Engineering Note: EN0048 Using a Hydro-Probe with the Eagle Batch System

Summary:	Using the Hydro-Probe with the Command Alkon Eagle Batch System
Products affected:	HP02, HPXT, HP04, XT02 only
Revision Date:	November 2014 Author: Keith Legg

Summary

The Hydro-Probe is a versatile digital moisture sensor. It can be connected to a PC to calibrate and suit the equipment it is connected to. It is therefore possible to connect a Hydro-Probe to the Command Alkon Eagle batching system, in place of a Command Alkon moisture sensor.

In general Command Alkon moisture sensors and older Hydronix sensors (Hydro-Probe I - HP01) have been interfaced to the Eagle system through either a Command Data 'CDI View', or a Hydronix Hydro-View II unit. These methods are both described in this engineering note, together with how the Hydro-Probe can be interfaced directly to the Eagle system.

The engineering note is separated into three sections as follows:

Option A: Interfacing the Hydro-Probe directly to the Eagle system.
Option B: Interfacing the Hydro-Probe to the Eagle system using the Hydronix Hydro-View II unit.
Option C: Interfacing the Hydro-Probe to the Eagle system using the Command Data CDI View unit.

Each option is split into the following four sections:

1 Connection to the Eagle system

2 Configuring the Hydro-Probe sensor

3 Matching the output to the Eagle system

4 Material calibration

Note: All references to hydro-Com in this engineering note refer to software versions up to v1.8.0. For later versions please refer to the appropriate user guide for details.

1   Connecting a Hydro-Probe to a PC

With the use of a converter it is possible to connect a Hydro-Probe to a PC. Hydronix have two types of converter available which will convert the RS485 to the relevant port on the PC. The SIM01 converter is a RS485-USB converter and the K2-ADE converter is a RS485-RS232 converter. For more information please refer to the relevant sensor user guide.

Specially written for basic diagnostics, configuration and material calibration, the 'Hydro-Com' software can be freely downloaded from http://www.hydronix.com

2 Option A: Interfacing the Hydro-Probe directly to the Eagle system

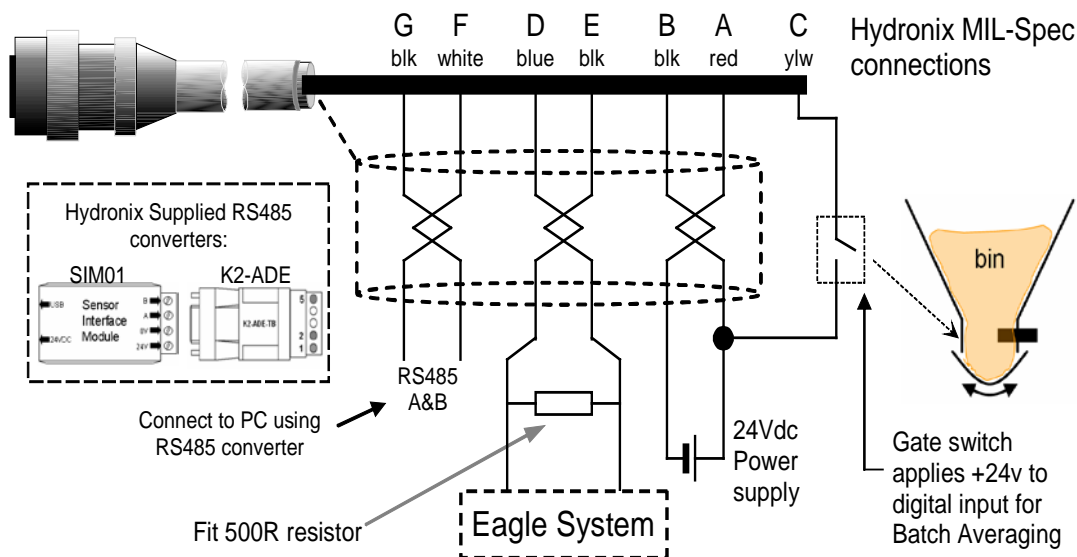### 2.1 Connection to the Eagle System

The Hydro-Probe is connected to the Eagle system directly.

It is recommended that a separate 24Vdc supply is used to power the Hydro-Probe. This supply should be capable of supplying up to 200mA operating current per sensor with 1A start-up.

New shielded/twisted pair cables should be installed and brought back to the control room. The analogue wires should then be connected to the Eagle system. The RS485 wires should be connected to a suitable RS485 converter, for conversion to either RS232 or USB, into a PC for sensor configuration and material calibration.

It is also very important that a normally open switched input is used to establish the start/stop periods for batch averaging. This can be derived from the batch controller or a bin gate-switch as illustrated below. This will then switch the 24Vdc average/hold digital input to the Hydro-Probe. Here sensor readings are sampled and averaged until the gate closes, which switches the sensor back into static mode where the average reading is held constant.
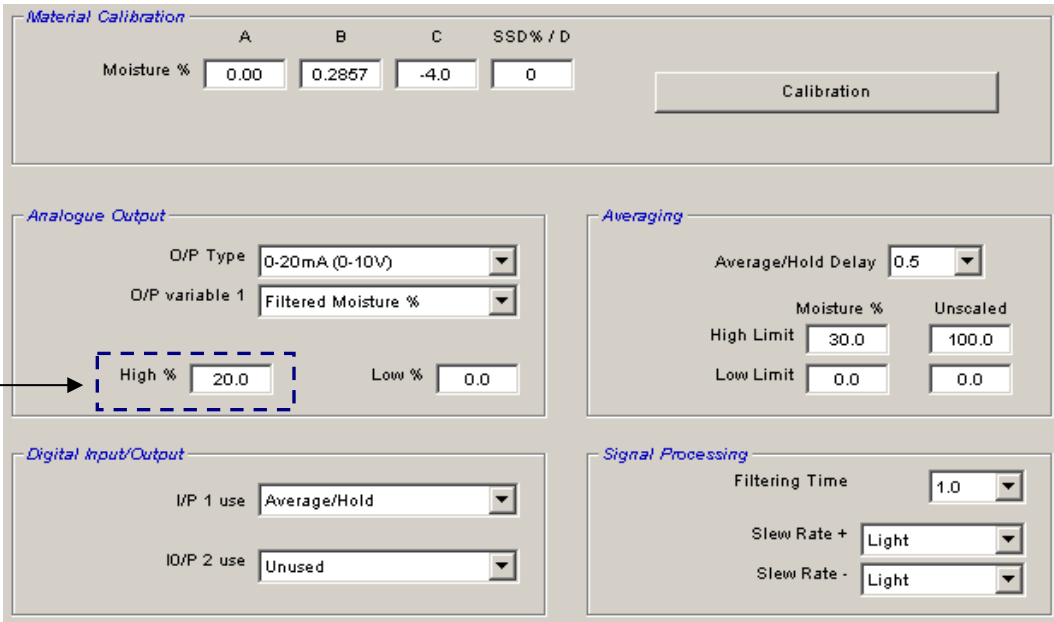
> *Important: The Hydronix supplied 500-Ohm resistor must be wired as shown, to convert the current loop output to the required voltage input.*

Hydronix Sensor Cable (Part # 0975)				Connect To:
Twisted Pair #	**MIL-Spec pins**	**Cable colour**	**Signal Description**	
1	A	Red	+15-30Vdc	24Vdc power supply
1	B	Black	0V	
2	C	Yellow	1st digital input	N/O relay to signal start/stop of batching
3	D	Blue	Analogue Positive (+)	Eagle System
3	E	Black	Analogue Return (-)	
4	F	White	RS485 A	PC com port using RS485 adapter
4	G	Black	RS485 B	

2.2   Configuring the Hydro-Probe

With the sensor correctly connected to the PC and detected on Hydro-Com, go to the 'Configuration' page and check the configuration is set to the following:

See section 2.3 to set this value

Note: The A, B, C, SSD values will change once the sensor is calibrated to the material.

2.3   Matching the output to the Eagle system

The Eagle system needs to be configured to display a moisture value in the range 0-10%, for a given voltage input range, which can be either 0-5Vdc or 0-10Vdc. For this, the Hydro-Probe moisture- voltage output range needs to be matched to the Eagle voltage-moisture input.

If possible, determine the voltage range of the analogue input card in the Eagle panel.

2.4 Material Calibration

To obtain an accurate moisture output from the sensor, it will be necessary to calibrate the Hydro-Probe to the material. This is carried out and stored inside the sensor.

The calibration correlates Unscaled readings made by the sensor, to the actual moisture of the material, determined in the laboratory by drying samples. The calibration calculates a set of coefficients which are stored in the sensor and used to output actual moisture. These coefficients are determined using the calibration page in the Hydro-Com software.

The Hydro-Com calibration page is accessed from the configuration page. For full details on the material calibration using Hydro-Com, refer to the appropriate Hydro-Com user manual.

Note that if free moisture is required the SSD moisture should be filled in with the appropriate absorption moisture of the specific material.

The Following are Examples of the Command Alkon Version 8.7X screens and an overview from their manual.

NOTE: The Following Screen ONLY appears if you have enabled the Probe Option. Contact Command Alkon for the necessary Licenses and or Hardware needed to do this.

Before Calibrating the Computer to the Probes you must first fill out the information on the probe configuration Menu. Once you have set up the gates and Materials on the Moisture Configuration Menu, You are ready to calibrate the Computer to the Probe Output.

2.4.1 To Calibrate the Hydro-Probe Analogue Output to the Computer

Using the Arrow to the Left of the Scale Input Column, Select the Probe you want to Calibrate.

If the voltage input range is 0-5Vdc:

- Using the Hydro-Com software, go to the 'Configuration' page and set the 'High %' to 40% and press the 'Write' button.
- Using the Hydro-Com software, go to the 'Diagnostics' page and press the 'Analogue Output Test' button. This will enable the user to force the Hydro-Probe current loop output to a fixed value.
- Force the output to 0mA using the '0mA' button. Then set the low value (F1) in the Eagle to   0%.

```
                         Low Probe Calibration


Esc to exit                           Enter probe reading  0.0 %
```

- Using the slider force the output to 5mA. The set the high value (F2) in the Eagle to 10%

```
                        High Probe Calibration


Esc to exit                           Enter probe reading  10.0 %
```

- Press F5 to Enter this Configuration.

If the voltage input range is 0-10Vdc:

- Using the Hydro-Com software, go to the 'Configuration' page and set the 'High %' to 20% and press the 'Write' button.
- Using the Hydro-Com software, go to the 'Diagnostics' page and press the 'Analogue Output Test' button. This will enable the user to force the Hydro-Probe current loop output to a fixed value.
- Force the output to 0mA using the '0mA' button. Then set the low value (F1) in the Eagle to   0%.

```
                         Low Probe Calibration


Esc to exit                           Enter probe reading  0.0 %
```

- Using the slider force the output to 10mA. Then set the high value (F2) in the Eagle to 10%.

```
                    High Probe Calibration

Esc to exit                      Enter probe reading  10.0  %
```

- Press F5 to Enter this Configuration.

2.4.2   ADDITIONAL Eagle Software Initial Setup Information:

2.4.2.1   Scale Input

Plant Setup Scale Configuration Screen.

```
Agg       0 Lb   Ready·················································Demo·   Admix
Cem       0 Lb   Ready·················································Demo·
Water     0 Gal  Ready                                                      Ready

Scale    Type of   unit/grad    Full
Input    Material  Lb    kg     Scale

  1        Agg      40    18    40000
  2        Cem      10     5    10000
  3        Wat       5     2     5000
  4                  0     0        0
  5                  0     0        0
  6                  0     0        0



                    DEMO Scale Calibration Menu
                          F6  = DEMO Calibrate all scales


F5  = EDIT Scale Configuration      F10 = RETURN to Plant Setup Menu
                                                              3:33 AM
```

The same Scale inputs you have in your Probe Calibration Screen are the same 6 inputs used in the Scale configuration Screen. The Scale input used above cannot be used for Moisture Probes. By looking at the above example you will see that Scale Channels 1,2, and 3 are being used as Scales and are not available for use as Moisture Probe interface channels.

2.4.2.2   Gate

Enter the number of the Bin Gate which the Probe is in.

2.4.2.3   Material

This is automatically entered as you select the Gate Number. Press the <Page Up> or <Page Down> to display each Material name. Once Selected Hit <Enter>

2.4.2.4   Moisture

The Moisture of the Material in Percentage.

2.4.2.5   Count

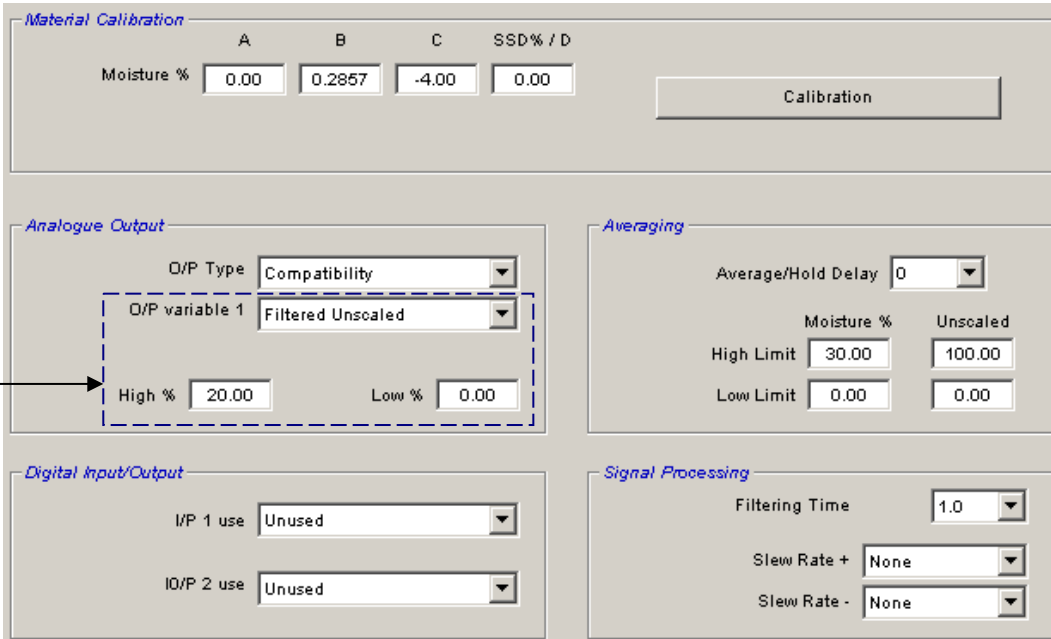This is the Raw Counts from the Eagles Analogue to Digital Converter.

3 Option B: Interfacing the Hydro-Probe to the Eagle system using the Hydronix Hydro-View II.

This engineering note is not designed to provide user details on the Hydro-View. For full user information on the Hydro-View II please refer to the Hydro-View II User Guide HD0022.

Note: This connection configuration is only available for sensor with the compatibility output facility (HP02, HXPT). All other Hydro-Probe versions are not suitable for this connection method.

3.1 Connection to the Eagle System

The Hydro-Probe is connected to the Hydro-View II as detailed below.

New shielded/twisted pair cables should be installed and brought back to the control room. The analogue return and the sensor supply should then be connected to the Hydro-View.

The RS485 wires should be connected to a suitable RS485 converter, for conversion to either RS232 or USB, into a PC for sensor configuration and material calibration.

It is also very important that a normally open switched input is used to establish the start/stop periods for batch averaging. This can be derived from the batch controller or a bin gate-switch as illustrated below. This will then switch the 24Vdc (provided from the Hydro-View) input into the Hydro-View for the average/hold facility. Here sensor readings are sampled and averaged until the gate closes, which switches the Hydro-View II back into static mode where the average reading is held constant.

Important: The Hydronix supplied 500-Ohm resistor must be wired as shown, to convert the current loop output to the required voltage input.

Hydronix Sensor Cable (Part # 0975)				Connect To:
Twisted Pair #	MIL-Spec pins	Cable colour	Signal Description	
1	A	Red	+15-30Vdc	Hydro-View Pin 1
1	B	Black	0V	Hydro-View Pin 2
3	D	Blue	Analogue Positive (+)	Hydro-View Pin 4
3	E	Black	Analogue Return (-)	Hydro-View Pin 5
4	F	White	RS485 A	PC com port using
4	G	Black	RS485 B	RS485 adapter

Hydronix Hydro-View II		Connect To:
Pin	Signal Description	
6	Analogue Out –	Eagle
7	Analogue Out +	System

3.2   Configuring the Hydro-Probe

When a Hydro-Probe is connected to a Hydro-View, the output type of the sensor must be set to 'Compatibility'.

With the sensor correctly connected to the PC and detected on Hydro-Com, go to the 'Configuration' page and check the configuration is set to the following:

In Compatibility mode these parameters have no effect

3.3 Matching the output to the Eagle system

The Eagle system needs to be configured to display a moisture value in the range 0-10%, for a given voltage input range of either 0-5Vdc or 0-10Vdc, i.e. the moisture-voltage output from the Hydro-View II needs to be matched to the voltage-moisture input in the Eagle.

This voltage input range is determined by the Eagle panel which will need to be established.

If the voltage input range is 0-5Vdc:

- On the Hydro-View II, enter the main menu and scroll down to 'Access Code'. There are multiple codes that can be used, for example code 100. Scroll down to the menu item 'Output Setup', and ensure the following parameters are set to: 'Minimum %' = 0.00, Maximum %' = 40.00

The next step is to force the Hydro-View II voltage output to a fixed output in order to set the input moisture required on the Eagle system.

- *Forcing the Hydro-View II output to 0V (0%):* From the main menu enter 'Output Setup'. Set the 'Calibrate %' parameter to 0% and the 'Variable' parameter to 'CALIBRATE'. Exit the menu and update the settings. This will force the voltage output to represent a voltage relating to 0%, i.e. 0V. Then set the low value in the Eagle to 0%.
- *Forcing the Hydro-View II output to 5V (10%):* From the main menu enter 'Output Setup'. Set the 'Calibrate %' parameter to 5% and the 'Variable' parameter to 'CALIBRATE'. Exit the menu and update the settings. This will force the voltage output to represent a voltage relating to 10%, i.e. 5V. Then set the low value in the Eagle to 10%.

This will have set the Hydro-View II to output the correct voltage for a given moisture, and the Eagle to display the correct moisture for a given voltage input.

Return to normal operating mode by setting the 'Variable' parameter (in the 'Output Setup' menu) back to its original setting. As a guide this would be set to either:

'AVERAGE' If using a switched input to the Hydro-View for batch averaging (preferable) as shown in section B2.

'NOW' If no switch is used for batch averaging.

If the voltage input range is 0-10Vdc:

- On the Hydro-View II, enter the main menu and scroll down to 'Access Code'. There are multiple codes that can be used, for example code 100. Scroll down to the menu item 'Output Setup', and ensure the following parameters are set to: 'Minimum %' = 0.00, Maximum %' = 20.00

The next step is to force the Hydro-View II voltage output to a fixed output in order to set the input moisture required on the Eagle system.

- *Forcing the Hydro-View II output to 0V (0%):* From the main menu enter 'Output Setup'. Set the 'Calibrate %' parameter to 0% and the 'Variable' parameter to 'CALIBRATE'. Exit the menu and update the settings. This will force the voltage output to represent a voltage relating to 0%, i.e. 0V. Then set the low value in the Eagle to 0%.

- *Forcing the Hydro-View II output to 5V (10%):* From the main menu enter 'Output Setup'. Set the 'Calibrate %' parameter to 10% and the 'Variable' parameter to 'CALIBRATE'. Exit the menu and update the settings. This will force the voltage output to represent a voltage relating to 10%, i.e. 5V. Then set the low value in the Eagle to 10%.

This will have set the Hydro-View II to output the correct voltage for a given moisture, and the Eagle to display the correct moisture for a given voltage input.

Return to normal operating mode by setting the 'Variable' parameter (in the 'Output Setup' menu) back to its original setting. As a guide this would be set to either:

'AVERAGE'   If using a switched input to the Hydro-View for batch averaging (preferable) as shown in section B2.

'NOW'   If no switch is used for batch averaging.

3.4   Material Calibration

To obtain an accurate moisture output from the sensor, it will be necessary to calibrate the Hydro-Probe to the material. This is carried out and stored in the Hydro-View.

The Hydro-View measures the Unscaled voltage from the sensor, and then scales this to actual moisture of the material, determined in the laboratory by drying samples, The 0-10V output of the Hydro-View which is then connected to the Eagle gives a direct reading of moisture

Follow the instructions on the Hydro-View user guide HD0022 to calibrate the Hydro-Probe to the material.

It is very important that both low and high points are derived from actual batching, and that no 'bucket tests' are used.

Note also that if free moisture is required the SSD moisture should be filled in with the appropriate absorption moisture of the specific material.

4 Option C: Interfacing the HP02 to the Eagle system using the Command Alkon CDI View
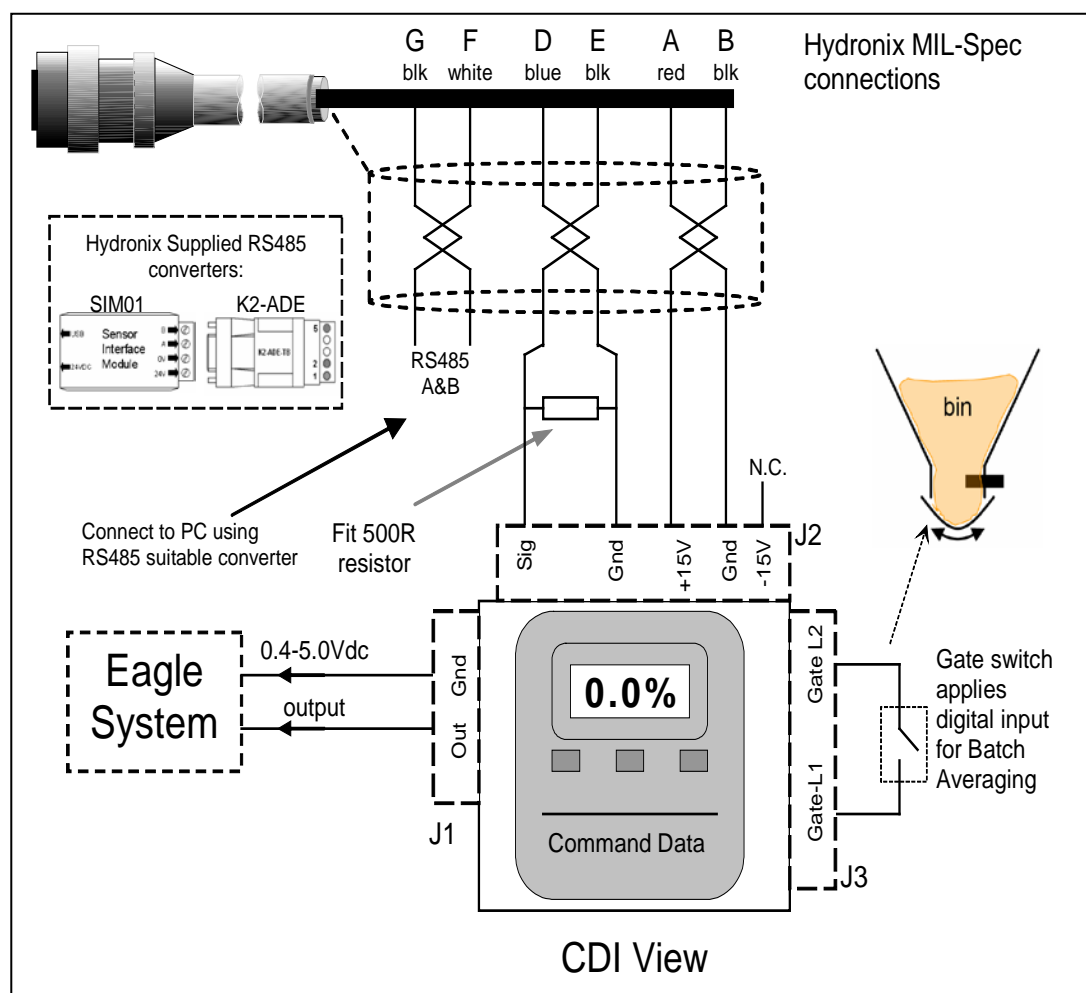
This engineering note is not designed to provide user details on the Command Data CDI View. Please refer to the CDI View Manual for full information.

4.1 Connection to the Eagle System

The Hydro-Probe is connected to the CDI View as detailed below. New shielded/twisted pair cables should be installed and brought back to the control room. The analogue return and the sensor supply should then be connected to the Hydro-View. The RS485 wires should be connected to a suitable RS485 converter, for conversion to either RS232 or USB, into a PC for sensor configuration and material calibration.

It is also very important that a normally open switched input is used to establish the start/stop periods for batch sampling. This can be derived from the batch controller or a bin gate-switch as illustrated opposite. This will then switch the Gate Open HOT forcing the CDI View into dynamic mode. Here sensor readings are sampled and averaged until the gate closes, which switches the CDI View back into static mode where the average reading is held constant.

Important: The Hydronix supplied 500-Ohm resistor must be wired as shown, to convert the current loop output to the required voltage input.
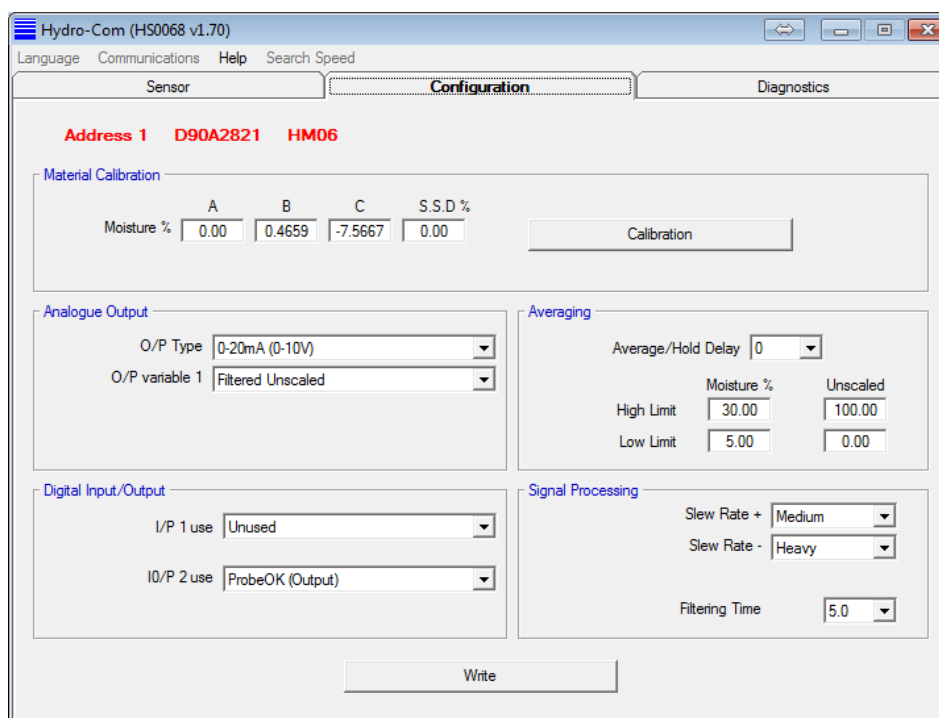
Hydronix Sensor Cable (Part # 0975)				Connect To:
Twisted Pair #	MIL-Spec pins	Cable colour	Signal Description	
1	A	Red	+15-30Vdc	CDI View, Terminal J2, +15V
1	B	Black	0V	CDI View, Terminal J2, GND
3	D	Blue	Analogue Positive (+)	CDI View, Terminal J2, SIG
3	E	Black	Analogue Return (-)	CDI View, Terminal J2, GND
4	F	White	RS485 A	PC com port using
4	G	Black	RS485 B	RS232-485 adapter

CDI View		Connect To:
Pin	Signal Description	
J1, OUT	0.4-5.0V Output	Eagle
J1, GND	0.4-5.0V Output	System

4.2   Configuring the Hydro-Probe

When a Hydro-Probe is connected to a CDI View, the output type of the sensor must be set to 'Filtered Unscaled'.

With the sensor correctly connected to the PC and detected on Hydro-Com, go to the 'Configuration' page and check the configuration is set to the following:

4.3 Matching the output to the Eagle system

The CDI View must be configured to work with the Hydronix sensor. This is done in the sensor selection setting ('PrbE') within the system menu. Setting 'PrbE' to 0000 will set the system to read Hydronix sensors.

4.4 Material Calibration

To obtain an accurate moisture output from the sensor, it will be necessary to calibrate the Hydro-Probe to the material. This is carried out and stored in the CDI View.

The CDI-View measures the unscaled voltage from the sensor, and then scales this to actual moisture of the material, determined in the laboratory by drying samples, The 0.4-5V output of the CDI-View which is then connected to the Eagle gives a direct reading of moisture.

Follow the instructions on the CDI View Manual to calibrate the Hydro-Probe to the material.

It is very important that both low and high points are derived from actual batching, and that no 'bucket tests' are used.

Note also that if free moisture is required the SSD moisture should be filled in with the appropriate absorption moisture of the specific material.