentally. For example, assume the temperature increases by 20°C and to keep the mix at the right consistency, 5 litres more is added which brings the final target at 8%, an increase of 0.5% from when it was calibrated. Therefore the temperature coefficient would be 0.025 (0.5/20).
- (ii) Temperature – this is the base temperature from which the compensation will be calculated. It should be the temperature when the recipe was calibrated.

Q: What is the minimum amount of water that needs to be added to a batch to achieve a good calibration?

A: In order to calibrate a recipe then there must be a reasonable change in the sensor readings before and after the water addition, and in general the higher the difference the better the accuracy. To achieve this, the calibration water should be at least be a 1/3 of the total water that's added. The difference between the wet and dry readings should always be greater than 4 unscaled units.

Q: Which mode is better to use when batching and how do I know for my specific application?

A: There is no rule as to which is better, as it may vary between applications and mixers. See chapter 10 for more details.

Q: Can I switch back and forth from auto to calc mode without problems?

A: If the recipe is already calibrated and the weight of materials in the mixer remains unchanged, then the two modes can be switched back and forth. This assumes that the Auto mode has already been optimised to run efficiently.

Q: What are the basic requirements for the unit to work with my system?

A: For the controller to work automatically with the system, the minimum input/output signals are water meter (input), start (input), reset (input), fine valve (output) and mix complete (output). All other inputs/outputs are optional.

Q: There is a utility that allows me to download the mix log etc. Does this utility (or any of the Hydronix software) work on an Apple or a Mac? If not, when would this be available?

A: At the time of publishing, Hydronix do not have any software utilities or have a development program writing software that runs on Apple or Mac computers.

Q: The deviation for the dry and wet mix are stored in the mix log. Are these deviations of unscaled values or deviations of % moisture?

A: The deviations stored in the mix log can be viewed in moisture or unscaled units. See Chapter 11 for more details.

Q: What admixtures affect the moisture sensor?

A: The sensor has the ability to linearly measure water content in a material, therefore if chemicals are added they will affect the moisture signal to a certain degree. In most cases the effect will be negligible but there are some instances the admixture may effect the calibration enough to require a 2-point calibration. See Chapter 12 for more details.

Q: If I have a breakdown for a short time while batching, and the HC05 has finished its sequence, will it restart and add more water if the batch dries out in the mixer?

A: In Auto mode, if the moisture goes below the minus tolerance during the final mix time, the cycle will revert back to the final wet phase and more water will be dosed to bring the moisture back up to the target. In calc mode, if the moisture goes below the minus tolerance the controller will wait until the end of the cycle and alarm.

If the mix cycle is finished and the controller has hit 'mix complete', then the only water that can be added is by manually trimming extra water. At mix complete the 'Trim' function can be used, although this will be removed once the reset it received.

Q: My Hydro-Control V is not working consistently. What information is necessary for Hydronix to help me diagnose the problems?

A: The mix log is a very useful tool for diagnosing problems with the controller. It is also useful to know is the recipe, system and control parameters. These can be downloaded from the controller using the RS232 port. Hydronix have a PC utility to help save all this data to a PC, which can be downloaded from the web site. These files can be emailed or faxed to the Hydronix as an aid for diagnostics.

Q: My Hydro-Control V needs to be sent for repair. If I get a service replacement how do I transfer all the parameters from the old to the new unit?

A: All data can be downloaded from one Hydro-Control V onto a PC and then uploaded to another unit. Therefore assuming that the damaged unit still switches on and has a

functioning RS232 port, then all the data can be transferred. To do this, install the 'Hydro-Control V Utility' from the website and do a FULL backup.

Q: How do I calibrate my controller to display real moisture?

A: To display real moisture, when calibrating a recipe enter the true moisture for the final target. The true moisture can be determined from a sample of the concrete at the end of the mix. It is important to ensure that the correct dry weight is entered into the recipe for the calibration.

Q: Does the Hydro-Control V display water/cement ratio?

A: The final water cement ratio is displayed in the mix log. This value will only be true if the cement weight is entered into the recipe and the recipe has been calibrated to display true moisture.

Q: Why can I not switch the mode over to Calc mode?

A: To be able to switch to Calc or Calib mode, a sensor must be connected to the controller and the dry weight parameter must be already entered into the recipe.

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 1483 468900 or by email: support@hydronix.com.

Symptom: Displays shows 'Polling' - no output from sensor

Possible explanation	Check	Required result	Action required on failure
No power to sensor.	DC power at rear of Hydro-Control V, pins 26 + 28	+24Vdc	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	Filtered Unscaled readings in the 'Diagnostics' > 'Monitor' menu by selecting 'Fil2'.	* 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 Chapter 10. Moisture signal should be stable at the end of the first and final mix times for increased accuracy.

* Note that the air reading on the Hydro-Probe Orbiter may not read close to zero. The unscaled reading for this sensor in air will be around 4-6 unscaled.

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 through 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 the opto LED should light up. Check wiring when the opto is on.	See Chapter 10 for more details.	Force relay to switch on and check wiring. Go to setup menu > enter password > Test > HCV > Output. Select output and switch on.
Blown fuse	Remove rear cover and check continuity of the fuse on the specific opto	Continuity check ok, zero ohms.	Contact Hydronix for replacement fuse.

	module using a meter.		
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Symptom: Faulty input

<i>Possible explanation</i>	<i>Check</i>	<i>Required result</i>	<i>Action required on failure</i>
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 through 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 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 V 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

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

The moisture reading from the sensor can only indicate what is happening in your mixer. The speed of reading, or the time taken to reach a steady reading when the materials are homogeneous, reflects the effectiveness of the mixer. By taking some simple precautions the overall performance can be considerably improved and the cycle time reduced with consequent financial savings.

Mixer

- Look at the mixing process. Check how the water disperses. If water sits on top of the aggregates for a time before dispersing, then spray bars will be required to disperse the water into the mixer more quickly to shorten the mixing time.
- Spray bars are more effective than single water inlets. The wider the area the water sprays, the faster it will mix into the material.
- Keep the mixer blades adjusted to 0-2mm above the mixer floor. This will have the following benefits:
 - All the residual mix is discharged when emptying the mix.
 - Mixing action close to the floor of the mixer is improved, thereby improving the reading of the sensor.
 - Wear on the mixer floor plates will be reduced.
 - Reduced cycle times will result in savings on power and wear.

Ingredients

- If the aggregate masses are not corrected for high moisture contents, then the aggregate/cement ratio will change considerably, having an adverse effect on consistency and concrete performance.
- If the aggregates are very wet, as may be the case at the beginning of the day due to water draining in the storage bin then there may be more water in the aggregates than the mix requires.
- The moisture content of the aggregates should be above the saturated surface dry (SSD).
- Hot cement can affect consistency (workability) and thus water demand.
- Changes in ambient temperature can affect water demand.
- Where possible, the cement addition should follow within a few seconds after the commencement of the addition of sand and aggregates. Combining the materials together in this way will greatly assist the mixing process.

Consistency

The sensor measures moisture, not consistency.

Many factors affect consistency, but may not affect moisture content. These might include:

- Aggregate grading (coarse/fine ratio)
- Aggregate/cement ratio
- Admixture dosage dispersion
- Ambient temperature
- Water/cement ratio
- Ingredient temperature
- Colours

Calibration based water addition

- When calibrating, omit the admixtures.
- When performing a calibration it is advised that both the dry and wet mix times are extended to ensure that both are homogeneous.
- A different calibration may be required for large variations in batch volume (e.g. half batches).
- Calibrate when conditions and ingredients are typical e.g. not first thing in the morning when the aggregates are very wet, or when the cement is hot.
- When using a calibration-based water addition method, it is essential to obtain a correct dry reading.
- Dry mix time must be long enough to obtain stability of the signal.

Mixing

- Minimum mix times are a function of the mix design (ingredients and mixer) not just the mixer.
- Different mixes may need different mix times.
- Keep batch sizes as consistent as possible e.g. $2.5\text{m}^3 + 2.5\text{m}^3 + 1.0\text{m}^3$ is not as good as $3 \times 2.0\text{m}^3$.
- Keep the premix time as long as possible, to the detriment of the wet mix time if necessary.

Operator password

No password necessary.

Operators can:

- Start, stop, pause and abort the system
- Create, select and edit recipes

Supervisor passwords

There are two levels of supervisory passwords. The **Advanced** and **Hydronix** passwords, allow access to the Hydro-Control V control and advanced control parameters respectively. These are programmed into the Hydro-Control V firmware and **cannot be changed**. If the passwords become known to unauthorised people, those people will have access to the system control parameters, which if incorrectly set could make the system unstable. Therefore these passwords should not be released.

Advanced password

The advanced password is **3737**

- Access the top page of the system menu (water meter settings, timeouts)
- Access the system diagnostics

Hydronix password

The Hydronix password is **0336**

- Allows access to Advanced password functions
- Allows access to Advanced control parameters

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