

INTELLIGENT HART GATEWAY PLUS (HG1+)

USER GUIDE

Revision 1.8

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1 GETTING STARTED

1.1 INTRODUCTION

This document applies only to system using the following minimum software versions

RAP tools	V 4.3.0
HGX tools	V 2.0.0
HGX Templates	V 7.3.6

The HG1+ is a versatile device that provides convenient and reliable access to field instrument data for instruments that support the HART interface standard.

The HG1+ can be used as a HART Modem, allowing industry standard or proprietary software to talk directly to the instruments via a real or virtual serial port, or it may be used as a Modbus interface to the field instruments in support of SCADA, DCS, PLC or other Modbus capable hosts.

The HG provides the following functionality:

1. HART Modem over serial interface, selectable as RS232, RS422 or RS485
2. HART Modem over Ethernet using a Virtual Serial Port for remote access
3. RTU Modbus gateway over serial interface, selectable as RS232, RS422 or RS485
4. Encapsulated (via TCP) RTU Modbus over Ethernet
5. TCP/IP Modbus gateway over Ethernet

The HART modem and Modbus gateway facilities may be used at the same time with the HG1+ automatically arbitrating access to the HART loop to ensuring each function has a fair share of the available bandwidth. This concurrent functionality allows for applications, for example, in which the HG1+ primarily provides access for SCADA or DCS systems via the Modbus TCP/IP interface and simultaneously allows system engineers to run field maintenance packages such as PACTware, FieldCare or RadarMaster etc. on the real or virtual serial port without interrupting the principle data acquisition activity.

When used as a Modbus Gateway, the HG1+ fully supports all mandatory and common practice HART commands and all data embodied in these commands is available to be read or written via Modbus registers. Furthermore, the HG1+ can implement any device specific command using additional configuration files (device templates).

This remainder of this document gives details of how the HG1+ should be installed and configured.

1.2 SOFTWARE INSTALLATION

To configure the HG1 you must install the product support software onto your PC. The installation files for this can be downloaded directly from the HG1 itself, or from RAP Systems website. We recommend that you check our website periodically for any updates to your products firmware of the PC configuration tools.

To download and install the product support software please follow the instructions below.

1.2.1 DOWNLOADING SOFTWARE FROM HG1

NOTE: Software installation files can only be downloaded directly from HG1 devices whose serial number begins with the letter 'M' i.e Mxxxxxxxxxx. If your device is not of this type then you must download the relevant files from the RAP systems website, as described later in this section.

- Connect the HG1 to a 24V DC power supply (see section 1.3 – hardware installation)
- Connect the HG1 to your local network via the Ethernet connector – Note that the HG1 is supplied with a default IP address of 192.168.1.250 (this may be changed later if desired)
- Open a browser on your computer and navigate to 192.168.1.250 – this will take you to the products home page from where you can download the required installation files.



Industrial Control and Process Automation Products

Intelligent HART Gateway (HG1Lx)

Full product information and support can be found on our website together with the latest versions of the documentation and software. For your convenience, however, the documentation and software as shipped with your product can be found below:

Configuration

- [HGx Templates](#)

Documentation

- [Datasheet](#)
- [User Guide](#)

Software

- [HGx Tools](#)
- [RAP Tools](#)

First download and read the **User Guide**. Connect your HART Transmitter and proceed to download and install **HGx Templates, HGx Tools** and **RAP Tools** suite of software. Run the configuration tool and create your first configuration. Download it to your module and you're ready to go!

If you require any further assistance, please contact our support department. See our website for further details.

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- Click on [HGx Templates](#), [HGx Tools](#) and [RAP Tools](#) to download them to your computer. These files are compressed and you should un-zip them into a convenient folder. Once unzipped, click on each of the three uncompressed files in turn to install the software.
- Restart your PC once all files have been installed.

1.2.2 DOWNLOADING SOFTWARE FROM WEBSITE

You can download the same installation files from the RAP Systems website, and doing so ensures that you have the latest versions of the utilities. To do so visit the RAP Systems Website and navigate to the product support downloads page found at:

<http://www.rapsystems.co.uk/support/download-page/>

- Login (on the right-hand side) using the user name and password that you obtained when you registered with RAP Systems. If you haven't already registered, you will need to do so now to gain access to the downloads.
- Download, unzip and install the following files
 - ❖ *HGx plus Tools* (under the Utilities tab)
 - ❖ *HGx plus Templates* (under the Utilities tab)
 - ❖ *HGx RAP tools* (under the Utilities tab)
- Reboot your PC

1.2.3 VIRTUAL SERIAL PORT DRIVERS

The software installation process automatically installs drivers to allow remote access to the HG1 from third party field device management software packages such as PACTware, permitting offsite monitoring and maintenance of HART devices.

See section 7.0 for a description on how to setup and use this feature.

1.2.4 FIRMWARE UPDATES

RAP systems periodically publishes updated firmware for the HG1 on its website. It is recommended that you keep your device up to date with the latest firmware release. To do so visit RAP systems support page:

<http://www.rapsystems.co.uk/support/download-page/>

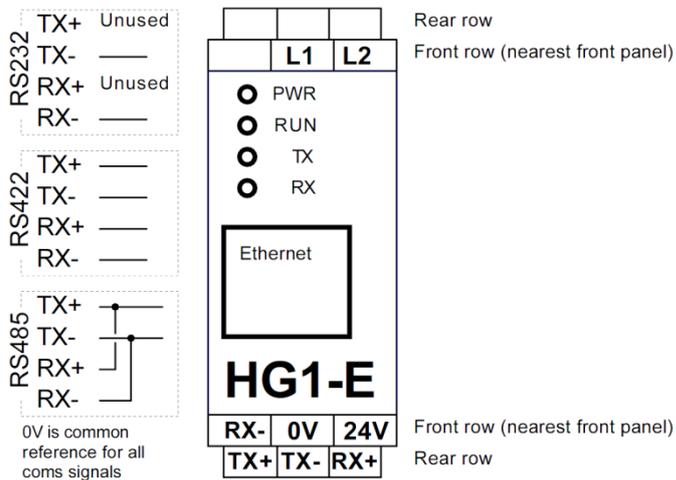
and navigate to the firmware download section. Download the latest revision of firmware applicable to your device, unzip the file and follow the read.me instructions included in the download.

Firmware revisions V3.x.x and greater are applicable to HG1 products with serial numbers starting with the letter 'M', whilst V2.x.x revisions are applicable to HG1 products with serial numbers that do not start with 'M'.

You can identify the currently installed firmware revision using the LiveView application – see section 2.

1.3 HARDWARE INSTALLATION

The HG1+ is connected to a 24V DC power supply and to the instrument loop using screw terminals. Connection of the Modbus interface is via a RJ45 connector. The screw terminal designation is shown in figure 1.0 below:

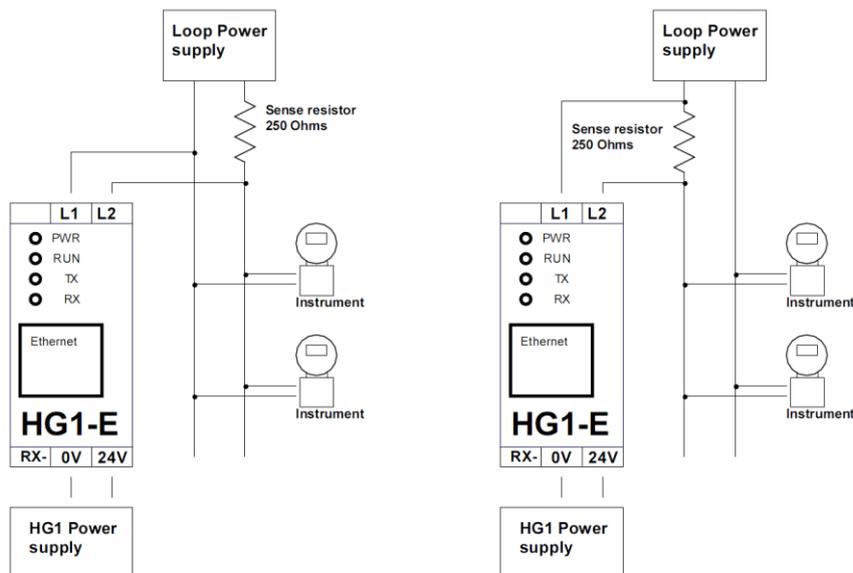


There are four green LEDs on the HG1+ front panel:

- PWR** Illuminates when the device has power
- RUN** Illuminates when the device has successfully started up
- TX** Illuminates when the device transmits data onto the HART loop
- RX** Illuminates when the device detects data on the HART loop

When using RS485, it is required that the TX+, RX+ signals and the TX-, RX- signals are joined together externally as shown in the diagram above. For RS232 the TX- and RX- pair are used for the TX and RX signals respectively. For all serial interface modes, the 0V power supply signal is the 0V reference for the communications signals.

Loop connections are via the L1 and L2 screw terminals as shown below. The HG1+ does not embed a loop sense resistor, this must be provided externally.

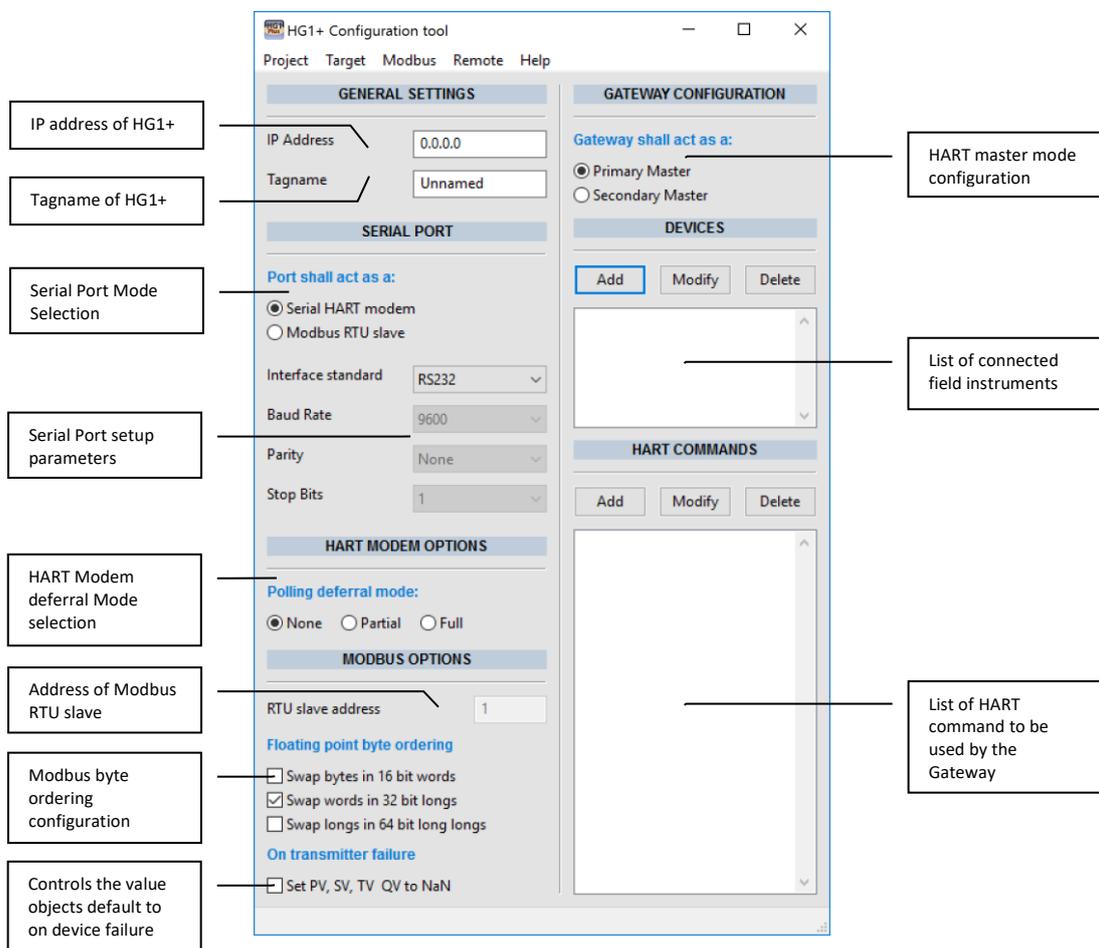


HG1+ typical loop connection arrangements

2 CONFIGURATION TOOL OVERVIEW

The HG1+ is managed using the HGx configure tool which allows the user to create and download a configuration to the device. The configuration can be saved to a file on the PC as part of system archiving and may be loaded and restored at will. The configuration tool provides a menu driven graphical interface outlined below, detailed use of this tool is given in the remainder of this document:

When first run, HGxConfigure presents a blank window with a simple top level menu bar with **PROJECT**, **TARGET**, **MODBUS**, **REMOTE** and **HELP**, once a new project is created, or an existing project is opened using the Project menu then the following is displayed:



The tool provides several drop-down menus - **PROJECT**, **TARGET**, **MODBUS**, **REMOTE** and **HELP** - used to control the application:

Project	New
	Load from Disk
	Load from HG1
	Save
	SaveAs
	Close
	Exit

Creates a new, default configuration for the HG1+ which can be modified to meet actual application needs.
Load a previously saved configuration from the PC's hard disk
Load the configuration currently in the HG1 itself
Saves a configuration to the hard disk.
Saves a configuration to the hard disk with a given name
Closes the currently open configuration
Exits the program

Target	Change Network Settings
	Configure
	Reboot
	View Live Data
	Options

Opens the Rap Tools device scanner utility allowing the HG1+ network settings (such as IP address) to be altered.
Download the currently open configuration to the HG1+
Restarts the HG1+
Display live data from the HG1+
Change Port Numbers associated with Ethernet services

Modbus	Save Modbus Map	As Text File
		As CSV
		For Citect

Saves the HG1+ Modbus map as a text file on the PC
Saves the HG1+ Modbus map as a comma separated file on the PC suitable for use in Excel.
Saves the HG1+ Modbus map as a comma separated file on the PC in a format that can be imported directly into the a Citect SCADA application.

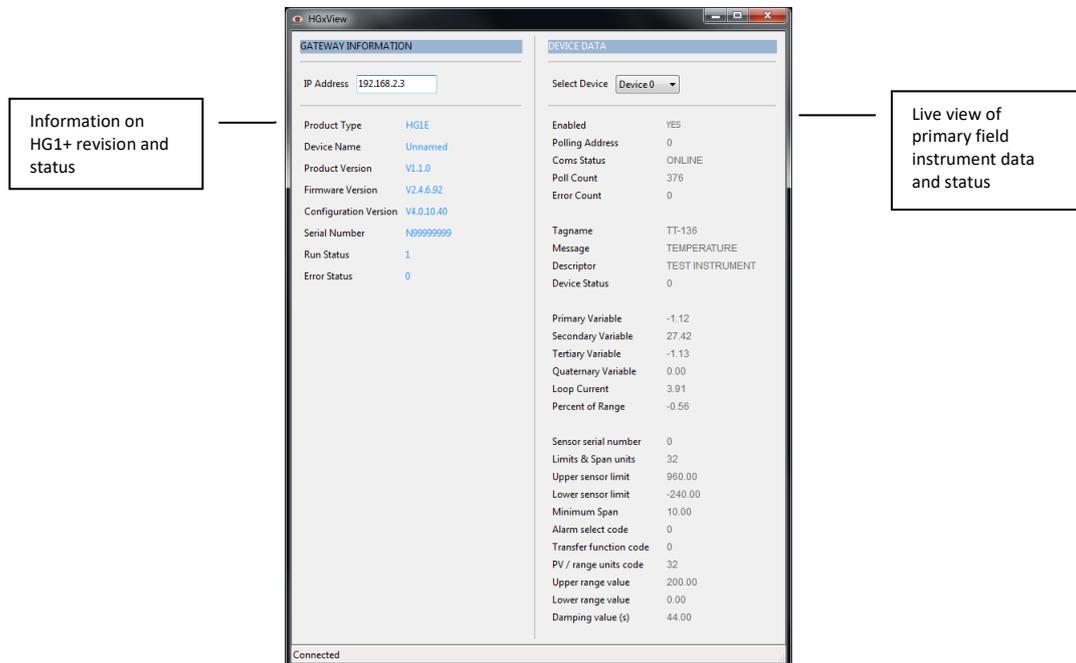
Remote	Remote COM port settings
--------	--------------------------

Configure virtual COM port for remote access to HG1

Help	Documentation
	About

Provides access to HG1+ product documentation
Displays information about the tool.

The **View Live Data** Menu option opens a separate application that displays live data from the HG1+, useful for confirming the device status and communications to the field instruments.



3 BASIC SETUP - SETTING THE IP ADDRESS

Whether you intend to use the HG1+ as a Modem or as a Modbus gateway you need to configure the devices' IP address.

The HG1+ is supplied with a pre-configured static IP address of 192.168.1.250 which may be changed to any desired static IP, or the HG1+ maybe instructed to obtain its IP on start-up via a DHCP server. The IP address is changed using from the **Target→Change Network Settings** menu of the HGx Configuration units tool as described below.

Connection from the module to the host computer is via the Ethernet interface port. The device should be connected to the host PC either directly (using a cross-over cable) or via the local network through a suitable Ethernet switch.

The following method will work even if your local subnet is different from the default provided with the HG1+. However, if this is the case then you should widen your subnet mask as required.

1. Start the HGx Configuration Tool.
2. Ensure the HG1+ is connected to the host PC and is powered.
3. Choose **Target/Change Network Settings** menu option. The device scanner program will start and automatically search for any connected devices, showing the results in a table.
4. Highlight the desired device from the table (even if only one device exists)
5. Click on the **Edit** button.

6. Select either DHCP or enter you own choice of static IP and subnet mask (it is a good idea to also complete the default gateway setting)
7. Click on **OK**
8. Wait while the HG1 network settings are changed and the device is rebooted. This process could take up to 1 minute.
9. Close the program.

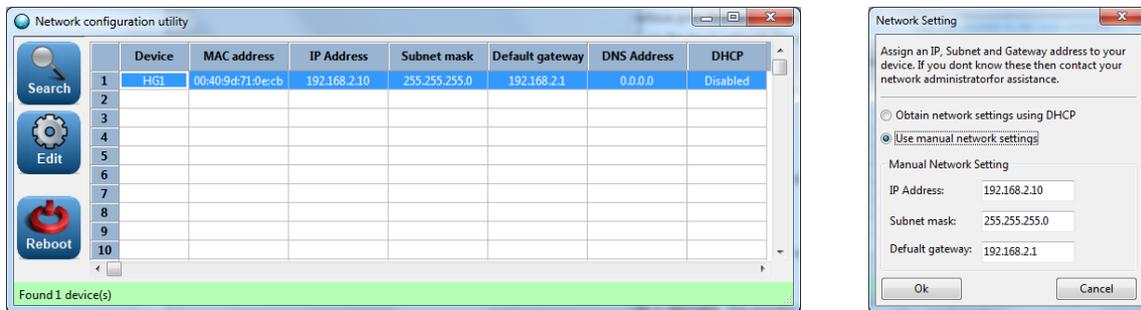


Figure 1 Using the Device scanner program

4 HART MODEM

This section applies to users who wish to use the HG1+ as a Hart Modem. Modbus Gateway users can ignore this and jump straight to section 5. Note that the HG1+ can be used as a Hart Modem and Modbus gateway simultaneously, in which case both sections are relevant to the reader.

As a Hart modem the HG1+ accepts raw Hart data from the serial interface or the virtual serial port via the Ethernet interface. This raw data is converted by the HG1+ into an FSK (Frequency Shift Keyed) signal and placed on the instrument loop.

Data returned to the HG1+ from instruments on the loop is transmitted out of the serial or virtual serial interface back to the host computer, the HG1+ does not alter the contents of the transmitted or receive data in any way and it is up to the host computer to properly form and decode the Hart packets.

The physical serial interface can be configured to use RS232, RS422 or RS485 signal levels. The baud rate, data length, parity and stop bits are not configurable; they are fixed at 1200 baud, 8 data bits, odd parity and one stop bit as per the Hart standard.

Unlike traditional Hart modems the HG1+ provides two services to simplify use with Hart communications loops.

AUTO RTS : Traditional Hart modems require the host computer to control the RTS signal on the serial interface (this is used to control direction of data flow to or from the loop). The HG1+ does this automatically; the top end has simply to send the TX data and wait for a reply from the transmitter. This permits the use of two wire communications standards where the RTS signal is unavailable.

AUTO BUS SHARING: The Hart protocol allows to two master devices to use the Hart loop simultaneously, typically this would be a primary device and a handheld configuration tool, although other arrangements are possible. Implementing the required Hart protocol to achieve this is a non-trivial task. The HG1+ manages this aspect of the hart protocol automatically. In a multi master environment the HG1+ buffers data it receives from the serial or virtual port and waits until the Hart loop becomes free before placing the data onto it. It returns only that data which intended for the host computer in response to its transmission.

From the host computers perspective, the multi-mastering functionality is implemented transparently and, with one exception, no additional measures are needed to use the HG1+ in a multi master environment. The exception relates to response timing; in a multi master environment the HG1+ may have to wait up to 0.5 seconds to get access the Hart bus (waiting for the other master device to finish its bus transaction). This potentially introduces a delay in the response to the message sent from the host. For proper operation in a multi master environment the host computer must tolerate this potential increased response time.

Configuring the HG1+ as a Hart Modem is simple, the following steps are taken:

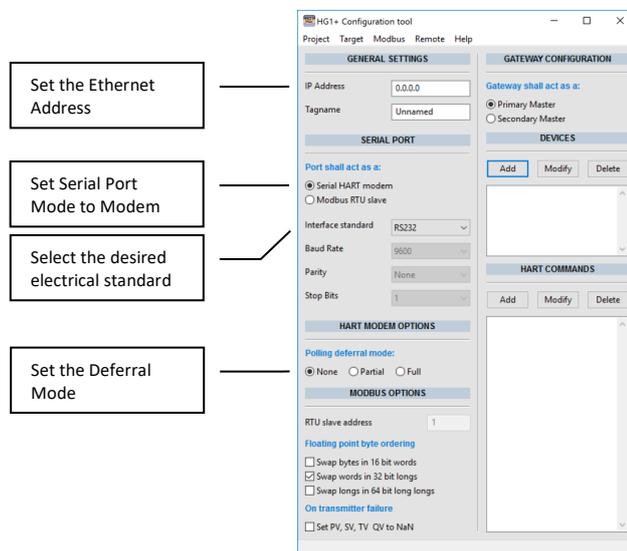
1. Install the Configuration tools as described in section 1.2
2. If you intend to use the HG1+ as a Hart modem over Ethernet via the virtual serial port, then you should configure the virtual serial port driver on your PC as described in section 7.0
3. Configure the HG1+ Ethernet address as described in section 3.0
4. If the HG1 is to used simultaneously as a HART modem and Modbus gateway, then you should select the appropriate deferral mode from the configuration tool as described in section 5.3

If you intend to communicate with the HG1+ via the **virtual serial port** then nothing further is required, it is ready for use.

If you wish to use the **physical serial interface** you must follow these additional steps to configure the serial port interface type (e.g. RS232, 422 or 485).

Start the HGx Configure tool

1. Select **Project→New** from the menu bar
2. Enter the IP address you assigned to the HG1+ in the box labelled **IP Address**
3. Select the serial interface standard you wish to use from the drop-down selection box marked **Interface Type**
4. Save the configuration using the **Project→SaveAs** menu item, use any suitable name.
5. Select the **Target→Configure** menu item. The configuration tool will then configure and restart the HG1+. The process takes about 30 seconds. Once the HG1+ has restarted it is ready for use.

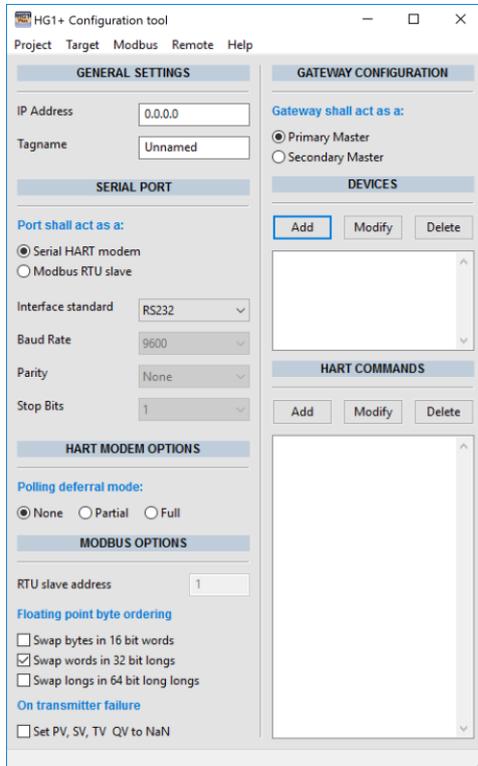


Note that the Baudrate, Parity and Stopbits are greyed out when Modem mode is selected. These parameters are fixed at 1200 baud, 8 data bits, odd parity and 1 stop bit and cannot be altered in this mode.

The other facilities of the configuration tool are used to configure the Modbus Gateway functionality and are not relevant when using the HG1+ as a simple modem.

5 MODBUS GATEWAY

Configuring the HG1+ Modbus Gateway is quick and simple and starts by creating a new project using **Project→New**. You will be presented with the following screen:



- Enter the **IP address** of the HG1+
- If desired, give the HG1+ **Tagname** – this is used only for documentation purposes and has no functional effect.
- Choose if the **serial port** is to be used as a Modem or as an RTU Modbus slave interface.
- Select the electrical **Interface standard** for the serial port (RS232, RS422 or RS485). If you selected RTU Modbus slave then also specify the additional serial port parameters including **Baudrate**, **Parity** and **Stopbits** (the data length is fixed at 8 bits)
- Choose the preferred **polling deferral mode** (see section 5.3)
- If RTU Modbus Slave has been selected then specify the **RTU slave address**
- If any RTU or TCP/IP Modbus slave is to be used, then specify the appropriate **floating point byte ordering** required by the host system

Ticking the box under **On transmitter failure** causes the HG1 to set the primary, secondary, tertiary and quaternary process variables to a value of NaN (Not a Number) if the attached HART transmitter fails. When left un-ticked the HG1 returns the last good values for these objects under failed conditions.

Primary or **Secondary master** selection specifies the mode of operation of the HG1+ on the HART loop. The HG1+ is a HART master device that communicates with HART slave devices (the hart transmitters). The HART protocol specification allows a maximum of two HART master devices on the same HART loop, these are called the Primary master and the Secondary master. The HG1+ can be configured to be either a primary or secondary master device.

You should configure the HG1+ to be a primary master if:

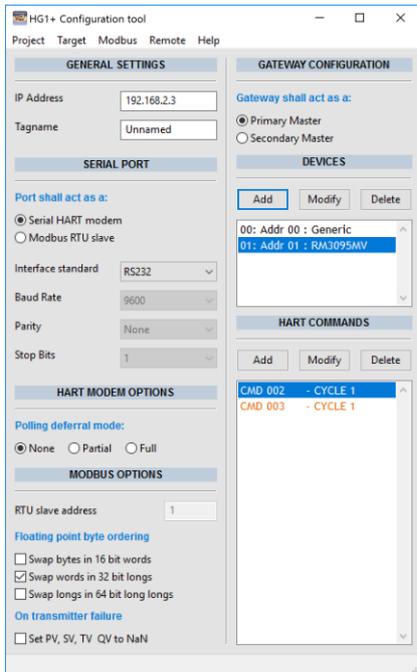
- It is the only master device connected to the loop, or
- You intend to connect a secondary master device to the loop such as a hand-held configuration device.

You should configure the HG1+ to be a secondary master if:

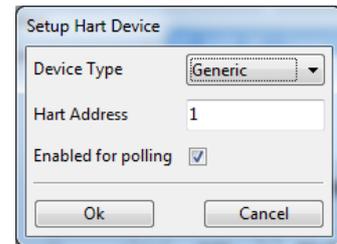
- There is already a primary master connected to the loop, such as a DCS, SCADA or PLC HART master.

5.1 ADDING SMART DEVICES

Once the basic setup has been completed it is necessary to declare which devices will be connected to the HG1+ via the HART loop interface. Devices may be added, modified and deleted from the device list using the **Add**, **Modify** and **Delete** (note 1) buttons under the Devices section of the right-hand panel. This image shows the configuration tool with initial configuration complete and one generic and one Rosemount device added:



When you add a device, you will be presented with a dialogue box asking for Device Type, Device Address and an Enable option. By default, all newly added devices are **Generic** i.e. they support the mandatory and common practice HART commands – this device type will work with all HART devices and will allow the HG1+ to read and write all common data points. If you require the HG1+ to access device specific, non-standard data, then you should select your transmitter type from the drop down menu labelled **Device Type** on the top right. If your transmitter is not listed, then contact RAP Systems for a template file for your device.



The polling address of the transmitter should be entered in the **Hart Address** field.

When checked, the **Enabled** checkbox tells the HG1+ that the device is present and may be polled. This control is useful for temporarily disabling a device that has failed or under maintenance. Devices can be modified by double clicking the device in the list or by using the Modify button.

NOTE: Important information on deleting devices. The Modbus map for the HG1+ has blocks of registers assigned to each configured Smart device i.e. The first device in the device list is associated with the first block of Modbus registers, the second device is associated with the second block and so on. If you delete a device, then the Modbus registers associated with the remaining devices change. Therefore, it is advisable to finalise the HG1+ configuration before implementing the Modbus map in systems intended to communicate with it. The following diagram illustrates this:

Temp transducer	Modbus block 1
Pressure Transducer	Modbus block 2
Valve	Modbus block 3
Flow meter	Modbus block 4

Modbus assignments with four devices

Temp transducer	Modbus block 1
Valve	Modbus block 2
Flow meter	Modbus block 3
	Modbus block 4

Modbus assignments after deleting the pressure transducer. Note how the Valve and Flow meter device have moved up the list and get new Modbus associations

If you wish to remove a previously configured device and do not want the Modbus map to change, this can be achieved by disabling the device rather than deleting it (uncheck the **Enabled** tick box for the unwanted device).

5.2 CONFIGURING THE COMMAND TABLE

The HG1+ automatically polls the field instruments for their **offline** data as required to ensure that this data is always available and valid in the Modbus data map. Offline data is obtained from the field instrument under the following conditions:

- At start-up
- After a communications failure
- After the field instrument indicates that some aspect of its configuration has changed

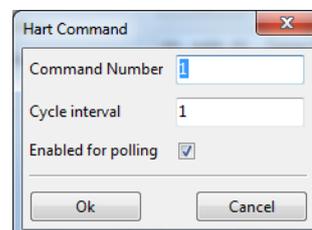
Offline data objects are always valid and can be read from the Modbus interface at any time. Section 6 explains how to download the Modbus map from the HG1 and how to identify which objects are offline data.

Online data (i.e. measured process variables or other data that changes in response to the process) are polled according to the entries in the HG1+ command table. By default, this table contains Hart commands 2 and 3 which pull back the four primary variables PV, SV, TV and QV along with loop current and percentage of range. For most applications, this is sufficient and no changes to the default command table are required.

- ❖ The meaning of each hart command can be found the **HART Commands Document No: 1345794149** which is available from the RAP Systems website)

Advances users may wish to modify the default command list to access data from instruments that implement device specific hart commands. Up to 20 commands may be specified per instrument. These commands will be executed repeatedly at a rate defined by the **Cycle interval** setting associated with the command; a command with a cycle interval of 1 will be executed every cycle (i.e. as fast as possible), a cycle interval of 10 would be executed every tenth cycle and so on. High priority commands should be given a low cycle time.

Commands are added, modified and deleted from the command list using the **Add**, **Modify** and **Delete** buttons under the HART COMMANDS section of the right hand panel. Commands can also be edited by double clicking on a command in the list. Clicking the **Add** button will bring up a dialog box as shown here in which you can enter the desired Hart command number, the required execution cycle interval and choose to enable or disable the command.



- ❖ NOTE: On start-up, or after recovering from a communications failure, or on discovering a transmitter for the first time, the HG1+ will execute all configured commands once before adopting the timings specified by

the Cycle fields. This ensures that all data (even those with large cycle time settings) are valid and up to date.

5.3 CHOOSING THE POLLING DEFERRAL MODE

When the HG1+ is used as a Hart Modem to allow third party software to communicate with the field instruments, it may be necessary to consider the polling deferral mode setting. This setting controls how the HG1+ allocates access to the Hart loop between the needs of the automatic polling mechanism and the needs of the third party software using the Hart Modem interface.

None (Equal Access) shares the loop equally between the polling and the Hart Modem interface.

Partial causes the polling mechanism to defer, to some extent, to the Hart Modem, the Hart Modem will get most the available bandwidth (about 75%) and the polling will get the remaining.

Full causes the polling mechanism to stop entirely whilst the Hart Modem is being used.

The reason why this setting may be of importance is related to the effect sharing the Hart loop has on the timing of instrument responses to a third-party application using the Hart Modem facility. In the **None** deferral mode the third-party application may have to wait a small amount of time (approx 0.5 seconds) before its message gets placed on the Hart loop as the loop may be in use by the automatic polling mechanism. Depending on how the third-party software has been designed this may cause it to think the field instrument communications have failed with a timeout. If such a problem is apparent, then the first steps to a solution are to check the software configuration options to see if there is a setting for the Hart timeout. This should be set to 2 seconds if available. If this is no mechanism to change the timeout settings, then the problem can be avoided by selecting either **Partial** or **Full** deferral. **Full** deferral should be used only if the other two options do not produce the required results as it inhibits the automatic polling (and therefore the Modbus data remain static) during the period that the third-party software is active.

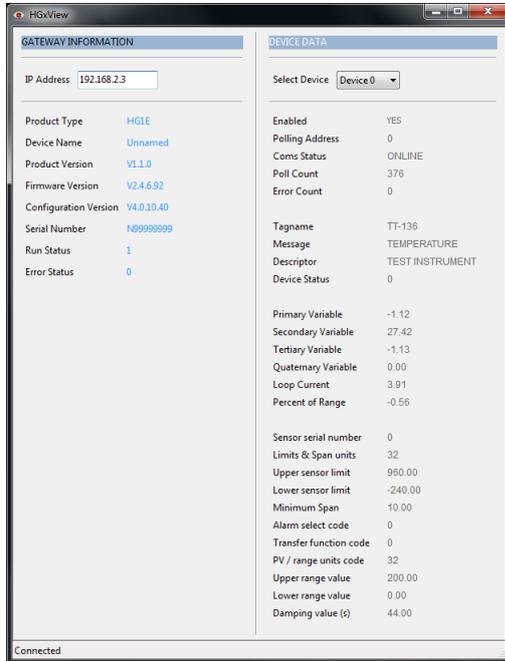
5.4 SAVING AND UPLOADING THE CONFIGURATION

Once all the required devices have been added to the configuration, and their respective command tables populated as needed, the configuration should be saved on your PC. For this you use the **SaveAs** or **Save** option from the Projects menu; this is a required step before the configuration can be uploaded to the HG1+. You will be asked to provide a filename for the saved project. You may reload saved projects at any time for examination, modification or to upload to another HG1+ using the **Load from Disk** menu option.

After saving the project the configuration can be uploaded to the HG1+ by choosing the **Configure** item from the **Target** menu. The process takes a short while and the HG1+ will be re-started once complete. The HG1+ is now fully configured and ready for use.

5.5 VIEWING LIVE DATA

It is possible to use the configuration tool to view live data from the HG1+, this includes information about the HG1+ itself, the status and health of connected smart devices and values of primary data from the devices. Select the **View Live Data** item from the Target menu to start the viewer:



The left-hand panel provides information about the HG1+, including its operational status and version numbers.

The right-hand panel shows data, in real time, being obtained from connected smart devices. Use the **Select Device** drop down to choose which devices data is displayed.

The condition of the communications link to the device can be assessed by examining the Coms Status, Poll Count and Error Count fields.

6 USING THE MODBUS INTERFACE

The HG1+ provides three types of Modbus slave interface to cover the needs of any master application:

Modbus TCP/IP: This interface is available via the Ethernet port and conforms to the Modbus TCP/IP standard. The HG1+ defaults to using Port number 502 for this interface; however, this may be changed by the user through the Target/Options menu of the configuration tool. It is permitted for multiple Modbus TCP master devices to connect to the HG1 at the same time.

Modbus RTU: This interface provides Modbus RTU functionality over the HG1+ serial port. The port may be configured as to use RS232, RS422 or RS485 interface standards. There can be only one Modbus RTU (serial) master connected to the HG1+

Encapsulated Modbus RTU: This interface provides standard Modbus RTU framing, however the data is sent via the Ethernet port, encapsulated in TCP frames. The HG1+ defaults to using port number 1100 for this interface; this may be changed by the user through the Target/Options menu of the configuration tool. It is permitted for multiple encapsulated Modbus RTU master devices to connect to the HG1 at the same time.

All three Modbus slave interfaces may be used at the same time.

Each HART device configured in the HG1 has an associated set of Modbus registers which may be used by any Modbus master device to gain access to the transducer data for the device. The **Hart Module Device Database** document, available from the RAP systems website, defines the entire set of database objects accessible within HG1. The Modbus map which specifies the Modbus address of each database point is downloaded directly from the HG1 itself using the configuration tool.

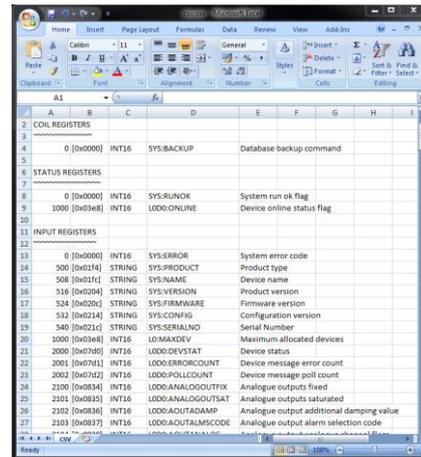
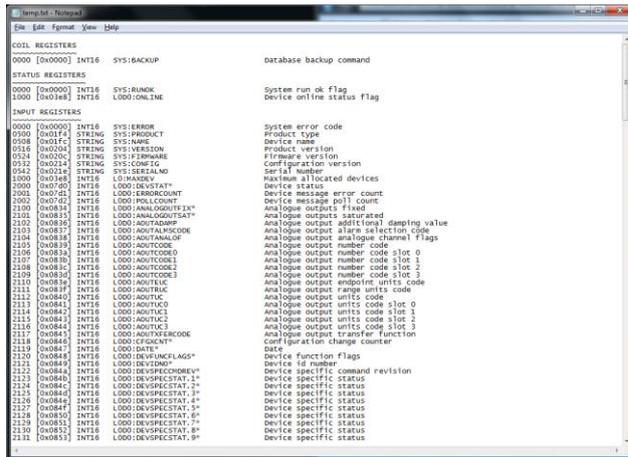
Modbus/Save Modbus Map/As Text File saves the Modbus map as a text file which may be examined by any text editor such as notepad or word.

Some objects identified by the text file will have an asterisk at the end of their database name. This asterisk is not part of the name, rather it is there to indicate that the associated object is either (a) Part of the field instruments *offline data* that is automatically polled by the HG1 on startup, after communications failure or on change of the field instrument configuration, or (b) a *write through* object which is automatically transferred to the field instrument when the Modbus point is written to.

Write through object are those starred objects found in the holding register section of the map, whilst *offline data* are those starred objects found input register section.

Modbus/Save Modbus Map/As CSV file saves the Modbus map as a comma separated value file suitable for importing into excel or other spreadsheet packages

Modbus/Save Modbus Map/For Citect generates a CSV file suitable for import directly into the Citect SCADA package.



6.1 WRITING DATA TO A SMART DEVICE & ON DEMAND COMMANDS

For many common objects, it is possible simply to write to the relevant Modbus register and the HG1+ will pass this data onwards to the field instrument. These 'write through' objects can be identified by referring to the Modbus Map text file generated by using the **Modbus/Save Modbus Map/As Text File** menu option from the configuration tool; those with an asterisk following their database name in the Holding register section are write through objects.

There are some objects supported by the Hart protocol that cannot simply be mapped in this way (either because they are dependent on other database points, or are part of a manufacturer's device specific command set), these objects require a different approach as describe below.

The general steps to perform write for these types of data are:

1. Identify the Hart command required to write the object (see HART Commands reference manual)
2. Write to the Modbus registers associated with the objects in the write fields of the Hart command
3. Write the **polling address** of the destination instrument to the Modbus register for L0:USRSADDR
4. Write the desired **HART command number** to the Modbus register for L0:USRCMDNO
5. Write a value of **1** to the Modbus register for L0:USRCMDEXE

EXAMPLE: To write a specific device variables damping value to field instrument with polling address 7

1. Consult the HART Commands reference manual to determine the appropriate command number (55 '**Write device variable damping value**')
2. Write the two objects in command 55's write field list (DVCODE.1 and DVDAMP.1) using Modbus registers for these objects (Holding registers 2111 and 2206)
3. Write the Polling address of the target instrument (7) to L0:USRSADDR (Modbus holding register 1003)

4. Write a 1 to L0:USRCMDEXE (Modbus Holding register 1001) to trigger the command

On receiving a 1 in the L0:USRCMDEXE register, the HG1+ will action the HART command. If the command was successful then the HG1+ will write a 0 back into the L0:USRCMDEXE register to indicate success. If the command fails then a value of -1 will be written.

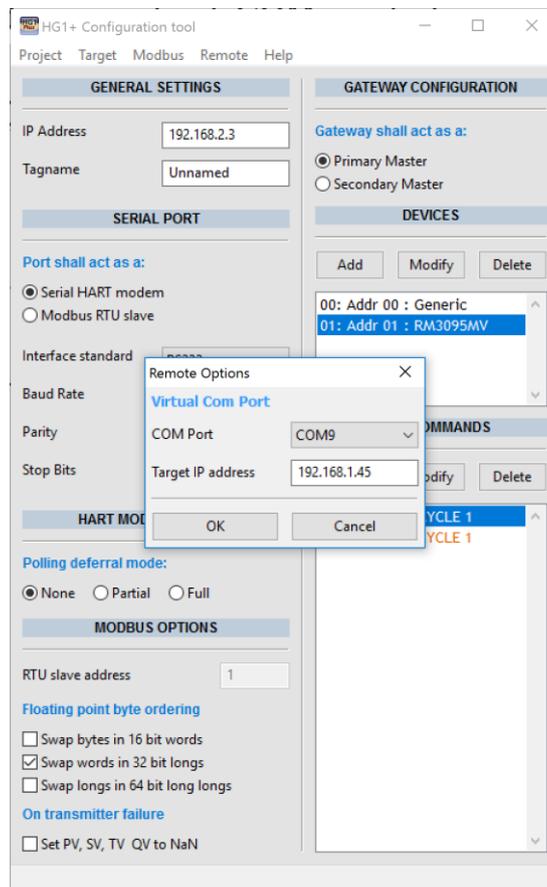
The same procedure can be used to trigger any command, including those that have no actual data content (such as **Set PV Zero** or **Perform Self-Test**). You may also trigger read commands that take parameters, such as command 62 **Read Analogue Outputs** which require four parameters to be setup before the read can be triggered. This **On Demand** mechanism can be used to trigger **any** HART command, read or write. Thus, it may be used to execute a read command on an "as needed" basis in addition to the normal cyclical polling of data set up using the command table configuration.

7 REMOTE ACCESS

The HG1 can be accessed remotely over a LAN using the Virtual COM port facility.

The HGX installation software includes a COM port driver which creates a virtual serial port on the PC accessible by any software that would normally use a traditional COM port, including pactWare, FieldCare, RadarMaster etc. The virtual com port 'connects' to the HG1 over the Ethernet network, allowing the host PC to be located remotely from the HG1 itself.

To configure the virtual com port, open the HGX configure tools and select the **Remote→Remote COM Port Settings** menu. This will open a dialog box in which you can specify the virtual COM port name, and the IP address of the target HG1.



Changes to these setting take effect immediately, and the settings remain in effect even if the PC is restarted. Once configured, it is not necessary to open the HGX configure application to use the com port.

8 FACTORY RESET

It is possible to force the HG1 to revert to factory settings. This may be needed in circumstances such as when the configures IP address of the unit has been lost or forgotten.

Performing a factory reset will have the following effect.

- The current device configuration will be erased
- The Network settings will revert to
 - o IP 192.168.1.250
 - o Network mask 255.255.255.0

Following a factory reset, a new configuration must be downloaded to the unit.

To perform a factory reset take the following steps.

1. Power OFF the unit
2. Using a wire, short together the 0v screw terminal to the unused screw terminal next to the two loop terminals – see diagram below
3. Power ON the unit and wait two minutes
4. Remove power and remove the wire link
5. Repower the unit and re-configure as needed.

