Honeywell

Service Manual
990 SmartRadar FlexLine

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Contents

CHAPTER 1 GENERAL

1.1 Target Group for this Service Manual

The SmartRadar FlexLine Service Manual is intended for service engineers who are assigned to commission the SmartRadar FlexLine.

1.2 Structure of this Manual

Chapter Title	Description
1 - GENERAL	This chapter provides the introductory information for the manual.
2 - SAFETY	This chapter provides all the essential and mandatory safety instructions, precautions, and measures. It also describes the safety conventions used, the labelling information, and the compliance information.
3 - SYSTEM ARCHITECTURE	This chapter provides an introductory impression of the SmartRadar FlexLine's modular-shaped hardware architecture.
4 - SERVICE TOOLS	This chapter provides the description of the SmartView and the Engauge service tool.
5 - INSTALLATION	This chapter provides a reference to the *Installation Guide* for the SmartRadar FlexLine to make sure the relevant module(s) are accurately installed, before starting the commissioning.
6 - CONFIGURATION	This chapter gives all information required to configure the OneWireless infrastructure, SmartRadar FlexLine devices, and protocol tunneling.
7 - COMMISSIONING	This chapter provides the information required for an accurate commissioning of one or more SmartRadar FlexConn modules.

1.3 Trademarks

HART® is a registered trademark of the HART Communication Foundation.

1.4 Contact

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CHAPTER 2 SAFETY AND SECURITY

2.1 General

The SmartRadar FlexLine is a radar-based level gauge which is used in inventory measurement systems. It can also be used to interface with other systems and sensors such as pressure, density, or temperature sensors.

For the correct and safe servicing of this product, it is essential that all personnel follow the generally accepted safety procedures in addition to the safety precautions specified in this manual.

2.2 Safety Conventions

2.2.1 Warnings

The following warning symbol is used in this manual to urge attention in order ***to prevent personal injuries*** or dangerous situations, further described in this manual.

Symbol	Description	Remark
	General warning	Will always be explained by text.

2.2.2 Cautions

The following caution mark is used in this manual to urge attention in order ***to prevent damages to the equipment*** further described in this manual.

Symbol	Description
	General caution sign

2.3 Safety Instructions

2.3.1 Safety Instructions

See the safety instructions shipped with the device for installation, commissioning, operation, and maintenance.

2.3.2 EC Declaration of Conformity (for EU)

Refer to the EC declaration of conformity shipped with the device.

2.3.3 Control Drawings for FM & CSA

Refer to the control drawings shipped with the device.

2.3.4 Users

The mechanical and electrical installation must be carried out only by trained personnel with knowledge of the requirements for installation of explosion-proof equipment in hazardous areas.

The entire installation procedure must be carried out in accordance with national, local, and company regulations.

The entire electrical installation shall be carried out in accordance with the national requirements for electrical equipment to be installed in hazardous areas.

2.3.5 Additional Information

If you require additional information, contact Honeywell or its representative.

2.3.6 Environmental Conditions

Observe the environmental conditions for the temperature and the pressure.

2.4 Liability

The information in this installation guide is the copyright property of Honeywell. Honeywell disclaims any responsibility for personal injury or damage to equipment caused by:

- Deviation from any of the prescribed procedures,
- Execution of activities that are not prescribed,
- Neglect of the safety regulations for handling tools and use of electricity.

The contents, descriptions and specifications in this Service Manual are subject to change without notice. Honeywell accepts no responsibility for any errors that may appear in this Service Manual.

WARNING! Only certified technicians are authorized to make changes on the SmartRadar configuration. All modifications must be in accordance to the guidelines as set forth by Honeywell. Modifications not authorized by Honeywell will invalidate the approval certificates.

2.5 Labels

FIGURE 2-1 Identification label with Safety note on the SmartRadar FlexLine

NOTE: Labels are exemplary and subject to change.

2.6 Personal Safety

WARNING! National, local and company regulations regarding personal safety must be followed.

Pay attention to the kind of product in the tank. If there is any danger for your health, wear a gas mask and take all the necessary precautions.

WARNING! Take appropriate precautions when chemical or toxic product vapors are present (compressed air, chemical protection suit, and detection equipment).

2.7 Warnings and Cautions

2.7.1 General

2.7.1.1 Opening of the Instrument

WARNING! DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT

When it is required to open the instrument in an explosive hazardous environment, take care of the following:

WARNING! Make sure that the power to the device is switched off before you open the covers of the device. Failure to do so may cause danger to persons or damage the equipment. All covers of the device must be closed before switching the power on again.

WARNING! Treat the flange surface of the cover and the housing with care.
Keep the flange surface free of dirt.
The O-ring must be present and undamaged.

2.7.1.2 Closing of the Instrument

Cover flanged joint must be cleaned before closing.

The closing flange bolts of the lid of the SmartRadar FlexLine must be fastened with a torque of 15.5 Nm.

2.7.1.3 Tools

WARNING! Use non-sparking tools and explosion-proof testers. Use suitable explosion-proof tools (for example, testing devices)!

2.7.1.4 Working Environment

2.7.1.4.1 Hazardous Area

WARNING! Potential Electrostatic Charging Hazard!

Avoid generation of static electricity.

In case a OneWireless SmartRadar FlexLine is installed, do NOT wipe the surface of the antenna with dry cloth, and do NOT clean its surface with a solvent.

If electrostatically charged, discharging of the antenna surface to a person or a tool could ignite a surrounding hazardous atmosphere.

2.7.1.4.2 Safe Area

WARNING! Avoid generation of static electricity. Make sure no explosive gas mixtures are build up in the working area.

2.7.1.5 Required Skills

WARNING! The technician must be trained and qualified to safely install equipment in hazardous areas. The technician must work in accordance with national, local and company regulations.

2.8 Commissioning and Maintenance

- The entire installation procedure must be carried out in accordance with national, local, and company regulations.

  The entire electrical installation shall be carried out in accordance with the national requirements for electrical equipment to be installed in hazardous areas.

- All wiring entries must be closed such that the approvals are not invalidated. See the Installation Guide for the SmartRadar FlexLine, to make sure that the correct thread type is selected.

  For installations using cable glands, use Ex d compound barrier glands (in case of use with the SmartConn integrated junction box, see below instead).

  Use increased safety (Ex e) cable glands in case a SmartConn box is used.

  For installations using conduits, each conduit must be sealed within 18 inches of the enclosure.

- Improper installation of cable glands, conduits or stopping plugs invalidates the Ex approval of this device.

- Make sure that the housing of the device is properly bonded to the Protective Earth (PE).

2.9 Accordance to Regulations

2.9.1 Explosion Safety

- **ATEX**
  - **FlexLine with Integrated (HART) SmartView**
    II 1/2 G Ex d [ia] IIB T4 according to KEMA 07ATEX0010 X
    including Integrated SmartView according to KEMA 07ATEX0011
    or HART SmartView according to DEKRA 16ATEX0103
  - **FlexLine without Integrated (HART) SmartView**
    II 1/2 G Ex d IIB T6 or Ex d [ia] IIB T6 according to
    KEMA 07ATEX0010 X
  - **SmartConn**
    II 2 G Ex e ia IIB T6 according to KEMA 07ATEX0093

- **IECEx**
  - **FlexLine with Integrated (HART) SmartView**
    Zone 0/1 Ex d [ia] IIB T4 according to IECEx KEM 07.0003X
    including Integrated SmartView according to IECEx KEM 07.0004
    or HART SmartView according to IECEx DEK 16.0063
  - **FlexLine without Integrated (HART) SmartView**
    Zone 0/1 Ex d IIB T6 or Ex d [ia] IIB T6 according to
    IECEx KEM 07.0003X
  - **SmartConn**
    Zone 1 Ex e ia IIB T6 according to IECEx KEM 07.0031
- **FM**
  - **FlexLine with Integrated SmartView**
    Class I, Division 1, Groups C and D, T4, according to 3030575
    including optional Integrated SmartView according to 3030575
  - **FlexLine without Integrated SmartView**
    Class I, Division 1, Groups C and D, T6, according to 3030575
- **CSA**
  - **FlexLine with Integrated SmartView**
    Class I, Division 1, Groups C and D, T4, Enclosure 4X, Dual Seal
    Ex d [ia Ga] IIB T4 IP66 / IP67 Ga/Gb, Dual Seal according to 1921040
    including optional Integrated SmartView according to 1921040
  - **FlexLine without Integrated SmartView**
    Class I, Division 1, Groups C and D, T6, Enclosure 4X, Dual Seal
    Ex d [ia Ga] IIB T6 IP66 / IP67 Ga/Gb, according to 1921040
  - **SmartConn**
    Ex e [ia Ga] IIB T6 IP66 / IP67 Gb, according to 1921040
- **INMETRO**
  - **FlexLine without SmartConn and with Integrated SmartView**
    Ex d [ia Ga] IIB T4 Ga/Gb According to TÜV 13.0977 X
    including optional Integrated SmartView according to
    TÜV 13.0977 X
  - **FlexLine without SmartConn and without Integrated SmartView**
    Ex d [ia Ga] IIB T6 Ga/Gb According to TÜV 13.0977 X
  - **FlexLine with SmartConn and with Integrated SmartView**
    Ex d e [ia Ga] IIB T4 Ga/Gb According to TÜV 13.0977 X
    including optional Integrated SmartView according to
    TÜV 13.0977 X
  - **FlexLine with SmartConn and without Integrated SmartView**
    Ex d e [ia Ga] IIB T6 Ga/Gb According to TÜV 13.0977 X

2.9.2 Compliance to radio communication equipment approvals

2.9.2.1 R & TTE (Radio & Telecommunication Terminal Equipment)

This device complies with EN 302372 of the R&TTE Directive The device does not cause harmful interference and accepts any interference received.

WARNING! Changes or modifications made to this equipment not approved by Honeywell invalidate the R&TTE

2.9.2.2 FCC (Federal Communication Commission)

FCC information:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

WARNING! In order to comply with FCC radiofrequency(RF) exposure limits, antennas should be located at a minimum of 7.9inches (20cm) or more from the body of all persons.

2.9.2.3 IC (Industry Canada)

Industry Canada Statement:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This class B digital apparatus complies with Canadian ICES-003

Cet appareil contient des émetteurs / récepteurs exemptés de licence qui sont conformes aux RSS exempts de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas provoquer d'interférences et
2. Cet appareil doit accepter toutes les interférences, y compris celles pouvant entraîner son dysfonctionnement.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

NOTE: This device is certified to measure liquid levels in metal, concrete or similar materials, enclosed tanks

NOTE: The radiated output power of the device is far below the exposure limits. Nevertheless, use the device in such a manner that the potential for human contact during normal operation is minimal.

2.9.3 Low-Voltage Directive

The device is suitable for the following:

- Pollution degree 2
- Overvoltage category II
- Class I equipment

2.10 Component Protection

Ensure that the following components are physically protected in a controlled area:

- Gauge and the SmartLink devices
- Networks in which the Gauge and the SmartLink nodes operate
- Hosts that connect to the Gauge and the SmartLink nodes operate

2.11 Security Considerations

The 990 SmartRadar FlexLine provides several features designed to prevent accidental changes to the device configuration or calibration data.

These features include:

- **Configuration Lock** protection of HART SmartView local commissioning tool and display
- **Configuration Lock** protection for every communication interface
- Hardware W&M write protect jumper / switch per FlexConn board
- Hardware full configuration write protect jumper / switch per FlexConn board
- Hardware **Configuration Lock** read protect jumper / switch
- Software W&M write protect seal

A hardware write-protect jumper / switches locks out W&M / all changes regardless of the entry of a **Configuration Lock**. The hardware jumper requires physical access to the device as well as partial disassembly and should not be modified where the electronics are exposed to harsh conditions or where unsafe conditions exist.

For W&M configuration changes without changing the W&M hardware jumper position the accredited service engineer or notified body representative may choose to rely on the software W&M write protect seal.

Security note 1

During commissioning the hardware full configuration write protect jumper / switch for each FlexConn board should be placed so no unintended or accidental configuration changes will be possible.

For security and unintended changes by people that are not allowed making changes the "Protect all configuration jumper" must be placed on all boards after device commissioning and a physical seal shall be applied to the outsight of the device.

Put the "Protect all configuration entities" jumper of all relevant boards so no external resource can modify anything of the configuration (operational settings) of the 990 SmartRadar FlexLine.

Security note 2

During (at a last step of the) commissioning the hardware W&M write protect jumper / switch should be placed so no unintended or accidental metrology configuration changes will be possible.

Security note 3

During commissioning the default Configuration Locks should be changed at first use.

Board	Default Configuration Lock
CAN-BPM (HCI-BPM)	ENRAF2
CAN-HART (FCI-HRT)	AAAAAA
CAN-TRL2 (HCI-TRL)	ENRAF2
CAN-HART-SLAVE (HCI-HAO)	ENRAF2

During (at a last step of the) commissioning the hardware Configuration lock read protect jumper / switch should be placed so the changed Configuration Locks could not be read out anymore.

Security note 4

After commissioning the 990 SmartRadar FlexLine enclosure should be physically sealed.

By having the physical seals applied the boards are not directly accessible to remove the hardware configuration protection jumpers.

In case the physical seals are removed tamper is detected by visual inspection which will be interpreted as fraud from a legal perspective.

Security note 5

The Honeywell 990 SmartRadar FlexLine level gauge provides integration into HART©, Modbus, Enraf Fieldbus (BPM), Emerson Rosemount Fieldbus (TRL2) and ISA100.11a networks. Best practices should be followed as specified by the respective standards and advisements.

How to report a security vulnerability

For the purpose of submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software or device.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.

To report potential security vulnerability against any Honeywell product, please follow the instructions at:

https://honeywell.com/pages/vulnerabilityreporting.aspx

Submit the requested information to Honeywell using one of the following methods:

Send an email to security@honeywell.com.

or

Contact your local Honeywell Process Solutions Customer Contact Centre (CCC) or Honeywell Technical Assistance Centre (TAC) listed in the “Support and Contact information” section of this document.

CHAPTER 3 SYSTEM ARCHITECTURE

3.1 SmartRadar FlexLine Architecture for R120 and R230

The SmartRadar FlexLine system is built up from interchangeable hardware modules. These modules consist of uniform printed circuit boards (PCBs), each of them representing a different, unique functionality. Together with the software implemented on these hardware parts, each PCB makes up a FlexConn module. These modules communicate with each other through the serial CAN-Bus on the DIN rail backplane - on which they are mounted - or wireless by using the OneWireless Network option. See FIGURE 3-1.

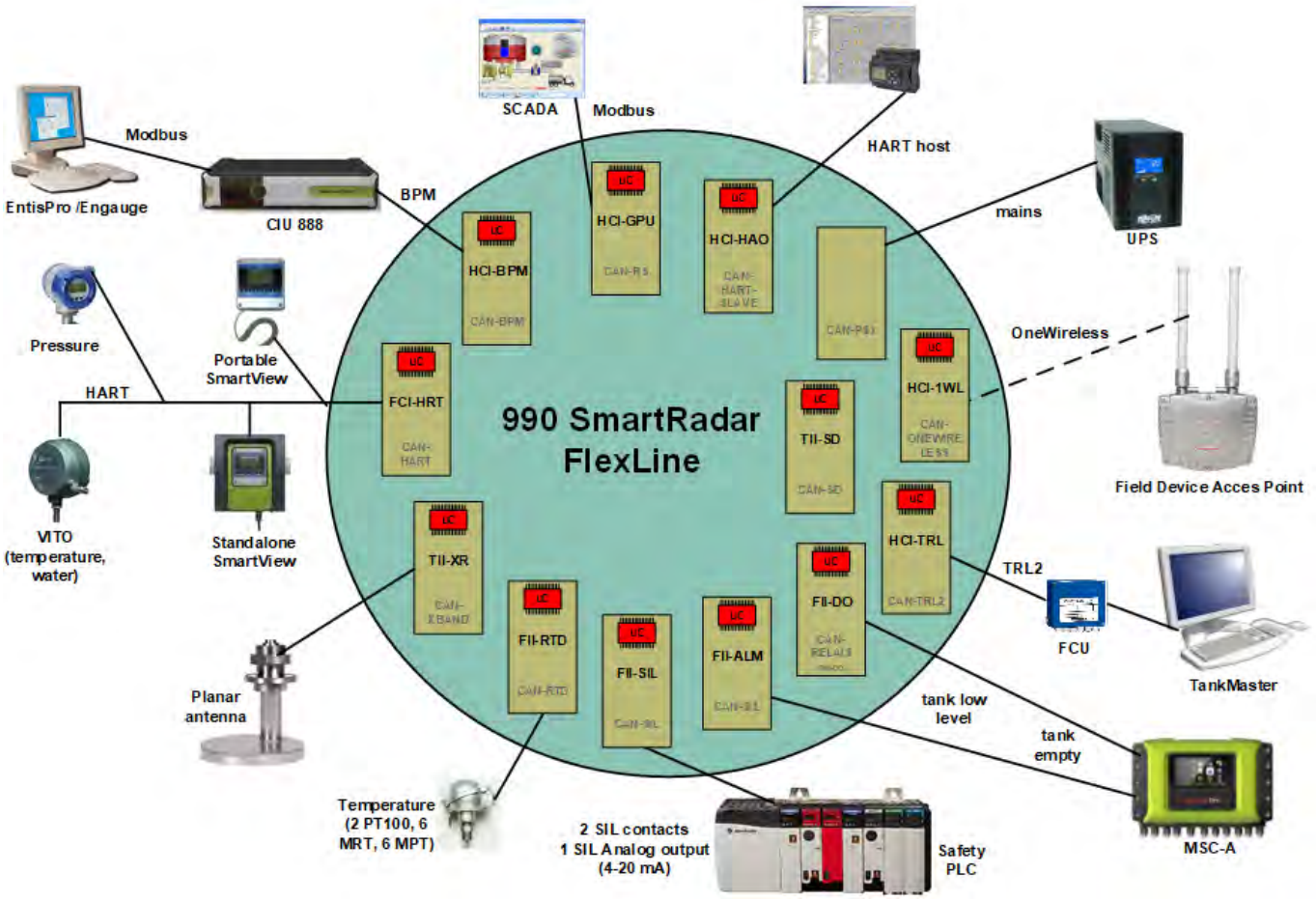


FIGURE 3-1 SmartRadar FlexLine system architecture overview

3.2 FlexConn Modules

One of the main characteristics of the SmartRadar FlexLine architecture is its placement flexibility of the FlexConn modules. Any types of modules can be added at any locations. Two identical modules can also be placed in the SmartRadar FlexLine system.

Each FlexConn module has one or more functions. In general, this can be a *sensor* function, a *communication* function, or a *digital-interface* function.

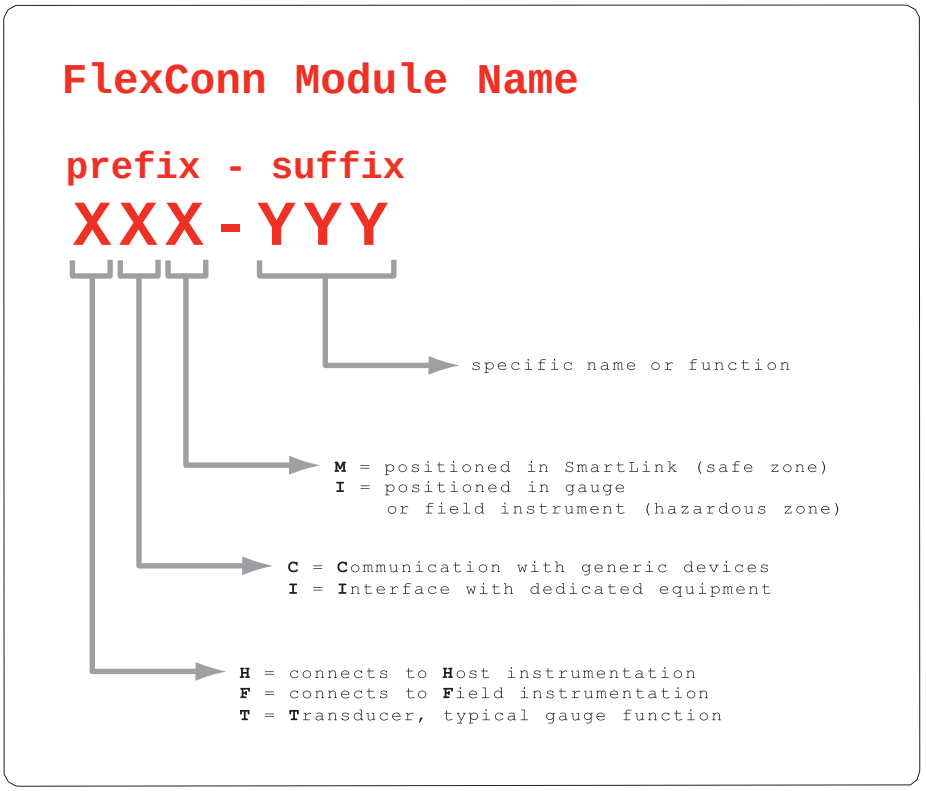
A *sensor* function measures or calculates a process value, or it obtains a process value from a connected external instrument.

A *communication* function ensures communication with a communication interface unit or with a DCS, SCADA, tank inventory, or another terminal automation system.

A *digital-interface* function controls digital output or reads digital input from instruments around the storage tank.

NOTE: Some FlexConn PCBs are also used in the SmartLink system.

Each FlexConn module has a unique name, which is built according to the following image:



Each FlexConn PCB consists of a *generic* and a *specific* electronic part. The generic part can be found on any FlexConn modules. The specific electronics part represents an application-specific function. See FIGURE 3-3.

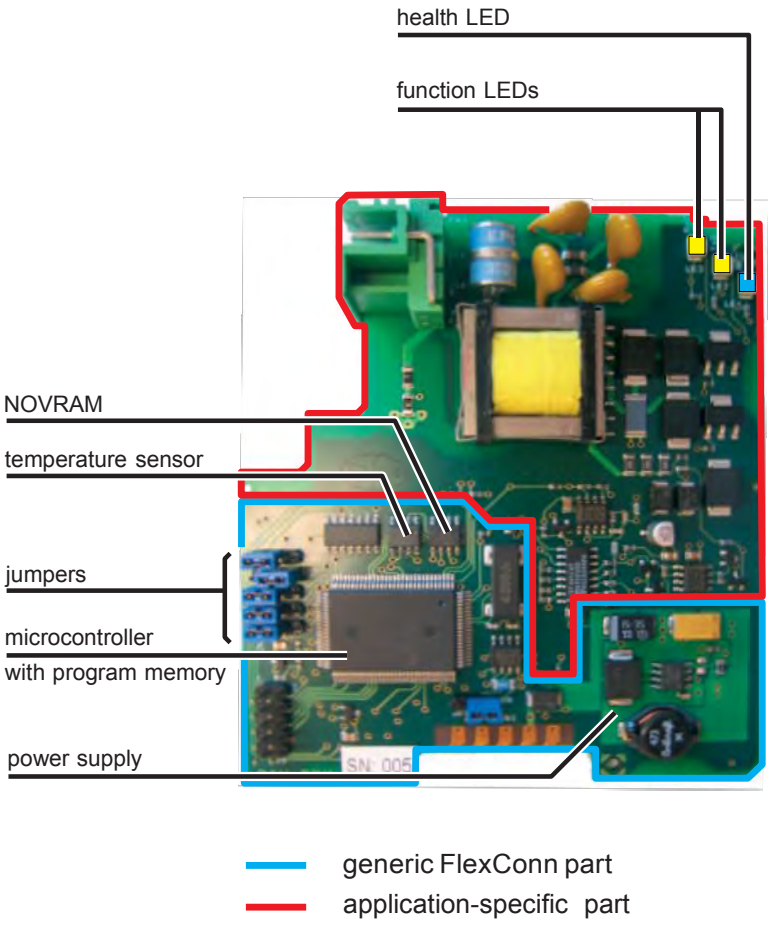


FIGURE 3-3 A typical FlexConn PCB layout

The following parts are available on the *generic* electronics part.

- **The program memory**

This memory contains the module-specific software.

- **The microprocessor / controller**

The microprocessor executes the module-specific software stored in the program memory.

- **The non-volatile memory**

The commissioning parameters and the diagnostics data are stored when the power is switched off.

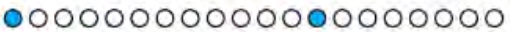
■ Jumpers

With the jumpers, specific hardware settings can be made:

Jumper Number	Function
1	All warning and monitoring-related commissioning entities are protected and cannot be changed
2	The password is protected from being read
3	All commissioning entities are protected and cannot be changed
4	Board-specific jumper
5	Board-specific jumper

■ Health LED

The Health LED (= LE1, the blue circle) indicates the general health status of the FlexConn module.

Health Status	Flashing Pattern
Good	
Uncertain	
Bad	

■ 2 function LEDs

These LEDS indicate module-specific activities, such as for instance data being transmitted or received.

■ **3 voltage monitors**

The output of these monitors, being voltage levels from three different FlexConn PCB locations, are used for diagnostics purposes.
See FIGURE 3-4.

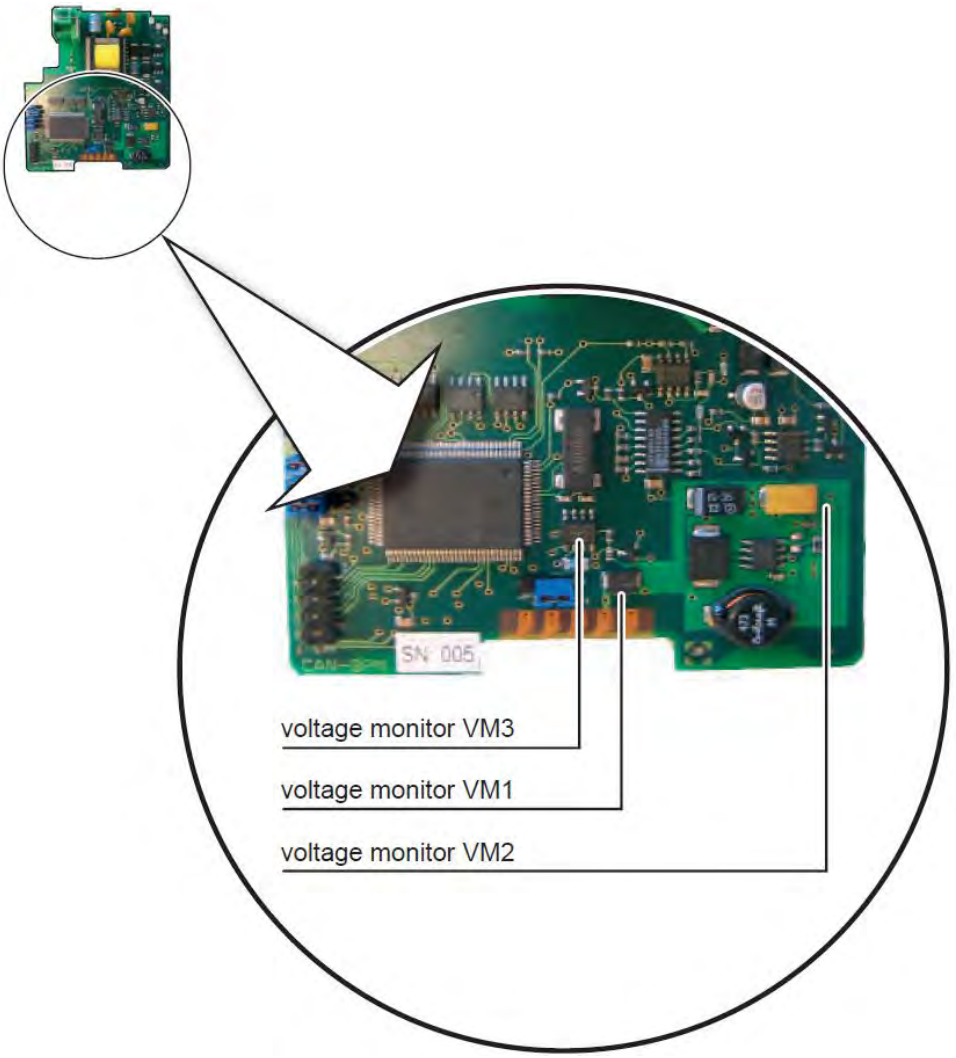


FIGURE 3-4 Locations of the 3 voltage monitors

■ **1 temperature sensor**

For the operational PCB, this sensor acts as an input for environmental temperature diagnostics. The PCB's environmental temperature is used as a measure for the temperature inside the SmartRadar FlexLine.

3.3 Entities

Information exchange between the various FlexConn modules takes place by means of the *entities*.

An *entity* represents a unique information association in the FlexConn architecture. This information may consist of measuring data, status data, commissioning parameters, diagnostics data, or commands.

In addition to the information exchange between FlexConn modules, entities are used for data presentation on the SmartView display, and for the communication between the Engauge service tool and the SmartRadar FlexLine.

The entities are represented by a textual description, for example, “Reset”, “Tank bottom”, “Health”, or “Baudrate”.

The entities structure is related to the following:

- General status information
- Generic FlexConn part
- Function-specific FlexConn part

3.3.1 Status Entities

The “Health” and “Commissioned” entities provide information about the general FlexConn module status and the functions implemented on this module.

3.3.1.1 Health Entity

The “Health” entity reflects the condition of the entire module, each single module function, and the calculated or measured value of a sensor function.

The “Health” entity structure is defined by following items:

1. status
2. status category
3. status code

The *status* field gives high-level information:

- good
- uncertain
- bad

The following table provides information about the *status category* that is, the general reason *why* the status is good, uncertain, or bad.

Status	Status Category
Good	actual
	manual
	last valid
	stored
Uncertain	instrument
	environment
Bad	general hardware fail
	general firmware fail
	general commissioning fail
	general calibration fail
	general operational fail
	over range (data available!)
	under range (data available!)
	no data available
	un-initialized
	killed

The following tables provides information about the *status code* and the *specific reason* why the status is good, uncertain, or bad. This information is presented as an information number coupled with a textual description of this specific situation.

Good								Uncertain						Bad							
actual		manual		last valid		stored		instrument			environment			un-init	killed	no data	under range	over range	hw fail	sw fail	cal fail
001	056	077	104	632	328	207	782	065	478	199	389	011	072	.....							

- Each ***board*** implements “health” as generic information based on the function (s) health(s).
- Each ***function*** implements “health” as generic information.
- Each ***sensor*** and ***digital I/O*** function implements an entity called “Primary Value”, which in addition to the actual measured value also contains a “health” status.

3.3.1.2 Commissioned Entity

The “Commissioned” entity informs the end user if the most important commissioning entities of the concerned FlexConn module and its implemented functions are set correctly.

- True = the most important entities are set correctly
- False = the most important entities are ***not*** set correctly

3.3.2 Generic Entity

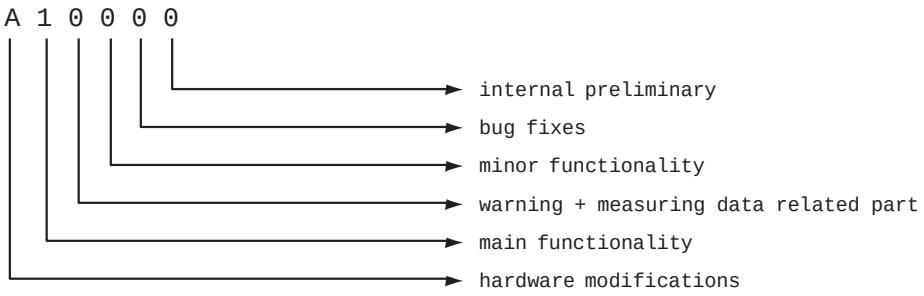
The following command entities are implemented as generic functions.

- “Reset device”
- “Reset board”

The following information is available through the entities.

- “Board name” = FlexConn module name
- “Board hardware version” = Hardware version of the FlexConn PCB
- “Firmware version” = Version of the software running on the FlexConn module

The firmware (software) version data is built up according to the format below:



The last digit is not shown in the official or formal releases.

3.3.3 Function-specific Entities

For the function-specific entities, see Chapter "Commissioning".

3.4 SmartView Display

3.4.1 General

The SmartView is used to set and control most of the FlexConn module settings.

FIGURE 3-5 An impression of the SmartView

For each *sensor* and *digital I/O* function implemented on a FlexConn module, a Primary Value screen is available on the *SmartView* display.

In the left bottom quarter of the display, the Primary Value's "Health" status is displayed.

Status	Display Text
Good	
Uncertain	uncertain
Bad	bad

Below the Status field, the Status category is displayed:

Status Category	Display Text
actual	
manual	manual
last valid	last valid
stored	stored
instrument	instrument
environment	environment
general hardware fail	hardware
general firmware fail	software
general commissioning fail	commission
general calibration fail	calibration
general operational fail	operational

Status Category	Display Text
over range	over range
under range	under range
no data available	no data
un-initialized	no init
killed	killed

3.4.2 Status Entities on SmartView

Select sub-menu “commissioning” from the main menu to view the survey results of all FlexConn modules present in the SmartRadar FlexLine system.

Each module is followed by an indication for the “**H**ealth” and the “**C**ommissioned” status respectively. In case of an unreliable or fault situation, the “**I**nformation” column displays an information code in addition. This information code reveals the specific reason about the current status.

This diagnostic is available for each individual FlexConn module. See example below.

```
            H C I
FII-DO      G N
```

- The “Health” indication is as follows:

“G” = Good

“U” = Uncertain

“B” = Bad

- The “Commissioned” indication is as follows:

“Y” = the most important entities are set correctly

“N” = the most important entities are ***not*** set correctly

Starting from the “commissioned” menu and selecting the specific FlexConn module, the above diagnostics is repeated for each module *function*. See example below.

```
FII-DO:>
board       H C I

Relay 1     G N
Relay 2     G Y
Relay 3     U Y nnn
Relay 4     B Y
```

3.4.3 Generic Entities on SmartView

From the functions survey screen of the concerning FlexConn module, the generic entity commands or the commissioning entity can be selected through the “board” entry.

```
FII-DO:>
board       H C I

Relay 1     G N
Relay 2     G Y
Relay 3     U Y nnn
Relay 4     B Y
```

3.4.4 Specific Entities on SmartView

Selecting a specific function, for instance, “Relay 2”, gives access to the specific entities for this function.

The specific entities are described in Chapter "Commissioning".

3.5 Engauge Service Tool

The Engauge service tool is a computer application in which all the FlexConn module settings can be performed.

Using the Engauge's explorer, double-click on the module's icon to individually select each FlexConn module of the SmartRadar FlexLine. The "board descriptor" is loaded which results in a screen with "tab" pages. Select these tab pages, to set the specific module details.

See FIGURE 3-6 for an example of an Engauge tool.

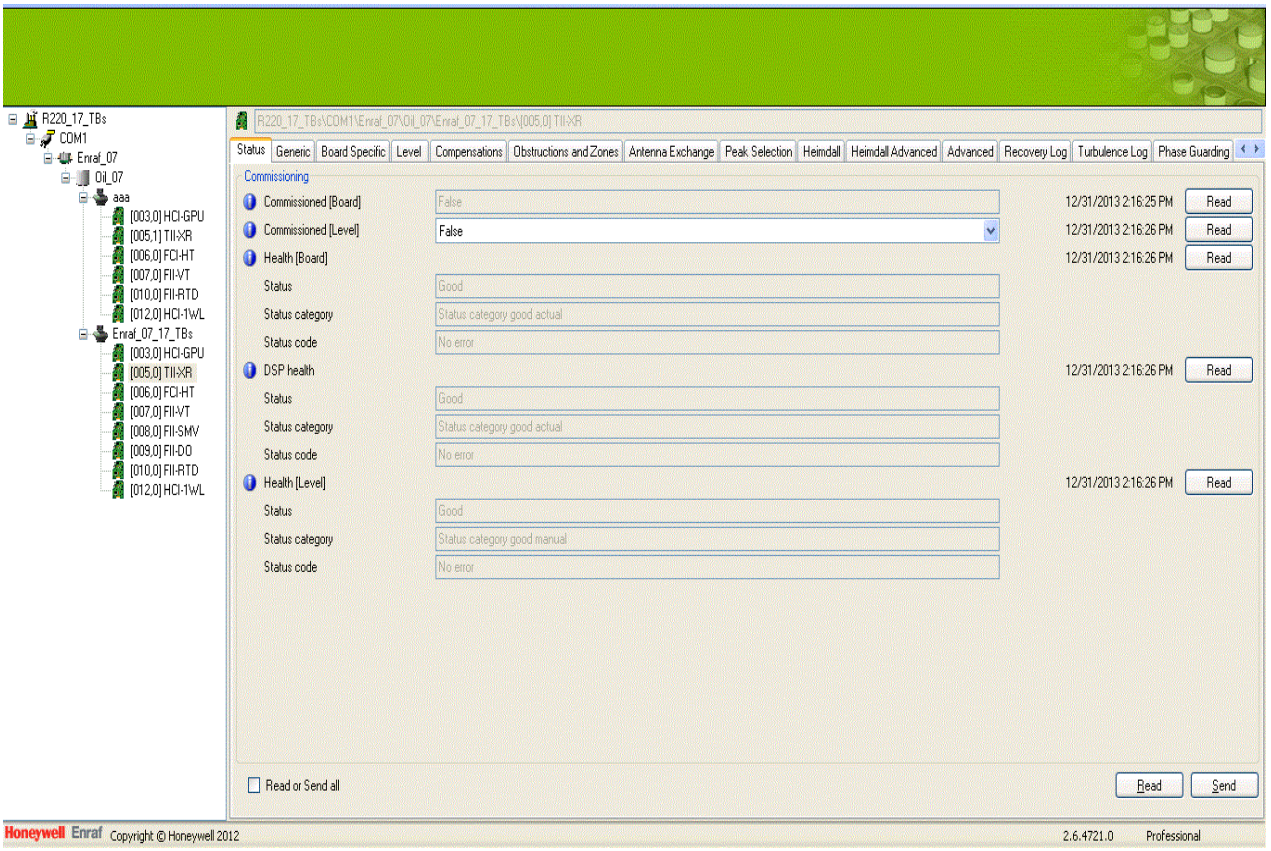


FIGURE 3-6 Example of an Engauge screen

For configuring SmartRadar FlexLine through TRL/2, SmartLink needs to be used. Please refer Section "Configuration of Gauge Using SmartLink and Engauge" on page 228 for further details.

3.5.1 Status Entities in Engauge

Each board descriptor user interface starts with the tab page “Status”. In this tab page the “Health” and “Commissioning” entities for the complete module and the individual functions are placed.

3.5.2 Generic Entities in Engauge

The “Status” tab page is always followed by the “Generic” tab page, in which the general commands and diagnostics entities are placed.

3.5.3 Board-specific Entities in Engauge

The “Generic” tab page is always followed by the “Board specific” tab page, in which the board-specific entities are placed. These entities are specific for each individual FlexConn module type. The board-specific entities are further described in Chapter 7 - Commissioning.

3.5.4 Specific Entities on Engauge

After the board-specific tab page, for each implemented function on the concerned FlexConn module a specific tab page follows.

For example, for the FII-DO module, the below listed specific tab pages are present:

- Relay 1
- Relay 2
- Relay 3
- Relay 4

In case of complex functions, extra tab pages can exist, containing the specific functions involved.

The specific entities are described in Section "Commissioning".

3.5.5 Function-generic Entities on Engauge

The function category “generic entities” are placed at the bottom of each function tab page in Engauge.

For each category (sensor, digital I/O, communication, display), the basic Engauge version contains only one entity:

“Function identification”.

With this entity, you can change the function name, which is available on the SmartView Primary Value screen and in Engauge.

CHAPTER 4 SERVICE TOOLS

4.1 SmartView

4.1.1 General

The *SmartView* is the basic tool in which you can communicate with the SmartRadar FlexLine modules.

Open keyboard contacts may be dangerous in an explosion-hazardous environment. The *SmartView* is built up as a totally shielded explosion safe tool.

4.1.2 SmartView Versions

The *SmartView* can be delivered in three versions:

- *SmartView* fixed on the instrument
- *SmartView* as a tank-side indicator (stand-alone)
- A portable *SmartView*

fixed on the instrument | as a tank-side indicator | as a portable tool

FIGURE 4-1 The 3 different SmartView options

4.1.3 Connections

Within a hazardous environment, connecting or disconnecting electrical equipment is dangerous, because of the sparking risks.

The **portable** *SmartView* however is designed such that it **may be connected/disconnected within a hazardous zone**.

The **fixed** version *SmartViews* (integrated within the instrument or tank side mounted) contain pre-installed fixed connections.

4.1.4 SmartView Controls

The SmartView has 5 push buttons and an LCD-screen with a backlight that can be switched on/off as desired. By using the menu, the SmartRadar FlexLine control operations can be performed.

FIGURE 4-2 The SmartView controls

The following table provides the functions of the buttons available on the SmartView:

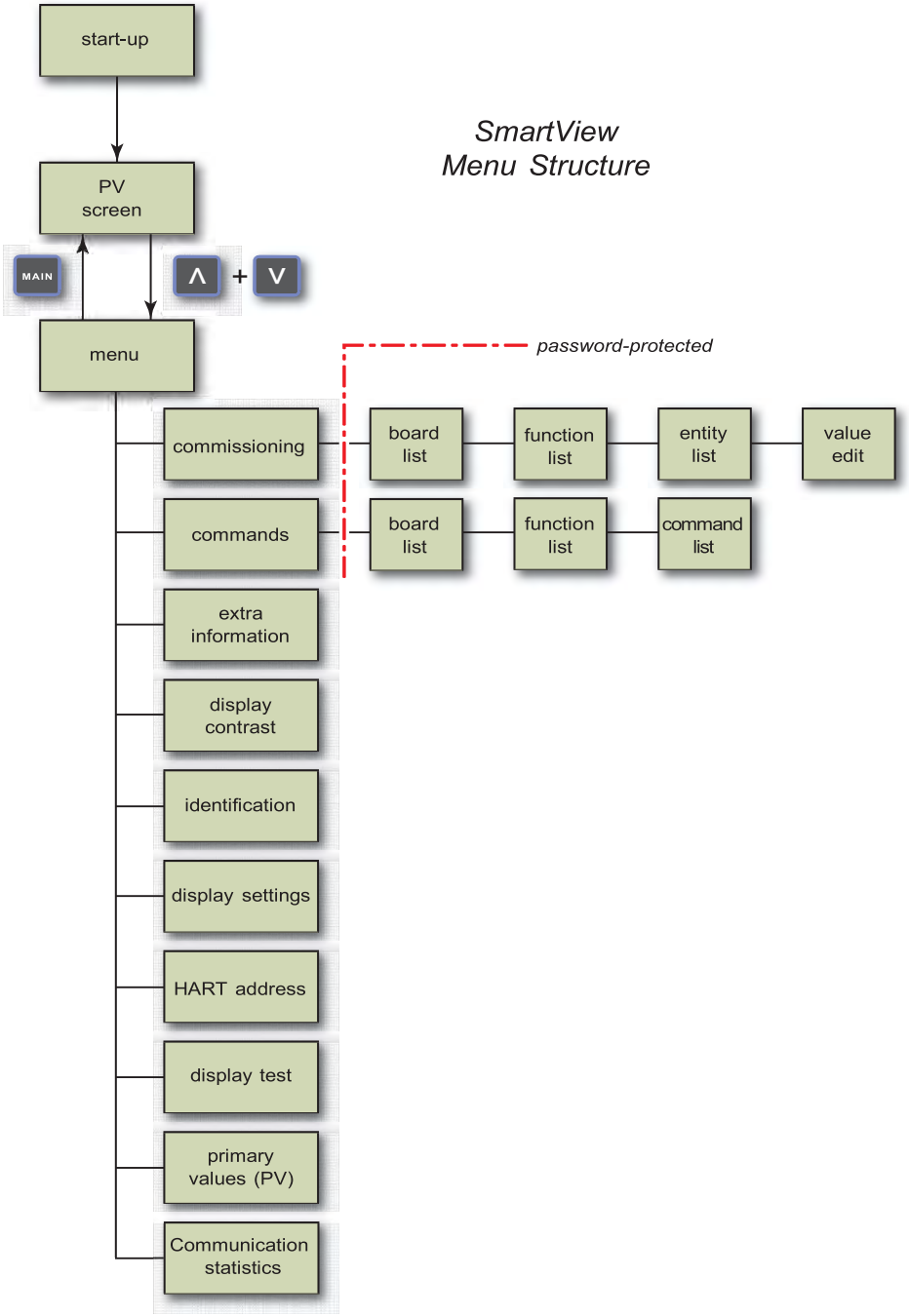
Button	Function *within menu ...*	
>	PV	Go to next PV screen
	Commissioning	Move cursor 1 position to the right
	Display contrast	Increase contrast
	Backlight	Toggle between ON and OFF
	Display settings	Toggle between ON and OFF
<	PV	Go to previous PV screen
	Commissioning	Leave current menu screen, and go to higher-level menu. *Important: Leaving an edit screen this way will undo all editing!*
	Commands	Leave current menu screen, and go to higher-level menu.
	Display contrast	Decrease contrast
	Backlight	Toggle between ON and OFF
	Display settings	Toggle between ON and OFF
< + >	Commissioning	Confirm selected choice
	Commands	Confirm selected choice

Button	Function *within menu ...*	
	Commissioning	Within the *menu* screens, move cursor 1 line up Within the *edit* screens, scroll characters as long as the button is pressed
	Commands	Move cursor 1 line up
	Display settings	Toggle between *Main screen* and *Standby* mode
	Identification	Go to next identification screen
	Commissioning	Within the *menu* screens, move cursor 1 line down Within the *edit* screens, scroll down 1 character
	Commands	Move cursor 1 line down
	Display settings	Toggle between *Main screen* and *Standby* mode
	Identification	Go to next identification screen
	Show menu	
	Go to PV screen	
	Standby mode - Pressing any buttons will activate SmartView again	

4.1.5 SmartView Menu Structure

4.1.5.1 SmartView Screens

Depending on the state of the menu process and the pressed button(s), the following screens can be displayed.



SmartView Menu Structure

4.1.5.1.1 Start-up Screen

The *SmartView* starts up displaying the following:

1. Black test (all pixels ON)
2. Blank test (all pixels OFF)
3. Enraf logo + software version + tank ID
4. PV screen

4.1.5.1.2 Menu Screen

By using the [menu] screen of the *SmartView* (see FIGURE 4-19) you can *view and/or modify settings*, or you can *send a specific command* to a sensor or a digital I/O board.

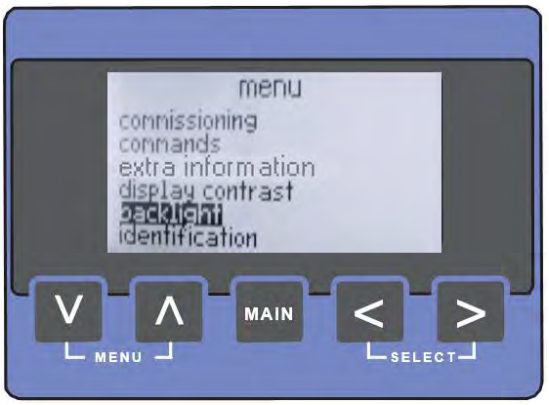


FIGURE 4-3 The menu screen

Menu Item	Description
[menu]	Screen title.
[commissioning]	Configuration parameters can be set
[commands]	Allows you to send a command to a sensor or digital I/O board
[display contrast]	Allows you to adjust the display contrast
[backlight]	Allows you to switch ON or OFF the backlight
[identification]	Displays information about the following: • Tank name • Tank address • Customer ID • SmartView software version • SmartView address • FlexConn module name, board ID, board instance, and software version

Menu Item	Description
[display settings]	Allows you to switch ON/OFF buttons time-out: • Main screen: If the button is not pressed within 15 minutes, *SmartView* switches to PV screen • Standby mode: If the button is not pressed within 15 minutes, *SmartView* switches to standby mode
[display test]	Performs blank/black test.
[extra information]	The [extra information] screen displays information about a specific function. See also 4.2.5.1.7.

TABLE 4-1 The menu items

4.1.5.1.3 Backlight Screen

The [backlight] screen (see FIGURE 4-4) allows you to *enable/disable the backlight*. The *SmartView* only turns the backlight ON if following conditions are met:

- [backlight] is enabled by the host
- [backlight] is enabled by the user

When the left or right button is pressed, the backlight settings immediately changes. The backlight setting is stored in non-volatile memory.

FIGURE 4-4 The backlight screen

4.1.5.1.4 *Display Contrast Screen*

The [display contrast] screen (see FIGURE 4-20) displays a horizontal scroll bar. By moving the scroll bar, you can *adjust the contrast*. Moving to the right immediately increases the contrast, moving to the left decreases the contrast.

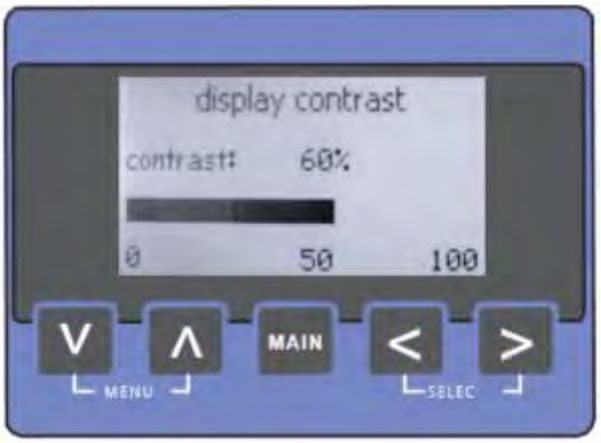


FIGURE 4-5 The display contrast screen

4.1.5.1.5 *Display Settings Screen*

The [display settings] screen allows you to *set the time-outs* for the *buttons*. The screen displays the following items:

Feature	Possible States	Default
Buttons time-out to main screen	ON/OFF	ON
Buttons time-out to standby mode	ON/OFF	ON

4.1.5.1.6 *Display Test Screen*

When the [display test] screen is selected, *the SmartView* performs a *black/blank test*. SmartView begins drawing a rectangle of 64 x 128 pixels, filled with black pixels for a period of 2s. After that period, the screen is cleared using a rectangle filled with white pixels for a period of 2s.

4.1.5.1.7 Identification Screen

The [identification] screen (see examples in FIGURE 4-21) allows you to *scroll through the available FlexConn modules*, using the up and down buttons, to obtain information regarding the following:

- SmartView (see left screen)
  - the tank name
  - the tank address
  - software version
  - SmartView address
  - customer ID
- FlexConn modules (see right screen)
  - board name
  - board id
  - instance
  - software version

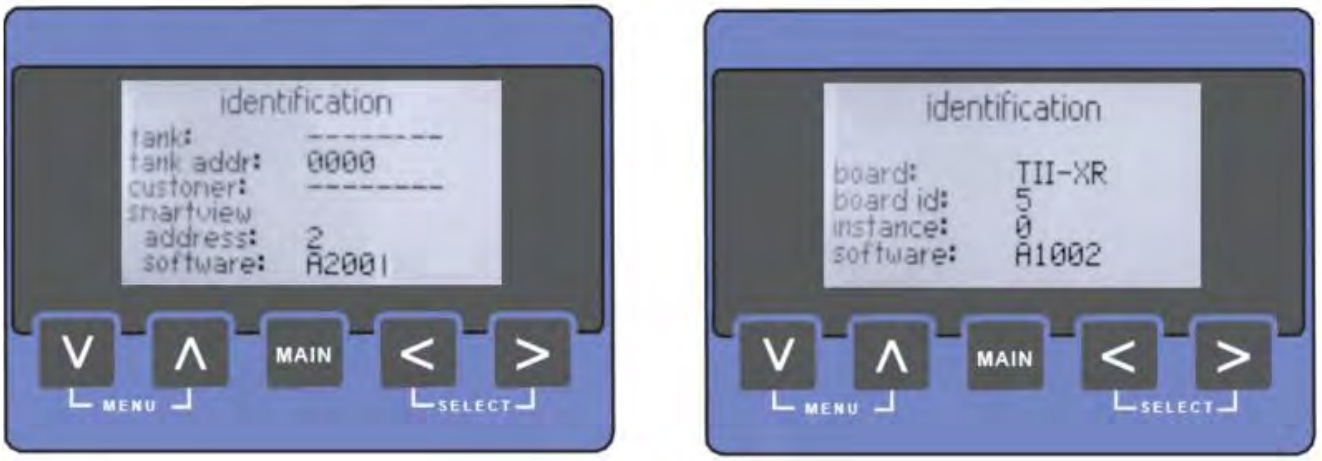


FIGURE 4-6 Identification screen examples

4.1.5.1.8 Extra Information Screen

The [extra information] mode can be configured to display either the [level & temperature] screen or the [extra information] screen (see FIGURE 4-22). The [extra information] screen *displays information* about a specific function. *The specific functions are described in CHAPTER 7.* The [level & temperature] screen (see FIGURE 4-22) *displays information* about the measured product level and temperature. In this menu mode, it is *not* possible to change any settings.

NOTE: In case of an error situation, the level fields are filled with "#" and the temperature fields with "9".

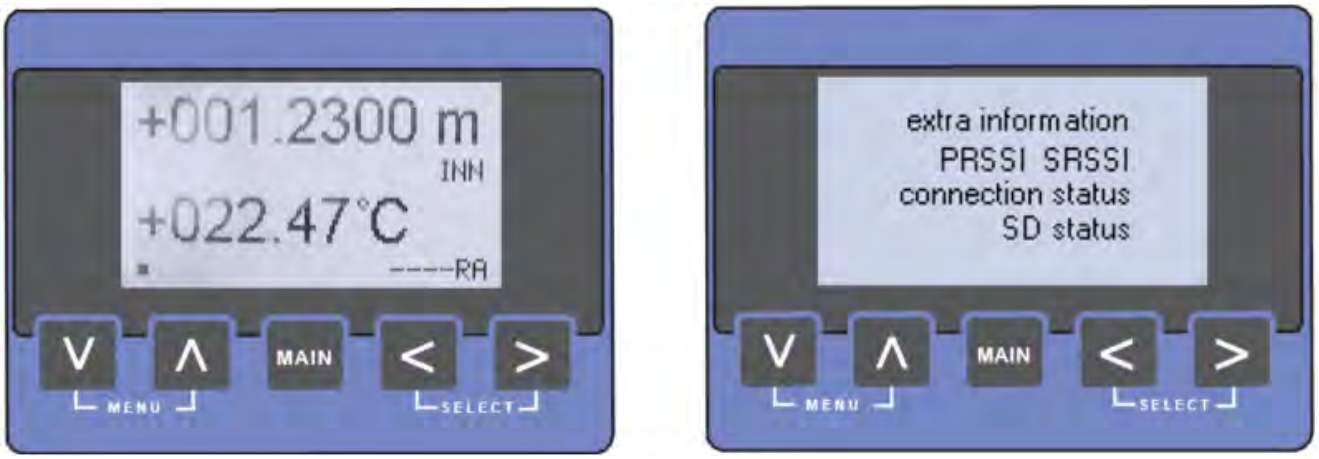


FIGURE 4-7 The level & temperature screen (left) and the extra information screen (right)

4.1.5.1.9 Primary Value Screen

The [Primary Value] screen (PV-screen), displayed in FIGURE 4-23, depicts information about data measured by a sensor, or information about the status of a digital I/O. See Table 4-2.

FIGURE 4-8 PV-screen examples (left: level status, right: digital I/O status)

Data Field	Max. Size [characters]	Description
Primary Value	9	The measured value, for example, +025.1277
PV identification	13	Quantity name, for example, • Product level • Product temperature • P1 pressure
PV units	5	Quantity unit, for example • m • kg/m^3 • kPa
PV type	3	Type can be: • INN (innage) • ULL (ullage) • REL (relative) • ABS (absolute)
PV health	9	Status of the Primary Value: • UNCERTAIN • BAD

Data Field	Max. Size [characters]	Description
PV representation	15	Representation of the PV: • Manual • Last valid • Stored • Instrument • Environment • Hardware • Software • Commission • Calibration • Operational • No data • No init. • Killed • Over range • Under range
PV alarms	9	Alarm type that occurred: • High High • High • Low • Low Low
Tank identification	8	Tank name, for example, CRUDE 07
Alive indicator	1	Blinking cursor (bottom right) indicates PV being updated

TABLE 4-2 Primary Value (PV) items

REMARKS: 1. In error situation, the data fields are filled with "#".

2. *SmartView* enters standby mode when the communication with the host is lost.

3. The data fields PV health, PV representation, and PV alarms are only visible if they are applicable.

4.1.5.1.10 Password Screen

The [commands] and [commissioning] menus are password-protected. The [password] screen (see FIGURE 4-24) appears when you enter the [commands] or the [commissioning] menu.

When the password is entered correctly (only once for both menu entries), you can change the values. 15 minutes after the last button is pressed, the password needs to be re-entered.

FIGURE 4-9 The password screen

4.1.5.1.11 Commands Menu Screens

- The [commands] menu starts with the [board list] screen (see FIGURE 4-25).
  You can *navigate through the board list* by using the up and down buttons. A board can be selected by simultaneously pressing the left + right button.

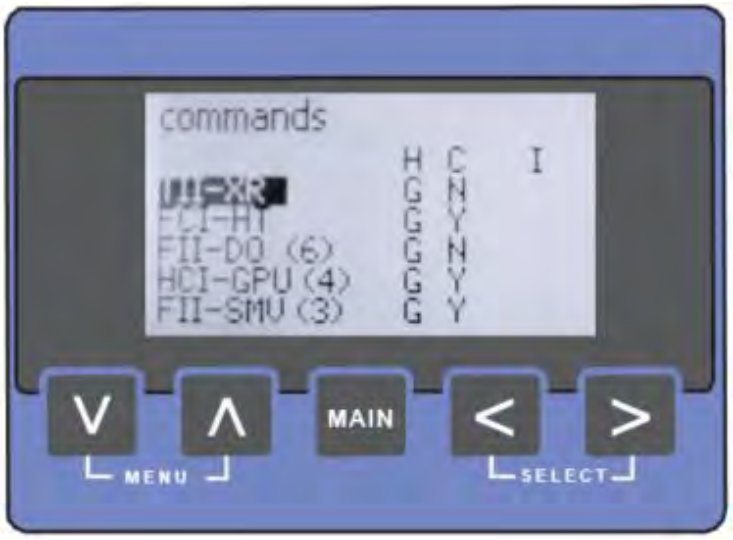


FIGURE 4-10 The board list screen

- The [function list] screen (see FIGURE 4-26) displays all the *available functions* of the previously selected board. You can navigate through the function list by using the up and down buttons. You can return to the [board list] screen by pressing the left button. A function can be selected by simultaneously pressing the left + right button. If a FlexConn module does *not* contain any function commands, this is indicated in the list (<no cmd>).

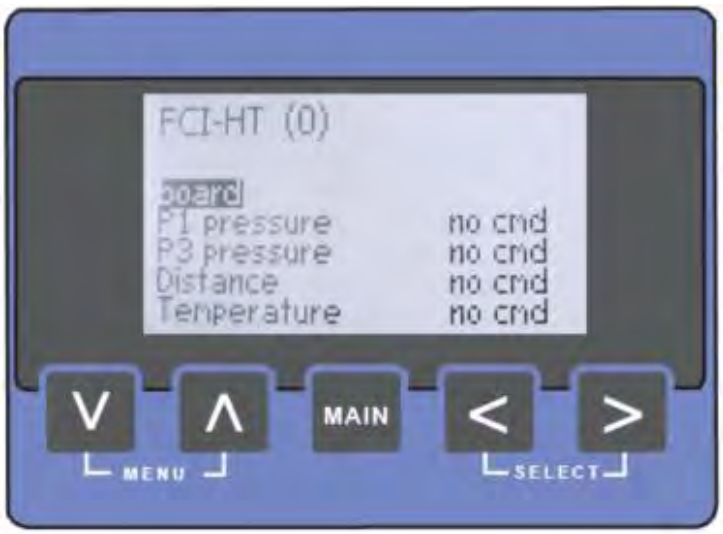


FIGURE 4-11 The function list screen

- When an available function is selected, the [command list] screen is presented (see FIGURE 4-27). You can navigate through the function list by using the up or down button. A command can be selected by simultaneously pressing the left + right button. You can return to the [function list] screen by pressing the left button.

FIGURE 4-12 The command list screen

4.1.5.1.12 Commissioning Menu Screen

- The [commissioning] menu starts with the [board list] screen (see FIGURE 4-28).
  You can *navigate through the board list* by using the up or down button. A board can be selected by simultaneously pressing the left + right button.

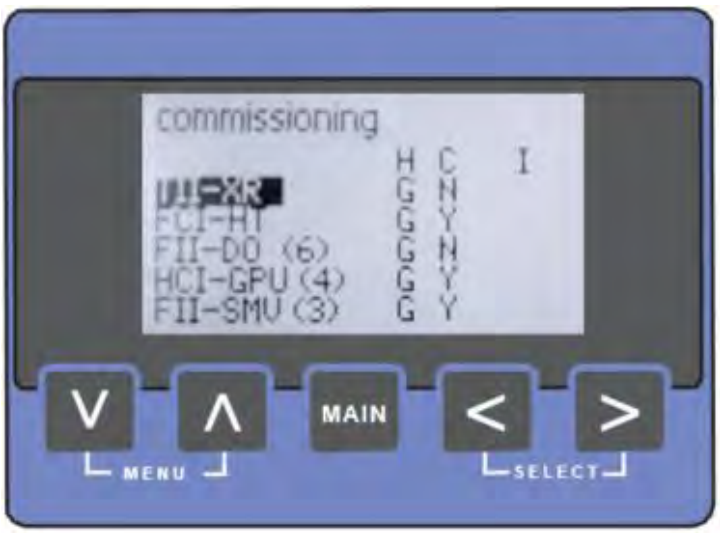


FIGURE 4-13 The board list screen (commissioning)

- The [function list] screen (see FIGURE 4-29) *displays all configurable entities* of a function.
  The actual entity value is also visible.
  You can *navigate through the board list* by using the up or down button. A function can be selected by simultaneously pressing the left + right button. You can return to the [board list] screen by pressing the left button.

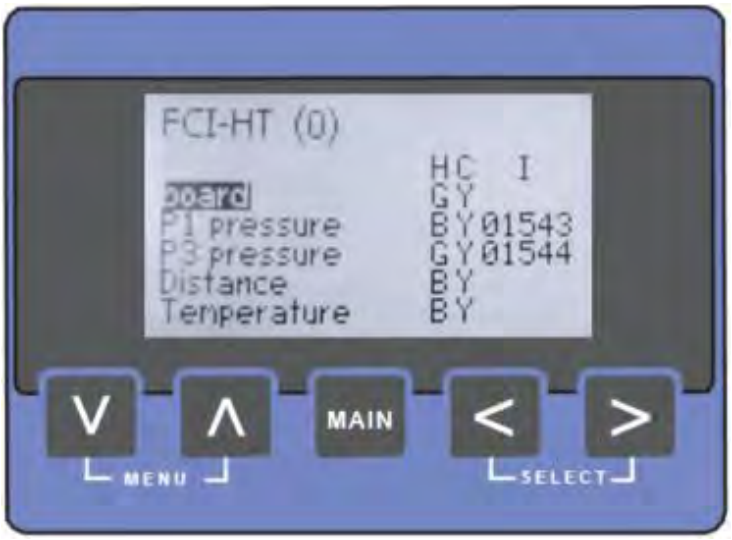


FIGURE 4-14 The function list screen (commissioning)

- On selection of an available function, the [entity list] screen is presented (see FIGURE 4-30). You can *navigate through the entity list* by using the up or down button. An entity can be selected by simultaneously pressing the left + right button. You can return to the [function list] screen by pressing the left button.

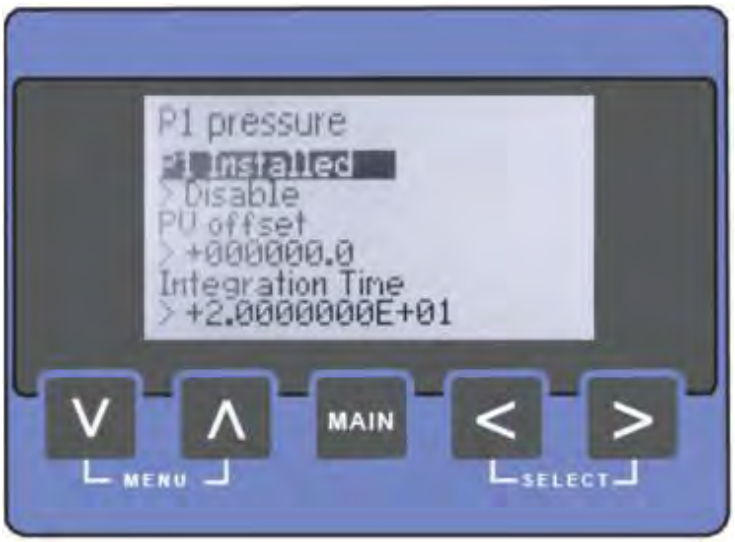


FIGURE 4-15 The entity list screen

- On selection of an available entity, the [value edit] screen is presented (see FIGURE 4-31).
  - If an *invalid* value is entered, the message “value out of range” is displayed.
  - If the value is *not accepted* by the FlexConn module, the message “value not accepted” is displayed.
  - You can scroll along the characters by push and hold the up button.
  - An entity modification is only executed on simultaneously pressing the left + right button. After this, first a range check is performed. If the modification is accepted, you return to the [value edit] screen.
  - The cursor can be shifted to the right by pressing the right button.
  - You can return to the [entity list] screen by pressing the left button.

*NOTE: Use the left button to return to the [entity list] screen **without executing** the modification(s). Press the left + right button simultaneously to undo this (these) modification(s)!*

FIGURE 4 -16 Examples of the value edit screen

4.2 HART SmartView

4.2.1 General

The HART SmartView is the basic tool in which you can communicate with the SmartRadar FlexLine modules.

Open keyboard contacts may be dangerous in an explosion-hazardous environment. The HART SmartView is built up as a totally shielded explosion-safe tool.

4.2.2 HART SmartView Versions

The *HART SmartView* can be delivered in three versions:

- *Integrated HART SmartView*
- *HART SmartView* as a tank-side indicator (stand-alone)
- A portable *HART SmartView*

Integrated SmartView | as a tank-side indicator | as a portable tool

FIGURE 4-17 The 3 different HART SmartView options

4.2.3 Connections

Within a hazardous environment, connecting or disconnecting electrical equipment is dangerous, because of the sparking risks.

The **portable** HART SmartView however is designed such that it **may be connected/disconnected within a hazardous zone**.

The **fixed** version *HART SmartViews* (integrated within the instrument or tank-side mounted) contain pre-installed fixed connections.

4.2.4 HART SmartView Controls

The HART SmartView has 5 push buttons and an LCD-screen. By using the menu, the SmartRadar FlexLine control operations can be performed.

FIGURE 4-18 The HART SmartView controls

The following table provides the functions of the buttons available on the HART SmartView:

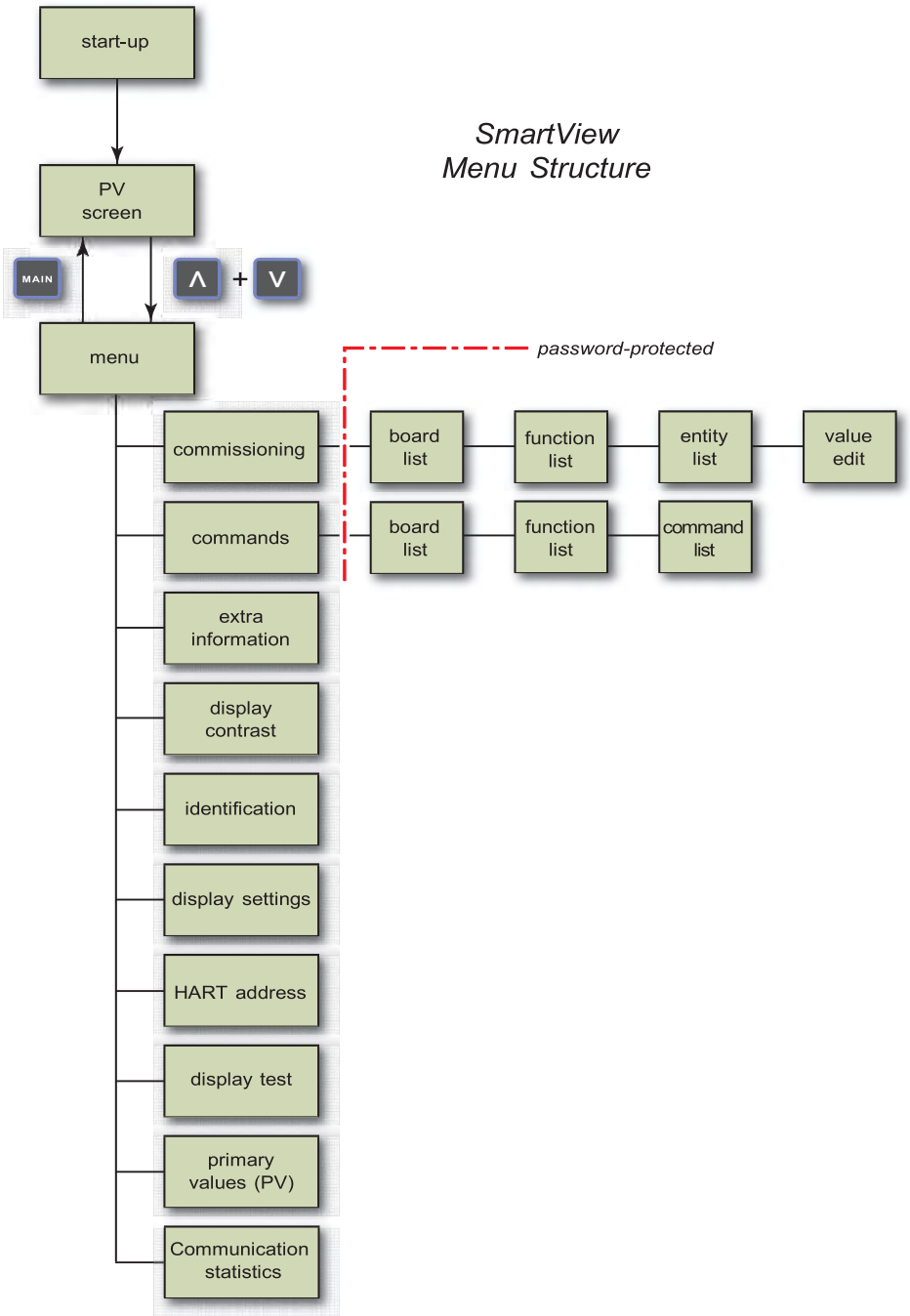
Button	Function *within menu ...*	
>	PV	Go to next PV screen
	Commissioning	Move cursor 1 position to the right
	Display contrast	Increase contrast
	Display settings	Toggle between ON and OFF
	HART address	Toggle between address 7 and 8
<	PV	Go to previous PV screen
	Commissioning	Leave current menu screen, and go to higher-level menu. *Important: Leaving an edit screen this way will undo all editing!*
	Commands	Leave current menu screen, and go to higher-level menu.
	Display contrast	Decrease contrast
	Display settings	Toggle between ON and OFF
	HART address	Toggle between address 7 and 8
< + >	Commissioning	Confirm selected choice
	Commands	Confirm selected choice

Button	Function *within menu ...*	
	Commissioning	Within the *menu* screens, move cursor 1 line up Within the *edit* screens, scroll characters as long as the button is pressed
	Commands	Move cursor 1 line up
	Identification	Go to next identification screen
	Commissioning	Within the *menu* screens, move cursor 1 line down Within the *edit* screens, scroll down 1 character
	Commands	Move cursor 1 line down
	Identification	Go to next identification screen
	Show menu	
	Go to PV screen	

4.2.5 HART SmartView Menu Structure

4.2.5.1 HART SmartView Screens

Depending on the state of the menu process and the pressed button(s), the following screens can be displayed.



4.2.5.1.1 *Start-up Screen*

The HART SmartView starts up displaying the following:

1. Black test (all pixels ON)
2. Blank test (all pixels OFF)
3. Honeywell logo + Software version and checksum
4. PV screen or the standby screen

4.2.5.1.2 *Menu Screen*

By using the [menu] screen of the HART SmartView (see FIGURE 4-19) you can *view and/or modify settings*, or you can *send a specific command* to a sensor or a digital I/O board.

FIGURE 4-19 The menu screen

Menu Item	Description
[menu]	Screen title.
[commissioning]	Configuration parameters can be set
[commands]	Allows you to send a command to a sensor or digital I/O board
[extra information]	The [extra information] screen displays information about a specific function. See also 4.2.5.1.7.
[display contrast]	Allows you to adjust the display contrast
[identification]	Displays information about the following: • Tank name • Tank address • Customer ID • HART SmartView software version • HART SmartView address • FlexConn module name, board ID, board instance, and software version

Menu Item	Description
[display settings]	Allows you to switch ON/OFF the keypad time-out: • If the buttons are not pressed within 5 minutes, the HART SmartView will switch to the PV screen
[HART address]	Allows you to switch between address 7 and 8
[display test]	Performs blank/black test.
[Communication statistics]	Display communication errors and activity

TABLE 4-3 The menu items

4.2.5.1.3 Display Contrast Screen

The [display contrast] screen (see FIGURE 4-20) displays a horizontal scroll bar. By moving the scroll bar, you can *adjust the contrast*. Moving to the right immediately increases the contrast, moving to the left decreases the contrast.

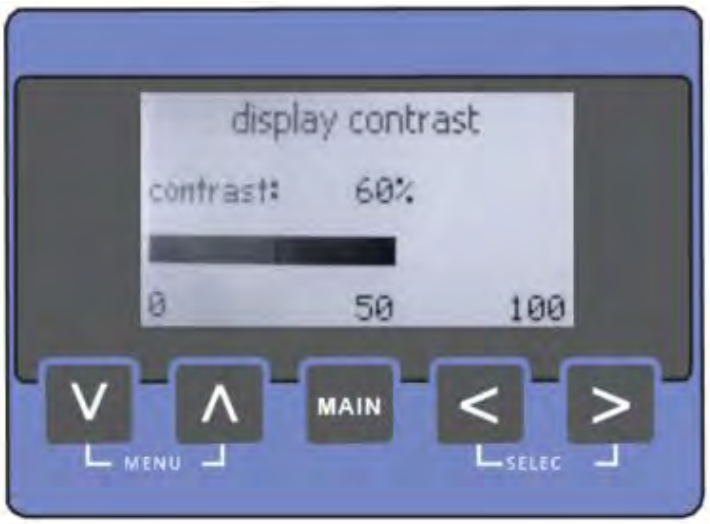


FIGURE 4-20 The display contrast screen

4.2.5.1.4 Display Settings Screen

The [display settings] screen allows you to *set the time-outs* for the *buttons*. The screen displays the following items:

Feature	Possible States	Default
After keypad timeout go to main screen	ON/OFF	ON

4.2.5.1.5 Display Test Screen

When the [display test] screen is selected, *the* HART SmartView performs a *black/blank test*. HART SmartView begins drawing a rectangle of 64 x 128 pixels, filled with black pixels for a period of 1 second. After that

period, the screen is cleared using a rectangle filled with white pixels for a period of 1 second.

4.2.5.1.6 Identification Screen

The [identification] screen (see examples in FIGURE 4-21) allows you to *scroll through the available FlexConn modules*, using the up and down buttons, to obtain information regarding the following:

- HART SmartView (see left screen)
  - the tank name
  - the tank address
  - customer ID
  - SmartView
    - + address
    - + software version
    - + software checksum
- FlexConn modules (see right screen)
  - board name
  - board id
  - instance
  - software version

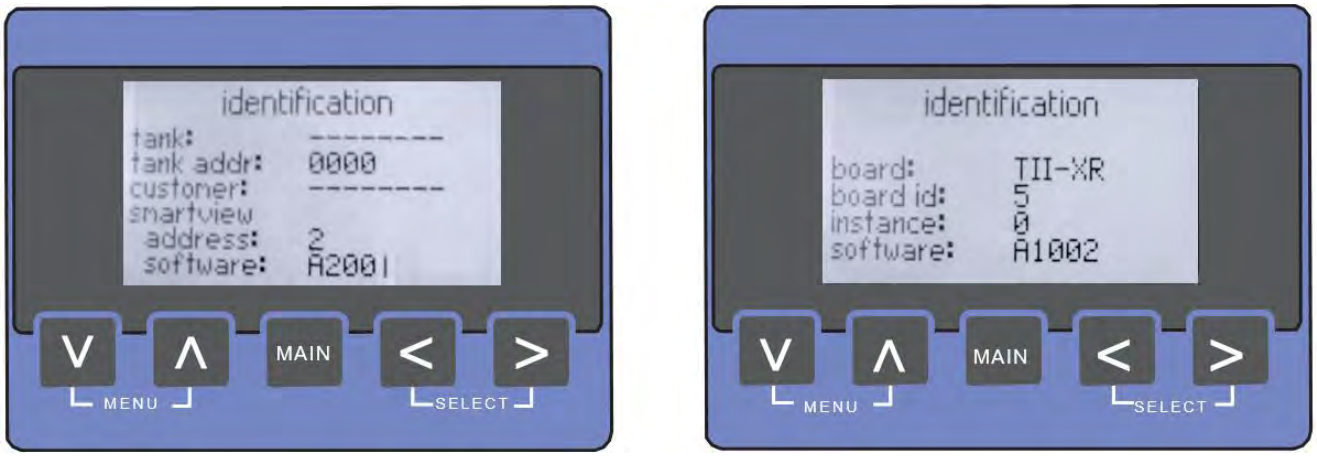


FIGURE 4-21 Identification screen examples

4.2.5.1.7 *Extra Information Screen*

The [extra information] mode can be configured to display either the [level & temperature] screen or the [extra information] screen (see FIGURE 4-22). The [extra information] screen *displays information* about a specific function. The specific functions are described in CHAPTER 7. The [level & temperature] screen (see FIGURE 4-22) *displays information* about the measured product level and temperature. In this menu mode, it is *not* possible to change any settings.

NOTE: In case of an error situation, the level fields are filled with "#" and the temperature fields with "9".

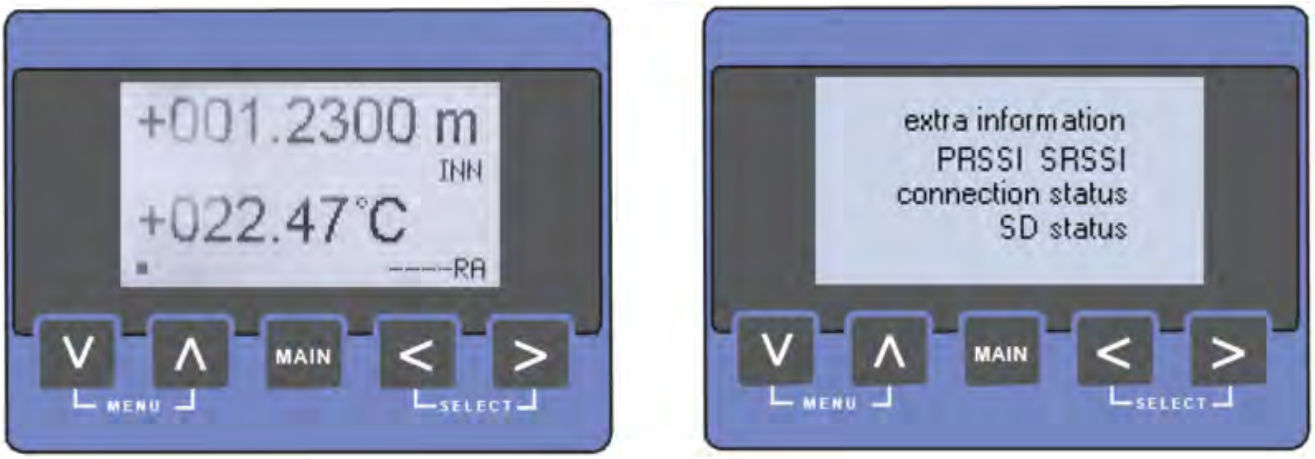


FIGURE 4-22 The level & temperature screen (left) and the extra information screen (right)

4.2.5.1.8 *Primary Value Screen*

The [Primary Value] screen (PV-screen), displayed in FIGURE 4-23, depicts information about data measured by a sensor, or information about the status of a digital I/O. See Table 4-2.

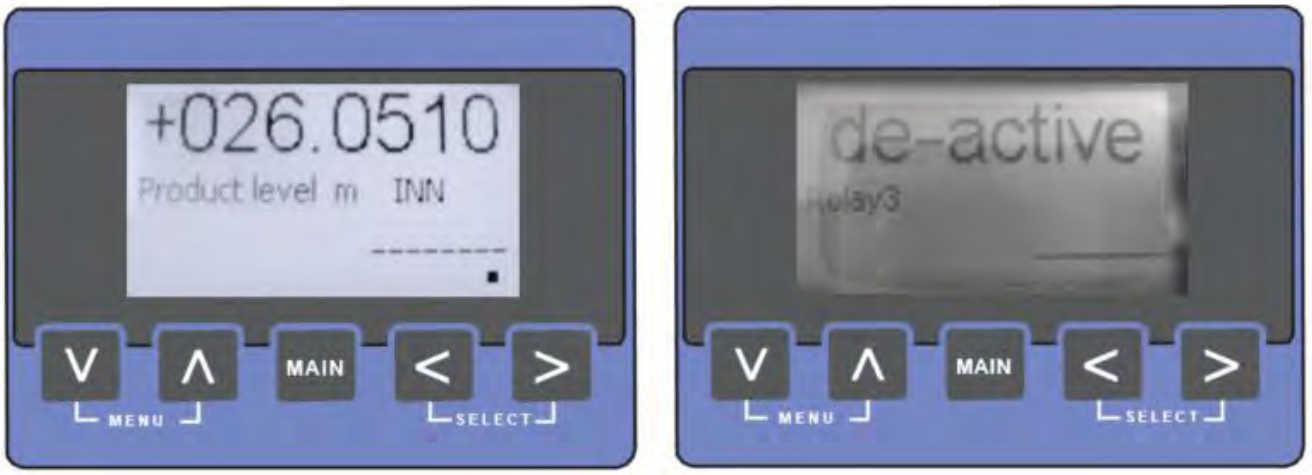


FIGURE 4-23 PV-screen examples (left: level status, right: digital I/O status)

Data Field	Max. Size [characters]	Description
Primary Value	9	The measured value, for example, +025.1277
PV identification	13	Quantity name, for example, • Product level • Product temperature • P1 pressure
PV units	5	Quantity unit, for example • m • kg/m^3 • kPa
PV type	3	Type can be: • INN (innage) • ULL (ullage) • REL (relative) • ABS (absolute)
PV health	9	Status of the Primary Value: • UNCERTAIN • BAD

Data Field	Max. Size [characters]	Description
PV representation	15	Representation of the PV: • Manual • Last valid • Stored • Instrument • Environment • Hardware • Software • Commission • Calibration • Operational • No data • No init. • Killed • Over range • Under range
PV alarms	9	Alarm type that occurred: • High High • High • Low • Low Low
Tank identification	8	Tank name, for example, CRUDE 07
Alive indicator	1	Blinking cursor (bottom right) indicates PV being updated

TABLE 4-2 Primary Value (PV) items

REMARKS:
1. In error situation, the data fields are filled with "#".
2. HART SmartView enters standby mode when the communication with the host is lost.
3. The data fields PV health, PV representation, and PV alarms are only visible if they are applicable.

4.2.5.1.9 Password Screen

The [commands] and [commissioning] menus are password-protected. The [password] screen (see FIGURE 4-24) appears when you enter the [commands] or the [commissioning] menu.

When the password is entered correctly (only once for both menu entries), you can change the values. 15 minutes after the last button is pressed, the password needs to be re-entered.

FIGURE 4-24 The password screen

4.2.5.1.10 Commands Menu Screens

- The [commands] menu starts with the [board list] screen (see FIGURE 4-25).
  You can *navigate through the board list* by using the up and down buttons. A board can be selected by simultaneously pressing the left + right button.

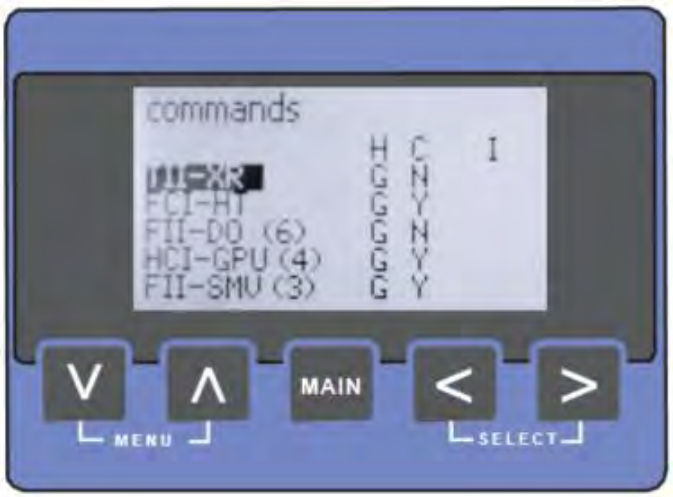


FIGURE 4-25 The board list screen

- The [function list] screen (see FIGURE 4-26) displays all the *available functions* of the previously selected board. You can navigate through the function list by using the up and down buttons. You can return to the [board list] screen by pressing the left button. A function can be selected by simultaneously pressing the left + right button. If a

FlexConn module does not contain any function commands, this is indicated in the list (<no cmd>).

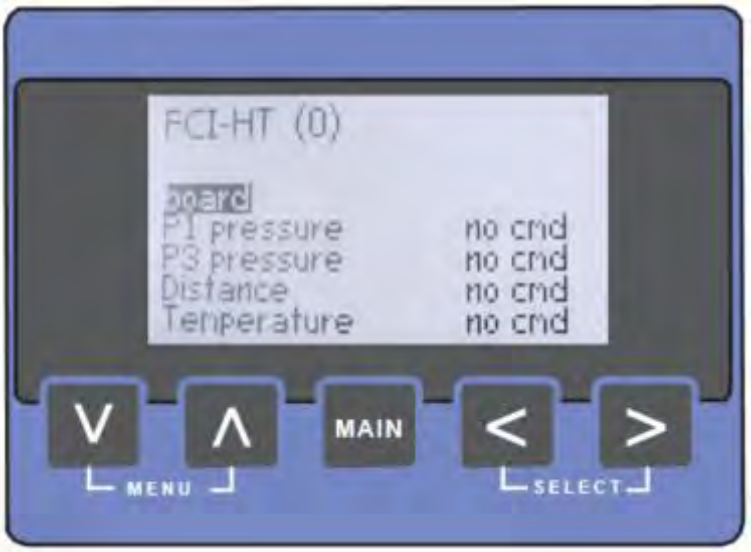


FIGURE 4-26 The function list screen

- When an available function is selected, the [command list] screen is presented (see FIGURE 4-27). You can navigate through the function list by using the up or down button. A command can be selected by simultaneously pressing the left + right button. You can return to the [function list] screen by pressing the left button.

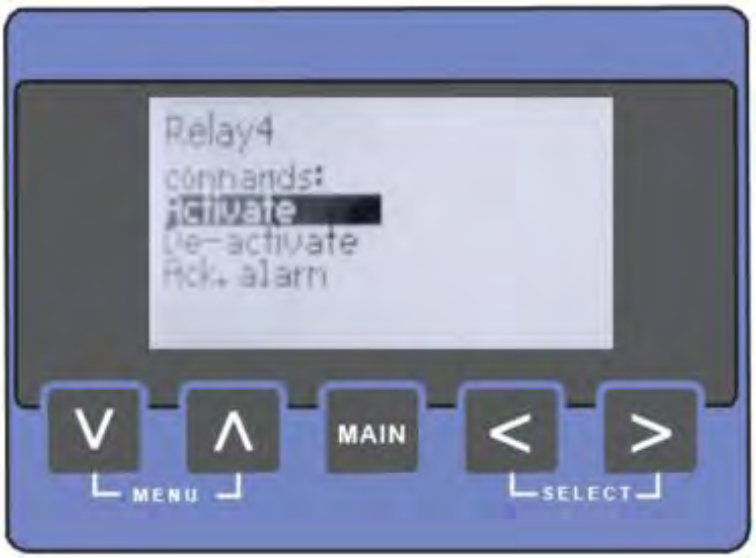


FIGURE 4 -27 The command list screen

4.2.5.1.11 Commissioning Menu Screen

- The [commissioning] menu starts with the [board list] screen (see FIGURE 4-28).
- You can navigate through the board list by using the up or down button. A board can be selected by simultaneously pressing the left + right button.

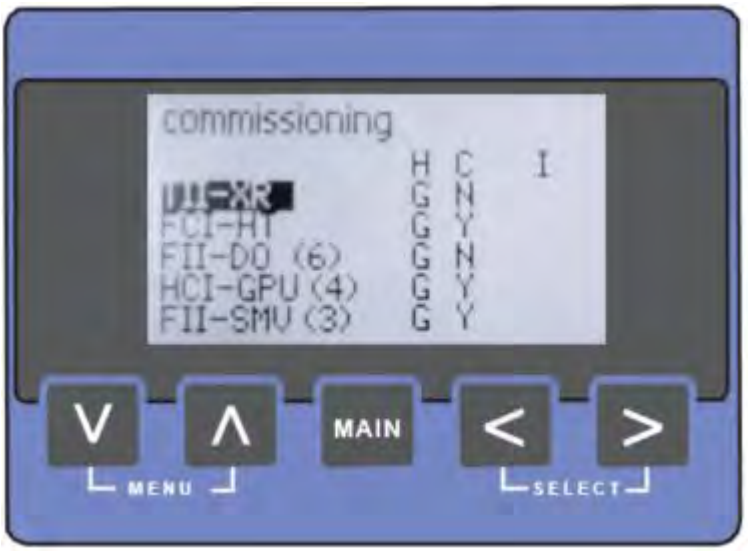


FIGURE 4-28 The board list screen (commissioning)

- The [function list] screen (see FIGURE 4-29) *displays all configurable entities* of a function.
  The actual entity value is also visible.
  You can *navigate through the board list* by using the up or down button. A function can be selected by simultaneously pressing the left + right button. You can return to the [board list] screen by pressing the left button.

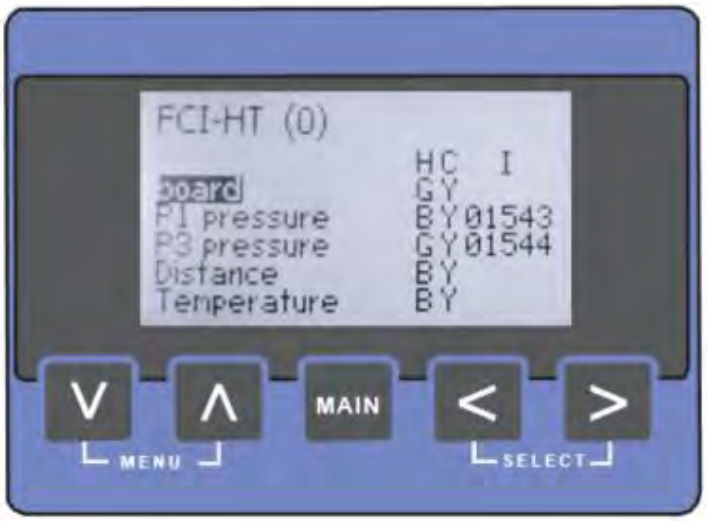


FIGURE 4-29 The function list screen (commissioning)

- On selection of an available function, the [entity list] screen is presented (see FIGURE 4-30). You can *navigate through the entity list* by using the up or down button. An entity can be selected by simultaneously pressing the left + right button. You can return to the [function list] screen by pressing the left button.

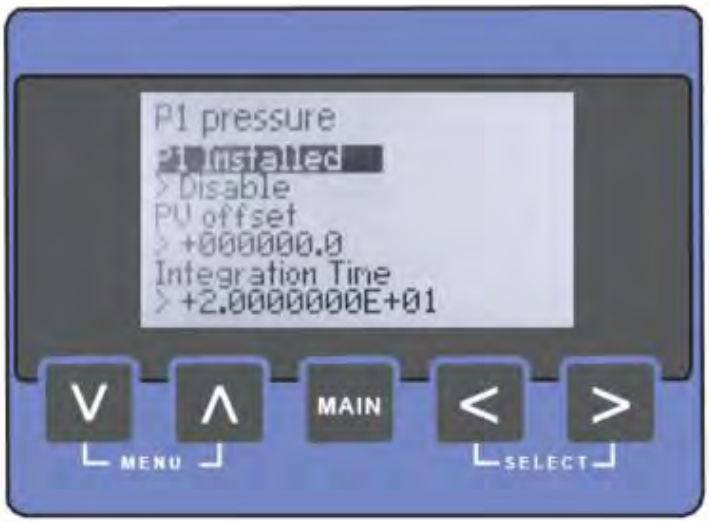


FIGURE 4-30 The entity list screen

- On selection of an available entity, the [value edit] screen is presented (see FIGURE 4-31).
  - If an *invalid* value is entered, the message “value out of range” is displayed.
  - If the value is *not accepted* by the FlexConn module, the message “value not accepted” is displayed.
  - You can scroll along the characters by push and hold the up button.
  - An entity modification is only executed on simultaneously pressing the left + right button. After this, first a range check is performed. If the modification is accepted, you return to the [value edit] screen.
  - The cursor can be shifted to the right by pressing the right button.
  - You can return to the [entity list] screen by pressing the left button.

*NOTE: Use the left button to return to the [entity list] screen **without executing** the modification(s). Press the left + right button simultaneously to undo this (these) modification(s)!*

FIGURE 4-31 Examples of the value edit screen

4.2.5.1.12 HART address screen

The HART address screen allows you to change the address of the HART SmartView. When the button left or right is pressed the new address is immediately active. The address is stored in non-volatile memory (see FIGURE 4-32).

FIGURE 4-32 HART address

4.2.5.1.13 Communication statistics

The Communication statistics gives you an overview of the communication stability. (see FIGURE 4-32).

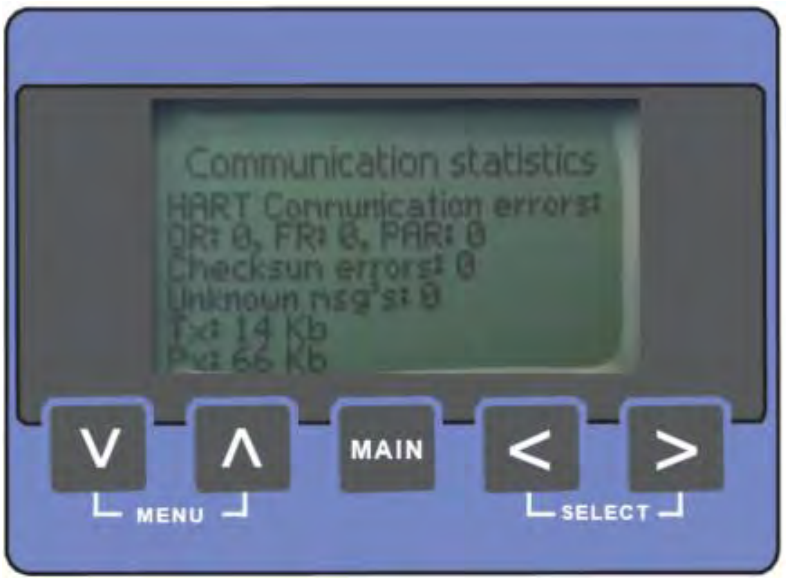


FIGURE 4-33 Communication statistics

Character level errors:

Symbol	Description	Meaning
OR	Number of overrun errors	The HSV drops characters
FR	Number of framing errors	The HSV has problems reading the characters
PAR	Number of parity errors	The characters are corrupt

Message level errors:

Symbol	Description
Checksum errors	Number of received corrupt messages
Unknown msg's	Number of unknown messages that the HSV received

Communication Activity:

Symbol	Description
Tx	Number of bytes transmitted after startup in Kb [1024 bytes]
Rx	Number of bytes received after startup in Kb [1024 bytes]

4.3 Engauge

4.3.1 Connecting the Engauge Service Tool

The *Engauge* service tool is a computer application by which the configuration parameters (entities) can be set to the proper application proper values. Those entities can be sent to 990 SmartRadar FlexLine FlexConn boards. In addition to that diagnostic entities can be read from the device by the Engauge tool.

4.3.1.1 Wired Connections Situation (FIGURE 4-34)

Connecting the serial COM-port of a computer or a laptop through an RS-232 (or RS-485) transmission line to either a Communication Interface Unit (CIU) or a SmartLink, enables the control of a SmartRadar FlexLine system.

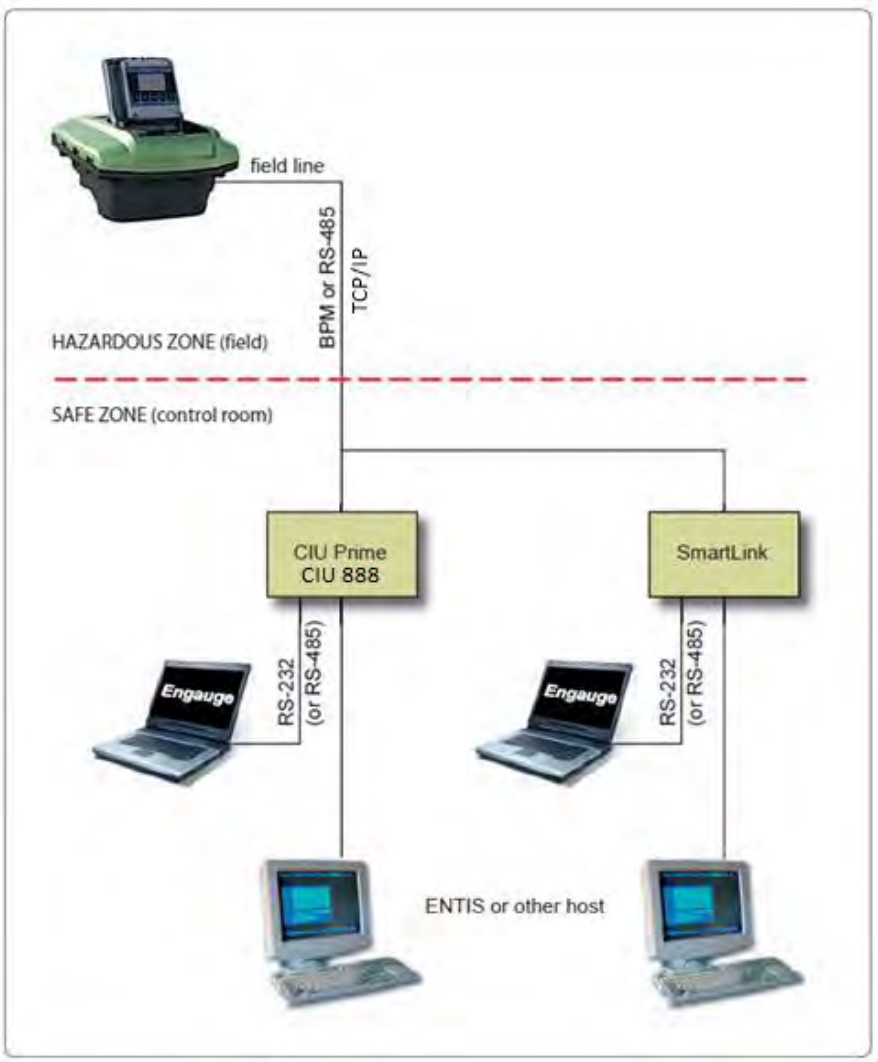


FIGURE 4-34 Connecting the *Engauge* service tool - wired connections

4.3.1.2 OneWireless Situation (FIGURE 4-35)

Connecting the serial COM-port of a computer or a laptop through an RS-232 (or RS-485) transmission line and a Lantronix server, or directly through an Ethernet connection (*Engauge* version 2.4 and later), to a OneWireless gateway enables the control of a OneWireless SmartRadar FlexLine system.

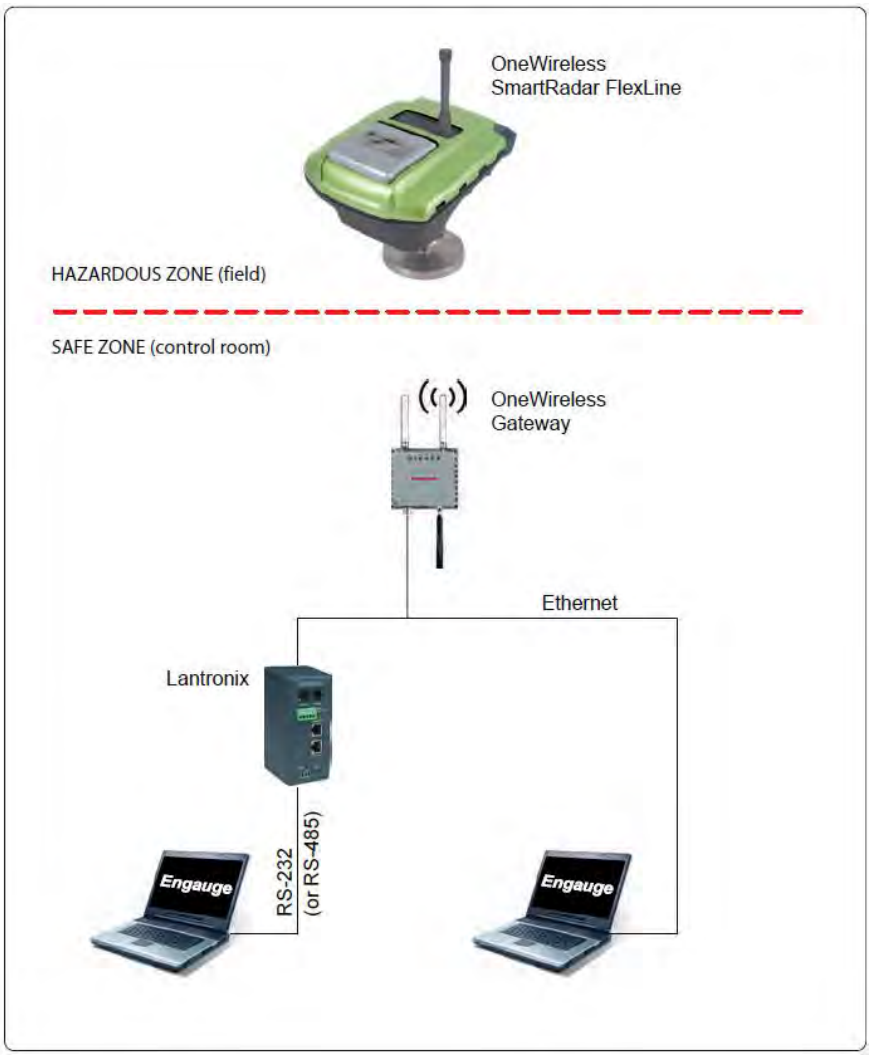


FIGURE 4-35 Connecting the Engauge service tool - OneWireless

4.3.2 Using Engauge

After starting the *Engauge* application, first the specific transmission address of the concerned SmartRadar FlexLine system must be set correctly. Also, the transmission speed (baudrate) must be set.

After this is performed, *Engauge's* explorer appears, and each FlexConn module of the concerned SmartRadar FlexLine system is visible on the left panel. See FIGURE 4-36.

Double-click on the module's icon on the left panel to edit the each individual SmartRadar FlexLine module. The "board descriptor" is loaded and a screen with "tab" pages appears.

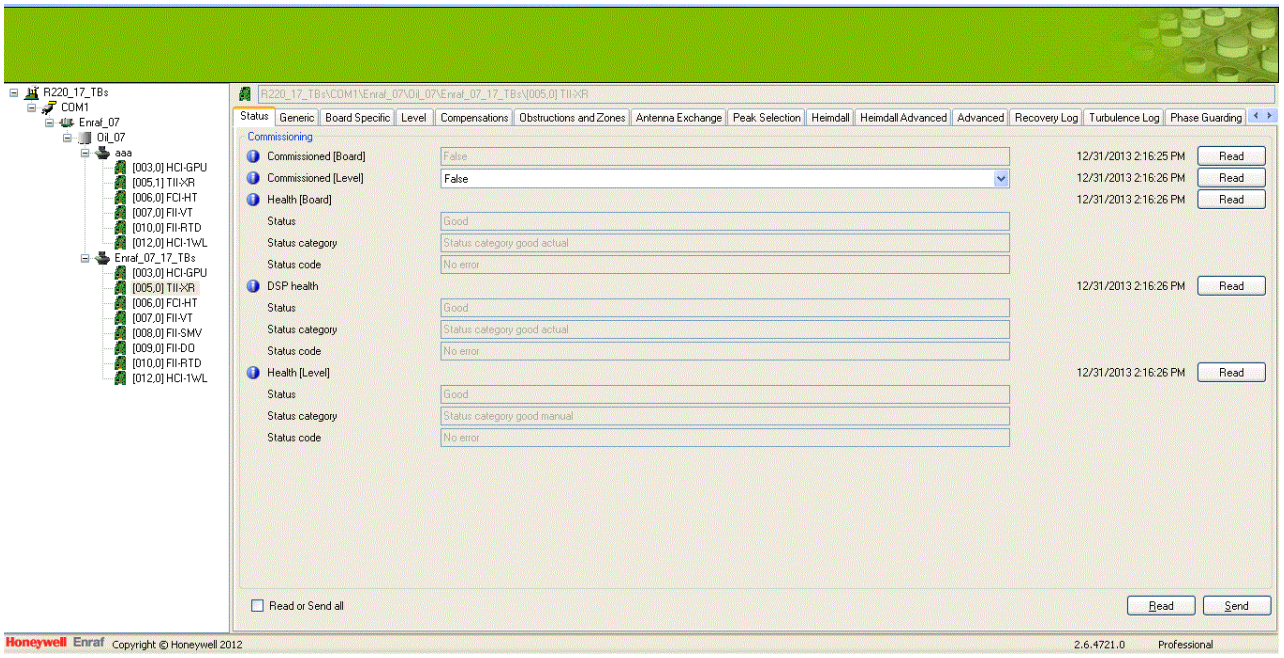


FIGURE 4-36 Example (1) of an *Engauge* screen

Browse through the tab pages to reveal the same information/ parameter settings which can be found using the HART SmartView, but in a more user friendly way.

However, some settings or commands can only be executed by *Engauge*. For example, executing an Alarm simulation test is only available through *Engauge*.

4.3.3 Some Engauge Screen Examples

Following are some of the *Engauge* screen samples.

After configuring a communication protocol(UDP/COM), running a OneWireless Site scan will list all devices connected to the OneWireless network. This list is displayed in the left panel.

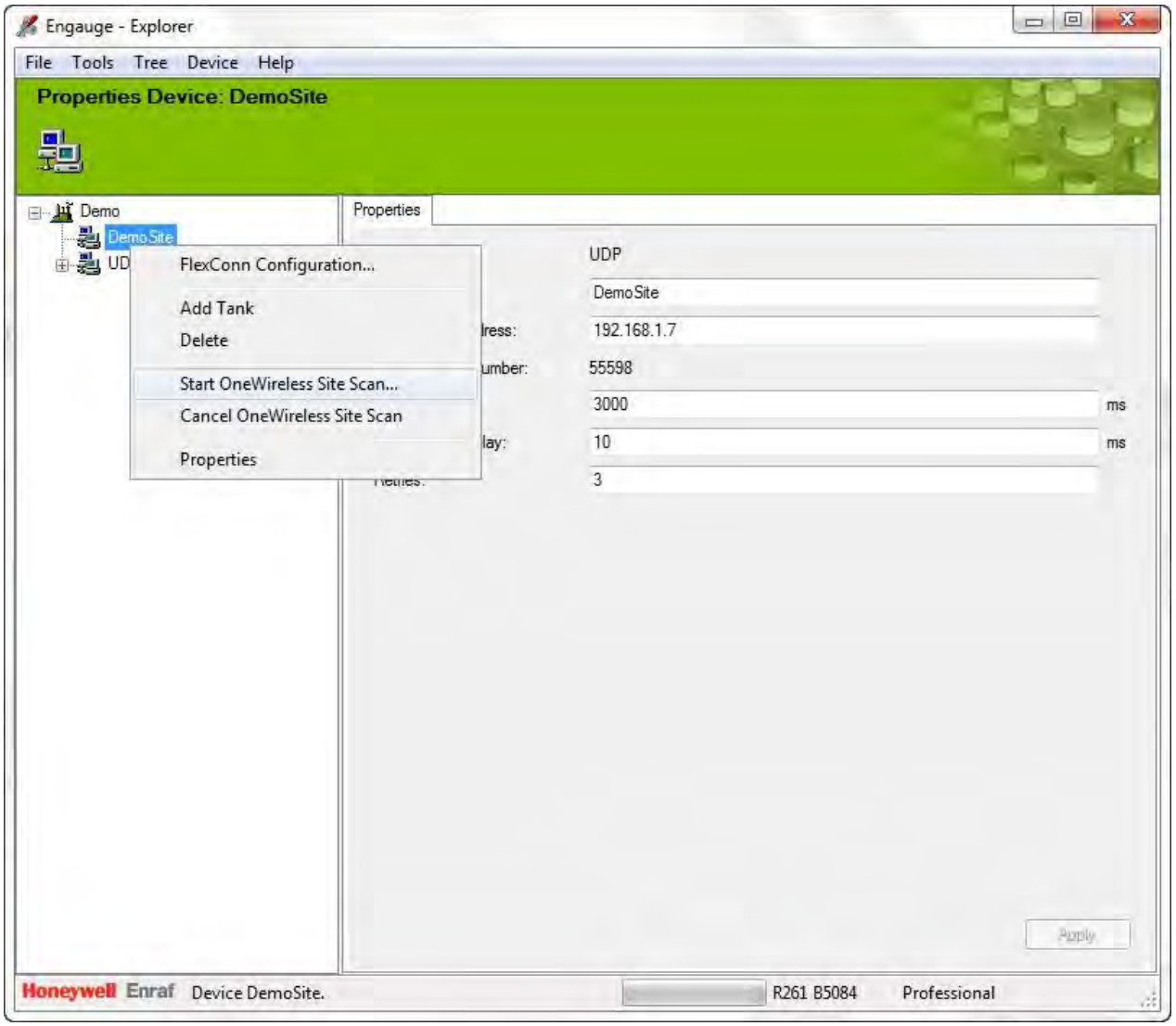


FIGURE 4-37 Example (2) OneWireless Site Scan

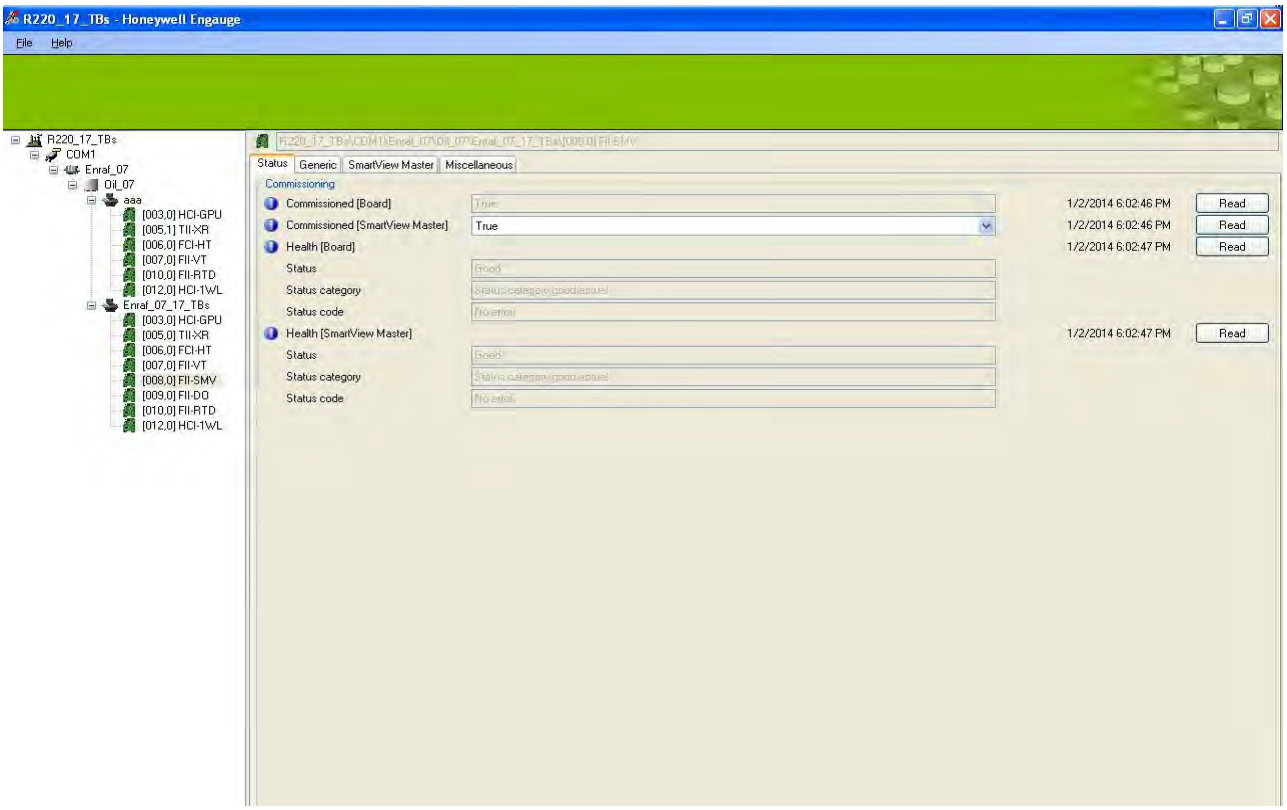


FIGURE 4-38 Example (3) of an *Engauge* screen

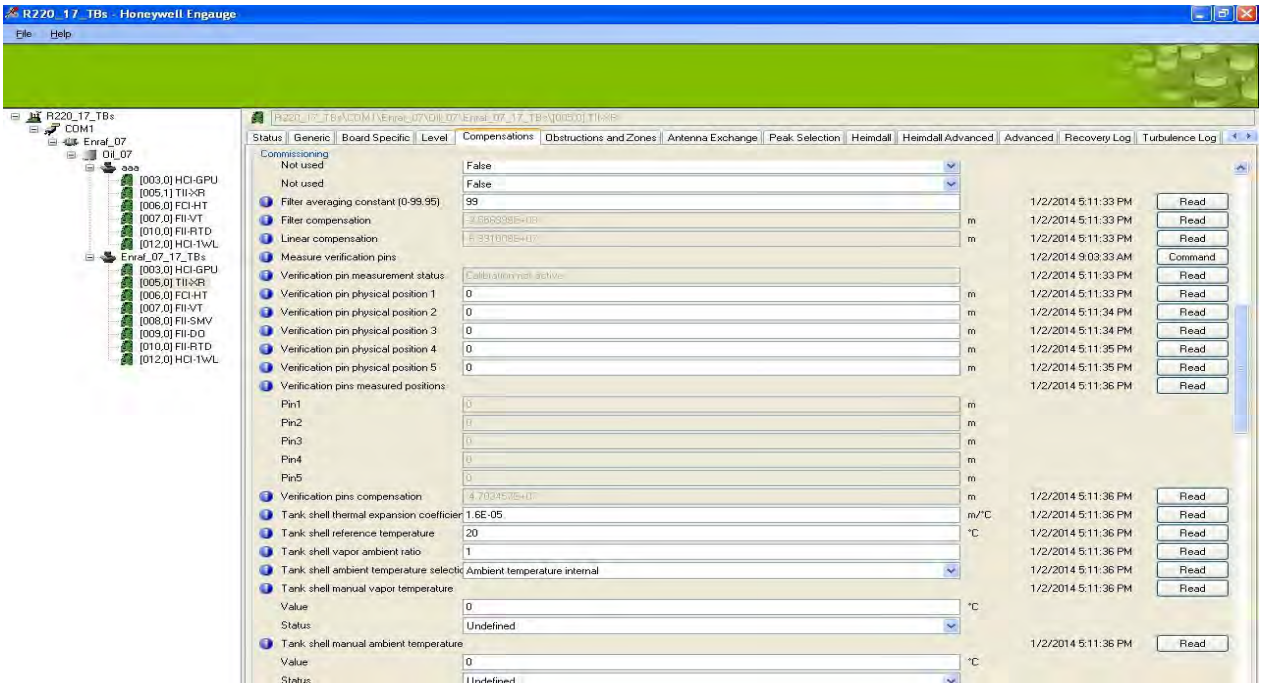


FIGURE 4-39 Example (4) of an *Engauge* screen

4.4 Configuring OneWireless infrastructure

4.4.1 Configuring WDM using the First Time Configuration Wizard

After installing the WDM, you need to configure the WDM to enable it to function in the OneWireless Network. The **First Time Configuration Wizard** guides you through the initial configuration of the WDM. The **First Time Configuration Wizard** appears ONLY when you log on to the OneWireless user interface for the first time or after the WDM is deleted (returning to factory defaults).

Considerations

The following are some of the network configuration rules that you must follow while configuring the network properties.

- FDN and PCN must be on separate subnets.
- FDN IP address must be outside the FDAP IP address range.
- FDN subnet mask must include FDN IP address and FDAP IP address range.
- Default PCN gateway must be on the same subnet as PCN.

WARNING! If you are performing a migration, skip this section and proceed with the tasks available in the OneWireless Migration User's Guide.

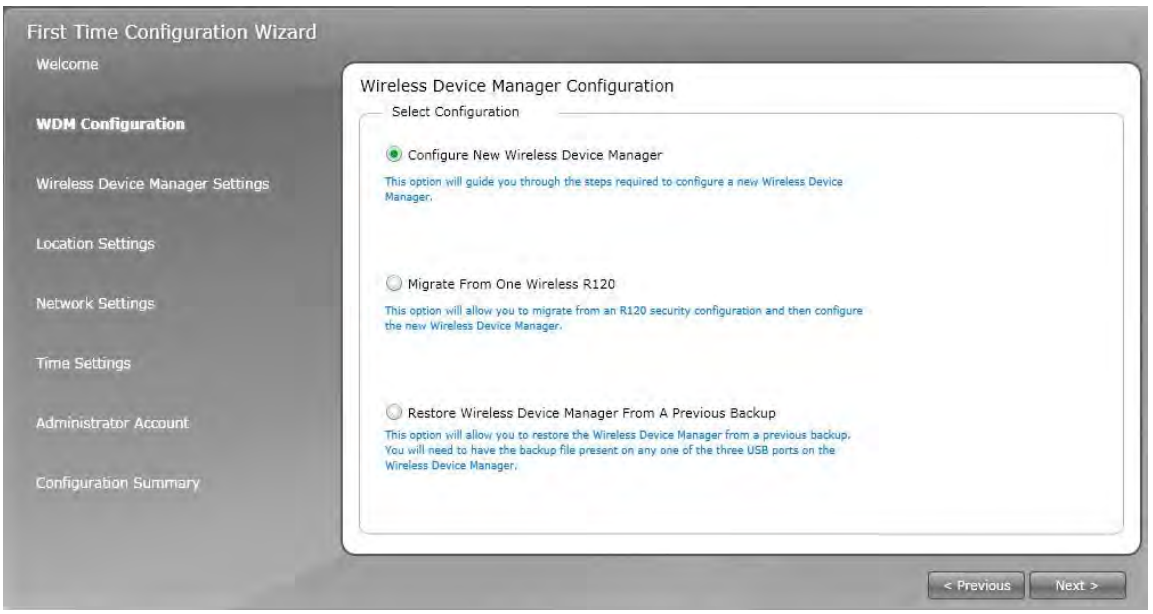
To configure WDM using the First Time Configuration Wizard

1. Log on to the OneWireless user interface using the default **User ID** and **Password**.

   The **First Time Configuration Wizard** appears.

2. On the **Welcome** page of the **First Time Configuration Wizard**, click **Next**.

3. On the **Wireless Device Manager Configuration** page, click **Configure New Wireless Device Manager** and click **Next**.

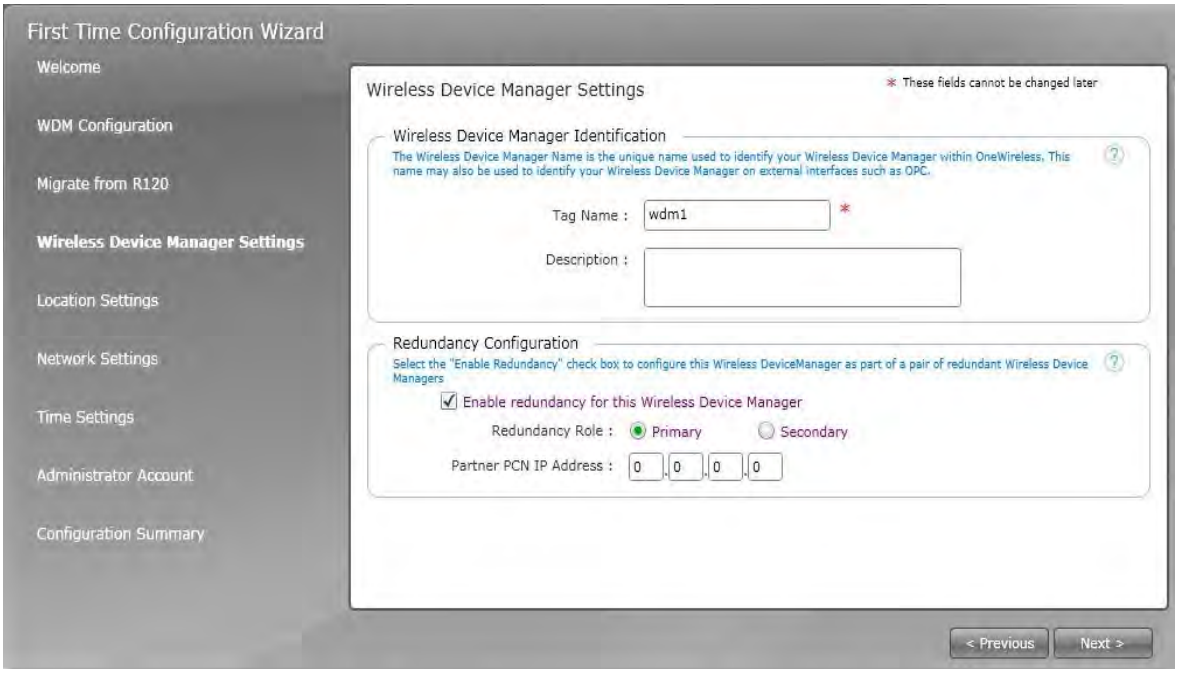


4. On the **Wireless Device Manager Settings** page, type the WDM **Tag Name** and the **Description**.

   The **Tag Name** is the unique name that is used to identify the WDM. It can be up to 16 characters long and must begin with an alphabetic character.

Do not use special characters in the Tag Name; underscore is the only acceptable character. After completing the initial configuration, you cannot change the WDM name.

The **Description** can be up to 255 characters long.



5. If you need to configure redundant WDM, then under **Redundancy Configuration**, configure the following:
   a) Select **Enable redundancy for this Wireless Device Manager** check box.
   b) Click the **Redundancy Role**, as required. You can select either **Primary** or **Secondary** option depending on the redundancy role.
   c) In the **Partner PCN IP Address** box, type the IP address of the partner WDM.

NOTE: When redundancy is enabled, the primary WDM is assigned physical ID A and the secondary WDM is assigned physical ID B. The physical IDs are displayed in the UI during normal operation. Tagging the physical hardware with matching labels makes it easy to distinguish the WDMs later.

6. Click **Next**.

   The **Location Settings** page appears.

*WARNING! If you have selected the **Redundancy Role** as **Secondary** in the **Wireless Device Manager Settings** page, then the **Location Settings** page options are disabled.*

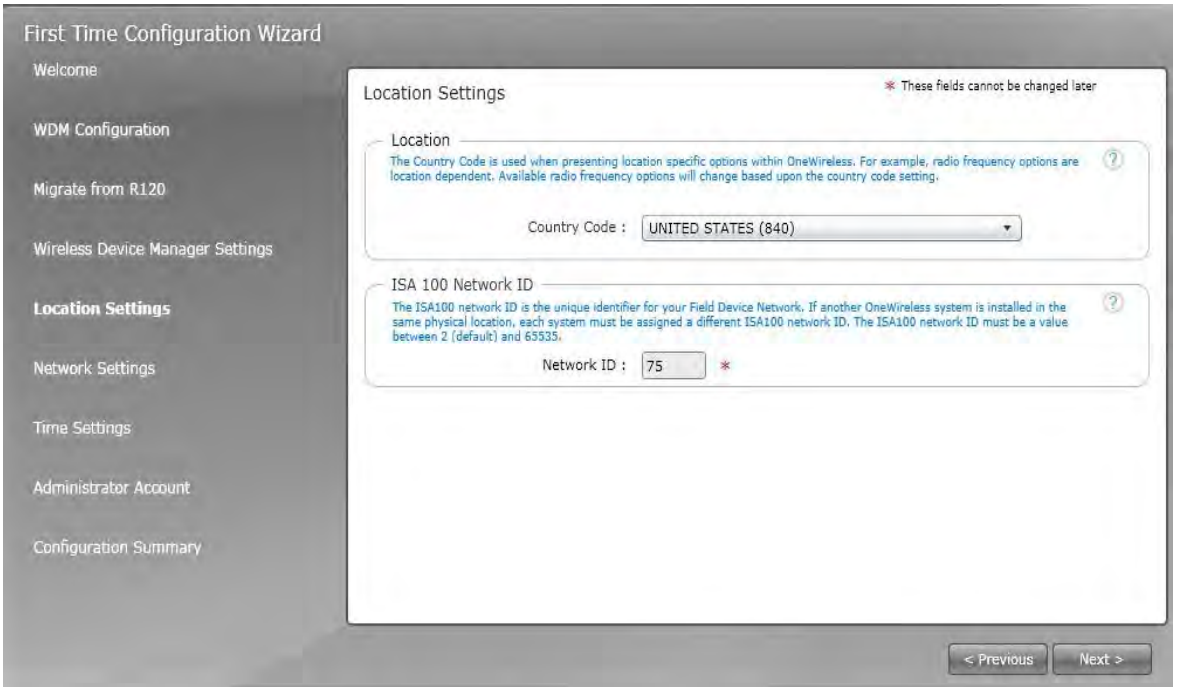
7. Under **Location**, select the **Country Code**.

   The country code is used to define any location-specific settings within the OneWireless Network. For example, radio frequency options are location

dependent and vary depending on the country code setting. After completing the first time configuration, you cannot modify the **Country Code**.

8. Under **ISA 100 Network ID**, type the **Network ID**.

   The ISA100 Network ID is the unique identifier for the network. It must contain a value between 2 (default) and 65535. After completing the first time configuration, you cannot change the **Network ID**.



9. Click **Next**.

   The **Network Settings** page appears.

10. Under **Field Device Network (FDN)**, configure the network settings for the wireless field device network as follows.

    a) **Field Device Network IP Address**: These settings are used to configure the wireless field device network Ethernet connection for the WDM. This is used for communication with FDAP.

*WARNING! After completing the initial configuration, you cannot change the **Field Device Network IP Address** specified in the **First Time Configuration Wizard**.*

    b) **Subnet Mask**: A subnet mask identifies the bits of an IP address that are reserved for the network address. For example, if the IP address of a particular node is 192.168.2.3 with a subnet mask of 255.255.255.0, the subnet mask indicates that the first 24 bits of the address represent the network address. The last 8 bits can be used for individual node addresses on that network.

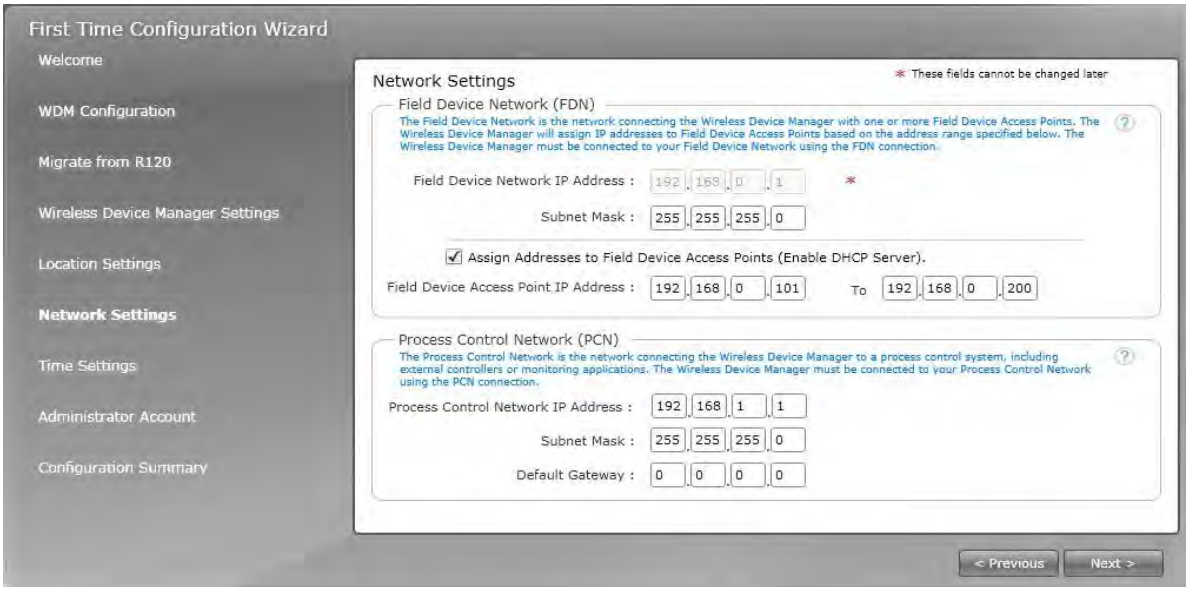
    c) **Assign Addresses to Field Device Access Points (Enable DHCP Server)**: Select this check box to enable the WDM to act as the DHCP Server. Ensure you do not select the check box if

the network has another DHCP Server. It is recommended to enable the WDM to act as the DHCP Server.

d) **Field Device Access Point IP Address**: This option is enabled only if you have selected the **Enable DHCP Server** check box. Accept the default range or configure the IP address range according to the network settings in the plant network. The WDM that acts as the DHCP Server assigns IP addresses based on the range specified. Ensure that the IP addresses of the Access Points are not within the DHCP address range.

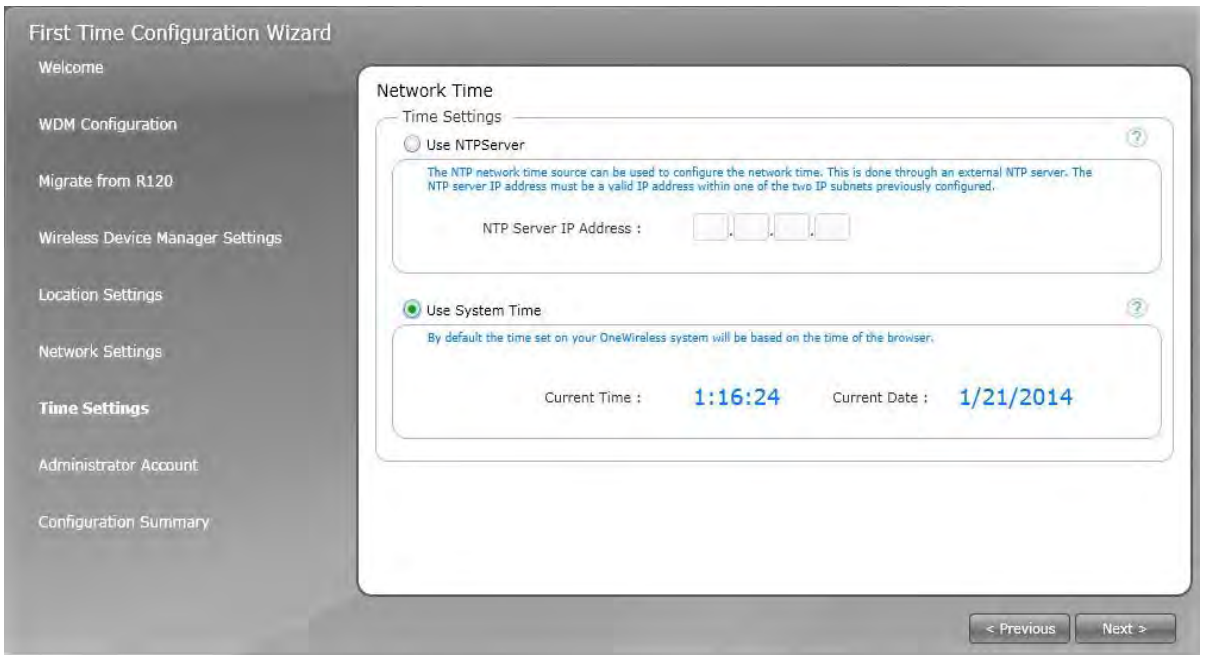
If you do not enable DHCP Server during the first time configuration, it is possible to enable this at a later stage using the Property Panel.

WARNING! DHCP server configuration option is disabled on a secondary WDM.



11. Under **Process Control Network (PCN)**, configure the process control network settings as follows.
    - **Process Control Network IP Address**: The process control network settings are used to configure the process control network Ethernet connections for the WDM. This is used for communication with monitoring applications and external controllers.
    - **Subnet Mask**
    - **Default gateway**: Used to access the subnets outside the PCN subnet. This is an optional configuration option.
12. Click **Next**.

The **Network Time** page appears.



WARNING! The network time settings configuration is disabled on the secondary WDM. Upon synchronization, the secondary WDM syncs time from primary over the FDN interface.

13. Click **Use NTPServer** or **Use System Time**, as required.

    You can use either the NTP server or system time to configure the network time of the OneWireless Network.

NOTE: By default, the network time is configured as the system time. Consider the following while configuring an external NTP server.

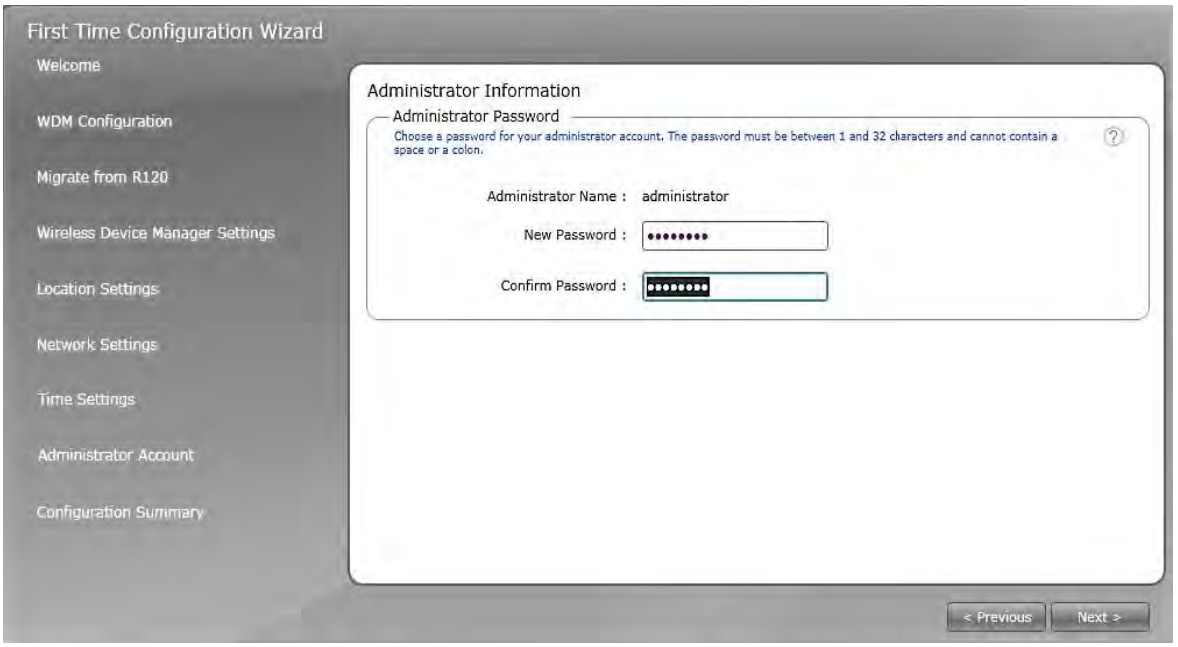
- NTP server should be on the PCN or FDN.
- NTP server IP address must be within FDN or PCN subnet unless a default gateway has been configured on the PCN subnet and the NTP server is accessible through the default gateway.
- NTP server IP address should not overlap with the FDN and PCN IP addresses.
- NTP server IP address should not overlap with FDAP IP address range, if DHCP Server is enabled.

14. If you are selecting NTP server, enter the **NTP Server IP Address** and click **Next**.

    The **Administrator Information** page appears.

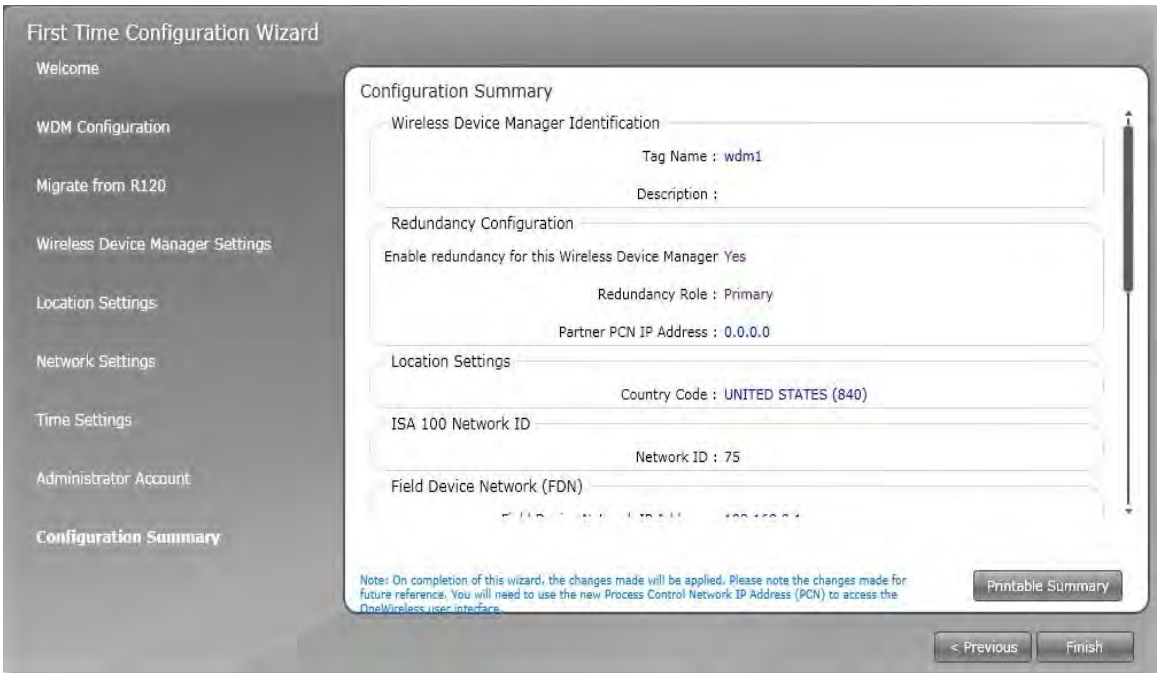
15. Type the user name and password in the **Administrator Name, New Password**, and **Confirm Password** fields.
    - The default user name configured for the WDM is **administrator**. You can change the default user name in the **First Time Configuration Wizard**, if required. However, you cannot change the user name after completing the initial configuration.

- The password must contain at least one character and can contain up to 32 characters. It should not start or end with a space and must not contain single quote (‘).



16. Click **Next**.

    The **Configuration Summary** page appears which displays the summary of all the configuration information specified in the **First Time Configuration Wizard**. An incorrect entry is indicated by a warning icon. Hovering the mouse over the icon displays a tooltip with the information about the incorrect entry.



17. Verify the WDM settings, correct errors if any, and then click **Finish**.

    If there are any errors in the configuration information that you have provided, then the system does not allow you to click **Finish**.

18. On the **Browser Redirect** dialog box, click **OK**.

    The wizard redirects the Web browser to the revised process control network IP address.

WARNING! If you are configuring the WDM to use the same process control network IP address, then the wizard redirects the Web browser.

If you have configured the WDM using a different PCN IP subnet than the computer, then you need to reconfigure the network settings of the computer to access the user interface using the IP address on the new subnet.

4.5 General Configuration Notes

The firmware of the FlexConn boards can be upgraded by using:

- the Engauge service tool remotely or

- the CAN-SD FlexConn upgrade board locally in the device.

The board at which Engauge is communicating to (mostly CAN-BPM) can not be upgraded by Engauge.

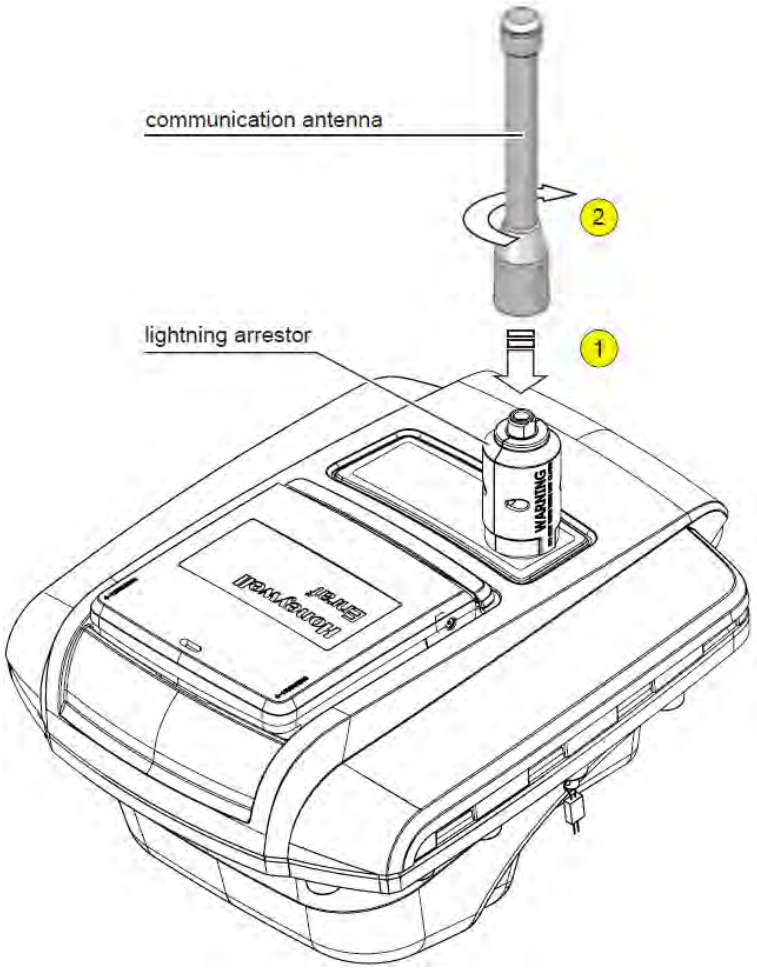
Sometimes Engauge reports a message "Upgrade failed". This message can be ignored because it is a false message and the upgrade is successful.

CHAPTER 5 INSTALLATION

Attention!

- Before starting with commissioning activities, first **make sure all mechanical and electrical installation aspects have been completed correctly**.
- For installation, see the *Installation Guide* for the SmartRadar FlexLine.
- In case the **OneWireless Communication Option (HCI-1WL)** is installed, a **lightning arrestor** is integrated by default. The lightning arrestor (see figure below) prevents the inside electronics from being affected in case of a nearby lightning strike. Although it protects against multiple discharges, it can be replaced as a preventive maintenance action. Preventive maintenance interval depends on location, position of the equipment, grounding, and other protection measures installed.

NOTE: Contact our service department for any guidance if needed, through e-mail: enraf.helpdesk@honeywell.com



CHAPTER 6 CONFIGURING THE ONEWIRELESS NETWORK COMPONENTS FOR R230

6.1 Provisioning the OneWireless Network components

6.1.1 Provision the WDM using over-the-air provisioning method

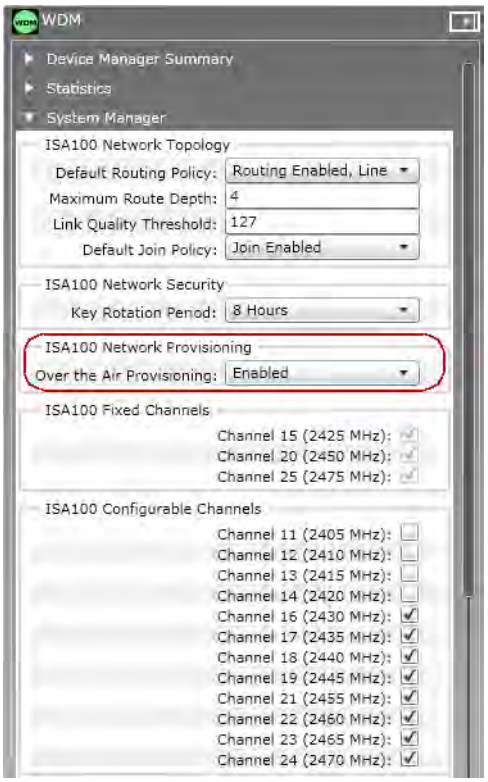
Devices in the OneWireless Network can be provisioned using over-the-air provisioning method. WDM provisions the access points and the access points that are enabled to function as provisioning devices can provision the field devices. To enable over-the-air provisioning capability, you must enable this feature in the user interface.

Any access point that is in the factory default state, when connected to the OneWireless Network can join the network as an un-provisioned device. In this state, the WDM contains only the basic details about the device such as the Tag Name, EUI64, and Radio Revision. Also, there is no active data communication between the WDM and the device in the un-provisioned state. You can accept or reject an un-provisioned device using the user interface. If accepted, the WDM sends the provisioning data to the device and the device transitions to provisioning state. A device with the new security data sends join request to the WDM.

To provision the access points using over-the-air provisioning method

1. On the Selection Panel, select the WDM.
2. On the Property Panel, expand **System Manager**.
3. Under **ISA100 Network Provisioning**, in the **Over the Air Provisioning** group, select **Enabled**.

   The WDM is enabled for over-the-air provisioning support.



4. Click **Apply**.

   The un-provisioned access points start appearing in the Selection Panel. You can filter the device list to view only the un-provisioned access points in the network.

5. On the ribbon bar, in the **Filter** group, click **Device Status** > **Un-Provisioned**.
6. Expand the extended Selection Panel to view the available device parameters.
7. Select the required access point in the Selection Panel or the map view and then click **Accept** on the ribbon bar.

NOTE: You can select multiple access points using the Selection Panel or the map view. Use SHIFT+ click to

select multiple items in a successive list. Use CTRL+click to select multiple items not in succession.
It is recommended that you select and accept only 10 devices at a time.

The **Accept Over the Air Devices** dialog box appears. The dialog box displays all the un-provisioned access points that you have selected for enabling over-the-air provisioning.

8. Click **Accept**.

   The **Progress** column displays the status as **In Progress**, **Provisioning**, and then **Completed** when complete. Do not close the dialog box when over-the-air provisioning is initiated for devices.

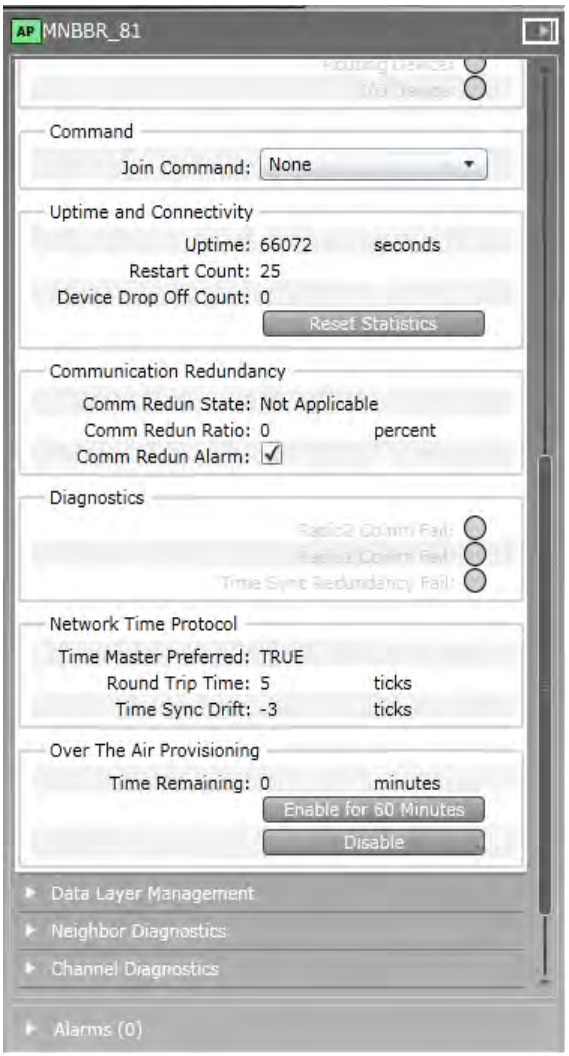
9. Click **Close**.

   The **Accept Over the Air Devices** dialog box closes.

NOTE: R230 SmartRadar FlexLine field devices can be provisioned using the over-the-air provisioning method and also by using an SD card.

6.1.2 Provision SmartRadar FlexLine field devices using over-the-air provisioning method

1. On the Selection Panel, select the access point.
2. On the Property Panel, expand **Device Management**.
3. Under **Over The Air Provisioning**, click **Enable for 60 Minutes**.



The access point functions as a provisioning device for 60 minutes. The un-provisioned SmartRadar FlexLine field devices that are in the factory default state start appearing in the Selection Panel. Note that if you do not accept or reject the devices within 60 minutes, the devices automatically disappear from the user interface.

4. To filter the SmartRadar FlexLine field device list:

   On the ribbon bar, in the **Filter** group, click **Device Status** > **Un-Provisioned**.

   The un-provisioned devices appear in the Selection Panel. The extended Selection Panel enables you to view the available device parameters.

   The device establishes a communication link with the access point after it attains the un-provisioned state. This link persists even if the device is not provisioned using the connected access point. If the

device needs to be provisioned using a different access point, reject the device and then delete it from the user interface, so that the device can rejoin through a different access point for provisioning.

5. Select the required SmartRadar FlexLine field device in the Selection Panel or the map view and then click **Accept** on the ribbon bar.

NOTE: You can select multiple access points using the Selection Panel or the map view. Use SHIFT+click to select multiple items in a successive list. Use CTRL+click to select multiple items not in succession.

It is recommended that you select and accept only 10 devices at a time.

The **Accept Over the Air Devices** dialog box appears.

The dialog box displays all the un-provisioned devices that you have selected for enabling over-the-air provisioning.

NOTE: To reject a device from joining the network using over-the-air provisioning method.

*Select the required device and click **Reject** in the ribbon bar.*
*The **Reject Over the Air Devices** dialog box displays.*

*Click **Reject**.*
*The **Progress** column displays the status as **In Progress**, and then **Completed**, when complete.*

*Click **Close**.*
*The **Reject Over the Air Devices** dialog box closes.*

6. Click **Accept**.

   The **Progress** column displays the status as **In Progress**, **Provisioning**, and then **Completed**, when complete. Do not close the dialog box when over-the-air provisioning is initiated for devices.

7. Click **Close**.

   The **Accept Over the Air Devices** dialog box closes.

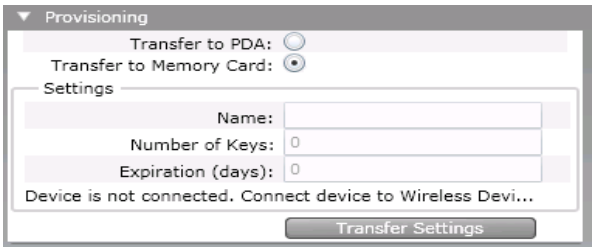
   All the field devices that you have selected for over-the-air provisioning are provisioned.

NOTE: By default, the selected SmartRadar FlexLine field devices are provisioned and joined as line powered routers.
*Select **Device Management** > **Routing Assignment** > **Routing Disabled** to disable the routing field devices to function as line powered routers.*

6.1.3 Provision SmartRadar FlexLine field devices using SD card

To provision a SmartRadar FlexLine field device using a SD card

1. Connect an SD card to a computer or a laptop and format the card with the default windows settings.
2. Generate a security key using the OneWireless Device Manager and transfer the key to the SD card.



3. Power OFF the SmartRadar FlexLine device and open the enclosure.
4. Insert the SD card in the SD card slot provided on the HCI-1WL board.
5. Close the SmartRadar FlexLine device and power it ON.

   ISA100 key is provisioned automatically.

6.1.4 Removing the provisioning key from SmartRadar FlexLine gauge

To enable the SmartRadar FlexLine gauge to join another network, you must remove the security configuration on the device and then re-provision the device using over-the-air provisioning.

To remove the provisioning key from SmartRadar FlexLine gauge

1. On SmartView, press the UP ARROW and DOWN ARROW simultaneously (**MENU** push buttons) to view the menu items on the display.
2. On the display, scroll to the **commands** item using the MENU buttons.
3. Press the LEFT ARROW and RIGHT ARROW (**SELECT p**ush buttons) simultaneously.

   You are prompted to enter the password. The default password for SmartView is AAAAAA.

4. Use the MENU push buttons to enter the password and then press the **SELECT** push buttons.

   The list of commands appears.

5. Scroll to select the CAN-1WL FlexConn board name and then press the **SELECT** push buttons.
6. Scroll to select **board** and then press the **SELECT** push buttons.
7. Scroll to select **Restore Default** then press the **SELECT** push buttons.

The provisioning key on the SmartRadar FlexLine gauge is now removed.

6.1.5 Resetting the provisioning key from SmartRadar FlexLine gauge using a SD card

To reset the provisioning key from a SmartRadar FlexLine gauge using a SD card

1. Connect an SD card to a computer or a Laptop and format the card with default windows settings.
2. Generate a reset key using the OneWireless Device Manager and transfer the key to the SD card.
3. Power OFF the SmartRadar FlexLine device and open the enclosure.
4. Insert the SD card in the SD card slot provided on the HCI-1WL board.
5. Close the SmartRadar FlexLine device and power it on.

The provisioning key on the SmartRadar FlexLine is automatically reset and the device enters the factor default mode.

6.2 Configuring SmartRadar FlexLine field device

6.2.1 Loading the Device Description file

A Device Description (DD) file is usually a zip file that is available on the disk supplied in the Honeywell Process Solutions website. It contains information about the device type, commands that are supported by the device, and other device-specific data. A DD file for a particular field device is used to describe the device and to interpret messages and the device status.

NOTE: To ensure consistency in the channel names, load the DD files before the device joins the network.

To load the Device Description file

1. On the ribbon bar, in the **Maintenance** group, click **Templates**.

   The **Load DD File** dialog box appears.
2. Click **Load DD File**.
3. Browse to the directory location of the DD file.
4. Select the DD file and click **Open**.

   The DD file is uploaded to the WDM and an upload success message appears.
5. Click **Close** to close the **Load DD File** dialog box.
6. Repeat steps to load the DD files for all the device types.

6.2.2 Configuring routing assignment

After joining the network for the first time, a field device capable of operating as a router and an I/O device initializes its routing assignment based on the current default routing policy. It is possible to override the default routing policy by configuring routing assignment for field devices. Configuring device routing assignment results in restarting the device with a new role.

6.2.2.1 Considerations

- Device routing assignment can be configured only for devices that are capable of operating as routers and I/O devices.

To configure routing assignment

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Device Management**.
3. Select **Routing Assignment**, as appropriate.

   The following are the **Routing Assignment** options available.

   - **Routing Disabled** — Disables the ability of a routing field device to function as a router. The field device can function only as an I/O device.
   - **Routing Enabled** — Enables the routing field device to function as a router and an I/O device. The default join policy configured is **Follow System Manager Policy**.
   - **Not Applicable**
     - Does not apply to devices that are capable of operating as access points.
     - Does not apply to devices that are only capable of operating as routers.
4. Select one of the following **Join Assignment** options, as required.

   The **Join Assignment** overrides the system manager join policy. This is applicable only for routing field devices.

   - **Join Disabled** — Disables device-join through this device.
   - **Join Enabled** — Enables device-join through this device.
   - **Follow System Manager Policy** — Enables the device to follow the system manager join policy. Device-join through this device depends on the configured system manager join policy.

   The **Join Status** is a read-only parameter that indicates the resultant join state for all the devices.

   - Access Points, FDAP access points, and FDAP routers have the **Join Assignment** permanently set to J**oin Enabled**.
   - Non-routing field devices have the **Join Assignment** permanently set to **Join Disabled**.

- Routing field devices have the default **Join Assignment** set to **Follow System Manager Policy.**

By default, the selected SmartRadar FlexLine field devices are provisioned and joined as line powered routers. Select **Device Management** > **Routing Assignment** > **Routing Disabled** to disable the routing field devices to function as line powered routers.

5. Click **Apply**.

6.2.3 Configure tag name and description

To configure tag name and description

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Field Device Summary**.
3. Type the required **Tag Name**.

NOTE: You can change the Tag Name by double-clicking the field device name in the Selection Panel.

4. Type the required **Description**.
5. Click **Apply**.

6.2.4 Configure publication rate

The publication data for input and output field devices can be configured using the Input Publication panel in the Property Panel. Depending on the device type, a field device can have an Input Publication panel. This is determined by the DD file for the field device.

The Input Publication panel contains the following configuration options.

- **Contract Status -** A contract is a communication resource (bandwidth) allocation between two devices on the ISA100 network. The following are the status values that are displayed depending on the status of the contract.
  - **Not Configured** - No contract established due to incorrect configuration of the device.
  - **Activating** - Contract establishment is in progress.
  - **Active** - Contract is active.
  - **Active, Negotiated Down** - If a device requests a contract for periodic publications at a fast rate (such as 1 second) and if the communication resources are not available, the contract is negotiated down to a slower publication period (such as 5 seconds).
  - **Terminating** - Contract termination is in progress.
  - **Failed** - Contract establishment is failed.
  - **Inactive** - Contract is inactive.
- **Rate** - The rate at which a field device publishes data.

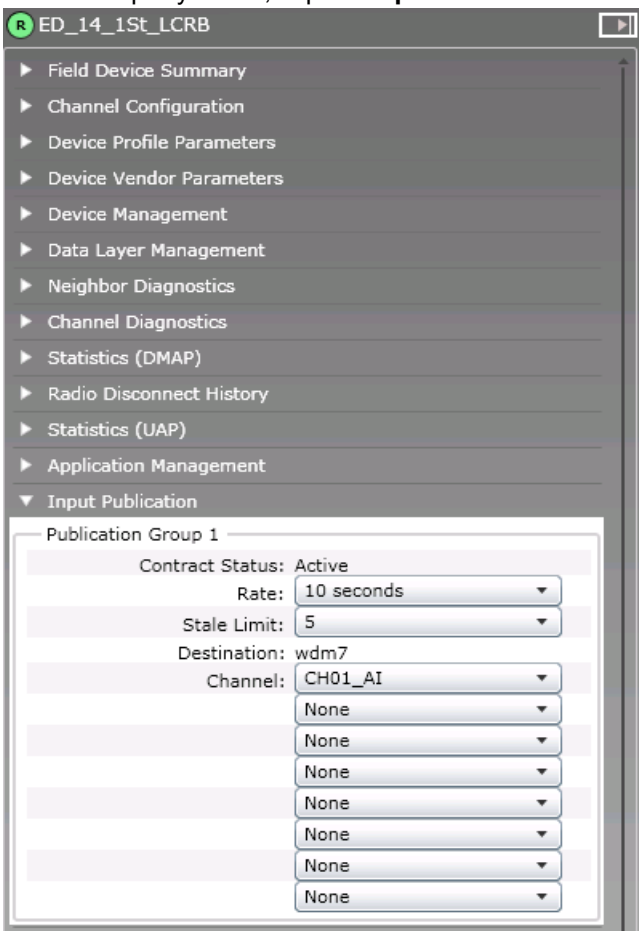
*NOTE: Honeywell recommends that you set the **Rate** as 10 seconds.*

- **Stale Limit** - Defines the maximum number of stale input values that can be received before the input status is set to Bad. It is recommended that for 1 second publication period, the stale limit should be set to 15 seconds. For all other publication periods (5 seconds, 10 seconds, 30 seconds, and 1 minute), the stale limit should be set to 5.
- **Destination** - Destination of publication for output devices.
- **Channel** - The list of channels for which the publication configuration applies.

NOTE: When a device joins the network, the WDM automatically configures its publication period as 10 seconds.

To configure publication rate and stale limit

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Input Publication**.



3. In the **Rate** field, select the publication rate, as appropriate.
4. In the **Stale Limit** field, select the stale limit, as appropriate.
5. Click **Apply**.

6.3 Configuring SmartRadar FlexLine field device channels

6.3.1 Configure Mode and Scale

To configure Scale

1. On the Selection Panel, select the SmartRadar FlexLine field device channel.
2. On the Property Panel, expand **Process Variable** to view the following read-only parameters in the OneWireless user interface.

NOTE: The configuration of the engineering units should be performed using the Engauge tool only. The parameter values of the sensor cards get reflected in the OneWireless user interface as read-only parameters.

- **EU at 100%**: Specifies the high range PV value in Engineering Units.
- **EU at 0%**: Specifies the low range PV value in Engineering Units.
- **Units Index**: Specifies the unit of the measurement value. The value varies according to the sensor type selected for a channel. For example, the process value of the TII-XR sensor card is displayed as CH01_AI_1 and the Units Index is set to m.

3. Click **Apply**.

*NOTE: After applying the changes, the newly configured values appear under the **Scale** panel.*

To configure Mode

1. On the Property Panel, expand **Mode**.
2. In the **Target** list, select the mode as required.

   The mode types available are Normal, OOS, and Auto.

3. Click **Apply**.

6.3.2 Add channels to publication groups

Perform the following steps to enable/disable the PV publication capability of field devices.

To add channels to publication groups

1. On the Selection Panel, select the SmartRadar FlexLine field device channel.
2. On the Property Panel, expand **Input Publication** panel.

3. In the **Channel** drop-down list, select the channels for which data publication needs to be enabled.

*NOTE: To disable data publication, select **None** in the **Channel** list.*

4. Click **Apply**.

6.3.3 Remove channels from publication groups

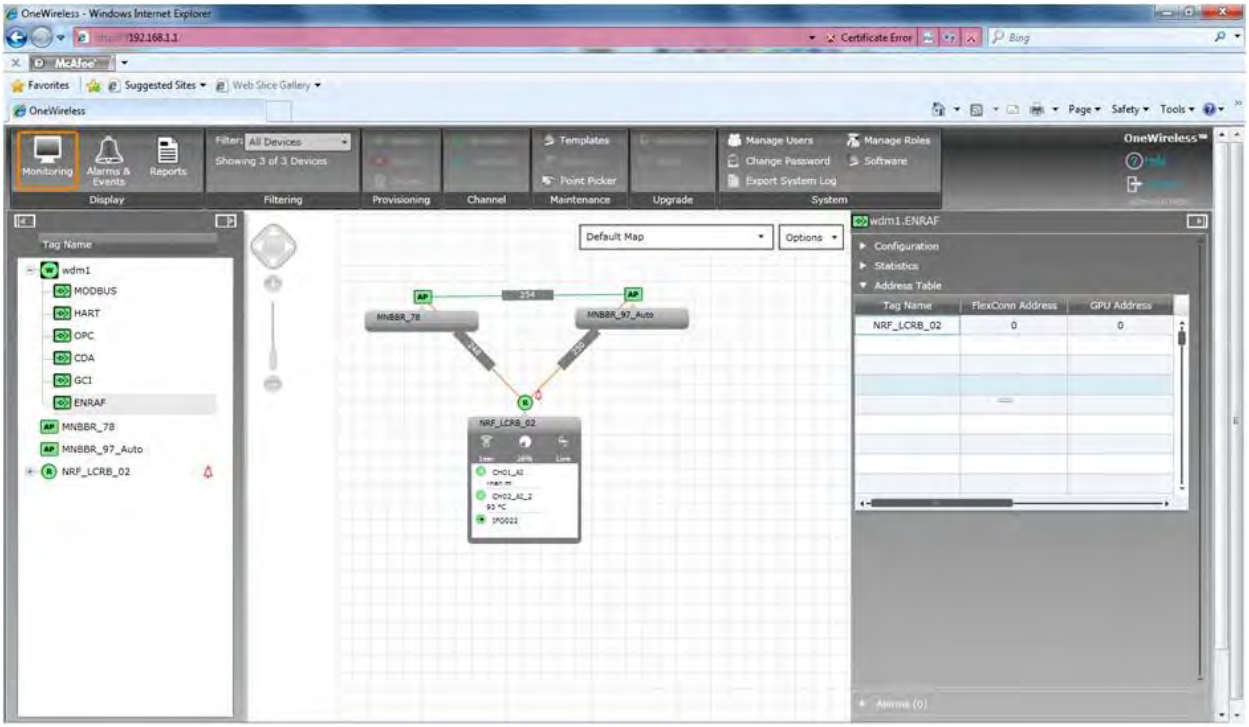
To remove channels from publication groups

1. On the Selection Panel, select the SmartRadar FlexLine field device channel.
2. On the Property Panel, expand **Input Publication**.
3. For the channel to be deleted from the publication group, click **None** in the **Channel** drop-down list.
4. Click **Apply**.

6.4 Activating SmartRadar FlexLine field device in OneWireless Network

The ISA100 wireless field devices maintain a database of process configuration, identification, and diagnostic information in memory. WDM allows accessing this information from the SmartRadar FlexLine client applications (CIU Prime hardware or Engauge software). This enables monitoring the ISA100 wireless field devices like any other field device.

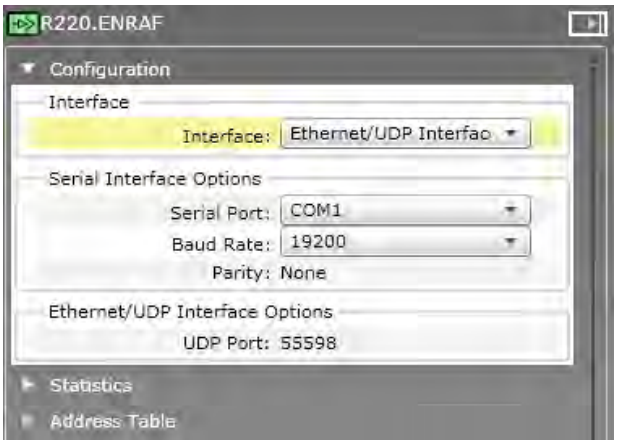
OneWireless Network uses serial communication interface to support data transmission between the applications and the WDM. It also uses Ethernet/UDP interface for data transmission.



6.4.1 Activate ENRAF Ethernet UDP interface on OneWireless user interface

To activate ENRAF Ethernet/UDP interface on the OneWireless user interface

1. On the Selection Panel, expand the WDM icon and select **ENRAF**.
2. On the Property Panel, expand **Configuration** panel.
3. In the **Interface** list, click **Ethernet/UDP Interface**.



4. Under the **Ethernet/UDP Interface Options**, the UDP port number of the port on which the WDM is connected is displayed.
5. Click **Apply**.

6.4.2 Configure CIU Prime and CIU Plus using the Ensite Pro configuration tool

The following details describe the settings for CIU Prime configuration. For more information regarding the Ensite Pro configuration tool, refer to the *Ensite Pro Configuration Tool Instructional manual*.

1. In the **Edit CIU Prime** dialog box, enter the following details in HostPort1 and HostPort2.

   1. Baudrate - Select 19200 as the baudrate from the drop-down list.

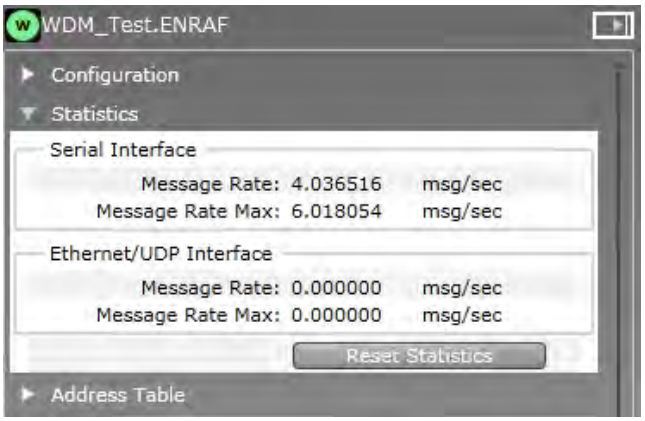
   2. Turn-around delay - Enter 10 msec as the turn around delay.

2. In the **CIU Prime - FieldPort Settings** dialog box, enter the following details in FieldPort.
   1. Time-out - Enter 500 msec as the time-out
   2. Retries - Enter 3 as the number of retries.

6.4.3 Monitor performance of ENRAF interface

To monitor performance of ENRAF interface

1. On the Selection Panel, select the ENRAF interface.
2. On the Property Panel, expand **Statistics**.



3. Verify the following attributes to monitor the performance of the ENRAF interface.
   - **Message Rate**: Number of messages processed by the interface, per second.
   - **Message Rate Max**: Maximum number of messages processed by the interface, per second.
4. Click **Reset Statistics** to reset all the ENRAF interface statistics.

6.4.4 Configuring field devices

6.4.4.1 Configure field device properties

To configure tag name and description

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Field Device Summary**.
3. Type the required **Tag Name**.

NOTE: You can change the Tag Name by double-clicking the field device name in the Selection Panel.

4. Type the required **Description**.
5. Click **Apply**.

6.4.4.2 Configure publication rate

The publication data for input and output field devices can be configured using the Input Publication panel in the Property Panel. Depending on the device type, a field device can have an Input Publication panel. This is determined by the DD file for the field device.

The Input Publication panel contains the following configuration options.

- **Contract Status** - A contract is a communication resource (bandwidth) allocation between two devices on the ISA100 network. The following are the status values that are displayed depending on the status of the contract.
  - **Not Configured** - No contract established due to incorrect configuration of the device.
  - **Activating** - Contract establishment is in progress.
  - **Active** - Contract is active.
  - **Active, Negotiated Down** - If a device requests a contract for periodic publications at a fast rate (such as 1 second) and if the communication resources are not available, the contract is negotiated down to a slower publication period (such as 5 seconds).
  - **Terminating** - Contract termination is in progress.
  - **Failed** - Contract establishment is failed.
  - **Inactive** - Contract is inactive.
- **Rate** – The rate at which a field device publishes data.

*NOTE: Honeywell recommends that you set the **Rate** as 10 seconds.*

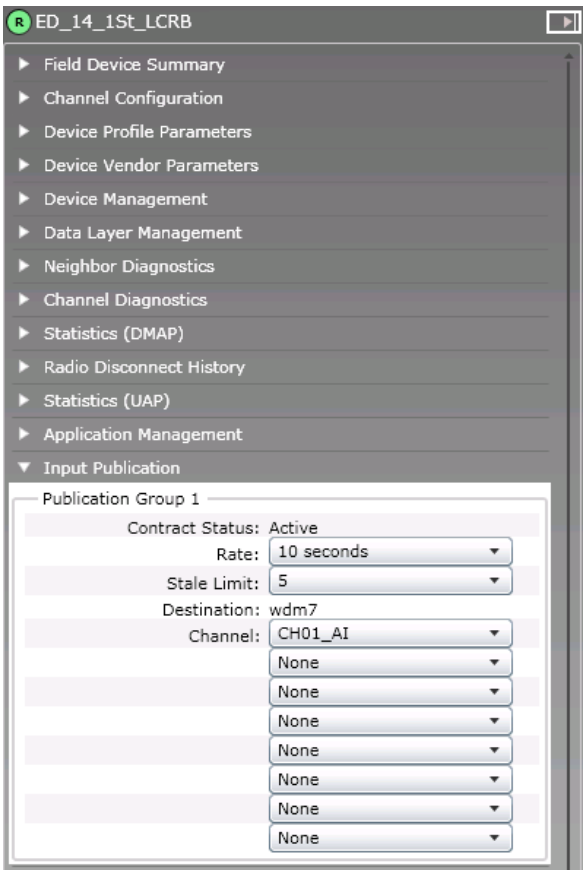
  - **Stale Limit** – Defines the maximum number of stale input values that can be received before the input status is set to Bad. It is recommended that for 1 second publication period, the stale limit should be set to 15. For all other publication periods (5 seconds, 10 seconds, 30 seconds, and 1 minute), the stale limit should be set to 5.

- **Destination** – Destination of publication for output devices.
- **Channel** – The list of channels for which the publication configuration applies.

NOTE: When a device joins the network, the WDM automatically configures its publication period as 10 seconds.

To configure publication rate and stale limit

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Input Publication**.



3. In the **Rate** field, select the publication rate, as appropriate.
4. In the **Stale Limit** field, select the stale limit, as appropriate.
5. Click **Apply**.

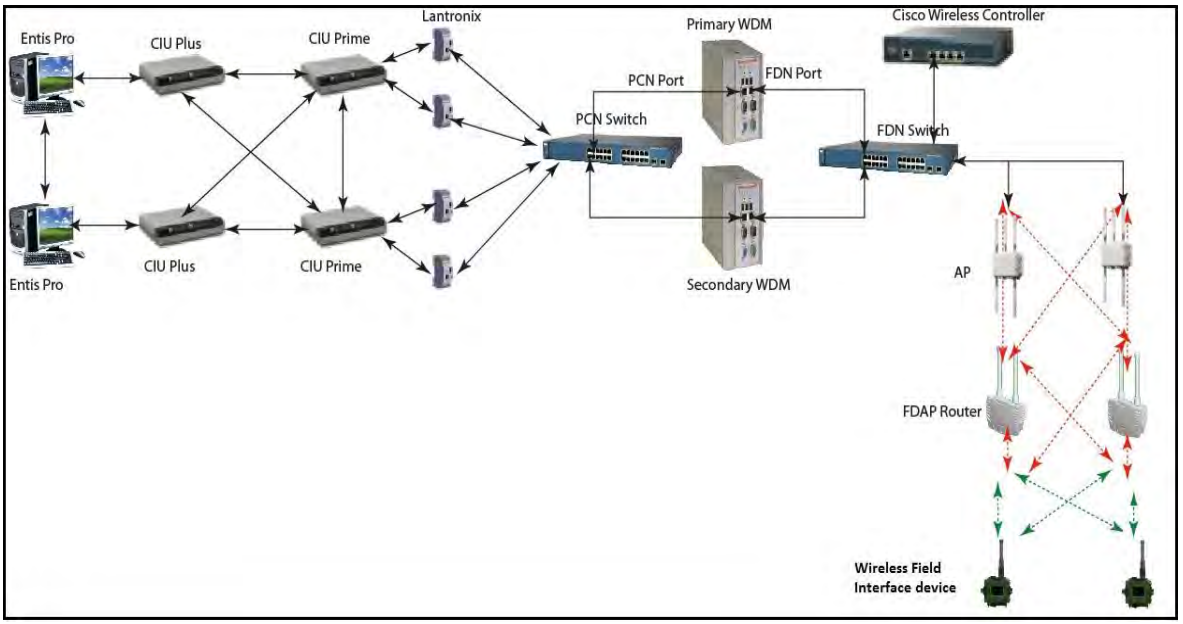
6.5 Configuring the protocol tunneling

This release of ISA100 FlexLine R230 supports integration with OneWireless R230. OneWireless R230 WDM supports GPU and FlexConn protocol tunnel. The Applications (Engauge tool/CIU Prime) that support GPU and FlexConn protocol tunnel, communicate with the WDM for configuring and monitoring the ISA100 FlexLine R230 devices.

Protocol tunneling can be established for the SmartRadar FlexLine field device in the following two ways.

1. Serial tunneling through RS-232 or RS-485
2. Ethernet/UDP tunneling

The serial RS-232 is configured on COM1 of the WDM and serial RS-485 is configured on COM2 of the WDM. Redundancy is not supported with the serial RS-232 protocol tunneling. Multiple clients are supported with the Ethernet/ UDP.



6.5.1 Configure SmartRadar FlexLine field device interface

To configure Interface Summary and Interface Object Parameters

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Interface Summary** and **Interface Object Parameters**.

3. Under **Interface Summary**, enter the following read/write parameter details.
   a) **Name -** Type the required name for the channel.
   b) **Description -** Type the required description for the channel.

4. Under **Interface Object Parameters**, the following details are displayed
   a) **FlexConn Instrument Address** - The address of the instrument for FlexConn messages.

WARNING! Each instrument must have a unique FlexConn Address

   b) **GPU Instrument Address** - The address of the instrument for GPU messages.

WARNING! Each instrument must have a unique GPU Address

   c) **CIU Address Emulation** - The status of CIU Address Emulation. **Enabled** or **Disabled**. IF CIU Address Emulation is Enabled, the device will not communicate with CIU Prime, instead it communicates directly with WDM.
   d) **CIU Instrument Address** - The CIU instrument address.
   e) **GPU Publish Record Enable** - The status of the selected GPU publish record.

6.5.2 Configure ENRAF serial interface

To access the field device data, you need to configure the Enraf interface from the OneWireless user interface.

Prerequisites

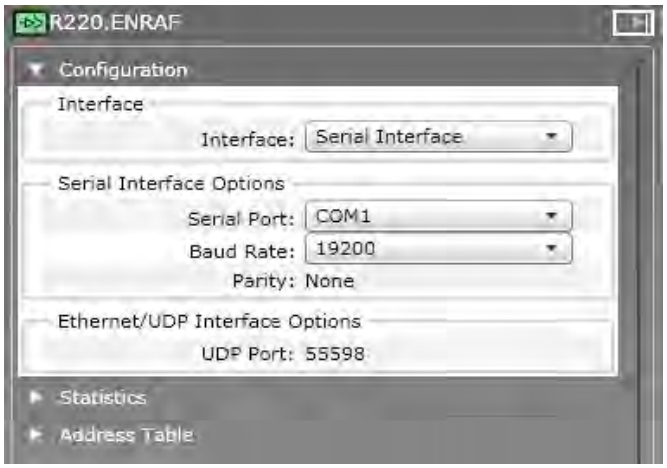
Ensure the following:

- The SmartRadar FlexLine field devices are connected to the WDM using a serial cable.
- The SmartRadar FlexLine field devices are joined in the ISA100 Wireless network.
- The GPU address and the FlexConn address configured for a SmartRadar FlexLine field devices should be unique for each device in the network.
- For more information regarding the GPU address and the FlexConn address, refer to the section 6.5.1 - Configure SmartRadar FlexLine field device interface.
- If RS-232 serial communication is required, then connect the RS-232 serial cable between the COM1 port of the WDM and the client.
- If RS-485 serial communication is required, then connect the RS-485 serial cable between the COM2 port of the WDM and the client.

To configure ENRAF serial interface

1. On the Selection Panel, expand the WDM icon and select **ENRAF**.
2. On the Property Panel, expand **Configuration** panel.

3. In the **Interface** list, click **Serial Interface**.



4. Configure the following under **Serial Interface Options**.
   - **Serial Port**: Select the serial port on which the serial cable is connected. The available options are COM1 and COM2.
   - **Baud Rate**: Select **19200** as the baud rate for ENRAF serial interface.
   - **Parity**: This is a read-only parameter and displays the value as **None**.
5. Click **Apply**.

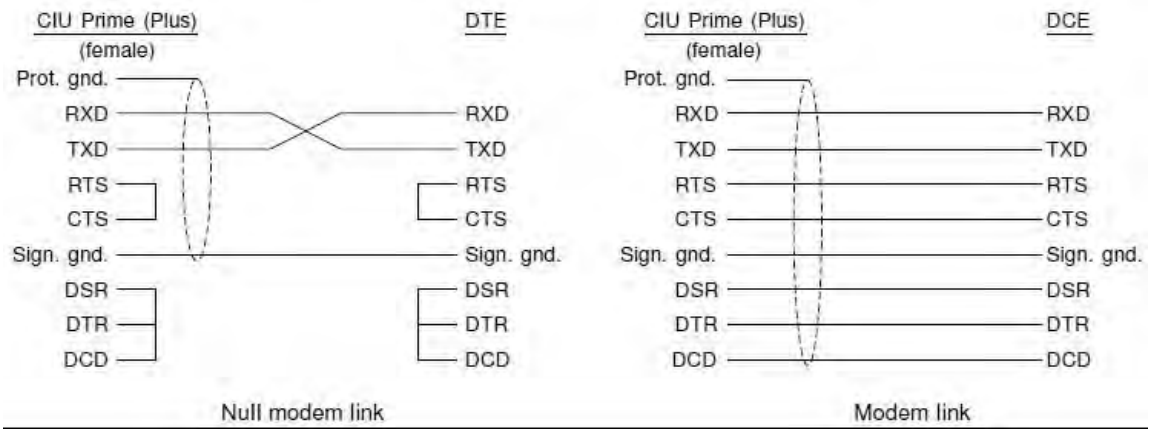
6.5.2.1 Serial interface connection

For serial interface connection, connect a serial cable from the interface client to the serial port on the WDM.

6.5.2.1.1 Rs-232

For RS-232, select the serial port on which the serial cable is connected as COM1.

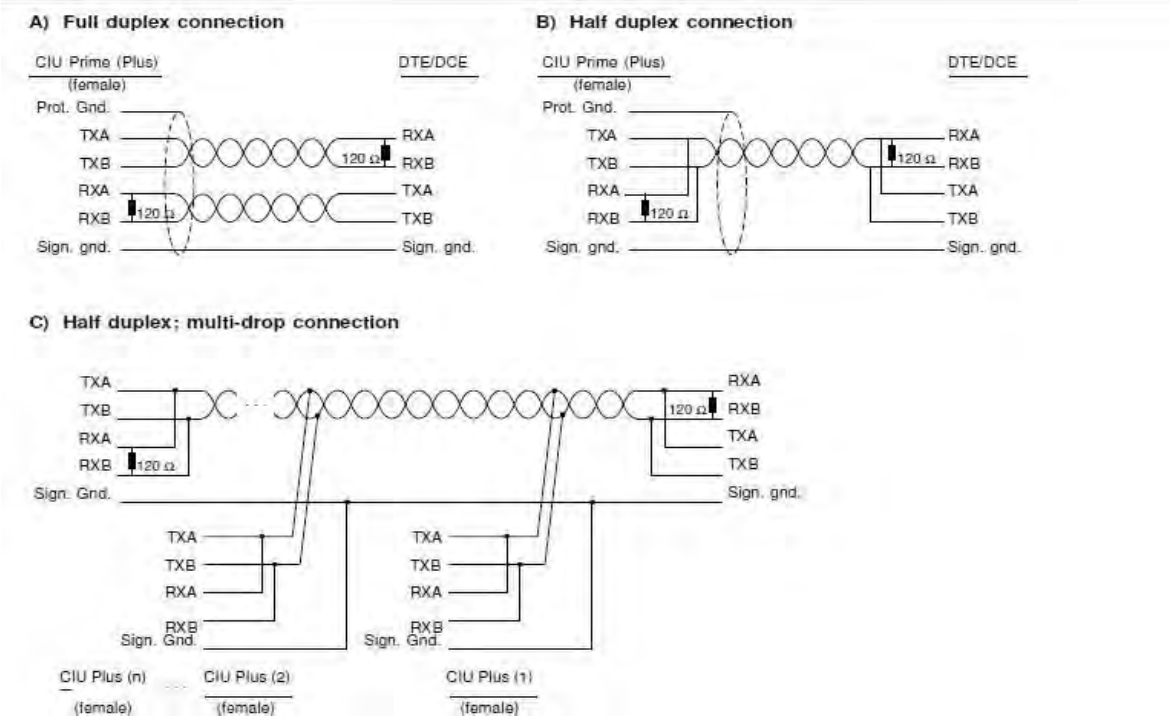
Signal Name	Pin number	
	9 pins	25 pins
Protective ground	Chassis	1
DCD	1	8
RXD	2	3
TXD	3	2
DTR	4	20
Signal ground	5	7
DSR	6	6
RTS	7	4
CTS	8	5



6.5.2.1.2 RS-485

The Modbus, HART, and SmartRadar FlexLine (ENRAF®) interfaces supports RS-485. For RS-485, select the serial port on which the serial cable is connected as COM2.

Signal Name	Pin number
	9 pins
Protective ground	Chassis
RXA	2
RXB	8
TXA	3
TXB	7
Signal ground	5



6.5.3 Configure ENRAF Ethernet/UDP interface

You can convert Ethernet/UDP interface by using a Lantronix device or a serial-to-Ethernet/UDP driver.

Following are the high-level tasks to be performed.

- Install and configure the Lantronix device.
- Assign an IP address to the Lantronix device.
- Configure the Standard Serial Tunnel firmware settings on the Lantronix device.
- Activate ENRAF Ethernet/UDP interface on the OneWireless user interface.

6.5.3.1 Install and configure the Lantronix device

Install the Lantronix DeviceInstaller software on the SmartRadar FlexLine client machine using the documentation and media packaged with the device. After installing the DeviceInstaller software, assign an IP address to the Lantronix device.

6.5.3.2 Assign IP address to the Lantronix device

Perform the following steps to assign or reassign an IP address to the Lantronix device.

To assign or reassign an IP address to the Lantronix device

1. From the **Start** menu, open **Lantronix DeviceInstaller**.
2. Click **Device** > **Assign IP Address**.
3. When prompted for device identification, enter the **MAC address** of the Lantronix device and click **Next**.

   The MAC address is located on a sticker on the side of the device.
4. When prompted for the assignment method, choose **Assign a specific IP address** to assign a static IP address to the Lantronix device and click **Next**.
5. Enter the **IP address**, **subnet mask**, and **default gateway** for the Lantronix device and click **Next**.
6. Click **Assign**.

   The device now uses the new IP address and has network access.

6.5.3.3 Configure Standard Serial Tunnel settings on the Lantronix device

Configure Standard Serial Tunnel firmware to enable it to properly tunnel SmartRadar FlexLine field device messages from the RS-232 serial port to the Ethernet port of the WDM.

To configure Standard Serial Tunnel settings on the Lantronix device

1. From the **Start** menu, open **Lantronix DeviceInstaller**.

2. In the **Lantronix Devices** tree on the left pane, select the Lantronix Xpress-DR or Lantronix Xpress-DR-IAP device name.
3. On the **Telnet Configuration** tab, click **Connect**.
4. When prompted, press **Enter** to go to the setup mode.
5. On the **Main** menu, press **1** on the keyboard to configure channel 1 and set the configuration parameters as follows:
   - Baud Rate = 19200
   - I/F Mode = 4C
   - Flow = 00
   - Port Number = 34568
   - Connect Mode = CC
   - Datagram Mode = 01

     The Remote IP Address can be entered only when the Datagram Mode is set to 01.
   - Remote IP Address = IP Address of the WDM
   - Remote Port = 55598
   - Packet Control = 00
   - Send Character 1 = 00
   - Send Character 2 = 00
6. Press **9** on the keyboard, to save and exit the **Lantronix** main menu.

CHAPTER 7 COMMISSIONING

7.1 General

7.1.1 Introduction

This chapter provides an overview of the *commissioning* information as per the FlexConn module.

NOTE: Not all modules are always present.

Commissioning a FlexConn module is performed by setting software parameters and the *entities* (see Chapter 3), to the desired specific values. This can either be performed by using *Engauge* or *SmartView* (see Chapter 4).

7.1.2 Text Conventions

In contrast with explanatory text, all instruction text is preceded by a ☛.

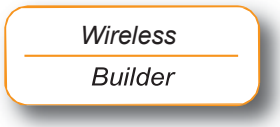
All [Entity] and <entity-related> text is recognizable formatted. When - for instance - all required FlexConn module entities are commissioned, the [Board Commissioned] entity displays <True>. If not, it displays <False>.

All !Command! text is also recognizable formatted, If - for instance - an !Activate! command is given, the result is <Activated>.

In this chapter, each *commissioning-instruction* text is recognizable by the *Engauge/SmartView icon* in the margin.

When a commissioning instruction or command *cannot* be initiated by *SmartView*, the  icon is provided.

When a commissioning instruction or command can only be initiated through SmartView, the SmartView-only button is visible (left).



In some cases the *Wireless Builder* and/or the *Key Server Manager* application(s) for R120 are used. This is indicated by a corresponding button (left).

7.2 Enraf Fieldbus (HCI-BPM)

7.2.1 Introduction

The Host Communication Instrument - Bi-Phase Mark (HCI-BPM) board is a communication module for the instrument (gauge).

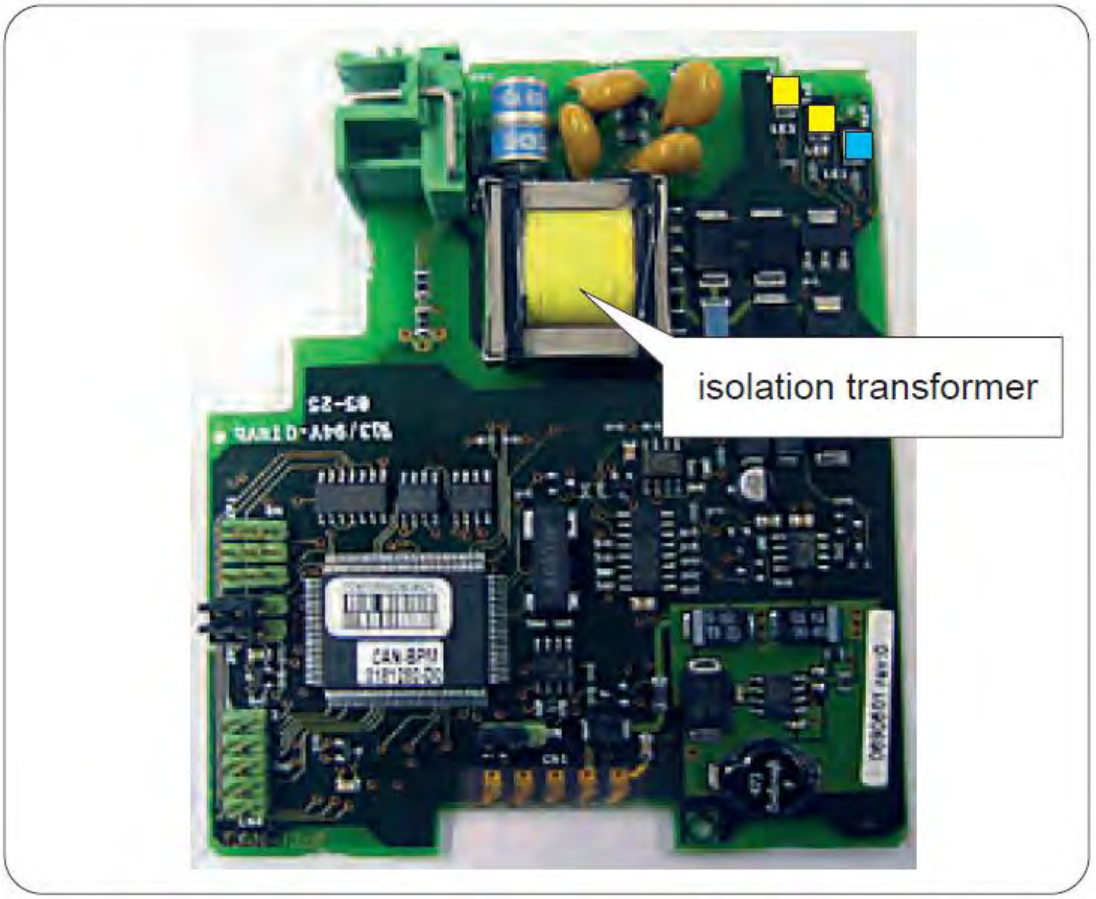


FIGURE 7-1 The HCI-BPM board with its isolation transformer

As a result of any requirements on the cable quality, the connection of 10 to 15 devices per field bus, and cable lengths up to 10 km, the Bi-Phase Mark (BPM) signaling is used in many data transmission installations between various instrumentation and Communication Interface Unit (CIU) configurations.

Also, the BPM technology provides excellent protection against lightning. For the exchange of the BPM signals, the HCI-BPM board uses an isolation transformer for galvanic isolation (see FIGURE 7-1). Further protection against heavy lightning is realized by internal ground shields, separated wiring, and ground tracks.

The HCI-BPM module supports the following two protocols

- The Enraf GPU protocol with its records and items (limited);
- The Enraf FlexConn protocol with its entities.

The module can communicate with the following:

- 880 CIU prime
- 858 CIU
- 780 SmartLink

7.2.2 Commissioning the HCI-BPM

For a correct functioning of the HCI-BPM module in an instrument (gauge), the following entities can be set by using either *Engauge* or *SmartView*.

☛ By using the following table, check each entity for correctness.

Name	Value Range	Default Value	Explanation
[Baudrate]	<1200> <2400> <4800>	<1200>	Communication speed
[BPM sensitivity] 	<1..8>	<8>	The sensitivity of the receiver circuit. 1 = weakest 8 = strongest
[Identification]	8 characters for example, <TANK1234>	<-------->	Name of a tank or instrument.
[GPU instrument address]	<0..99>	<0>	The address of this instrument for GPU messages. Note: Each instrument must have a unique GPU address.
[FlexConn instrument address]	<0..1899>	<0>	The address of this instrument for FlexConn messages. Note: Each instrument must have a unique FlexConn address.
[Level units]	<Meters> <Inches> <Feet> <Fractions>	<Meters>	The unit in which level-related GPU records and items are displayed.
[Temperature units]	<Celsius> <Fahrenheit>	<Celsius>	The unit in which temperature-related GPU records and items are displayed.

Name	Value Range	Default Value	Explanation
[Pressure units]	<pascal> <kilo pascal> <psi small> (2 digits before separator) <psi large> (3 digits before separator)	<pascal>	The unit in which pressure-related GPU records and items are displayed.
[Density units]	<kilogram m3> <degrees API> <pounds ft3>	<kilogram m3>	The unit in which density-related GPU records and items are displayed.
[Decimal separator]	<point> <comma>	<point>	The decimal separator in which GPU-related records and items are displayed.
[Level type]	<innage> <ullage>	<innage>	The level-related GPU records and items can be shown as an innage or ullage. Note: • *Innage* is the level of the product measured from the bottom. • *Ullage* is the level of free space from the roof till the product.
[Password]	<.....> 6 characters	<ENRAF2>	Password for entering the protected level. Note: Some settings reside under the protected level.
[Function identification] 	<.....> 13 characters	<BPM-slave>	The name of the current function of this module. This name is visible on the *SmartView* display.

☛ After having checked/set all before listed entities, make sure you check the following:

- The [Board Commissioned] and the [BPM slave Commissioned] entities are <True>.
- The [Board Health] and the [BPM slave Health] entities are <GOOD>.

7.3 Enraf GPU-FlexConn / Modbus Protocol (HCI-GPU)

7.3.1 Introduction

The Host Communication Instrument - Gauge Processing Unit (HCI-GPU) board is a communication module for the instrument (gauge).

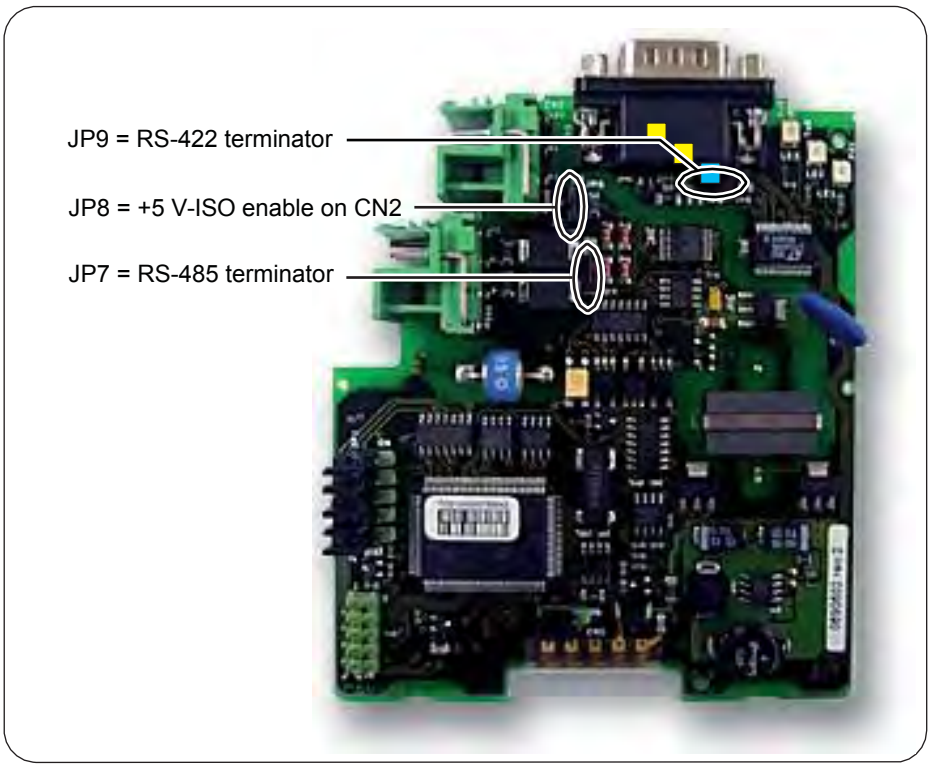


FIGURE 7-2 The HCI-GPU board

The HCI-GPU can communicate with any hosts through three different communication protocols:9

- The Enraf GPU protocol with its records and items (limited)
- The Enraf FlexConn protocol with its entities
- The Modbus protocol

In the first situation the CAN-RS module behaves similar to an Enraf GPU slave, communicating through the Enraf GPU protocol. If a valid record or item is received, a related FlexConn message type A is issued to the CAN-Bus for obtaining the desired data.

In the second situation, when production-, test-, configuration-, and service tools are used, the FlexConn protocol must be used through the RS232/485 physical layer.

In the third situation the CAN-RS module behaves similar to a Modbus slave communicating through the Modbus protocol.

NOTE: A protocol switch has been implemented to switch back and forward between the GPU-FlexConn and the Modbus protocol.

The physical layers for the communication are RS-232, isolated and non-isolated, and RS-485, isolated. RS-232 is used for direct point-to-point connections whereas RS-485 facilitates a multi-point network with up to 32 drivers and 32 receivers.

The HCI-GPU (slave) module can be used in any field devices provided with the FlexConn architecture.

The Modbus protocols can be used when the SmartRadar FlexLine interfaces to a DCS or SCADA system.

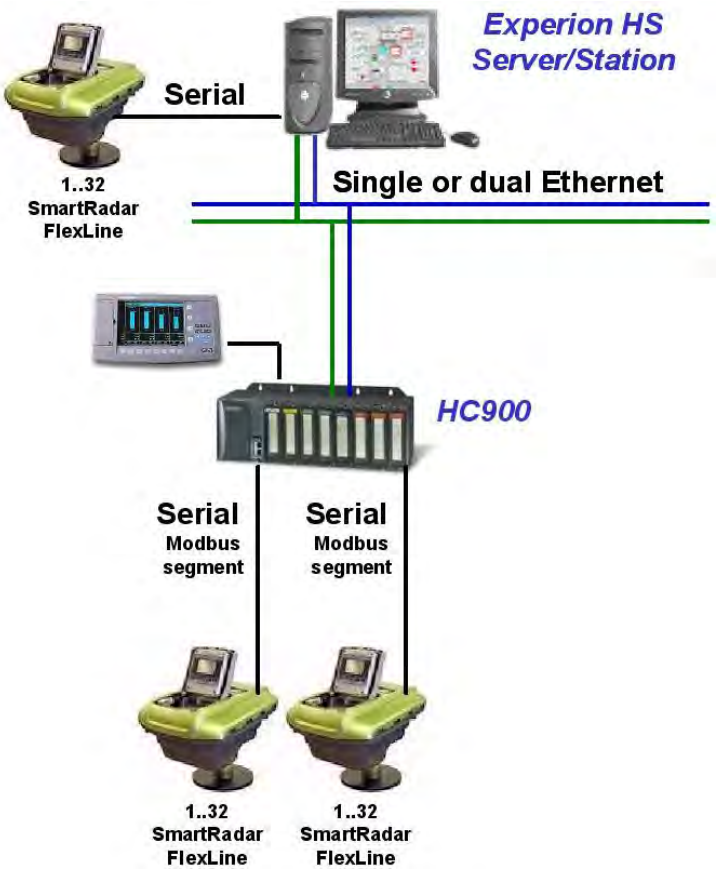


FIGURE 7-3 Typical example of a SmartRadar FlexLine in a Modbus topology

7.3.2 Specifications

- **System Specification:**
  - Typical TurnAround Delay (TAD) = 35 ms *
  - Maximum TAD = 65 ms *
  - Refresh rate of 32 FlexLines on one link = 5.76 sec * (@ scan rate of 180 ms)

- Refresh rate of 32 FlexLines on one link = 4.80 sec * (free running host mode: no scan rate setting)

- **Recommended minimum host settings:**
  - Time out >= 65 ms * (assuming time out measurement resets at start of slave message)
  - Scan rate >= 180 ms *

* Note: @ 100 register @ 19K2 baud

7.3.3 Commissioning the HCI-GPU - Modbus Protocol

7.3.3.1 Introduction

The Modbus protocol is developed by Modicon and is used to establish master-slave/client-server communication between intelligent devices. Modbus is a *de facto* open standard and the most widely used network protocol in the industrial manufacturing environment.

There are different types of Modbus. The most common is Modbus Remote Terminal Unit (RTU) which is based on serial (twisted pair) communication like RS-485 and RS-232. Honeywell Enraf has implemented this Modbus RTU protocol in its gauges as an option.

With RS-485 communication a bus structure can be built. It is possible to connect a maximum of 32 gauges (as slaves) to one host (master). Each slave has its unique address.

The host (master) initiates the communication by addressing one of the slaves in its query. Only the addressed slave (gauge) responds.

With RS-232 communication there can be only one slave (the gauge) and one master (the host).

7.3.3.2 Modbus Protocol Description

A Modbus message is placed by the transmitting device into a frame that has a known beginning and ending point. This allows receiving devices to begin at the start of the message, read the address portion and determine which device is addressed, and to know when the message is completed.

RTU mode is a binary mode of data representation. Messages start with a silent interval of at least 3.5 character times. This is easily implemented as a multiple of character times at the baud rate that is being used on the network (shown as T1T2T3T4 in next figure).

The first field then transmitted is the device address. The gauges monitor the bus continuously, including during the silent intervals. When the first byte (the address byte) is received, each gauge decodes it to find out if it is the addressed gauge.

Following the last transmitted byte, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval.

A typical message frame is shown below:

Start	Address	Function	Data	CRC check	End
T1T2T3T4	8 bits	8 bits	n * 8 bits	2 * 8 bits	T1T2T3T4

- **Start**: Synchronisation 3.5 character time elapsed.
- **Address**: The address field of a message frame contains eight bits. The address must be in the range 1 to 247 (decimal). A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.
- **Function**: The function code field of a message frame contains eight bits. **With the Modbus protocol only function code 03 (read holding registers) and function code 05 (force single coil) are supported.** When a message is sent from a master to a slave the function code field informs the slave the kind of action to perform. For a normal response, the slave simply echoes the original function code.
- **Data**: The data field is constructed using sets of two 8 bit bytes (16 bit registers). The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. The data field of a response from a slave to a master contains the requested data.
- **CRC check**: The CRC check field contains a 16-bit value implemented as two eight-bit bytes. The error check value is the result of a **C**yclical **R**edundancy **C**heck (CRC) calculation performed on the message contents. The CRC field is appended to the message as the last field in the message.
- **End**: Synchronization 3.5 character time elapsed.

7.3.3.2.1 Function Codes

- **Function code 03: Read holding registers**
  Holding registers are located in the memory range (4)0000 ... (4) FFFFH. Register values can range from 0000 to FFFFH. Depending on the use, the registers contain a value or bit coded status in single (16 bit) or double (32 bit) register signed (two=s complement) or not signed.
  - The query message specifies the starting register and quantity of registers to be read:

Slave address	Function 03	Start address	No. of registers	CRC check
8 bits	8 bits	16 bits	16 bits	16 bits

″ The register data in the response message is packed as two bytes:

Slave address	Function 03	Byte count (N)	Data	CRC check
8 bits	8 bits	8 bits	(N) x 8 bits	16 bits

″ The amount of bytes N is double the amount of requested registers, because each register occupies two bytes.

Request		Response	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	03	Function	03
Starting Address Hi	00	Byte Count	06
Starting Address Lo	6B	Register value Hi (108)	02
No. of Registers Hi	00	Register value Lo (108)	2B
No. of Registers Lo	03	Register value Hi (109)	00
		Register value Lo (109)	00
		Register value Hi (110)	00
		Register value Lo (110)	64

- **Function code 05 Write single coil**
  Coils are located in the memory range (0)0000 ... (0) FFFFH. The value of a coil can be forced to: FF00H = ON, or 0000H = OFF.

  ″ The query message specifies the coil reference to be forced:

Slave address	Function 05	Coil address	Force data	CRC check
8 bits	8 bits	16 bits	16 bits	16 bits

″ The normal response is an echo of the query, returned after the coil state has been forced:

Request		Response	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	05	Function	05
Output Address Hi	00	Output Address Hi	00
Output Address Lo	AC	Output Address Lo	AC
Output Value Hi	FF	Output Value Hi	FF
Output Value Lo	00	Output Value Lo	00

Slave address	Function 05	Coil address	Force data	CRC check
8 bits	8 bits	16 bits	16 bits	16 bits

7.3.3.3 Commissioning Notes

While commissioning, ensure the following:

- For **gauge configuration** --> FlexConn must be used.
- For **data monitoring and certain gauge commands** --> Modbus can be used.
- A changeover is done by the **protocol switch**.

Protocol switching is bound to the following:

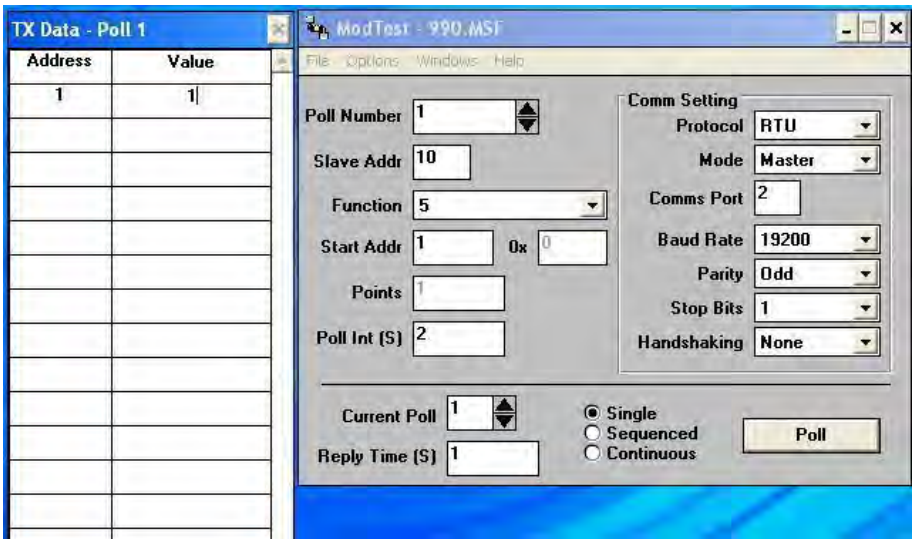
- **Engauge** only supports **GPU-FlexConn to Modbus** switching.
  Once the HCI-GPU is in Modbus mode, Engauge cannot execute any modifications as Engauge does NOT support Modbus communication.
  This scenario may be found at a first-time installation or during servicing issues.
- **SmartView** supports **both** GPU-FlexConn to Modbus and Modbus to GPU-FlexConn switching at any time, the actual protocol type being visible real time.
  Suitable on issues in the field.
- With the data monitoring the **Modbus host** can issue certain commands such as Overfill test, Reset, Alarm Test, and **Modbus to GPU-FlexConn** switching.
- It is recommended to disconnect the SmartRadar FlexLine from the Modbus communication link when using Engauge with the GPU-FlexConn protocol.

Using ...	Switching possible from ...
Engauge	GPU-FlexConn --> Modbus
SmartView	GPU-FlexConn --> Modbus
	Modbus --> GPU-FlexConn
Modbus command	Modbus --> GPU-FlexConn

For example, (with ModTest screen example of Daniel Europe Ltd. below):

To switch from Modbus to GPU-FlexConn, the following must be performed:

- Set `Function = 5; Address = 1; Value = 1.`
- Activate by pressing the `Poll` button.



7.3.3.4 Commissioning

For a correct functioning of the HCI-GPU module in an instrument (gauge), the following entities can be set by using either *Engauge* or *SmartView*.

☛ By using the following table, check each entity for correctness.

Name	Value Range	Default Value	Explanation
[FlexConn Modbus protocol switch]	<FlexConn> <Modbus>	<FlexConn-GPU>	If production-, test-, configuration-, and/or service tools are to be used, switch to the FlexConn protocol by selecting <FlexConn-GPU>.
[Baudrate]	<1200> <2400> <4800> <9600> <19200> <38400> <57600> <115200>	<19200>	Communication speed
[Turn around delay] 	<0..2000 ms>	<0 ms>	The turnaround delay is the minimum time the HCI-GPU waits, before starting to answer the host.
[Parity]	<Odd> <Even> <None>	<Odd>	User can have different parities depending on the application.
<Stopbits>	<1> <2>	<1>	
[Modbus slave address]	<1..247>	<1>	On a site there can be multiple gauges connected through the RS-485 physical link and hence different CAN-RS boards can be identified by unique slave addresses. However, note that RS-485 supports **only 32 devices** in multidrop and so must be the addresses.

Name	Value Range	Default Value	Explanation
[Modbus register address offset] 	<0x0000..0xEE00>	<0>	As per Modbus, function code 03 supports 0000 to FFFF register addressing. Considering Modbus map starting at 0x0000 and 0x1000 and keeping this constant, the offset address should be (0xFFFF - 0x1138 = 0xEEC7). For Round off number 0xEE00. Offset can be moved anywhere between 0x0000 to 0xEE00. 0x1138 is the total number of registers of both Modbus map.
[Level units]	<Feet> <Fractions> <Inches> <Meters>	<Meters>	The unit in which level-related records and items are shown.
[Temperature units]	<Celsius> <Fahrenheit>	<Celsius>	The unit in which temperature-related records and items are shown.
[Pressure units]	<Kilo Pascal> <Pascal> <psi large> <psi small>	<Pascal>	The unit in which pressure-related records and items are shown.
[Density units]	<Degrees API> <Dimension relative density at 60F> <kilogram m3> <pounds ft3>	<kilogram m3>	The unit in which density-related GPU records and items are shown.
[Communication type] 	<comm ni rs232> <comm iso rs232> <comm iso rs485>	<comm ni rs232>	Communication type *NOTE: It must be configured at the GPU slave tab of Engauge. See 7.3.3.*
[Function identification] 	<.....> 13 characters	<GPU-slave>	The name of the current function of this module. This name is visible on the *SmartView* display.
[Function priority] 			

7.3.3.5 Modbus Holding Registers

Internal values in a Modbus device are stored in holding registers. These registers are two bytes wide and can be used for various purposes. Some registers contain configuration parameters where

others are used to return measured values (temperatures and so on) to the host.

The holding registers start counting at 40001. They are addressed in the Modbus message structure with addresses starting at 0.

- **Byte order in Modbus registers**

For data type that is long and float IEEE-754, the 32 bits are divided over two 16-bits registers.

Reference:

″ Long and Floating point, IEEE-754 (little endian):

address+0	Byte 1
address+1	Byte 2
address+2	Byte 3
address+3	Byte 4

″ Long and Floating point, IEEE-754 **Modbus presentation** (big endian), the word swapped and the byte swapped:

Register x	Lo Byte 4
	Hi Byte 3
Register x+1	Lo Byte 2
	Hi Byte 1

- The first table that follows contains all gauge data in **fixed point format** starting at **0x0000**. A **scaling factor** needs to be applied here.
- The second table contains all gauge data in **floating point format** starting at **0x1000**. **No scaling** to be applied here.
  - ″ Floating point: IEEE-754
  - ″ Signed integers: two's complement

7.3.3.5.1 Fixed Point Format Gauge Data

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Scaling factor	Interpretation
1	Product Level	0x0000	SD40001	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Scaling factor	Interpretation
						FRACTIONS	divide by 16	
	ProductLevelStatus	0x0002	40003	char	1			See 7.3.3.6.1
	ProductLevelAlarms	0x0003	40004	char	1			See 7.3.3.6.13
2	Water Level	0x0004	SD40005	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
	WaterLevelStatus	0x0006	40007	char	1			See 7.3.3.6.2
3	ProductTemp	0x0007	SD40008	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
	ProductTempStatus	0x0009	40010	char	1			See 7.3.3.6.3
4	VapRoomTemp	0x000A	SD40011	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
	VapRoomTempStatus	0x000C	40013..16	byte	4			See 7.3.3.6.4
5	VapRoomPress	0x0010	SD40017	long	2	PASCAL	multiply by 100	
						KILO_PASCAL	divide by 1000	
						PSI	divide by 1000	
	VapRoomPressStatus	0x0012	40019..23	byte	5			See 7.3.3.6.5
6	ObsDensity	0x0017	SD40024	long	2	KILOGRAM_PER_M3	divide by 100	
						POUNDS_PER_FT3	divide by 10000	
						DEGREES_API	divide by 1000	
	ObsDensityStatus	0x0019	40026..30	byte	5			See 7.3.3.6.6
7	Gauge Status	0x002A	40043	byte	1			See 7.3.3.6.14
8	Spot temperature 1	0x0200	SD40513	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
9	Spot temperature 1 pos.	0x0202	SD40515	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
10	Spot temperature 2	0x0204	SD40517	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
11	Spot temperature 2 pos	0x0206	SD40519	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
12	Spot temperature 3	0x0208	SD40521	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
13	Spot temperature 3 pos.	0x020A	SD40523	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
14	Spot temperature 4	0x020C	SD40525	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Scaling factor	Interpretation
15	Spot temperature 4 pos.	0x020E	SD40527	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
16	Spot temperature 5	0x0210	SD40529	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
17	Spot temperature 5 pos.	0x0212	SD40531	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
18	Spot temperature 6	0x0214	SD40533	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
19	Spot temperature pos. 6	0x0216	SD40535	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
20	Spot temperature 7	0x0218	SD40537	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
21	Spot temperature 7 pos.	0x021A	SD40539	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
22	Spot temperature 8	0x021C	SD40541	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
23	Spot temperature 8 pos.	0x021E	SD40543	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
24	Spot temperature 9	0x0220	SD40545	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
25	Spot temperature 9 pos.	0x0222	SD40547	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
26	Spot temperature 10	0x0224	SD40549	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
27	Spot temperature 10 pos.	0x0226	SD40551	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
28	Spot temperature 11	0x0228	SD40553	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Scaling factor	Interpretation
29	Spot temperature 11 pos.	0x022A	SD40555	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
30	Spot temperature 12	0x022C	SD40557	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
31	Spot temperature 12 pos.	0x022E	SD40559	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
32	Spot temperature 13	0x0230	SD40561	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
33	Spot temperature 13 pos.	0x0232	SD40563	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
34	Spot temperature 14	0x0234	SD40565	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
35	Spot temperature 14 pos.	0x0236	SD40567	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
36	Spot temperature 15	0x0238	SD40569	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
37	Spot temperature 15 pos.	0x023A	SD40571	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
38	Spot temperature 16	0x023C	SD40573	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
39	Spot temperature 16 pos.	0x023E	SD40575	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
40	Ambient Temperature	0x0300	SD40769	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
	Ambient TemperatureStatus	0x0302	40771	integer	1			See 7.3.3.6.7
41	Product Pressure	0x0303	SD40772	long	2	PASCAL	multiply by 100	
						KILO_PASCAL	divide by 1000	
						PSI	divide by 1000	
	Product PressureStatus	0x0305	40774	byte	5			See 7.3.3.6.8

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Scaling factor	Interpretation
42	Hart Input Variable 1	0x030A	SD40779	long	2	METRES	divide by 10000	
						FEET	divide by 1000	
						INCHES	divide by 100	
						FRACTIONS	divide by 16	
	Hart Input Variable 1 Status	0x030C	40781	Integer	1			See 7.3.3.6.9
43	Hart Input Variable 2	0x030D	SD40782	long	2	CELSIUS	divide by 100	
						FAHRENHEIT	divide by 100	
	Hart Input Variable 2 Status	0x030F	40784	Integer	1			See 7.3.3.6.9
44	Hart Input Variable 3	0x0310	SD40785	long	2	PASCAL	multiply by 100	
						KILO_PASCAL	divide by 1000	
						PSI	divide by 1000	
	Hart Input Variable 3 status	0x0312	40787	Integer	1			See 7.3.3.6.9
45	Hart Input Variable 4	0x0313	SD40788	long	2	KILOGRAM_PER_M3	divide by 100	
						POUNDS_PER_FT3	divide by 10000	
						DEGREES_API	divide by 1000	
	Hart Input Variable 4 status	0x0315	40790	Integer	1			See 7.3.3.6.9
46	Hart Input Variable 5	0x0316	SD40791	long	2	Free format	divide by 100	
	Hart Input Variable 5 status	0x0318	40793	Integer	1			See 7.3.3.6.9
47	First Relay Board - Relay 1	0x0319	SD40794	long	2			
	First Relay Board - Relay 1 Status	0x031B	40796	Integer	1			See 7.3.3.6.10
48	First Relay Board - Relay 2	0x031C	SD40797	long	2			
	First Relay Board - Relay 2 Status	0x031E	40799	Integer	1			See 7.3.3.6.10
49	First Relay Board - Relay 3	0x031F	SD40800	long	2			
	First Relay Board - Relay 3 Status	0x0321	40802	Integer	1			See 7.3.3.6.10
50	First Relay Board - Relay 4	0x0322	SD40803	long	2			
	First Relay Board - Relay 4 Status	0x0324	40805	Integer	1			See 7.3.3.6.10
51	Second Relay Board - Relay 1	0x0325	SD40806	long	2			
	Second Relay Board - Relay 1 Status	0x0327	40808	Integer	1			See 7.3.3.6.10
52	Second Relay Board - Relay 2	0x0328	SD40809	long	2			

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Scaling factor	Interpretation
	Second Relay Board - Relay 2 Status	0x032A	40811	Integer	1			See 7.3.3.6.10
53	Second Relay Board - Relay 3	0x032B	SD40812	long	2			
	Second Relay Board - Relay 3 Status	0x032D	40814	Integer	1			See 7.3.3.6.10
54	Second Relay Board - Relay 4	0x032E	SD40815	long	2			
	Second Relay Board - Relay 4 Status	0x0330	40817	Integer	1			See 7.3.3.6.10
55	Overfill Protection Status First Relay Board	0x0331	40818	char	1			See 7.3.3.6.12
56	Overfill Protection Status Second Relay Board	0x0332	40819	char	1			
57	Safety ShutDown Timer Left First Relay Board	0x0333	40820	Integer	1			
58	Safety ShutDown Timer Left Second Relay Board	0x0334	40821	Integer	1			
59	Analog Output	0x0335	SD40822	long	2	N.A.	divide by 100	
	Analog OutputStatus	0x0337	40824	integer	1			See 7.3.3.6.11
60	Tank Identification	0x0338	40825	char	8	N.A.		
61	GPU Device Number	0x0340	40833	integer	1			

7.3.3.5.2 Floating Point Format Gauge Data

Par.no.	Modbus	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
1	ProductLevel	0x1000	SD44097	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
	ProductLevelStatus	0x1002	44099	char	1		See 7.3.3.6.1
	ProductLevelAlarms	0x1003	44100	char	1		See 7.3.3.6.13
2	WaterLevel	0x1004	SD44101	floating point	2	METRES	
						FEET	
						INCHES	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
						FRACTIONS	
	WaterLevelStatus	0x1006	44103	char	1		See 7.3.3.6.2
3	ProductTemp	0x1007	SD44104	floating point	2	CELSIUS	
						FAHRENHEIT	
	ProductTempStatus	0x1009	44106	char	1		See 7.3.3.6.3
4	VapRoomTemp	0x100A	SD44107	floating point	2	CELSIUS	
						FAHRENHEIT	
	VapRoomTempStatus	0x100C	44109..12	byte	4		See 7.3.3.6.4
5	VapRoomPress	0x1010	SD44113	floating point	2	PASCAL	
						KILO_PASCAL	
						PSI	
	VapRoomPressStatus	0x1012	44115..19	byte	5		See 7.3.3.6.5
6	ObsDensity	0x1017	SD44120	floating point	2	KILOGRAM_PER_M3	
						POUNDS_PER_FT3	
						DEGREES_API	
	ObsDensityStatus	0x1019	44122..26	byte	5		See 7.3.3.6.6
7	Gauge Status	0x102A	44139	byte	1		See 7.3.3.6.14
8	Spot temperature 1	0x1200	SD44609	floating point	2	CELSIUS	
						FAHRENHEIT	
9	Spot temperature 1 pos.	0x1202	SD44611	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
10	Spot temperature 2	0x1204	SD44613	floating point	2	CELSIUS	
						FAHRENHEIT	
11	Spot temperature 2 pos.	0x1206	SD44615	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
12	Spot temperature 3	0x1208	SD44617	floating point	2	CELSIUS	
						FAHRENHEIT	
13	Spot temperature 3 pos.	0x120A	SD44619	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
14	Spot temperature 4	0x120C	SD44621	floating point	2	CELSIUS	
						FAHRENHEIT	
15	Spot temperature 4 pos.	0x120E	SD44623	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
16	Spot temperature 5	0x1210	SD44625	floating point	2	CELSIUS	
						FAHRENHEIT	
17	Spot temperature 5 pos.	0x1212	SD44627	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
18	Spot temperature 6	0x1214	SD44629	floating point	2	CELSIUS	
						FAHRENHEIT	
19	Spot temperature 6 pos.	0x1216	SD44631	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
20	Spot temperature 7	0x1218	SD44633	floating point	2	CELSIUS	
						FAHRENHEIT	
21	Spot temperature 7 pos.	0x121A	SD44635	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
22	Spot temperature 8	0x121C	SD44637	floating point	2	CELSIUS	
						FAHRENHEIT	
23	Spot temperature 8 pos.	0x121E	SD44639	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
24	Spot temperature 9	0x1220	SD44641	floating point	2	CELSIUS	
						FAHRENHEIT	
25	Spot temperature 9 pos.	0x1222	SD44643	floating point	2	METRES	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
						FEET	
						INCHES	
						FRACTIONS	
26	Spot temperature 10	0x1224	SD44645	floating point	2	CELSIUS	
						FAHRENHEIT	
27	Spot temperature 10 pos.	0x1226	SD44647	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
28	Spot temperature 11	0x1228	SD44649	floating point	2	CELSIUS	
						FAHRENHEIT	
29	Spot temperature 11 pos.	0x122A	SD44651	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
30	Spot temperature 12	0x122C	SD44653	floating point	2	CELSIUS	
						FAHRENHEIT	
31	Spot temperature 12 pos.	0x122E	SD44655	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
32	Spot temperature 13	0x1230	SD44657	floating point	2	CELSIUS	
						FAHRENHEIT	
33	Spot temperature 13 pos.	0x1232	SD44659	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
34	Spot temperature 14	0x1234	SD44661	floating point	2	CELSIUS	
						FAHRENHEIT	
35	Spot temperature 14 pos.	0x1236	SD44663	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
36	Spot temperature 15	0x1238	SD44665	floating point	2	CELSIUS	
						FAHRENHEIT	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
37	Spot temperature 15 pos.	0x123A	SD44667	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
38	Spot temperature 16	0x123C	SD44669	floating point	2	CELSIUS	
						FAHRENHEIT	
39	Spot temperature 16 pos.	0x123E	SD44671	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
40	Ambient Temperature	0x1300	SD44865	floating point	2	CELSIUS	
						FAHRENHEIT	
	Ambient TemperatureStatus	0x1302	44867	integer	1		See 7.3.3.6.7
41	Product Pressure	0x1303	SD44868	floating point	2	PASCAL	
						KILO_PASCAL	
						PSI	
	Product Pressure Status	0x1305	44870	byte	5		See 7.3.3.6.5
42	Hart Input Variable 1	0x130A	SD44875	floating point	2	METRES	
						FEET	
						INCHES	
						FRACTIONS	
	Hart Input Variable 1 Status	0x130C	44877	Integer	1		See 7.3.3.6.9
43	Hart Input Variable 2	0x130D	SD44878	floating point	2	CELSIUS	
						FAHRENHEIT	
	Hart Input Variable 2 Status	0x130F	44880	Integer	1		See 7.3.3.6.9
44	Hart Input Variable 3	0x1310	SD44881	floating point	2	PASCAL	
						KILO_PASCAL	
						PSI	
	Hart Input Variable 3 status	0x1312	44883	Integer	1		See 7.3.3.6.9
45	Hart Input Variable 4	0x1313	SD44884	floating point	2	KILOGRAM_PER_M3	
						POUNDS_PER_FT3	
						DEGREES_API	

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
	Hart Input Variable 4 status	0x1315	44886	Integer	1		See 7.3.3.6.9
46	Hart Input Variable 5	0x1316	SD44887	floating point	2	Free format	
	Hart Input Variable 5 status	0x1318	44889	Integer	1		See 7.3.3.6.9
47	First Relay Board - Relay 1	0x1319	SD44890	floating point	2		
	First Relay Board - Relay 1 Status	0x131B	44892	Integer	1		See 7.3.3.6.10
48	First Relay Board - Relay 2	0x131C	SD44893	floating point	2		
	First Relay Board - Relay 2 Status	0x131E	44895	Integer	1		See 7.3.3.6.10
49	First Relay Board - Relay 3	0x131F	SD44896	floating point	2		
	First Relay Board - Relay 3 Status	0x1321	44898	Integer	1		See 7.3.3.6.10
50	First Relay Board - Relay 4	0x1322	SD44899	floating point	2		
	First Relay Board - Relay 4 Status	0x1324	44901	Integer	1		See 7.3.3.6.10
51	Second Relay Board - Relay 1	0x1325	SD44902	floating point	2		
	Second Relay Board - Relay 1 Status	0x1327	44904	Integer	1		See 7.3.3.6.10
52	Second Relay Board - Relay 2	0x1328	SD44905	floating point	2		
	Second Relay Board - Relay 2 Status	0x132A	44907	Integer	1		See 7.3.3.6.10
53	Second Relay Board - Relay 3	0x132B	SD44908	floating point	2		
	Second Relay Board - Relay 3 Status	0x132D	44910	Integer	1		See 7.3.3.6.10
54	Second Relay Board - Relay 4	0x132E	SD44911	floating point	2		
	Second Relay Board - Relay 4 Status	0x1330	44913	Integer	1		See 7.3.3.6.10
55	Overfill Protection Status First Relay Board	0x1331	44914	char	1		See 7.3.3.6.12
56	Overfill Protection Status Second Relay Board	0x1332	44915	char	1		See 7.3.3.6.12
57	Safety Shutdown Timer Left First Relay Board	0x1333	44916	Integer	1		
58	Safety Shutdown Timer Left Second Relay Board	0x1334	44917	Integer	1		
59	Analog Output	0x1335	SD44918	floating point	2	N.A.	
	Analog Output Status	0x1337	44920	integer	1		See 7.3.3.6.11

Par.no.	Modbus parameter	Modbus address (hex)	Modbus Address (dec)	Data type	No. of registers	Conversion units	Interpretation
60	Tank Identification	0x1338	44921	char	8	N.A.	
61	GPU Device Number	0x1340	44929	integer	1		

7.3.3.6 Status Information

After being requested by the host, the slave returns the relevant status information. The following tables provide the possible received status bytes from the relevant registers, such as product level, product temperature and so on.

For a listing of ASCII codes, see 7.3.4 - Standard ASCII codes.

7.3.3.6.1 Product Level

This register contains the bit-coded product level status. This status information is coded such that an ASCII code for a character is generated. The ASCII characters are listed below.

Product Level status	Meaning
F	invalid level data
C	out of measuring range
B	measurement blocked
M	warning
?	reduced accuracy
-	valid product level

7.3.3.6.2 Water Level

This register contains the bit-coded water level status. This status information is coded such that an ASCII code for a character is generated. The ASCII characters are listed below.

Water Level status	Meaning
F	invalid water alarm data
A	water above probe warning
Z	water below probe warning
-	valid water level

7.3.3.6.3 Product Temperature

This register contains the bit-coded product temperature status. This status information is coded such that an ASCII code for a character is generated. The ASCII characters are listed below.

Product Temperature status	Meaning
F	invalid temperature alarm data
T	reduced accuracy
-	valid data

7.3.3.6.4 Vapor Room Temperature

Four registers contain the bit-coded Vapor room temperature status. With exception of the first register, the status information is coded such that an ASCII code for a character is generated. The 8-bits ASCII coded character is placed in the Low byte of the register; the High byte remains empty (zero).

Vapor Room Temperature status	Meaning
0	Indicates the highest immersed (spot) element of the temperature element
1	bit 0 - General temperature fail 1 - Fail in average product temperature 2 - Fail in average Vapor temperature 3 - Level exceeds lowest (spot)element 4 - Level exceeds highest (spot)element 5 - (Spot)element fail 6 - one 7 - zero
2	bit 0 - Last valid level used 1 - Manual level used 2 - Level time out 3 - Device not calibrated (MTT) 4 - Exceeding differential temp. range (MTT) 5 - Out of specified temperature range 6 - one 7 - zero
3	bit 0 - No previous store command 1 - Alternative element selected (MRT) 2-5 - zero 6 - one 7 - zero

7.3.3.6.5 Vapor Room Pressure

Five registers contain the bit-coded Vapor room pressure and observed density status. The status information is coded such that an ASCII code for a character is generated. The 8-bits ASCII coded

character is placed in the Low byte of the register; the High byte remains empty (zero).

Vapor Room Pressure status	Meaning
0	bit 0 - General option board fail 1 - Low level alarm 2 - Low low level alarm 3 - High level alarm 4 - High high level alarm 5 - Level time out 6 - one 7 - zero
1	bit 0 - P1 exceeds min. / max. trip pressure 1 - P2 exceeds min. / max. trip pressure 2 - P3 exceeds min. / max. trip pressure 3 - Exceeding range P1 4 - Exceeding range P2 5 - Exceeding range P3 6 - one 7 - zero
2	bit 0 - Fail P1 1 - Fail P2 2 - Fail P1 3 - Manual P3 used 4 - Last valid P3 used 5 - Manual level used 6 - one 7 - zero
3	bit 0 - Last valid density used 1 - Manual density used 2 - High density alarm 3 - Low density used 4 - HTG level fail 5 - No previous store command 6 - one 7 - zero
4	bit 0 - Manual gas density used 1 - Level below LN 2 - Last valid level used 3 - Invalid level reading 4 - API underflow/overflow or negative density 5 - zero 6 - one 7 - zero

7.3.3.6.6 Observed Density

See 7.3.3.6.5 - Vapor Room Pressure.

7.3.3.6.7 Ambient Temperature

Health status code	Meaning
2561	LOWEST_ELEMENT_OFFSET_NOT_COMMISSIONED
2562	MRT_ELEMENT_LENGTH_NOT_COMMISSIONED
2563	MEASUREMENT_TYPE_NOT_COMMISSIONED
2564	ELEMENT_TYPE_NOT_COMMISSIONED
2565	NUMBER_OF_ELEMENTS_NOT_COMMISSIONED
2566	SECOND_ELEMENT_OFFSET_NOT_COMMISSIONED
2567	SENSOR_LENGTH_NOT_COMMISSIONED
2568	RTD_ELEMENT_POSITION_NOT_COMMISSIONED
2569	RTD_CONFIGURATION_NOT_COMMISSIONED
2570	MULTI_ELEMENT_OPTION_NOT_COMMISSIONED
2571	DYNAMIC_EXCLUSION_NR_OF_ELEMENTS_NOT_COMMISSIONED
2572	LOW_ELEMENT_USAGE_MEASUREMENT_TYPE_NOT_COMMISIONED
2573	TEMPERATURE_ELEMENT_EXCLUDE_ZONE_NOT_COMMISSIONED
2574	SMOOTHING_LEVEL_NOT_COMMISSIONED
2575	R_ELEMENT_SHORTCUT
2576	R_ELEMENT_NOT_CONNECTED
2577	T_ELEMENT_OUT_OF_RANGE
2578	ELEMENT_IN_WATER
2579	ELEMENT_FAIL
2580	NO_VALID_PRODUCT_LEVEL
2581	ELEMENT_SKIPPING
2582	NO_RELEVANT_ELEMENTS
2583	LEVEL_BELOW_LOWEST_ELEMENT
2584	NO_LAST_VALID_VALUE_AVAILABLE
2585	LEVEL_BELOW_TEMP_EXCLUDE_ZONE
2586	LEVEL_IN_TEMP_EXCLUDE_ZONE
2587	R_CABLE_OUT_OF_LIMITS
2588	R_TEST_OUT_OF_LIMITS
2589	VCC1_OUT_OF_LIMITS
2590	R_ELEMENT_INVALID_VALUE
2591	VOLTAGE_MON_PRIMARY_CIRCUIT_LO_LIM_EXCEEDED
2592	VOLTAGE_MON_PRIMARY_CIRCUIT_HI_LIM_EXCEEDED
2593	PROBE_RANGE_NOT_COMMISSIONED
2594	PROBE_OUT_OF_WNM_RANGE

Health status code	Meaning
2596	PRODUCT_LEVEL_NO_STATUS_CATEGORY_GOOD_ACTUAL

7.3.3.6.8 Product Pressure

See 7.3.3.6.5 - Vapor Room Pressure.

7.3.3.6.9 HART variable

Health status code	Meaning
1536	MORE_STATUS_AVAILABLE
1537	PV_OUT_OF_LIMITS
1538	SV_OR_TV_OUT_OF_LIMITS
1539	DEVICE_MALFUNCTION
1540	WRONG_PV_UNIT_CODE
1541	SCAN_INITIALIZING
1542	PRODUCT_LEVEL_SCAN_ERROR
1543	P1_NOT_INSTALLED
1544	P3_NOT_INSTALLED
1545	NO_P1_AVAILABLE
1546	NO_P3_AVAILABLE
1547	UNCERTAIN_P1
1548	UNCERTAIN_P3
1549	MANUAL_P1_USED
1550	MANUAL_P3_USED
1551	LAST_VALID_P3_USED
1552	NO_MANUAL_OR_LAST_VALID_P3
1553	NO_PRODUCT_LEVEL_AVAILABLE
1554	UNCERTAIN_PRODUCT_LEVEL
1555	PRODUCT_LEVEL_BELOW_MINIMUM_HIMS
1556	LAST_VALID_PRODUCT_LEVEL_USED
1557	MANUAL_PRODUCT_LEVEL_USED
1558	NO_WATER_LEVEL_AVAILABLE
1559	UNCERTAIN_WATER_LEVEL
1560	LAST_VALID_WATER_LEVEL_USED
1561	WATER_LEVEL_ABOVE_P1

Health status code	Meaning
1562	NEGATIVE_DENSITY_CALCULATED
1563	NO_MANUAL_OR_LAST_VALID_DENSITY
1564	MANUAL_WATER_LEVEL_USED
1565	DENSITY_OPTION_NOT_ENABLED
1566	P1_ERROR
1567	P3_ERROR
1568	G1_ERROR
1569	G2_ERROR
1570	G3_ERROR
1571	G4_ERROR
1572	G5_ERROR
1573	DENSITY_ERROR
1574	P1_UNCERTAIN
1575	P3_UNCERTAIN
1576	G1_UNCERTAIN
1577	G2_UNCERTAIN
1578	G3_UNCERTAIN
1579	G4_UNCERTAIN
1580	G5_UNCERTAIN
1581	DENSITY_UNCERTAIN
1582	TOO_MANY_HART_DEVICES_DETECTED
1583	WATER_LEVEL_SCAN_ERROR

7.3.3.6.10 Relay

Health status code	Meaning
2305	RELAY_TEST_FAILED
2307	PV_SCAN_VALUE_BAD
2308	PV_SCAN_VALUE_UNCERTAIN
2309	INVALID_MESSAGE_LENGTH
2310	NACK_CODE_RECEIVED
2311	ERROR_REQUESTING_ENTITY
2312	NO_BOARD_AVAILABLE
2313	ERROR_RELAY_1
2314	ERROR_RELAY_2
2315	ERROR_RELAY_3
2316	ERROR_RELAY_4
2317	LICENSE_NOT_SET
2318	REDUNDANT_BOARD_ERROR
2319	XBAND_OVERFILL_DISABLED
2320	NOT_COMMISSIONED
2321	BOARD_HEALTH_BAD
2322	REDUNDANT_BOARD_HEALTH_BAD
2323	REDUNDANT_BOARD_COM_FAIL
2324	SAFETY_TIMER_EXPIRED
2325	COMMISSIONING_MISMATCH
2326	RELAY_MODE_NOT_COMMISSIONED
2327	XBAND_BOARD_MISSING
2328	XBAND_LEVEL_BAD
2329	ALARM_MODE_NOT_COMMISSIONED
2330	MONITOR_BOARD_PARAMETERS_NOT_COMMISSIONED

7.3.3.6.11 Analog Output

Health status code	Meaning
2817	CALIBRATION_SET_POINTS_NOT_CALIBARTED
2818	POLLING_ADDRESS_SET_TO_NON_ZERO
2819	DAC_READ_BACK_FAIL
2820	AO_INITIALIZING
2821	BURNOUT_VALUE_OUT_OF_RANGE
2822	ANAOUT_FIXED_AT_4MA
2823	MULTI_DROP_MODE
2824	TUNNEL_FAILED_IN_GETTING_AN_ENTITY
2825	TUNNEL_FAILED_IN_PUTTING_AN_ENTITY
2826	UNITS_NOT_SELECTED
2827	LINKED_PV_NOT_SET
2828	LINKED_SV_NOT_SET
2829	LINKED_TV_NOT_SET
2830	LINKED_QV_NOT_SET
2831	PV_UNIT_CODE_NOT_SELECTED
2832	RANGE_VALUES_NOT_SELECTED
2833	PV_OUT_OF_LIMITS
2834	UPPER_TRANSDUCER_LIMIT_NOT_SET
2835	TRANSDUCER_SERIAL_NUMBER_NOT_SET
2836	UNABLE_TO_GET_LINKED_VARIABLE
2837	UPPER_RANGE_VALUE_GREATER_THAN_UPPER_TRANSDUCER_LIMIT
2838	LOWER_RANGE_VALUE_LESS_THAN_LOWER_TRANSDUCER_LIMIT

7.3.3.6.12 Overfill Protection Status

For a listing of ASCII codes, see 7.3.4 - Standard ASCII codes.

Overfill Protection status	Meaning
O	Overfill
W	Warning
H	Healthy

7.3.3.6.13 Alarms

Product Level Alarm status	Meaning
0	no alarm
1	Low level product alarm tripped
2	High level product alarm tripped
3	Low low level product alarm tripped
4	High high level product alarm tripped
255	alarm failure

7.3.3.6.14 Gauge Status

The following table lists the Gauge status information and the description.

Gauge status (decimal)	Meaning
0	Level gauge is measuring level
255	Level gauge is in failure

7.3.3.7 Modbus Coils

The following table lists Modbus commands and their related addresses (coils) and data.

Modbus command	Modbus address (hex)	Modbus address (dec)	Data	Number of registers
FlexConn Modbus Protocol Switch	0x00	00001	0xFF00	1
Reset Device	0x10	00017	0xFF00	1
Product Level Alarm Test Hi Hi	0x11	00018	0xFF00	1
Product Level Alarm Test Hi	0x12	00019	0xFF00	1
Product Level Alarm Test Lo	0x13	00020	0xFF00	1
Product Level Alarm Test Lo Lo	0x14	00021	0xFF00	1
Start Proof Test First Relay Board	0x15	00022	0xFF00	1
Stop Proof Test First Relay Board	0x16	00023	0xFF00	1
Start Proof Test Second Relay Board	0x17	00024	0xFF00	1
Stop Proof Test Second Relay Board	0x18	00025	0xFF00	1

NOTE: Coils are names for memory addresses. Also, coils are pre-defined variable names. A coil is a boolean (bit) variable, and a register is an integer (word) variable.

7.3.3.8 Modbus Exception Handling

When a Modbus master device sends a request to a FlexLine device, it expects a normal response. One of four possible events can occur from the master's query:

- If the FlexLine device receives the request without a communication error, and can handle the query normally, it returns a normal response.
- If the FlexLine device does not receive the request due to a communication error, no response is returned. The master program eventually processes a timeout condition for the request. Typically 2 retries are carried out before going into fail.
- If the FlexLine device receives the request, but detects a communication error (parity, LRC, CRC), no response is returned. The master program eventually processes a timeout condition for the request.
- If the FlexLine device receives the request without a communication error, but cannot handle it (for example, if the request is to read a non–existent output or register), the FlexLine device will return an exception response informing the master of the nature of the error.

The exception-response message has two fields that differentiate it from a normal response:

- **Function** code field:
  In a normal response, the FlexLine device echoes the function code of the original request in the function code field of the response. All function codes have a most–significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the FlexLine device sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.
  With the function code's MSB set, the master's application program can recognize the exception response and can examine the data field for the exception code.
- **Data** field:
  In a normal response, the FlexLine device may return data or statistics in the data field (any information that was requested in the request). In an exception response, the FlexLine device returns an exception code in the data field. This defines the FlexLine device condition that caused the exception.

Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the FlexLine device. This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the FlexLine device is in the wrong state to process a request of this type, for example, because it is unconfigured and is being asked to return register values.

Code	Name	Meaning
02	Illegal Data Address	The data address received in the query is not an allowable address for the FlexLine device. More specifically, the combination of reference number and transfer length is invalid.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for FlexLine device.

7.3.4 Standard ASCII codes

Dec	Oct	Hex	Binair	Code	Dec	Oct	Hex	Binair	Code	Dec	Oct	Hex	Binair	Code
32	040	20	0100000	SP	64	100	40	1000000	@	96	140	60	1100000	`
33	041	21	0100001	!	65	101	41	1000001	A	97	141	61	1100001	a
34	042	22	0100010	"	66	102	42	1000010	B	98	142	62	1100010	b
35	043	23	0100011	#	67	103	43	1000011	C	99	143	63	1100011	c
36	044	24	0100100	$	68	104	44	1000100	D	100	144	64	1100100	d
37	045	25	0100101	%	69	105	45	1000101	E	101	145	65	1100101	e
38	046	26	0100110	&	70	106	46	1000110	F	102	146	66	1100110	f
39	047	27	0100111	'	71	107	47	1000111	G	103	147	67	1100111	g
40	050	28	0101000	(	72	110	48	1001000	H	104	150	68	1101000	h
41	051	29	0101001	)	73	111	49	1001001	I	105	151	69	1101001	i
42	052	2A	0101010	*	74	112	4A	1001010	J	106	152	6A	1101010	j
43	053	2B	0101011	+	75	113	4B	1001011	K	107	153	6B	1101011	k
44	054	2C	0101100	,	76	114	4C	1001100	L	108	154	6C	1101100	l
45	055	2D	0101101	-	77	115	4D	1001101	M	109	155	6D	1101101	m
46	056	2E	0101110	.	78	116	4E	1001110	N	110	156	6E	1101110	n
47	057	2F	0101111	/	79	117	4F	1001111	O	111	157	6F	1101111	o
48	060	30	0110000	0	80	120	50	1010000	P	112	160	70	1110000	p
49	061	31	0110001	1	81	121	51	1010001	Q	113	161	71	1110001	q
50	062	32	0110010	2	82	122	52	1010010	R	114	162	72	1110010	r
51	063	33	0110011	3	83	123	53	1010011	S	115	163	73	1110011	s
52	064	34	0110100	4	84	124	54	1010100	T	116	164	74	1110100	t
53	065	35	0110101	5	85	125	55	1010101	U	117	165	75	1110101	u
54	066	36	0110110	6	86	126	56	1010110	V	118	166	76	1110110	v
55	067	37	0110111	7	87	127	57	1010111	W	119	167	77	1110111	w
56	070	38	0111000	8	88	130	58	1011000	X	120	170	78	1111000	x
57	071	39	0111001	9	89	131	59	1011001	Y	121	171	79	1111001	y
58	072	3A	0111010	:	90	132	5A	1011010	Z	122	172	7A	1111010	z
59	073	3B	0111011	;	91	133	5B	1011011	[	123	173	7B	1111011	{
60	074	3C	0111100	<	92	134	5C	1011100	\	124	174	7C	1111100	|
61	075	3D	0111101	=	93	135	5D	1011101	]	125	175	7D	1111101	}
62	076	3E	0111110	>	94	136	5E	1011110	^	126	176	7E	1111110	~
63	077	3F	0111111	?	95	137	5F	1011111	_	127	177	7F	1111111	**DEL**

7.4 The OneWireless Communication Option (HCI-1WL) - Double slot (for R120)

7.4.1 Introduction

The Host Communication Instrument OneWireless (HCI-1WL) board is a communication module for the instrument (gauge).

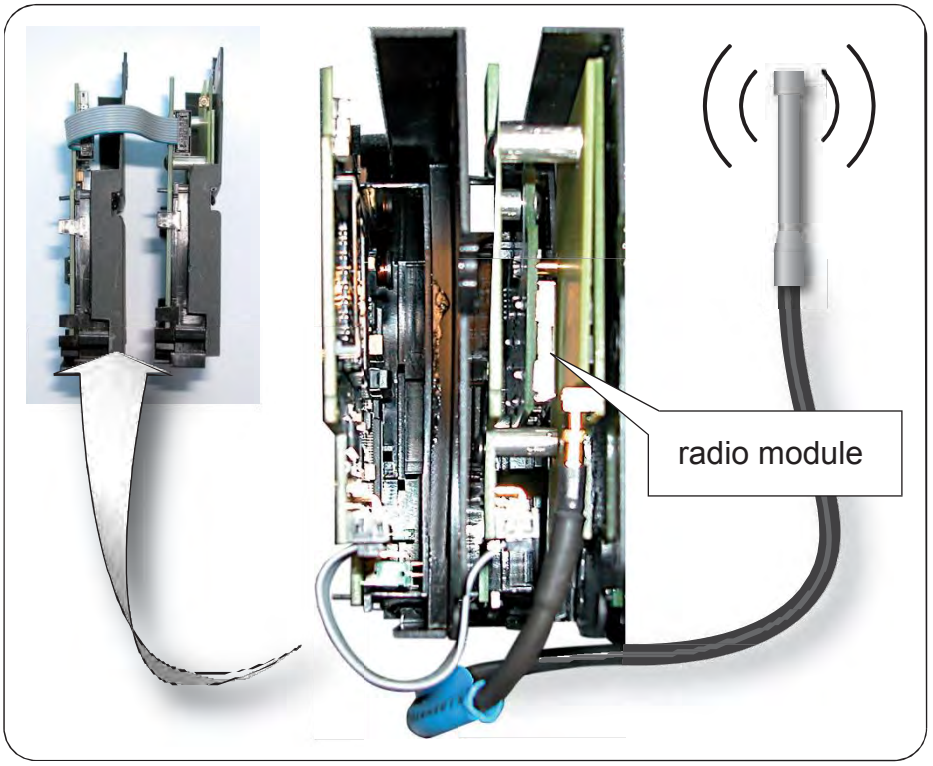


FIGURE 7-4 The HCI-1WL duplex board with flat cable interconnection

This module consists of two boards (see FIGURE 7-6): a standard FlexConn board with a memory-card interface, and an interface board with a standard Honeywell OneWireless Radio board attached. If this wireless communication option is installed, the Instrument (gauge) can communicate with a host system using the OneWireless network through three different ways:

- Directly through the OneWireless Network (using the HCI-1WL board).
- By using a *protocol tunnel* through the OneWireless network:
  - Through the Enraf FlexConn protocol.
  - Through the Enraf GPU protocol.

OneWireless is an all digital, two-way communication mesh network that interconnects industrial field sensors to a central system.

OneWireless has defined standards to which field devices and operator stations communicate with one another. The communications protocol is built as an "open system" to allow all field devices and equipment that are built to the OneWireless standard to be integrated into a system, regardless of the device manufacturer. This interoperability of devices using OneWireless technology is to become an industry standard for automation systems.

In the OneWireless network, devices like the SmartRadar FlexLine publish their measuring values autonomously at the network. Through an OPC server connected to gateway(s), the data is made available for further use.

The Honeywell Enraf GPU and FlexConn protocols are implemented for communication with Honeywell Enraf Tank Inventory Software systems. For example, Entis Pro, Entis XL, and Entis XS. Additionally, these protocols enable communication with configuration and diagnostic tools such as *Engauge*. These protocols are implemented in the same way as in the HCI-GPU and HCI-BPM. Therefore, they only support the same limited set of GPU records and items.

7.4.2 Potential Electrostatic Charging Hazard

WARNING! Do NOT wipe the surface of the antenna with dry cloth, and do NOT clean its surface with a solvent.

If electrostatically charged, discharge the antenna surface to a person or a tool that could ignite a surrounding hazardous atmosphere.

7.4.3 Adding a Radar to the OneWireless Network

7.4.3.1 Introduction

Before a radar is visible in the OneWireless network, it must be supplied with a correct network security key, so it is allowed to join the protected wireless network.

You must be properly trained in Honeywell OneWireless solutions before adding the SmartRadar in a OneWireless network. To establish communication with the OneWireless network the *Key Server Manage*r and *Wireless Builder (R120 or later)* tools are required. Refer to the respective manuals for details.

*CAUTION! **France** restricts outdoor use to 10mW (10 dBm) EIRP in the frequency range of 2,454-2,483.5 MHz. Installations in France must limit EIRP to 10 dBm for operating modes utilizing frequencies in the range of 2,454 – 2,483.5MHz. For this reason, Honeywell Enraf does not recommend configuring frequency hopping modes that use this frequency range.*

For installations in France, use only the following OneWireless Frequency Hopping (FH) Mode Selections: *EU Channel #1, EU Channel #7, NA/EU Guard Bands and NA/EU Channel 3 (FH Mode selections #4, 5, 8 and 10).*

7.4.3.2 Preparing the Radar

Before adding a radar to a one wireless network, old security information must be removed from the radar. To prevent this from happening by accident, this functionality is only available through the *SmartView*. To erase the security information:

1. Go to [Menu] > [Commands]
2. Enter the password
3. Go to the HCI-1WL
4. Select [Board] and issue the [Restore Default] command.

7.4.3.3 Authentication

1. Ensure the OneWireless Network is operational, including running Key Server Manager (KSM) software, and at least 1 multi-node configured as gateway.
2. Use the KSM to write security information to a memory card. See the Key Server Manager manual for instructions on how to use the key server. For a sample screen, see FIGURE 7-5.
3. Insert the memory card into the memory card slot of the HCI-1WL device.
4. Make sure to fully close the device if it is installed in an explosion hazardous area.
5. Switch on the device

The device will now automatically join the OneWireless network.

You can follow the authentication/joining process by navigating to the correct page on the *SmartView*, see 7.5.7.1. Or by using *Engauge*, see 7.5.8.1, if there is also a wired connection available.

If the message [NOREDUN] or [CONNECT] does NOT become visible, the authentication failed.

☛ If authentication failed, verify that the wireless network is operating correctly, and try again with a new security key.

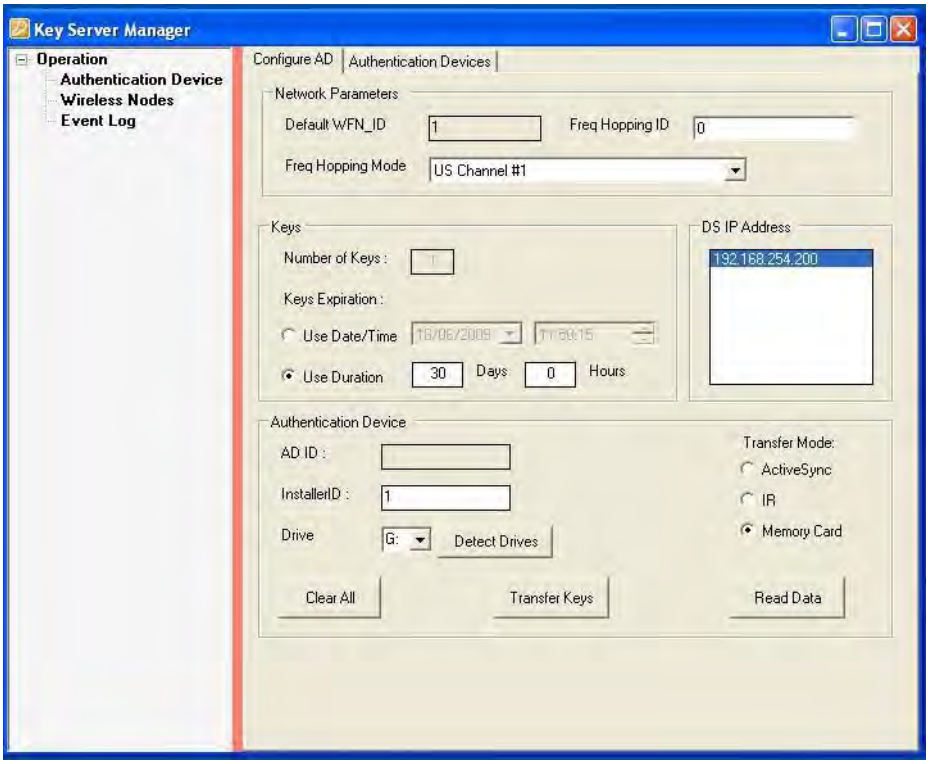


FIGURE 7-5 Sample screen of the Key Server Manager

7.4.4 Removing a Radar from the OneWireless Network

To remove a radar from a OneWireless Network, the security key information must be removed from the radar. To prevent this from happening by accident, this functionality is only available through the *SmartView*.

To erase the security key information:

1. Go to [Menu] > [Commands]
2. Enter the password
3. Go to the HCI-1WL
4. Select [Board] and issue the [Restore Default] command.

7.4.5 Commissioning the HCI-1WL in the OneWireless Network for R120

7.4.5.1 Introduction

When the authentication process is completed, the SmartRadar can be commissioned in the OneWireless network.

Before you continue with this step, ***familiarize yourself with the Wireless Builder configuration tool*** for the OneWireless network. For a detailed operation guide for the Wireless Builder, Refer to the ***OneWireless Wireless Builder User's Guide, R120***.

With the Wireless Builder you can create, delete, commission, load, and unload the SmartRadar just like any other OneWireless devices. You can also activate and inactivate transducer blocks, and program the different parameters, such as publication period, as with any other devices.

Once the Authentication process has been successfully completed, the SmartRadar automatically is listed in the *Online* window of Wireless Builder as an *un-commissioned device*.

Right-click the device to commission it as described in the Wireless Builder manual.

By default, the SmartRadar contains *one transducer block, Radar Level*.

More transducer blocks can be added, during further commissioning.

7.4.5.2 Transducer Blocks for R120

7.4.5.2.1 Introduction

Besides the Radar Level transducer block, up to 16 additional transducer blocks can be added to the device through the Wireless Builder. This can easily be performed by using the *"drag and drop"* method.

The specific parameters for all the available transducer blocks can be set through the Wireless Builder. This section describes the procedures to use the Configuration Form to configure the transducer blocks (channels).

Refer to the *Configuring Channels* chapter in the OneWireless manual for more information. ***This Transducer Blocks section only explains the additional or non-standard items.***

7.4.5.2.2 Adding Transducer Blocks

To configure each channel, you must add transducer blocks to this device.

Wireless Builder

☛ Expand the device template in the *Library* tree (click +), to view all the available transducer blocks.

☛ Drag and drop the transducer block(s) that must be instantiated (= made concrete) from the Library tree to the device in the *Offline* tree.

NOTE: Each transducer block can only be added to the instrument ***once****.*

☛ After adding the relevant transducer block(s), load the device to *activate* the transducer blocks.

NOTE: Refer to the Block instantiation in the OneWireless Wireless builder User's Guide for more information.

The following additional transducer blocks are available.

Transducer Block	See section
Product level	-
Ambient temp	-
Average product temperature	-
Configurable Transducer block 1 Configurable Transducer block 2	7.4.5.2.5
Configurable Transducer block 3 Configurable Transducer block 4	
Observed Density	-
Product pressure	-

Transducer Block	See section
Relay output 1	7.4.5.2.7
Relay output 2	
Relay output 3	
Relay output 4	
Temperature Details	7.4.5.2.6
Vapor pressure	-
Vapor temperature	-
Water level	-

All Transducer blocks can be loaded for any SmartRadars. However, a transducer block provides only valid data when a relevant option is installed in the SmartRadar.

For a temperature transducer blocks to be available, an FII-RTD or FII-VT must be installed in the SmartRadar and for the Relay output transducer blocks to work accurately, an FII-DO must be installed, and so on.

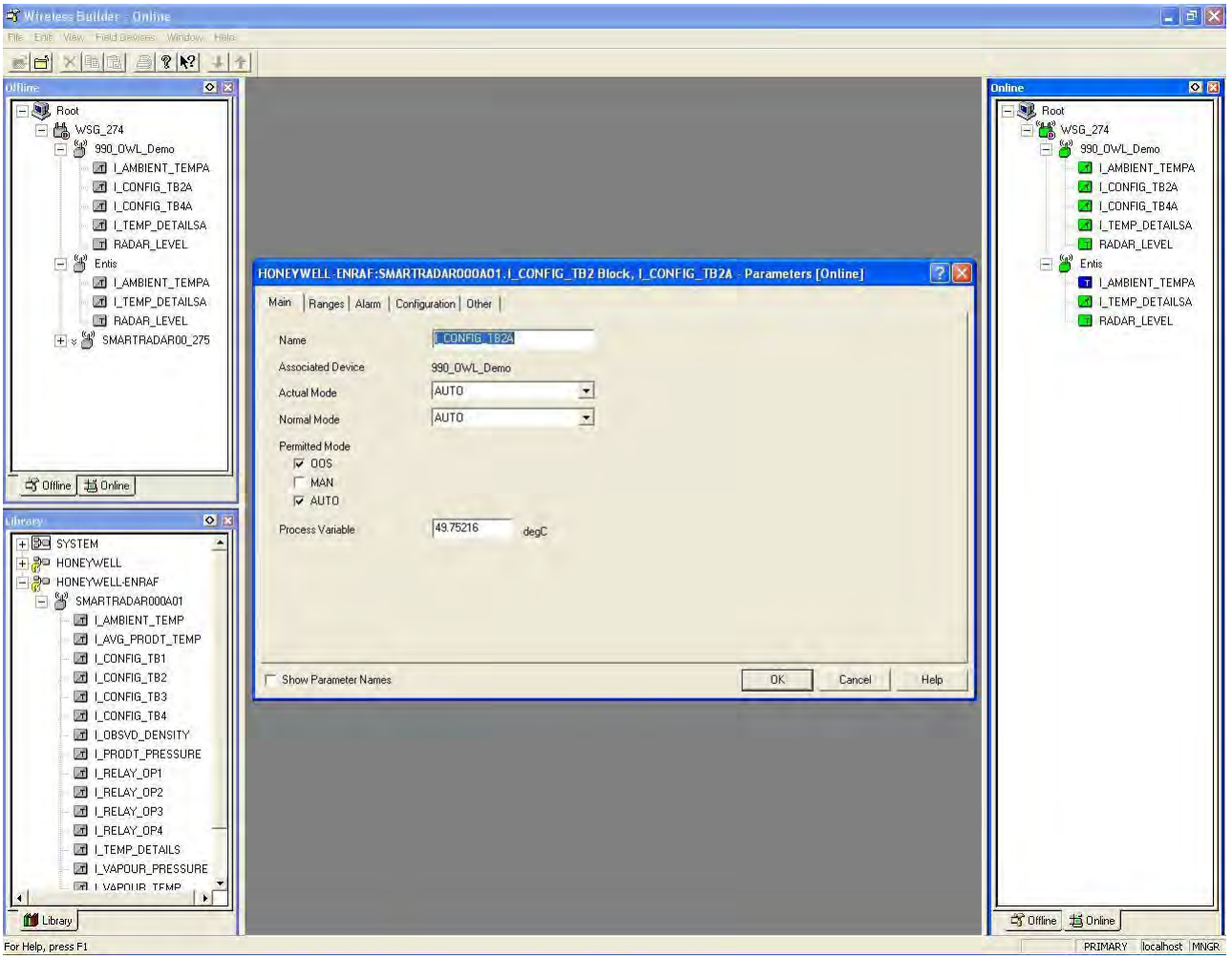
7.4.5.2.3 General Transducer Block Settings

Click the transducer block of an instrument in the *Online* window. A window appears with the details for this particular transducer block.

7.4.5.2.4 Wireless Builder Screens

7.4.5.2.4.1 Main Tab

The Main Tab contains the general settings of the Transducer Block (TB).

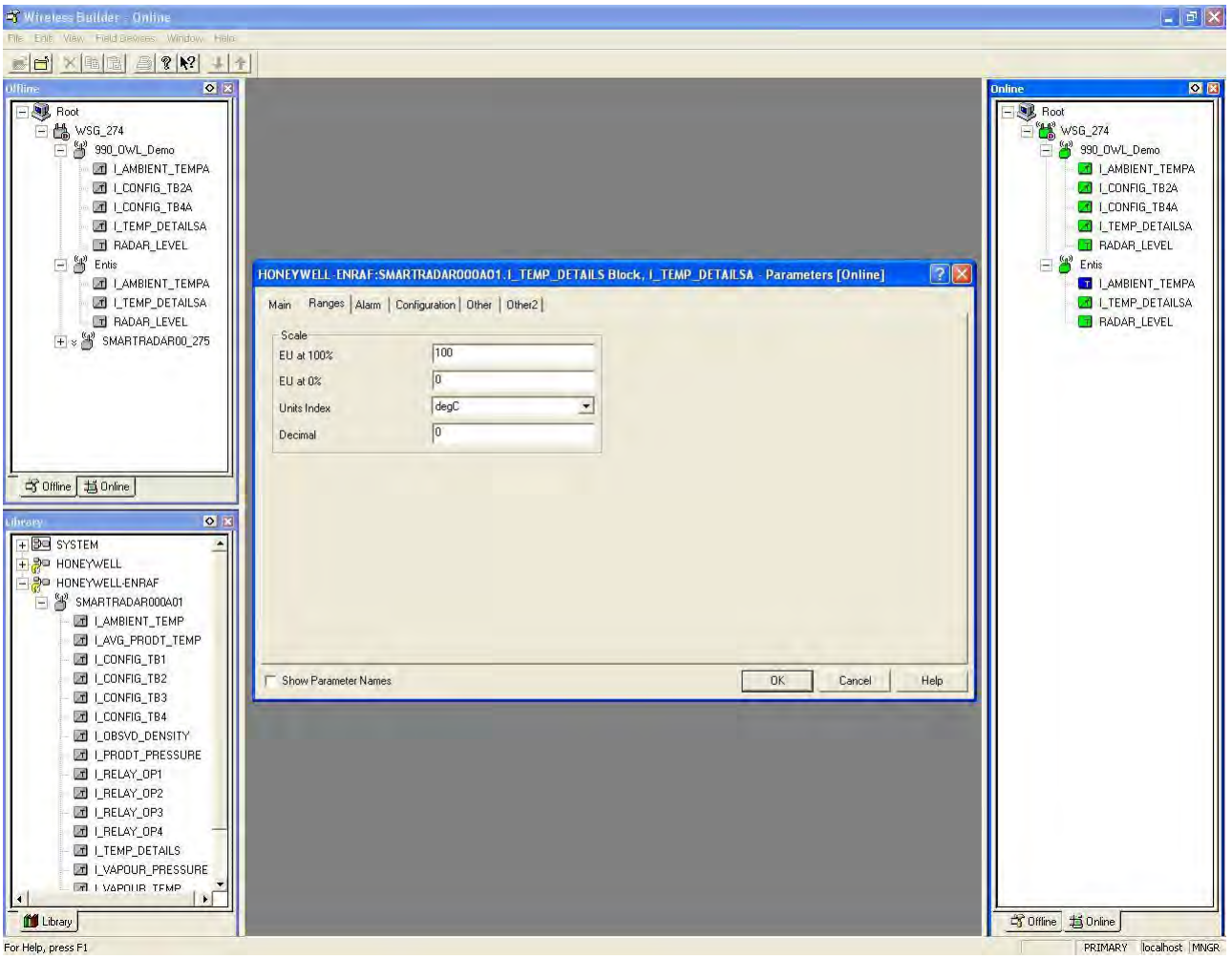


Parameter	Description
Name	Specify the name of the transducer block.
Associated Device	Specifies the device that contains the transducer block that you are editing. The device name is set during commissioning with the Wireless Builder and is stored in the TAG descriptor entity.
Actual Mode	Specify the actual operation mode of the transducer block. This may differ from the normal mode. For example, if the device is Out of Service.
Normal Mode	Specify that this is the mode the transducer block should be in normal situations.
Permitted Mode	Specify the permitted modes for the transducer block.

Parameter	Description
Process Variable	You can manually overwrite the parameter (such as level), if the transducer block is set to manual mode. This is not standard within OneWireless. The manual value entered here is also available in the FlexConn environment. If the Transducer block is not in Manual mode an error code is generated after selecting OK.

7.4.5.2.4.2 Ranges Tab

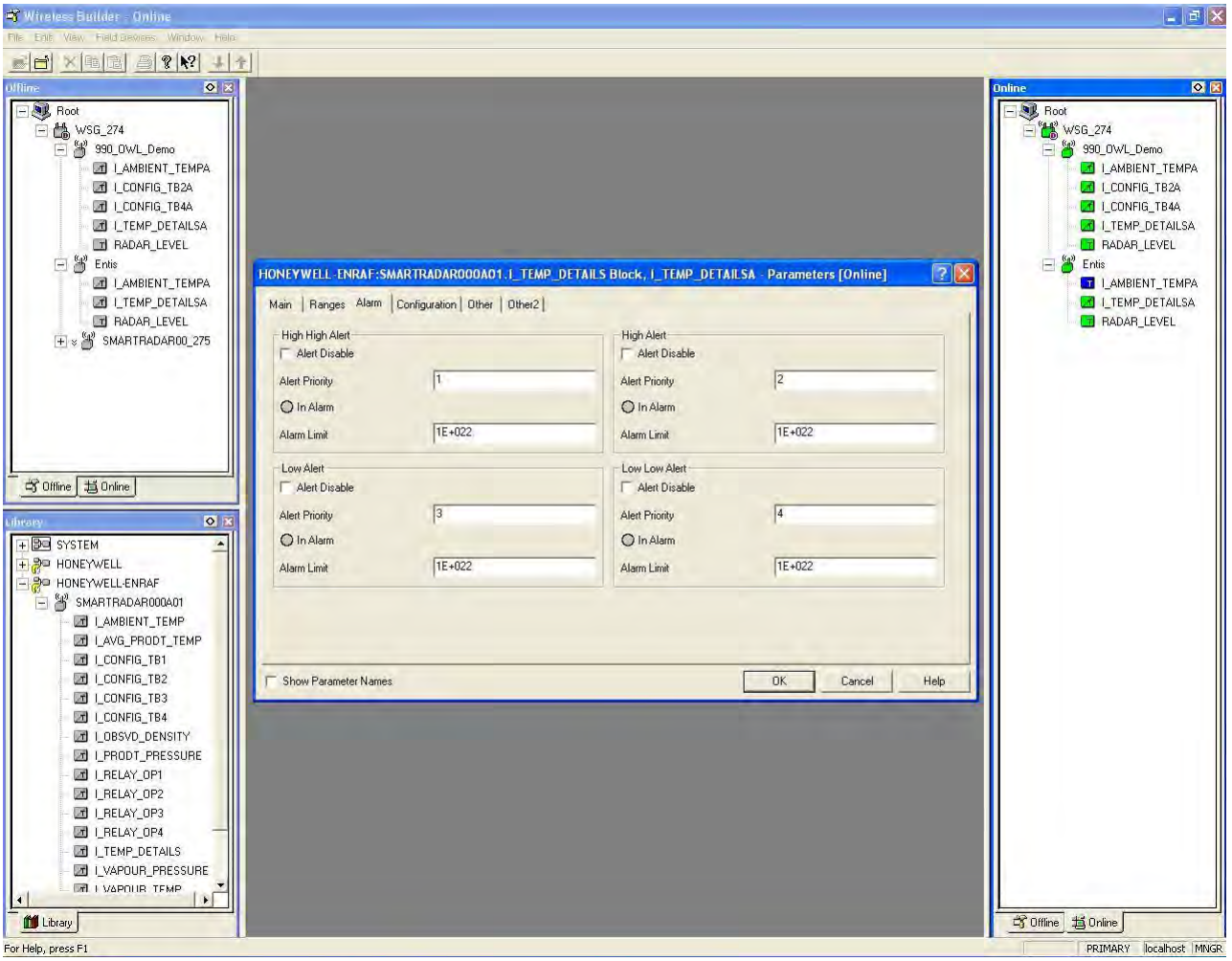
The Ranges tab contains the settings for Engineering units.



Parameter	Description
EU at 100%	Not used in the SmartRadar FlexLine.
EU at 0%	Not used in the SmartRadar FlexLine.
Units Index	Select the required engineering unit from the list of available units. (Level units for the level TB, and temperature units for the Temperature TB) **Note**: For supported units, see 7.4.5.2.8.
Decimal	Not used in the SmartRadar FlexLine.

7.4.5.2.4.3 Alarm Tab

The Alarm tab contains the various alarm settings (High high, High, Low, and Low low).



Parameter	Description
Alert Disable	Use this option to disable an alarm.
Alert Priority	Use this option to define the alert priority. For more information on alert priority, see the OneWireless Documentation.
In Alarm	Specifies the actual alarm status.
Alarm Limit	Specify the alarm trip point.

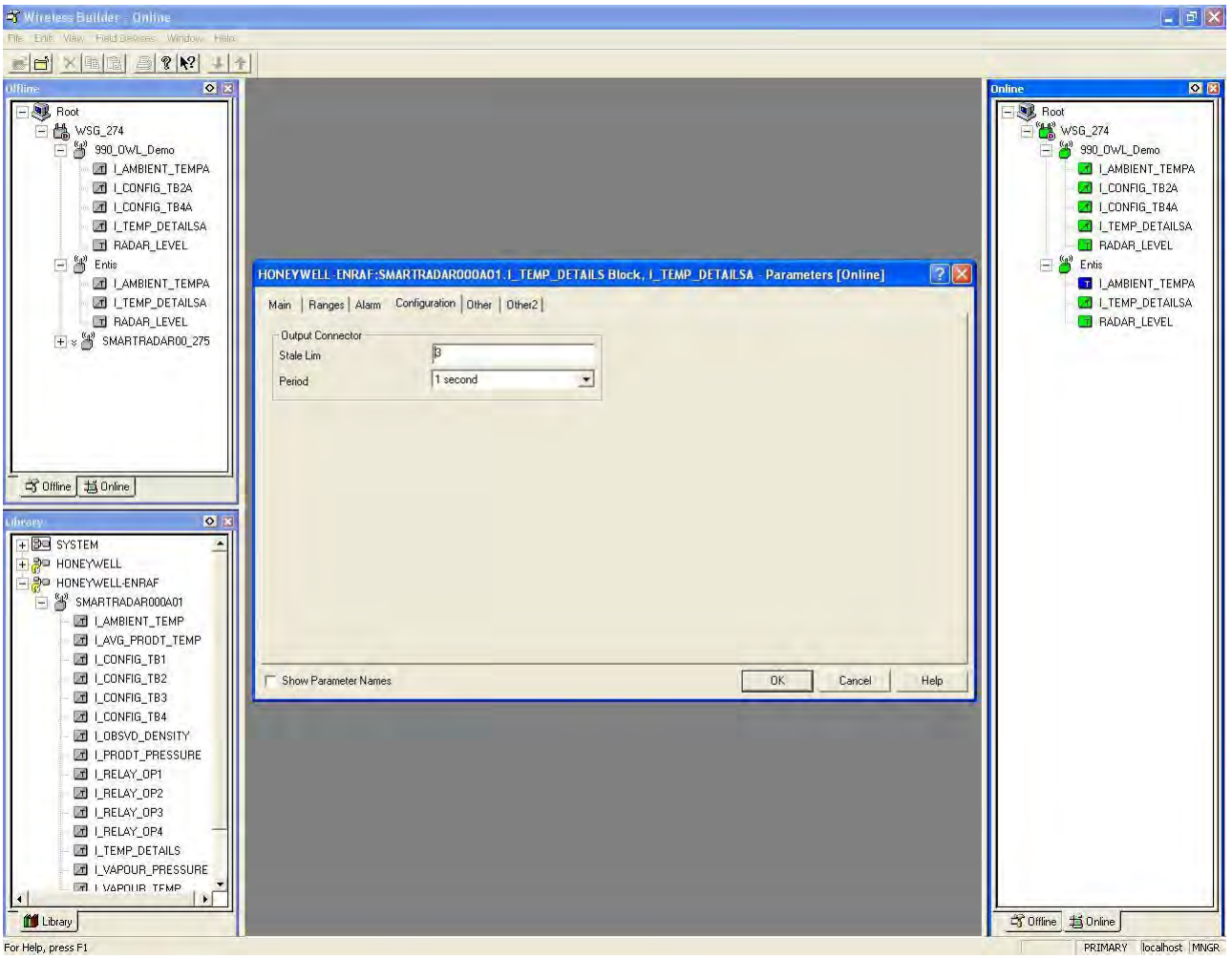
NOTE: The alarm hysteresis is defined in the "Other" tab.

NOTE: Providing alerts on measured variables is not standard in OneWireless. Be careful when you use these alarms as these alarms are also used in

Experion. As these alarms are visible as system alarms and NOT as process alarms.

7.4.5.2.4.4 Configuration Tab

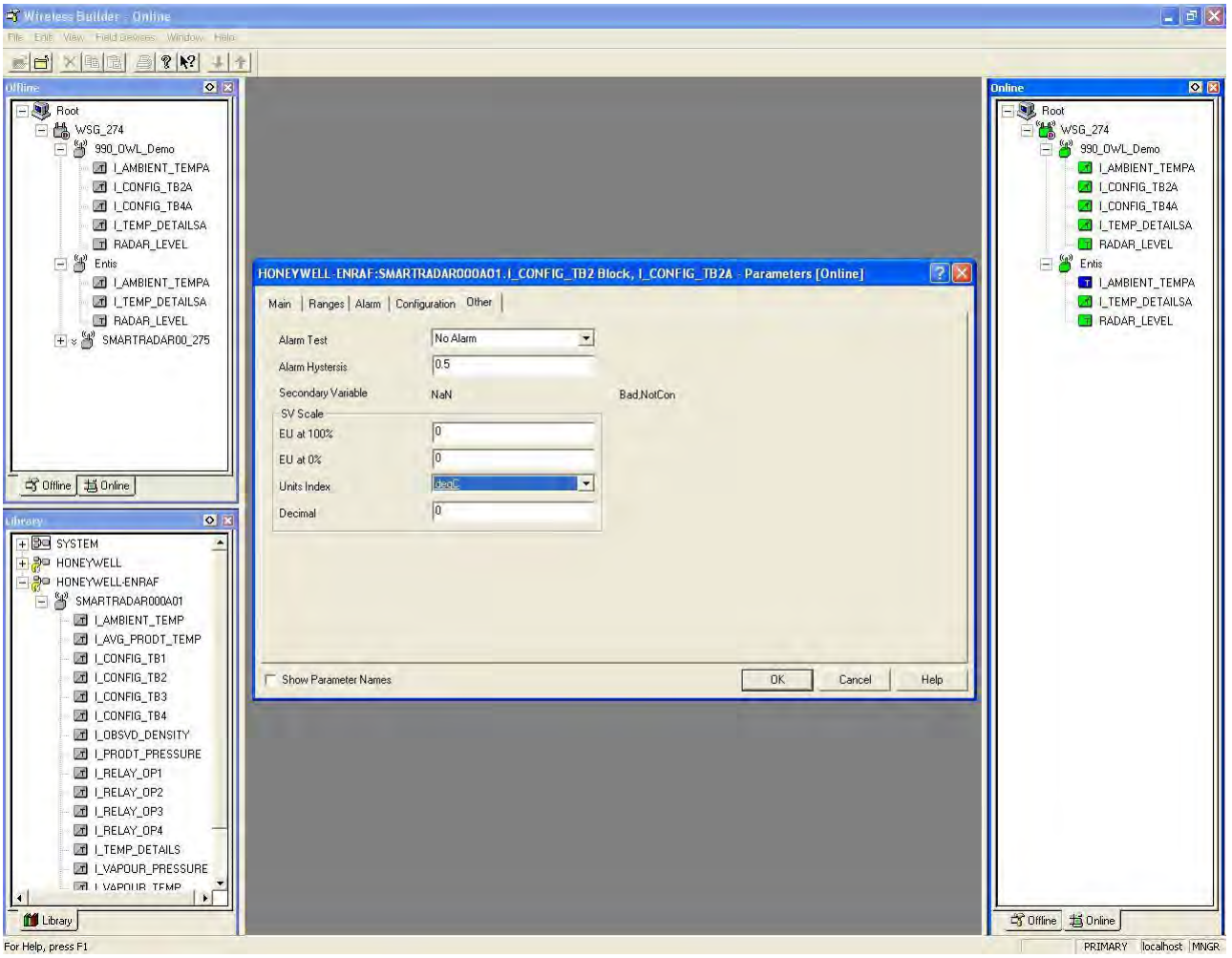
The Configuration tab describes the publication time and time-out settings.



Parameter	Description
Stale Lim	Specify the Publication data stale limit. For more details, see OneWireless documentation.
Period	Specify the publication time for the primary variable of this transducer block. The values can be 1, 5, 10, or 30 seconds. For more details, see OneWireless documentation.

7.4.5.2.4.5 Other Tab (1)

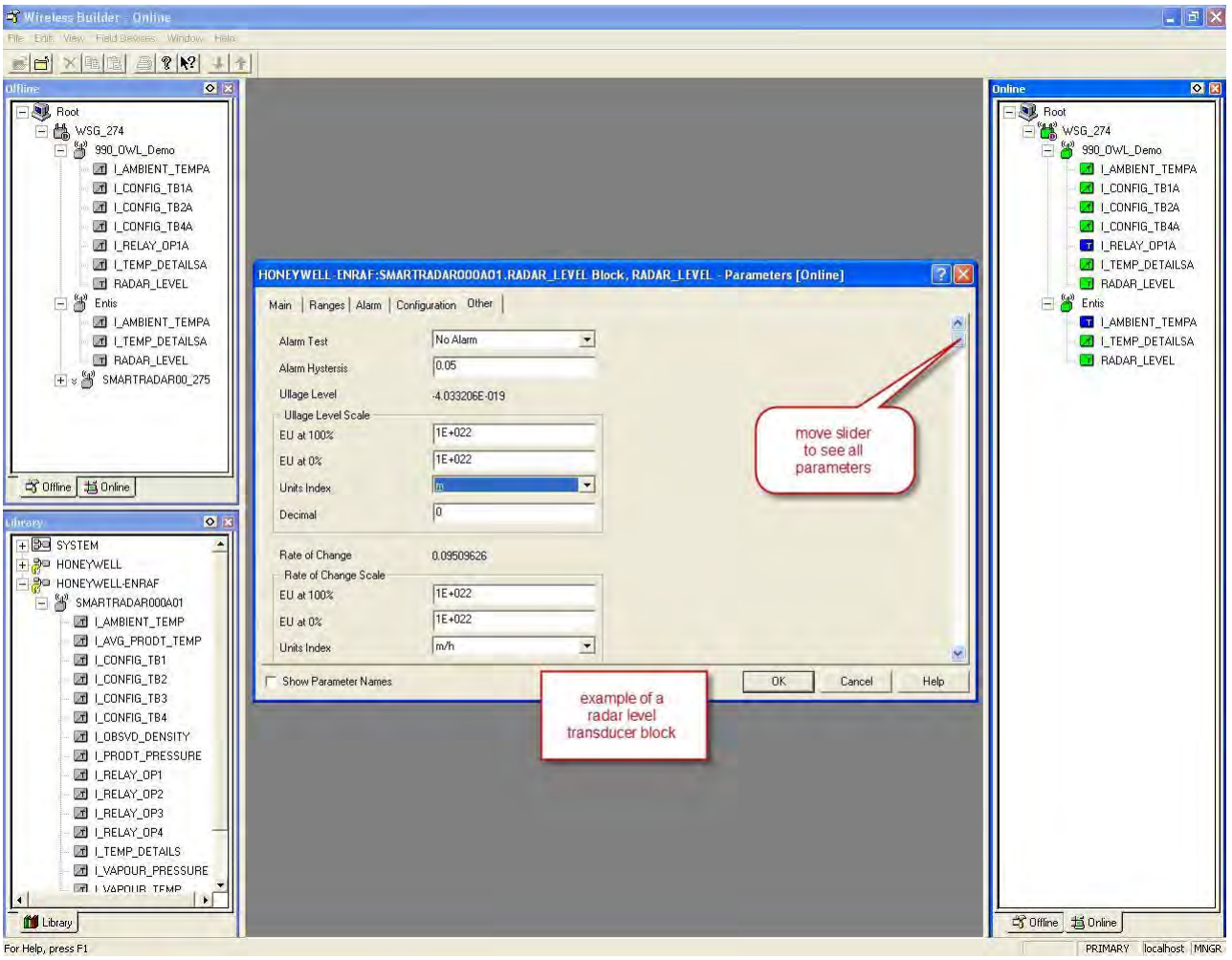
The Other tab is used to initiate an alarm test.



Parameter	Description
Alarm Test	Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command. For detail settings, see 7.4.5.2.4.6.
Alarm Hysteresis	Specify the alarm hysteresis setting. For detail settings, see 7.4.5.2.4.6.

7.4.5.2.4.6 Other Tab (2)

The Other tab details are specified in the figure below.



Parameter	Description
Alarm Test	Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command. For detail settings, see 7.4.5.2.4.6.
Alarm Hysteresis	Specify the alarm hysteresis setting. For detail settings, see 7.4.5.2.4.6.
Ullage Level Scale:	
- EU at 100%	Not used in the SmartRadar FlexLine.
- EU at 0%	Not used in the SmartRadar FlexLine.
- Units Index	Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB). Note: For supported units, see 7.4.5.2.8.
- Decimal	Not used in the SmartRadar FlexLine.

Parameter	Description
Rate of Change Scale:	
- EU at 100%	Not used in the SmartRadar FlexLine.
- EU at 0%	Not used in the SmartRadar FlexLine.
- Units Index	Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB). Note: For supported units, see 7.4.5.2.8.
- Decimal	Not used in the SmartRadar FlexLine

7.4.5.2.5 Configurable Transducer Block Settings

The *configurable* transducer blocks do not represent a fixed input function of the SmartRadar. Configurable transducer blocks can be programmed to represent any available functions on any of the available FlexConn boards in the SmartRadar.

*NOTE: The configuration of the configurable transducer blocks must be done **using Engauge**.*

Example

Configurable Transducer block 1 could be programmed to represent the radar level from the CAN-XBAND. Then the PV of this tranducer block represents the PV of the radar level function, the Innage value. The SV of this transducer block represents the SV of the radar level function, the Ullage level.

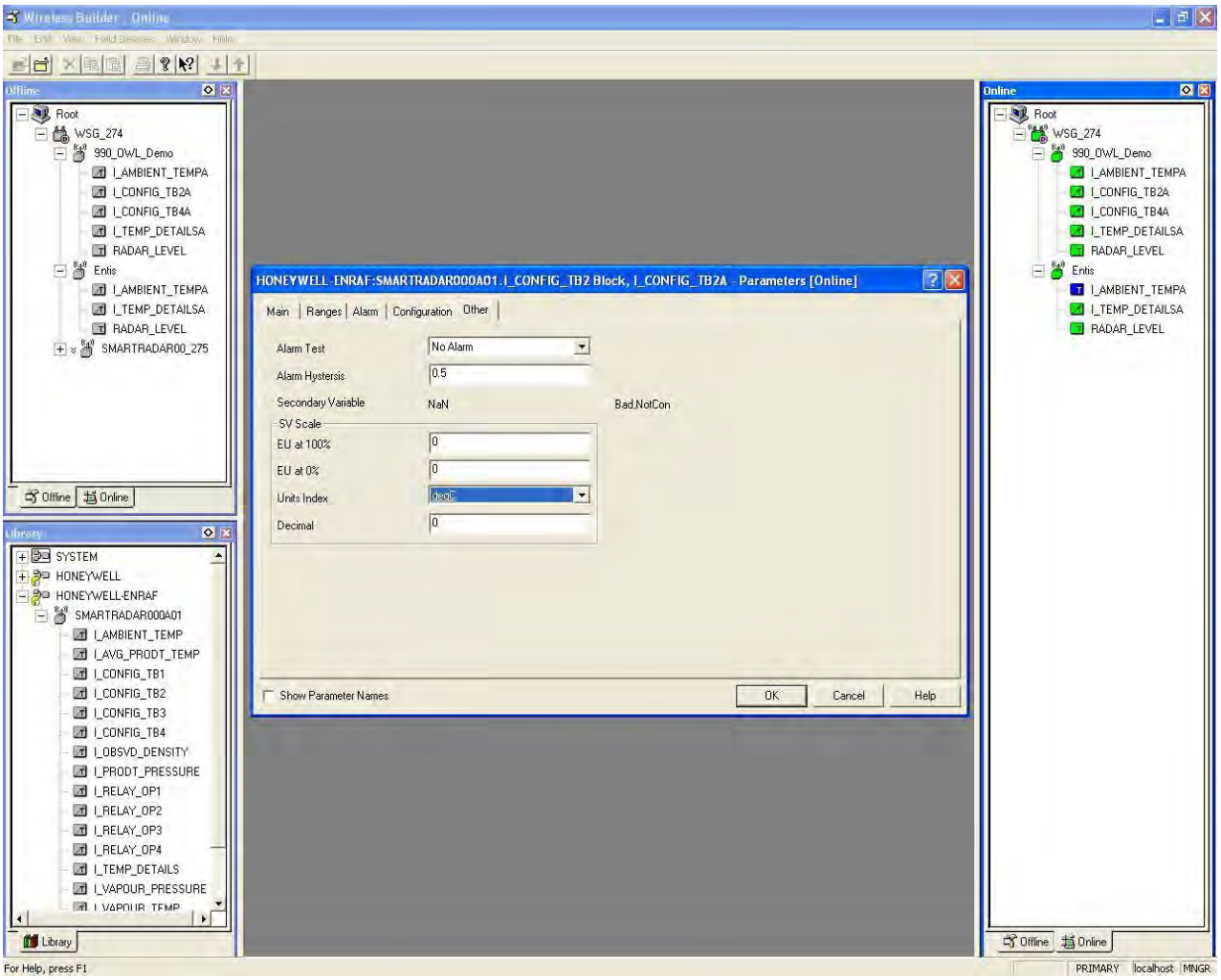
The current firmware version does have *some limitations* on what can be programmed in these transducer blocks.

- Configurable *Transducer block 1* can only represent *Levels*. This is valid for both the PV and the SV.
- Configurable *Transducer block 2* can only represent *Temperatures*. This is valid for both the PV as the SV.
- Configurable *Transducer block 3* can only represent *either pressure or Density*. This is valid for both the PV and the SV.
- Configurable *Transducer block 4* can represent parameters with variable dimensional units. The following parameters are supported: *Level, Temperature, Pressure, Density, Current, or NO UNIT*. This is valid for both the PV and the SV.

In wireless builder these limitations must be taken into account *when changing the units index*, for both the PV as the SV. If you select a dimensional unit that is not supported by the Transducer block then an error message appears.

The *Units Index* for the PV is available on the *Ranges* tab.

The *Units Index* for the SV is available on the *Other* tab. This tab has a different layout than in a standard transducer block, and is described below.



Parameter	Description
Alarm Test	Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command. For detail settings, see 7.4.5.2.4.6.
Alarm Hysteresis	Specify the alarm hysteresis setting. For detail settings, see 7.4.5.2.4.6.
Secondary Variable	Specifies the secondary variable of this transducer block. This Secondary Variable equals the Secondary Value (SV) of the assigned FlexConn function.
- EU at 100%	Not used in the SmartRadar FlexLine.
- EU at 0%	Not used in the SmartRadar FlexLine.

Parameter	Description
- Units Index	Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB). **Note**: See also limitations described before. **Note**: For supported units, see 7.4.5.2.8.
- Decimal	Not used in the SmartRadar FlexLine.

7.4.5.2.6 Temperature Details Transducer Block Settings

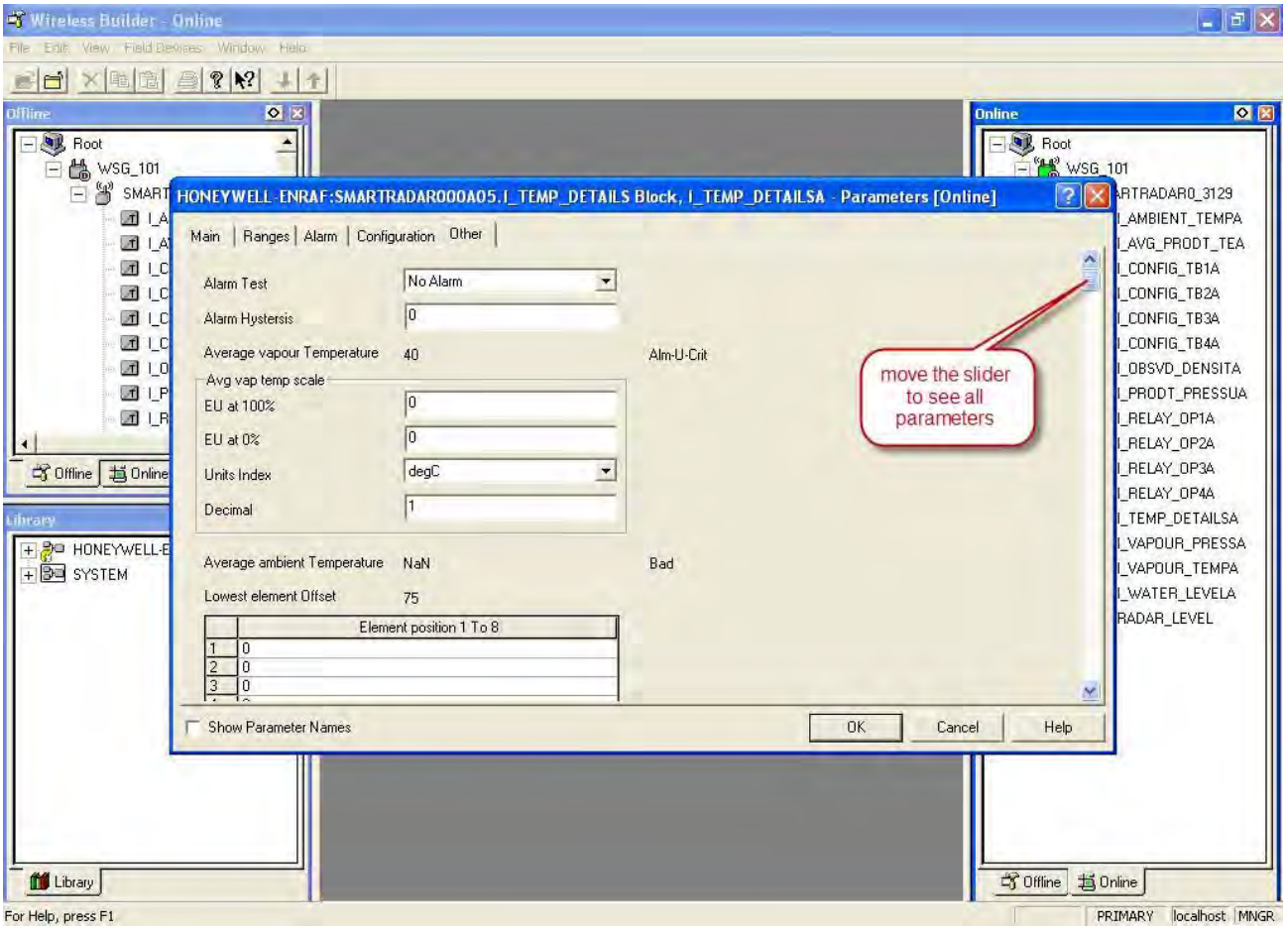
The *Temperature Details transducer block* is an additional temperature transducer block that can be used if details of individual temperature elements (for example, to make a temperature profile) are relevant.

The Average product temperature transducer block publishes the average product temperature as PV and the Vapor Temperature as SV.

The additional parameters can be used through the OneWireless user interface or the OPC server.

NOTE: This Transducer block is not necessary when making temperature profiles through a tool that uses GPU communication.

The temperature details can be found on the *Other* tab. This tab has a different layout than it has in a standard transducer block. It is described below.



Parameter	Description
Alarm Test	Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command. For detail settings, see 7.4.5.2.4.6.
Alarm Hysteresis	Specify the alarm hysteresis setting. For detail settings, see 7.4.5.2.4.6.
Average Vapor temperature	Specifies the average Vapor temperature
EU at 100% (avg temp scale)	Not used in the SmartRadar FlexLine.
EU at 0%	Not used in the SmartRadar FlexLine.

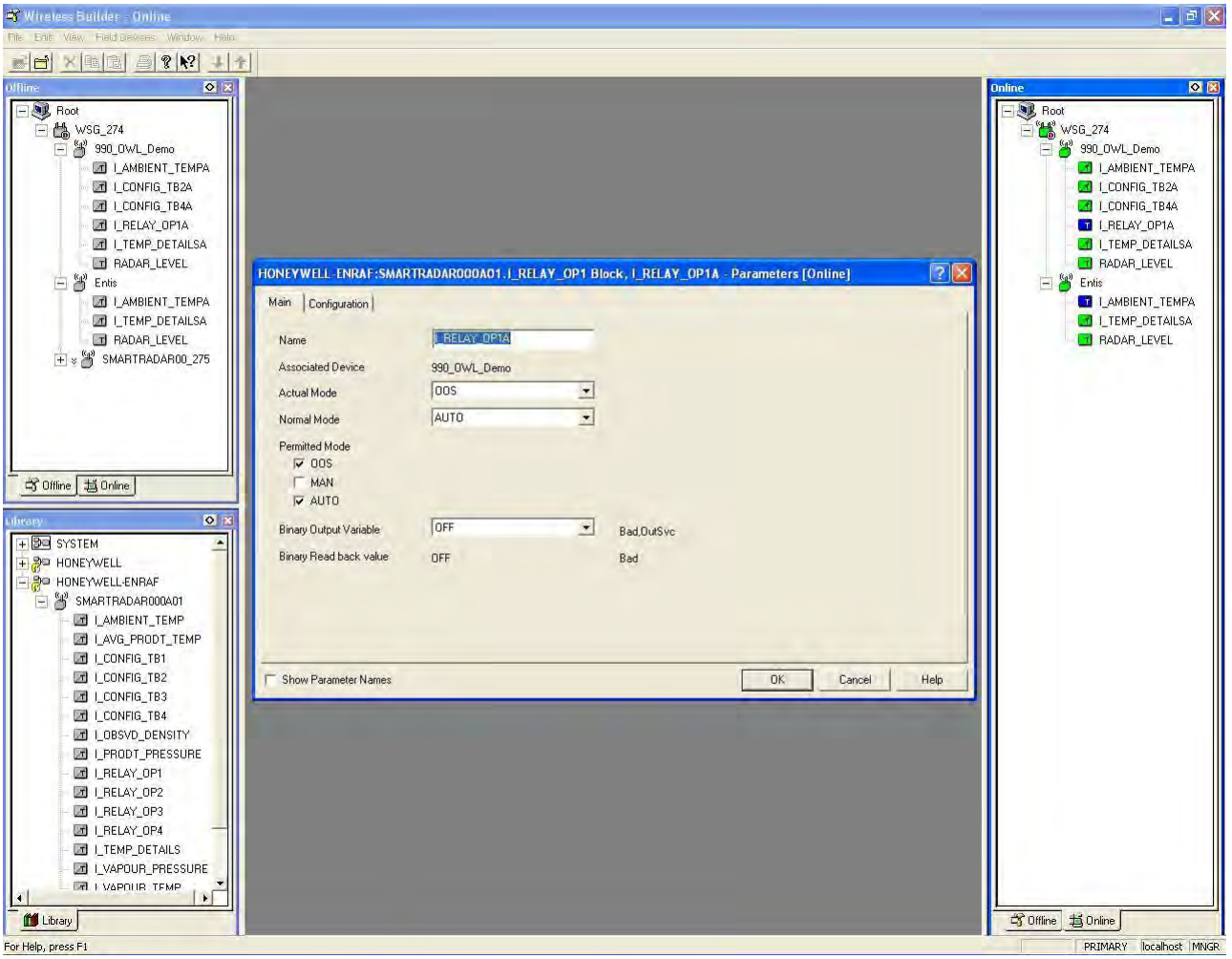
Parameter	Description
Units Index	Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB). **Note**: For supported units, see 7.4.5.2.8.
Decimal	Not used in the SmartRadar FlexLine.
Average Ambient temperature	Specifies the average ambient temperature.
Lowest element offset	Specifies the offset of lowest temperature element relative to the bottom of the tank.
Element position 1...8	Specify the position of the temperature elements 1...8.
Element position 9...16	Specify the position of the temperature elements 9...16
EU at 100% (level scale)	Not used in the SmartRadar FlexLine.
EU at 0%	Not used in the SmartRadar FlexLine.
Units Index	Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB). **Note**: For supported units, see 7.4.5.2.8.
Decimal	Not used in the SmartRadar FlexLine.
Element temperature 1...8	Specify the temperature of element 1...8.
Element temperature 9...16	Specify the temperature of element 9...16.
Element temperature status 1...8	Specify the status of element temperature 1...8.
Element temperature status 9...16	Specify the status of element temperature 9...16.
Number of elements	Specifies the number of installed temperature elements.
MRT or RTD element type	Specifies the type of installed temperature element. TPL = MTT Honeywell Enraf QSA = MRT Sangamo SPL = Spot PT100 Large SPS = Spot PT100 Small SNI = Spot Ni191 SSS = Spot Sangamo CU90 SCB = Spot Beacon CU90 SCN = Spot CU90 Nulectohm

7.4.5.2.7 Relay Output Transducer Block Settings

The *Relay output transducer blocks* are standard *Binary Output* transducer blocks. (In contrast to all other transducer blocks, which are *Analog Input* transducer blocks.)

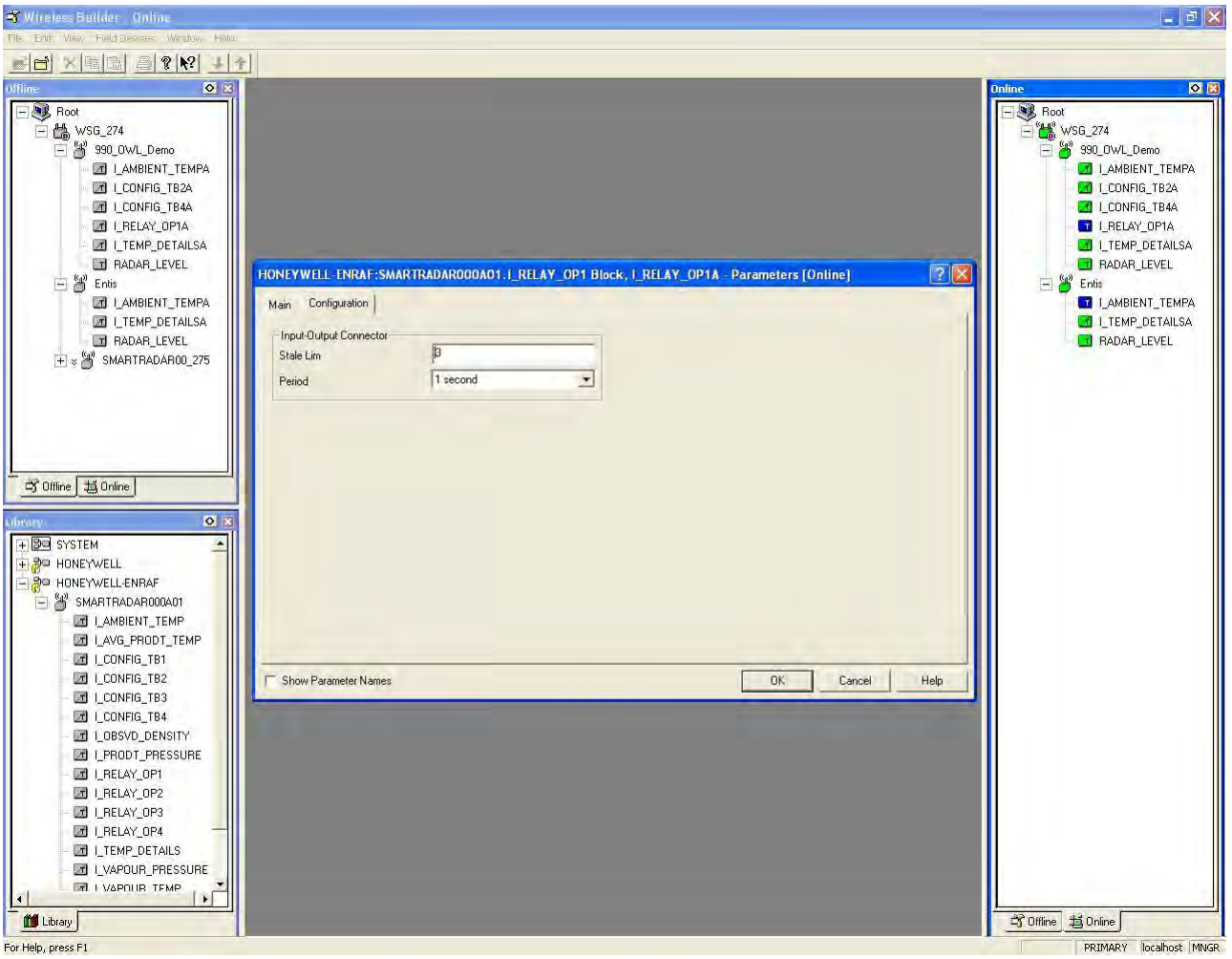
There are 4 relay output blocks, each representing one of the 4 relays that can be installed in the SmartRadar FlexLine. These transducer blocks can be used to remotely control the relays, provided these relays are programmed as remote controllable in Engauge.

For more information about the block, refer to the figure and the table below which describes the important parameters.



Parameter	Description
Name	Specify the name of the transducer block.

Parameter	Description
Associated Device	Specifies the device that contains the transducer block you are editing. The device name is set during commissioning with Wireless Builder and is stored in the TAG descriptor entity.
Actual Mode	Specify the actual operation mode of the transducer block. This may differ from the normal mode, for example if the device is Out of Service.
Normal Mode	Specify the mode that the transducer block should be in normal situations.
Permitted Mode	Select the permitted modes for the transducer block.
Binary Output Variable	Select this option to control the relay. This field has no function if the relay itself is not programmed to be a remote controlled relay.
Binary Read back value	Select the read-back value to represent the actual position of the relay.



Parameter	Description
Stale Lim	Specify the publication data stale limit. For more details, see OneWireless documentation.

Parameter	Description
Period	Select the publication time to determine the primary variable of this transducer block. This can be 1, 5, 10, or 30 seconds. For more details, see OneWireless documentation.

7.4.5.2.8 Supported Units

The SmartRadar FlexLine supports the following units.

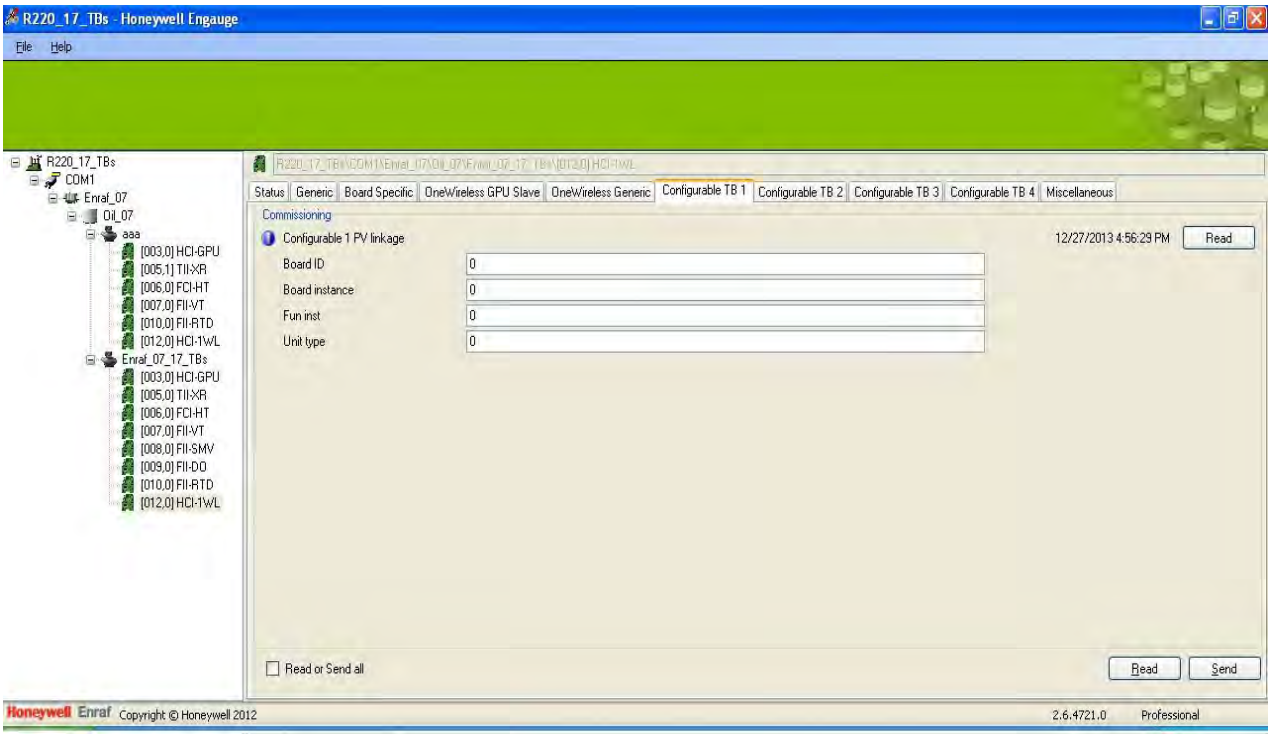
Parameter	Supported Units
Level and position	Meters (m)
	Millimeters (mm)
	Inches (in)
	Feet (ft)
Level rate of change	Millimeters / second (mm/s)
	Meters / hour (m/h)
	Inch / minute (in/min)
	Feet / minute (ft / minute)
Temperature	Degrees Celsius (ºC)
	Degrees Fahrenheit (ºF)
Pressure	Pascal (Pa)
	kilo Pascal (kPa)
	bar
	psi
Density	kg / m^3
	kg / l
	g / ml
	lbs / ft^3
	deg API

7.4.5.3 Commissioning the HCI-1WL Configurable Transducer Blocks

The configuration of the configurable transducer blocks can*not entirely be performed through the Wireless Builder*.

To configure the configurable transducer blocks, the following entities must be set by using *Engauge*.

NOTE: These settings are only available for Engauge Professional users.



Name	Explanation	Value Range	Default
[Board ID]	The board ID of the board that contains the function you want to map to the configurable transducer block. Look in the board list which boards are available.	<0...255>	<0>
[Board Instance]	The board instance of the board that contains the function you want to map. This is usually 0. Look in the board list to see if any boards are available more than once in the instrument.	<0...7>	<0>
[Function Instance]	This identifies the function which data you want to map to this transducer block.	<0...15>	<0>
[Unit Type]	The unit type is necessary to identify in One Wireless.	<0...5>	<0> units of data: 0 = no unit 1 = level 2 = temperature 3 = pressure 4 = density 5 = current

All 4 configurable transducer blocks have the same settings in *Engauge*. However, the various configurable transducer blocks are reserved for particular types of data:

- *Configurable Transducer block 1* is reserved for *level* data.
- *Configurable Transducer block 2* is reserved for *temperature* data.
- *Configurable Transducer block 3* is reserved for *density and pressure* data.
- *Configurable Transducer block 4* can be used for *any* of the data types mentioned above.

The *Secondary Variable* (SV) of the configurable function block is automatically assigned to the *Secondary Value of the FlexConn board function* that is linked to the Primary Variable PV as described before.

Example

To link a configurable transducer block to the Radar Level of the TII-XR, the following settings need to be configured:

[Board ID] = 5
[Board instance] = 0
[Function instance] = 1
[Unit type] = 1

7.5 The OneWireless Communication Option (HCI-1WL) - Single Slot (for R230)

7.5.1 Introduction

The Host Communication Instrument OneWireless (HCI-1WL) board is a communication module for the instrument (gauge).

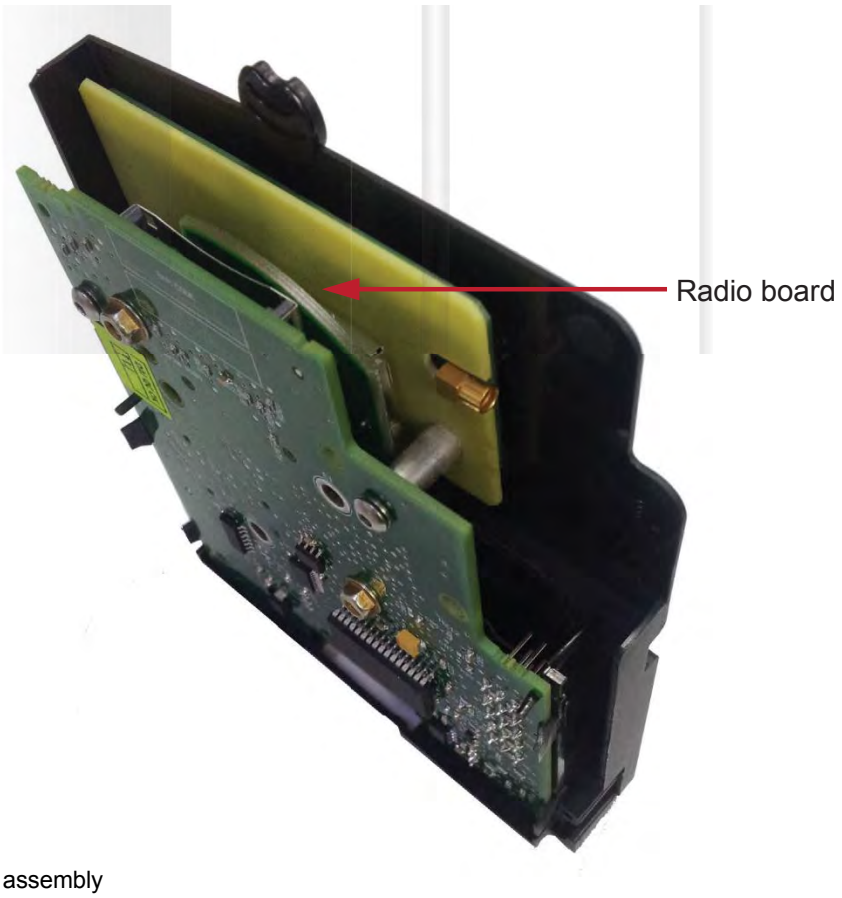


FIGURE 7-6 The HCI-1WL single slot assembly

This module consists of (see FIGURE 7-6): a standard FlexConn board with a memory-card interface, and a standard Honeywell OneWireless Radio board.

HCI-1WL module is used to communicate with the gauge. The Radio module board enables wireless communication with the gauge.

If this wireless communication option is installed, the instrument (gauge) can communicate with a host system using the OneWireless network using the following the following ways:

- Directly through the OneWireless Network (using the HCI-1WL board).

- By using a *protocol tunnel* through the OneWireless network:
  - Through the Enraf FlexConn protocol.
  - Through the Enraf GPU protocol.

OneWireless is an all digital, two-way communication mesh network that interconnects industrial field sensors to a central system.

OneWireless has defined standards to which field devices and operator stations communicate with one another. The communications protocol is built as an "open system" to allow all field devices and equipment that are built to the OneWireless standard to be integrated into a system, regardless of the device manufacturer. This interoperability of devices using OneWireless technology is to become an industry standard for automation systems.

In the OneWireless network, devices like the SmartRadar FlexLine publish their measuring values autonomously at the network. Through an OPC server connected to gateway(s), the data is made available for further use.

The Honeywell Enraf GPU and FlexConn protocols are implemented for communication with Honeywell Enraf Tank Inventory Software systems. For example, Entis Pro, Entis XL, and Entis XS. Additionally, these protocols enable communication with configuration and diagnostic tools such as *Engauge*. These protocols are implemented in the same way as in the HCI-GPU and HCI-BPM. Hence, they only support the same limited set of GPU records and items.

7.5.2 Potential Electrostatic Charging Hazard

WARNING! Do NOT wipe the surface of the antenna with dry cloth, and do NOT clean its surface with a solvent.

If electrostatically charged, discharge of the antenna surface to a person or a tool could ignite a surrounding hazardous atmosphere.

7.5.3 Adding a Radar to the OneWireless Network

7.5.3.1 Introduction

Before a radar is visible in the OneWireless network, it must be supplied with a correct network security key, so it is allowed to join the protected wireless network.

You must be properly trained in Honeywell OneWireless solutions before adding the SmartRadar in a OneWireless network. To establish communication with the OneWireless network the SD card, WDM, and the Wireless user interface tools are required. Refer to the respective manuals for details.

CAUTION

CAUTION! ***France*** *restricts outdoor use to 10mW (10 dBm) EIRP in the frequency range of 2,454-2,483.5 MHz. Installations in France must limit EIRP to 10 dBm for operating modes utilizing frequencies in the range of 2,454 – 2,483.5MHz. For this reason, Honeywell Enraf does not recommend configuring frequency hopping modes that use this frequency range.*

For installations in France, use only the following OneWireless Frequency Hopping (FH) Mode Selections: *EU Channel #1, EU Channel #7, NA/EU Guard Bands and NA/EU Channel 3 (FH Mode selections #4, 5, 8 and 10).*

7.5.3.2 Preparing the Radar

Before adding a radar to a one wireless Network, old security information must be removed from the radar. To prevent this from happening by accident, this functionality is only available through the *SmartView*. To erase the security information:

Engauge
SmartView

1. Go to [Menu] > [Commands]
2. Enter the password
3. Go to the HCI-1WL
4. Select [Board] and issue the [Restore Default] command.

7.5.3.3 Authentication

1. Ensure the OneWireless Network is operational and at least 1 multimode configured as gateway.
2. Provision a SmartRadar FlexLine field device using the SD card to authenticate the keys from the WDM.
3. Insert the SD card into the memory card slot of the HCI-1WL device.
4. Make sure to close the device if it is installed in an explosion hazardous area.
5. Switch on the device

The device is now automatically join the OneWireless network.

You can follow the authentication/joining process by navigating to the correct page on the *SmartView*, see 7.5.7.1. Or by using *Engauge*, see 7.5.8.1, if there is also a wired connection available.

If the message [NOREDUN] or [CONNECT] does NOT become visible, the authentication failed.

☛ If authentication failed, verify that the wireless network is operating correctly, and try again with a new security key.

7.5.4 Removing a Radar from the OneWireless Network

To remove a radar from a OneWireless Network, the security key information must be removed from the radar. To prevent this from

happening by accident, this functionality is only available through the *SmartView*.

To erase the security key information:

☛ Go to [Menu] > [Commands]

☛ Enter the password

☛ Go to the HCI-1WL

☛ Select [Board] and issue the [Restore Default] command.

7.5.5 Commissioning the HCI-1WL in the OneWireless Network for R230

7.5.5.1 Introduction

When the authentication process is completed, the SmartRadar can be commissioned in the OneWireless network.

Before you continue with this step, ***familiarize yourself with the OneWireless user interface*** for the OneWireless network. For a detailed operation guide for the OneWireless user interface, refer to the ***OneWireless Wireless Device Manager User's Guide, R230 or later***.

With the OneWireless user interface you can create, delete, commission, load, and unload the SmartRadar just like any other OneWireless devices. You can also activate and inactivate transducer blocks, and program the different parameters, such as publication period, as with any other devices.

Once the Authentication process has been successfully completed, the SmartRadar automatically is listed in the *left pane* of the OneWireless user interface as an *un-commissioned device*.

Follow the procedures mentioned in the *OneWireless Wireless Device Manager User's Guide* to commission the devices.

By default, the SmartRadar contains *transducer block: Radar Level*.

During further commissioning, more transducer blocks can be added.

7.5.5.2 Transducer Blocks for R230

7.5.5.2.1 Introduction

Besides the Radar Level transducer block, up to 16 additional transducer blocks can be added to the device using the OneWireless user interface.

The specific parameters for all the available transducer blocks can be set using the OneWireless user interface.

Refer to the *Configuring SmartRadar FlexLine field device channels* section for more information regarding the configuration of the field device channels.

This section explains about the additional or non-standard transducer block items. Additionally, it also describes the procedures to configure the transducer blocks (channels).

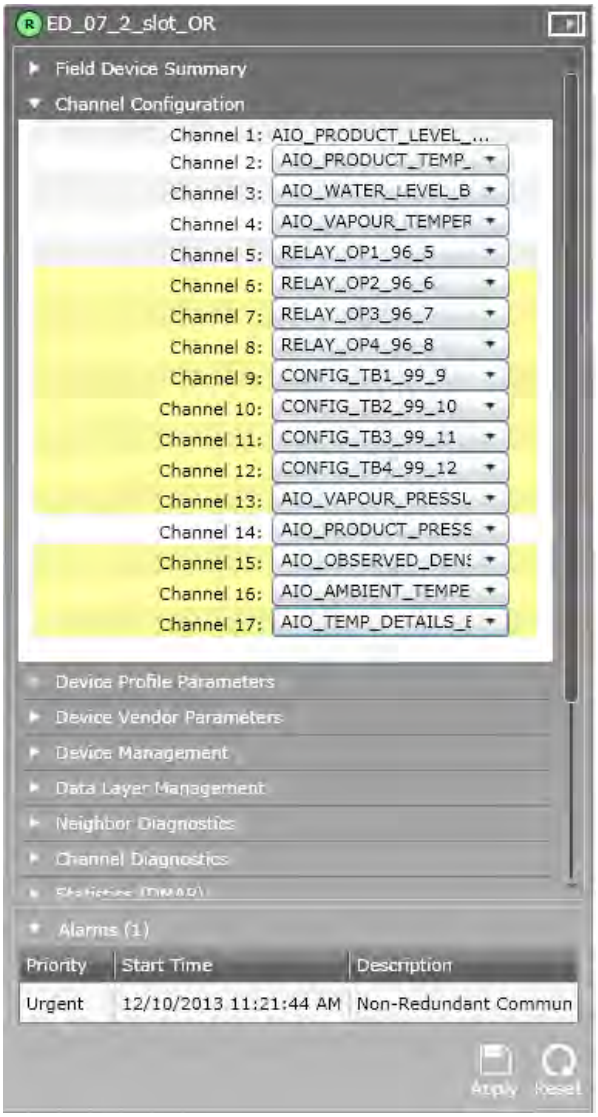
NOTE: Each transducer block can only be added to the SmartRadar FlexLine field device once. Only 8 transducer blocks (including one Level transducer block) can be configured at a time.

7.5.5.2.2 Adding Transducer Blocks

To configure a channel, you must first add the transducer blocks to this field device.

To add a transducer block

1. On the **Selection Panel**, select the field device.
2. Expand **Channel Configuration** and click the respective instantiable object type for the channel to be instantiated.



3. Click **Apply**.

To add channel to publication group

1. On the **Property Panel**, expand **Input Publication** panel.
2. In the **Channel** drop-down list, click the channel for which data publication needs to be enabled.
3. Click **Apply**.

To activate the channel

1. On the **Selection Panel**, select the field device channel.
2. Do one of the following:
   - On the ribbon bar, in the **Channel** group, click **Activate**.
   - On the **Property Panel**, expand **Mode** and then in the **Target** list, click **Auto**.
3. Click **Apply**.

   The channel icon appears as green indicating active mode.

NOTE: Only 2 channels can be instantiated at one time. On instantiating more than 2 channels may lead to an error.

The following additional transducer blocks are available.

Channel	Transducer Block	Board	See Section
Channel 1	Product Level	TII-XR	7.5.5.2.5
Channel 2	Average Product temperature	FII-VT & FII-RTD	7.5.5.2.6
Channel 3	Water Level	FII-VT	7.5.5.2.7
Channel 4	Vapor Temperature	FII-VT & FII-RTD	7.5.5.2.8
Channel 5	Relay output 1	FII-DO	7.5.5.2.10
Channel 6	Relay output 2	FII-DO	
Channel 7	Relay output 3	FII-DO	
Channel 8	Relay output 4	FII-DO	
Channel 9	Configurable Transducer block 1		7.5.5.2.9
Channel 10	Configurable Transducer block 2		
Channel 11	Configurable Transducer block 3		
Channel 12	Configurable Transducer block 4		
Channel 13	Vapor Pressure	FII-HT	7.5.5.2.11
Channel 14	Product Pressure	FII-HT	7.5.5.2.12
Channel 15	Observed Density	FII-HT	7.5.5.2.13
Channel 16	Ambient Temperature	FII-RTD	7.5.5.2.14
Channel 17	Temperature details	FII-RTD	7.5.5.2.15

All the transducer blocks can be loaded to any SmartRadar FlexLine field device. However, a transducer block provides only valid data when a relevant option is installed in the SmartRadar FlexLine field device.

For example, for a temperature transducer blocks to become available, an FII-RTD or FII-VT must be installed in the SmartRadar FlexLine field device, and for the Relay output transducer blocks to work accurately, an FII-DO must be installed.

7.5.5.2.3 General Transducer Block Settings

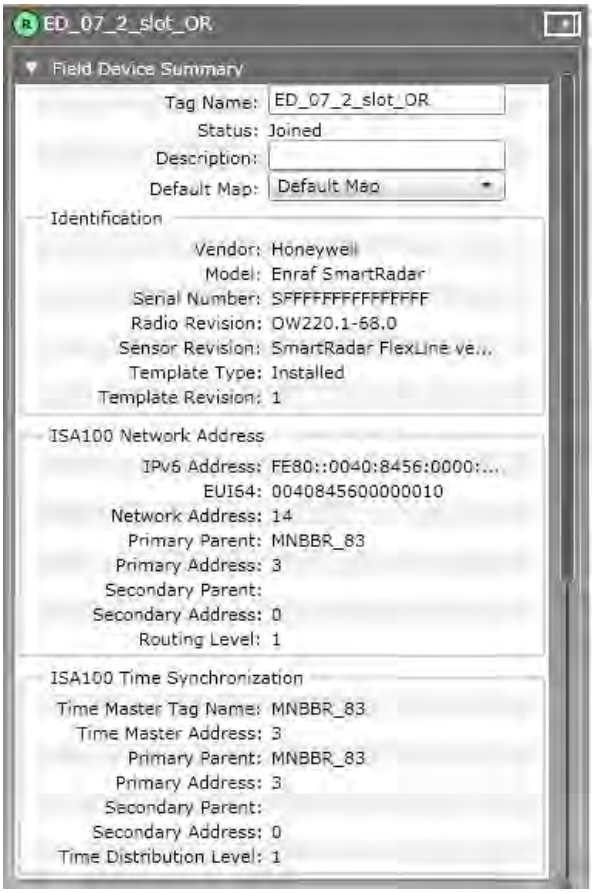
To view general transducer block settings, on the **Property Panel**, expand **Channel Configuration** which displays a list of instantiated channels.

7.5.5.2.4 OneWireless User Interface

7.5.5.2.4.1 Configure field device properties

The **Field Device Summary** displays the general details of the field device.

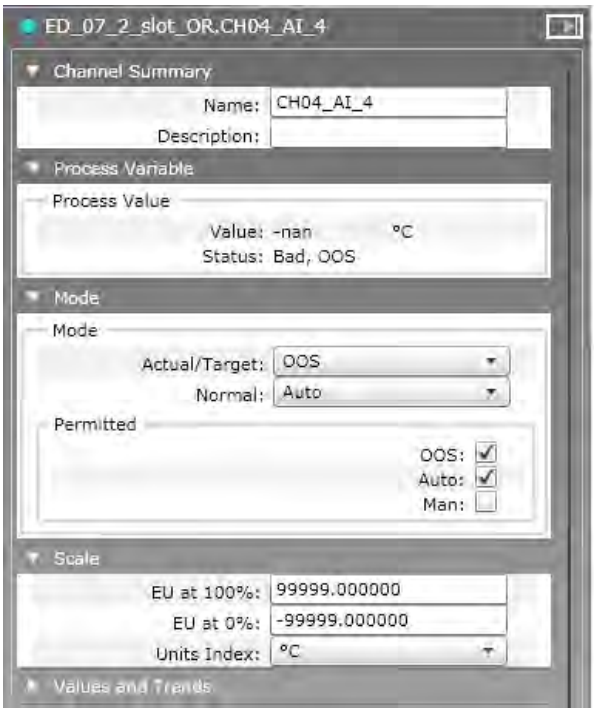
For more information regarding the details to configure the tag name and description, refer to the "Click Reset Statistics to reset all the ENRAF interface statistics." section.



7.5.5.2.4.2 Configure Mode and Scale

Configure the Mode and Scale entities for the SmartRadar FlexLine field device channel.

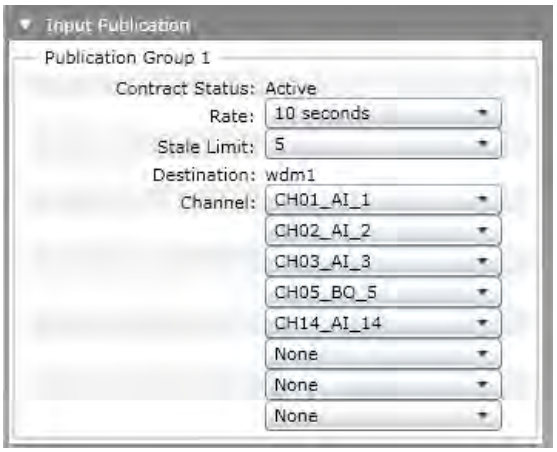
For more information regarding the configuration of the mode and scale entities, refer to the "Configure Mode and Scale" section.

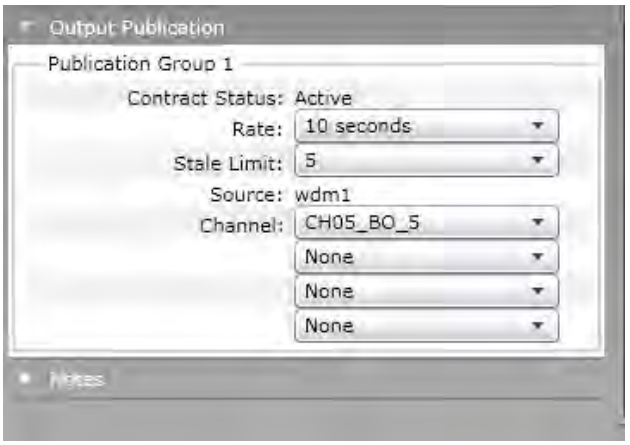


7.5.5.2.4.3 Configure publication rate

The publication data for input and output field devices can be configured using the Input Publication panel in the Property Panel. Depending on the device type, a field device can have an **Input Publication** panel. This is determined by the DD file for the field device.

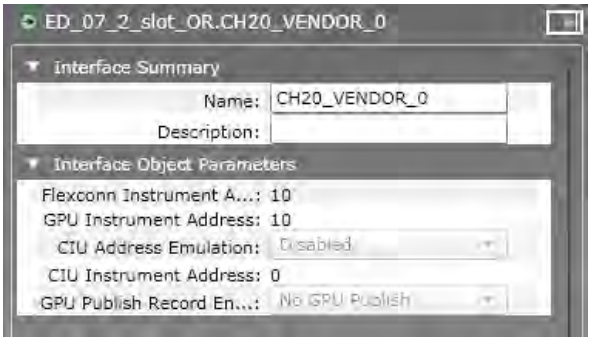
For more information regarding the configuration of the Input publication and Output publication entities, refer to the "Configure publication rate" section.





7.5.5.2.4.4 Configure SmartRadar FlexLine field device interface

To configure Interface Summary and Interface Object Parameters, refer to the section "Configuring SmartRadar FlexLine field device".



7.5.5.2.5 Product Level Transducer Block settings

Product level transducer blocks can be used to publish product level data measurements from the TII-XR boards. Product level data is used to calculate the volume of the product contained in the tank.

The product level transducer block publishes product levels as PV and ullage product level as SV.

7.5.5.2.6 Average Product Temperature Transducer Block settings

Average product temperature Transducer Blocks can be used to publish product temperature values measured using either FII-VT or FII-RTD boards.

The average product temperature transducer block publishes average product temperature as PV.

7.5.5.2.7 Water level transducer block settings

Water level transducer blocks can be used to publish water level data measurements from FII-VT board.

The water level transducer block publishes water levels as PV and ullage level as SV.

7.5.5.2.8 Vapor Temperature Transducer Block settings

Vapor temperature transducer blocks can be used to publish average vapor temperature values measured using FII-HT board.

The vapor temperature transducer blocks publish average vapor temperature as PV.

7.5.5.2.9 Configurable Transducer Block Settings

The *configurable* transducer blocks do not represent a fixed input function of the SmartRadar. Configurable transducer blocks can be programmed to represent any available functions on any of the available FlexConn boards in the SmartRadar.

NOTE: The configuration of the configurable transducer blocks must be performed using Engauge.

Example

Configurable Transducer block 1 is programmed to represent the radar level from the CAN-XBAND. Then the PV of this tranducer block represents the PV of the radar level function, the Innage value. The SV of this transducer block represents the SV of the radar level function, the Ullage level.

- Configurable *Transducer blocks 1 to 4* can represent parameters with variable dimensional units. The following parameters are supported: *Level (TII-XR), Temperature (FII-VT and FII-RTD), Pressure (FII-HT), Density (FII-HT), or NO UNIT*. This is valid for both the PV and the SV.

7.5.5.2.10 Relay Output Transducer Block Settings

The *Relay output transducer blocks* are standard *Binary Output* transducer blocks. (In contrast to all other transducer blocks, which are *Analog Input* transducer blocks.)

There are 4 relay output blocks, each representing one of the 4 relays that can be installed in the SmartRadar FlexLine. These transducer blocks can be used to remotely control the relays, provided these relays are programmed as remote controllable in Engauge.

For more information about the block, refer to the figure and the table below which describes the important parameters.

Parameter	Description
Actual/Target	Specifies the actual operation mode of the transducer block. This may differ from the normal mode, for example if the device is Out of Service.
Normal	Specifies the mode the transducer block should be in normal situations.
Permitted Mode	Specifies the permitted modes for the transducer block which can be selected.
Output Variable	Specifies the value to control the relay. This field has no function if the relay itself is not programmed to be a remote controlled relay.
Readback Value	Specifies the read-back value that represents the actual position of the relay.

7.5.5.2.11 Vapor Pressure Transducer Block Settings

Vapor Pressure transducer blocks can be used to publish average vapor pressure values measured using the FII-HT board.

The vapor pressure transducer block publishes vapor pressure as PV.

Additionally, the pressure type (absolute or relative) is also published.

NOTE: While using the Engauge tool, vapor pressure is displayed under the 'P3 Pressure' sub tab.

7.5.5.2.12 Product Pressure Transducer Block Settings

Product pressure transducer blocks can be used to publish standard product pressures values measured using the FII-HT board.

The product pressure transducer block publishes product pressure as PV and secondary pressure as SV.

Additionally, the pressure type (absolute or relative) is also published.

NOTE: While using the Engauge tool, product pressure is displayed under the 'P1 Pressure' sub tab, and the secondary pressure is displayed under the 'Pressure' sub tab.

7.5.5.2.13 Observed Density Transducer Block Settings

Observed density transducer blocks can be used to publish observed density values measured using the FII-HT boards.

The observed density transducer block publishes observed density as PV and product temperature as SV.

NOTE: While using the Engauge tool, observed density is displayed under the 'HIMS Density' sub tab.

7.5.5.2.14 Ambient Temperature Transducer Block Settings

Ambient temperature transducer blocks can be used to publish ambient temperature values measured from FII-RTD boards.

The ambient temperature transducer block publishes ambient temperature as PV.

7.5.5.2.15 Temperature Details Transducer Block Settings

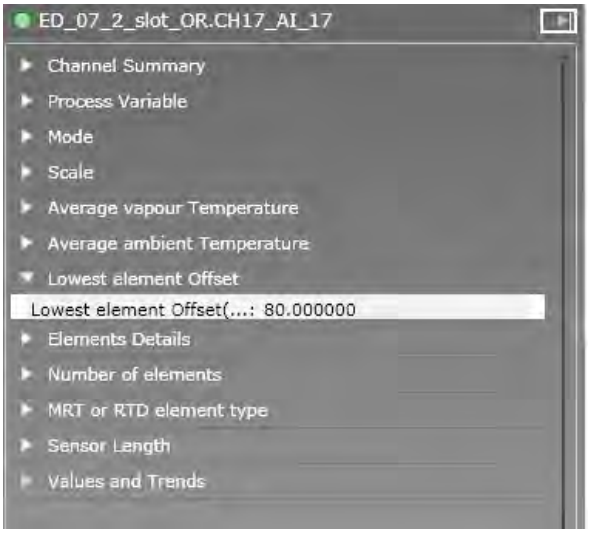
The *Temperature Details transducer block* is an additional temperature transducer block that can be used if details of individual temperature elements (for example, to make a temperature profile) are relevant.

The Average product temperature transducer block publishes the average product temperature as PV and the Vapor Temperature as SV.

The additional parameters can be used through the OneWireless user interface or the OPC server.

NOTE: This Transducer block is not necessary when you create temperature profiles through a tool that uses GPU communication.

For more information about the block, refer to the figure and the table below which describes the important parameters.



Parameter	Description
Average Vapor Temperature	Specifies the average Vapor temperature.
Average Ambient temperature	Specifies the average ambient temperature
Lowest element Offset	Specifies the offset of the lowest temperature element relative to the bottom of the tank.
Number of elements	Specifies number of installed temperature elements.

Parameter	Description
MRT or RTD element type	Specifies the type of installed temperature element. TPL = MTT Honeywell Enraf QSA = MRT Sangamo SPL = Spot PT100 Large SPS = Spot PT100 Small SNI = Spot Ni191 SSS = Spot Sangamo CU90 SCB = Spot Beacon CU90 SCN = Spot CU90 Nulectohm

7.5.5.2.16 Supported Units

The SmartRadar FlexLine supports the following units.

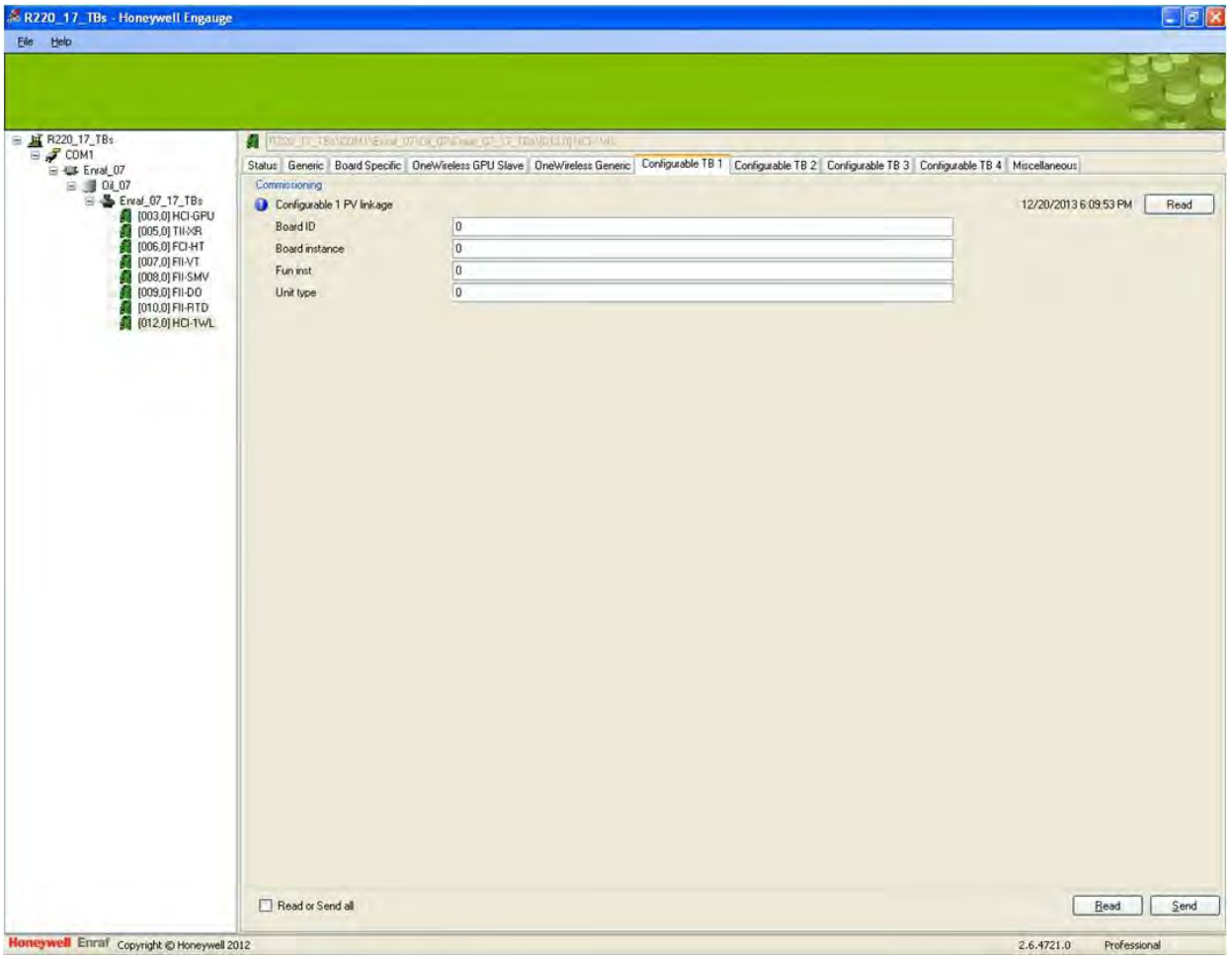
Parameter	Supported Units
Level and position	Meters (m)
	Millimeters (mm)
	Inches (in)
	Feet (ft)
Level rate of change	Millimeters / second (mm/s)
	Meters / hour (m/h)
	Inch / minute (in/min)
	Feet / minute (ft / minute)
Temperature	Degrees Celsius (ºC)
	Degrees Fahrenheit (ºF)
Pressure	Pascal (Pa)
	kilo Pascal (kPa)
	bar
	psi
Density	kg / m^3
	kg / l
	g / ml
	lbs / ft^3
	deg API

7.5.5.3 Commissioning the HCI-1WL Configurable Transducer Blocks

The configuration of the configurable transducer blocks can*not entirely be performed through the OneWireless user interface*.

To configure the configurable transducer blocks, the following entities must be set by using *Engauge*.

NOTE: These settings are only available for Engauge Professional users.



Name	Explanation	Value Range	Default
[Board ID]	Specifies the board ID for the board that contains the function that you want to map to the configurable transducer block. Check the board list which boards are available.	<0...255>	<0>

Name	Explanation	Value Range	Default
[Board instance] 	Specifies the board instance for the board that contains the function you want to map. The default value is 0. Look in the board list to see if any boards are available more than once in the instrument.	<0...7>	<0>
[Function inst] 	Specifies which data you want to map to this transducer block.	<0...15>	<0>
[Unit type] 	Specifies the necessary unit type in One Wireless.	<0...5>	<0> units of data: 0 = no unit 1 = level 2 = temperature 3 = pressure 4 = density 5 = current

All 4 configurable transducer blocks have the same settings in Engauge. Configurable Transducer block 1 through 4 can be used for level, temperature, density and pressure.

The *Secondary Variable* (SV) of the configurable function block is automatically assigned to the *Secondary Value of the FlexConn board function* that is linked to the Primary Variable PV as described before.

Example
To link a configurable transducer block to the Radar Level of the TII-XR, the following settings need to be configured:

[Board ID] = 5
[Board instance] = 0
[Function instance] = 1
[Unit type] = 1

7.5.6 Commissioning the HCI-1WL for GPU and FlexConn Communication

By using a *protocol tunnel* through the OneWireless network, it is possible to connect the standard Honeywell Enraf Entis systems, or service tools.

The physical connection between the Entis systems or service tools is either through an *Ethernet* connection to the Gateway, or through an

RS-232 line through a *Lantronix RS-to-Ethernet convertor* to the Gateway. See chapter 4.2.1 for details.

For the correct functioning of the HCI-GPU module in an instrument (gauge), the following entities ***can*** be set by using either *Engauge* or *SmartView*.

☛ By using the following table, check each entity for correctness.

Name	Value Range	Default Value	Explanation
[Identification]	8 characters e.g. <TANK1234>	<-------->	Name of a tank or instrument
[GPU instrument address]	<0..99>	<0>	The address of this instrument for GPU messages. Note: Each instrument must have a unique GPU address.
[GPU Caching] 	<caching off> <GPU B record> <GPU C record> <GPU D record> <GPU L record> <GPU M record>	<caching off>	By switching on caching, the system performance can be greatly improved. Switching caching on for a record means that the OneWireless network will automatically keep an up-to-date copy of this record in the internal cache of the gateway. This copy will be refreshed each second. Any request for this record will NOT be sent to the instrument but *directly be answered from the cache*. Note: Do not use this setting for W&M approved systems.
[FlexConn instrument address]	<0..1899>	<0>	The address of this instrument for FlexConn messages. Note: Each instrument must have a unique FlexConn address.
[Level units]	<meters> <inches> <feet> <fractions>	<meters>	The unit in which level-related GPU records and items are shown.
[Temperature units]	<celsius> <fahrenheit>	<celsius>	The unit in which temperature-related GPU records and items are shown.

Name	Value Range	Default Value	Explanation
[Pressure units]	<pascal> <kilo pascal> <psi small> (2 digits before separator) <psi large> (3 digits before separator)	<pascal>	The unit in which pressure-related GPU records and items are shown.
[Density units]	<kilogram m3> <degrees API> <pounds ft3>	<kilogram m3>	The unit in which density-related GPU records and items are shown.
[Decimal separator]	<point> <comma>	<point>	The decimal separator in which GPU-related records and items are shown.
[Level type]	<innage> <ullage>	<innage>	The level-related GPU records and items can be shown as an innage or ullage. Note: • *Innage* is the level of the product measured from the bottom. • *Ullage* is the level of free space from the roof till the product.
[Password]	<.....> 6 characters	<ENRAF2>	Password for entering the protected level. Note: Some settings reside under the protected level.
[Function identification] 	<.....> 13 characters	<GPU-slave>	The name of the current function of this module. This name is visible on the *SmartView* display.

☛ After having checked/set all before listed entities, make sure

- the [Board Commissioned] and the [OneWireless GPU slave Commissioned] entities are <True>;

the [Board Health] and the [OneWireless GPU slave Health] entities are <GOOD>.

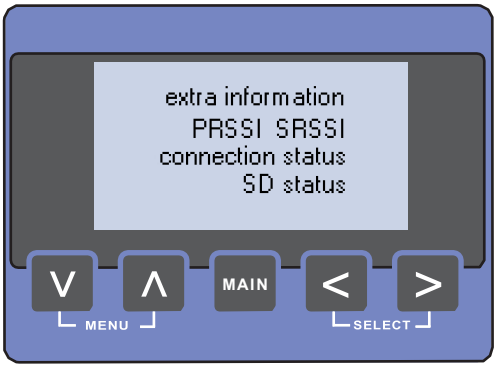
7.5.7 Using the SmartView with the OneWireless Communication Option

7.5.7.1 Introduction

The *SmartView* replaces the display that is usually available on OneWireless transmitters.

7.5.7.2 SmartView OneWireless Status Display

At the *SmartView*, there is a special OneWireless status display available, called the [extra information] display. See screen below.



Parameter	Description
PRSSI	Primary RSSI = Signal strength indicator for primary wireless connection
SRSSI	Secondary RSSI = Signal strength indicator for the redundant wireless connection
Connection status	Radio connection status
SD Status	SD-memory card status

This screen is required during commissioning for the authentication process and to check the wireless connection quality. It can also be used in case of wireless connection problems.

☛ At the SmartView, enter the menu by pressing Λ + V simultaneously.

☛ Scroll to the menu item [extra information], and press < + > simultaneously, to enter the OneWireless screen.

NOTE: Since this [extra information] screen is also used for other purposes, it may be possible that you have to configure the 990 SmartRadar to show this screen when the [extra information] menu item is selected. This can be done on the SmartView itself or by using Engauge, see 7.8.2.

- Signal strength (RSSI = Radio Signal Strength Indicator)

The signal strength is shown in dBm. Below -80 to -85 dBm no reliable connection is possible.

When there is no redundant wireless connection the secondary RSSI does not show a relevant value.

- Connection status

In the display of the SmartView the following Connection status messages can / is visible:

Display Text	Description
NO KEY:	No security key information available Insert a memory card with security information.
MACCONN	Intermediate message during connection process.
SECCONN	
CONNECT	The device is connected to the OneWireless network via 2 multinode / gateways.
DISCOVR	Intermediate message during connection process.
NOTCONN	The radio is not connected. Make sure the OneWireless network is operational. Could also happen if the radar is moved to another network.
SECURNG	Intermediate message during connection process.
NOREDUN	The device is connected to the OneWireless network via 1 multinode / gateway only.
BAD KEY	No valid key available. Could happen if the radar is moved to another network (e.g. from factory to customer/ from workshop to real-life network etcetera).

- SD Status

In the display of the SmartView one out of the following SD card statuses is visible:

Display Text	Description
SDOK	SD card with security key present.
NOSD	No security key / No SD card / Bad SD card.

7.5.8 Radio Board Diagnostic Information and Commands

7.5.8.1 Introduction

Diagnostic information, such as the data in the [extra information] screen, and more, can also be read using *Engauge* (professional version), or with the [Commissioning] screen of the *SmartView*.

Additionally, there are 3 commands that can be given to the radio board on the HCI-1WL module.

7.5.8.2 Commands

☛ Select [Read device information], to read the *static* information from the radio board.

After executing this command, the static information from the radio board is read from the radio board and made available in diagnostic entities. See 7.5.8.3.

☛ Select [Read dynamic info], to read the *dynamic* information from the radio board.

After executing this command, the dynamic information from the radio board is read from the radio board and made available in diagnostic entities. See 7.5.8.3.

☛ Select [Restore Defaults], *to remove the security key information* from the radar.

In this way, the radar is disconnected from the wireless network.

NOTE: This command CANNOT be given via Engauge.

CAUTION! With this command, all settings on the radio board will be erased!

7.5.8.3 Diagnostic Information

- SD Card Status

Display Text	Description
SDOK	SD card with security key present.
NOSD	No security key / No SD card / Bad SD card.

- Connection Status

Display Text	Description
NO KEY:	No security key information available. Insert a memory card with security information.
MACCONN	Intermediate message during connection process.
SECCONN	
CONNECT	The device is connected to the OneWireless network via 2 multinodes / gateways.
DISCOVR	Intermediate message during connection process.
NOTCONN	The radio is not connected. Make sure the OneWireless network is operational. Could also happen if the radar is moved to another network.
SECURNG	Intermediate message during connection process.

Display Text	Description
NOREDUN	The device is connected to the OneWireless network via 1 multinode / gateway only.
BAD KEY	No valid key available. Could happen if the radar is moved to another network (e.g. from factory to customer/ from workshop to real-life network etcetera).

- Radio Signal Status

Parameter	Description
TX power level	Transmission power level. Note: This is an Advanced Setting! Please read section 7.5.9 before changing this setting.
PRSSI	Primary RSSI = Signal strength indicator for primary wireless connection.
SRSSI	Secondary RSSI = Signal strength indicator for the redundant wireless connection.

- Additional Items

Parameter	Description
Radio diagnostic	No explanation. These diagnostic information items are only relevant if requested by the factory.
Radio software build number	
Radio Network address	
Radio communication channel	
Wireless Network ID	
Radio mode	
Radio IEEE Address	

7.5.9 Advanced Settings - Transmission Power Level

Professional installers are allowed to change to power settings in situations that an *external antenna* is used to compensate for long external cables.

CAUTION! It is NOT allowed to set the transmission power to a higher level than is allowed by the local authorities. When a radar with an integrated antenna is ordered, the value is set to the correct value in the factory.

CAUTION! Only when an external antenna is used, it is allowed to change this setting and only according to the table below.

- For transmission power-level settings, see table below.

Area	Antenna Type	Integrated	Remote Cable length 1 m	Remote Cable length 3 m	Remote Cable length 10 m
		Maximum transmission power level setting			
Europe	4 dBi	9	10	10	12
	8 dBi	4	5	6	7
	14 dBi	Not possible	1	1	2
USA and Canada	All types	20			

*CAUTION! For the remote antenna cables, **only the cables provided by Honeywell Enraf** are approved for use. The use of any other cables or cable lengths are NOT allowed by the Radio approvals.*

- The values in the above tables have been determined through agency certification testing.
- The above output-power levels include the loss from the Lightning Arrestor (0.5dBm).

CAUTION! Lightning arrestor must be in place for all installations.

- The following shall apply for antenna type, frequency range, application/usage, and agency/country compliance:
  - Antennas with a higher gain as shown above shall not be used.
  - Maximum overall radio output power shall not exceed 10 mW EIRP (Europe) respectively 100 mW EIRP (USA and Canada) over the full band.
- Industry Canada Compliance Statement:
  - This device has been designed to operate with the antenna types listed in this document, and having a maximum gain of 8 dBi. Antenna types not included in this list or having a gain greater than 8 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.
  - This device complies with Part 15 of the FCC rules **and RSS-GEN of IC**.

7.5.10 Firmware Upgrade for R120

You can upgrade the radio firmware through OneWireless *Wireless Builder*.

For more details see the Wireless Builder manual in the chapter *"Upgrading Firmware in commissioned device"*.

*NOTE: Only the **radio firmware** can be upgraded through Wireless Builder. Firmware upgrade of the HCI-1WL board and the other FlexConn boards is performed through the normal FlexConn upgrade procedures.*

7.5.11 Firmware Upgrade for R230

7.5.11.1 Upgrading the SmartRadar FlexLine device firmware using Wireless Device Manager

The devices at the farthest hop level must be upgraded first.

Sensor firmware

To upgrade the SmartRadar FlexLine sensor firmware, refer to section "Upgrading CAN-1WL FlexConn board of SmartRadar FlexLine gauge" in the *SmartRadar FlexLine Migration User's Guide*.

Radio firmware

1. On the Selection Panel of the OneWireless user interface, select the field device.

   You can select multiple devices of the same type using the Selection Panel or the map view. Use SHIFT+click to select multiple items in a successive list. Use CTRL+click to select multiple items not in succession.

2. On the ribbon bar, in the **Upgrade** group, click **Radio**.

The **Radio Firmware Upgrade** dialog box appears.

3. In the **Available Firmware Files** list, select the required firmware upgrade files.

   By default, the firmware upgrade file appears in the list. If the file is not available in the list, perform the following steps to open the firmware file.

   a) Click **Add** to browse to the directory location of the firmware upgrade file.

   b) Click **Open**.

4. Click **Upgrade**.

The **Radio Firmware Upgrade** dialog box appears.

The **Firmware Upgrade Status** dialog box displaying the status of the upgrade appears. Closing the dialog box allows the upgrade operation to run in the background. The upgrade status is displayed in the status bar. Click the firmware upgrade status box to open the dialog box again. If multiple users are simultaneously upgrading different device firmware, all the users can view the progress of all the device upgrades.

5. Close the **Firmware Upgrade Status** dialog box.
6. Verify the upgraded version of the firmware is as follows:

a) On the Selection Panel of the OneWireless user interface, select the field device.
b) On the Property Panel, expand **Device Manager Summary**.
c) Under **Identification** group, review the firmware version displayed in the **Sensor Revision** field.

7.5.11.2 Upgrading the SmartRadar FlexLine firmware using the Engauge service tool

The Engauge service tool is used for upgrading the SmartRadar FlexLine field device firmware. For more information regarding the Engauge service tool, refer to the *Service Manual SmartRadar FlexLine*.

Perform one of the following methods to upgrade the firmware based on the boards which need to be upgraded:

1. The sensor boards (TII-XR, FCI-HT, FII-VT, FII-SMV, FII-RTD, HCI-GPU, HCI-BPM, and FII-DO) can be upgraded through the Engauge tool using the protocol tunnel.
2. HCI-1WL (CAN-1WL) board can also be upgraded through the OneWireless user interface through the Application Firmware Upgrade.

WARNING! The HCI-1WL (CAN-1WL) board should not be upgraded using the Engauge tool. This results in the SmartRadar FlexLine field device dropping from the network permanently and it also damages the card.

Considerations

Following are some of the considerations for upgrading the device firmware.

- You can upgrade only the application firmware or radio firmware of a device at a time.
- You can upgrade only the firmware of three devices simultaneously from the OneWireless user interface.
- Starting the radio firmware upgrade operation of lower hop and upper hop devices simultaneously, results in the failure of upgrade operation of the lower hop device. When the devices are in different hops, it is recommended to perform the upgrade of only one device at a time.
- Upgrading the radio firmware of a device, which routes communication between other devices, results in communication failure.

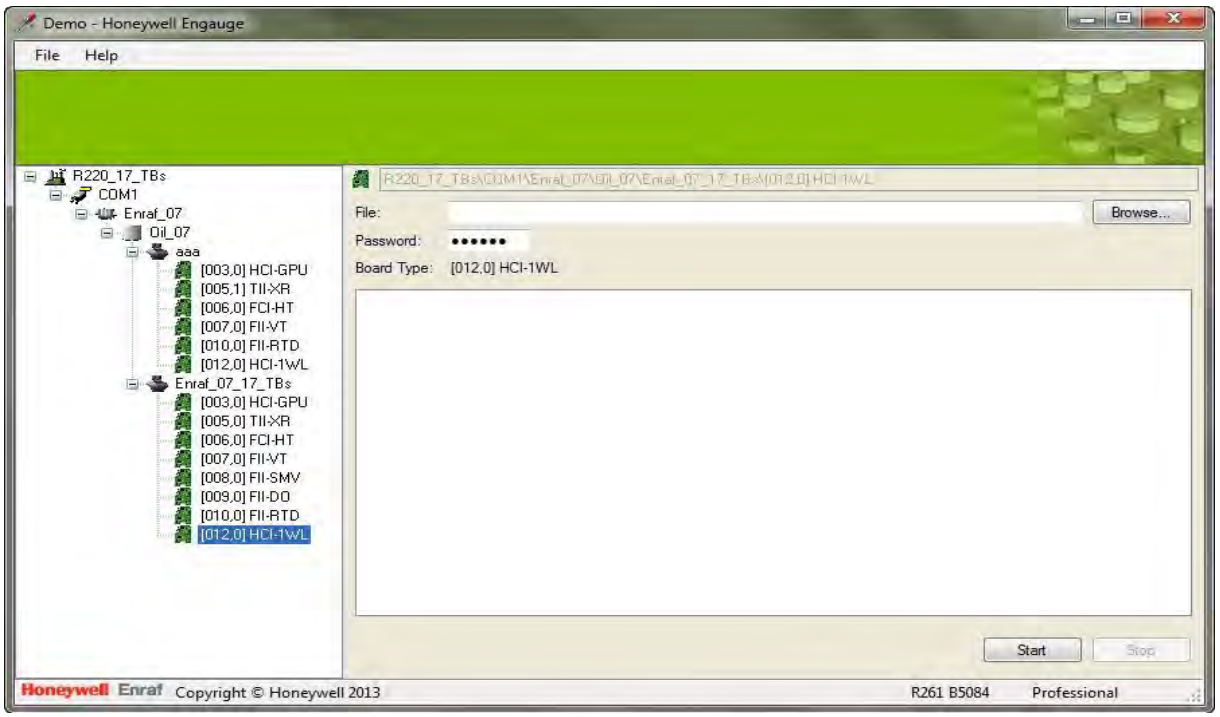
To upgrade the SmartRadar FlexLine firmware for the cards using Engauge service tool

1. Double-click the module icon's in the Engauge's explorer, to select each FlexConn module.

   The board descriptor is then loaded with the tab pages. Select the tab pages, to enter the settings of the specific module.

2. On the Engauge service tool explorer, select the required FlexConn module on the left panel.
3. Right-click the FlexConn module and choose **Firmware Update...**

   The **FlexConn Firmware Update — Engauge** dialog box appears.



4. Depending on the firmware type, the available upgrade files appear by default. Select the required file from the list of upgrade files.

   If the file is not available in the list, perform the following steps.

   a) Click **Browse** to browse to the directory location of the firmware upgrade file.

   b) Click **Open**.
5. Click **Start**.

   The upgrade status is displayed in the status bar.
6. Close the **FlexConn Firmware Update — Engauge** dialog box.
7. Enter the **Time Out** value in the Engauge tool as 9999 ms.

7.6 Product Level Measurement (TII-XR)

7.6.1 Introduction

The Transducer Interface Instrument - X-Band Radar (TII-XR) - is the heart of Enraf's precision X-band (10 GHz) radar system.

It uses the Frequency Modulated Continuous Wave (FMCW) and synthesized pulse reflection principle. Using Enhanced Performance Signal processing (EPS), a smart level detection is possible by filtering out known obstacles.

FIGURE 7-7 The TII-XR board with its Digital Signal Processor

Housed within an explosion-proof, RF-shielded compartment - which also contains a number of other FlexLine modules - and together with a planar radar antenna, it forms the SmartRadar FlexLine system.

7.6.2 Basic Commissioning

7.6.2.1 General

In general, the user is interested in the tank's product *volume*. To calculate this volume, the primary input is the product *level* within the tank. This level is measured by the radar.

For correct measuring results, a number of parameters such as [Tank bottom position], [Upper reference position], and [Offset to roof] must be defined before.

In addition, alarm settings and compensation (filtering) constants are to be set.

This can be done by using either *Engauge* or *SmartView*.

7.6.2.2 Level Start-Up

For entity definitions, see FIGURE 7-8 and FIGURE 7-9.

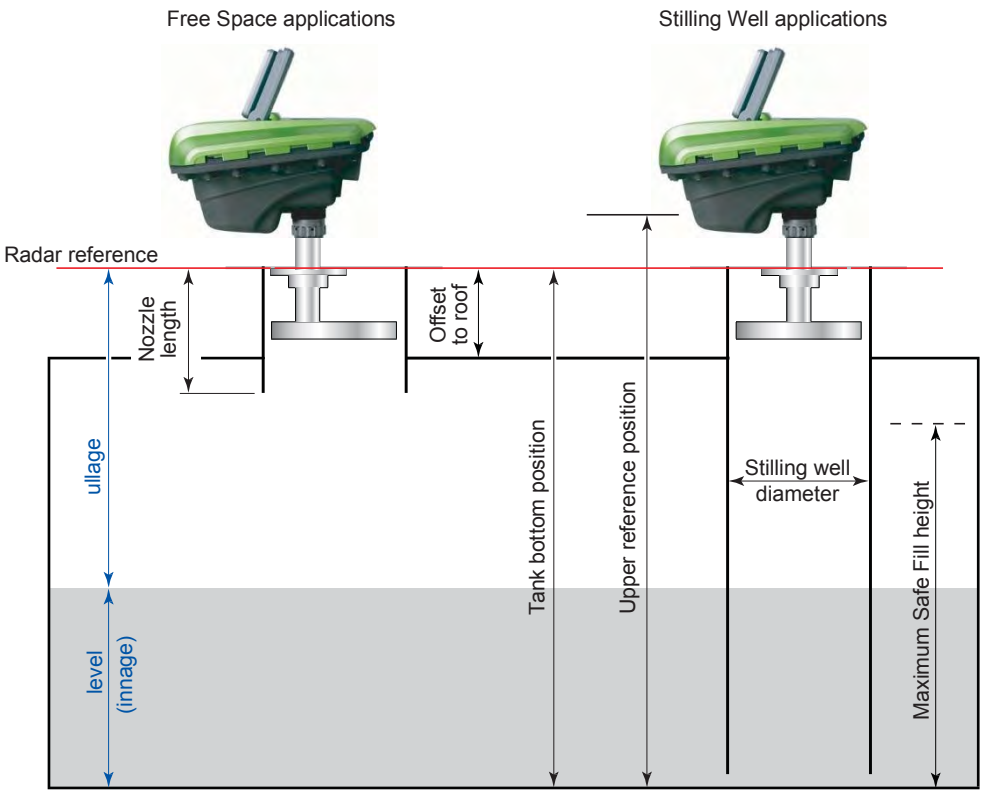


FIGURE 7-8 Basic commissioning entities

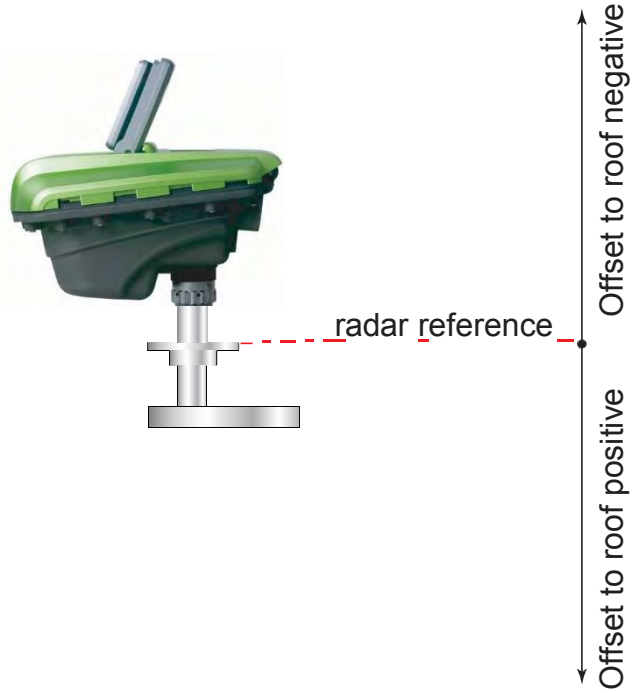


FIGURE 7-9 Definition of [Offset to roof]

Engauge
SmartView

☛ To get the radar gauge level without any compensations enabled (but with averaging filter and maximum Safe fill warnings enabled), program the entities listed in the tables below.

☛ For a *Free space* application, program following entities:

Entity Name	Explanation
[Tank bottom position]	The gauge uses this information to calculate the level (innage), and to determine the position of the bottom reflection (part of peak selection).
[Maximum Safe fill]	With this entity, the gauge checks if the programmed upper measuring range is valid ([Minimum measurable distance] at least <0.5 m> from the antenna).
[Upper reference position]	This entity is only used if “ullage” is to be read from the SmartRadar FlexLine. The ullage is then calculated from the measured level (innage) as [Upper reference position]-measured level.
[Offset to roof]	The distance between radar reference and the tank roof. The gauge uses this information to determine the position of the echoes caused by the product and the roof. A positive value means the roof is below radar reference (see also FIGURE 7-9).

Entity Name	Explanation
[Nozzle length]	Needs only to be set if the antenna is installed inside the nozzle.

☛ For a *Stilling well* application, program following entities:

Entity Name	Explanation
[Tank bottom position]	The gauge uses this information to calculate the level (innage), and to determine the position of the bottom reflection (part of peak selection).
[Maximum Safe fill]	With this entity, the gauge checks if the programmed upper measuring range is valid ([Minimum measurable distance] at least <0.5 m> from the antenna).
[Upper reference position]	This entity is only used if "ullage" is to be read from the SmartRadar FlexLine. The ullage is then calculated from the measured level (innage) as [Upper reference position]-measured level.
[Stilling well diameter]	The inner diameter of the stilling well.

7.6.2.3 Level Check

With the [Accept reference] command, the gauge's innage or ullage value is initialized in accordance with the before programmed reference data. From here the gauge will follow all relative level changes.

This command will only be accepted if the product level is <GOOD>.

This command also puts the SmartRadar FlexLine in accurate level measurement mode, so this command MUST be given!

The [Accept reference] command can handle either a reference *innage* or a reference *ullage* level. To adjust to an innage level fill in entity [Reference innage], to adjust to an ullage level fill in entity [Reference ullage]. This level value is mostly obtained by a manual level measurement (hand dip); see FIGURE 7-10.

When all values are sent to the SmartRadar FlexLine, the [Accept reference] command can be given.

When an innage or ullage reference value is not available, the [Accept reference] command must be given without filling any of these entities. The SmartRadar FlexLine will now be put into accurate level measurement mode.

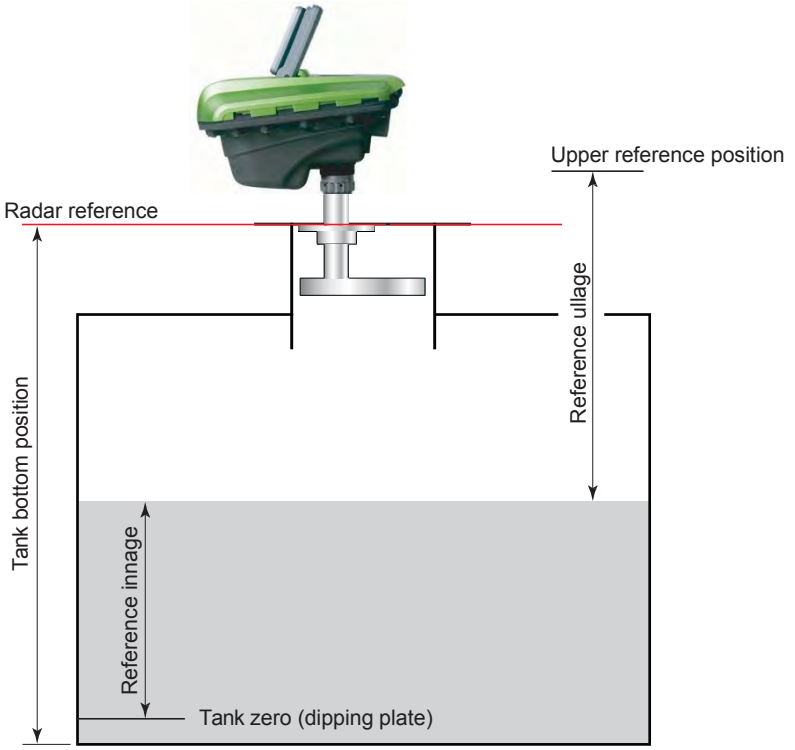


FIGURE 7-10 Level check entities

NOTE: This command does not adjust the [Tank bottom position]*, so this entity should be set manually to approximately the correct value (within ± 0.1 m).*

Engauge
SmartView

☛ Give the [Accept reference] command.

☛ Make sure the [Accept reference status] is <GOOD>.

Some remarks for the *Engauge* users:

- To make sure the [Accept reference] command works fine, all entities must have been sent to the gauge (no yellow backgrounds may be visible) prior to giving the command.

☛ To read the [Accept reference status], push the [Read] button (is *not* automatically displayed).

Some remarks for the *SmartView* users:

- On the *SmartView* display, the advanced entity [Reference radar] is visible as well. The value of this entity must be left to the default value <+999.9999>.

☛ Check [Reference status] in the commissioning menu, to see if the command has been accepted.

7.6.2.4 Alarm Settings

Engauge
SmartView

☛ Set the entities [High high alarm], [High alarm], [Low alarm], [Low low alarm], and [Alarm hysteresis] to the desired values.

For definitions, see FIGURE 7-11

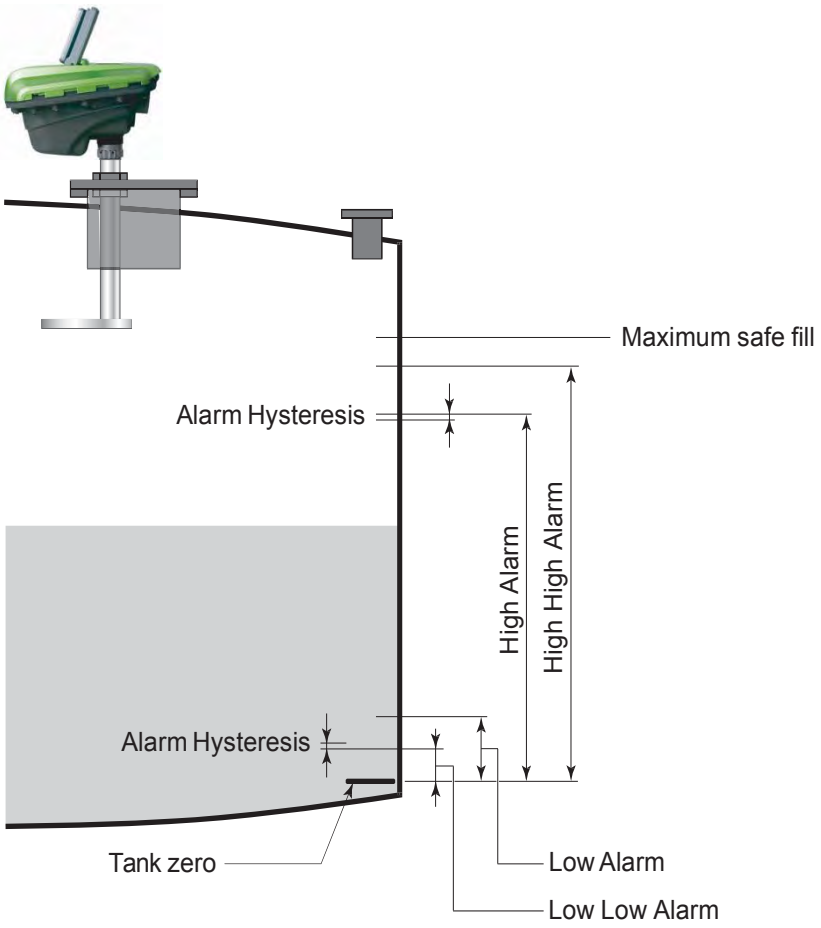


FIGURE 7-11 Alarm and hysteresis definitions

Attention!

- All above mentioned entities MUST be set as the defaults are extremes (1E+12). If they are not, no errors will be displayed, but the [Commissioned] entity will be <False>.
- If the alarm entities are correctly set, but the [Alarm hysteresis] is not, then any alarms that would raise will never be set off! So, watch the [Commissioned] status.
- Be aware that the alarm status is only visible in the [Primary value] entity (*innage*)! It is *not* visible in the [Secondary value] entity (ullage).
- Although the GPU-protocol always contains the alarm status, the current software only passes the actual alarm status to this protocol if the gauge is set to *innage* control. So, when ullage status is asked for by the GPU-protocol, NO alarm statuses are displayed.

Workaround solution: Set the GPU records to *innage*.