

Advantys STB

Standard Modbus Plus Network Interface
Module

Applications Guide

8/2009

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Table of Contents



	Safety Information	5
	About the Book	7
Chapter 1	Introduction	9
	What Is a Network Interface Module?	10
	What Is Advantys STB?	13
	About Modbus Plus	17
	How Nodes Access the Modbus Plus Network	20
	Using Peer Cop	22
Chapter 2	The STB NMP 2212 NIM	25
	External Features of the STB NMP 2212	26
	STB NMP 2212 Fieldbus Interface	28
	Rotary Switches: Setting the Network Node Address	29
	LED Indicators	31
	Advantys STB Island Status LEDs	33
	The CFG Interface	36
	Power Supply Interface	39
	Logic Power	41
	Selecting a Source Power Supply for the Island's Logic Power Bus	43
	Module Specifications	46
Chapter 3	How to Configure the Island	47
	How Do Modules Automatically Get Island Bus Addresses?	48
	How to Auto-Configure Default Parameters for Island Modules	50
	How to Install the STB XMP 4440 Optional Removable Memory Card	51
	Using the STB XMP 4440 Optional Removable Memory Card to Configure the Island	54
	What is the RST Button?	57
	How to Overwrite Flash Memory with the RST Button	58

Chapter 4	Fieldbus Communications Support	61
	An Example of a Modbus Plus View of the Process Image	62
	Predefined Diagnostics Registers in the Data Image	70
	Error Checking and Recovery	78
	Communication Access Registers	79
	Supported Modbus Plus Commands	82
	Fault Handling	83
Chapter 5	Application Examples	85
	Sample Island Assembly	86
	A Modbus Plus Connection Example	88
	Peer Copping the Island	90
	Multi-master Aspects and Limitations of Peer Cop	95
	MSTR Function Block	97
Chapter 6	Advanced Configuration Features	99
	STB NMP 2212 Configurable Parameters	100
	Configuring Mandatory Modules	104
	Prioritizing a Module	106
	What Is a Reflex Action?	107
	Island Fallback Scenarios	111
	Saving Configuration Data	113
	Write-Protecting Configuration Data	114
	A Modbus View of the Island's Data Image	115
	The Island's Process Image Blocks	118
	The HMI Blocks in the Island Data Image	120
	Test Mode	122
	Run-Time Parameters	124
	Virtual Placeholder	129
Glossary	131
Index	155

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, 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 an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

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

⚠ CAUTION

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

CAUTION

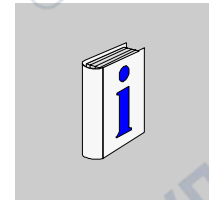
CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

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 the installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

This book describes the STB NMP 2212 Advantys STB standard Modbus Plus network interface module (NIM). The STB NMP 2212 can communicate with a fieldbus master over Modbus Plus. The NIM represents the island configuration as a single node on a Modbus Plus network.

This *Guide* includes the NIM's:

- role in a Modbus Plus network
- capabilities as the gateway to the Advantys STB island
- external and internal interfaces
- flash memory and removable memory
- integrated power supply
- auto-configuration capability
- saving configuration data
- island bus scanning functionality
- data exchange capabilities
- diagnostic messages
- specifications

Validity Note

This document is valid for Advantys 4.5 or later.

Related Documents

Title of Documentation	Reference Number
Advantys STB Analog I/O Modules Reference Guide	31007715 (E), 31007716 (F), 31007717 (G), 31007718 (S), 31007719 (I)

Advantys STB Digital I/O Modules Reference Guide	31007720 (E), 31007721 (F), 31007722 (G), 31007723 (S), 31007724 (I)
Advantys STB Counter Modules Reference Guide	31007725 (E), 31007726 (F), 31007727 (G), 31007728 (S), 31007729 (I)
Advantys STB Special Modules Reference Guide	31007730 (E), 31007731 (F), 31007732 (G), 31007733 (S), 31007734 (I)
Advantys STB System Planning and Installation Guide	31002947 (E), 31002948 (F), 31002949 (G), 31002950 (S), 31002951 (I)
Advantys STB Configuration Software Quick Start User Guide	31002962 (E), 31002963 (F), 31002964 (G), 31002965 (S), 31002966 (I)
Advantys STB Reflex Actions Reference Guide	31004635 (E), 31004636 (F), 31004637 (G), 31004638 (S), 31004639 (I)

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User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

Introduction

1

Introduction

This chapter describes the STB NMP 2212 Advantys STB Modbus Plus network interface module (NIM) and its support for the island as a Modbus Plus network node.

The chapter begins with an introduction of the NIM and a discussion of its role as the gateway to the Advantys STB island. There is a brief overview of the island itself, followed by a description of the major characteristics of the Modbus Plus fieldbus protocol.

Some information in this chapter is specific to the STB NMP 2212 and some is common to all Advantys STB NIMs.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
What Is a Network Interface Module?	10
What Is Advantys STB?	13
About Modbus Plus	17
How Nodes Access the Modbus Plus Network	20
Using Peer Cop	22

What Is a Network Interface Module?

Purpose

Every island requires a network interface module (NIM) in the leftmost location of the primary segment. Physically, the NIM is the first (leftmost) module on the island bus. Functionally, it is the gateway to the island bus. That is, all communications to and from the island bus pass through the NIM. The NIM also has an integrated power supply that provides logic power to the island modules.

The Fieldbus Network

An island bus is a node of distributed I/O on an open fieldbus network, and the NIM is the island's interface to that network. The NIM supports data transfers over the fieldbus network between the island and the fieldbus master.

The physical design of the NIM makes it compatible with both an Advantys STB island and your specific fieldbus master. Whereas the fieldbus connector on each NIM type may differ, the location on the module front panel is essentially the same.

Communications Roles

Communications capabilities provided on a standard NIM include:

Function	Role
data exchange	The NIM manages the exchange of input and output data between the island and the fieldbus master. Input data, stored in native island bus format, is converted to a fieldbus-specific format that can be read by the fieldbus master. Output data written to the NIM by the master is sent across the island bus to update the output modules and is automatically reformatted.
configuration services	Custom services can be performed by the Advantys configuration software. These services include changing the operating parameters of the I/O modules, fine-tuning island bus performance, and configuring reflex actions. The Advantys Configuration Software runs on a computer attached to the NIM's CFG interface (<i>see page 36</i>). (For NIMs with Ethernet port connectivity, you can also connect to the Ethernet port.)
human-machine interface (HMI) operations	A serial Modbus HMI panel can be configured as an input and/or output device on the island. As an input device, it can write data that can be received by the fieldbus master; as an output device, it can receive updated data from the fieldbus master. The HMI can also monitor island status, data, and diagnostic information. The HMI panel must be attached to the NIM's CFG port.

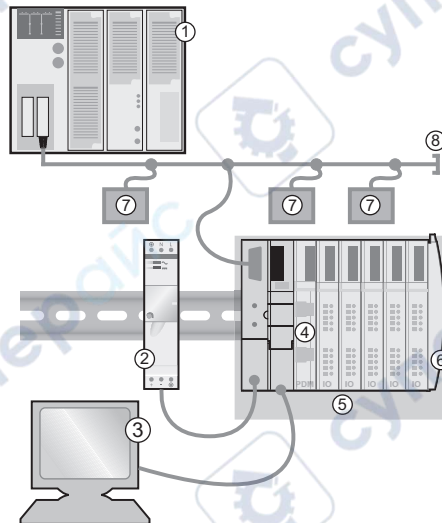
Integrated Power Supply

The NIM's built-in 24-to-5 VDC power supply provides logic power to the I/O modules on the primary segment of the island bus. The power supply requires a 24 VDC external power source. It converts the 24 VDC to 5 V of logic power for the island. Individual STB I/O modules in an island segment generally draw a logic bus current of between 50 and 265 mA. (Consult the *Advantys STB System Planning and Installation Guide* for current limitations at various operating temperatures.) If the logic bus current drawn by the I/O modules totals more than 1.2 A, additional STB power supplies need to be installed to support the load.

The NIM delivers the logic power signal to the primary segment only. Special STB XBE 1300 beginning-of-segment (BOS) modules, located in the first slot of each extension segment, have their own built-in power supplies, which provide logic power to the STB I/O modules in the extension segments. Each BOS module that you install requires 24 VDC from an external power supply.

Structural Overview

The following figure illustrates the multiple roles of the NIM. The figure provides a network view and a physical representation of the island bus:



- 1 fieldbus master
- 2 external 24 VDC power supply, the source for logic power on the island
- 3 external device connected to the CFG port (a computer running the Advantys Configuration Software or an HMI panel)
- 4 power distribution module (PDM): provides field power to the I/O modules
- 5 island node
- 6 island bus terminator plate
- 7 other nodes on the fieldbus network

- 8 fieldbus network terminator (if required)

What Is Advantys STB?

Introduction

Advantys STB is an assembly of distributed I/O, power, and other modules that function together as an island node on an open fieldbus network. Advantys STB delivers a highly modular and versatile slice I/O solution for the manufacturing and process industries.

Advantys STB lets you design an island of distributed I/O where the I/O modules can be installed as close as possible to the mechanical field devices that they control. This integrated concept is known as *mechatronics*.

Island Bus I/O

An Advantys STB island can support as many as 32 I/O modules. These modules may be Advantys STB I/O modules, preferred modules, and enhanced CANopen devices.

The Primary Segment

STB I/O modules on an island may be interconnected in groups called segments.

Every island has at least one segment, called the *primary segment*. It is always the first segment on the island bus. The NIM is the first module in the primary segment. The primary segment must contain at least one Advantys STB I/O module and can support a logic bus current of up to 1.2 A. The segment also contains one or more power distribution modules (PDMs), which distribute field power to the I/O modules.

Extension Segments

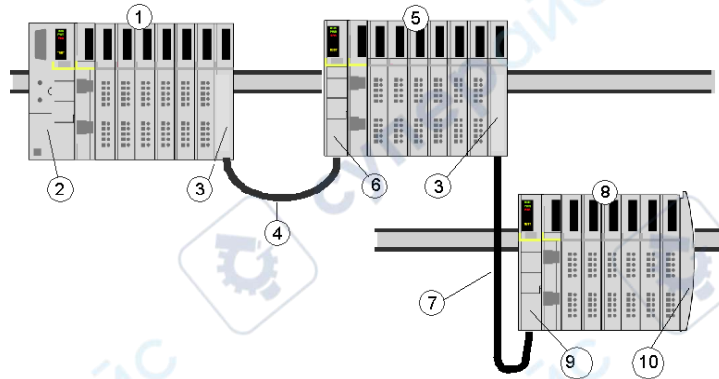
When you are using a standard NIM, Advantys STB I/O modules that do not reside in the primary segment can be installed in *extension segments*. Extension segments are optional segments that enable an island to be a truly distributed I/O system. The island bus can support as many as six extension segments.

Special extension modules and extension cables are used to connect segments in a series. The extension modules are:

- STB XBE 1100 EOS module: the last module in a segment if the island bus is extended
- STB XBE 1300 BOS module: the first module in an extension segment

The BOS module has a built-in 24-to-5 VDC power supply similar to the NIM. The BOS power supply also provides logic power to the STB I/O modules in an extension segment.

Extension modules are connected by lengths of STB XCA 100x cable that extend the island communication bus from the previous segment to the next BOS module:



- 1 primary segment
- 2 NIM
- 3 STB XBE 1100 EOS bus extension module(s)
- 4 1 m length STB XCA 1002 bus extension cable
- 5 first extension segment
- 6 STB XBE 1300 BOS bus extension module for the first extension segment
- 7 4.5 m length STB XCA 1003 bus extension cable
- 8 second extension segment
- 9 STB XBE 1300 BOS bus extension module for the second extension segment
- 10 STB XMP 1100 termination plate

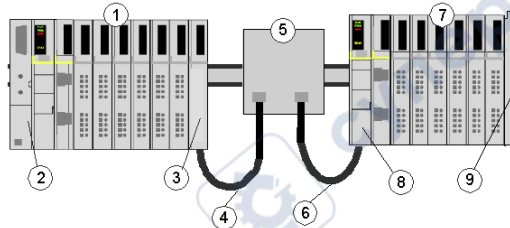
Bus extension cables are available in various lengths, ranging from 0.3 m (1 ft) to 14.0 m (45.9 ft).

Preferred Modules

An island bus can also support those auto-addressable modules referred to as *preferred modules*. Preferred modules do not mount in segments, but they do count as part of the 32-module maximum system limit.

A preferred module can connect to an island bus segment through an STB XBE 1100 EOS module and a length of STB XCA 100x bus extension cable. Each preferred module has two IEEE 1394-style cable connectors, one to receive the island bus signals and the other to transmit them to the next module in the series. Preferred modules are also equipped with termination, which must be enabled if a preferred module is the last device on the island bus and must be disabled if other modules follow the preferred device on the island bus.

Preferred modules can be chained to one another in a series, or they can connect to Advantys STB segments. As shown in the following figure, a preferred module passes the island bus communications signal from the primary segment to an extension segment of Advantys STB I/O modules:



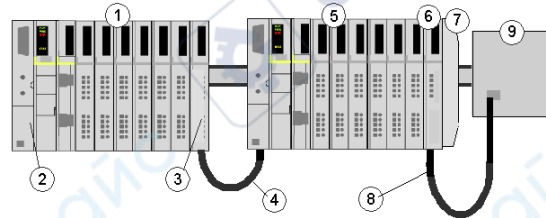
- 1 primary segment
- 2 NIM
- 3 STB XBE 1100 EOS bus extension module
- 4 1 m length STB XCA 1002 bus extension cable
- 5 preferred module
- 6 1 m length STB XCA 1002 bus extension cable
- 7 extension segment of Advantys STB I/O modules
- 8 STB XBE 1300 BOS bus extension module for the extension segment
- 9 STB XMP 1100 termination plate

Enhanced CANopen Devices

You may also install one or more enhanced CANopen devices on an island. These devices are not auto-addressable, and they must be installed at the end of the island bus. If you want to install enhanced CANopen devices on an island, you need to use an STB XBE 2100 CANopen extension module as the last module in the last segment.

NOTE: If you want to include enhanced CANopen devices in your island, you need to configure the island using the Advantys Configuration Software, and you need to configure the island to operate at 500 kbaud.

Because enhanced CANopen devices cannot be auto-addressed on the island bus, they must be addressed using physical addressing mechanisms on the devices. The enhanced CANopen devices together with the CANopen extension module form a sub-network on the island bus that needs to be separately terminated at the beginning and end. A terminator resistor is included in the STB XBE 2100 CANopen extension module for one end of the extension sub-network; the last device on the CANopen extension must also be terminated with a 120 Ω resistor. The rest of the island bus needs to be terminated after the CANopen extension module with an STB XMP 1100 termination plate:



- 1 primary segment
- 2 NIM
- 3 STB XBE 1100 EOS bus extension module
- 4 1 m length STB XCA 1002 bus extension cable
- 5 extension segment
- 6 STB XBE 2100 CANopen extension module
- 7 STB XMP 1100 termination plate
- 8 typical CANopen cable
- 9 enhanced CANopen device with 120 Ω termination

Length of the Island Bus

The maximum length of an island bus (the maximum distance between the NIM and the last device on the island) is 15 m (49.2 ft). This length must take into account the extension cables between segments, extension cables between preferred modules, and the space consumed by the devices themselves.

About Modbus Plus

Introduction

Modbus Plus communications handle data exchanges between all devices on the fieldbus. The Modbus Plus protocol is based on a logical token bus (token passing). Each node on the network needs to be assigned a unique address in the range 1 to 64, and a node can access the network once it receives the token. A Modbus Plus communication channel supports three primary functions:

- point-to-point data exchanges between nodes
- broadcast exchanges of global data between participating nodes
- multidrop exchanges of specific data

Point-to-point exchanges implement the underlying Modbus protocol and can be configured with MSTR function blocks in the control logic program.

Global data exchange is the method by which the fieldbus master writes island bus output data from the STB NMP 2212 NIM.

Through specific data, the fieldbus master reads input to the STB NMP 2212 NIM. Multi-drop exchanges are implemented via a utility called Peer Cop (*see page 22*).

NOTE: For more information than that presented in this topic, refer to the Modbus Plus Network Planning and Installation Guide (890 USE 100).

Modbus Plus Services

In general, the Modbus Plus token passing architecture uses standard Modbus commands to support:

- multi-master data exchanges
- up to 64 nodes on a network
- multi-network connections through bridges
- message transfer via routing
- an operating baud rate of 1 Mbit/s

The STB NMP 2212 NIM supports the simultaneous transfer of up to 125 registers per data access request. It uses single-register commands such as PRESET MULTIPLE REGISTERS and READ/WRITE 4xxx REGISTER.

Bridging Networks

Multiple Modbus Plus networks can be joined through Bridge Plus devices. Messages originating at one network node can be routed through one or more bridges to a destination node on another network. This facilitates the design of time-critical applications in which each network employs only the devices required for the timing of the local process. Messages are passed through bridges to other networks as needed.

Modbus devices and custom serial devices can join the Modbus Plus network through bridge multiplexers. A bridge multiplexer provides four serial ports that are separately configurable to support Modbus or custom RS-232/RS-485 devices. Serial devices can communicate with both the Modbus Plus devices and serial devices at the other serial ports.

The Logical Network

Every Modbus Plus network node is identified by a unique address that you assign to it. A node address is independent of its physical location on the network. Addresses are in the range 1 . . . 64, and do not have to be sequential. Duplicate addresses are not allowed.

Network nodes function as peer members on the logical token ring. A node gains write-access to the network upon receipt of the token. The token is a grouping of bits that is passed in a rotating address sequence from one node to another. Each Modbus Plus network maintains its own token rotation sequence independently of the other networks. Where multiple networks are joined by bridges, the token is *not* passed through the bridge device.

When a node has the token, it can initiate message transactions with other nodes. Each message contains routing fields that define the message source and destination, including any routing path through bridges to nodes on other Modbus Plus networks.

When it passes the token, the node can write to a global database that is broadcast to all nodes on the network. Global data is transmitted as a field within the token frame. Other nodes monitor the token passing and may extract the global data if they have been programmed to do so. Use of the global database allows rapid updating of alarms, setpoints, and other system data. Each Modbus Plus network maintains its own global database.

The Physical Network

The network bus consists of a twisted-pair shielded cable that is run in a direct path between successive nodes. The two data lines in the cable are not sensitive to polarity. However, it is a good idea to follow a standard wiring convention.

The network consists of one or more cable sections, with any section able to support up to 32 nodes over a maximum cable distance of 450 m. Sections can be joined by repeaters to extend the network length and to support up to 64 nodes.

The cable length between any pair of nodes must be at least 10 ft (3 m). The maximum cable length between two nodes is the same as the maximum section length—450 m.

Nodes are connected to the cable by a tap device. The tap provides through-connections for the network trunk cable, drop-connections for the cable to the node device, and a grounding terminal.

The tap also contains a resistive termination that is connected by two internal jumpers. The tap at each end of a cable section requires that both of its jumpers be connected to prevent signal reflections. All of the taps that are in-line on a cable section require their jumpers to be removed (open).

How Nodes Access the Modbus Plus Network

The Token Rotation Sequence

When the network is initialized, each node becomes aware of the other active nodes. Each node builds a table identifying the other nodes on its network. Initial ownership of the token is established, and a token rotation sequence begins. Your choice between laying out your application as one large network, or as several smaller networks, affects the timing of the complete token rotation.

The token sequence is determined by node addresses. Token rotation begins at the network's lowest-addressed active node, proceeding consecutively through each higher-addressed node, until the highest-addressed active node receives the token. That node then passes the token to the lowest one to begin a new rotation. If a node leaves the network, a new token-passing sequence will be established to bypass it, typically within 100 ms. If a new node joins, it will be included in the address sequence, typically within 5 s (worst case time is 15 s). The process of deleting and adding nodes is automatic.

Effect of Application Layout on Node Access

Tokens are not passed through Bridge Plus nodes, although messages can be addressed through Bridge Plus nodes to destination nodes. You can therefore construct your networking application as several smaller networks, joined by Bridge Plus nodes. The fast token rotation time in each small network allows rapid transfer of high-priority data, with lower-priority data passing through bridges to other networks. This facilitates time-critical messaging to nodes that are tightly linked in an application.

Where multiple networks are joined by bridges, each network performs its token passing process independently of the other networks.

Point to Point Message Transactions

While a node holds the token, it can send the application messages it has to transmit. Each message can contain up to 100 controller registers (16-bit words) of data. The other nodes monitor the network for incoming messages.

When a node receives a message, it sends an immediate acknowledgment to the originating node. If the message is a request for data, the receiving node will begin assembling the requested data into a reply. When the reply message is ready, it will be transmitted to the requestor upon receipt of a subsequent token that grants permission to transmit.

Nodes can also transact messages containing local and remote operating statistics. These include information such as identification of active nodes, current software version, network activity, and error reporting. If a node transmits a request to read the statistics of another node, the entire transaction is completed while the originating node holds the token. The remote node's statistics are embedded in its acknowledgement. The remote node does not need to acquire the token to transmit the statistics.

After a node transmits all of its messages, it passes the token sequentially to the next node. Protocols for token passing and messaging are transparent to the application.

Global Database Transactions

When a node passes the token, it can broadcast up to 32 words (16 bits each) of global information to all other nodes on the network. The information is contained in the token frame. The process of sending global data when transmitting the token is controlled independently by the application program on each node.

Global database applications include time synchronization, rapid notification of alarm conditions, and multicasting of setpoint values and constants to all devices in a common process. This allows uniform and rapid transmission of global data without having to assemble and transmit separate messages to the individual devices.

Access to a network's global database is available only to the nodes on the same network because the token is not passed through bridge devices to other networks. A Modbus Plus application can determine which data items are useful to nodes on a remote network, and forward them as necessary.

Global Data Tables

Global data is accessible to the application programs running on other nodes on the same network. Each node maintains a table of global data sent by every other node on the network. Although only one node accepts the passed token, all nodes monitor the token transmission and can read its contents. All nodes receive and store global data in the table.

The table contains separate areas for each node's global data. Each node's application program can selectively use or ignore the global data from specific nodes. Each node's application determines when and how to use the global data.

Using Peer Cop

Why Use Peer Cop

When you use Peer Cop for data transactions, each sending node can specify unique references as data sources and each receiving node can specify the same or different references as data destinations. When nodes receive global data, they can index to specific locations in the incoming data and extract specific lengths of data. Data transactions are handled rapidly as part of each token pass.

Applications can be designed in which alarms and setpoints are transmitted (globally), with required actions by specific nodes also defined (specifically). Because all nodes detect the token passes, Peer Cop global data can be rapidly known to all nodes, with each node's specific data requirements known only to itself.

Because Peer Cop data is transacted as part of the token pass, it applies to each network independent of any other networks that are part of the Modbus Plus system. Tokens are not exchanged between networks because they are not passed through Bridge Plus devices. Each network maintains its own Peer Cop database, with its own system of global broadcasting and specific node addressing.

Data Transactions

Point-to-point data can be transacted while a node holds the token and during its token pass with Modbus Plus Peer Cop. Up to 500 words (16 bits each) can be directed to specific data references in node devices prior to release of the token, and up to 32 words can be globally broadcast to all nodes as part of the token frame. Because all nodes monitor the network, each node can extract data that is specifically addressed to that node. All nodes detect the token pass, and can extract global data messages from the token frame. Defined data references (like controller registers) are used as sources and destinations. For example, a block of registers can be the data source at the transmitting node, and the same block or another block can be the data destination in the receiving node.

The delivery of Peer Cop data to destination nodes is independent of the next address used in the token pass. The token is always passed to the next node in the network's address sequence. The token frame, however, can contain Peer Cop global messages that are unrelated to the next address and which are globally broadcast to all nodes.

Each node is configured through its software to handle Peer Cop data transactions. Nodes must be specifically configured to send and receive the data. Nodes that have not been configured for Peer Cop will ignore the data transactions.

Sending Data

Nodes can be configured to send two kinds of Peer Cop data:

- **Global Output:** up to 32 words of data can be broadcast globally from each node to all nodes. Source data references are specified in the node configuration.
- **Specific Output:** up to 32 words of data can be transmitted to any specific node. Multiple node destinations can be specified, up to the maximum of 500 data words. Any nodes on the network can be specifically addressed as destinations. A unique block of references can be specified as the data source for each targeted node.

Receiving Data

Nodes can be configured to receive two kinds of Peer Cop data:

- **Global Input:** up to 32 words of global data can be received by each node from each other node on the network. Destination references are specified in the receiving node's configuration. Up to eight blocks of references can be specified, giving up to eight separate destinations for the data received from each source node. The incoming data can be indexed to establish the starting point and length of each block of data to be extracted from the message and delivered to each destination.
- **Specific Input** up to 32 words of data can be received from any specific node. Each node on the network can be specifically defined as a data source, up to the maximum of 500 data words.



The STB NMP 2212 NIM

2

Introduction

This chapter describes the Advantys STB Modbus Plus NIM's external features, connections, power requirements, and product specifications.

What's in this Chapter?

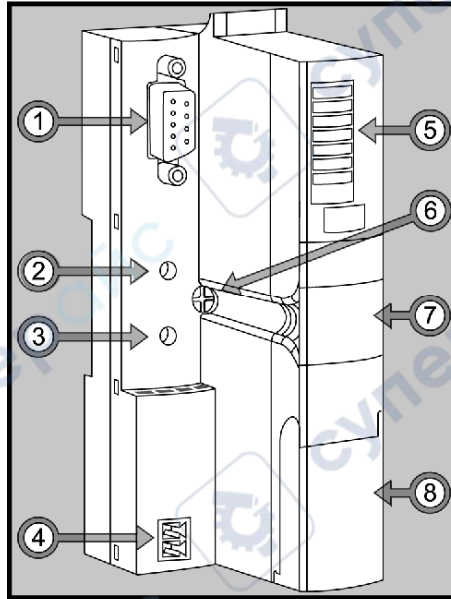
This chapter contains the following topics:

Topic	Page
External Features of the STB NMP 2212	26
STB NMP 2212 Fieldbus Interface	28
Rotary Switches: Setting the Network Node Address	29
LED Indicators	31
Advantys STB Island Status LEDs	33
The CFG Interface	36
Power Supply Interface	39
Logic Power	41
Selecting a Source Power Supply for the Island's Logic Power Bus	43
Module Specifications	46

External Features of the STB NMP 2212

Introduction

The physical features of the STB NMP 2212 are called out in the figure below:



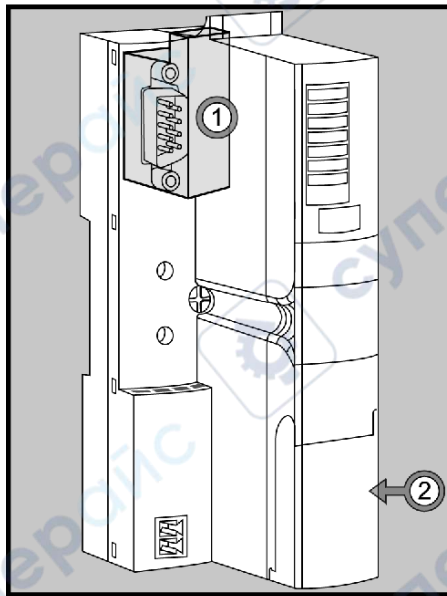
The features are described in the following table:

Feature	Function
1 fieldbus interface	a 9 pin SUB-D (female) connector used to connect the NIM and the island bus to a Modbus Plus fieldbus network
2 upper rotary switch	the two rotary switches are used together to specify the NIM's node ID on the Modbus Plus fieldbus
3 lower rotary switch	
4 power supply interface	a two-pin receptacle for connecting an external 24 VDC power supply to the NIM
5 LED array	colored LEDs that illuminate in various patterns to visually indicate the operational status of the island bus
6 release screw	a mechanism that needs to be turned if you need to remove the NIM from the DIN rail (see the <i>Automation Island System Planning and Installation Guide</i> (890 USE 171 00) for details)

Feature		Function
7	removable memory card <i>(see page 51)</i> drawer	a plastic drawer in which a removable memory card can be seated and inserted in the NIM
8	CFG port <i>(see page 36)</i> cover	a liftable lid on the NIM's front panel that covers the CFG interface and the RST button

Housing Shape

The L-shaped external housing of the NIM is designed to accommodate the attachment of a fieldbus connector without raising the depth profile of the island:



- 1 space reserved for the fieldbus connector
- 2 NIM housing

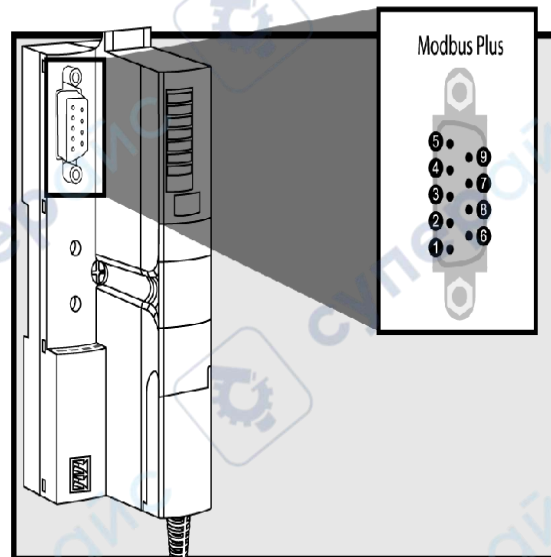
STB NMP 2212 Fieldbus Interface

Summary

The fieldbus interface on the STB NMP 2212 connects the island and the Modbus Plus network. The interface is a female nine-receptacle SUB-D connector.

Fieldbus Port Connections

The fieldbus interface is located on the front of the STB NMP 2212 at the top:



The NIM connects to the network via a Modbus Plus drop cable. Drop cables are available in two lengths:

- 2.4 m (8 ft) model number 990NAD21110
- 6 m (20 ft) model number 990NAD21130

For a detailed description of other network cabling and accessories, refer to the *Modbus Plus Network Planning and Installation Guide* (890 USE 100).

Baud

The STB NMP 2212 is not equipped with switches for setting the device's baud. Modbus Plus runs at a set baud rate of 1 Mb.

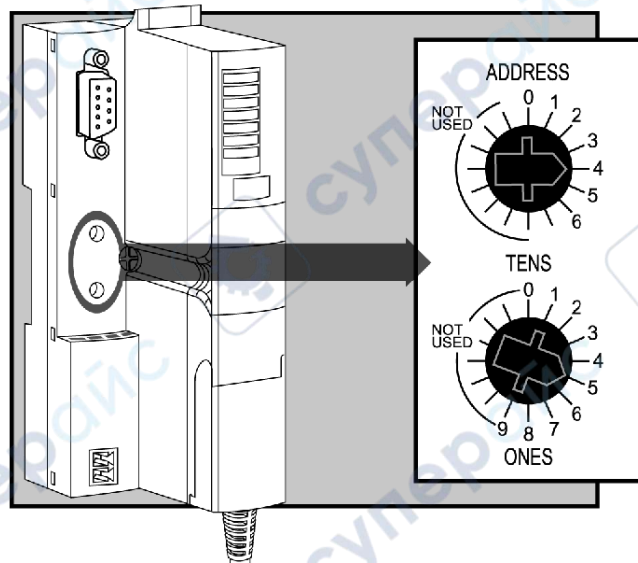
Rotary Switches: Setting the Network Node Address

Summary

As a node on a Modbus Plus network, the Advantys STB island requires a network address. The address can be a numeric in the range 1 to 64 that is unique with respect to all other nodes on the network. The node address is set with a pair of rotary switches on the NIM module. A Modbus Plus master device communicates with the island by addressing the NIM's node ID.

Physical Description

The two rotary switches are located on the front of the STB NMP 2212, below the fieldbus interface. The upper switch represents the tens digit and the lower switch represents the ones digit:



Setting the Node Address

To set the node address:

Step	Action	Comment
1	Power down the island.	The changes you are about to make will be detected only at the next power up.
2	Select a node address that is available on the network.	

Step	Action	Comment
3	With a small screwdriver, set the lower rotary switch to the position that represents the digit in the ones position of your selected node address.	For example, if the node address is 45, set the lower switch to 5.
4	With a small screwdriver, set the upper rotary switch to the position that represents the digit in the tens position of your selected node address.	For example, if the node address is 45, set the upper switch to 4.
5	Power up the island.	The NIM reads the rotary switch settings only during power up.

Using the Node Address

The node address is not stored in Flash memory. The NIM reads the node address from the rotary switches each time the island powers up. For this reason, it is best to leave the rotary switches set to the same address. This way, the fieldbus master identifies the island at the same node address at each power up.

Valid and Invalid Node Addresses

Each rotary switch position that you can use to set the node address for your island is marked incrementally on the NIM housing. The available positions on each rotary switch are:

- upper switch—0 to 6 (tens digit)
- lower switch—0 to 9 (ones digit)

It is mechanically possible to set any node address from 00 to 69. However, address 00 and addresses 65 through 69 are invalid. Only node addresses 1 ... 64 are valid.

If the island has an invalid node address, it cannot communicate on the network.

LED Indicators

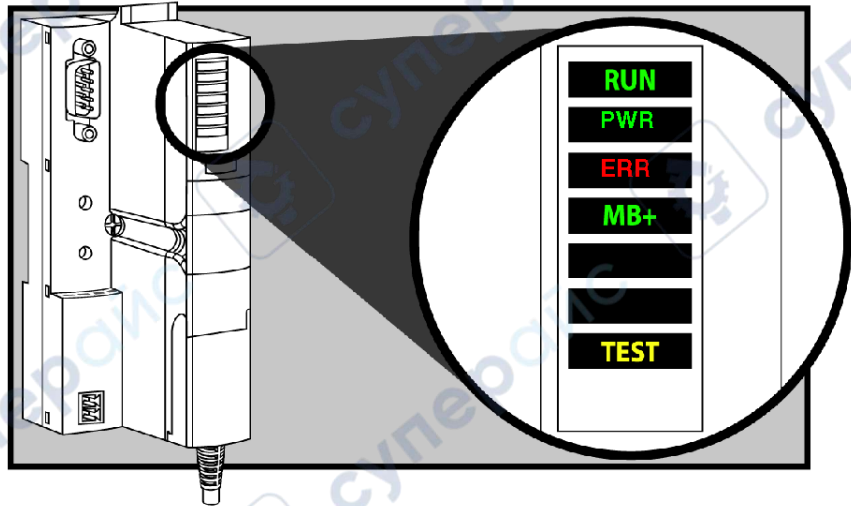
Introduction

The five LEDs on the STB NMP 2212 visually indicate the operating status of the island bus on a Modbus Plus network. The LED array is located at the top of the NIM front bezel:

- The RUN and PWR LEDs indicate activity or events on the NIM.
- The ERR LED indicates the detection of an error on the island.
- The MB+ LED indicates the status of data exchange between the Modbus Plus fieldbus master and the Advantys STB island bus.
- The TEST LED is controlled by the Advantys Configuration Software.

LED Location

The figure shows the LEDs used by the STB NMP 2212:



Using the LED Tables

Individual blinks are approximately 200 ms. There is a 1-second interval between blink sequences. For example:

- blinking: blinks steadily, alternating between 200 ms on and 200 ms off.
- blink 1: blinks once (200 ms), then 1 second off.
- blink 2: blinks twice (200 ms on, 200 ms off, 200 ms on), then 1 second off.
- blink *N*: blinks *N* (some number of) times, then 1 second off.

NOTE: It is assumed that the *PWR* LED is on continuously, indicating that the NIM is receiving adequate power. (see page 33) If the *PWR* LED is off, logic power (see page 41) to the NIM is off or insufficient.

Modbus Plus Diagnostic LED

This table describes the colors and blink patterns of the MB+ LED that indicate normal operations and detected error conditions on the STB NMP 2212:

Label	Pattern	Meaning
MB+ (green)	steady off	peer processor not functioning
	flash every 160 ms	no error on fieldbus
	flash every 1 s	Node is in MONITOR_OFFLINE state. In this state, the node can hear activity on the other nodes but cannot not transmit date itself.
	2 flashes, off 2 s	The node can detect the network token being passed among other nodes, but it cannot receive it.
	3 flashes, off 1.7 s	no other active nodes on the link or receiver of this node is bad
	4 flashes, off 1.4 s	duplicate node address detected

Advantys STB Island Status LEDs

About the Island Status LEDs

The following table describes:

- the island bus condition(s) communicated by the LEDs
- the colors and blink patterns used to indicate each condition

As you refer to the table, keep in mind the following:

- It is assumed that the *PWR* LED is on continuously, indicating that the NIM is receiving adequate power. If the *PWR* LED is off, logic power (*see page 41*) to the NIM is off or insufficient.
- Individual blinks are approximately 200 ms. There is a 1-second interval between blink sequences. Please note:
 - blinking: blinks steadily, alternating between 200 ms on and 200 ms off.
 - blink 1: blinks once (200 ms), then 1 second off.
 - blink 2: blinks twice (200 ms on, 200 ms off, 200 ms on), then 1 second off.
 - blink *N*: blinks *N* (some number of) times, then 1 second off.
 - If the *TEST* LED is on, either the Advantys configuration software or an HMI panel is the master of the island bus. If the *TEST* LED is off, the fieldbus master has control of the island bus.

Island Status LED Indicators

RUN (green)	ERR (red)	TEST (yellow)	Meaning
blink: 2	blink: 2	blink: 2	The island is powering up (self test in progress).
off	off	off	The island is initializing. The island is not started.
blink: 1	off	off	The island has been put in the pre-operational state by the RST button. The island is not started.
		blink: 3	The NIM is reading from the removable memory card (<i>see page 54</i>).
		on	The NIM is overwriting its Flash memory with the card's configuration data. (See note 1.)
off	blink: 8	off	The contents of the removable memory card are invalid.
blinking (steady)	off	off	The NIM is configuring (<i>see page 47</i>) or auto-configuring (<i>see page 50</i>) the island bus. The island bus is not started.
blinking	off	on	Auto-configuration data is being written to Flash memory. (See note 1.)
blink: 3	blink: 2	off	Configuration mismatch detected after power up. At least one mandatory module does not match. The island bus is not started.

RUN (green)	ERR (red)	TEST (yellow)	Meaning
off	blink: 2	off	The NIM has detected a module assignment error; the island bus is not started.
	blink: 5		invalid internal triggering protocol
off	blink: 6	off	The NIM detects no I/O modules on the island bus.
	blinking (steady)	off	The NIM detects no I/O modules on the island bus ... or ... No further communications with the NIM are possible. Probable causes: <ul style="list-style-type: none"> • internal condition • wrong module ID • device did not auto-address (<i>see page 48</i>) • mandatory module is incorrectly configured (<i>see page 104</i>) • process image is not valid • device is incorrectly configured (<i>see page 50</i>) • The NIM has detected an anomaly on the island bus. • receive/transmit queue software overrun
on	off	off	The island bus is operational.
on	blink 3	off	At least one standard module does not match. The island bus is operational with a configuration mismatch.
on	blink: 2	off	There is a serious configuration mismatch (when a module is pulled from a running island). The island bus is now in pre-operational mode because of one or more mismatched mandatory modules.
blink: 4	off	off	The island bus is stopped (when a module is pulled from a running island). No further communications with the island are possible.
off	on	off	Internal condition: The NIM is inoperable.
[any]	[any]	on	Test mode is enabled: The configuration software or an HMI panel can set outputs. (See note 2.)
<p>1 The TEST LED is on temporarily during the Flash overwrite process.</p> <p>2 The TEST LED is on steadily while the device connected to the CFG port is in control.</p>			

Power LED

The PWR (power) LED indicates whether or not the STB NIC 2212's internal power supplies are operating at the correct voltages. The PWR LED is directly driven by the STB NIC 2212's reset circuitry.

The following table summarizes the PWR LED states:

Label	Pattern	Meaning
PWR	Steady on	The STB NIC 2212 internal voltages are all at or above their minimum voltage level.
PWR	Steady off	One or more of the STB NIC 2212 internal voltages is below minimum voltage level.

The CFG Interface

Purpose

The CFG port is the connection point to the island bus for either a computer running the Advantys Configuration Software or an HMI panel.

Physical Description

The CFG interface is a front-accessible RS-232 interface located behind a hinged flap on the bottom front of the NIM:



The port uses an 8-pin HE-13 (male) connector.

Port Parameters

The CFG port supports the set of communication parameters listed in the following table. If you want to apply any settings other than the factory default values, you must use the Advantys Configuration Software:

Parameter	Valid Values	Factory Default Settings
bit rate (baud)	2400/4800/9600/19200/ 38400/ 57600	9600
data bits	7/8	8
stop bits	1 or 2	1
parity	none / odd / even	even
Modbus communications mode	RTU	RTU

NOTE: To restore all of the CFG port's communication parameters to their factory default settings, push the RST button (*see page 57*) on the NIM. Be aware, however, that this action overwrites all of the island's current configuration values with factory default values.

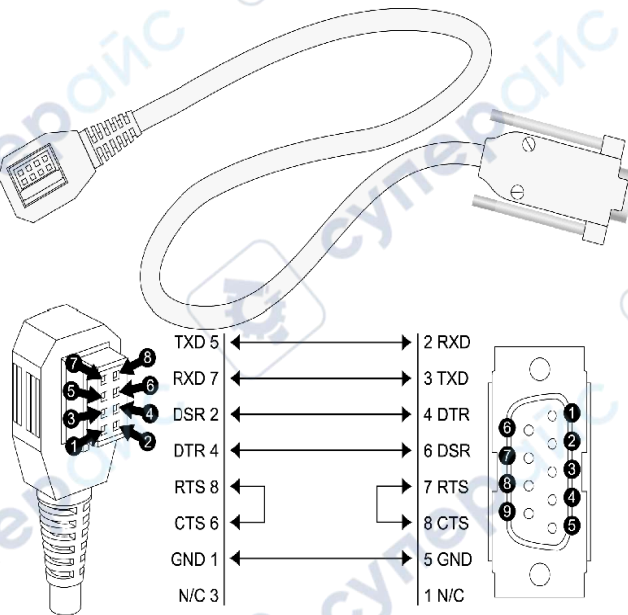
If you want to retain your configuration and still use the RST button to reset your port parameters, write the configuration to an STB XMP 4440 removable memory card (*see page 51*) and insert the card in its drawer in the NIM.

You can also password-protect a configuration (*see page 114*). If you do this, however, the RST button is disabled and you are unable to use it to reset the port parameters.

Connections

An STB XCA 4002 programming cable must be used to connect the computer running the Advantys Configuration Software or a Modbus-capable HMI panel to the NIM through the CFG port.

The STB XCA 4002 is a 2 m (6.23 ft) shielded, twisted-pair cable with an 8-receptacle HE-13 (female) connector on one end that plugs into the CFG port and a 9-receptacle SUB-D (female) connector on the other end that plugs into a computer or an HMI panel:



TXD transmit data
RXD receive data
DSR data set ready
DTR data terminal ready
RTS request to send
CTS clear to send
GND ground reference
N/C not connected

The following table describes the specifications for the programming cable:

Parameter	Description
model	STB XCA 4002
function	connection to a device running the Advantys Configuration Software connection to an HMI panel
communications protocol	Modbus, either RTU or ASCII mode
cable length	2 m (6.23 ft)
cable connectors	<ul style="list-style-type: none">• 8-receptacle HE-13 (female)• 9-receptacle SUB-D (female)
cable type	multiconductor

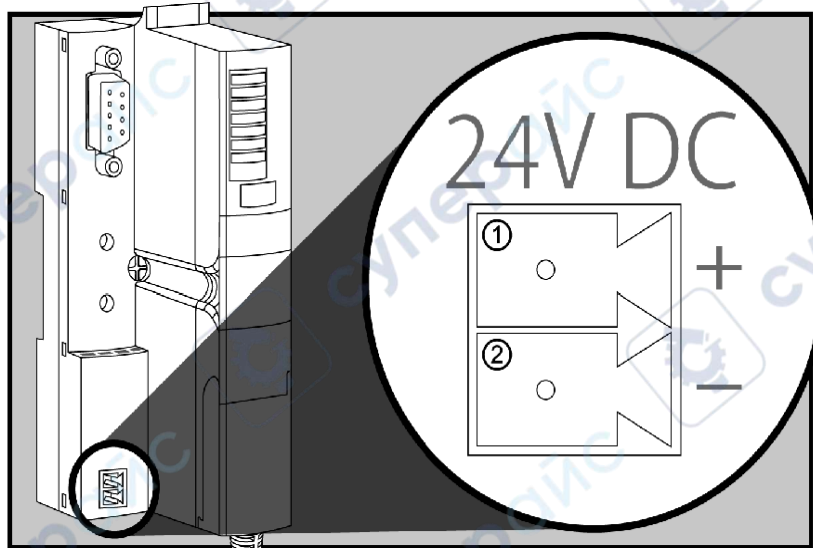
Power Supply Interface

Introduction

The NIM's built-in power supply requires 24 VDC from an external SELV-rated power source. The connection between the 24 VDC source and the Advantys STB island is the two-receptacle connector illustrated below.

Physical Description

Power from the external 24 VDC supply comes in to the NIM through a two-receptacle connector located at the bottom left of the module:



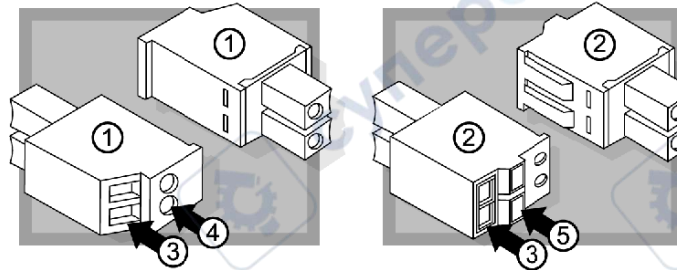
- 1 receptacle 1—24 VDC
- 2 receptacle 2—common voltage

Connectors

Use either:

- a *screw type* power connector, available in a kit of 10 (model STB XTS 1120)
- a *spring clamp* power connector, available in a kit of 10 (model STB XTS 2120)

The following illustrations show two views of each power connector type. A front and back view of the STB XTS 1120 screw type connector is shown on the left, and a front and back view of the STB XTS 2120 spring clamp connector is shown on the right:



- 1 STBXTS 1120 screw-type power connector
- 2 STBXTS 2120 spring clamp power connector
- 3 wire entry slot
- 4 screw clamp access
- 5 spring clamp actuation button

Each entry slot accepts a wire in the range 0.14 to 1.5 mm² (28 to 16 AWG). Each connector has a 3.8 mm (0.15 in) pitch between the receptacles.

We recommend that you strip 9 mm from the wire's jacket for the connection.

Logic Power

Introduction

Logic power is a 5 VDC power signal on the island bus that the I/O modules require for internal processing. The NIM has a built-in power supply that provides logic power. The NIM sends the 5 V logic power signal across the island bus to support the modules in the primary segment.

External Source Power

⚠ CAUTION

IMPROPER GALVANIC ISOLATION

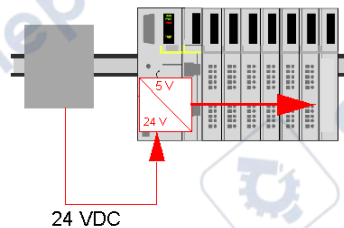
The power components are not galvanically isolated. They are intended for use only in systems designed to provide SELV isolation between the supply inputs or outputs and the load devices or system power bus. You must use SELV-rated supplies to provide 24 VDC source power to the NIM.

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

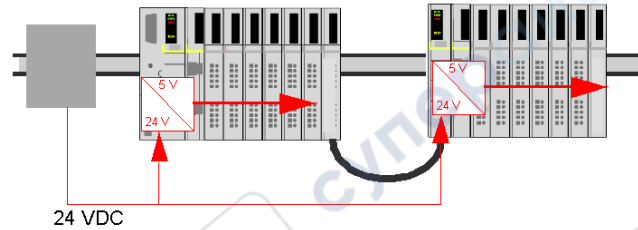
Input from an external 24 VDC power supply (*see page 43*) is needed as the source power for the NIM's built-in power supply. The NIM's built-in power supply converts the incoming 24 V to 5 V of logic power. The external supply must be rated *safety extra low voltage* (SELV-rated).

Logic Power Flow

The figure below shows how the NIM's integrated power supply generates logic power and sends it across the primary segment:



The figure below shows how the 24 VDC signal is distributed to an extension segment across the island:



The logic power signal is terminated in the STB XBE 1100 module at the end of the segment (EOS).

Island Bus Loads

The built-in power supply provides logic bus current to the island. If the logic bus current drawn by the I/O modules exceeds the available current, install additional STB power supplies to support the load. Consult the *Advantys STB System Planning and Installation Guide* for the current provided and consumed by Advantys STB modules at various operating temperatures and voltages.

Selecting a Source Power Supply for the Island's Logic Power Bus

Logic Power Requirements

An external 24 VDC power supply is needed as the source for logic power to the island bus. The external power supply connects to the island's NIM. This external supply provides the 24 V input to the built-in 5 V power supply in the NIM.

The NIM delivers the logic power signal to the primary segment only. Special STB XBE 1300 beginning-of-segment (BOS) modules, located in the first slot of each extension segment, have their own built-in power supplies, which provide logic power to the STB I/O modules in the extension segments. Each BOS module that you install requires 24 VDC from an external power supply.

Characteristics of the External Power Supply

⚠ CAUTION

IMPROPER GALVANIC ISOLATION

The power components are not galvanically isolated. They are intended for use only in systems designed to provide SELV isolation between the supply inputs or outputs and the load devices or system power bus. You must use SELV-rated supplies to provide 24 VDC source power to the NIM.

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

The external power supply needs to deliver 24 VDC source power to the island. The supply that you select can have a low range limit of 19.2 VDC and a high range limit of 30 VDC. The external supply must be rated *safety extra low voltage* (SELV-rated).

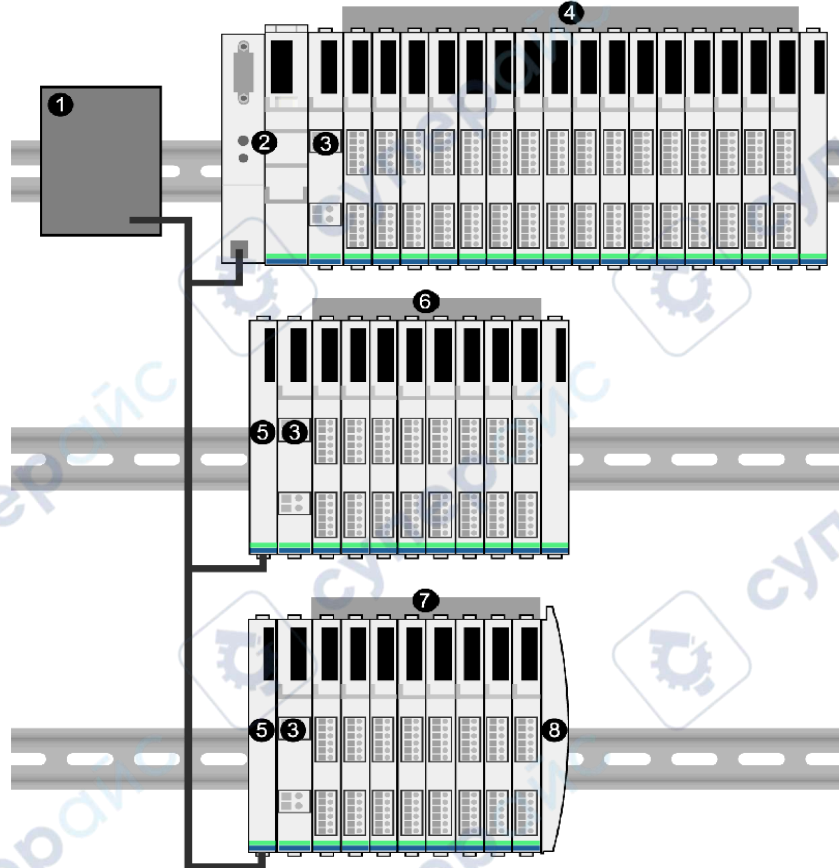
The SELV rating means that, in addition to basic insulation between hazardous voltages and the DC output, a second supplementary insulation layer has been added. As a result, if a single component/insulation does not perform, the DC output does not exceed SELV limits.

Calculating the Wattage Requirement

The amount of power (*see page 41*) that the external power supply must deliver is a function of the number of modules and the number of built-in power supplies installed on the island.

The external supply needs to provide 13 W of power for the NIM and 13 W for each additional STB power supply (like an STB XBE 1300 BOS module). For example, a system with one NIM in the primary segment and one BOS module in an extension segment would require 26 W of power.

Here is an example of an extended island:



- 1 24 VDC source power supply
- 2 NIM
- 3 PDM
- 4 primary segment I/O modules
- 5 BOS module
- 6 first extension segment I/O modules
- 7 second extension segment I/O modules
- 8 island bus terminator plate

The extended island bus contains three built-in power supplies:

- the supply built into the NIM, which resides in the leftmost location of the primary segment
- a power supply built into each of the STB XBE 1300 BOS extension modules, which reside in the leftmost location of the two extension segments

In the figure, the external supply would provide 13 W of power for the NIM plus 13 W for each of the two BOS modules in the extension segments (for a total of 39 W).

NOTE: If the 24 VDC source power supply also supplies field voltage to a power distribution module (PDM), you must add the field load to your wattage calculation. For 24 VDC loads, the calculation is simply *amps x volts = watts*.

Suggested Devices

The external power supply is generally enclosed in the same cabinet as the island. Usually the external power supply is a DIN rail-mountable unit.

We recommend using ABL8 Phaseo power supplies.

Module Specifications

Overview

The following information describes the general specifications for the NIM.

Specifications

The following table lists the system specifications for the STB NMP 2212:

General Specifications		
dimensions	width	40.5 mm (1.59 in)
	height	130 mm (5.12 in)
	depth	70 mm (3.15 in)
interface connectors	to the Modbus Plus network	9-receptacle female SUB-D
	to the external 24 VDC power supply	2-receptacle connector
built-in power supply	input voltage	24 VDC nominal
	input power range	19.2 ... 30 VDC
	input current	400 mA @ 24 VDC
	output voltage to the island bus	5 VDC @ 1.2 A
	output current rating	5 VDC @ 1.2 A
	isolation	no internal isolation (isolation must be provided by a SELV-rated external 24 VDC source power supply)
	noise immunity (EMC)	EN 61131-2
addressable I/O modules/island supported	32 maximum	
segments supported	primary (required)	one
	extension (optional)	six maximum
MTBF	200,000 hours ground benign (GB)	
storage temperature	-40 to 85°C	
operating temperature range*	0 to 60°C	
agency certifications	refer to the <i>Advantys STB System Planning and Installation Guide, 890 USE 171 00</i>	
*This product supports operation at normal and extended temperature ranges. Refer to the <i>Advantys STB System Planning and Installation Guide, 890 USE 171 00</i> for a complete summary of capabilities and limitations.		

How to Configure the Island

3

Introduction

The information in this chapter describes the auto-addressing and auto-configuration processes. An Advantys STB system has an auto-configuration capability in which the actual configuration of I/O modules on the island is read and saved to Flash.

The removable memory card is discussed in this chapter. The card is an Advantys STB option for storing configuration data offline. Factory default settings can be restored to the island bus I/O modules and the CFG port by engaging the RST button.

The NIM is the physical and logical location of all island bus configuration data and functionality.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
How Do Modules Automatically Get Island Bus Addresses?	48
How to Auto-Configure Default Parameters for Island Modules	50
How to Install the STB XMP 4440 Optional Removable Memory Card	51
Using the STB XMP 4440 Optional Removable Memory Card to Configure the Island	54
What is the RST Button?	57
How to Overwrite Flash Memory with the RST Button	58

How Do Modules Automatically Get Island Bus Addresses?

Introduction

Each time that the island is powered up or reset, the NIM automatically assigns a unique island bus address to each module on the island that engages in data exchange. All Advantys STB I/O modules and preferred devices engage in data exchange and require island bus addresses.

About the Island Bus Address

An island bus address is a unique integer value in the range 1 through 127 that identifies the physical location of each addressable module on the island. The NIM's address is always 127. Addresses 1 through 32 are available for I/O modules and other island devices.

During initialization, the NIM detects the order in which modules are installed and addresses them sequentially from left to right, starting with the first addressable module after the NIM. No user action is required to address these modules.

Addressable Modules

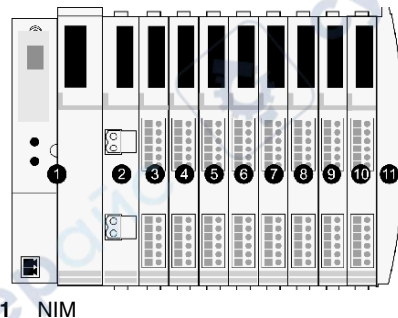
Advantys STB I/O modules and preferred devices are auto-addressable. Enhanced CANopen modules are not auto-addressable. They require manual address settings.

Because they do not exchange data on the island bus, the following are not addressed:

- bus extension modules
- PDMs such as the STB PDT 3100 and STB PDT 2100
- auxiliary power supplies, such as the STB CPS 2111
- termination plate

An Example

For example, if you have an island bus with eight I/O modules:



- 2 STB PDT 3100 (24 VDC power distribution module)
- 3 STB DDI 3230 24 VDC (2-channel digital input module)
- 4 STB DDO 3200 24 VDC (2-channel digital output module)
- 5 STB DDI 3420 24 VDC (4-channel digital input module)
- 6 STB DDO 3410 24 VDC (4-channel digital output module)
- 7 STB DDI 3610 24 VDC (6-channel digital input module)
- 8 STB DDO 3600 24 VDC (6-channel digital output module)
- 9 STB AVI 1270 +/-10 VDC (2-channel analog input module)
- 10 STB AVO 1250 +/-10 VDC (2-channel analog output module)
- 11 STB XMP 1100 (island bus termination plate)

The NIM would auto-address it as follows. Note that the PDM and the termination plate do not consume island bus addresses:

Module	Physical Location	Island Bus Address
NIM	1	127
STB PDT 3100 PDM	2	not addressed: does not exchange data
STB DDI 3230 input	3	1
STB DDO 3200 output	4	2
STB DDI 3420 input	5	3
STB DDO 3410 output	6	4
STB DDI 3610 input	7	5
STB DDO 3600 output	8	6
STB AVI 1270 input	9	7
STB AVO 1250 output	10	8
STB XMP 1100 termination plate	11	not applicable

Associating the Module Type with the Island Bus Location

As a result of the configuration process, the NIM automatically identifies physical locations on the island bus with specific I/O module types. This feature enables you to hot swap a non-operational module with a new module of the same type.

How to Auto-Configure Default Parameters for Island Modules

Introduction

All Advantys STB I/O modules are shipped with a set of predefined parameters that allow an island to be operational as soon as it is initialized. This ability of island modules to operate with default parameters is known as auto-configuration. Once an island bus has been installed, assembled, and successfully parameterized and configured for your fieldbus network, you can begin using it as a node on that network.

NOTE: A valid island configuration does not require the intervention of the optional Advantys Configuration Software.

About Auto-Configuration

Auto-configuration occurs under these circumstances:

- The island is powered up with a factory default NIM configuration. (If this NIM is subsequently used to create a new island, auto-configuration does not occur when that new island is powered.)
- You push the RST button (*see page 57*).
- You force an auto-configuration using the Advantys Configuration Software.

As part of the auto-configuration process, the NIM checks each module and confirms that it has been properly connected to the island bus. The NIM stores the default operating parameters for each module in Flash memory.

Customizing a Configuration

In a custom configuration, you can:

- customize the operating parameters of I/O modules
- create reflex actions (*see page 107*)
- add enhanced CANopen standard devices to the island bus
- customize other island capabilities
- configure communication parameters (STB NIP 2311 only)

How to Install the STB XMP 4440 Optional Removable Memory Card

Introduction

CAUTION

LOSS OF CONFIGURATION: MEMORY CARD DAMAGE OR CONTAMINATION

The card's performance can be degraded by dirt or grease on its circuitry. Contamination or damage may create an invalid configuration.

- Use care when handling the card.
- Inspect for contamination, physical damage, and scratches before installing the card in the NIM drawer.
- If the card does get dirty, clean it with a soft dry cloth.

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

The STB XMP 4440 removable memory card is a 32-kbyte subscriber identification module (SIM) that lets you store (*see page 113*), distribute, and reuse custom island bus configurations. If the island is in edit mode and a removable memory card containing a valid island bus configuration is inserted in the NIM, the configuration data on the card overwrites the configuration data in Flash memory, and is adopted when the island starts up. When the island is in protected mode, it ignores the presence of a removable memory card.

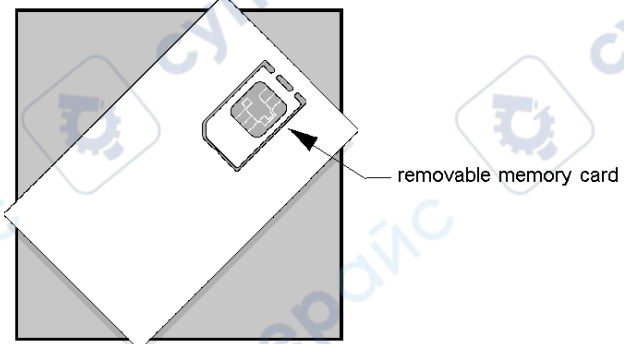
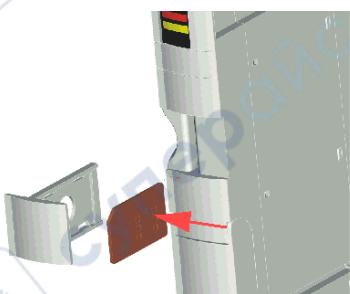
The removable memory card is an optional Advantys STB feature.

Remember:

- Keep the card free of contaminants and dirt.
- Network configuration data, such as the fieldbus baud setting, cannot be saved to the card.

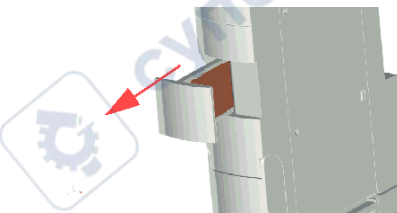
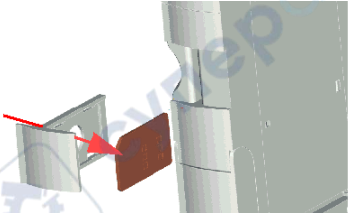
Installing the Card

Use the following procedure to install the memory card:

Step	Action
1	<p>Punch out the removable memory card from the plastic card on which it is shipped.</p>  <p>Make sure that the edges of the card are smooth after you punch it out.</p>
2	<p>Open the card drawer on the front of the NIM. If it makes it easier for you to work, you may pull the drawer completely out from the NIM housing.</p>
3	<p>Align the chamfered edge (the 45° corner) of the removable memory card with the one in the mounting slot in the card drawer. Hold the card so that the chamfer is in the upper left corner.</p> 
4	<p>Seat the card in the mounting slot, applying slight pressure to the card until it snaps into place. The back edge of the card must be flush with the back of the drawer.</p>
5	<p>Close the drawer.</p>

Removing the Card

Use the following procedure to remove the memory card from the NIM. As a handling precaution, avoid touching the circuitry on the card.

Step	Action
1	Open the card drawer. 
2	Push the removable memory card out of the drawer through the round opening at the back. Use a soft but firm object like a pencil eraser. 

Using the STB XMP 4440 Optional Removable Memory Card to Configure the Island

Introduction

A removable memory card is read when an island is powered on or during a reset operation. If the configuration data on the card is valid, the current configuration data in Flash memory is overwritten.

A removable memory card can be *active* only if an island is in *edit* mode. If an island is in protected mode (*see page 114*), the card and its data are ignored.

Configuration Scenarios

The following discussion describes several island configuration scenarios that use the removable memory card. (The scenarios assume that a removable memory card is already installed in the NIM.):

- initial island bus configuration
- replace the current configuration data in Flash memory in order to:
 - apply custom configuration data to your island
 - temporarily implement an alternative configuration; for example, to replace an island configuration used daily with one used to fulfill a special order
- copying configuration data from one NIM to another, including from a non-operational NIM to its replacement; the NIMs must have the same part number
- configuring multiple islands with the same configuration data

NOTE: Whereas writing configuration data *from* the removable memory card to the NIM does not require use of the optional Advantys Configuration Software, you must use this software to save (write) configuration data *to* the removable memory card in the first place.

Edit Mode

Your island bus must be in edit mode to be configured. In edit mode, the island bus can be written to as well as monitored.

Edit mode is the default operational mode for the Advantys STB island:

- A new island is in edit mode.
- Edit mode is the default mode for a configuration downloaded from the Advantys Configuration Software to the configuration memory area in the NIM.

Initial Configuration and Reconfiguration Scenarios

Use the following procedure to set up an island bus with configuration data that was previously saved (*see page 113*) to a removable memory card. You can use this procedure to configure a new island or to overwrite an existing configuration. (**NOTE:** The use of this procedure destroys your existing configuration data.)

Step	Action	Result
1	Install the removable memory card in its drawer in the NIM (<i>see page 51</i>).	
2	Power on the new island bus.	The configuration data on the card is checked. If the data is valid, it is written to Flash memory. The system restarts automatically, and the island is configured with this data. If the configuration data is invalid, it is not used and the island bus stops. If the configuration data was in edit mode, the island bus remains in edit mode. If the configuration data on the card was password-protected (<i>see page 114</i>), your island bus enters protected mode at the end of the configuration process. NOTE: If you are using this procedure to reconfigure an island bus and your island is in protected mode, you can use the configuration software to change the island's operational mode to edit.

Using the Card and the RST Function to Reconfigure an Island

You can use a removable memory card in combination with the RST function to overwrite the island's current configuration data. The configuration data on the card can contain custom configuration features. Using the data on the card, you can add password protection to your island, change the I/O module assembly, and change the user-modifiable CFG port settings (*see page 36*). *Using this procedure destroys your existing configuration data.*

Step	Action	Comment
1	Place the island bus in edit mode.	If your island is in protected mode, you can use the configuration software to change the island's operational mode to <i>edit</i> .
2	Press the RST button for at least two seconds.	If your configuration data was in edit mode, the island bus remains in edit mode. If the configuration data on the card was protected, your island bus enters protected mode at the end of the configuration process.

Configuring Multiple Island Buses with the Same Data

You can use a removable memory card to make a copy of your configuration data; then use the card to configure multiple island buses. This capability is particularly advantageous in a distributed manufacturing environment or for an OEM (original equipment manufacturer).

NOTE: The island buses may be either new or previously configured, but the NIMs must all have the same part number.

What is the RST Button?

Summary

The RST function is basically a Flash memory overwriting operation. This means that RST is functional only after the island has been successfully configured at least once. All RST functionality is performed with the RST button, which is enabled only in edit mode (see page 54).

Physical Description

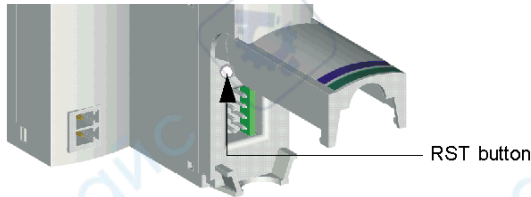
⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION/CONFIGURATION OVERWRITE—RST BUTTON

Do not attempt to restart the island with the RST button. Pushing the RST button reconfigures the island with default settings (no custom parameters).

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

The RST button is located immediately above the CFG port (see page 36), and behind the same hinged cover:



Holding down the RST button for 2 seconds or longer causes Flash memory to be overwritten, resulting in a new configuration for the island.

If the island is already auto-configured, there is no consequence other than the island stops during the configuration process. However, island parameters that you previously customized with the Advantys Configuration Software are overwritten by default parameters during the configuration process.

Engaging the RST Button

To engage the RST button, it is recommended that you use a small screwdriver with a flat blade no wider than 2.5 mm (.10 in). Do not use a sharp object that might damage the RST button, nor a soft item like a pencil that might break off and jam the button.

How to Overwrite Flash Memory with the RST Button

Introduction

CAUTION

UNINTENDED EQUIPMENT OPERATION/CONFIGURATION DATA OVERWRITTEN—RST BUTTON

Do not attempt to restart the island by pushing the RST button. Pushing the RST button (*see page 57*) causes the island bus to reconfigure itself with factory default operating parameters.

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

The RST function allows you to reconfigure the operating parameters and values of an island by overwriting the current configuration in Flash memory. RST functionality affects the configuration values associated with the I/O modules on the island, the operational mode of the island, and the CFG port parameters.

The RST function is performed by holding down the RST button (*see page 57*) for at least two seconds. The RST button is enabled only in edit mode. In protected mode (*see page 114*), the RST button is disabled; pressing it has no effect.

NOTE: Pressing the RST button does not affect network settings.

RST Configuration Scenarios

The following scenarios describe some of the ways that you can use the RST function to configure your island:

- Restore factory-default parameters and values to an island, including to the I/O modules and the CFG port (*see page 36*).
- Add a new I/O module to a previously auto-configured (*see page 50*) island. If a new I/O module is added to the island, pressing the RST button forces the auto-configuration process. The updated island configuration data is automatically written to Flash memory.

Overwriting Flash Memory with Factory Default Values

The following procedure describes how to use the RST function to write default configuration data to Flash memory. Follow this procedure if you want to restore default settings to an island. This is also the procedure to use to update the configuration data in Flash memory after you add an I/O module to a previously auto-configured island bus. *Because this procedure overwrites the configuration data, you may want to save your existing island configuration data to a removable memory card before pushing the RST button.*

Step	Action
1	If you have a removable memory card installed, remove it (<i>see page 53</i>).
2	Place the island in edit mode (<i>see page 54</i>).
3	Hold the RST button (<i>see page 57</i>) down for at least two seconds.

The Role of the NIM in this Process

The NIM reconfigures the island bus with default parameters as follows:

Stage	Description
1	The NIM auto-addresses (<i>see page 48</i>) the I/O modules on the island and derives their factory-default configuration values.
2	The NIM overwrites the current configuration in Flash memory with configuration data that uses the factory-default values for the I/O modules.
3	It resets the communication parameters on its CFG port to their factory-default values (<i>see page 36</i>).
4	It re-initializes the island bus and brings it into operational mode.



Fieldbus Communications Support

4

Introduction

This chapter describes how an Advantys STB island node can be accessed from other devices on a Modbus Plus fieldbus network.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
An Example of a Modbus Plus View of the Process Image	62
Predefined Diagnostics Registers in the Data Image	70
Error Checking and Recovery	78
Communication Access Registers	79
Supported Modbus Plus Commands	82
Fault Handling	83

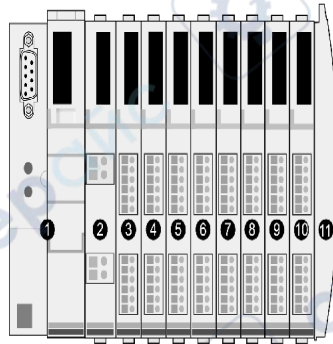
An Example of a Modbus Plus View of the Process Image

Summary

The following example shows what the output data process image and the input data and I/O status process image might look like when they represent a specific island bus configuration.

The Sample Configuration

The sample island comprises the following 10 modules and a termination plate:



- 1 network interface module
- 2 24 VDC power distribution module
- 3 STB DDI 3230 24 VDC two-channel digital input module
- 4 STB DDO 3200 24 VDC two-channel digital output module
- 5 STB DDI 3420 24 VDC four-channel digital input module
- 6 STB DDO 3410 24 VDC four-channel digital output module
- 7 STB DDI 3610 24 VDC six-channel digital input module
- 8 STB DDO 3600 24 VDC six-channel digital output module
- 9 STB AVI 1270 +/-10 VDC two-channel analog input module
- 10 STB AVO 1250 +/-10 VDC two-channel analog output module
- 11 STB XMP 1100 island bus termination plate

The I/O modules have the following island bus addresses (*see page 48*):

I/O Model	Module Type	Island Bus Address
STB DDI 3230	two-channel digital input	1
STB DDO 3200	two-channel digital output	2
STB DDI 3420	four-channel digital input	3
STB DDO 3410	four-channel digital output	4
STB DDI 3610	six-channel digital input	5
STB DDO 3600	six-channel digital output	6

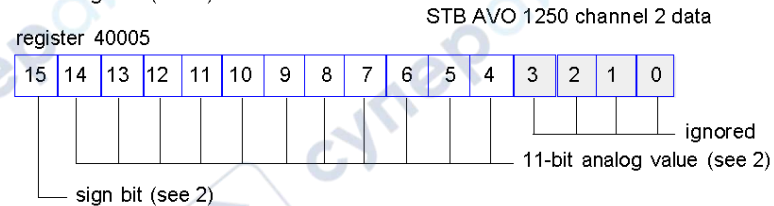
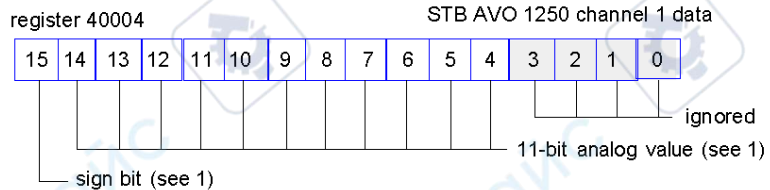
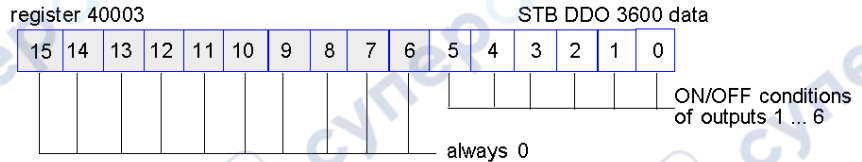
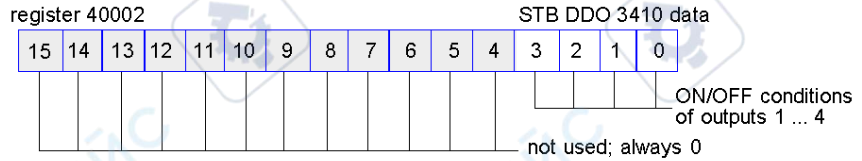
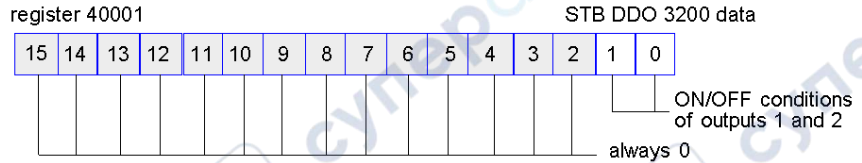
I/O Model	Module Type	Island Bus Address
STB AVI 1270	two-channel analog input	7
STB AVO 1250	two-channel analog output	8

The PDM and the termination plate do not consume island bus addresses and are not represented in the process image.

The Output Data Process Image

Let's look first at the register allocation required to support the output data process image (*see page 118*). This is the data written to the island from the fieldbus master to update the output modules on the island bus. The four output modules are affected—the three digital output modules at addresses 2, 4, and 6 and the one analog output module at address 8.

The three digital output modules utilize one Modbus Plus register each for data. The analog output module requires two registers, one for each output channel. A total of five registers (40001 through 40005) are used for this configuration:



- 1 The value represented in register 40004 is in the range +10 to -10 V, with 11-bit resolution plus a sign bit in bit 15.
- 2 The value represented in register 40005 is in the range +10 to -10 V, with 11-bit resolution plus a sign bit in bit 15.

The digital modules use the LSBs to hold and display their output data. The analog module uses the MSBs to hold and display its output data.

The Input Data and I/O Status Process Image

Now let's look at the register allocation required to support the input data and I/O status process image (*see page 119*). This is the information that the NIM collects from the island modules so that it can be read by the fieldbus master or by some other monitoring device.

All eight I/O modules are represented in this process image block. The modules are assigned registers in the order of their island bus addresses, starting at register 45392.

Each digital I/O module uses two contiguous registers:

- Digital input modules use one register to report data and the next to report status.
- Digital output modules use one register to echo the output data and the next to report status.
- The STB DRC 3210 relay uses only one status register.

NOTE: The value in an *echo output data* register is basically a copy of the value written to the corresponding register in the output data process image. Generally, this is the value written to the NIM by the fieldbus master, and its echo is not of much interest. When an output channel is configured to perform a reflex action (*see page 107*), however, the echo register provides a location where the fieldbus master can look to see the current value of the output.

The analog input module uses four contiguous registers:

- the first register to report the data for channel 1
- the second register to report status for channel 1
- the third register to report the data for channel 2
- the fourth register to report status for channel 2

The analog output module uses two contiguous registers:

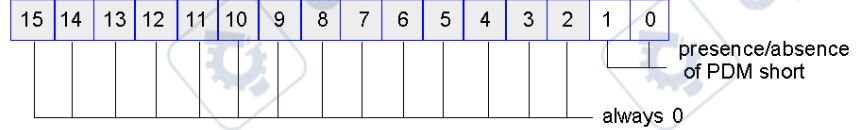
- the first register to report status for channel 1
- the second register to report status for channel 2

In total, 18 registers (45392 through 45409) are used to support our configuration:

register 45392 STB DDI 3230 data



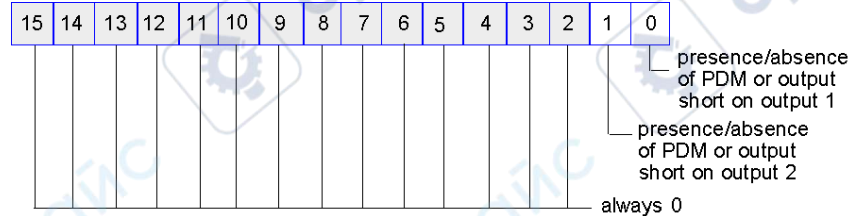
register 45393 STB DDI 3230 status



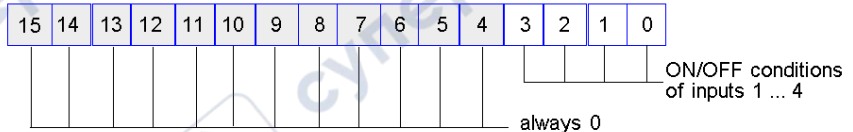
register 45394 STB DDO 3200 echo output data



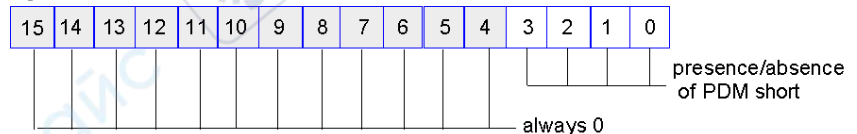
register 45395 STB DDO 3200 status

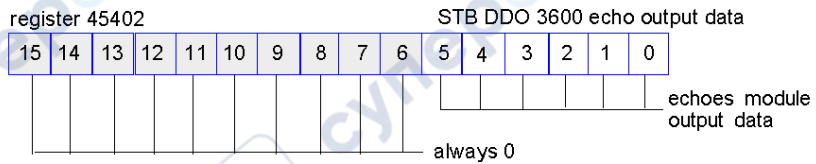
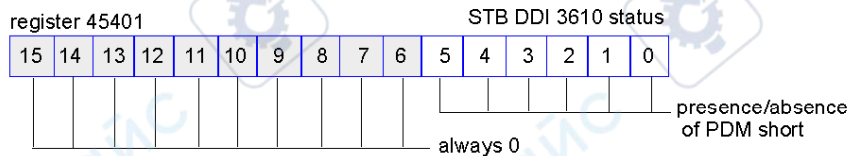
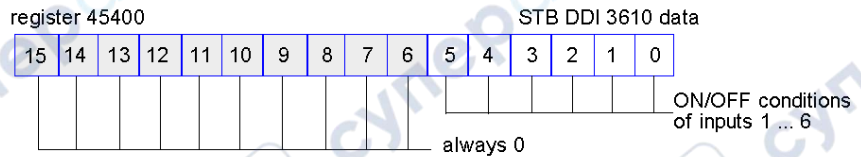
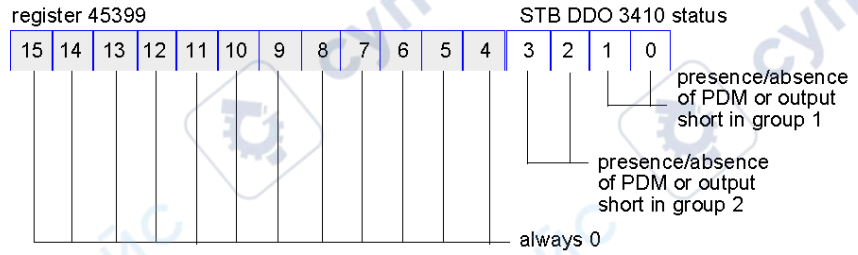
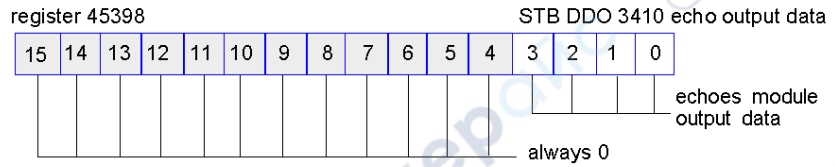


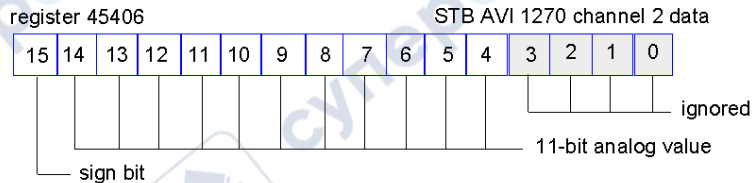
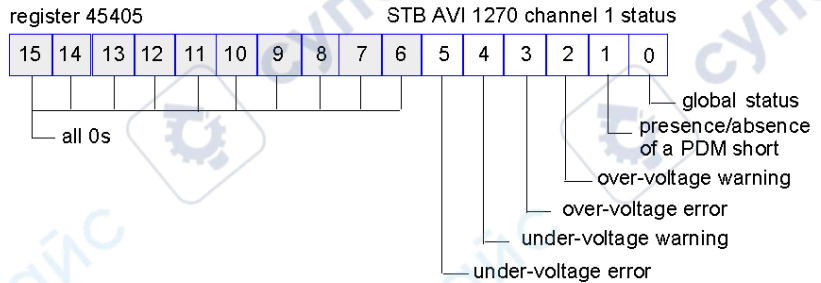
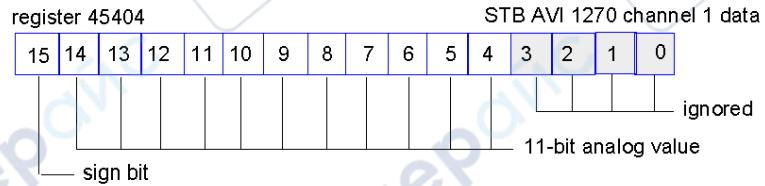
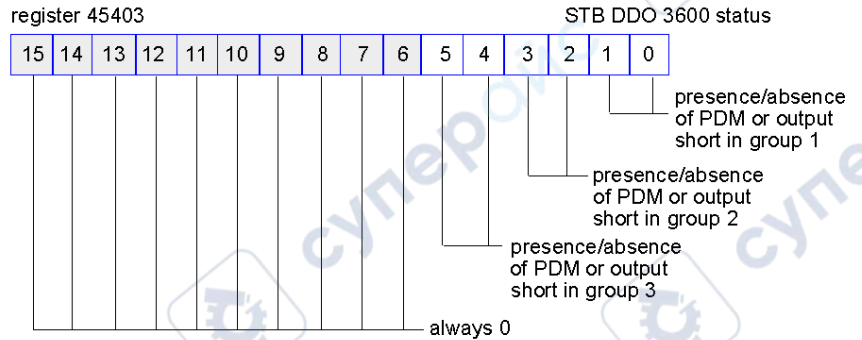
register 45396 STB DDI 3420 data

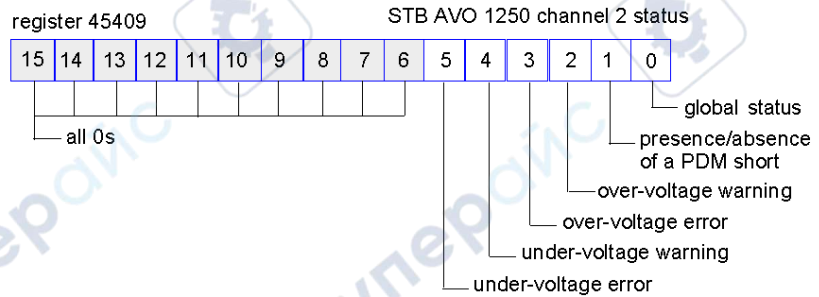
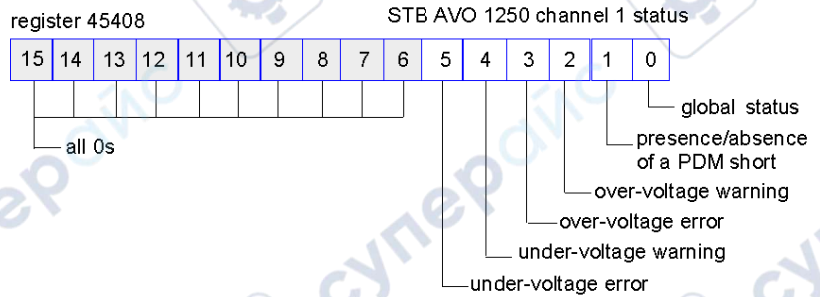
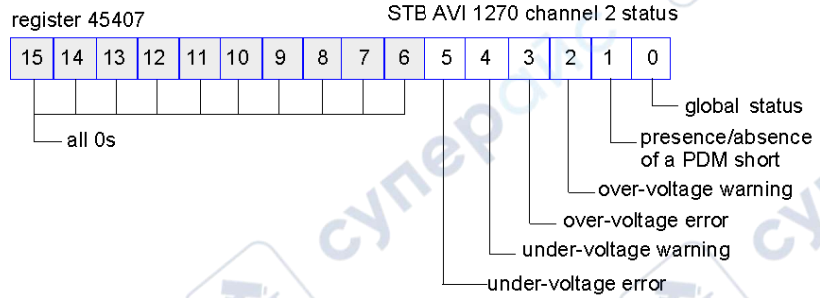


register 45397 STB DDI 3420 status









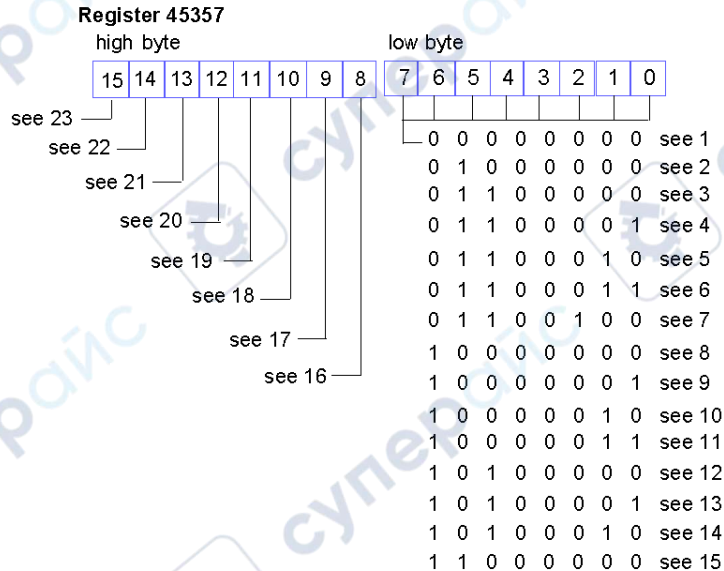
Predefined Diagnostics Registers in the Data Image

Summary

Thirty-five contiguous registers (45357 through 45391) in the island bus data image (see page 116) are provided for reporting diagnostic information. These registers have predefined meanings that are described below. They can be accessed by Modbus Plus and monitored through an HMI panel or by the Advantys configuration software.

Island Communications Status

Register 45357 describes the state of communications across the island bus. The low byte (bits 7 through 0) displays one of 15 possible eight-bit patterns that indicates the current state of communication. Each bit in the high byte (bits 15 through 8) is used to signal the presence or absence of a specific error condition:

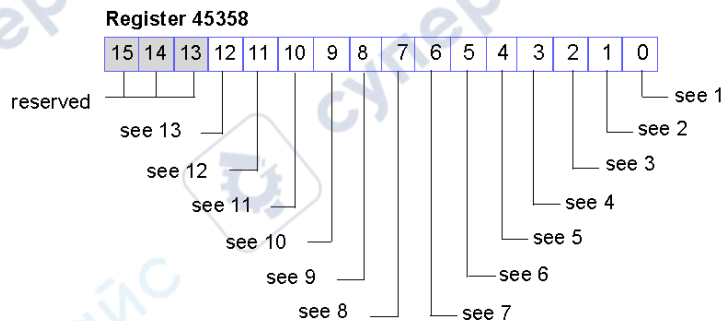


- 1 The island is initializing.
- 2 The island has been put in the pre-operational state, for example, with the reset function in the Advantys STB configuration software.
- 3 The NIM is configuring or auto-configuring—communication to all modules is reset.
- 4 The NIM is configuring or auto-configuring—checking for any modules that are not auto-addressed.
- 5 The NIM is configuring or auto-configuring—Advantys STB and preferred modules are being auto-addressed.
- 6 The NIM is configuring or auto-configuring—boot-up is in progress.
- 7 The process image is being set up.

- 8 Initialization is complete, the island bus is configured, the configuration matches, and the island bus is not started.
- 9 Configuration mismatch—non-mandatory or unexpected modules in the configuration do not match, and the island bus is not started.
- 10 Configuration mismatch—at least one mandatory module does not match, and the island bus is not started.
- 11 Serious configuration mismatch—the island bus has been set to pre-operational mode, and initialization is aborted.
- 12 The configuration matches, and the island bus is operational.
- 13 Island is operational with a configuration mismatch. At least one standard module does not match, but all the mandatory modules are present and operating.
- 14 Serious configuration mismatch—the island bus was started but is now in pre-operational mode because of one or more mismatched mandatory module(s).
- 15 Island has been set to pre-operational mode, for example, with the stop function in the Advantys STB configuration software.
- 16 A value of 1 in bit 8 is a fatal error. It indicates a low-priority receive queue software overrun error.
- 17 A value of 1 in bit 9 is a fatal error. It indicates a NIM overrun error.
- 18 A value of 1 in bit 10 indicates an island bus-off error.
- 19 A value of 1 in bit 11 is a fatal error. It indicates that the error counter in the NIM has reached the warning level and the error status bit has been set.
- 20 A value of 1 in bit 12 indicates that the NIM's error status bit has been reset.
- 21 A value of 1 in bit 13 is a fatal error. It indicates a low-priority transfer queue software overrun error.
- 22 A value of 1 in bit 14 is a fatal error. It indicates a high-priority receive queue software overrun error.
- 23 A value of 1 in bit 15 is a fatal error. It indicates a high-priority transfer queue software overrun error.

Error Reporting

Each bit in register 45358 is used to report a global error condition. A value of 1 in the bit indicates that a specific global error has been detected:



- 1 Fatal error. Because of the severity of the error, no further communications are possible on the island bus.

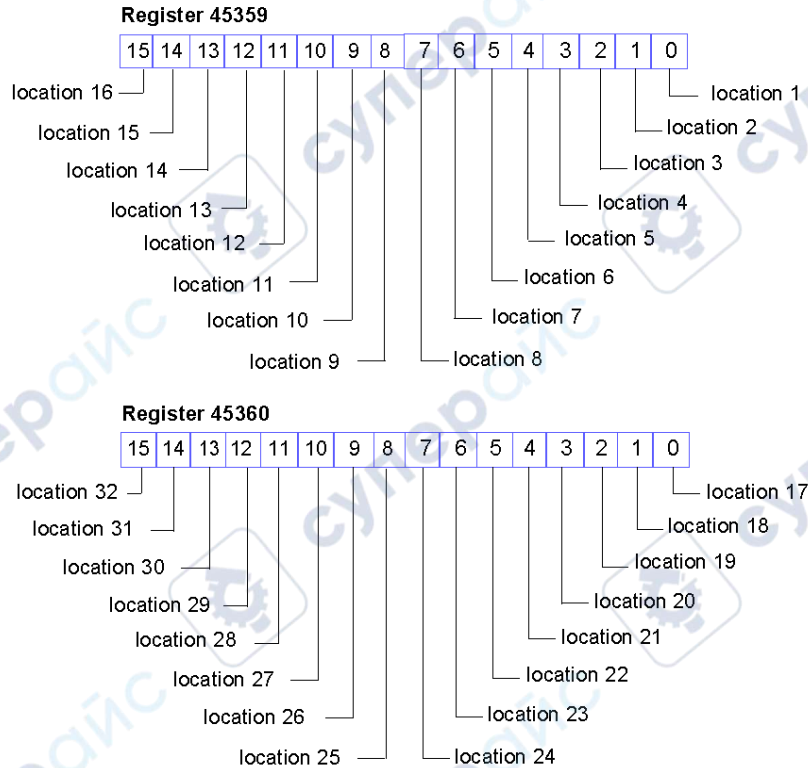
- 2 Module ID error—a standard CANopen device is using a module ID reserved for the Advantys STB modules.
- 3 Auto-addressing has failed.
- 4 Mandatory module configuration error.
- 5 Process image error—either the process image configuration is inconsistent, or it could not be set up during auto-configuration.
- 6 Auto-configuration error—a module is not in its configured location, and the NIM cannot complete auto-configuration.
- 7 Island bus management error detected by the NIM.
- 8 Assignment error—the initialization process in the NIM has detected a module assignment error.
- 9 Internal triggering protocol error.
- 10 Module data length error.
- 11 Module configuration error.
- 12 Reserved.
- 13 Timeout error.

Node Configuration

The next eight contiguous registers (registers 45359 through 45366) display locations where modules have been configured on the island bus. This information is stored in Flash memory. At start up, the actual locations of the modules on the island are validated by comparing them to the configured locations stored in memory. Each bit represents a configured location:

- A value of 1 in a bit indicates that a module has been configured for the associated location.
- A value of 0 in a bit indicates that a module has not been configured for the associated location.

The first two registers, shown below, provide the 32 bits that represent the module locations in a typical island configuration. The remaining six registers (45361 through 45366) are available to support island expansion capabilities.



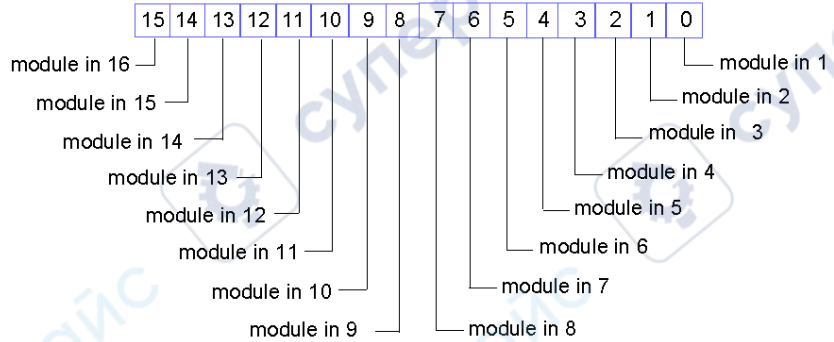
Node Assembly

The next eight contiguous registers (registers 45367 through 45374) indicate the presence or absence of configured modules in locations on the island bus. This information is stored in Flash memory. At start up, the actual locations of the modules on the island are validated by comparing them to the configured locations stored in memory. Each bit represents a module:

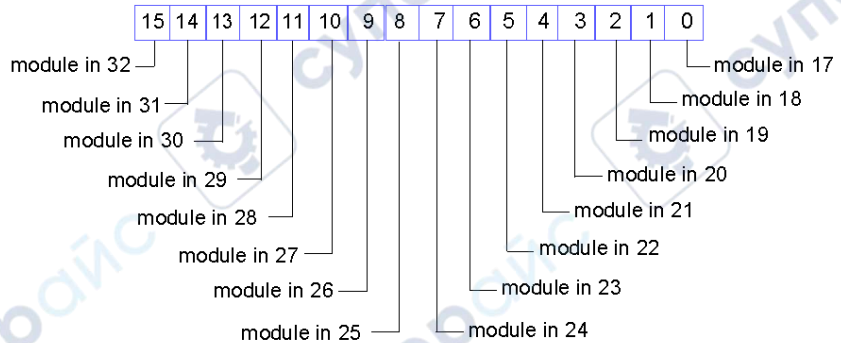
- A value of 1 in a given bit indicates either that the configured module is not present or that the location has not been configured.
- A value of 0 indicates that the correct module is present in its configured location.

The first two registers, shown below, provide the 32 bits that represent the module locations in a typical island configuration. The remaining six registers (45369 through 45374) are available to support island expansion capabilities.

Register 45367



Register 45368

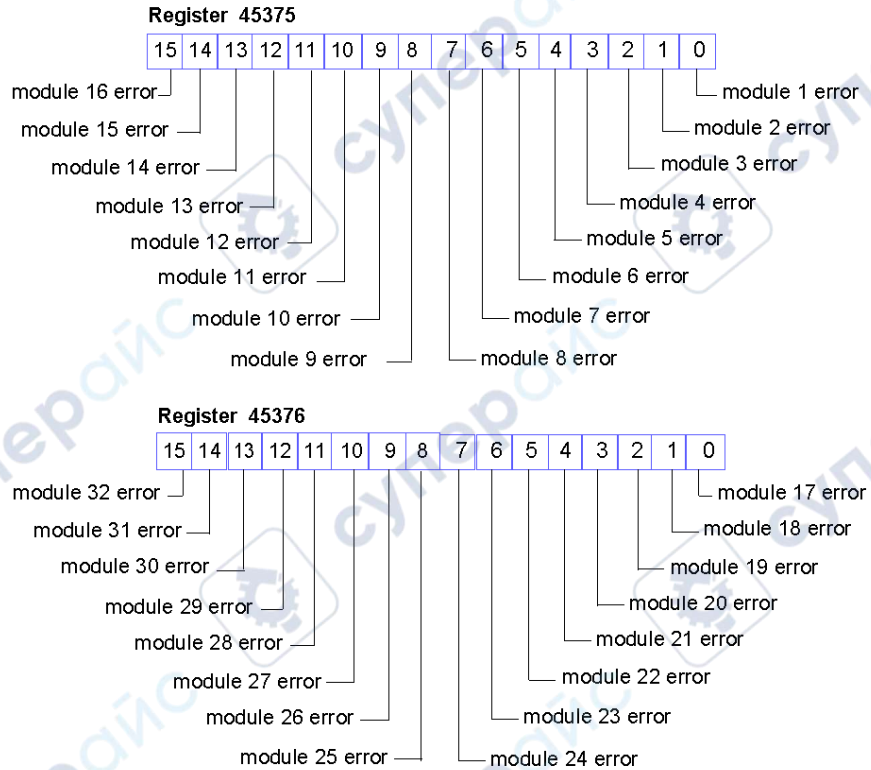


Emergency Messages

The next eight contiguous registers (registers 45375 through 45382) indicate the presence or absence of newly received emergency messages for individual modules on the island. Each bit represents a module:

- A value of 1 in a given bit indicates that a new emergency message has been queued for the associated module.
- A value of 0 in a given bit indicates that no new emergency messages have been received for the associated module since the last time the diagnostic buffer was read.

The first two registers, shown below, provide the 32 bits that represent the module locations in a typical island configuration. The remaining six registers (45377 through 45382) are available to support island expansion capabilities.



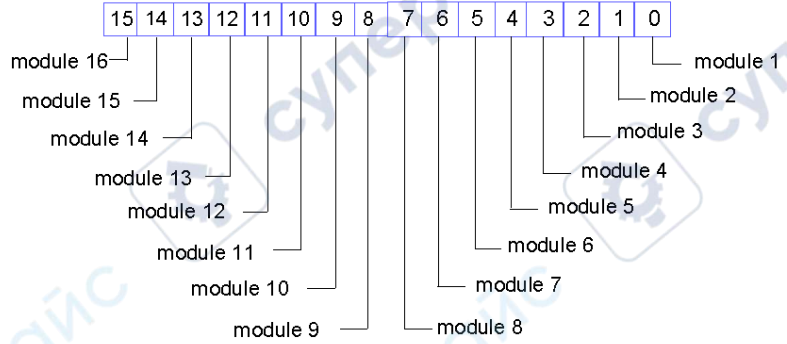
Fault Detection

The next eight contiguous registers (registers 45383 through 45390) indicate the presence or absence of operational faults detected on the island bus modules. Each bit represents a module:

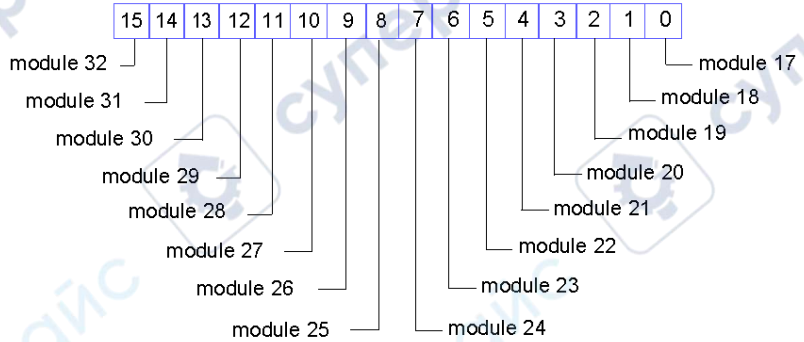
- A value of 1 in a bit indicates that the associated module is operating and that no faults were detected.
- A value of 0 in a bit indicates that the associated module is not operating either because it has a fault or because it has not been configured.

The first two registers, shown below, provide the 32 bits that represent the module locations in a typical island configuration. The remaining six registers (45385 through 45390) are available to support island expansion capabilities

Register 45383

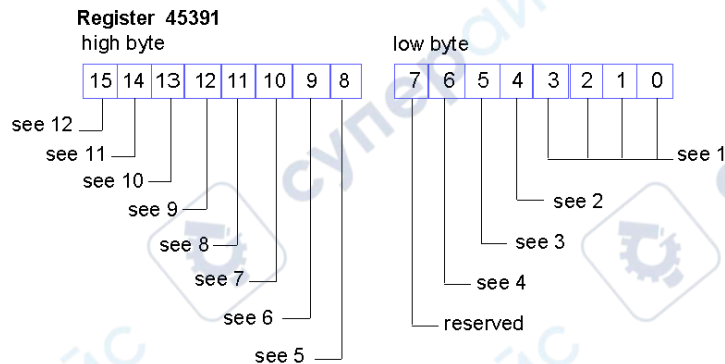


Register 45384



NIM Status

The high and low bytes in register 45391 report the status of the STB NMP 2212:



- 1** Bits 0, 1, 2 and 3 represent the fieldbus handler state (FBHS): A value of 0 0 0 0 indicates that the entire island bus is in reset state. A value of 0 0 0 1 indicates that communications are in reset state. A value of 0 0 1 0 indicates that the NIM is checking the state of the island configuration. A value of 0 0 1 1 indicates that the Modbus Plus peer processor is initializing. A value of 0 1 0 0 indicates that data exchange is occurring.
- 2** Reserved.
- 3** Bit 5 represents the Peer Cop enabled status (PCP_ENA). 0 indicates that Peer Cop is disabled. 1 indicates that Peer Cop is enabled.
- 4** Bit 6 represents the presence or absence of a Peer Cop address fault (PCP_ADDR): A value of 0 indicates no Peer Cop address conflict. A value of 1 indicates a Peer Cop address conflict (00 or greater than 64).
- 5** A value of 1 in bit 8 indicates a fatal device error.
- 6** A value of 1 in bit 9 indicates an internal failure—at least one global bit is set.
- 7** A bit value of 1 in bit 10 indicates an external failure—the problem is on the fieldbus.
- 8** A value of 1 in bit 11 indicates that the configuration is protected—the RST button is disabled and the configuration software requires a password before you can write. A bit value of 0 indicates that the configuration is standard—the RST button is enabled and the configuration software is not password-protected.
- 9** A value of 1 in bit 12 indicates that the configuration stored on the removable memory card is invalid.
- 10** A value of 1 in bit 13 indicates that reflex action functionality has been configured. (For NIMs with firmware version 2.0 or greater.)
- 11** A value of 1 in bit 14 indicates that one or more island modules have been hot-swapped. (For NIMs with firmware version 2.0 or greater.)
- 12** A value of 0 in bit 15 indicates that the Modbus Plus master has mastery over the output data in the island's process image. A bit value of 1 indicates that the Advantys configuration software has mastery over the output data in the island's process image.

Error Checking and Recovery

Introduction

When a node sends a data message, it expects an immediate acknowledgment of receipt by the destination. If none is received, the node will attempt up to two retransmissions of the message. If the final retry is unsuccessful, the node sets an error which can be sensed by the application program.

Duplicate Nodes

If a node detects a valid transmission from another node using the same address, the node becomes silent and sets an error which can be sensed by the application. The node will remain silent as long as the duplicate node continues to participate in the token rotation. If two devices have been inadvertently assigned the same address, the application program can detect the duplication and handle it while the rest of the application continues.

Recovery

When a node transmits the token, it monitors the network for new activity from its successor. If the node detects no valid activity, it makes one retry to pass the token. If no activity is detected after the retry, the node remains silent. This causes the network to be initialized and a new token sequence to be created.

Communication Access Registers

Summary

To describe the I/O process image data, Modbus Plus provides four sets of registers:

- data descriptor registers
- module status registers
- special registers (one pair)
- ASCII header registers

Data Descriptor Registers

Descriptor registers in the address range of 43000 ... 44000 report information about the modules on the island. Information is presented in terms of the object and the node to which it belongs. They are structured as follows:

Structure	Mapping in Process Image Register	Entry in Modbus Register 43000/44000
MSB (node ID set on the rotary switches)		Modbus register 43000/44000 offset + 0
LSB (part number)		
number of registers in the process image		Modbus register 43000/44000 offset + 1
1. object index (word)	Modbus register 40201 offset + 0	Modbus register 43000/44000 offset + 2
2. object index (word)	Modbus register 40201 offset + 1	Modbus register 43000/44000 offset + 3
.
<i>n</i> . object index ()	Modbus register 40201 offset + <i>n</i> - 1	Modbus register 43000/44000 offset + <i>n</i>

Modbus Plus Module Status Registers

A set of module status registers provides additional information about the I/O image sizes, the remaining timeouts, the firmware version and other general status information. The structure of this register block is as follows:

Register Order	Register Description
4F801	number of words in this status block (14)
4F802	number of I/O module input bytes
4F803	number of I/O module output bytes
4F804	reserved

Register Order	Register Description
4F805	STB NMP 2212 firmware revision number; for example: <ul style="list-style-type: none"> ● 000Ahex - major revision ● 010Ahex - minor revision
4F806	number of words in the ASCII header block, determined by the length of the MODULE_ASCII_HEADER
4F807	last node address to communicate
4F808	remaining ownership reservation time, in increments of 1 ms
4F809	remaining outputs holdup time, in increments of 10 ms
4F810	reserved
4F811	reserved
4F812	reserved
4F813	number of bytes in the HMI-to-PLC table
4F814	number of bytes in the PLC-to-HMI table

Modbus Plus Special Registers

Modbus Plus provides a set of special registers that describe state information. Two of these registers are used by the STB NMP 2212 NIM. These registers are *not* configurable via the Advantys configuration software, their values are not saved with the application, and they do not retain their values after a power cycle:

Register	hexadecimal value	decimal value
Module Holdup Timeout	4F001	61441
Reservation Timeout	4F002	61442

The *module holdup timeout* register specifies the amount of time outputs are held in their current states if there is no new Modbus write command to update the outputs. If the module's holdup time expires before a new write command is received, all outputs go to their fallback states. The value in the register expresses time in 10 ms increments. The default value is 100 (indicating that the NIM will wait 1 s for Modbus Plus communications), but may be varied through the corresponding register (at a minimum of 300 ms and a maximum of 60 s).

NOTE: Values written beyond the limits will be automatically set back to the limit.

The value in this register is refreshed each time there is a successful write to any register in the output process image.

NOTE: When write commands to a Modbus Plus NIM are stopped, an output module located on the NIM's island maintains its output states from that time until any pre-programmed timeout value expires. After that, the predefined fallback states are set.

However, if the network communication cable is disconnected at the NIM, island output module states are not maintained for the holdup time duration. They immediately go to the predefined fallback states.

The *reservation timeout* register defines the maximum duration that the STB NMP 2212 NIM will hold the token without communicating before it relinquishes its exclusive write privileges from that master. Once the NIM gives up the token, the island may be accessed on a first-come/first-serve basis by another node on the network. The value in the register expresses time in ms increments. The default value is 60000, indicating that the NIM will hold the token without communications for 60 s. The reservation timeout value is refreshed each time there is a successful write to any register in the output process image.

Modbus Plus ASCII Header Registers

The ASCII header registers contain a short ASCII description of the module. The registers are located in the process image at 4FC01 length of 10 registers. The name is given in the variable MODULE_ASCII_HEADER. Note that the ASCII header register is used (e.g., by the Mbpstat software tool) to determine the node description under the menu Show node personality.

Variable (4FC01)	Description
ASCII_NODE_IDENTIFICATION	ADVANTYS STB NMP2212-MODBUS PLUS FIELDBUSCOUPLER DIG
MODULE_ASCII_HEADER	ADVANTYS STB NMP2212

Supported Modbus Plus Commands

Summary

This topic discusses those Modbus Plus commands that are supported by the STB NMP 2212 NIM.

Embedded Modbus Commands

The table below describes the most common Modbus Plus commands and their implementation in the Advantys Modbus Plus NIM:

Modbus Command	Description	Implemented
read holding registers (0x03)	reads contents of 4xxx output registers	yes
preset single register (0x06)	sets the contents of a single 4xxx register	yes
get/clear network statistics (0x08, sub 21)	obtains network statistics from the device	yes
preset multiple registers (0x10)	presets values into a sequence of 4xxx holding registers	yes
mask write register 4xxx (0x16)	modifies content of a specified 4xxx register using a combination of AND, OR mask, and current contents of the register	no
read/write 4xxx register (0x17)	performs one read and one write operation in one command	yes
read input registers (0x04)	reads the binary contents of the input registers (3xxx) in the slave	yes

Exception Response Codes

When a Modbus command cannot be executed or contains invalid information, the responding node sends back an exception response. This response is composed of the original command function code (+ 0x80) and some exception code from the following table:

Exception Code	Value	Description
illegal function	0x01	illegal Modbus function code (command not supported by the NIM)
illegal data address	0x02	illegal address (address not supported or invalid by/in the process image)
illegal data value	0x03	illegal value in data field (e.g., number of registers to be read exceed address bound)
island bus in inappropriate state	0x10	island bus is not running (0xA2 > state >= 0xA0)
configuration tool mastery	0x11	configuration tool has mastery over the module outputs
no write permission now	0x12	requesting node has actually no writer permission (multi-master mode)

Fault Handling

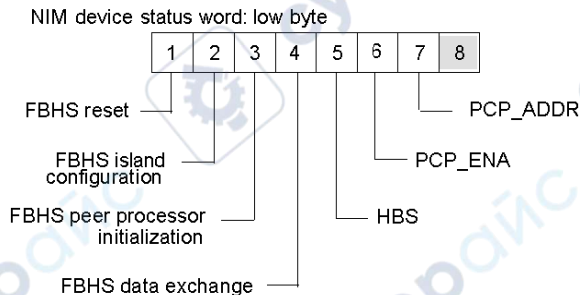
Summary

The following discussion presents two ways to access fault diagnostics from the STB NMP 2212 NIM:

- The lower byte of the NIM device status word, which can be accessed via the NIM's CFG port, provides specific diagnostic information from the fieldbus handler (FBH).
- If you use a software tool to access the island via Modbus function code 125, sub-function 9, you can access additional diagnostic messages in an error buffer.

Low Byte of the NIM Device Status Word

The FBH routine indicates whether Peer Cop has been configured and whether or not the heartbeat has been stopped by the handler. Bits 1 ... 4 in the NIM device status word display several fieldbus handler status (FBHS) conditions, bit 5 displays NIM's heartbeat status (HBS), bit 6 indicates whether or not Peer Cop is enabled (PCP_ENA), and bit 7 indicates whether or not there is a node address conflict (PCP_ADDR):



Bit 1: FBHS reset 0 = island has not been reset; 1 = island is in reset state

Bit 2: FBHS island configuration 0 = island has valid configuration; 1 = island is not properly configured

Bit 3: FBHS Peer Cop initialization 0 = Peer Cop initialized; 1 = Peer Cop not initialized

Bit 4: FBHS data exchange 0 = data exchange status OK; 1 = fault detected in the data exchange

Bit 5: HBS 0 = heartbeat detected; 1 = no heartbeat detected

Bit 6: PCP ENA 0 = Peer Cop disabled; 1 = Peer Cop enabled

Bit 7: PCP ADDR 0 = no address conflict; 1 = Peer Cop address fault detected

Bit 8 reserved

Error Buffer Debugging Messages

The FBH also writes a set of error messages that can be accessed through an HMI panel or the Advantys configuration software via Modbus function code 125:

Message	Code	Meaning
MBP init diagnostic failed	0x3001	The Modbus Plus <i>diagnostic</i> command has failed during initialization
MBP init configuration status failed	0x3002	The Modbus Plus <i>configuration status</i> command has failed during initialization
MBP init abort transaction failed	0x3003	The Modbus Plus <i>abort transaction</i> command has failed during initialization
MBP init get service failed	0x3004	The Modbus Plus <i>get service</i> command has failed during initialization
MBP init set Peer Cop configuration failed	0x3005	The Modbus Plus <i>set Peer Cop configuration</i> command has failed during initialization
MBP init set ASCII header failed	0x3006	The Modbus Plus <i>set ASCII header text</i> command has failed during initialization
MBP no Peer Cop configured	0x3007	Peer Cop has not been configured
MBP timeout occurred	0x3008	A timeout has occurred. <i>See the following table.</i>

When an MBP timeout message appears, the next byte in the associated function contains a value that indicates the cause of the timeout error:

Byte Value	Cause of the Timeout Error
0x00	The main state machine of the FBH has not been switched in an appropriate amount of time.
0x01	An execution timeout has occurred on a low-level <i>exec_get_service_request</i> function.
0x02	An execution timeout has occurred on a low-level <i>exec_abort_transaction</i> function.
0x03	An execution timeout has occurred on a low-level <i>exec_configuration_status</i> function.
0x04	An execution timeout has occurred on a low-level <i>exec_get_slave_command_from_input_path</i> function.
0x05	An execution timeout has occurred on a low-level <i>exec_put_slave_response_to_input_path</i> function.
0x06	An execution timeout has occurred on a low-level <i>exec_get_specific_input_from_peer_cop_request</i> function.
0x07	An execution timeout has occurred on a low-level <i>exec_set_ASCII_text_header</i> function.

Application Examples

5

Introduction

The connection example that follows describes how to connect and commission an Advantys STB island with an STB NMP 2212 Modbus Plus NIM. The connection example does not use a specific host because Modbus Plus is an open protocol.

The application example implements a sample island assembly with an Advantys STB NMP 2212 Modbus Plus NIM at the head.

This chapter also includes information about two of the more common ways in which data is acquired from island modules, through the Peer Cop tool and through the MSTR function block.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Sample Island Assembly	86
A Modbus Plus Connection Example	88
Peer Copping the Island	90
Multi-master Aspects and Limitations of Peer Cop	95
MSTR Function Block	97

Sample Island Assembly

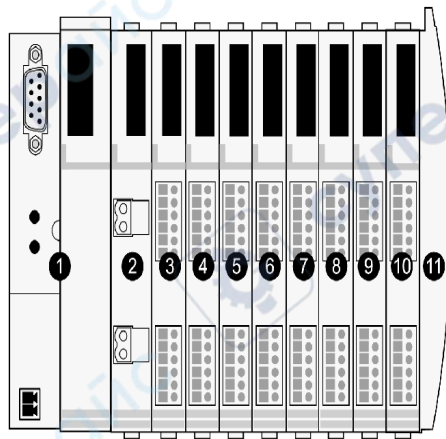
Introduction

To complete the configuration example(s) in this chapter, you will need to implement a particular Advantys STB island assembly. Your island assembly is independent of the network's master scanner because the island is represented by the NIM as a single node on the fieldbus network.

Sample Island Assembly

The sample I/O system used in this chapter's application example(s) implements a variety of analog and digital modules.

The following Advantys STB island modules are used in the example(s):



- 1 STB NMP 2212, Modbus Plus NIM
- 2 STB PDT 3100, 24 VDC Power Distribution Module
- 3 STB DDI 3230, 24 VDC 2-channel digital input module (2 bits of data, 2 bits of status)
- 4 STB DDO 3200, 24 VDC 2-channel digital output module (2 bits of data, 2 bits of echo output data, 2 bits of status)
- 5 STB DDI 3420, 24 VDC 4-channel digital input module (4 bits of data, 4 bits of status)
- 6 STB DDO 3410, 24 VDC 4-channel digital output module (4 bits of data, 4 bits of echo output data, 4 bits of status)
- 7 STB DDI 3610, 24 VDC 6-channel digital input module (6 bits of data, 6 bits of status)
- 8 STB DDO 3600, 24 VDC 6-channel digital output module (6 bits of data, 6 bits of echo output data, 6 bits of status)
- 9 STB AVI 1270, +/-10 VDC 2-channel analog input module (16 bits of data [channel 1], 16 bits of data [channel 2], 8 bits of status [channel 1], 8 bits of status [channel 2])
- 10 STB AVO 1250, +/-10 VDC 2-channel analog output module (8 bits of status [channel 1], 8 bits of status [channel 2], 16 bits of data [channel 1], 16 bits of data [channel 2])
- 11 STB XMP 1100 termination plate

The I/O modules in the above island assembly have the following island bus addresses:

I/O Model	Module Type	Island Bus Address
STB DDI 3230	two-channel digital input	1
STB DDO 3200	two-channel digital output	2
STB DDI 3420	four-channel digital input	3
STB DDO 3410	four-channel digital output	4
STB DDI 3610	six-channel digital input	5
STB DDO 3600	six-channel digital output	6
STB AVI 1270	two-channel analog input	7
STB AVO 1250	two-channel analog output	8

The NIM, the PDM, and the termination plate do not consume island bus addresses, and they do not exchange data or status objects with the fieldbus master.

Data Exchange

In this example, I/O message transactions are defined in the Peer Cop table of the PLC fieldbus master. Table entries could be made with a Schneider panel software such as Concept or Modsoft. In this example we use Concept, but the methodology would be basically the same if you were to use Proworx.

The Peer Cop table specifies the PLC registers used for the I/O data storage. It also specifies the node addresses of the NIMs that will handle that data. We place the master is at node 1, which is the default node address. If you want to have your master at another node ID, use the Advantys configuration software to set this in the NIM's control word. If you do not do this, Peer Cop will not be available.

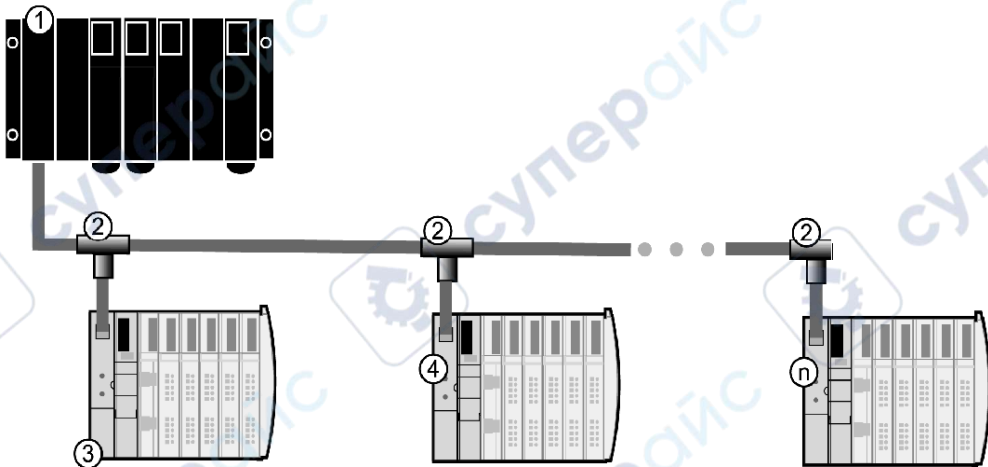
In this example, we have 18 words of input data (which includes status from all the modules and echo data from the output modules) and 5 words of output data. Input data and output data are Peer Copped separately

A Modbus Plus Connection Example

Architecture

The Modbus Plus network bus consists of a shielded twisted-pair cable in a direct path between successive nodes. The two data lines in the cable are not sensitive to polarity. The minimum cable length between any pair of nodes is 3 m (10 ft). The maximum cable length between two nodes is 450 m (1500 ft).

Nodes are connected to the cable with a tap device supplied by Schneider. This tap provides through-connections for the network trunk cable, drop connections to the node device, and a grounding terminal. The tap also contains a resistive termination that is connected by two internal jumpers. The jumpers at each end of a cable section must be connected to prevent signal reflections:



- 1 master PLC
- 2 Modbus Plus taps
- 3 node 1 on the Modbus Plus fieldbus, in this case an island
- 4 another island as Modbus Plus node 2
- n the last node on the Modbus Plus fieldbus (up to 64)

For detailed information, part numbers and recommendations regarding cables, connectors, and other accessories, refer to the *Modbus Plus Network Planning and Installation Guide* (890 USE 100, version 4).

Modbus Plus Functions

The register functions in the NIM can be addressed by the Modbus Plus master with implemented Modbus read/write function codes. The individual register address is entered in place of the address of a module channel.

The *xxxx* following the leading character represents a four-digit address location in user data memory:

Reference Type	Reference Description
3xxx	A register containing a 16-bit value received from an external source such as an analog signal.
4xxx	A register used to store 16 bits of numerical data (binary or decimal), or to send the data from the Modbus Plus master to an output channel.

Peer Copping the Island

Objective

This example uses Peer Cop (*see page 22*) as the tool for setting up the data exchange between the NIM and the fieldbus master. Peer Cop is an automatic exchange service between stations connected to the same local Modbus Plus segment. This service maintains constant control over I/O modules that have been polled by implicit exchanges. The Advantys NIM requires that input words be read as global inputs and that the output words be written as specific outputs.

Peer Copping the Input Data

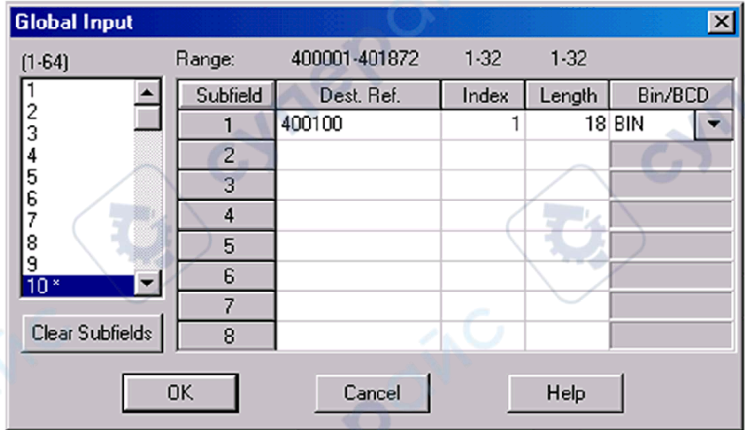
The I/O modules in the sample island (*see page 86*) consume 18 Modbus registers in the NIM's input data image area:

Modbus Register	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
45392	empty (set to 0)														N1 data	
	STB DDI 3230 data															
45393	empty (set to 0)														N1 status	
	STB DDI 3230 status															
45394	empty (set to 0)														N2 echo	
	STB DD0 3200 feedback															
45395	empty (set to 0)														N2 status	
	STB DD0 3200 status															
45396	empty (set to 0)												N3 data			
	STB DDI 3420 data															
45397	empty (set to 0)												N3 status			
	STB DDI 3420 status															
45398													N4 echo			
	STB DDO 3410 feedback															
45399													N4 status			
	STB DDO 3410 status															
45400											N5 data					
	STB DDI 3610 data															
45401											N5 status					
	STB DDI 3610 status															
45402											N6 echo					
	STB DDI 3600 feedback															

Modbus Register	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
45403	STB DDI 3600 status											N6 status				
	N7channel 1 data															
45404	AVI 1270 channel 1 data															
	AVI 1270 channel 1 status											N7 channel 1 status				
45405	N7channel 2 data															
	AVI 1270 channel 2 data															
45406	AVI 1270 channel 2 status											N7 channel 2 status				
	N8 channel 1 status															
45407	AVI 1250 channel 1 status															
	AVI 1250 channel 2 status											N8 channel 2 status				
45408	N8 channel 2 status															
	AVI 1250 channel 2 status															

You need to Peer Cop all the registers associated with modules from which you want data. The maximum number of input registers you can Peer Cop is 32. In this example, we will Peer Cop all 18 registers:

Step	Action	Result
1	Open the PLC Configuration screen. From the Config Extensions folder in your Concept Project browser, double click Peer Cop .	The Peer Cop screen opens.

Step	Action	Result																																													
2	In the Global box, click the Input button.	The Global Input screen opens.																																													
	 <table border="1" data-bbox="477 256 1222 683"> <thead> <tr> <th>Subfield</th> <th>Dest. Ref.</th> <th>Index</th> <th>Length</th> <th>Bin/BCD</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>400100</td> <td>1</td> <td>18</td> <td>BIN</td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Subfield	Dest. Ref.	Index	Length	Bin/BCD	1	400100	1	18	BIN	2					3					4					5					6					7					8				
Subfield	Dest. Ref.	Index	Length	Bin/BCD																																											
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3	From the (1, 64) list box on the left of the screen, select the node ID number that is set via the rotary switches on the STB NIP 2212 NIM.	The master now knows the NIM's Modbus Plus address.																																													
4	In the Dest. Ref column of the Subfield 1 row, enter the 4x register number where you want to map the data from the first input register.	The master will map the input data from register 45392 in the NIM's process image to the specified memory location.																																													
5	In the Index column of the Subfield 1 row, enter a value of 1.																																														
6	In the Length column of the Subfield 1 row, enter a value of 18.	The master will map the input data from registers 45393 ... 45409 in the NIM's process image to the next 17 contiguous registers after the one specified in step 4 above.																																													
7	In the BIN/BCD column of the Subfield 1 row, choose the desired data display format.																																														
8	Push OK .	The input data for the Peer Cop is now defined.																																													

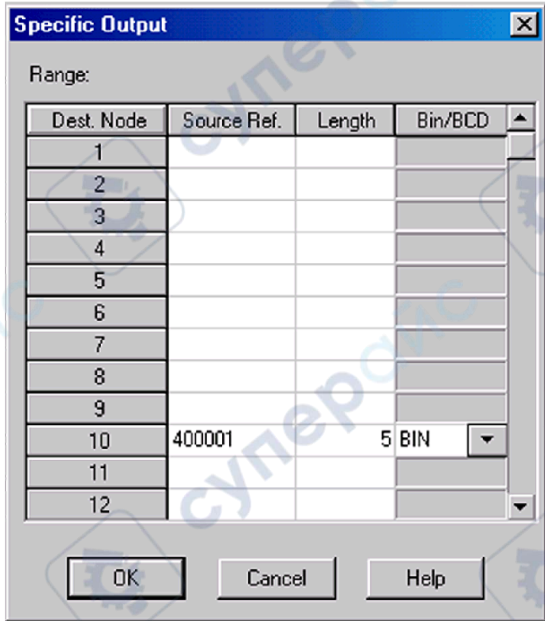
Peer Copping the Output Data

The I/O modules in the sample island bus assembly (see page 86) consume five Modbus registers in the output data image area:

Modbus Register	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40001	empty (set to 0)														N2 data	
	STB DDI 3230 data															
40002	empty (set to 0)												N4 data			
	STB DDO 3420 data															
40003	empty (set to 0)										N6 data					
	STB DDO 3600 data															
40004	N8 channel 1 data															
	STB AVO 1250, channel 1 data															
40005	N8 channel 2 data															
	STB AVO 1250, channel 2 data															

To Peer Cop the data in the output registers:

Step	Action	Result
1	Open the PLC Configuration screen. From the Config Extensions folder in your Concept Project browser, double click Peer Cop .	The Peer Cop screen opens.

Step	Action	Result
2	In the Specific box, click the Output button.	The Specific Output screen opens.
		
3	In the Dest. Node column on the left of the screen, go to the Node ID number that is set via the rotary switches on the STB NIP 2212 NIM .	The master now knows the NIM's Modbus Plus address.
4	In the associated Source Ref. row, enter 40001.	The source location for the first register of output source data is defined.
5	In the associated Length row, enter a value of 5.	Output source registers 40001 ... 40005 are now defined.
6	In the associated Bin/BCD row, choose the desired data display format.	
7	Push OK .	The output data for the Peer Cop is now defined.

Multi-master Aspects and Limitations of Peer Cop

Summary

Input data for the STB NMP 2212 NIM starts at Modbus Plus address 45392 (30090). Output data starts at address 40001. The NIM uses specific *output* data and global *input* data for Peer Cop data transfers:

- *global input data*—transferred to and processed at any node on the network
- *specific output data*—configured for a single node since only one node has exclusive write permission

NOTE: By default, this node address for specific output data is set to 1. Using the Advantys configuration software, you can assign any node address in the range 1 ... 64 via the fieldbus handler control word.

Peer Cop Length

The length of Peer Cop's global output/specific input varies depending on the actual configuration of I/O words in the island. The lengths will be limited to 32 words at maximum—any additional words will be cut off. To have an idea to how many input or output data words are configured, consult the process image (for example, with the Advantys configuration software). The number of specific input words, for example, is exactly the number of output words in the process image.

Handling Multi-Master Access

In addition to Peer Cop, a dedicated mechanism is needed to handle multi-master access to the island. This can be achieved with a timeout reservation register. Keep in mind the following operating principles:

- Initially, the first-come/first-serve principle determines which node gets write access.
- If a node has sent a write request, the island's outputs are exclusively reserved for that node for the time value stored in the reservation timeout register.
- If the privileged node sends another write request within the reservation timeout, the reservation timeout is re-triggered.
- During reservation timeout, other nodes do not have write access to the outputs.
- Once a reservation timeout has completed without further write requests from the privileged node, the first-come/first-serve principle is in effect again.
- By default, a reservation timeout interval will last 60 s.
- A reservation timeout interval may be varied by writing to the register.
- A reservation timeout may be triggered by a write request via Peer Cop or an MSTR block; non-privileged data will be ignored by Peer Cop.
- If simultaneous write requests from two nodes occur in Peer Cop while the first-come/first-serve principle is in effect, the node with the lower address will be preferred for write privileges.

NOTE: The value in the timeout reservation register corresponds to the timeout interval in ms. For example, if a value of 23578 (decimal) is written to register, the reservation timeout interval will be 23578 ms.

The Fieldbus Handler Control Word

The fieldbus handler control word is used in the exchange of Peer Cop configuration information. You can manipulate this control word via the Advantys configuration software. The word is characterized as follows:

- Only the low byte of the word is used; the high byte is reserved.
- A value in the range 0 ... 63 addresses one specific node on the Modbus Plus network (at address 1 ... 64, respectively) from which specific Peer Cop input data will be received (output data to the modules).
- The default value is 0 (node address 1).
- A value of 64 indicates that Peer Cop is disabled (not configured).
- Any value greater than 64 is invalid.

Disabling Peer Cop

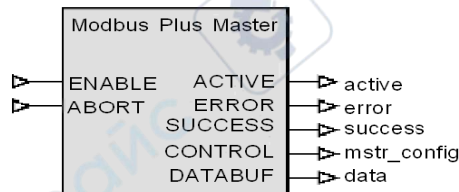
To disable Peer Cop, you need to use the Advantys configuration software.

MSTR Function Block

Summary

In addition to Peer Copping data (*see page 90*), you can write data to and read data from the sample island assembly (*see page 86*) with the MSTR function block in Concept or other Schneider configuration software packages.

This topic describes the steps for reading and writing to the input and output registers in the sample island assembly using the MSTR function block:



NOTE: This topic does not discuss the full functionality of the MSTR function block for any specific configuration tool. For that information, consult the user manuals for your particular configuration software.

The Control Block

The MSTR control block is composed of nine registers for read or write functions. Brief descriptions of the registers as they pertain to this application example are in the following table:

Register	Name	Description
1	function mode	001 (write), 002 (read)
2	error code	This register holds a hex value for an MSTR error
3	length	This register reports the number of registers sent to the node or read from the node.
4	location in remote node at which data will be stored or received	This value in this register defines the 4xxxx starting register in the node from which the data is written or read.
5	first routing register	In this register, enter the node ID that reflects the setting on the rotary switches (<i>see page 29</i>).
6 . . . 9	routing information	These registers designate the second through fifth routing path addresses (advanced routing).

The MSTR Input Registers

To read the 19 input registers of the MSTR function block:

Step	Action	Comment
1	In the first register, set the nine-register control block in the CONTROL portion of the MSTR function block to 2 (read data).	
2	No action is required for the second register.	This read-only register is a storage area for returned error codes.
3	In the third register, define the length of the registers to be read.	In this case, 19 input registers.
4	In the fourth register, define the starting address of the registers to be read. (This is the offset value for the 40000 register.)	For example, if input data starts at address 45392 of the process image, you must enter an offset of 5392.
5	In the fifth register, enter the node ID that reflects the setting on the rotary switches (<i>see page 29</i>).	

When invoked, the 19 words of input data for the node (the fourth register, above) will be placed in the data buffer area of the MSTR block. The block can be constantly enabled or disabled by the application.

The MSTR Output Registers

To write to the output registers of the MSTR function block:

Step	Action	Comment
1	In the first register, set the control block in the CONTROL portion of the MSRT function block to 1 (write data).	
2	No action is required for the second register.	This read-only register is a storage area for returned error codes.
3	In the third register, define the length of the registers to be written.	In this example, enter 6 for the six output registers.
4	In the fourth register, define the island destination to where you want to write. (This is the offset value for the 40000 register.)	The output process image starts at 40001, so you must enter an offset of 1.
5	In the fifth register, enter the node ID that reflects the setting on the rotary switches (<i>see page 29</i>).	

When the output data block is invoked, you will be able to transmit data from the application program directly to the island outputs.

Advanced Configuration Features

6

Introduction

This chapter describes the advanced and/or optional configuration features that you can add to an Advantys STB island.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
STB NMP 2212 Configurable Parameters	100
Configuring Mandatory Modules	104
Prioritizing a Module	106
What Is a Reflex Action?	107
Island Fallback Scenarios	111
Saving Configuration Data	113
Write-Protecting Configuration Data	114
A Modbus View of the Island's Data Image	115
The Island's Process Image Blocks	118
The HMI Blocks in the Island Data Image	120
Test Mode	122
Run-Time Parameters	124
Virtual Placeholder	129

STB NMP 2212 Configurable Parameters

Introduction

The following information describes how to configure parameters for the STB NMP 2212 using the Advantys configuration software.

The following operating parameters are user configurable:

- data size (in words) of PLC output data transmitted to the HMI panel and HMI input data sent to the PLC
- fieldbus handler control word, used to indicate the address of the network node from which the island receives Peer Cop data
- maximum node ID for the last module assembled on the island bus, including CANopen devices

General Information

For general information about the NIM module (model name, version number, vendor code, etc.), do the following:

Step	Action	Comment
1	Open your island configuration with the Advantys configuration software.	The STB NMP 2212 is the leftmost module in your island assembly.
2	Double-click on the NIM in the configuration workspace.	The <i>module editor</i> window appears.
3	Select the <i>General</i> tab.	General information about the STB NMP 2212 is displayed.

Accessing Configurable Parameters

To access the NIM values that are configurable:

Step	Action	Comment
1	Double-click on the STB NMP 2212 in the island editor.	The <i>module editor</i> window appears.
2	Select the <i>Parameters</i> tab.	Configurable parameters are located under this tab.
3	In the <i>Parameter name</i> column, expand the <i>Additional Info Store List</i> by clicking on the + (plus) sign.	The configurable parameters are displayed.

Selecting the Display Format

By default, the values for the configurable NIM parameters use decimal notation. You can change the display format to hexadecimal notation, and vice-versa:

Step	Action	Comment
1	Double-click on the NIM in the island editor.	The <i>module editor</i> window appears.
2	Select the <i>Parameters</i> tab.	
3	Click on the checkbox in front of <i>Hexadecimal</i> at the top right of the module editor window. Note: To use decimal notation, again, click on this checkbox to disable hexadecimal notation.	The values for the configurable parameters will display in hexadecimal notation.

Reserved Sizes (HMI to PLC)

The network interprets data from the HMI as input and reads it from the input data table in the process image. This table is shared with data from all input modules on the island bus. When the reserved size (HMI to PLC) is selected, the range of available data sizes (in words) is displayed. Space that you reserve for the HMI to PLC data must not exceed the maximum value shown (125 words).

Reserved Sizes (PLC to HMI)

The network transmits data to the HMI as output by writing it to the output data table in the process image. This table is shared with data for all output modules on the island bus. When the reserved size (PLC to HMI) is selected, the range of available data sizes (in words) is displayed. Space that you reserve for the PLC to HMI data must not exceed the maximum value shown (125 words).

Reserving Data Sizes

To transfer data to the PLC from a Modbus HMI panel attached to the CFG port, you must reserve space for that data. To reserve data sizes:

Step	Action	Result
1	In the <i>module editor</i> window, select the <i>Parameters</i> tab.	
2	In the <i>Parameter name</i> column, expand the <i>Additional Info Store List</i> by clicking on the + (plus) sign.	The configurable NIM parameters are displayed.
3	Double-click in the <i>Value</i> column next to <i>Reserved Size (Words) of HMI to PLC table</i> .	The value is highlighted.

Step	Action	Result
4	Type a value for the data size to be reserved for data sent from the HMI panel to the PLC.	The value <i>plus</i> the data size of your island cannot exceed the maximum value. If you accept the default value (0), no space will be reserved in the HMI table in the process image.
5	Repeat steps 2-4 to select a value for the <i>Reserved Size (Words) of PLC to HMI table row</i> .	
6	Click on the <i>OK</i> button to save your work.	
7	Click on the <i>Apply</i> button to configure the NIM with these values.	

Fieldbus Handler Control Word Values

The value of the fieldbus handler control word identifies the Modbus Plus network node transmitting Peer Cop data. Note that you can configure only the lower byte of the control word; the upper byte is reserved.

Peer cop functionality uses the following values:

- *0 (default) to 63*—Peer cop data is received from the node that corresponds to this value. *0* indicates Peer Cop data from address 1, *1* indicates Peer Cop data from node 2, etc.
- *64*—Peer cop function disabled.
- *65 or higher*—invalid

Fieldbus Handler Control Word

To configure the fieldbus handler control word:

Step	Action	Result
1	In the <i>module editor</i> window, select the <i>Parameters</i> tab.	
2	In the <i>Parameter name</i> column, expand the <i>Additional Info Store List</i> by clicking on + (plus) sign.	The configurable NIM parameters are displayed.
3	Double-click in the <i>Value</i> column next to <i>Fieldbus Handler Control Word</i> .	The range of available nodes (0 to 64) is displayed.
4	Type a value that identifies the node from which Peer Cop data will be received (<i>see page 102</i>).	
5	Click on the <i>OK</i> button to save your work.	
6	Click on the <i>Apply</i> button to configure the NIM with these values.	

CANopen Device Node IDs

From the Parameters tab, you can set the maximum node ID of the last module on the island bus. The last module may be a standard CANopen device. Standard CANopen devices follow the last segment of STB I/O modules. CANopen modules are addressed by counting backwards from the value you specify here. The ideal node ID sequence is sequential.

For example, if you have an island with five STB I/O modules and three CANopen devices, a maximum node ID of at least 8 (5 + 3) is required. This will result in node IDs of 1 through 5 for STB I/O modules and 6 through 8 for standard CANopen devices. Using the default ID of 32 (the maximum number of modules the island can support) will result in node IDs of 1 through 5 for STB I/O modules and 30 through 32 for standard CANopen devices. Unless required, high addresses are not desirable if any of your standard CANopen devices has a limited address range.

Assigning the Max. Node ID (CANopen Devices)

To enter the highest node ID used by a CANopen device on the island bus:

Step	Action	Comment
1	In the <i>module editor</i> window, select the <i>Parameters</i> tab.	Configurable parameters are on this tab.
2	In the box next to <i>Max. node ID on the CANopen extension</i> , enter a node ID.	This node ID represents the last CANopen module on the island bus.

Configuring Mandatory Modules

Summary

As part of a custom configuration, you can assign *mandatory* status to any I/O module or preferred device on an island. The mandatory designation indicates that you consider the module or device critical to your application. If the NIM does not detect a healthy mandatory module at its assigned address during normal operations, the NIM stops the entire island.

NOTE: The Advantys Configuration Software is required if you want to designate an I/O module or a preferred device as a mandatory module.

Specifying Mandatory Modules

By default, the Advantys STB I/O modules are in a non-mandatory (*standard*) state. Mandatory status is enabled by clicking on the mandatory checkbox on a module or preferred device's **Options** tab. Depending on your application, any number of modules that your island supports can be designated as mandatory modules.

Effects on Island Bus Operations

The following table describes the conditions under which mandatory modules affect island bus operations and the NIM's response:

Condition	Response
A mandatory module is not operating during normal island bus operations.	The NIM stops the island bus. The island enters fallback mode (<i>see page 111</i>). I/O modules and preferred devices assume their fallback values.
You attempt to hot swap a mandatory module.	The NIM stops the island bus. The island enters fallback mode. I/O modules and preferred devices assume their fallback values.
You are hot swapping a standard I/O module that resides to the left of a mandatory module on the island bus, and the island loses power.	When power is restored, the NIM attempts to address the island modules but must stop at the empty slot where the standard module used to reside. Because the NIM is now unable to address the mandatory module, it generates a mandatory mismatch condition. The island does not start when this condition is present.

Recovering from a Mandatory Stop

WARNING

UNINTENDED EQUIPMENT OPERATION/LOSS OF CONFIGURATION—RST BUTTON WHILE RECOVERING FROM MANDATORY STOP

Pushing the RST button (*see page 57*) causes the island bus to reconfigure itself with factory-default operating parameters, which do not support mandatory I/O status.

- Do not attempt to restart the island by pushing the RST button.
- If a module is unhealthy, replace it with the same module type.

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

Pushing the RST button (*see page 57*) while recovering from a mandatory stop loads the island's default configuration data.

Hot Swapping a Mandatory Module

If the NIM has stopped island bus operations because it cannot detect a healthy mandatory module, you can recover island bus operations by installing a healthy module of the same type. The NIM automatically configures the replacement module to match the removed module. Assuming that other modules and devices on the island bus are correctly configured and conform to their configuration data as written to Flash memory, the NIM starts or restarts normal island bus operations.

Prioritizing a Module

Summary

Using the Advantys configuration software, you can assign priority to digital input modules in your island assembly. Prioritization is a method of fine tuning the NIM's I/O scan of the island bus. The NIM will scan modules with priority more frequently than other island modules.

Limitations

You can prioritize only modules with digital inputs. You cannot prioritize output modules or analog modules. You can prioritize only 10 modules for a given island.

What Is a Reflex Action?

Summary

Reflex actions are small routines that perform dedicated logical functions directly on the Advantys island bus. They allow output modules on the island to act on data and drive field actuators directly, without requiring the intervention of the fieldbus master.

A typical reflex action comprises one or two function blocks that perform:

- Boolean AND or exclusive-OR operations
- comparisons of an analog input value to user-specified threshold values
- up- or down-counter operations
- timer operations
- the triggering of a latch to hold a digital value high or low
- the triggering of a latch to hold an analog value at a specific value

The island bus optimizes reflex response time by assigning the highest transmission priority to its reflex actions. Reflex actions take some of the processing workload off the fieldbus master, and they offer a faster, more efficient use of system bandwidth.

How Reflex Actions Behave

WARNING

UNEXPECTED OUTPUT OPERATION

For outputs that are configured to respond to reflex actions, the output state represented in the island's network interface module (NIM) may not represent the actual states of the outputs.

- Turn off field power before you service any equipment connected to the island.
- For digital outputs, view the echo register for the module in the process image to see the actual output state.
- For analog outputs, there is no echo register in the process image. To view an actual analog output value, connect the analog output channel to an analog input channel.

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

Reflex actions are designed to control outputs independently of the fieldbus master controller. They may continue to turn outputs on and off even when power is removed from the fieldbus master. Use prudent design practices when you use reflex actions in your application.

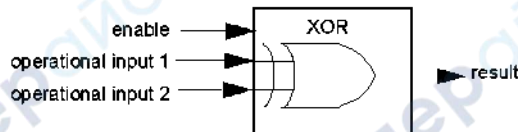
Configuring a Reflex Action

Each block in a reflex action must be configured using the Advantys configuration software.

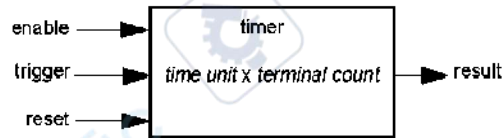
Each block must be assigned a set of inputs and a result. Some blocks also require that you specify one or more user-preset values—a compare block, for example, requires that you preset threshold values and a delta value for hysteresis.

Inputs to a Reflex Action

The inputs to a reflex block include an enable input and one or more operational inputs. The inputs may be constants or they may come from other I/O modules on the island, from virtual modules or outputs from another reflex block. For example, an XOR block requires three inputs—the enable and two digital inputs that contain the Boolean values to be XORed:



Some blocks, such as the timers, require reset and/or trigger inputs to control the reflex action. The following example shows a timer block with three inputs:



The trigger input starts the timer at 0 and accumulates *time units* of 1, 10, 100 or 1000 ms for a specified number of counts. The reset input causes the timer accumulator to be reset.

An input to a block may be a Boolean value, a word value, or a constant, depending on the type of reflex action it is performing. The enable input is either a Boolean or a constant *always enabled* value. The operational input to a block such as a digital latch must always be a Boolean, whereas the operational input to an analog latch must always be a 16-bit word.

You will need to configure a source for the block's input values. An input value may come from an I/O module on the island or from the fieldbus master via a virtual module in the NIM.

NOTE: All inputs to a reflex block are sent on a change-of-state basis. After a change-of-state event has occurred, the system imposes a 10 ms delay before it accepts another change of state (input update). This feature is provided to minimize jitter in the system.

Result of a Reflex Block

Depending on the type of reflex block that you use, it will output either a Boolean or a word as its result. Generally, the result is mapped to an *action module*, as shown in the following table:

Reflex Action	Result	Action Module Type
Boolean logic	Boolean value	digital output
integer compare	Boolean value	digital output
counter	16-bit word	first block in a nested reflex action
timer	Boolean value	digital output
digital latch	Boolean value	digital output
analog latch	16-bit word	analog output

The result from a block is usually mapped to an individual channel on an output module. Depending on the type of result that the block produces, this action module may be an analog channel or a digital channel.

When the result is mapped to a digital or analog output channel, that channel becomes dedicated to the reflex action and can no longer use data from the fieldbus master to update its field device.

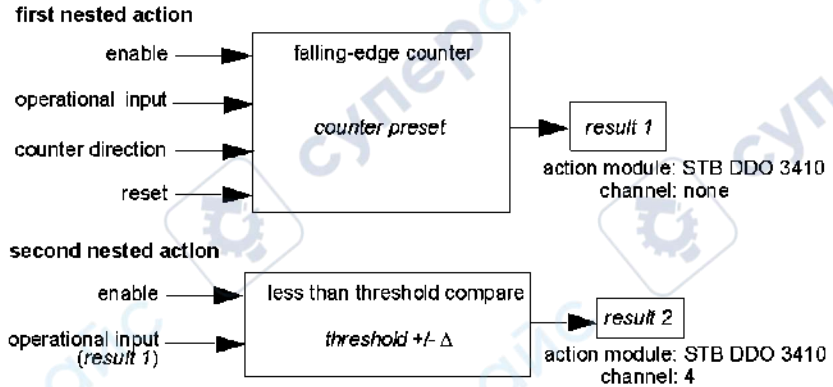
The exception is when a reflex block is the first of two actions in a nested reflex action.

Nesting

The Advantys configuration software allows you to create nested reflex actions. One level of nesting is supported—i.e., two reflex blocks, where the result of the first block is an operational input to the second block.

When you nest a pair of blocks, you need to map the results of both to the same action module. Choose the action module type that is appropriate for the result of the second block. This may mean that in some cases you will need to choose an action module for the first result that does not seem to be appropriate according to the table above.

For example, say you want to combine a counter block and a compare block in a nested reflex action. You want the result of the counter to be the operational input to the compare block. The compare block will then produce a Boolean as its result:



Result 2 (from the compare block) is the result that the nested reflex action will send to an actual output. Because the result of a compare block needs to be mapped to a digital action module, *result 2* is mapped to channel 4 on an STB DDO 3410 digital output module.

Result 1 is used only inside the module—it provides the 16-bit operational input to the compare block. It is mapped to the same STB DDO 3410 digital output module that is the action module for the compare block.

Instead of specifying a physical channel on the action module for *result 1*, the channel is set to *none*. In effect, you are sending *result 1* to an internal reflex buffer where it is stored temporarily until it is used as the operational input to the second block. You are not really sending an analog value to a digital output channel.

Number of Reflex Blocks on an Island

An island can support up to 10 reflex blocks. A nested reflex action consumes two blocks.

An individual output module can support up to two reflex blocks. Supporting more than one block requires that you manage your processing resources efficiently. If you are not careful with your resources, you may be able to support only one block on an action module.

Processing resources are consumed quickly when a reflex block receives its inputs from multiple sources (different I/O modules on the island and/or virtual modules in the NIM). The best way to preserve processing resources is to:

- use the *always enabled* constant as the enable input whenever possible
- use the same module to send multiple inputs to a block whenever possible

Island Fallback Scenarios

Introduction

In the event of a communications interruption on the island or between the island and the fieldbus, output data is put into a fallback state. In this state, output data is replaced with pre-configured fallback values. This makes known the module's output data values when the system recovers from this condition.

Fallback Scenarios

There are several scenarios in which Advantys STB output modules go into their fallback states:

- loss of fieldbus communications: Communications with the PLC are lost.
- loss of island bus communications: There is an internal island bus communications interruption, indicated by a missing heartbeat message from either the NIM or a module.
- change of operating state: The NIM may command the island I/O modules to switch from a running to a non-running (stopped or reset) state.
- missing or non-operating mandatory module: The NIM detects this condition for a mandatory island module.

NOTE: If a mandatory (or any other) module is not operating, it needs to be replaced. The module itself does not go into its fallback state.

In all of these fallback scenarios, the NIM disables the heartbeat message.

Heartbeat Message

The Advantys STB system relies on a heartbeat message to verify the integrity and continuity of communications between the NIM and the island modules. The health of island modules and the overall integrity of the Advantys STB system are monitored through the transmission and reception of these periodic island bus messages.

Because island I/O modules are configured to monitor the NIM's heartbeat message, output modules go into their fallback states if they do not receive a heartbeat message from the NIM within the defined interval.

Fallback States for Reflex Functions

Only an output module channel to which the result of a reflex action (*see page 107*) has been mapped can operate in the absence of the NIM's heartbeat message.

When modules that provide input for reflex functionality are not operating or are removed from the island, the channels that hold the result of those reflex actions go into their fallback states.

In most cases, an output module that has one of its channels dedicated to a reflex action goes to its configured fallback state if the module loses communication with the fieldbus master. The only exception is a two-channel digital output module that has both of its channels dedicated to reflex actions. In this case, the module may continue to solve logic after a loss of fieldbus communication. For more information about reflex actions, refer to the *Reflex Actions Reference Guide*.

Configured Fallback

To define a customized fallback strategy for individual modules, you are required to use the Advantys Configuration Software. Configuration is done channel by channel. You can configure a single module's multiple channels with different fallback parameters. Configured fallback parameters (implemented only during a communications interruption) are part of the configuration file stored in the NIM's non-volatile Flash memory.

Fallback Parameters

You can select either of two fallback modes when configuring output channels with the Advantys Configuration Software:

- *hold last value*: In this mode, outputs retain the last values they were assigned before the fallback condition was triggered.
- *predefined value*: In this (default) mode, you can select either of two fallback values:
 - 0 (default)
 - some value in acceptable range

The permissible values for fallback parameters in the *predefined value* mode for discrete and analog modules and reflex functions appear in the following table:

Module Type	Fallback Parameter Values
discrete	0/off (default)
	1/on
analog	0 (default)
	not 0 (in range of acceptable analog values)

NOTE: In an auto-configured system, default fallback parameters and values are always used.

Saving Configuration Data

Introduction

The Advantys configuration software allows you to save configuration data created or modified with this software to the NIM's Flash memory and/or to the removable memory card (*see page 51*). Subsequently, this data can be read from Flash memory and used to configure your physical island.

NOTE: If your configuration data is too large, you will receive a message when you attempt to save it.

How to Save a Configuration

The following procedure describes the steps you use to save a configuration data file to Flash memory directly and to a removable memory card. For more detailed procedural information, use the configuration software's online help feature:

Step	Action	Comment
1	Connect the device running the Advantys Configuration Software to the CFG port (<i>see page 36</i>) on the NIM.	For NIM modules that support Ethernet communications, you can connect the device directly to the Ethernet port.
2	Launch the configuration software.	
3	Download the configuration data that you want to save from the configuration software to the NIM.	A successful download saves the configuration data to the NIM's flash memory.
4	Install the card (<i>see page 52</i>) in the host NIM, then use the Store to SIM card command.	Saving the configuration data to the removable memory card is optional. This operation overwrites old data on the SIM card.

Write-Protecting Configuration Data

Introduction

As part of a custom configuration, you can password-protect an Advantys STB island. Only authorized persons have write privileges to the configuration data currently stored in Flash memory:

- Use the Advantys Configuration Software to password-protect an island's configuration.
- For some modules, it is possible to password-protect the island configuration through an embedded web site.

The island runs normally in protected mode. All users have the ability to monitor (read) the activity on the island bus. If a configuration is write-protected, access to it is restricted in the following ways:

- An unauthorized user is unable to overwrite the current configuration data in Flash memory.
- The RST button (*see page 57*) is disabled, and pushing it has no effect on island bus operations.
- The presence of a removable memory card (*see page 51*) is ignored. The configuration data currently stored in Flash cannot be overwritten by data on the card.

NOTE: The STB NIP 2311 NIM never ignores the removable memory card.

Password Characteristics

A password must meet the following criteria:

- It must be between 0 and 6 characters in length.
- Only alphanumeric ASCII characters are permitted.
- The password is case-sensitive.

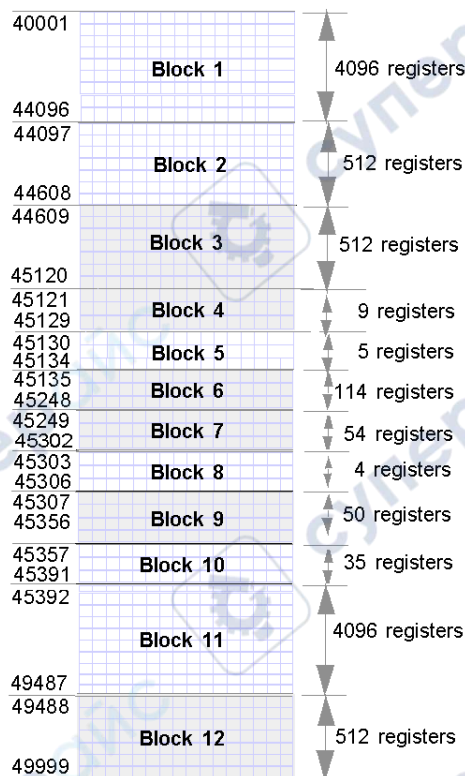
If password protection is enabled, your password is saved to Flash memory (or to a removable memory card) when you save the configuration data.

NOTE: A password-protected configuration is inaccessible to anyone who does not know the password. Your system administrator is responsible for keeping track of the password and the list of authorized users. If the assigned password is lost or forgotten, you are unable to change the island's configuration.

If the password is lost and you need to reconfigure the island, you need to perform a destructive reflash of the NIM. This procedure is described on the Advantys STB product Web site at www.schneiderautomation.com.

The Data Image

The 9999 contiguous registers in the Modbus data image start at register 40001. This figure shows the subdivision of data into sequential blocks:



Block 1 output data process image (4096 registers available)

Block 2 fieldbus master-to-HMI output table (512 registers available)

Block 3 reserved (512 registers available)

Block 4 9-register block reserved for future read/write use

Block 5 5-register RTP Request Block

Block 6 114-register block reserved for future read/write use

Block 7 54-register block reserved for future read/write use

Block 8 4-register RTP Response Block

Block 9 50-register block reserved for future read-only use

Block 10 35 predefined island bus status registers

Block 11 input data/status process image (4096 registers available)

Block 12 HMI-to-fieldbus master input table (512 registers available)

Each block has a fixed number of registers reserved for its use. Whether or not all the registers reserved for that block are used in an application, the number of registers allocated to that block remains constant. This permits you to know at all times where to begin looking for the type of data of interest to you.

For example, to monitor the status of the I/O modules in the process image, look at the data in block 11 beginning at register 45392.

Reading Register Data

All the registers in the data image can be read by an HMI panel connected to the island at the NIM's CFG port (*see page 36*). The Advantys configuration software reads all this data, and displays blocks 1, 2, 5, 8, 10, 11, and 12 in the Modbus Image screen in its I/O Image Overview.

Writing Register Data

Some registers, usually configured number of registers in block 12 (registers 49488 through 49999) of the data image, may be written to by an HMI panel (*see page 120*).

The Advantys configuration software or an HMI panel may also be used to write data to the registers in block 1 (registers 40001 through 44096). The configuration software or the HMI panel must be the island bus master in order for it to write to the data image—i.e., the island must be in *test* mode.

The Island's Process Image Blocks

Summary

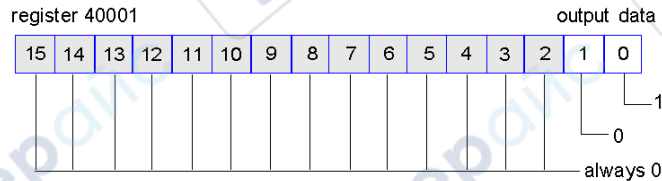
Two blocks of registers in the island's data image (see page 116) are the focus for this discussion. The first block is the output data process image, which starts at register 40001 and goes to register 44096. The other block is the input data and I/O status process image, which also consumes 4096 registers (45392 through 49487). The registers in each block are used to report island bus device status and to dynamically exchange input or output data between the fieldbus master and the island's I/O modules.

Output Data Process Image

The output data block (registers 40001 through 44096) handles the output data process image. This process image is a Modbus representation of the control data that has just been written from the fieldbus master to the NIM. Only data for the island's output modules is written to this block.

Output data is organized in 16-bit register format. One or more registers are dedicated to the data for each output module on the island bus.

For example, say you are using a two-channel digital output module as the first output module on your island bus. Output 1 is on and output 2 is off. This information would be reported in the first register in the output data process image, and it would look like this:



where:

- Normally, a value of 1 in bit 0 indicates that output 1 is on.
- Normally, a value of 0 in bit 1 indicates that output 2 is off.
- The remaining bits in the register are not used.

Some output modules, such as the one in the example above, utilize a single data register. Others may require multiple registers. An analog output module, for example, would use separate registers to represent the values for each channel, and might use the 11 or 12 most significant bits to display analog values in IEC format.

Registers are allocated to output modules in the output data block according to their addresses on the island bus. Register 40001 always contains the data for the first output module on the island (the output module closest to the NIM).

Output Data Read/Write Capabilities

The registers in the output data process image are read/write-capable.

You can read (i.e., monitor) the process image using an HMI panel or the Advantys Configuration Software. The data content that you see when you monitor the output data image registers is updated in near-real time.

The island's fieldbus master also writes updated control data to the output data process image.

Input Data and I/O Status Process Image

The input data and I/O status block (registers 45392 through 49487) handles the input data and I/O status process image. Every I/O module on the island bus has information that needs to be stored in this block.

- Each digital input module reports data (the on/off status of its input channels) in one register of input data and I/O status block, then reports its status in the next register.
- Each analog input module uses four registers in the input data and I/O status block. It represents the analog data for each channel in separate registers and the status of each channel in separate registers. Analog data is usually represented with 11- or 12-bit resolution in the IEC format; status in an analog input channel is usually represented by a series of status bits that report the presence or absence of an out-of-range value in a channel.
- Each digital output module reports an echo of its output data to a register in the input data and I/O status block. Echo output data registers are essentially copies of the register values that appear in the output data process image. This data is usually not of much interest, but it can be useful in the event that a digital output channel has been configured for a reflex action. In this case, the fieldbus master can see the bit value in the echo output data register even though the output channel is being updated inside the island bus.
- Each analog output module uses two registers in the input data and I/O status block to report status. Status in an analog output channel is usually represented by a series of status bits that report the presence or absence of an out-of-range value in a channel. Analog output modules do not report data in this block.

A detailed view of how the registers in the input data and I/O status block are implemented is shown in the process image example.

The HMI Blocks in the Island Data Image

Summary

An HMI panel that communicates using the Modbus protocol can be connected to the CFG port (*see page 36*) on the NIM. Using the Advantys configuration software, you can reserve one or two blocks of registers in the data image (*see page 115*) to support HMI data exchange. When an HMI panel writes to one of these blocks, that data is accessible to the fieldbus master (as inputs). Data written by the fieldbus master (as outputs) is stored in a different reserved block of registers that the HMI panel can read.

HMI Panel Configuration

Advantys STB supports the ability of an HMI panel to act as:

- an input device, which writes data to the island's data image that is read by the fieldbus master
- an output device, which can read data written by the fieldbus master to the island's data image
- a combined I/O device

HMI Input Data Exchange

Input data to the fieldbus master can be generated by the HMI panel. Input controls on an HMI panel might be elements such as:

- push buttons
- switches
- a data entry keypad

To use an HMI panel as an input device on the island, you need to enable the HMI-to-fieldbus master block in the island's data image (*see page 116*) and specify the number of registers in this block that you want to use for HMI-to-fieldbus master data transfers. You must use the Advantys configuration software to make these configuration adjustments.

The HMI-to-fieldbus master block can comprise up to 512 registers, ranging from register 49488 to 49999. (Your actual register limit will be dictated by your fieldbus.) This block follows immediately after the standard input data and I/O status process image (*see page 119*) block (registers 45392 through 49487) in the island's data image.

The HMI panel writes the input data to a specified number of registers in the HMI-to-fieldbus master block. The NIM manages the transfer of the HMI data in these registers as part of the overall input data transfer—it converts the 16-bit register data to a fieldbus-specific data format and transfers it together with the standard input data and I/O status process image to the fieldbus. The fieldbus master sees and responds to HMI data as if it were standard input data.

HMI Output Data Exchange

In turn, output data written by the fieldbus master can be used to update enunciator elements on the HMI panel. Enunciator elements might be:

- display indicators
- buttons or screen images that change color or shape
- data display screens (for example, temperature read-outs)

To use the HMI panel as an output device, you need to enable the fieldbus-to-HMI block in the island's data image (*see page 116*) and specify the number of registers in this block that you want to use. You need to use the Advantys configuration software to make these adjustments to your configuration.

The fieldbus master-to-HMI block can comprise up to 512 registers, ranging from register 44097 to 44608. This block follows immediately after the standard output data process image (*see page 118*) block (registers 40001 through 44096) in the island's data image.

The fieldbus master writes output update data in native fieldbus format to the HMI data block concurrent with writing this data to the output data process image area. The output data is placed in the fieldbus master-to-HMI block. Upon request by the HMI via a Modbus *read* command, the role of the NIM is to receive this output data, convert it to 16-bit Modbus format, and send it over the Modbus connection at the CFG port to the HMI panel.

NOTE: The *read* command enables all Modbus registers to be read, not just those in the block reserved for fieldbus master-to-HMI data exchange.

Test Mode

Summary

Test Mode indicates that the output data of the STB island's process image is not controlled by a fieldbus master device, but is instead controlled by either the Advantys Configuration Software or an HMI. When the STB island is operating in Test Mode, the fieldbus master cannot write the STB island's outputs, but can continue to read its inputs and diagnostic data.

Test Mode is configured off-line, downloaded with the island configuration, then activated online.

Select Test Mode Settings in the **Online** menu to open the Test Mode configuration window, where you can select a test mode setting. Test Mode settings are stored with other STB island configuration settings both in the NIM's flash memory and in a SIM card, if one is attached to the NIM.

When Test Mode is activated, the NIM's TEST LED is lit, and bit #5 of the NIM Status word in register 45391 is set to 1.

NOTE: Loss of Modbus communications do not affect Test Mode.

There are three Test Mode settings:

- Temporary Test Mode
- Persistent Test Mode
- Password Test Mode

The following sections describe the process and effect of activating Test Mode.

Temporary Test Mode

When operating online, use the Advantys Configuration Software (not an HMI) to activate Temporary Test Mode, by selecting **Test Mode** in the **Online** menu.

Once activated, Temporary Test Mode is deactivated by:

- de-selecting **Test Mode** in the **Online** menu
- cycling power to the NIM
- selecting **Reset** in the **Online** menu
- performing Autoconfiguration
- downloading a new island configuration to the NIM (or inserting a SIM card with a new island configuration into the NIM and cycling power to the NIM).

Temporary Test Mode is the default Test Mode configuration setting.

Persistent Test Mode

Use the Advantys Configuration Software to configure the STB island for Persistent Test Mode. When the download of this configuration is complete, Persistent Test Mode is activated. Thereafter, the STB island operates in Test Mode each time power is cycled to the island. When Persistent Test Mode is activated, the STB island's process image output data is controlled exclusively by either the HMI or the configuration software. The fieldbus master no longer controls these outputs.

Persistent Test Mode is deactivated by:

- downloading a new island configuration to the NIM (or inserting a SIM card with a new island configuration into the NIM and cycling power to the NIM)
- performing Autoconfiguration.

Password Test Mode

Use the Advantys Configuration Software to enter a password to the STB island's configuration settings. The password you input must have an integer value from 1 to 65535 (FFFF hex).

After the changed configuration (including the password) has been downloaded, you can activate Password Test Mode only by using an HMI to issue a single Modbus Register write command to send the password value to Modbus Register 45120.

After Password Test Mode is activated, the STB island's process image output data is controlled by either the HMI or the configuration software. In this case, the fieldbus master no longer controls these outputs.

Password Test Mode, once activated, is deactivated by:

- cycling power to the NIM
- selecting **Reset** in the **Online** menu
- performing Autoconfiguration
- downloading a new island configuration to the NIM (or inserting a SIM card with a new island configuration into the NIM and cycling power to the NIM)
- using an HMI to issue a single Modbus register write command to send the password value to Modbus Register 45121 (STB NIC 2212 and STB NIP 2311 NIMs only)

NOTE: Password Test Mode must be activated only by using the NIM's configuration port. All attempts to enter Password Test Mode using the fieldbus (via NIM models STB NMP 2212 or STB NIP 2212) are unsuccessful.

Run-Time Parameters

Introduction

For STB modules, the Advantys Configuration Software provides the RTP (run-time parameters) feature. It can be used for monitoring and modifying selected I/O parameters and Island bus status registers of the NIM while the Island is running. This feature is available only in standard STB NIMs with firmware version 2.0 or later.

RTP must be configured using the Advantys Configuration Software before it can be used. RTP is not configured by default. Configure RTP by selecting **Configure run-time Parameters** in the **Options** tab of the NIM Module Editor. This allocates the necessary registers within the NIM's data process image to support this feature.

Request and Response Blocks

Once configured, use the RTP feature by writing up to 5 reserved words in the NIM's output data process image (the RTP request block) and by reading the value of 4 reserved words in the NIM's input data process image (the RTP response block). The Advantys Configuration Software displays both blocks of reserved RTP words in the Island's **I/O Image Overview** dialog box, both in the **Modbus Image** tab and (for NIMs with a separate fieldbus image) in the **Fieldbus Image** tab. In each tab, the blocks of reserved RTP words appear after the block of process I/O data and before the block of HMI data (if any).

NOTE: The Modbus address values of the RTP request and response blocks are the same in all standard NIMs. The fieldbus address values of the RTP request and response blocks depend upon the network type. Use the **Fieldbus Image** tab of the **I/O Image Overview** dialog box to obtain the location of the RTP registers. For Modbus Plus and Ethernet networks, use the Modbus register numbers.

Exceptions

Any parameter you modify using the RTP feature does not retain its modified value if one of the following events occurs:

- Power is cycled to the NIM.
- A **Reset** command is issued to the NIM using the Advantys Configuration Software.
- A **Store to SIM Card** command is issued using the Advantys Configuration Software.
- The module whose parameter has been modified is hot-swapped.

If a module is hot-swapped, as indicated by the HOT_SWAP indicator bit, you can use the RTP feature to detect which module has been hot-swapped and to restore the parameters to their previous values.

Test Mode

When the NIM is operating in test mode, the NIM's output data process image (including the RTP request block) can be controlled either by the Advantys Configuration Software or by an HMI (depending upon the test mode configured). Standard Modbus commands can be used to access the RTP words. If the NIM is in test mode, the fieldbus master cannot write to the RTP request block in the NIM's output data process image.

RTP Request Block Words Definitions

The following table lists RTP request block words:

Modbus Address	Upper Byte	Lower Byte	Data Type	Attribute
45130	sub-index	toggle + length	unsigned 16	RW
45131	index (high data byte)	index (low data byte)	unsigned 16	RW
45132	data byte 2	data byte 1 (LSB)	unsigned 16	RW
45133	data byte 4 (MSB)	data byte 3	unsigned 16	RW
45134	toggle + CMD	Node ID	unsigned 16	RW

NOTE: The RTP request block is also presented in the manufacturer specific area of the CANopen fieldbus as an object with a dedicated index of 0x4101 and sub-index 1 to 5 (data type = unsigned 16, attribute = RW).

The NIM performs range checking on the above bytes as follows:

- index (high / low byte): 0x2000 to 0xFFFF for write; 0x1000 to 0xFFFF for read
- toggle + length: length = 1 to 4 bytes; the most significant bit contains the toggle bit
- toggle + CMD: CMD = 1 to 0x0A (see the table *Valid Commands*, below); most significant bit contains toggle bit
- Node ID: 1 to 32 and 127 (the NIM itself)

The toggle+CMD and toggle+length bytes are at either end of the RTP request register block. The NIM processes the RTP request when the same value is set in the respective toggle bits of these two bytes. The NIM processes the same RTP block again only when both values have changed to a new identical value. We recommend that you configure new matching values for the two toggle bytes (toggle+CMD and toggle+length) only after you have constructed the RTP request between them.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Write all bytes in the RTP request before you set the `toggle+CMD` and `toggle+length` bytes to the same new value.

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

RTP Response Block Words Definitions

The following list shows RTP response block words:

Modbus Address	Upper Byte	Lower Byte	Data Type	Attribute
45303	status (the most significant bit is used to indicate whether RTP service is enabled: MSB=1 means enabled)	<code>toggle + CMD</code> <code>echo</code>	unsigned 16	RO
45304	data byte 2	data byte 1 (LSB)	unsigned 16	RO
45305	data byte 4 (MSB)	data byte 3	unsigned 16	RO
45306	-	<code>toggle + CMD</code> <code>echo</code>	unsigned 16	RO

NOTE: The RTP response block is also presented in the manufacturer specific area of the CANopen fieldbus as an object with a dedicated index of 0x4100 and sub-index 1 to 4 (data type = unsigned 16, attribute = RO).

The `toggle+CMD` `echo` bytes are located at the end of the register range to let you validate the consistency of the data wrapped within these bytes (in case RTP response block words are not updated in a single scan). The NIM updates the status byte and the 4 data bytes (if applicable) before updating the `toggle+CMD` `echo` bytes in Modbus register 45303 and 45306 to equal the value of the `toggle+CMD` byte of the corresponding RTP request. You must first check that both `toggle+CMD` bytes match the `toggle+CMD` byte in the RTP request block before making use of the data inside the RTP response block.

Valid RTP Commands

The following list shows valid commands (CMDs):

Command (CMD)	Code (Except the msb)	Valid Node IDs	Allowed State of the Addressed Node	Data Bytes
Enable RTP (Only After RTP Has Been Configured Using the Advantys Configuration Software)	0x08	127	N/A	-
Disable RTP	0x09	127	N/A	-
Reset Hot-Swap Bit	0x0A	1-32	N/A	-
Read Parameter	0x01	1-32, 127	pre-operational operational	data bytes in response, length to be given
Write Parameter	0x02	1-32	operational	data bytes in request, length to be given

The most significant bit of an RTP request block's `toggle+CMD` byte is the toggle bit. A new command is identified when the value of this bit changes and matches the value of the toggle bit in the `toggle+length` byte.

A new RTP request is processed only if the preceding RTP request has finished. Overlapping RTP requests are not allowed. A new RTP request made before the completion of a preceding request is ignored.

To determine when an RTP command has been processed and its response is complete, check the values of the `toggle+CMD echo` bytes in the RTP response block. Continue to check both `toggle+CMD` bytes in the RTP response block until they match the RTP request block's `toggle+CMD` byte. Once they match, the contents of the RTP response block is valid.

Valid RTP Status Messages

The following list shows valid status messages:

Status Byte	Code	Comment
Success	0x00 or 0x80	0x00 for successful completion of a Disable RTP command
Command not Processed due to Disabled RTP	0x01	-
Illegal CMD	0x82	-
Illegal Data Length	0x83	-
Illegal Node ID	0x84	-
Illegal Node State	0x85	Access is denied because a node is absent or not started.
Illegal Index	0x86	-
RTP Response Has More Than 4 Bytes	0x87	-
No Communication Possible on the Island Bus	0x88	-
Illegal Write to Node 127	0x89	-
SDO Aborted	0x90	If an SDO protocol error is detected, the data bytes in the response contain the SDO abort code according to DS301.
General Exception Response	0xFF	This is a status event of a type other than those specified above.

The most significant bit of the status byte in the RTP response block indicates whether RTP is enabled (1) or disabled (0).

Virtual Placeholder

Summary

The virtual placeholder feature lets you create a standard island configuration and depopulated variations of that configuration that share the same fieldbus process image, thereby letting you maintain a consistent PLC or fieldbus master program for various island configurations. The depopulated islands are physically built using only those modules that are not marked as *not present*, thus saving cost and space.

As part of an Advantys STB island custom configuration, you can set *Virtual Placeholder* status for any STB I/O or preferred third-party module whose node address is assigned by the NIM during auto-addressing.

After a module has been assigned Virtual Placeholder status, you can physically remove it from its Advantys STB island base, while retaining the island's process image. All modules that physically remain in the Advantys STB island configuration will retain their previous node addresses. This lets you physically alter the design of your island, without having to edit your PLC program.

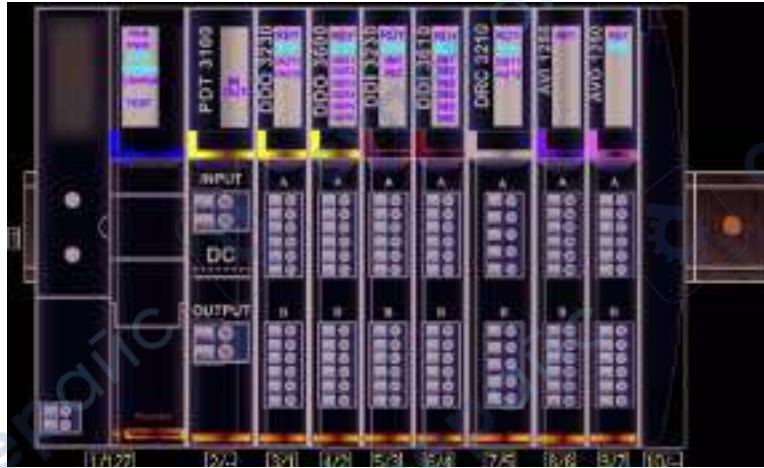
NOTE: Advantys configuration software is required to set Virtual Placeholder status.

Setting Virtual Placeholder Status

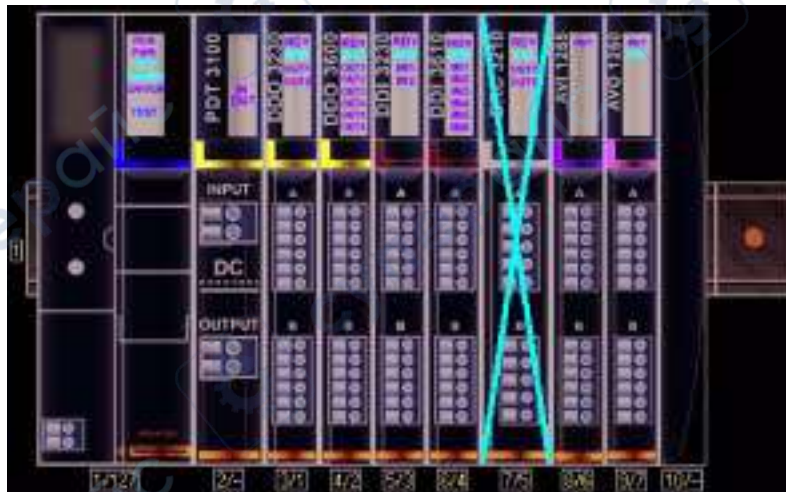
To set Virtual Placeholder status:

Step	Action
1	Open the STB I/O or preferred third-party module's property window.
2	In the Options tab, select Not Present .
3	Click OK to save your settings. The Advantys STB configuration software marks the virtual placeholder module with a red "X" (as shown below).

For example, the following island configuration contains a NIM, a PDM, 2 digital Input modules, 2 digital output modules, a digital relay output module, an analog input module, and an analog output module:



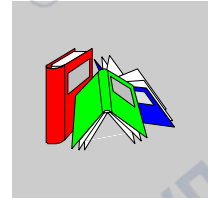
After you assign Virtual Placeholder status to the DRC 3210 digital relay output module (by selecting **Not Present** in its Options tab), the Advantys STB configuration software marks the virtual placeholder module with a red "X" as shown below:



For example, when you physically construct the above configuration, you would build the island without the DRC-3210 and its base.

NOTE: Any reflex output, that is configured to use a virtual placeholder module as an input, will constantly be in fallback.

Glossary



0-9

100Base-T

An adaptation of the IEEE 802.3u (Ethernet) standard, the 100Base-T standard uses twisted-pair wiring with a maximum segment length of 100 m (328 ft) and terminates with an RJ-45 connector. A 100Base-T network is a baseband network capable of transmitting data at a maximum speed of 100 Mbit/s. "Fast Ethernet" is another name for 100Base-T, because it is ten times faster than 10Base-T.

10Base-T

An adaptation of the IEEE 802.3 (Ethernet) standard, the 10Base-T standard uses twisted-pair wiring with a maximum segment length of 100 m (328 ft) and terminates with an RJ-45 connector. A 10Base-T network is a baseband network capable of transmitting data at a maximum speed of 10 Mbit/s.

802.3 frame

A frame format, specified in the IEEE 802.3 (Ethernet) standard, in which the header specifies the data packet length.

A

agent

1. SNMP – the SNMP application that runs on a network device.
2. Fipio – a slave device on a network.

analog input

A module that contains circuits that convert analog DC input signals to digital values that can be manipulated by the processor. By implication, these analog inputs are usually direct. That means a data table value directly reflects the analog signal value.

analog output

A module that contains circuits that transmit an analog DC signal proportional to a digital value input to the module from the processor. By implication, these analog outputs are usually direct. That means a data table value directly controls the analog signal value.

application object

In CAN-based networks, application objects represent device-specific functionality, such as the state of input or output data.

ARP

The ARP (address resolution protocol) is the IP network layer protocol, which uses ARP to map an IP address to a MAC (hardware) address.

auto baud

The automatic assignment and detection of a common baud rate as well as the ability of a device on a network to adapt to that rate.

auto-addressing

The assignment of an address to each Island bus I/O module and preferred device.

auto-configuration

The ability of Island modules to operate with predefined default parameters. A configuration of the Island bus based completely on the actual assembly of I/O modules.

B

basic I/O

Low-cost Advantys STB input/output modules that use a fixed set of operating parameters. A basic I/O module cannot be reconfigured with the Advantys Configuration Software and cannot be used in reflex actions.

basic network interface

A low-cost Advantys STB network interface module that supports up to 12 Advantys STB I/O modules. A basic NIM does not support the Advantys Configuration Software, reflex actions, nor the use of an HMI panel.

basic power distribution module

A low-cost Advantys STB PDM that distributes sensor power and actuator power over a single field power bus on the Island. The bus provides a maximum of 4 A total power. A basic PDM requires a 5 A fuse to protect the I/O.

BootP

BootP (bootstrap protocol) is an UDP/IP protocol that allows an internet node to obtain its IP parameters based on its MAC address.

BOS

BOS stands for beginning of segment. When more than 1 segment of I/O modules is used in an Island, an STB XBE 1200 or an STB XBE 1300 BOS module is installed in the first position in each extension segment. Its job is to carry Island bus communications to and generate logic power for the modules in the extension segment. Which BOS module must be selected depends on the module types that shall follow.

bus arbitrator

A master on a Fipio network.

C**CAN**

The CAN (controller area network) protocol (ISO 11898) for serial bus networks is designed for the interconnection of smart devices (from multiple manufacturers) in smart systems for real-time industrial applications. CAN multi-master systems ensure high data integrity through the implementation of broadcast messaging and advanced diagnostic mechanisms. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

CANopen protocol

An open industry standard protocol used on the internal communication bus. The protocol allows the connection of any enhanced CANopen device to the Island bus.

CI

This abbreviation stands for command interface.

CiA

CiA (CAN in Automation) is a non-profit group of manufacturers and users dedicated to developing and supporting CAN-based higher layer protocols.

CIP

Common Industrial Protocol. Networks that include CIP in the application layer can communicate seamlessly with other CIP-based networks. For example, the implementation of CIP in the application layer of an Ethernet TCP/IP network creates an EtherNet/IP environment. Similarly, CIP in the application layer of a CAN network creates a DeviceNet environment. Devices on an EtherNet/IP network can therefore communicate with devices on a DeviceNet network via CIP bridges or routers.

COB

A COB (communication object) is a unit of transportation (a message) in a CAN-based network. Communication objects indicate a particular functionality in a device. They are specified in the CANopen communication profile.

configuration

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

CRC

cyclic redundancy check. Messages that implement this error checking mechanism have a CRC field that is calculated by the transmitter according to the message's content. Receiving nodes recalculate the field. Disagreement in the two codes indicates a difference between the transmitted message and the one received.

CSMA/CS

carrier sense multiple access/collision detection. CSMA/CS is a MAC protocol that networks use to manage transmissions. The absence of a carrier (transmission signal) indicates that a network channel is idle. Multiple nodes may try to simultaneously transmit on the channel, which creates a collision of signals. Each node detects the collision and immediately terminates transmission. Messages from each node are retransmitted at random intervals until the frames are successfully transmitted.

D

DDXML

Device Description eXtensible Markup Language

device name

A customer-driven, unique logical personal identifier for an Ethernet NIM. A device name (or *role name*) is created when you combine the numeric rotary switch setting with the NIM (for example, STBNIP2212_010).

After the NIM is configured with a valid device name, the DHCP server uses it to identify the island at power up.

DeviceNet protocol

DeviceNet is a low-level, connection-based network that is based on CAN, a serial bus system without a defined application layer. DeviceNet, therefore, defines a layer for the industrial application of CAN.

DHCP

dynamic host configuration protocol. A TCP/IP protocol that allows a server to assign an IP address based on a device name (host name) to a network node.

differential input

A type of input design where two wires (+ and -) are run from each signal source to the data acquisition interface. The voltage between the input and the interface ground are measured by two high-impedance amplifiers, and the outputs from the two amplifiers are subtracted by a third amplifier to yield the difference between the + and - inputs. Voltage common to both wires is thereby removed. Differential design solves the problem of ground differences found in single-ended connections, and it also reduces the cross-channel noise problem.

digital I/O

An input or output that has an individual circuit connection at the module corresponding directly to a data table bit or word that stores the value of the signal at that I/O circuit. It allows the control logic to have discrete access to the I/O values.

DIN

Deutsche industrial norms. A German agency that sets engineering and dimensional standards and now has worldwide recognition.

Drivecom Profile

The Drivecom profile is part of CiA DSP 402 (profile), which defines the behavior of drives and motion control devices on CANopen networks.

E

economy segment

A special type of STB I/O segment created when an STB NCO 1113 economy CANopen NIM is used in the first location. In this implementation, the NIM acts as a simple gateway between the I/O modules in the segment and a CANopen master. Each I/O module in an economy segment acts as a independent node on the CANopen network. An economy segment cannot be extended to other STB I/O segments, preferred modules or enhanced CANopen devices.

EDS

electronic data sheet. The EDS is a standardized ASCII file that contains information about a network device's communications functionality and the contents of its object dictionary. The EDS also defines device-specific and manufacturer-specific objects.

EIA

Electronic Industries Association. An organization that establishes electrical/electronic and data communication standards.

EMC

electromagnetic compatibility. Devices that meet EMC requirements can operate within a system's expected electromagnetic limits without interruption.

EMI

electromagnetic interference. EMI can cause an interruption, malfunction, or disturbance in the performance of electronic equipment. It occurs when a source electronically transmits a signal that interferes with other equipment.

EOS

This abbreviation stands for end of segment. When more than 1 segment of I/O modules is used in an Island, an STB XBE 1000 or an STB XBE 1100 EOS module is installed in the last position in every segment that has an extension following it. The EOS module extends Island bus communications to the next segment. Which EOS module must be selected depends on the module types that shall follow.

Ethernet

A LAN cabling and signaling specification used to connect devices within a defined area, e.g., a building. Ethernet uses a bus or a star topology to connect different nodes on a network.

Ethernet II

A frame format in which the header specifies the packet type, Ethernet II is the default frame format for NIM communications.

EtherNet/IP

EtherNet/IP (the Ethernet Industrial Protocol) is especially suited to factory applications in which there is a need to control, configure, and monitor events within an industrial system. The ODVA-specified protocol runs CIP (the Common Industrial Protocol) on top of standard Internet protocols, like TCP/IP and UDP. It is an open local (communications) network that enables the interconnectivity of all levels of manufacturing operations from the plant's office to the sensors and actuators on its floor.

F**fallback state**

A known state to which an Advantys STB I/O module can return in the event that its communication connection is not open.

fallback value

The value that a device assumes during fallback. Typically, the fallback value is either configurable or the last stored value for the device.

FED_P

Fipio extended device profile. On a Fipio network, the standard device profile type for agents whose data length is more than 8 words and equal to or less than 32 words.

Fipio

Fieldbus Interface Protocol (FIP). An open fieldbus standard and protocol that conforms to the FIP/World FIP standard. Fipio is designed to provide low-level configuration, parameterization, data exchange, and diagnostic services.

Flash memory

Flash memory is nonvolatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

FRD_P

Fipio reduced device profile. On a Fipio network, the standard device profile type for agents whose data length is two words or less.

FSD_P

Fipio standard device profile. On a Fipio network, the standard device profile type for agents whose data length is more than two words and equal to or less than 8 words.

full scale

The maximum level in a specific range—e.g., in an analog input circuit the maximum allowable voltage or current level is at full scale when any increase beyond that level is over-range.

function block

A function block performs a specific automation function, such as speed control. A function block comprises configuration data and a set of operating parameters.

function code

A function code is an instruction set commanding 1 or more slave devices at a specified address(es) to perform a type of action, e.g., read a set of data registers and respond with the content.

G

gateway

A program or hardware that passes data between networks.

global_ID

global_identifier. A 16-bit integer that uniquely identifies a device's location on a network. A global_ID is a symbolic address that is universally recognized by all other devices on the network.

GSD

generic slave data (file). A device description file, supplied by the device's manufacturer, that defines a device's functionality on a Profibus DP network.

H**HMI**

human-machine interface. An operator interface, usually graphical, for industrial equipment.

hot swapping

Replacing a component with a like component while the system remains operational. When the replacement component is installed, it begins to function automatically.

HTTP

hypertext transfer protocol. The protocol that a web server and a client browser use to communicate with one another.

I**I/O base**

A mounting device, designed to seat an Advantys STB I/O module, hang it on a DIN rail, and connect it to the Island bus. It provides the connection point where the module can receive either 24 VDC or 115/230 VAC from the input or output power bus distributed by a PDM.

I/O module

In a programmable controller system, an I/O module interfaces directly to the sensors and actuators of the machine/process. This module is the component that mounts in an I/O base and provides electrical connections between the controller and the field devices. Normal I/O module capacities are offered in a variety of signal levels and capacities.

I/O scanning

The continuous polling of the Advantys STB I/O modules performed by the COMS to collect data bits, status, and diagnostics information.

IEC

International Electrotechnical Commission. Founded in 1884 to focus on advancing the theory and practice of electrical, electronics, and computer engineering, and computer science. EN 61131-2 is the specification that deals with industrial automation equipment.

IEC type 1 input

Type 1 digital inputs support sensor signals from mechanical switching devices such as relay contacts and push buttons operating in normal environmental conditions.

IEC type 2 input

Type 2 digital inputs support sensor signals from solid state devices or mechanical contact switching devices such as relay contacts, push buttons (in normal or harsh environmental conditions), and 2- or 3-wire proximity switches.

IEC type 3 input

Type 3 digital inputs support sensor signals from mechanical switching devices such as relay contacts, push buttons (in normal-to-moderate environmental conditions), 3-wire proximity switches and 2-wire proximity switches that have:

- a voltage drop of no more than 8 V
- a minimum operating current capability less than or equal to 2.5 mA
- a maximum off-state current less than or equal to 1.5 mA

IEEE

Institute of Electrical and Electronics Engineers, Inc. The international standards and conformity assessment body for all fields of electrotechnology, including electricity and electronics.

industrial I/O

An Advantys STB I/O module designed at a moderate cost for typical continuous, high-duty-cycle applications. Modules of this type often feature standard IEC threshold ratings, usually providing user-configurable parameter options, on-board protection, good resolution, and field wiring options. They are designed to operate in moderate-to-high temperature ranges.

input filtering

The amount of time that a sensor must hold its signal on or off before the input module detects the change of state.

input polarity

An input channel's polarity determines when the input module sends a 1 and when it sends a 0 to the master controller. If the polarity is *normal*, an input channel sends a 1 to the controller when its field sensor turns on. If the polarity is *reverse*, an input channel sends a 0 to the controller when its field sensor turns on.

input response time

The time it takes for an input channel to receive a signal from the field sensor and put it on the Island bus.

INTERBUS protocol

The INTERBUS fieldbus protocol observes a master/slave network model with an active ring topology, having all devices integrated in a closed transmission path.

IOC object

Island operation control object. A special object that appears in the CANopen object dictionary when the remote virtual placeholder option is enabled in a CANopen NIM. It is a 16-bit word that provides the fieldbus master with a mechanism for issuing reconfiguration and start requests.

IOS object

Island operation status object. A special object that appears in the CANopen object dictionary when the remote virtual placeholder option is enabled in a CANopen NIM. It is a 16-bit word that reports the success of reconfiguration and start requests or records diagnostic information in the event that a request is not completed.

IP

internet protocol. That part of the TCP/IP protocol family that tracks the internet addresses of nodes, routes outgoing messages, and recognizes incoming messages.

IP Rating

Ingress Protection rating according to IEC 60529.

IP20 modules are protected against ingress and contact of objects larger than 12.5 mm. The module is not protected against harmful ingress of water.

IP67 modules are completely protected against ingress of dust and contact. Ingress of water in harmful quantity is not possible when the enclosure is immersed in water up to 1 m.

L

LAN

local area network. A short-distance data communications network.

light industrial I/O

An Advantys STB I/O module designed at a low cost for less rigorous (e.g., intermittent, low-duty-cycle) operating environments. Modules of this type operate in lower temperature ranges with lower qualification and agency requirements and limited on-board protection; they usually have limited or no user-configuration options.

linearity

A measure of how closely a characteristic follows a straight-line function.

LSB

least significant bit, least significant byte. The part of a number, address, or field that is written as the rightmost single value in conventional hexadecimal or binary notation.

M

MAC address

media access control address. A 48-bit number, unique on a network, that is programmed into each network card or device when it is manufactured.

mandatory module

When an Advantys STB I/O module is configured to be mandatory, it must be present and healthy in the Island configuration for the Island to be operational. If a mandatory module is inoperable or is removed from its location on the Island bus, the Island goes to a pre-operational state. By default, all I/O modules are not mandatory. You must use the Advantys Configuration Software to set this parameter.

master/slave model

The direction of control in a network that implements the master/slave model is always from the master to the slave devices.

Modbus

Modbus is an application layer messaging protocol. Modbus provides client and server communications between devices connected on different types of buses or networks. Modbus offers many services specified by function codes.

MOV

metal oxide varistor. A 2-electrode semiconductor device with a voltage-dependant nonlinear resistance that drops markedly as the applied voltage is increased. It is used to suppress transient voltage surges.

MSB

most significant bit, most significant byte. The part of a number, address, or field that is written as the leftmost single value in conventional hexadecimal or binary notation.

N**N.C. contact**

normally closed contact. A relay contact pair that is closed when the relay coil is de-energized and open when the coil is energized.

N.O. contact

normally open contact. A relay contact pair that is open when the relay coil is de-energized and closed when the coil is energized.

NEMA

National Electrical Manufacturers Association

network cycle time

The time that a master requires to complete a single scan of all of the configured I/O modules on a network device; typically expressed in microseconds.

NIM

network interface module. This module is the interface between an Island bus and the fieldbus network of which the Island is a part. A NIM enables all the I/O on the Island to be treated as a single node on the fieldbus. The NIM also provides 5 V of logic power to the Advantys STB I/O modules in the same segment as the NIM.

NMT

network management. NMT protocols provide services for network initialization, diagnostic control, and device status control.

O

object dictionary

Part of the CANopen device model that provides a map to the internal structure of CANopen devices (according to CANopen profile DS-401). A device's object dictionary (also called the *object directory*) is a lookup table that describes the data types, communications objects, and application objects the device uses. By accessing a particular device's object dictionary through the CANopen fieldbus, you can predict its network behavior and build a distributed application.

ODVA

Open Devicenet Vendors Association. The ODVA supports the family of network technologies that are built on the Common Industrial Protocol (EtherNet/IP, DeviceNet, and CompoNet).

open industrial communication network

A distributed communication network for industrial environments based on open standards (EN 50235, EN50254, and EN50170, and others) that allows the exchange of data between devices from different manufacturers.

output filtering

The amount that it takes an output channel to send change-of-state information to an actuator after the output module has received updated data from the NIM.

output polarity

An output channel's polarity determines when the output module turns its field actuator on and when it turns the actuator off. If the polarity is *normal*, an output channel turns its actuator on when the master controller sends it a 1. If the polarity is *reverse*, an output channel turns its actuator on when the master controller sends it a 0.

output response time

The time it takes for an output module to take an output signal from the Island bus and send it to its field actuator.

P

parameterize

To supply the required value for an attribute of a device at run-time.

PDM

power distribution module. A module that distributes either AC or DC field power to a cluster of I/O modules directly to its right on the Island bus. A PDM delivers field power to the input modules and the output modules. It is important that all the I/O clustered directly to the right of a PDM be in the same voltage group—either 24 VDC, 115 VAC, or 230 VAC.

PDO

process data object. In CAN-based networks, PDOs are transmitted as unconfirmed broadcast messages or sent from a producer device to a consumer device. The transmit PDO from the producer device has a specific identifier that corresponds to the receive PDO of the consumer devices.

PE

protective earth. A return line across the bus for fault currents generated at a sensor or actuator device in the control system.

peer-to-peer communications

In peer-to-peer communications, there is no master/slave or client/server relationship. Messages are exchanged between entities of comparable or equivalent levels of functionality, without having to go through a third party (like a master device).

PLC

programmable logic controller. The PLC is the brain of an industrial manufacturing process. It automates a process as opposed to relay control systems. PLCs are computers suited to survive the harsh conditions of the industrial environment.

PowerSuite Software

PowerSuite Software is a tool for configuring and monitoring control devices for electric motors, including ATV31, ATV71, and TeSys U.

preferred module

An I/O module that functions as an auto-addressable device on an Advantys STB Island but is not in the same form factor as a standard Advantys STB I/O module and therefore does not fit in an I/O base. A preferred device connects to the Island bus via an EOS module and a length of a preferred module extension cable. It can be extended to another preferred module or back into a BOS module. If it is the last device on the Island, it must be terminated with a 120 Ω terminator.

premium network interface

A premium NIM has advanced features over a standard or basic NIM.

prioritization

An optional feature on a standard NIM that allows you to selectively identify digital input modules to be scanned more frequently during a the NIM's logic scan.

process I/O

An Advantys STB I/O module designed for operation at extended temperature ranges in conformance with IEC type 2 thresholds. Modules of this type often feature high levels of on-board diagnostics, high resolution, user-configurable parameter options, and higher levels of agency approval.

process image

A part of the NIM firmware that serves as a real-time data area for the data exchange process. The process image includes an input buffer that contains current data and status information from the Island bus and an output buffer that contains the current outputs for the Island bus, from the fieldbus master.

producer/consumer model

In networks that observe the producer/consumer model, data packets are identified according to their data content rather than by their node address. All nodes *listen* on the network and consume those data packets that have appropriate identifiers.

Profibus DP

Profibus Decentralized Peripheral. An open bus system that uses an electrical network based on a shielded 2-wire line or an optical network based on a fiber-optic cable. DP transmission allows for high-speed, cyclic exchange of data between the controller CPU and the distributed I/O devices.

R

reflex action

A simple, logical command function configured locally on an Island bus I/O module. Reflex actions are executed by Island bus modules on data from various Island locations, like input and output modules or the NIM. Examples of reflex actions include compare and copy operations.

repeater

An interconnection device that extends the permissible length of a bus.

reverse polarity protection

Use of a diode in a circuit to protect against damage and unintended operation in the event that the polarity of the applied power is accidentally reversed.

rms

root mean square. The effective value of an alternating current, corresponding to the DC value that produces the same heating effect. The rms value is computed as the square root of the average of the squares of the instantaneous amplitude for 1 complete cycle. For a sine wave, the rms value is 0.707 times the peak value.

role name

A customer-driven, unique logical personal identifier for an Ethernet NIM. A role name (or *device name*) is created when you:

- combine the numeric rotary switch setting with the NIM (for example, STBNIP2212_010), or . . .
- edit the **Device Name** setting in the NIM's embedded web server pages

After the NIM is configured with a valid role name, the DHCP server uses it to identify the island at power up.

RTD

resistive temperature detect. An RTD device is a temperature transducer composed of conductive wire elements typically made of platinum, nickel, copper, or nickel-iron. An RTD device provides a variable resistance across a specified temperature range.

RTP

run-time parameters. RTP lets you monitor and modify selected I/O parameters and Island bus status registers of the NIM while the Advantys STB Island is running. The RTP feature uses 5 reserved output words in the NIM's process image (the RTP request block) to send requests, and 4 reserved input words in the NIM's process image (the RTP response block) to receive responses. Available only in standard NIMs running firmware version 2.0 or higher.

Rx

reception. For example, in a CAN-based network, a PDO is described as an RxPDO of the device that receives it.

S

SAP

service access point. The point at which the services of 1 communications layer, as defined by the ISO OSI reference model, is made available to the next layer.

SCADA

supervisory control and data acquisition. Typically accomplished in industrial settings by means of microcomputers.

SDO

service data object. In CAN-based networks, SDO messages are used by the fieldbus master to access (read/write) the object directories of network nodes.

segment

A group of interconnected I/O and power modules on an Island bus. An Island must have at least 1 segment and, depending on the type of NIM used, may have as many as 7 segments. The first (leftmost) module in a segment needs to provide logic power and Island bus communications to the I/O modules on its right. In the primary or basic segment, that function is filled by a NIM. In an extension segment, that function is filled by an STB XBE 1200 or an STB XBE 1300 BOS module.

SELV

safety extra low voltage. A secondary circuit designed and protected so that the voltage between any 2 accessible parts (or between 1 accessible part and the PE terminal for Class 1 equipment) does not exceed a specified value under normal conditions or under single-fault conditions.

SIM

subscriber identification module. Originally intended for authenticating users of mobile communications, SIMs now have multiple applications. In Advantys STB, configuration data created or modified with the Advantys Configuration Software can be stored on a SIM (referred to as the “removable memory card”) and then written to the NIM’s Flash memory.

single-ended inputs

An analog input design technique whereby a wire from each signal source is connected to the data acquisition interface, and the difference between the signal and ground is measured. For the success of this design technique, 2 conditions are imperative: the signal source must be grounded, and the signal ground and data acquisition interface ground (the PDM lead) must have the same potential.

sink load

An output that, when turned on, receives DC current from its load.

size 1 base

A mounting device, designed to seat an STB module, hang it on a DIN rail, and connect it to the Island bus. It is 13.9 mm (0.55 in.) wide and 128.25 mm (5.05 in.) high.

size 2 base

A mounting device, designed to seat an STB module, hang it on a DIN rail, and connect it to the Island bus. It is 18.4 mm (0.73 in.) wide and 128.25 mm (5.05 in.) high.

size 3 base

A mounting device, designed to seat an STB module, hang it on a DIN rail, and connect it to the Island bus. It is 28.1 mm (1.11 in.) wide and 128.25 mm (5.05 in.) high.

slice I/O

An I/O module design that combines a small number of channels (usually between 2 and 6) in a small package. The idea is to allow a system developer to purchase just the right amount of I/O and to be able to distribute it around the machine in an efficient, mechatronics way.

SM_MPS

state management_message periodic services. The applications and network management services used for process control, data exchange, diagnostic message reporting, and device status notification on a Fipio network.

SNMP

simple network management protocol. The UDP/IP standard protocol used to manage nodes on an IP network.

snubber

A circuit generally used to suppress inductive loads—it consists of a resistor in series with a capacitor (in the case of an RC snubber) and/or a metal-oxide varistor placed across the AC load.

source load

A load with a current directed into its input; must be driven by a current source.

standard I/O

Any of a subset of Advantys STB input/output modules designed at a moderate cost to operate with user-configurable parameters. A standard I/O module may be reconfigured with the Advantys Configuration Software and, in most cases, may be used in reflex actions.

standard network interface

An Advantys STB network interface module designed at moderate cost to support the configuration capabilities, multi-segment design and throughput capacity suitable for most standard applications on the Island bus. An Island run by a standard NIM can support up to 32 addressable Advantys STB and/or preferred I/O modules, up to 12 of which may be standard CANopen devices.

standard power distribution module

An Advantys STB module that distributes sensor power to the input modules and actuator power to the output modules over two separate power buses on the Island. The bus provides a maximum of 4 A to the input modules and 8 A to the output modules. A standard PDM requires a 5 A fuse to protect the input modules and an 8 A fuse to protect the outputs.

STD_P

standard profile. On a Fipio network, a standard profile is a fixed set of configuration and operating parameters for an agent device, based on the number of modules that the device contains and the device's total data length. There are 3 types of standard profiles: Fipio reduced device profile (FRD_P), Fipio standard device profile (FSD_P), and the Fipio extended device profile (FED_P).

stepper motor

A specialized DC motor that allows discrete positioning without feedback.

subnet

A part of a network that shares a network address with the other parts of a network. A subnet may be physically and/or logically independent of the rest of the network. A part of an internet address called a subnet number, which is ignored in IP routing, distinguishes the subnet.

surge suppression

The process of absorbing and clipping voltage transients on an incoming AC line or control circuit. Metal-oxide varistors and specially designed RC networks are frequently used as surge suppression mechanisms.

T**TC**

thermocouple. A TC device is a bimetallic temperature transducer that provides a temperature value by measuring the voltage differential caused by joining together two different metals at different temperatures.

TCP

transmission control protocol. A connection-oriented transport layer protocol that provides reliable full-duplex data transmission. TCP is part of the TCP/IP suite of protocols.

telegram

A data packet used in serial communication.

TFE

transparent factory Ethernet. Schneider Electric's open automation framework based on TCP/IP.

Tx

transmission. For example, in a CAN-based network, a PDO is described as a TxPDO of the device that transmits it.

U

UDP

user datagram protocol. A connectionless mode protocol in which messages are delivered in a datagram to a destination computer. The UDP protocol is typically bundled with the Internet Protocol (UPD/IP).

V

varistor

A 2-electrode semiconductor device with a voltage-dependant nonlinear resistance that drops markedly as the applied voltage is increased. It is used to suppress transient voltage surges.

voltage group

A grouping of Advantys STB I/O modules, all with the same voltage requirement, installed directly to the right of the appropriate power distribution module (PDM) and separated from modules with different voltage requirements. Never mix modules with different voltage requirements in the same voltage group.

VPCR object

virtual placeholder configuration read object. A special object that appears in the CANopen object dictionary when the remote virtual placeholder option is enabled in a CANopen NIM. It provides a 32-bit subindex that represents the actual module configuration used in a physical Island.

VPCW object

virtual placeholder configuration write object. A special object that appears in the CANopen object dictionary when the remote virtual placeholder option is enabled in a CANopen NIM. It provides a 32-bit subindex where the fieldbus master can write a module reconfiguration. After the fieldbus writes to the VPCW subindex, it can issue a reconfiguration request to the NIM that begins the remote virtual placeholder operation.

W**watchdog timer**

A timer that monitors a cyclical process and is cleared at the conclusion of each cycle. If the watchdog runs past its programmed time period, it generates a fault.

Index



A

ABL8 Phaseo power supply, *45*
action module, *109*
address
 valid, *30*
addressable module, *14, 48, 48, 62*
Advantys configuration software, *36, 100, 104, 106, 108, 109, 113, 114, 117, 117, 119*
agency approvals, *46*
ASCII header registers
 Modbus Plus, *81*
auto-addressing, *14, 48, 59*
auto-configuration
 and reset, *50, 58, 59*
 defined, *50*
 initial configuration, *50*

B

baud
 CFG port, *36, 58*
 fieldbus interface, *58*

C

CFG port
 devices connecting to, *10, 36, 37*
 parameters, *36, 59*
 physical description, *36*
configurable parameters, *100, 100*
configuration
 Modbus Plus communication, *17*

configuration data
 restoring default settings, *36, 54, 59*
 saving, *54, 59*
custom configuration, *50, 51, 54, 58, 104, 113, 114*

D

data descriptors
 Modbus Plus, *79*
data exchange, *10, 32, 33, 48, 120, 121*
data image, *64, 65, 116, 118, 120*
data size, *101, 102*
diagnostics block
 in the process image, *70*
 island communications, *70*

E

edit mode, *36, 51, 54, 54, 55, 58*
extension cable, *14, 42*
extension module, *11, 13, 41, 42, 43, 44, 48*
extension segment, *11, 13, 41, 42, 43, 44*

F

factory default settings, *36, 50, 54, 59*
fallback state, *104, 111*
fallback value, *104, 112*
fieldbus handler control word, *102*
fieldbus interface, *28*
fieldbus interface, pin-out, *28*

fieldbus master

- and the output data image, *63, 119*
- fieldbus-to-HMI block, *121*
- HMI-to-fieldbus block, *120*
- LED, *32*

Flash memory

- Advantys configuration software, *113*
- and reset, *57, 59*
- overwriting, *54, 59, 114*
- saving configuration data, *50*

G

- global bits errors, *71*

H

- HE-13 connector, *37*
- heartbeat message, *111*
- HMI
 - data exchange, *100, 101*
- HMI panel
 - data exchange, *10, 117, 117, 120, 121*
 - functionality, *120*
 - process image blocks, *120*
- hot-swapping
 - mandatory modules, *105*
- hot-swapping modules, *49, 104*
- housing, *27*

I

- initial configuration, *54, 55*
- inputs
 - to a reflex block, *108*

island bus

- communications, *10*
- configuration data, *51, 54, 59, 114*
- extending, *13, 14, 42*
- fallback, *111*
- LEDs, *33*
- mastery of, *33*
- maximum length, *16*
- operational mode, *33, 54, 58*
- overview, *11, 13*
- status, *70*
- termination, *11, 14, 62*

island bus

- configuration data, *62*
- island bus example, *48, 62*
- island bus password, *55, 114*
- island bus sample assembly, *86*

L

LED

- physical description, *31*

LEDs

- and COMS states, *33*
- and reset, *33*
- island bus, *33*
- MNSG, *32*
- MNSR, *32*
- PWR LED, *32, 33*
- TEST LED, *33*

logic power

- considerations, *11, 14, 41, 41, 42, 43*
- integrated power supply, *10, 11, 41, 43, 43*
- signal, *41*
- source power supply, *11, 43*

M

- mandatory I/O modules, *104, 104*
- mandatory module hot swapping, *105*
- Modbus Plus
 - address, valid, *30*
 - standards, *46*
- Modbus Plus network, *26*

Modbus Plus protocol, 64
Modbus Plus, fieldbus interface, 28, 28
Modbus protocol, 36, 38, 115, 118, 120
module status registers
 Modbus Plus, 79

N

nested reflex actions, 109
network connection, 28
network considerations, 10, 56
NIM
 housing, 27
node
 address, valid, 30
node address
 setting, 29
number of reflex blocks on an island, 110

O

outputs
 from a reflex block, 109

P

parameterization, 50
PDM, 41, 45, 48, 49, 62
Peer Cop, 100, 102
PLC, 101
preferred module, 14
primary segment, 11, 13, 41, 43
prioritization, 106
process image
 analog input and output module data, 65, 119
 and reflex actions, 65
 diagnostic blocks, 70
 digital input and output module data, 65,

119
 echo output data, 65
 fieldbus-to-HMI block, 121
 graphical representation, 116
 HMI blocks, 120
 HMI-to-fieldbus block, 120
 I/O status image, 65, 115, 119, 120
 input data image, 65, 119, 120
 output data image, 63, 118, 121
 overview, 115
protected mode, 37, 51, 54, 55, 55, 58, 114

R

reflex action
 and fallback, 111
 and the echo output data image area, 65, 119
 overview, 107
reflex block types, 107
removable memory card, 36, 51, 53, 54, 113
rotary switches, 29
 physical description, 29
RST button
 and auto-configuration, 59
 and Flash memory, 57, 59
 caution, 57, 58
 disabled, 37, 114
 functionality, 50, 57, 58, 58
 LED indications, 33
 physical description, 57
run-time parameters, 124

S

sample island assembly, 86
source power supply
 considerations, 43
 logic power, 11, 43
 recommendations, 45
 SELV-rated, 39, 41, 43, 43
 two-receptacle wiring connector, 39
special registers
 Modbus Plus, 80

specifications

CFG port, 36

STB NMP 2212, 46

STB XCA 4002 programming cable, 38

standard I/O modules, 104

STB NMP 2212

node address, 29, 29

specifications, 46

STB NMP 2212, physical features, 26

STB XCA 4002 programming cable, 37

STB XMP 4440 removable memory card

and reset, 36, 55

installing, 52

removing, 53

STB XMP 4440 removable memory card

storing configuration data, 36

STB XMP 4440 removable memory card

storing configuration data, 54

STB XTS 1120 screw type power connector,

39

STB XTS 2120 spring clamp field wiring con-

connector, 39

storing configuration data

and reset, 59

in Flash memory, 50, 104, 113

to a removable memory card, 36, 51, 54,

104, 113

T

termination plate, 11, 49, 62

test mode, 33

troubleshooting

emergency messages, 74

global bits errors, 71

island bus, 70, 72, 73, 75

LEDs, 32

using the Advantys STB LEDs, 33

with the Advantys configuration software,

70

with the HMI panel, 70

V

virtual placeholder, 129