Engineering Note

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Title:	Hydro-Control IV firmware variants
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Summary:	This document describes the release history of Hydro-Control IV system firmware

Introduction

This note describes how the firmware in the Hydro-Control IV system has changed since the product was originally launched. In general, the Hydro-Control IV may be upgraded to the current standard by replacement of the system EPROM - this document will highlight where other modifications may be necessary. If in doubt, refer to your supplier.

Note that the Hydro-Control IV user guide may not match the current revision of firmware supplied. This situation is particularly true where new issues have been made to support additional languages as in this instance a revision to the user guide will not normally be made.

To simplify reading this, the most recent changes made for current releases are document first, followed by a history of earlier revisions.

Identification of firmware version - Operator terminal

The Hydro-Control IV will display the current version of firmware installed for a few seconds when power is applied. This will be of the form HS0012 Vx.xx where...

HS0012	is a Hydronix firmware product code for Hydro-Control IV operator terminal models with hardware revision letters A, B or C.
HS0019	is a Hydronix firmware product code for Hydro-Control IV operator terminal models with hardware revision letters D or above.
Vx.xx	is the version number of the firmware, x.xx being substituted accordingly

The first digit of the version number will only change where major new features have been added to the system and incompatibilities may result. The digits after the decimal point indicate that minor features have been added and/or error corrections have been made.

Identification of firmware version - Input/output unit

The input/output unit contains a microcontroller with built in EPROM memory. The identification of this part may be made by reference to the attached label. In this case, the relevant numbers are...

HS0013	Hydronix firmware product code.
Vx.xx	Version number of the firmware.

The version number of the operator terminal and input/output unit will in general be different.

HS0012 & HS0019 - Operator terminal firmware current release - V3.02 – 11/11/99

Remote recipe selection
Incorrect operation of remote recipe selection corrected.
Setting Recipe source to HC4 Binary option to select up to 4 recipes remotely using the two digital inputs of the HC IV.

HS0012 & HS0019 - Operator terminal firmware current release - V3.01 – 11/10/99

Polish Language
Polish language option added

German Language
Minor corrections made.

Auto Track
The Auto Track facility now has two sets of parameters allowing different limits to be set for the dry mix and wet mix cycles.

Remote recipe selection
Option to select up to 4 recipes remotely using the digital inputs of the HC IV.

Keypad function changes

 Hand key renamed ''Manual hold''. Toggles between Manual hold mode and Automatic.

 Automatic key renamed ''Water Addition''. Toggles between Automatic, Preset and Two point calibration modes of water addition.

 Water trim key has added functionality when in Preset or Two point calibration mode. Allows the operator to set the pre-set water volume.

 Calibration key has added functionality when in Two point calibration mode. Allows the Two point Calibration Water amount to be adjusted.

Calibration
Changes made to calibration methods to improve performance of the system for wet cast products.

A "Two Point Calibration" method has been added to the water addition method. This simplifies the calibration process when the system is used in Wet Mix applications or when Admixes are used.

There are now three methods of calibration.

- Automatic. Dry cast and Block products **without** colour or additives. The user selects a "good mix" from the mix log for a batch that produced the correct product and presses the calibrate button. No other action required.
- Preset   Dry cast and Block products **without** colour or additives. Used when a new recipe is being configured for the first time to "teach" the HC IV the new mix design. Also used as an emergency backup mode in the event of damage to the sensor. The system adds a set amount of water to the mix and records the effects of the water addition in the mix log. When the correct

amount of water has been added, the "good mix" can be calibrated by selecting batch record from the mix log and pressing the calibrate button. No other action required. The Hydro-Control IV can then be set to run in Automatic.

- Two Point calibration.   Dry cast and Block products **with** colour or additives, where the HC IV admix 1 and/or 2 control signals are used, and **wet cast** with or without additives. This mode is essentially the same as Preset mode except the Hydro-Control IV adds the water in two amounts. The first water addition, Calibration water, is normally set at 50% of the Preset water but may be adjusted to any value up to the Preset water value.   The second water addition is then calculated by the HC IV as the Preset water value minus the calibration water. Admixes if used will be added to the mix during the second water addition.

The following calibration items have been removed:-

- Multipoint calibration and graphical displays.
- Quadratic calibration
- Two Shot water addition.
- Run Mix Cycle setup.

HS0012 - Operator terminal firmware previous release history…

V1.00 - 6/11/94

This has all the main features from the original specification included. These have been tested as far as possible and this version forms a working release for pilot systems.

It includes the main functions of the old Hydro-Control system except for thumbwheel selection and printouts.

RS232 control of recipe, weight, auto and preset water is possible, although reading end of mix data via RS232 is not.

Three options for end of mix signalling are included. These should satisfy most interfacing requirements.

Immediate (known) revisions required are...

1)   Additional signal processing options to deal with TEKA mixer problems.
2)   RS232 end of mix data request (* commands).
3)   RS232 configuration menu, and printer set-up.
4)   Report generation to printer.
5)   Support for remote recipes etc. using RS485 I/O.

V1.10 - 15/11/94

Introduces *Sel-Sync* facility as sensor type #3. This allows the detection of a mixer blade or similar 'sensor' event which is then used to synchronise a chain of readings. The parameters are set up in a sub-menu from the *Sensor Set-up* menu. This facility has been introduced in response to (1) in V1.00.

V1.11 - 17/11/94

RS232 receive auto % data now accepts 2 decimal places, but throws away the last digit. This maintains compatibility with the previous Hydro-Control system allowing existing clients driver software to work correctly.

Pass-code applied to hand-mode selection. This was introduced as a special requirement and will be selectable at some future release.

Improvements made to status displays to show current mode, trim etc.

V1.12, V1.12a - 28/11/94

Pass-code on hand mode disabled as standard - special release available (now identified by 'a' suffix on version number) if required.

V1.13B - 18/3/95

Beta version for Baumer exhibition only.

Includes support for German (translated by ORU Italy) and English languages with facilities for adding extra languages later.

V1.13 - 25/3/95

Now includes Italian language support translated by ORU Italy.

Remote recipe selection via second input/output rack added.

Error in alarms configuration menu fixed. This caused sensor fault and leaking water valve fault to be interchanged resulting in configuration changes apparently having no effect.

Error fixed relating to use of precision water meters where if set to less than 0.1L per pulse, small increments were ignored.

End of mix printout added as interim support for printer.

N.B. Remote recipe selection is only possible with input/output units fitted with HS0013 V1.01 or later and the operator terminal must be to revision B or later - refer to EN0002 for details of this requirement.

V1.14, V1.14a - 21/6/95

Includes Dutch (Flemish) language support translated by ECHO Engineering.

Synchronisation using sensor type 2 allows use of *Sel-sync* timing chain from an external 24Vdc input between terminals 14,16 on the operator terminal.

V2.00 BETA - 21.7.95

This is an interim release for evaluation pending full trials with a formal release expected mid August 1995. It includes most of the features of the planned release excluding water weighing.

Error corrections from previous versions

Entering automatic hold state now inhibits water valves. This was reported by ORU Italy. Note that this will still allow hand water to be added (if hand mode is selected).

Timed water addition

This has been added at the request of ORU. The flow rates for coarse and fine water valves are set up in the Water Setup menu in 0.1 litre per second steps.

Two-shot mixing

Two shot mixing facility added as per previous Hydro-Control model. This is setup in the Mixer control setup menu. The mix log data structure has also been modified to allow for extra data relating to two-shot mode.

Language selection

Languages which are not yet implemented have been commented out so that they do not appear on the menu.

Water trim

The limits on this have now been made variable to cater for different mixer sizes. The limit is set in the Mixer control setup menu.

Auto correction

If a mix is too dry at the end of a mix cycle, the operator is now given the opportunity to use an auto-correction method to add water to the mix. This recalculates the water target (including -ve values of operator trim), adds the water and then remixes. The result is again checked at the end.

Alarm log

Alarm log entries now include details of recipe/batch to which they refer.

Sensor signal processing

Variable results have been obtained using the sensor signal 'Sel-sync' processing method described in Version 1.10. Whilst performance has generally been good, mixer blade wear causes some difficulty in maintaining this performance.

The sensor signal processing has therefore been modified to use a filtering method based on taking a standard deviation of the most recent set of sensor readings as the basis for signal spike rejection.

The controlling parameter for this is referred to as 'Input sensitivity' in the sensor setup menu and is applied to sensor type number 3. Values around 10 would appear to produce good results - larger values allow more noise through whilst smaller values may lead to a completely static reading (which will trigger a sensor update alarm).

The results of this processing can be seen using the sensor capture display where each reading is indicated by a flag at the top of the display.

To see the effect of this filtering technique, a sample waveform from a sensor has been included in the EPROM and this can be used to simulate the input from the sensor. To try this, set sensor type to 3 and simulation mode to 1 in the sensor setup menu, and then employ the sensor capture display - you will see a waveform captured from a static pan mixer at a site in England. Varying the value of 'Input sensitivity' and restarting the sensor capture will allow you to judge the effect.

Sensor type 2 allows use of an external proximity switch as discussed earlier. This technique is referred to as external sync on the system and the series of timers associated with this is accessed through the external sync sub-menu. The sensor capture display can also be used to indicate the results of using this sensor type number.

Each sensor input processing technique always results in a 'voltage' being converted to a moisture value 10 times per second, using the standard filtering algorithm described in the manual - the sensor type simply indicates how and when the voltage value will be obtained.

A new alarm has been added which is triggered if either sensor type 2 or 3 does not produce a valid update within a pre-determined time which is programmed into the sensor setup menu. Note that for sensor type 2, this may indicate that the mixer has stopped rotating or that there is a broken proximity switch.

Remote recipe selection

A straight binary option has been added to reduce the number of digital I/O lines required to implement this function.

Mix data record output

A computer connected to the RS232 line may now request the results of the last mix by issuing the ASCII command character sequence *1 followed by a carriage return. This is compatible with earlier versions of the Hydro-Control but results in much more data.

The reply from the Hydro-Control IV is a series of numbers separated by commas in the following format...

rrr	Recipe number
bbbb	Batch count
aaaa	Aggregate weight
ttt.t	Auto water target from recipe
mmmm	Water mode (1 = preset, 2 = automatic)
aaa.a	Total water added
ddd.d	Dry mix moisture content.
www.w	Wet mix moisture content.
cc.cc	Water/cement ratio.
ttt.t	Operator water trim.
eee.e	Water error.
hhh.h	Water added by hand.
www.w	2nd shot water.
dddd	Dry mixing time.
wwww	Wet mixing time.
wwww	2nd wet mix time.
tttt	Total mixing time.
ffffff	Decimal number representing alarms which occurred in the mix.

The alarm flags field ffffff is a decimal number with values as follows...

1	Cement timeout
2	Admix 1 timeout
4	Admix 2 timeout
8	Mix cycle aborted
16	No water required
32	Reduced admix 1 rinse water
64	No admix 1 rinse water
128	Wet mix accepted
256	Wet mix rejected
512	Dry mix accepted
1024	Dry mix rejected
2048	Water meter fault

These individual values are combined to produce the value output.

Water valve operation

Coarse and fine valves no longer come on together during the coarse feed - only the coarse valve is used at this time. This has been done to allow the water feeds to come from different sources such as recycled and clean water. This should not have too much effect on existing systems, although potentially it will reduce the flow rate slightly during the coarse feed.

Data changes

Since the data structures have been changed for this issue, many of the data structures will be reset to default values when an upgrade is performed. You should therefore make a note of any important data before installing the new EPROM.

Future versions of the firmware will allow the battery backed data to be offloaded onto a PC which will in turn allow the data to be preserved between issues. Keep in touch with Hydronix for details of this facility.

Version 2.01 BETA - 2.8.95

Stability checking

Stability checking of the readings at the end of critical phases has now been implemented. This uses three parameters in the control menu...

Auto-track time	This is the time for which the stability is measured. Ideally, the time should include at least one full cycle of any low frequency variation in the sensor signal. Default is 10 seconds.
Auto-track deviation	This is used to determine whether the signal is 'stable'. A value of zero disables auto-tracking completely. Default value 0.25.
Auto-track lock	Not a very meaningful name, but determines how sensitive the tracking code is to changes in the input signal. The default value is 5 and should be left at this unless careful analysis of any effects is performed i.e. by reference to a set of captured sensor data.

When the sensor reading is deemed stable, the software interpolates the best value and shows this as a horizontal line across the trend display. The moisture reading on the main display also reflects this interpolated value when the reading is stable.

Status flags are recorded in the mix log at the same time as the unscaled inputs are logged. These flags are then used to determine whether calibration is allowed. The new flags are...

4096	Stable X1
8192	Stable X2
16384	Stable X3

Hand mode lock

To avoid having two sets of EPROMs for ECHO and the rest, I have introduced a simple lock onto the mixer control menu. When set, a pass code is required to access hand mode.

V2.02 BETA - 9.8.95

Some modifications have been made to improve the operator interface, particularly on plants where the recipe in use changes frequently.

Automatic adjustment of recipe preset value

The recipe preset value is now automatically adjusted according to the last automatic water quantity which produced an in-tolerance mix with stable sensor readings. This means that switching from automatic to preset mode will not cause a 'bump' due to the preset values being widely different from current conditions.

Unstable readings at end of dry-mix

Following on from the previous version, the control sequence has now been interlocked with the auto-tracking facility.
If the sensor reading is unstable at the end of the programmed dry-mix time, the dry mix will be extended until the reading becomes stable or the expired dry-mix time is twice the programmed value, whichever occurs first. In the latter case, a dry-mix time limit alarm is issued and the preset water quantity is used from the recipe instead.

This event is logged in the end of mix log flags as...

32768   Dry mix time limit exceeded.

New use of 'trim' facility

The trim key now accesses the 'trim' value in automatic water mode or the 'preset' value in preset water mode. The trim value is no longer applied in preset mode.

Pressing the trim key invites the recipe number to be selected. This allows the operator to ensure he is editing the value in the correct recipe. The previous method sometimes caused confusion when the recipe number was being changed by an external source.

Recipe 'Auto water enable'

This is a new recipe parameter which indicates that the recipe can be used with automatic water correction. If set to 0, then irrespective of the mixer control setup 'water method' parameter the recipe will always be made to preset water. This should aid commissioning new recipes as it allows automatic mode to be used selectively.

The 'auto water enable' is set to 1 whenever the calibration operation is performed successfully. Hence if the water method is already set to Automatic, performing a calibration on a recipe will immediately cause the next mix on that recipe to operate in automatic mode.

Sensor display scaling

The moisture values shown on the main status page were previously only scaled to a recipe's calibration values when a mix was started. The calibration values now become active during the 'waiting to start mix' phase and are updated whenever the recipe number is changed in this state. This allows the system to be used in a 'monitor mode' during commissioning and is in response to a request from ORU Italy.

Display updates

In order to provide better 'feedback' to the operator the display is now cleared on pressing a key to select a new display. Whilst this does not improve the redraw time of the main status display, it provides instant feedback on the key depression and will help prevent operators pressing keys several times. Display redraw times will be worked on separately in future versions.

V2.10 RELEASE - 15.8.95

Parameter sources

Trim source can now be set to KEYPAD, RS232 or RECIPE. If set to RECIPE, then the TRIM key is disabled from the operator level. The Preset source also behaves in this way.

RS232 usage

RS232 port usage now defaults to PRINTER, as this is the most common requirement.

End of mix report

End of mix report format now changed to include automatic pagination with headings applied to the top of each page. The column width made available by removing field descriptions to headings has been used to include additional data from the mix log, including the mix log flags which are printed as two 16-bit signed decimal integers (although held internally as a 32-bit integer).

Other reports

The following additional reports are included...
- Automatic reports on recipe, mix setup, sensor setup, water setup changes.
- Recipe printout on demand.
- Automatic alarm event printouts.

Due to the way in which 'option lists' are held internally, these will print out as numeric rather than string values. This may be changed later.

Foreign language support on most printed reports is now included if required, although special character mapping for Epson printers has not been checked and so some foreign messages may appear differently when printed.

Water weighing

Water weighing (negative method) now implemented. Requires an input/output rack capable of supporting analogue inputs - contact sales office for further details and availability.

This modified input/output unit redefines the spare input 8 as an output which is used to pre-fill a weighing tank to a preset level between mix cycles.

The water is then weighed out of the weigh tank using the standard coarse and fine water valves.

All other parameters remain the same, although the settling time may require adjustment.

The weigh scale is calibrated using the I/O diagnostic display and a two-point calibration method.

The input/output unit will accommodate most of the analogue input module types from OPTO-22 range, such as 0-10Vdc, 4-20mA, etc. Consult Hydronix sales for a list of available module types.

See also HS0013 revisions later in this document.

Remote link RS232 port capabilities

Water trim can now be adjusted using the serial link with a >T1=xx.x command format.

The current moisture content can be read from the serial link using a *2 command format. The reply gives the current moisture content, the unscaled input, and the sensor alarm flags in the following form...

        -nn.nn,-ll.ll,-fffff

where...

nn.nn   is the instantaneous moisture value.
ll.ll   is the instantaneous unscaled moisture value.

fffff   is a series of status flags including sensor fault alarms.

The software version identification string (as used at start up) can be accessed via the serial port using a *3 command. This will allow external software to identify changes in the HC-IV capabilities if required.

Unstable readings at end of wet-mix phases

The remainder of the control sequence has now been interlocked with the auto-tracking facility so that wet mix phases are now extended up to a maximum of twice the programmed time if the reading is unstable.

The result of this is reflected in additional mix log flags as indicated below. No operator alarms are issued in this case.

Mix data record output

The reply from the Hydro-Control IV to a *1 command has been modified slightly from the original format by the introduction of a second flags field, labelled FFFFFF below. The format for the flag fields now matches the end of mix printed report.

rrr	Recipe number
bbbb	Batch count
aaaa	Aggregate weight
ttt.t	Auto water target from recipe
mmmm	Water mode (1 = preset, 2 = automatic)
aaa.a	Total water added
ddd.d	Dry mix moisture content.
www.w	Wet mix moisture content.
cc.cc	Water/cement ratio.
ttt.t	Operator water trim.
eee.e	Water error.
hhh.h	Water added by hand.
www.w	2nd shot water.
dddd	Dry mixing time.
wwww	Wet mixing time.
wwww	2nd wet mix time.
tttt	Total mixing time.
ffffff	Decimal numbers representing alarms and other events which
FFFFFF	occurred in the mix.

The flags field ffffff is a decimal number with values as follows...

1	Cement timeout
2	Admix 1 timeout
4	Admix 2 timeout
8	Mix cycle aborted
16	No water required
32	Reduced admix 1 rinse water
64	No admix 1 rinse water
128	Wet mix accepted
256	Wet mix rejected
512	Dry mix accepted
1024	Dry mix rejected
2048	Water meter fault
4096	Stable X1
8192	Stable X2
16384	Stable X3

The flags field FFFFFF is a decimal number with values as follows...

      1   Dry mix time limit exceeded.
      2   Wet mix time limit exceeded.
      4   Wet mix 2 time limit exceeded.
      8   Correction wet mix time limit exceeded.

Splitting the flag fields in this way makes them more readable and generally easier to manipulate.

V2.11 RELEASE - 12.9.95

Following trials on wet-mixing systems, some minor changes have been made...

Signal processing

With sensor type 3 selected, it was possible for the system to interpret an extended period of unstable sensor readings as a stable control value, although an alarm would be indicated. This error has now been fixed.

Preset fall-back

In the event of a fall back to preset value when a stable sensor reading could not be obtained at the end of the dry mix period (see *Unstable readings at end of dry mix* in V2.02), the operator trim value would be mistakenly applied to the preset value from the recipe. This has been fixed. In fact the remainder of the mixing cycle is now completed in preset mode, rather than simply using the preset water value.

Mix Extension time

The facility to extend the mixing cycle times by up to a factor of 2 in the event of an unstable reading worked very well, but proved inflexible in determining the optimum setting for dry and wet mix times. A new parameter has been added to the mixer control menu to allow the extension time to be set in seconds, rather than being a simple multiple of the mixing time. This now allows a sensible value to be set for dry mix, say 20 seconds, whilst the mix extension time can be set to an equally appropriate value.

This parameter defaults to 20 seconds.

Printer resource locking

An error which could cause the system to 'hang' in the event of an alarm occuring whilst printing reports to the printer has been fixed. This was found to be a resource locking problem and would have first appeared in V2.10.

Audible alarm

The audible alarm output is now cancelled by a cycle reset.

V2.12 RELEASE - 19.9.95

US Customary units

US Customary units added. Selecting this at the language menu option causes system to operate in US Gals and lbs. This is done by altering % calculation by a factor of 835 in various places, since 1 US gal of water weighs 8.35 lbs.

The magic figures used here are...

      1 US Gal = 3.785412 litre.
      1 litre = 1 kg.
      1 lb = 0.45359247 kg

which gives 1 gal = 3.785412 / 0.45359247 lb = 8.3454 lb, rounded to 8.35lb in the system.

Language selection

Selection of US Customary units is performed in the Language Selection menu. Because this new facility changes the basic operation of the system, the language menu is now pass-code protected at the highest level..

Waveform simulation

Due to shortage of space in the existing EPROM, the simulation waveform duration has been cut. This will be restored in future versions.

RS485 interface

Serial communication libraries have been updated to allow the use of a two-wire RS485 interface to the input/output system, although 4-wire remains supported. Note that a 2-wire link can only be used with HS0013 V1.01 and above - see later.

Water meter alarm

This will now cause the water valves to be shut and remain shut until a reset signal is issued. This is to prevent a faulty water meter from flooding a mixer.

V2.13 - 25.9.95

Calibration calculation

Implementation of US Customary Units in V2.12 introduced an error into calibration calculation. Mixing cycles containing more than 32 litres of water cannot be used for calibration purposes. This has been fixed.

V2.14 - 2.10.95

U.S. Customary units

Some minor errors in displays have been fixed.

Sensor Trace facility

An option now exists to output the sensor signal via the RS232 serial port as a series of hexadecimal values which can be captured by a terminal program and turned into a hard copy graph. Sampling is performed at 100Hz.This facility is for research and diagnostic purposes only and in use the performance of the operator interface is degraded considerably, although overall control performance will be maintained.

V2.30 - 5/2/96

Water meter error

Water meter scaling values of the form x.xN litres per pulse where N is non-zero did not work correctly. Fixed.

Admix 1 time-out alarm

This could occur spuriously in earlier versions when water delivery time exceeded the admix timeout. Fixed.

Water fill disable facility

Setting water fill level to 0Kg now inhibits water fill output, allowing fill to be performed by external system using (say) level switches. However, this should be completed before end of dry mix period as tare value is recorded at this stage.

Water weighing calibration error

Original weighing code made erroneous offset calculation. Fixed.

Water weighing display error

When filling, -ve values less than -99.9Kg displayed incorrectly due to too small field width. Fixed.

Water meter alarm

Accepting the water meter alarm now causes a re-try, allowing the valves to re-open.

Display rounding

The moisture display on the status page was incorrectly rounded to 1 decimal place. Fixed.

Languages

Considerable work has been put in to tidy up Non-English languages. Thanks to all concerned.

V2.31 - 3/4/96

Two-shot mixing

An arithmetic error in earlier versions caused the quantity of first shot water to be modulus 65.5 litres i.e. the remainder after dividing by 65.5. The second shot water would have been adjusted appropriately. This error has been fixed.

Divide by zero

A divide by zero error, caused by setting the *Water Scale X1* and *X2* parameters to the same value has been fixed. Note that this error is not recoverable without clearing the battery backed memory and you should therefore not try to invoke this fault.

Fine water valve operation

A change made in version 2.00 (see later) prevented both coarse and fine water valves operating together. This has been found to cause problems with systems using *SERIES* valve configurations. To accommodate these configurations you can now set the *Fine water delivery* to a negative value which allows both coarse and fine valves to operate together, as with early versions of the firmware. For example, setting the value to -5.0 litres, will cause both valves to turn on during the coarse feed with the fine water valve remaining open for the last 5.0 litres.

Remote recipe selection

Some communications problems have been experienced when using the remote recipe selection facility. Symptoms include apparent 'lock-up' at the start of a mix cycle, coupled with a very high error rate on the RS485 diagnostic display. This has been tracked down to a communications timing problem and has now been fixed.

Factory default settings

A facility for resetting the configuration to factory defaults has been added. Currently this appears as a separate menu item accessed by an additional pass-code (31415) although this may change in future versions.

Cycle Start button

Some users have requested a cycle start facility from the HC-IV keypad. This has been implemented, although it is not recommended except perhaps for commissioning purposes.
The facility is enabled by setting the *Hand mode lock* parameter to a value of 2, after which soft key F5 will indicate a mix cycle start graphic when the status display page is active. You should disable this for normal operation.

Auto/Hand mode confirmation

Several users have suggested the removal of the confirmation boxes which appear when changing between hand and automatic mode. In response to these requests, these have now been removed and therefore 'hand' and 'auto' keys will change mode instantly. We believe that this simplifies the system for the operator and therefore this will be a permanent change.

RS232 Mix log dump facility

It is now possible to request a 'dump' of all the mix log records currently held in the system. This is achieved using a '*4' command (see RS232 section in the manual for general guidance).
The format of the log is as per '*1' command with the exception that the three unscaled sensor input values are appended to each record.
This will be documented completely in later versions of the operating guide.

V2.32 - 10/4/96

HS0019

Support for revision D operator terminal introduced.

V2.33 - 29/4/96

Display of pre-set water units

Sometimes the units (i.e. litres or gallons) displayed for pre-set water were incorrect. This has been fixed.

Internal changes

Some other internal changes have been effected to provide improved performance from the revision D operator terminal hardware.

V2.34 - 20/5/96

New language added. (No formal release made).

V2.35 - 31/7/96

Simulation waveform

This was inadvertently omitted in V2.32 and has now been reintroduced.

Digipot

Erratic behaviour noticed on some revision D operator terminals due to higher speed processor. This has been improved.

Demonstration EPROM

A demonstration/simulation program is now available which allows a PC to simulate a batching plant and moisture sensor. This communicates with the operator terminal via the serial port. A special EPROM is needed in the operator terminal to accept data from the PC in this way.

V2.40 - 19/2/97

Real time clock

Software support for real time clock now added. This allows time/date stamping of batch reports and mix log data.

RS232 capabilities

A new set of RS232 commands allows access to each item in the recipe and mix-log databases as follows…

- Read/write recipe database parameters (including calibration values).
- Read any mix-log record.
- Globally reset all recipes to pre-set water mode (reset 'Auto-Enable' flag).
- Change water mode (pre-set/automatic).

Improvements have been made to the RS232 diagnostic display.

Backup/restore utility

A set of DOS utilities are available to allow the entire contents of the operator terminal memory to be saved to and loaded from a PC disk via the RS232 port.

Default values

Some default values have been changed to improve initial system commissioning. These are indicated in the Hydro-Control IV User Guide.

Mix set-up cycles

The system has previously logged an incorrect value for 'Unscaled input 2' during mix set-up cycles. This only affects systems using admix control and has now been fixed.

The system will now wait for a stable reading during the first wet-mix of a mix set-up cycle. This was previously not the case and prevented calibrations being performed with such cycles.

Mix complete option

The hand mode 'reset sequence' facility has been extended to include an option to either 'complete' or 'abort' the current cycle. If the 'complete' option is chosen, a mix complete signal is issued. This has been included at the request of several customers.

Mix data record output

A new flag field has been added to signify mix set-up cycle first wet-mix time limit
The flags field FFFFFF is a decimal number with values as follows...

1	Dry mix time limit exceeded.
2	Wet mix time limit exceeded.
4	Wet mix 2 time limit exceeded.
8	Correction wet mix time limit exceeded.

Splitting the flag fields in this way makes them more readable and generally easier to manipulate.

V2.41 - 12/5/97

Beta test version of 2.42 but does not include changes to dry-mix hand water addition. Not formally released.

V2.42 - 19/5/97

Multi-point calibration method

Improvements to the calibration method now allow the results of several mix cycles to be combined to produce better overall performance and an extended working range. Calibration is now performed through a new graphical interface which allows both linear and quadratic methods This is described in full in engineering note EN0019.

Hand water

Hand water additions made during the dry-mix time are no longer treated as part of the water addition. This allows the system to be placed in hand mode during the dry-mix time and water to be added to help calibrate or test the system in automatic.

Recipe read/write commands

The recipe read/write RS232 commands will now return or set the first entry in the multi-point calibration table. No support is provided currently for accessing other points in this table.

V2.43 - 23/9/97

Spanish Language

Support for Spanish language added.

Maximum batch weight increased

The upper limit on batch weight numeric input has been increased to allow for large mixers operating in US Customary units.

V2.45 – 30/7/98

Japanese Language

Support for Japanese language added.

'Trap in Task 7 - Divide by Zero' error

Symptom: Setting the Trend display maximum and minimum values to the same setting would cause a divide by zero error to occur.

This problem has been fixed.

Water continues to be delivered after manual reset

Symptom: If the sequence was reset from the front panel during water delivery, the water control sequence would not be reset correctly and would open the water valves again the next time the system was placed in auto.

This problem has been fixed.

Alarm timers continue to run in Automatic Hold

Symptom: When the system is dropped into Automatic Hold, Cement and Admix timeout timers may continue to run, leading to an alarm condition.

This problem has been fixed. Using Automatic Hold will now drop out the call outputs and freeze the alarm timers, which will run again when the Start Mix input is next raised.

N.B. The HC-IV will NOT take action on Cement or Admix Done inputs whilst in Automatic Hold mode. Automatic Hold is a legacy operation from earlier versions of Hydro-Control and should preferably not be used on new systems.

Alarm configuration not saved/restored with backup/restore utilities

Symptom: The alarms configuration database is not saved to disk when the 'backup' utility is used.

The problem was fixed in version 1.1 of the utility software (available on www.hydronix.com) which must be used in conjunction with firmware releases 2.43 or above. This change was inadvertently omitted from the previous version of this engineering note.

Sequence may hang when using Admix 1 with small amounts of water

Symptom: The HC-IV may stop in the 'Adding main water' state if you are using Admix 1 and only a small quantity of water is required.

The HC-IV calculates the required water from the moisture value in the dry mix, then subtracts Admix1 rinse water from this value. If the resulting number is zero or < 0, then zero is assumed. The water addition control sequence in this case was not being initiated - hence a hang up occurs with the 'Adding main water' message displayed.

This situation would only arise when using Admix1 and when the programmed admix rinse water is greater than or equal to the required water addition, which may occur when the dry material moisture content approaches the final water target.

This problem has been fixed.

Spurious Admix1 timeout alarms and sequence hang up

Symptom: An Admix1 timeout alarm is generated during the main water addition phase. Introducing an Admix1 Delay may affect the alarm, but only masks the symptoms of incorrect operation.

Cause: This alarm occurs when the system did not receive the Admix1Done input in response to the call. The HC-IV is intended to operate this way.

Explanation: When the Admix1 Call comes on, the HC-IV starts a timer (Admix 1 Timeout) waiting for the Admix1Done input. The timer runs whenever the call is on and the input is off. If the control system simply pulses the Admix1Done input during the water addition phase, then the timer will continue to run after the input is removed. If the water addition phase is sufficiently long, then the timer can expire and the alarm will occur.

The Admix1Done input is not latched by the HC-IV and is only examined during the 'Waiting For Admix 1' state - consequently, if the input has been removed by this time the system will hang, although the cause will be obvious from the message displayed.

Workarounds:
(1) Introducing an Admix1Delay will move the admix addition period, and its associated alarm timeout, relative to the water addition. If the delay is sufficiently long, then the water addition will complete before the admix and consequently the HC-IV will be ready to accept the Admix1Done input before the timeout occurs. However, variability in the water addition or admix addition times will result in spurious errors.

(2) The method of using pulsed inputs is not desirable from a control point of view since it relies on a specified response time from the HC-IV. The HC-IV design relies on a true handshake between the 'call' output and the corresponding 'done' input. This is true of cement and admix calls. The control system, when acknowledging a 'call' should leave the corresponding 'done' signal active until the call has been removed by the HC-IV.

(3) A modification has been made in V2.45. This now latches the Admix1Done input at the appropriate time and removes the call, making the sequence reasonably robust to pulsed Admix1Done inputs, although this is not the preferred approach for the reasons given earlier.

V2.47 – 17/9/98

Japanese Language

Minor corrections made to Japanese language.

Dutch Language

Additions and corrections made.

Calibration

Options on calibration modes now available to meet customer preferences. These are selected using the Hand Mode Lock parameter as follows…

The Hand Mode Lock parameter (Mixer control setup) now operates as a bit field, rather than a simple numeric value. Each bit has the following significance…

Bit	Operation
0	**0**: Hand mode can be selected from front panel. **1**: Hand mode cannot be selected.
1	**0**: Cycle start cannot be issued from soft-key. **1**: A cycle start soft-key will appear on the default display. This is for diagnostic purposes only and is not intended to be enabled during normal operation.
3,2	**00**: Multi-point calibration operation enabled. **01**: Single point calibration operation. New calibration values will overwrite old ones & the system functions essentially as at version 2.40. The graph (straight line) is displayed, but no other options are available.

	10: Multi-point calibration, but first calibration set (wet and dry points) are not removed as newer points are added. This allows the first set of points to be used as an 'anchor' for the calibration and gives some manual control over the quadratic function in particular. The intention is for this to be used to establish a very dry working point when there is no real information available. **11**: Undefined – do not use.
15 through 4	Currently unused – set to zero.

The first set of calibration data is now editable via the recipe, as per versions 2.40 and earlier.

The Hand Mode Lock parameter has been adopted for this purpose since…
It is very infrequently used, and therefore has very little effect on customers.
Avoiding the addition of new parameters also avoids the requirement to update utility software since all data structures remain the same size.

Graphics redraw error in calibration function

Symptom: Introducing new calibration values might cause the display to lock up until the system is reset. All other functions appear normal.

This has been found to be a data related problem and has been fixed.

Cannot set a –ve tolerance value from RS232 port

Symptom: Sending a command to set the negative tolerance for a recipe resulted in a positive value being set.

This has been found to be a message processing error and has been fixed.

Millennium compliance

All data records output by the system now generate the year in four digit format. All values are still maintained internally to two digits, so internal storage is not affected. The year 1990 is assumed to be the wrap-around year, so that year numbers below 90 are assumed occur after the millennium. Note that this may affect external systems which make use of the data. RS232 requests which access the mix log data will need to process four digit year information accordingly.
Setting the real-time clock from the front panel still uses two digits and its operation should be obvious.

Sensor trace function now stops at 128 seconds

When multi-point calibration was introduced in version 2.43, sufficient memory for 10 calibration sets per recipe together with associated calibration coefficients was required. This is approximately 24K bytes. To accommodate this, the sensor trace buffer had to be shortened accordingly. This fact was not documented in earlier engineering notes.

HS0013 - Input/Output unit firmware current release - V2.01 - 8 /7/96

Some digital filtering applied to inputs to improve EMC performance.

Compatibility issues

The following table summarises compatibility issues across the components in the Hydro-Control IV system. The table does not include all options or revisions, simply those which are interdependent. In general, unless the specific facility is mentioned below, other combinations of hardware and firmware will be compatible, but if in doubt, please check the preceding notes for guidance or contact Hydronix technical support.

FACILITY	OPERATOR TERMINAL REVISION				INPUT/OUTPUT REVISION			
	A	B	C	HS0012	A	B	C	HS0013
High speed water counting				N.A.				V1.01
Remote recipe selection				V1.13 (no binary)				V1.01
2-Wire RS485				V2.12				V1.01
Water weighing				V2.30				V2.00

Upgrading

In general, it will be possible to upgrade any of the items in the above table to the current issue. Hardware revisions will generally necessitate a return to Hydronix. Contact Hydronix for guidance.

HS0013 - Input/Output unit firmware previous release history

V1.00 - 13/10/94

Initial release. Cannot be used on a multi-drop RS485 link as the RS485 transmitter is not turned off when idle. Supports basic input/output unit facilities only with DIP switch settings of...

1	ON
2	OFF
3	OFF
4	OFF
5	ON
6	OFF
7	OFF
8	OFF

V1.01 - 25/3/95

Provides higher speed counting of water meter pulses (up to 100Hz with fast Opto-22 input module) in basic input/output configuration.

Now supports multi-drop RS485 use, allowing support for remote recipe selection.
Can be switched to use as remote recipe selection unit by setting DIP switches according to...

INPUT / OUTPUT UNIT		REMOTE RECIPE UNIT	
1	ON	1	OFF
2	OFF	2	ON
3	OFF	3	OFF
4	OFF	4	OFF
5	ON	5	OFF
6	OFF	6	ON
7	OFF	7	OFF
8	OFF	8	OFF

N.B. Units fitted with V1.01 firmware or later must be used in conjunction with an operator terminal of hardware revision B or later which includes 'fail-safe' line biassing resistors - see EN0002 for further details.

V2.00 - 1/1/96

Includes support for water weighing by redefining channel 8 as an output. If the water weighing facility is required, then the input/output unit must also be built to revision B or later to provide the analogue input
module support. See also *Water Weighing* in HS0012 release 2.0 earlier in this document.