Harmony XB5R
ZBRN1/ZBRN2
User Manual

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

This documentation is a reference for the wireless transmitters used with the ZBRN• Harmony Hub.

The purpose of this document is to:

- show you how to install and operate your Harmony Hub.
- show you how to connect Harmony Hub with wireless transmitters, programmable logic controllers (PLCs), and other devices.
- help you become familiar with Harmony Hub features.

NOTE: Read and understand this document and all related documents *(see page 8)* before installing, operating, or maintaining your Harmony Hub.

The users must read through the entire document to understand all its features.

Validity Note

This documentation is valid for the ZBRN• Harmony Hub.

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the datasheet.
6	To save or print a datasheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Title of Documentation	Reference Number
Harmony XB5R Wireless and Battery-less Pushbutton	960562 (Eng), 960563 (Fre), DIA5ED2110402EN (Eng), DIA5ED2110402FR (Fre)
Harmony XB5R Expert Instruction Sheet	EIO0000000812 (Eng), EIO0000000813 (Fre), EIO0000000814 (Ger), EIO0000000815 (Spa), EIO0000000816 (Ita), EIO0000000817 (Chs), EIO0000000818 (Por)
Magelis Box iPC Modular and Display Optimized, Universal and Performance (HMIBMI, HMIBMO, HMIBMP, HMIBMU, HMIDM) - User Manual	EIO0000003374 (Eng), EIO0000003375 (Fre), EIO0000003376 (Ger), EIO0000003377 (Spa), EIO0000003378 (Ita), EIO0000003379 (Chs),
ZBRN1 Instruction Sheet	S1B87888
ZBRN2 Instruction Sheet	S1B87941
ZBRCETH Instruction Sheet	S1B88209
Packages Instruction Sheet	S1A57199
Receivers Instruction Sheet	S1A57202
Transmitter with Metal or Plastic Head and Cap Instruction Sheet	S1A57198
Relay Antenna Instruction Sheet	S1A57194
Handy Box Instruction Sheet	S1A57210

You can download these technical publications and other technical information from our website at https://www.schneider-electric.com/en/download

Product Related Information

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the equipment.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only persons with expertise in the design and programming of control systems are allowed to program, install, alter, and apply this product.
- Follow all local and national safety codes and standards.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Chapter 1
Introduction

Offer Description

Overview

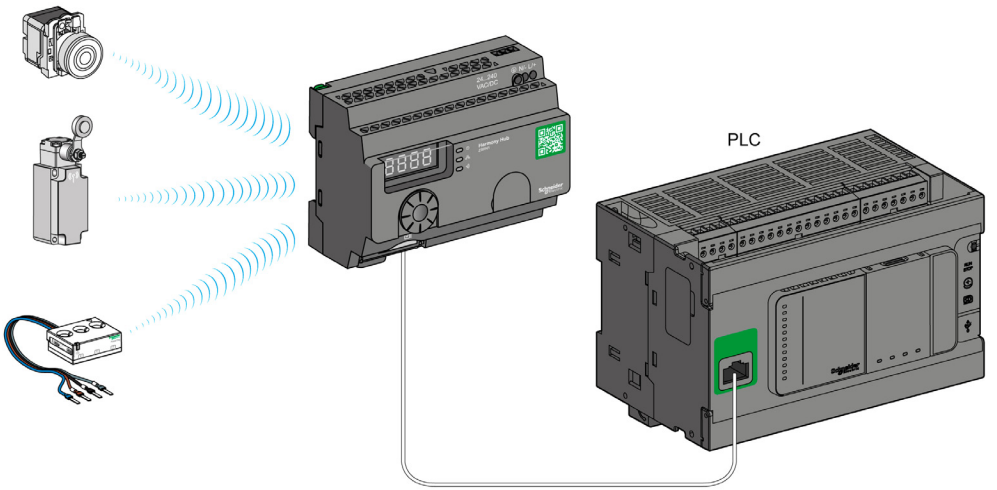
The Harmony XB5R offer using Harmony Hub allows more flexibility and simplicity in the installation. Wireless transmitters technology reduces the wiring and the cost of installation. Harmony Hub converts radio frequency inputs into various communication protocols and operates as intermediate equipment between a transmitter and a PLC or industrial PCs (IT/OT box) that support Modbus TCP protocols.

Harmony Hub can be used with transmitters such as XB4R and XB5R wireless and batteryless pushbuttons, rope pull switch, mushroom head pushbuttons, emergency stop monitoring, wireless and batteryless limit switches, temperature and energy sensors.

It has a wide range of industrial and building applications. For example, in packing lines, automatic doors in logistic centers, manufacturing of vehicles in automotive industries, for bag filling in cement industries, and for efficient use of power in office lighting.

Basic Architecture with PLC

The following figure shows the transmission between three transmitters and a ZBRN1 Harmony Hub:



NOTE: You can associate 1 Harmony Hub with up to 60 transmitters. Each transmitter has a unique ID (for example, 030079B1).

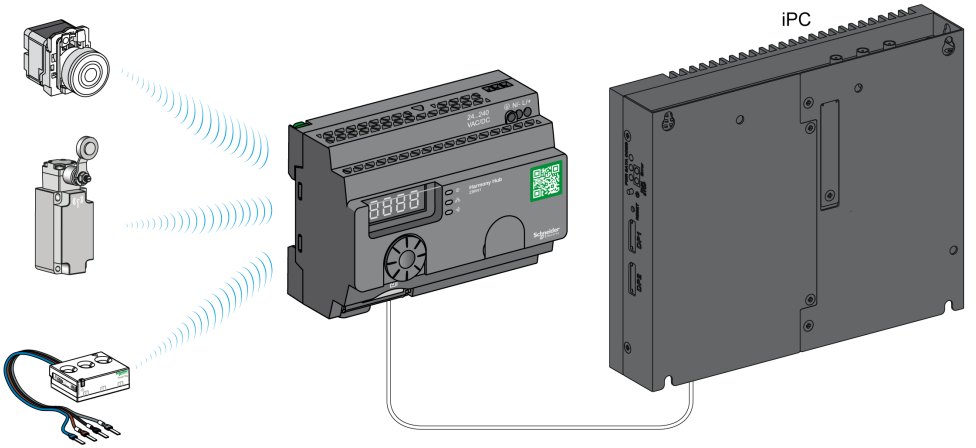
IT/OT Architecture

Harmony Hub provides network connectivity openness by operating as intermediate equipment between the wireless devices and PLCs (Programmable Logic Controller) or all industrial PCs (IT/OT box) that support Modbus TCP protocols.

Harmony Hub is providing an easy way to digitalize your production line to improve operation efficiency (OEE) by using a non-intrusive wireless system easy to connect to your IT system.

Harmony Hub collect physical signals from an operator interface or secondary sensing to generate computed data information for CMMS tools and operation management tools.

Data can be analyzed through our dedicated EcoStruxure platform through AVEVA Software, Maintenace Advisor software, and Augmented Operator Advisor application.



For details, refer to IT/OT Architecture *(see page 179)*.

Compatible Transmitters

Harmony Hub is compatible with:

- The Harmony battery-less and wireless pushbuttons offer based on radio technology
- The Harmony battery-less and wireless rope pull switch
- The OsiSense battery-less and wireless radio limit switches
- Temperature sensors with battery
- Energy sensors

The following figures show some examples of transmitters:

Example 1: pushbutton with a plastic head

ZB5RTA1

Example 2: pushbutton with a metal head

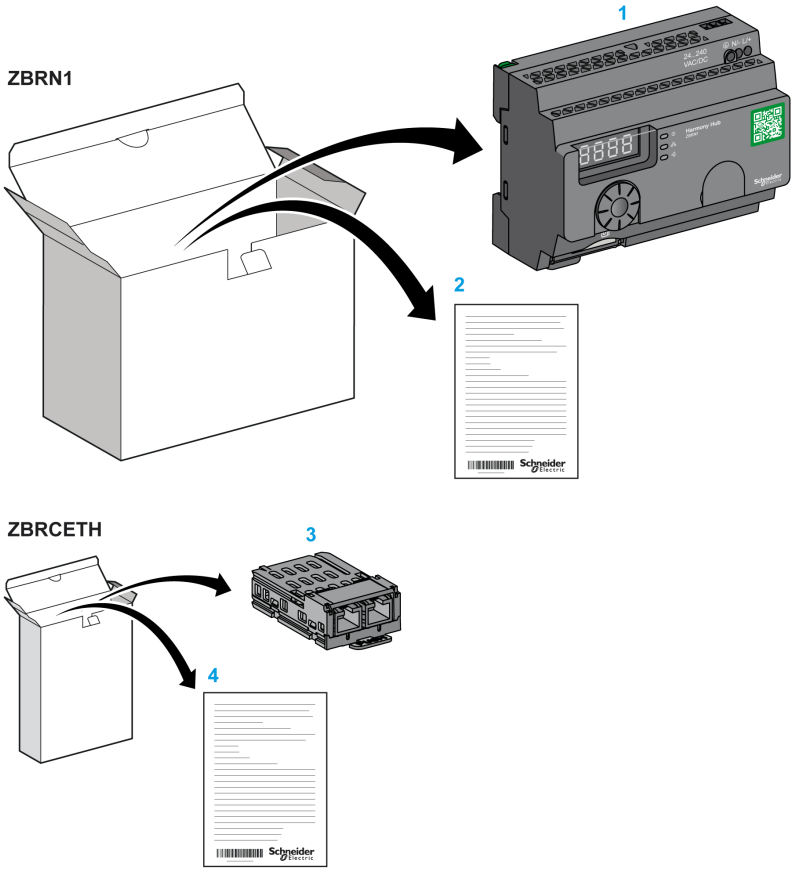
ZB4RTA3

Example 3: pushbutton with a plastic head enclosed in a handy box

ZB5RTA3 + ZBRM01

Product References

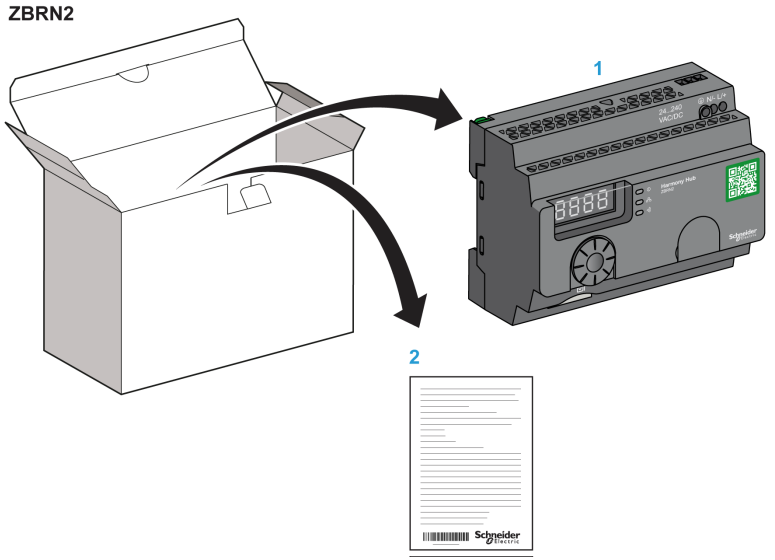
ZBRN1: Standard Harmony Hub with Communication Module



1 Harmony Hub
2 Instruction Sheet (ZBRN1)
3 Modbus TCP Communication module
4 Instruction Sheet (ZBRCETH)

NOTE: ZBRN1 must be associated with a communication module, reference ZBRCETH (Ethernet protocol).

ZBRN2: Harmony Hub for Modbus Serial Line Communication



1 Harmony Hub
2 Instruction Sheet

Difference Between ZBRN1 and ZBRN2

ZBRN2 has an embedded communication port for a Modbus serial line, whereas ZBRN1 can support different protocols using a communication module.

Chapter 2
Physical Description

Purpose

This chapter provides an overview of the Harmony XB5R ZBRN1 and ZBRN2 hardware: description, output connectors, installation, and power supply connections.

What Is in This Chapter?

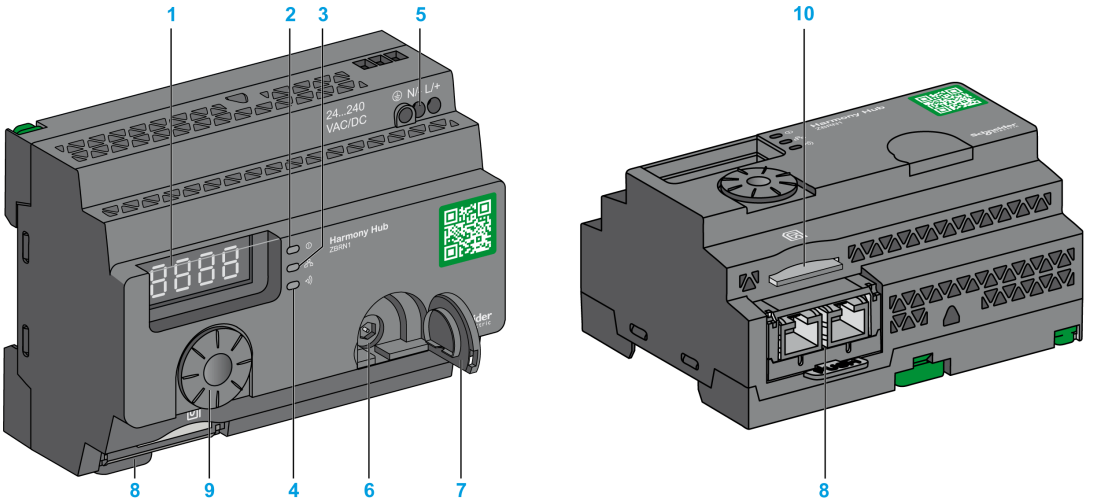
This chapter contains the following sections:

Section	Topic	Page
2.1	Product Overview	18
2.2	Installation	20
2.3	Specifications	33
2.4	Data Management	36

Section 2.1
Product Overview

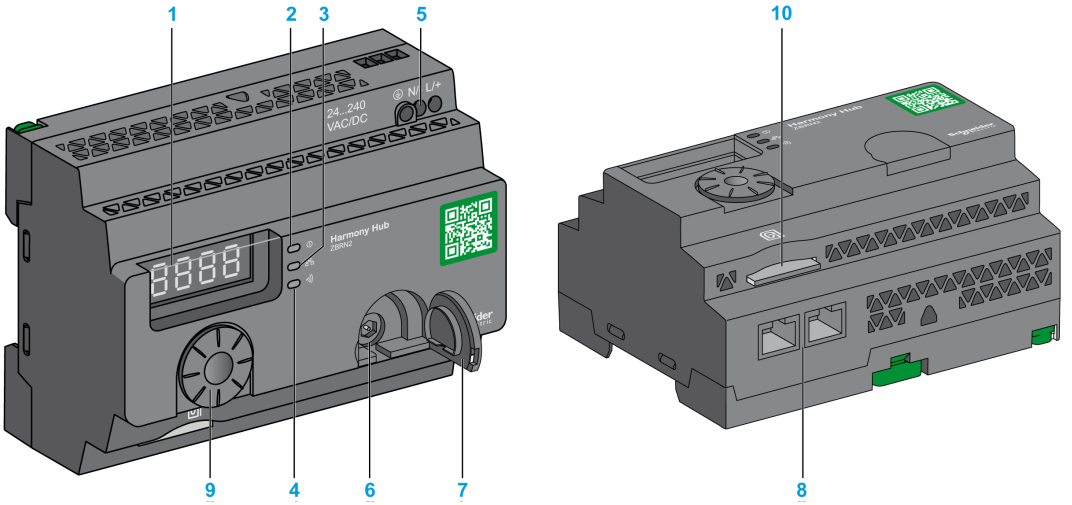
Hardware Description

ZBRN1



1 Four 7-segments displays with 5 LEDs
2 Power LED
3 Communication LED
4 Radio signal strength LED
5 Power input terminal block
6 Connector for the optional external antenna
7 Protective plug for the connector for the optional external antenna
8 ZBRCETH Communication module inserted with 2 RJ45 Ethernet connectors
9 Jog dial
10 SD memory card slot

ZBRN2



1 Four 7-segments displays with 5 LEDs
2 Power LED
3 Communication LED
4 Radio signal strength LED
5 Power input terminal block
6 Connector for the optional external antenna
7 Protective plug for the connector for the optional external antenna
8 2 RS-485 Modbus serial line connectors
9 Jog dial
10 SD memory card slot

Section 2.2
Installation

What Is in This Section?

This section contains the following topics:

Topic	Page
Installation Requirements	21
Mechanical Installation	28
Environmental Features	30
Housing	32

Installation Requirements

Before Starting

Read and understand this chapter before beginning the installation of your Harmony Hub.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the equipment.
- Use only the specified voltage when operating this equipment and any associated products.

Failure to follow these instructions will result in death or serious injury.

Operating Environment

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Install and operate this equipment according to the environmental conditions described in the operating limits.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Installation Considerations

⚠ WARNING

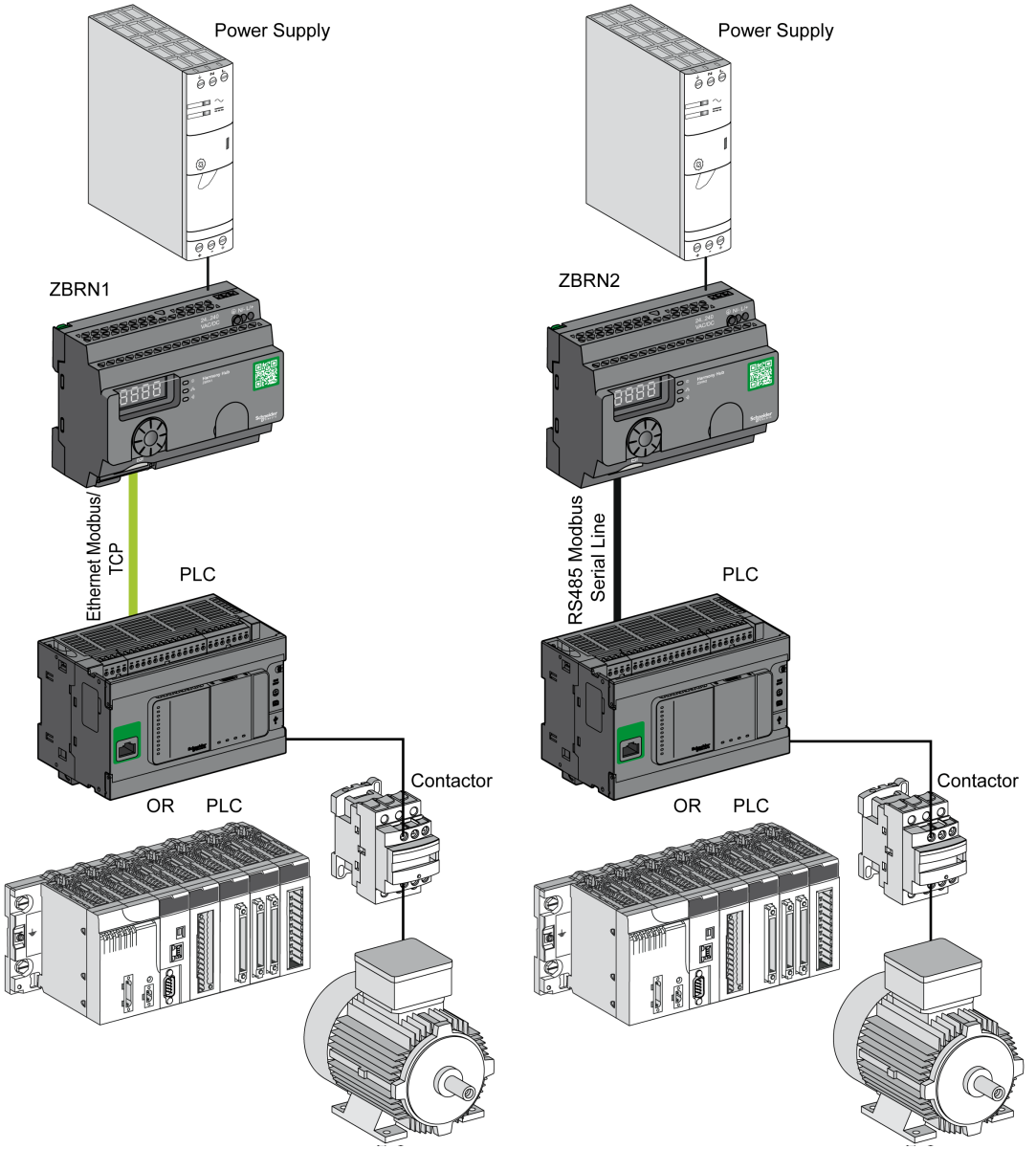
UNINTENDED EQUIPMENT OPERATION

- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Install and operate this equipment in an enclosure appropriately rated for its intended environment.
- Do not use this equipment in safety critical and hoisting machine functions due to:
  - No permanent communication
  - No acknowledge of the message from the receiver to the transmitters.
- Do not disassemble, repair, or modify this equipment.
- Do not connect any wiring to reserved, unused connections, or to connections designated as not connected (N.C.).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Architecture

The following figure shows the general principle of Harmony Hub architecture:



NOTE:

- The previous figure is not exhaustive. It shows only the general principle of the architecture.
- Refer to the specifications section *(see page 33)* for detailed wiring diagram and instructions for Harmony Hubs.
- Refer to the user manual of your associated products for detailed wiring diagrams and instructions.
- Harmony Hub can be connected to any PLC supporting the network buses listed in this document.

Connection Requirements

Power Supply Connection

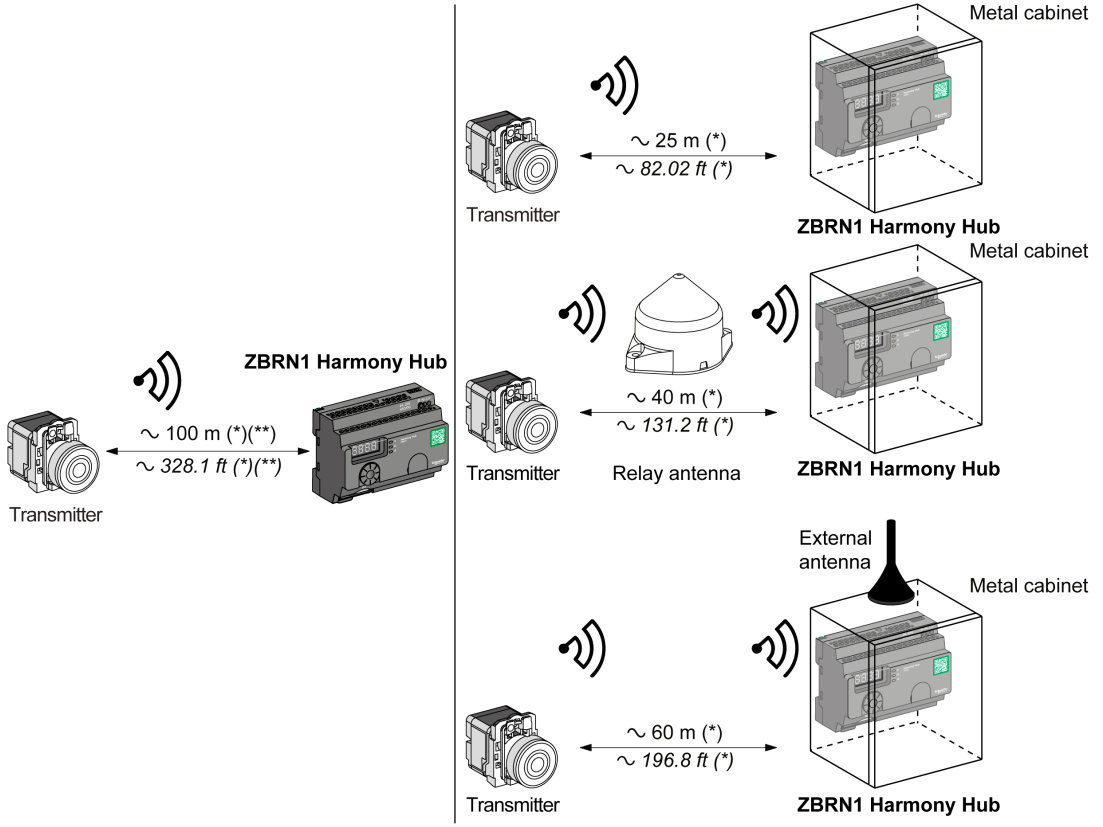
24...240 Vac/Vdc

Network connection

- RS-485 Modbus serial line network
- Ethernet Modbus TCP network

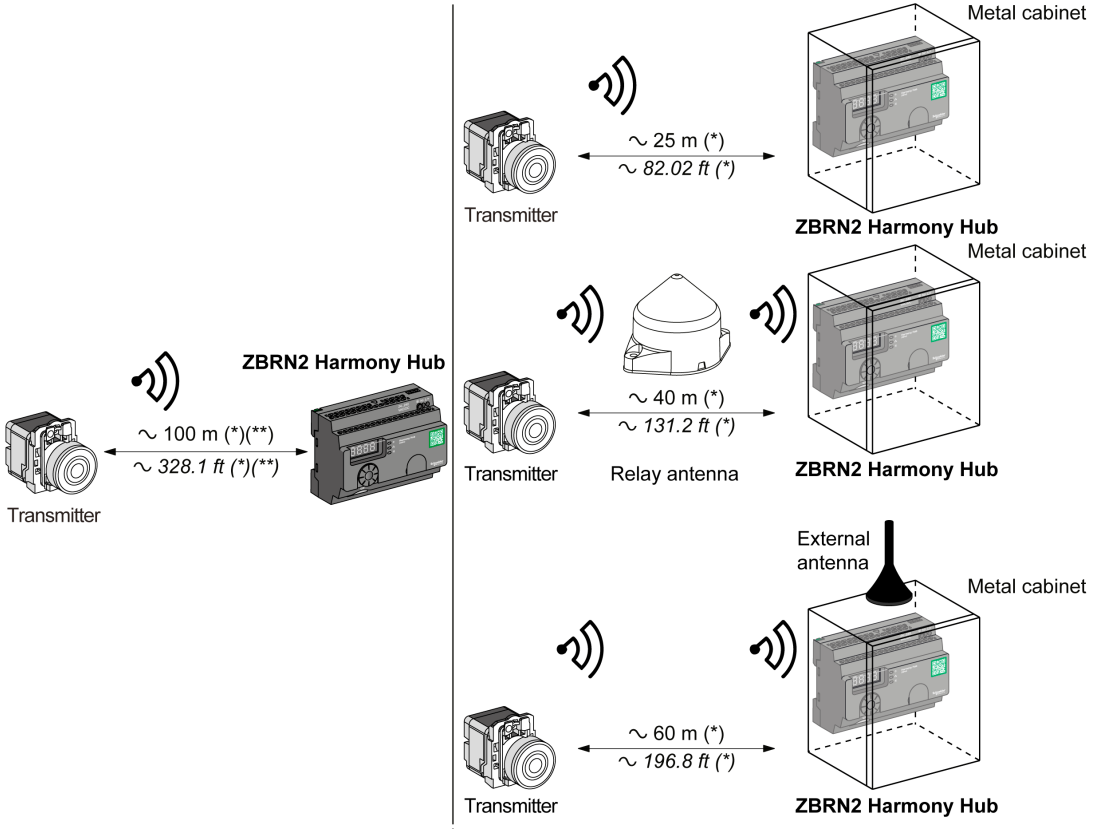
Maximum Distances

The following figure shows the maximum distance between the transmitters and the ZBRN1 Harmony Hubs:



(*) The application environment can modify the typical values.
(**) Free field (unobstructed and without electromagnetic perturbations).

The following figure shows the maximum distance between the transmitters and the ZBRN2 Harmony Hubs:



(*) The application environment can modify the typical values.
(**) Free field (unobstructed and without electromagnetic perturbations).

The level of signal attenuation depends on the material through which the signal passes:

Material	Attenuation
Glass window	10...20 %(*)
Plaster wall	30...45 %(*)
Brick wall	60 %(*)
Concrete wall	70...80 %(*)
Metal structure	60...100 %(*)
(*) Values for indication purpose only. Actual values depend on the thickness and nature of the material.	

NOTE: You can add ZBRA1 or ZBRA2 antenna or both to increase the range. The reception is reduced if Harmony Hub is placed in a metal cabinet.
For further information on the use of ZBRA1 and ZBRA2 antennas, refer to the Radio chapter *(see page 99)*.

Impact of the radio performances in the environment:
- For any environment, the radio performances are subjected to be instable due to perturbations made by any kind of industrial machines, processes, or electronic devices.
- As a consequence at any time, it is possible that the radio frames sent by a transmitter will not be caught by the receiver during the perturbation.
- With Harmony XB5R offer, only one radio frame is sent to the receiver, there is no permanent radio communication. This reason prevents the use of Harmony XB5R offer for applications where permanent reliability and/or permanent precisions are needed.

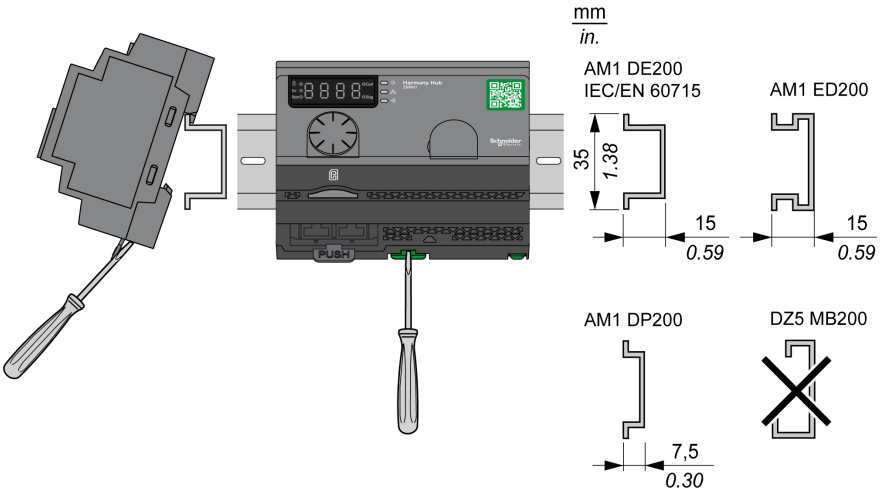
Mechanical Installation

Mounted on DIN Rail

Harmony Hub must be installed on DIN rails complying with EN/IEC 60715.

To install Harmony Hub, use a tool to press down the D lock for inserting the DIN rail.

The following figure shows the position of Harmony Hub on the DIN rail:

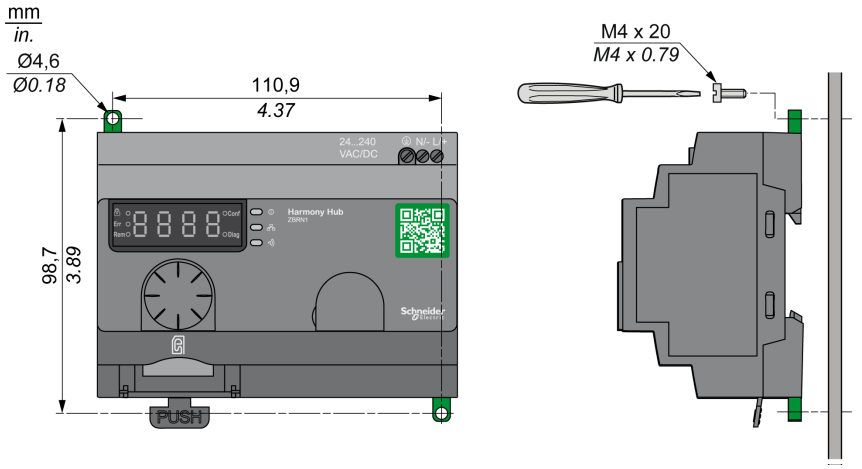


Mounted on a Grid or Plate

Harmony Hub can be installed on a grid or a plate.

The following steps explain how to install the module:

Step	Action
1	Pull out the panel mounting hooks.
2	Mount Harmony Hub on the grid or plate using the screws as shown in the following figure.



Environmental Features

Specifications

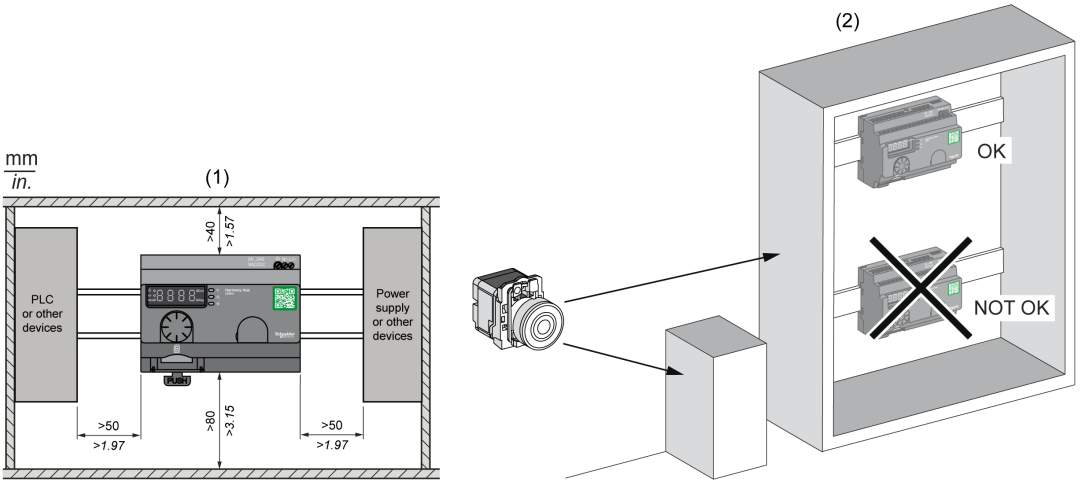
The following table shows the general environmental specifications:

Characteristics		Specifications
Standards	Conformity to standards	R&TTE 1999/5/EC, LVD 2006/95/EC, EMC2004/108/EC
	Conformity to standards	EN/IEC 60947-1, EN/IEC 60947-5-1, EN/IEC60950-1, IEC61131-2, EN 300440-2, EN300489-3, EN300328, EN62311
	Conformity to standards	UL 508 (USA), CSA C22-2 n° 14 (Canada), CCC (China), Gost (Russia)
	Radio certifications	FCC (USA), CSA, RSS (Canada), C-Tick (Australia), ANATEL (Brazil), SRRC (China), MIC (Japan)
Agencies		
UL	USA	UL508, 17th edition
CSA	Canada	CSA C22.2, No. 142-M2000
C-Tick	Australia	–
GOST	Russia	–
ANATEL	Brazil	–
FCC	USA	–
SRRC	China	–
CCC	China	–
MIC	Japan	–
RSS	Canada	–
Ambient operating temperature		–25...+55 °C (–13...+131 °F)
Storage temperature		–40...+70 °C (–40...+158 °F)
Relative humidity		95% RH at 55 °C (131 °F)
Degree of pollution		2 (IEC60664-1)
Degree of protection		IP20
Shock resistance		Half sine wave acceleration: 11 ms 30 gn (IEC 60068-2 27)
Resistance to vibration		±3.5 mm (±0.13 in.): 5...8.14 Hz 1 gn: 8.14...150 Hz when mounted on a panel 2 gn: 8.45...150 Hz when mounted on a DIN rail (IEC 60068-2-6)

Characteristics	Specifications
Altitude requirement	Operation: 0...2000 m (6561.66 ft) Storage: 0...3000 m (9842.49 ft)
	Only used at altitude not exceeding 2000 m (6561.66 ft). 
	Only used in non-tropical climate regions. 

Housing

Clearances and Mounting Position



(1) To enhance the signal reception, observe the above positioning.

(2) In a metal cabinet, the optimum place for Harmony Hub is on the top. This position avoids obstacles and enhances the signal reception.

Section 2.3
Specifications

Electrical Specifications

Power Supply Specifications

Harmony Hub complies with the following power requirements:

Electrical Features	Description	
	AC Power Supply	DC Power Supply
Rated voltage	24...240 Vac	24...240 Vdc
Voltage range	21...264 Vac	21...264 Vdc
Rated frequency	50/60 Hz	–
Frequency range	47...63 Hz	–
Under voltage protection	No	No
Terminal blocks	3-pin terminal with a pitch of 7.62 mm (0.3 in.) on the output terminal block	
Immunity to short interruptions (Conforming to IEC 61000-4-11)	10 ms	10 ms
Dielectric strength with others	3000 Vac / 4250 Vdc (input-output) 1500 Vac / 2150 Vdc (input-PE*)	
Short-circuit protection	Yes (internal fuse 2 A, 250 V)	
* PE = protective earth ground		

Power Supply Connections

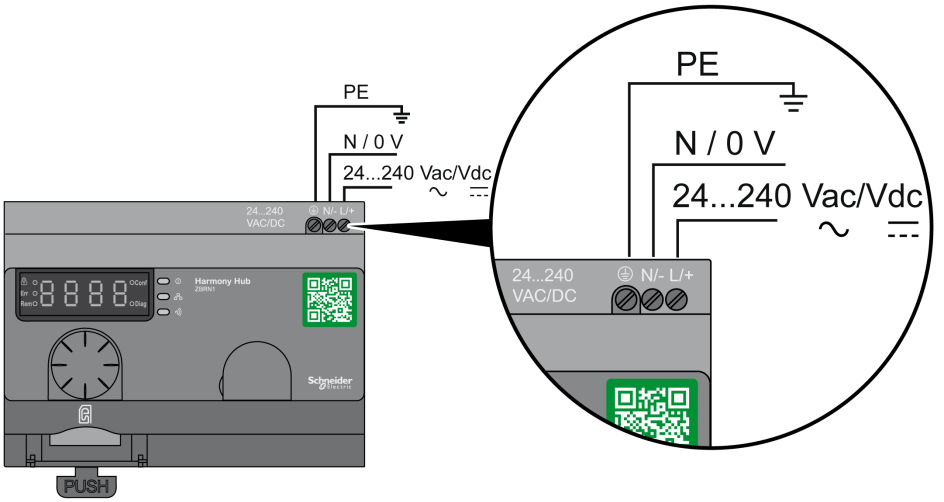
You can connect the power supply to any common supply from 24...240 Vac/Vdc.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Comply with the wiring diagram shown immediately after this message.

Failure to follow these instructions will result in death or serious injury.



The following table shows the recommended wire sizes for the L/+ and N/- terminals:

mm / in. (6 / 0.24)				
mm^2	0,75	0,75…2,5	1…4	1…1,5
AWG	*18*	*18…14*	*17…12*	*17…16*

The following table shows the recommended wire sizes for the PE terminal (protective earth ground):

mm / in. (6 / 0.24)		
mm^2	0,75...4	0,75...4
AWG	*18...12*	*18...12*

The following table shows the recommend torque for the 3 terminals:

Ø 3,5 mm / *0.14 in.*		N•m	0,35 ± 0,05
		lb-in	*3.10 ± 0.44*

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

For the protective earth ground (PE) wiring, use a cable not longer than 300 mm (11.8 in.).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following table shows the input power consumption:

Reference	Input Power
ZBRN1	9 W
ZBRN2	3.3 W

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Supply this product with a power line protected by a circuit breaker rated 16 A maximum and a ground fault circuit breaker.
- A readily accessible disconnect device shall be incorporated external to the equipment.
- Install this product in an electrical cabinet and lock the cabinet using a key.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Section 2.4
Data Management

What Is in This Section?

This section contains the following topics:

Topic	Page
Compatibility Rules	37
Transmitter Types	38
Monostable Input	40
Set/Reset	41

Compatibility Rules

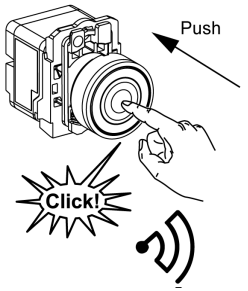
Transmitter Compatibility

ZBRT2 transmitter is compatible with the following only:

- ZBRR• receivers with firmware version 2.0 and higher
- ZBRA1 relay antenna with firmware version 2.0 and higher
- ZBRN• Harmony Hubs with firmware version higher than 1.2

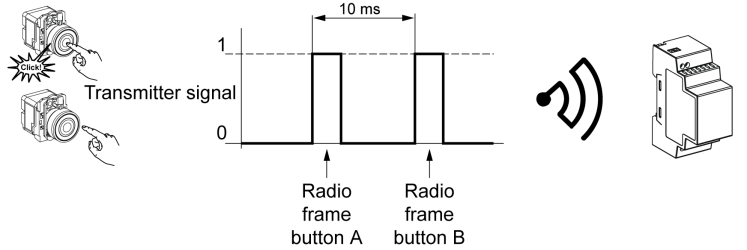
Transmitter Types

ZBRT1 and ZBRTP Transmitters



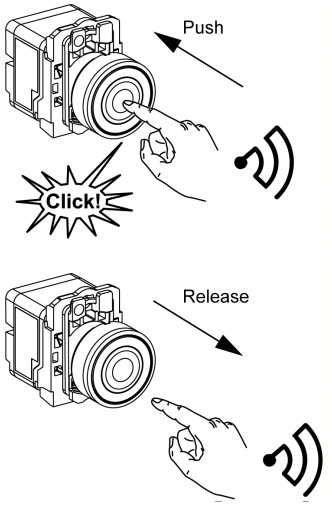
The radio message is sent when the button is pressed, signaled by a click. If the button is held down, the message is not transmitted continuously. The message is not sent when the button is released.

To avoid any conflict of multiple transmission from different transmitters, a minimum of 10 ms is required between each radio transmission.



ZBRT1 is used for applications where single pulse is required (for example, remote start of machine and reset after machine fault detection).

ZBRT2 Transmitter



The radio message is sent when the button is pressed, signaled by a click. If the button is held down, the message is not transmitted continuously.

A second radio message is sent when the button is released. This message is not transmitted continuously. It is transmitted once, at the release of the pushbutton.

This transmitter is used only for the set/reset output mode.

Monostable Input

Principle

The battery-less transmitter is equipped with a dynamo generator that converts mechanical energy (produced by pressing the pushbutton) into electrical energy. A radio-coded message with a unique ID code is sent in single pulse form.

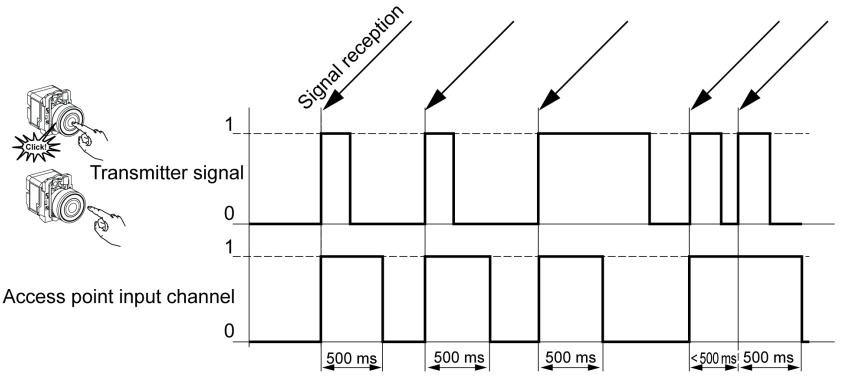
The radio signal is transmitted when the pushbutton is pressed. This action is indicated by a click in the example shown below. If the button is held, the signal is not transmitted continuously. No signal is sent when the button is released.

The corresponding input channel of Harmony Hub stays active, depending on the input holding time range, from 100 ms...1 s.

The input holding time is set for all the input channels.

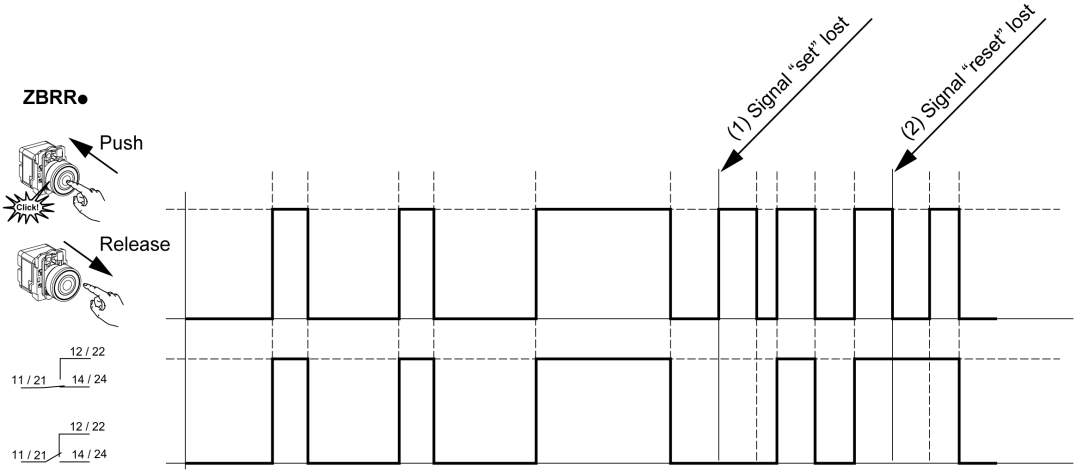
Example

The following figure shows an example of a monostable channel with the input holding time of 500 ms:



Set/Reset

Pushbutton Set/Reset



NOTE:

1. Release and push again to resynchronize
2. Push and release again to resynchronize

Chapter 3
ZBRN2 Modbus Serial Line Communication

Purpose

This chapter provides an overview of the Modbus layout description, communication and status indicator, line termination mode, settings, and the supported functions.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Communication on The Modbus Network	44
Communication and Status Indicator	47
Modbus Serial Line Wiring	48
Modbus Settings and Supported Functions	50
Modbus Serial Line Cables	52

Communication on The Modbus Network

Introduction

The Modbus protocol is a master/slave protocol. It allows a single master to request responses from the slaves, or to act based on the request. The master can address individual slaves, or can send a broadcast message to all slaves. The slaves return a message (response) to requests addressed to them individually. The slaves do not return responses to broadcast requests from the master.

⚠ WARNING

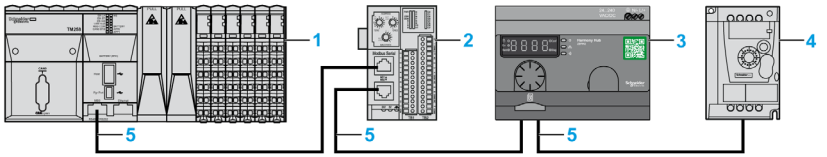
RISK OF UNINTENDED EQUIPMENT OPERATION

Do not use more than one master on the Modbus network. Unintended I/O behavior can result if more than one master is able to communicate on the network at the same time.

Depending on the I/O configuration, unintended equipment operation can result if more than one master is in use.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

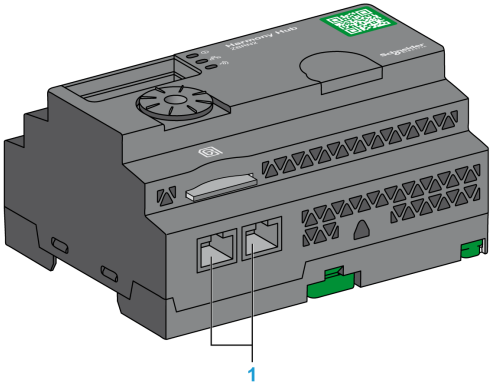
Network Connection



1 PLC as master
2 Modbus Advantys OTB network interface module
3 ZBRN2 Harmony Hub
4 ATV12 drive
5 Modbus serial line

Modbus Serial Ports

The following figure shows the serial line connectors in ZBRN2 :



1 Serial line connectors

ZBRN2 offers 1 Modbus serial line communication port equipped with 2 RJ45 plugs. It enables wiring between the devices without using a hub.

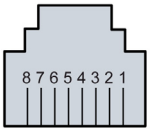
The following table shows the specifications of ZBRN2 :

Features	Specification
Function	Modbus slave and Modbus RTU
Plug	2 RJ45 connectors
Isolated	Yes
Maximum cable length	1000 m (3280.83 ft)
Polarization	No
Supported baud rates	Auto/1200/2400/4800/19200/38400/115200
Parity	Even/Odd/No/Auto
Stop bit	1 bit (even and odd) 2 bits (no parity)

RJ45 Layout Description

Modbus serial port is an RS-485, 2-wire and common Modbus serial line using a RJ45 connector.

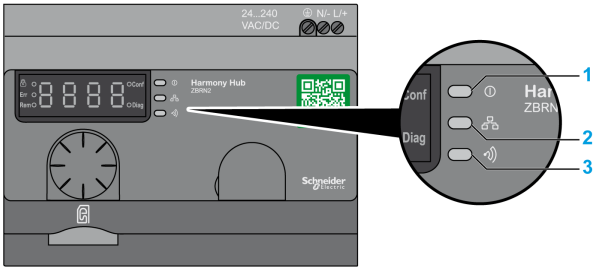
The following figure shows the layout of RJ45 connector:



RJ45 pin	Signal	Description
1	Unused	–
2	Unused	–
3	Unused	–
4	D1	Transmission signal.
5	D0	Reception signal.
6	Unused	Reserved.
7	Unused	Reserved (5...24 Vdc).
8	Common	Common of signal and supply.

Communication and Status Indicator

Modbus Communication and Status LED



1 Power LED
2 Communication LED
3 Radio signal strength LED

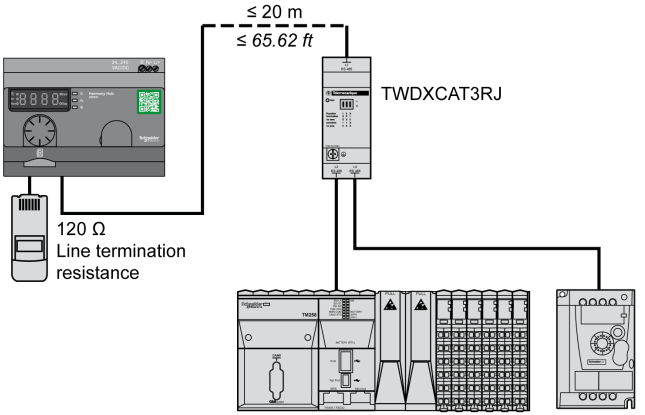
The yellow Modbus communication LED shows the following status:

- On/flashing: Data is being exchanged (depends on the quantity of information).
- Off: No data is being exchanged.

Modbus Serial Line Wiring

Network Connection

You can directly connect Harmony Hub to a PLC for a distance up to 20 m (65.62 ft) as shown in the following figure:



⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

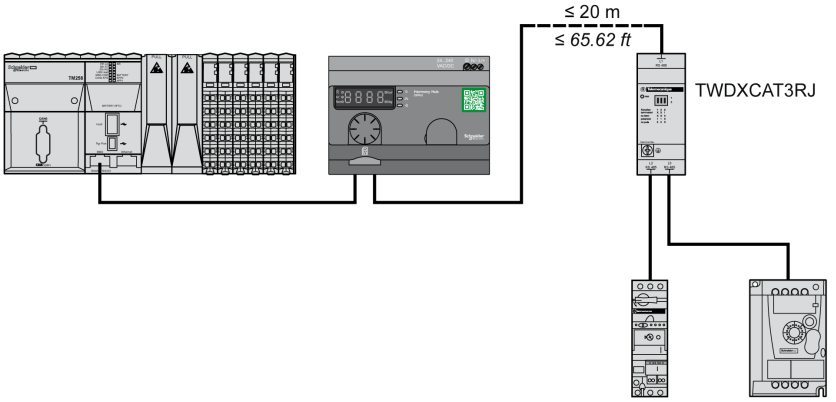
- Use a Modbus serial line cable not longer than 20 m (65.62 ft).
- Add a 120 ohm termination line when Harmony Hub is located at the end of the Modbus serial line (reference VW3A8306RC).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Using TWDXCAT3RJ

TWDXCAT3RJ is used for three connections, polarization, and line termination.

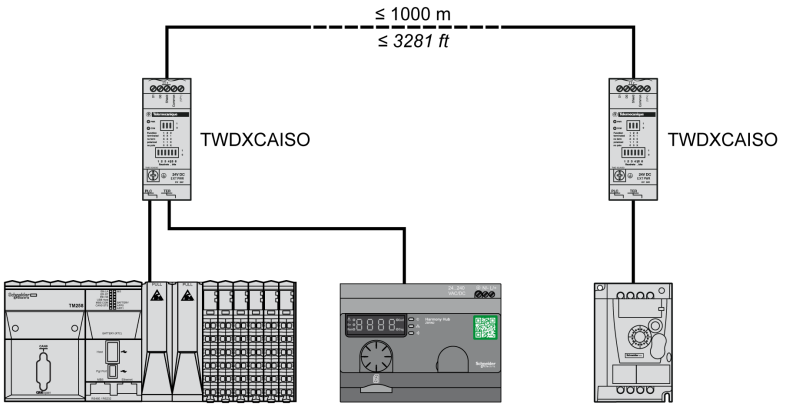
The following figure shows the connection of the device on the bus using TWDXCAT3RJ:



Using TWDXCAISO

TWDXCAISO is used for isolation and line termination.

The following figure shows the connection of the device on the bus using TWDXCAISO (even if Harmony Hub is already isolated):



For distances longer than 20 m (65.62 ft), verify that the other devices connected to the bus are isolated. If other devices are not isolated, use the TWDXCAISO module.

Modbus Settings and Supported Functions

Modbus Message Structure

The Modbus protocol uses 16-bit words (registers) divided into 2 bytes of 8 bits each. A Modbus message starts with a header followed by a 1-byte address. A Modbus message uses a Modbus function as its first byte.

The following table shows the full structure of a Modbus RTU message:

Address	Modbus Messages		CRC
	Function Code	Data	
1 byte	1 byte	n-byte field	2 bytes

List of Supported Commands

The following table shows the list of Modbus commands:

Modbus Function Code: Dec Index (Hex)	Sub-Function: Modbus Encapsulated Interface	Command
01 (0001 H)	–	Read coils.
03 (0003 H)	–	Read holding registers.
06 (0006 H)	–	Write single register.
16 (0010 H)	–	Write n registers.
43 (002B H)	14 (000E H)	Read device identification.

NOTE: Registers can be read or written only if the registers are adjacent.

Reading Coils (01):

This function code is used to read the content of one or more contiguous coil statuses in a slave.

Reading holding registers (03):

This function code is used to read the content of one or more adjacent registers in a slave.

Writing a register (06):

This function code is used to write the content of a register in a slave.

Writing n registers (16):

This function code is used to write the content of one or more contiguous registers in the slave.

Identification (43 Modbus Encapsulated Interface 14):

This function code is used to read the identification and other information relating to the physical description of a slave.

List of Identification Registers

The following table lists the Modbus identification registers:

Identifier	Register Name	Value	Data Type
0 (0000 H)	VendorName	Schneider Electric	ASCII string
1 (0001 H)	ProductCode	ZBRN1: 052848 ZBRN2: 052849	
2 (0002 H)	MajorMinorRevision	1.0 for the first official version	
3 (0003 H)	VendorUrl	http://www.schneider-electric.com	
4 (0004 H)	ProductName	Harmony	
5 (0005 H)	ModelName	ZBRN1 ZBRN2	

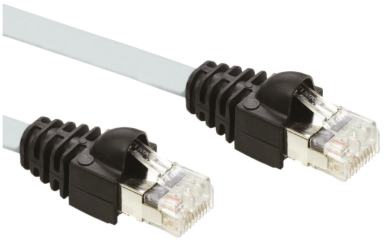
Abort Code

Function Code	Abort Code	Description
03 H	02 H	One of the registers does not exist.
	03 H	Incorrect register number
	04 H	Unavailable value
06 H	02 H	The register does not exist.
	04 H	Invalid value or register in read only.
10 H	02 H	The register does not exist.
	03 H	Incorrect register number
	04 H	Invalid value or register in read only.
2B H	01 H	Modbus encapsulated interface different from 14
	02 H	Identifier does not exist.
	03 H	Identifier > 4 or = 0

Modbus Serial Line Cables

Modbus Serial Line Cables for ZBRN2 Harmony Hub

The following figure shows the Modbus serial line cable with 2 RJ45 connectors to connect to any device supporting the protocol:



1

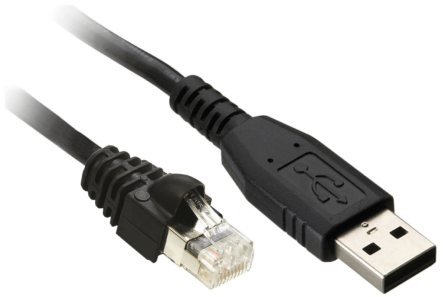
Item	Description	Reference	Length
1	Modbus serial line cable	VW3A8306R03	0.3 m (0.9 ft)
		VW3A8306R10	1 m (3.2 ft)
		VW3A8306R30	3 m (9.8 ft)

The following figure shows the Modbus serial line cable with 1 RJ45 connector and 1 mini DIN connector to connect to a Twido PLC:

2

Item	Description	Reference	Length
2	Modbus serial line cable for Twido PLC	TWDXCARJ003	0.3 m (0.9 ft)
		TWDXCARJ010	1 m (3.2 ft)
		TWDXCARJ030	3 m (9.8 ft)

The following figure shows the Modbus serial line cable with 1 RJ45 connector and one USB connector to connect to a PC:

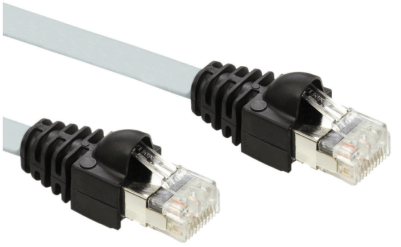


3

Item	Description	Reference	Length
3	Modbus serial line cable	TCSMCNAM3M002P	2.5 m (8.2 ft)

The following figures show USB to RS-485 converter and Modbus serial line cable to connect to a PC:

4a



4b

Item	Description	Reference	Length
4a	USB to RS-485 converter	TSXCUSB485	–
4b	Modbus serial line cable	VW3A8306R03	–

The following figures show USB to RS-485 converter and Modbus serial line cable to connect to a Twido PLC.

5a

5b

Item	Description	Reference	Length
5a	USB to RS-485 converter	TSXCUSB485	–
5b	Modbus serial line cable for Twido PLC	TWDXCARJP03P	–

Chapter 4
ZBRN1 Ethernet Communication

What Is in This Chapter?

This chapter contains the following topics:

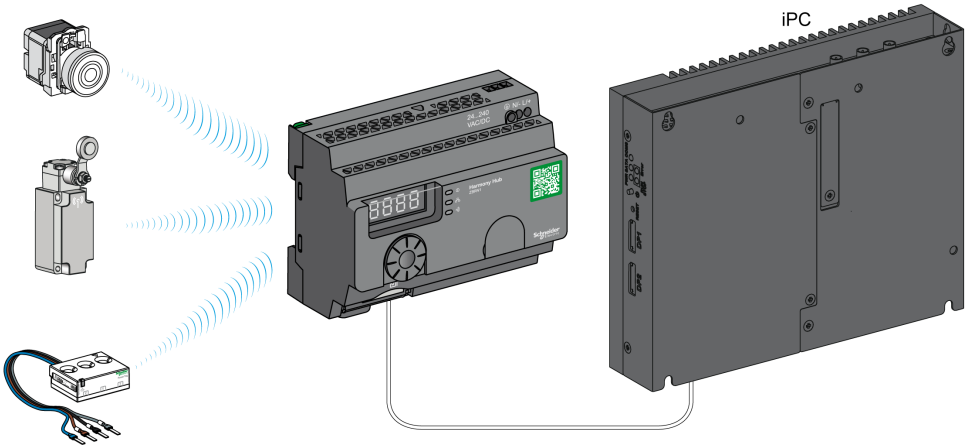
Topic	Page
Communication on The Ethernet Network	56
Addressing Modes	60
Communication and Status Indicator	62
Modbus TCP Settings and Supported Functions	64
Ethernet Cable	65

Communication on The Ethernet Network

Introduction

Ethernet is a widely used, low-cost technology for local area networks. This technology is used to exchange data between several devices connected together on a network.

Network Connection

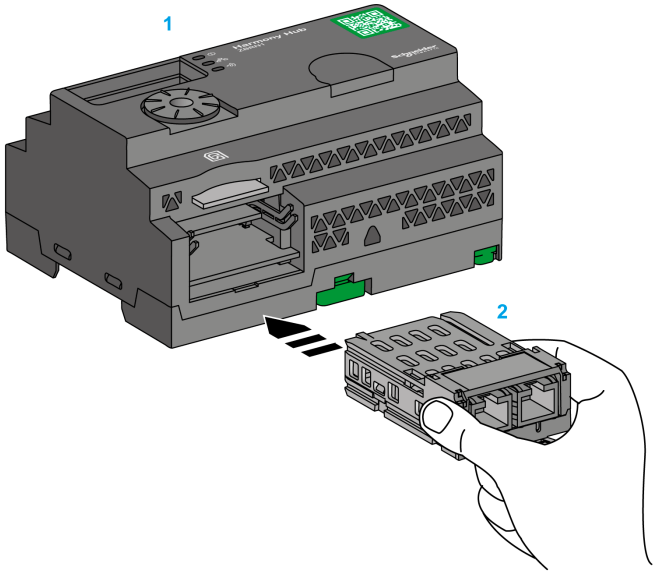
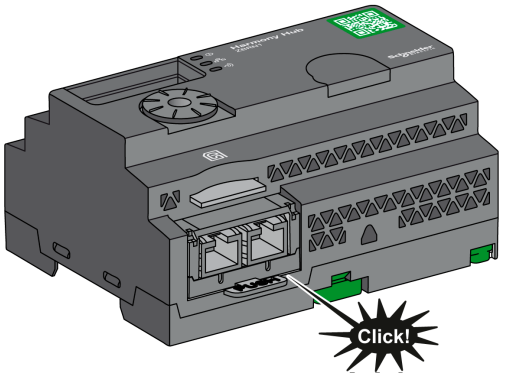


1 Ethernet Advantys OTB network interface module
2 ZBRN1 Harmony Hub associated with ZBRCETH communication module
3 PLC
4 Ethernet

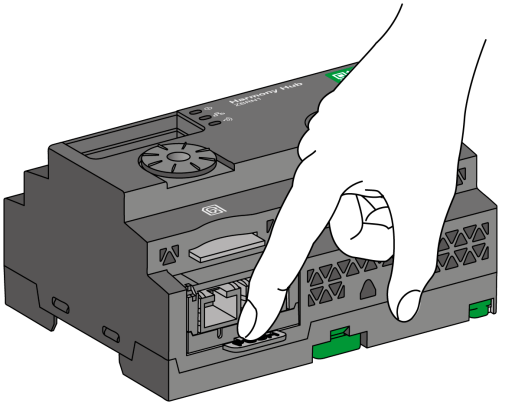
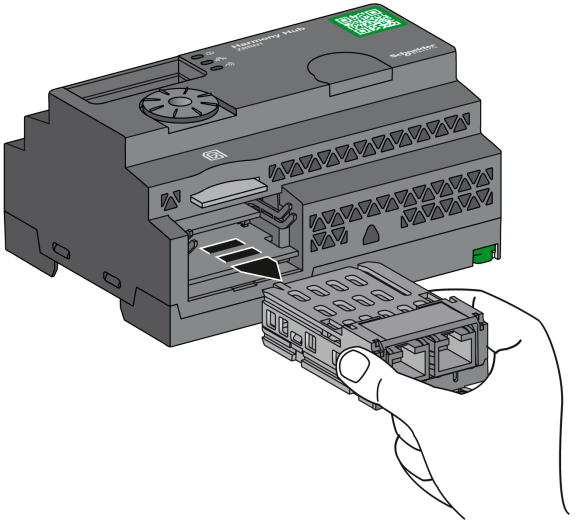
ZBRCETH Communication Module

ZBRCETH is a communication module that supports Ethernet Modbus TCP protocol.

The following procedure describes the insertion of the communication module:

Step	Action
1	Disconnect all power from the ZBRN1 Harmony Hub.
2	Place the module in ZBRN1 Harmony Hub.  **1** ZBRN1 Harmony Hub **2** ZBRCETH communication module
3	Press firmly into place. 

The following procedure describes the removal of the communication module:

Step	Action
1	Disconnect all power from the ZBRN1 Harmony Hub.
2	Push down the release tab. 
3	Pull out the module. 

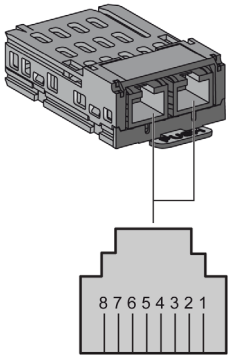
ZBRCETH offers one Ethernet communication port equipped with two RJ45 plugs. It enables daisy chain wiring between devices without using a switch.

The following table shows the specifications of the communication module:

Feature	Specifications
Plug	Two RJ45 connectors
Driver	• 10/100 MB/s • Auto negotiation • Half/Full duplex
Type of cable	Shielded
Topology	Daisy chain
Automatic polarity correction	Yes

RJ45 Layout Description

ZBRCETH communication module has two RJ45 connectors for Ethernet connectivity as shown in the following figure:



The following table shows the pin details of the RJ45 connector:

RJ45 pins	Signal	Description
1	TX+	Transmission signal
2	TX-	Transmission signal
3	RX+	Reception signal
4	Unused	–
5	Unused	–
6	RX-	Reception signal
7	Unused	–
8	Unused	–

Addressing Modes

Address Assignment

Assign the IP address to Harmony Hub using one of the following methods:

- By a DHCP (dynamic host control protocol) server.
- By a BOOTP (bootstrap protocol) server (BOOTP zone).
- Using the IP address stored in the flash memory.

NOTE: If Harmony Hub detects a duplicate address, it does not start until a unique address is assigned to the transmitter.

Address Assignment by a DHCP Server

The IP address assigned by a DHCP server is stored in a table of DHCP server.

Step	Action	Comments
1	Select **DHCP** mode from the Ethernet menu using the jog dial on Harmony Hub.	For further information, refer to the IP setting menu *(see page 124)*.
2	Select the **DHCP** value between 0–159 using the jog dial.	This action defines the device name.
3	Wait 10 s.	When the display stops flashing after 10 s, Harmony Hub triggers a request for an IP address.

Address Assignment by BOOTP Server

The BOOTP server contains a MAC address table for the device connected to network with its IP address. The following steps explain how to assign the address to Harmony Hub from the BOOTP server:

Step	Action	Comments
1	Select the **BOOTP** mode from the Ethernet menu using the jog dial on Harmony Hub.	For further information, refer to the IP setting menu *(see page 124)*.
2	Wait 10 s.	When the display stops flashing after 10 s, Harmony Hub triggers a request for an IP address.

Assignment of Stored IP Addresses

Harmony Hub uses the IP address stored in its flash memory. The following steps explain how to assign the address to Harmony Hub from the flash memory:

Step	Action	Comments
1	Select the **Static IP** mode from the Ethernet menu using the jog dial on Harmony Hub.	Harmony Hub uses the IP address stored in the flash memory. For further information, refer to the IP setting menu *(see page 124)*.
2	Wait 10 s.	When the display stops flashing after 10 s, Harmony Hub triggers a request for an IP address.

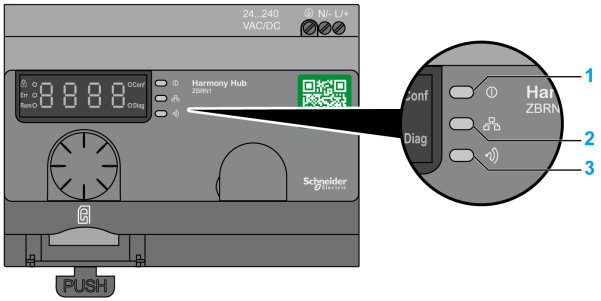
Modbus Unit ID Parameter

Use the PLC with the following UIDs to access the device communication details:

- Use UID 247 to access the Ethernet diagnostics information (ZBRCETH communication module server).
- Use UID 248 or 255 to access the Modbus TCP registers, such as input registers and holding time (ZBRN1 Harmony Hub server).

Communication and Status Indicator

Status LED on The ZBRN1 Harmony Hub

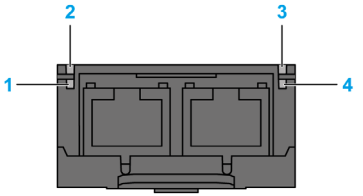


1 Power LED
2 Communication LED
3 Radio signal strength LED

The yellow Ethernet communication LED shows the following status:

- On/flashing: Data is being exchanged (depends on the quantity of information).
- Off: No data is being exchanged.

Status LED on The ZBRCETH Communication Module



The following table shows the Ethernet Modbus TCP LED status:

Item	Name	LED State	Description	Module State
1	Link/Activity port 1	Solid green	Ethernet link is present at 100 Mbit/s.	The module is detecting an Ethernet link.
		Flashing green	Ethernet link is present with Ethernet traffic at 100 Mbit/s.	The module is detecting Ethernet traffic.
		Solid yellow	Ethernet link is present at 10 Mbit/s.	The module is detecting an Ethernet link.
		Flashing yellow	Ethernet link is present with Ethernet traffic at 10 Mbit/s.	The module is detecting Ethernet traffic.
2	Module status	Green	On.	The module is turned on.
			Off.	The module is off.
3	Network status	Red	Harmony Hub is being turned on.	The module is being turned on.
		Solid green	The network is operating normally.	The module is operating normally.
		4 flashes	A duplicate IP condition exists.	The module is offline.
		5 flashes	The module is attempting to get an IP configuration from BootP server.	The module is sending BOOTP/DHCP requests to a BootP server and awaiting a reply.
		6 flashes	The operation is normal with default IP addressing settings.	The BootP request timed out. The module applies the default IP address (85.16.x.y).
4	Link/Activity port 2	Solid green	Ethernet link is present at 100 Mbit/s.	The module is detecting an Ethernet link.
		Flashing green	Ethernet link is present with Ethernet traffic at 100 Mbit/s.	The module is detecting Ethernet traffic.
		Solid yellow	Ethernet link is present at 10 Mbit/s.	The module is detecting an Ethernet link.
		Flashing yellow	Ethernet link is present with Ethernet traffic at 10 Mbit/s.	The module is detecting Ethernet traffic.

Modbus TCP Settings and Supported Functions

For further information on Modbus TCP settings, refer to the Modbus Settings and Supported Functions *(see page 50)*.

Ethernet Cable

Ethernet Cable for ZBRN1 Harmony Hub

The following figure shows the Ethernet cable used to connect to the terminal equipment:

1

Item	Description	Reference	Length
1	Ethernet cable (2 x RJ45 connectors, one at each end)	490NTW00002U	2 m (6.6 ft)
		490NTW00005U	5 m (16.4 ft)
		490NTW00012U	12 m (39.4 ft)

Chapter 5
Modbus Registers

Introduction

All the following addresses are indicated according to the IEC %MW standard format.

For access to Modbus registers, add 1 to each address.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not write or read the register addresses which are not mentioned in this document. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

All the registers used are 16 bits.

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
5.1	Harmony Hub Input Channels Registers	68
5.2	Diagnostic Registers	76
5.3	Configuration Registers	91

Section 5.1
Harmony Hub Input Channels Registers

What Is in This Section?

This section contains the following topics:

Topic	Page
Input Channels Registers	69
Type 1 Input Channels Registers	71
Type 5 Input Channels Registers	72
Type 6 Input Channels Registers	73

Input Channels Registers

Input Channels

The following table presents the input channel registers:

Register Address	Name	Access Type(1)	Input Channel	Channel Status	Description
0000	Input register 1	R	0...15	0: Off 1: On	Stores the status (0 or 1) of input channels from 0 to 15 (2).
0001	Input register 2	R	16...31	0: Off 1: On	Stores the status (0 or 1) of input channels from 16 to 31 (2).
0002	Input register 3	R	32...47	0: Off 1: On	Stores the status (0 or 1) of input channels from 32 to 47 (2).
0003	Input register 4	R	48...59	0: Off 1: On	Stores the status (0 or 1) of input channels from 48 to 59 (2).
0004 … 0009	Reserved	-	-	-	-
0010 … 0042	Input Channel 0 data	R	0	-	Stores the data of input channel 0.
0043 … 1956	Input Channel 1…58 data	R	1...58	-	Stores the data of input channels from 1 to 58.
1957 … 1989	Input Channel 59 data	R	59	-	Stores the data of input channel 59.
1990 … 1999	Reserved	-	-	-	-

1 R: Read only.
2 Only for pushbuttons and limit switches.

Input Registers

Input registers 1…4 are reserved to type 1 and some type 6 transmitters. Each bit represents an input of Harmony Hub. When a message is received, the status bit is updated to 1 for the duration of the holding time.

Input register 1:

A 16-bit register stores the status of channels from 0...15. One bit is assigned for one input channel to store the input status as 0 or 1.

Input register 2:

A 16-bit register stores the status of channels from 16...31. One bit is assigned for one input channel to store the input status as 0 or 1.

Input register 3:

A 16-bit register stores the status of channels from 32... 47. One bit is assigned for one input channel to store the input status as 0 or 1.

Input register 4:

A 16-bit register to store the status of channels from 48...59. One bit is assigned for one input channel to store the input status as 0 or 1.

NOTE: Out of the 16 bits of the register, 12 bits are used to store the status of the input channel.

Input Channel Data Registers

The input channel data table (0010…1989) is composed with 60 sub-sections for the 60 inputs.

Each sub-section is 33 registers long.

For the input channel N (0…59):

First input data register address (N) = 33 * N + 10

The content of each input channel data registers depends on the transmitter type:

- Type 1 input channel registers for push buttons and limit switches. *(see page 71)*
- Type 5 input channel registers for thermal monitoring sensors. *(see page 72)*
- Type 6 input channel registers for generic ZigBee and power tag sensors. *(see page 73)*

Type 1 Input Channels Registers

Type 1 Input Channels Data

The following table presents the type 1 transmitter data mapping:

Offset Register	Name	Access Type	Channel Status	Description
+0	Device type	R	Bit 0…Bit 7: Type of transmitter ● 0: none ● 1…6: type number Bit 8…Bit 15: Reserved	Stores the type of transmitter associated to the input channel.
+1	Time out RSSI	R	Bit 0…Bit 7: Timeout flag: ● True: FF H (time out expired) ● False: 00 H Bit 8…Bit 15: RSSI: ● (-127…127 dBm) ● -128: Invalid value	Stores the time-out flag and the radio reception power value.
+2 +3	Time stamp	R	Two registers to store the double word value. +2: Stores the most significant word. +3: Stores the least significant word. ● FFFF FFFF H: Invalid value ● 00FF 0000 H: Rollback value	Stores the details of the time stamp (µs/320).
+4…32	Reserved	-	-	-
R: Read only.				

Type 5 Input Channels Registers

Type 5 Input Channels Data

The following table presents the type 5 transmitter data:

Offset Register	Name	Access Type	Channel Status	Description
+0	Device type	R	Bit 0…Bit 7: Type of transmitter ● 0: none ● 1…6: type number Bit 8…Bit 15: Reserved	Stores the type of transmitter associated to the input channel.
+1	Time out RSSI	R	Bit 0…Bit 7: Timeout flag: ● True: FF H (time out expired) ● False: 00 H Bit 8…Bit 15: RSSI: ● (-127…127 dBm) ● -128: Invalid value	Stores the time-out flag and the radio reception power value.
+2 +3	Time stamp	R	Two registers to store the double word value. +2: Stores the most significant word. +3: Stores the least significant word. ● FFFF FFFF H: Invalid value ● 00FF 0000 H: Rollback value	Stores the details of the time stamp (µs/320).
+4	Battery voltage	R	Bit 0…Bit 7: Battery voltage ● FF H: Invalid value Bit 8…Bit 15: Reserved	Stores the internal battery voltage (0.01 mV).
+5	Reserved	-	-	-
+6	Temperature	R	● 8000 H: Invalid value	Stores the measured temperature (0.01 °C).
+7…32	Reserved	-	-	-
R: Read only.				

Type 6 Input Channels Registers

Type 6 Input Channels Data

The following table presents the type 6 generic I/O transmitter data:

Offset Register	Name	Access Type	Channel Status	Description
+0	Device type	R	Bit 0…Bit 7: Type of transmitter ● 0: none ● 1…6: type number Bit 8…Bit 15: Reserved	Stores the type of transmitter associated to the input channel.
+1	Time out RSSI	R	Bit 0…Bit 7: Timeout flag: ● True: FF H (time out expired) ● False: 00 H Bit 8…Bit 15: RSSI: ● (-127…127 dBm) ● -128: Invalid value	Stores the time-out flag and the radio reception power value.
+2 +3	Time stamp	R	Two registers to store the double word value. +2: Stores the most significant word. +3: Stores the least significant word. ● FFFF FFFF H: Invalid value ● 00FF 0000 H: Rollback value	Stores the details of the time stamp (µs/320).
+4	Battery voltage	R	Bit 0…Bit 7: Battery voltage ● FF H: Invalid value Bit 8…Bit 15: Reserved	Stores the internal battery voltage (0.01 mV).
+5	Internal Temperature	R	● -200…200 °C ● 8000 H: Invalid value	Stores the internal temperature (°C).
+6	Temperature	R	● 8000 H: Invalid value	Stores the measured temperature (0.01 °C).
+7 +8 +9 +10	Energy	R	Four registers to store the energy value. +7: Stores the most significant word. +10: Stores the least significant word. ● FFFF FFFF FFFF FFFF H: Invalid value	Stores the energy (without unit).
+11	Unit	R	-	Stores the unit of measure.
+12	Power A	R	● 8000 H: Invalid value	Stores the measured power phase A (W).
+13	Power B	R	● 8000 H: Invalid value	Stores the measured power phase B (W).
R: Read only.				

Offset Register	Name	Access Type	Channel Status	Description
+14	Power C	R	• 8000 H: Invalid value	Stores the measured power phase C (W).
+15	Current A	R	• FFFF H: Invalid value	Stores the measured current phase A (A *100).
+16	Current B	R	• FFFF H: Invalid value	Stores the measured current phase B (A *100).
+17	Current C	R	• FFFF H: Invalid value	Stores the measured current phase C (A *100).
+18	Voltage A	R	• FFFF H: Invalid value	Stores the measured voltage phase A (V *100).
+19	Voltage B	R	• FFFF H: Invalid value	Stores the measured voltage phase B (V *100).
+20	Voltage C	R	• FFFF H: Invalid value	Stores the measured voltage phase C (V *100).
+21 +22	CO2	R	Two registers to store the double word value. +21: Stores the most significant word. +22: Stores the least significant word. • 7FC0 0000 H: Invalid value	Stores the measured CO2 level (0.01 %).
+23 +24	CO	R	Two registers to store the double word value. +23: Stores the most significant word. +24: Stores the least significant word. • 7FC0 0000 H: Invalid value	Stores the measured CO level (0.01 %).
+25	Illuminance	R	• FFFF H: Invalid value	Stores the measured illuminance (10,000*Log(Lux)+1).
+26	Pressure	R	• FFFF H: Invalid value	Stores the measured pressure (10*kPa).
+27	Flow	R	• FFFF H: Invalid value	Stores the measured flow ($100*m^3/h$).
+28	Humidity	R	• 0…10,000 • FFFF H: Invalid value	Stores the measured humidity (100*%).
+29	Occupancy	R	Bit 0…Bit 7: Occupancy • FF H: Invalid value Bit 8…Bit 15: Reserved	Stores the status occupancy (without unit).
+30	State On/Off	R	Bit 0…Bit 7: State On/Off • FF H: Invalid value Bit 8…Bit 15: Reserved	Stores the state On/Off (without unit).
R: Read only.				

Offset Register	Name	Access Type	Channel Status	Description
+31	Level state	R	Bit 0…Bit 7: Level state ● FF H: Invalid value Bit 8…Bit 15: Reserved	Stores the level state (without unit).
+32	Door lock state	R	Bit 0…Bit 7: Door lock state ● FF H: Invalid value Bit 8…Bit 15: Reserved	Stores the door lock state (without unit).
R: Read only.				

Section 5.2
Diagnostic Registers

What Is in This Section?

This section contains the following topics:

Topic	Page
Module Diagnostics	77
Communication Diagnostics	86
Error Codes	88

Module Diagnostics

Product Information

The following table presents the product information registers:

Register Address	Name	Access Type	Status	Description
4000	Device name	R	1: ZBRN1 2: ZBRN2	Stores the device name.
4001	Firmware version	R	Example for 0121: V01.21	Stores the firmware version.
4002	Communication protocol	R	Bit 0: ZBRN2 (Modbus serial line) Bit 1: ZBRN1 (Ethernet)	Stores the communication protocol used by Harmony Hub.
4003	Configuration	R	Bit 0: The device is being configured through the user interface. Bit 1: The device is being configured through the SD card interface. Bit 2: The device is being configured through the Modbus interface.	Stores the configuration status of the device.
4004	Detected error	R	For more details, refer to Harmony Hub error codes *(see page 88)*.	Stores the code of the detected error.
4005	Communication status	R	Bit 0: ZBRN2 (Modbus serial line) Bit 1: ZBRN1 (Ethernet)	Stores the communication protocol used by Harmony Hub.
4006	Configuration file version	R	Example for 0121: V01.21 FFFF H: No file used	Stores the configuration file version.
4007	Client ID	R	Bit 0…Bit 3 0: None 1…15: Client ID	Stores the client ID.
R: Read only. RW: Read and write.				

Register Address	Name	Access Type	Status	Description
4008	Action status	R	Bit 0…Bit 7: Action status ● 0: Action successful ● 1: Action not successful ● 2: Invalid parameter Bit 8…Bit 15: Action code ● 0: None ● 1: Off-line association ● 2: On-line association ● 3: Remove device ● 4: Clear all devices ● 5: Start teach ● 5: Stop teach ● 15: Start remote configuration ● 16: Stop remote configuration ● 17: Get device ● 22: Update the radio connection ● 24: Start tech all ● 240: Jump test	Stores the Modbus action and the related status.
4009	Input	R	Bit 0…Bit 7: Current input for action Get Device	-
R: Read only. RW: Read and write.				

Binding List Information

The following table presents the binding list information registers:

Register Address	Name	Access Type	Status	Description
4010	Number of max binding	R	-	Stores the maximal quantity of sensors on the binding list.
4011	Bound quantity	R	-	Stores the number of inputs occupied (with associated off-line and associated on-line sensors)
4012	Paired quantity	R	-	Stores the number of inputs associated on-line
4013	No paired quantity	R	-	Stores the number of inputs associated off-line
4014	Number of max Device types	R	-	Stores the number of transmitter types supported
4015	Device type enable	R	Bit field ● Bit 0: Type 0 (free) ● Bit x: Type x	Stores the flags to show the supported transmitter types.
R: Read only. RW: Read and write.				

Radio Communication Information

The following table presents the radio communication information registers:

Register Address	Name	Access Type	Status	Description
4016	Radio connection firmware version	R	Bit 0…Bit 7: xx	Stores the ZigBee stack version: Vxx.yy.zz
4017		R	Bit 0…Bit 7: zz Bit 8…Bit 15: yy	
4018	Radio connection - Packets received counter	R	Two registers to store the double word value. 4018: Stores the most significant word. 4019: Stores the least significant word. The value is incremented each time Harmony Hub receives a packet from an associated transmitter.	Stores the number of packets received by radio connection.
4019		R		
4020	Radio connection - Bad packets received counter	R	Two registers to store the double word value. 4020: Stores the most significant word. 4021: Stores the least significant word. The value is incremented each time Harmony Hub receives a bad packet from an associated transmitter.	Stores the number of bad packets received by radio connection.
4021		R		
4022	Radio connection - Packets sent counter	R	Two registers to store the double word value. 4022: Stores the most significant word. 4023: Stores the least significant word. The value is incremented each time Harmony Hub sends a packet to an associated transmitter.	Stores the number of packets sent by radio connection.
4023		R		
4024	Radio channel	R	11...26: The radio channel with frequency 2.405 GHz (channel 11...26 IEEE 802.15.4).	Stores the details of the radio channel.
4025	Emitted radio signal strength	R	-22…4: Signal strength in dBm -127: Starting or OFF -128: Error detected.	Stores the details of the signal strength for emission.
4026	Radio connection state	R	0: OFF 20: HOLD 21: INIT 22: SCAN 23: RUN 24: Commissioning FE H: Starting FF H: Error detected.	Stores the details of the radio connection state.
R: Read only. RW: Read and write.				

Register Address	Name	Access Type	Status	Description
4027	Radio device type	R	0: None (off) 1: Green power 2: ZigBee green power concentrator 3: ZigBee green power router 4: Controller under upgrade 24: Commissioning FE H: Starting FF H: Error detected.	Stores the current radio device type.
4028	Radio Pan ID	R	0001 H…FFFE H 0000 H: Off, starting or error detected	Stores the radio Pan ID.
4029	Radio short address	R	0000 H…FFFC H FFFD H: Off,or error detected FFFE H: Starting	Stores the radio short address.
4030	Radio IEEE address	R	Four registers to store the IEEE address. 4030: Stores the most significant word. 4033: Stores the least significant word.	Stores the radio IEEE address.
4031				
4032				
4033				
4034	Radio connection - Boot counter	R	The value is incremented each time Harmony Hub radio connection restarts.	Stores the number of radio connection restarts.
4035 … 4039	Reserved	-	-	-
R: Read only. RW: Read and write.				

Modbus Serial Line Communication Information

The following table presents the Modbus serial line communication information registers:

Register Address	Name	Access Type	Status	Description
4040	Modbus boot counter	R	The value is incremented each time Harmony Hub Modbus controller restarts.	Stores the number of Modbus controller restarts.
4041 … 4049	Reserved	-	-	-
4050	Modbus error counter	R	The value is incremented each time Harmony Hub Modbus controller detects an error.	Stores the number of Modbus detected errors.
4051 … 4089	Reserved	-	-	-
4090	Modbus system clock	R	Four registers to store the Modbus system clock. 4090: Stores the most significant word. 4093: Stores the least significant word.	Stores the Modbus system clock (ms).
4091				
4092				
4093				
4094 … 4099	Reserved	-	-	-
R: Read only. RW: Read and write.				

Input Channel Transmitter Information

The following table presents the input channel 0 transmitter information registers:

Register Address	Name	Access Type	Status	Description
4100 4101	Green power - Input 0 Frame counter	R	Two registers to store the double word value. 4100: Stores the most significant word. 4101: Stores the least significant word. The value is incremented each time Harmony Hub input 0 receives a frame from an associated transmitter.	Stores the number of the Green power - input 0 frame counter.
4102 4103	Green power - Input 0 Time stamp	R	Two registers to store the double word value. 4102: Stores the most significant word. 4103: Stores the least significant word. The value is updated each time Harmony Hub input 0 receives a frame from an associated transmitter.	Stores the details of the Green power - input 0 time stamp (µs/320).
4104 4105	Green power - Input 0 Packets received counter	R R	Two registers to store the double word value. 4104: Stores the most significant word. 4105: Stores the least significant word. The value is incremented each time Harmony Hub receives a packet from an associated transmitter.	Stores the number of the Green power - input 0 packets received since last restart.
4106 4107	Green power - Input 0 Bad packets received counter	R R	Two registers to store the double word value. 4106: Stores the most significant word. 4107: Stores the least significant word. The value is incremented each time Harmony Hub receives a bad packet from an associated transmitter.	Stores the number of the Green power - input 0 bad packets received since last restart.
4108 4109	Green power - Input 0 Lost packets received counter	R R	Two registers to store the double word value. 4108: Stores the most significant word. 4109: Stores the least significant word. The value is incremented each time Harmony Hub detects a lost packet from an associated transmitter.	Stores the number of the Green power - input 0 lost packets since last restart.
4110	Green power - Input 0 Radio link strength	R	Bit 0…Bit 7: LQI (0…255) Bit 8…Bit 15: Radio reception power (-128…127 dBm)	Stores the radio signal strength of the Green power input 0
R: Read only. RW: Read and write.				

Register Address	Name	Access Type	Status	Description
4111	Green power - Input 0 Teach status	R	Bit 0…Bit 7: Detected error code ● 00: No error detected ● 01: Commissioning unsupported ● 02: Commissioning Error Transmitter Type ● 03: Commissioning Error Manufacturer ID ● 04: Commissioning Error Manufacturer Product ID ● 05: Commissioning Error Security ● 06: Commissioning Error Transmitter Capacity ● 07: Commissioning Error Cluster List ● 08: Data Command ID filter ● 09: No data ● 10: Data unsupported Command ID ● 11: Data Error parse Length Manufacturer ID ● 12: Data Error parse Length Cluster ID ● 13: Data Error parse Length Attribute Id ● 14: Data Error parse Length data ● 15: Data unsupported data Type ● 17: Data Mismatch data Type ● 18: Data Parse Error ● 16: Data Error Search Attribute ● 19: Data Error ● 20: Process E3 invalid unit attribute ● 21: Process E3 invalid value attribute ● 22: Process E3 Error ● 23: process ZCL Invalid Metering Value ● 24: process ZCL Invalid Electrical measurement Current value ● 25: process ZCL Invalid Electrical measurement Voltage value ● 26: process ZCL Invalid Electrical measurement Power value ● 27: Process Error Bit 8…Bit 15: Teach status) ● 1: Sensor is selected for a teach action	Stores the teach status for the Green power input 0.
R: Read only. RW: Read and write.				

Register Address	Name	Access Type	Status	Description
4112 … 4113	-	-	-	Reserved
4114	Green power - Input 0 Type 2 sensor details	R	Bit 0…Bit 7: Type 2 sensor timeout Bit 8…Bit 15: Type 2 clamp type	Stores the clamp type and timeout.
R: Read only. RW: Read and write.				

NOTE: For the input channel N (0…59): Register address (N) = 14 * N + 4100

Communication Diagnostics

Modbus Serial Line Communication Diagnostics

The following table presents the Modbus serial line communication diagnostics registers:

Register Address	Name	Access Type	Status	Description
5000	Actual baud rate	R	1: 1200 bps 2: 2400 bps 3: 4800 bps 4: 9600 bps 5: 19,200 bps 6: 38,400 bps 7: 115,200 bps	Stores the baud rate at which the data is sent.
5001	Actual frame setting	R	1: The frame format sent is 8 data bits, even parity, and 1 stop bit. 2: The frame format sent is 8 data bits, odd parity, and 1 stop bit. 3: The frame format sent is 8 data bits, no parity, and 2 stop bits.	Stores the data frame format received by Harmony Hub.
5002 5003	Number of packages received	R R	Two registers to store the double word value. 5002: Stores the most significant word. 5003: Stores the least significant word.	Stores the number of packages received by Harmony Hub.
5004 5005	Number of bad packages received	R R	Two registers to store the double word value. 5004: Stores the most significant word. 5005: Stores the least significant word.	Stores the number of bad packages received by Harmony Hub.
5006 5007	Number of packages sent	R R	Two registers to store the double word value. 5006: Stores the most significant word. 5007: Stores the least significant word.	Stores the number of packages sent by the transmitters.
5008 5009	Number of bad packages sent	R R	Two registers to store the double word value. 5008: Stores the most significant word. 5009: Stores the least significant word.	Stores the number of bad packages sent by the transmitters.
5010 … 5999	-	-	-	Reserved
R: Read only.				

Modbus TCP Communication Diagnostics

The following table presents the Modbus TCP communication diagnostics registers:

Register Address	Name	Access Type	Status	Description
5000	IP address	R	Two registers to store the four bytes value. 0.0.0.0 … 255.255.255.255	Stores the IP address used.
5001				
5002	IP mask	R	Two registers to store the four bytes value. 0.0.0.0 … 255.255.255.255	Stores the IP mask used.
5003				
5004	IP gateway	R	Two registers to store the four bytes value. 0.0.0.0 … 255.255.255.255	Stores the IP gateway used.
5005				
5006	MAC address	R	Three registers to store the MAC address.	Stores the MAC address used.
5007				
5008				
5009 … 5018	-	-	-	Reserved
5019	Number of packages received	R	Two registers to store the double word value. 5019: Stores the most significant word. 5020: Stores the least significant word.	Stores the number of packages received by Harmony Hub.
5020		R		
5021	Number of bad packages received	R	Two registers to store the double word value. 5021: Stores the most significant word. 5022: Stores the least significant word.	Stores the number of bad packages received by Harmony Hub.
5022		R		
5023	Number of packages sent	R	Two registers to store the double word value. 5023: Stores the most significant word. 5024: Stores the least significant word.	Stores the number of packages sent by Harmony Hub.
5024		R		
5025	Number of bad packages sent	R	Two registers to store the double word value. 5025: Stores the most significant word. 5026: Stores the least significant word.	Stores the number of bad packages sent by the transmitters.
5026		R		
5027 … 5999	-	-	-	Reserved
R: Read only.				

Error Codes

Harmony Hub Error Codes

The following table presents Harmony Hub error codes:

Error Code	Detected Error Range	Description
00	General	No error detected
01		Target not supported
02		Invalid version of Industrial configuration
03		Industrial configuration not found
04		Invalid Industrial configuration
05		Assert Error
10	SD memory card For more details on the SD card files, refer to File management and diagnostics *(see page 163)*.	The SD card cannot be accessed
11		The SD card is write protected
12		Not enough space available in the SD card
13		Invalid parameter
14		Invalid network configuration file
15		Invalid device configuration file
16		More than one network configuration file in the net folder
17		More than one device configuration file in the device folder
18		No network configuration file in the net folder
19		No device configuration file in the device folder
20	Green Power	COM_FCS_ERROR
21		Invalid Status Code in response
22		Process Timeout
23		Request Invalid
24		Request Execution Timeout
25		Invalid parameter
26		Decode Message Error
27		Module Invalid Capacity
28		Incompatible Version
29		Start/Stop Process
2A		Error during start Process
2B		Error during run Process
2C		Error during upgrade Process
2D		Undefined message

Error Code	Detected Error Range	Description
30	Ethernet	Duplicate IP address
31		Invalid IP address
32		Communication module detected error
33		Communication module not supported
34		Communication module not detected
40	Data	Error while processing device data
41		Error while processing device commissioning
50	Watchdog	Harmony Hub Reset
51		Other Reset
60	Backup	Invalid configuration slot 1
61		Invalid configuration slot 2
62		Invalid configuration slot 1 and slot 2
63		Initialization configuration slot 1
64		Initialization configuration slot 2
65		Store configuration slot 1
66		Store configuration slot 2
67		Store 2 configuration slot 1
68		Store 2 configuration slot 2
70	Modbus	Modbus Invalid configuration
80	Action	Trace Action Process

Transmitter Error Codes

The following table presents the transmitter error codes:

Error Code	Detected Error Range	Description
00	General	No error detected
10	Commissioning	Commissioning unsupported
11		Commissioning Error Device Type
12		Commissioning Error Manufacturer ID
13		Commissioning Error Manufacturer Product ID
14		Commissioning Error Security
15		Commissioning Error Device Capacity
16		Commissioning Error Cluster List
20	Data	Data Command ID filter
21		No data
22		Data unsupported Command ID
23		Data Error parse Length Manufacturer ID
24		Data Error parse Length Cluster ID
25		Data Error parse Length Attribute Id
26		Data Error parse Length data,
27		Data unsupported data Type,
28		Data Error Search Attribute
29		Data Mismatch data Type
2A		Data Parse Error
2B		Data Error
30…37	Process E3	Reserved
40	Process ZCL	Process ZCL Invalid Metering Value 1
41		Process ZCL Invalid Metering Value 2
42		Process ZCL Invalid Metering Value 3
43		Process ZCL Invalid Metering Value 4
44		Process ZCL Invalid Electrical measurement Current value 1
45		Process ZCL Invalid Electrical measurement Current value 2
46		Process ZCL Invalid Electrical measurement Voltage value 1
47		Process ZCL Invalid Electrical measurement Voltage value 2
48		Process ZCL Invalid Electrical measurement Power value 1
49		Process ZCL Invalid Electrical measurement Power value 2
50	Process	Process Error

Section 5.3
Configuration Registers

What Is in This Section?

This section contains the following topics:

Topic	Page
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Module Configuration

Channel Configuration

The following table presents the channel configuration for all inputs registers:

Register Address	Name	Access Type	Input Channel	Channel Status	Description
6000	Radio communication mode	RW	–	0: None (off) 1: Green power 2: ZigBee green power concentrator 3: ZigBee green power router	Stores the radio communication mode.
6001	Radio channel	RW	–	11...26: The radio channel with frequency 2.405 GHz (channel 11...26 IEEE 802.15.4).	Stores the radio channel.
6002	Radio Pan ID	RW	–	0001 H…FFFF H	Stores the radio Pan ID.
6003	Emitted radio signal strength	RW	–	-22…4: Signal strength in dBm	Stores the details of the signal strength for emission.
6004 … 6009	Reserved	–	–	–	–
6010	Table selection	RW	–	0: One UID per Harmony Hub 1…4: One UID per sensor	Stores the table selection.
6011 … 6019	Reserved	–	–	–	–
6020	Holding time	RW	–	0: 100 ms 1: 200 ms 2: 300 ms 3: 400 ms 4: 500 ms 5: 1 s	Stores the holding time for all the input channels.
6021 … 6099	Reserved	–	–	–	–
RW: Read and write.					

Holding time:

A 16-bit register stores the holding time of the input channels.

Teaching List

The following table presents the teaching list registers:

Register Address	Name	Access Type	Input Channel	Channel Status	Description
6100 … 6159	Teaching list	RW	0…59	Bit 0 to 2: ● 0: The channel is disabled. ● 1…6: The type 1…6 transmitter is used. Bits3 to 13 are not used. Bit 14: Pairing status ● 0: Sensor associated online. ● 1: Sensor associated offline. Bit 15: Address type length ● 0: Address Type Source Id on 4 bytes. ● 1: Address Type IEEE on 8 bytes.	Stores the details of the transmitter used.
6160 … 6199	Reserved	–	–	–	–
RW: Read and write.					

Teaching list:

A 16-bit register stores the details of the transmitters used.

Input Parameters 1…2

The following table presents the input parameters registers 1…2:

Register Address	Name	Access Type	Input Channel	Channel Status	Description
6200 … 6259	Input parameter 1 list	RW	0…59	Holding time.	Stores the input parameter 1 list.
6260 … 6299	Reserved	–	–	–	–
6300 … 6359	Input parameter 2 list	RW	0…59	–	Stores the input parameter 2 list.
6360 … 6399	Reserved	–	–	–	–
RW: Read and write.					

MAC Addresses

The following table presents the MAC addresses registers:

Register Address	Name	Access Type	Input Channel	Channel Status	Description
6400 … 6519	Transmitter ID/MAC addresses	RW	0…59	srcID4: First byte of the MAC address. srcID5: Second byte of the MAC address. srcID6: Third byte of the MAC address. srcID7: Fourth byte of the MAC address.	Stores the MAC addresses of the transmitters. Two registers are used to store MAC address of one transmitter. Example: Transmitter ID (written on the transmitter label) = 030079B1. Registers 6410–6411, input channel 5. 6410: stores 0300 (2 bytes of the transmitter ID). 6411: stores 79B1 (2 bytes of the transmitter ID).
6520 … 6639	Transmitter ID/MAC extended addresses	RW	0…59	srcID0: First byte of the MAC address. srcID1: Second byte of the MAC address. srcID2: Third byte of the MAC address. srcID3: Fourth byte of the MAC address.	Stores the MAC extended addresses of the transmitters. Two registers are used to store extended MAC address of one transmitter. Example: Transmitter ID (written on the transmitter label) = 030079B1. Registers 6530–5331, input channel 5. 6530: stores 0300 (2 bytes of the transmitter ID). 6531: stores 79B1 (2 bytes of the transmitter ID).
6640 … 6699	Reserved	–	–	–	–
RW: Read and write.					

Transmitter/MAC addresses:

Two registers of 16 bits store the MAC address of the transmitters.

The first byte of the MAC address is stored in 8 bits of register 1.

The second byte of the MAC address is stored in 8 bits of register 1.

The third byte of the MAC address is stored in 8 bits of register 2.

The fourth byte of the MAC address is stored in 8 bits of register 2.

Input Parameters 3…5

The following table presents the input parameters registers 3…5:

Register Address	Name	Access Type	Input Channel	Channel Status	Description
6700 … 6759	Input parameter 3 list	RW	0…59	–	Stores the input parameter 3 list.
6760 … 6799	Reserved	–	–	–	–
6800 … 6859	Input parameter 4 list	RW	0…59	–	Stores the input parameter 4 list.
6860 … 6899	Reserved	–	–	–	–
6900 … 6959	Input parameter 5 list	RW	0…59	–	Stores the input parameter 5 list.
6960 … 6999	Reserved	–	–	–	–
RW: Read and write.					

Communication Configuration

Modbus Serial Line Communication Configuration

Register Address	Name	Access Type	Status	Description
7000	Baud rate	RW	1: 1200 bps 2: 2400 bps 3: 4800 bps 4: 9600 bps 5: 19,200 bps 6: 38,400 bps 7: 115,200 bps	Stores the baud rate at which the data is sent.
7001	Frame setting	RW	0: Automatic detection 2: The frame format sent is 8 data bits, odd parity, and 1 stop bit. 3: The frame format sent is 8 data bits, no parity, and 2 stop bits.	Stores the data frame format received by Harmony Hub.
7002	Slave ID	RW	1…247	Stores the Modbus slave ID of Harmony Hub.
7003	Auto detection	RW	0: Auto detection mode is disabled. 1: Auto detection mode is enabled.	Stores the auto detection mode.
7004 … 7999	-	-	-	Reserved
RW: Read and write.				

Modbus TCP Communication Configuration

Register Address	Name	Access Type	Status	Description
7000	IP address	RW	Two registers to store the four bytes value. 0.0.0.0 … 255.255.255.255	Stores the IP address.
7001				
7002	IP mask	RW	Two registers to store the four bytes value. 0.0.0.0 … 255.255.255.255	Stores the IP mask.
7003				
7004	IP gateway	RW	Two registers to store the four bytes value. 0.0.0.0 … 255.255.255.255	Stores the IP gateway.
7005				
7006	IP mode	RW	0: DHCP 1: BOOTP 2: Stored. 3: Default.	Stores the IP mode.
7007	IP name	RW	0…255	Stores the IP name.
7008 … 7999	-	-	-	Reserved
RW: Read and write.				

Chapter 6
Radio

Radio Receiver

Introduction

Harmony Hub is equipped with a radio receiver. It receives radio frames from wireless transmitters.

Radio Receiver Specifications

The following table shows the specifications of the radio receiver:

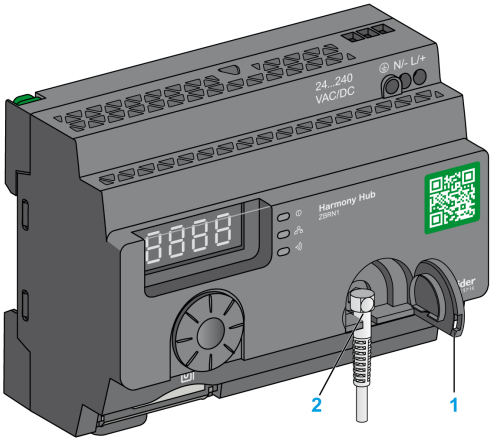
Characteristics	Specifications
Frequency	2.405 GHz (channel 11 IEEE 802.15.4)
Maximum distance	100 m (328.08 ft) (when Harmony Hub is in free field)

For more details, refer to Maximum Distances *(see page 25)*.

ZBRA2 External Antenna

The ZBRA2 external antenna is an accessory, which you have to order separately. You can connect it to Harmony Hub to improve the signal reception.

To install the ZBRA2 external antenna, open the protective plug and connect the antenna as shown in the following figure:



1 Protective plug
2 Radio connector

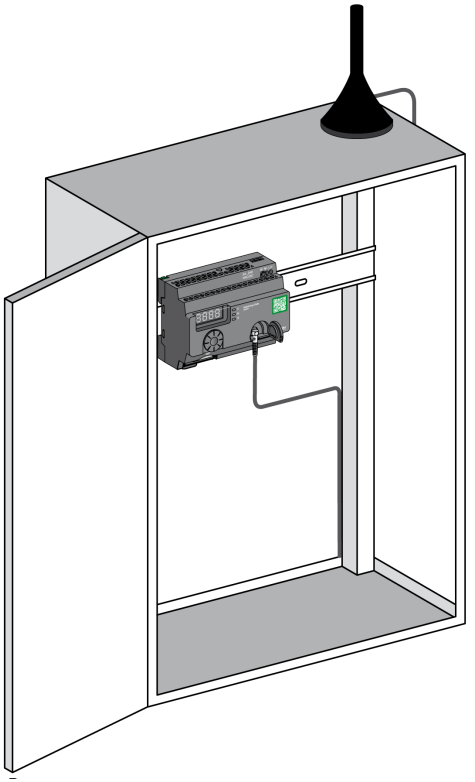
NOTE: Only the ZBRA2 external antenna can be connected to the radio connector.

The following table shows the specifications of ZBRA2 antenna:

Parameters	Specifications
Bandwidth	83...100 MHz
Frequency	2400...2483 MHz
Gain	>3 dBi
Impedance	50 ohms
Polarization	Vertical
RF connector	Radial R 300113100
Cable length	2 m (6.56 ft)

Mounting Tips for The ZBRA2 External Antenna

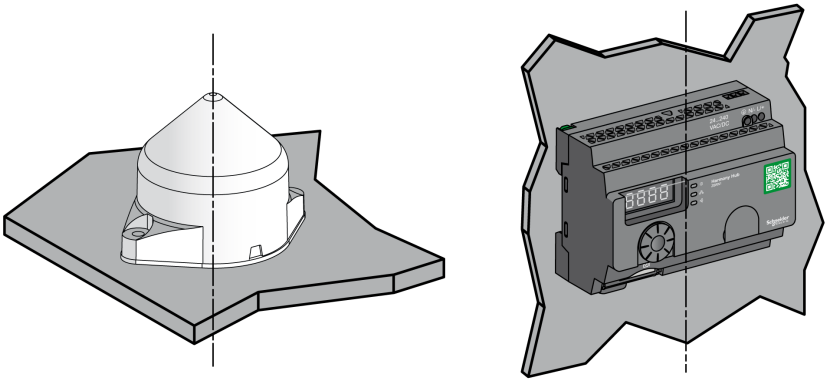
The ZBRA2 external antenna is to be placed on the top of the metal cabinet where Harmony Hub is installed as shown in the following figure:



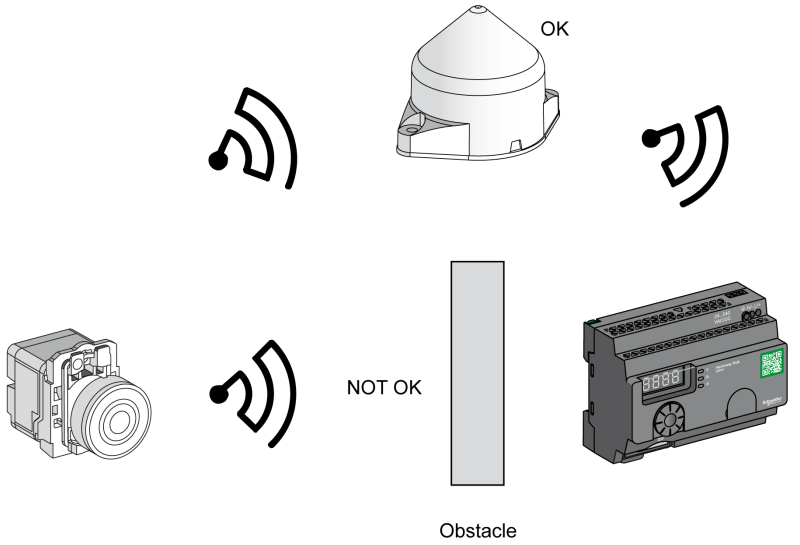
The antenna is equipped with a magnet at the bottom to mount it on the metal cabinet. When the ZBRA2 external antenna is connected to Harmony Hub, you can also use the ZBRA1 relay antenna.

Mounting Tips for The ZBRA1 Relay Antenna

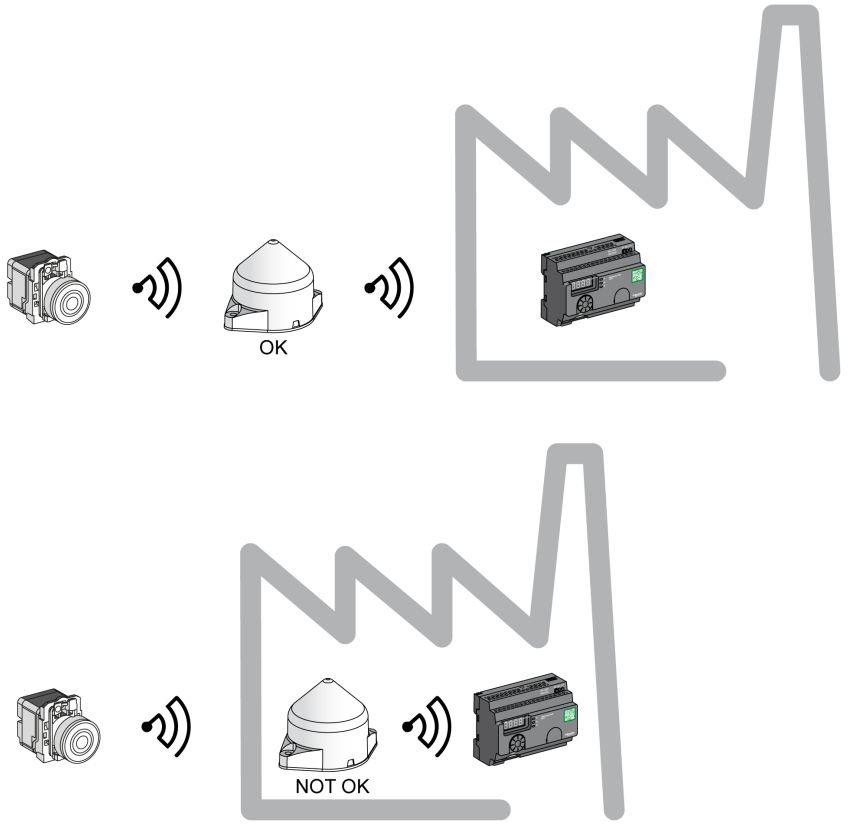
The ZBRA1 relay antenna and Harmony Hub are installed with regard to their vertical axis as shown in the following figure:



The relay antenna is used to bypass the obstacle as shown in the following figure:



You can also use the relay antenna to amplify the signal before an obstacle that cannot be bypassed, such as a factory building as shown in the following figure:



NOTE: In this case, if there is no relay antenna, the signal received by Harmony Hub may not be sufficient.

The following table shows the differences between ZBRA1 and ZBRA2:

ZBRA1	ZBRA2
An active antenna (transceiver) for increasing the signal reception.	A passive antenna for increasing the signal reception without saturating the bandwidth.
Repeats the signal received from the transmitter and amplifies it.	Does not repeat the signal received from the transmitter.
Consumes power.	Does not consume power.

FCC USA and I C Canada Compliance Statement (ZBRN1 and ZBRN2)

This device complies with part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following 2 conditions:

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

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivante:

1) L’appareil ne doit pas produire de brouillage.
2) L’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

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.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter (IC: 7002C-ZBRN1, 7002C-ZBRN2) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio (identifier IC: 7002C-ZBRN1, 7002C-ZBRN2) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

- ZBRN1 and ZBRN2: Maximal gain of internal antenna = 6 dB / allowed impedance: 50 Ohm.
- ZBRA2: Maximal gain of external antenna (including cable) = 1 dB / allowed impedance: 50 Ohm.

Any changes or modifications not expressly approved by Schneider Electric could void the user's authority to operate the equipment.

Chapter 7
User Interface

What Is in This Chapter?

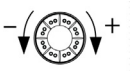
This chapter contains the following topics:

Topic	Page
Principle	108
Modes	111
Configuration Menu	115
Diagnostic Menu	128
SD Card Menu	131

Principle

Jog Dial Operation

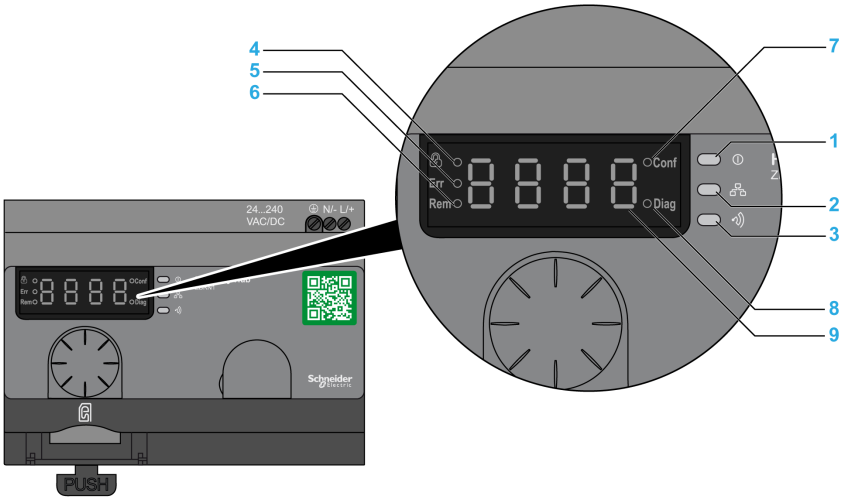
The following table shows the operation of the jog dial:

Input Keys	Function
	Turn the jog dial clockwise/counterclockwise for menu navigation and to increase/decrease the parameter values.
 = *ENT* Single click	Press once the jog dial for less than 3 s to validate the parameters entered.
 = *ESC* Double click	Press twice the jog dial to return to the previous menu.
 Long press	Press and maintain the jog dial for more than 3 s to return to the **Ready** mode immediately.
	When Harmony Hub is in the **Ready** mode, press the jog dial for more than 3 s to lock the user interface.
	When Harmony Hub is locked, press the jog dial for more than 3 s to unlock the user interface.

NOTE: If there is no action on the jog dial after 3 minutes, Harmony Hub automatically switches to **Ready** mode. For more information, refer to Modes *(see page 111)*.

User Interface LEDs

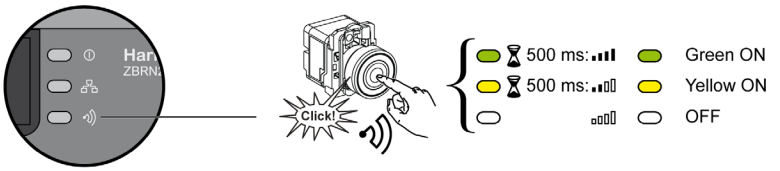
The following figure shows LEDs on the user interface:



Item	LED	Color	Function
1	Power	Green	On: The unit is turned on. Off: The unit is turned off.
2	Communication	Yellow	Flashing: Communication for the Ethernet or Modbus serial line is detected on the bus. Off: No communication for the Ethernet or Modbus serial line is detected on the bus.
3	Radio signal strength	Green/Yellow	The LED color indicates the strength of the radio signal. See Radio Signal Strength LED *(see page 110)*.
4	Lock	Red	On: The user interface is locked. Off: The user interface is unlocked.
5	**Err**	Red	On: Harmony Hub has detected an error. Off: Harmony Hub did not detect an error.
6	**Rem**	Red	On: Harmony Hub is in auto teach mode and is remotely configured by DTM. Off: Harmony Hub is not remotely configured.
7	**Conf**	Red	On: **Configuration** menu is active. Off: **Configuration** menu is not active.
8	**Diag**	Red	On: **Diagnostic** menu is active. Off: **Diagnostic** menu is not active.
9	**Display**	Red	Slow flashing: The parameter value can be changed through the jog dial. Fast flashing 3 times: The parameter setting was successful.

Radio Signal Strength LED

The following figure shows the status of the radio signal strength LED:



Modes

Operating Modes

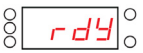
Harmony Hub has the following 3 basic operating modes:

- **Ready**
- **Configuration**
- **Diagnostic**

Ready Mode

The normal working state of Harmony Hub is **Ready** mode. When Harmony Hub is switched on, it displays the protocol (for example, SL for serial line) and the firmware version (for example, 01.00). Then, it switches to **Ready** mode, and the power LED turns on.

The following figure shows the default screen in **Ready** mode:



In **Ready** mode, Harmony Hub receives the input signal from the transmitter, the input/output LED turns on, and the radio signal strength LED indicates the strength of the input signal.

The following figure shows the input status in run mode:

NOTE: The 7 segment display shows the channel number and input value for 1 s. The red LED indicates that the user interface is locked.

All the parameters of the device are set in **Configuration** mode. All parameters are accessible as read-only values in **Diagnostic** mode.

You can switch from **Ready** mode to **Configuration** or **Diagnostic** modes by pressing the jog dial once when Harmony Hub is in **Ready** mode.

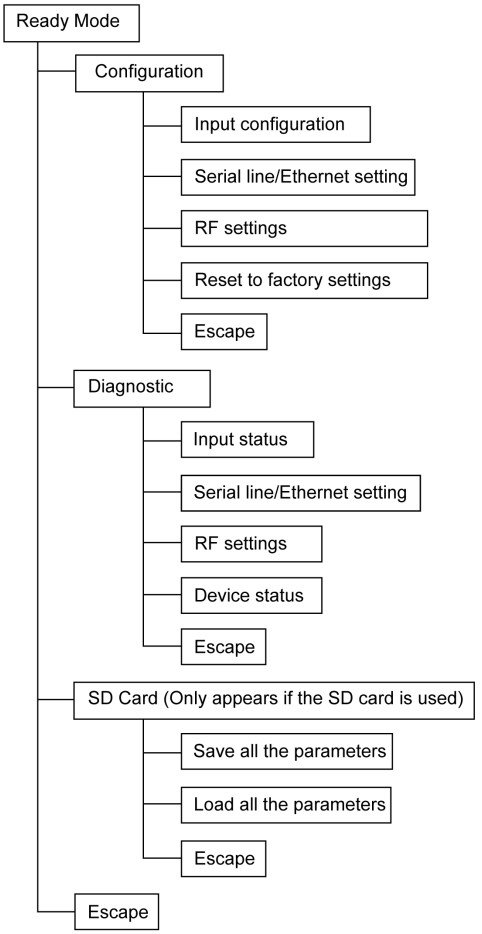
You can turn the jog dial clockwise or counterclockwise to navigate through the different menus while in **Ready** mode.

In online auto binding mode, the dedicated LED turns on and the 7 segment LED displays the current binding channel.You can modify the binding channel from the DTM, refer to Teach Screen *(see page 148)*.

The following figure shows the default screen in online auto binding mode:

NOTE: You can exit from auto-binding mode by rotating the jog dial clockwise or counterclockwise.

The following figure shows the menu structure:



The following table shows the properties of the **Configuration** menu:

Menu	Parameters (Can Be Configured)
Input configuration	Allows you to do the following operations: ● Auto teach. ● Auto unteach. ● Manual teach. ● Manual unteach. For further information, refer to Input Configuration *(see page 116)*.
Serial line settings	Allows you to set the following: ● Manual baud rate ● Manual frame format ● Auto baud rate ● Auto frame format For further information, refer to Serial Line Menu *(see page 122)*.
Ethernet Modbus/TCP settings	Allows you to do the following operations: ● Select the DHCP mode. ● Select the BOOTP mode. ● Select the static IP mode. ❍ Set the 4 bytes IP address. ❍ Set the 4 bytes subnet mask. ❍ Set the 4 bytes gateway address. ❍ Save the IP address. For more information, refer to IP Setting Menu *(see page 124)*.
Radio frequency	Allows you to do the following operations: ● Active/deactivate the radio communication ● Set the power transmission level ● Set the radio frequency channel ● Set the PAN ID For further information, refer to Radio frequency menu *(see page 126)*.
Reset to factory settings	Allows you to do the following operations: ● Reset the communication parameter to the default value. ● Reset all the parameters to the default value. ● Set the communication parameters. ● Set all the parameters. For further information, refer to Factory Mode *(see page 126)*.

The following table shows the properties of the **Diagnostic** menu:

Menu	Parameters Displayed
Input status	Status of the transmitter.
Serial link information	• Slave ID. • Baud rate. • Frame format.
Ethernet information	• IP address. • Subnet mask. • Gateway address. • MAC address.
Radio frequency	• RF state (r U n or o F F) • RF channel • RF power transmission level (in dBm) • PAN ID • Green Power Brick version
Device status	• Code of the detected error. • Device reference (ZBRN1/ZBRN2). • Firmware version. • Channel.
For further information, refer to Diagnostic Menu *(see page 128)*.	

The following table shows the properties of the **SD card** menu:

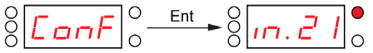
Menu	Parameters
Save all parameters	Allows you to save all the parameters in the SD card.
Load all parameters	Allows you to load all the parameters from the SD card.
For further information, refer to SD Card Menu *(see page 131)*.	

Configuration Menu

Introduction

You can enter all the settings for Harmony Hub from the **Configuration** menu. When you activate the **Configuration** menu, configuration LED turns on.

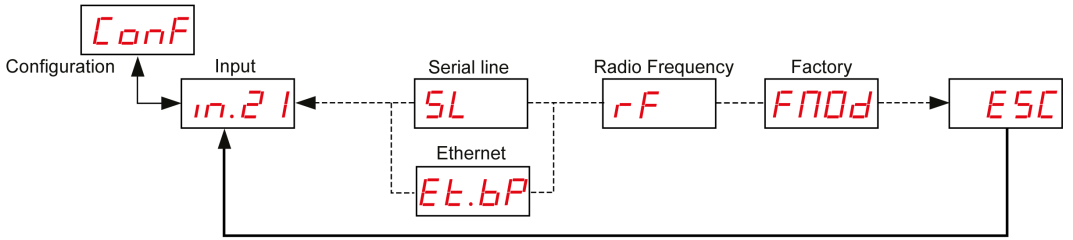
The following figure shows the display screen when **Configuration** menu is active:



NOTE: In this example, the value 21 represents the total number of configured inputs.

Organization Tree

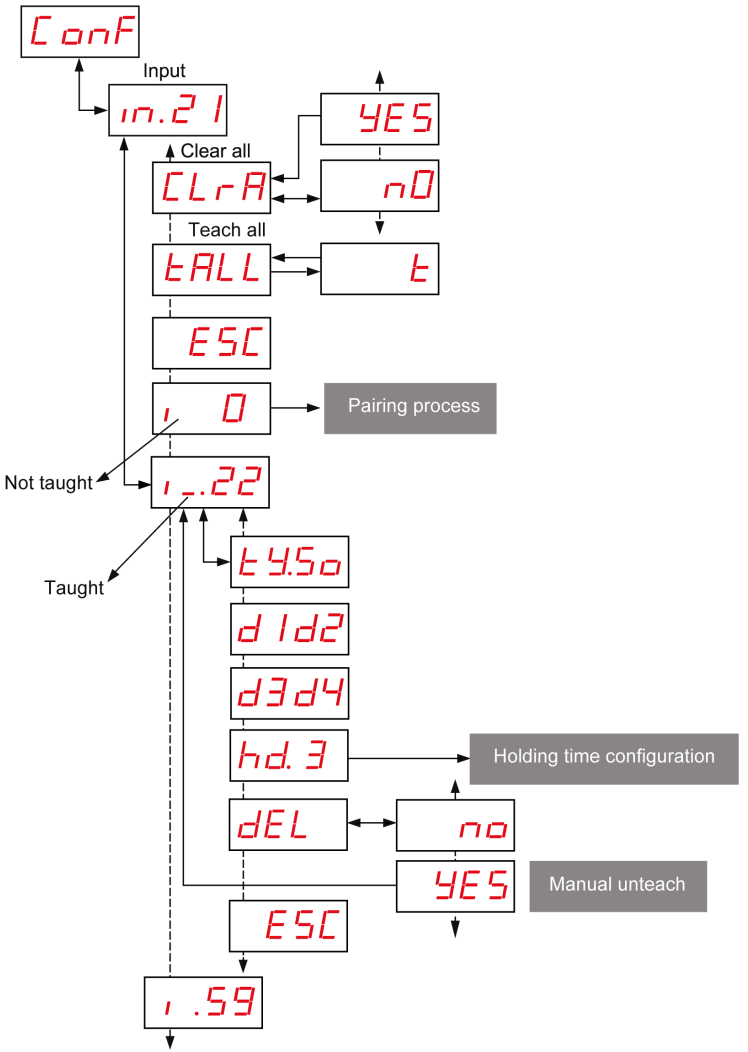
The following figure shows the **Configuration** menu structure:



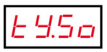
Code	Name/Description
ConF	**Configuration** menu.
in.21	**Input** menu. *(see page 116)*
SL	**Serial Line** setting menu *(see page 122)*. It appears only in ZBRN2.
Et.bP	**IP Setting** menu *(see page 124)*. It appears only in ZBRN1.
rF	**Radio Frequency** menu *(see page 126)*.
FMOd	**Factory mode** menu *(see page 127)*. It allows you to reset the device settings to the default factory mode.

Input Configuration

The following figure shows the organization tree of **Input Configuration** menu:

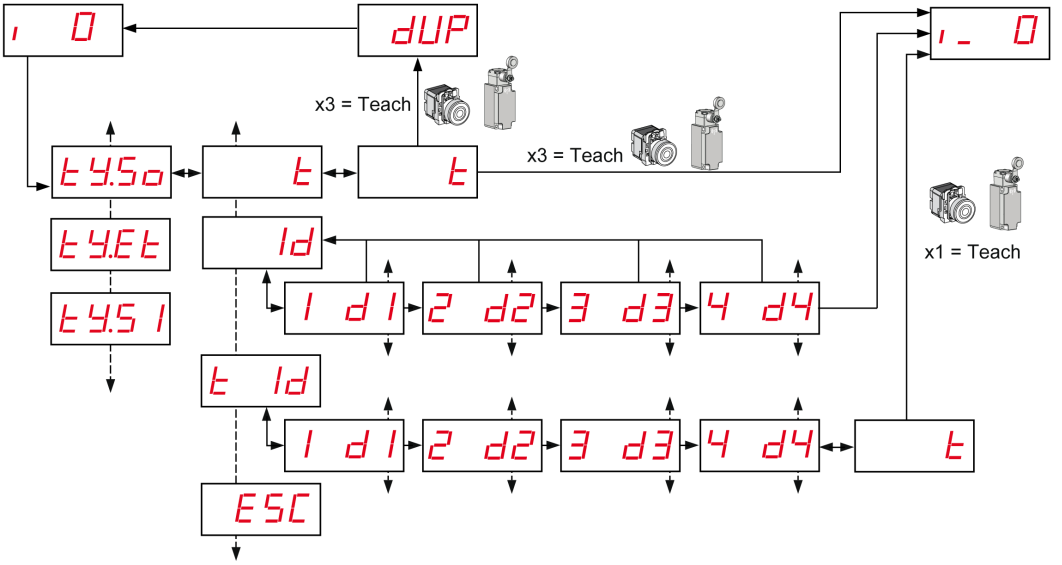


Pairing Process For more details, refer to Pairing Process *(see page 174)*.
Holding time For more details, refer to Holding time menu *(see page 120)*.

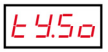
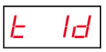
Code	Name/Description	Range	Factory Setting
	Displays the channel number which is taught.	0–59	0
	Transmitter taught.	–	–
	Transmitter not taught. For details, refer to pairing process description.	–	–
	Type of Transmitter	So Et S1	–
 	First byte of MAC/ID and second byte of the MAC/ID. Third byte of the MAC/ID and fourth byte of the MAC/ID.	–	–
	Input Holding Time Menu *(see page 120)*.	–	–
	Unteach all the transmitters.	–	–
	Launch auto teach process for the inputs with an ID configured but not yet paired (6 input maximum).	–	–
	Auto teach mode.	–	–

Pairing Process

The following figure shows the pairing process for type 0 devices (pushbuttons and limit switches):

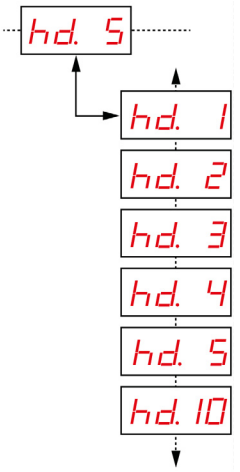


1 For other type of transmitter, refer to Pairing Procedures *(see page 174)*.

Code	Name/Description	Range	Factory Setting
	Transmitter taught.	–	–
	Transmitter not taught.	–	–
	Type of Transmitter	So Et S1	–
	teach mode.	–	–
	The transmitter is already taught. Duplication of MAC addresses is not allowed.	–	–
	Enter the 4 bytes of the MAC/ID of the transmitter.	–	–
	Enter the 4 bytes of the MAC/ID of the transmitter then launch the auto tech process	–	–
	First byte of MAC/ID. Second byte of the MAC/ID. Third byte of the MAC/ID. Fourth byte of the MAC/ID.	00…FF 00…FF 00…FF 00…FF	00

Input Holding Time Menu

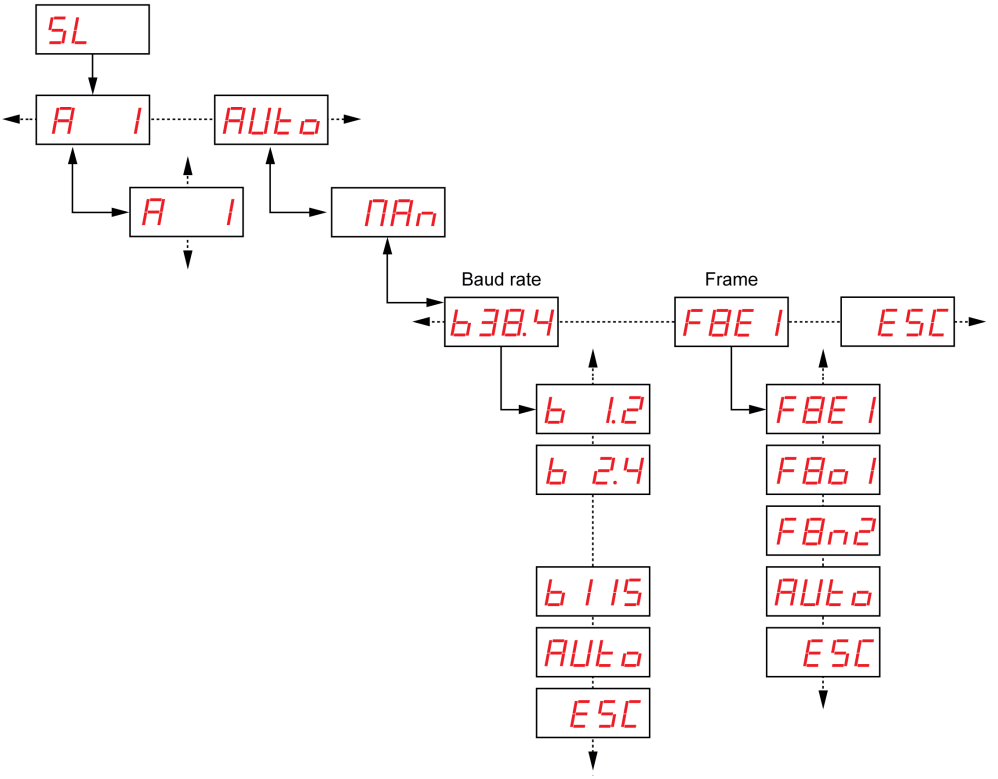
The following figure shows the organization tree of **Input Holding Time** menu:

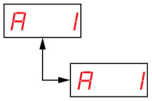


Code	Name/Description	Range	Factory Setting
	Input holding time setting menu.	1 = 100 ms	1 = 100 ms
		2 = 200 ms	
		3 = 300 ms	
		4 = 400 ms	
		5 = 500 ms	
		10 = 1 s	

Serial Line Menu

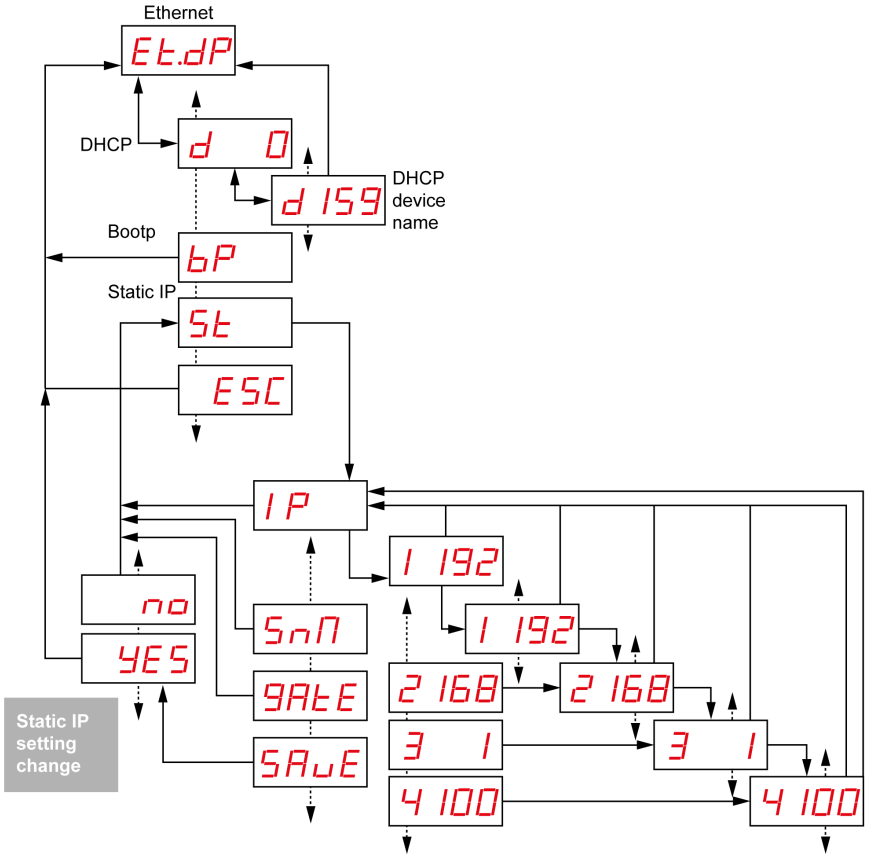
The following figure shows the organization tree of **Serial Line** menu:

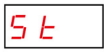


Code	Name/Description	Range	Factory Setting
	Slave address menu. It allows you to set the slave address.	1–247	1
	Enables auto detection mode. All the parameters (baud rate and frame setting) are set automatically.	–	Auto
	Allows you to set the baud rate and frame setting manually.	–	–
	Baud rate menu. It allows you to select the baud rate value from the list.	1.2 = 1200 bps	–
		2.4 = 2400 bps	
		4.8 = 4800 bps	
		9.6 = 9600 bps	
		19.2 = 19,200 bps	
		38.4 = 38,400 bps	
		115 = 15,200 bps	
	Frame setting menu. It allows you to select the frame format from the list.	8e1 = Even parity	Auto
		8o1 = Odd parity	
		8n2 = No parity	

IP Setting Menu

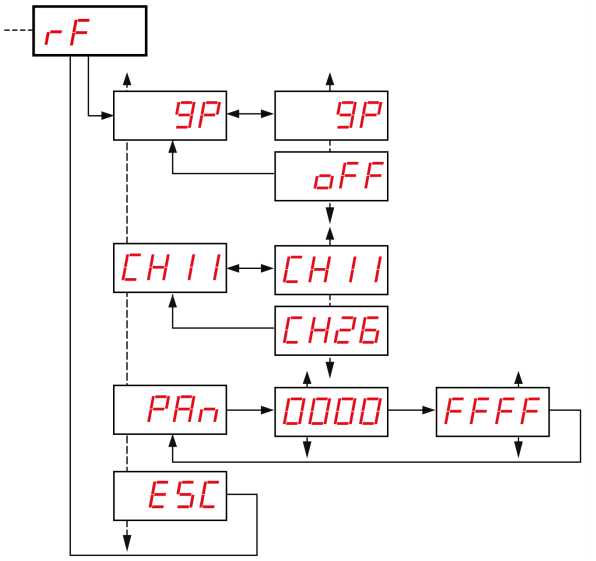
The following figure shows the organization tree of **IP Setting** menu:



Code	Name/Description	Range	Factory Setting
	Harmony Hub uses DHCP mode to set the network-specific parameters.	-	-
	In DHCP mode, enter the device name. Harmony Hub gets the IP address from the DHCP server. **Example:** The complete device name is ZBRN1_078 when the value is set to 78.	000–159	000
	Harmony Hub uses BOOTP mode to set the network-specific parameters.	-	-
	BOOTP mode Harmony Hub gets the IP address from BOOTP server.	–	–
	Harmony Hub uses static IP mode to set the network-specific parameters.	–	–
	In static IP mode, the IP address, subnet mask, and gateway are entered manually using the jog dial.	–	–
	Enter the 4 bytes of the subnet address.	–	–
	Enter the 4 bytes of the gateway address.	–	–
	Enable the IP address and return to the previous menu.	–	–

Radio Frequency Menu

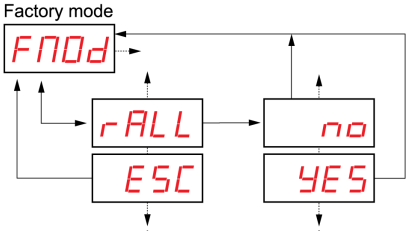
The following figure shows the organization tree of **Radio Frequency** menu:



Code	Name/Description
9P	Activate/deactivate the radio communication.
CH11	Select the radio frequency channel (11…26).
PAn	Enter the PAN ID of the Harmony Hub (0000 H…FFFF H).
ESC	Quit to return to the previous menu.

Factory Mode

The following figure shows the organization tree of **Factory Mode** menu:



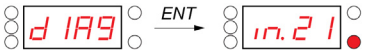
Code	Name/Description
rALL	Reset all the parameter values to default setting.
ESC	Quit to return to the previous menu.

Diagnostic Menu

Introduction

Diagnostic menu gives the information about various settings of the device and the detected error status. When you activate the **Diagnostic** menu, **Diagnostic** LED turns on.

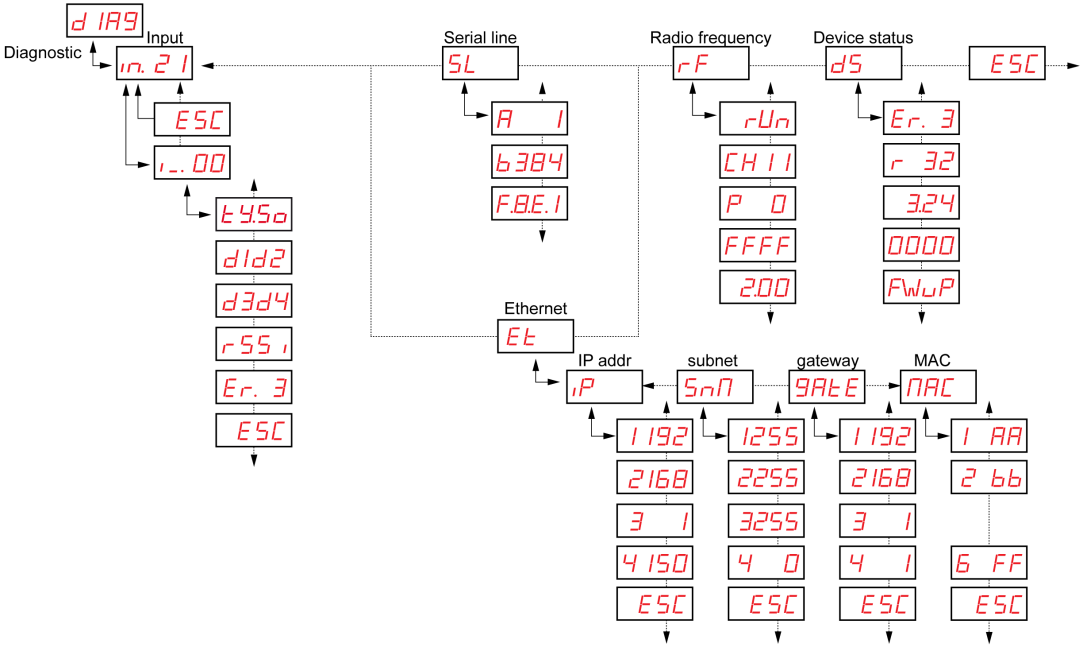
The following figure shows the display screen when the **Diagnostic** menu is active:

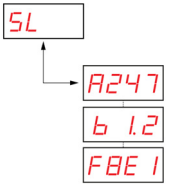
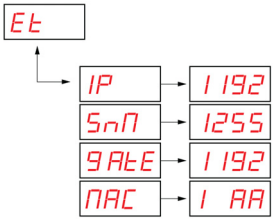
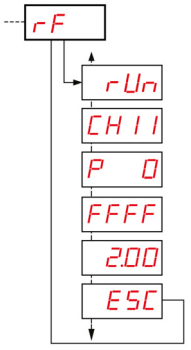


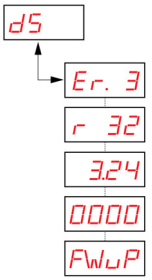
NOTE: In this example, the value 21 represents the total number of configured inputs.

Organization Tree

The following figure shows the **Diagnostic** menus:



Code	Name/Description
	**Diagnostic** menu.
	Displays the binding information, such as the current binding number.
	Displays the serial information: ● Slave address ● Current baud rate ● Frame setting
	Displays the IP information: ● IP address ● Subnet mask ● Gateway ● MAC address
	Displays the radio frequency status: ● RF state (`run` or `oFF`) ● RF channel ● RF power transmission level (in dBm) ● PAN ID ● Green Power Brick version

Code	Name/Description
	Displays the device status: ● Code of the detected error ● Product version ● Application version ● Industrial configuration version ● Firmware update (only when `SD:/EA_sme.txt` is present ● Firmware update action **NOTE:** To clear a detected error, press the jog dial when selecting the code of the detected error parameter.

NOTE: The serial line information menu exists only for ZBRN2. The IP information menu exists only for ZBRN1.

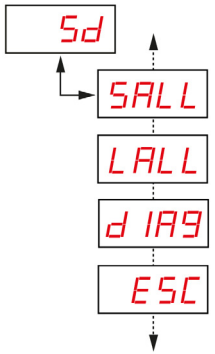
SD Card Menu

Introduction

The SD card menu allows you to back up and restore the binding and network parameters.

Organization Tree

The following figure shows the SD card menus:



Code	Name/Description
Sd	The SD card setting menu allows you to back up and restore the binding and network parameters.
SALL	Allows you to save all the parameters in the SD card. To validate this parameter, select **Yes** from the submenu.
LALL	Loads all the parameters from the SD card. To validate this parameter, select **Yes** from the submenu.
d IAG	Allows you to save all the binding information in the SD card. To validate this parameter, select **Yes** from the submenu.

NOTE: The SD card menu appears only if the SD card is inserted into the device.

Chapter 8
DTM

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Introduction	134
Configuration	135
Diagnostics	146

Introduction

General

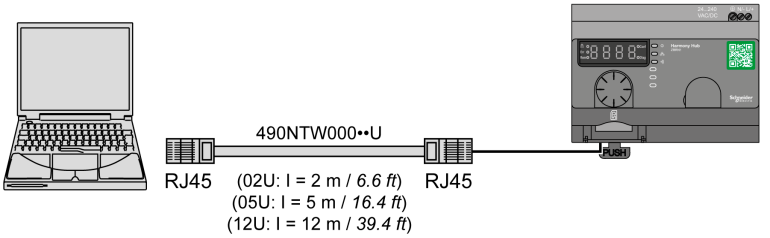
The device type manager (DTM) is a part of the field device tool (FDT) standard. The DTM contains an FDT-compliant interface to enable communication with the connected system.

NOTE: Use DTM only for pushbuttons and limit switches.

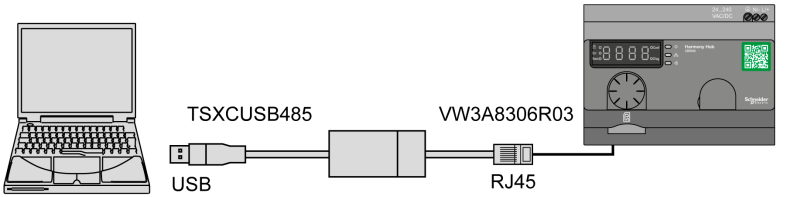
Connection to a PC

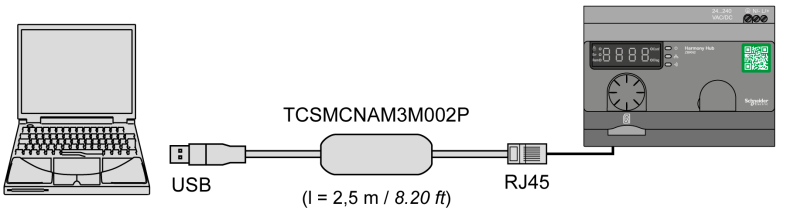
To use the DTM feature, connect the PC to Harmony Hub.

ZBRN1: Connect Harmony Hub to the PC as shown in the following figure:



ZBRN2: Connect Harmony Hub to the PC as shown in the following figure:





Configuration

Overview

The offline configuration data is classified into 4 types, which are as follows:

- Device module
- Teach screen
- Protocol information
- I/O status

The following table shows the communication DTMs and their product references:

Communication DTMs	Product Reference
Ethernet Modbus TCP	ZBRN1
Modbus serial line	ZBRN2

NOTE:
The related product reference is selected automatically when the communication DTM is selected.

The communication DTM is selected through the DTM catalog.

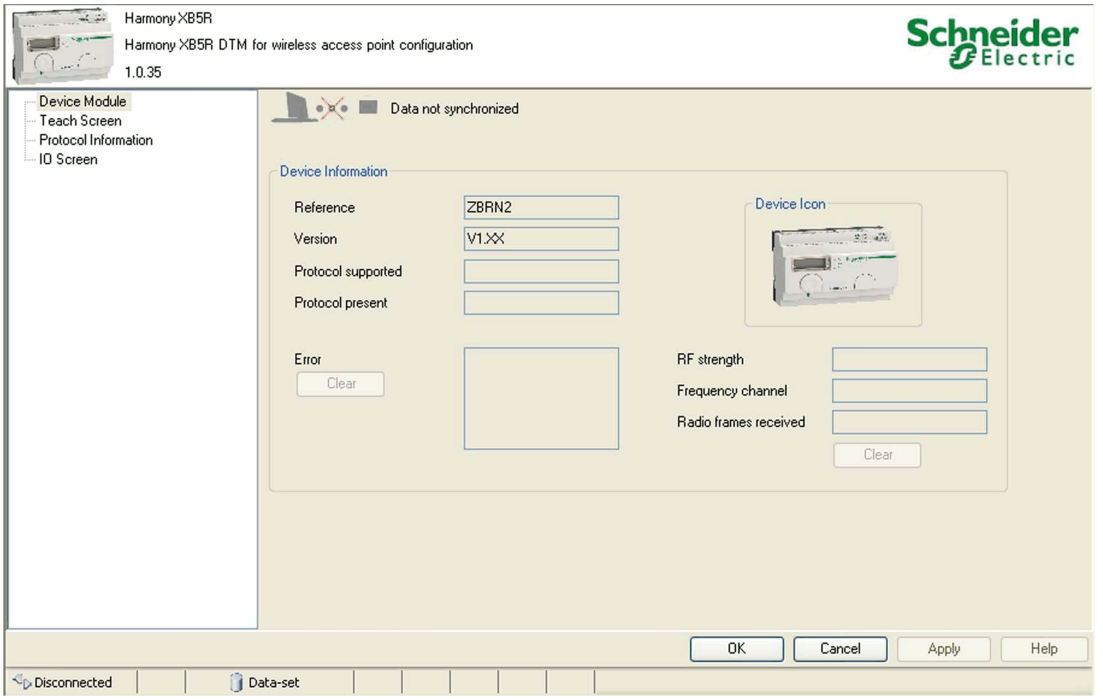
The DTMs are compatible with the following Schneider Electric FDT containers:

- **SoMachine V3.1 or higher for Modbus serial line, V4.1 SP1 or higher for Ethernet Modbus/TCP**
- **Unity Pro V5.0**

The DTMs are also compatible with the third-party FDT containers, such as M&M (recommended) and PactWare.

Device Module

The following figure shows the offline **Device Module** screen:

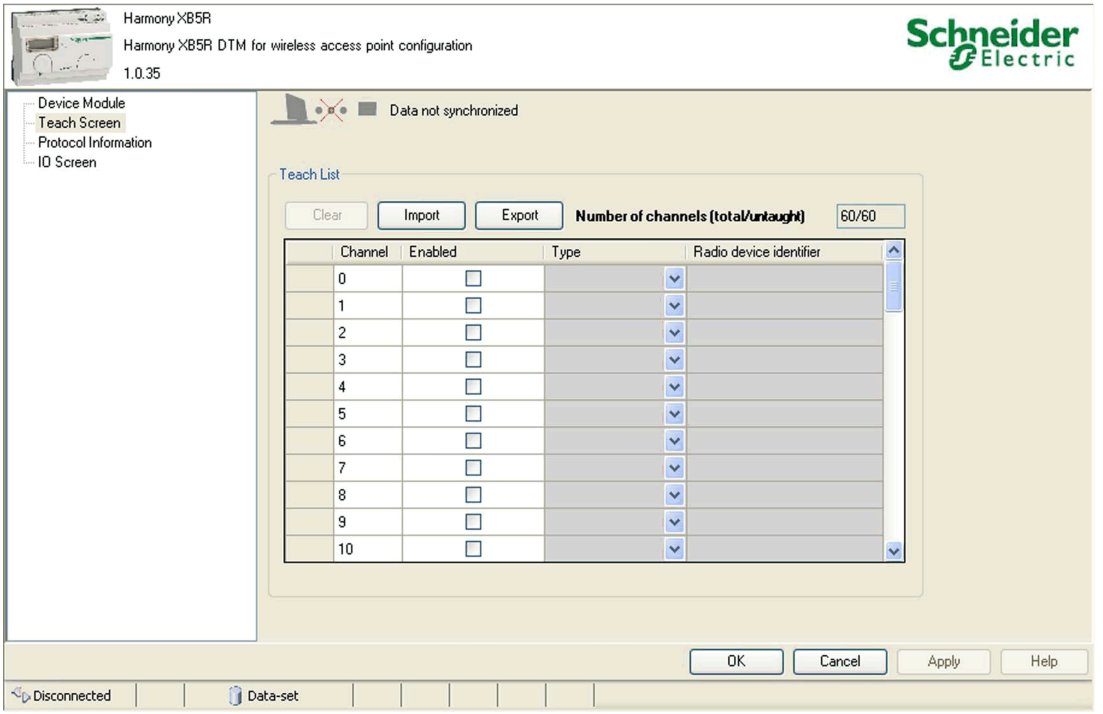


The following table shows the properties of the offline **Device Module**:

Parameters	Description	Status
Auto Refresh	Automatically updates the signal information (available only in online mode).	Disabled
Reference	Displays the product reference.	Enabled
Version	Displays the product firmware version.	Enabled
Protocol supported	Displays the supported protocol.	Disabled
Protocol present	Displays the protocol present.	Disabled
Device Icon	Displays the graphical representation of the device.	Disabled
RF strength	Displays the strength of the radio frequency signal.	Disabled
Frequency channel	Displays the frequency channel. Default value is 11.	Disabled
Radio frames received	Displays the number of the GP (Green Power) frames received.	Disabled
Clear	Clears the signal information and details of the detected error.	Disabled
Error	Displays the code of the detected error.	Disabled

Teach Screen

The following figure shows the offline **Teach Screen**:



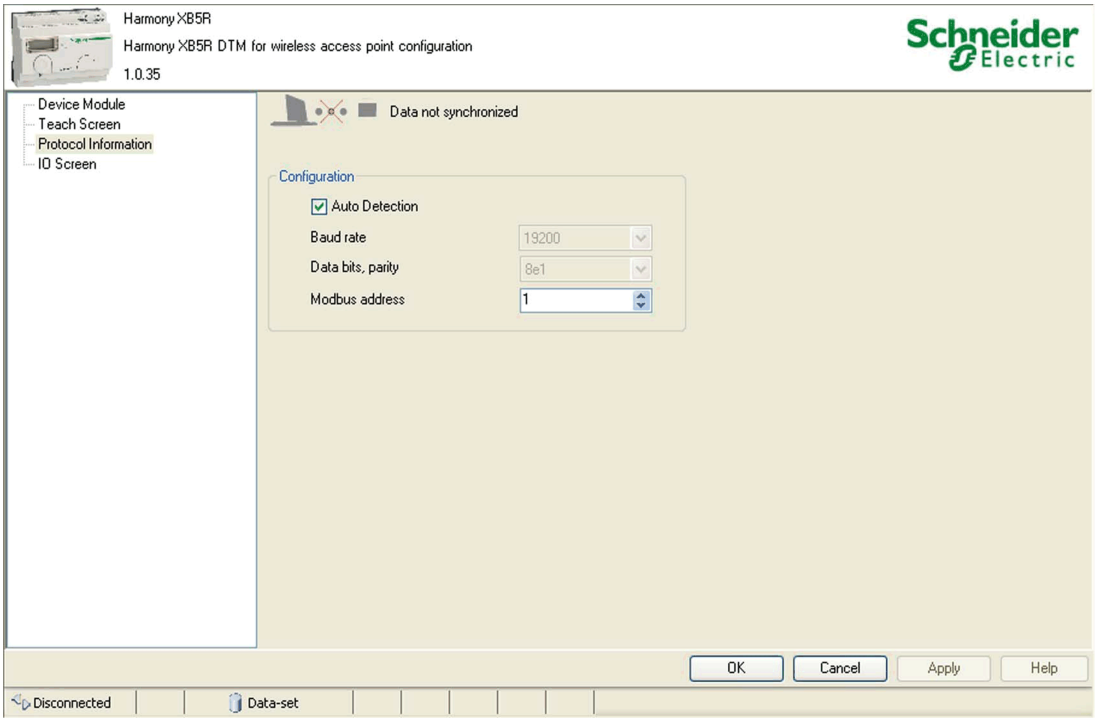
NOTE: Harmony Hub supports 60 transmitters (for example: ZBRT1). The **Teach List** contains the radio device identifier of each transmitter.

The following table shows the properties of the offline **Teach Screen**:

Parameters	Description	Status
Clear	Clears the teach list.	Enabled
Import	Import the saved file to use the previous teach information.	Enabled
Export	Exports the teach list to your hard drive.	Enabled
Channel	Displays the number of transmitters that can be used.	Enabled
Enabled	Displays the status of the channel (whether taught or not).	Enabled
Type	Select the device type (type 1 by default).	Enabled
Radio device identifier	Enter the identifier of the transmitter radio device. Radio device identifier must be in format AA:BB:CC:DD (4 bytes length).	Enabled
Number of channels (total/untaught)	Displays the number of taught transmitters.	Disabled

Protocol Information

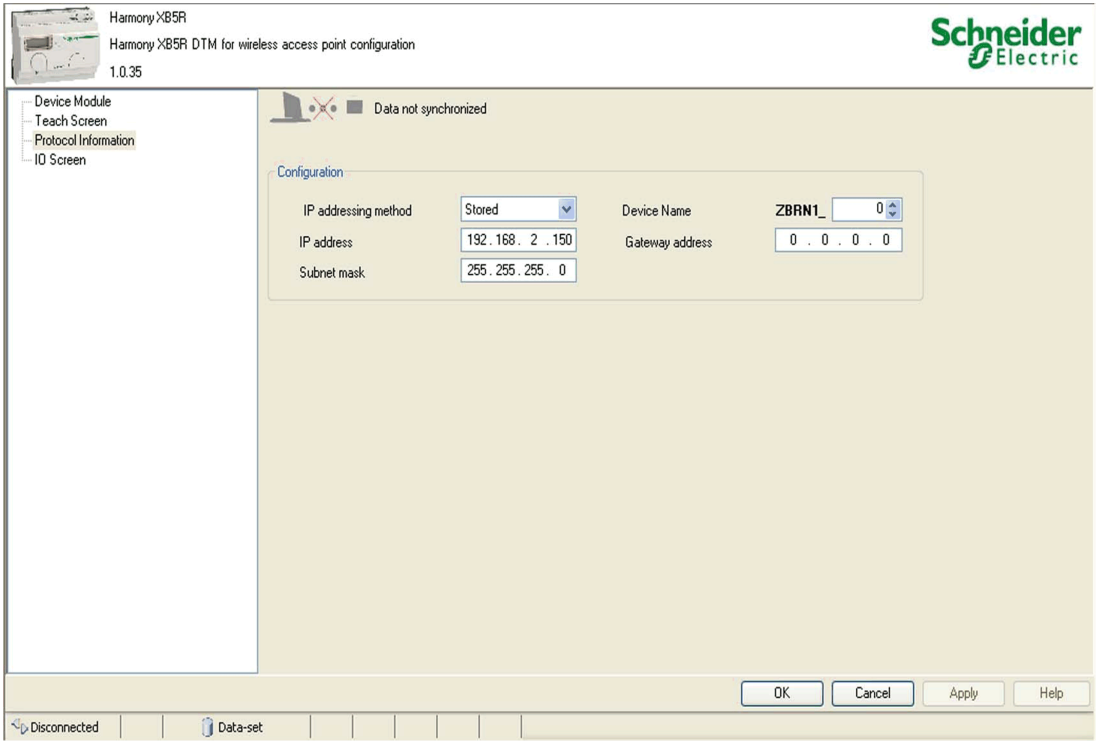
The following figure shows the offline Modbus serial line **Protocol Information** screen:



The following table shows the properties of the offline Modbus serial line **Protocol Information**:

Parameters	Description	Value	Status
Auto Detection	Automatically sets the protocol information, depending on the first data frame received.	–	Enabled
Baud rate	Select a baud rate from the list.	Auto	Enabled
		1200 bps	
		2400 bps	
		4800 bps	
		9600 bps	
		19,200 bps	
		38,400 bps	
		115,200 bps	
Data bits, parity	Select a parity from the list.	Auto	Enabled
		8e1	
		8o1	
		8n1	
Modbus address	Enter the Modbus address.	1–247	Enabled

The following figure shows the offline Ethernet Modbus TCP **Protocol Information** screen:

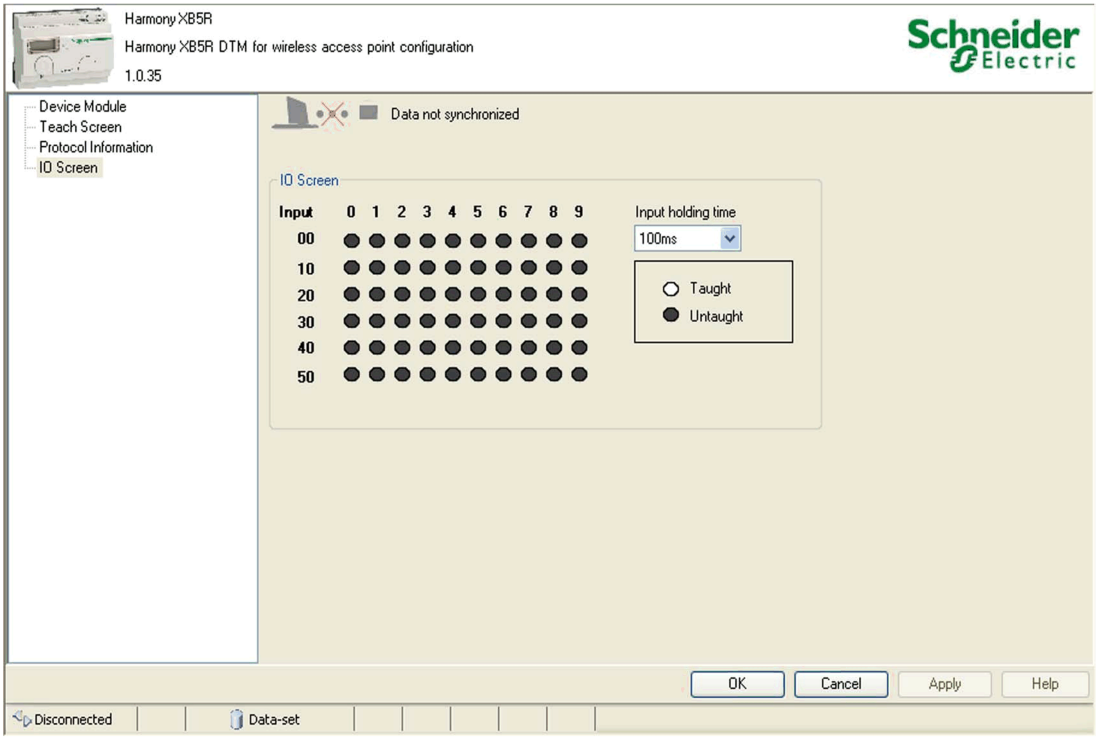


The following table shows the properties of the offline Ethernet Modbus TCP **Protocol Information**:

Parameters	Description	Value	Status
IP addressing method	Select the IP addressing method from the list.	DHCP	Enabled
		BOOTP	
		Static IP	
IP address	Enter the IP address.	–	Enabled
Subnet mask	Enter the subnet mask address.	–	Enabled
Device Name ZBRN1_	Enter the number of the ZBRN1 device, which uses same protocol. **Example**: If the value is set to 78, the complete device name is ZBRN1_078.	000-159	Enabled
Gateway address	Enter the gateway address.	–	Enabled

I/O Screen

The following figure shows the offline **IO Screen**:



The following table shows the properties of **IO Screen** in offline mode:

Item	Parameters	Description	Values
1	**Input**	Displays the input status (whether taught or not).	–
2	**Input holding time**	Select the input holding time from the list.	100 ms
			200 ms
			300 ms
			400 ms
			500 ms
			1 s

The following table shows the input status:

Color	Meaning
Gray	Input is untaught.
White	Input is taught.

Steps to Configure ZBRN1

1. Select the **Ethernet Modbus/TCP channel** from the communication DTM.
2. Select the **IP addressing method** from the list in the **Protocol Information** screen.
3. Enter the address parameters (depending on the **IP addressing method**).
4. Select the **Input holding time** from the list in the **IO Screen**.
5. Download the configuration to the device.

Steps to Configure ZBRN2

1. Select the **Modbus Serial channel** from the communication DTM.
2. Enter the teach information manually, or import the existing teach details.
3. Select the **Baud rate**, **Data bits, parity**, and **Modbus address** from the list in **Protocol Information** screen.
4. Select the **Input holding time** from the list in the **IO Screen**.
5. Download the configuration on Harmony Hub.

Diagnostics

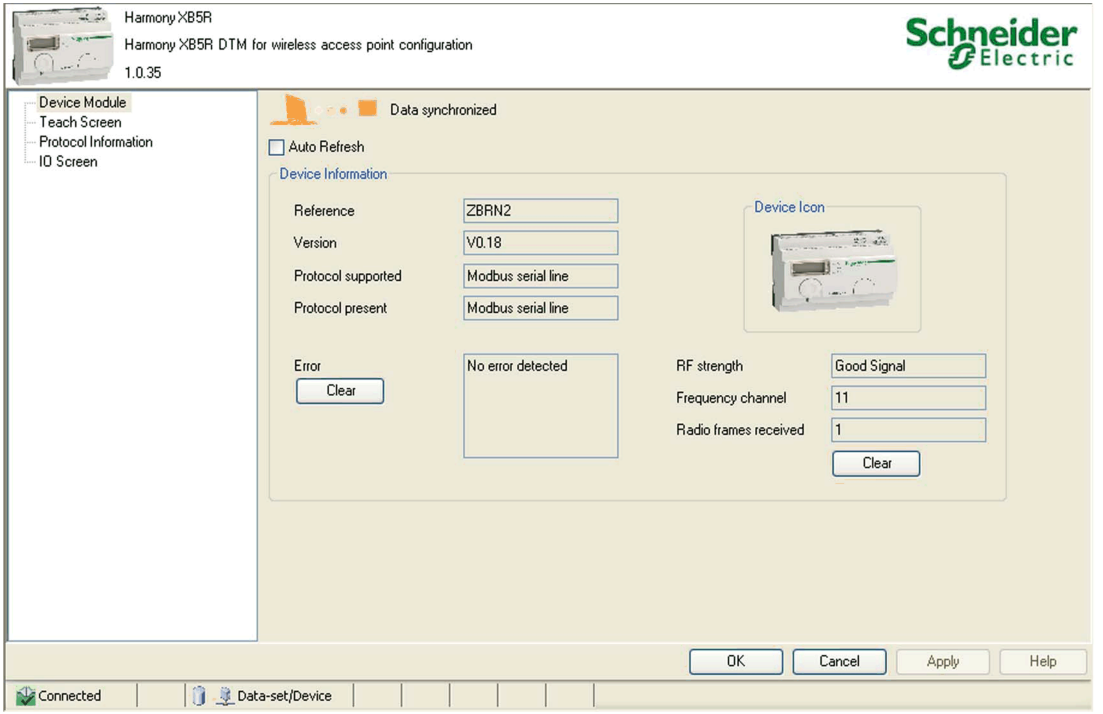
Overview

The online diagnostic data is classified into 4 types, which are as follows:

- Device module
- Teach list
- Protocol information
- I/O status

Device Module

The following figure shows the online **Device Module** screen:

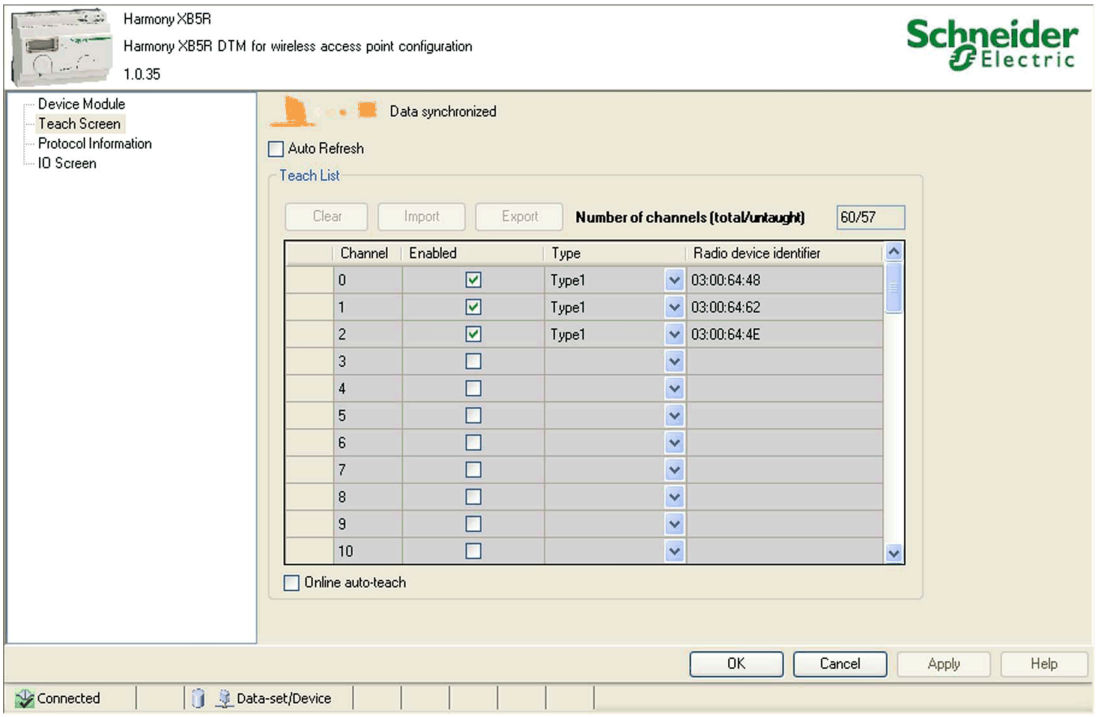


The following table shows the properties of the online **Device Module**:

Parameters	Description	Status
Auto Refresh	Automatically updates the signal information.	Enabled
Reference	Displays the product reference.	Enabled
Version	Displays the product version.	Disabled
Protocol supported	Displays the supported protocol.	Enabled
Protocol present	Displays the protocol present.	Enabled
Device Icon	Displays the graphical representation of the device.	Enabled
RF strength	Displays the strength of the radio frequency signal.	Enabled
Frequency channel	Displays the frequency channel (default value is 11).	Enabled
Radio frames received	Displays the number of GP (Green Power) packages received.	Enabled
Clear	Clears the signal information and detected error details.	Enabled
Error	Displays the code of the detected error.	Enabled

Teach Screen

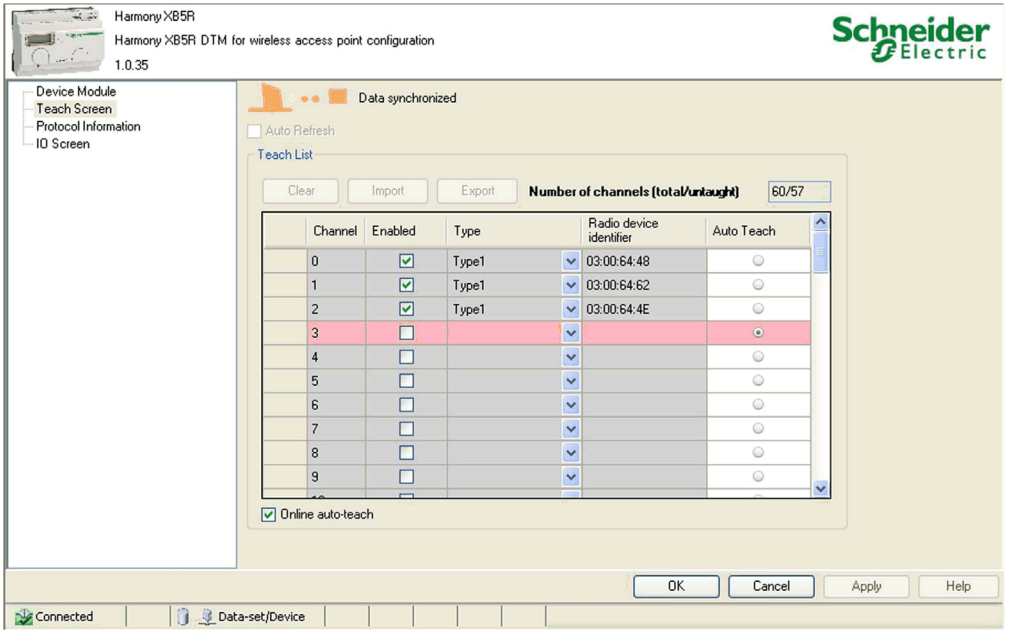
The following figure shows the online **Teach Screen**:



The following table shows the properties of the online **Teach Screen**:

Parameters	Description	Status
Auto Refresh	Automatically updates the teach information.	Enabled
Clear	Clears the teach list.	Disabled
Import	Import the saved file to use the previous teach information.	Disabled
Export	Exports the teach list to your hard drive.	Disabled
Channel	Displays the number of transmitters that can be used.	Disabled
Enabled	Displays the status of the channel (whether taught or not).	Disabled
Type	Displays the device type.	Disabled
Radio device identifier	Displays the identifier of the radio device.	Disabled
Number of channels (total/untaught)	Displays the number of taught transmitters.	Enabled
Online auto-teach	Automatically teaches the transmitter to the active channel.	Disabled

The following figure shows the online **Teach Screen** when online auto-teach is active:

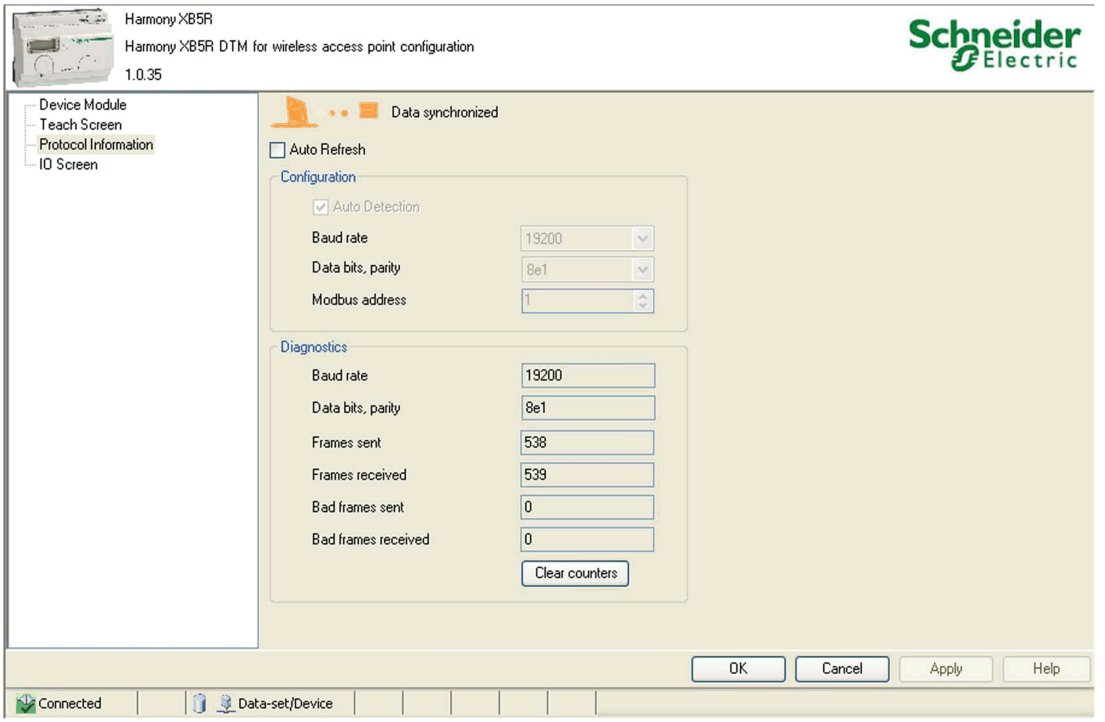


Auto-teach features are as follows:

- Check the **Online auto-teach** check box. The active channel is highlighted with the active option.
- Press the transmitter 3 times to bind it to the active channel.
- Uncheck the **Online auto-teach** check box to disable auto teach of the transmitter.

Protocol Information

The following figure shows the online Modbus serial line **Protocol Information** screen:



The online Modbus serial line **Protocol Information** has the following 2 sub sections:

- **Configuration**
- **Diagnostics**

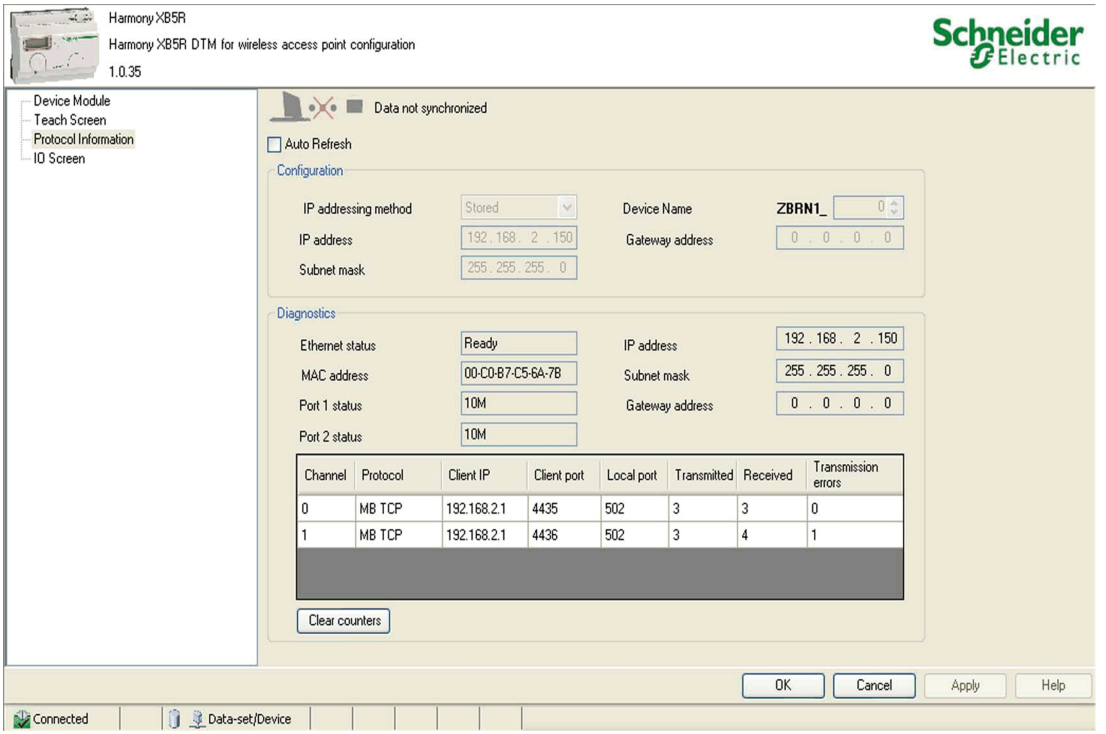
The following table shows the properties of the **Configuration** information of the online Modbus serial line **Protocol Information**:

Parameters	Description	Status
Auto Refresh	Automatically refreshes the product information.	Enabled
Baud rate	Displays the selected baud rate.	Disabled
Data bits, parity	Displays the selected data bit and parity.	Disabled
Modbus address	Displays the Modbus address.	Disabled

The following table shows the properties of the **Diagnostics** information of online Modbus serial line **Protocol Information**:

Parameters	Description	Status
Baud rate	Displays the active baud rate.	Enabled
Data bits, parity	Displays the active data bit and parity.	Enabled
Frames sent	Displays the number of GP (Green Power) frames sent.	Enabled
Frames received	Displays the number of GP (Green Power) frames received.	Enabled
Bad frames sent	Displays the number of bad frames sent.	Enabled
Bad frames received	Displays the number of bad frames received.	Enabled
Clear counters	Clears all the diagnostics information.	Enabled

The following figure shows the online Ethernet Modbus TCP **Protocol Information** screen:



The following table shows the properties of the **Configuration** information of online Ethernet Modbus TCP **Protocol Information**:

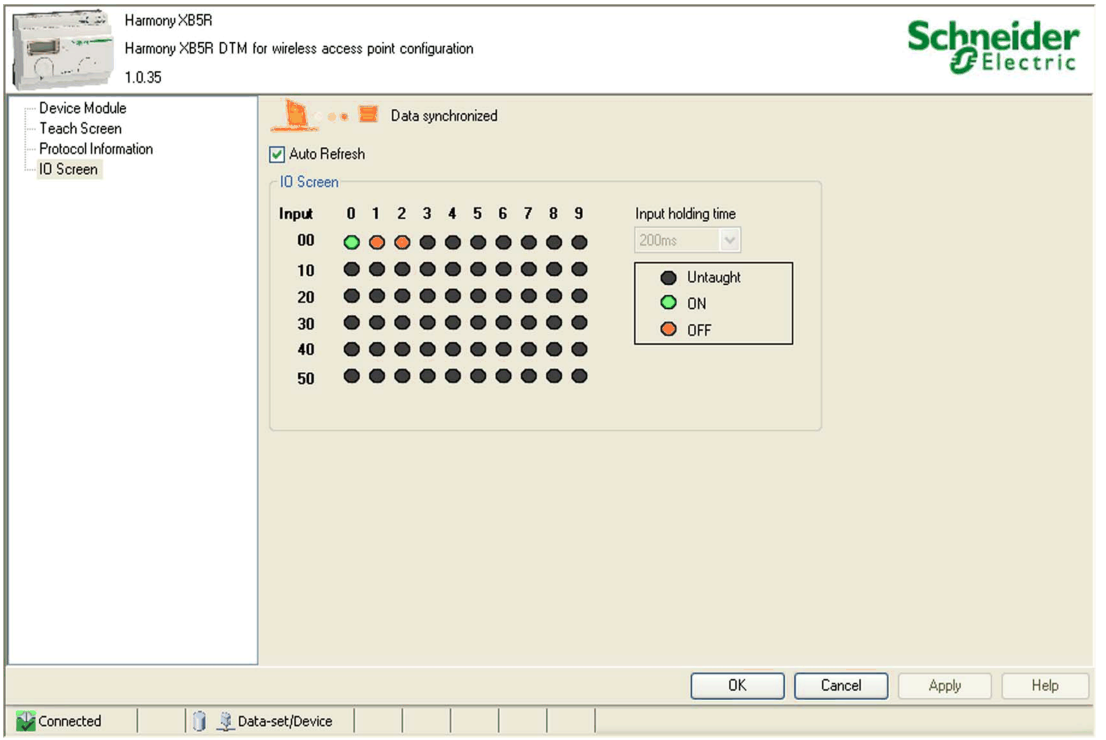
Parameters	Description	Status
IP addressing method	Displays the selected IP addressing method.	Disabled
IP address	Displays the selected IP address.	Disabled
Gateway address	Displays the selected gateway address.	Disabled
Device Name ZBRN1_	Displays the number of devices, which uses same protocol information.	Disabled
Subnet mask	Displays the selected subnet mask address.	Disabled

The following table shows the properties of the **Diagnostics** information of online Ethernet Modbus TCP **Protocol Information**:

Parameters	Description	Status
Ethernet status	Displays the Ethernet status.	Enabled
IP address	Displays the IP address.	Enabled
Port 1 status	Displays the port 1 status.	Enabled
Port 2 status	Displays the port 2 status.	Enabled
MAC address	Displays the Ethernet MAC address.	Enabled
Subnet mask	Displays the subnet mask address.	Enabled
Gateway address	Displays the gateway address.	Enabled
Channel	Displays the number of transmitters in use.	Enabled
Protocol	Displays the protocol used (Ethernet Modbus TCP).	Enabled
State	Displays the connection status.	Enabled
Client IP	Automatically refreshes the product information (Established, connecting, listening, and idle).	Enabled
Client port	Displays the client port address.	Enabled
Local port	Displays the local port address.	Enabled
Transmitted	Displays the address of the port from which the data is transmitted.	Enabled
Received	Displays the address of the port that receives the data.	Enabled
Transmission errors	Displays the address of the port that has a detected error.	Enabled

I/O Screen

The following figure shows the online **IO Screen**:



The following table shows the properties of the **IO Screen** in online mode:

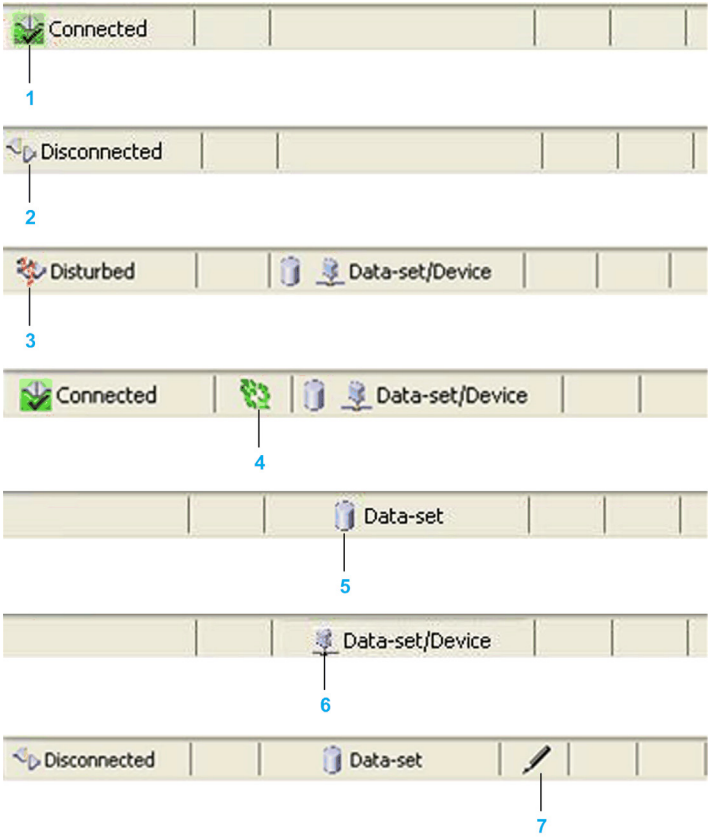
Item	Parameter	Description
1	**Auto Refresh**	Automatically updates the input status.
2	**Input**	Displays the input status.
3	**Input holding time**	Displays the input holding time.

The following table shows the input status:

Color	Meaning
Gray	Input is untaught.
Green	Input is on.
Red	Input is off.

Status Area

The following figure shows some examples of the connection status:



Item	Icon	Meaning
1		DTM is in online mode.
2		DTM is in offline mode.
3		A communication interruption is detected.
4		Communication between the DTM and device is active.
5		The offline data is stored in the DTM.
6		The data is stored in the device.
7		The parameter has been modified.

Chapter 9
SD Card

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Introduction	158
Functions	160
File Management and Diagnostics	163

Introduction

General

The secure digital card (SD card) is an ultra small flash memory card designed to provide high-capacity memory in a small size. The minimum capacity of the SD card is 16 Mb.

SD Card Insertion and Removal

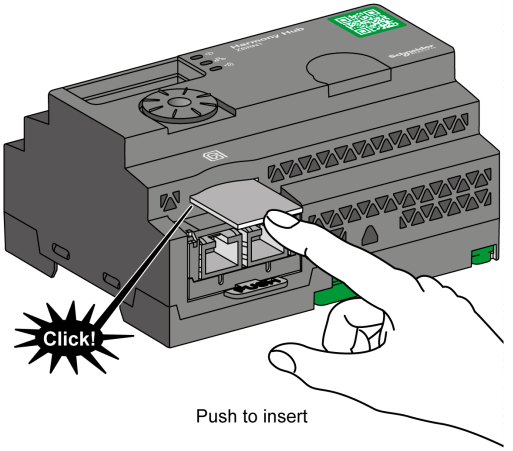
⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

- Do not expose the SD card to any of the following:
  - Electrostatic or electromagnetic sources.
  - Heat, sunlight, water, or moisture.
  - High radiation. High-level radiation can erase the content of the SD card.
- Avoid impact to the SD card.

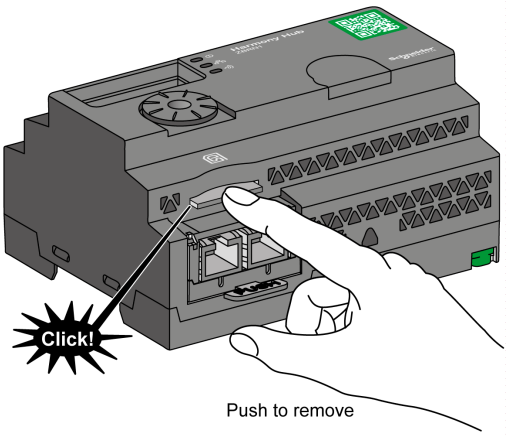
Failure to follow these instructions can result in injury or equipment damage.

The following figure shows how to insert the SD card into Harmony Hub:



Push to insert the SD card into the SD card slot on Harmony Hub. Make sure that the SD card is inserted properly.

The following figure shows how to remove the SD card from Harmony Hub:



Push to remove the SD card from the SD card slot on Harmony Hub.

Functions

Supported Features

The SD card supports the following features:

- Saving the configuration and network parameters
- Loading the configuration and network parameters
- Firmware update operation

Saving The Configuration

The following steps explain how to save the configuration and network parameters:

Step	Action
1	Insert an empty SD card into Harmony Hub.
2	On the **SD card** menu, select **Save all**.
3	Select **Yes** from the submenu to validate the action.
4	Wait until Yes stop blinking.
5	This action creates 2 subfolders in the SD card: ● */device*: Stores the device configuration file *ZBRNxxDEV.CSV*. ● */net*: Stores the network configuration file *ZBRNxxNET.CSV* **NOTE:** You can update the .CSV files manually and load them into Harmony Hub afterwards.

Loading The Configuration

The following steps explain how to load the device configuration and network parameters:

Step	Action
1	Insert the SD card into Harmony Hub.
2	Make sure that the files you want to load are located in the appropriate SD card subfolders (create */device* and */net* subfolders if they do not exist in the SD card): ● */device*: Stores the device configuration file *ZBRNxxDEV.CSV* ● */net*: Stores the network configuration file *ZBRNxxNET.CSV* **NOTE:** *ZBRNxDEV.CSV* is the same file used in the Import/Export DTM feature.
3	On the **SD card** menu, select **Load all**.
4	Select **Yes** from the submenu to validate the action.
5	Wait until Yes stop blinking.

Firmware Update

This feature allows the user to update Harmony Hub firmware with the SD card.

NOTE: A firmware update does not erase Harmony Hub configuration. Modbus settings, RF settings and binding list are kept in memory after firmware update.

In the specific case of an update from V1.03 to V2.00 or V3.00, it is highly recommended to follow the guide in the following chapter (see 5.2.7).

NOTE:
The firmware requires upgrading in the following cases:
- Schneider Electric recommends or requires the upgrade.
- There is a new functionality that is required and is only available by firmware upgrade.

In all other cases, it is not necessary to upgrade the firmware.

While using “FWUP” action on the HMI menu, it is possible to see “FWUP” and Err. LED blinking for 2 seconds. This indicates that the SD card is asking for “checking and repair”. Therefore, the action is interrupted and the SD card is “repaired”. A second try at this action launches “FWUP” action.

The following steps explain how to update Harmony Hub firmware:

Step	Action
1	Load .bin files in `SD:/EA_image/fw_app/` folder.
2	Add `SD:/EA_sme.txt` (file is empty, just the name matters).
3	Insert SD card into Harmony Hub (unlocked).
4	In Harmony Hub menu, select **Rdy → Diag → dS → FWUP**.
5	Restart Harmony Hub.
6	Harmony Hub proceeds to update for a minute. Then, Harmony Hub restarts.

The following steps explain how to update Harmony Hub firmware:

Step	Action
1	Load .bin files in `SD:/custom_folder/` folder.
2	Add `SD:/ap_fwup.txt`. This file contains the path of the new .bin image (1)(2).
3	Insert SD card into Harmony Hub (unlocked).
4	Restart Harmony Hub.
5	The Radio signal strength LED becomes orange for 1 s during restart, indicating a success of the update.

1 Example of `ap_fwup.txt` file content:
`Custom_folder/STM32_Application_Vx.xx.bin` or
`Custom_folder\\STM32_Application_Vx.xx.bin`
2 If the SD card allows writing, `ap_fwup.txt` file is deleted after the update.

The following steps explain how to update the Brick Green Power:

Step	Action
1	Load .bin files in `SD:/EA_image/gp/` folder.
2	Add `SD:/EA_sme.txt` (file is empty, just the name matters).
3	Insert SD card into Harmony Hub (unlocked).
4	In Harmony Hub menu, select **Rdy → Diag → dS → FWUP**.
5	Restart Harmony Hub.
6	Harmony Hub proceeds to update for a minute. Then, Harmony Hub restarts.

The following steps explain how to update the Brick Green Power:

Step	Action
1	Load .bin files in `SD:/custom_folder2/` folder.
2	Add `SD:/gp_fwup.txt`. This file contains the path of the new .bin image (1)(2).
3	Add `SD:/EA_sme.txt` (file is empty, just the name matters).
4	Insert SD card into Harmony Hub (unlocked).
5	In Harmony Hub menu, select **Rdy → Diag → dS → FWUP**.
6	Harmony Hub proceeds to update for a minute. Then, Harmony Hub restarts.
1 Example of `gp_fwup.txt` file content: `Custom_folder2/GP_Brick_CC2530_SBL2_Vx.x.x.bin` or `Custom_folder2\\GP_Brick_CC2530_SBL2_Vx.x.x.bin` **2** If the SD card allows writing, `gp_fwup.txt` file is deleted after the update.	

NOTE: Both User application and Brick Green Power can be updated simultaneously with the HMI menu “FWUP”.

File Management and Diagnostics

File Management

The following table shows the file names with the path used in the SD card:

Files	Description
User application	
SD:/device/ZBRNxxDEV.CSV	Device configuration file including the transmitters binding list.
SD:/device/ZBRNxxDEV.CSV.bck**i**	Backup file (1).
SD:/net/ZBRNxxNET.CSV	Network configuration file including Harmony Hub general settings.
SD:/net/ZBRNxxNET.CSV.bck**i**	Backup file (1).
SD:/diag/ZBRNxxdiag.CSV	Diagnostic file including the transmitters diagnostic information.
SD:/diag/ZBRNxxdiag.CSV.bck**i**	Backup file (1).
FW Updates	
SD:/EA_image/gp/xxxx.bin	Binary file for the update of the CC2530 application. Path SD:/EA_image/gp/ is default path when using “FWUP” **NOTE:** By default, the first file found in the folder is taken for update. Other files are ignored.
SD:/EA_image/fw_app/xxxx.bin	Binary file for the update of the user application. Path SD:/EA_image/fw_app/ is default path when using “FWUP” **NOTE:** By default, the first file found in the folder is taken for update. Other files are ignored.
SD:/EA_sme.txt	Enables and displays the menu “FWUP” (Firmware Update) (for “gp” and “ap” updates only). This file is empty.
SD:/ap_fwup.txt	Enables the update of the user application. Can be created by the user to load .bin file from a specific path, and update the application on the restart of Harmony Hub. Can be generated automatically when using “FWUP”.
SD:/gp_fwup.txt	Enables the update of the green power application. Can be created by the user to load .bin file from a specific path. Can be generated automatically when using “FWUP”.
Industrial configuration	
SD:/EA_image/indus/xxxx.bin	Binary file for the update of the industrial configuration. Path SD:/EA_image/indus/ can be modified.
SD:/indus_up.txt	Enables the update of the industrial parameters on the restart of Harmony Hub. Must be created by the user to load .bin file from a specific path.

(1) **i**: [0…5]. When new files are stored in the SD card, instead of erasing previous files, Harmony Hub saves the files with extension bck**i**. Harmony Hub can store 6 older files, bck0 is the most recent.

SD Card Diagnostics

The following table shows the diagnostic details of the SD card:

Code of the Detected Error	Device Indication	Description
00	The **SD Card** menu is available.	SD card is present in Harmony Hub.
	The **SD Card** menu is not available.	SD card is not present in Harmony Hub.
10	**Error** LED turns on.	SD card cannot be accessed or is not compatible.
11	**Error** LED turns on.	SD card is write-protected.
12	**Error** LED turns on.	Not enough space in the SD card.
13	**Error** LED turns on.	Invalid parameter in the SD card.
14	**Error** LED turns on.	Network configuration file `ZBRNxxNET.CSV` is invalid.
15	**Error** LED turns on.	Device configuration file `ZBRNxxDEV.CSV` is invalid.
16	**Error** LED turns on.	More than 1 network configuration file is stored in the Net folder while restoring, which is not allowed.
17	**Error** LED turns on.	More than 1 Device configuration file is stored in the Net folder while restoring, which is not allowed.
18	**Error** LED turns on.	Network configuration file is not available in the SD card.
19	**Error** LED turns on.	Device configuration file is not available in the SD card.

Device Configuration File

The Device configuration file *ZBRNxxDEV.CSV* contains the sensors binding list.

Location in the SD card: `SD:/device/ZBRNxxDEV.CSV`.

Device configuration file content:

Parameter name	Value	Description
Input	[0: 59]	-
Enable	True / False	True: A transmitter is associated False: The input is free
Association mode	[1:4]	1: Static (No security) 2: OTA Sensor (Security Sensor) 3: OTA (No security) 4: OTA Box (Security Box)
Type	[Type1: Type6]	Type1: Pushbutton or limit switches Type2…Type4: Reserved Type5: Thermal monitoring sensors Type6: Generic ZigBee, PowerTag sensors
Address	[00000001 H: FFFFFFFE H]	Unique Zigbee ID of the transmitter.
Security Type	[0:5]	Handles both security level and security type parameters (These parameters will be updated automatically in the gateway once the transmitter is associated online). 0: None 1: L0 (Static, No security) 2: L1 (Static, Long OOB) 3: L2 (Static, Long Shared) 4: L3 (Static, Full OOB) 5: L4 (Static, Full Shared) Security Long: signature with frame counter over 4 bytes Security Full: signature + encryption
Security Key	Format 00:00….00:00 (16 bytes)	Encryption key
Param1	Type1: [1:6]	Type1: Holding time 1: 100 ms 2: 200 ms 3: 300 ms 4: 400 ms 5: 500 ms 6: 1 s
	Type2: [0: 65635]	Reserved
Param2	Type2: [0: 100]	Reserved

Example of Device configuration file with three transmitters:

Input	Enable	Association	Type	Address	Security Type (1)	Security key	Param1	Param2
0	True	1	Type 1	03005EAA H	1		5	
1	True	2	Type 5	FFC12430 H	0			
2	True	2	Type 6	E2000356 H	0			

(1) “Security Type” for Type 1 is set to 1 since transmitters are paired with No security.
“Security Type” for Type 5 is set to 0 since we want to take sensor’s security. Once the sensor is Associated Online, this parameter will be automatically set to its right value.
“Security Type” for Type 6 is set to 0 since the sensor in the example is secured.

CSV files generated by SD card (with SAll HMI command) present 60 lines, one per input. It is not mandatory to write those 60 lines: Harmony Hub only consider lines with “Enable” parameter set to True.

Network Configuration File

The Network configuration file *ZBRNxxNET.CSV* contains Harmony Hub parameters.

Location in the SD card: `SD:/net/ZBRNxxNET.CSV`.

Network configuration file content:

Parameter Name	Value	Default Value	Description
General settings			
RF mode	[0:3]	1	0: Off 1: Green Power 2: Zigbee Green Power Concentrator 3: Zigbee Green Power Router
Channel	[11:26]	11	Radio channel
PanID	[0001 H: FFFF H]	FFFF H	Radio Panel ID
PWTX	[-22:4]	0	Radio Power TX
Modbus settings			
Auto detection	TRUE / FALSE	TRUE	TRUE: Automatic detection of Master Modbus Settings FALSE: Baud rate and Frame setting are set by eponym parameters
Baud rate	[1:7]	5	1: 1200 bps 2: 2400 bps 3: 4800 bps 4: 9600 bps 5: 19200 bps 6: 38400 bps 7: 115200 bps
Frame setting	[1:3]	1	1: 8e1 (8 data bits, even parity, 1 stop bit) 2: 8o1 (8 data bits, odd parity, 1 stop bit) 3: 8n2 (8 data bits, no parity, 1 stop bit)
Table selection	[0:4]	0	0: One UID per Harmony Hub [1:4]: One UID per device
Default settings			
Holding time	[1:6]	1	1: 100 ms 2: 200 ms 3: 300 ms 4: 400 ms 5: 500 ms 6: 1000 ms
Default voltage	[0:65535]	2300	Reserved
Default CosPhi	[0:100]	100	Reserved

Diagnostic File

The diagnostic file *ZBRNxxDIAG.CSV* contains the transmitters information.

Location in the SD card: `SD:/diag/ZBRNxxDIAG.CSV`.

Diagnostic file content:

Parameter name	Value	Description
Input	[0: 59]	-
Status	[On-Line, Off-Line]	Off-Line: the input parameters are configured (via SD card, Modbus or screen menu) but no radio exchanges have been performed On-Line: Input is paired, radio exchanges have been performed.
Type	[Type1: Type6]	Type1: Pushbutton or limit switches Type2…Type4: Reserved Type5: Thermal monitoring sensors Type6: Generic ZigBee, PowerTag sensors
Address	[00000001 H: FFFFFFFE H]	Unique Zigbee ID of the sensor
RSSI	UINT8 Unit: dBm Invalid value: -128	Radio reception power
PCBA temperature	INT16 [-200; 200] Unit: °C Invalid value: 8000 H	Device temperature
Battery Voltage	UINT8 Invalid value: FF H	Internal battery voltage

Chapter 10
First Installation

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
First Start Up	170
Configuration	172
Pairing Procedures	174

First Start Up

Overview

Follow this procedure when installing and starting up Harmony Hub.

ZBRN1 Startup Procedure

The following table shows the startup procedure for ZBRN1 Harmony Hub:

Step	Action	Comments
1	Unpack your Harmony Hub (ZBRN1) and check the contents of the package.	Contents of the package: Instruction Sheet, Harmony Hub (ZBRN1), communication module (ZBRCETH), and ZBRCETH Instruction Sheet.
2	Insert the communication module in Harmony Hub.	Refer to ZBRCETH Communication Module *(see page 57)*.
3	Choose an appropriate cabinet.	Refer to Mechanical Installation *(see page 28)*.
4	Install Harmony Hub on a DIN rail, a grid, or a plate.	
5	Connect the external antenna to Harmony Hub (optional).	Refer to Mounting Tips for ZBRA2 External Antenna *(see page 101)*.
6	Ensure that upstream power is off. Connect the external 24...240 Vac/Vdc power supply.	Refer to Power Supply Connections *(see page 34)*.
7	Turn on the power.	–
8	Configure Harmony Hub, either through the user interface (8a) or the DTM (8b).	–
8a	Configure Harmony Hub through the user interface.	Refer to User Interface *(see page 115)*.
8b	Connect Harmony Hub to the PC.	Refer to Connection to a PC *(see page 134)*.
	Configure Harmony Hub thought the DTM.	Refer to Configuration *(see page 135)*.
	Disconnect the PC.	–
9	Connect Ethernet communication buses and network.	Refer to the Ethernet Cable *(see page 65)*.
10	Verify all the connections.	–
11	Run the application.	–

ZBRN2 Startup Procedure

The following table shows the startup procedure for the ZBRN2 Harmony Hub:

Step	Action	Comments
1	Unpack your Harmony Hub (ZBRN2) and check the contents of the package.	Contents of the package: Instruction Sheet, Harmony Hub (ZBRN2).
2	Choose an appropriate cabinet.	Refer to Mechanical Installation *(see page 28)*.
3	Install Harmony Hub on a DIN rail, a grid, or a plate.	
4	Connect the external antenna to Harmony Hub (optional).	Refer to Mounting Tips for the ZBRA2 External Antenna *(see page 101)*.
5	Ensure that upstream power is off. Connect the external 24...240 Vac/Vdc power supply.	Refer to Power Supply Connections *(see page 34)*.
6	Turn on the power.	–
7	Configure Harmony Hub, either through the user interface (7a) or the DTM (7b).	–
7a	Configure Harmony Hub through the user interface.	Refer to User Interface *(see page 115)*.
7b	Connect Harmony Hub to the PC.	Refer to Connection to a PC *(see page 134)*.
	Configure Harmony Hub through the DTM.	Refer to Configuration *(see page 135)*.
	Disconnect the PC.	–
8	Connect the serial line communication buses and network.	Refer to Modbus Serial Line Cables *(see page 52)*.
9	Connect line termination devices to Harmony Hub (optional).	Refer to Modbus Serial Line Cabling *(see page 48)*.
10	Verify all the connections.	–
11	Run the application.	–

Configuration

Mandatory Settings

Configure the following 2 types of parameters:
- Communication protocol
- Wireless devices association

Configure Harmony Hubs using one of the following methods:
- Through the user interface. Refer to Configuration Menu *(see page 115)*.
- Remotely using a PC through the DTM Configuration *(see page 135)*.
  Use DTM only for pushbuttons and limit switches.

Transmitters Association Definition

For each input channel of Harmony Hub, the following states are possible:
- Empty: No transmitter associated with the input.
- Associated off-line: The input parameters are configured but no radio exchanges have been performed.
- Associated on-line: The input parameters are configured and radio exchanges have been performed.

HMI display for the input states:
- I 02 means that the input 2 is free
- I - 02 means that the input 2 is associated off-line
- I _ 02 means that the input 2 is associated on-line

ZigBee Over The Air

The transmitter may be:
- Static: Data are only sent by the transmitter to Harmony Hub during pairing.
  There is no encryption key or the encryption key is hard-coded in the transmitter and sent to Harmony Hub.
- OTA (Over the Air): The transmitter and Harmony Hub exchange data while pairing.
  The encryption key is generated by Harmony Hub and sent to the transmitter.

Supported Transmitter Types

The following transmitter types are supported:

Type number	HMI label	Related transmitters
1	So	Push buttons, limit switches, …
2	E3	Reserved
3	th	Reserved
4	CL	Reserved
5	Et	Thermal monitoring sensors
6	S1	Generic ZigBee, PowerTag sensors

Pairing Modes

Depending on the type of transmitter associated, three pairing modes are available:

Menu	Description	Compatible transmitters
id	Manual pairing. The ID of the transmitter is set manually.	Static transmitters ● So ● S1
tE	Teach pairing(1) The first transmitter emitting a pairing request is paired to this input	OTA transmitters ● So ● Et ● S1
tE id	Teach pairing with ID(1) Only the transmitter emitting a pairing request with the correct ID is paired to this input	OTA transmitters ● So ● Et ● S1
(1) The pairing request must be received by Harmony Hub within 2 minutes after the pairing mode has been selected.		

Pairing Procedures

Overview

The steps to follow to add and pair a transmitter to an input of Harmony Hub depends on the type of transmitter to add.

In the following examples, we consider that four inputs are already configured and that the new transmitter is paired to the free input 2.

Adding a Type 1 Transmitter Trough The User Interface

NOTE: Type 1 transmitters can be paired with several Harmony Hubs.

Steps to follow to add a type 1 transmitter using the `id` pairing mode:

Step	Action	Comment
1	Go on a free input of Harmony Hub (input 2 in this example).	`rdy > ConF > in.04 > i 02`
2	Select the type of transmitter.	`ty.So`: pushbuttons or limit switches
3	Select the pairing mode.	`id`: Manual pairing
4	Enter the first two digits of the transmitter ID.	-
5	Enter the last two digits of the transmitter ID.	`i_02` is displayed (associated on-line)

Steps to follow to add a type 1 transmitter using the `t` pairing mode:

Step	Action	Comment
1	Go on a free input of Harmony Hub (input 2 in this example).	`rdy > ConF > in.04 > i 02`
2	Select the type of transmitter.	`ty.So`: pushbuttons or limit switches
3	Select the pairing mode.	`t`: Teach pairing
4	Harmony Hub is waiting for a paring request.	`t` is blinking If the commissioning request is not received within 2 minutes `i 02` is displayed, the input is free.
5	Press the transmitter button 3 times.	`t 1` is displayed at first press `t 2` is displayed at second press `t 3` is displayed quickly at third press `i_02` is displayed (associated on-line)

Steps to follow to add a type 1 transmitter using the tEid pairing mode:

Step	Action	Comment
1	Go on a free input of Harmony Hub (input 2 in this example).	rdY > ConF > in.04 > i 02
2	Select the type of transmitter.	tY.So: pushbuttons or limit switches
3	Select the pairing mode.	tEid: Teach pairing with ID
4	Enter the first two digits of the transmitter ID.	-
5	Enter the last two digits of the transmitter ID.	-
6	Harmony Hub is waiting for a paring request.	tE is blinking If the commissioning request is not received within 2 minutes, i-02 is displayed (associated off-line), refer to Teach an Associated Off-line Transmitter *(see page 177)*.
7	Press the transmitter button once.	i_02 is displayed (associated on-line)

Adding a Type 5 Transmitter Trough The User Interface

NOTE: Type 5 transmitters can be paired with only one Harmony Hub. The transmitter must be unpaired before to pair it to Harmony Hub.
To unpair the thermal monitoring sensor, press and maintain the transmitter button until its embedded led flashes three times, and wait 15 s before to start the new pairing.

Steps to follow to add a type 5 transmitter using the tEid pairing mode:

Step	Action	Comment
1	Go on a free input of Harmony Hub (input 2 in this example).	rdY > ConF > in.04 > i 02
2	Select the type of transmitter.	tY.EE: Thermal monitoring sensors
3	Select the pairing mode.	tEid: Teach pairing with ID
4	Enter the first two digits of the transmitter ID.	-
5	Enter the last two digits of the transmitter ID.	-
6	Harmony Hub is waiting for a paring request.	tE is blinking If the commissioning request is not received within 2 minutes, i-02 is displayed (associated off-line), refer to Teach an Associated Off-line Transmitter *(see page 177)*.
7	Press and maintain the transmitter button until its embedded led flashes two times to set it on commissioning mode	tE 1 is displayed at first frame received tE 2 is displayed at second frame received tE 3 is displayed quickly at third frame received i_02 is displayed (associated on-line)

Adding a Type 6 Transmitter Trough The User Interface

NOTE: Type 6 transmitters can be paired with only one Harmony Hub.The transmitter must be unpaired before to pair it to Harmony Hub.
To unpair the PowerTag, switch off Harmony Hub, power cycle the PowerTag transmitter and wait until its embedded led flashes red. It is automatically unpaired.

Steps to follow to add a type 6 transmitter using the tid pairing mode:

Step	Action	Comment
1	Go on a free input of Harmony Hub (input 2 in this example).	rdY > ConF > in.04 > i 02
2	Select the type of transmitter.	tY.S 1: Generic transmitter, PowerTag
3	Select the pairing mode.	t id: Teach pairing with ID
4	Enter the first two digits of the transmitter ID.	-
5	Enter the last two digits of the transmitter ID.	-
6	Harmony Hub is waiting for a paring request.	t is blinking If the commissioning request is not received within 2 minutes, i - 02 is displayed (associated off-line), refer to Teach an Associated Off-line Transmitter *(see page 177)*.
7	The self-powered PowerTag transmitter sends frame periodically.	t 1 is displayed at first frame received t 2 is displayed at second frame received t 3 is displayed quickly at third frame received i_02 is displayed (associated on-line)

Teach an Associated Off-line Transmitter Trough The User Interface

A transmitter is associated off-line if the transmitter ID is already configured but no radio exchanges have been performed.

Steps to follow to teach a transmitter that is associated off-line:

Step	Action	Comment
1	Go on an associated off-line input of Harmony Hub (input 2 in this example).	rdY > ConF > in.04 > i-02
2	Select the pairing mode.	t: Teach pairing
3	Harmony Hub is waiting for a paring request.	t is blinking If the commissioning request is not received within 2 minutes, i-02 is displayed (associated off-line).
4	According to the transmitter type: ● Type 1: Press the transmitter button 3 times. ● Type5: Press and maintain the transmitter button until its embedded led flashes two times to set it on commissioning mode. ● Type 6: The self-powered PowerTag transmitter sends frame periodically.	t 1 is displayed at first frame received t 2 is displayed at second frame received t 3 is displayed quickly at third frame received i_02 is displayed (associated on-line)

Chapter 11
Architectures

IT/OT Architecture

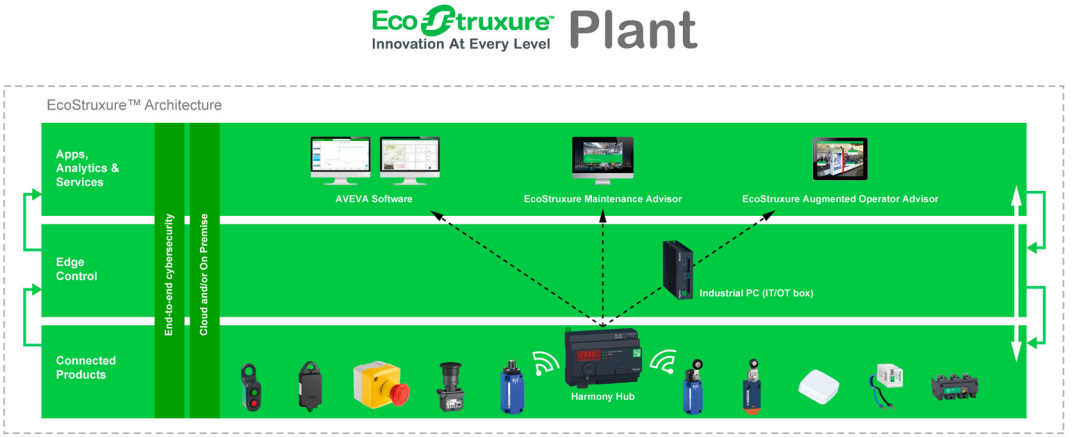
Overview

You can communicate with Schneider Electric applications and software:

- **EcoStruxure Augmented Operator Advisor**:
  - Instant diagnostic
  - Real-time information
  - Reduce human errors
  - Contactless maintenance
- **EcoStruxure Maintenance Advisor**:
  - Saving up to 30% effort of maintenance effort
  - Avoiding assets failures
  - Shortening scheduled downtime
- **EcoStruxure AVEVA Software**:
  - Engineering
  - Planning & Operations
  - Asset Performance
  - Monitoring and Control
- **EcoStruxure Machine Advisor**:
  - Cloud-based services platform for machine builders
  - Track machines in operation worldwide
  - Monitor performance data and fix exceptional events
  - Reducing support costs by up to 50%

Architecture Examples for ZBRN1

Architecture example for ZBRN1 in a plant environment:



Architecture example for ZBRN1 in a machine environment: