Hydro-Control VI

Operators Guide

To re-order quote part number:	HD0456
Revision:	1.1.0
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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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Revision history

Revision No	Software Version	Date	Description of Change
V1.0.0		July 2010	First Release
V1.1.0		November 2010	User Account Management and Plant Operator information added

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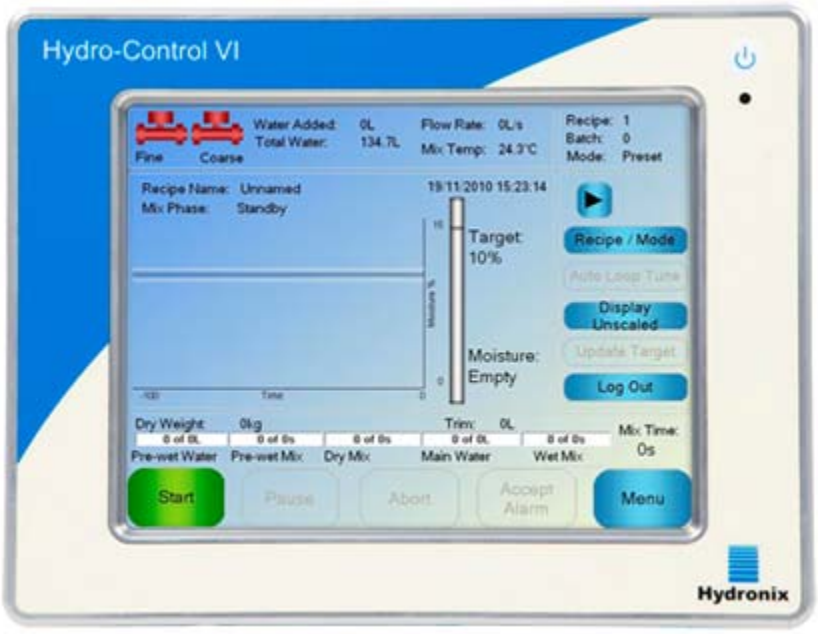


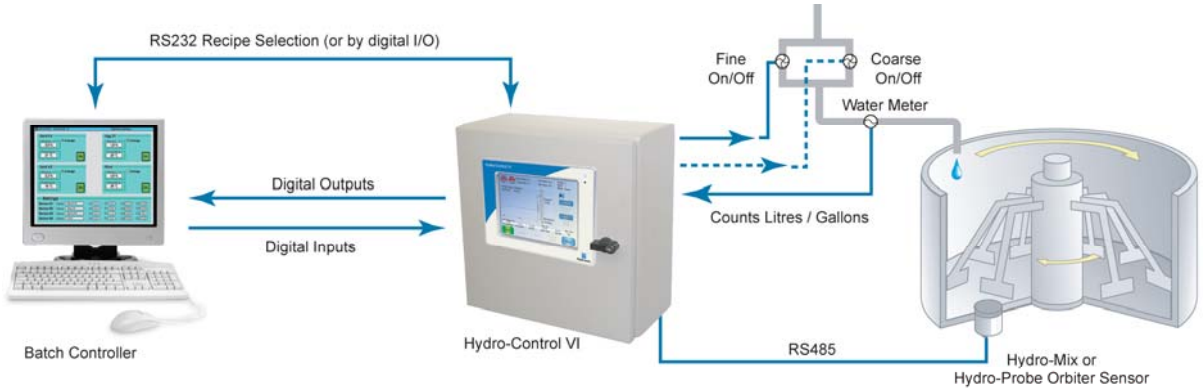
Figure 1: The Hydro-Control VI

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. The unit monitors 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 Overview Screen and there are intuitive and easy to use graphical tools for setting up the recipes in the system.

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



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

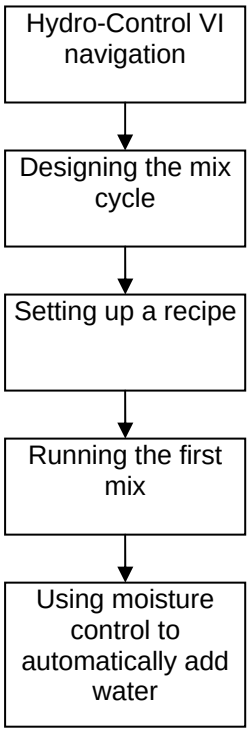
Digital Outputs:
Coarse Water (switches on the coarse valve), Fine Water (switches on the fine valve), Admix, Prewet Done, Mix Complete, Alarm, Water Tank Fill

2 About this manual

This manual has been designed to act as a reference guide for an operator, describing the basic recipe design and setup, and goes on to more advanced techniques such as fine tuning the moisture control modes.

This manual complements the Installation Guide which details the installation, all the system parameters and initial setup of the Hydro-Control VI.

The manual is divided into chapters which cover setting up recipes in and using the Hydro-Control VI to make concrete.



Chapter 2 describes how to navigate around the Hydro-Control VI and introduces the system

Chapter 4 introduces the mix cycle and Chapter 5 explains the difference between the water addition modes.

Chapter 6 describes the recipe editor and how to edit the parameters to get the desired result.

Chapter 7 shows how to run the first mix and tune the basic preset water addition mode.

Chapter 8 explains how to calibrate the system and start using moisture control for automatic addition of the water into the mixer.

1 Applying Power

The Hydro-Control VI is switched on by pressing the power button in the top right hand corner of the unit. The blue light below will illuminate and the unit will boot up the control system.

The unit will first display two self test screens and will then boot the Windows XP Embedded Operating System. During this time, the Microsoft logo will be displayed, after which the unit will display the Hydronix logo, followed by a splash screen with the version number.

The unit is ready to use when the Overview Screen shown in Figure 2 is displayed. A message across the centre of the screen is displayed to show when the Hydro-Control is searching for the sensor.

2 The Overview Screen

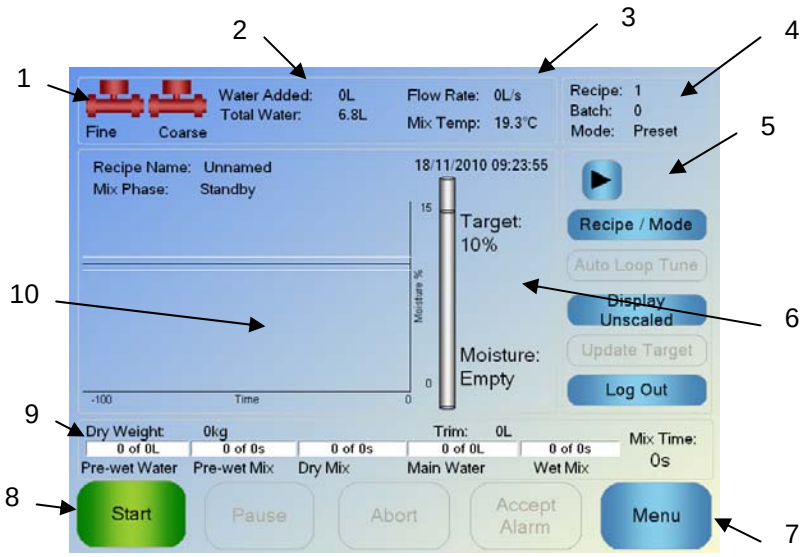


Figure 2: The Overview Screen of the Hydro-Control VI

1. Valve icons indicate when the water valves are energised
2. Displays Water Added during the current phase and Total Water added to the batch.
3. Displays the Flow Rate and current Temperature of the process.
4. Displays the current Recipe number in use. The Batch number increments with each batch made for each Recipe. Mode indicates the control mode in operation for the given Recipe (Preset, AUTO or CALC).
5. Dialog box allowing quick access to certain recipe related functions. These are referred to later as “quick buttons”
   - The Right Arrow, view/hide dialog box buttons.
   - Recipe/Mode allows the user to switch Recipes and also to change the Control mode used for each Recipe.
   - AUTO Loop Tune allows adjustment of the AUTO Mode Parameters (see page 43,44).
   - Display Unscaled switches the units shown on the main display between moisture value and sensor unscaled values.
   - Update Target, is enabled when the current mix is in the Mix Complete phase. This allows the moisture target of the current Recipe to be updated to the final moisture value of the current batch.
   - Log In / Log Out button

6. Indicator bar showing the Recipe moisture target and current moisture value. When in air 'EMPTY' is indicated.
7. Menu, selects the Main Menu screen allowing navigation to all other functions.
8. Main control buttons for controlling the mix cycle. Start, Pause, Abort and Accept Alarm.
9. Progress bars show which phase the current batch is in and the progress bars will update with recipe parameters that are currently being used. The Mix Time indicator shows the time that the current batch has been running.
10. This area has the current recipe name and phase at the top and a graph which shows the last 100 seconds of moisture value.

3 User Login / Logout

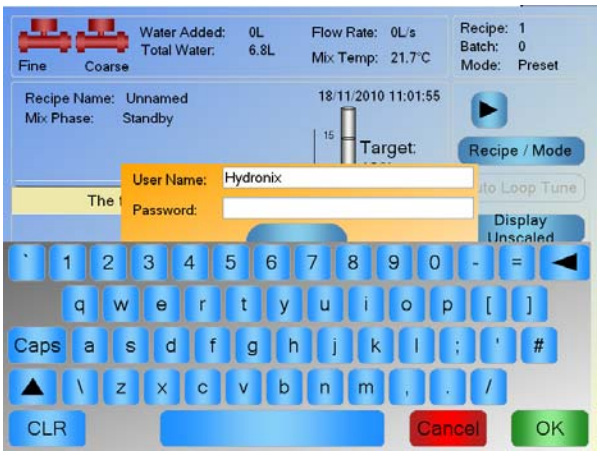
There are three levels of access in the Hydro-Control VI:

- Plant Operator –Access to the Overview Screen only. Chapter 3 describes Plant Operator controls.
- Supervisor – Access barred to setting up user accounts, sensor configuration and system parameters
- Administrator – Full access rights

To Login from the Overview screen:

1. Press the Log In Button 

2. Enter the user name and password by pressing each textbox and typing using the onscreen keyboard



3. Press OK. If the login attempt is successful the Menu button in the bottom right hand corner of the screen will become enabled.

Once a user has logged in, the Log In button on the Overview Screen will change to a Log Out button.

When a user has finished using the Hydro-Control VI, they should press the Log Out button 

. The Log Out button will revert back to the Log In button and the menu button in the bottom right hand corner will be greyed out, indicating that it is disabled.

4 The Main Menu

Pressing the button marked menu in the bottom right hand corner of the Overview Screen will display the menu screen (See Figure 3). This allows access to the different areas of the Hydro-Control VI.

Figure 3: The Menu Screen

4.1 Version number

The first line displays the version number of the software currently running.

4.2 Buttons

Overview

Displays the overview screen from which you can control the mix cycle and view details about the batch and recipe currently in use.

Recipe Overview

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

Mix Log

Displays a list of previously run batches and allows the user to view information about the previous batches and also to calibrate the system from a batch.

IO Setup

Allows configuration and test of the inputs and outputs. Configuration instructions are detailed in the Installation Guide (HD0455).

Sensor Configuration

Displays the sensor configuration screen allowing changes to the filtering and analogue output. Configuration instructions are detailed in the Installation Guide (HD0455).

System Parameters

This button enables configuration of the system parameters, including water meter and valve setup, AUTO Mode and Auto-track parameters, system time and date and alarm

configuration. It also displays the system diagnostic page which shows system temperatures and voltages.

Remote Communications

The remote communications screen displays diagnostic information regarding the RS232 communications port. Configuration instructions are detailed in the installation guide.

5 The Recipe Overview

Recipes are created, edited and deleted in the recipe editor which is accessed by pressing the Menu button and then pressing the Recipe Overview button. A list of available recipes is then displayed and can be selected by pressing on them. To scroll around the list, you can use the up and down arrows (1) on the right hand side of the screen. You can also use the Find Recipe button (2) to go directly to a known recipe number.

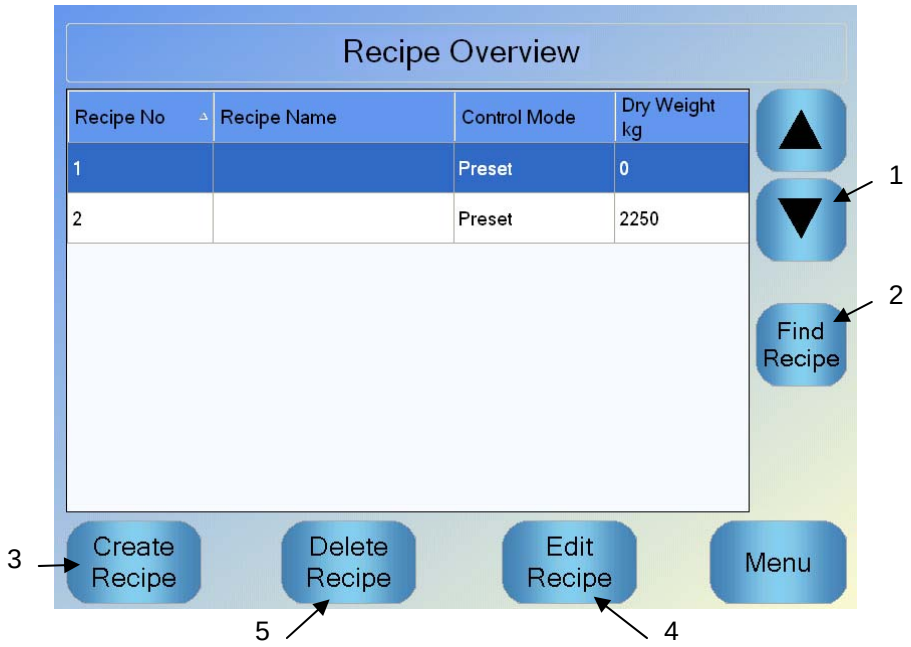


Figure 4: The Recipe Overview Screen

To create a recipe, press the Create Recipe button (3) and this will display a wizard which will take you through the steps needed to create a basic recipe. This process is covered in further detail in Chapter 7.

To edit a recipe select it by highlighting it in the list, either by using the arrows or by pressing on the recipe, and then press the Edit Recipe button (4).

To delete a recipe, select it in the list and then press the Delete Recipe button (5).

6 The Mix Log

The mix log gives access to information about previous mixes that have been run on the system, and allows the mix traces to be accessed. These show a graphical trace over time of the change in moisture for each cycle. See Chapter 10 for further details.

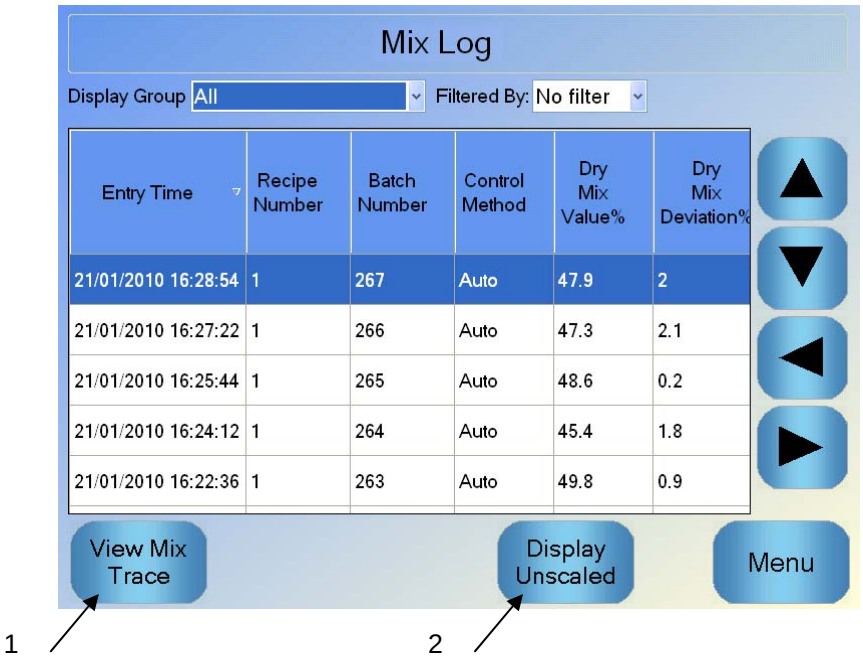


Figure 5: The Mix Log screen

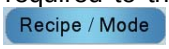
Navigation through the logs is performed using the arrow keys. The left and right arrows scroll across the different components displayed in the list, such as mix averages, times, and alarms, and the different mix log components. The display of these items can also be filtered using the 'Display Group' option to reduce the number of columns that are displayed.

1. View Mix Trace, displays more detailed information about the batch selected as well as a graph showing the sensor reading during the batch. There is also an option to calibrate the recipe using the batch as a template. More information on the calibration process is given in Chapter 10.
2. Display Unscaled, switches the display of the values shown in the mix log between moisture readings and sensor unscaled readings.

7 System Parameters

Most of the system parameters will have been set up by the person installing the system and are detailed in the Installation Guide (HD0455). For day to day operation, the operator of the system should be familiar with the water addition modes, Auto-track and the system alarm parameters.

Chapter 3 Plant Operator Controls

A plant operator will rarely need to adjust parameters, therefore no access is required to the main menu. To access the plant operator controls press the Recipe / Mode button 

on the Overview screen. The following screen will be displayed.

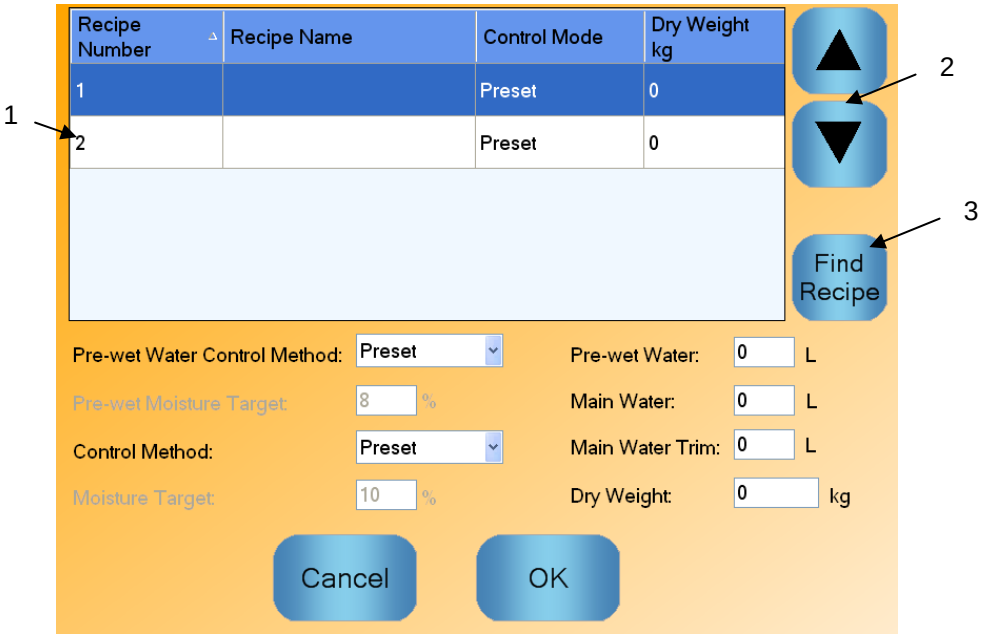


Figure 6 - Recipe/Mode Screen

The recipe list (1) lists all the recipe of the system. It is possible to choose which recipe is selected by pressing the line which displays the recipe you require.

The scroll buttons (2) can be used to move up and down the list.

If there are a lot of recipes the find recipe button (3) can be pressed. A recipe number can be entered and the system will find the desired recipe.

In Preset mode it is not possible to adjust moisture targets as the system will add only fixed amounts of water. In AUTO or CALC mode it is not possible to adjust the water values as the water addition is controlled to the water target. See Chapter 5 for an explanation of the different water addition modes.

If it becomes necessary to adjust the water addition slightly to correct for workability it is advisable to adjust the amount of admixture used. If this is not possible the Main water trim parameter can be used to adjust the overall amount of water added to maintain workability. If it is found a certain amount of trim is always required personnel with supervisor access should be notified to re-calibrate the mix. The procedure for this is described in Chapter 8 section 2.3. For detailed descriptions of each parameter see Chapter 6.

Chapter 4 Understanding the Mix Cycle

It is important to understand the mix cycle in order to be able to optimise the system for best performance, accuracy and repeatability. This chapter defines the phases of a mix cycle and describes the options that are available.

1 The simple mix cycle

One of the simplest cycles is shown in the moisture trace in Figure 7.

Once material is loaded, the batch control PLC activates the 'Start' signal to start the Hydro-Control VI cycle. The first phase of the cycle is the Dry Mix Time, set in the recipe parameters. After this period, water is added, after which the Wet Mix Time commences. At the end of the Wet Mix Time the cycle is finished and the 'Mix Complete' signal is activated. This signals to the batch control PLC to discharge the mixer.

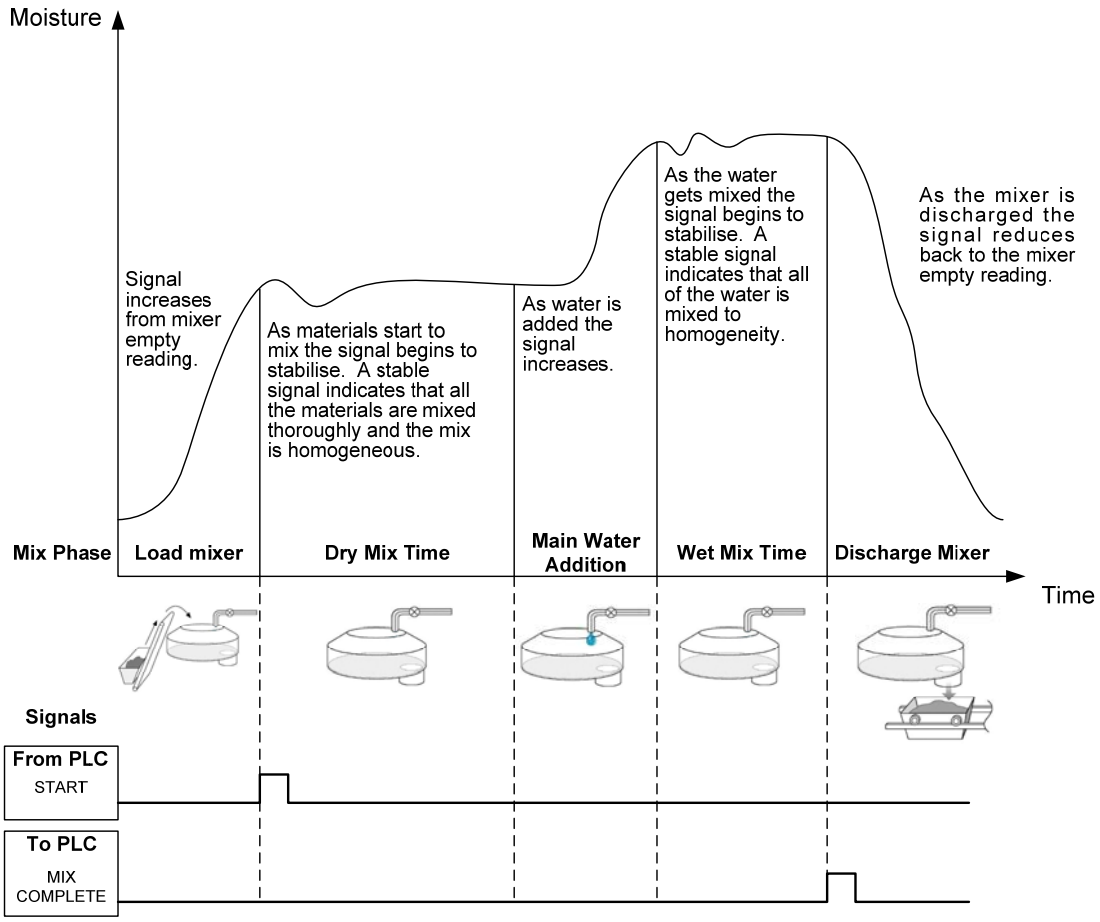


Figure 7: A simple mix cycle

2 Pre-wet Water

2.1 What is Pre-wet Water?

Pre-wet Water is a quantity of water that may be optionally added at the beginning of the mix cycle before the Dry Mix phase.

2.2 Why use Pre-wet Water?

Pre-wet Water may be used for several reasons. These include:

1. To reduce cycle times. This is especially true for large batches requiring large quantities of water. The Pre-wet Water (typically 2/3 of the total water) is dosed with the addition of the aggregates. This enables the bulk of the required water to be mixed into the material earlier in the mix cycle. The moisture sensor is then used to accurately dose the remaining 1/3 water.
2. To improve the efficiency of the mixing process when using certain admixtures, so that when the chemicals/dyes are added they are not being added to dry material.
3. To wet the aggregates before adding the cement to the mixer. This may be necessary for a number of reasons, for example to aid the mixing of cement into the material (preventing 'balling up') or perhaps a 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.
4. To wet the aggregates to bring them above their Water Absorption Value (WAV – also known as the SSD – "Saturated Surface Dry" point), 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 moisture of the raw materials), then the recipe could be setup to put 40 litres of pre-wet water. The remainder of the water can be added in the main water phase.

2.3 Additional I/O for Pre-wet Water

When adding Pre-wet Water to the aggregates the Hydro-Control VI has an output called "Pre-wet Done" which is activated at the end of the pre-wet phase in the cycle. This can be used by a batch control PLC to control the loading of the cement.

If using the "Pre-wet Done" signal it is best practice to pause the Hydro-Control until the cement has finished loading. For this the Hydro-Control VI has an input called "Cement In". After the "Pre-wet Done" output is given, the Hydro-Control waits for the "Cement In" before continuing onto the Dry Mix phase.

Whilst the Hydro-Control is paused, there is a timer running that will trigger an alarm if the "Cement In" input is not received within a set amount of time. If the "Cement In" input is not used then the Cement Timeout parameter in the recipe **must** be set to zero to disable the alarm.

2.4 The Mix Cycle when using Pre-wet Water

The mix cycle when using Pre-wet Water is shown, along with a typical moisture trace, in Figure 8.

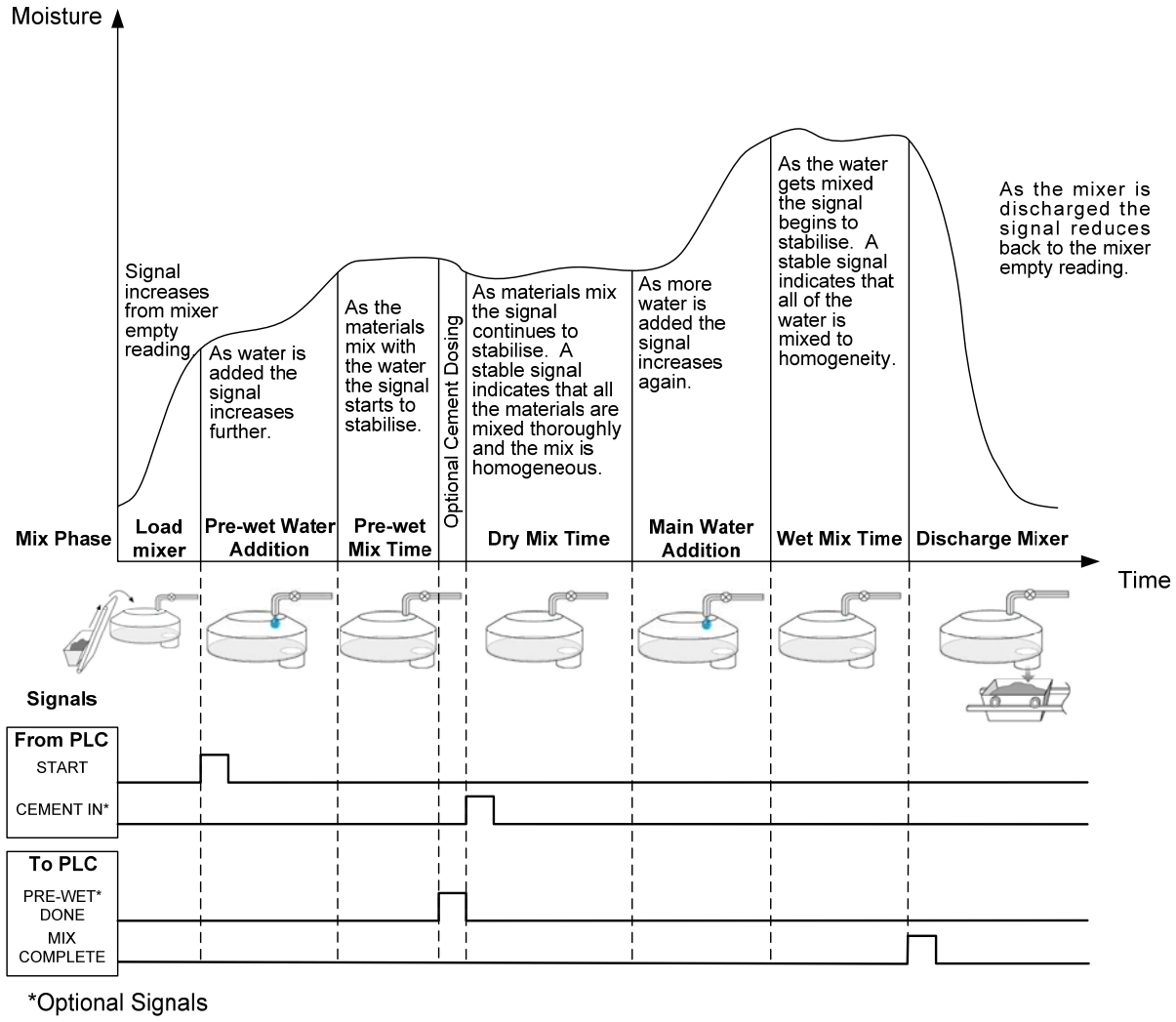


Figure 8: The mix cycle with pre-wet

The Hydro-Control VI starts its cycle when the “Start” signal is received. The first phase is the addition of the Pre-wet Water followed by the mix time defined in the parameter “Pre-wet Mix Time”. The “Pre-Wet Done” output then goes high and, if enabled, the Hydro-Control pauses until the “Cement In” input is activated (the Cement Timeout parameter in the recipe must be set to enable the “Cement In” input).

The next phase is the dry mix time, set in the recipe. After this period, water is added, after which the wet mixing time commences, also set in the recipe. At the end of the wet mix time the cycle is finished and the “Mix Complete” signal is set, which signals the batch control PLC to unload the mixer.

The Hydro-Control has been designed with three modes of water addition, Preset Mode, AUTO Mode and CALC Mode. In all installations, the initial setup of each mix design should be done with the water addition set to Preset Mode.

1 Preset Mode

No sensor signal is required to operate in this mode, which simply adds the fixed amount of water in litres, gallons, kilograms, pounds or seconds as defined by the recipe.

Preset Mode is used when setting up a recipe to add a fixed quantity of water to the mixer. The amount of water that is added can be adjusted on subsequent batches to optimise the amount of water added to the mix. After a good batch has been made, that batch can then be selected in the mix log and a recipe calibration can be obtained automatically.

As the Preset Mode does not require a signal from the sensor, it may be used in the event of a sensor problem to keep a system running. To enable an easier changeover from CALC Mode or AUTO Mode to Preset Mode, when batches are completed, the system will update the preset water parameter with the amount of water dosed.

2 CALC Mode

This mode takes a reading at the end of the dry mix, and then calculates the exact quantity of water required to reach the moisture target in the recipe using calibration data and the dry weight of the materials in the mixer.

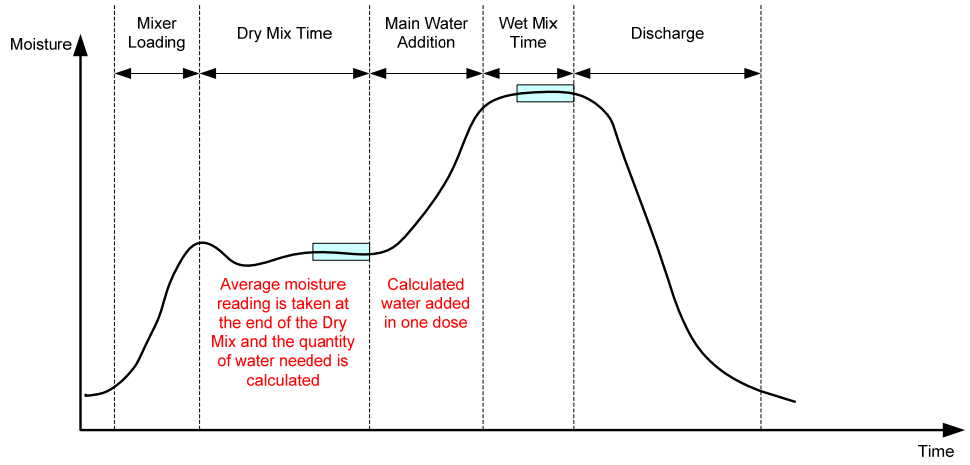


Figure 9: The moisture during CALC Mode

Figure 9 shows a typical moisture trace during a batch run in CALC Mode. The boxes show the point at which an average moisture reading is taken at the end of the Dry Mix and Wet Mix Times.

The length of time that the system uses for averaging is defined using the Averaging Time parameter in the System Parameters.

As the moisture calculation relies in part on the dry weight of the materials in the mixer, it is necessary that the dry weight parameter in the recipe is accurate. If there is a possibility of this changing, for example if the raw material moisture is not being compensated for, then it is preferable to use AUTO Mode.

For best results, it is important to have a stable moisture reading (homogenous mix) at the end of the Dry Mix Phase to give accurate data for the water calculation. However it is not necessary to have complete homogeneity at the end of the final mix stage. If the final product homogeneity is not important, for example if there is further processing after the mixer, then the Wet Mix Time can be decreased.

3 AUTO Mode

The AUTO Mode progressively adds water to the mixer to achieve a defined moisture target. The Hydro-Control controls the speed at which the water is added and slows the addition as the current moisture nears the target moisture in order to accurately reach the target without overshooting it.

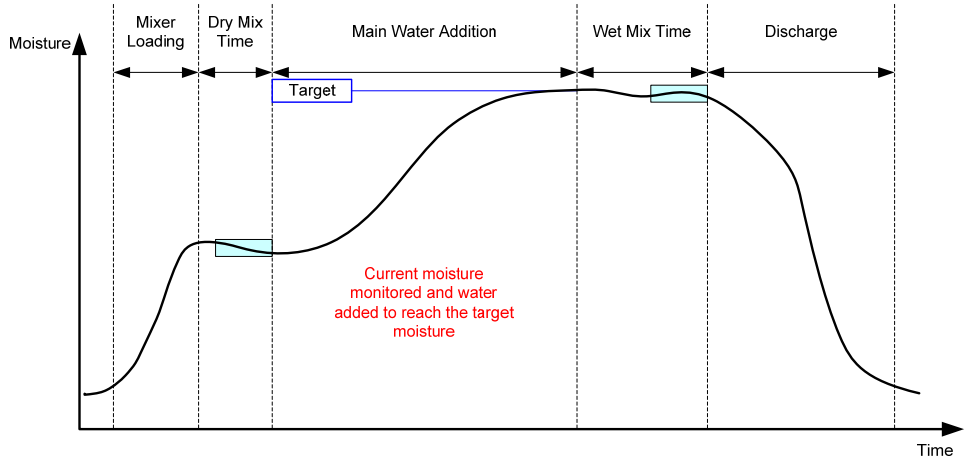


Figure 10: The moisture during AUTO Mode

Figure 10 shows a typical moisture trace during a batch run in AUTO Mode.

As there is no requirement for complete homogeneity during the Dry Mix Phase, the Dry Mix Time can be made shorter than in CALC Mode so the water can start to be added earlier in the batch.

The system is shipped with default parameters for controlling the water addition. To optimise the system these settings may require adjustment.

To ensure that the moisture is correct and that the mix is homogeneous, it is important to allow a sufficient Wet Mix Time before discharging the mixer.

4 Selecting the best mode – AUTO or CALC?

The most appropriate mode for moisture control varies depending on the application. It is important to understand the differences between AUTO Mode and CALC Mode in order to select the mode that is the most appropriate.

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

  If yes then AUTO Mode will work without needing to have an exact dry weight parameter in the recipe before a batch is made. To use CALC Mode the dry weight recipe parameter would have to be updated on a batch by batch basis, either by sending it using the RS232 port on the Hydro-Control VI, or by manually editing the recipe.

- Is the water supply pressure constant?

  The AUTO Mode control method requires water to be added consistently. If there are changes in flow rates due to pressure fluctuation, then the AUTO Mode will not be able to perform optimally.

- Are mixing times critical?

  If yes then it is likely that CALC Mode may be quicker to use than AUTO Mode.

- Is it possible to achieve a stable reading in the dry mix time?

  A prerequisite of CALC Mode is that the water calculation is based on a correct and stable dry mix reading for addition in a single dose. If the dry mix reading is not stable enough then it is unlikely that CALC Mode will give the desired accuracy. AUTO Mode does not need a stable signal due to water being added continuously to reach the target.

Chapter 6 Editing recipes

This chapter explains how to edit a recipe and describes the recipe parameters and how they are used. Once a recipe has been created, it will appear in the list on the recipe overview screen. To edit any recipe simply press on it to select it in the list, and then press the Edit Recipe button.

1 The Recipe Editor

[Menu->Recipe Overview->Edit Recipe]

Figure 11: The recipe editor screen (page 1)

1.1 Recipe Details

Recipe parameter	Description
Recipe Number	This is the number of the recipe in the Hydro-Control VI.
Batch Number	This is the number of the last batch made.
Recipe Name	This is the name of the recipe which is displayed on the Overview Screen.

1.2 Water Addition

Recipe parameter	Description
2 Step Addition	This enables the two step addition mode, which splits the main water addition into two stages. During the second stage the Admixture signal is activated. This can be used whilst dosing admixtures that have a large effect on the sensor calibration to keep the moisture display accurate.

Recipe parameter	Description
Pre-wet Water	This is the fixed amount of water to add during the pre-wet phase of the mix cycle if the Pre-wet Water Control Method is set to Preset Mode. If not using Pre-wet Water then set this value to zero.
Pre-wet Water Limit	In the pre-wet phase this value limits the amount of water that will be added before the system alarms.
Main Water	This is the amount of water to add during the main water phase of the mix cycle if the system is in Preset Mode.
Main Water Limit	This is the maximum amount of water that the system will add or calculate to add before it alarms. If the system is in CALC Mode a check is made when the water calculation has been made. If the system is in AUTO Mode then the system alarms when the system reaches this value.
Main Water Trim	This is the amount of trim water to add to the recipe. Trim water is included in the water calculation and changes the target when calibrating the system to allow for a calibration to be made to a batch which is not perfect.

1.3 Material addition/Mixing Times

Recipe parameter	Description
Dry Weight	This is the dry weight of all of the materials in the mixer, including all aggregates and cement. If this can change due to weighing errors or moisture correction, this value should be sent from the batch control system to allow the calculation to be done to the best accuracy.
Cement Weight	This is the weight of the cement added and, if entered, the Hydro-Control log will contain the water/cement ratio for a particular batch.
Cement Timeout	This is the amount of time that the system will wait after issuing a pre-wet done signal before alarming if it has not received the cement in signal.
Pre-wet Mix Time	This is the amount of time that the system will mix after adding the Pre-wet water before it sets the pre-wet done signal. This can be used if it is required to mix the water into the batch before adding cement. The cement should be controlled using the Pre-wet Done signal and once the cement dose is complete the Cement In signal should be activated.
Dry Mix Time	This is the amount of time to mix the batch after the pre-wet water has been added and mixed, and the Cement In signal has been received (if used). After this time, the main water is added.
Wet Mix Time	This is the amount of time to mix after the main water has been added before signalling Mix Complete.

Using the Next button will give page 2 of the recipe editor screen.

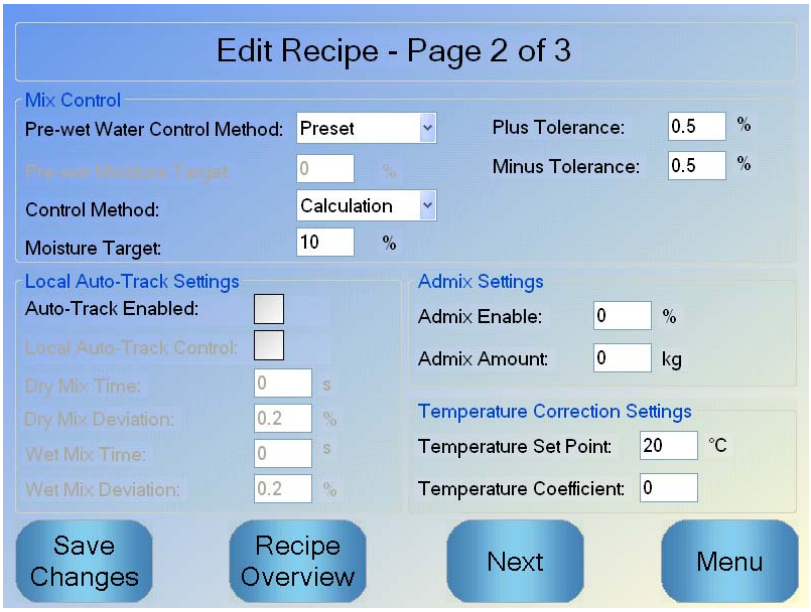


Figure 12: The recipe editor screen (page 2)

1.4 Mix Control

Recipe parameter	Description
Pre-wet Water Control Method	This is the method used to control the addition of the pre-wet water. If Preset is used, then the fixed quantity of water specified on Page 1 is used. If the method is set to Auto then the addition is governed by the pre-wet moisture target.
Pre-wet Moisture Target	If the Pre-wet water control method is set to Auto then this setting defines the target for the moisture addition.
Control Method	This parameter defines the way in which the main water addition is controlled. It has three settings, Preset, Auto and Calc. These methods are discussed in Chapter 5.
Moisture Target	If the main Control Method is set to Auto or Calc then this setting defines the moisture target (as a moisture percentage) that the automatic mode is using.
Plus/Minus Tolerance	These settings define the limits (as a moisture percentage) used for the upper and lower limits before alarms are triggered to indicate the final moisture is out of tolerance with the moisture target defined in the previous parameter.

1.5 Local Auto-track Settings

Recipe parameter	Description
Auto-track Enabled	This setting enables the Auto-track feature for this recipe. For more information on this feature see Chapter 8.
Local Auto-track Control	If enabled the recipe will use the locally set parameters for the Auto-track function instead of the ones set on the system parameters page.
Dry Mix Time	When using Auto-track control, this is the amount of time that the Dry Mix must be within the Dry Mix Deviation below to continue. If the sensor signal has not stabilised within this window by the end of the Dry Mix Time the system will prompt the operator to continue regardless of whether it has stabilised or not.
Dry Mix Deviation	This is the maximum deviation that the sensor signal must be within in order for the system to continue.
Wet Mix Time	When using Auto-track control, this is the amount of time that the Wet Mix must be within the Wet Mix Deviation below to continue. If the sensor signal has not stabilised within this window by the end of the Wet Mix Time, the system will prompt the operator to continue regardless of whether it has stabilised or not.
Wet Mix Deviation	This is the maximum deviation that the sensor signal must be within in order for the system to continue.

1.6 Admix Settings

Recipe parameter	Description
Admix Enable	This is the point in % during the main water phase that the Admix signal will be set.
Admix Amount	Not used by the Hydro-Control but appears in the Recipe. This is the amount of admix stated in the mix design. This can be manually input for information only.

1.7 Temperature Correction Settings

Recipe parameter	Description
Temperature Set Point	This is the base temperature for the temperature coefficient to work from.
Temperature Coefficient	This is the change in unscaled per degree Celsius that the current temperature is different from the Temperature Set Point that is added to or subtracted from the target unscaled. This is used to allow the concrete to vary depending on the temperature to allow for the increased rate of hydration in hotter atmospheres.

Using the Next button gives Page 3 of the recipe editor screen.

Figure 13: The recipe editor screen (page 3)

1.8 Calculation Mode Settings

Recipe parameter	Description
Moisture Offset 1 Moisture Gain 1	These are the calibration coefficients for the recipe. These define the relationship between the amount of moisture in the batch and the unscaled sensor value. These are automatically calculated when you calibrate a recipe.
Moisture Offset 2 Moisture Gain 2	These are the calibration coefficients for the recipe with the admixture in. These are automatically calculated when you calibrate a recipe using the two step preset method.

1.9 Auto Mode Settings

Recipe parameter	Description
Local Auto Control	This parameter becomes active when the recipe Control Method is set to Auto. In normal use the Hydro-Control will work without a problem with the Auto Parameters in the System Parameters. However it may be necessary to set up specific parameters for difficult mixes. This allows the system parameters to be overridden and the local parameters to be used to control the rate of the water addition.
Proportional Gain	This parameter is used by the control mode to adjust the rate that the water is added to the mixer. This defines the initial speed of the water into the mixer.

Recipe parameter	Description
Integral Gain	This parameter is used by the control mode to adjust the rate that the water is added to the mixer. This adjusts the rate of the water addition based on the amount of time the addition has taken. This can be used to correct an offset at the end of the water addition without having to use excess Proportional Gain which can cause overshoot.
Derivative Gain	This parameter is used by the control mode to adjust the rate that the water is added to the mixer. It adjusts the rate of water addition based on the rate of change of the difference between the current moisture and the target.

Chapter 7 Running the first mix

This chapter explains how to set up a recipe and run it for the first time.

1 The recipe wizard

[Menu->Recipe Overview->Create Recipe]

Figure 14: The Create Recipe Wizard screen

The recipe wizard enables the operator to easily configure a new recipe. It automatically prompts for the most important information required in order to set up a new recipe.

Recipe wizard parameter	Description
Base On Recipe Number	Select an existing recipe to use as a template. This is a quick way of copying parameters from one recipe to another.
Auto Recipe Number	Select to automatically assign the next available recipe number.
Recipe Number	Use this to enter a user defined recipe number if the above parameter is not ticked.
Cement Timeout	This is the amount of time after the “Pre-wet Done” signal has been given before the Hydro-Control triggers an alarm to alert that it has not received the Cement In signal. This is required if using the Hydro-Control “Pre-wet Done” signal to control the cement addition to the mixer.
Dry Weight	This is the dry weight of the mix, including the cement.
Pre-wet Water	This is the amount of water to add during the pre-wet phase. To skip water addition during this phase, set this to zero.
Main Water	This is the fixed amount of water to add during the main water addition when running in Preset mode.
Dry Mix Time	This defines the dry mix time.

Recipe wizard parameter	Description
Wet Mix Time	This is the amount of time to mix for after adding the main water and before signalling that the mix is complete.

2 Setting the recipe for the first mix

Before selecting which control mode to use for a given recipe it is necessary to begin using the Preset Mode to make a number of batches by adding water in a controlled manner and observing the mixing characteristics of the mixer.

2.1 Recipe Setup

2.1.1 Selecting Mix Times

The dry and wet mixing times will ultimately affect how well the materials are mixed. Users need to be aware that when these times are reduced, as the case may be in high production environments, there is a balance between speed and quality.

The sensor shows the moisture variation as the materials are mixed. When the reading stabilises, this indicates a homogenous mix. When using CALC Mode it is important to obtain stable dry and wet mix readings to use for calibrating the water calculation. After calibration is complete, the wet mix time can be reduced depending on the required quality and homogeneity of the mix.

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 Dry Mix and Wet Mix times is to extend them to begin with, and then shorten once you know how long the signal has been stable for.

Using Auto-track during initial setup and testing is not recommended until the mixer characteristics have been observed.

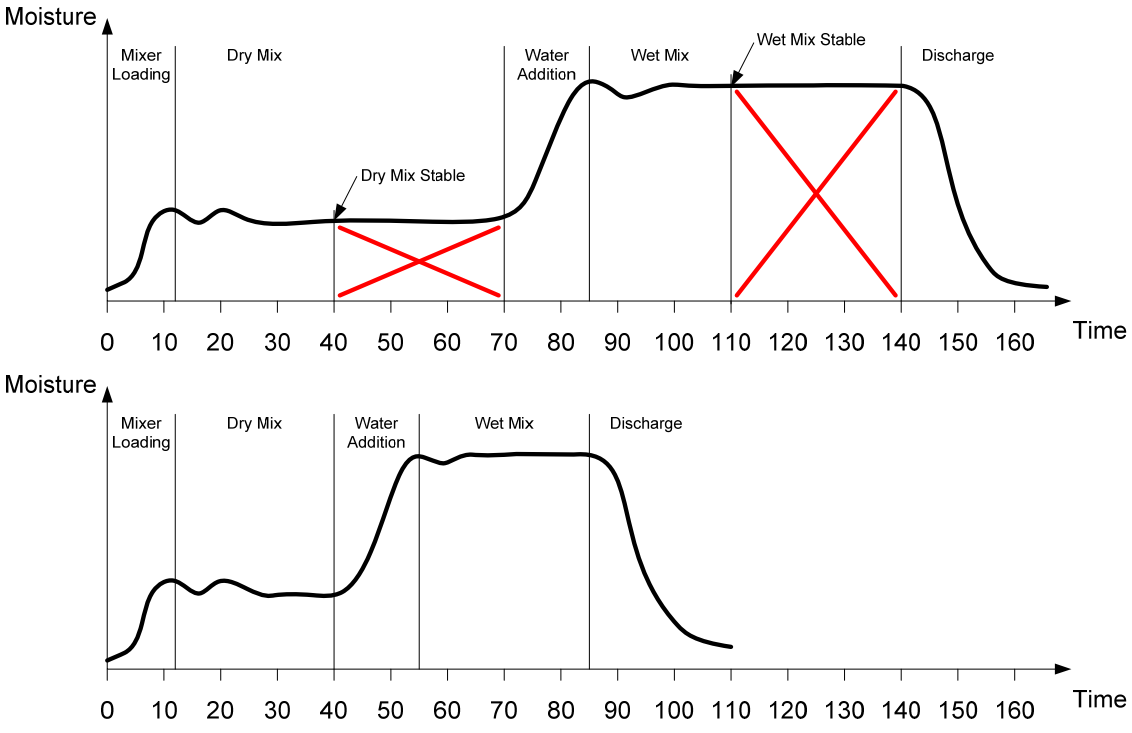


Figure 15: Extending the mix times for calibration

The top diagram in Figure 15 shows a mix trace for a recipe that is configured with a Dry Mix and Wet Mix time of 60 seconds. Both the Dry Mix and the Wet Mix reach stability sooner than the 60 seconds defined. These mixing times maybe be reduced by approximately 30 seconds as indicated by the red cross. The lower diagram shows the resultant mix with a shorter overall mixing time.

2.1.2 Setting the Water Quantity

To achieve the correct consistency (slump, workability) the correct amount of water must be added and the simplest way to determine this is as follows.

Batches are made of the recipe required using the Preset mode. After each batch is completed the output quality is checked and the water quantity for the next batch changed if necessary. For the first batches the water is reduced to deliberately make mixes that are too dry, and then the Trim function is used to open the valves to add more water until a point where the mix consistency is correct. The recipe is then updated automatically with the trim water that was added and can be run again. This process is detailed below.

After the correct water quantity has been determined the recipe can be calibrated using the mix log as detailed in Chapter 8.

2.2 Setting the recipe parameters for water quantity and mixing times.

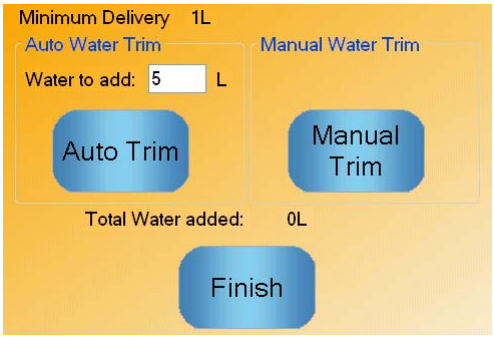
Task	Action
Go to the Overview Screen and press the Menu button.	Press 
Select the Recipe Overview button.	Press 
Select the Create Recipe button.	Press 
Set the Main Water parameter.	This is the quantity of water to be dosed into the mix. Set this to a value that is approximately 10 litres less than the final amount. The rest will be added manually using the trim function.
Set the Dry Mix and Wet Mix Times.	Initially select longer times than are required, for example 70 seconds each. These will be reduced later when the performance of the mixer is evaluated.
Enter the Dry Weight, Pre-wet and Cement Timeout (if used).	
Select Finish to return to the Recipe Overview screen.	Press 

Task	Action
Select the new recipe from the Recipe List, then select Menu.	Press 
Select Overview to return to the Main Overview screen.	Press 

2.3 Start the mix cycle

Task	Action
Make sure that the batch control is set so that the mix will not be discharged automatically. This will allow the mix consistency to be checked. On the Overview Screen, press the Start button. Alternatively, start the mix cycle using the batch control system. Wait for the cycle to finish.	Press 

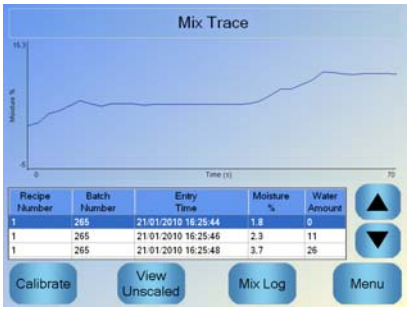
2.4 Trim the water manually to reach the desired consistency

Task	Action
Check the consistency of the mix.	If possible, observe the mix in the mixer through the inspection hatch to see if more water is needed.
On the Overview Screen, press the Trim button to select the trim function options.	Press 
Either: To add a set quantity of water, enter the amount of water to add and press “Auto Trim” or To add water manually, press the “Manual Trim” button to open the water valve. The water valve will remain open until the button is released.	
Repeat the previous step until the mix is at the desired consistency, and then press the Finish button.	Press 

Task	Action
Press the update button to copy the current moisture value into the recipe's moisture target parameter. It is important to make sure the sensor value is stable before pressing this button. Then discharge the mix manually using the batch control system. Once discharged press the red Finish button to end the cycle.	Press  Press 

2.5 Checking the mix log

After running the first mix, it is important to view the mix log to check that the mix times are long enough.

Task	Action
From the overview page, press the menu button.	Press 
Press the Mix Log button	Press 
From the Mix Log, select the mix that you are interested in (the last mix is highlighted by default). You can use the Filtered By option at the top to change the filtering options for the list. To change the mix log display between moisture and unscaled, press the Display Unscaled button. Displaying the Deviation values in unscaled (Dry DeviationUS and Wet DeviationUS) shows the stability of the signal during the Averaging Time at the end of the mixing phases. For a good calibration with CALC Mode, the Deviation should be less than 3 unscaled, and for best results the Deviation must be less than 0.5 unscaled.	
To check the signal stability press the View Mix Trace button.	Press 
Check that the sensor signal is stable during the Dry Mix and Wet Mix. If the signal is not stable then increase the mix times and run another batch to check the stability. It may be advantageous to extend the mixing times to be able to ascertain the point at which the signal becomes stable.	

This chapter describes how to select between using CALC Mode and AUTO Mode for a given recipe and how to configure and optimise a recipe for that mode.

1 Moisture Control and Homogeneity

The aim of moisture control is to accurately reach a chosen moisture target in the shortest time possible.

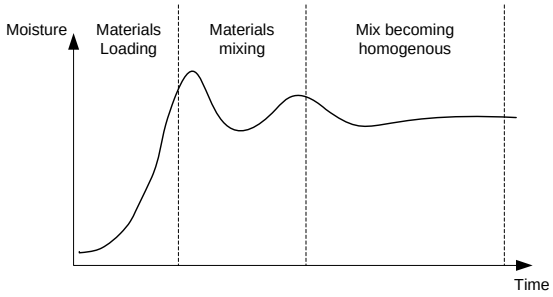


Figure 16: Mix trace showing homogeneity

The sensor shows the dispersal of the moisture and other materials as they move around the mixer. The trace from the sensor accurately shows the state of homogeneity as shown in Figure 16. A mix is homogenous when the materials are all evenly mixed and the water has been dispersed throughout the mix. When the sensor signal is stable (when it reaches a flat line), the mix has reached a homogenous state.

The degree of homogeneity required can be defined by the user and this will affect the mix time.

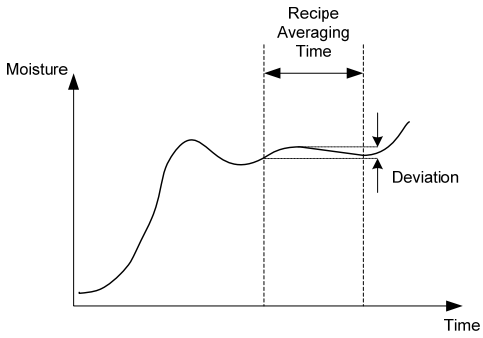


Figure 17: How the deviation is calculated

The Mix Log shows the homogeneity of the mix by displaying a deviation which is calculated as the difference between the maximum and minimum values seen during the averaging time as shown in Figure 17. This calculation is performed at the end of the Dry Mix and Wet Mix phases.

If the deviation is higher than that required, then the mix times must be extended to allow the mixer more time to homogenise the raw materials.

During the wet mix stage, it may not be important to have a completely stable signal when the system is used for general production, as the requirement for homogeneity will depend on the product being made and whether more mixing happens after the discharge from the mixer.

If using the Auto-track function then it is important to ensure that the deviation limit parameters used in the recipe are not set too high.

It is always best to view deviations in unscaled units as this is not affected by any calibration values that are defined in the recipe.

2 CALC Mode

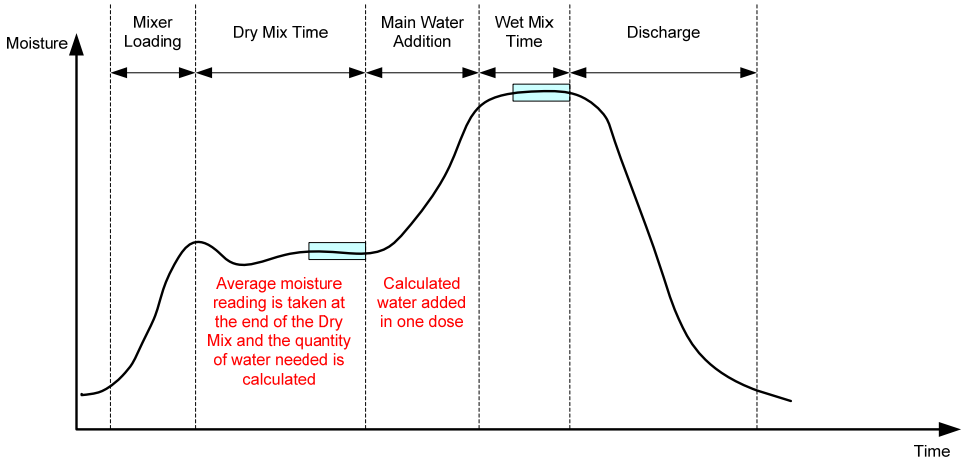


Figure 18: The moisture during CALC Mode

2.1 Introduction

CALC Mode takes an average moisture reading at the end of the dry mix phase and uses that to calculate a quantity of water to add to reach the target defined in the recipe. The water addition is then performed as one complete addition.

Advantages:

- CALC Mode is less dependant on the quality of the mixing action or the final homogeneity in the mixer and therefore may be faster in certain applications.
- The calculated water is dosed in one shot making the main water addition phase quicker than AUTO Mode.
- Different applications will require a different level of homogeneity in the final product. Running in CALC Mode enables the water/cement ratio to be correctly adjusted for without a long Wet Mix Time.
- As the water calculation is performed at the end of the Dry Mix and the Main Water Addition is performed in one shot, the degree of homogeneity at the end of the Wet Mix can be varied by adjusting the Wet Mix Time. It is important to note that if the Wet Mix Time is shortened then the alarm tolerances may need to be increased to stop the controller from alarming at the end of the mix, due to the mix not being completely homogenous.

Disadvantages:

- The dry reading used for the calculation must be stable which usually requires the dry mix time to be longer than is necessary for AUTO Mode control.
- The water calculation is batch size dependant so if the dry weight of material varies significantly then the recipe must be updated with the current batch weight, either by manually editing the recipe or sending the value from a remote connection.
- If significant changes are made to the recipe then it will need to be recalibrated.

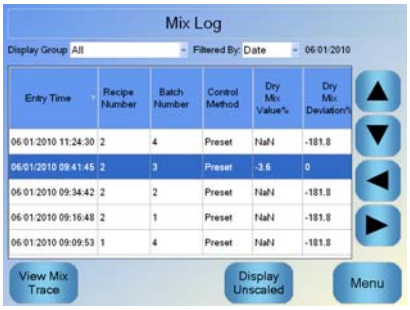
2.2 Configuring the recipe

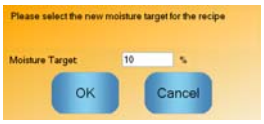
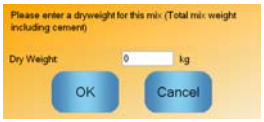
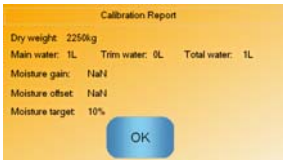
When using CALC Mode each recipe must first be calibrated. This is done by using a batch that has previously been run which is of the correct moisture and quality. The previous chapter details how to run the first batch. The Hydro-Control will then use the data recorded during the batch to generate a calibration for the recipe to use with further batches.

For a good calibration it is important for the sensor signal to be as stable as possible during the averaging periods at the end of both the dry and wet mix times. The stability of the signal can be improved by extending the mix time to allow time for the mix to become homogenous. For the best calibration, the deviations should be as close to zero as possible, always less than 3 unscaled units and preferably less than 0.5 unscaled units.

When planning to use a mix for calibration it may be necessary to temporarily extend mixing times to investigate how the signal changes over time. After the calibration has been completed, the wet mix time can be reduced for actual plant operation. It is important to note that this can affect the quality of the mix produced.

2.3 The CALC Mode calibration procedure

Task	Action
Identify a good batch to use as a basis for the calibration.	Select a mix that has the following: • Correct final moisture • Stable dry and wet readings (low deviation values) • More than 5 unscaled between dry and wet average readings
Press the Menu button.	Press 
Press the Mix Log button.	Press 
Select the mix in the Mix Log that corresponds to the selected good batch. Check the stability of the mix by setting the mix log to Display Unscaled and looking at the Dry and Wet Mix Deviation. These should be less than 3 and preferably less than 0.5.	Select the mix in the Mix Log 
Press View Mix Trace.	Press 
Press the Calibrate button.	Press 

Task	Action
Enter a moisture target, and then press OK. The moisture target value is only used to set the display value that the operator sees on the Overview Screen. It can be any value chosen by the user, and does not have to be an accurate value. However, if a real moisture value is required then one of the following values can be entered: • The theoretical value from the mix design • The moisture calculated from the raw materials • The result of a bake out of the calibrated batch • If the result of a bake out is used then it should be noted that this should be done as quickly as possible as it will be affected by the hydration process. The concrete should be spread thinly before performing the bake out.	Enter the Moisture Target value  Press OK
If the mix consistency would have been improved by adding or subtracting a certain quantity of water, then this value can be added at this point, and the OK button pressed.	Enter the Water Trim value  Press OK
If no dry weight has been entered into the recipe, then the calibration process will prompt the operator to enter one at this point.	Enter the Dry Weight value  Press OK
The Hydro-Control will then display a summary of the parameters that the calibration will be based on. Check the details and press OK. Press the Menu button and then the Overview button to return to the Overview Screen.	Press OK 

After calibration it is always good practice to monitor the following batches of the same recipe and to check the strength and quality of the mix output.

2.4 Optimising CALC Mode

CALC Mode works by taking one average value at the end of the Dry Mix, and a second average value at the end of the Wet Mix. Using these two values and the percentage moisture change between the two points (this is the quantity of water added divided by the batch weight) it is possible to calculate the quantity of water that is needed to get from any other start point to the target moisture value.

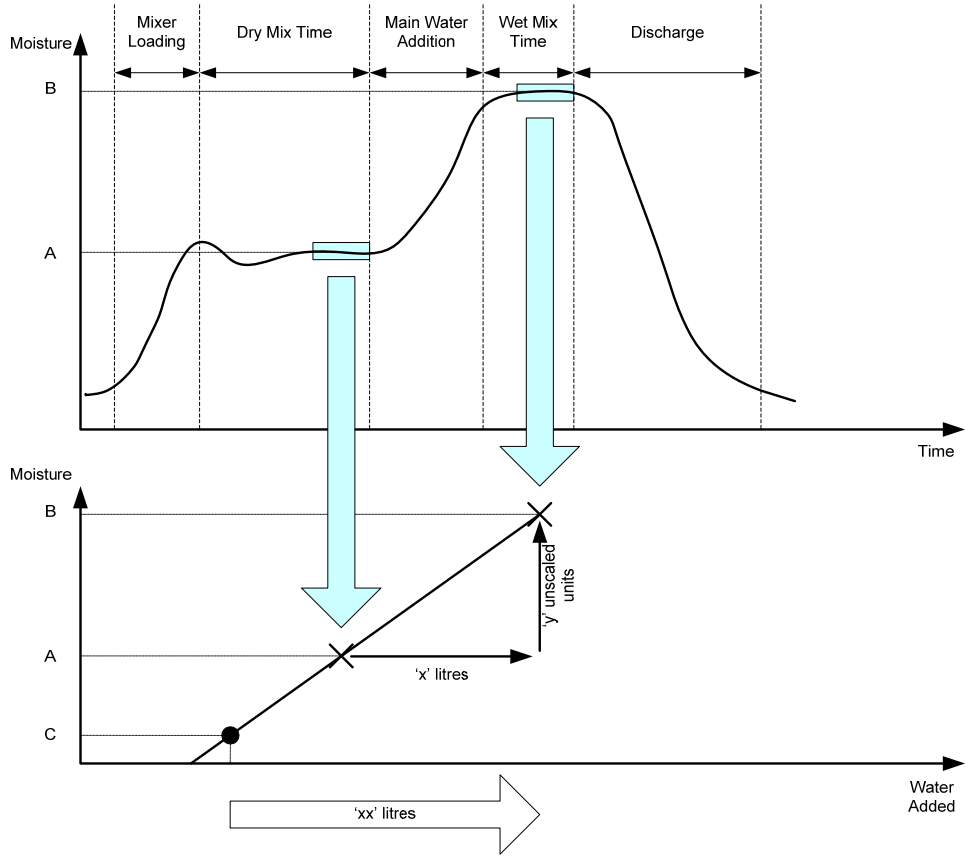


Figure 19: The CALC Mode Calculation

As the diagrams in Figure 19 show, if it takes 'x' litres to get from moisture point A to moisture point B then, as the sensor unscaled value is linear with moisture, a calibration line can be obtained that can then be used to calculate the amount of water needed to get from any new moisture point to the target value, B. In the diagram example it takes 'xx' litres to get from point C to the target.

The real moisture percentage values are not required for this calculation as it relies only on the change in the unscaled values. In order to achieve an accurate calibration the following values must be known:

- Batch weight
- Quantity of water added
- An accurate Dry Mix sensor reading
- An accurate Wet Mix sensor reading (which also gives the target value)

It is important that there is sufficient difference between the sensor reading taken at the end of the dry mix phase and the sensor reading taken at the end of the wet mix phase, to give a good moisture range for the calibration calculation.

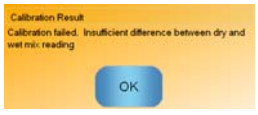


Figure 20: The calibration failed error message

The Hydro-Control requires the difference between the two readings to be greater than 4 unscaled (this is approximately 1% moisture). If this is not the case then the error message shown in Figure 20 is displayed. It is necessary to reduce the amount of pre-wet water going into the mixer or to use drier aggregates.

The deviation of the signal during each of the dry and wet mix averaging phases must be minimal in order to give a correct average value for the calculation. The deviation is displayed on the Mix Log screen, when viewed as unscaled units the value should be less than 3 unscaled, and preferably below 0.5.

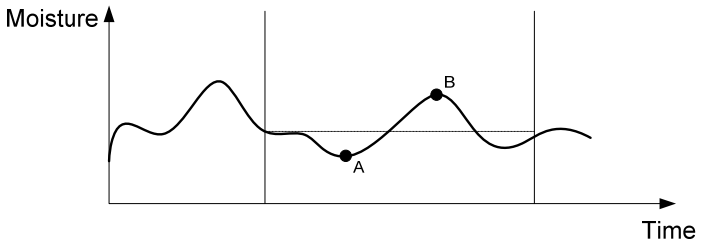


Figure 21: Comparison of averaging times

From Figure 21, it can be seen that if the signal is not averaged, then the instantaneous value taken for the calculation could be, as an example, at point A or point B and would not be representative of the moisture in the mixer. Therefore it is important to average the signal and to make sure that the averaging time is set correctly. A longer averaging time will give a better average reading but will also extend the mix time. In normal circumstances a typical averaging time would not be greater than 10 seconds.

After a calibration has been set, the system should be monitored for at least two more mixes to check that the system is correctly compensating for changes in the dry moisture.

2.5 Dry weights

If the raw material dry weights change between batches then this value must be updated in the recipe. This can either be manually entered for each batch or sent by the control system to the Hydro-Control. Using incorrect values will result in the calculation incorrectly determining the moisture change for the calibration.

Even when using a mixer moisture control system, it is important to correct for the weight of the moisture in the raw material being used to ensure that the mix design is consistent. Any moisture in the raw materials will affect the weight of raw material dosed and will affect the aggregate/cement ratio.

It is important to use a control system that controls all of the raw materials being added into the mixer, in particular all materials should be added to the mixer in the same order each time and admixtures should be dosed at the same time during the cycle so that the effect of any materials on the sensor signal is consistent.

3 AUTO Mode

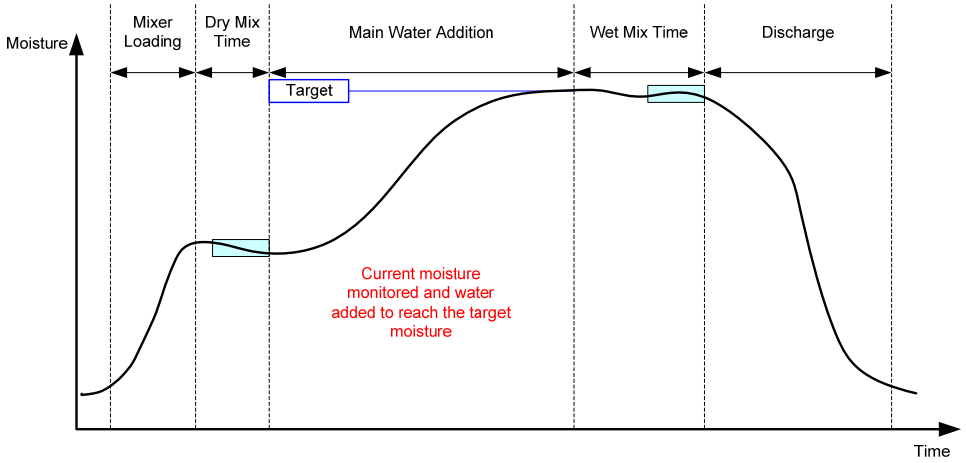


Figure 22: The moisture during AUTO Mode

3.1 Introduction

AUTO Mode adds water progressively to reach the moisture target defined in the recipe parameters.

Advantages:

- As the control only relies on the current reading and moisture target, no calibration of the recipe is required, if the true moisture values do not need to be displayed.
- A short dry mixing time can be used, for example 10 seconds, as the water amount is not calculated at the end of the dry mix phase.
- AUTO Mode is more independent of the dry weight of material. Therefore the control will work even if there are minor changes in the batch sizes. It is still recommended to use a separate recipe for large changes in batch size, for example, half batches.

Disadvantages:

- The AUTO Mode is more dependant on mixer efficiency than the CALC Mode as the sensor must be able to monitor the water that has been dosed. This is not always the case in some mixers and therefore it can take a long time for total water addition, as water must be added more slowly to allow the sensor to detect the added water and for the Hydro-Control VI to react accordingly.
- The AUTO Mode parameters may need to be adjusted for optimal performance of the system as described in section 3.3 below.

3.2 Configuring the recipe

It is not necessary to calibrate a recipe when using AUTO Mode unless real moisture values are required. The only recipe parameter that is required for the Hydro-Control to add the correct quantity of water for each mix is the 'Moisture Target %' which is determined by running test mixes and recording the value at the end of a good quality mix.

When a recipe is created the Hydro-Control uses a default calibration to calculate the moisture for display. Some operators prefer to use an arbitrary value for the moisture target such as 10% and to use this to monitor repeatability and deviation.

If required it is possible to calibrate the recipe to display a real moisture value. The same sequence as for CALC Mode should be used (see section 2.3 above). After entering the calibration data the Recipe will default to CALC Mode and should be set to Auto Mode.

3.3 Optimising

Different installations will mix the water in at different rates and therefore the AUTO Mode parameters may need to be adjusted to optimise the speed and accuracy of the water addition.

The AUTO Mode water addition is adjusted using 3 AUTO Mode parameters, Proportional Gain, Integral Gain and Derivative Gain. Normally these parameters are set globally for all recipes using the values in the System Parameters pages, but these can be over-ridden for individual recipes if necessary.

For most applications, it is only necessary to change the Proportional Gain, and there is an option on the recipe selection screen to do this easily without having to go to the recipe editor. The Integral and Derivative Gains are disabled by setting their values to zero.

In order to optimise the AUTO Mode, it is necessary to run a number of batches whilst increasing the Proportional Gain value to a point where it just overshoots the target value, then reduce the gain value so that it stops overshooting the target, and this gives the optimal value for the Proportional Gain parameter.

If during the water addition phase the moisture value approaches the target but is not able to reach it then this may be due to insufficient water being added each time the valves are pulsed. The Integral Gain should be increased with an associated reduction in Proportional Gain to prevent overshoot in the initial stages of the water addition.

If the coarse valve is not on long enough during the water addition, increasing the Derivative Gain whilst decreasing the Proportional Gain will allow the coarse valve to be on for longer in the initial stages without ultimately overshooting the target.

The Minus Tolerance in the recipe parameters is used as a deadband and when the moisture value reaches this offset from the target the target is deemed to have been reached.

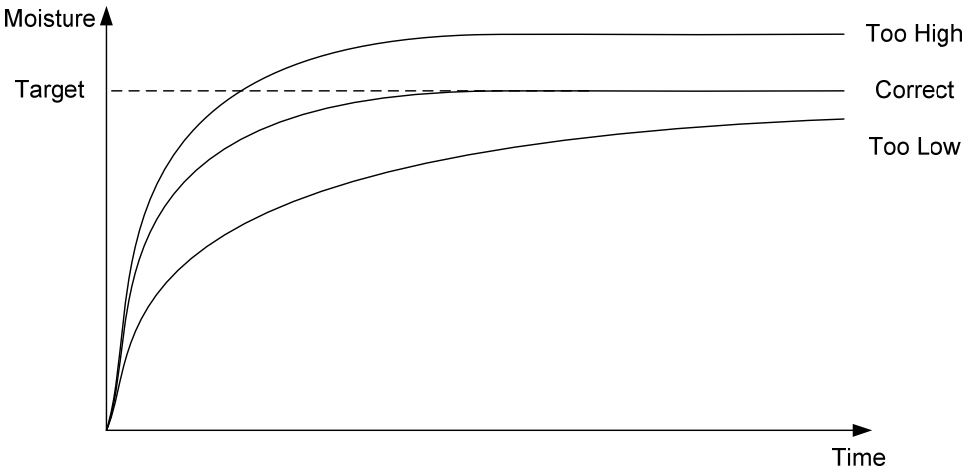


Figure 23: The effect of changing the Proportional Gain

As can be seen from Figure 23, if the Proportional Gain is set too high then the moisture will overshoot the target value. If the Proportional Gain is set too low then the water is added to slowly and the moisture will take too long to get to the target value.

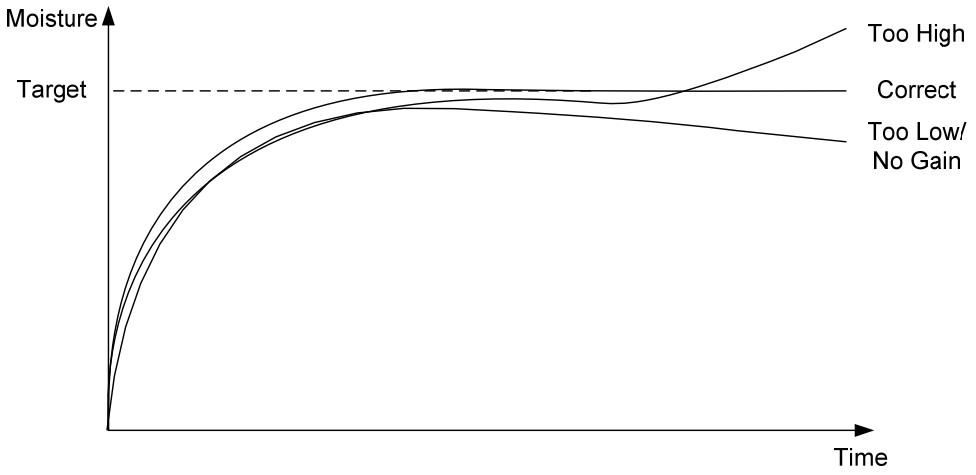


Figure 24: The effect of changing the Integral Gain

Figure 24 shows the effect of changing the Integral Gain. Integral Gain will act to increase the water flow depending on the length of time that has passed. This can be used to correct the addition when the moisture tails off after the initial water addition.

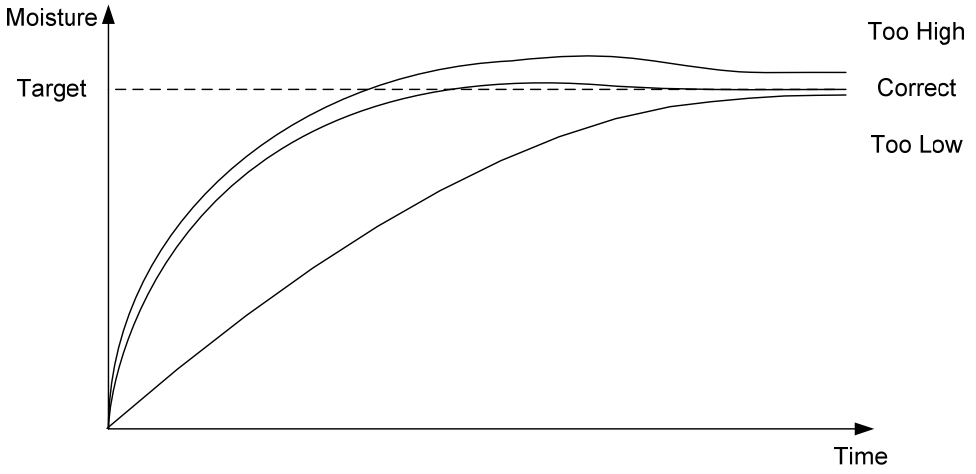


Figure 25: The effect of changing the Derivative Gain

The Derivative Gain only needs to be changed if there is overshoot on the target that settles as the water is mixed in as shown in Figure 25.

4 Using admixtures

4.1 Introduction

In general, admixtures or colours should be dosed after the water addition has started so as not to be added on top of the dry material. Dosing simultaneously with the water aids dispersion into the mix and can help the mixing action, improve mix quality and reduce mix cycle times. Refer to the manufacturers datasheets from the admixture supplier for specific advice regarding admixture dosing.

Because admixtures do not have the same electrical properties as water, if they are added part way through a mix cycle the effect is to change the properties of the base material and hence change the relationship between the unscaled value and the moisture % part way through the mix cycle. In most cases the admixture is added in the same proportion to each batch and the final moisture % target will be correct. This is regardless of the operating mode in use. However, the moisture value recorded at the end of the Dry Mix time (before the addition of the admixture) will not represent a true moisture %.

The Admix Enable % parameter in the Recipe is used to control the point at which the admixture is dosed during the main water addition phase. In CALC Mode this is a percentage of total calculated water and in AUTO Mode it is a percentage of the final moisture target.

In cases where an admixture is being used and where an actual moisture % for both the Dry Mix and the Wet Mix is required for quality records the Hydro-Control can utilise the 2-Step Water Addition mode to achieve this.

The 2-Step water addition mode can be used in all operating modes but is configured in Preset Mode using a two step water addition technique shown in Figure 26. The operation of AUTO and CALC is not effected, the calibration automatically changes at the appropriate time so that a correct moisture % is always shown throughout the mix.

If a 2-Step Water Addition is required check the 2-Step Addition box in the Recipe and set the Admix Enable % to the value required.

It should be noted that the 2-Step Water Addition mode does not affect the calibration performed for the water control in CALC Mode.

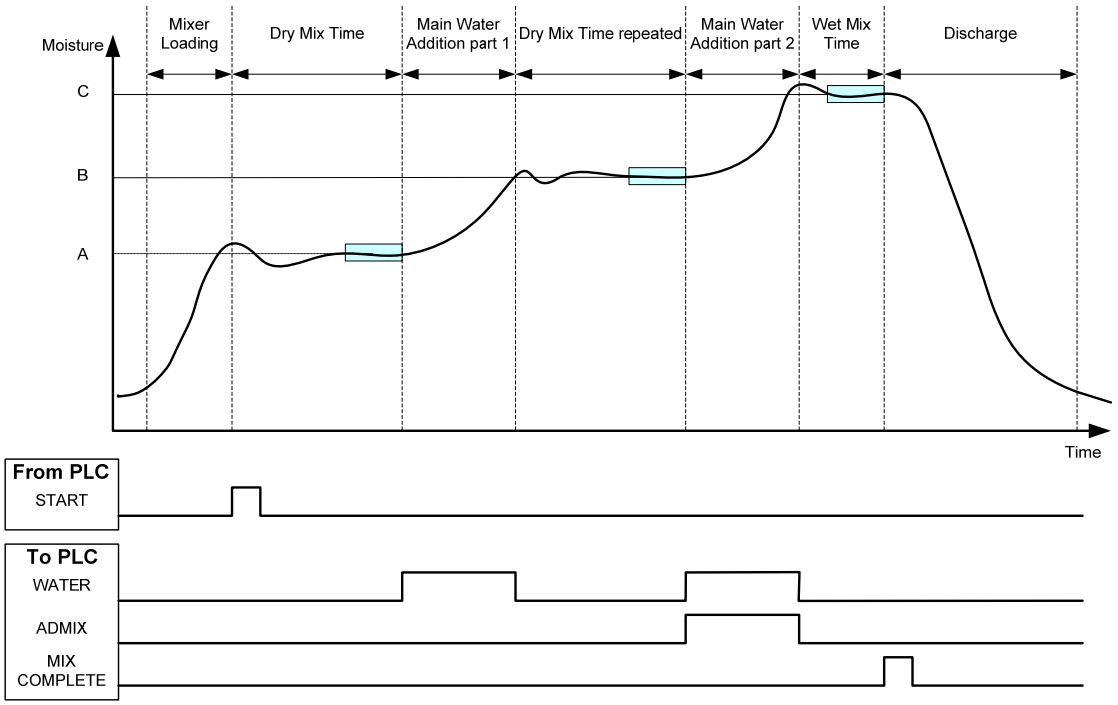


Figure 26: The 2 step preset mode cycle

Figure 27 shows the 2-Step Water Addition calibration points that are taken from the cycle shown in Figure 26. The line from point A to point C is used for the water calculation when in CALC Mode. The moisture value shown before admixture addition is based on the A to B line and after the admixture addition the B to C line is used.

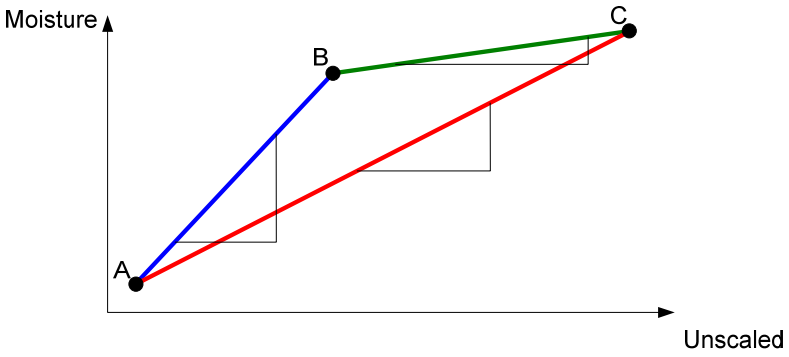
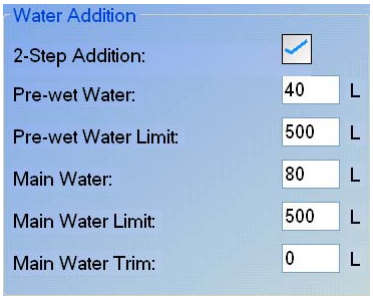
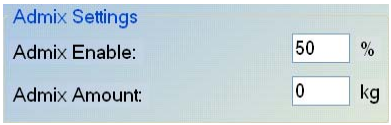


Figure 27: The calibration lines from the 2-step preset mode cycle

4.2 Setting up the 2-Step Water Addition

This procedure requires that you have already set up the basic recipe as per Chapter 7.

Task	Action
Press the Menu button.	Press 
Press the Recipe Overview button.	Press 
Select the recipe to set up and then press the Edit Recipe button.	Press 
On Page 1, in the Water Addition section, select the box '2 Step Addition.'	
On Page 2 go to the Admix Settings and set the Admix Enable to the point in the main water addition that you require the admixtures to be introduced. If required the amount of Admixture can be entered here and will be reported in the Mix Log.	
Save the recipe changes, then press menu and then overview to return to the Overview Screen	Press 

After the recipe has been setup, run the mix and then adjust the quantity of water as in the normal calibration in order to get a good mix at the end of the batch.

Once a good mix has been obtained then the calibration can be performed from the mix log using the same procedure as a normal mix.

5 Auto-Track

Auto-track is an alternative to using defined mixing times and allows the Hydro-Control to automatically adjust the mix time for each phase so that it will finish mixing when the deviation in the sensor value is within the user defined Auto-track parameters set in the Recipe. This is useful if variation in the raw materials causes differences in the mixer action which then varies the time taken to homogenise the material.

There are separate Auto-track parameters for the Dry Mix phase and the Wet Mix phase. These consist of an Auto-track Time and an Auto-track Deviation. The sensor signal must remain within the Auto-track Deviation for the duration of the Auto-track Time before moving to the next mixing phase.

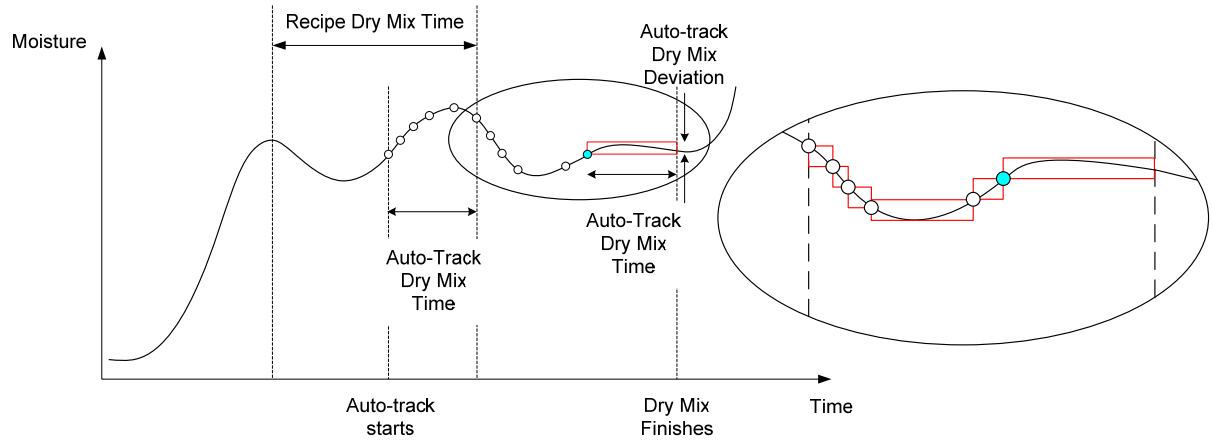


Figure 28: Mix trace showing the Auto-track function

Figure 28 shows the mix trace for a Dry Mix phase using the Auto-track feature. The Auto-track feature is enabled at the point Dry Mix Time – Auto-track Time. It will then continue to mix until the Auto-track parameters are met or to the end of Dry Mix Time.

The Auto-track monitors the sensor values. If the value falls outside of the Auto-track Mix Deviation parameter the Auto-track timer is reset as shown in the inset diagram in Figure 28. If during the mixing phase the values remain within the Auto-track Mix Deviation parameter for the defined Auto-track Mix Time then the Hydro-Control continues to the next phase.

If the Auto-track deviation parameters are not met within the allotted Dry Mix Time the system repeats the mixing phase a second time. If after a second Dry Mix time sufficient stability has not been achieved the Hydro-Control will alarm ‘Max Dry Mix Time Reached’ or ‘Max Wet Mix Time Reached’ if during the Wet Mix phase. The operator will then be prompted to either stop the mixing phase and move on to the next phase or repeat the mixing time. If the mix time is repeated then the Hydro-Control will automatically update the mix time in the recipe so that the next time it is run the longer mixing time is used.

5.1 Considerations When Setting up Auto-track

The following points should be considered when setting up Auto-track.

- Dry Mix Time should be set to half the overall anticipated dry mixing time.
- In CALC Mode the Auto-track Mix Deviation should be set small enough to ensure a stable reading is used as the basis for the water addition calculation. For example, a 0.1% deviation allows a 0.1% change in the water calculated.

- The Wet Mix Deviation should be set dependant on the required final homogeneity of the mix. For example, pipes will require a high degree of homogeneity whereas a plain block may require less homogeneity.

In Auto Mode where a short Dry Mix Time is often used, Auto-track can be used to delay water addition until the cement is reasonably mixed. This can improve repeatability if the aggregate moisture values vary.

6 Temperature Compensation

In environments where the are large changes in temperature it can be necessary to change the viscosity of the mix. It is advisable to do this by varying the amount of admixture in the mix. In this circumstance it is advisable to calibrate the recipe when the least amount of admix is required (usually at the coolest part of the day). The mix should be completed normally and when the mix complete signal is given any additional admixture can be added.

In some systems it is not possible to vary admixture addition in this way. In this situation the amount of water can be varied based on water demand increase per °C. Temperature Correction Settings in the recipe can be used to do this. The Hydro-Control will adjust the moisture target to compensate. It should be noted that this method will increase variance in the water/cement ratio and thus widen strength variation tests.

The temperature compensation works simply by taking the difference between the current temperature and the ‘Temperature Set Point’ parameter in the recipe and multiplying the result by the ‘Temperature Coefficient’ parameter. This value is then added (or subtracted if negative) to the moisture target for the recipe at the start of the batch.

Example

A recipe is calibrated at 25degC to a moisture target of 10%.

At 35degC (an increase of 10degC) a moisture target of 11% (an increase of 1%) is required to maintain consistency.

In the above example, for each 1degC increase in temperature a corresponding 0.1% increase in the moisture target is required. For this example, the temperature coefficient should be set to 0.1%.

It should be noted that adjusting the water demand due to temperature will cause variation in the Water/Cement ratio. When setting up this parameter ensure that Water/Cement ratios will remain in tolerance for the working temperature range.

If the temperature coefficient is set to zero this function is disabled.

Chapter 9 Alarm Configuration

The Hydro-Control VI has a number of alarms that may be configured to assist in managing, monitoring and controlling the mixing process. When an alarm is triggered the Hydro-Control displays a visual prompt on the screen to indicate the nature of the problem to the operator and give possible resolutions, the Alarm OPTO output is also activated to signal that a problem exists to the batch control system. This output could also be used to trigger an audible or visual warning. The alarm is also recorded in the Mix Log.

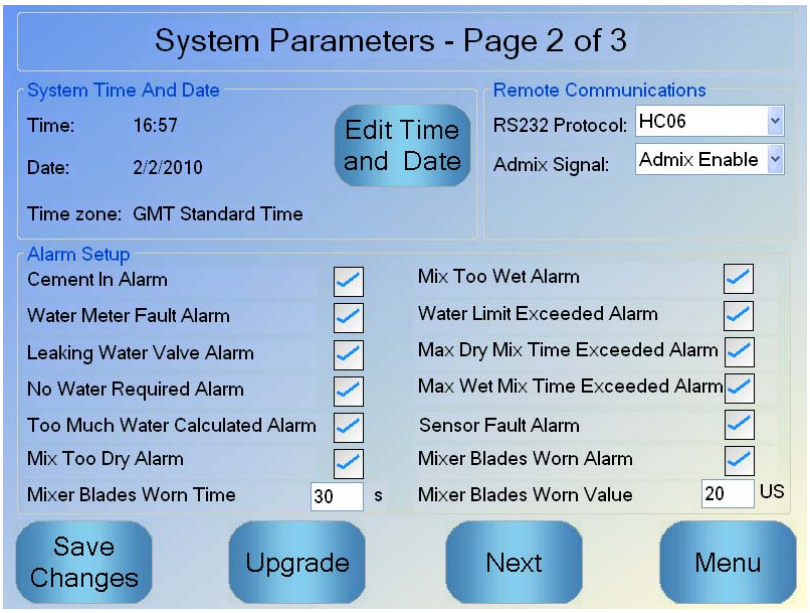


Figure 29: Page 2 of the System Parameters screen

Alarms can be enabled, disabled and configured from page 2 of the System Parameters as shown in Figure 29. When troubleshooting alarms, the wiring connections and any related OPTO Input and Output modules should be checked to make sure that they are not the cause of the fault. Inputs and Outputs can be checked using the I/O Setup And Status screen as shown in Figure 30.

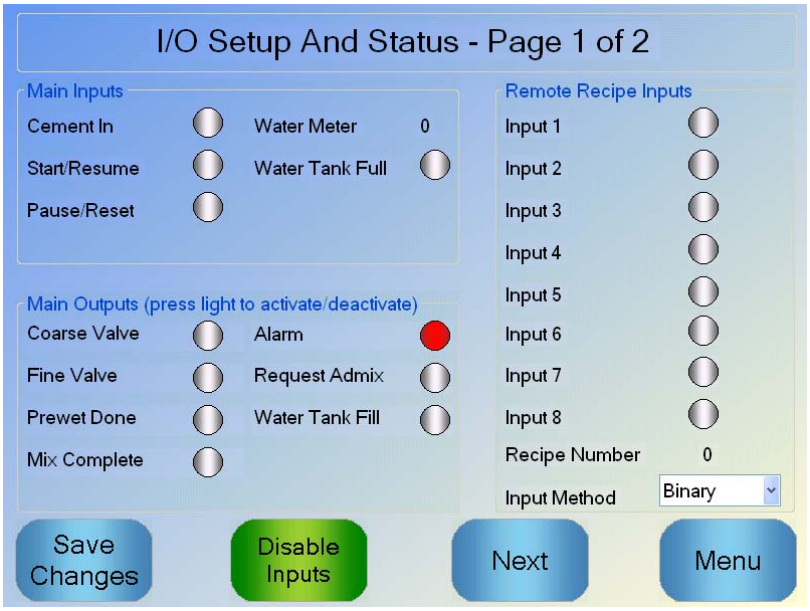


Figure 30: Page 1 of the I/O setup and status screen

Cement In Alarm

This alarm is triggered if the 'Cement In' input signal is not received within the time defined by the 'Cement Timeout' parameter in the Recipe after the 'Pre-Wet Done' output signal is set.

Check:

- Cement is feeding from the cement silos.
- The control system is sending the "Cement In" signal to the Hydro-Control correctly and within the timeout. If the control system does not send the Cement In signal then the timeout in the recipe should be set to zero.

Water Meter Fault Alarm

This alarm is triggered if a water valve has been opened and the water meter has not pulsed within the time set by the 'Water Meter Timeout' parameter defined in the System Parameters pages.

Check:

- The operation of the water valves.
- The water meter operation. To check the input go to the I/O setup screen shown in Figure 30 and ensure that the water meter counter increments when the water valves are opened.

Leaking Water Valve Alarm

This alarm is triggered if the water meter pulses when both of the water valves have been closed for more than 5 seconds during the dry and wet mix phases.

Check:

- The valves to see if they are leaking.
- The water meter is working correctly.

Waiting For Tank Fill Alarm (Only available if Expansion Board is fitted)

This alarm is triggered if the Hydro-Control has reached a water addition stage when using weighed water and the Water Tank Full input has not been received.

Check:

- Water tank filling should be investigated. It may be filling slowly or not at all. If needed then the mix times, or the time between mixes should be lengthened to allow the water tank time to fill.

No Water Required Alarm

This alarm is triggered in CALC Mode if the calculation has determined that no water is needed as the dry mix moisture is already at or above the target for the recipe.

Check:

- The moisture level of the incoming aggregates.
- Reduce any Pre-wet water that is added. If no Pre-wet water is being added, then consideration of the aggregate handling and storage is advised.

Too Much Water Calculated Alarm

This alarm is triggered in CALC Mode when the calculated water required is above the 'Water Limit' parameter defined in the recipe.

Check:

- The recipe 'Water Limit' parameter is high enough.
- The calibration of the recipe is still correct. It may be necessary to recalibrate the recipe using the Preset mode.

Pre-wet Target Not Reached Alarm

This alarm triggers during AUTO Mode water addition during the Pre-wet phase if the added water has reached the Pre-wet Water Limit defined in the recipe and the sensor moisture value has not reached the Pre-wet Target.

Check:

- The Pre-wet target is low enough.
- The AUTO mode is tuned correctly.
- The Pre-Wet Water Limit is set high enough.

Mix Too Dry Alarm

Mix Too Wet Alarm

These alarms are triggered at the end of the Wet Mix Phase if the average moisture recorded during the Recipe Averaging Time is below or above the target by more than the 'Minus Tolerance' or 'Plus Tolerance' parameters specified in the recipe. The mix can then be rejected or accepted by the operator and this is recorded in the mix log. If the mix is rejected then the operator also has an option to activate the 'Mix Complete' signal.

Check:

- The calibration is correct, in particular the stability of the signal at the end of the mixes (indicated in the Mix Log by the Mix Time Deviation). A more stable signal will give a much more repeatable result.
- The tolerances in the recipe parameters can be increased, if necessary, to decrease the number of alarms.

Water Limit Exceeded Alarm

In AUTO Mode this alarm is triggered if the water addition has reached the 'Water Limit' parameter defined in the recipe.

Check:

- The recipe 'Water Limit' parameter is high enough.
- The AUTO Mode tuning should be adjusted to not overshoot the target value.

Max Dry Mix Time Exceeded Alarm

Max Wet Mix Time Exceeded Alarm

These alarms are triggered when the Auto-track is running and the sensor reading has not stabilised within the configured Auto-track values before the end of the Dry Mix and Wet Mix Times set in the recipe.

Check:

- The Auto-track control settings are set correctly. The frequency this alarm is triggered can be reduced by decreasing the Auto-track Mix Time or increasing the allowed Mix Deviation, either in the recipe or the system parameters.
- The recipe mix time parameters are set to be long enough for the mix to stabilise.

Sensor Fault Alarm

This alarm is triggered when the Hydro-Control detects a problem with the RS485 communications with the sensor.

Check:

- Ensure that communications cables are routed away from heavy duty power cables and electrical equipment.
- Ensure cables are of the required standard
- Ensure that the cable screen is connected at the sensor end only.

Further information on cabling can be found in the sensor user guides.

1 Introduction

The mix log records information on mix cycles that have been run with the Hydro-Control VI. The following information about each batch is stored:

- A log of the sensor reading taken once per second during the mix cycle.
- Details of the quantity of water calculated and the parameters used to calculate it.
- A log of the actual water dosed into the batch.

This enables the following functionality within the mix log pages:

- Calibration of recipes from a previous batch.
- Analysis of previous batches for diagnostic and quality assurance.
- View of the mix log trace to analyse homogeneity during the mix times.

2 Accessing The Mix Log

The mix log is accessed on the Hydro-Control itself from the Overview Screen by pressing the Menu button 

and then the Mix Log button 

.

Figure 31: The Mix Log

The Mix Log screen contains the batch details of all the mixes that have been run. Additional data can be accessed by scrolling the screen using the left and right arrow keys. Filter options may also be used to filter the number of mixes shown and the Display Group control may be used to filter the data shown for each mix by date, recipe or alarm type.

The filter options can be used to refine the logs displayed by date, recipe or Alarm type.

The Display Unscaled button can be used to toggle between moisture % values and unscaled values. The moisture % values have been derived from moisture % target set at the time of making the batch.

The columns in the log summary are described in the following table:

Column	Units	Description
Entry Time		Time that the batch was completed.
Recipe Number		The number of the recipe that was made.
Batch Number		The batch number is an incrementing number for each batch made of that recipe.
Control Method		The method used to control the batch. This can be Preset, AUTO or CALC.
Dry Mix Value	%/US	This is the moisture value taken during the Averaging Time or Auto-track time at the end of the Dry Mix.
Dry Mix Deviation	%/US	This is the deviation in the signal taken during the Averaging Time or Auto-track time at the end of the Dry Mix.
Target Value	%/US	This is the final target value to be achieved for the recipe.
Wet Mix Value	%/US	This is the moisture value taken during the Averaging Time or Auto-track time at the end of the Wet Mix.
Wet Mix Deviation	%/US	This is the deviation in the signal taken during the Averaging Time or Auto-track time at the end of the Wet Mix.
Pre-wet Water	l/gal/sec/lbs/kg	This is the quantity of Pre-Wet Water that was added.
Target Water	l/gal/sec/lbs/kg	This is the amount of water that was calculated as being needed. This is the target for the Main Water Addition.
Automatic Trim	l/gal/sec/lbs/kg	This is the automatically calculated Trim value that was added during the calibration of the recipe.
Manual Trim	l/gal/sec/lbs/kg	This is the amount of water that the operator selected to add or subtract manually during the batch.
Addition Error	l/gal/sec/lbs/kg	This is the difference between the actual quantity calculated for the batch and the amount actually added as recorded by the flow meter.
Total Water	l/gal/sec/lbs/kg	This is the total amount of water added to the mixer by the Hydro-Control during the batch.
Water/Cement Ratio		This is the ratio of the water in the batch calculated from the average moisture value during the wet mix and the dry weight (and so assumes the moisture calibration has been entered as a real moisture value) to the amount of cement added into the mixer.

Column	Units	Description
Dry Mix Time	Seconds	This is the Dry Mix Time of the batch.
Wet Mix Time	Seconds	This is the Wet Mix Time of the batch.
Water Addition Time	Seconds	This is the total time taken to add the water during the batch.
Total Time	Seconds	This is the total mix time, from the time that the start signal is received by the Hydro-Control to the time that the Hydro-Control activates the Mix Complete signal.
Dry Weight	Kg/lbs	This is the dry weight of the batch.
Cement Weight	Kg/lbs	This is the weight of the cement that was added to the batch if it has been entered into the recipe or sent from the batch control system.
Moisture Gain 1		This is the first Moisture Gain value used to calculate the moisture for display.
Moisture Offset 1		This is the first Moisture Offset value used to calculate the moisture for display.
Moisture Gain 2		This is the second Moisture Gain value used to calculate the moisture for display. This is used to rescale the graph after admixtures have been added to the mixer.
Moisture Offset 2		This is the second Moisture Offset value used to calculate the moisture for display. This is used to rescale the graph after admixtures have been added to the mixer.
Calc Gain		This is the Gain value used to calculate the quantity of water to add to the mixer when running calculation mode.
Calc Offset		This is the Offset value used to calculate the quantity of water to add to the mixer when running calculation mode.
Proportional Gain		This is the Proportional Gain value used during the batch if the system is running in Auto mode.
Derivative Gain		This is the Derivative Gain value used during the batch if the system is running in Auto mode.
Preset Type		This is the control method for the Prewet Water addition. This can be either Preset or Auto.

Column	Units	Description
Admix Enable Percentage		This is the point during the water addition phase at which the Hydro-Control activates the Admix signal so that the batch control system can begin dosing the admixtures. It is based on the percentage of the total water that has been added.
Cement In Error		A Cement In alarm was triggered during the batch.
Water Meter Fault		A Water Meter Fault alarm was triggered during the batch.
Leaking Water Valve		A Leaking Water Valve alarm was triggered during the batch.
Waiting For Water Tank Fill		A Waiting For Water Tank Fill alarm was triggered during the batch.
No Water Required		A No Water Required alarm was triggered during the batch.
Too Much Water Calculated		A Too Much Water Calculated alarm was triggered during the batch.
Prewet Target Not Reached		A Prewet Target Not Reached alarm was triggered during the batch.
Mix Too Wet Rejected		A Mix Too Wet alarm was triggered during the batch and the mix was rejected by the operator.
Mix Too Dry Rejected		A Mix Too Dry alarm was triggered during the batch and the mix was rejected by the operator.
Mix Too Wet Accepted		A Mix Too Wet alarm was triggered during the batch and the mix was accepted by the operator.
Mix Too Dry Accepted		A Mix Too Dry alarm was triggered during the batch and the mix was accepted by the operator.
Water Limit Exceeded		A Water Limit Exceeded alarm was triggered during the batch.
Max Dry Mix Time Exceeded		A Max Dry Mix Time Reached alarm was triggered during the batch.
Max Wet Mix Time Exceeded		A Max Wet Mix Time Reached alarm was triggered during the batch.
Mix Aborted		The Mix was aborted during the batch.
Searching For Sensor		The Sensor communication was lost during the batch.

3 Viewing the Mix Trace

To access details for a particular batch, select one of the batches from the list and then click the View Mix Trace button. This will then display the mix trace page, which provides a graphical representation of the moisture variation throughout the mix cycle. It provides a quick way of identifying the degree of homogeneity at any point during the mix and allows optimisation of the cycle time by seeing areas of homogeneity, for example at the end of the dry and wet mixes, where the mix times can be reduced without compromising the final mix.

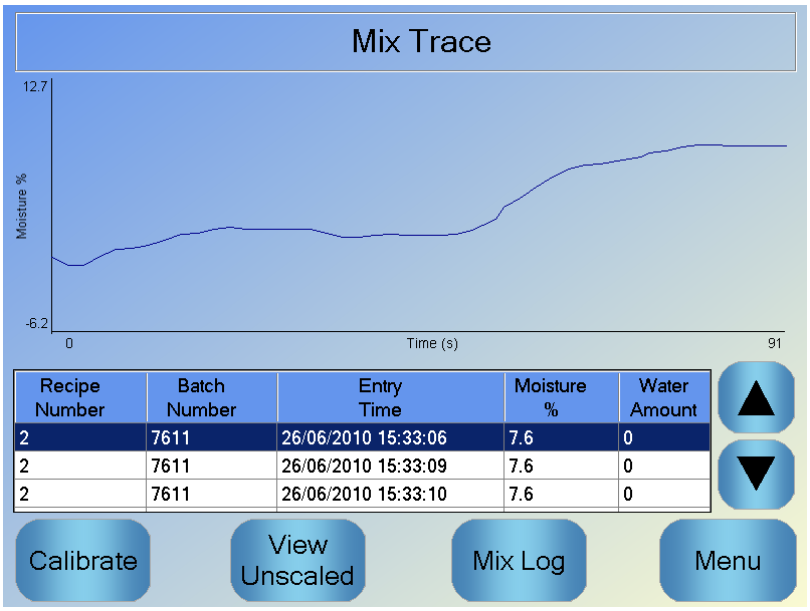


Figure 32: The Mix Trace screen

The mix details at the bottom of the screen contain a list of points recorded during the batch and the amount of water added by the controller at that point in the batch.

4 Backing up and Restoring

4.1 Backup

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

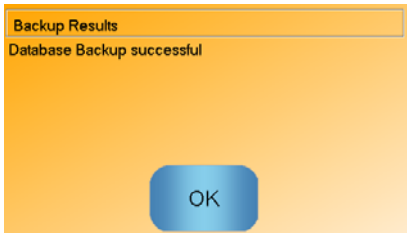
1. Insert a memory stick into one of the USB ports.
2. Press the Menu button 

.
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

4.2 Restore

To restore the Hydro-Control database:

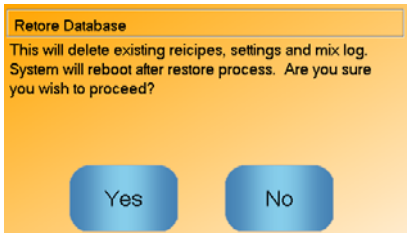
1. Insert a Memory Stick containing a backup of the Hydro-Control into one of the USB ports (The file HC06Database.sdf should be in the root directory of the Memory Stick).
2. Press the Menu button 

.
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 Overview Screen is shown.

Chapter 11 Setting Up User Accounts

For some companies it may not be necessary to set up user accounts. If there are not any user accounts set up on the system the menu button in the bottom right hand corner of the overview screen will always be enabled.

If user accounts are used, at least one account must have administrative access.

To access user accounts press the menu button 

followed by the user accounts button. 

The user accounts screen is then displayed.

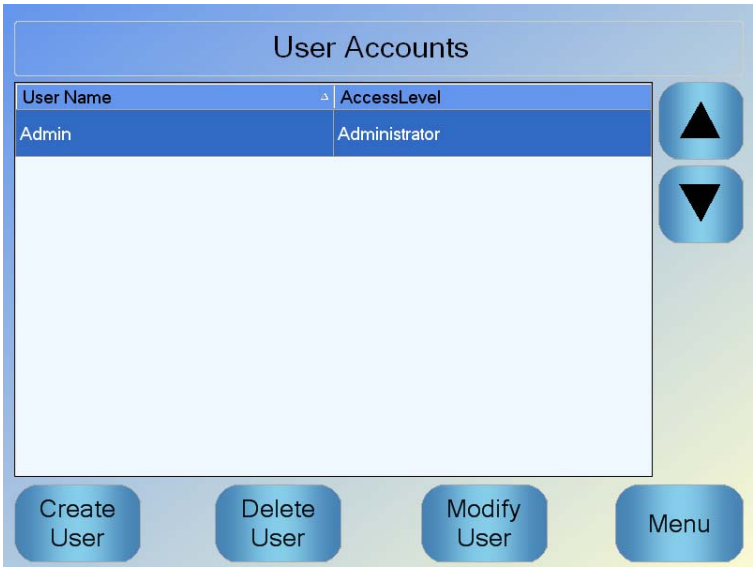


Figure 33 - User accounts screen

The up / down arrows can be used to move up and down the user list. Alternately a user can be selected simply by pressing the desired user on the list. Pressing the modify or delete buttons will affect the highlighted user.

To create a user press the create user button and add the information to the account editor screen. Press the textboxes to enter the user information and press the OK button when done.

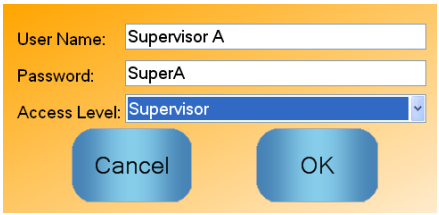


Figure 34 - User account editor screen

Chapter 12 Optimisation

The moisture reading from a 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.

1 Mixer

- Mixers vary in performance, a well maintained mixer will always be more efficient than a poorly maintained 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.
- Add water during the aggregate addition.
- 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 mixer.
  - The 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 in power consumption and reduce mixer wear.

2 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. There will also be varying ratios of the different aggregates used and this can increase the amount of water to achieve the repeatable consistency
- 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 should be added either at the same time or within a few seconds after the start of the addition of sand and aggregates. Combining the materials together in this way will greatly assist the mixing process.

3 Consistency

A 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

4 Calibration based water addition

- When calibrating, omit the admixtures, metal fibres and plastic fibres.
- 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.

5 Mixing

- Minimum mix times are a function of the mix design (ingredients) not just the mixer.
- Different mixes may require different mix times.
- Keep batch sizes as consistent as possible e.g. $2.5m^3 + 2.5m^3 + 1.0m^3$ is not as good as $3 \times 2.0m^3$.
- In CALC Mode, keep the dry mix time as long as possible to allow the required water to be calculated correctly, to the detriment of the wet mix time if necessary.

Chapter 13 Frequently Asked Questions

Q: The Hydro-Control display continually says "Searching For Sensor on address xx"

A: This message indicates that there is a problem with the communication between the Hydro-Control VI 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 Appendix A for more details on communication diagnostics.

– – –

Q: How do I recalibrate the touch screen?

A: If the calibration on the touch screen is incorrect, then you can push the small recessed button on the top panel of the Hydro-Control next to the CompactFlash card panel. A screwdriver or pencil can be inserted to push the button which restarts the touch screen calibration utility.

– – –

Q: I ordered AC modules instead of DC modules, so I added my own relay to switch over from AC in the Hydro-Control VI 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 parallel 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 the Installation Guide for more details.

– – –

Q: Can I adjust the contrast on the display?

A: There is no way of adjusting the contrast of the display on a Hydro-Control VI. If either the backlight or the contrast if 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 110v AC unit but the label on the back shows a 24v DC power input. Is this labelling a mistake, should I just wire 110v AC to power the unit instead?

A: The 110v AC 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 VI units require a 24v DC power supply.

– – –

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 'Menu' and the version number will then be displayed.

– – –

Q: I have 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 air and water factory calibration settings are correct. This process is fully detailed in the Hydro-Probe Orbiter User Guide. The calibration can be performed using the Hydro-Control VI from the Sensor Configuration page. After changing the 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. However the signal should be monitored during the first batches of each recipe to check that nothing has been affected.

– – –

Q: I have a recipe running that has been calibrated. 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 mix design?

A: Any change in the mix design may need a different calibration and so should be run with a separate Hydro-Control recipe. 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: On hot days I have to add extra water to my recipes, is there a way to do this automatically?

A: Each recipe has a temperature compensation coefficient which allows the moisture target to be changed depending on the temperature of the mix. This can help to maintain consistency of the mix as the when the temperature increases the concrete becomes less workable, hence more water is added to increase the slump. The temperature compensation is described in Chapter 8.

It should be noted that to maintain the water/cement ratio of the concrete the workability should be controlled using admixtures rather than by changing the amount of water added.

– – –

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

A: In order to calibrate a recipe then there must be a reasonable change in the sensor readings before and after the water addition. To achieve this, the Final Water addition should be at least 1/3 of the total water that is added. The difference between the wet and dry readings must always be greater than 5 unscaled units for the calibration calculation to work. A greater difference between the Dry Mix and Wet Mix Values will give a better calibration result.

– – –

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 8 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 batch controller?

A: For the Hydro-Control to work automatically with the batch control system, the required 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: The deviations 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 10 for more details.

– – –

Q: How do 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 where the admixture may affect the signal enough to require the recipe to be calibrated from a batch that has been run using 2-step water addition. See Chapter 8 for more details.

– – –

Q: My Hydro-Control VI 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 the recipe, system and control parameters. These can be transferred onto a USB Memory Stick by doing a Backup. The file can be emailed to Hydronix as an aid for diagnostics.

– – –

Q: My Hydro-Control VI 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 System, Recipe and Mix Log data can be downloaded from one Hydro-Control VI onto a USB Memory Stick and then uploaded to another unit. Therefore assuming that the damaged unit still switches on and has a functioning RS232 or USB port, then all the data can be transferred.

– – –

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 either be determined from a sample of the concrete at the end of the mix, or by calculating the amount of water in the mixer using the mix design parameters. It is important to ensure that the correct dry weight is entered into the recipe for the calibration.

– – –

Q: Does the Hydro-Control VI 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.

Appendix A 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 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 VI, 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 Overview 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 Chapter 8. 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 the OPTO LED should light up. Check wiring when 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	With the Hydro-Control VI powered on, check that 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.	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 boot-up	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	System Card will need replacing – Contact Hydronix for further information.

Appendix B 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 VI 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

The time taken for the Dry Mix, which is the first mix that occurs after the pre-wet water has been added.

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 moisture content of the material calculated as a percentage of moisture using the dry weight of the material.

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 the sensor is measuring moisture in. The material must be flowing and must completely cover the sensor's ceramic faceplate.

Moisture

The water held in the material. Moisture is defined in either dry weight or wet weight and is given as a percentage.

Pre-wet Water

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

Probe

See Sensor.

RS485

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

RS485 Address

As more than one sensor can be on a RS485 network together, the address determines which sensor is which. The sensors leave the factory set to address 16 by default.

Sensor

The sensor is the physical probe that is used to measure moisture in materials. The sensor consists of a stainless steel case containing the electronic components connected to a resonator which sits behind a ceramic faceplate.

Trim Water

This is an amount of water that is added to the mixer after the calculated amount has been added. This can be added manually by the operator or automatically from the recipe.

Unscaled

This is the raw value of the sensor, and is a value that changes linearly with the amount of moisture in the material being measure. It is pre-set in the factory for each sensor and is between 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 VI.

Wet Mix Time

This is the time taken for the wet mix which is the mix that occurs at the end of the mix after all the main water has been added.

Wet Weight Moisture

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

Appendix C 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
HD0455	Hydro-Control VI Users Guide
HD0412	Hydro-Mix VII User Guide
HD0215	Hydro-Probe Orbiter User Guide (Static Mounting)
HD0256	Hydro-Probe Orbiter User Guide (Rotating Mounting)

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