
SW02, HART Master Reference Manual





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Summary

SW02 is a generic HART Master suited as an introduction to the HART communication technology. It is also a tool for configuring Fint's HART modules: T210, T310 and T810

- HART master PC program
- SW02 runs under Windows 7, 8 and 10
- Menus for
 - Re-ranging
 - Application configuration using the T210 and T310
 - Device logistics
- Window for continuous update of measured variables
- Menus for configuring T210 and T310 to adapt to the instrument connected.

Fieldbus International AS
Ullern Alle 28
0381 Oslo
Norway

Tel. +47 - 22 13 19 10
Fax. + 47 - 22 13 19 11
<http://www.fint.no>

INSTALLATION

The SW002 software runs under Windows 7, 8 or 10.

Install the installation CD in the CD driver on your PC. Click on Set-up.exe. The HART Master will be installed in the directory specified.

Figure 1 shows how you connect a HART transmitter and the PC. A HART modem must be connected to a USB port on the PC. The COM port may be selected when you start the programme. The modem connects across a loop resistor (typically 250 ohm).

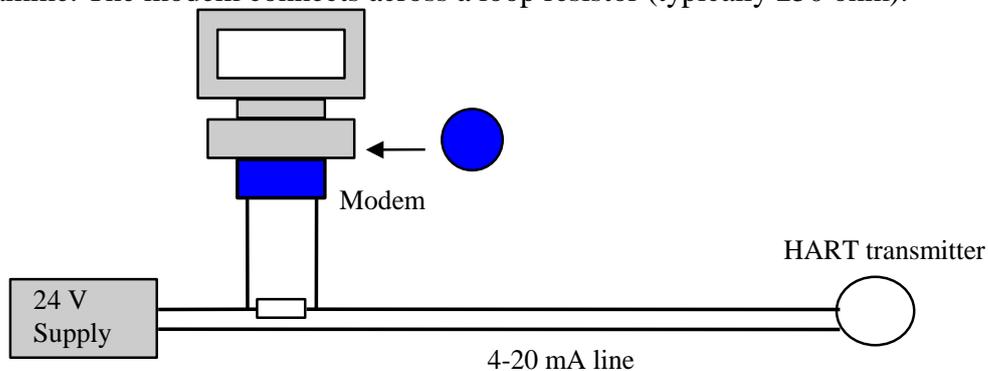


Figure 1 HART system setup

The figure below show the opening window of SW02. If the method of connecting to the instrument and the COM port is selected, then it is simply to press “Connect” and SW02 will try to connect and start reading from the connected T210.

First time its is however better to enter the “Setting” menu to select COM port and method for accessing the instrument.

SW02 can scan the COM ports and the the user must choose the port where the HART modem is located.

To detect the instrument using address 0 with broadcast is the most common way start communicating with the HART device and for first time communication with T210 or T310 this is the method. If the device is put into multi-drop mode by given a short address different from 0, using the alternative methods by scanning an address range.



Figure 2 Opening Window of SW02

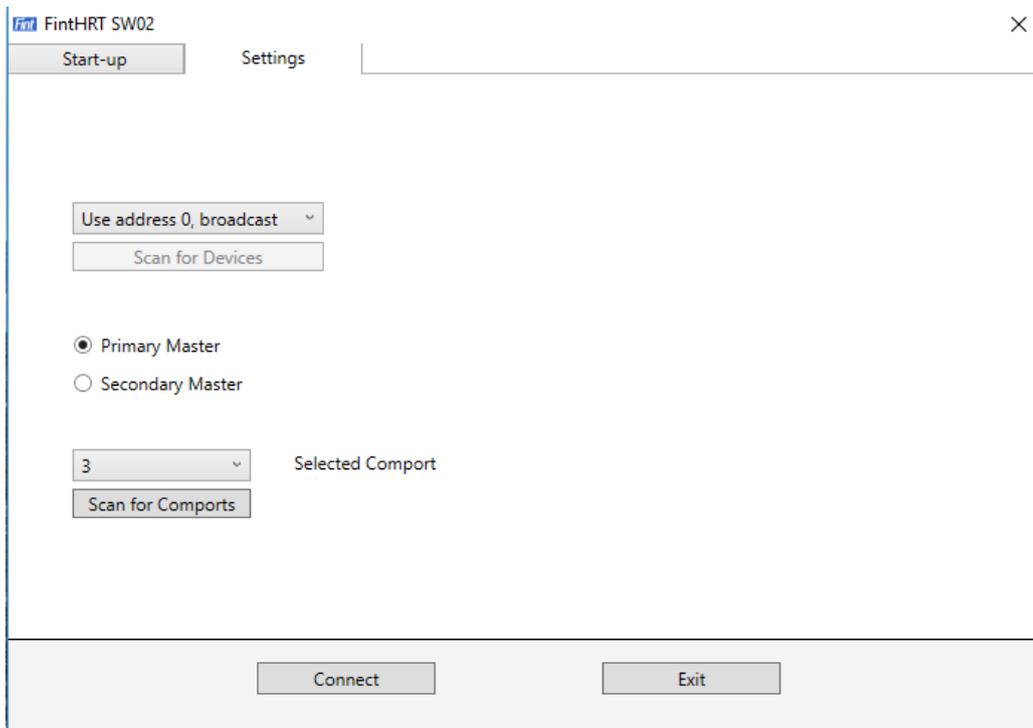


Figure 3 Setting menu

THE MENUS.

Online menu

When clicking “Connect” SW02 tries to establish connection with the instrument using the chosen connection method. If the instrument is detected, all required information is read from the instrument. This takes a few seconds. Then the online menu comes up. Heree the continuously updated variable are displayed as a digital value and graphically. See Figure 4 below.

Configuration menus are shown as tabs and can be entered

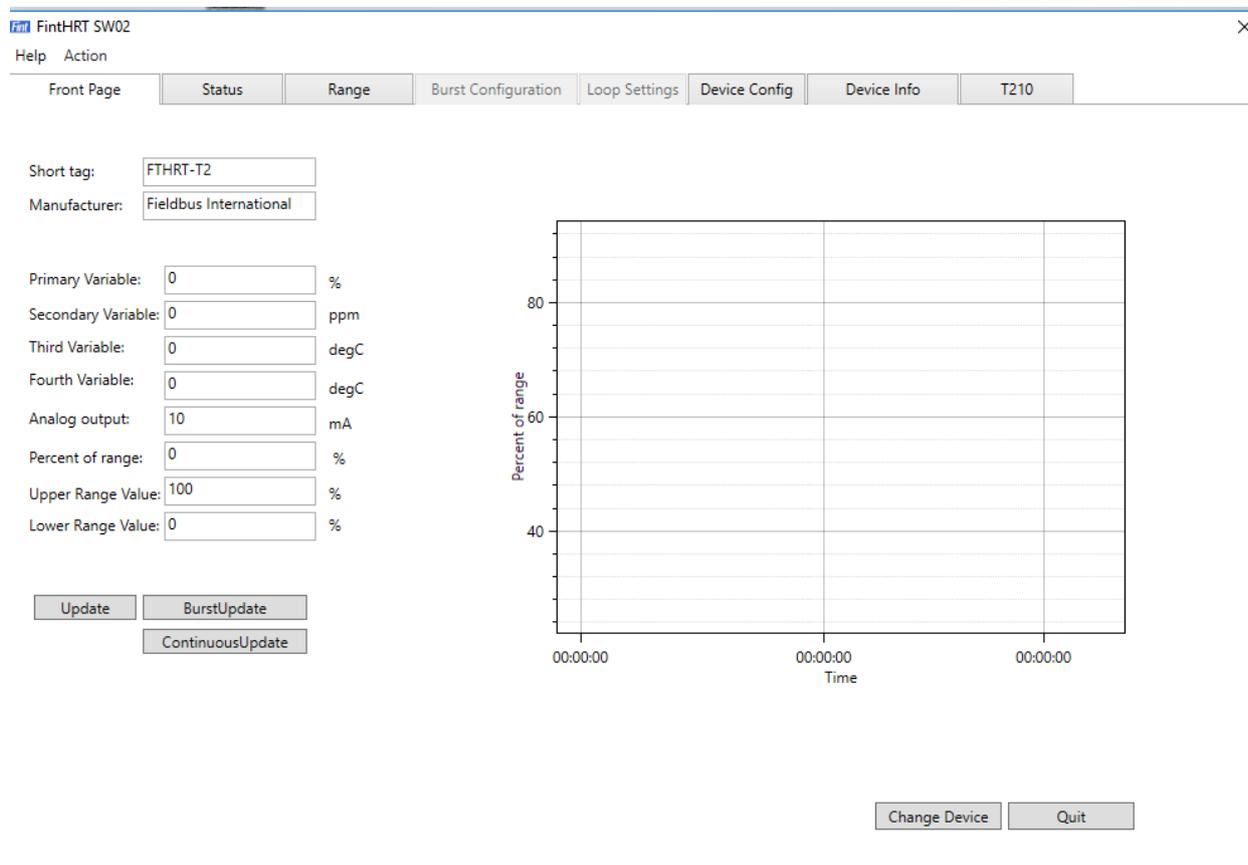


Figure 4 The online menu

Updating dynamic variables

Unless you press one of the buttons in Update, there is no dynamic communication with the HART device. Pressing “Update” will ensure that all dynamic data is updated once. The “Start Continuous Update” button will start standard HART communication that will ensure update of the dynamic variables twice a second. The “Burst Continuous Update” will set the HART device

in burst and the HART device will start sending a Command 3 response, continuously. This will increase the update rate to three times a second.

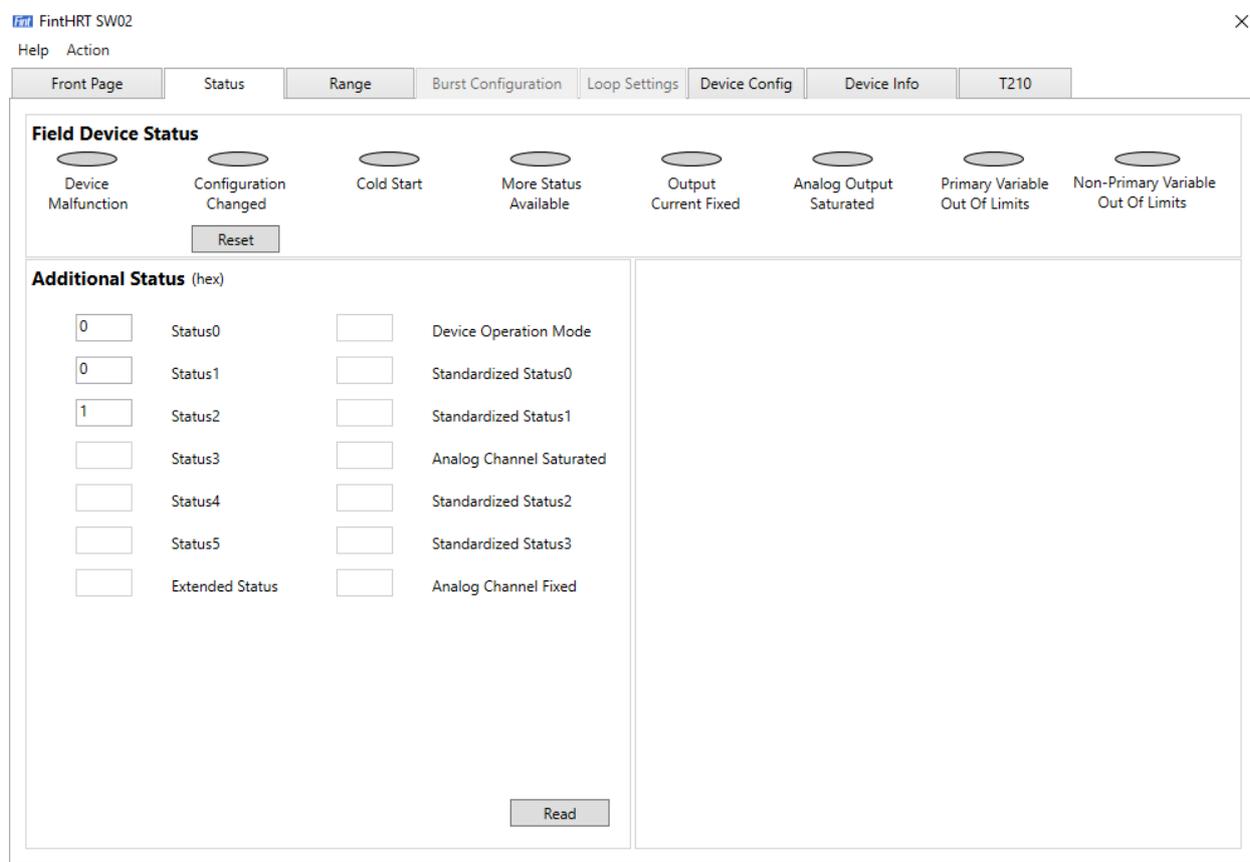
Status

The Status menu show both the Field Device Status and the Additional Status. The Field Device status is returned with all HART responses from the instrument. The status gives the dynamic information about the HART device.

Some HART devices support the “Configuration Change “ flag. The “Reset Flag” button is used to reset the flag.

Some HART devices use the “Cold Start” flag to signal that the device has been power cycled since last time it communicated HART.

Most devices support more status information than given in the Field Device status. This status information called the Additional status. If there is a change in the Additional status, a flag in the Field device status, the “Additional Status” flag is set. When the Additional Status flag is set, the Additional Status is read. There is no decoding of the additional status flags as they vary from instrument type to instrument type.



FintHRT SW02

Help Action

Front Page Status Range Burst Configuration Loop Settings Device Config Device Info T210

Field Device Status

Device Malfunction
 Configuration Changed
 Cold Start
 More Status Available
 Output Current Fixed
 Analog Output Saturated
 Primary Variable Out Of Limits
 Non-Primary Variable Out Of Limits

Reset

Additional Status (hex)

<input type="text" value="0"/>	Status0	<input type="text"/>	Device Operation Mode
<input type="text" value="0"/>	Status1	<input type="text"/>	Standardized Status0
<input type="text" value="1"/>	Status2	<input type="text"/>	Standardized Status1
<input type="text"/>	Status3	<input type="text"/>	Analog Channel Saturated
<input type="text"/>	Status4	<input type="text"/>	Standardized Status2
<input type="text"/>	Status5	<input type="text"/>	Standardized Status3
<input type="text"/>	Extended Status	<input type="text"/>	Analog Channel Fixed

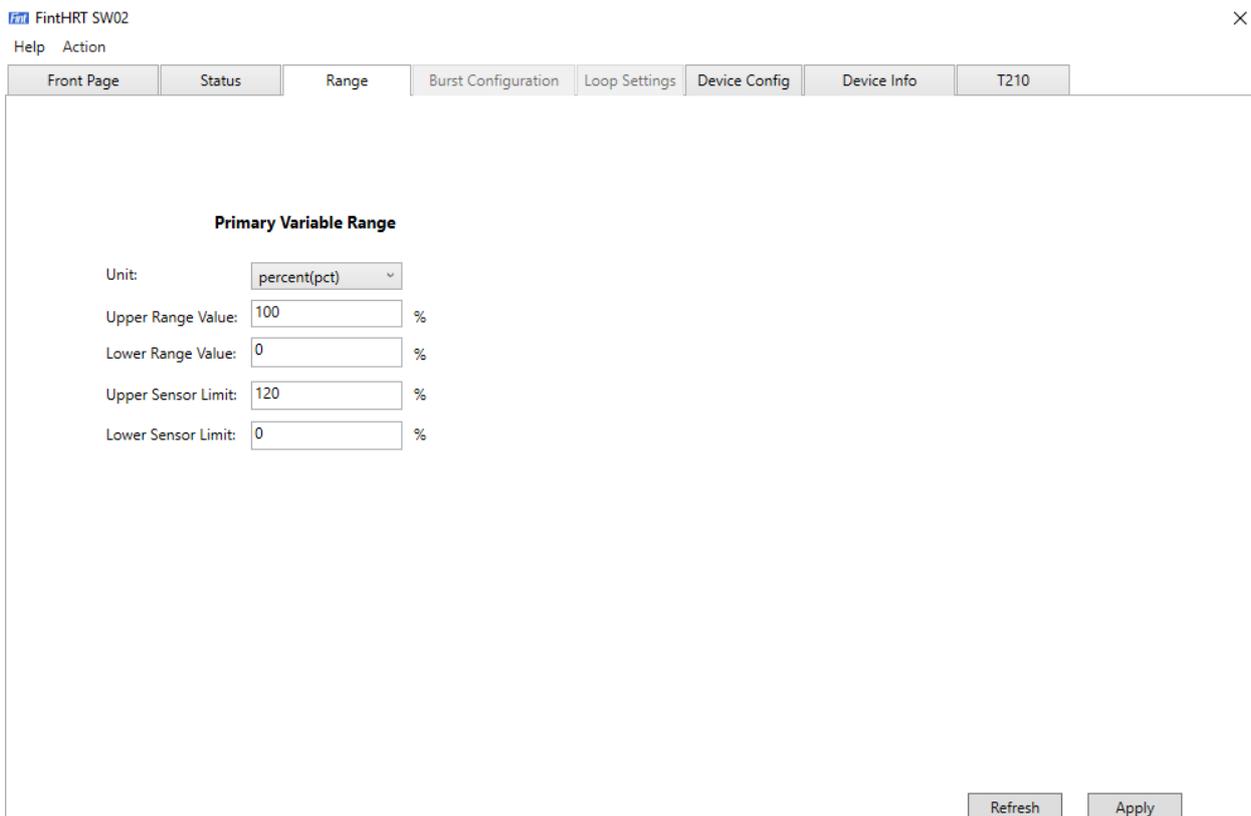
Read

Range

The range is defining the physical limits corresponding to the 4 and the 20 mA range. Upper Range is consequently equal to 20 mA and 4 mA equal to Lower Range. The range can be programmed by entering the corresponding physical limits.

NOTE! This menu shows what the end-user will see. The range values needs to be set in the factory to ensure that the range values matches the Range of the device. In the case that the user should not be allowed to change the range, the Minimum Span must be set equal to the range. If so it will not be possible to change any value in this menu

The Range values needs to be within the Sensor limits.



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Help Action

Front Page Status Range Burst Configuration Loop Settings Device Config Device Info T210

Primary Variable Range

Unit:

Upper Range Value: %

Lower Range Value: %

Upper Sensor Limit: %

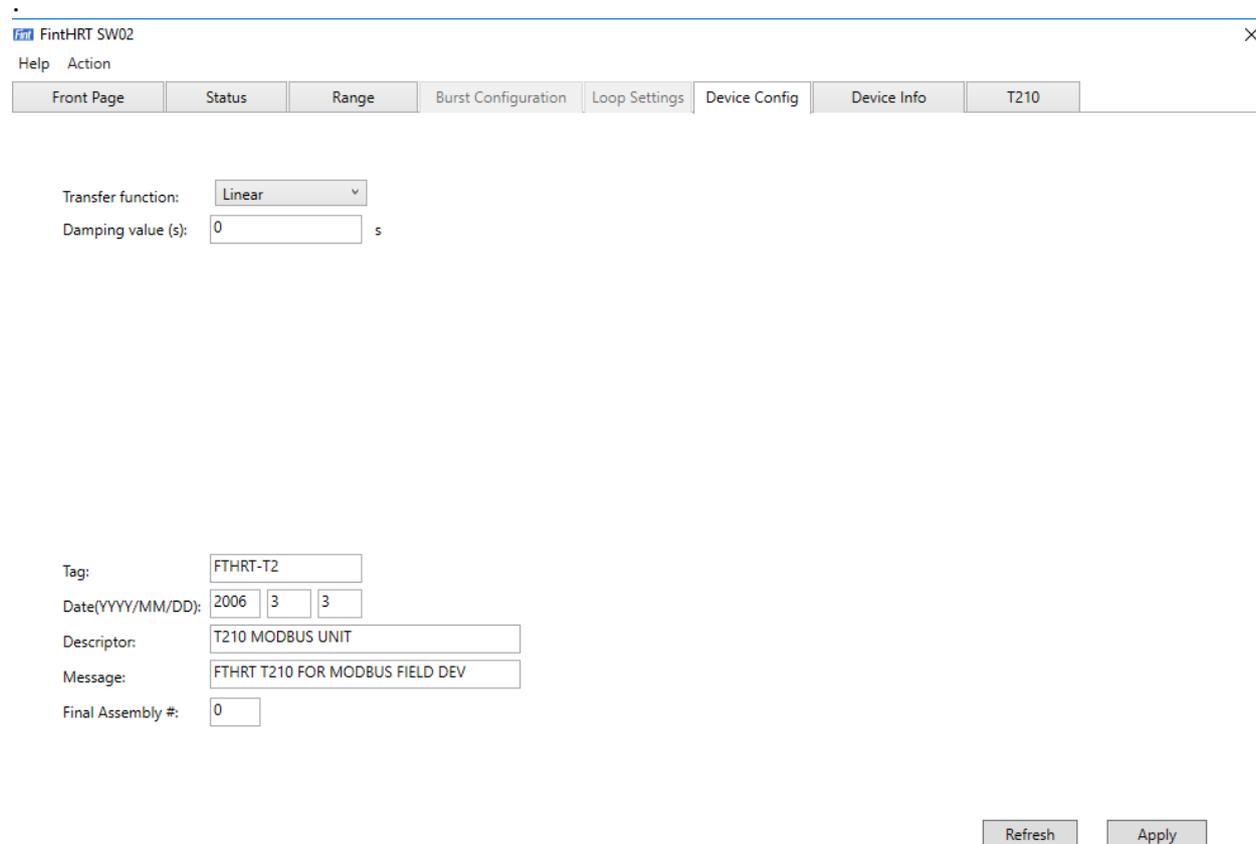
Lower Sensor Limit: %

Figure 5 Menu for re-ranging.

Device information

This menu is used to configure the HART device. Any HART device shall support “TAG”, “Descriptor”, “Message” “Final Assembly number” and “Date”.

Damping value is the time constant of a first order filter used for filtering the Primary Variable (PV).



FintHRT SW02

Help Action

Front Page Status Range Burst Configuration Loop Settings Device Config Device Info T210

Transfer function: Linear

Damping value (s): 0 s

Tag: FTHRT-T2

Date(YYYY/MM/DD): 2006 3 3

Descriptor: T210 MODBUS UNIT

Message: FTHRT T210 FOR MODBUS FIELD DEV

Final Assembly #: 0

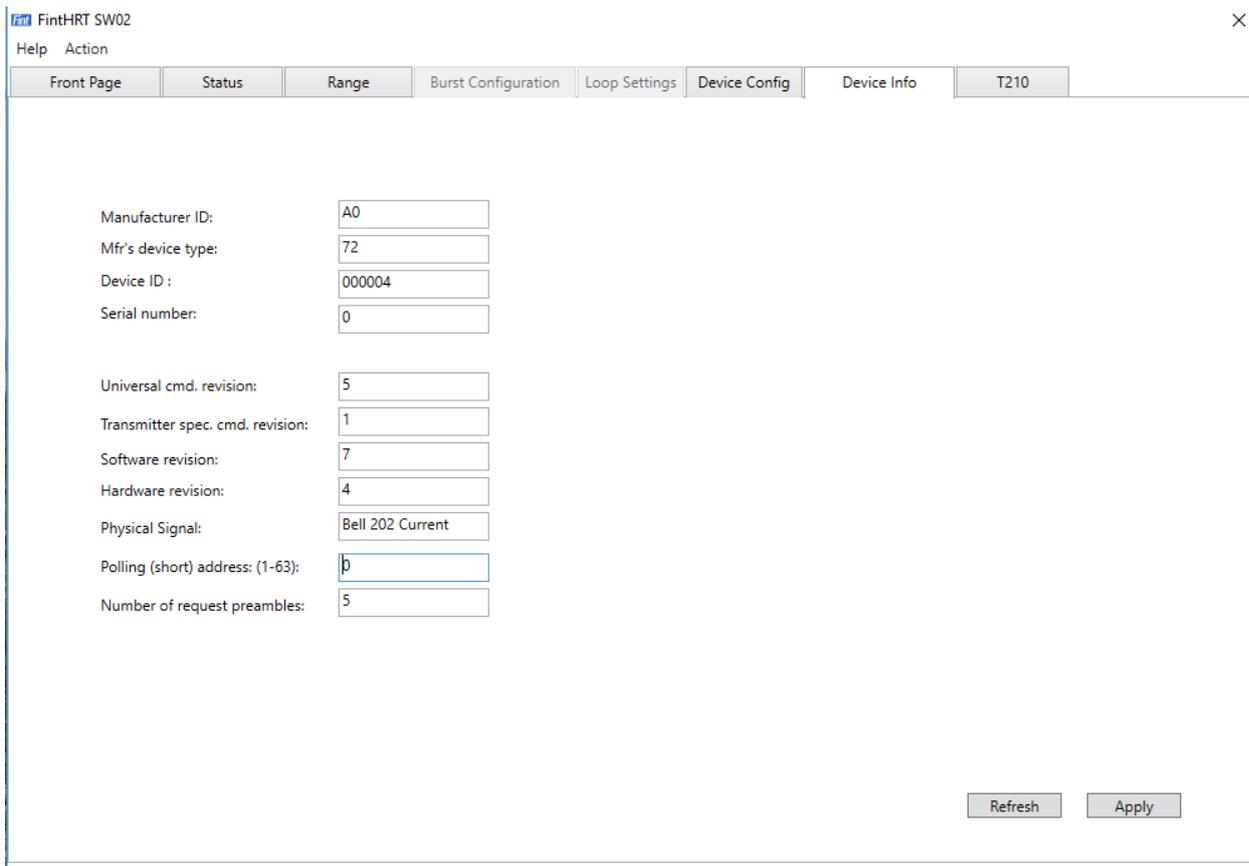
Refresh Apply

Figure 6 Device configuration menu

HART information

This menu displays the logistic information related to the HART device. This is the information a HART Master is using to establish contact with the device in order to start to communicate. Some of the information is used to establish the unique HART long address, and some of the information is used by the Master to select the correct DD for a device.

The only parameter that can be configured is the “Polling (short) address”. If this address is configured to be different from “0”, the device is forced into multidrop. To take the device out of multidrop mode, write address “0” to the device. This window will not necessarily show the actual short address of the device, but rather display “0”, because there is no HART command that allows the Master to read the present address from the device. The short address is not used in a normal communication with the device, only to establish contact initially. When the contact is established, the unique Long address is used.



The screenshot shows a software window titled "FintHRT SW02" with a menu bar containing "Help" and "Action". Below the menu bar is a tabbed interface with tabs for "Front Page", "Status", "Range", "Burst Configuration", "Loop Settings", "Device Config", "Device Info", and "T210". The "Device Config" tab is active, displaying a list of HART device parameters, each with a corresponding input field:

Manufacturer ID:	A0
Mfr's device type:	72
Device ID :	000004
Serial number:	0
Universal cmd. revision:	5
Transmitter spec. cmd. revision:	1
Software revision:	7
Hardware revision:	4
Physical Signal:	Bell 202 Current
Polling (short) address: (1-63):	0
Number of request preambles:	5

At the bottom right of the window, there are two buttons: "Refresh" and "Apply".

Figure 7 HART logistic information

Configuration of the HART module, T210/T310

There are extra menus in the SW02 for configuration of T210/T310. They are visible only when a T210 or a T310 is connected to SW02.

Modbus configuration

The Modbus communication configuration menu is the first that is entered.

The Modbus parameters need to be configured first. That comprises:

- Modbus device address
- Modbus baud rate, parity etc.
- CRC byte ordering
- Time-out time for Modbus responses.

High –low is the normal byte ordering for the CRC.

The time-out time is given in ms. It should not exceed the HART time-out time of 256 ms and a suitable margin should be used. Time-out time longer than 200 ms is not advisable. If longer time-out times are required, the T210/T310 will respond with status “busy” and a consecutive HART request needs to be issued to fetch the response.

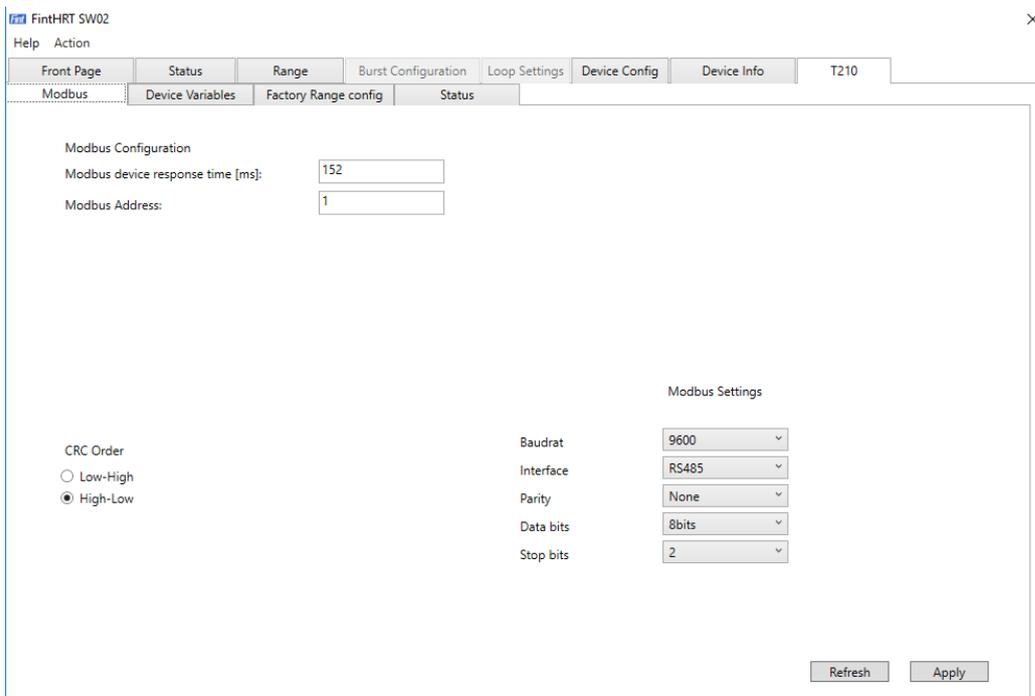


Figure 8 Modbus communication configuration

MODbus register configuration

The next step is to configure the device register addresses. There are four Device Variables that can be fetched from the MODbus device. The registers may be located freely in the device. The variables will be read using Modbus Function Code 3 or 4 .

FintHRT SW02 ×

Help Action

Front Page Status Range Burst Configuration Loop Settings Device Config Device Info T210

Modbus Device Variables Factory Range config Status

	Register address	Data type	Scaling factor	Offset	Device Variable Configuration	
Device Variable 0:	0	FLOAT 3 2 1 0	1	0	Class For Device Variable 0:	Concentration
Device Variable 1:	2	FLOAT 3 2 1 0	1	0	Unit For Device Variable 0:	percent(pct)
Device Variable 2:	4	FLOAT 3 2 1 0	1	0	Class For Device Variable 1:	Concentration
Device Variable 3:	6	FLOAT 3 2 1 0	1	0	Unit For Device Variable 1:	parts per million(l)
					Class For Device Variable 2:	Temperature
					Unit For Device Variable 2:	Degrees Celsius(°)
					Class For Device Variable 3:	Temperature
					Unit For Device Variable 3:	Degrees Celsius(°)

Register addresses are given in data register format.
 Data register = Holding register - 40 001
 Data register = Input register - 30 001

Function Code
 Code 3
 Code 4

Transmitter Variable Codes
 Primary Variable Code: 0
 Secondary Variable Code: 1
 Third Variable Code: 2
 Fourth Variable Code: 3

Refresh Apply

Figure 9 Configuration of Device variable in T210 or T310

It is the register address as it will be transmitted to the device that is used in the configuration. In the configuration below, the following MODbus registers are read:

read	MODbus Register address	Data register address	Registers
Device Variable 0	40100	99	99 + 100
Device Variable 1	40104	103	103
Device Variable 2	40105	104	104 + 105
Device Variable 3	40107	106	106 + 107

In the example below the data type for Device variable 0 is selected to be Float 3 2 1 0. This implies that two consecutive registers are read. The selected byte ordering (IEEE 754) is to be 3 2 1 0 where 3 is the most significant byte and byte 3 and 2 are located in the first register, the

register with the lower address. Variable 1 is a Unsigned Short Integer, stored in one Modbus register.

Each variable can be scaled using a multiplying factor and an offset. For Long or Short Integer values, the scaling factor is used to move the decimal point. The value can be stored in the Modbus instrument with a fixed point representation. If the values is stored with one decimal point, the scaling factor must be 0,1 to make the right conversion.

	Register address	Data type	Scaling factor	Offset
Device Variable 0:	99	FLOAT 3 2 1 0	1	0
Device Variable 1:	103	U SHORT 1 0	1	0
Device Variable 2:	104	FLOAT 3 2 1 0	1	0
Device Variable 3:	106	FLOAT 3 2 1 0	1	0

Register addresses are given in data register format.
 Data register = Holding register - 40 001
 Data register = Input register - 30 001

Function Code

- Code 3
 Code 4

Figure 10 Configuration of variables

Device variable unit class configuration

The T210/T310 can now read variables from the assigned Modbus registers. The next operation is to assign Variable class and units to these variables. Variable Class will be things like pressure, flow or another type of measurement. The value as it is stored in the Modbus instrument is stored in an engineering unit. By configuring Variable Class and engineering unit for each variable, we will tell T210/T310 which unit is used. This will allow the value to be presented correctly on the HART side and allow unit conversion to be performed within T210/T310 if required. See Figure 11

Device Variable Configuration

Class For Device Variable 0:	Concentration ▾
Unit For Device Variable 0:	percent(pct) ▾
Class For Device Variable 1:	Concentration ▾
Unit For Device Variable 1:	parts per million(l) ▾
Class For Device Variable 2:	Temperature ▾
Unit For Device Variable 2:	Degrees Celsius(°) ▾
Class For Device Variable 3:	Temperature ▾
Unit For Device Variable 3:	Degrees Celsius(°) ▾

Figure 11 Engineering unit and Variable class configuration

PV range values

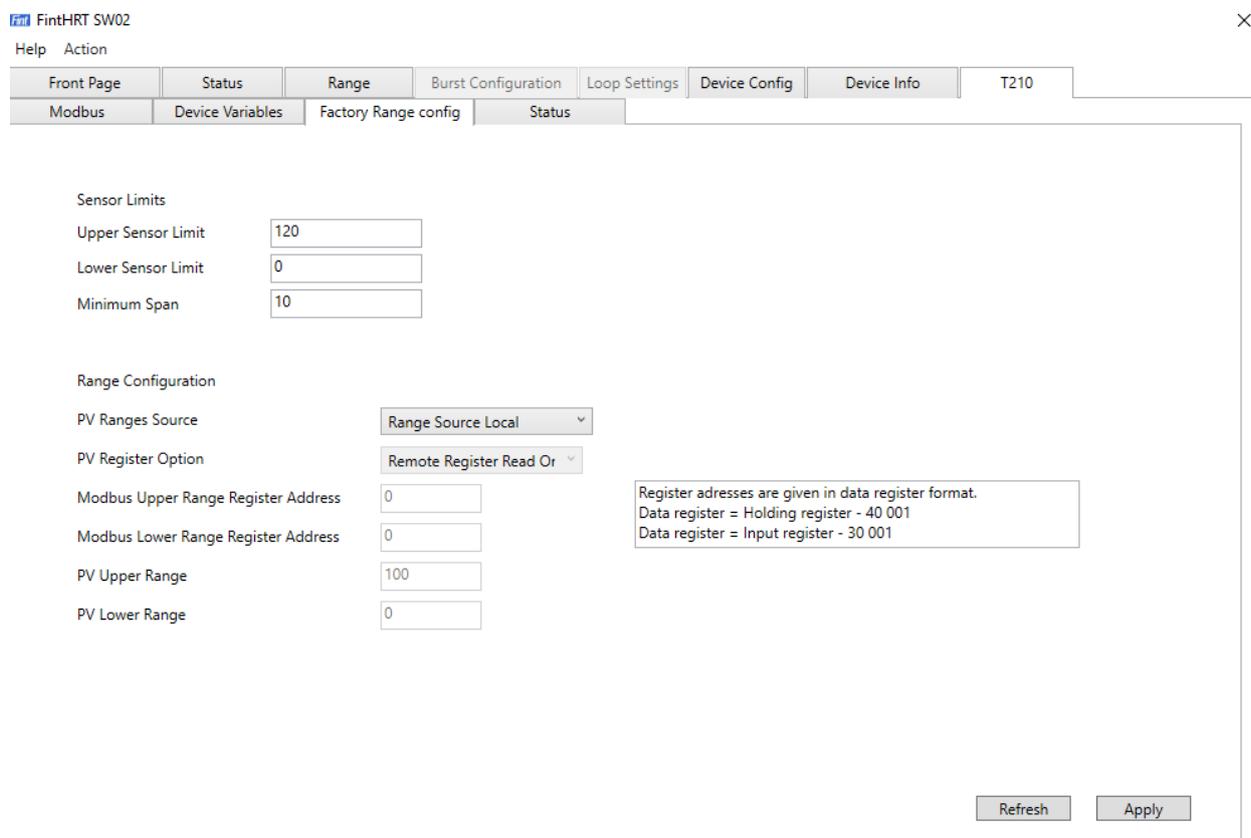
The 4-20 mA range is important to set so T210 is harmonized with the instrument. If end-user reranging shall be possible the range values must be available as Modbus registers and linked to the T210 range values.

If the range values are not available in Modbus registers, the values must be set in T210 and in such a way that they cannot be changed.

The configuration menu allow to configure the source for the Range values, Remote (in the instrument) or Local (in T210).

If the range values can be set using Modbus registers (Range source Remote), the register addresses needs to be set. If these registers are Writable, this is also selected.

If the Range source is Local (only resides in T210/T310), the Range values themselves are configured.



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Help Action

Front Page Status Range Burst Configuration Loop Settings Device Config Device Info T210

Modbus Device Variables Factory Range config Status

Sensor Limits

Upper Sensor Limit

Lower Sensor Limit

Minimum Span

Range Configuration

PV Ranges Source

PV Register Option

Modbus Upper Range Register Address

Modbus Lower Range Register Address

PV Upper Range

PV Lower Range

Register addresses are given in data register format.
Data register = Holding register - 40 001
Data register = Input register - 30 001

Refresh Apply

Figure 12 Factory Range configuration

Sensor Limits

The sensor limits are the absolute limits of the measured variable. The range values cannot be set outside these limits. These values should be defined for an instrument. The range value can be scaled down. The Minimum Span is a parameter that informs the user that he should not reduce the range lower than this value without effecting the accuracy of the instrument.

If the device using T210 shall have a fixed 4-20 Ma Range that the user never shall change, the Upper and Lower Sensor Limits must be set equal to the Upper and Lower Range and Minimum Span set equal to the total Range.

Dynamic variable assignment

When all the configuration is done, the last setting is to assign the Device Variables to Dynamic variables. The Dynamic variables are the variables presented by the HART instrument called Primary Variable (PV), Secondary Variable (SV) etc. These variables need to be reassigned even though the assignment can be correct. The assignment ensures that the correct variable class and unit code are converted to the HART output. For this reason any configuration operation should be completed with a reassignment of the Dynamic variables.

Transmitter Variable Codes

Primary Variable Code:	<input type="text" value="0"/>
Secondary Variable Code:	<input type="text" value="1"/>
Third Variable Code:	<input type="text" value="2"/>
Fourth Variable Code:	<input type="text" value="3"/>

Figure 13 Dynamic Variable Assignment



Status – Additional status

It is possible to select a register in the Modbus instrument as a feeder for the Additional status.

The Modbus register address and Function Code needs to be configured.

FintHRT SW02 X

Help Action

Front Page	Status	Range	Burst Configuration	Loop Settings	Device Config	Device Info	T210
Modbus	Device Variables	Factory Range config	Status				

Modbus Status

Status Register:

Function Code

Code 3

Code 4