HygroClip Alarm (HCA) version 2

Programmable Alarm and Control Card

Instruction Manual

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Applicability:

This manual is valid for all devices with firmware version 2.x, where 2.x can be 2.0, 2.1, etc. Changes to the last digit of the version number reflect minor firmware changes that do not affect the manner in which the device should be operated.

Note: Configuration of this device requires a PC with the optional ROTRONIC HW4 software version 1.2.2 or higher. Instructions for using the software are not included in this manual. These instructions are shipped separately on the software CD ROM.

1 Overview

The HygroClip Alarm (**thereafter referred to as HCA**) is a programmable alarm and control card with an internal clock, one RS-485 port and two logical inputs that can be used to monitor the state of a contact such as a door, push button, switch, etc. The HCA is designed for use with other ROTRONIC products that are part of the HW4 measurement system [1].

Four single pole double throw (SPDT) relay contacts are available to control a variety of devices such as a humidifier, dehumidifier, heater, cooling coil, siren, etc. The HCA also features two logical inputs that can be used to monitor the state of a contact such as a door, push button, switch, etc.

The HCA can be programmed to monitor a variety of input variables:

- Values measured or calculated by instruments and probes that are on the same RS-485 multi-drop network as the HCA
- Alarms directly generated by the devices connected to the RS-485 multi-drop (out-of-limit values, no communication with a probe, data logger memory card or power supply problem)
- State of the HCA two logical inputs (external contacts)
- No communication with a device being monitored
- Alarms generated by the PC running the ROTRONIC HW4 software.

Each of the 4 relay contacts can be freely programmed with its own alarm function. A large choice of virtual components such as comparators, gates, flip flops, delays, real time alarms make it possible to use the HCA for a variety of alarm tasks ranging from simple to fairly complex.

Configuration and programming of the HCA requires a PC running the ROTRONIC HW4 software as well as one ROTRONIC instrument equipped with both a PC interface and a RS-485 port. Up to 4 virtual push buttons and 4 virtual switches can be programmed into the HCA. These are typically used to remotely cancel or enable an alarm from the PC.

During operation, the logical state of the HCA inputs and relays, as well as any alarm condition detected by the HCA, can be monitored from a PC running the HW4 software. The HCA internal clock [2] provides a date and time stamp to the 680 most recent events retained in the HCA internal memory. Events retained by he HCA can be reviewed and printed from the PC.

The HCA features an auto-polling mode that makes it possible to operate the HCA on a RS-485 network without a PC. This mode is automatically activated whenever the HCA itself is not regularly polled by a PC. In the auto-polling mode, the HCA takes over the task of sending data

requests to the instruments and probes that it is programmed to monitor. The ability of the HCA to operate independently of a PC provides an additional layer of protection in the event of a PC failure.

[1] *The HW4 System is comprised of the HW4 validated software for data monitoring and recording and a number of instruments – indicators, data loggers and transmitters that can be connected to a PC (COM, USB, RS-485 or Ethernet – wired or wireless).*

[2] *The clock can be automatically synchronized with the PC date and time.*

2 Software compatibility

The HCA version 2 is compatible with the ROTRONIC HW4 software version 1.2.2 or higher. The HCA version 2 is not compatible with the ROTRONIC HW3 software.

3 Baud rate and RS-485 address requirements

The HCA can only be used as a RS-485 slave. Prior to connecting the HCA to the RS-485 port of a master or to an existing RS-485 multi-drop network, you should make a note of the following:

- Devices with mismatched Baud rate will not communicate together.
- A device with a duplicate RS-485 address will not be able to communicate with other device on the same RS-485 multi-drop

The HCA is supplied with a Device Configuration Protocol that shows the factory Baud rate setting as well as the RS-485 address of the HCA.

When using the HCA for the first time, **be sure to follow the initial configuration steps provided in this manual**.

4 General description

4.1 Power requirements

The HCA is available with a choice of two basic internal power modules:

- HygroClip Alarm 1:12 to 35 VDC (maximum 300 mA) or 12 to 24 VAC (50/60 Hz).
- HygroClip Alarm 2: 90 to 264 VAC (50/60 Hz).

Note: The HCA can also be powered from an external 12…15 VDC voltage supply, connected to the RS-485 terminal (see Electrical connections).

4.2 RS-485 port and networking

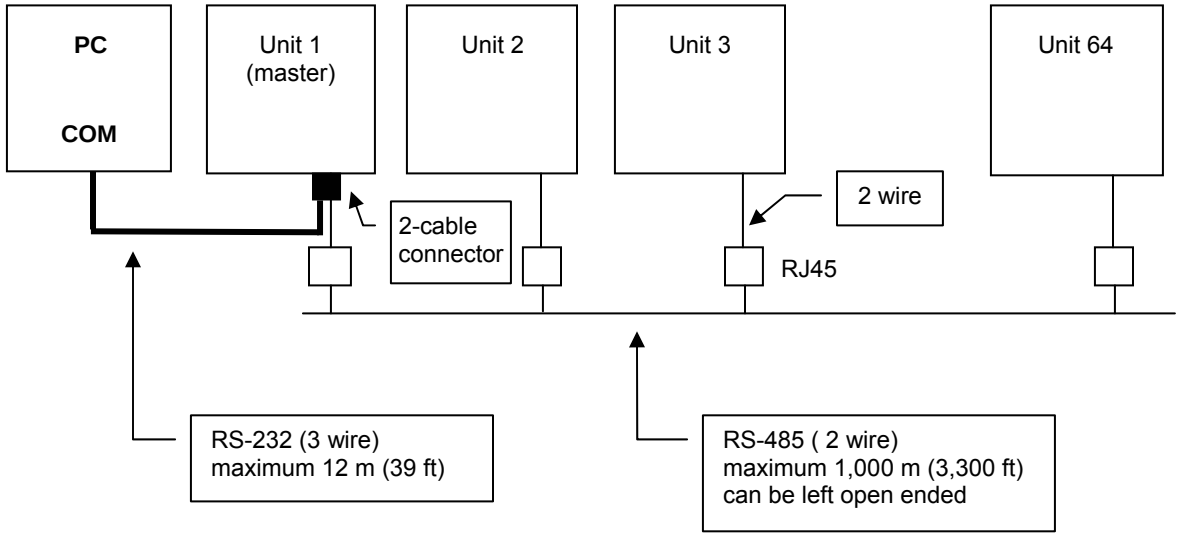
The RS-485 port is used to connect the HCA to a RS-485 multi-drop network consisting of at least another ROTRONIC humidity-temperature instrument. Connection via RS-485 requires two wires: RI + and RI -. Be sure to observe the polarity of the RS-485 connection.

Up to 64 instruments, HCA included, can be connected together by a RS-485 multi-drop. The master (RS-485 address 1) is always the unit that is connected to the PC by means of a COM port (RS-232), USB port or Ethernet port. Since the HCA has only a RS-485 port it cannot be the master unit.

Within a RS-485 multi-drop, each device (master or slave) should have a unique RS-485 address and all devices should use the same baud rate. See “Configuring the HCA”.

In the case of a RS-232 connection between the first unit on the network (master) and the PC, 3 wires are required: RX, TX and GND. Without a signal booster, our recommendation is to limit the maximum cable length to 12 m (39 ft). It may be possible to use up to 150 m (490 ft) of cable, but this not guaranteed.

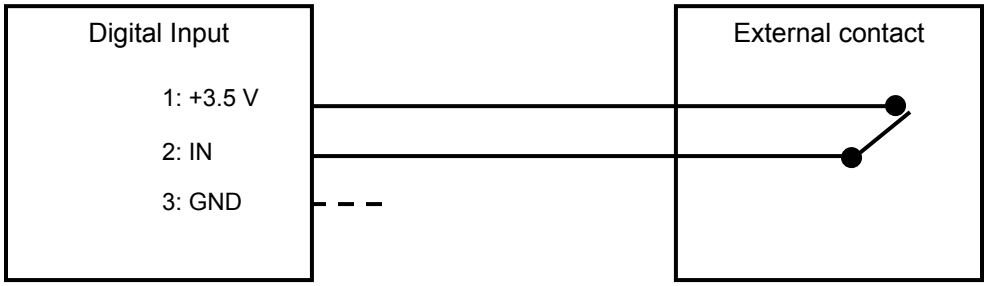
Regarding the RS-485 wiring, please consult “Electrical installation guidelines” provided in this manual.



4.3 Logical inputs

The HCA has two logical inputs labeled Input 1 and Input 2. These inputs can be used, for example, to monitor the status of up to two electrical contacts (door closed or open, etc.).

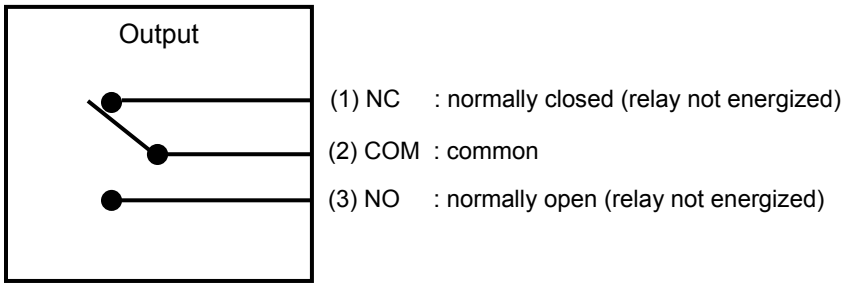
Depending on whether the external contact is closed or open, the state of input “IN” is a logical 1 (+3.5 V) or a logical 0 (“IN” is internally tied to ground by a 4.72 kΩ pull-down resistor).



Note: Pin 3 (GND) is reserved for special applications and is not normally used.

4.4 Relay contacts (outputs)

The HCA has four identical relay contacts, labeled Output 1 to 4. Each contact is a single pole double throw (SPDT)



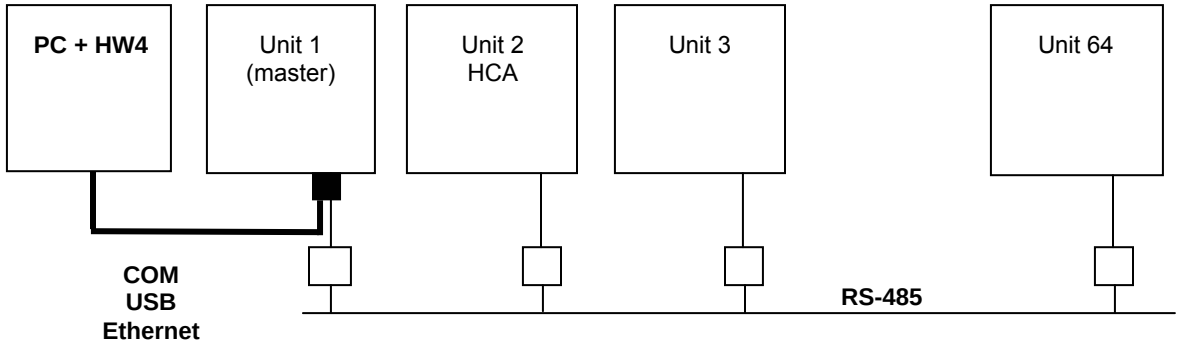
Contact Rating: 10 A at 250 VAC or 30 VDC, 12 A at 125 VAC. Please observe these ratings to avoid damaging the contacts.

The logical state of a relay is as follows:

1 : relay energized
0 : relay de-energized

4.5 Passive mode and auto-polling mode

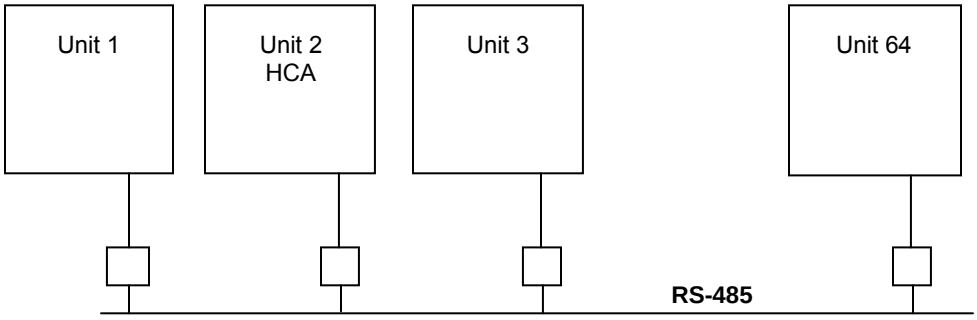
Passive mode: RS-484 network with HW4 PC



When the RS-485 network is connected to a HW4 PC, via a master, the HW4 PC takes over the task of sending data requests and instructions to the different units on the RS-485 network. Each unit remains silent unless interrogated by the PC.

As long as the polling interval of the HW4 PC is set to 1 minute or less, the HCA remains silent unless interrogated by the HW4 PC (passive mode). In the passive mode, the HCA listens to the data sent by the instruments that it is programmed to monitor.

Auto-polling mode: RS-485 network without HW4 PC (no PC or PC crash)



The HCA switches automatically to the auto-polling mode in the following situations:

- The polling interval of the HW4 PC is set to more than 1 minute
- The HW4 PC is disabled
- No PC is connected to the RS-485 network

In the auto-polling mode, the HCA takes over the task of polling the instruments that it is programmed to monitor. The polling interval is 10 seconds. When several HCA are connected to the same RS-485 network, each HCA does its own auto-polling, one HCA at a time.

NOTES:

When using the HCA in a network driven by a HW4 PC, be sure that the HW4 software is configured to interrogate all of the devices that the HCA is programmed to monitor.

Do not include a virtual push-button as part of an alarm function when the HCA will be used without a PC (auto-polling mode). Operation of a virtual push-button requires a connection to the HW4 PC by way of a master device.

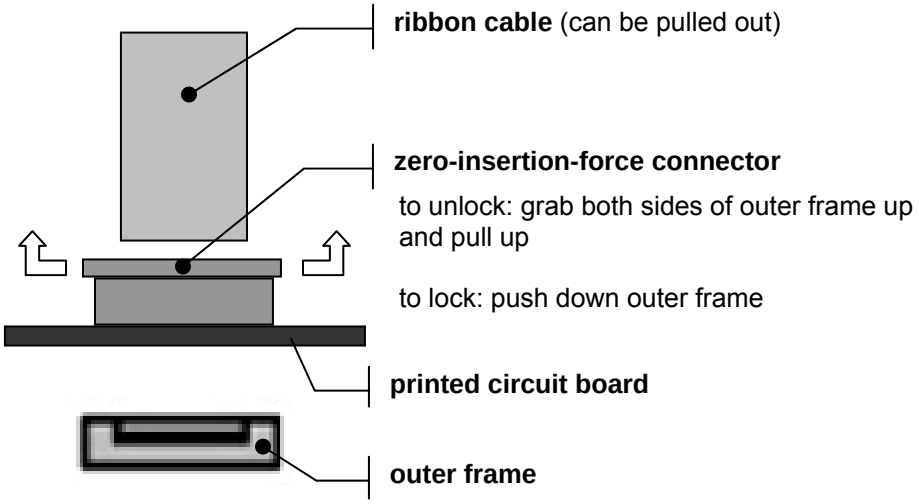
Do not include a virtual switch as part of an alarm function that has to keep operating after a brief interruption of power. The logical state of a virtual switch is automatically set to 0 whenever the HCA loses power.

5 Installation

Remove the front cover to gain access to the mounting holes and to the terminals of the HCA.

The front cover is connected to the main PCB by a flat ribbon cable. When removing the front cover, this cable can become detached. This is nothing to worry about; the cable can be easily re-attached.

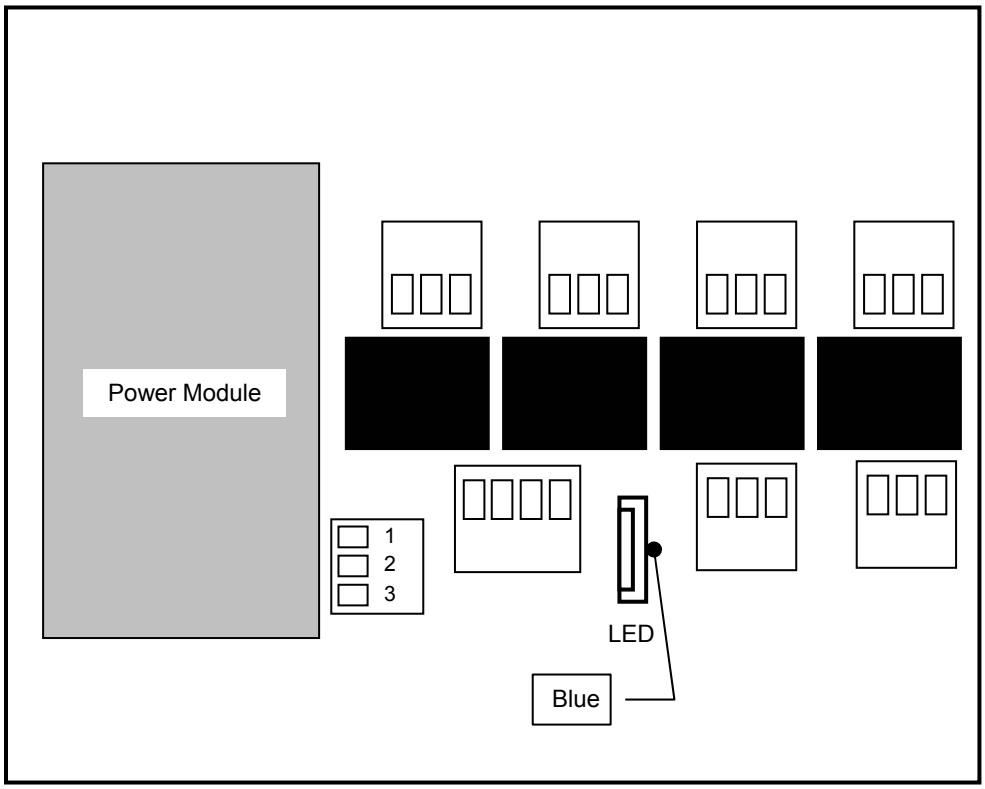
Zero-insertion-force connectors are used both on the Main PCB and on the small PCB located inside of the cover.



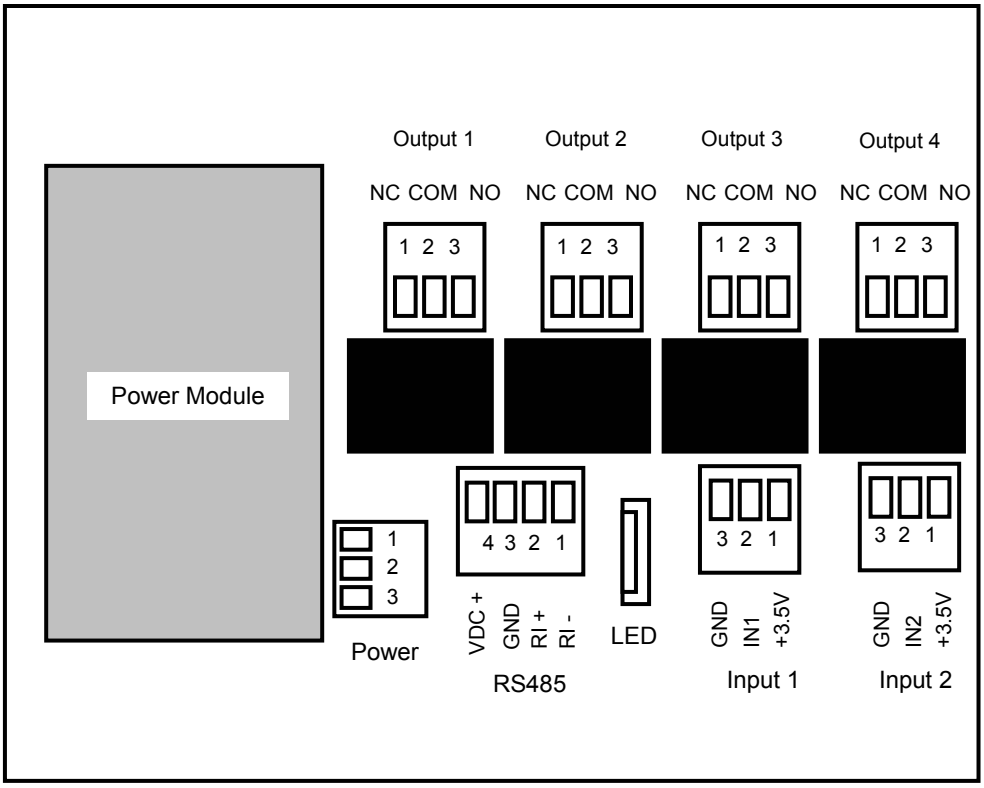
To re-attach the ribbon cable, unlock the connector (see above) and slide the cable back into the connector as indicated below. Lock the connector in place and verify the cable is firmly held in place. Each end of the ribbon cable has a contact side and a blue insulated side. When inserting the cable in the connector, position the contact side of the flat ribbon cable as indicated below.

a) PCB inside of the cover:

b) Main PCB



5.1 Electrical connections

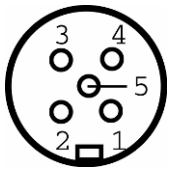


Power	1: AC neutral or DC - 2: AC phase or DC + 3: Ground
RS485 See note below	1: RI – 2: RI + 3: GND 4: VDC +
Logical Input 1 to 2	GND : ground – provides a logical 0 when connected to “IN” IN : logical input +3.5V : provides a logical 1 when connected to “IN”
Output 1 to 4 Relays	NC : normally closed (relay is not energized) COM : common NO : normally open (relay not energized)

Note: Pos. 3 and 4 of the RS-485 terminal block may be used to power the HCA, and other devices [1] connected to the RS-485 multi-drop, from a single external 12…15 VDC power supply with an adequate mA rating. In this situation, do not connect the power terminal block to a power source.

[1] The following devices can be powered from the RS-485 multi-drop: HygroLog NT with docking station, HygroClip DI interface (use 4-wire cabling for the multi-drop). Devices such as the HygroLab indicator, HygroFlex and M33 transmitters cannot be powered from the RS-485 multi-drop.

RS485 connector (solder side of matching male connector)



Pin #	Function
1	Not used
2	Not used
3	GND
4	RI +
5	RI -

6 Configuring the HCA

6.1 Required equipment

The following is required in order to configure and program the HCA:

- ROTRONIC HW4 software version 1.2.2 or higher, installed on a PC (HW4 PC)
- One master device connected to the HW4 PC [1]

[1] The master device can be any ROTRONIC device which is a member of the HW4 system and that is equipped with a RS-485 port (examples: HygroLog NT with docking station, HygroClip DI interface, HygroFlex 2, HygroFlex 3, HygroLab 2, etc.). The master device can be connected to the PC using any of the connections methods accepted by HW4: COM port (RS-232), USB port or Ethernet Network (wired or wireless).

6.2 Default factory settings

The default factory settings for the RS-485 interface of the HCA are as follows:

Baud rate : see Device Configuration Protocol [1]
Data bits : 8
Stop bits : 1
Parity : none

RS-485 address : 0 - see Device Configuration Protocol [1]

[1] The HCA is supplied with a Device Configuration Protocol that shows the Baud rate setting as well as the RS-485 address of the HCA.

6.3 About the baud rate and RS-485 address

The HCA can only be used as a RS-485 slave. Prior to connecting the HCA to the RS-485 port of a master, you should verify that the Baud rate of the master (and any slave already connected to the master) is set to the value shown on the HCA Device Configuration Protocol. If necessary, temporarily change the Baud rate of the master to allow communication with the HCA.

A Baud rate of 57600 bps is the recommended value for the HygroLog NT data logger because this value permits a faster download of log files.

A Baud rate of 19200 bps is the recommended value for the HygroLab 2 indicator as well as for the HygroFlex and M33 transmitters. When necessary, the Baud rate can be temporarily changed to 57600 bps to allow configuration of another device.

The Baud rate of the HCA or any other ROTRONIC device can only be changed with the Device Manager function (Digital Interface tab) available from within the HW4 software.

In order to be configured, the HCA requires a RS-485 connection to a master device that is itself connected to a PC with the ROTRONIC HW4 software installed. For more information, please consult both the master device manual and the HW4 software manual.

6.4 Basic RS-485 multi-drop network requirements

All devices connected to the same RS-485 multi-drop network should meet the following requirements (see also “Electrical installation guidelines” in this manual):

- All devices must use the same baud rate
- Each device within the same RS-485 multi-drop must have a unique RS-485 address

By default, all ROTRONIC products with RS-485 interface are shipped by the factory with the RS-485 network address 0.

HW4 can be used to manually change the RS-485 address of a device.

Preferably, HW4 should be allowed to automatically change the RS-485 address of all devices that are connected to the same RS-485 multi-drop. When the HW4 software searches for RS-485 slaves, any master with the RS-485 address 0 is automatically changed to RS-485 address 1. Within an RS-485 multi-drop, any slave with RS-485 address 0 is automatically changed to RS-485 address 2 or higher as soon as it is detected by HW4 (up to the maximum of 64).

6.5 Initial configuration steps

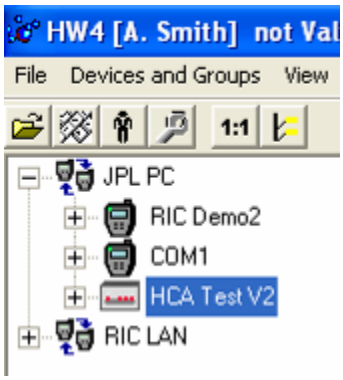
1) Disconnect any slave that may be attached to the master device that will be used to configure the HCA. Delete any existing slave from the HW4 device tree (left pane of the HW4 main screen)

2) Make sure that the master device is both powered and connected to the HW4 PC. Start HW4 and, if necessary, discover the master device. Make sure that the master device appears in the HW4 device tree and that it is properly communicating with the PC (no icon with a red cross). In the device tree, select the master device and open its Device Manager. Select “Interface” or “Digital Interface”. Verify that the Baud rate is set to the value provided in the HCA Device Configuration Protocol. If necessary, make a note of the current Baud rate value of the master device and temporarily change this value to the Baud rate of the HCA (Not performing this step may prevent any communication between the master device and the HCA.)

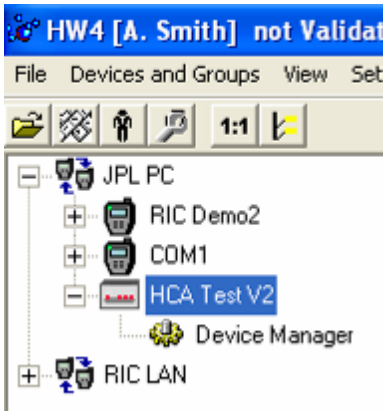
3) Connect the HCA to the RS-485 port of the master device and power the HCA.

4) From the HW4 main menu bar select Devices and Groups > Search for RS-485 slaves.

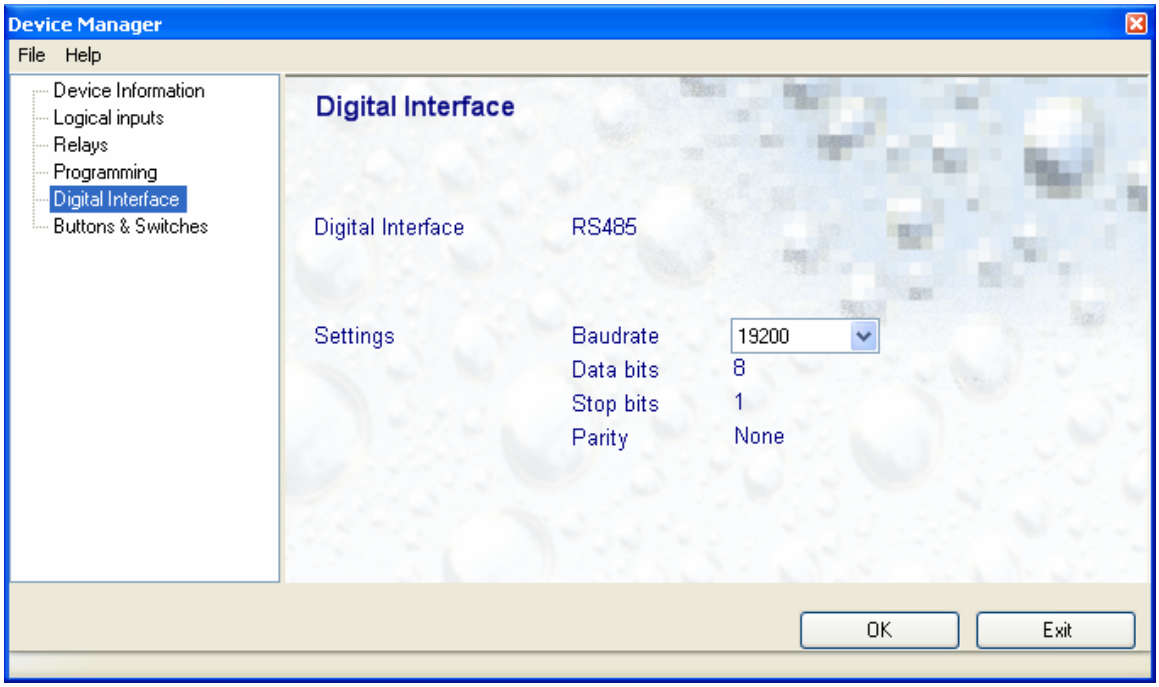
5) Verify that the HCA appears as an icon in the HW4 device tree and that there is no red cross on top of the icon (see example below). Note that the search for RS-485 slaves automatically causes the RS-484 address of the HCA to be changed from 0 to 2 (assuming that the master device has address 1).



6) In the HW4 device tree, click on the + sign to the left of the HCA to display the Device Manager. Click on Device Manager:



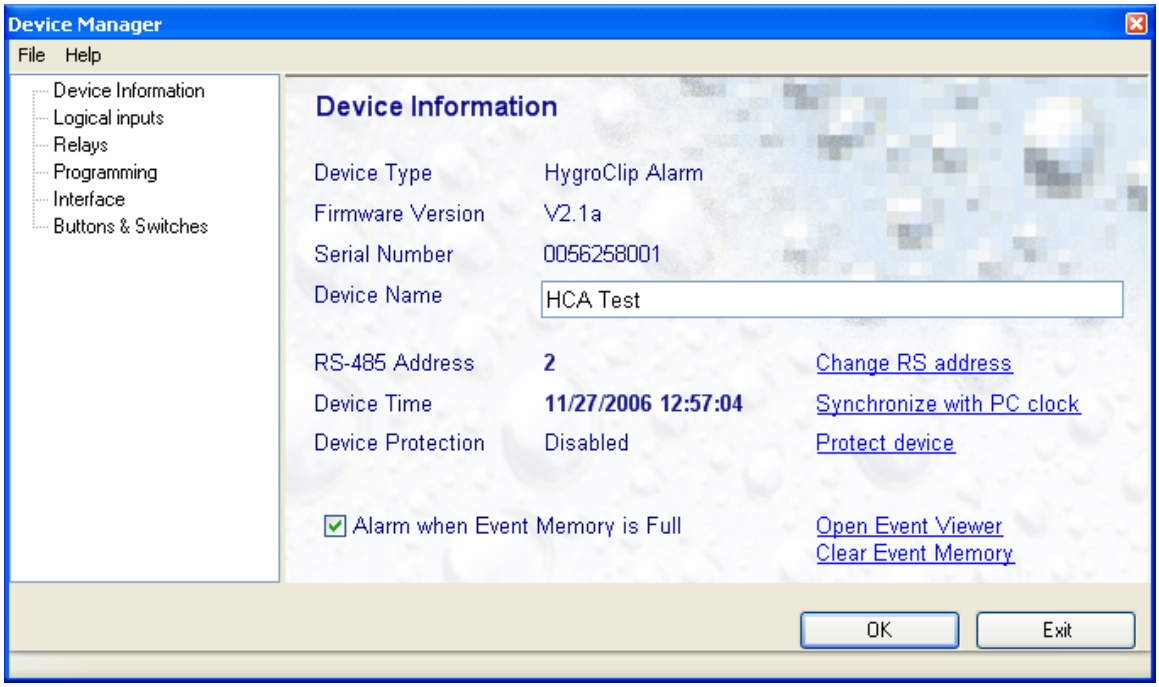
7) In the left pane of the HCA Device Manager, click on Digital Interface. **If necessary**, change the Baud rate of the HCA to the original Baud rate of the master device. Note that this will temporarily prevent communication between the master device and the HCA.



8) **If necessary**, click on the + sign to the left of the master device In the HW4 device tree to display the Device Manager.

9) **If necessary**, return the master device Baud rate to its original value. This will re-establish the communication between the master device and the HCA.

10) **If additional slaves are to be used in the same RS-485 network as the HCA,** click on Device Information in the left pane of the HCA Device Manager. Click on the blue link labeled "Change RS address" and change the HCA address back to 0.



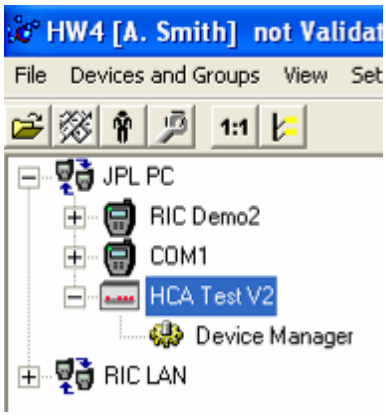
11) Connect any other slaves to the RS-485 multi-drop and run again the Search for RS-485 slaves in the HW4 main menu Bar > Devices and Groups. This step ensures that the HCA will be given a unique RS-485 address within the RS-485 multi-drop.

12) Verify that the master device as well as the HCA and any other slave in the same RS-485 multi-drop are present in the HW4 device tree.

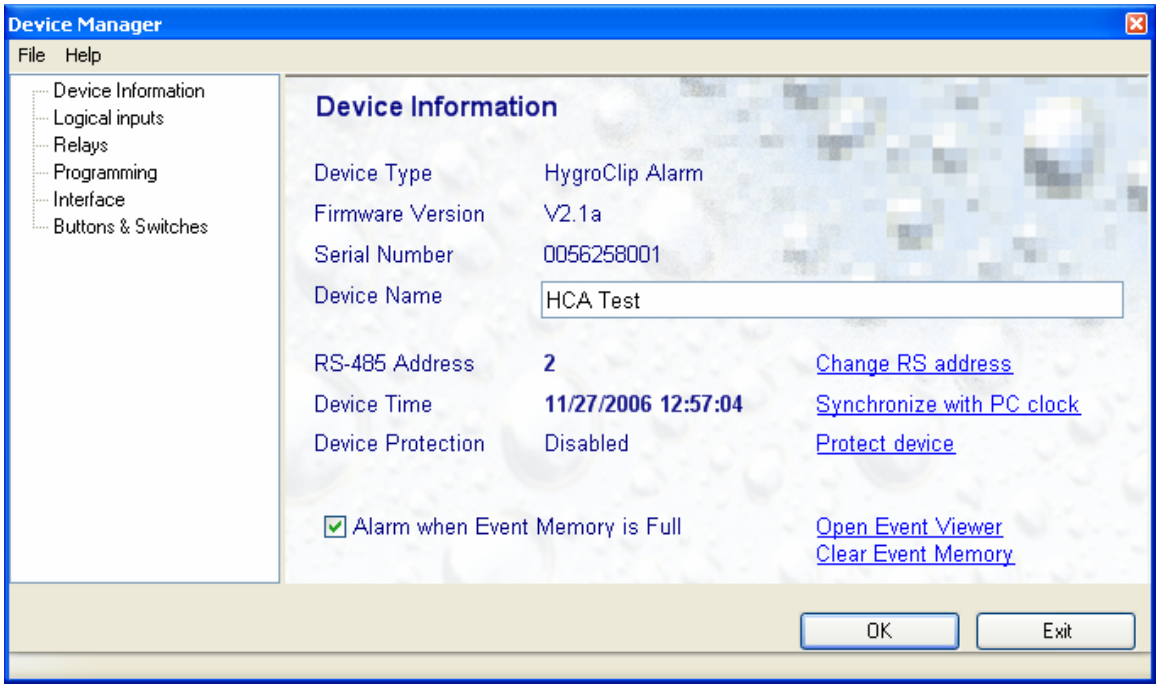
Finish configuring and programming the HCA as explained under “HCA Device Manager” and “Programming the HCA”.

7 HCA Device Manager

From the HW4 device tree, click on the + sign to the left of the HCA to display the Device Manager. Click on Device Manager:



7.1 Device information



- **Device name**: this text will be displayed by HW4 next to the device icon. If possible use a unique device name.

- **RS485 address**: click on the underlined link to change the device address to be used in conjunction with a RS-485 network (multi-drop). Each network address should be unique and within the values of 2 to 64. 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.

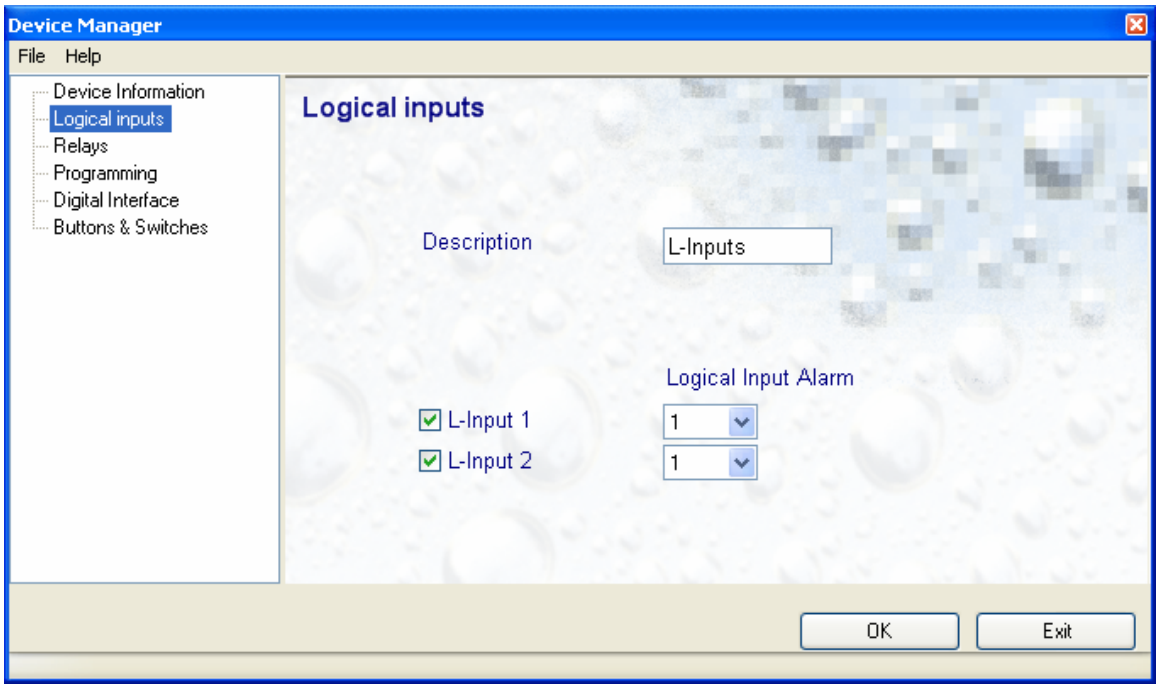
- **Adjust device to PC time**: click on the underlined link to set the device date and time to match the PC.

- **Protect device**: for a description of this function, see **Device Protection**.

- **Open Event Viewer / Clear Event Memory**: click on one of the underlined links to view (and print) the events recorded by the device memory or to clear the memory of all recorded events. For more details, see: **Event Memory and Event Viewer**.

- **Trigger an alarm when event memory is full**: check this box to have the HCA send an alarm to the PC whenever the event memory is full.

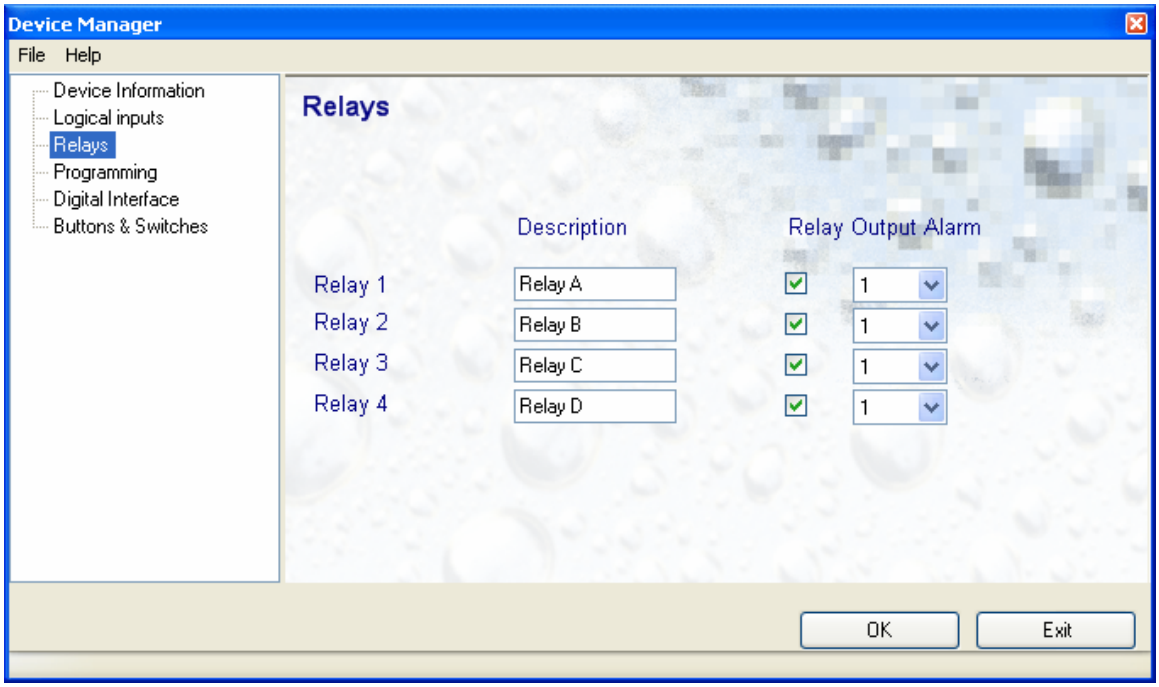
7.2 Logical inputs



- **Description**: this text will be displayed by HW4 in the current values table.

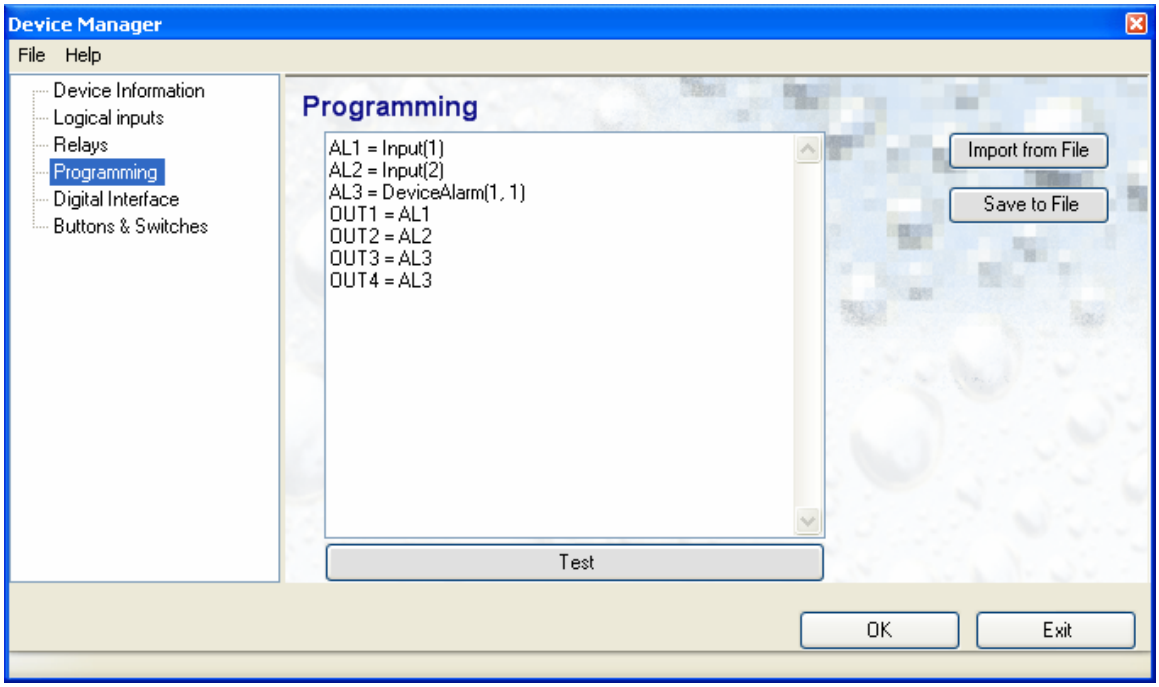
- **Logical Input 1 / Logical Input 2**: put a check mark in the box next to Logical Input 1 and/or Logical Input 2 to enable monitoring of the logical input alarm status by HW4. The logical state that triggers an alarm can be defined under “Logical Input Alarm”.

7.3 Relays



- **Description**: this text will be displayed by HW4 in the current values table.
- **Relay Output Alarm**: put a check mark in the box next to each relay to enable monitoring of the relay alarm status by HW4. The logical state that triggers an alarm can be defined under “Relay Output Alarm” (logical 1 means that the relay is energized).

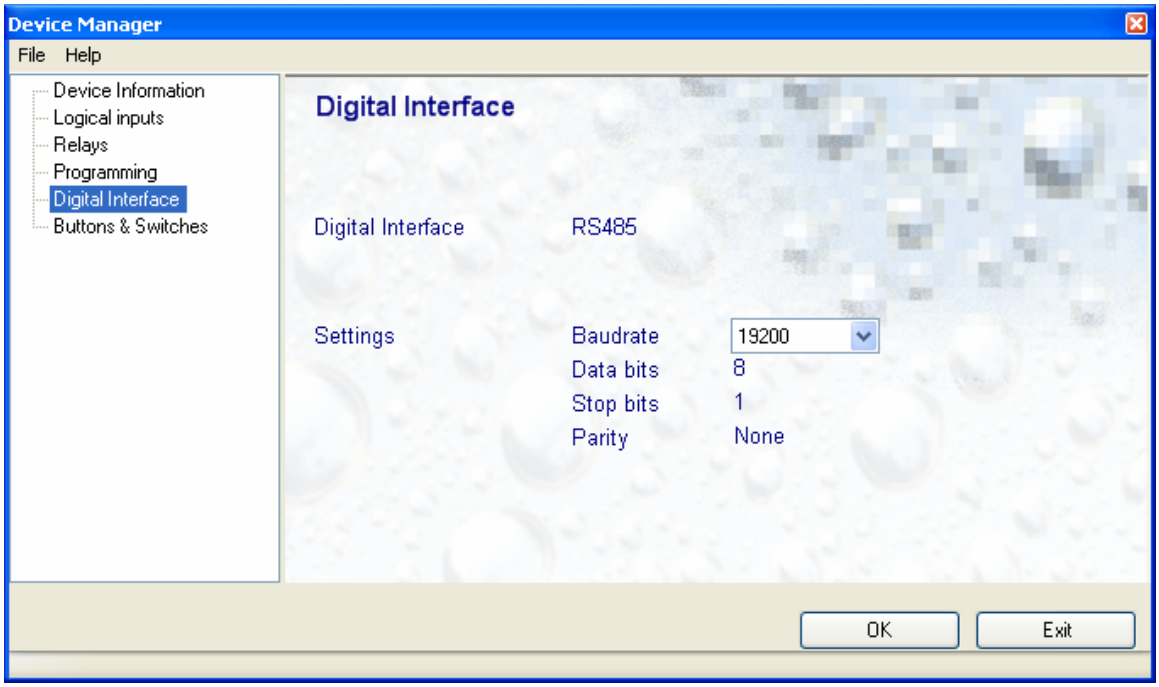
7.4 Programming



Program statements can be typed directly in the white area located under the heading "Programming". The functionality of this area is equivalent to a simple text editor (see screen shot below). See **Programming the HCA**

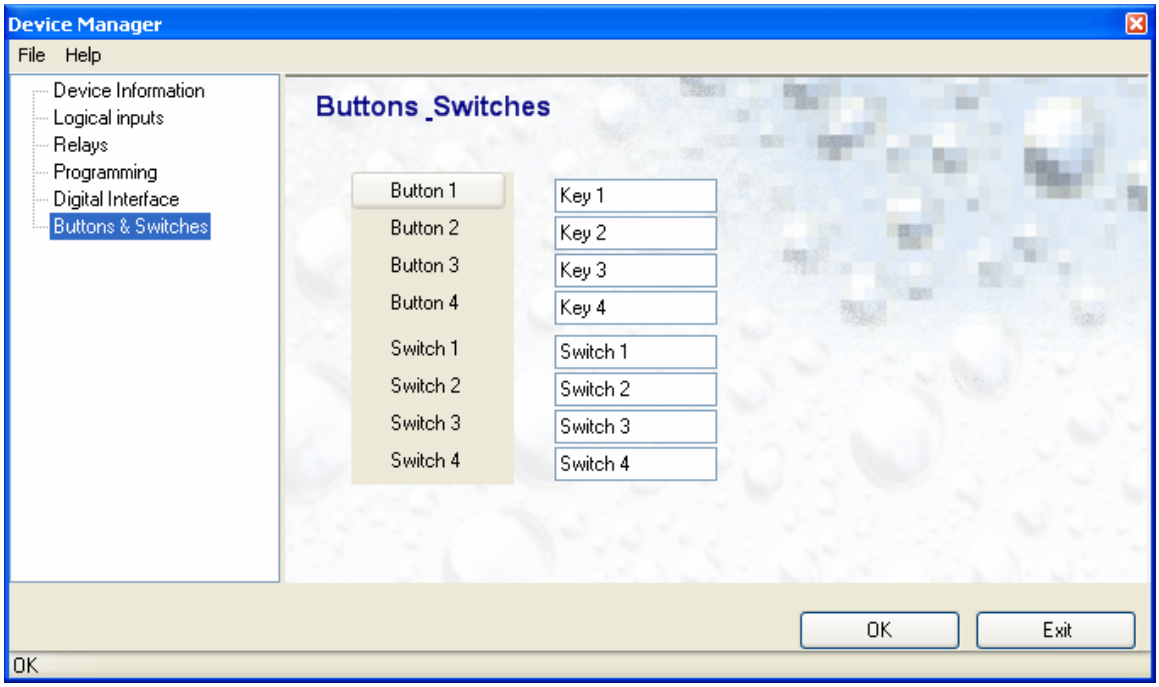
- **Import from File**: use this button to import a program from the PC (normally, programs are files with the TXT extension and are located in the ROTRONIC_HW4\SYS subdirectory).
- **Save to File**: use this button to save the current program to a file with the TXT extension (normally this file will be saved on the PC in the ROTRONIC_HW4\SYS subdirectory).

7.5 Digital interface



- **Baud rate**: use the box to select either 19200 (recommended) or 57600 (for use with HygroLog NT and HygroClip Interface only)

7.6 Buttons and Switches



See: **Accessing the HCA Virtual Push Buttons and Switches**

8 Device protection

This function is used to protect a device against malicious users (available with firmware version 2.1a or higher). 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)

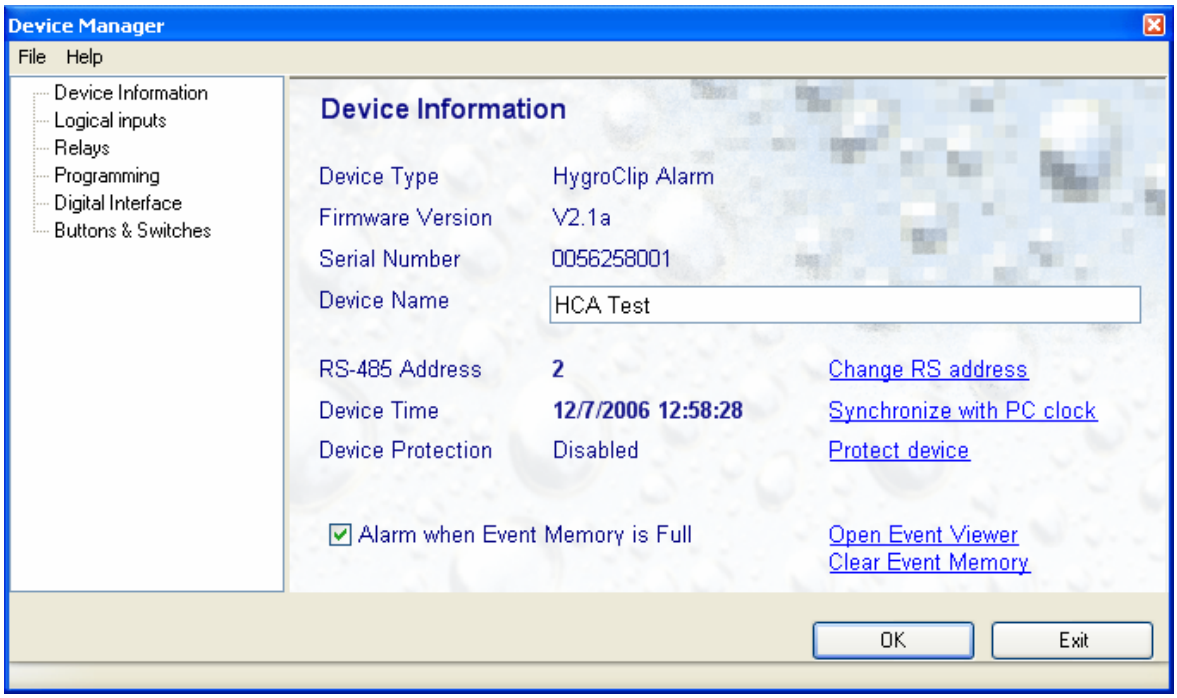
Warning:

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

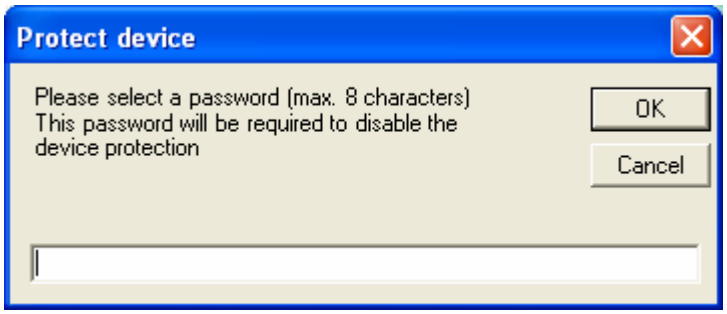
- Automatic address change when adding new devices to a RS-485 multi-drop network
- Automatic synchronization with the HW4 PC clock

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

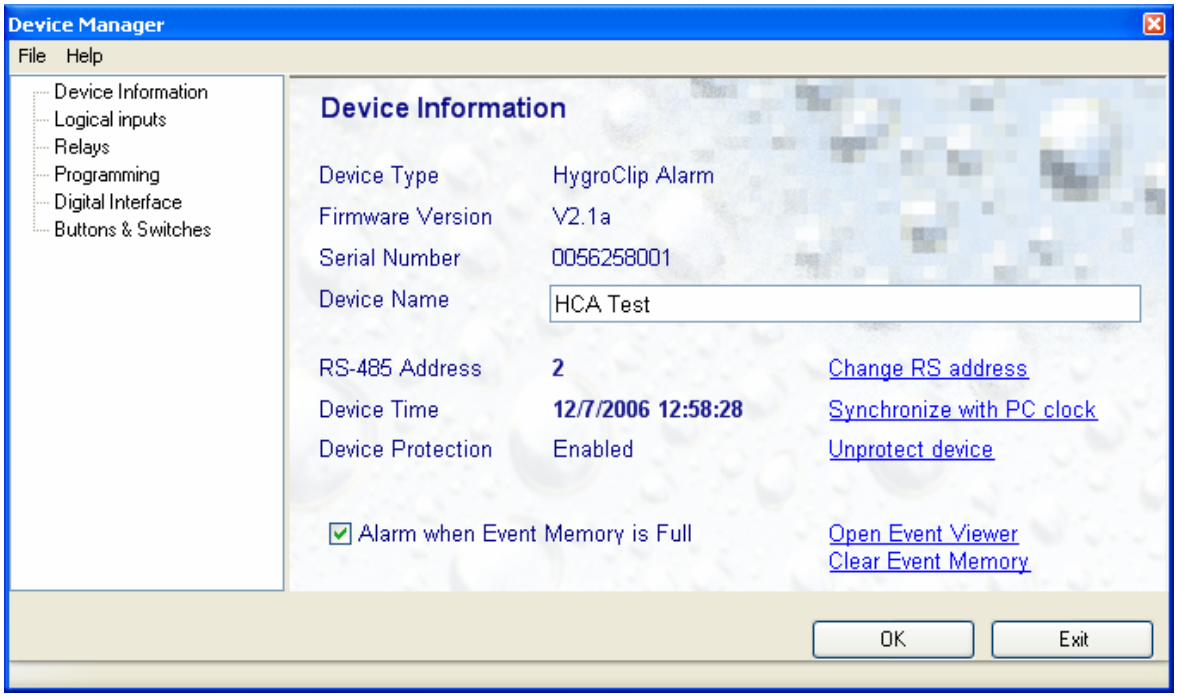
Select the device in the device tree and open Device Manager > Device Information:



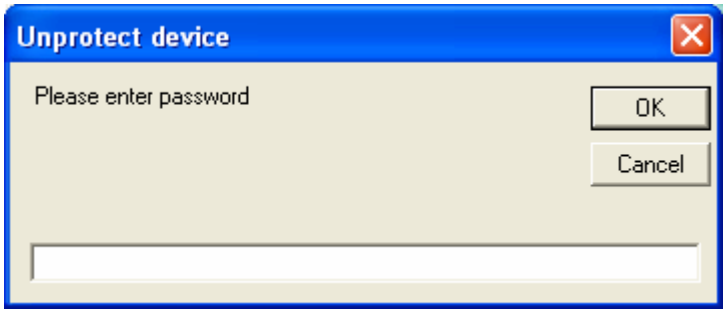
To protect the device, click on the underlined link. HW4 opens the following form where a password can be entered (maximum 8 characters):



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



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!** to unprotect the device (include the exclamation marks). After one minute the default password is not accepted.

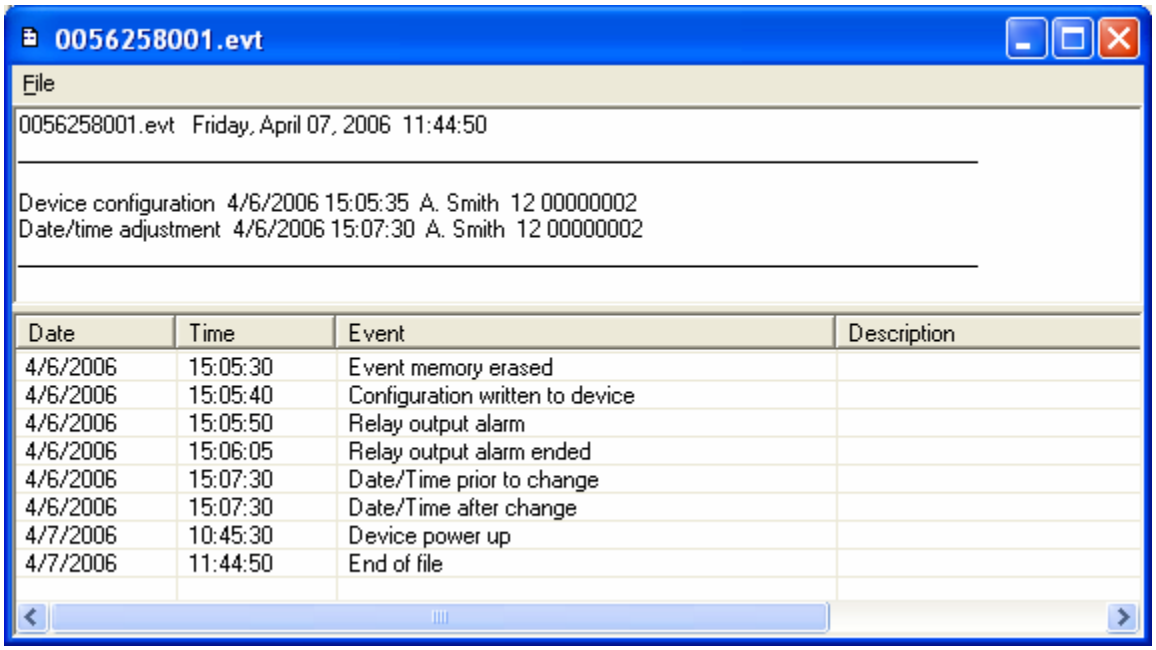
9 Event memory and Event viewer

The HCA features an internal memory that can retain up to 680 events. When the memory is full, the oldest event is erased whenever a new event is recorded. The following events are automatically recorded by the HCA:

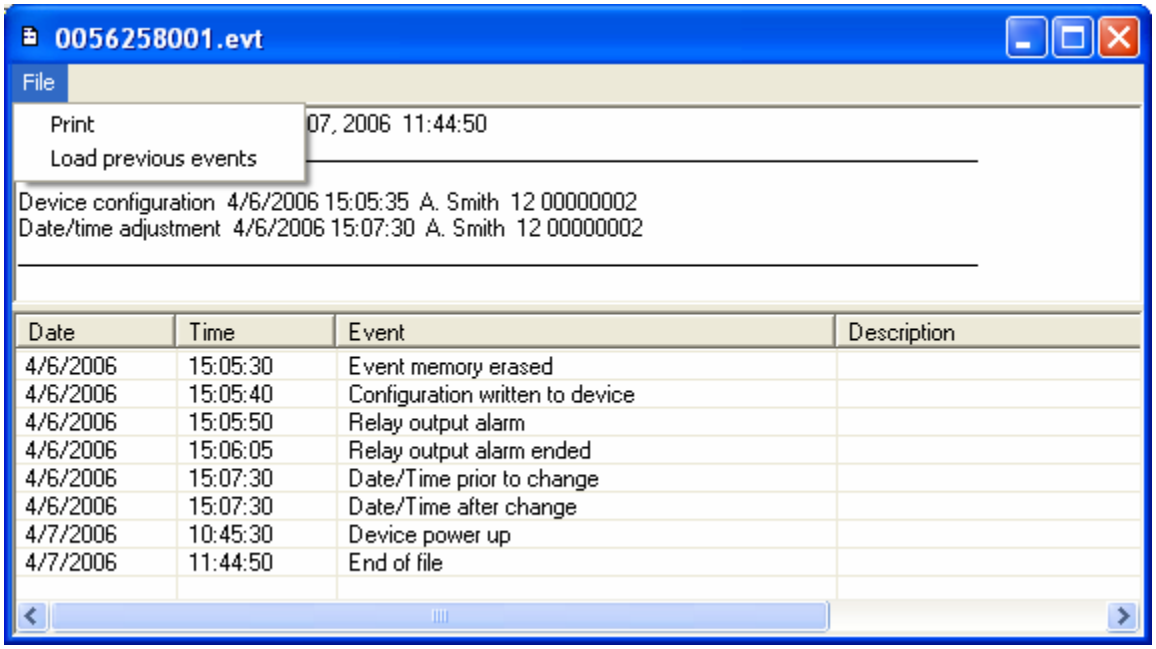
- Logical input alarm
- End of logical input alarm
- Relay output alarm
- End of relay output alarm
- Device power up
- Watchdog overflow
- Configuration written to device
- Date/Time prior to being changed
- Date/Time after being changed
- RS-485 address changed
- Event memory erased

Accessing the events memory requires the HCA to be connected via RS-485 and a master device to a PC with the HW4 software. Using HW4, the Event Viewer is accessed or the event memory is cleared from the HCA device manager.

Event Viewer: the Event Viewer displays the most current events.

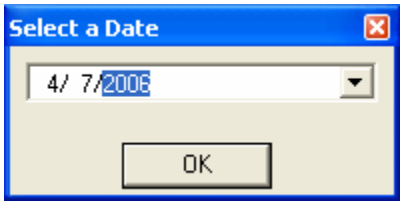


File: the file item is located on the Event Viewer menu bar:



Print: prints the current contents of the event viewer to a printer or to a file.

Load previous events: opens a date selection box and allows loading in the viewer events from a previous day (this operation can be repeated several times).

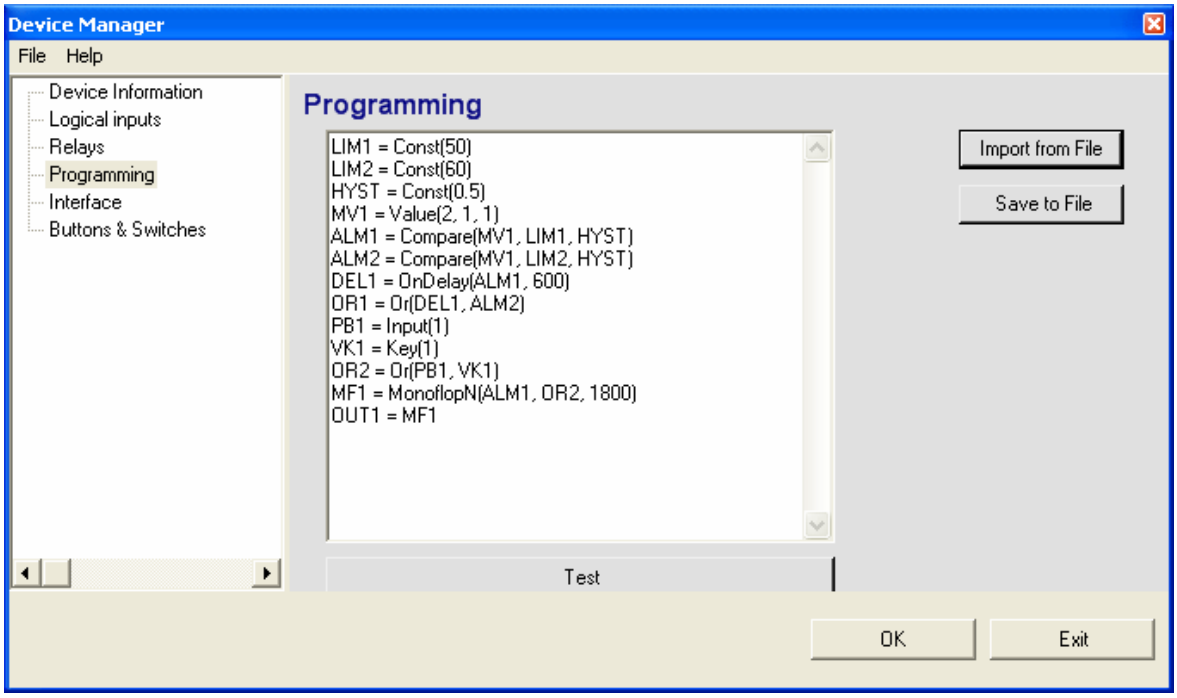


10 Programming the HCA

This section assumes that you have previously read the sections “Configuring the HCA” and “HCA Device Manager”.

10.1 Device Manager programming screen

In the HW4 device tree, click on the + sign to the left of the HCA to display the Device Manager. Open the Device Manager and select Programming.



Program statements can be typed directly in the white area located under the heading “Programming”. The functionality of this area is equivalent to a simple text editor (see screen shot below).

The syntax of the program can be checked by clicking on the “Test” button. Any line with a syntax error is automatically highlighted.

11 HCA programming language

Note: A simple programming example is provided at the end of the programming section.

11.1 Variable names

In principle, variables can be given any name with the following restrictions:

OUT1 to OUT4: these variable names are reserved for the logical status of relays 1 to 4

In addition, the following should not be used as variable names:

ADD
ALARM
AND
AND8
COMPARE
CONST
DAYALARM
DEVICEALARM
DFLIPFLOP
DIV
HOURALARM
HW4ALARM
INPUT
KEY
MONOFLOPN
MONOFLOPR
MONTHALARM
MUL
NAND
NOR
OFFDELAY
ONDELAY
OR
OR8
PWM
SUB
SWITCH
TFLIPFLOP
VALUE
WEEKALARM
XNOR
XOR

Variable name length

In principle, there is no set limit for the length of a variable name. However, the total number of characters in any program should not exceed 1,700.

11.2 Input variables and associated functions

The HCA can accept up to 64 input variables, including variables corresponding to the status of virtual buttons and switches. The actual limit of the number of input variables depends on the number of additions, subtractions, multiplications, divisions and constants used in the program.

The following functions can be used to associate an input variable with data read from any device that is in the same RS-485 multi-drop as the HCA, or from the HCA itself.

Var (Float) = **Value** (*Address, Input number, Parameter*)

Used to capture the values measured by a probe such as humidity, temperature, dew point, etc.

Address : RS-485 address of the device
Input number : device input number to which the probe is connected
Parameter : humidity or analog signal (1), temperature (2), calculated parameter (3)

Example: MV1 = Value (2, 1, 1)

Variable MV1 is the numerical value of humidity, measured by the probe connected to input 1 of the device with RS-485 address 2

Var (Boolean) = **Alarm** (*Address, Input number, Parameter*)

Device inputs can be configured to trigger an alarm for out-of-limit values. For example, this may be used to trigger an alarm when a probe is disconnected or when it does not communicate with the device. As an alternative to using a numerical input value and a comparator, the HCA can make direct use of the alarm status of a device input as an input variable.

Address : RS-485 address of the device
Input number : device input number
Parameter : (1) humidity or analog signal, (2) temperature, (3) calculated parameter

Example: AS1 = Alarm (2, 1, 1)

Variable AS1 is the logical alarm status (0 or 1) of humidity, measured by the probe connected to input 1 of the device with RS-485 address 2

Var (Boolean) = **DeviceAlarm** (*Address, Mode*)

Depending on the configuration, devices can provide a global alarm. The status of a device global alarm can be used by the HCA as an input variable.

Address : RS-485 address of the device
Mode : (1) measured or calculated value alarm, (2) memory card, (3) low battery, (4) external power supply

(2), (3) and (4): these modes are used only when monitoring a HygroLog NT

Var (Boolean) = **HW4Alarm** (*Code*)

When communicating with the HCA, HW4 reports its own alarm status. The alarm status of HW4 can be used by the HCA as an input variable.

Code : (1) Software error, (2) HW4 has no access to a required PC path

HW4Alarm takes the value 1 (True) only one time per instance of an HW4 alarm and this state is maintained for only about 5 seconds.

Var (Boolean) = **Input** (*Index*)

The status of the HCA logical inputs can be used as an input variable to monitor external contacts.

Index : (1) input 1, (2) input 2

11.3 Output variables

The HCA has 4 Boolean output variables corresponding to the logical status of the 4 relays:

OUT1 : logical status of relay 1
OUT2 : logical status of relay 2
OUT3 : logical status of relay 3
OUT4 : logical status of relay 4

Logical status 1: relay is energized, Logical status 0: relay is de-energized.

11.4 Internal Boolean variables

The HCA can accept up to 256 Boolean variables. Such variables can be made to correspond to the logical output of a comparator or other logical function or to the logical status of the HCA 4 relays.

Note that the logical status of any HCA output relay can be used as an input for logical functions.

11.5 Constants

Var (Single) = **Const** (*number*)

Constants are single precision numbers used as a parameter in mathematical operations and logical functions.

11.6 Mathematical operations

Var (Float) = **Add** (*Var 1, Var 2*)

Used to add two numerical (non-Boolean) variables

Var (Float) = **Sub** (*Var 1, Var 2*)

Used to subtract the value of Var 2 from the value of Var 1 (non-Boolean variables)

Var (Float) = **Mul** (*Var 1, Var 2*)

Used to multiply the value of Var 1 by the value of Var 2 (non-Boolean variables)

Var (Float) = **Div** (*Var 1, Var 2*)

Used to divide the value of Var 1 by the value of Var 2 (non-Boolean variables)

11.7 Logical functions

Comparator

Var (Boolean) = **Compare** (*Var 1, Var2, Var 3*)

This function compares the value of two numerical variables (equivalent to an IF statement). A third variable is used as hysteresis.

Compare : True (1) when Var 1 > Var 2
: False (0) when Var 1 < Var 2 – Var 3

When the status of any of the variables is invalid, the result of Compare is always True (1).

Time Delay On

Var (Boolean) = **OnDelay** (*Input, Delay*)

This function reproduces a transition of the input from 0 to 1 after a specified amount of time.

Input : Boolean input variable
Delay : time delay in seconds (1…65534)

The OnDelay function should be used sparingly as this function requires a timer.

Time Delay Off

Var (Boolean) = **OffDelay** (*Input, Delay*)

This function reproduces a transition of the input from 1 to 0 after a specified amount of time.

Input : Boolean input variable
Delay : time delay in seconds (1…65534)

The OffDelay function should be used sparingly as this function requires a timer.

Gates

Gates are used to combine two Boolean variables according to the rules of Boolean algebra. The following types are available:

Var (Boolean) = **AND** (*Var 1, Var 2*)
Var (Boolean) = **OR** (*Var 1, Var 2*)

Var (Boolean) = **XOR**(*Var 1, Var 2*)
Var (Boolean) = **NAND** (*Var 1, Var 2*)
Var (Boolean) = **NOR** (*Var 1, Var 2*)
Var (Boolean) = **XNOR** (*Var 1, Var 2*)

The state of the output (Var) is as follows:

Inputs		Output					
Var 1	Var 2	AND	OR	XOR	NAND	NOR	XNOR
0	0	0	0	0	1	1	1
0	1	0	1	1	1	0	0
1	0	0	1	1	1	0	0
1	1	1	1	0	0	0	1

Two additional gates, each with 8 inputs are also available:

Var (Boolean) = **AND8** (*Var 1, Var 2, Var 3, Var 4, Var 5, Var 6, Var 7, Var 8*)
Var (Boolean) = **OR8** (*Var 1, Var 2, Var 3, Var 4, Var 5, Var 6, Var 7, Var 8*)

D-Flip-flop

Var (Boolean) = **DFlipFlop** (*D-Input, Trigger, Reset*)

The output of DFlipFlop takes the current value of the D-Input (Boolean variable) each time that the trigger input transitions from 0 to 1 (positive flank). The output does not change in between transitions of the trigger input. The state of the output is always a logical 0 when the (asynchronous) reset input is a logical 1.

T-Flip-flop

Var (Boolean) = **TFlipFlop** (*Trigger, Reset*)

The state of the T-Flip-Flop output changes with each positive flank of the trigger input. The state of the output is always a logical 0 when the (asynchronous) reset input is a logical 1.

Monoflop (non re-triggerable)

Var (Boolean) = **MonoFlopN** (*Trigger, Reset, Pulse Width*)

The output of the MonoFlopN takes the logical state 1 for a set period of time (pulse width) when the trigger input transitions from 0 to 1. The output does not react to additional positive flanks of the trigger input as long as the state of the Monoflop output is a logical 1. Setting the logical state of the Reset input to 1, immediately changes the logical state of the Monoflop output to 0.

Pulse Width : Time in seconds (1…65534) during which the logical state of the output is 1

The MonoFlopN function should be used sparingly as this function requires a timer.

Monoflop (re-triggerable)

Var (Boolean) = **MonoFlopR** (*Trigger, Reset, Pulse Width*)

The output of the MonoFlopR takes the logical state 1 for a set period of time (pulse width) when the trigger input transitions from 0 to 1. The duration of the output pulse (logical state 1) is prolonged when additional positive flanks are detected on the trigger input. Setting the logical state of the Reset input to 1, immediately changes the logical state of the output to 0.

Pulse Width : Time in seconds (1…65534) during which the logical state of the output is 1

The MonoFlopR function should be used sparingly as this function requires a timer.

Pulse Width Modulator (PWM)

Var (Boolean) = **PWM** (*Enable, Active Time, Passive Time*)

The PWM periodically generates a pulse of defined duration. When the logical state of the Enable input is 0, the logical state of the PWM output is always 0.

Enable : Boolean variable or constant
Active Time : Time in seconds (1…65534) during which the logical state of the output is 1
Passive Time : Time in seconds (1…65534) during which the logical state of the output is 0

The PWM function should be used sparingly as this function requires a timer.

Real Time Alarm (RTA)

The output of the RTA transitions from 0 to 1 whenever the date and time of the HCA internal clock matches the day and the time programmed in the RTA. After one minute, the RTA output transitions back to 0.

The HCA features the following:

Var (Boolean) = **HourAlarm** (*Min*)
Var (Boolean) = **DayAlarm** (*Hour, Min*)
Var (Boolean) = **WeekAlarm** (*Day, Hour, Min*)
Var (Boolean) = **MonthAlarm** (*Date, Hour, Min*)

Date : Date of the day (1…31)
Day : Day of the week (1…7) for Monday to Sunday
Hour : 00…23
Min : 00…59

Virtual Push Button

Var (Boolean) = **Key** (*Index*)

Index : number of the push button (1…4)

A virtual push button simulates on the HW4 PC the function of a hardware push button. The logical state of the button output is normally 0 and is briefly equal to 1 whenever the button is actuated. The HCA features 4 virtual push buttons which can be accessed in HW4 by opening Device Manager > Virtual Buttons & Switches after selecting the HCA in the HW4 device tree. A virtual push button can be actuated by clicking on it with the mouse.

Virtual push buttons are typically used to cancel an alarm remotely.

NOTE: *Access to a virtual push-button requires a connection to the HW4 PC. Do not use a virtual push-button as part of an alarm function that should operate when the HCA is used without an HW4 PC (auto-polling mode).*

Virtual Switch

Var (Boolean) = **Switch** (*Index*)

Index : number of the switch (1…4)

A virtual switch simulates on the PC the function of a hardware switch. The logical state of the switch output is 0 when the switch is open and is equal to 1 when the switch is closed. The HCA features 4 virtual switches which can be accessed in HW4 by opening Device Manager > Buttons & Switches after selecting the HCA in the HW4 device tree. A virtual switch can be closed by clicking on it with the mouse as illustrated above for switch 1.

Virtual switches are typically used to temporarily enable or disable an alarm function (requires connection to a PC with HW4 running).

NOTE: *The logical state of a virtual switch is automatically set to 0 (open) whenever the HCA loses power. Do not include a virtual switch as part of an alarm function that has to keep operating after a brief interruption of power.*

11.8 Program example

The following program example illustrates the 3 steps required to program the HCA:

Step 1: prepare a detailed task description:

An alarm condition exists for the humidity measured by a specific probe:

IF the measured value is equal to or greater than 50 %RH **during at least 10 minutes**

OR

IF the measured value is equal to or greater than 60 %RH **for any length of time**

Each time that such a condition occurs, Relay contact 1 closes and **stays closed for 30 minutes** (to energize a bell)

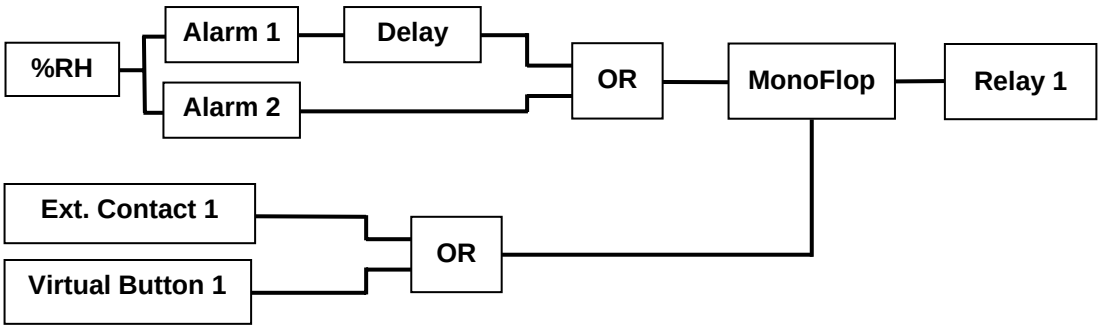
The **alarm can be cancelled at any time** by:

Pushing on a local reset button (hardware)

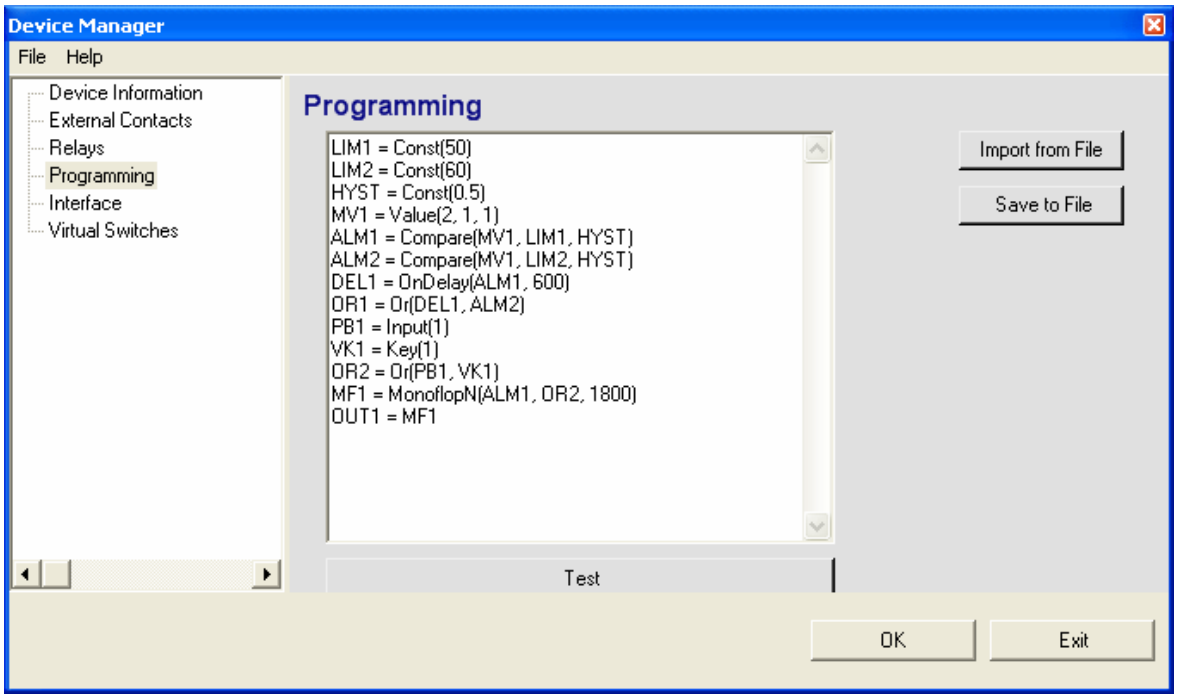
OR

Clicking with the mouse on a virtual button (requires a PC with the HW4 software).

Step 2: prepare a logical diagram



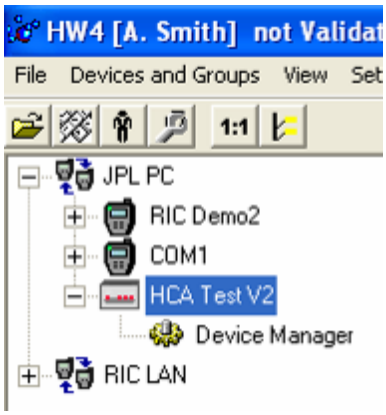
Step 3: enter the program statements in Device Manager:

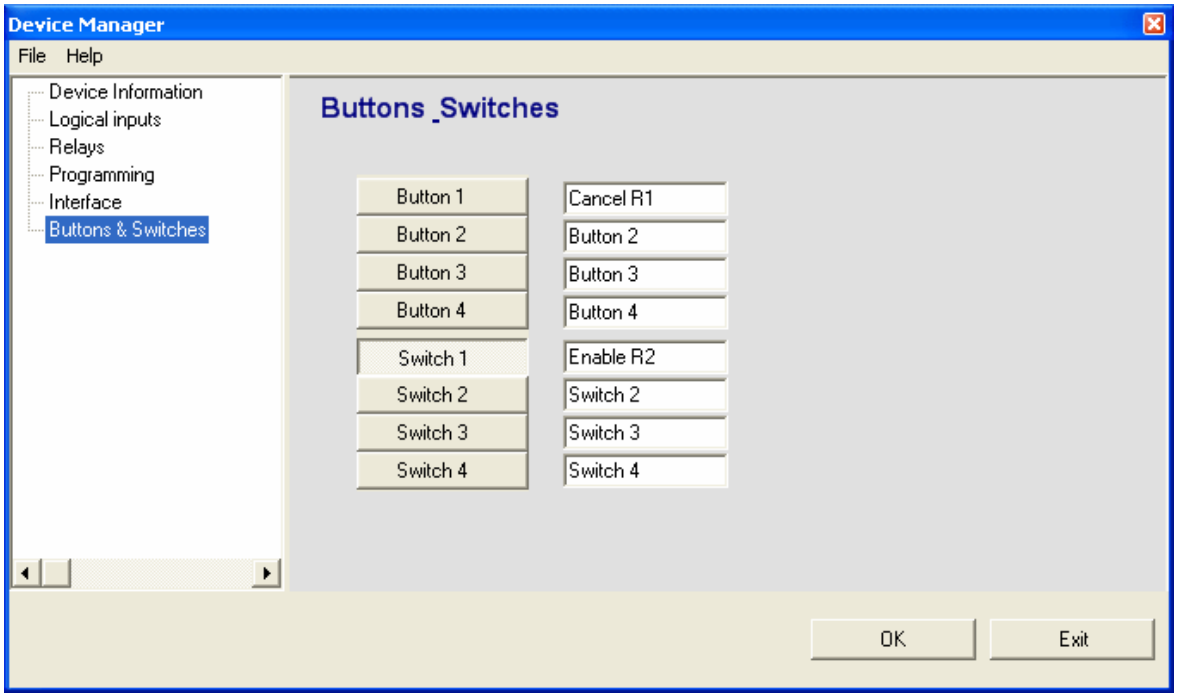


All programming statements can be typed directly in the programming field (same as with a text editor). The syntax can be checked by clicking on the “Test” button. Any line with a syntax error is automatically highlighted.

12 Accessing the HCA virtual push buttons and switches

From the HW4 device tree, click on the + sign to the left of the HCA to display the Device Manager. Click on Device Manager and select Buttons & Switches:





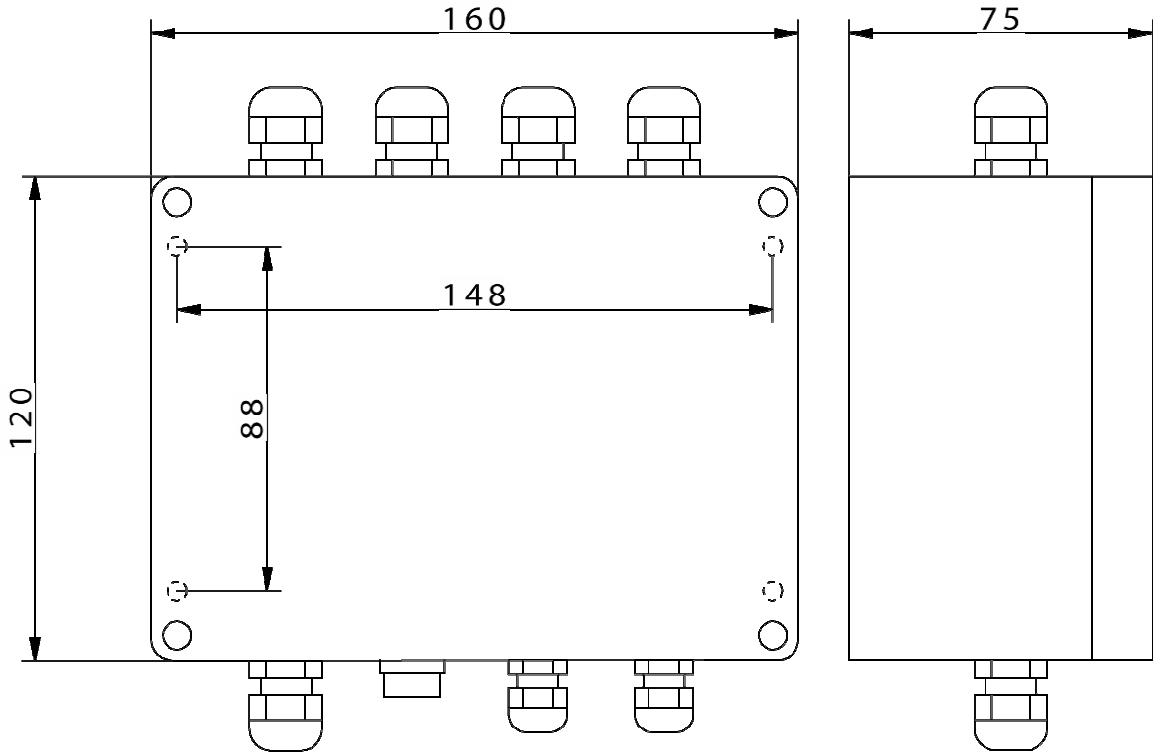
- A virtual push button can be actuated by clicking on it with the mouse.
- A virtual switch can be closed by clicking on it with the mouse as illustrated above for switch 1.

Click on the Exit button after clicking on a push button or changing the position of a switch.

13 Specifications

Operating Voltage	12 to 35 VDC / 300 mA max. or 12 to 24 VAC 90 to 264 VAC 50/60 Hz
Operating limits	0…99 %RH (non condensing) -40...60°C (-40...140°F)
Communications Port	RS485
Number of digital inputs	2
Number of Relay Contacts	4 x SPDT
Contact Rating	10 A at 250 VAC or 30 VDC, 12 A at 125 VAC
Electrical Connections	cable grips and terminals [1)] connector for RS-485
Housing Material	ABS
Housing Dimensions	160 x 120 x 75 mm (6.30 x 4.72 x 2.95”)
Weight	720 g (1 lb 10 oz)
Protection grade	IP65 / NEMA 4

1) Recommended cable for cable grips: 7…9 mm diameter (0.275..0.354”) with 18 AWG wires.



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:

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

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

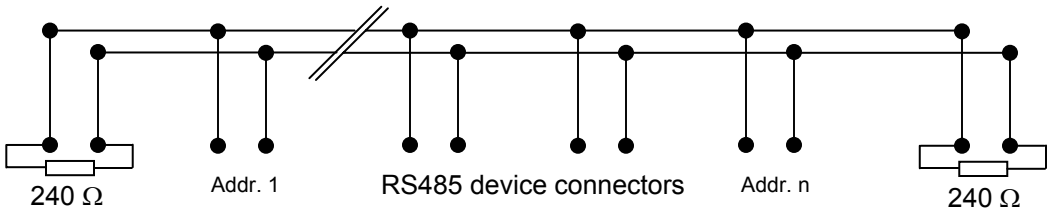
Using a symmetrical transmission method in combination with low capacity/ low attenuation twisted pair cables, allows extremely reliable long distance connections. The use of a high grade shielded cable avoids cross talk between the transmitted signals and also reduces the potential of external interference. 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



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 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	Dec. 7, 2006	See Hardware and firmware changes below
_11	Jan 11, 2007	Added RS-485 connector
_12	May 3, 2007	Made minor editorial changes

Release _10: Hardware and firmware changes:

Firmware Version	Date	PCB-No.
2.0	Apr. 7, 2006	66.0747.0204
2.1a	Dec. 7, 2006	66.0747.0304

- Firmware version 2.1a: HCA Device Manager – Device Information (accessible only with the HW4 software) - added link to protect / unprotect device against unauthorized configuration changes.