Advantys STB

Standard INTERBUS Network Interface Module
Applications Guide

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Schneider Electric

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Safety Information

Important Information

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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.

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⚠ 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

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About the Book
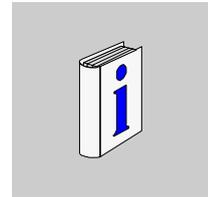
At a Glance

Document Scope

This guide describes the specific functionality of the STB NIB 2212, the Advantys STB standard interface module to an INTERBUS network. To assist you with setting up your Advantys STB island on an INTERBUS network, extensive, real-world INTERBUS application examples are included. These instructions assume the reader has a working familiarity with the INTERBUS fieldbus protocol.

This guide includes the following information about the STB NIB 2212:
- role in an INTERBUS network
- role as the gateway to Advantys STB island
- external and internal interfaces
- flash memory and removable memory
- integrated power supply
- auto-configuration
- saving configuration data
- island bus scanner functionality
- data exchange between the island and the master
- 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 Digial 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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Introduction

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Introduction

This chapter describes the STB NIB 2212 Advantys STB standard INTERBUS network interface module and its support for the island as an INTERBUS network node.

The chapter begins with an introduction to 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 INTERBUS fieldbus protocol.

What's in this Chapter?

This chapter contains the following topics:

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 *(see page 32)*. (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:
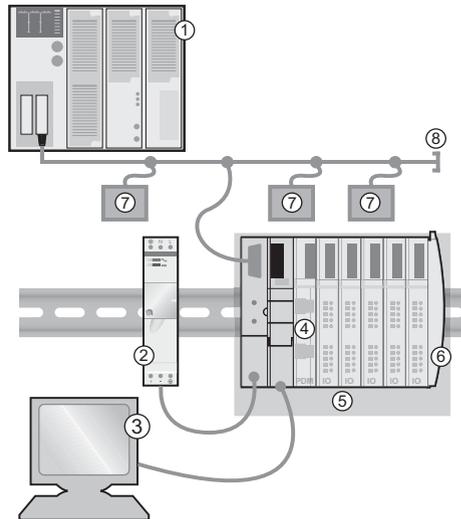
1   fieldbus master
2   external 24 VDC power supply, the source for logic power on the island
3   external device connected to the CFG port (a computer running the Advantys Configuration Software or an HMI panel)
4   power distribution module (PDM): provides field power to the I/O modules
5   island 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 100*x* cable that extend the island communication bus from the previous segment to the next BOS module:
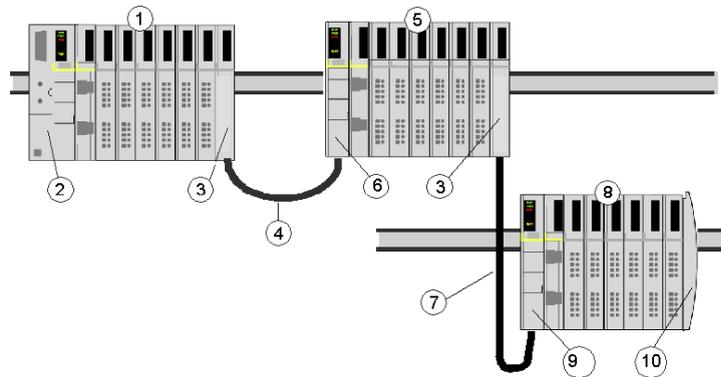
1 primary segment
2 NIM
3 STB XBE 1100 EOS bus extension module(s)
4 1 m length STB XCA 1002 bus extension cable
5 first extension segment
6 STB XBE 1300 BOS bus extension module for the first extension segment
7 4.5 m length STB XCA 1003 bus extension cable
8 second extension segment
9 STB XBE 1300 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 100*x* 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:
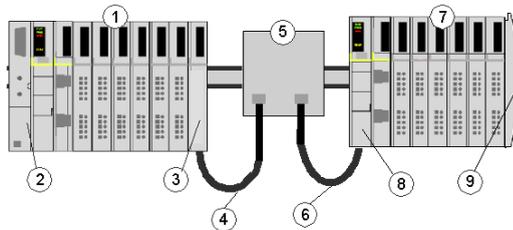
1 primary segment
2 NIM
3 STB XBE 1100 EOS bus extension module
4 1 m length STB XCA 1002 bus extension cable
5 preferred module
6 1 m length STB XCA 1002 bus extension cable
7 extension segment of Advantys STB I/O modules
8 STB XBE 1300 BOS bus extension module for the extension segment
9 STB XMP 1100 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:
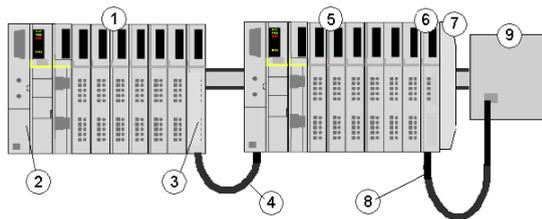
1 primary segment
2 NIM
3 STB XBE 1100 EOS bus extension module
4 1 m length STB XCA 1002 bus extension cable
5 extension segment
6 STB XBE 2100 CANopen extension module
7 STB XMP 1100 termination plate
8 typical CANopen cable
9 enhanced CANopen device with 120 Ω termination

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 INTERBUS

Introduction

INTERBUS implements a master/slave network model. It can communicate with up to 512 nodes over a distance of 12.8 km, and can read 1024 inputs and write 1024 outputs in 4 ms. Despite exceptional configuration flexibility, system performance and the reliability of I/O data have not been compromised.

Each network slave has an *in* connector for receiving data and an *out* connector for transmitting data on the ring. The last device (sometimes having no *out* connector) automatically closes and terminates the network ring.

Components of a simplified INTERBUS network are shown in the figure below:
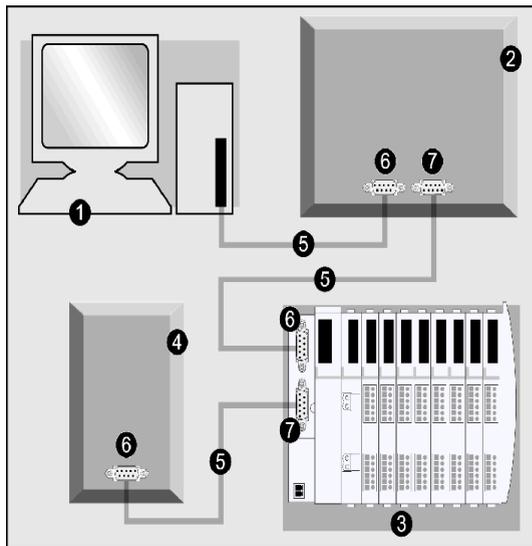
1 PC/PLC
2 slave device
3 Advantys STB island with INTERBUS NIM at the head
4 slave device
5 INTERBUS network cable
6 in connection (receive)
7 out connection (transmit)

INTERBUS Club is the supporting trade association that creates specifications for INTERBUS networks and devices.

NOTE: For more on standard INTERBUS specifications and mechanisms, refer to *www.interbusclub.com*.

Physical Layer

The physical layer contains a single twisted pair of shielded wires. The STB NIB 2212 INTERBUS implements the SUPI 3 (serial universal peripheral interface) ASIC from Phoenix Contact.

Network Topology

The INTERBUS network observes a master/slave model with active ring topology, having all devices integrated in a closed transmission path. There are three types of bus structures in the ring:

- *remote bus*—The Advantys STB island (with an STB NIB 2212 INTERBUS NIM at the head) connects to this section. Remote bus characteristics include:
  - 12.8 km (maximum) network length
  - 512 possible connections
  - 400 m (maximum) between devices
  - 256 devices (maximum)

- *local bus* (not supported)—The local bus ring is used to connect I/O devices in a remote substation enclosure. Local bus characteristics include:
  - 8 devices (maximum)
  - 1.5 m (maximum) between devices
  - 10 m (maximum) network length
  - 800 mA (maximum) current

- *sensor loop*—The sensor loop is connected directly to sensors and actuators without the use of bridge routers. Sensor loop characteristics include:
  - 1 unshielded pair (+ 24 V)
  - 32 devices (maximum)
  - 10 m (maximum) network length

NOTE: An Advantys STB island with an INTERBUS NIM head can be implemented only as a remote bus node.

Transmission Media

While it is possible to connect INTERBUS devices with a variety of media (fiber optics, SMG, etc.), the STB NIB 2212 NIM only supports networks that are connected with twisted pair copper wiring (RS-485). Network connectors (*in* and *out*) are 9-pin SUB-D *(see page 25)* types. The TDMA transmission method is implemented for transmission rates of 500 kbits/s.

Node Addressing

The INTERBUS master device is self-configuring because INTERBUS slave devices are auto-addressed according to their sequence in a serial ring structure. The master identifies read/write data in terms of a node's relative position in the ring, not by a fixed address. The sequential location of slaves corresponds to the order of input and output data in the master's buffer.

The ring structure uses a distributed shift register. In a single bus cycle, data from the master to the slaves (and from the slaves to the master) is transferred. The cycle ends when the loop back word is returned to the master. Each node is a component on the shift register ring on which data is circulated.

The NIM's EDS

For a particular device to be recognized on your network, a corresponding electronic data sheet (EDS) file must be exported to your master device. This ASCII file contains information about a device's:
- *identity*—the node's classification is presented in terms of the manufacturer code
- *data size*—the master's input buffer must account for the amount of data expected from the device

NIM Limitations

The standard STB NIB 2212 INTERBUS NIM supports up to 16 words of INTERBUS cyclic data. It does not support the parameter communication protocol (PCP).

The STB NIB 2212 NIM Module

2

Introduction

This chapter describes the STB NIB 2212 standard NIM's external features, connections, power requirements, and product specifications.

What's in this Chapter?

This chapter contains the following topics:

External Features of the STB NIB 2212 NIM

Introduction

The physical features critical to STB NIB 2212 INTERBUS NIM operations are called out in the illustration below:
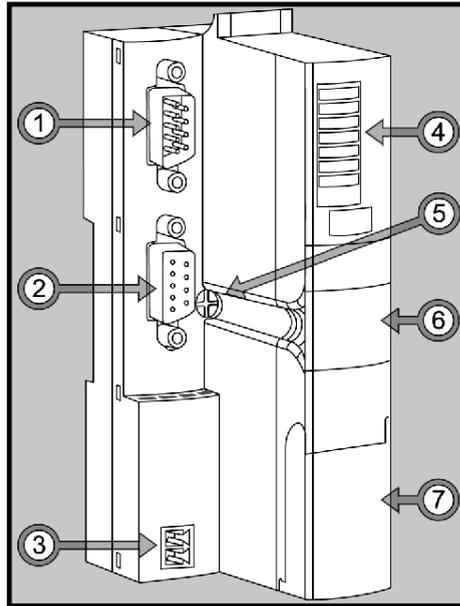
The features in the above illustration are described briefly in the following table:

Feature	Function
1	fieldbus interface *(see page 25)* (in)	Nine-pin SUB-D (male) connector used for the incoming INTERBUS fieldbus network cable.
2	fieldbus interface *(see page 25)* (out)	Nine-pin SUB-D (female) connector used for the outgoing INTERBUS fieldbus network cable.
3	power supply interface *(see page 35)*	A two-receptacle connector *(see page 35)* for connecting an external 24 VDC power supply to the NIM.
4	LED array *(see page 27)*	Colored LEDs that use various patterns to visually indicate the operational status of the island bus.
5	release screw	A mechanism used to remove the NIM from the DIN rail. (See the *Advantys STB System Planning and Installation Guide* for details.)

	Feature	Function
6	removable memory card drawer	A plastic drawer in which a removable memory card *(see page 47)* can be seated and then inserted into the NIM.
7	CFG *(see page 32)* port cover	A hinged flap on the NIM's front panel that covers the CFG interface *(see page 32)* and the RST button *(see page 53)*.

Housing Shape

The L-shaped external housing of the NIM is designed to accommodate the attachment of the in and out INTERBUS network connectors without raising the depth profile of the island:
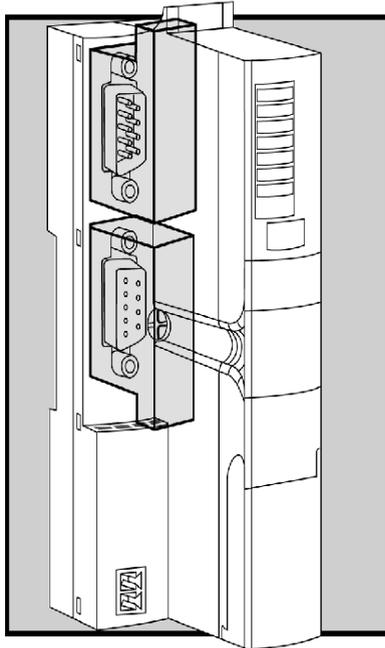
1   space reserved for the network connectors
2   NIM housing

Explosive Environments

The STB NIB 2212 module is ATEX and FM certified for use in hazardous locations where potentially explosive atmospheres may exist. For details see Explosive Environments in the *Advantys STB System Planning and Installation Guide* (890 USE 171).

⚠ DANGER

EXPLOSIVE ENVIRONMENT HAZARD

Do not substitute components which may impair suitability for ATEX Ex or FM Class 1 Division 2 certifications.

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

STB NIB 2212 Fieldbus Interface

Summary

The fieldbus interface on the STB NIB 2212 is the point of connection between an Advantys STB island bus and the INTERBUS network. Like every INTERBUS node, the NIM has two nine-pin SUB-D connectors for data reception (*in*) and transmission (*out*). The connectors are located on the face of the NIM.

Fieldbus Port Connections

The *in* and *out* fieldbus interfaces are located on the front of the INTERBUS NIM at the top:
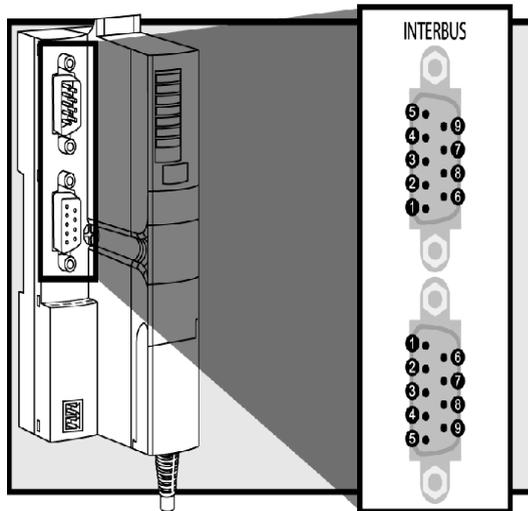
It is recommended that you use 9-pin SUB-D connectors compliant with INTERBUS Club or corresponding international standard.

The *in* connector is optically isolated. The signal level is according to EIA RS-485.

The pin-out for both the *in* (upper) and *out* (lower) connectors should be according to the table below (pin numbers correspond to callouts in the figure above):

Pin	Signal (in)	Signal (out)
1	DO1	DO2
2	DI1	DI2
3	GND1	GND
4	unused	unused
5	+5 V1	+5 V

Pin	Signal (in)	Signal (out)
6	/DO1	/DO2
7	/DI1	/DI2
8	unused	unused
9	unused	RBST (see note below)

NOTE: The RBST pin detects the presence of a subsequent node on the ring. In the absence of this detection (or if the node has no *out* connector at all), the network ring is closed.

INTERBUS Networking Cable and Connectors

The drop cable from the fieldbus to the Advantys STB INTERBUS NIM (and the one from the NIM to the next INTERBUS node) must have connectors that observe this pin assignment scheme. INTERBUS networking cables are shielded, twisted-pair electrical cables, compliant with INTERBUS standard DR-303-1. There should not be an interruption to any wire in bus cables. This allows for a future specification for use of reserved pins.

LED Physical Description

Overview

The seven LEDs implemented in the STB NIB 2212 INTERBUS NIM are visual indications of the operating status of the island bus on an INTERBUS network. The LED array is located at the top of the NIM front bezel.

General Indications

The following LEDs indicate the status of data exchange between the INTERBUS fieldbus master and the Advantys island bus:

- LED 4: RC (remote bus check)
- LED 5: BA (bus active)
- LED 6: RD (remote bus disabled)

The following LEDs indicate activity or events on the NIM *(see page 29)*:

- LED 1: RUN
- LED 2: PWR/UL
- LED 3: ERR
- LED 7: TEST

Location

The seven LEDs are located on the front of the NIM:
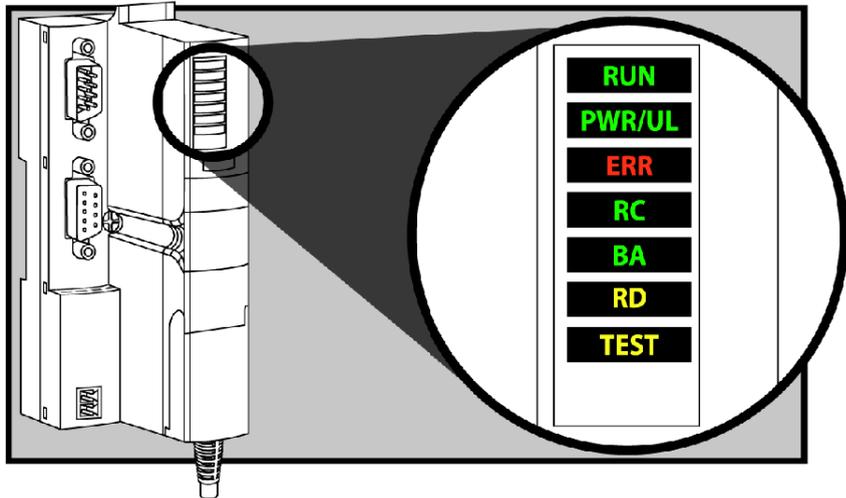
Using the LED Tables

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 29)* If the *PWR* LED is off, logic power *(see page 37)* to the NIM is off or insufficient.

INTERBUS Communications LEDs

The following table describes the indicated condition(s) and the colors and blink patterns that the RC (*remote bus check*), BA (*bus active*), and RD (*remote bus disabled*) LEDs use to show normal operations and error conditions for an Advantys INTERBUS NIM on an INTERBUS fieldbus.

Label	Pattern	Meaning
BA (green)	on	The module is transmitting data messages on the network.
	off	The module is not transmitting data messages on the network.
RC (green)	on	The island's incoming bus is correctly connected, and the bus master device is not sending a bus reset signal.
	off	The island's incoming bus is not correctly connected, or the bus master device is sending a bus reset signal.
RD (yellow)	on	The island's outgoing bus is disabled.
	off	The island's outgoing bus is enabled.

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 37)* 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 *(see page 50)*.
		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 *(see page 43)* or auto-configuring *(see page 46)* 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: ● internal condition ● wrong module ID ● device did not auto-address *(see page 44)* ● mandatory module is incorrectly configured *(see page 96)* ● process image is not valid ● device is incorrectly configured *(see page 46)* ● 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.)
1 The TEST LED is on temporarily during the Flash overwrite process.			
2 The TEST LED is on steadily while the device connected to the CFG port is in control.			

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 53)* 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 47)* and insert the card in its drawer in the NIM.

You can also password-protect a configuration *(see page 106)*. 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:
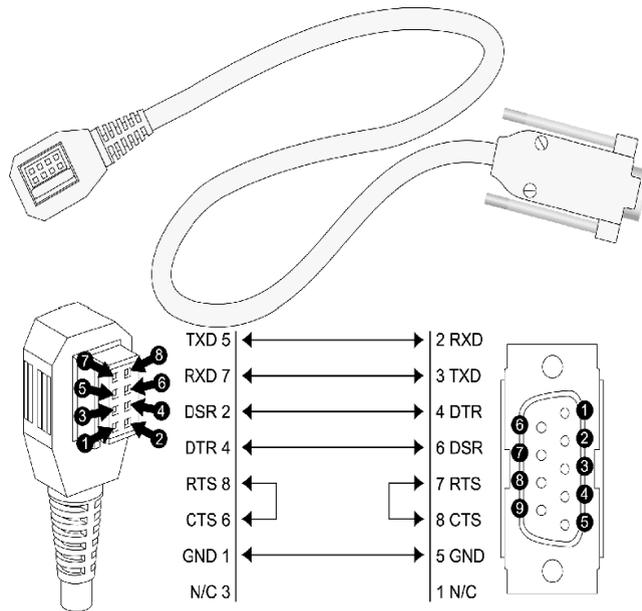
TXD transmit data
RXD receive data
DSR data set ready
DTR data terminal ready
RTS request to send
CTS clear to send
GND ground reference
N/C not connected

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	● 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:
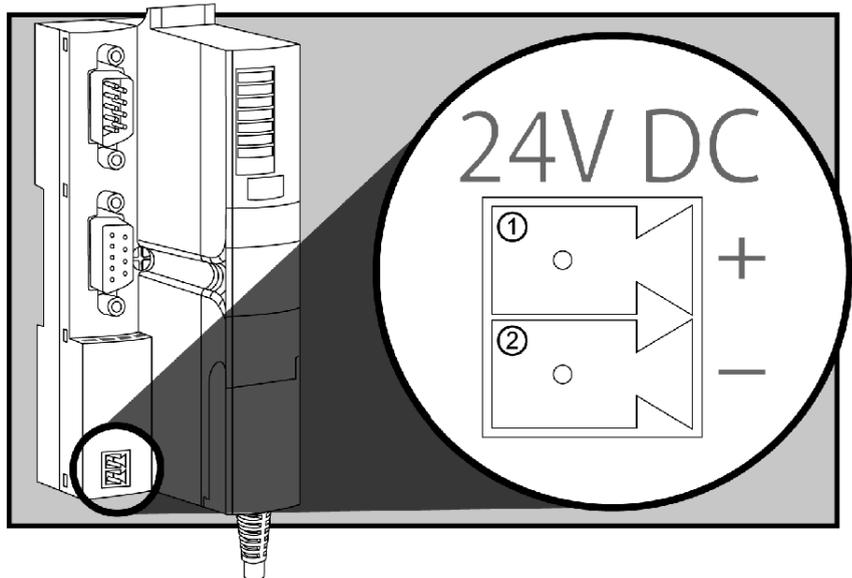
1   receptacle 1—24 VDC
2   receptacle 2—common

Connectors

Screw-type and spring-type connectors are provided with the NIM. Replacement connectors are also available.

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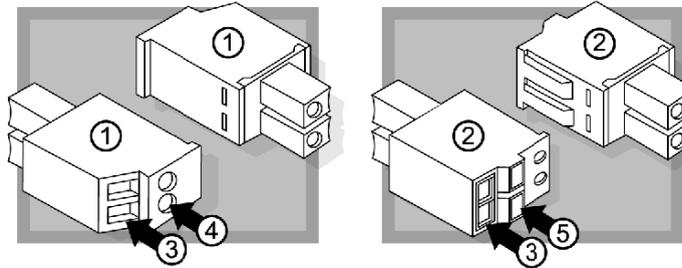
1   STB XTS 1120 screw-type power connector
2   STB XTS 2120 spring clamp power connector
3   wire entry slot
4   screw clamp access
5   spring clamp actuation button

Each entry slot accepts a wire in the range 0.14 to 1.5 mm^2 (28 to 16 AWG).

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 39)* 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:
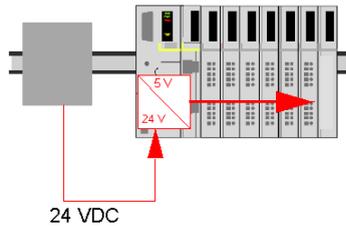
24 VDC

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

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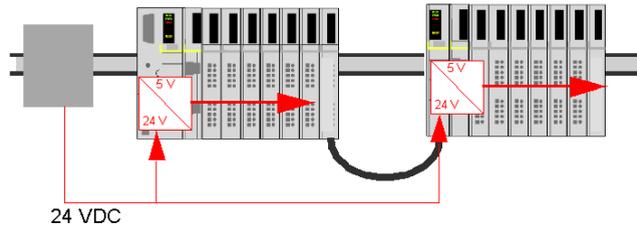
The logic power signal is terminated in the STB XBE 1100 module at the end of the segment (EOS).

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 38)* 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:
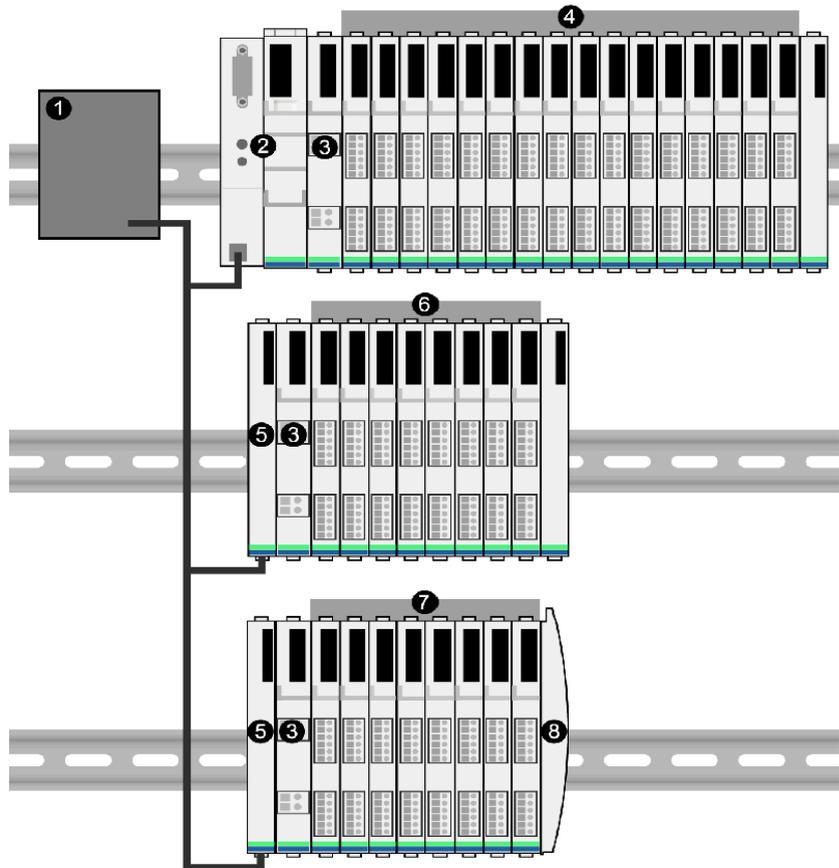
1 24 VDC source power supply
2 NIM
3 PDM
4 primary segment I/O modules
5 BOS module
6 first extension segment I/O modules
7 second extension segment I/O modules
8 island bus terminator plate

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 Detail

The following table lists the system specifications for the STB NIB 2212 INTERBUS NIM:

General Specifications		
dimensions	width	40.5 mm (1.59 in)
	height	130 mm (5.12 in)
	depth	70 mm (3.15 in)
interface connectors	from INTERBUS network	nine-pin SUB-D connector (male)
	to INTERBUS network	nine-pin SUB-D connector (female)
	RS-232 port for configuration software or HMI panel	8-receptacle HE-13
	to external 24 VDC power supply	2-receptacle
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 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 supported	per segment	16 maximum
	per island	32 maximum
segments supported	primary (required)	one
	extension (optional)	six maximum
standards	INTERBUS conformance	INTERBUS Club (*www.ibsclub.com*)
	MTBF	200,000 hours GB (ground benign)
storage temperature		-40 to 85° C
operating temperature range*		0 to 60° C
agency certifications		refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171 00*
*This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171 00* for a complete summary of cabalities and limitations.		

How to Configure the Island

<div style="text-align: right">

3

</div>

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:

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:
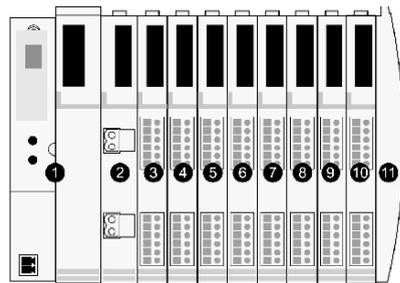
1 NIM
2 STB PDT 3100 (24 VDC power distribution module)

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 53)*.
● 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 99)*
● 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 105)*, 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	Punch out the removable memory card from the plastic card on which it is shipped. removable memory card Make sure that the edges of the card are smooth after you punch it out.
2	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.
3	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.
4	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.
5	Close the drawer.
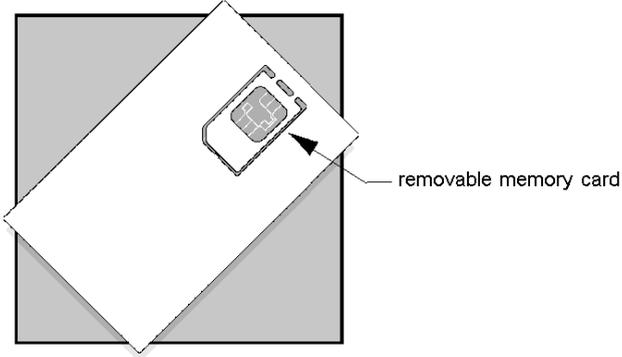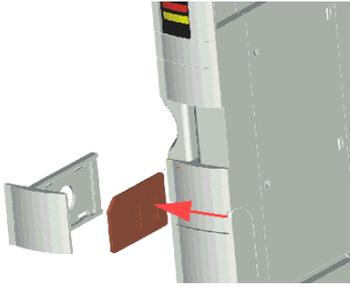
Removing the Card

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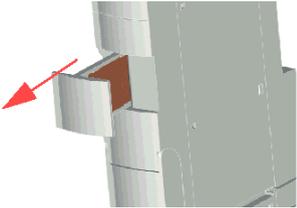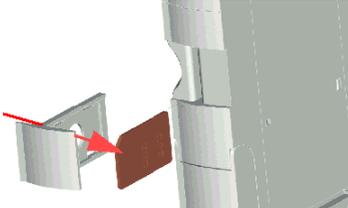
Using the STB XMP 4440 Optional Removable Memory Card to Configure the Island

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 106)*, 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 105)* 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 *(see page 47)*.	
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 *(see page 106)*, 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 32)*. *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 *edit*.
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 50)*.

Physical Description

⚠ **CAUTION**
UNINTENDED EQUIPMENT OPERATION/CONFIGURATION OVERWRIT-TEN—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 32)*, and behind the same hinged cover:
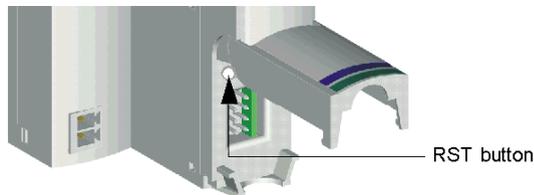
RST button

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

<table>
<tr><td>

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION/CONFIGURATION DATA OVER-WRITTEN—RST BUTTON

Do not attempt to restart the island by pushing the RST button. Pushing the RST button *(see page 53)* causes the island bus to reconfigure itself with factory default operating parameters.

Failure to follow these instructions can result in injury or equipment damage.
</td></tr>
</table>

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 53)* for at least two seconds. The RST button is enabled only in edit mode. In protected mode *(see page 106)*, 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 32)*.
- Add a new I/O module to a previously auto-configured *(see page 46)* 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 *(see page 49)*.
2	Place the island in edit mode *(see page 50)*.
3	Hold the RST button *(see page 53)* 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 *(see page 44)* 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 *(see page 32)*.
4	It re-initializes the island bus and brings it into operational mode.

Fieldbus Communications Support

4

Introduction

This chapter describes how the INTERBUS master sets up communications between itself and an Advantys STB island bus. The chapter describes the parameterization, configuration, and diagnostics services that are performed in order to configure the island bus as a node on an INTERBUS network.

To communicate with an Advantys STB island, the INTERBUS master sends output data across its network to the STB NIB 2212 INTERBUS NIM. The NIM transfers this output data from the master across the island bus to the destination output modules. The NIM will collect input data from the island bus I/O modules. That data is transmitted in bit-packed format over the INTERBUS network to the fieldbus master.

What's in this Chapter?

This chapter contains the following topics:

The INTERBUS ID Code

Introduction

In the simplest terms, the INTERBUS ID code is a 16-bit word that describes the data type and data length of network devices.

The ID cycle is part of the INTERBUS network's initialization process. After determining the length of its own data during network initialization, every network device reports its functionality and byte length in the two-byte ID code.

The ID code also includes information about the module type (digital/analog, input/output/mixed).

The Low and High Bytes

The ID code's data type is transmitted in the ID code's low byte, while data length and message information is reported in the high byte:
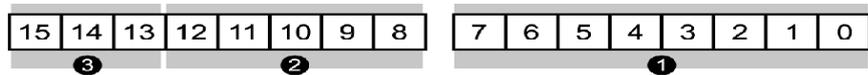
1 data type (03h, 33h)
2 data length (0 to 16 words)
3 messages (for management functions)

Data Type

The INTERBUS NIM identifies the device's data type by recognizing one of two data types:

Data Type	Signal Direction	Signal Type
03h	input/output	digital
33h	input/output	analog or mixed

NOTE: Data from the HMI panel is analog.

Data Length

The following table shows the relationship between the actual data length of the island and the length of the code on INTERBUS. The actual data length (anywhere from 0 to 16 words) represents the greater of the input or output data length.

Actual Length of Island Data	INTERBUS Data Length	Data Length Code (Hex)
up to 1 word*	1 word	1
2 words	2 words	2
3 words	3 words	3
4 words	4 words	4
5 words	5 words	5
6 words	6 words	E
7 words	7 words	F
8 words	8 words	6
9 words	9 words	7
10 words	10 words	15
11 to 12 words	12 words	16
13 to 14 words	14 words	17
15 to 16 words	16 words	12
17 to 24 words**	24 words	13
25 to 26 words*	26 words	11
* The status word is included in the data length, so the minimum allowable data length for an Advantys island is 2 words (data word + status word).		
** The STB NIB 2212 INTERBUS NIM supports only up to 16 words in each direction (input/output).		

Data Exchange

Introduction

This topic discusses the manner in which bit packed process image data is exchanged between the STB NIB 2212 NIM and an INTERBUS fieldbus master.

NOTE: In this discussion, *data* and *words* described as *input* and *output* are defined relative to the master. For example, the master receives *input* data and transmits *output* data.

Data and Status Objects

Data exchange between the island and the INTERBUS fieldbus master involves three types of objects:

- *data objects*—operating values the INTERBUS master either reads from the input modules or writes to the output modules
- *status objects*—module health records sent by I/O modules and read by the INTERBUS master
- *echo output data objects*—sent by digital object modules to the INTERBUS master; these objects are usually a copy of the data objects, but they can contain useful information when a digital output point is configured to handle the result of a reflex action

The following table shows the relationship between different object types and different module types. It also shows the size of the different objects:

Module Type		Objects in the Input Data Image		Objects in the Output Data Image	
		Objects	Size	Objects	Size
digital input		data	1 byte or less	does not apply	
		status*	1 byte or less	does not apply	
digital output		echo output data	1 byte or less	data	1 byte or less
		status*	1 byte or less	does not apply	
analog input	channel 1	data	2 bytes	does not apply	
		status	1 byte	does not apply	
	channel 2	data	2 bytes	does not apply	
		status	1 byte	does not apply	
analog output	channel 1	status	1 byte	data	2 bytes
	channel 2	status	1 byte	data	2 bytes
*Not available for every module. Check *The Advantys Hardware Components Reference Guide* (890 USE 172 00) for relevant modules.					

The Internal Process Image

The STB NIB 2212's process image contains memory areas (buffers) for the temporary storage of input and output data. The internal process image is part of the NIM's island bus scanner area.

The island bus manages data exchange in both directions:
- *input data from the island bus*—The island bus scanner operates continuously, gathering data as well as status and confirmation bits and putting them into the process image's input buffer.
- *output data to the island bus*—The island bus scanner handles output data and places it in the process image's output buffer.

Input data and output data are assembled in the order of the island bus I/O modules (from left to right).

Word Boundaries and Bit Packing

Every entry in the process image is in a multiple-word format. If modules on the island bus have input or output data entries that are not multiple words, the corresponding word in the process image is moved to the next word boundary.

For example, a module with one bit of output data starts on a word boundary in the process image's output data buffer. The next process image entry starts on the next word boundary, thereby transmitting 15 unused bits of the module's first word, resulting in latency during data transmission on the fieldbus.

Bit packing allows bits of data on the fieldbus from different digital I/O modules to be put together in a single byte, resulting in optimized bandwidth.

Bit Packing Rules

The STB NIB 2212 NIM observes the following rules for the bit packing of the external process image:
- The input and output process image sizes are limited to 16 words each.
- The first word of the input process image contains NIM status information. The first word of the output process image contains the NIM control word.
- Bit packing follows the addressing order of the island bus I/O modules, from left to right starting with the primary segment.
- The data object (or echo output data object) for a specific module precedes the status object for that module.
- Status objects and data objects for the same or different I/O module may be packed in the same word if the size of the combined objects is 16 bits or less.
- If the combination of objects requires more than 16 bits, the objects will be placed in separate contiguous bytes. A single object cannot be split over two word boundaries.
- For analog input modules, channel 1 data is followed immediately by channel 1 status, then channel 2 data and channel 2 status.

Input and Output Data Exchange

The application of the INTERBUS bit packing rules to the sample island
(see page 78) assembly (in the *Applications Example* chapter) will result in 4 words
of output data and 10 words of input data. The tables that follow show how digital
data is bit packed for optimization, and how data, status, and echo output data (from
outputs) appear in the PLC as the same data type (*digital input data*). In these
tables, *N* refers to the island node number. That is, *N1* represents the first
addressable node (module) on the sample island bus, *N2* the second, and so forth.

Output Data Exchange

The following table shows how the 4 words of the sample island *(see page 78)*
assembly output data process image are organized after applying the bit packing
rules:

	Bit Number															
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	NIM control word															
2	empty (set to 0)				N6 output data				N4 output data				N2 output data			
3	N8 (channel 1) analog output data															
4	N8 (channel 2) analog output data															

Input Data Exchange

The following table shows how the 10 words of the sample island *(see page 78)*
assembly output data process image are organized after applying the bit packing
rules (the first word contains the NIM status):

	Bit Number															
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	NIM status															
2	N3 input status				N3 input data				N2 output status		N2 output echo		N1 input status		N1 input data	
3	empty (set to 0)		N5 input data						N4 output status				N4 output echo			
4	empty (set to 0)				N6 output echo				N5 input status							
5	empty (set to 0)								N6 output status							
6	N7 (channel 1) analog input data															
7	empty (set to 0)								N7 (channel 1) analog input status							
8	N7 (channel 2) analog input data															
9	N8 (channel 1) analog output status								N7 (channel 2) analog input status							
10	empty (set to 0)								N8 (channel 2) analog output status							

Control and Status Words

Introduction

Understanding the manner in which the INTERBUS master's *control* word corresponds to the NIM's *status* word is crucial to gathering diagnostic information from the STB Advantys island. Output image and input image are defined relative to the master.

When the INTERBUS master requests diagnostic data from the island, the requested information will be delivered in the low byte of the NIM's status word.

NOTE: In this discussion, *input* and *output* describe the process image from the master device's perspective. For example, the master receives the *input* process image and transmits the *output* process image.

Control Word

The control word is the first word in the output image. By setting the word's output, the INTERBUS master can select up to 256 bytes of status information from the NIM. Because the NIM control word is treated like a data word, you can choose different status information at the application program level.

Status Word

The status word is the first word in the input image. The NIM automatically responds to the master's control word by providing the requested data in the low byte of its status word.

Process Data Flow

During data exchange, the master writes the output image, including the control word. The high byte of the master's control word specifies the information requested from slave devices. The slaves respond with a status word in which the high byte (selector) value corresponds to that of the control word.

The correspondence of high byte values for the *control* and *status* words are shown in the following figure:
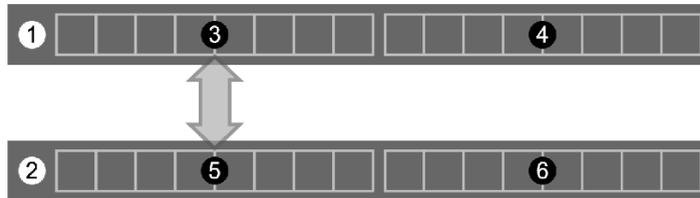
1   output image control word (written by the master)
2   input image status word (transmitted by the NIM)
3   control word high byte (selector)
4   control word low byte (inconsequential value)
5   status word high byte (selector)
6   status word low byte (contains the information requested by the master)

The default control word value (0) will return NIM status and diagnostics information in the low byte of the status word.

Status Range

The selector addresses one byte in the status range from the following table:

Status Byte	Selector	Description
NIM status	0h	NIM status and diagnostics info
global diagnostics		indicates the occurrence of a fatal error or the detection of a network error (also reports local island bus errors)
	1h	low byte
	2h	high byte
island bus diagnostics	3h	diagnostics on the island bus
island bus state	4h	the communication state and diagnostics of the island bus
node configured data	5h–14h	characterizes every node as configured or not configured
node assembly fault	15h–24h	characterizes every node as deviating from its configured and expected state
node operational	25h–34h	characterizes every module station as active or inactive
node error	35h–44h	characterizes every device in which an unresolved internal error has occurred
device information	45h	NIM type
WLF node	46h	node that exceeds word limitation
f/w version	47h	major firmware revision (low byte)
f/w version	48h	major firmware revision (high byte)
f/w version	49h	minor firmware revision (low byte)
f/w version	4Ah	minor firmware revision (high byte)
NIM device status	4Bh	NIM status (valid for firmware 2.0 and higher, otherwise reserved)
—	4Ch . . . FFh	reserved (set to 0)

Diagnostic Data

Introduction

This topic discusses the diagnostic and error data for the Advantys STB NIB 2212 INTERBUS NIM.

For a status word's given selector value, the corresponding information is transmitted in the word's low byte.

NIM Status (Selector 00h)

When the selector value is 00, *NIM status* low byte information is transmitted as the status word's low byte value:

Bit	Meaning of Value
D0	device failure
	1 = any module on the island bus has failed
	0 = no module failure
D1	internal failure
	1 = any global diagnostic bit (except *RESET*) is set
	0 = all global diagnostic bits are set to 0
D2	word length failure
	1 = output or input data length exceeds its respective word limits
	0 = output and input data lengths are within their respective word limits
D3	protected mode
	1 = NIM in protected mode—RST button is disabled and the island configuration requires a password to write to it
	0 = NIM not in protected mode—RST button is enabled and the island configuration is not password-protected
D4, D5, D6	error code
	0x00 = no error
	0x01 = self-test failed—ID code does not match first initialization, power reset required
	0x02 = at least one global bit has been set
	0x03 = expired request timer
	0x04 = empty assembly list
	0x05 = expired confirm timer
	0x06 = wrong island bus state at initialization
	0x07 = an error code higher than 0x07 (reserved)

Bit	Meaning of Value
D7	1 = Advantys configuration software is controlling the output data of the island's process image
	0 = fieldbus master is controlling the output data of the island's process image

When one of the above errors occurs (except D3, protected mode), the NIM reports a *module error* to the INTERBUS network master. The user can then initiate an appropriate action.

Global Diagnostics (Selector 01h, 02h)

Global diagnostics provide the error/status information for internal island bus operations. The *global diagnostics* array is composed of a low byte and a high byte.

When the selector value is 01, *global diagnostics* low byte information is transmitted as the status word's low byte value:

Bit	Meaning
D0*	*fatal error*—Because of the severity, no further communications are possible on the island bus.
D1*	*module ID error*—A standard CANopen device is using a module ID reserved for the Advantys STB modules.
D2*	Auto-addressing *(see page 44)* has failed.
D3*	Mandatory module configuration error.
D4*	*process image error*—Either the process image configuration is inconsistent or it could not be set during auto-configuration.
D5*	*auto-configuration error*—A module has been detected out of order and the NIM can not complete auto-configuration.
D6	Island bus management error detected by the NIM.
D7*	*assignment error*—The initialization process in the NIM has detected a module assignment error, possibly the result of application parameter mismatches.
*fatal NIM errors	

When the selector value is 02, *global diagnostics* high byte information is transmitted as the status word's low byte value:

Bit	Meaning
D0*	internal triggering protocol error
D1*	module data length error
D2*	module configuration error
D3	application parameter error
D4	application parameter services or timeout error
D5	reserved
D6	reserved
D7	reserved
*fatal NIM errors	

NOTE: Errors marked with an asterisk (*) in the *global diagnostics* tables are fatal NIM errors. They are caused by internal errors related to either the NIM or a failure in the island configuration software or hardware.

The detection of these errors will result in the stopping of the island bus. The only ways to get out of this error state are to cycle the power, reset the island, or clear the error with the Advantys configuration software.

Communications Diagnostics (Selector 03h)

When the selector value is 03, the *communications diagnostic* information is transmitted as the status word's low byte value:

Communication Diagnostic	Meaning of Value
D0*	1 = low-priority receive queue software overrun error
D1*	1 = NIM overrun error
D2*	1 = island bus-off error
D3*	1 = NIM's error counter has reached the warning level and error status bit has been set
D4	1 = NIM error status bit has been reset
D5*	1 = low-priority transfer queue software overrun error
D6*	1 = high-priority receive queue software overrun error
D7*	1 = high-priority transfer queue software overrun error
*fatal NIM errors	

Island Bus State (Selector 04h)

The *island bus state* represents the main states of the island bus scanner, the firmware that drives the island bus.

When the selector value is 04, the *island bus state* information is transmitted as the status word's low byte value:

Byte Value	Meaning
00h	The island is initializing.
40h	The island bus has been set to pre-operational mode, for example, by the reset function in the Advantys STB configuration software.
60h	*NIM is configuring or auto-configuring*—Communication to all modules is reset.
61h	*NIM is configuring or auto-configuring*—Checking the module ID.
62h	The NIM is auto-addressing the island.
63h	*NIM is configuring or auto-configuring*—Bootup is in progress.
64h	The process image is being set up.
80h	Initialization is complete, the island bus is configured, the configuration matches, and the island bus is not started.
81h	*configuration mismatch*—Non-mandatory or unexpected modules in the configuration do not match and the island bus is not started.
82h	*configuration mismatch*—At least one mandatory module does not match and the island bus is not started.
83h	*serious configuration mismatch*—The island bus is set to pre-operational mode and initialization is aborted.
A0h	The configuration matches and the island bus is operating.
A1h	Island is operational with a configuration mismatch. At least one standard module does not match, but all mandatory modules are present and operating.
A2h	*serious configuration mismatch*—The island bus was started but is now in pre-operational mode because of one or more mismatched mandatory module(s).
A4h*	Nodes are individually set to operational through a *Run network* or *Start heartbeat* request.
A5h*	Nodes are individually set to operational. The last missing mandatory module has been successfully booted but there are missing optional or unexpected modules.
C0h	Island has been set to pre-operational mode, for example, the stop function in the Advantys STB configuration software.
*Transient state—When this segmented transmission is complete, the island bus is updated.	

Node Configured (Selector 05h–14h)

Node configured is an array of 8 words. Each bit represents one specific addressable I/O module on the island bus.

- A value of 1 in a bit position indicates that the corresponding module is configured in the island system.
- A value of 0 indicates that the node is not configured as a slave to the master.

When the selector value is from 05h to 14h, information about a particular module's configuration (according to the following table) is transmitted as the status word's low byte value:

Selector Value	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Status Data
05h	8	7	6	5	4	3	2	1	modules 1–8
06h	16	15	14	13	12	11	10	9	modules 9–16
07h	24	23	22	21	20	19	18	17	modules 17–24
08h	32	31	30	29	28	27	26	25	modules 25–32
. . .									
13h	120	119	118	117	116	115	114	113	modules 113–120
14h		127	126	125	124	123	122	121	modules 121–127

The INTERBUS NIM supports a maximum of 32 modules. The first four bytes (05h–08h) provide the 32 bits that represent the module locations in a typical island configuration. The remaining diagnostic bytes are available to support island expansion capabilities.

Node Assembly Fault (Selector 15h–24h)

Node assembly fault is an array of 8 words. Each bit represents one specific module (node) on the island bus. If the configuration of a module mismatches, the corresponding bit is set:

- A value of 1 in a bit position indicates 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 in its configured location.

When the selector value is from 15h to 24h, information about a particular module's assembly fault (according to the following table) is transmitted as the status word's low byte value:

Selector Value	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Status Data
15h	8	7	6	5	4	3	2	1	modules 1–8
16h	16	15	14	13	12	11	10	9	modules 9–16
17h	24	23	22	21	20	19	18	17	modules 17–24
18h	32	31	30	29	28	27	26	25	modules 25–32

Selector Value	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Status Data
. . .									
23h	120	119	118	117	116	115	114	113	modules 113–120
24h		127	126	125	124	123	122	121	modules 121–127

The INTERBUS NIM supports a maximum of 32 modules. The first four bytes (15h–18h) provide the 32 bits that represent the module locations in a typical island configuration. The remaining diagnostic bytes are available to support island expansion capabilities.

Node Operational (Selector 25h–34h)

Node operational is an array of 8 words. Each bit represents one specific addressable I/O module on the island bus.

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

When the selector value is from 25h to 34h, information about a particular module's operational status (according to the following table) is transmitted as the status word's low byte value:

Selector Value	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Status Data
25h	8	7	6	5	4	3	2	1	modules 1–8
26h	16	15	14	13	12	11	10	9	modules 9–16
27h	24	23	22	21	20	19	18	17	modules 17–24
28h	32	31	30	29	28	27	26	25	modules 25–32
. . .									
33h	120	119	118	117	116	115	114	113	modules 113–120
34h		127	126	125	124	123	122	121	modules 121–127

The INTERBUS NIM supports a maximum of 32 modules. The first four bytes (25h–28h) provide the 32 bits that represent the module locations in a typical island configuration. The remaining diagnostic bytes are available to support island expansion capabilities.

Node Error (Selector 35h–44h)

Node error is an array of 8 words. Each bit represents one specific addressable I/O module on the island bus. After the master receives an emergency message (not error-free) from a module, the corresponding bit is set:

● A value of 1 in a bit position indicates the presence of a newly received emergency message.

● A value of 0 in a bit position indicates that no values have changed since the last reading of the diagnostic buffer.

When the selector value is from 35h to 44h, information about a particular module's error message (according to the following table) is transmitted as the status word's low byte value:

Selector Value	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Status Data
35h	8	7	6	5	4	3	2	1	modules 1–8
36h	16	15	14	13	12	11	10	9	modules 9–16
37h	24	23	22	21	20	19	18	17	modules 17–24
38h	32	31	30	29	28	27	26	25	modules 25–32
. . .									
43h	120	119	118	117	116	115	114	113	modules 113–120
44h		127	126	125	124	123	122	121	modules 121–127

The INTERBUS NIM supports a maximum of 32 modules. The first four bytes (35h–38h) provide the 32 bits that represent the module locations in a typical island configuration. The remaining diagnostic bytes are available to support island expansion capabilities.

Device Information (Selector 45h)

When the selector value is 45h, device information is transmitted as the status word's low byte value according to the meaning of bits in the following table:

Bit	Meaning
D0/D1	The combined value of 2 for these two bits indicates the standard version of the INTERBUS NIM (STB NIB 2212).
	The combined value of 3 for these two bits indicates the premium version of the INTERBUS NIM.
D2*	input word limit—When set (bit value = 1), the input word length exceeds the 16-word limit. When not set (bit value = 0), the input word length is within the 16-word limit.
D3*	output word limit—When set (bit value = 1), the output word length exceeds the 16-word limit. When not set (bit value = 0), the output word length is within the 16-word limit, or bit D2 is already set.

Bit	Meaning
D4	reserved
D5	reserved
D6	reserved
D7	reserved
*Input and output word limitation failures are discussed further at *WLF Node (Selector 46h)*.	

WLF Node (Selector 46h)

When the selector value is 46h, the node ID of the module responsible for the word limit failure is sent in the status word's low byte. When the low-byte value of the status word is FFh, the HMI panel *(see page 10)* is responsible for the word limit failure.

Major F/W Version (Selector 47h, 48h)

When the selector value is 47h, the *low* byte of the NIM's major firmware revision is sent. When the selector value is 48h, the *high* byte of the NIM's major firmware revision is sent.

Minor F/W Version (Selector 49h, 4Ah)

When the selector value is 47h, the *low* byte of the NIM's minor firmware revision is sent. When the selector value is 4Ah, the *high* byte of the NIM's minor firmware revision is sent.

NIM Device Status (Selector 4Bh)

The following information is valid for firmware version 2.0 and greater; selector 4Bh is reserved in firmware version 1.0.

When the selector value is 4Bh, *NIM device status* is transmitted as the status word's low byte value:

Bit	Meaning of Value
D0	device failure
	1 = any module on the island bus has failed
	0 = no module failure
D1	internal failure
	1 = any global diagnostic bit (except *RESET*) is set
	0 = all global diagnostic bits are set to 0

Bit	Meaning of Value
D2	external failure
	1 = the problem is on the fieldbus
	0 = no problem on the fieldbus
D3	protected mode
	1 = NIM in protected mode—RST button is disabled and the island configuration requires a password to write to it
	0 = NIM not in protected mode—RST button is enabled and the island configuration is not password-protected
D4	removable memory card validity
	1 = configuration on the removable memory card is invalid
	0 = either the configuration on the removable memory card is valid or the card is not used
D5	presence of reflex actions
	1 = reflex action capability has been configured on this island
	0 = no reflex actions configured on this island
D6	hot swap indication
	1 = one or more island modules have been hot swapped (replaced); this bit may be reset only by real-time parameter access
	0 = either no modules have been hot swapped or the bit has been reset via RTP
D7	1 = Advantys configuration software is controlling the output data of the island's process image
	0 = fieldbus master is controlling the output data of the island's process image

Reserved (Selector 4Ch–FFh)

The control word's selector value range from 4Ch–FFh is reserved. The NIM responds to these selector values by setting all bits in the status word's low byte to 0.

Application Example

5
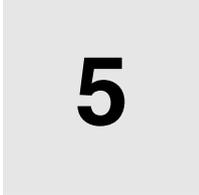
Introduction

This chapter presents two examples for configuring the Advantys STB island on an INTERBUS network. Each example implements the same sample island assembly with an Advantys STB NIB 2212 INTERBUS NIM at the head.

What's in this Chapter?

This chapter contains the following topics:

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):
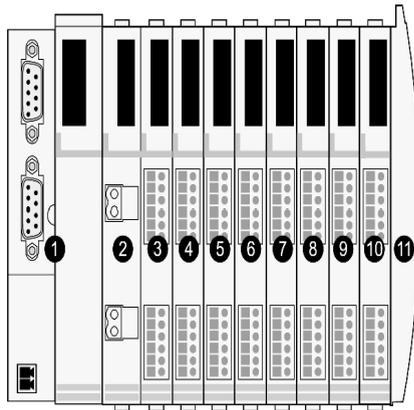
1 STB NIB 2212, INTERBUS NIM
2 STB PDT 3100, 24 VDC Power Distribution Module
3 STB DDI 3230, 24 VDC 2-channel digital input module (2 bits of data, 2 bits of status)
4 STB DDO 3200, 24 VDC 2-channel digital output module (2 bits of data, 2 bits of echo output data, 2 bits of status)
5 STB DDI 3420, 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.

Network Configuration Considerations

Introduction

This topic covers items to consider before you configure your INTERBUS network for use with an Advantys STB island.

Connection Figure

The following figure shows the connections between a master device and its slave devices on an INTERBUS network:
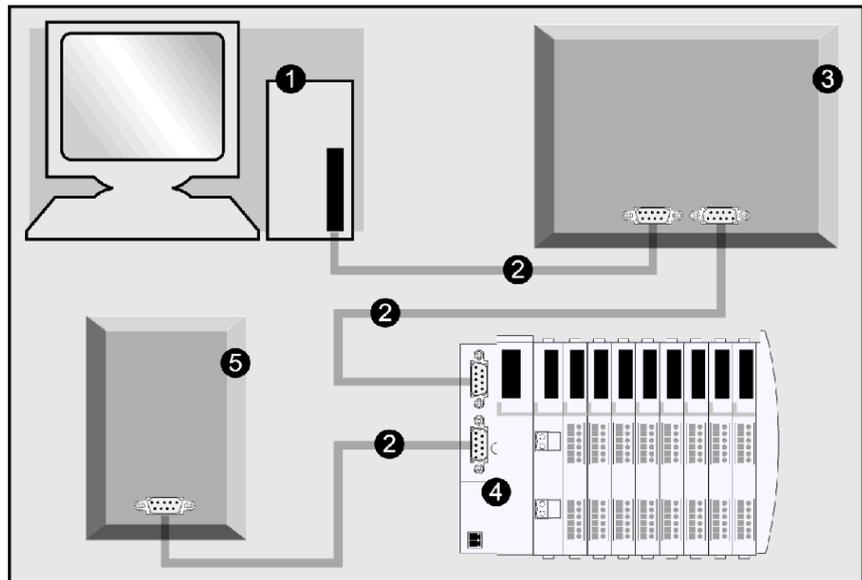
1 PC/PLC
2 INTERBUS network cable (not supplied)
3 network node
4 Advantys STB sample island assembly
5 slave device (terminating)

NOTE: An Advantys STB island with an INTERBUS NIM head can be implemented only as a remote bus node. For information about INTERBUS network topology, see About INTERBUS *(see page 17)*.

Before You Begin

Before attempting to use the application examples in this chapter, make sure:
- your Advantys modules are assembled, installed, and powered according to your particular system, application, and network requirements
- you know the input and output process data lengths for your specific configuration (the sample island assembly's *(see page 78)* input length is 160 bits and the output length is 64 bits)

You should have a working familiarity with both the INTERBUS fieldbus protocol and your configuration software, either SyCon or CMD.

NOTE: For specific information about your configuration software, consult the manufacturer's documentation included with your Hilscher (SyCon) or Phoenix Contact (CMD) product.

SyCon Considerations

You should have the basic EDS file and corresponding bitmap files that were supplied with the STB NIB 2212 INTERBUS NIM (also available at *www.schneider-automation.com*), or you have created an EDS *(see page 85)* that is specific to the sample island assembly *(see page 78)* with the Advantys or SyCon configuration software.

CMD Considerations

You should have the Schneider device database, Schneider_Device_DB, available at *www.schneiderautomation.com*. It includes the Advantys STB catalog entry. If you don't have this database, you can create a configuration-specific device by following the instructions for CMD configuration elsewhere in this chapter *(see page 87)*.

The sample island assembly's *(see page 78)* input length is 160 bits and the output length is 64 bits. If you do not account for the entire data length of your island, process data will be truncated or connection to the network will be impossible.

Using SyCon to Configure an STB Island on INTERBUS

Introduction

Use these directions to add any master device and an Advantys STB island slave to your configuration with SyCon. The stages of this process are described in the following table:

Stage	Description
1	add a master to your network configuration
2	add the NIM to your network configuration
3	create an EDS for the Advantys STB island
4	save and download the configuration

Configuring in the SyCon Workspace

The SyCon workspace should resemble the following figure after you've used these instructions (*Add a Master*, *Add the NIM*) to add the CIF30 master and INTERBUS NIM slave to your network configuration:

Add a Master

The following directions are the same for all master devices. In this case, the Hilscher CIF30 PCMCIA card is used. Use the steps in the following table to add an INTERBUS master to your configuration:

Step	Action	Comment
1	From SyCon's Insert menu, select Master.	A list of INTERBUS masters appears in the Insert Master dialogue box.
2	Select CIF30-IBM from the Available devices list and click Add.	The CIF30-IBM appears in the Selected devices list.
3	Press OK.	The CIF30-IBM appears in the SyCon workspace.

The NIM's EDS

If you created a configuration-specific EDS with the Advantys configuration software, it must be copied into SyCon's Available devices list using the Copy EDS command in SyCon's File menu before you can add the NIM to the configuration. You can also copy the corresponding bitmap files (Advantys_r.bmp, Advantys_s.bmp, and Advantys_d.bmp) with the Advantys configuration software. They are at the location from which you exported your Advantys EDS file.

Add the NIM

The head of the island node is the STB NIB 2212 INTERBUS NIM. You must import the NIM's EDS before you configure the island as a network device. To add the NIM to the network configuration:

Step	Action	Comment
1	From SyCon's Insert menu, select Remote Bus Device or the insert remote device icon.	The Advantys STB island can only be used as a remote node on INTERBUS.
2	Decide where you want to insert the NIM device.	Blue circles in the workspace indicate possible insertion points.
3	Click in the appropriate blue circle.	The Insert Remote Bus Device dialogue box appears.
4	Select the NIM's EDS from the Available devices list and click Add.	The EDS appears in the Selected devices list. If not, follow the directions at *Create an EDS*.
5	Press OK.	The island appears in the SyCon workspace.

The EDS Generator Screen

SyCon's EDS Generator screen should resemble the following figure after you've customized it with the instructions at *Create an EDS*:

Create an EDS

You can create an EDS using directions in the Advantys STB Configuration Software Quick Start User Guide. You can also use SyCon's EDS Generator to create an EDS by following these instructions:
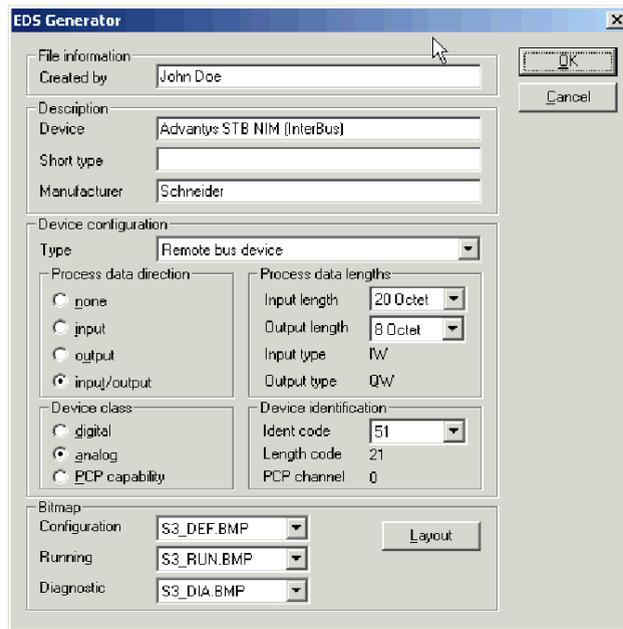
Step	Action	Comment
1	From SyCon's Tools menu, select EDS Generator.	The EDS Generator dialogue box appears.
2	In the Created by text field, enter the creator's name.	Use your own name.
3	In the Device text field, enter the device name and manufacturer.	The device will use the name you enter here when it appears in the configuration workspace.
4	From SyCon's Type pull-down menu, select Remote Bus Device.	The Advantys STB island can only be used as a remote node on INTERBUS.
5	Specify the Process data direction by selecting input/output.	The selection of input/output supports the mixture of input *and* output modules in the sample island *(see page 78)*.
6	Specify the analog Device class.	The selection of analog supports the mixture of digital and analog modules in the sample island *(see page 78)*. PCP capability is not supported by the INTERBUS NIM.
7	Specify the Process data length by selecting an input length of 20 octets, and an output length of 8 octets.	Bit packing for the sample island *(see page 78)* indicates 10 words of input and 4 words of output. (An octet represents one-half of a data word.)
8	An Ident code should appear under Device identification.	The above selection of analog (Device class) will put *51* (33h) in the Ident code, although other values are available in the Ident code pull-down menu.
9	In the Configuration (Bitmap) text field, select the desired .bmp file or accept the defaults.	The .bmp file graphically represents the node in the SyCon workspace. Accepting default bitmaps or importing others will not affect system performance.

Saving and Downloading the Configuration

You can save your configuration with the standard Windows commands in the File menu. The Online menu provides options for downloading and debugging your configuration.

Using CMD to Configure an STB Island on INTERBUS

Introduction

Use these directions to add an Advantys STB island slave to your INTERBUS network using Phoenix Contact's CMD software. The employed master device is a controller board that you select. In this example, we will use a PC with an IBS/4K controller board. The stages of this process are described in the following table:

Stage	Description
1	Add the controller board
2	Add the island slave
3	Save and download the configuration

The CMD Workspace

In this configuration example, you will add a master device and an Advantys STB island slave to your configuration using CMD.

The CMD workspace should resemble the following figure after you've added the controller board and INTERBUS NIM slave to your network configuration with the following instructions:
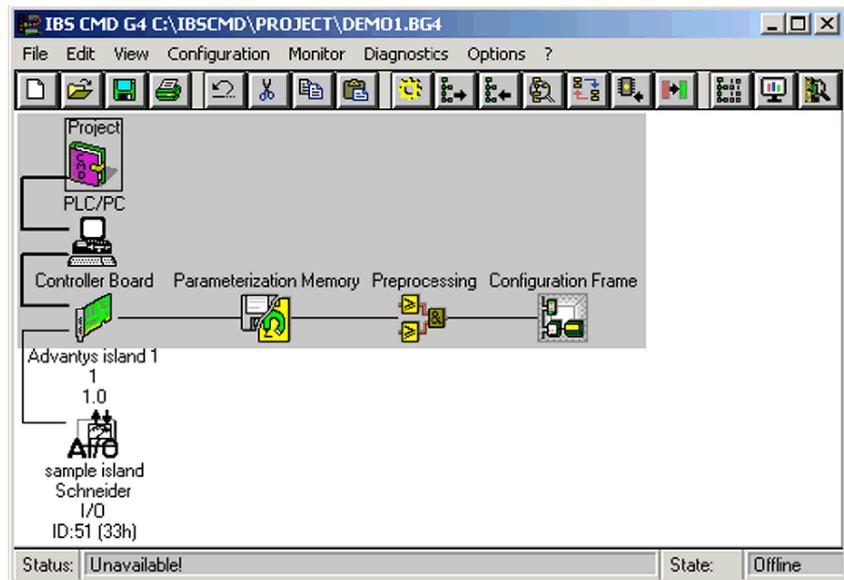
Add the Controller Board

Use the following instructions to add a master device (the selected controller board) to your configuration project.

Step	Action	Comment
1	To create a new project, choose New from the File menu.	A new project window appears. Default project components are already in the project view.
2	In the project window, select (left-click) the Controller Board icon.	A selection box appears around the Controller Board icon.
3	Right-click on the Controller Board icon, scroll down, and left-click Type.	The Select Controller Board dialogue box appears.
4	From the Available Types list, select your controller board.	In this case, select the IBS/4K.

Adding the Island Slave

If you have Schneider's device database (Schneider_Device_DB), you can import it into CMD. The following instructions are for manually creating a new configuration-specific device when a configured one is not available:

Step	Action	Comment
1	In your configuration, right-click on the Controller Board icon, scroll down, and left-click Insert ID Code.	The Insert Device Description dialogue box appears.
2	In the ID Code field, enter the ID code for your island.	Use **51** (33h) for the ID code data type *(see page 60)* of the sample island *(see page 78)*.
3	In the Process Data Channel field, enter your island's process data length.	The sample island assembly's *(see page 78)* input data length is 160 bits and the output data length is 64 bits (including the control and status words).
4	At Device Type, select Remote Bus Device.	The Advantys island is always configured as a remote bus device.
5	In the Station Name field, enter a station name for your island node.	Choose your own station name for the Advantys island.
6	In the Device Name field, enter a name for your island node.	Choose your own device name for the Advantys island.
7	In the Manufacturer Name field, enter a name for your island node.	Enter Schneider for the manufacturer name.
8	In the Device Type field, enter a name for your island node.	Enter a device type that you feel describes the nature of the Advantys island. I/O will suffice.

Saving and Downloading the Configuration

You can save your configuration with the standard Windows commands in the File menu. The Online menu provides options for downloading and debugging your configuration.

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:

STB NIB 2212 Configurable Parameters

Introduction

This topic discusses the configuration of INTERBUS NIM parameters 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
- maximum node ID for the last CANopen device

General Information

To get general information about the NIM module (model name, version number, vendor code, etc.):

Step	Action	Comment
1	Open your configuration with the Advantys configuration software.	The NIM is the leftmost module in your island assembly.
2	Double-click on the NIM in the configuration workspace.	The *module editor* window appears.
3	Select the *General* tab.	The *General* tab gives general information about the NIM.

Accessing Configurable Parameters

To access the NIM values that are configurable:

Step	Action	Comment
1	Double-click the NIM module in the configuration workspace.	The *module editor* window appears.
2	Select the *Parameters* tab.	Configurable parameters are on this tab.
3	In the *Parameter name* column, expand the *Additional Info Store List* by clicking on the plus (+) sign.	The configurable NIM parameters become visible.

The Module Editor Window

The NIM's module editor window should resemble the following figure after you have displayed the configurable parameters using the above procedure:
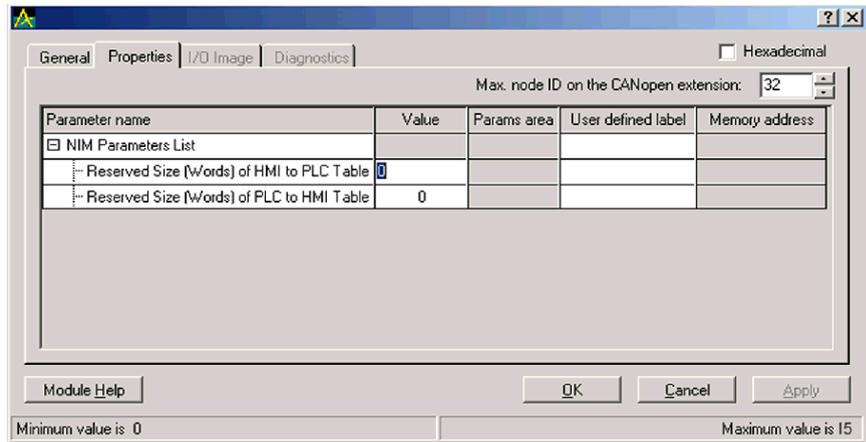
Values in the window are in decimal format by default. To display values in hexadecimal, check the *hexadecimal* box at the top of the window.

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) value is selected, the range of available data sizes (in words) appears in the window (see the above figure). The maximum size includes both the input data produced by the island modules and the HMI to PLC data. Therefore, space that you reserve for the HMI to PLC data—plus the input data from the island bus modules—must not exceed the maximum value shown. For example, if your input modules produce 10 words of input data, you can reserve only the remaining five words (out of 15 maximum) of the input data table for the HMI to PLC data.

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) value is selected, the range of available data sizes (in words) appears in the window (see the above figure). The maximum size includes both the data sent to the island modules and the PLC to HMI data. Therefore, space that you reserve for PLC to HMI data—plus the output data for the island bus modules—must not exceed the maximum value. For example, if your output modules consume four words of output data, you can reserve only the remaining 11 words (out of 15 maximum) of the output data table for the PLC to HMI data.

Reserving Data Sizes

To transfer data to the PLC from a Modbus HMI you must reserve sizes for that data. To reserve these data sizes:

Step	Action	Result
1	In the *module editor* window, select the *Parameters* tab.	
2	In the *Parameter name* column, expand the *Additional Info Store List* by clicking on the plus (+) sign.	The configurable NIM parameters become visible.
3	Double-click in the *Value* column next to the *Reserved Size (Words) of HMI to PLC table*.	The value is highlighted.
4	Enter a value that represents the data size that will be reserved for data sent from the HMI panel to the PLC.	The value you enter *plus* the data size of your island can not exceed the maximum value. If you accept the default (0), no space will be reserved in the HMI table in the process image.
5	Repeat the above steps to select a *Value* for the *Reserved Size (Words) of PLC to HMI table* row.	
6	Press *OK* when you have entered the desired data sizes.	

CANopen Device Node IDs

On the Parameters tab, you can set the maximum node ID of the last module on the island bus. Standard CANopen devices follow the last segment of STB I/O modules. CANopen modules are addressed by counting backwards from the value you enter 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. Those unnecessarily high addresses are not desirable if any of your standard CANopen devices have 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 *module editor* window, select the *Parameters* tab.	Configurable parameters are on this tab.
2	In the box next to *Max. node ID on the CANopen extension*, 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 *(see page 103)*. 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 53)* 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 53)* 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 of 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

<table>
<tr><td>⚠ WARNING</td></tr>
<tr><td>

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.

</td></tr>
</table>

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:
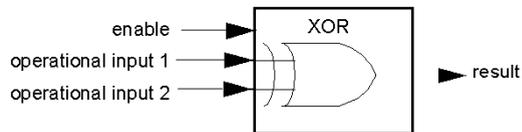
Some blocks, such as the timers, require reset and/or trigger inputs to control the reflex action. The following example shows a timer block with three inputs:
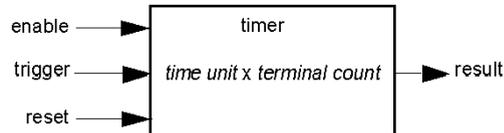
The trigger input starts the timer at 0 and accumulates *time units* of 1, 10, 100 or 1000 ms for a specified number of counts. The reset input causes the timer accumulator to be reset.

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:

first nested action

enable ———▶	**falling-edge counter**
operational input ———▶	
	counter preset
counter direction ———▶	
reset ———▶	

———▶ `result 1`

action module: STB DDO 3410
channel: none

second nested action

enable ———▶	less than threshold compare
operational input ———▶	*threshold +/- Δ*
(result 1)	

———▶ `result 2`

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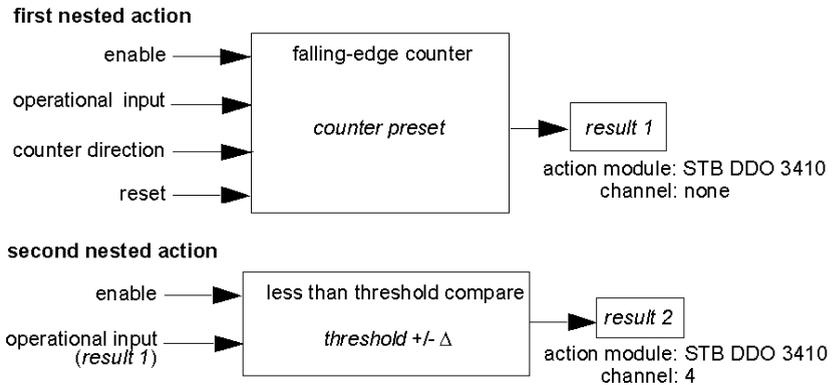
Result 2 (from the compare block) is the result that the nested reflex action will send to an actual output. Because the result of a compare block needs to be mapped to a digital action module, *result 2* is mapped to channel 4 on an STB DDO 3410 digital output module.

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 99)* 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 47)*. 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 *(see page 32)* 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 *(see page 48)* 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 53)* is disabled, and pushing it has no effect on island bus operations.
- The presence of a removable memory card *(see page 47)* 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*.

A Modbus View of the Island's Data Image

Summary

A block of Modbus registers is reserved in the NIM to hold and maintain the island's data image. Overall, the data image holds 9999 registers. The registers are divided into contiguous groups (or blocks), each dedicated to a specific purpose.

Modbus Registers and Their Bit Structure

Registers are 16-bit constructs. The most significant bit (MSB) is bit 15, which is displayed as the leftmost bit in the register. The least significant bit (LSB) is bit 0, displayed as the rightmost bit in the register:

MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The bits can be used to display operating data or device/system status.

Each register has a unique reference number, starting at 40001. The content of each register, represented by its 0/1 bit pattern, may be dynamic, but the register reference and its assignment in the control logic program remain constant.

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:
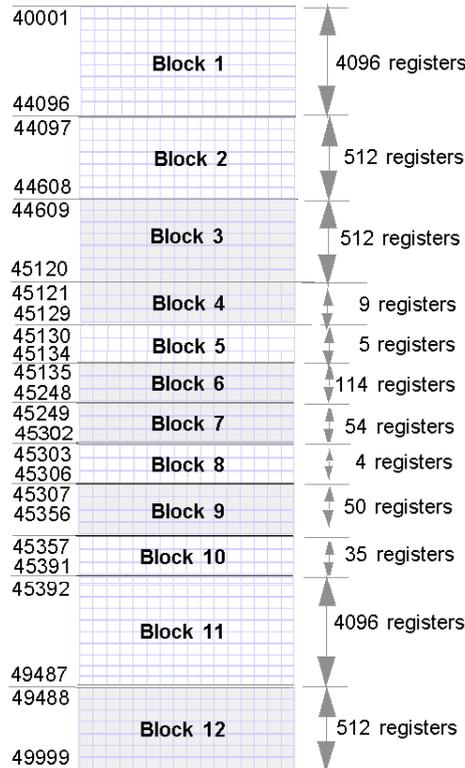
Block 1 output data process image (4096 registers available)
Block 2 fieldbus master-to-HMI output table (512 registers available)
Block 3 reserved (512 registers available)
Block 4 9-register block reserved for future read/write use
Block 5 5-register RTP Request Block
Block 6 114-register block reserved 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 32)*. 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 128)*.

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 108)* 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:
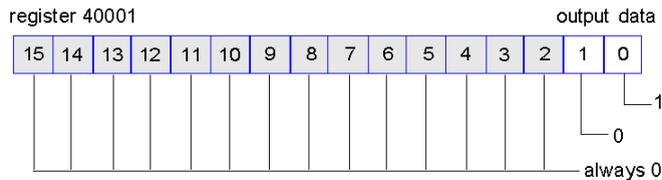
where:

- 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.
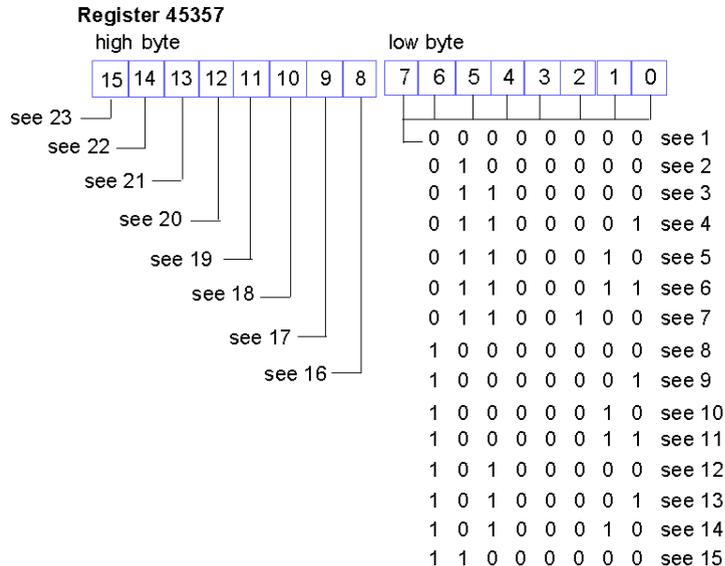
Predefined Diagnostics Registers in the Data Image

Summary

Thirty-five contiguous registers (45357 through 45391) in the island bus data image *(see page 108)* are provided for reporting diagnostic information. These registers have predefined meanings that are described below. They can be accessed 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:

Register 45357

high byte								low byte								
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

see 23
see 22
see 21
see 20
see 19
see 18
see 17
see 16

0	0	0	0	0	0	0	0	see 1
0	1	0	0	0	0	0	0	see 2
0	1	1	0	0	0	0	0	see 3
0	1	1	0	0	0	0	1	see 4
0	1	1	0	0	0	1	0	see 5
0	1	1	0	0	0	1	1	see 6
0	1	1	0	0	1	0	0	see 7
1	0	0	0	0	0	0	0	see 8
1	0	0	0	0	0	0	1	see 9
1	0	0	0	0	0	1	0	see 10
1	0	0	0	0	0	1	1	see 11
1	0	1	0	0	0	0	0	see 12
1	0	1	0	0	0	0	1	see 13
1	0	1	0	0	0	1	0	see 14
1	1	0	0	0	0	0	0	see 15

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:
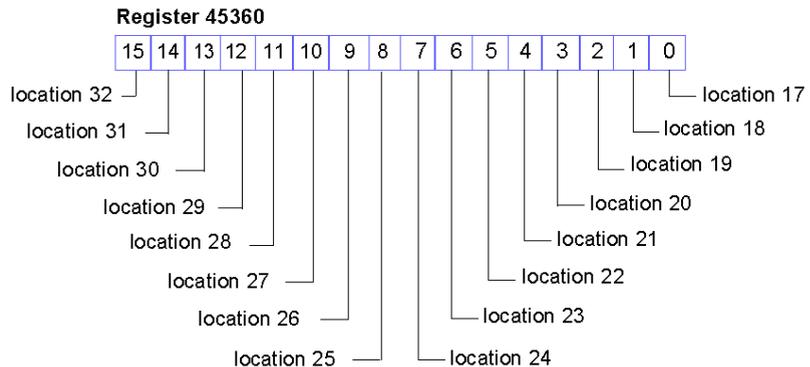
Register 45358

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

reserved
see 13
see 12
see 11
see 10
see 9
see 8
see 7
see 6
see 5
see 4
see 3
see 2
see 1
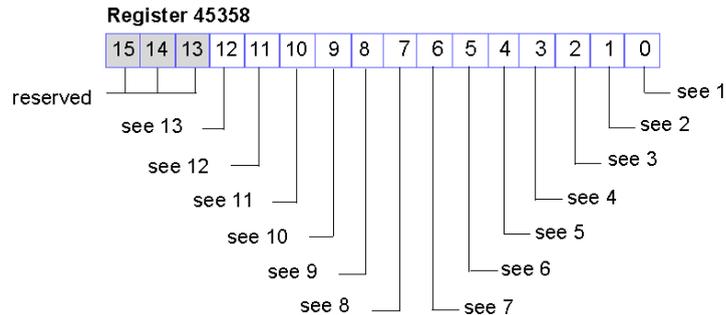
1 Fatal error. Because of the severity of the error, no further communications are possible on the island bus.

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, possibly the result of at least one application parameter mismatch.

9 Internal triggering protocol error.

10 Module data length error.

11 Module configuration error.

12 Application parameter error.

13 Application parameter services or 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.

Register 45359

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

location 16
location 15
location 14
location 13
location 12
location 11
location 10
location 9

location 1
location 2
location 3
location 4
location 5
location 6
location 7
location 8

Register 45360

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

location 32
location 31
location 30
location 29
location 28
location 27
location 26
location 25

location 17
location 18
location 19
location 20
location 21
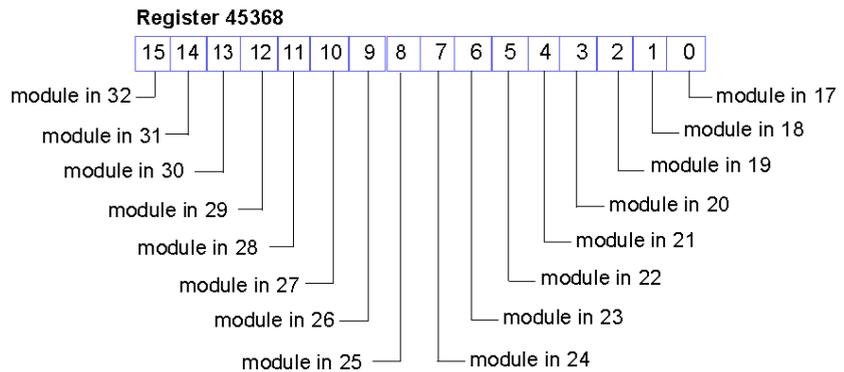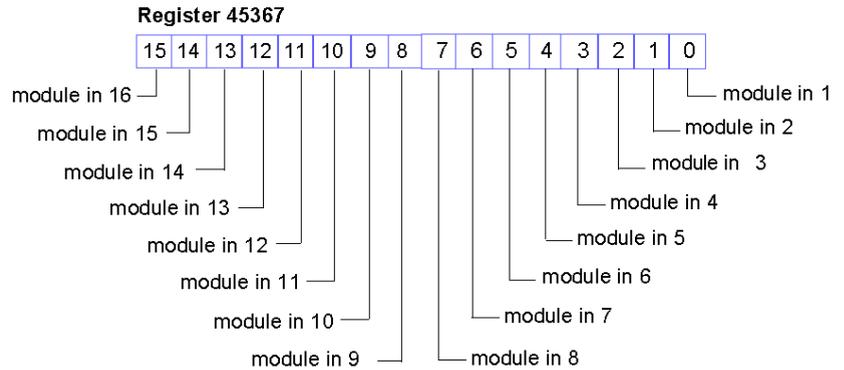location 22
location 23
location 24

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

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

module in 16
module in 15
module in 14
module in 13
module in 12
module in 11
module in 10
module in 9

module in 1
module in 2
module in 3
module in 4
module in 5
module in 6
module in 7
module in 8

Register 45368

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

module in 32
module in 31
module in 30
module in 29
module in 28
module in 27
module in 26
module in 25

module in 17
module in 18
module in 19
module in 20
module in 21
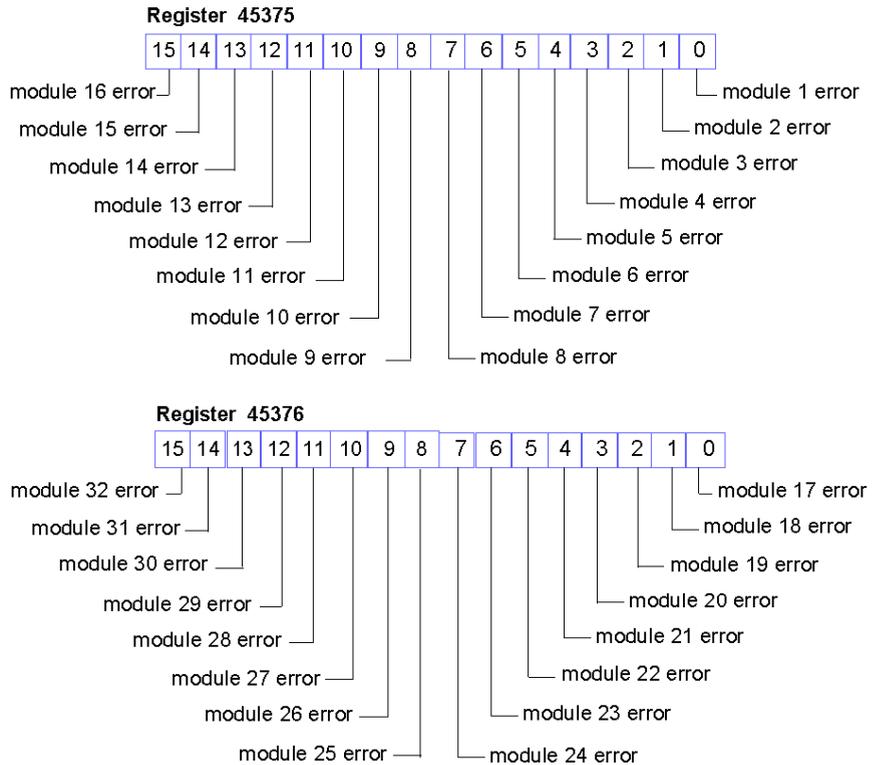module in 22
module in 23
module in 24

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.
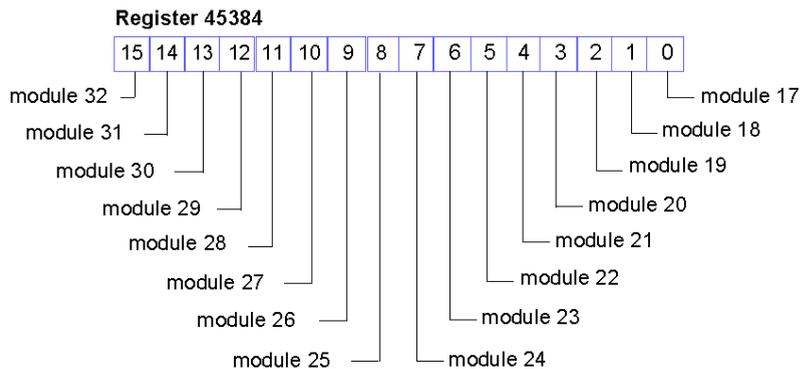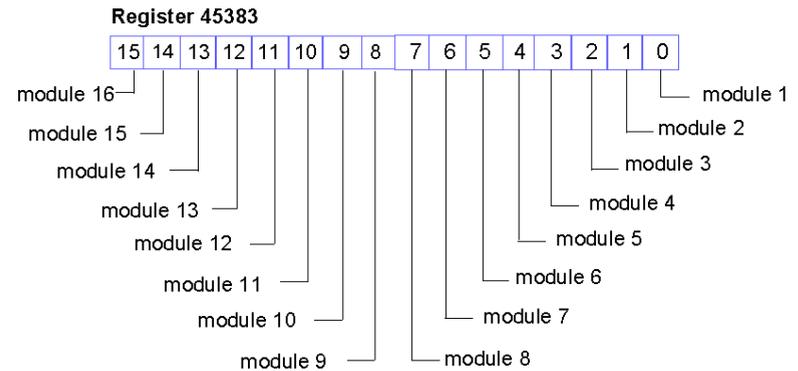
Register 45375

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

module 16 error
module 15 error
module 14 error
module 13 error
module 12 error
module 11 error
module 10 error
module 9 error

module 1 error
module 2 error
module 3 error
module 4 error
module 5 error
module 6 error
module 7 error
module 8 error

Register 45376

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

module 32 error
module 31 error
module 30 error
module 29 error
module 28 error
module 27 error
module 26 error
module 25 error

module 17 error
module 18 error
module 19 error
module 20 error
module 21 error
module 22 error
module 23 error
module 24 error

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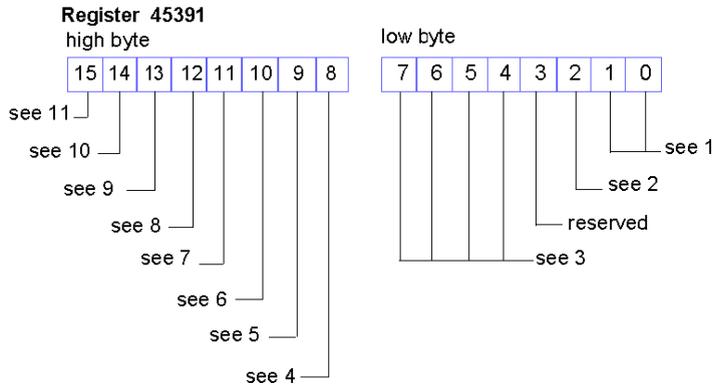
● A value of 1 in a bit indicates that the associated module is operating and that no faults were detected.
● A value of 0 in a bit indicates that the associated module is not operating either because it has a fault or because it has not been configured.

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

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

module 16
module 15
module 14
module 13
module 12
module 11
module 10
module 9

module 1
module 2
module 3
module 4
module 5
module 6
module 7
module 8

Register 45384

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

module 32
module 31
module 30
module 29
module 28
module 27
module 26
module 25

module 17
module 18
module 19
module 20
module 21
module 22
module 23
module 24

NIM Status

The high and low bytes in register 45391 report the status of the INTERBUS NIM:

Register 45391

high byte

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |

low byte

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

see 11

see 10

see 9

see 8

see 7

see 6

see 5

see 4

see 1

see 2

reserved

see 3

1 The combined value of bits 0 and 1 indicates the NIM version. A value of 1 indicates the economy version. A value of 2 indicates the standard version. A value of 3 indicates the premium version.

2 A value of 1 in bit 2 indicates that either the input or output data exceeds its word limit. A value of 0 indicates that both the input and output data are within their respective word limits.

3 The combined value of bits 4 through 7 indicate errors that occur during island bus scanning. A value of 0x00 indicates no error. A value of 0x01 indicates a self-test failure. A value of 0x02 indicates at least one global bit has been set. A value of 0x03 indicates an expired request timer. A value of 0x04 indicates an empty assembly list. A value of 0x05 indicates an expired confirm timer. A value of 0x06 indicates a wrong island bus state at initialization. Values from 0x07 to 0x0F are reserved.

4 Module failure—A value of 1 in bit 8 indicates the failure of an island bus module.

5 A value of 1 in bit 9 indicates an internal failure—at least one global bit is set.

6 A bit value of 1 in bit 10 indicates an external failure—the problem is on the fieldbus.

7 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.

8 A value of 1 in bit 12 indicates that the configuration on the removable memory card is invalid.

9 A value of 1 in bit 13 indicates that reflex action functionality has been configured. (For NIMs with firmware version 2.0 or greater.)

10 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.)

11 Island bus output data master—A value of 0 in bit 15 indicates that the fieldbus master device is controlling the output data of the island's process image. A bit value of 1 indicates that the Advantys configuration software is controlling the output data of the island's process image.
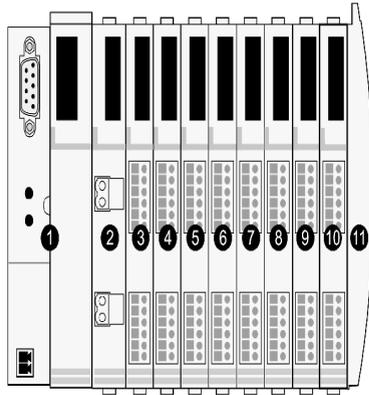
An Example of a Modbus View of the Process Image

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 it represents 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

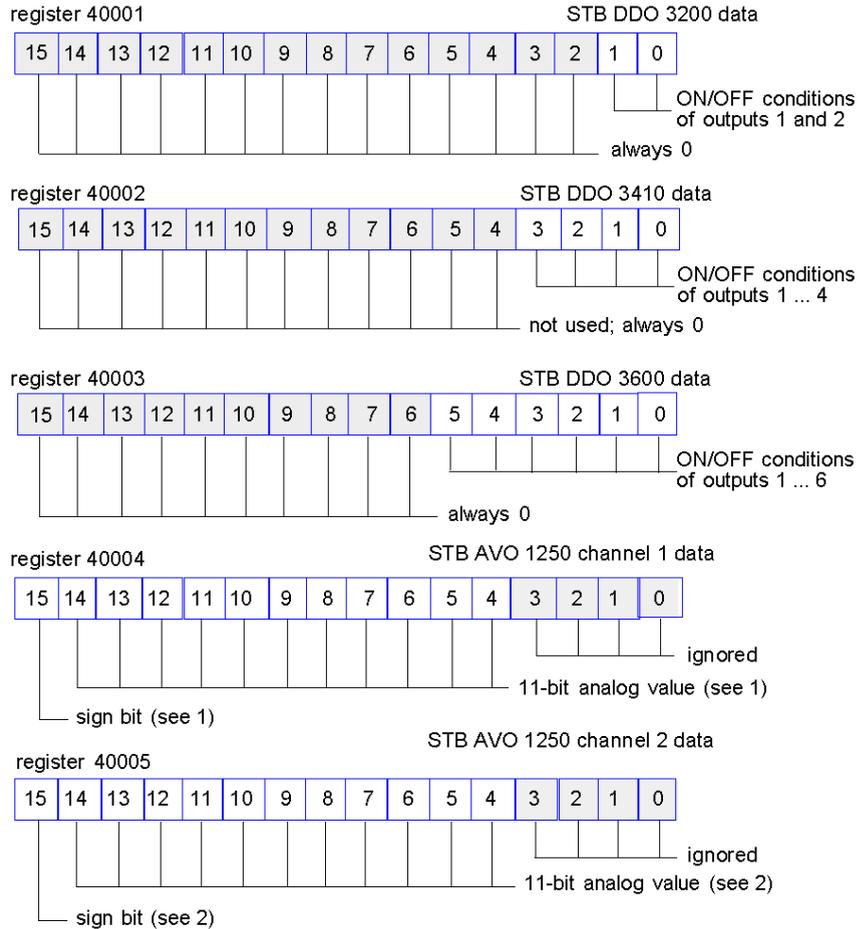The I/O modules have the following island bus addresses *(see page 44)*:

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 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 110)*. 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 register apiece for data. The analog output module requires two registers, one for each output channel. A total of five registers (registers 40001 through 40005) are used for this configuration:

register 40001   STB DDO 3200 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ON/OFF conditions of outputs 1 and 2
always 0

register 40002   STB DDO 3410 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ON/OFF conditions of outputs 1 ... 4
not used; always 0

register 40003   STB DDO 3600 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ON/OFF conditions of outputs 1 ... 6
always 0

register 40004   STB AVO 1250 channel 1 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ignored
11-bit analog value (see 1)
sign bit (see 1)

register 40005   STB AVO 1250 channel 2 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ignored
11-bit analog value (see 2)
sign bit (see 2)

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 111)*. 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 output data and the next to report status.

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 of not much interest. When an output channel is configured to perform a reflex action *(see page 99)*, however, the echo register provides a location where the fieldbus master can look to see the current value of the output.
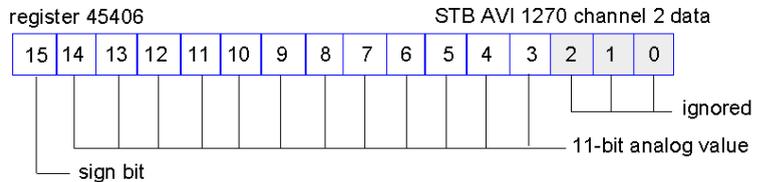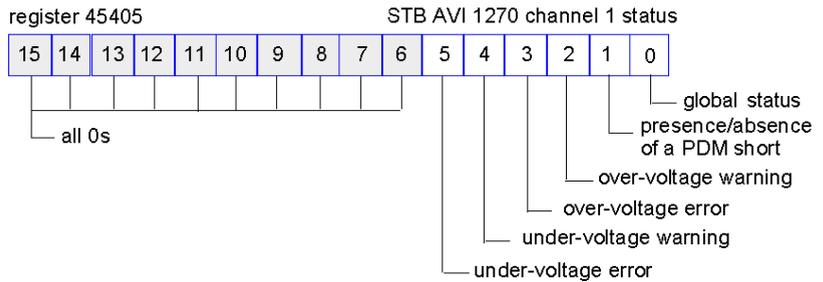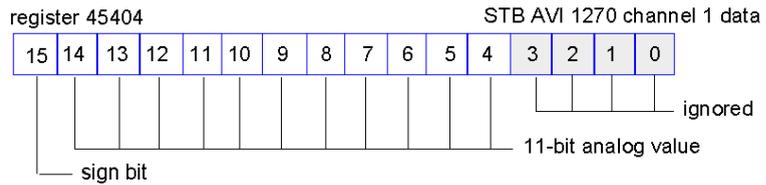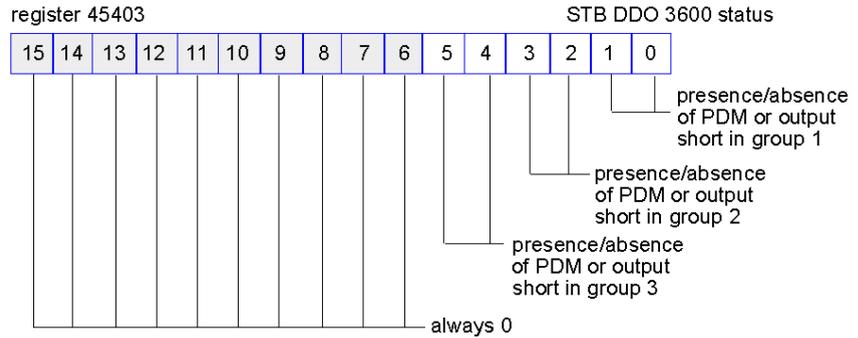
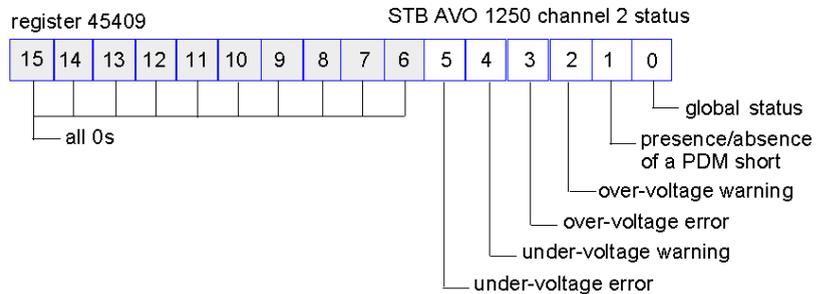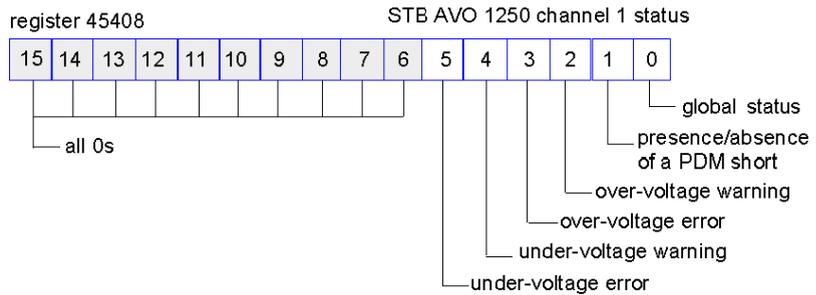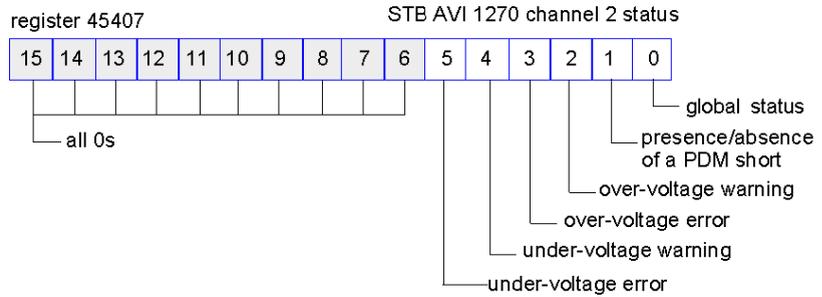The analog input module uses four contiguous registers:

- 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 (registers 45392 through 45409) are used to support our configuration:

register 45392   STB DDI 3230 data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

ON/OFF conditions of inputs 1 and 2

always 0

register 45393   STB DDI 3230 status

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

presence/absence of PDM short

always 0

register 45394   STB DDO 3200 echo output data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

echoes module output data

always 0

register 45395   STB DDO 3200 status

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

presence/absence of PDM or output short on output 1

presence/absence of PDM or output short on output 2

always 0

register 45396   STB DDI 3420 data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

ON/OFF conditions of inputs 1 ... 4

always 0

register 45397   STB DDI 3420 status

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

presence/absence of PDM short

always 0

register 45398   STB DDO 3410 echo output data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

echoes module output data

always 0

register 45399   STB DDO 3410 status

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

presence/absence of PDM or output short in group 1

presence/absence of PDM or output short in group 2

always 0

register 45400   STB DDI 3610 data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

ON/OFF conditions of inputs 1 ... 6

always 0

register 45401   STB DDI 3610 status

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

presence/absence of PDM short

always 0

register 45402   STB DDO 3600 echo output data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

echoes module output data

always 0

register 45403   STB DDO 3600 status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

presence/absence of PDM or output short in group 1

presence/absence of PDM or output short in group 2

presence/absence of PDM or output short in group 3

always 0

register 45404   STB AVI 1270 channel 1 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ignored

11-bit analog value

sign bit

register 45405   STB AVI 1270 channel 1 status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

all 0s

global status

presence/absence of a PDM short

over-voltage warning

over-voltage error

under-voltage warning

under-voltage error

register 45406   STB AVI 1270 channel 2 data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

ignored

11-bit analog value

sign bit

register 45407   STB AVI 1270 channel 2 status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

all 0s

global status
presence/absence of a PDM short
over-voltage warning
over-voltage error
under-voltage warning
under-voltage error

register 45408   STB AVO 1250 channel 1 status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

all 0s

global status
presence/absence of a PDM short
over-voltage warning
over-voltage error
under-voltage warning
under-voltage error

register 45409   STB AVO 1250 channel 2 status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

all 0s

global status
presence/absence of a PDM short
over-voltage warning
over-voltage error
under-voltage warning
under-voltage error

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 32)* on the NIM. Using the Advantys configuration software, you can reserve one or two blocks of registers in the data image *(see page 107)* 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 108)* 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 111)* 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 108)* 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 110)* 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 to16-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)	`toggle + CMD echo`	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	-	`toggle + CMD echo`	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:
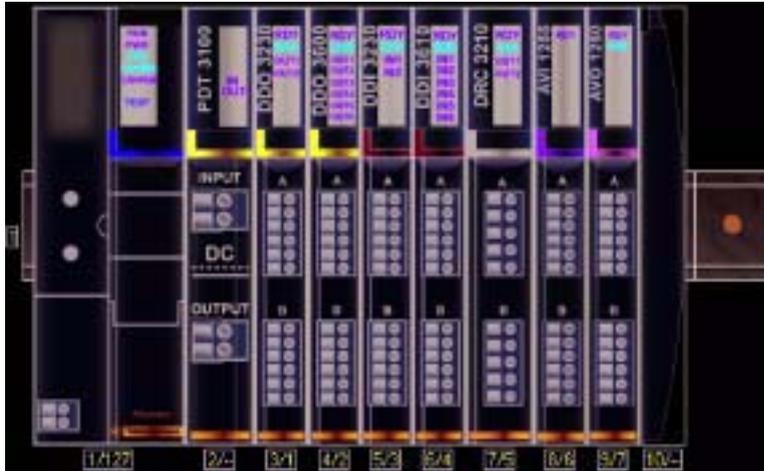
After you assign Virtual Placeholder status to the DRC 3210 digital relay output module (by selecting **Not Present** in its Options tab), the Advantys STB configuration software marks the virtual placeholder module with a red "X" as shown below:
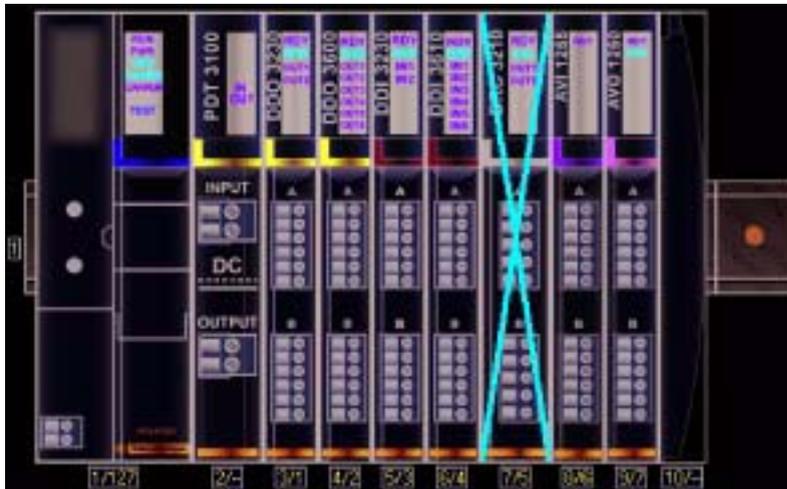
For example, when you physically construct the above configuration, you would build the island without the DRC-3210 and its base.

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

Glossary
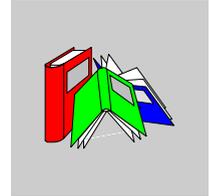
0-9

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, nd diagnostics information.

IEC

International Electrotechnical Commission Carrier. 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.

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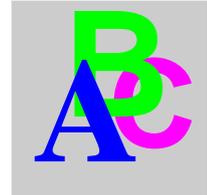
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