

<b>IN-E-HyClip DI-V1_10</b> <small>Document code</small>	Rotronic AG Bassersdorf, Switzerland <small>Unit</small>
<b>HygroClip DI digital interface: instruction manual</b> <small>Document title</small>	<p style="text-align: right;"><b>Instruction Manual</b></p> <small>Document Type</small> <p style="text-align: center;">Page 1 of 24</p>

# HygroClip DI Digital Interface v 1.0

## Instruction Manual



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## 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.

**IMPORTANT:** operation of the HygroClip DI requires a PC with the ROTRONIC HW4 software version 1.2.2 or higher. Instructions for using the HW4 software are not included in this manual. These instructions are shipped separately on the software CD ROM.

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## 1. Overview

The 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 can also be used to connect to a PC other instruments from ROTRONIC that have a RS-485 port such as the HygroFlex and M33 transmitters, HygroLab 2 indicator, etc.

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 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 (user supplied).

## 2. 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

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## HygroClip DI-4



- 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-4-WL



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

## 3. Power supply

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

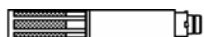
## 4. Probes

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):

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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

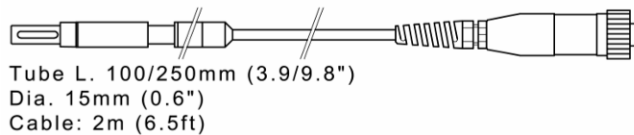


Blade L. 280mm (11")  
W. 18mm (0.7")  
T. 4mm (0.16") Cable: 2m (6.5ft)

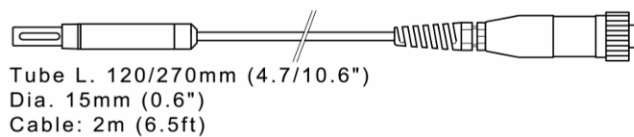
HygroClip HS28 sword probe  
measurement of paper stacks/rolls  
max. 85°C (185°F)

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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 is not compatible with the HygroClip DI.



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

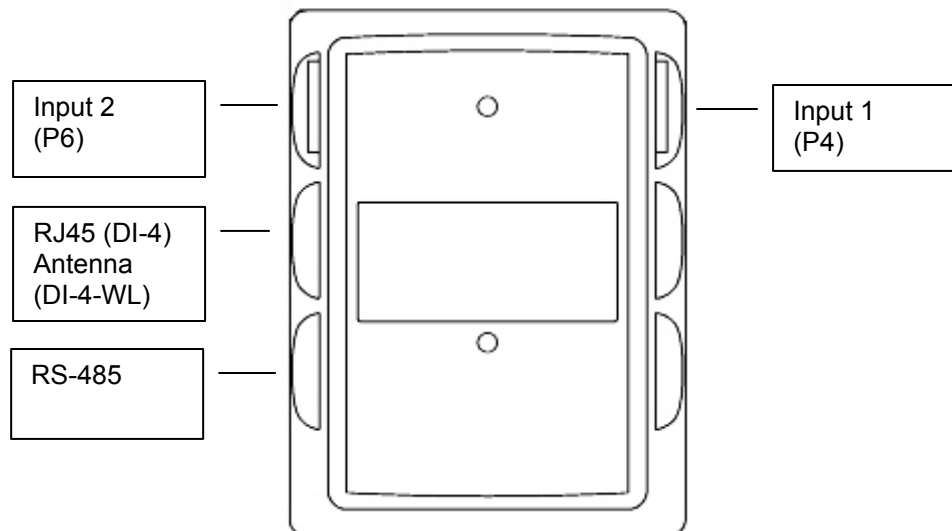
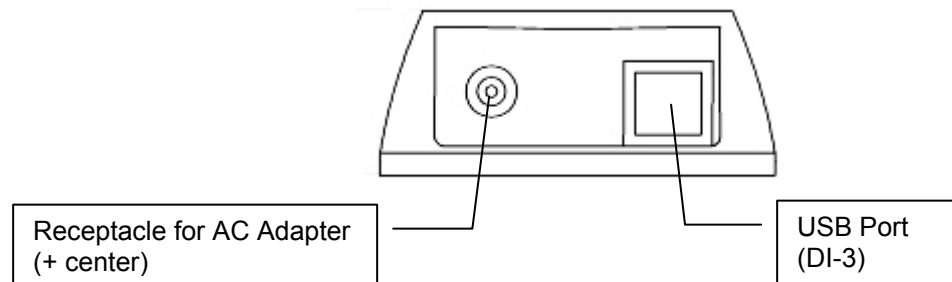


HygroClip IM-1 (120mm) / IM-3 (270mm)  
for through-wall installation in high humidity applications  
max. 200°C (392°F) - wire mesh filter



HygroClip IE-1 (G 1/2") / IE-3 (NPT 1/2")  
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

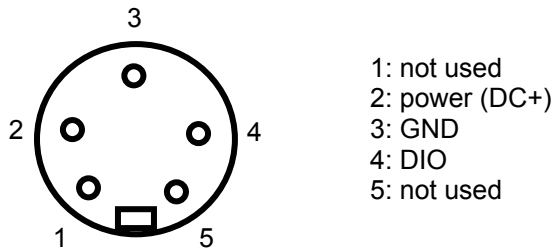
## 5. Connector identification



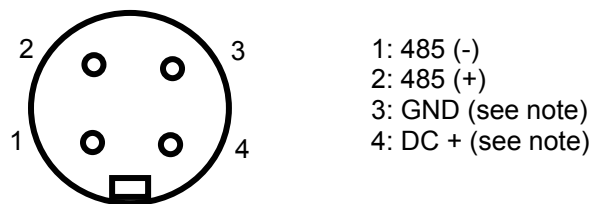
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## 6. Pin-out diagrams

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



RS-485 port - solder side of matching male connector



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.

## 7. Operation with the HW4 software

### 7.1 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

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Operating System compatibility:

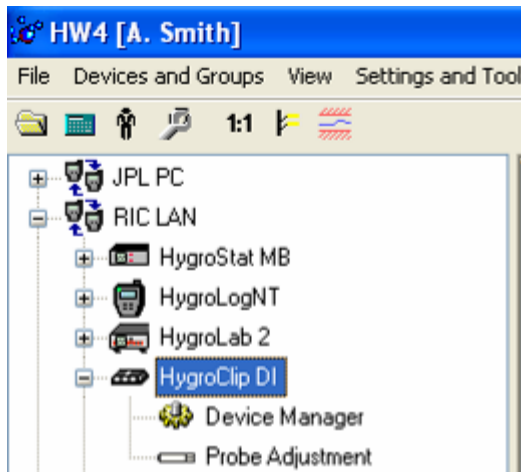
- Windows XP, NT4 with SP 6a or higher
- Windows 2000 with SP 2 or higher
- Windows Server 2003

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.

## 7.2 HW4 Device Manager

NOTE: for additional instructions, please consult the HW4 on-line instruction manual

After discovering the HygroClip DI with HW4, the functions available for the HygroClip DI are illustrated below:



To open the Device manager form, click with the mouse on Device Manager. The Device Manager form is used to configure the HygroClip DI and to read device specific information. When Device Manager is started, it automatically interrogates the device and downloads its current configuration.



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The forms that are available within the Device Manager form are listed in a tree located on the left pane of the form. To select a form, click on it with the left mouse button.

## Device Manager Menu Bar

The Device manager menu bar is located at the top of the form.

### File

- **Open:** opens the device configuration directory specified in the HW4 Settings Form - File Locations Tab - and displays all available device configuration files (extension .DAT). Any device configuration file that was previously saved can be opened to quickly configure an instrument. If so desired, any directory and any file type may be opened.
- **Save As:** saves the current configuration to a file (extension .DAT) in the device configuration directory specified in the HW4 Settings Form - File Locations Tab. If so desired, any directory and any file type may be specified.
- **Exit:** exits Device Manager

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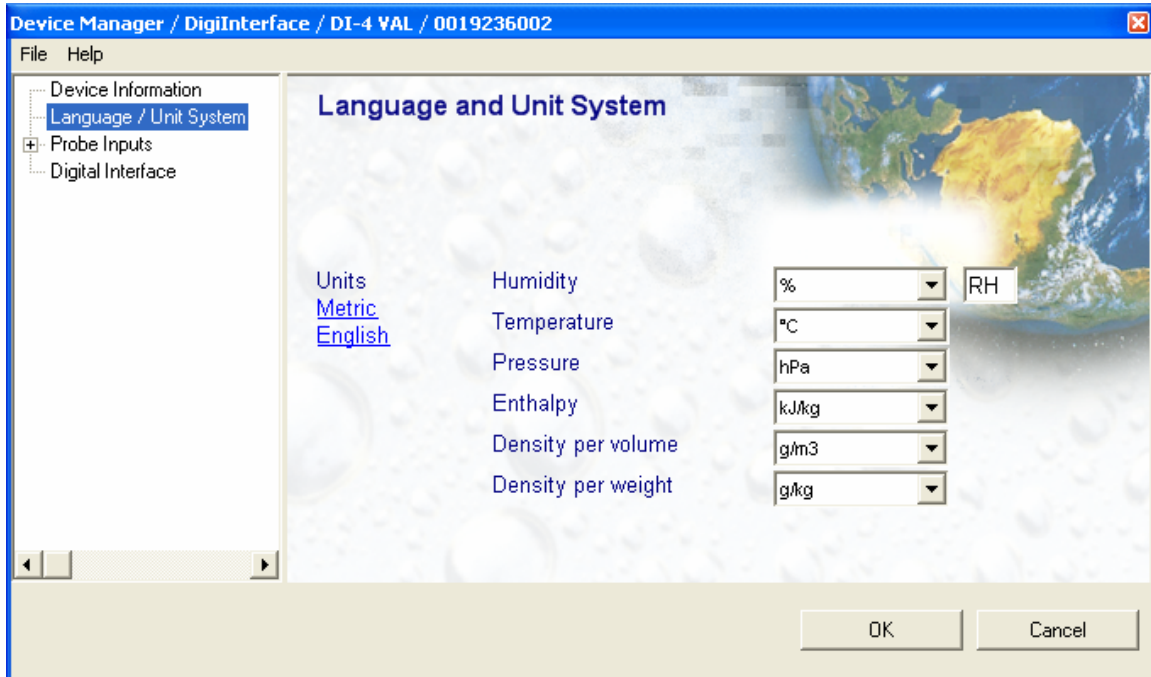
## Device Information



- **Device name:** this text will be displayed next to the instrument model information. As far as possible use a unique device name.
- **RS485 address:** click on the underlined link to change the instrument address to be used in conjunction with an RS-485 network (multi-drop). Each network address should be unique and within the values of 0 to 63. Note: the default factory RS-485 address is 0. Unless necessary, do not manually modify this address. HW4 will automatically change the RS-485 address of the device, if so required.
- **Device Protection:** for a description of this function, see **Device Protection** in this manual.

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## Language / Unit System



- **Units:** use the underlined links to the right of the form to globally change the unit system used by the instrument. If the unit system offers several choices such as In Hg or PSI for pressure, choose a unit by left clicking on the arrow to the right of each text box.

Humidity: the symbol to be used after the % symbol (RH) should be typed in the text box.

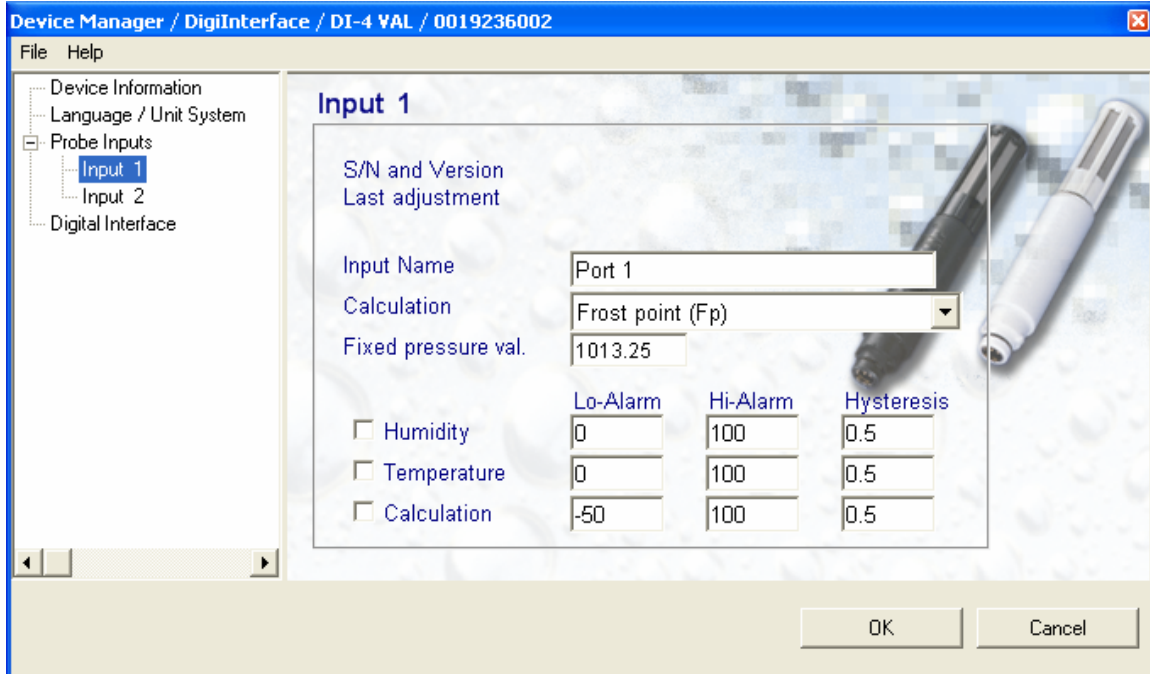
Note: the units selected for density per volume and density per weight also apply to vapor concentration and specific humidity.

**IMPORTANT:** Do not change the language / units settings while the PC is recording data.

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## Probe Inputs

Clicking on the plus sign to the left of “Probe Inputs” expands the tree and displays probe inputs 1 and 2.



Note: the HygroClip DI accepts HygroClip probes only.

- **Input Name:** use a maximum of 12 characters
- **Calculation:** Each probe input of the HygroClip DI can be set to compute 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)

Left click on the arrow to the right of the list box and select the parameter to be calculated by the HygroClip DI for this particular probe. This is also the calculated parameter that HW4 will display for this probe.

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Dew point (Dp) or Frost point (Fp): depending on the selection made here, HW4 will display either the symbol Dp or the symbol Fp. The symbol Fp indicates that any value below freezing is a frost point as opposed to a dew point. When selected, the symbol Fp is also be displayed for values above freezing. This of course is to be understood as being the same as dew point.

- **Fixed pressure value:** Calculating some of the psychrometric parameters requires barometric pressure as an input. Enter here the fixed pressure value that will be used by the HygroClip DI. Note that this numerical value should be consistent with the pressure unit that was selected under Language / Unit System.
- **Alarm:** alarm conditions can be defined for humidity, temperature and the calculated parameter. Values that are below the low alarm value or above the high alarm value will trigger an alarm. A value can be specified for the alarm function hysteresis. This value is used for both the low and the high alarm. To trigger an alarm only in the event that a probe is missing, disconnected or not transmitting data, simply enable the alarm for one of the parameters and set the Hi and Lo values to the range of the probe (for example 0 and 100 for humidity). All versions of HW4 will show an out-of-limits value alarm in red on the monitor screen. HW4 Professional can also be configured (HW4 global settings - Alarm settings tab) to display an alarm table and generate a report whenever an out-of-limits condition occurs.

## Digital Interface

The screenshot shows a software window titled "Device Manager / DigiInterface / DI-4 VAL / 0019236002". The window has a menu bar with "File" and "Help". On the left, there is a tree view with the following items: "Device Information", "Language / Unit System", "Probe Inputs", and "Digital Interface" (which is selected and highlighted in blue). The main content area is titled "Interface Information" and contains the following settings:

- Interface: Ethernet 192.168.57.125
- Data transmission:
  - Baudrate: 19200 (selected in a dropdown menu)
  - Data bits: 8
  - Stop bits: 1
  - Parity: None

At the bottom right of the window, there are two buttons: "OK" and "Cancel".

This form is used to select the RS-485 baud rate between 57600 and 19200. Other data cannot be changed from within the form. Select the Baud rate depending on which devices you plan to connect with the HygroClip DI. Devices such as the HygroFlex transmitter normally use 19200 bps.

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**IMPORTANT:**

All devices within an RS-485 multi-drop should use the same baud rate. Communication within the RS-485 multi-drop will not work when the devices are configured with different baud rates.

HygroClip DI-4 and DI-4-WL: after changing the baud rate in Device Manager, you should also reflect the change in the configuration of the internal Digi International module used by the device to connect to the LAN. See Baud rate compatibility requirements.

### **7.3 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.

### **7.4 Device protection**

This function is used to protect the HygroClip DI against malicious users. This is particularly useful when the device is exposed to the Internet. When a device is protected, the following functions are disabled:

- All Device Manager functions
- Log function programming (HygroLog NT)
- Probe adjustment
- Deletion of files from the device memory card (HygroLog NT)

**Warning:**

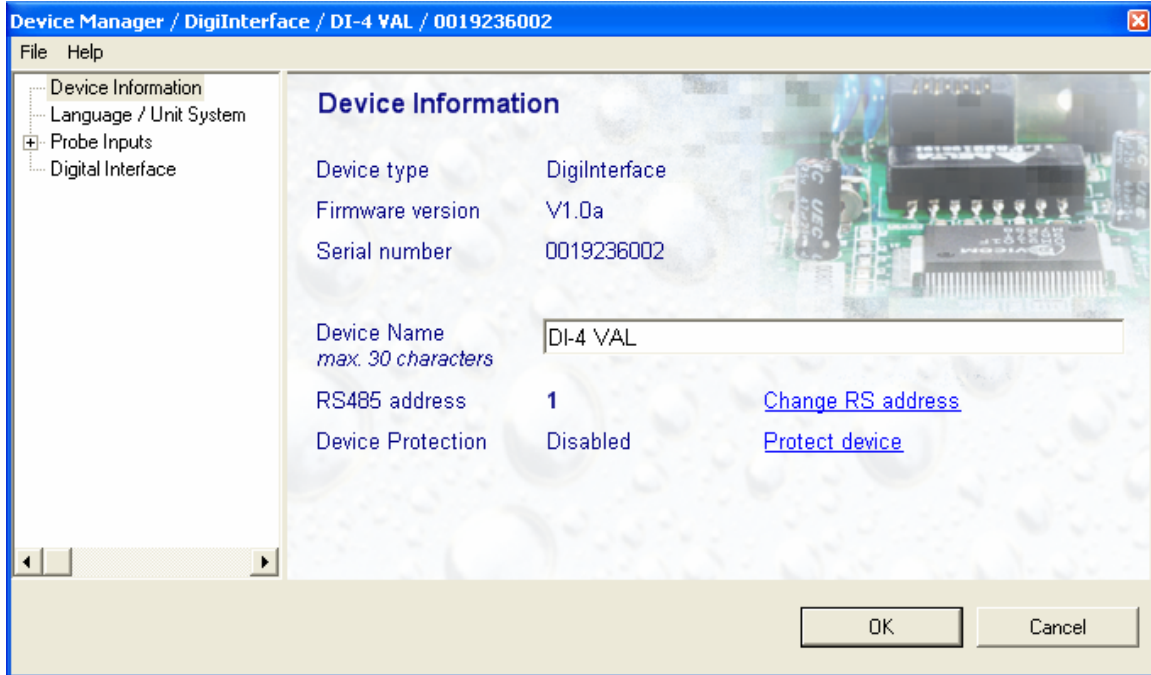
The following HW4 automatic functions are also disabled for the protected device:

- Automatic address change when adding new devices to a RS-485 multi-drop network
- Automatic synchronization with the HW4 PC clock

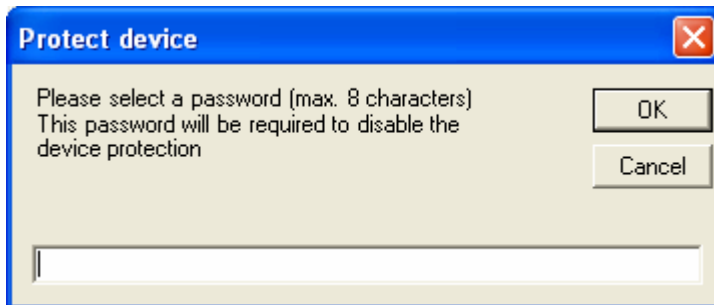
The procedure used to protect or unprotect a device is described, using the HygroClip DI as an example:

Select the device in the device tree and open Device Manager > Device Information:

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To protect the device, click on the underlined link. HW4 opens the following form where a password can be entered (maximum 8 characters):



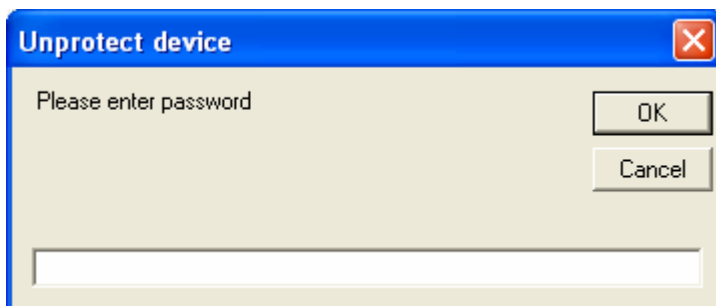
Enter the password and click on the OK button. HW4 confirms that the device is now protected:



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To unprotect the device and enable all functions, click on the underlined link. HW4 opens the password form:



Enter the password and click on the OK button. HW4 confirms that the device is now unprotected.

**FORGOT THE PASSWORD?** - should you forget the password used to protect the device, remove power from the device (HygroLog NT: remove the battery). After restoring power to the device, you have about one minute to use the default password **!resume!** and unprotect the device (include the exclamation marks). After one minute the default password is not accepted.



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## 7.5 Probe adjustment

Please consult the HW4 on-line instruction manual.

## 8. Baud rate compatibility requirements

Depending on the model, devices from ROTRONIC use one of the following Baud rates as the factory default:

- 57600 bps: HygroLog NT data logger and docking stations
- 19200 bps: HygroPalm and HygroLab indicators, HygroFlex and M33 transmitters, HygroClip Alarm programmable alarm card, HygroClip DI interface, HygroStat MB Thermo-Hygrostat

### IMPORTANT:

- All devices connected to a RS-485 multi-drop network (master and slaves) must use the same Baud rate
- In the case of a device with an Ethernet (TCP/IP) module, the Baud rate of the module must be the same as the Baud rate of the device

Devices and internal Ethernet modules with mismatched Baud rate will not communicate together.

- The Baud rate configuration of a ROTRONIC device can be changed with the **Device Manager** function (Digital Interface tab) available from within the HW4 software.
- The Baud rate of a Digi Module can be changed only from the module web interface. See separate document **IN-E-TCPIP-Conf\_10.doc** (also available in PDF format).

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## 9. Ethernet local area network

ROTRONIC devices with an Ethernet (TCP/IP) interface presently use an internal module manufactured by Digi International (Digi Connect ME for a wired connection, Digi Connect WI-ME for a wireless connection). Both types of module feature a web interface that is used to configure the module.

**IMPORTANT:** The TCP/IP settings of both the HygroClip DI-4 and DI-4-WL should be configured to be compatible with the local area network. Detailed instructions are provided separately in document **IN-E-TCPIP-Conf\_10.doc** (also available in PDF format).

Both the HygroClip DI-4 and DI-4-WL are shipped with a Device Configuration Certificate that provides information about the factory configuration settings of both the Ethernet module and device. See example below:

Setting	Value
DHCP or Static Address	Static
IP Address	192.168.1.1
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.0
TCP Port	2101
MAC Address	00:40:9D:28:2D:2A
Firmware Release (device)	1.4
User Name (web interface)	rotronic
Password (web interface)	wlan
Serial Port Configuration Profile	TCP Sockets
Basic Serial Settings	
Baud Rate	57600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

## 10. RS-485 multi-drop network

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

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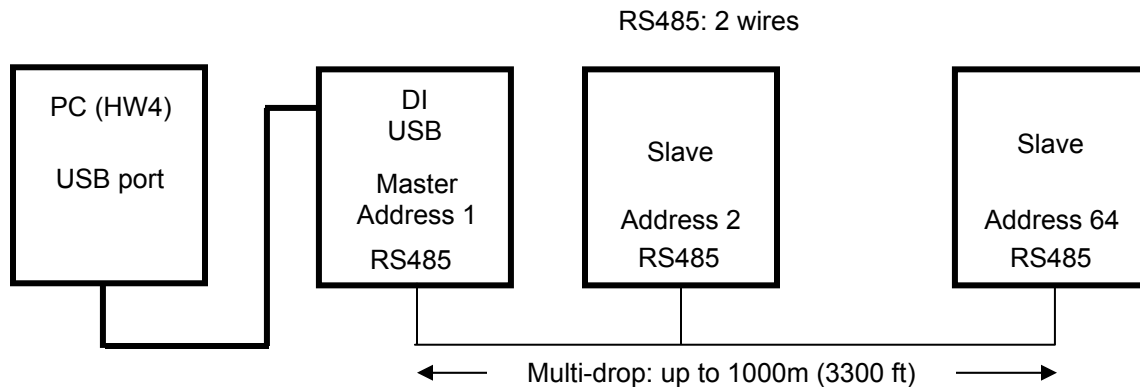
for RS-485 slaves” is being used, HW4 automatically changes from 00 to 01 the RS-485 address of any master that has slaves attached. As a result, all masters end up with the same RS-485 network address (01). In addition, HW4 automatically changes the RS-485 address of the slaves in each multi-drop from 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.

**Example: HygroClip DI with USB port**

The number of HygroClip DI with USB port that can be directly connected to a PC depends on the number of USB ports available on the PC.



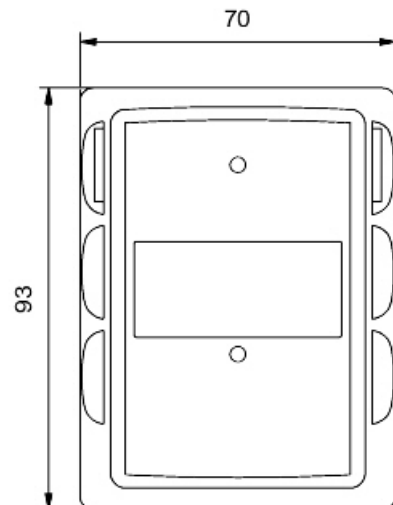
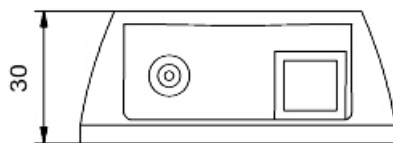
**IMPORTANT:**

- 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. See Baud rate compatibility requirements.
- HygroClip DI-4 and DI-4-WL: please note that the Baud rate of the HygroClip DI and the Baud rate of the internal Ethernet module should be set to the same value
- 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. Be sure to observe the polarity for each connection. Using 4-wire cable, offers the option of powering all devices in the multi-drop from a single DC voltage source.

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## 11. 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	93 x 70 x 30 mm		
Weight	about 175 g		
Conformance	EN 61000-6-3 + EN 61000-6-1 (residential) EN 61000-6-4 + EN 61000-6-2 (industrial) FDA CFR 21 / 11 / GAMP4		



Dimensions in mm

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## 12. 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-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. Cable length 3 meter (9.8 ft)
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.

## 13. Communications protocol

For customers who for any reason do not wish to 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.

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## 14. 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:

<ul style="list-style-type: none"> <li>• Bus signals such as RS485</li> <li>• Data signals for PCs, printers etc.</li> <li>• Shielded analog inputs</li> <li>• Unshielded direct current (&lt;= 60V)</li> <li>• Shielded process signals (&lt;= 25 V)</li> <li>• unshielded alternating current (&lt;= 25V)</li> <li>• Coaxial cables for CRT monitors</li> </ul>	in common bundles or channels / conduits
<ul style="list-style-type: none"> <li>• Direct current from 60 V to 400 V (unshielded)</li> <li>• Alternating current from 25V to 400 V (unshielded)</li> </ul>	in separated bundles or channels / conduits, without minimum distance
<ul style="list-style-type: none"> <li>• Direct and alternating current &gt; 400 V (unshielded)</li> <li>• Telephone lines</li> <li>• Lines leading into EX-rated areas</li> </ul>	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**

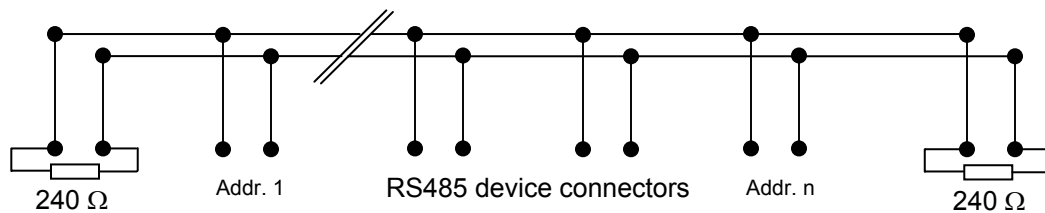
Using a symmetrical transmission method in combination with low capacity/ low attenuation twisted pair cables, allows extremely reliable long distance connections. The use of a high grade shielded cable avoids cross talk between the transmitted signals and also reduces the potential of external interference. 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**       **$\leq 300\text{pF/m}$  or  $90\text{ pF/ft}$**
- **Line impedance**         **$100\ \Omega \pm 15\ \Omega$**
- **Line resistance**         **$140\ \Omega/\text{km}$  or  $225\ \Omega$**
- **Signal lines**            **Twisted pair**

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

#### **RS485 Network**



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.

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The following points 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 ISO 9549 may have to be installed. You may also want to consider the use of fiber-optic cables.

## 15. Document releases

Doc. Release	Date	Notes
-10	Jan. 16, 2007	Original release

### Hardware and firmware:

Firmware Version	Date	PCB Number
1.0a	Apr. 26, 2006	Model DI-3: 66.0860.0015 Model DI-4: 66.0862.0015



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