# Hydronix Moisture Sensor
# Electrical Installation Guide

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|---|---|
| To re-order quote part number: | HD0678 |
| Revision: | 1.7.0 |
| Revision date: | Feb 2023 |

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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 | Date | Description of Change |
|---|---|---|
| 1.0.0 | Feb 2015 | First Release |
| 1.1.0 | May 2015 | Sensor Cable Product Number Changed |
| 1.2.0 | March 2016 | Sensor Interface References updated |
| 1.3.0 | March 2017 | Non-Mil Spec Sensor details added (Change to permanently wired sensor details added) |
| 1.4.0 | Nov 2017 | Update sensor Model Numbers |
| 1.5.0 | Dec 2021 | Cable Specification<br>Address update |
| 1.6.0 | Feb 2022 | Added I/O Protection section<br>Termination Resistor installation added |
| 1.7.0 | Jan 2023 | Added Hydro-Probe BX and CA Moisture Probe. Updated Termination resistor installation to include use of 0975AT cable |

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# 1 Introduction

This Electrical Installation guide is valid for the following Hydronix sensors only:

| | |
|---|---|
| Hydro-Probe | (Model number HP04 onwards) |
| Hydro-Probe XT | (Model number HPXT02 onwards) |
| Hydro-Probe Orbiter | (Model number ORB3 onwards) |
| Hydro-Probe SE | (Model number SE03 onwards) |
| Hydro-Mix | (Model number HM08 onwards) |
| Hydro-Mix HT | (Model Number HMHT01 onwards) |
| Hydro-Mix XT | (Model Number HMXT01 onwards) |
| Hydro-Probe BX | (Model Number HPBX01 onwards) |
| CA Moisture Probe | (Model Number CA0022) |

User guides for other model numbers are available for download from the Hydronix website: www.hydronix.com

# 2 Installation Guidelines

## 2.1 Mil Spec Connector Sensors

Hydronix supplies cable 0975A for use with these sensors and it is available in different lengths. Any extension cable required should be connected to the Hydronix sensor cable using a suitable screened junction box. The sensor is directly backward compatible with older 0090A cables (as used with the previous versions of Hydronix Moisture Sensors). When connecting to a 0090A cable it is not possible to use the 2nd analogue output provided by the sensor.

For installations using both Analogue Outputs, it is necessary to use Sensor Cable part number 0975A.

It is recommended to allow the sensor to stabilise for 15 minutes after applying power before use.

## 2.2 Permanently Wired Sensors

Some Hydronix sensors do not utilise the Mil spec connector as supplied with the 0975A cable. These sensors are supplied with a factory fitted permanent cable. However, all cable specifications and connection methods as detailed in this guide are identical to the 0975A cable.

## 2.3 Cable Specification

- Six pairs twisted (12 cores total) screened (shielded) cable with 22 AWG, 0.35mm$^2$ conductors.
- Screen (shield): Braid with 65% minimum coverage plus aluminium/polyester foil.
- Recommended cable types: Belden 8306, Alpha 6377
- Maximum cable run: 100m, separate to any heavy equipment power cables.

## 2.4 Cabling Recommendations

- Ensure that the cable is of a suitable quality
- Ensure that the RS485 cable is taken back into the control panel. This can be used for diagnostic purposes and takes the minimum of effort and cost to connect at the time of installation.
- Route the signal cable away from any power cables.
- Check that the installation is properly grounded.
- The cable should **only** be grounded at the sensor end.
- Ensure that the cable screen is **not** connected at the control panel.
- Ensure that there is continuity of the screen through any junction boxes.
- Keep the number of cable joins to a minimum.

# 3 Analogue Outputs

Two DC current sources generate analogue signals proportional to separately selectable parameters (e.g. filtered Unscaled, filtered moisture, average moisture, etc). See Configuration guide HD0679 for further details. Using the Hydro-Com software or direct computer control, the output may be selected to be:

1. 4-20 mA
2. 0-20 mA - 0-10 V output can be achieved using the 500 Ohm resistor supplied with the sensor cable.

Sensor cable (Part no 0975A) connections (for new installations):

| **Twisted Pair Number** | **MIL spec pins** | **Sensor connections** | **Cable colour** |
|---|---|---|---|
| 1 | A | +15-30V DC | Red |
| 1 | B | 0V | Black |
| 2 | C | 1st Digital input | Yellow |
| 2 | -- | - | Black (Cut back) |
| 3 | D | 1st Analogue Positive (+) | Blue |
| 3 | E | 1st Analogue Return (-) | Black |
| 4 | F | RS485 A | White |
| 4 | G | RS485 B | Black |
| 5 | J | 2nd Digital input | Green |
| 5 | -- | - | Black (Cut back) |
| 6 | K | 2nd Analogue Positive (+) | Brown |
| 6 | E | 2nd Analogue Return (-) | Black |
| | H | Screen | Screen |

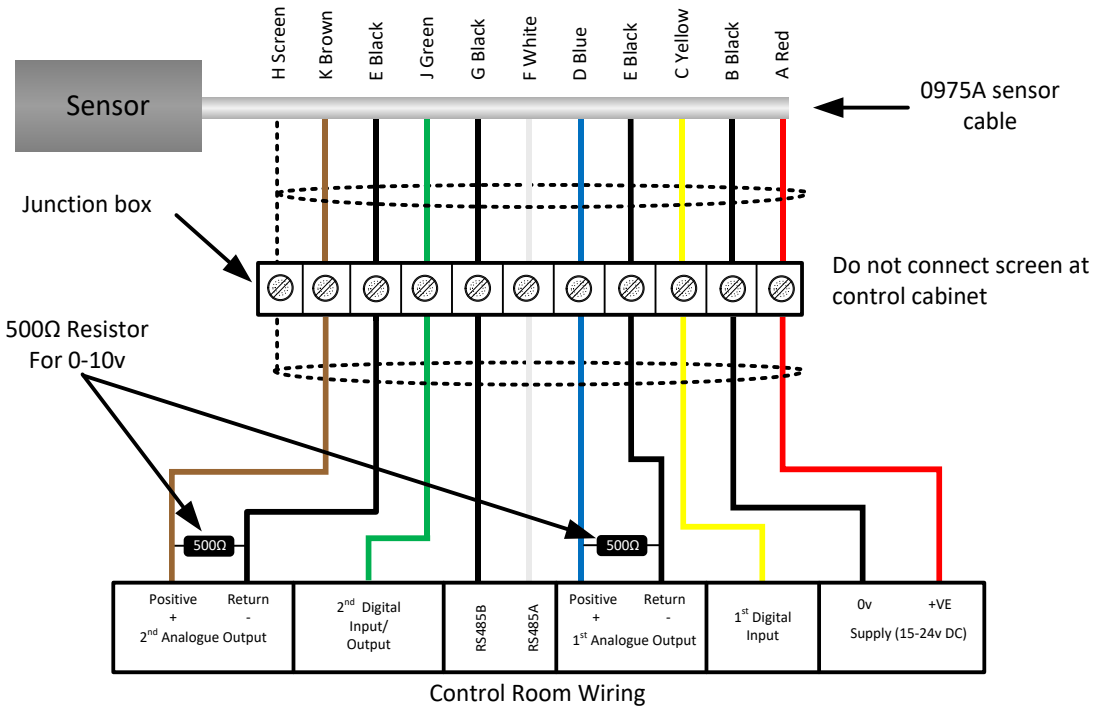



**Figure 1: 0975A Sensor Cable Connections**

***Note: The cable screen is grounded at the sensor. It is important to ensure that the installation where the sensor is installed is properly grounded.***

# 4 RS485 Multi-drop Connection

The RS485 serial interface allows up to 16 sensors to be connected together via a multi-drop network. Each sensor should be connected using a waterproof junction box.

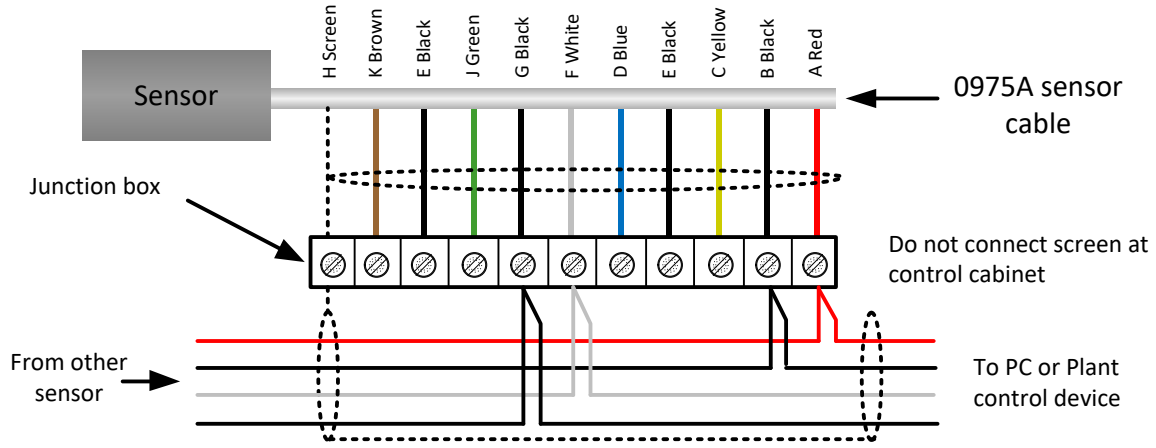



**Figure 2: RS485 Multi-drop Connections**

# 5 Termination Resistor and 0975AT Cable

To avoid data-corrupting reflections a 0975AT cable should be used to connect the last node of the network.

**NB: If there is only one node then an 0975AT cable should be used.**

A 120Ω resistor should be placed at the RS485 Master.

When multiple sensors are connected, or long cable lengths are used, a Termination Resistor and 0975AT can be used to improve the communication stability. Terminating the RS485 involves adding resistors at each end of the network. The 0975AT cable has a built in 120 Ω resistor. A 120Ω resistor (distributed with the 0975AT cable) should be used at the RS485 master. All other sensors must remain unterminated.

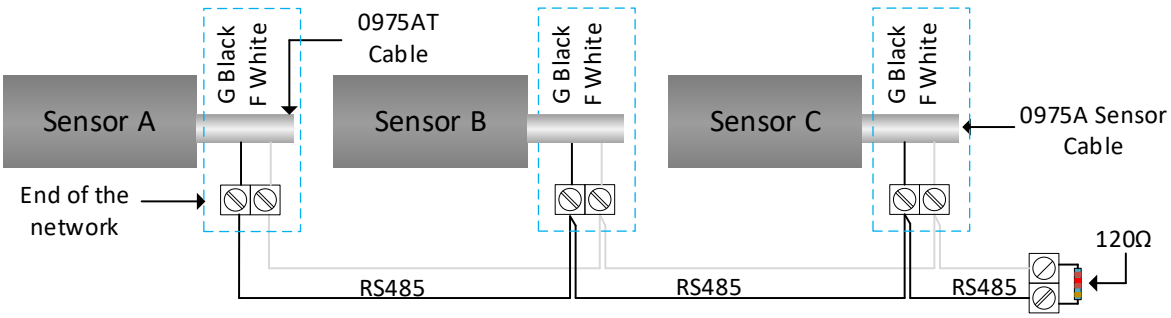



**Figure 3: Termination Resistor**

# 6 Digital Input/Output Connection

The sensor has two digital inputs, the second of which can also be used as an output for a known state. Full descriptions of how the digital inputs/output can be configured are included in the configuration guide HD0679. The most common use of the digital input is for batch averaging, where it is used to indicate the start and end of each batch. This is recommended as it provides a representative reading of the full sample during each batch.

An input is activated using 15 – 30vDC into the digital input connection. The sensor power supply may be used as an excitation supply for this, or alternatively an external source may be used as shown below.

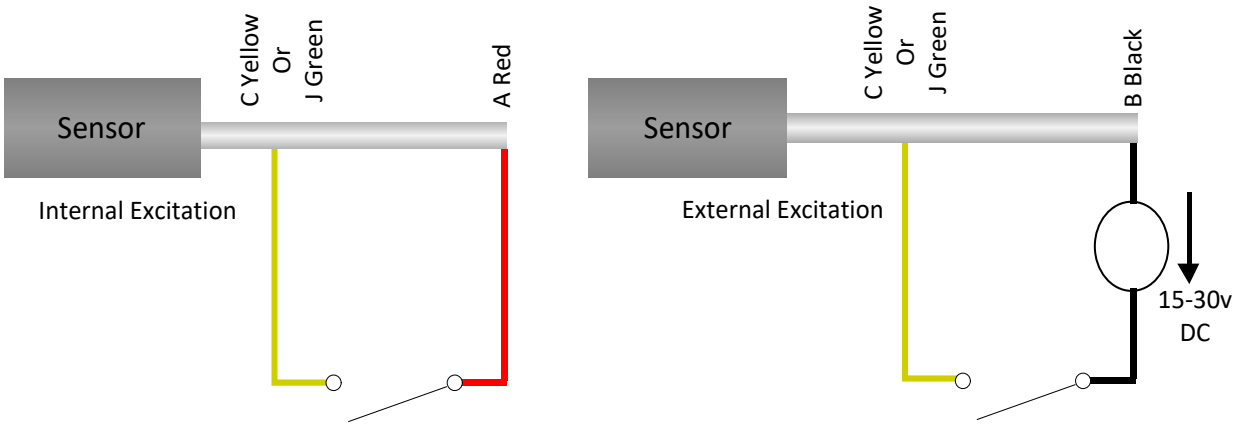



**Figure 4: Internal/External Excitation of Digital Input 1 & 2**

When the digital output is activated the sensor electronically switches pin J to 0V. This can be used to switch a relay for a signal, for example 'bin empty'. Note that the maximum current sink in this case is 500mA and in all cases over current protection should be used.

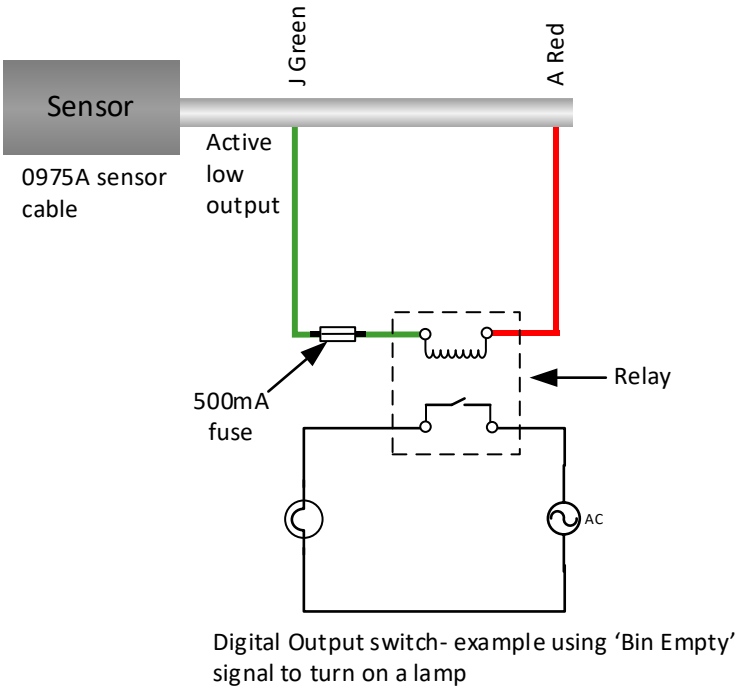



**Figure 5: Activation of Digital Output 2**

## 6.1 Digital I/O protection

Back electromotive force (Back EMF), also known as counter-electromotive force, is the electromotive force that opposes the change in current through a conductor. When current passes through a coil, such as an inductor, relay coil, motor or solenoid winding, energy is stored in the form of a magnetic field around the coil. When power is removed from the circuit, the magnetic field collapses producing a large reverse voltage spike which can damage sensitive components in the circuit such as transistors and diodes.

It is recommended that a “fly-wheel” diode is connected across any inductive load that is connected to the inputs or outputs of the sensor. This diode will suppress the back EMF voltage spike, protecting the inputs from damage. The recommended diode for this protection is a 1N4007 or equivalent. It should be connected as shown in Figure 6.

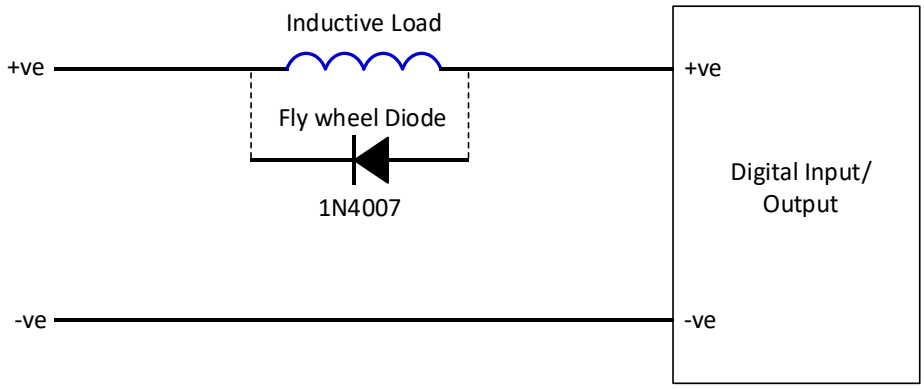



**Figure 6: I/O Protection**

# 7 Connecting the Sensor Cable to Rotating Connector (Orbiter)

## 7.1 Wiring for all Rotating Connector Types

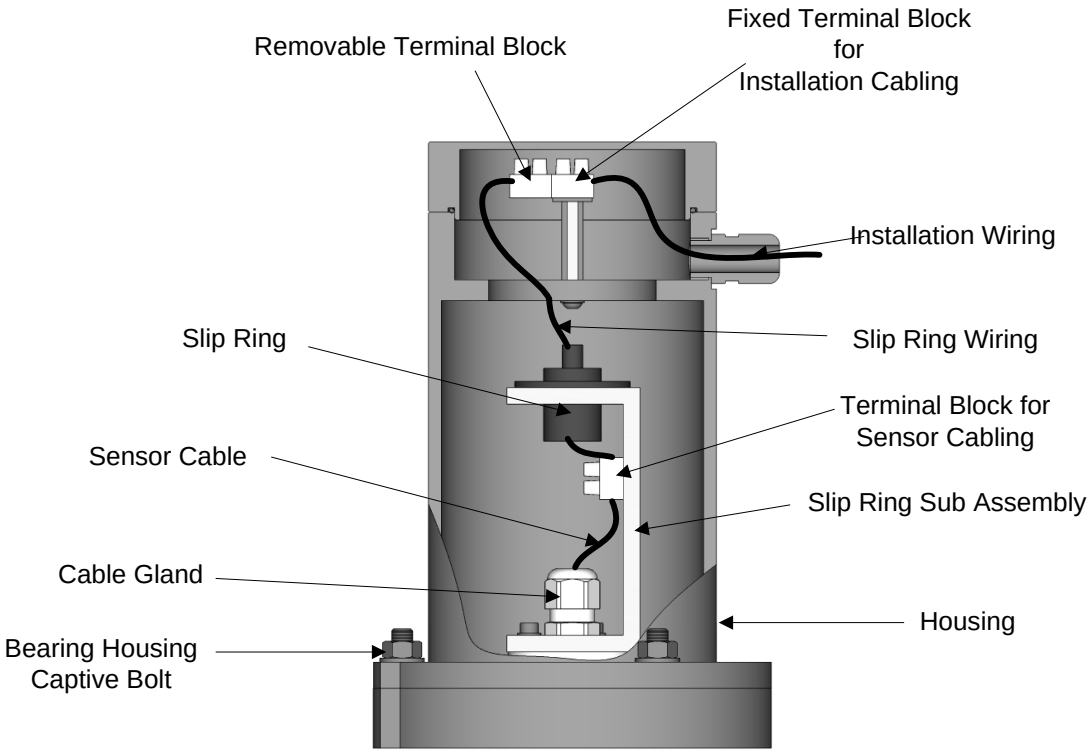
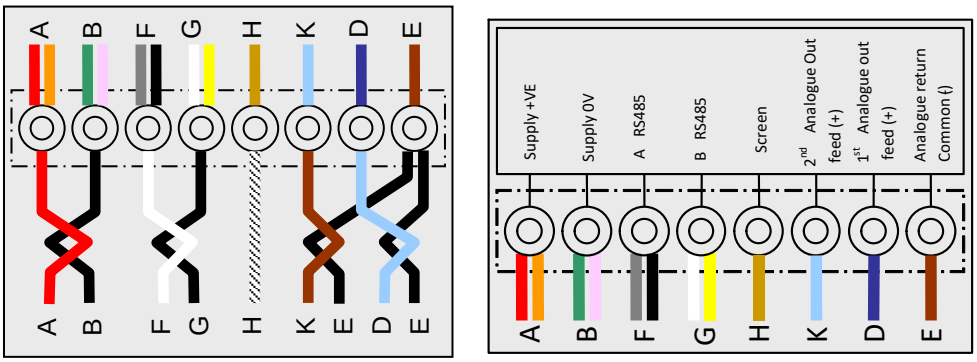



**Figure 7: Sensor Connections for all types of Rotating Connector.**




(A) Sensor Cable Connections (B) Plant Wiring Connections

**Figure 8: Wiring Diagram**

| Connection Port | Slip Ring Wire Colour | Sensor Wire Colour | Connection Type |
|---|---|---|---|
| A | Red/Orange | Red | Supply +VE |
| B | Green/Mauve | Black | Supply 0V |
| F | Grey /Black | White | A RS485 |
| G | White/Yellow | Black | B RS485 |
| H | Khaki | Screen | Screen |
| K | Light blue | Brown | 2nd analogue (+) |
| D | Dark blue | Light Blue | 1ST Analogue (+) |
| E | Dark brown | Black (From both analogue circuits) | Analogue return Common (-) |

**Table 1: Sensor cable to Slip Ring connections**

## 7.2 Connection - Rotating Connector Type "A"

- With the cable connected to the Hydro-Probe Orbiter and the Rotating Connector Housing removed, feed the cable up through the rotating shaft and Slip Ring Sub-Assembly gland and cut to the correct length. Ensure the cable and its protective hose do not interfere with the mixer arms. Tighten the gland.
- Cut back the cable sheath and crimp on bootlace ferrules. 8 conductors are required, unused conductors should be cut back.
- Connect to the terminals as per the diagram in the Rotating Connector (see Figure 8).
- Install the housing over the slip ring sub assembly and bolt down using the bearing housing captive bolts.

- Feed the installation cabling through the housing cable gland and cut to length. Wire the installation cable to the fixed terminal block as per the diagram in the lid (see Figure 8). Connect the removable terminal block plug from the slip ring sub-assembly.
- Fit the Rotating Connector lid and screw down.

## 7.3 Connection - Rotating Connector Type “B”

- With the cable connected to the Hydro-Probe Orbiter and the Rotating Connector Housing removed, feed the cable up through the cable gland and cut to the correct length.
- Cut back the cable sheath and crimp on bootlace ferrules. 8 conductors are used so any unused conductors should be cut back
- Connect to the terminals as per the diagram in the Rotating Connector (see Figure 8).
- Install the housing over the slip ring sub assembly and bolt down using the bearing housing captive bolts.
- Feed the plant cabling through the housing cable gland and cut to length. Wire the plant cable to the fixed terminal block as per the diagram in the lid (see Figure 8).
- Connect the removable terminal block plug from the slip ring sub-assembly.
- Fit the Rotating Connector lid and screw down.

# 1 Connecting to a PC

A converter is required to connect the RS485 interface to a PC. Up to 16 sensors may be connected at any time.

***Note: All sensors are set to address 16 as default. If more than one sensor is to be connected to a control system using the RS485 or to Hydronix Hydro-Com software all sensor address numbers must be different. See appropriate Hydro-Com user guide for more details.***

It is highly recommended that the RS485 signals be run to the control panel even if they are unlikely to be used as this will facilitate the use of diagnostic software should the need arise.

There are four types of converter supplied by Hydronix.

## 1.1 RS232 to RS485 Converter – D Type (part no: 0049B)

Manufactured by KK systems, this RS232 to RS485 converter is suitable for connecting up to six sensors on a network. The converter has a terminal block for connecting the twisted pair RS485 A and B wires. The converter can then be connected directly in to the PC serial communication port.

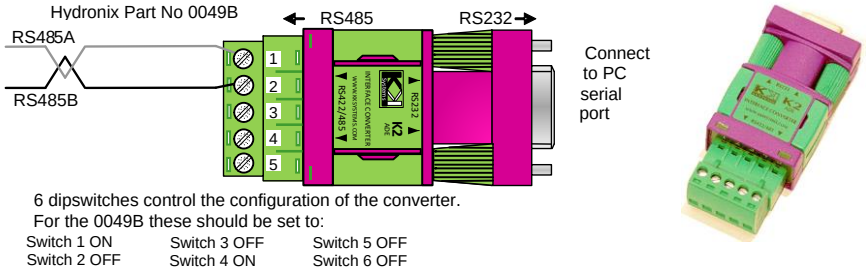



**Figure 9: RS232/485 Converter Connections (0049B)**

## 1.2 RS232 to RS485 Converter – DIN Rail Mounting (part no: 0049A)

Manufactured by KK systems, this powered RS232 to RS485 converter is suitable for connecting up to 16 sensors on a network. The converter has a terminal block for connecting the twisted pair RS485 A and B wires. The converter can then be connected to a PC serial communication port.

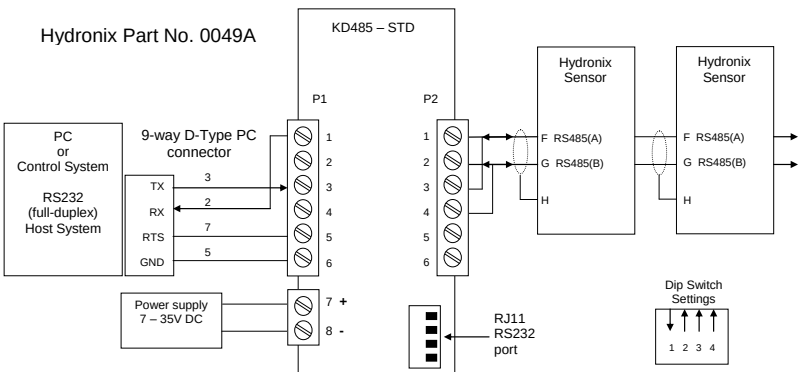



**Figure 10: RS232/485 Converter Connections (0049A)**

## 1.3 USB Sensor Interface Module

Manufactured by Hydronix, this USB-RS485 converter is suitable for connecting up to 16 sensors on a network. The converter has a terminal block for connecting the twisted pair RS485 A and B wires. The converter can then be connected to a USB port. The Sensor Interface Module is powered from the USB port. If sensor power is required the external 24v power supply can be used. See USB Sensor Interface Module User Guide (HD0303) for further information.

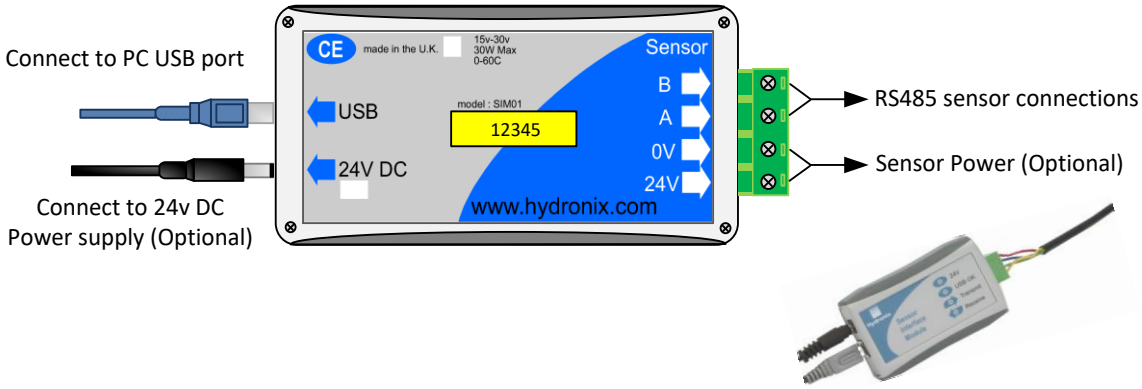



**Figure 11: RS232/485 Converter connections (Sensor Interface Module)**

## 1.4 Ethernet Adapter Kit (part no: EAK01)

Manufactured by Hydronix, the Ethernet adapter is suitable for connecting up to 16 sensors to a standard Ethernet network. An optional Ethernet Power Adapter Kit (EPK01) is also available which eliminates the need for additional expensive cables to be run to a remote location which does not have local power. If this is not used then the Ethernet adapter will require a local 24v power supply.

Hydronix Part No: EAK01

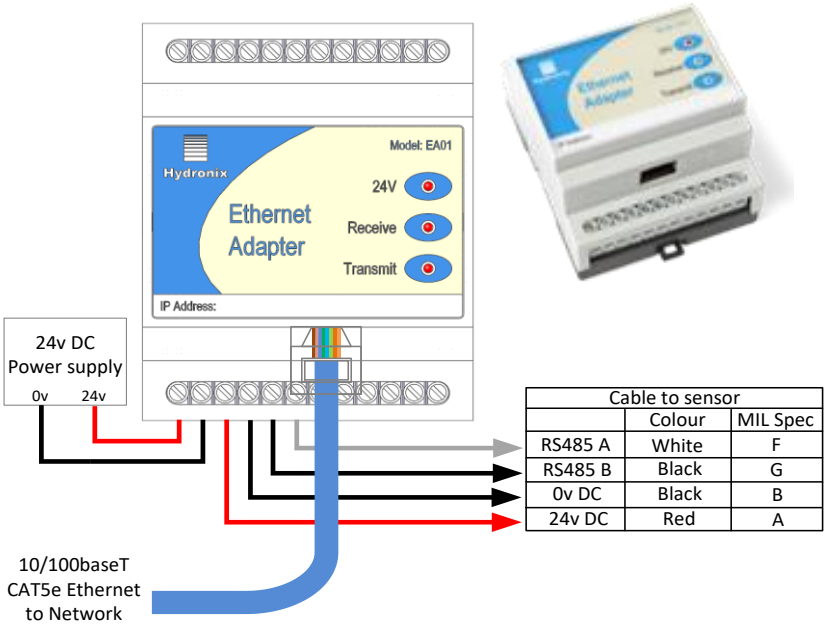



**Figure 12: Ethernet Adapter Connections (EAK01)**

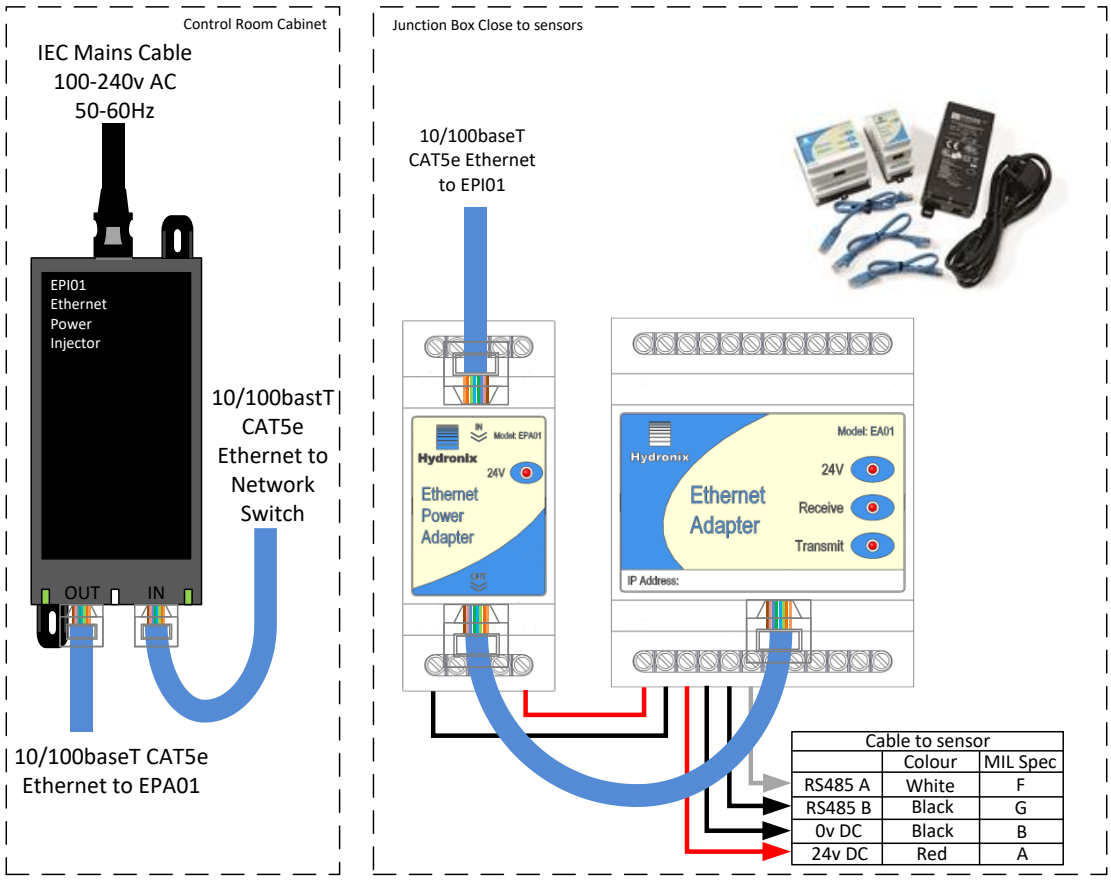



**Figure 13: Ethernet Power Adapter Kit Connections (EPK01)**

# 1 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 |
|---|---|
| HD0682 | Hydro-Com User Guide |
| HD0303 | Sensor Interface Module User Guide |
| HD0679 | Hydronix Microwave Moisture Sensor Configuration and Calibration Guide |
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