HygroClip DI
Digital Interface for HygroClip Probes
v 1.0

Instruction Manual

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Contents:

About the version number: this manual is valid for instruments with firmware version 1.0 (check using the ROTRONIC HW4 software, Device Manager). Changes in the last digit of the version number reflect minor changes in the internal software of the instrument that do not affect the manner in which the instrument should be operated.

Note: operation of the HygroClip DI requires a PC with the ROTRONIC HW4 software installed. Instructions for using the HW4 software are not included in this manual. These instructions are shipped separately on the software CD ROM.

Overview

HygroClip DI (Digital Interface) allows connecting up to two HygroClip digital humidity-temperature probes to a PC, either by means of a USB port or by means of a wired / wireless TCP/IP network (LAN / Internet). The HygroClip DI is designed to operate with the ROTRONIC HW4 networking software (v 1.2.2 or higher). Other than the capacity of the PC, there is no limit to the number of HygroClip DI that can be networked with the PC.

The main functions of the HW4 software include on-line data monitoring and recording by the PC, automatic generation of graphs and data tables, configuration of the HygroClip DI, and adjustment (calibration) of the HygroClip probes connected to the HygroClip DI.

The main features of the HygroClip DI are as follows:

● Two probe inputs (HygroClip probes)
● Choice of USB or Ethernet interface - wired or wireless
● RS-485 port for connecting up to 64 HygroClip DI (or other devices) to a multi-drop network.

Power for the HygroClip DI is normally provided by an external AC adapter. The RS-485 port also allows powering the HygroClip DI and other devices in a multi-drop network from a single DC power source.

Models

HygroClip DI-3

- USB port
- Two probe inputs (HygroClip probes)
- RS-485 port (4-pin connector: TX +, TX - , DC in, GND)
- Receptacle for AC adapter

HygroClip DI-3

- RJ45 port (wired Ethernet LAN)
- Two probe inputs (HygroClip probes)
- RS-485 port (4-pin connector: TX +, TX - , DC in, GND)
- Receptacle for AC adapter

HygroClip DI-3

- Wireless TCP/IP interface
- Two probe inputs (HygroClip probes)
- RS-485 port (4-pin connector: TX +, TX - , DC in, GND)
- Receptacle for AC adapter

Power

The HygroClip DI is shipped with a regulated 12 VDC / 100…240 VAC adapter (170 mA).

Probes

The HygroClip DI is designed for use with the ROTRONIC HygroClip digital humidity temperature probes. These are highly accurate probes which are adjusted entirely by means of software (no potentiometers). Because calibration and other data are stored in the probe non-volatile memory, the probes are fully interchangeable. When a probe requires adjustment / calibration or has to be repaired, it can be replaced with another probe in a few seconds.

The ROTRONIC HygroClip digital probes are available in different configurations so as to meet the requirements of each application.

The following probes have a 5-pin DAT-05 connector. An extension cable such as the MOK-02-B5 is required to connect these probes to the HygroClip DI (see Accessories):
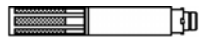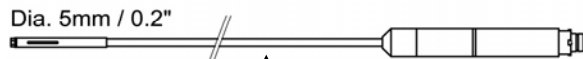
L. 100mm (3.9")
Dia. 15mm (0.6")

HygroClip S
measurement in air
max. 85°C (185°F) – wire mesh filter
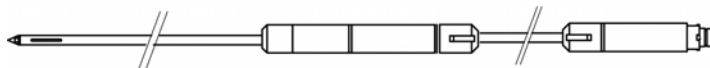
Tube L. 200mm (7.9")
Dia. 5mm (0.2")
Cable: 2m (6.5ft)

HygroClip SP05
measurement in air ducts
max. 85°C (185°F)

Dia. 5mm / 0.2"
Cable: 2m (6.5 ft)

HygroClip SC05
measurement in tight spaces
max. 100°C (212°F)
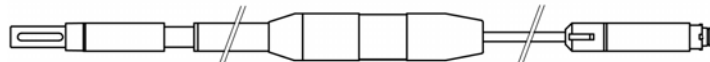
Tube L. 250/400mm/(9.8/15.7")
Dia. 15mm (0.6")
Cable: 2m (6.5ft)

HygroClip HK25 / HK40 air probe
measurement at high temperature
HK25: max. 150°C (302°F)
HK40: max. 200°C (392°F)
wire mesh filter
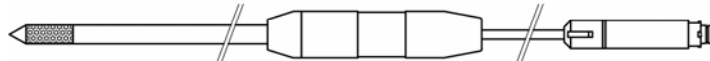
Tube L. 280mm (11")
Dia. 10mm (0.4")
Cable: 2m (6.5ft)

HygroClip HP28 insertion probe
measurement of materials in bulk
max. 85°C (185°F)
sintered steel filter
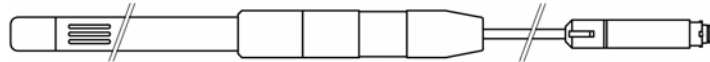
Blade L. 280mm (11")
W. 18mm (0.7")
T. 4mm (0.16")
Cable: 2m (6.5ft)

HygroClip HS28 sword probe
measurement of paper stacks/rolls
max. 85°C (185°F)

The following probes have a 7-pin connector. An adapter cable such as the T7-03-B5 is required for connection to the HygroClip DI (see Accessories). Extension cable model AC1616 may be used to allow up to 200 meter (656ft) probe separation (restrictions may apply - please consult factory):

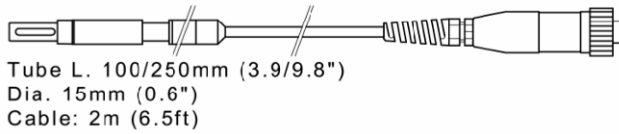Tube L. 100/250mm (3.9/9.8")
Dia. 15mm (0.6")
Cable: 2m (6.5ft)

Tube L. 120/270mm (4.7/10.6")
Dia. 15mm (0.6")
Cable: 2m (6.5ft)

Cable: 2m (6.5ft)

HygroClip IC-1 (100mm) / IC-3 (250mm)
for through-wall installation
max. 200°C (392°F) - wire mesh filter

HygroClip IM-1 (120mm) / IM-3 (270mm)
for through-wall installation in high humidity applications
max. 200°C (392°F) - wire mesh filter

HygroClip IE-1 (G ½") / IE-3 (NPT ½")
for compressed air (max. 50 bar / 725 PSI)
max. 85°C (185°F) – sintered steel filter
to avoid errors, temperature should be the same on both sides of the mounting wall

Connector identification

Receptacle for AC Adapter
(+ center)

USB Port
(DI-3)

Input 2
(P6)

Input 1
(P4)

RJ45 (DI-4)
Antenna
(DI-4-WL)
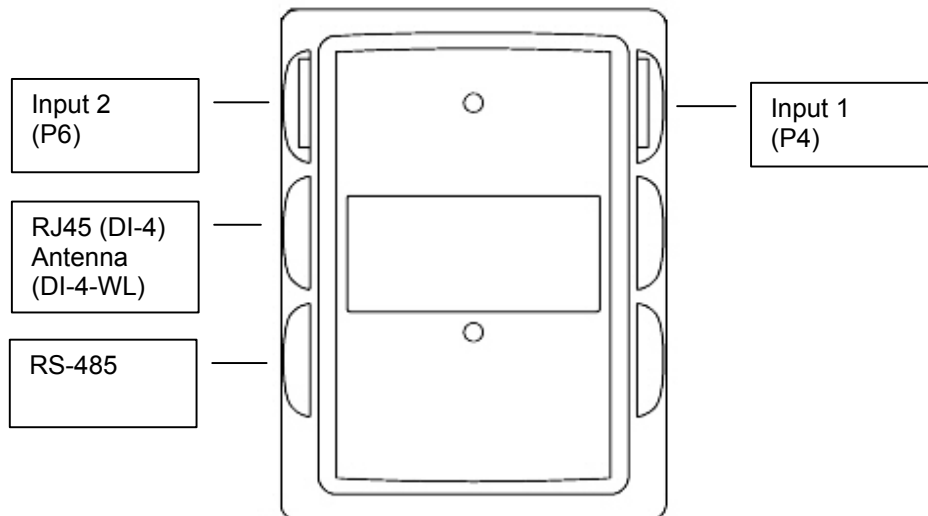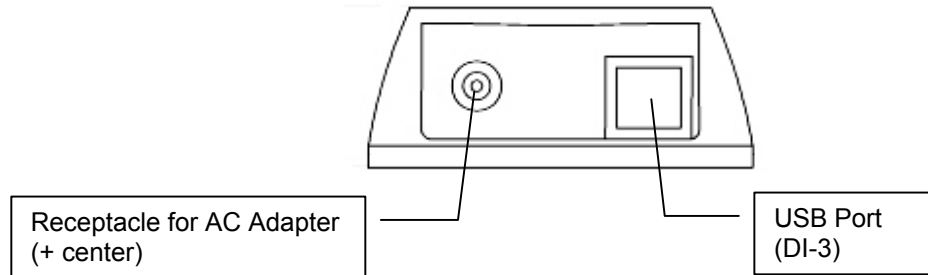
RS-485

Pin-out diagrams

Input 1, 2 and 3 (HygroLog NT2, NT3) - solder side of matching male connector

1: not used
2: power (DC+)
3: GND
4: DIO
5: not used
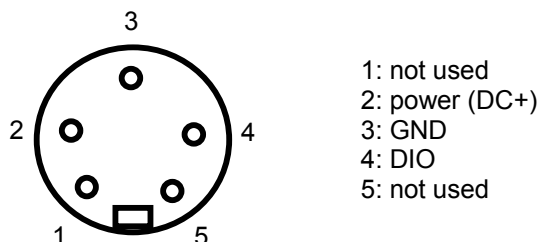
RS-485 port - solder side of matching male connector

1: 485 (-)
2: 485 (+)
3: GND (see note)
4: DC + (see note)
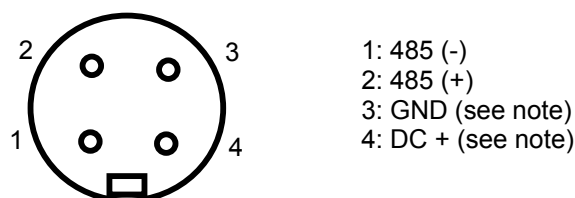
Note: use pins 3 and 4 to power multi-dropped instruments with a single external 12 VDC power supply with adequate mA rating. Pin 4 and the 12VDC receptacle normally used for the AC adapter are not connected.

Operation with the HW4 software

HW4 Software Requirements

Note: a full description of HW4 is available in a separate manual. This document can be downloaded from our web site.

The following are the minimum values required to install and run HW4 on a computer. It is highly recommended to exceed these values.

● Processor: Pentium II, 450 MHz
● RAM: 128 MB
● Available hard disk space: 50 MB
● Monitor: SVGA, 1024 x 768, 256 colors
● Ports: one free serial (COM) port or one free USB port

Operating System compatibility:

● Windows XP, NT4 with SP 6a or higher
● Windows 2000 with SP 2 or higher
● Windows Server 2003

HW4 was written for the Microsoft .NET framework and requires this framework to be installed on the computer.

The .NET framework offers significant improvements in the areas of networking and user security. When new software is being installed, the .NET framework also eliminates the potential problem of conflicting dynamic library files (DLL). According to Microsoft, the .NET framework will be used by all future Microsoft operating systems.

HygroClip DI settings and adjustments

- Device description (up to 30characters)
- RS-485 network address and baud rate
- Unit System (metric or English)
- Symbol used for humidity
- Individual input settings:
    - Probe / input description (maximum 12 characters)
    - Parameter to be calculated for an individual input
    - Barometric pressure fixed value
    - Alarm settings for humidity, temperature and calculated parameter
- Probe temperature and humidity adjustment

Calculated parameter

Using the HW4 software, the HygroClip DI can be set to compute for each probe one of the following psychrometric parameters.

Dew point (Dp)
Frost point (Fp)
Wet bulb temperature (Tw)
Enthalpy (H)
Vapor concentration (Dv)
Specific humidity (Q)
Mixing ratio by weight (R)
Vapor concentration at saturation (Dvs)
Vapor partial pressure (E)
Vapor saturation pressure (Ew)

A different parameter can be associated with each probe input.

Note: depending on whether dew point or frost point was selected, HW4 will display either the symbol Dp or the symbol Fp for values below freezing. The symbol Fp indicates that the value is a frost point as opposed to being a dew point. Regardless of the dew point / frost point selection, the symbol Dp is always displayed for values above freezing.

Some of the above parameters require barometric pressure as an input. A fixed pressure value can be specified as part of the HygroClip DI settings.

Alarm function

Using the HW4 software, both a high and a low alarm value can be associated with the humidity, temperature and calculated parameter of each probe input. A dead band value can also be specified for each parameter. This value is used for both the low and the high alarm conditions.

HW4 can be configured to report out-of-limit values and loss of communication with a probe. When measurement values are recorded on the PC and viewed as a data table with the HW4

software, values that correspond to an alarm condition are printed over a red background, based on the alarm settings of the HygroClip DI.

Compliance with FDA 21CFR Part II and GAMP

When used together with the validated ROTRONIC HW4 software – Professional Edition; the HygroClip DI complies with the FDA / GAMP requirements regarding electronic records and electronic signatures. HW4 is designed to keep track of configuration changes and of any probe adjustment. HW4 also keeps track of user events (main operations performed by each user) and self-events (software problems). The records generated by HW4 are protected, have an electronic signature and can be cross referenced one with the other.

Networking

Depending on the model, the following is available to connect the HygroClip DI to a PC: USB port or Ethernet (TCP/IP) – wired or wireless. The ROTRONIC HW4 software accepts a mix of these different connection types.

All models of HygroClip DI feature a RS-485 connector. When the number of available PC ports is limited, this connector can be used to connect together up to 64 HygroClip DI (or other devices) in a multi-dropped arrangement. In principle, an unlimited number of such networks can be monitored with the HW4 software, but each RS-485 multi-drop network is limited to 64 devices. The HygroClip DI can be used either as a slave or a master, without special configuration. The master is automatically the device that is directly connected to the PC or LAN by means of a USB port or TCP/IP port.

RS-485 Address: the RS-485 address is used to identify the individual devices that are connected to a RS-485 multi-drop and must be unique to each device. This address is part of the HygroClip DI communications protocol. The factory default for the RS-485 address is 00. In general, this address should not be changed manually (see note below). As far as HW4 is concerned, all masters can share the same RS-485 address. When the HW4 command "Search for RS-485 slaves" is being used, HW4 automatically changes from 00 to 01 the RS-485 address of any master that has slaves attached. As a result, all masters end up with the same RS-485 network address (01). In addition, HW4 automatically changes the RS-485 address of the slaves in each multi-drop from 00 (factory default) to a unique address ranging from 02 to 64. The same address range (02 to 64) is used again when there is more than one multi-drop RS485 network.

Notes:

- We recommend using HW4 to give each HygroClip DI a unique name for easier identification.
- In the situation where an RS-485 network is to be monitored by software other than HW4, you will have to use HW4 to give each device a unique RS-485 address prior to connecting to the network.

USB port

The number of docking stations with RS-232 or USB port that can be directly connected to a PC depends on the number of physical COM ports and USB ports available on the PC.

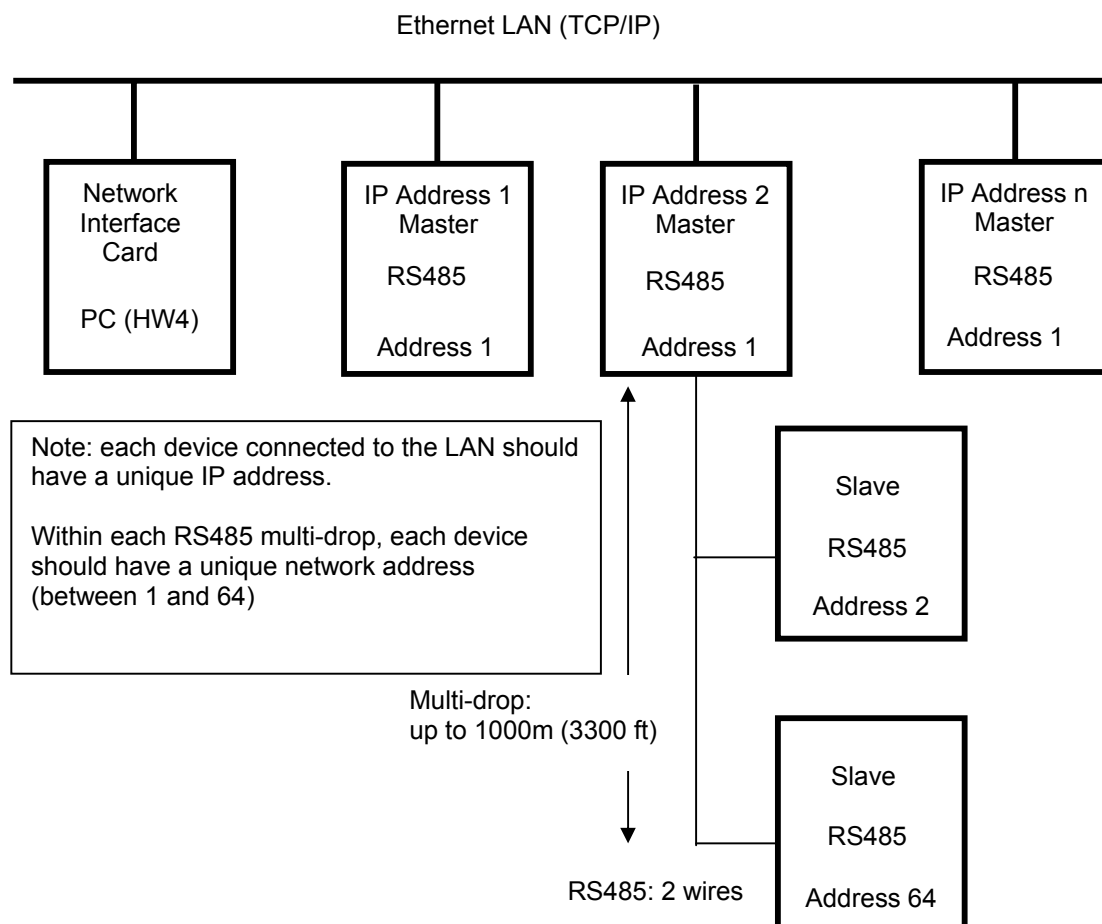RS485: 2 wires

```
┌──────────┐     ┌──────────┐   ┌──────────┐      ┌──────────┐
│ PC (HW4) │     │   USB    │   │  Slave   │      │  Slave   │
│          ├──┐  │  Master  │   │          │      │          │
│ USB port │  └──┤ Address 1│   │ Address 2│      │Address 64│
│          │     │  RS485   │   │  RS485   │      │  RS485   │
└────┬─────┘     └────┬─────┘   └────┬─────┘      └────┬─────┘
     └────────────────┘              │                 │
              ├──────────────────────┴─────────────────┘
        ◄── Multi-drop: up to 1000m (3300 ft) ──►
```
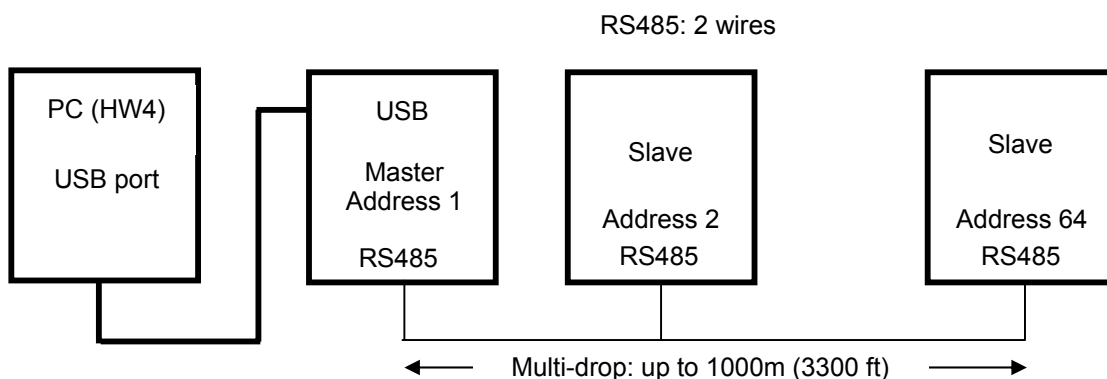
RJ45 connector or wireless (TCP/IP)

In principle, using a LAN or WLAN (TCP/IP) allows an unlimited number of HygroClip DI to be connected either locally or by way of the Internet. Both cases are compatible with the HW4 software.

Ethernet LAN (TCP/IP)

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═══╤═══════════╤═══════════╤═══════════════╤══════════
   │           │           │               │
┌──┴──────┐ ┌──┴──────┐ ┌──┴──────┐    ┌───┴─────┐
│ Network │ │IP Address│ │IP Address│    │IP Address│
│Interface│ │ 1 Master │ │ 2 Master │    │ n Master │
│  Card   │ │  RS485   │ │  RS485   │    │  RS485   │
│ PC (HW4)│ │Address 1 │ │Address 1 │    │Address 1 │
└─────────┘ └──────────┘ └────┬─────┘    └─────────┘
```

Note: each device connected to the LAN should have a unique IP address.

Within each RS485 multi-drop, each device should have a unique network address (between 1 and 64)

Multi-drop: up to 1000m (3300 ft)

RS485: 2 wires

```
┌──────────┐
│  Slave   │
│  RS485   │
│ Address 2│
└──────────┘

┌──────────┐
│  Slave   │
│  RS485   │
│Address 64│
└──────────┘
```
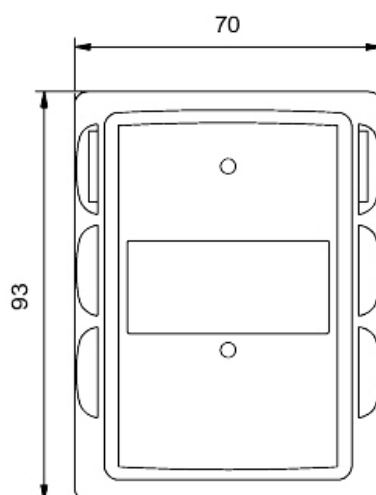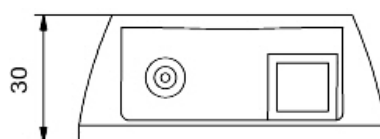
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IMPORTANT:

- If you change an instrument from master to slave, be sure to change the RS address of the instrument to 00 before establishing the RS-485 connection. Not doing so may prevent HW4 from detecting the instrument. After detecting the instrument, HW4 will automatically change the RS address to 02 or higher. Please note that HW4 may eventually change the address of any master with address 00.

- All devices within a multi-drop should use the same baud rate.

- The RS485 wiring can be done with a twisted pair (2-wire, telephone type) and wall mounted RJ45 receptacles. No shielded cable and no terminator should be required. <u>Be sure to observe the polarity for each connection</u>. Using 4-wire cable, offers the option of powering all devices in the multi-drop from a single DC voltage source.

See Appendix 1: Electrical Installation Guidelines

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Specifications

Model	HygroClip DI-3	HygroClip DI-4	HygroClip DI-4-WL
PC Interface	USB	RJ45	Wireless
Serial interface (RS-485)	Baud rate : 19200 or 57600 Data bits : 8 Stop bits : 1 Parity : none		
Probe inputs	2 (HygroClip humidity-temperature probes only)		
Operating limits electronics	0…100 %RH / -40…85 °C (-40…185°F)		
Measuring range	0…100 %RH HygroClip probes are available for temperatures within the range of -50…200°C / -58…392°F See probe specifications		
Accuracy at 23°C	±1.5 %RH / ±0.3°C		
Power	External adapter 12 VDC – 170 mA / 100…240 VAC, 50/60 Hz		
Housing	ABS, protection grade IP65		
Dimensions			
Logger	93 x 70 x 30 mm		
Weight	about 175 g		
Conformance	FDA CFR 21 / 11 / GAMP4		

Dimensions in mm

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Accessories

Order Code	Description
HW4-E	HW4 Edition software (CD ROM), single user
HW4-P	HW4 Professional software (CD ROM) FDA/GAMP conformance, multi user
MOK-02-DAT05	Extension cable for HygroClip probes with DAT05 connector (use for input 1 of the HygroLog NT2 / NT3). Cable length 2 meter (6.5 ft)
MOK-02-B5 MOK-05-B5	Adapter cable for HygroClip probes with DAT05 connector (use for inputs 2 to 7). Cable length 2 meter (6.5 ft) or 5 meter (16.4 ft)
T7-03-B5	Adapter cable for HygroClip probes with T7 connector (use for inputs 2 to 7). Cable length 3 meter (9.8 ft)
AC1616	Probe extension cable with T7 connectors and signal amplifier, 2 to 200 meter (6 to 656 ft) – restrictions may apply, please consult factory
AC1211	AC adapter 12VDC / 170mA, includes adapter for US receptacles
2/11/8818	Data cable USB type A-B – HygroClip DI to PC (length 1.8 m / 5.9 ft)
AC1614-02	RS-485 cable with 3-pin connector and tinned ends. Suitable for connecting to a terminal box. Length 2 meter / 6.5 ft.

Communications protocol

For customers who for any reason cannot use the HW4 software a description of the HygroClip DI communications protocol is available in a separate document.

This document (Com_NT.pdf) is available directly from ROTRONIC and can also be downloaded from our web site.

Appendix 1: Electrical Installation Guidelines

Power supply wiring

Heavy machinery and instrumentation should not share the same power supply wiring. If this cannot be avoided, noise filters and surge protectors should be used. Most UPS devices have those features already integrated.

General guidelines for signal cables

The following guidelines are derived from European Standard EN 50170 for the transmission of signals by copper wires. When planning an installation, the rules provided by EN 50170 should be followed under consideration of local circumstances to determine the position of machines and equipment.

All ROTRONIC HygroClip products are tested for Electromagnetic Compatibility according to following European standards:

- **EN 61000-6-3 + EN 61000-6-1 (residential)**
- **EN 61000-6-4 + EN 61000-6-2 (industrial)**

Whenever the level of electromagnetic interference is expected to be high, both the instruments and signal cables should be placed as far away as possible from the source of interference.

In general, signal cables should be installed in bundles or channels / conduits, separate from other cables as indicated in the table below:

• Bus signals such as RS485 • Data signals for PCs, printers etc. • shielded analog inputs • unshielded direct current (<= 60V) • shielded process signals (<= 25 V) • unshielded alternate current (<= 25V) • coaxial cables for CRT monitors	in common bundles or channels / conduits
• direct current from 60 V to 400 V (unshielded) • alternate current from 25V to 400 V (unshielded)	in separated bundles or channels / conduits, without minimum distance
• direct and alternate current > 400 V (unshielded) • Telephone lines • lines leading into EX-rated areas	in separated bundles or channels / conduits, without minimum distance

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Lightning protection

Cabling in areas with a risk of lightning requires a lightning protection. For cabling underground in between buildings, we recommend the use of special fiber optic cables. If this is not possible, use copper cables that are suitable for underground installation.

Additional guidelines for RS-485 wiring (products with a serial interface)

RS-485 Cable

Using a symmetrical transmission method in combination with low capacity/ low attenuation twisted pair cables, allows extremely reliable long distance connections. The use of a high grade shielded cable avoids cross talk between the transmitted signals and also reduces the potential of external interference. For the RS-485 cable, we recommend using a cable Cat. 5e ANSI/ TIA /EIA-568-A-5.

In general the RS-485 cable should be shielded and comply with the following specifications:

- **Cable capacitance**   **<=300pF/m or 90 pF/ft**
- **Line impedance**   **100 Ω ±15 Ω**
- **Line resistance**   **140 Ω/km or 225 Ω**
- **Signal lines**   **Twisted pair**

In addition, we recommend terminating each end of the RS-485 cable with a 240 Ohm resistor.

RS485 Network

240 Ω   Addr. 1   RS485 device connectors   Addr. n   240 Ω
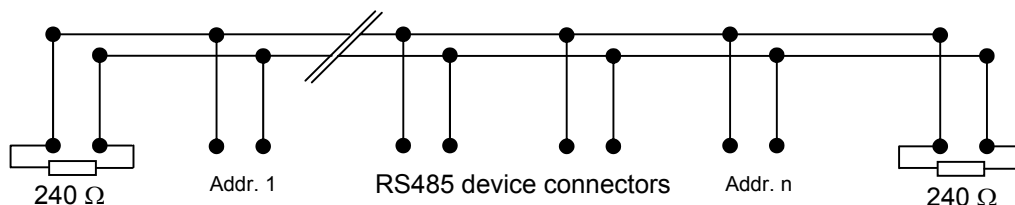
Note: all instruments connected to the network should use the same baud rate

Voltage potential issues

The existence of a voltage-potential between instruments that are interconnected can be a source on concern in large installations, installations with different mains power supply and in inter-building networking.

As a first measure, the shield of a signal cable should be connected at both ends. In the case of a data cable, a low-resistance potential equalization cable may also have to be used. This cable should be run parallel and as near as possible to the data cable, preferably in the same conduit. The shield of the data cable should under no circumstances be used as equalization cable! The conductors of the potential equalization cable should ideally be stranded in order to be effective also in case of high- frequency interference.

The following point should also be observed:

- Close the parasitic circuit
- Connect all devices to the potential equalizing cable as often as possible. Electrical conductors such as machine elements, metal tubes or supporting constructions should be integrated into the system.
- Protect the potential-equalization cable and connections against corrosion.
- Select the cross-section of the potential equalization cable according to the maximum equalization current.

If these different measures do not correct the problem, a galvanic separation according to ISO9549 may have to be installed. You may also want to consider the use of fiber-optic cables.