SoMachine

Scan for Buttons Linked to ZBRN Modules
Harmony ZBRN Library Guide

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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.

Table of Contents

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.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

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

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

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

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

At a Glance

Document Scope

This library guide explains how to read the status of the Harmony XB5R wireless and batteryless push-button used with ZBRN access points.

This document focuses on the application part of the project:

- How to configure a project for ZBRN modules.
- How to configure the ZBRN module with SoMachine.
- A quick way to read Harmony XB5R push-button states.

Validity Note

This document has been updated for the release of SoMachine V4.2.

Related Documents

Title of Documentation	Reference Number
SoMachine Programming Guide	EIO0000000067 (ENG); EIO0000000069 (FRE); EIO0000000068 (GER); EIO0000000071 (SPA); EIO0000000070 (ITA); EIO0000000072 (CHS)
M251 Logic Controller Programming Guide	EIO0000001462 (ENG); EIO0000001463(FRE); EIO0000001464 (GER); EIO0000001465 (SPA); EIO0000001466 (ITA); EIO0000001467 (CHS)
Harmony XB5R ZBRN1/ ZBRN2 User Manual	EIO0000001177 (ENG); EIO0000001178 (FRE); EIO0000001181 (GER); EIO0000001179 (SPA); EIO0000001180 (ITA); EIO0000001182 (CHS)

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

Product Related Information

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

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

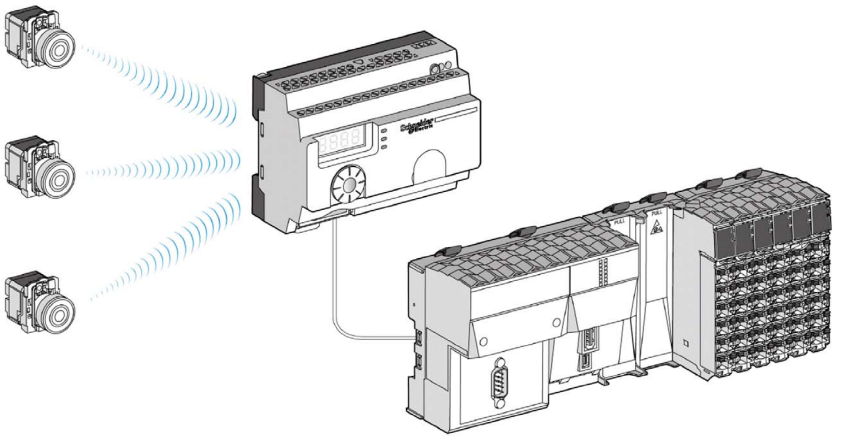
Chapter 1
System Requirements

System Requirements

Overview

The Harmony XB5R push-buttons are both wireless and batteryless. They are used with ZBRN access points allowing more flexibility and simplicity in the installation. The access point converts radio frequency inputs from the Harmony XB5R push-buttons into various communication protocols that can then be sent to a controller.

The following graphic shows the ZBRN module connected to a controller:



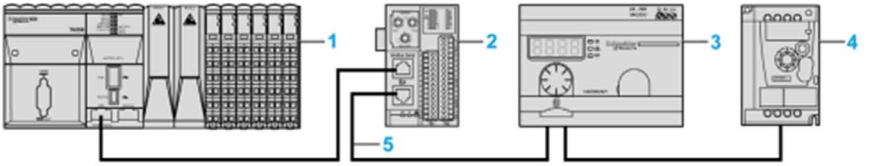
This document helps you to configure and use the ZBRN module in your application based on either:

- Modbus Serial Line (ZBRN2)
- Modbus TCP (ZBRN1)

NOTE: For the configuration of your ZBRN, refer to the ZBRN documentation *(see Harmony XB5R, ZBRN1/ZBRN2, User Manual)*.

Hardware Architecture

The following graphic shows an example, where the access point is part of a Modbus serial network, with the controller as a master and other devices as slaves:



1 Controller as master
2 Modbus Advantys OTB network interface module
3 ZBRN access point
4 ATV12 drive
5 Modbus serial line

Chapter 2
Modbus Serial Line Configuration

Adding a Device on the Modbus Serial IOScanner

Introduction

This section describes how to add a device on the Modbus IOScanner.

Add a Device on the Modbus IOScanner

To add a device on the Modbus IOScanner, select the **Generic Modbus Slave** in the **Hardware Catalog**, drag it to the **Devices tree**, and drop it on the **Modbus_IOScanner** node of the **Devices tree**.

For more information on adding a device to your project, refer to:

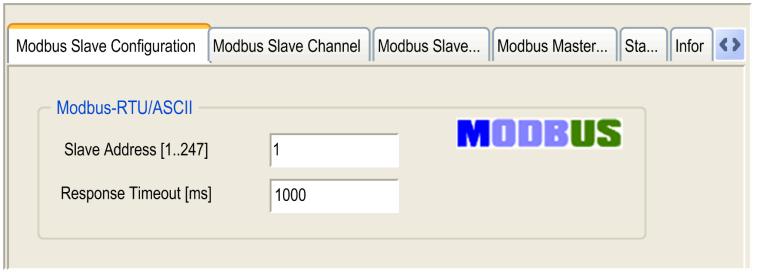
• Using the Drag-and-drop Method *(see SoMachine, Programming Guide)*

• Using the Contextual Menu or Plus Button *(see SoMachine, Programming Guide)*

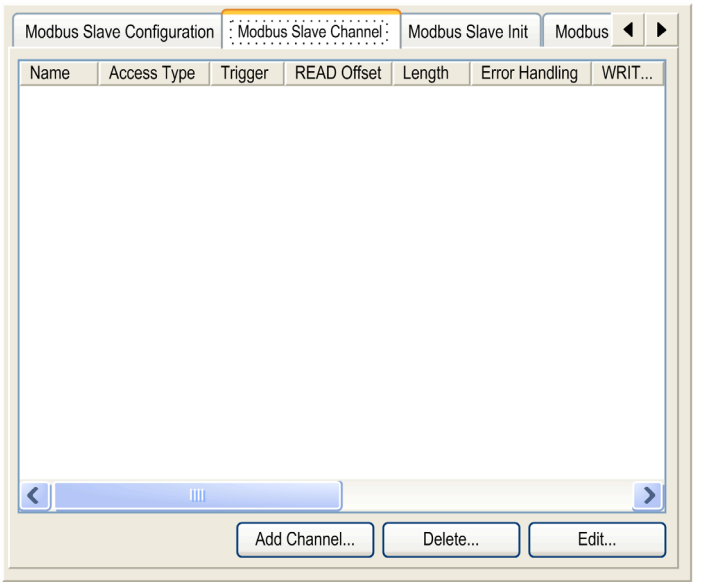
NOTE: The variable for the exchange is automatically created in the `%IWx` and `%QWx` of the **Modbus Serial Master I/O Mapping** tab.

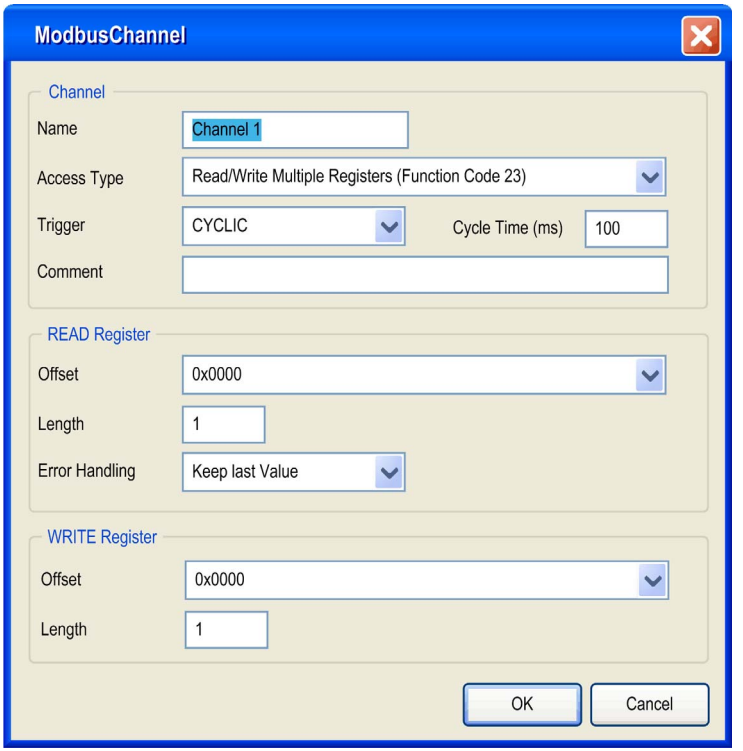
Configure a Device Added on the Modbus IOScanner

To configure the device added on the Modbus IOScanner, proceed as follow:

Step	Action
1	In the **Devices tree**, double-click **Generic Modbus Slave**. **Result:** The configuration window is displayed. 
2	Enter a **Slave Address** value for your device (choose a value from 1 to 247).
3	Choose a value for the **Response Timeout** (in ms).

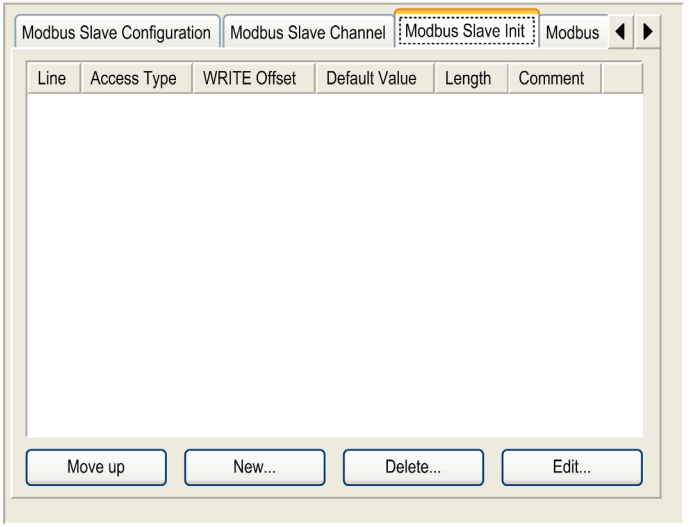
To configure the **Modbus Channels**, proceed as follow:

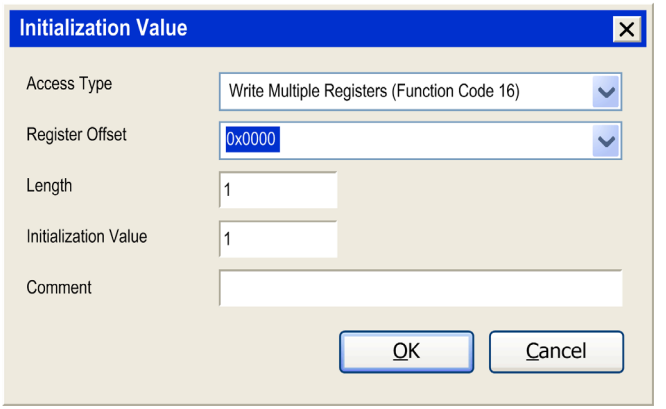
Step	Action
1	Click the **Modbus Slave Channel** tab: 

Step	Action
2	Click the **Add Channel** button: 

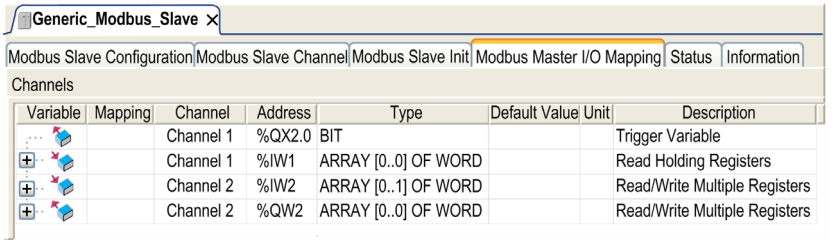
Step	Action
3	Configure an exchange: In the field **Channel**, you can add the following values: ● **Channel**: Enter a name for your channel. ● **Access Type**: Choose the exchange type: Read or Write or Read/Write multiple registers (i.e. %MW) *(see page 19)*. ● **Trigger**: Choose the trigger of the exchange. It can be either **CYCLIC** with the period defined in **Cycle Time (ms)** field or started by a **RISING EDGE** on a boolean variable (this boolean variable is then created in the **Modbus Master I/O Mapping** tab). ● **Comment**: Add a comment about this channel. In the field **READ Register** (if your channel is Read or Read/Write one), you can configure the %MW to be read on the Modbus slave. Those will be mapped on %IW (see Modbus Master I/O Mapping tab): ● **Offset**: Offset of the %MW to read. 0 means that the first object that will be read will be %MW0. ● **Length**: Number of %MW to be read. For example, if 'Offset' = 2 and 'Length' = 3, the channel will read %MW2, %MW3 and %MW4. ● **Error Handling**: choose the behavior of the related %IW in case of loss of communication. In the field**WRITE Register** (if your channel is Write or Read/Write one), you can configure the %MW to be written to the Modbus slave. Those will be mapped on %QW (see Modbus Master I/O Mapping tab): ● **Offset**: Offset of the %MW to write. 0 means that the first object that will be written will be %MW0. ● **Length**: Number of %MW to be written. For example, if 'Offset' = 2 and 'Length' = 3, the channel will write %MW2, %MW3 and %MW4.
5	Click **OK** to validate the configuration of this channel. **NOTE:** You can also: ● Click the **Delete** button to remove a channel. ● Click the **Edit** button to change the parameters of a channel.

To configure your **Modbus Initialization Value**, proceed as follow:

Step	Action
1	Click the **Modbus Slave Init** tab: 

Step	Action
2	Click **New** to create a new initialization value:  The **Initialization Value** window contains the following parameters: • **Access Type**: Choose the exchange type: Read or Write or Read/Write multiple registers (that is, `%MW`) *(see page 19)*. • **Register Offset**: Register number of register to be initialized. • **Length**: Number of `%MW` to be read. For example, if 'Offset' = 2 and 'Length' = 3, the channel will read `%MW2`, `%MW3` and `%MW4`. • **Initialization Value**: Value the registers are initialized with. • **Comment**: Add a comment about this channel.
4	Click **OK** to create a new **Initialization Value**. **NOTE:** You can also: • Click **Move up** to change the position of a value in the list. • Click **Delete** to remove a value in the list. • Click **Edit** to change the parameters of a value.

To configure your **Modbus Master I/O Mapping**, proceed as follow:

Step	Action
1	Click the **Modbus Master I/O Mapping** tab: 
2	Double-click in a cell of the **Variable** column to open a text field. Enter the name of a variable or click the browse button **[...]** and chose a variable with the **Input Assistant**.
3	For more information on I/O mapping, refer to SoMachine Programming Guide.

Access Types

This table describes the different access types available:

Function	Function Code	Availability
`Read Coils`	1	**ModbusChannel**
`Read Discrete Inputs`	2	**ModbusChannel**
`Read Holding Registers` (default setting for the channel configuration)	3	**ModbusChannel**
`Read Input Registers`	4	**ModbusChannel**
`Write Single Coil`	5	**ModbusChannel** **Initialization Value**
`Write Single Register`	6	**ModbusChannel** **Initialization Value**
`Write Multiple Coils`	15	**ModbusChannel** **Initialization Value**
`Write Multiple Registers` (default setting for the slave initialization)	16	**ModbusChannel** **Initialization Value**
`Read/Write Multiple Registers`	23	**ModbusChannel**

Chapter 3
Modbus TCP Configuration

What Is in This Chapter?

This chapter contains the following topics:

Configuring a Modbus TCP IOScanner

Prerequisites

Before configuring the Modbus TCP IOScanner:

- Set the IP address of the Ethernet 2 to **fixed mode**. It must be different from `0.0.0.0`.
- The connected devices must be in the same subnet as the Ethernet 2 port

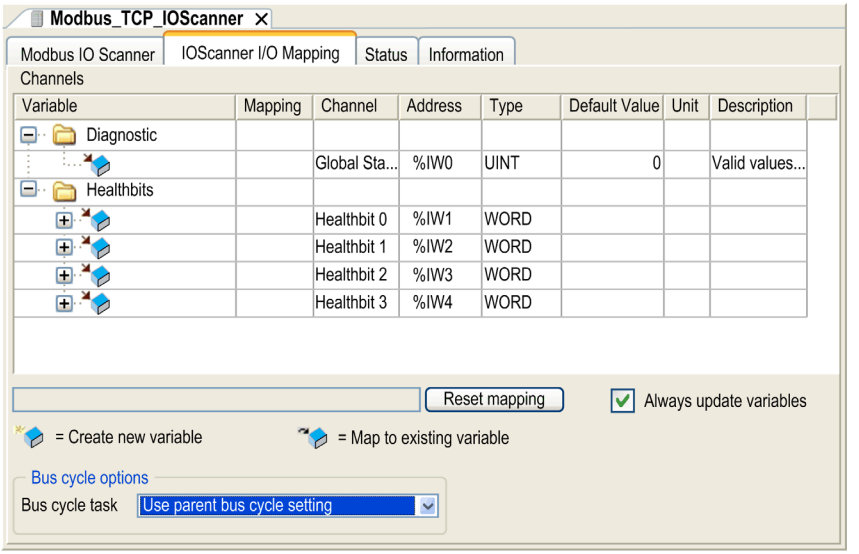
For more information on IP address, refer to Ethernet Configuration *(see Modicon M251 Logic Controller, Programming Guide)*.

Add a Modbus TCP IOScanner

The Modbus TCP IOScanner node is automatically added when a slave is added on the **Ethernet 2** node *(see Modicon M251 Logic Controller, Programming Guide)*.

Configure a Modbus TCP IOScanner

To configure a Modbus TCP IOScanner, proceed as follows:

Step	Action
1	In the **Devices tree**, double-click **Modbus_TCP_IOScanner**. **Result**: The configuration window is displayed.
2	Select the **IOScanner I/O Mapping** tab. 

Step	Action
3	Select the **Bus cycle task** in the list: ● **Use parent bus cycle setting** (by default), ● **MAST**, or ● An existing task of the project. **NOTE:** The **Bus cycle task** parameter inside the I/O mapping editor of the device that contains the Modbus TCP IOScanner defines the task responsible for the refresh of the I/O images (%QW, %IW). These I/O images correspond to the Modbus request sent to the Modbus slaves and the health bits.

NOTE: When the Modbus TCP IOScanner is configured, the post configuration file for the Ethernet 2 network is ignored.

Configuring a Generic Device on the Modbus TCP IOScanner

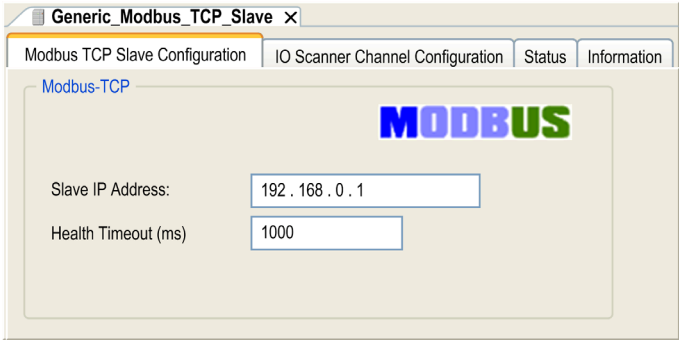
Overview

To configure a generic device added on the Modbus TCP IOScanner, complete the parameters in these two tabs:

- **Modbus TCP Slave Configuration**
- **IO Scanner Channel Configuration**

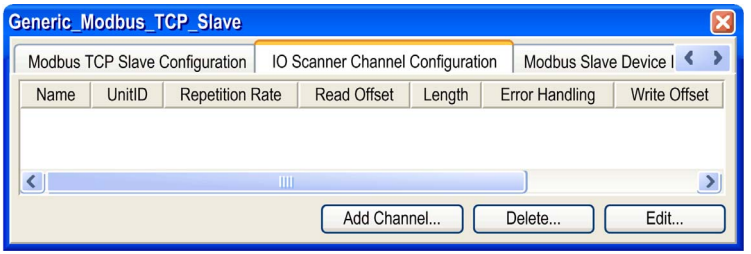
Modbus TCP Slave Configuration Tab

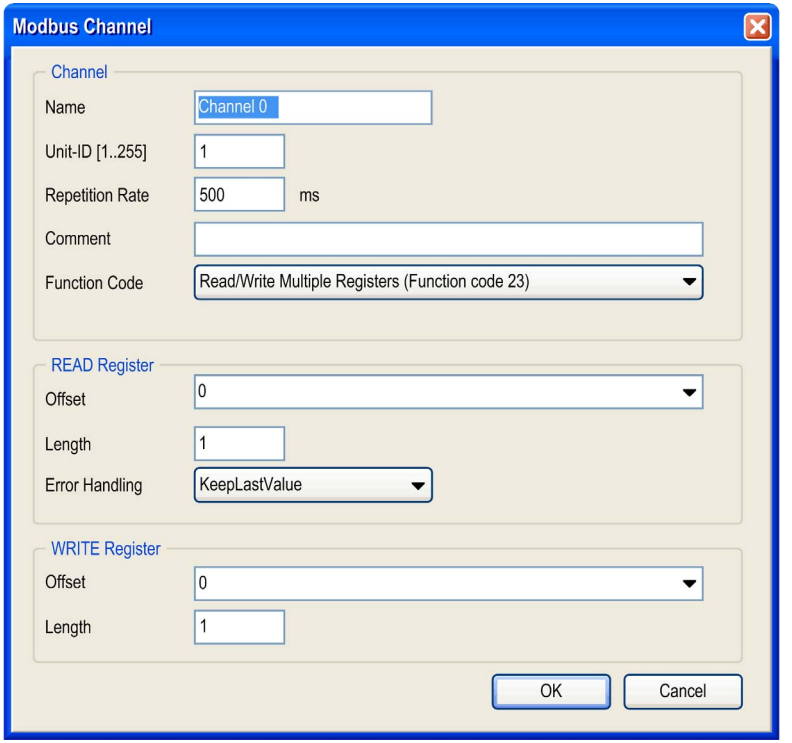
To configure the parameters in the **Modbus TCP Slave Configuration** tab, proceed as follows:

Step	Action
1	In the **Devices tree**, double-click **Generic_Modbus_TCP_Slave**. Result: The configuration window is displayed. 
2	Enter a **Slave IP Address** value (by default 192.168.0.1).
3	Enter a **Health Timeout (ms)** value (by default 1000). This represents the delay (in ms) between a request of the Modbus TCP IOScanner and a response from the slave. When the health timeout expires, the associated health bit values change to 0. Health bit values can be visualized in the IOScanner I/O Mapping tab *(see page 22)*.

IO Scanner Channel Configuration Tab

To configure the parameters in the **IO Scanner Channel Configuration** tab, proceed as follows:

Step	Action
1	Click the **IO Scanner Channel Configuration** tab: 
2	To remove a channel, select it and click **Delete**.
3	To change the parameters of a channel, select the channel and click **Edit**.

Step	Action
4	To add a channel, click **Add Channel**. This dialog box is displayed: 

Step	Action
5	In the **Channel** area, you can define: ● **Name**: optional string for naming the channel ● **Unit-ID [1..255]**: unit ID of the Modbus TCP slave device (by default 255). See note. ● **Repetition Rate**: polling interval of the Modbus request (by default 20 ms) ● **Comment**: optional field to describe the channel ● **Function Code**: type of Modbus request: ❍ **Read/Write Multiple Registers (Function code 23)** (by default) ❍ **Read Holding Registers (Function code 03)** ❍ **Write Multiple Registers (Function code 16)** In the **READ register** area, you can define: ● **Offset**: starting register number to read from 0 to 65535 ● **Length**: number of the registers to be read (depending on the function code). ● **Error Handling**: define the fallback value in the case of a communication interruption: ❍ **Keep Last Value** (by default) holds the last valid value ❍ **SetToZero** resets all values to 0 In the **WRITE register** area, you can define: ● **Offset**: starting register number to write from 0 to 65535 ● **Length**: number of the registers to be written (depending on the function code).
6	Click **OK** to validate the configuration of the channel.
7	Repeat steps 4 to 6 to create other channels that define the Modbus communication with the device. For each Modbus request, you must create a channel.

NOTE: Unit identifier is used with Modbus TCP devices which are composed of several Modbus devices, for example, on Modbus TCP to Modbus RTU gateways. In such case, the unit identifier allows reaching the slave address of the device behind the gateway. By default, Modbus/TCP-capable devices ignore the unit identifier parameter.

Chapter 4
Quick Reference Guide

What Is in This Chapter?

This chapter contains the following topics:

Verification of Buttons States

Validation Procedure

To validate, proceed as follows:

1. Click the **Modbus Master I/O Mapping** tab.
2. Connect and login to the controller.
3. Press one of the Harmony XB5R push-buttons and observe the change of state in the current value field.

NOTE: For more information refer to the ZBRN documentation *(see Harmony XB5R, ZBRN1/ZBRN2, User Manual)*.

The following figure shows the related values for the Harmony XB5R push-buttons within the variable list:

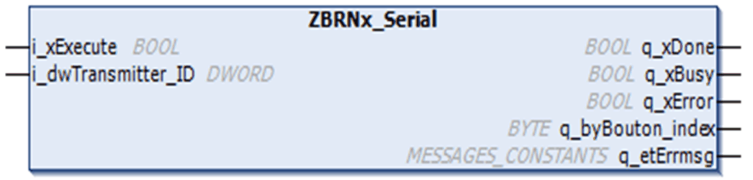
Variable	Mapping	Channel	Address	Type	Default Value	Current Value	Prep..
		Channel 0-15	%IW5	WORD		16=0001	
Btn1		Bit 0	%IX10.0	BOOL	FALSE	TRUE	
Btn2		Bit 1	%IX10.1	BOOL	FALSE	FALSE	
Btn3		Bit 2	%IX10.2	BOOL	FALSE	FALSE	
Btn4		Bit 3	%IX10.3	BOOL	FALSE	FALSE	
Btn5		Bit 4	%IX10.4	BOOL	FALSE	FALSE	
Btn6		Bit 5	%IX10.5	BOOL	FALSE	FALSE	
Btn7		Bit 6	%IX10.6	BOOL	FALSE	FALSE	
Btn8		Bit 7	%IX10.7	BOOL	FALSE	FALSE	
Btn9		Bit 8	%IX11.0	BOOL	FALSE	FALSE	
Btn10		Bit 9	%IX11.1	BOOL	FALSE	FALSE	
Btn11		Bit 10	%IX11.2	BOOL	FALSE	FALSE	
Btn12		Bit 11	%IX11.3	BOOL	FALSE	FALSE	
Btn13		Bit 12	%IX11.4	BOOL	FALSE	FALSE	
Btn14		Bit 13	%IX11.5	BOOL	FALSE	FALSE	
Btn15		Bit 14	%IX11.6	BOOL	FALSE	FALSE	
Btn16		Bit 15	%IX11.7	BOOL	FALSE	FALSE	

Identifying Buttons Linked to ZBRN Module

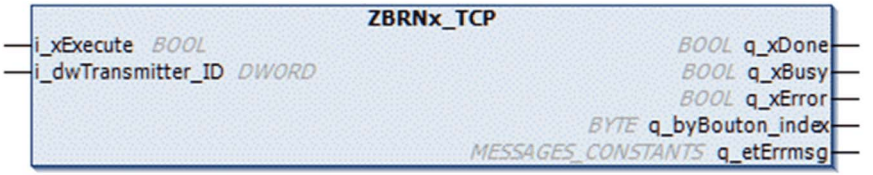
Function Block Description

The function blocks `ZBRNx_Serial` and `ZBRNx_TCP` get information to identify buttons linked to the ZBRN module. Therefore, a MAST task must include a POU (Program Organization Unit) that instantiates the required function block.

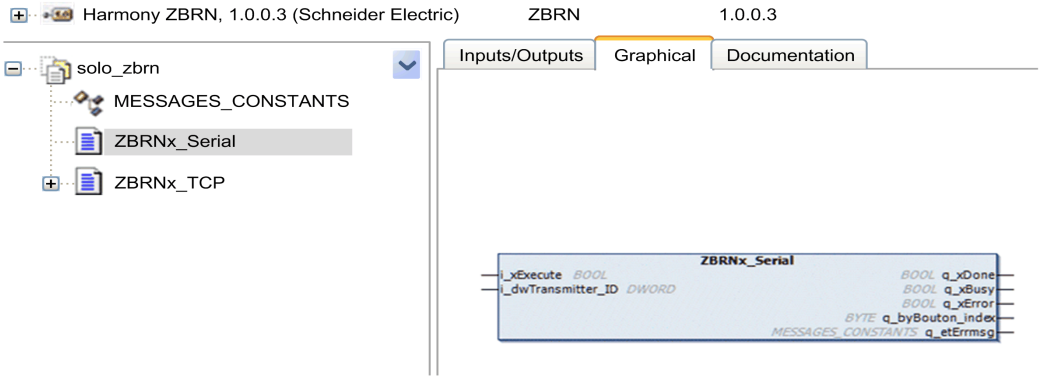
For Modbus serial:



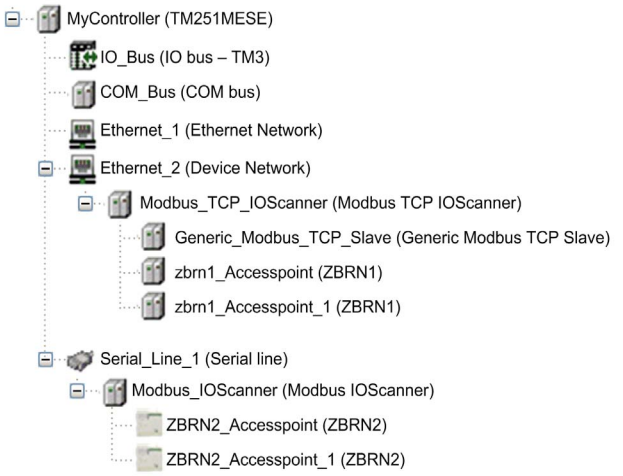
For Modbus TCP:



The following graphic shows the function block from library repository:



The graphic shows the devices in use with instances of each type:



I/O Variable Description

The table describes the input variables of the function blocks:

Input	Data Type	Description
`i_xExecute`	BOOL	Starts the buttons ID scan process.
`i_dwTransmitter_ID`	DWORD	Decimal value of the push-button ID to find.

The table describes the output variables of the function blocks:

Output	Data Type	Description
`q_xDone`	BOOL	TRUE when scan process is achieved.
`q_xBusy`	BOOL	TRUE while processing: no request is accepted.
`q_xError`	BOOL	Indicates an error is detected. When TRUE: refer to `q_etErrmsg` for more details.
`q_byBouton_index`	BYTE	Index of the push-button. Starts at 0.
`q_etErrmsg`	MESSAGES_CONSTANTS	Type of error detected

Glossary

A

application
A program including configuration data, symbols, and documentation.

C

configuration
The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

controller
Automates industrial processes (also known as programmable logic controller or programmable controller).

E

expansion bus
An electronic communication bus between expansion I/O modules and a controller.

H

health bit
Variable that indicates the communication state of the channels.

health timeout
Represents the maximal time (in ms) between a request of the Modbus IO scanner and a response of the slave.

I

I/O
(*input/output*)

M

MAST

A processor task that is run through its programming software. The MAST task has 2 sections:

- **IN:** Inputs are copied to the IN section before execution of the MAST task.
- **OUT:** Outputs are copied to the OUT section after execution of the MAST task.

P

POU

(*program organization unit*) A variable declaration in source code and a corresponding instruction set. POUs facilitate the modular re-use of software programs, functions, and function blocks. Once declared, POUs are available to one another.

program

The component of an application that consists of compiled source code capable of being installed in the memory of a logic controller.

R

repetition rate

Polling interval of the Modbus request that is sent.

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