Advantys STB

Counter Modules

Reference Guide

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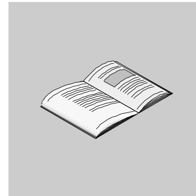
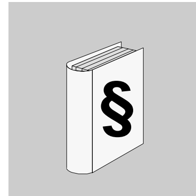


Safety Information



Important Information

NOTICE

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

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

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

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

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

⚠ CAUTION
CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE

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

About the Book

At a Glance

Document Scope

This document describes the physical and functional characteristics of the Advantys STB counter I/O modules, power distribution modules, and counter module accessories.

Validity Note

The data and illustrations found in this book are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by Schneider Electric.

Related Documents

Title of Documentation	Reference Number
Advantys STB Analog I/O Modules Reference Guide	31007715 (E), 31007716 (F), 31007717 (G), 31007718 (S), 31007719 (I)
Advantys STB Digital I/O Modules Reference Guide	31007720 (E), 31007721 (F), 31007722 (G), 3107723 (S), 31007724 (I)
Advantys STB Special Modules Reference Guide	31007730 (E), 31007731 (F), 31007732 (G), 31007733 (S), 31007734 (I)
Advantys STB System Planning and Installation Guide	890 USE 171 0x
Advantys STB Standard Profibus DP Network Interface Applications Guide	890 USE 173 0x

Title of Documentation	Reference Number
Advantys STB Basic Profibus DP Network Interface Applications Guide	890 USE 192 0x
Advantys STB Standard INTERBUS Network Interface Applications Guide	890 USE 174 0x
Advantys STB Basic INTERBUS Network Interface Applications Guide	890 USE 196 0x
Advantys STB Standard DeviceNet Network Interface Applications Guide	890 USE 175 0x
Advantys STB Basic DeviceNet Network Interface Applications Guide	890 USE 194 0x
Advantys STB Standard CANopen Network Interface Applications Guide	890 USE 176 0x
Advantys STB Basic CANopen Network Interface Applications Guide	890 USE 193 0x
Advantys STB Standard CANopen Devices	31006709 (E), 31006710 (F), 31006711 (G), 31006712 (S), 31006713 (I)
Advantys STB Standard Ethernet Modbus TCP/IP Network Interface Applications Guide	890 USE 177 0x
Advantys STB Standard Modbus Plus Network Interface Applications Guide	890 USE 178 0x
Advantys STB Standard Fipio Network Interface Applications Guide	890 USE 179 0x
Advantys STB Configuration Software Quick Start User Guide	890 USE 180 0x
Advantys STB Reflex Actions Reference Guide	890 USE 183 0x

Product Related Warnings

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

When controllers are used for applications with technical safety requirements, please follow the relevant instructions.

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

Failure to observe this product related warning can result in injury or equipment damage.

User Comments

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The Advantys STB Architecture: Theory of Operation

1

At a Glance

Overview

This chapter provides an overview of the Advantys STB system. It provides you with context for understanding the functional capabilities of an island and how its various hardware components interoperate with one other.

What's in this Chapter?

This chapter contains the following topics:

Advantys STB Islands of Automation

System Definition

Advantys STB is an open, modular distributed I/O system designed for the machine industry, with a migration path to the process industry. Modular I/O, power distribution modules (PDMs) and a network interface module (NIM) reside in a structure called an *island*. The island functions as a node on a fieldbus control network and is managed by an upstream fieldbus master controller.

Open Fieldbus Choices

An island of Advantys STB modules can function on a variety of different open industry-standard fieldbus networks. Among these are:

- Profibus DP
- DeviceNet
- Ethernet
- CANopen
- Fipio
- Modbus Plus
- INTERBUS

A NIM resides in the first position on the island bus (leftmost on the physical setup). It acts as the gateway between the island and the fieldbus, facilitating data exchange between the fieldbus master and the I/O modules on the island. It is the only module on the island that is fieldbus-dependent—a different type of NIM module is available for each fieldbus. The rest of the I/O and power distribution modules on the island bus function exactly the same, regardless of the fieldbus on which the island resides. You have the advantage of being able to select the I/O modules to build an island independent of the fieldbus on which it will operate.

Granularity

Advantys STB I/O modules are designed to be small, economical devices that provide you with just enough input and output channels to satisfy your application needs. Specific types of I/O modules are available with two or more channels. You can select exactly the amount of I/O you need and you do not have to pay for channels that you don't need.

Mechatronics

An Advantys STB system lets you place the control electronics in the I/O modules as close as possible to the mechanical devices they are controlling. This concept is known as *mechatronics*.

Depending on the type of NIM you use, an Advantys STB island bus may be extended to multiple segments of I/O on one or more DIN rails. Island bus extensions allow you to position the I/O as close as possible to the sensors and actuators they control. Using special extension cables and modules, an island bus may be stretched to distances up to 15 m (49.21 ft).

Environmental Considerations

This product supports operation at normal and extended temperature ranges and is ATEX certified for operation in hazardous environments. Refer to the Advantys STB System Installation and Planning Guide, 890 USE 171 00 for a complete summary of capabilities and limitations.

Types of Modules on an Advantys STB Island

Summary

Your island's performance is determined by the type of NIM that you use. NIMs for various field buses are available in different model numbers at different price points and with scalable operating capabilities. Standard NIMs, for example, can support up to 32 I/O modules in multiple (extension) segments. Low-cost basic NIMs, on the other hand, are limited to 16 I/O modules in a single segment.

If you are using a basic NIM, you may use only Advantys STB I/O modules on the island bus. With a standard NIM, you may use:

- Advantys STB I/O modules
- optional preferred modules
- optional standard CANopen devices

Advantys STB Modules

The core set of Advantys STB modules comprises:

- a set of analog, digital and special I/O modules
- open fieldbus NIMs
- power distribution modules (PDMs)
- island bus extension modules
- special modules

These core modules are designed to specific Advantys STB form factors and fit on base units on the island bus. They take full advantage of the island's communication and power distribution capabilities, and they are auto-addressable.

Preferred Modules

A *preferred module* is a device from another Schneider catalog, or potentially from a third-party developer, that fully complies with the Advantys STB island bus protocol. Preferred modules are developed and qualified under agreement with Schneider; they conform fully to Advantys STB standards and are auto-addressable.

For the most part, the island bus handles a preferred module as it does standard Advantys STB I/O module, with four key differences:

- A preferred module is not designed in the standard form factor of an Advantys STB module and does not fit into one of the standard base units. It therefore does not reside in an Advantys STB segment.
- A preferred module requires its own power supply. It does not get logic power from the island bus.
- To place preferred modules in you island, you must use the Advantys configuration software.
- You cannot use preferred modules with a basic NIM.

Preferred modules can be placed between segments of STB I/O or at the end of the island. If a preferred module is the last module on the island bus, it must be terminated with a 120 Ω terminator resistor.

Standard CANopen Devices

An Advantys STB island can support standard off-the-shelf CANopen devices. These devices are not auto-addressable on the island bus, and therefore they must be manually addressed, usually with physical switches built into the devices. They are configured using the Advantys configuration software. You cannot use a standard CANopen device with a basic NIM.

When standard CANopen devices are used, they must be installed at the end of the island. 120 Ω termination must be provided both at the end of the last Advantys STB segment and at the last standard CANopen device.

Island Segments

Summary

An Advantys STB system starts with a group of interconnected devices called the *primary segment*. This first segment is a mandatory piece of an island. Depending on your needs and on the type of NIM you are using (see *p. 14*), the island may optionally be expanded to additional segments of Advantys STB modules, called *extension segments* and to non-STB devices such as preferred modules and/or standard CANopen devices.

The Primary Segment

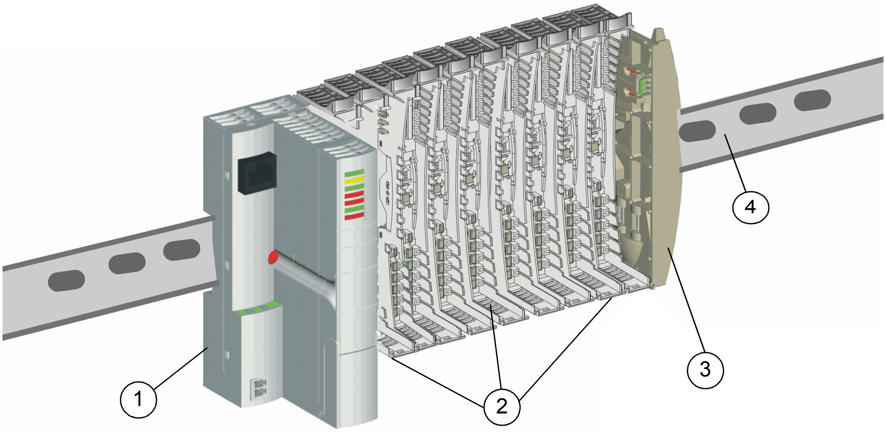
Every island bus begins with a primary segment. The primary segment consists of the island's NIM and a set of interconnected module bases attached to a DIN rail. The PDMs and Advantys STB I/O module mount in these bases on the DIN rail. The NIM is always the first (leftmost) module in the primary segment.

The Island Bus

The bases that you interconnect on the DIN rail form an island bus structure. The island bus houses the modules and supports the communications buses across the island. A set of contacts on the sides of the base units (see *p. 29*) provides the bus structure for:

- logic power
- sensor field power to the input modules
- actuator power to the output modules
- the auto-addressing signal
- island bus communications between the I/O and the NIM

The NIM, unlike the PDMs and I/O modules, attaches directly to a DIN rail:



1 NIM
2 module bases
3 termination plate
4 DIN rail

The DIN Rail

The NIM and the module bases snap onto a conductive metal DIN rail. The rail may be 7.5 mm or 15 mm deep.

The NIM

A NIM performs several key functions:

- It is the master of the island bus, supporting the I/O modules by acting as their communications interface across the island backplane
- It is the gateway between the island and the fieldbus on which the island operates, managing data exchange between the island's I/O modules and the fieldbus master
- It may be the interface to the Advantys configuration software; basic NIMs to not provide a software interface
- It is the primary power supply for logic power on the island bus, delivering a 5 VDC logic power signal to the I/O modules in the primary segment

Different NIM models are available to support the various open fieldbuses and different operational requirements. Choose the NIM that meets your needs and operates on the appropriate fieldbus protocol. Each NIM is documented in its own user manual.

PDMs

The second module on the primary segment is a PDM. PDMs are available in different models to support:

- 24 VDC field power to the I/O modules in a segment
- 115 VAC or 230 VAC field power to the I/O modules in a segment

The number of different I/O voltage groups that are installed on the segment determine the number of PDMs that need to be installed. If your segment contains I/O from all three voltage groups, you will need to install at least three separate PDMs in the segment.

Different PDM models are available with scalable performance characteristics. A standard PDM, for example, delivers actuator power to the output modules and sensor power to the input modules in a segment over two separate power lines on the island bus. A basic PDM, on the other hand, delivers actuator power and field power over a single power line.

The Bases

There are six types of bases that can be used in a segment. Specific bases must be used with specific module types, and it is important that you always install the correct bases in the appropriate locations in each segment:

Base Model	Base Width	Advantys STB Modules It Supports
STB XBA 1000	13.9 mm (0.54 in)	the size 1 base that supports 13.9 mm wide I/O modules (24 VDC digital I/O and analog I/O)
STB XBA 2000	18.4 mm (0.72 in)	the size 2 base that supports 18.4 mm I/O modules and the STB XBE 2100 CANopen extension module
STB XBA 2100	18.4 mm (0.72 in)	the size 2 base that supports an auxiliary power supply

Base Model	Base Width	Advantys STB Modules It Supports
STB XBA 2200	18.4 mm (0.72 in)	the size 2 base that supports the PDMs
STB XBA 2300	18.4 mm (0.72 in)	the size 2 base that supports BOS modules
STB XBA 2400	18.4 mm (0.72 in)	the size 2 base that supports EOS modules
STB XBA 3000	28.1 mm (1.06 in)	the size 3 base that supports many of the special modules

As you plan and assemble the island bus, make sure that you choose and insert the correct base in each location on the island bus.

I/O

Each segment contains a minimum of one Advantys STB I/O module. The maximum number of modules in a segment is determined by their total current draw on the 5 VDC logic power supply in the segment. A built-in power supply in the NIM provides 5 VDC to the I/O modules in the primary segment. A similar power supply built into the BOS modules provides 5 VDC for the I/O modules in any extension segments. Each of these supplies produce 1.2 A, and the sum of the logic power current consumed by all the I/O modules in a segment cannot exceed 1.2 A.

The Last Device on the Primary Segment

The island bus must be terminated with a 120 Ω terminator resistor. If the last module on the island bus is an Advantys STB I/O module, use an STB XMP 1100 terminator plate at the end of the segment.

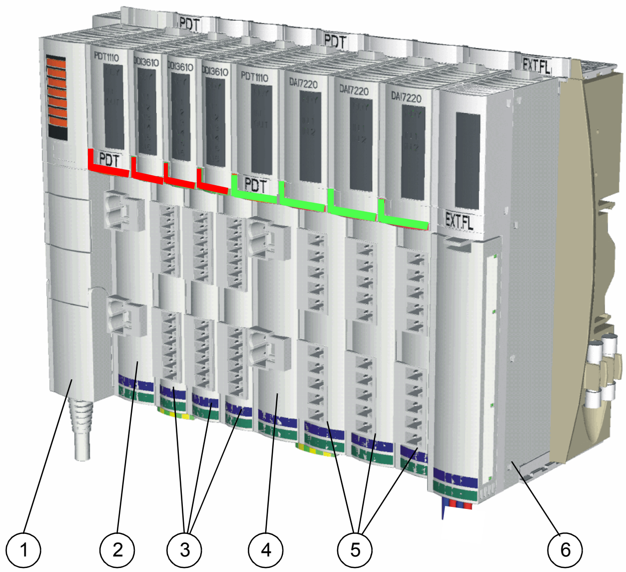
If the island bus is extended to another segment of Advantys STB modules or to a preferred module (see *p. 15*), you need to install an STB XBE 1000 EOS bus extension module in the last position of the segment that will be extended. Do not apply 120 Ω termination to the EOS module. The EOS module has an IEEE 1394-style output connector for a bus extension cable. The extension cable carries the island’s communications bus and auto-addressing line to the extension segment or to the preferred module.

If the island bus is extended to a standard CANopen device (see *p. 14*), you need to install an STB XBE 2100 CANopen extension module in the rightmost position of the segment and apply 120 Ω termination to island bus after the CANopen extension module—use the STB XMP 1100 terminator plate. You must also provide 120 Ω termination on the last CANopen device that is installed on the island bus.

Remember that you cannot use extensions when a basic NIM is in the primary segment.

An Illustrative Example

The illustration below shows an example of a primary segment with PDMs and I/O modules installed in their bases:



1 The NIM resides in the first location. One and only one NIM is used on an island.

2 A 115/230 VAC STB PDT 2100 PDM, installed directly to the right of the NIM. This module distributes AC power over two separate field power buses, a sensor bus and an actuator bus.

3 A set of digital AC I/O modules installed in a voltage group directly to the right of the STB PDT 2100 PDM. The input modules in this group receive field power from the island's sensor bus, and the output modules in this group receive AC field power from the island's actuator bus.

4 A 24 VDC STB PDT 3100 PDM, which will distribute 24 VDC across the island's sensor and actuator buses to a voltage group of 24 VDC I/O modules. This PDM also provides isolation between the AC voltage group to its left and the DC voltage group to its right.

5 A set of analog and digital I/O modules installed directly to the right of the STB PDT 3100 PDM.

6 An STB XBE 1000 EOS extension module installed in the last location in the segment. Its presence indicates that the island bus will be extended beyond the primary segment and that you are not using a basic NIM.

Logic Power Flow

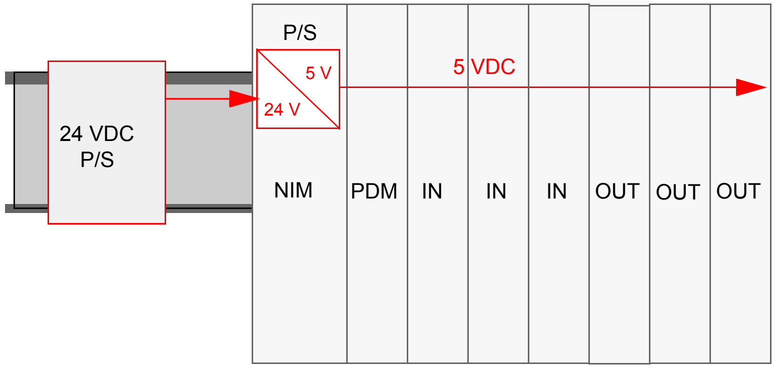
Summary

Logic power is the power that the Advantys STB I/O modules require to run their internal processing and light their LEDs. It is distributed across an island segment by a 5-to-24 VDC power supply. One of these power supplies is built into the NIM to support the primary segment; another is built into the STB XBE 1200 BOS modules to support any extension segments. If you need to provide more logic power in a primary or extension segment than the initial power supply can deliver, you may also use an STB CPS 2111 auxiliary power supply.

These power supplies require an external SELV-rated 24 VDC power source, which is usually mounted in the enclosure with the island.

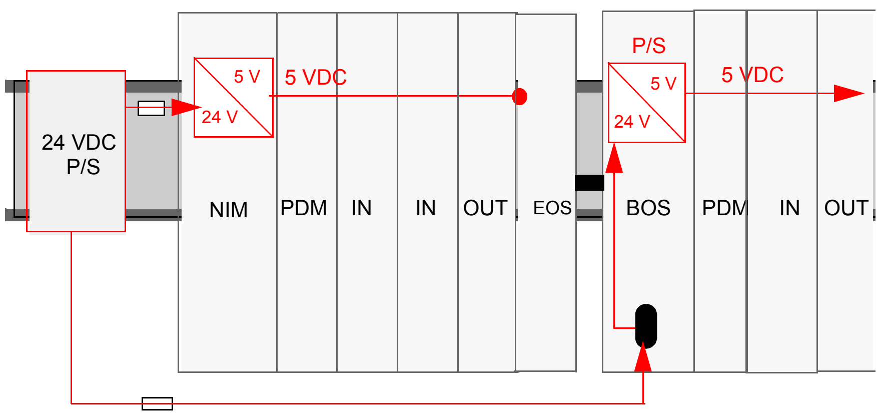
Logic Power Flow

The NIM converts the incoming 24 VDC to 5 VDC, and sends it across the island bus to the I/O modules in the primary segment:



This power supply provides 1.2 A of current to the primary segment. If the total current draw of all the modules on the island bus exceeds 1.2 A, you need to either use an auxiliary power supply or place some of the modules in one or more extension segment(s). If you use an extension segment, an EOS module is needed at the end of the primary segment, followed by an extension cable to a BOS module in an extension segment. The EOS terminates the 5 V logic power in the primary segment. The BOS in the next segment has its own 24-to-5 VDC power supply. It requires its own external 24 V power supply.

Here is an illustration of the extension segment scenario:



The Power Distribution Modules

Functions

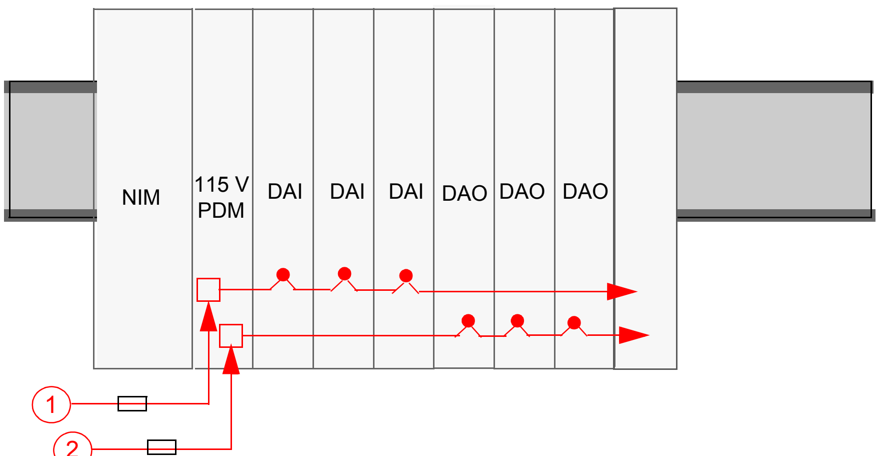
A PDM distributes field power to a set of Advantys STB I/O modules on the island bus. The PDM sends field power to the input and output modules in a segment. Depending on the PDM module you are using, it may distribute sensor power and actuator power on the same or on separate power lines across the island bus. The PDM protects the input and output modules with a user-replaceable fuse. It also provides a protective earth (PE) connection for the island.

Voltage Groupings

I/O modules with different voltage requirements need to be isolated from each other in the segment, and the PDMs serve this role. Each voltage group requires its own PDM

Standard PDM Power Distribution

A PDM is placed immediately to the right of the NIM in slot 2 on the island. The modules in a specific voltage group follow in series to the right of the PDM. The following illustration shows a standard STB PDT 2100 PDM supporting a cluster of 115 VAC I/O modules:



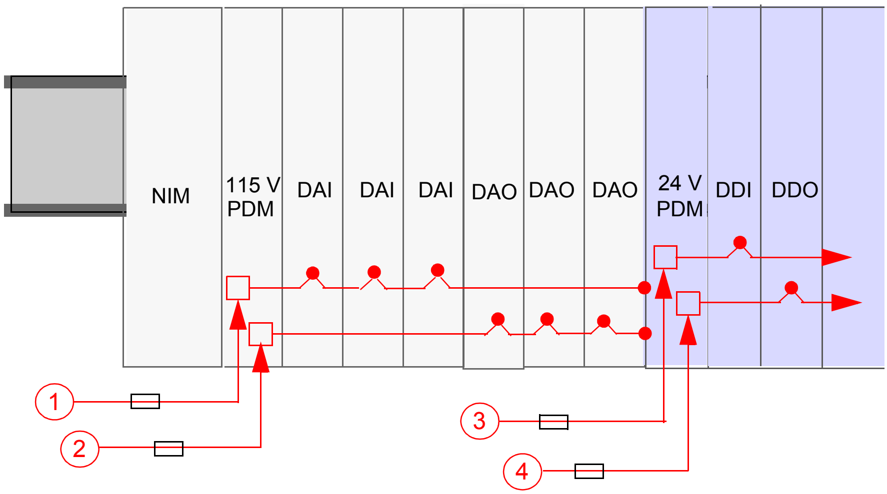
1 115 VAC sensor power signal to the PDM
2 115 VAC actuator power signal to the PDM

Notice that sensor power (to the input modules) and actuator power (to the output modules) are brought to the island via separate two-pin connectors on the PDM.

The island layout shown above assumes that all the I/O modules in the segment use 115 VAC for field power. Suppose, however, that your application requires a mix of 24 VDC and 115 VAC modules. A second PDM (this time a standard STB PDT 3100 module) is used for the 24 VDC I/O.

Note: When you plan the layout of an island segment that contains a mixture of AC and DC modules, we recommend that you place the AC voltage group(s) to the left of the DC voltage group(s) in a segment.

In this case, the STB PDT 3100 PDM is placed directly to the right of the last 115 VAC module. It terminates the sensor and actuator buses for the 115 VAC I/O voltage group and initiates new sensor and actuator buses for the 24 VDC modules:

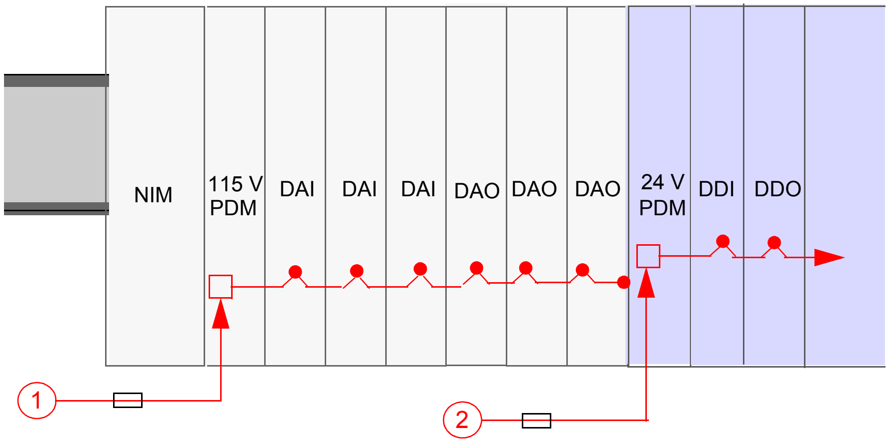


1 115 VAC sensor power signal to the PDM
2 115 VAC actuator power signal to the PDM
3 24 VDC sensor power signal to the PDM
4 24 VDC actuator power signal to the PDM

Each standard PDM contains a pair of time-lag fuses to protect the I/O modules in the segment. A 10 A fuse protects the output modules on the actuator bus, and a 5 A fuse protects the input modules on the sensor bus. These fuses are user-replaceable.

Basic PDM Power Distribution

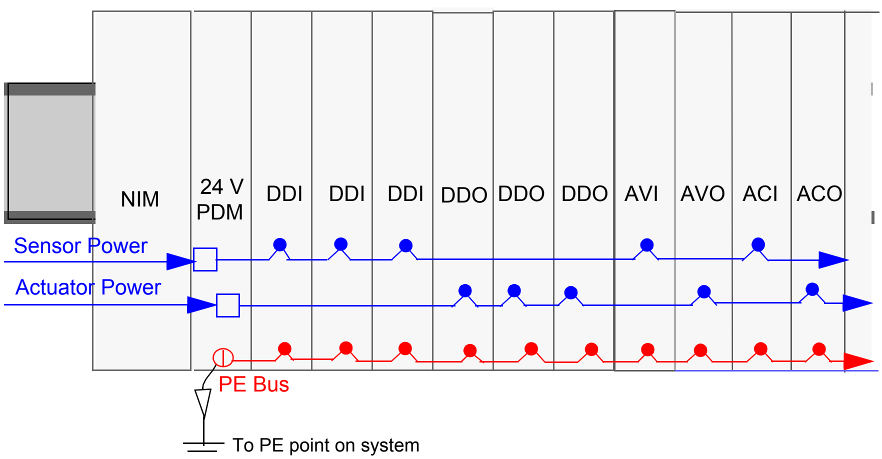
If your island uses basic PDMs instead of standard PDMs, then actuator power and sensor power are sent over a single power line:



Each basic PDM contains on 5 A time-lag fuse that protects the I/O modules in the segment. This fuse is user-replaceable.

PE Grounding

A captive screw terminal on the bottom of the PDM base makes contact with pin 12 (see *p. 30*) on each I/O base, establishing an island PE bus. The screw terminal on the PDM base meets IEC-1131 requirements for field power protection. The screw terminal should be wired to the PE point on your system.



Sensor Power and Actuator Power Distribution on the Island Bus

Summary

The sensor bus and the actuator bus need to be powered separately from external sources. Depending on your application, you may want to use the same or different external power supplies to feed the sensor bus and the actuator bus. The source power is fed to two two-pin power connectors on a PDM.

- The top connector is for the sensor power bus
- The bottom two-pin connector is for the actuator power bus

24 VDC Field Power Distribution

An external power supply delivers field power distributed to an STB PDT 3100 PDM.

⚠ 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.

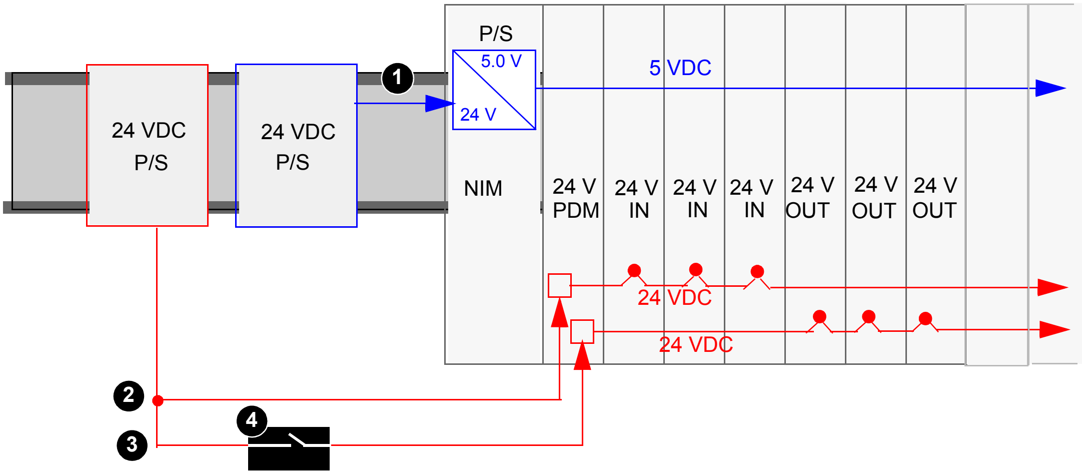
⚠ CAUTION

COMPROMISED DOUBLE INSULATION

Above 130 VAC, the relay module may compromise the double insulation provided by a SELV-rated power supply.
When you use a relay module, use separate external 24 VDC power supplies for the PDM supporting that module and the logic power to the NIM or BOS module when the contact voltage is above 130 VAC.

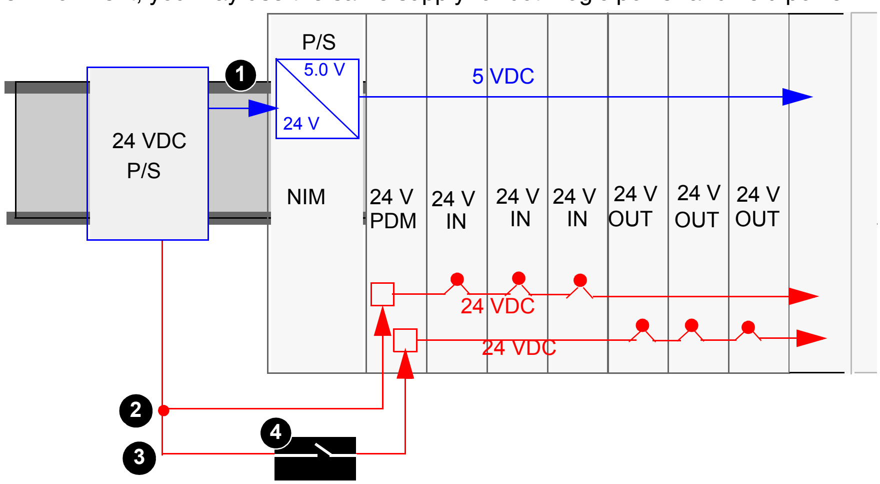
Failure to follow these instructions can result in injury or equipment damage.

To assure that the installation will perform to system specifications, it is advisable to use a separate 24 VDC supply for logic power to the NIM and for field power to the PDM:



1 24 VDC signal to the NIM's logic power supply
2 24 VDC signal to the segment's sensor bus
3 24 VDC signal to the segment's actuator bus
4 optional relay on the actuator bus

If the I/O load on the island bus is low and the system is operating in a low-noise environment, you may use the same supply for both logic power and field power:

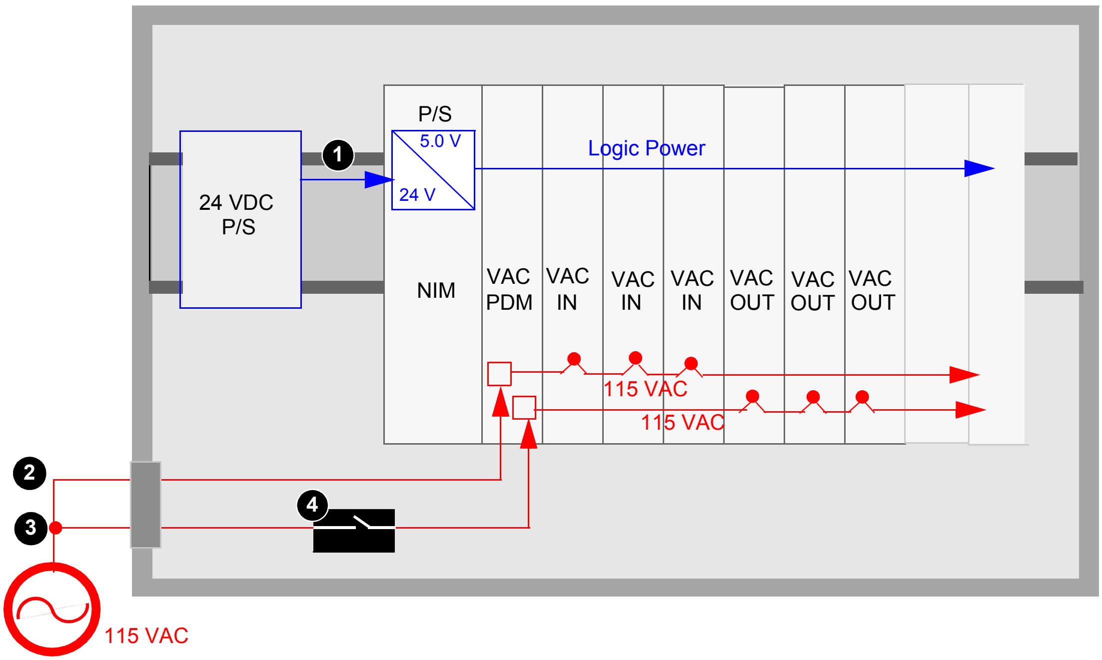


1 24 VDC signal to the NIM's logic power supply
2 24 VDC signal to the segment's sensor bus
3 24 VDC signal to the segment's actuator bus
4 optional relay on the actuator bus

Note: In the example above, a single power supply is used to provide 24 VDC to the NIM (for logic power) and the PDM. If any of the modules supported by the PDM is an STB relay module that operates at a contact voltage above 130 VAC, the double insulation provided by the SELV power supply is no longer present. Therefore, you will need to use a separate 24 VDC power supply to support the relay module.

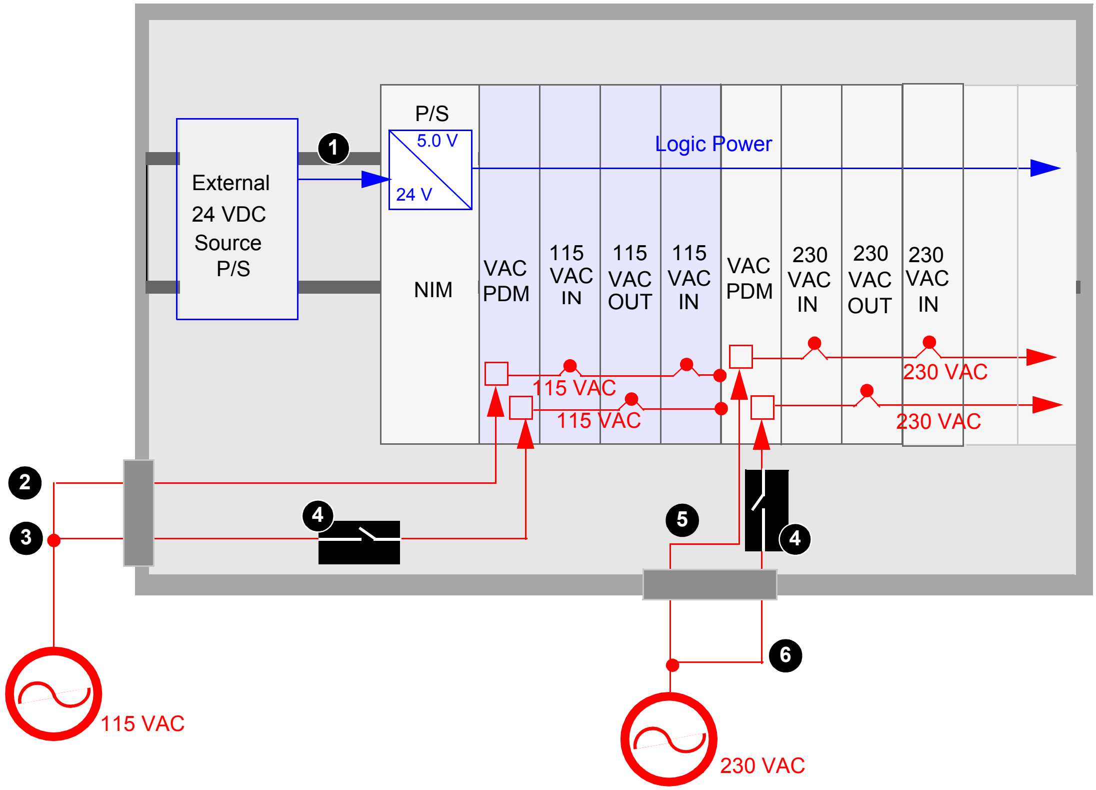
115 and 230 VAC Field Power Distribution

AC field power is distributed across the island by an STB PDT 2100 PDM. It can accept field power in the range 85 ... 264 VAC. The following illustration shows a simple view of 115 VAC power distribution:



1 24 VDC signal to the NIM's logic power supply
2 115 VAC signal to the segment's sensor bus
3 115 VAC signal to the segment's actuator bus
4 optional relay on the actuator bus

If the segment contains a mixture of both 115 VAC and 230 VAC I/O modules, you must take care to install them in separate voltage groups and support the different voltages with separate STB PDT 2100 PDMs:



1 24 VDC signal to the NIM's logic power supply
2 115 VAC signal to the segment's sensor bus
3 115 VAC signal to the segment's actuator bus
4 optional relay on the actuator bus
5 230 VAC signal to the segment's sensor bus
6 230 VAC signal to the segment's actuator bus

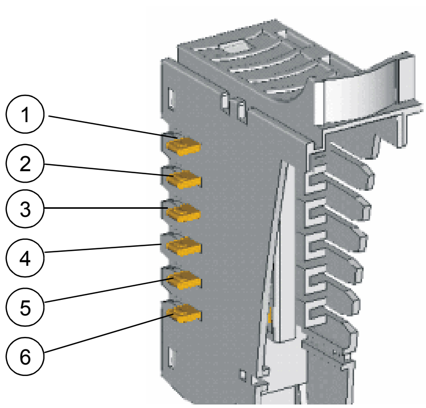
Communications Across the Island

Island Bus Architecture

Two sets of contacts on the left side of the base units—one set on the bottom and one on the top—enable the island to support several different communication and power buses. The contacts on the top left of a base support the island's logic side functions. The contacts at the bottom left of a base support the island's field power side.

Logic Side Contacts

The following illustration shows the location of the contacts as they appear on all the I/O bases. The six contacts at the top of the base support the logic side functionality:



1 reserved
2 common ground contact
3 5 VDC logic power contact
4 island bus communications (+) contact
5 island bus communications (-) contact
6 address line contact

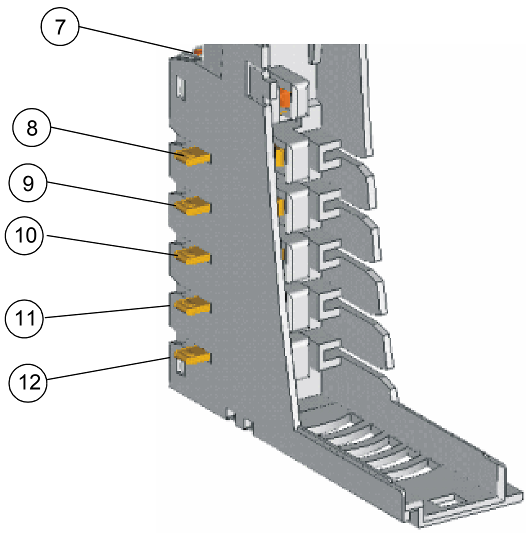
The following table lists the way the logic-side contacts are implemented on the different base units.

Base Unit	Logic-side Contacts
STB XBA 1000 size 1 I/O base	Contacts 2 ... 6 present and pass signals to the right. Contacts 2 and 3 terminate at the end of the segment; contacts 4, 5 and 6 pass to the end of the island bus.
STB XBA 2000 size 2 I/O base	Contacts 2 ... 6 present and pass signals to the right. Contacts 2 and 3 terminate at the end of the segment; contacts 4, 5 and 6 pass to the end of the island bus

Base Unit	Logic-side Contacts
STB XBA 2200 size 2 PDM base	Contacts 2 ... 6 present and pass signals to the right. Contacts 2 and 3 terminate at the end of the segment; contacts 4, 5 and 6 pass to the end of the island bus
STB XBA 2300 size 2 BOS base	Contacts 2 ... 6 are present and pass signals to the right
STB XBA 2400 size 2 EOS base	Contacts 1 ... 6 are present but the signals do not pass to the right
STB XBA 3000 size 3 I/O base	Contacts 2 ... 6 present and pass signals to the right. Contacts 2 and 3 terminate at the end of the segment; contacts 4, 5 and 6 pass to the end of the island bus

Field Power Distribution Contacts

The following illustration highlights the contacts at the bottom of the base, which support the island's field power distribution functionality:



7 a DIN rail clip that provides functional ground for noise immunity, RFI, etc.
8 and 9 sensor bus
10 and 11 actuator bus
12 PE, established via a captive screw on the PDM base units

The following table lists the way the field-side contacts are implemented on the different base units.

Base Unit	Logic-side Contacts
STB XBA 1000 size 1 I/O base	Contacts 7 ... 12 present. Contacts 7 and 12 are always made. Contacts 8 and 9 are made for input modules but not for output modules. Contacts 10 and 11 are made for output modules but not for input modules.
STB XBA 2000 size 2 I/O base	Contacts 7 ... 12 present. Contacts 7 and 12 are always made. Contacts 8 and 9 are made for input modules but not for output modules. Contacts 10 and 11 are made for output modules but not for input modules.
STB XBA 2200 size 2 PDM base	Contacts 7 and 12 present and are always made. Contacts 8 ... 11 are not connected on the left side—sensor and actuator power are delivered to the PDM from external power sources and passed to the right.
STB XBA 2300 size 2 BOS base	Contacts 7 ... 12 present but do not pass signals to the right. The BOS module does not receive field power.
STB XBA 2400 size 2 EOS base	Contacts 7 ... 12 are present but do not pass signals to the right. The EOS module does not receive field power.
STB XBA 3000 type 3 I/O base	Contacts 7 ... 12 present. Contacts 7 and 12 are always made. Contacts 8 and 9 are made for input modules but not for output modules. Contacts 10 and 11 are made for output modules but not for input modules.

Operating Environment

Environmental Specifications

The following information describes systemwide environmental requirements and specifications for the Advantys STB system.

Enclosure

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted and/or radiated disturbance.

All Advantys STB modules meet CE mark requirements for *open equipment* as defined by EN61131-2, and should be installed in an enclosure that is designed for specific environmental conditions and designed to prevent personal injury resulting from access to live parts. The interior of the enclosure must be accessible only by the use of a tool.

Note: Special requirements apply for enclosures located in hazardous (explosive) environments.

Requirements

This equipment meets agency certification for UL, CSA, CE, FM class 1 div 2 and ATEX. This equipment is intended for use in a Pollution Degree 2 industrial environment, in over-voltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 m (6500 ft) without derating.

Parameter	Specification	
protection	ref. EN61131-2	IP20, class 1
agency	ref. EN61131-2	UL 508, CSA 1010-1, FM Class 1 Div. 2, CE, ATEX and Maritime
isolation voltage	ref. EN61131-2	1500 VDC field-to-bus for 24 VDC
		2500 VDC field-to-bus for 115/230 VAC
	Note: No internal isolation voltage; isolation requirements must be met by using SELV-based external power supply.	
over-voltage class	ref. EN61131-2	category II
operating temperature range	0 ... 60° C (32 ... 140° F)	
extended operating temperature ranges	-25 ... 0° C (-13 ... 32° F) and 60 ... 70° C (140 ... 158° F) for qualified modules (see	
storage temperature	-40 ... +85° C (-40 ... +185° F)	
maximum humidity	95% relative humidity @ 60° C (noncondensing)	

Parameter	Specification	
supply voltage variation, interruption, shut-down and start-up	IEC 61000-4-11 ref. 61131-2	
shock	ref. IEC88, part 2-27	+/-15 g peak, 11 ms, half-sine wave for 3 shocks/axis
operating altitude	2000 m (2187 yd)	
transport altitude	3000 m (3281 yd)	
free-fall	ref. EN61131-2	1 m (1.09 yd)
agency certifications	ATEX @ 0 to 60°C and FM @ extended temperature ranges for specified modules	

Electromagnetic Susceptibility

The following table lists the electromagnetic susceptibility specifications:

Characteristic	Specification
electrostatic discharge	ref. EN61000-4-2
radiated	ref. EN61000-4-3
fast transients	ref. EN61000-4-4
surge withstand (transients)	ref. EN61000-4-5
conducted RF	ref. EN61000-4-6

Radiated Emission

The following table lists the emission specification ranges:

Description	Specification	Range
radiated emission	ref. EN 55011 Class A	30 ... 230 MHz, 10 m @ 40 dBμV
		230 ... 1000 MHz, 10 m @ 47 dBμV

The STB EHC 3020 40 kHz Counter Module

2

At a Glance

Introduction

This chapter provides you with a detailed description of the Advantys STB EHC 3020 40 kHz counter module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

What's in this Chapter?

This chapter contains the following sections:

2.1 STB EHC 3020 Physical Description

At a Glance

Introduction

This section describes the Advantys STB EHC 3020 counter module's external features, displays, connections, dimensions, and wiring requirements.

What's in this Section?

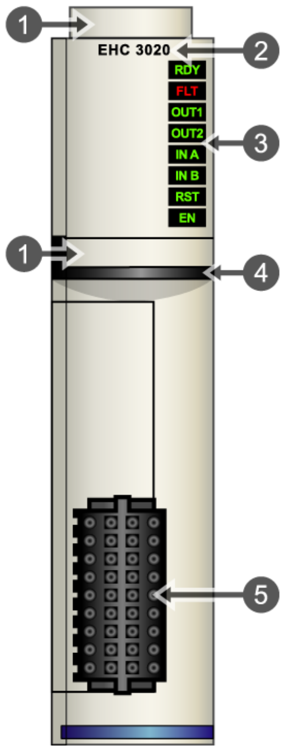
This section contains the following topics:

STB EHC 3020 Physical Description

Physical Characteristics

The STB EHC 3020 is an Advantys STB 40 kHz counter module. The module provides four 24 VDC digital inputs and two 24 VDC outputs and contains programmable compare blocks (see *p. 52*). The module operates in one of six user-configurable modes, which may be selected using the Advantys configuration software. (By default, it operates as a frequency counter (see *p. 55*).)

Front Panel View



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED array
4 black identification stripe, indicating an intelligent STB I/O module
5 field wiring clamp connector (power to input and output devices)

Ordering Information

The module can be ordered as part of a kit (STB EHC 3020 K), which includes:

- one STB EHC 3020 digital output module
- an STB XBA 3000 I/O base (see *p. 127*)
- field connections (see *p. 41*) via a special 18-terminal *spring clamp* connector

Individual parts may also be ordered for stock or replacement as follows:

- a standalone STB EHC 3020 digital output module
- a standalone STB XBA 3000 size 3 base
- a special STB XTS 2150 spring clamp connector

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module

For installation instructions and other details, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

Module Dimensions

width	module on a base	27.8 mm (1.09 in)
height	module only	125 mm (4.92 in)
	on a base	128.3 mm (5.05 in)
depth	module only	64.1 mm (2.52 in)
	on a base with connectors	75.5 mm (2.97 in) worst case (with spring clamp connectors)

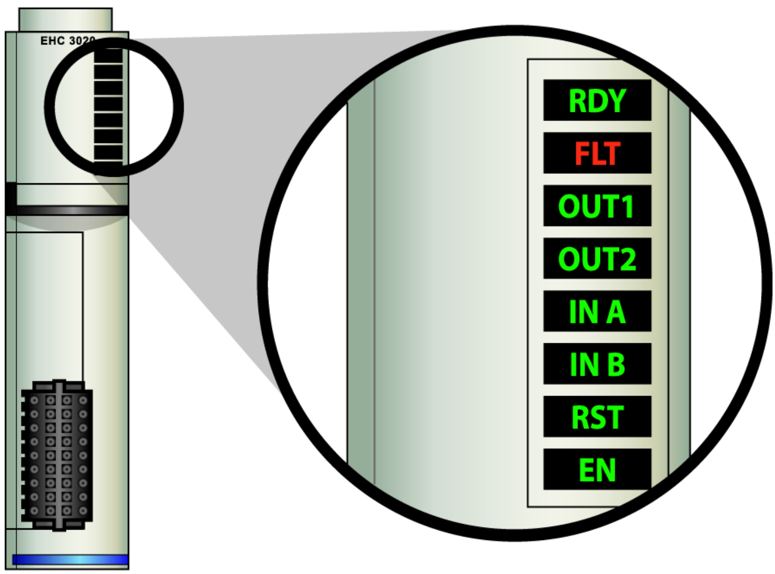
STB EHC 3020 LED Indicators

Purpose

The eight LEDs on the STB EHC 3020 counter module are visual indications of the operating status of the module, its two output channels, and its four input channels. The LED locations and their meanings are described below.

Location

The eight LEDs are positioned in a column at the top of the module. The figure below shows their locations:



Indications

The following table defines the meaning of the eight LEDs (where an empty cell indicates that the pattern on the associated LED doesn't matter):

RDY	FLT	OUT1	OUT2	IN A	IN B	RST	EN	Meaning
off	off	off						The module is either not receiving power or has failed.
on	off	normal						The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational

RDY	FLT	OUT1	OUT2	IN A	IN B	RST	EN	Meaning
on	flickering			blinking				Sensor bus has failed.
		blinking						Actuator bus has failed.
		flickering						Short circuit detected on OUT1.
			flickering					Short circuit detected on OUT2.
off	on	normal						The island bus is off.
	blink							There is an island bus controller error
flickering	off	off						Auto-addressing is in progress.
blinking		off						The module is either in pre-operational mode or in its fallback state.
on	off							The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational
		on						Voltage is present on OUT1.
		off						Voltage is absent on OUT1.
			on					Voltage is present on OUT2.
			off					Voltage is absent on OUT2.
				on				Voltage is present on IN A.
				off				Voltage is absent on IN A.
					on			Voltage is present on IN B.
					off			Voltage is absent on IN B.
						on		Voltage is present on RST.
						off		Voltage is absent on RST.
							on	Voltage is present on EN.
							off	Voltage is absent on EN.
on	on	on						The watchdog has timed out.
on or blinking	flickering							A sensor bus failure, an actuator bus failure, a short circuit on OUT1 and/or OUT2.
blinking								The island bus is not running.
normal—the LED is on if there is 24 VDC on the input or if the output is active.								
flickering—the LED is on for 50 ms then off for 50 ms.								
blinking—the LED is on for 200 ms then off for 200 ms.								
blink—the LED is on 200 ms then off for 1 s.								

STB EHC 3020 Field Wiring

Summary

The STB EHC 3020 module utilizes one 18-terminal field wiring connector. Connector pinouts and field wiring examples are presented below.

Field Sensors

The module has IEC type 3 inputs that support sensor signals from mechanical switching devices (operating in normal environmental conditions) such as relay contacts, limit switches, push buttons, and three-wire and two-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 mA
- a maximum off-state current less than or equal to 1.5 mA

Field Actuators

It supports field wiring to two-wire actuators such as solenoids, contacts, relays, alarms or panel lamps.

Outputs OUT1 and OUT2 are limited by a maximum current of 0.5 A each. Output sensor power from the PDM is short-circuit limited and thermal protected.

The Connector

The STB EHC 3020 module requires one 18-terminal STB XTS 2150 clamp style connector (sold separately). The connector has 18 terminals. Terminals 1 through 12 support inputs, and terminals 13 through 16 support outputs. Terminals 17 and 18 provide shield connections.

Field Wiring Requirements

Individual connector terminals accept one field wire. Use wire sizes in the range 0.51 ... 1.29 mm (24 ... 16 AWG).

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

Field Wiring Pinout

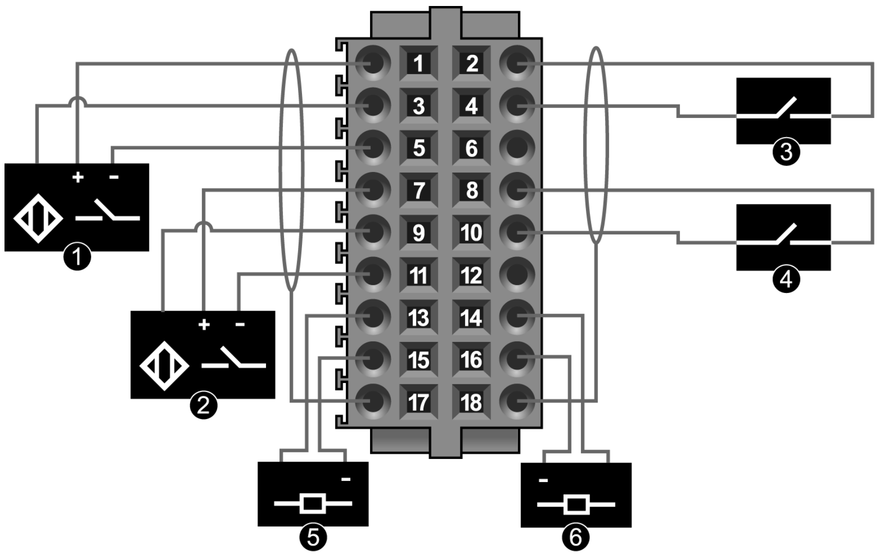
The input terminals provide three-wire connections for inputs IN A, IN B, RST, and EN. If you choose to used shielded wire, shield connections are provided on pins 17 and 18. The output terminals provide two-wire connections for outputs OUT1 and OUT2.

Pin	Function	Pin	Function
1	+24 VDC field power (from the PDM) for input IN A	2	+24 VDC field power (from the PDM) for the input EN
3	input IN A	4	input EN
5	field power return for input IN A	6	field power return for input EN
7	+24 VDC field power (from the PDM) for input IN B	8	+24 VDC field power (from the PDM) for input RST

Pin	Function	Pin	Function
9	input IN B	10	input RST
11	field power return for input IN B	12	field power return for input RST
13	output OUT1	14	output OUT2
15	output OUT1 return	16	output OUT2 return
17	shield connection for input IN A and input IN B.	18	shield connection for input EN and input RST.

Sample Wiring Diagram

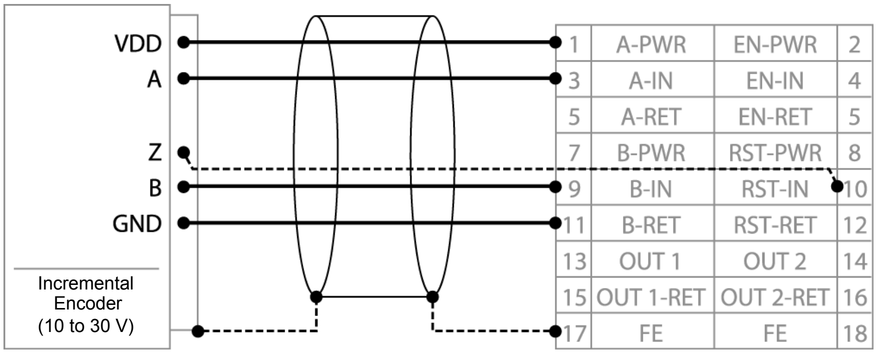
The following field wiring example shows three-wire input devices used on inputs IN A and IN B, two-wire devices used on inputs EN and RST, and two-wire output devices used on outputs OUT1 and OUT2. The four input devices use shielded cables tied to pins 17 and 18:



1 input IN A
2 input IN B
3 input EN
4 input RST
5 output OUT1
6 output OUT2

Note: To insert and remove wires from the connector, use a 2.5 x 0.4 mm screwdriver to open the round receptacle by *pushing* on the corresponding plate, numbers 1 to 18 in the figure above. Push the flexible plate down on the outside (the side closest to the corresponding receptacle). A screwing (rotating) or bending motion is not required.

The pin-out for the incremental encoder (10 to 30 V only) should be according to the following figure (pin numbers correspond to the callouts in the figure above):



Note: This is only a suggested wiring diagram. Consult the manufacturer's documentation for the wiring most appropriate to your encoder.

Requirements

Shielded, twisted pair cable is recommended. The shield should be tied to the shield (FE) terminal on the connector. For high-noise environments or when you connect the encoder, we recommend using the EMC kit (STB XSP 3000).

Note: See the Advantys STB System Planning and Installation Guide (890 USE 171) for further information on system field wiring requirements.

Input Filters

Each input uses an analog filter:

Input	Minimum Filter	Minimum Pulse	Maximum Frequency
IN A, IN B	2.5 µs	10 µs	40 kHz
EN, RST	25 µs	100 µs	4 kHz

These analog filters are always active.

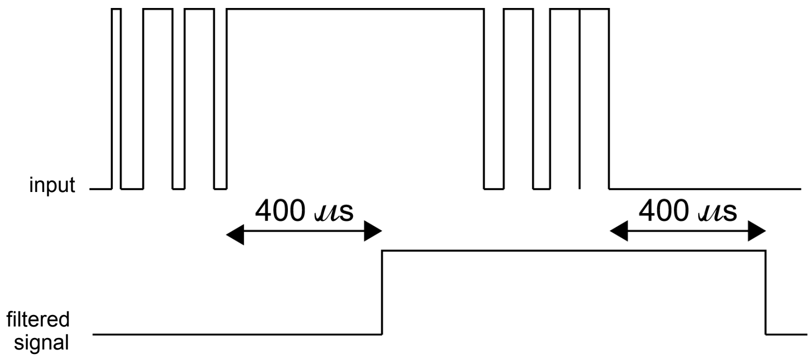
Bounce Filter

The counter module provides a configurable numerical bounce filter for inputs IN A and IN B. This filter allows you to limit unwanted noise on these input signals. It is possible to disable (the default setting) or enable the bounce filter independently on either channel. However, the filter time-constant is common to both inputs.

The following table shows the input characteristics with and without the numerical bounce filter:

Condition	Filter Minimum	Minimum Pulse (Without Bounce)	Frequency Maximum
without filter (default)	2.5 μs	10 μs	40 kHz
with filter (400 μs)	405 μs	410 μs	1 kHz
with filter (1.2 ms)	1.2 ms	1.25 ms	400 Hz

Bounce filter operation is shown in the figure below:



As the figure shows, the filtered signal is not on until the input has been consistently high for the configured time (400 μs). Likewise, the filtered signal is off when the input is consistently low for the configured time.

STB EHC 3020 Module Specifications

Technical Specifications

The STB EHC 3020 module's technical specifications are described in the following tables.

General Specifications

The STB EHC 3020 module's general specifications are described in the following tables.

General Specifications				
description	maximum input frequency		40 kHz	
I/O channels	number of digital input channels		four	
	number of digital output channels		two	
dimensions	width	module on a base	27.8 mm (1.09 in)	
	height	module only	125 mm (4.92 in)	
		on a base	128.3 mm (5.05 in)	
	depth	module only	64.1 mm (2.52 in)	
		on a base with connectors	75.5 mm (2.97 in) worst case (with screw clamp connectors)	
I/O base	STB XBA 3000 (size 3 base)			
hot swapping supported*	yes, with limitations—The module can be removed and inserted from its base while the island remains under power, but the counter may have to be reenabled when it is reinserted in its base. For mode-specific hot swapping information, see the discussion of the individual counting modes (see *p. 54*).			
reverse polarity protection	yes			
encoder compliance	yes (up and down mode only)			
fault recovery response	default		channels latched off—requires user to reset	
	user-configurable settings**		latch off	
			autorecovery	
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*		
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171*				
**Requires the Advantys configuration software.				
***This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.				

The STB EHC 3020 module's power bus specifications are described in the following table.

Advantys Power Bus		
island power bus	5 VDC bus current	< 60 mA typical at 5.2 VDC (+2 %, -4 %)
		< 100 mA maximum
isolation voltage	field-to-bus	1500 VDC for 1 min

The STB EHC 3020 module's power bus specifications are described in the following table.

Field Power Bus	
sensor power voltage	19.2 to 30.0 VDC
field power bus	33 mA maximum
actuator power current (24 VDC)	.5 A per channel, 1 A per module
max. power dissipation	1.8 W

Note: All counter values are reset when sensor power is lost.

Digital Input Specifications

The following table lists the digital input specifications for the STB EHC 3020 counter module:

Digital Input Specifications		
number of input channels	four	
digital Inputs ● IN A ● IN B ● EN ● RST	maximum input voltage	30 VDC continuous
	on input voltage	+11 to +30 VDC
	off input voltage	up to +5 VDC
	off input current	up to 1.5 mA
	nominal input current (24 VDC)	6 mA
	current at 11 VDC	> 2 mA
input response time	Refer to the input filter (see *p. 43*) and bounce filter (see *p. 44*) tables.	

Digital Output Specifications

The following table lists the digital output specifications for the STB EHC 3020 counter module:

Digital Output Specifications		
number of output channels	two	
output voltage	19.2 . . . 30.0 VDC	
minimum load current	none	
maximum load current	each point	0.5 A
	per module	1.0 A
	off state leakage/point	-0.1 mA max.
	on state output v. drop (max.)	3.0 VDC
	short circuit output current (each point)	1.5 A maximum
surge current maximum	self limiting per channel	
maximum load capacitance	50 μF	
load inductance maximum	0.5 Henry at 4 Hz switch frequency $L = 0.5/I^2 \times F$	where: • L = load inductance (Henry) • I = load current (A) • F = switching frequency (Hz)
maximum response time	< 1 s	frequency mode—when the frequency move in (0.2 kHz)
	< 0.2 s	frequency mode—when the frequency move in (2 kHz, 40 kHz)
	< 0.5 ms after measurement	event counting and period measurement modes
	< 0.5 ms after measurement	
	< 5 ms	up and down mode
output protection (internal)	transient voltage suppression	
short circuit protection/status	per channel	
fallback value (output channels)	default	predefined fallback values on both channels
	user-configurable settings*	hold last value
		predefined fallback value on one or both channels
fallback states for output channels (when *predefined* is the fallback mode)	default	both channels go to 0
	user-configurable settings*	each channel configurable for 1 or 0
polarity on individual output channels	default	logic normal on both channels
	user-configurable settings*	logic reverse on one or both channels
		logic normal on one or both channels
*Requires the Advantys configuration software.		

2.2 STB EHC 3020 Overview

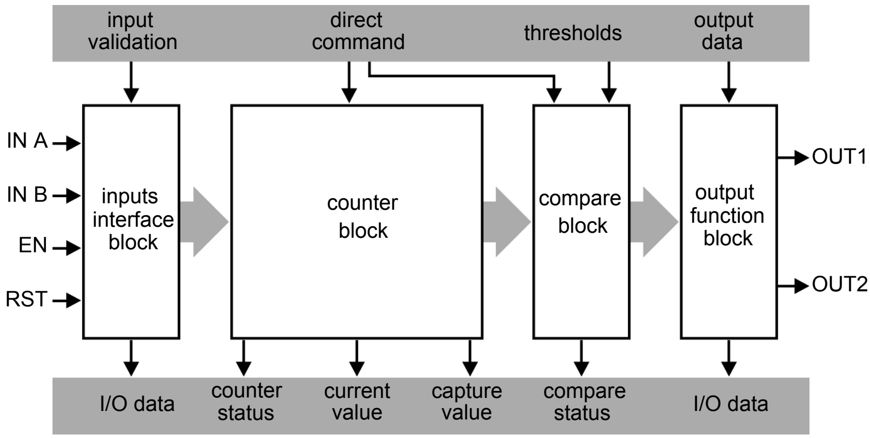
STB EHC 3020 Functional Overview

Introduction

The STB EHC 3020 is an industrial class I/O module designed to handle high duty cycles and to control continuous-operation equipment. It can be configured to operate in any of six modes (see *p. 54*) that support various measuring and counting operations.

Overview Diagram

The figure below illustrates the functionality of the STB EHC 3020 40 kHz counter module:



The module's onboard counter uses up to four digital inputs to produce a 16-bit *current value* result.

Input IN A is always a physical input brought into the counter module through a field wire connected to pin 3 (see *p. 41*). The other three inputs (input IN B, input EN, and input RST) may or may not be used, depending on the counter's operating mode. These three inputs may be physical or they may be controlled by the fieldbus master.

The 16-bit counter's current value is reported to the process image in the current value register (see *p. 100*), which can be read by the fieldbus master.

This internal 16-bit value is also sent to an onboard compare block (discussed later in this topic), which compares it against a pair of thresholds. These upper threshold and lower threshold values are user-configurable. The compare block reports the status of the current value relative to the thresholds to the process image in the compare status register (see *p. 99*).

If you want the module to produce outputs, you may also send this 16-bit value along with the upper threshold and/or lower threshold values to a pair of output functions. These output functions analyze the current value against the threshold value(s) in any one of 12 different ways and then produce a digital output based on that analysis.

Example

Based on the overview diagram (above), suppose the counter block produces a current value of 140. This value is sent to the current value register (see *p. 100*) in the process image and is simultaneously sent to the module's compare block. Suppose you have configured the compare block with a lower threshold value of 125 and an upper threshold value of 150. In the compare status register (see *p. 99*) of the process image, the compare block reports that the current value is between the lower threshold value and the upper threshold value.

Now suppose that output function 1 is configured to see if the current value is in the window defined by the lower threshold and upper threshold, and that output function 2 is configured to pulse when the current value is greater than the upper threshold value. The output function 1 analysis validates that the current value is within the threshold window, and the output function sends a value of 1 to output OUT1. The output function 2 analysis validates that the current value is not greater than the upper threshold value, and the output function does not send a pulse to output OUT2.

Counter Block

The counter block inside the module receives up to four inputs. The exact number of inputs depends on the selected operational mode. The counter block produces a 16-bit result that is put in the current value register (see *p. 100*) of the process image, which can be read by the fieldbus master.

The six user-configurable counting modes are:

- frequency counting (see *p. 55*)—speed and flow metering
- event counting (see *p. 58*)—event monitoring, counting spread events up to 65535 during a defined period
- period evaluation (see *p. 62*)—measures the interval between events (pulse delay evaluation, from 100 µs to 65 s)
- one-shot counting (see *p. 66*)—grouping process
- modulo (loop) counting (see *p. 70*)—packaging and labeling processes, flow rate regulation
- up/down counting (see *p. 75*)—accumulating

Counter adjustments are parameters that you can configure with the Advantys configuration software that apply to particular counter modes.

Items in the following list will direct you to the counter adjustment description for the six different counting modes:

- frequency counting mode adjustments (see *p. 55*)
- event counting mode adjustments (see *p. 59*)
- period evaluation mode adjustments (see *p. 63*)
- one-shot counting mode adjustments (see *p. 67*)
- modulo (loop) mode adjustments (see *p. 72*)
- up and down counter mode adjustments (see *p. 78*)

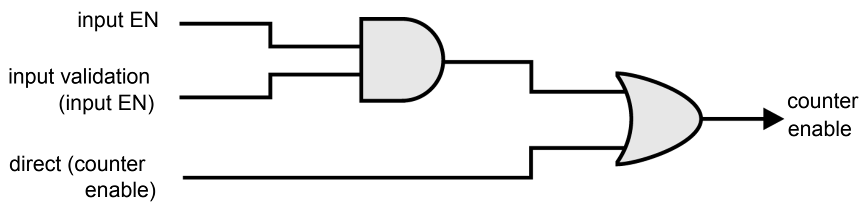
Counter Inputs

There are four inputs to this module. Input IN A is always directly controlled by a hardware sensor. The remaining inputs (IN B, EN, RST) can be controlled either by a sensor or by the fieldbus master. Input IN A is always used. Other inputs are mode-dependent.

There are two ways in which inputs IN B, EN, and RST can be controlled:

- through a physical input (when its corresponding input validation bit is set)
- set directly by the fieldbus master

The following diagram demonstrates how this is achieved:



As the figure shows, if the input validation bit is on, the counter enable can be controlled by the input EN. If the input validation bit is off, the counter enable can be controlled by the fieldbus master (the direct register in the process image (see *p. 102*)).

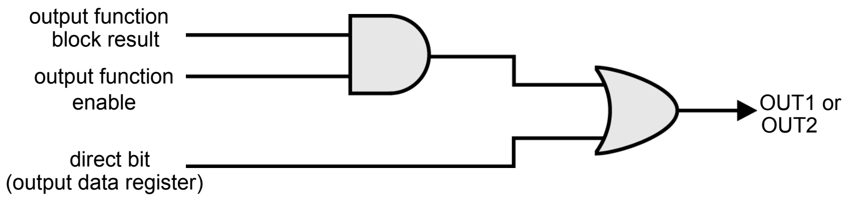
Note: The validation bit must be set if the input is controlled by the hardware input. The bit must not be set if the input is controlled by the fieldbus master.

Note: Input IN B can be configured to detect either the rising edge, falling edge, or both rising and falling edges. RST is rising edge only. EN is level triggered only.

Counter Outputs

There are two output channels on this module. Each output may be driven directly from the fieldbus master through the output data register (see *p. 100*) or from an output function block (see *p. 91*) result.

The following logic diagram describes how the counter module can control the physical output.



As stated, you can drive the output in one of two ways:

- directly, from the fieldbus master—Set the output function enable bit to off (0). The output will then match the state of the output bit in the output data register (see *p. 100*).
- from the output function block—Set the output bit in the output data register (see *p. 100*) to off (0). Then, set the corresponding output function enable bit. The output will then match the state of the output bit in the output function block result.

Note: When using the output blocks, make sure that the fieldbus master is not currently controlling the outputs in the output data register (see *p. 100*).

Input Data Registers

The input data for the STB EHC 3020 module is represented by six contiguous registers in the input process image (see *p. 97*) block:

- I/O data—the state of all inputs, outputs, and output function block results
- I/O status—counter module I/O error information
- counter status—various bits indicating the status of the counter operation (sometimes mode-specific)
- compare status—various bits indicating the status of compare operations with respect to user-defined thresholds
- current value—16-bit value the contains the actual current value
- capture value—This represents the current value at synchronization (modulo mode (see *p. 70*) only)

Output Data Registers

The output data for the STB EHC 3020 module is represented by five contiguous registers in the output process image (see *p. 100*) block:
- output data—output values and output function enable values
- input validation—input validation bits for inputs IN B, EN, and RST
- direct—bits that can be set by the fieldbus master to control counter operation
- *upper threshold*—threshold used for compare operations
- *lower threshold*—threshold used for compare operations

Compare Block

The compare block receives the 16-bit current value as input and evaluates the status of the current value relative to two user-defined threshold values.

The upper threshold and lower threshold values are represented by unsigned integers in the 0 to 65535 range. There are two ways to set the thresholds:
- *dynamically* (by output data)—over the fieldbus (default setting)
- *statically*—with the Advantys configuration software

For all modes, the value of the lower threshold should be set lower than the value of the upper threshold. If the upper threshold value is lower than the lower threshold value, the lower threshold value is ignored.

The compare enable bit (in the direct register (see *p. 102*) of the process image) needs to be set to enable compare block functionality.

The following status information is reported:
- current value register is less than the lower threshold
- current value register is greater than or equal to the lower threshold and less than or equal to upper threshold
- current value register is greater than the upper threshold
- capture value register is greater than or equal to the lower threshold and less than or equal to upper threshold
- capture value register is greater than or equal to the lower threshold and less than or equal to upper threshold

The status of the module's compare function is written to the compare status register (see *p. 99*) in the input block of the process image. The fieldbus master can read this register from the process image.

Output Function Blocks

This module supports two programmable output blocks that can control two digital outputs. Each of these blocks operates on the 16-bit current value in the current value register (see *p. 100*) of the process image. Output function block 1 dictates the behavior of output OUT1 while output function block 2 dictates the behavior of output OUT2.

To implement either output function block, its corresponding enable bit must be set by the fieldbus master.

Each output function behaves in one of 12 ways that you can select with the Advantys configuration software. The output value is set when the certain conditions are met:

- No direct action. The function block is not enabled.
- The function block output is set when the current value is less than the lower threshold value.
- The function block output is set when the current value is greater than or equal to the lower threshold and less than or equal to the upper threshold.
- The function block output is set when the current value is greater than the upper threshold value.
- The function block output generates a pulse when the current value is decreasing and becomes less than the lower threshold value.
- The function block output generates a pulse when the current value is increasing and becomes greater than or equal to the lower threshold value.
- The function block output generates a pulse when the current value is decreasing and becomes less than or equal to the upper threshold value.
- The function block output generates a pulse when the current value is increasing and becomes greater than the upper threshold value.
- The function block output is set when the counter stop bit in the counter status register is set (one-shot (see *p. 66*) mode).
- The function block output is set when the counter run bit in the counter status register is set (one-shot (see *p. 66*) mode).
- The function block output is set when the capture value is less than the lower threshold value (modulo mode (see *p. 70*) only).
- The function block output is set when the capture value is greater than or equal to the lower threshold and less than or equal to the upper threshold (modulo mode (see *p. 70*) only).

For operational modes in which the block generates a pulse, you can use the Advantys configuration software to independently configure the pulse width for each output (see below). The default pulse width is 10 ms.

Pulse Widths

If you choose one of the pulse generating blocks, you can independently configure the pulse width (see *p. 92*) for each output. The minimum pulse width value is 1 (1 ms) and the maximum pulse width value is 65535 (in 1 ms increments).

Each pulse width corresponds to one output:

- pulse width 1—applied to output OUT1 (default = 10 ms)
- pulse width 2—applied to output OUT2 (default = 10 ms)

2.3 STB EHC 3020 Counting Modes

At a Glance

Introduction

This section describes the six counting modes for the STB EHC 3020 counter module.

The *frequency* mode is the default operating mode for the counter module.

What's in this Section?

This section contains the following topics:

STB EHC 3020 Frequency Counting Mode

Summary

Use the counter's frequency mode to measure the frequency, speed, or the rate or flow of events. Frequency is presented as events per second (Hz). In this single-input mode (only IN A is required), the counter evaluates the rate of pulses applied to IN A at time-based intervals of either 10 ms or 100 ms. The interval is chosen automatically to optimize counter accuracy within the measurement period. The current value register (see *p. 100*) is updated at the end of each time base with the frequency (in Hz) of the pulses applied to IN A.

The frequency mode is the default mode for the STB EHC 3020 counter module.

Inputs

The following table lists the input(s) (IN A only) used in the frequency counting mode:

Input	Description	Source	
		Fieldbus Master	Hardware
IN A	count input	no	yes

Adjustments

The counter adjustments for the frequency counting mode are described in the following table:

Name	Valid Values	Source	
		Advantys	Fieldbus Master
scaling factor (see *p. 83*)	1 (default) to 255	yes	no
frequency: calibration factor (see *p. 83*)	1 to 200 (90.1 % to 110 % (default = 100)	yes	no
bounce numerical filter (see *p. 90*)	inactive (default), 400 µs, 1.2 ms	yes	no
communication mode (see *p. 87*)	by setting, by output data (default)	yes	no
upper threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
lower threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
note 1: when communication mode is set to *by output data*			
note 2: when communication mode is set to *by setting*			

Name	Valid Values	Source	
		Advantys	Fieldbus Master
note 3: The compare enable bit (Output/Direct/Channel4) must be set to active low (0) by the fieldbus master when changing threshold values if the communication mode is set to *by output data*.			

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

Status Information

Status information for the counter is reported in the counter status register (see *p. 99*) and the compare status register (see *p. 99*). Both registers are in the input block of the process image. The table below shows the applicable bits that are set in this mode when the listed conditions are met:

Register	Bit	Channel	Condition(s)
counter status	3	4	validity bit—The validity bit is used to indicate that the counter current value register and compare status register contain valid data. A *1* indicates valid data and a *0* indicates invalid data.
counter status	4	5	upper limit count bit—set when the current value register exceeds the 16-bit limit (input frequency is greater than 65535 Hz)
compare status	0	1	counter low bit—set when the current value register is less than the lower threshold
compare status	1	2	counter in window bit—set when the current value register is greater than or equal to the lower threshold and less than or equal to the upper threshold
compare status	2	3	counter high bit—set when current value register is greater than the upper threshold value

Output Functions

Each output can be individually controlled by the result of a user-selectable output function or directly by the fieldbus master. The following table describes the available output functions for the frequency counting mode:

Name	Available
off	yes
counter low (note 1)	yes
counter in window (note 2)	yes
counter high	yes
pulse = less than LT	yes
pulse = greater than LT	yes
pulse = less than UT	yes
pulse = greater than UT	yes
counter stop	no
counter run	no
capture low	no
capture in window	no
note 1: default (output function 2)	
note 2: default (output function 1)	

Hot Swapping

Hot swapping is supported by this module in this mode. However, the user has to check the state of the validity bit (see *p. 99*) in the application during module power-up and initialization. The compare status register (see *p. 99*) and current value register (see *p. 100*) information is only valid when the validity bit is high. The user should ignore any data from the compare status and current value register when the validity bit is low.

Limitations

The maximum input frequency that the counter module can measure in this mode is 40 kHz (with a duty cycle of 40 to 60 percent).

STB EHC 3020 Event Counting Mode

Summary

In event counting mode, the module accumulates a number of events that are received over a user-configurable time base. You can configure the accumulation of events for every 0.1 s, 1 s, 10 s, or 1 min.

The current value register (see *p. 100*) is updated at the end of each configured time base with the number of pulses received during the time base interval.

Inputs

The following table lists the inputs used in this mode and the possible sources for those inputs:

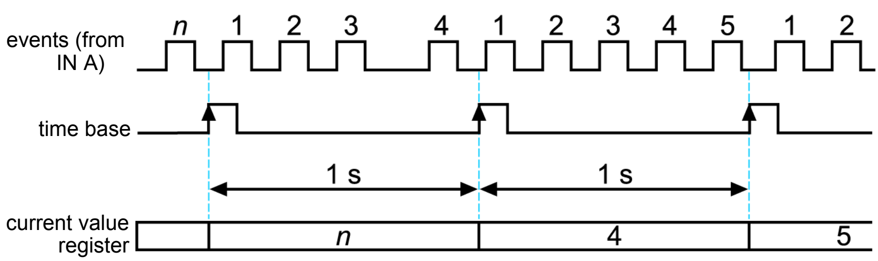
Input	Description	Source	
		Fieldbus Master	**Hardware**
IN A	count input	no	yes
IN B	sync input (note 1)	yes	yes
note 1: If IN B is configured as a logic input in the fieldbus master using the counter sync (direct register (see *p. 102*)) bit, only rising edges are detected. However, if IN B is configured as a hardware input, either the rising edge, falling edge, or both falling and rising edges can be detected, based on the sync mode adjustment.			

IN A is the only required input in this mode. Optionally, the sync input (IN B) can reset the internal current value and restart the internal time base. IN B can be hard-wired (provided that the corresponding input validation bit is set) or the fieldbus master can directly control it.

Functional Characteristics

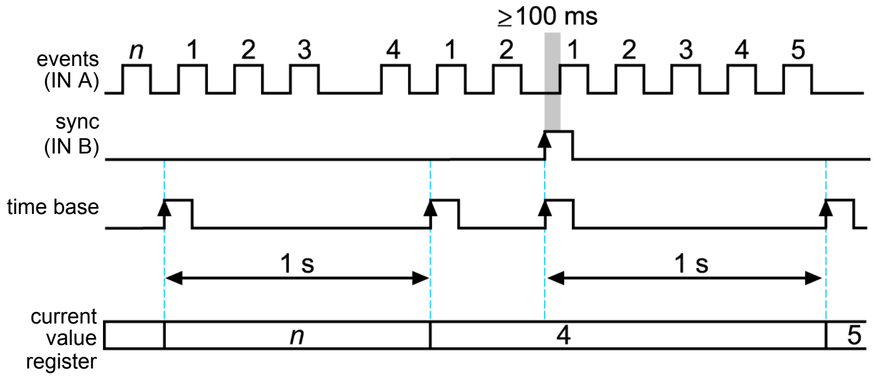
In event counting mode, the module accumulates a number of events over a user-configurable period. Pulses applied to IN A are counted. The output (current value register (see *p. 100*)) is the number of counts accumulated over one period.

The following timing diagram shows a simple example of an event counter with a 1 s time base:



As shown in the figure, the counter current value represents the number of events accumulated during the previous 1 s interval (time base). That is, the count of the last event from IN A (*n*) is reported as output to the current value register (see *p. 100*) while events in the next 1 s interval are counted. After the four events in that interval are counted, a 4 is placed in the current value while events in the next interval are counted.

IN B is available to be used as an optional synchronization pulse. When IN B sends a pulse to the counter it restarts the time base to 0 and restarts the event accumulation:



In the above figure, notice how the sync pulse can establish an interval between counting operations. The events that occur during that interval are not accumulated in the current value.

Note: If the number of events exceeds 65535 during a time base, the current value is immediately set to 65535 and the upper limit count bit is set.

Adjustments

The following table describes the adjustment parameters that can be applied in the event counting mode and the possible sources for those adjustments:

Name	Valid Values	Source	
		Advantys	**Fieldbus Master**
event counting time (see *p. 84*)	0.1 s, 1 s (default), 10 s, 1 m	yes	no
sync mode (see *p. 86*)	rising edge on IN B (default), falling edge on IN B, both edges on IN B	yes	no
bounce numerical filter (see *p. 90*)	inactive (default), 400 µs, 1.2 ms	yes	no

Name	Valid Values	Source	
		Advantys	**Fieldbus Master**
communication mode (see *p. 87*)	by setting, by output data (default)	yes	no
upper threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
lower threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
note 1: when communication mode is set to *by output data*			
note 2: when communication mode is set to *by setting*			
note 3: The compare enable bit (Output/Direct/Channel4) must be set to active low (0) by the fieldbus master when changing threshold values if the communication mode is set to *by output data*.			

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

Status Information

Status information for the counter is reported in the counter status register (see *p. 99*) and the compare status register (see *p. 99*) in the input block of the process image. The table below shows the applicable bits that are set in this mode when the listed conditions are met:

Register	Bit	Channel (Advantys I/O Image)	Condition(s)
counter status	3	4	validity bit—The validity bit is used to indicate that the counter current value register and compare status register contain valid data. A *1* indicates valid data and a *0* indicates invalid data.
counter status	4	5	upper limit count bit—Set when the counter value would exceed the 16-bit register limit (greater than 65535). Set for the duration of a time base and the current value is set to 65535.
compare status	0	1	counter low bit—Set when the current value register is less than the lower threshold value.
compare status	1	2	counter in window bit—set when the current value register is greater than or equal to the lower threshold and less than or equal to the upper threshold
compare status	2	3	counter high bit—set when current value register is greater than the upper threshold value

Output Functions

Each output can be individually driven by the result of a user-selectable output function or directly by the fieldbus master. The following table shows the output functions (see *p. 91*) available in this mode:

Name	Available
off	yes
counter low (note 1)	yes
counter in window (note 2)	yes
counter high	yes
pulse = less than LT	yes
pulse = greater than LT	yes
pulse = less than UT	yes
pulse = greater than UT	yes
counter stop	no
counter run	no
capture low	no
capture in window	no
note 1: default (output function 2)	
note 2: default (output function 1)	

Hot Swapping

Hot swapping is supported by this module in this mode. However, the user has to check the state of the validity bit (see *p. 99*) in the application during module power-up and initialization. The compare status register (see *p. 99*) and current value register (see *p. 100*) information is only valid when the validity bit is high. The user should ignore any data reported back from the compare status and current value registers when the validity bit is off.

Limitations

Any input required by this mode must be recognized for at least 10 µs if the bounce filter has not been activated.

The module counts pulses applied to IN A whenever the pulse is at least 10 µs long (400 µs or 1.2 ms long when the bounce filter is applied). The first countable pulse applied to IN A is not detected until 100 ms after each sync input. Pulses within 100 ms of the sync input are lost.

STB EHC 3020 Period Measuring Mode

Summary

In period measuring mode, the module measures the time that elapses during an event or between events. This duration is measured in units defined by the user. The user-defined duration can be 10 µs, 100 µs, or 1 ms.

The output data register is updated based on the time interval you select.

Inputs

Input IN A is the only available input in this mode. That is, pulses applied to IN A indicate the period to be measured. IN A, as it applies to the period measuring mode, is described in the following table:

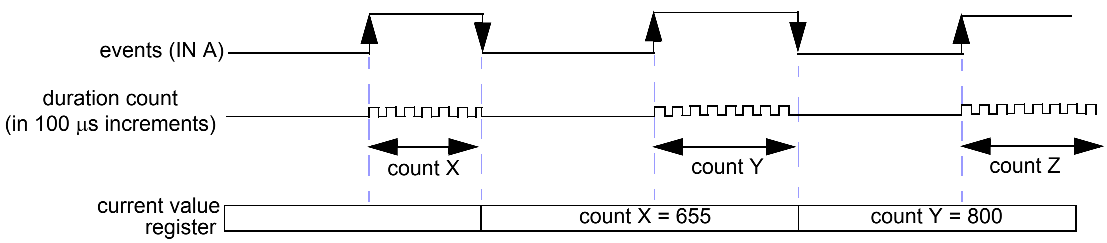
Inputs	Description	Source	
		Fieldbus Master	**Hardware**
IN A	count input	yes	no

Functional Characteristics

The measurement period begins at the rising edge of a pulse applied to IN A and may be measured either to the falling edge of that same pulse (*edge-to-opposite*) or to the rising edge of the next pulse (*edge-to-edge*). In either case, there must be a 5 ms interval between any two individual rising edges.

The shortest measurable length for a single pulse is 500 µs. The maximum size of a pulse you can measure in this mode is 65535 * time base.

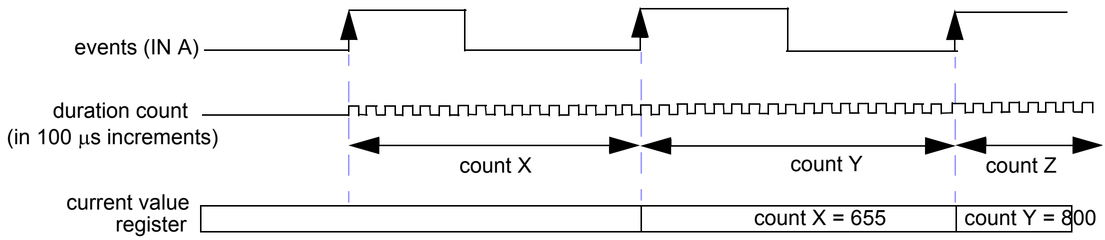
By setting the mode to *edge-to-opposite*, the time period during the event can be measured. The following figure shows the application of this mode with the implementation of a 100 µs period measurement value:



As the figure shows, the duration in edge-to-opposite mode is measured from the rising edge of an event to the falling edge of the same event. The measurement is reported as soon as the falling edge is detected:

- count X—*655* indicates a measurement of 65.5 ms
- count Y—*800* indicates a measurement of 80 ms

By setting the mode to *edge-to-edge* (the default), the time period between two events can be measured:



As shown above, the duration in edge-to-edge mode is measured from the rising edge of one event to the rising edge of the next event.

Adjustments

The counter adjustments for the period measuring mode are described in the following table:

Name	Valid Values	Source	
		Advantys	Fieldbus Master
period measuring resolution (see *p. 84*)	10 µs, 100 µs, 1 ms	yes	no
bounce numerical filter (see *p. 90*)	inactive (default), 400 µs, 1.2 ms	yes	no
communication mode (see *p. 87*)	by setting, by output data (default)	yes	no
upper threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
lower threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
note 1: when communication mode is set to *by output data*			
note 2: when communication mode is set to *by setting*			
note 3: The compare enable bit (Output/Direct/Channel4) must be set to active low (0) by the fieldbus master when changing threshold values if the communication mode is set to *by output data*.			

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

Status Information

The status information for the period measuring mode are described in the following table:

Register	Bit	Channel	Description
counter status	3	4	validity bit—The validity bit is used to indicate that the counter current value register and compare status register contain valid data. A *1* indicates valid data and a *0* indicates invalid data.
counter status	4	5	upper limit count bit—Set when the counter value is higher than 65535.
counter status	5	6	lower limit count bit—Set when IN A changes at a frequency greater than 200 Hz or has a pulse width less than 500 µs.
compare status	0	1	count low bit—Set when the current value register is less than the lower threshold value.
compare status	1	2	counter in window bit—Set when the current value register is greater than or equal to the lower threshold and less than or equal to the upper threshold.
compare status	2	2	counter high bit—Set when the current value register is greater than the upper threshold value.

Output Functions

The output functions for the period measuring mode are described in the following table:

Name	Available
off	yes
counter low (note 1)	yes
counter in window (note 2)	yes
counter high	yes
pulse = less than LT	yes
pulse = greater than LT	yes
pulse = less than UT	yes
pulse = greater than UT	yes
counter stop	no
counter run	no
capture low	no
capture in window	no
note 1: default (output function 2)	
note 2: default (output function 1)	

Hot Swapping

Hot swapping is supported by this module in this mode. However, the user has to check the state of the validity bit in the application during module power-up and initialization. The compare status register (see *p. 99*) and current value register (see *p. 100*) information is only valid when the validity bit is high. The user should ignore any data reported back from the compare status and current value registers when the validity bit is off.

Limitations

The maximum frequency of IN A is 200 Hz. That is, the minimum interval between two measurements is 5 ms.

In the edge-to-opposite mode, the minimum pulse width for IN A is 500 μs.

STB EHC 3020 One-Shot Counting Mode

Summary

The one-shot counting mode is conducive to grouping operations. In this mode, the current value is decremented (from a user-defined threshold) for each pulse applied to IN A until the counter reaches a value of 0. When the counter reaches 0, an output can be driven to signal the completion of the counting operation. The user-defined threshold parameter defines the number of parts to count (up to 65535) and is loaded automatically when the counter starts.

Note: If there are more than 10 I/O modules in your island configuration, you must prioritize the STB EHC 3020 module for one-shot counting operations. Refer to your NIM user manual for details.

Inputs

The three inputs used in the one-shot mode are described in the following table:

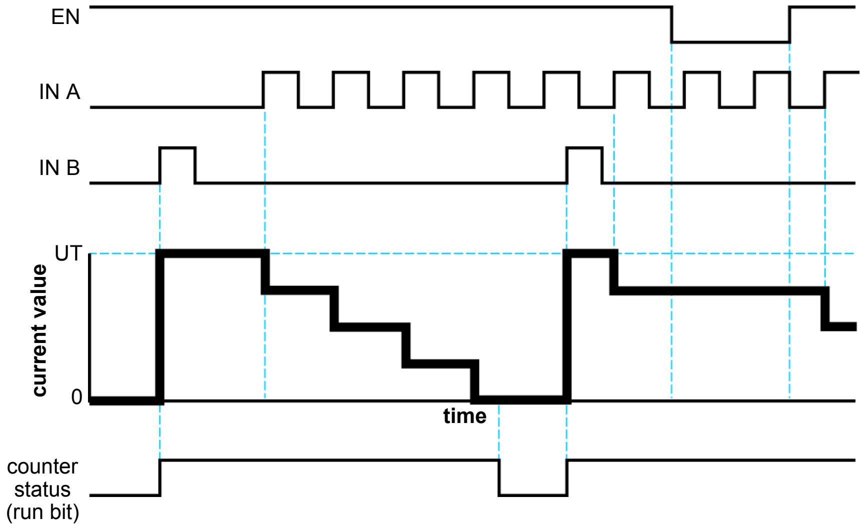
Inputs	Description	Source	
		Fieldbus Master	**Hardware**
IN A	count input	no	yes
IN B	sync input (note 1)	yes	yes (note 2)
EN	counter enable	yes	yes (note 2)
note 1: If IN B is configured as a logic input in the fieldbus master using the counter sync (direct register (see *p. 102*)), only rising edges are detected. However, if IN B is configured as a hardware input, either the rising edge, falling edge, or both falling and rising edges can be detected based on the sync mode adjustment.			
note 2: The corresponding validation bit must be set if either IN B or EN is controlled by the hardware input. The bit must not be set if either input is under the control of the fieldbus master.			

Input EN must be set in order to count pulses applied to IN A. On the active edge of IN B, the current value is set to the user-defined threshold value and the counter starts counting. Inputs IN B and EN can be hard-wired (providing that the corresponding input validation bit is set) or directly controlled by the fieldbus master.

Functional Characteristics

In one-shot counting mode, the module begins counting pulses applied to IN A after detecting an active edge on the sync input (IN B). It counts down from a user-configurable upper threshold value until the count reaches 0. The counter run bit is set to 1 while counting. It turns off (0) when the current value reaches 0. The counter stops and waits until it is restarted by another sync applied to IN B. The module also has an *enable* input (EN). This input must be set for the counter to count pulses applied to IN A. IN B and EN can be hard-wired (providing that the corresponding input validation bit is set) or directly controlled by the fieldbus master.

The one-shot counting mode uses the user-configured upper threshold (UT) value as a preset value to indicate the number of parts to be grouped:



The counter begins operating at the active edge on the sync input (IN B). The counter loads the preset with the upper threshold (UT) value and decrements the current value upon the detection of each subsequent pulse applied to IN A. When the current value reaches 0, the counter waits for a new sync input (IN B). Additional pulses applied to IN A have no effect on the value once it has reached 0.

Input EN must be high during counting operations. When this input goes low, the last reported current value is held and the counter ignores subsequent pulses applied to IN A. It does not, however, ignore the sync input on IN B. When input EN goes high again, the counter resumes counting operations.

Each time the counter starts, the run bit in the counter status register (see *p. 99*) is set. The bit goes low when the current value reaches 0.

If the sync input pulse (IN B) occurs while the counter is counting (prior to the current value reaching 0), the counter current value is preset with the threshold value and resumes counting from the preset value.

Adjustments

The counter adjustments for the one-shot mode are described in the following table:

Name	Valid Values	Source	
		Advantys	Fieldbus Master
scaling factor (see *p. 83*)	1 (default) to 255	yes	no
sync mode (see *p. 86*)	rising edge on IN B (default), falling edge on IN B, both edges on IN B	yes	no

Name	Valid Values	Source	
		Advantys	**Fieldbus Master**
bounce numerical filter (see *p. 90*)	inactive (default), 400 µs, 1.2 ms	yes	no
communication mode (see *p. 87*)	by setting, by output data (default)	yes	no
upper threshold (see *p. 88*)	0 to 65535	yes (note 2)	yes (note 1)
lower threshold (see *p. 88*)	0 to 65535	yes (note 2)	yes (note 1)
note 1: when communication mode is set to *by output data*			
note 2: when communication mode is set to *by setting*			

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

Status Information

Status information for the counter is reported in the counter status register (see *p. 99*) and the compare status register (see *p. 99*) in the input block of the process image. The table below shows the applicable bits that are set in this mode when the listed conditions are met:

Register	Bit	Channel (Advantys I/O Image)	Condition(s)
counter status	3	4	validity bit—The validity bit is used to indicate that the counter current value register and compare status register contain valid data. A *1* indicates valid data and a *0* indicates invalid data.
counter status	0	1	run bit—On while counter is running. Off when current value reaches 0. While off, waits for an active edge to be applied to sync input (IN B).
counter status	2	3	sync event bit—Set on active edge of B. Bit can be reset using reset sync and modulo bit in the direct register (see *p. 102*).
compare status	0	1	counter low bit—Set when current value register (see *p. 100*) is less than the lower threshold.
compare status	1	2	counter in window bit—Set when the current value register is greater than or equal to the lower threshold and less than or equal to the upper threshold.

Output Functions

Each output can be individually driven by the result of a user-selectable output function or directly with the fieldbus master. The following table shows the output functions (see *p. 91*) available in this mode:

Name	Available
off	yes
counter low (note 1)	yes
counter in window (note 2)	yes
counter high	no
pulse = less than LT	yes
pulse = greater than LT	yes
pulse = less than UT	no
pulse = greater than UT	no
counter stop	yes
counter run	yes
capture low	no
capture in window	no
note 1: default (output function 2)	
note 2: default (output function 1)	

Hot Swap

Electrically, the counter module may be hot swapped while power is applied. Be aware that data in the current value register will be lost when the module is removed from the island in this mode.

When the module is reinserted on the island, the state of IN B (sync) dictates the course of counting operations:

- IN B low—The counter will not begin counting until a rising edge applied to IN B is detected.
- IN B high—The counter will be preset with the user-defined value and will begin counting.

In either case, the validation bit will not be set until the data registers in the process image contain valid information.

Limitations

The following limitations apply to the one-shot counting mode:

- The maximum threshold value is mode is 65535.
- The minimum upper threshold value is 1.
- The minimum elapsed time between two rising edges on IN B (sync) or sync direct is 5 ms.

STB EHC 3020 Modulo (Loop) Counting Mode

Summary

The modulo counting mode is useful in packaging and labeling application in which a single action is performed repeatedly on a series of moving parts. In this mode, the counter repeatedly counts from 0 to a user-defined upper threshold (*UT*) or *modulo* value, minus 1. The current value never reaches the UT value, but one less than the threshold value.

Note: If you attempt to change the UT value while the counter is modulo counting, the new UT value is ignored and the counter uses the original UT value until the counter is re-initialized.

Note: If there are more than 10 I/O modules in your island configuration, you must prioritize the STB EHC 3020 module for modulo counting operations. Refer to your NIM user manual for details.

Inputs

The modulo mode uses three inputs. Input EN must be set in order to count the pulses applied to IN A. On the active edge of IN B, the current value is set to 0 and the counter starts counting. IN B and input EN can be hard-wired (providing that the corresponding input validation bit is set) or the fieldbus master can directly control them.

The inputs used in the modulo mode are described in the following table:

Inputs	Description	Source	
		Fieldbus Master	**Hardware**
IN A	count input	no	yes
IN B	sync input (note 2)	yes	yes (note 1)
EN	counter enable	yes	yes (note 1)
note 1: The corresponding validation bit must be set if IN B or EN is controlled by the hardware input. This bit must not be set if either input is controlled by the fieldbus master.			
note 2: If IN B is configured as a logic input in the fieldbus master using the counter sync (direct register (see *p. 102*)) bit, only the rising edges are detected. However, if IN B is configured as a hardware input, either the rising edge, falling edge, or both rising and falling edges can be detected based on the sync mode adjustment.			

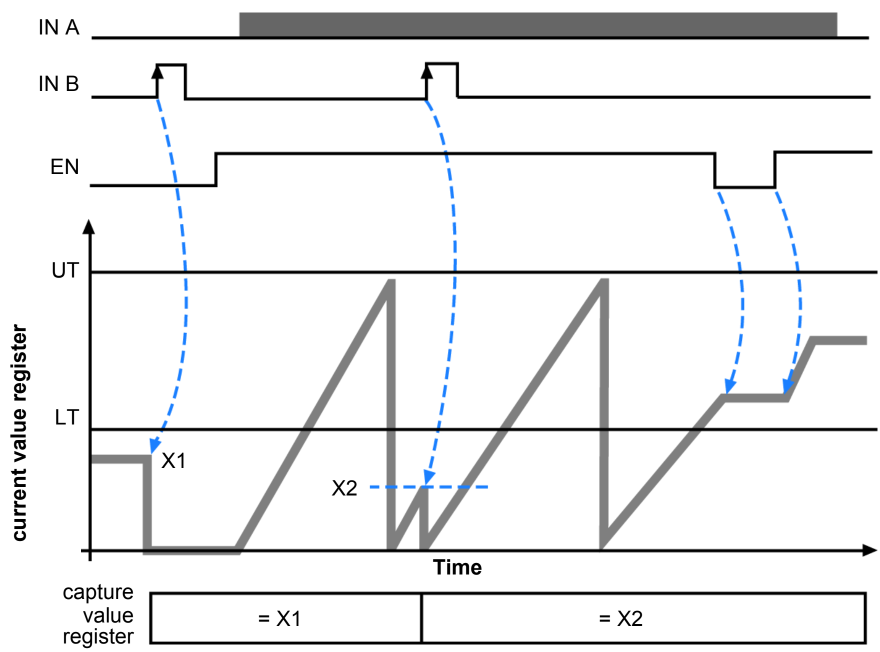
Functional Characteristics

The modulo counter mode uses the user-configured upper threshold (UT) value as the modulo limit.

In this counting mode, the module begins counting pulses from IN A after detecting an active edge on the sync input (IN B). It counts up from 0 until the count reaches the user-defined threshold value. The modulo event bit is set to 1 when the current value reaches the threshold. Unlike one-shot counting mode (see *p. 66*), in which the counter stops and waits until it is restarted by another sync on IN B, the current value is reset to 0 and counting continues.

The counter module also has an enable input (EN). This input must be set in order for the counter to count pulses applied to IN A. Input EN and IN B can be hard-wired (providing that the corresponding input validation bit is set) or the fieldbus master can directly control them.

The following timing diagram shows a typical application of the modulo counting mode in the default condition (rising edge on B):



As the figure shows, the counter begins operating at the active edge on the sync input (IN B), which also sets the capture value register (see *p. 100*) value to X1 and resets the current value register (see *p. 100*) to 0 and sets the sync event bit. Pulses applied to IN A are counted when EN is high. If one of these pulses pushes the current value to the upper threshold, the counter is reset to 0 and the modulo event bit is set to 1. The sync event bit and the modulo event bit can be reset using the *reset sync and modulo* bit in the direct register (see *p. 102*).

Any valid edge on IN B during counting operations results in:

- the counter's capture value register being set to the current value register value (X2)
- the current value register is reset to 0

As stated above, EN must be high during counting operations. When this input goes low, the last reported current value is held and the counter ignores subsequent pulses applied to IN A. It does not, however, ignore the sync input on IN B. When EN goes high again, the counter resumes counting operations.

Adjustments

The following table describes the adjustment parameters that can be applied in the modulo counting mode:

Name	Valid Values	Source	
		Advantys	**Fieldbus Master**
scaling factor (see *p. 83*)	1 (default) to 255	yes	no
sync mode (see *p. 86*)	rising edge on IN B (default), falling edge on IN B, both edges on IN B	yes	no
bounce numerical filter (see *p. 90*)	inactive,* 400 µs, 1.2 ms	yes	no
communication mode (see *p. 87*)	by setting, by output data (default)	yes	no
upper threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
lower threshold (see *p. 88*)	0 (default) to 65535 (note 3)	yes (note 2)	yes (note 1)
note 1: when communication mode is set to *by output data*			
note 2: when communication mode is set to *by setting*			
note 3: The compare enable bit (Output/Direct/Channel4) must be set to active low (0) by the fieldbus master when changing threshold values if the communication mode is set to *by output data*. Changed threshold values are effective immediately.			

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

Status Information

Status information for the counter is reported in the counter status register (see *p. 99*) and the compare status register (see *p. 99*) in the input block of the process image. The table below shows the applicable bits that are set in this mode when the listed conditions are met:

Register	Bit	Channel	Condition(s)
counter status	1	2	modulo event—Set when the counter current value reaches the modulo (upper threshold) value, setting the current value (see *p. 100*) value to 0. Can be reset by setting the *reset sync and modulo* bit in the direct register (see *p. 102*).
counter status	2	3	sync event bit—Set on active edge of B. Bit can be reset using the *reset sync and modulo* bit in the direct register (see *p. 102*).
counter status	3	4	validity bit—The validity bit is used to indicate that the counter current value register and compare status register contain valid data. A *1* indicates valid data and a *0* indicates invalid data.
compare status	0	1	counter low bit—Set when current value register (see *p. 100*) value is less than the lower threshold.
compare status	1	2	counter in window bit—Set when the current value register is greater than or equal to the lower threshold and less than or equal to the upper threshold.
compare status	3	4	capture low bit—Set when the capture value register (see *p. 100*) is less than the lower threshold value.
compare status	4	5	capture window bit—Set when the capture value register is greater than or equal to the lower threshold and less than or equal to the upper threshold.

Output Functions

Each output can be individually be driven by the result of a user-selectable output function or directly through the fieldbus master. The following table shows the available output functions in this mode:

Name	Available
off	yes
counter low (note 1)	yes
counter in window (note 2)	yes
counter high	no
pulse = less than LT	yes
pulse = greater than LT	yes
pulse = less than UT	no
pulse = greater than UT	no
counter stop	no

Name	Available
counter run	no
capture low	yes
capture in window	yes
note 1: default (output function 2)	
note 2: default (output function 1)	

Hot Swap

Electrically, the counter module may be hot swapped while power is applied. Be aware that data in the current value register will be lost when the module is removed from the island in this mode.

When the module is reinserted on the island, the state of IN B (sync) dictates the course of counting operations:
- IN B low—The counter will not begin counting until a rising edge applied to IN B is detected.
- IN B high—The counter will be preset to 0 and the user-defined value and will begin counting.

In either case, the validation bit will not be set until the data registers in the process image contain valid information.

Limitations

The minimum configurable modulo values depend on the IN A frequency according to the following table:

Counting Frequency	Configurable Modulo Values
up to 1 kHz	greater than 5
up to 5 kHz	greater than 25
up to 10 kHz	greater than 50
up to 40 kHz	greater than 200

If IN B is high when the modulo event occurs, the upper threshold is stored in the capture value (see *p. 100*) register.

Other limitations in this mode are:
- the minimum upper threshold value is 1
- the minimum elapsed time between two rising edges on IN B (sync) is 5 ms
- the minimum pulse on IN B is 500 µs

STB EHC 3020 Up and Down Counting Mode

Summary

In the up and down counter mode, the module behaves like a standard up/down counter. Depending on your application requirements, the counter can be configured in four different up/down submodes:

- differential counting
- up/down counting with directional signal
- quadrature direct mode
- quadrature reverse mode

Inputs

In all submodes, the reception of a rising edge on RST:

- resets the upper and lower limit count bits (if they have already been set by overflow or underflow conditions)
- presets the counter to a user-defined preset value (default = 0)
- starts counting operations

Input IN EN must also be set in order to count pulses. The inputs EN and RST can be hard-wired (providing that the corresponding input validation bit is set) or the fieldbus master can directly control them.

The inputs used in the up and down mode are described in the following table:

Input	Description				Source	
					Fieldbus Master	**Hardware**
Mode	**A = up B = down**	**A = impulse B = direction**	**Quadrature Direct**	**Quadrature Reverse**		
IN A	pulse count up	pulse count depends on IN B	count up when IN A leads IN B	count up when IN A lags IN B	no	yes
IN B (note 1)	pulse count down	1 = count up 0 = count down	count down when IN A lags IN B	count down when IN A leads IN B	no	yes
EN	counter enable				yes	yes (note 2)
RST	counter reset				yes	yes (note 2)
note 1: The input validation be is not used for input IN B.						
note 2: The corresponding validation bit must be set if EN or RST is controlled by the hardware input. This bit must not be set if EN or RST is controlled by the fieldbus master.						

Functional Characteristics (Submodes)

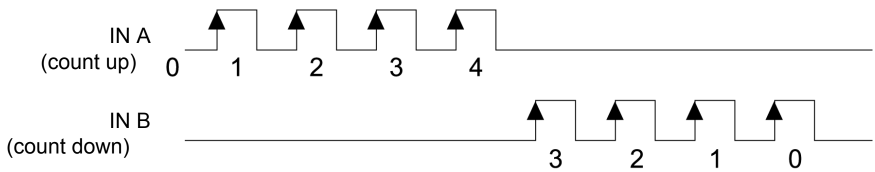
The counter module operates in one of four submodes:
- differential counter (A = up, B = down)
- up/down counter with directional signal (A = impulse, B = direction)
- incremental encoder measurements (quadrature direct and quadrature reverse submodes)

The functional characteristics of the four submodes are discussed individually below.

Submode: Differential Counter

In the differential counter (A = up, B = down) submode, all pulses applied to IN A cause the counter to increment, while all pulses applied to IN B cause the counter to decrement. Input EN must be *on* in order to count pulses applied to IN A and IN B. (A valid rising edge on RST must also have been received.)

A timing diagram for this submode is shown below:

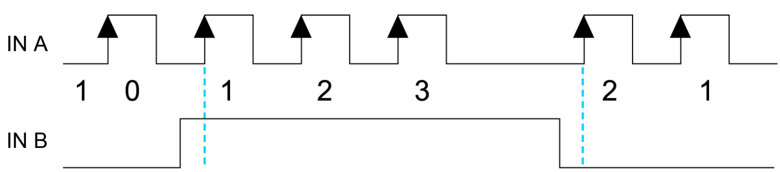


If the current value (see *p. 100*) exceeds 65535, the upper limit count bit is set in the counter status register (see *p. 99*). In this case, the counter stops and the current value remains at 65535. If the current value decreases below 0, the lower limit count bit is set in the counter status register. In this case, the counter stops and the current value remains at 0. In both cases, the counter waits for a rising edge on RST before it resumes counting. The rising edge of RST also resets the upper and lower limit count bits and presets the counter to the user-defined preset value.

Submode: Up/ Down Counter with Directional Signal

In the up/down counter with directional signal (A = pulse, B = direction) submode, all pulses applied to IN A cause the counter to increment if IN B is high. If IN B is low, pulses applied to IN A cause the counter to decrement. Input EN must be *on* in order to count pulses applied to IN A. (A valid rising edge on RST must also have been received.)

A timing diagram for this submode is shown below:

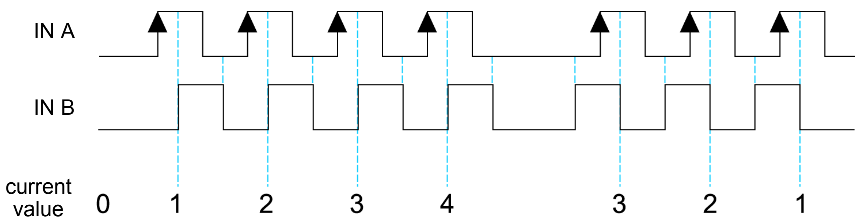


If the current value (see *p. 100*) exceeds 65535, the upper limit count bit is set in the counter status register (see *p. 99*). In this case, the counter stops and the current value remains at 65535. If the current value decreases below 0, the lower limit count bit is set in the counter status register. In this case, the counter stops and the current value remains at 0. In both cases, the counter waits for a rising edge on RST before it resumes counting. The rising edge of RST also resets the upper and lower limit count bits and presets the counter to the user-defined preset value.

Submodes: Encoder Measurements

The encoder measurements (quadrature direct and quadrature reverse submodes) are used for incremental encoder inputs in which the two input signals are 90 degrees out of phase with each other. The STB EHC 3020 counter module can measure two incoming, phased pulses applied to IN A and IN B.

The following figure shows the effect of the relative pulses applied to IN A and IN B have on the counter current value with a direct quadrature implementation:



As the figure shows, the current value register is incremented when a pulse applied to IN A is followed by a pulse applied to IN B. A pulse applied to IN A decreases the current value when it follows a pulse applied to IN B. Input EN must be *on* in order to count pulses applied to IN A. (A valid rising edge on RST must also have been received.)

The following table shows the characteristics of the two methods by which you can implement encoder measurements:

Quadrature Implementation	Scenario	Effect on Current Value Register
direct	IN B lags IN A	increment
	IN B leads IN A	decrement
reverse	IN B leads IN A	increment
	IN B lags IN A	decrement

If the current value (see *p. 100*) exceeds 65535, the upper limit count bit is set in the counter status register (see *p. 99*). In this case, the counter stops and the current value remains at 65535. If the current value decreases to less than 0, the lower limit count bit is set in the counter status register. In this case, the counter stops and the current value remains at 0. In both cases, the counter waits for a rising edge on RST before it resumes counting. The rising edge of RST also resets the upper and lower limit count bits and presets the counter to the user-defined preset value.

Adjustments

The following table describes the adjustment parameters that can be applied in the up/down counting mode and the possible sources for those adjustments:

Name	Valid Values	Source	
		Advantys	Fieldbus Master
up and down: submode (see *p. 85*)	A = up, B = down (default) A = impulse, B = direction quadrature direct quadrature reverse	yes	no
up and down: preset (see *p. 86*) (note 1)	0 (default) to 65535	yes	no
bounce numerical filter (see *p. 90*)	inactive (default), 400 μs, 1.2 ms	yes	no
communication mode (see *p. 87*)	by setting, by output data (default)	yes	no
upper threshold (see *p. 88*)	0 to 65535) (note 3)	yes (note 2)	yes (note 1)
lower threshold (see *p. 88*)	0 to 65535 (note 3)	yes (note 2)	yes (note 1)
note 1: value is loaded into the current value output register (see *p. 100*) on the rising edge of RST			
note 2: when communication mode is set to *by setting*			
note 3: The corresponding validation bit must be set if EN or RST is controlled by the hardware input. This bit must not be set if EN or RST is controlled by the fieldbus master.			

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

Status Information

Status information for the current value is reported in the counter status register (see *p. 99*) and the compare status register (see *p. 99*) in the input block of the process image. The table below shows the applicable bits that are set in this mode when the listed conditions are met:

Register	Bit	Channel	Condition(s)
counter status	3	4	validity bit—The validity bit is used to indicate that the counter current value register and compare status register contain valid data. A *1* indicates valid data and a *0* indicates invalid data.
counter status	4	5	upper limit count bit—set when the counter value is greater than 65535 (see note)
counter status	5	6	lower limit count bit—set when the counter value is less than 0 (see note)

Register	Bit	Channel	Condition(s)
compare status	0	1	counter low bit—set when current value register is less than the lower threshold
compare status	1	2	counter window bit—set when the current value register is greater than or equal to the lower threshold and less than or equal to the upper threshold
compare status	2	3	counter bit high—set when the current value register is greater than the upper threshold
note: When the upper or lower limit count bit is set, the counter stops and counter input pulses are ignored.			

Output Functions

Each output function can be driven by the result of a user-selectable output function or directly with the fieldbus master. The following table describes the available output functions for the up and down counting mode:

Name	Available
off	yes
counter low (note 1)	yes
counter in window (note 2)	yes
counter high	yes
pulse = less than LT	yes
pulse = greater than LT	yes
pulse = less than UT	yes
pulse = greater than UT	yes
counter stop	no
counter run	no
capture low	no
capture in window	no
note 1: default (output function 2)	
note 2: default (output function 1)	

Hot Swap

Electrically, the counter module may be hot swapped while power is applied. Be aware that data in the current value register will be lost when the module is removed from the island in this mode.

When the module is reinserted on the island, the state of input RST dictates the course of counting operations:
- RST low—The counter will not begin counting until a rising edge applied to RST is detected.
- RST high—The counter will be preset with the user-defined value and will begin counting.

In either case, the validation bit will not be set until the data registers in the process image contain valid information.

Limitations

The input frequency limit is 40 kHz in this mode. The first countable pulse after a reset is delayed by 1 ms.

2.4 STB EHC 3020 Configurable Parameters

At a Glance

Introduction

This section describes the parameter sets that can be configured for use with the STB EHC 3020 counter module.

Note: Refer to the Advantys STB Configuration Software Quickstart User Guide (890 USE 180) for instructions for configuring parameters for Advantys STB I/O modules.

What's in this Section?

This section contains the following topics:

STB EHC 3020 Counter Settings

Functional Characteristics

Items in the *Counter settings* parameters set are used to configure one of six counter operating modes and the parameters associated with each.

Using the RTP feature in your NIM, you can access the value of each parameter in the *Counter settings* parameters set.

Refer to the Advanced Configuration chapter in your NIM manual for general information on RTP.

Note: Standard NIMs with firmware version 2.0 or higher support RTP. RTP is not available in Basic NIMs.

Counting Function

The STB EHC 3020 counter module can operate in any one of six counting modes:
- Frequency (see *p. 55*) (default)—speed and flow metering
- Event Counting (see *p. 58*)—monitor events and count spread events up to 65535 during a defined period
- Period Measuring (see *p. 62*)—measure the interval between events (pulse delay evaluation, from 100 µs to 65 s)
- One-Shot Counting (see *p. 66*)—grouping process
- Modulo (see *p. 70*)—packaging and labeling processes and flow rate regulation
- Up and Down (see *p. 75*)—accumulating

To access the counting function parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	1
Data Byte 1	0 for Frequency 1 for Event Counting 2 for Period Measuring 3 for One-Shot Counting 4 for Modulo 5 for Up and Down

Scaling Factor

This value indicates the number of pulses applied to IN A that are required to change the current value. The range for this parameter is 1 (default) to 255. For example, if the scaling factor of 5 is configured, five pulses applied to IN A must be reported to change the current value by 1.

The scaling factor can be used in the frequency counting (see *p. 55*), one-shot counting (see *p. 66*), and modulo counting (see *p. 70*) modes. In other modes, the scaling factor is ignored.

The scaling factor parameter is represented as an unsigned 8-bit number. To access this parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	2
Data Byte 1	1 to 255

Frequency: Calibration Factor

The frequency calibration factor (used in frequency counting (see *p. 55*) mode) calibrates the current value from 90.1 % to 110 % in 0.1 % increments The range for this parameter is 1 to 200, with a default of 100. For example, if a calibration factor of 1 is configured, the current value is 90.1 % of the measured value. If the default calibration factor of 100 is used, the current value is 100 % of the measured value (equal to the measured value). If a calibration factor of 200 is configured, the current value is 110 % of the measured value.

The frequency calibration factor parameter is represented as an unsigned 8-bit number. To access this parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	3
Data Byte 1	1 to 200

Event Counting: Time

The event counting time parameter indicates the interval at which the current value will be reported. This parameter is used in the event counting mode (see *p. 58*) only.

The *event counting time* parameter is used to configure one of four values to indicate the time period for event accumulation. Available resolutions are:
- 0.1 s
- 1 s (default)
- 10 s
- 1 min

To access the event counting time parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	4
Data Byte 1	0 for 0.1 s 1 for 1 s 2 for 10 s 3 for 1 min

Period Measuring: Resolution

In Period Measuring (see *p. 62*) mode, the module measures the time that elapses during an event or between events. This duration is measured in units defined by the user in the *Period measuring: resolution* parameter.

The available periods are:
- *10 µs*—maximum value of period to measure = .655 s
- *100 µs* (default)—maximum value of period to measure = 6.55 s
- *1 ms*—maximum value of period to measure = 65.5 s

To access the period measuring resolution parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	5
Data Byte 1	0 for 10 µs 1 for 100 µs 2 for 1 ms

Period Measuring: Mode

In Period Measuring (see *p. 62*) mode, the *Period measuring: mode* parameter indicates the manner in which the duration of an event or period between events is measured. Available options are:
- *edge to edge on IN A* (default)—rising to rising gap measuring
- *edge to opposite on IN A*—pulse measuring (minimum pulse = 500 µs)

To access the period measuring mode parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	6
Data Byte 1	0 for edge to edge on IN A 1 for edge to opposite on IN A

Up and Down: Mode

The up and down parameter operates when the module is configured as an up and down counter:
- *A = UP, B = DOWN* (default)—standard differential counter
- *A = impulse, B = direction*—direction monitored by IN B at pulse applied to IN A
- *quadrature*—IN A, IN B, for incremental encoder (two methods for implementing encoder measurements):
  - *quadrature direct*
  - *quadrature reverse*

To access the up and down mode parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	7
Data Byte 1	0 for A = UP, B = DOWN 1 for A = impulse, B = direction 2 for quadrature direct 3 for quadrature reverse

Sync: Mode

The sync mode settings parameter indicates the edge on IN B that is recognized:
- *rising edge IN B* (default)—IN B recognized rising edge on pulse
- *falling edge IN B*—IN B recognized falling edge on pulse
- *both edges IN B*—IN B recognized both edges (rising/falling) on pulse

The sync mode parameter is applied only to the hardware IN B, not to the direct bit (set by the fieldbus master). This parameter can be used in the event counting (see *p. 58*), one-shot counting (see *p. 66*), and modulo (loop) counting (see *p. 70*) modes. In other modes, the sync mode is ignored.

To access the sync mode parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	9
Data Byte 1	0 for rising edge IN B 1 for falling edge IN B 2 for both edges IN B

Up and Down: Preset

The up and down parameter is used as a preset value in the up and down mode. At a reset signal, the preset value is loaded in to the current value. The range for this parameter is 0 (default) to 65535.

This parameter can be used only in the up and down (see *p. 75*) mode. In other modes, the up and down parameter is ignored.

The up and down preset parameter is represented as an unsigned 16-bit number. To access this parameter using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0xA0
Index (high byte)	0x24
Sub-index	8
Data Byte 1	0 to 65535

Note: When the RTP feature is used to preset the count value in an STB EHC 3020 module, sv:01.60 or lower, the existing count value goes to 0 and no further counting occurs. The counter validity bit also goes to 0.
If a direct counter reset is then issued, the new preset value takes effect and counting begins.

STB EHC 3020 Compare Settings

Functional Characteristics

The 16-bit current value is sent to an onboard compare block that compares the value with a range defined by upper and lower threshold values.

Items in the *Compare settings* parameter set are:
- *communication mode*—The mode selection indicates whether the thresholds are set at run time (*By output data*) or at configuration time (*By setting*).
- *upper and lower threshold values*—Thresholds are applicable only when the selected communications mode is *By setting*.

Using the RTP feature in your NIM, you can access the value of each parameter in the *Compare settings* parameters set.

Refer to the Advanced Configuration chapter in your NIM manual for general information on RTP.

Note: Standard NIMs with firmware version 2.0 or higher support RTP. RTP is not available in Basic NIMs.

Communication Mode

The counter will implement threshold values sent from the fieldbus master or those configured by the user, according to the selected communication mode:
- *By output data* (default)—When selected, the module uses the threshold values set by the fieldbus master. These values are stored in the upper and lower threshold registers of the process image. Threshold values set in this manner are *flexible*, meaning the user can change the values while the counter module is running.
- *By setting*—When selected, the module uses the user-configured values for the upper and lower thresholds. Values set at configuration can not be changed while the counter is running.

To access the communications mode parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA1
Index (high byte)	0x24
Sub-index	1
Data Byte 1	0 for By setting 1 for By output data

Threshold Values

The upper threshold and lower threshold values used by the output function blocks are represented by unsigned integers in the 0 (default) to 65535 range. The module will use the user-defined values set in these parameters when the selected communication mode is *By setting*. The parameters are:

- upper threshold value
- lower threshold value

> **Note:** The *upper threshold value* has other functions in the one-shot (see *p. 66*) and modulo (see *p. 70*) modes. Refer to the discussion about those modes for further information.

The threshold value parameters are represented as an unsigned 16-bit number. To access these parameters using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0xA1
Index (high byte)	0x24
Sub-index	2 for upper threshold value 3 for lower threshold value
Data Byte 1	0 to 65535

STB EHC 3020 Input Settings

Functional Characteristics

Items in the *Input settings* parameter set are used to configure the characteristics of the bounce numerical filter for inputs IN A and IN B.

Using the RTP feature in your NIM, you can access the value of each parameter in the *Input settings* parameters set.

Refer to the Advanced Configuration chapter in your NIM manual for general information on RTP.

Note: Standard NIMs with firmware version 2.0 or higher support RTP. RTP is not available in Basic NIMs.

Bounce Numerical Filter

Inputs IN A and IN B can be independently configured to have an input bounce filter (see *p. 44*) for contact closure inputs.

You can set the bounce numerical parameter with the Advantys configuration software. The bounce filter time is the same for both channels. Note that setting the bounce filter time alone does not enable the filter.

There are two available values for the bounce filter time:
- 400 µs
- 1.2 ms

To access the bounce numerical filter parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA2
Index (high byte)	0x24
Sub-index	1
Data Byte 1	0 for 400 µs 1 for 1.2 ms

You can independently activate or deactivate the bounce filter for IN A or IN B. There are two available states for each input:
- *Active*—bounce filter enabled for the input
- *Inactive* (default)—bounce filter disabled for the input

To access the Input A and Input B filter parameters using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA2
Index (high byte)	0x24
Sub-index	2 for IN A 3 for IN B
Data Byte 1	0 for Inactive 1 for Active

STB EHC 3020 Output Function Block Settings

Functional Characteristics

The configurable parameters in the *Output function settings* block are used to control the module's two digital outputs.

Each of the two output function blocks (see *p. 52*) operates on the 16-bit current value. Output function block 1 controls output OUT1 while output function block 2 controls output OUT2.

Using the RTP feature in your NIM, you can access the value of the output function and pulse width parameters.

Refer to the Advanced Configuration chapter in your NIM manual for general information on RTP.

> **Note:** Standard NIMs with firmware version 2.0 or higher support RTP. RTP is not available in Basic NIMs.

Output Functions

Each output function behaves in one of 12 ways that you can select with the Advantys configuration software:

- *Off*—No direct action. The function block is not enabled.
- *Counter low*—The function block output is set when the current value is less than the lower threshold value.
- *Counter in window*—The function block output is set when the current value is greater than or equal to the lower threshold and less than or equal to the upper threshold
- *Counter high*—The function block output is set when the current value is greater than the upper threshold value.
- *Pulse=Less than LT*—The function block output generates a pulse when the current value is decreasing and becomes less than the lower threshold value.
- *Pulse=Greater than LT*—The function block output generates a pulse when the current value is increasing and becomes greater than or equal to the lower threshold value.
- *Pulse=Less than UT*—The function block output generates a pulse when the current value is decreasing and becomes less than or equal to the upper threshold value.
- *Pulse=Greater than UT*—The function block output generates a pulse when the current value is increasing and becomes greater than the upper threshold value.
- *Counter stop*—The function block output is set when the counter run bit in the counter status register is not set (one-shot mode (see *p. 66*) only).
- *Counter run*—The function block output is set when the counter run bit in the counter status register is set (one-shot mode (see *p. 66*) only).
- *Capture low*—The function block output is set when the capture value is less than the lower threshold value (modulo mode (see *p. 70*) only).

- *Capture in window*—The function block output is set when the capture value is greater than or equal to the lower threshold and less than or equal to the upper threshold (modulo mode (see *p. 70*) only).

To access an output function parameter using RTP, write the following values to the RTP request block:

Length	1
Index (low byte)	0xA3
Index (high byte)	0x24
Sub-index	1 for OUT1 3 for OUT2
Data Byte 1	0 for Off 1 for Counter Low 2 for Counter in Window 3 for Counter High 4 for Pulse=Less than LT 5 for Pulse=Greater than LT 6 for Pulse=Less than UT 7 for Pulse= Greater than UT 8 for Counter stop 9 for Counter run 10 for Capture low 11 for Capture in window

Pulse Width

If you choose one of the pulse generating blocks, you can independently configure the pulse width for each output. The minimum pulse width is 1 (1 ms) and the maximum pulse width value is 65535 (in 1 ms increments).

Your selection independently controls the pulse width of one of the output function blocks:

- pulse width 1—applied to output OUT1 (default = 10 ms)
- pulse width 2—applied to output OUT2 (default = 10 ms)

These parameters apply when you select an output function in which the result is a pulse output (Pulse = Less than LT, Pulse = Greater than LT, Pulse = Less than UT, Pulse = Greater than UT).

The pulse width parameter is represented as an unsigned 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0xA3
Index (high byte)	0x24
Sub-index	2 for OUT1 4 for OUT2
Data Byte 1	1 to 65535

STB EHC 3020 Output Settings

Functional Characteristics

The STB EHC 3020 counter module supports the transmission of output data to two 24 VDC field actuators. Using the Advantys configuration software, you can customize the following operating parameters:
- the module's response to fault recovery
- *logic normal* or *logic reverse* output polarity for each channel on the module
- a fallback mode and state for each channel on the module

Fault Recovery Responses

If a short circuit is detected on one of the output channels, the module will do one of the following:
- automatically latch off the channel, or
- latch off and attempt to automatically recover and resume operation on the channel when the fault is corrected

The factory default setting is *latched off*, where the module latches off an output channel that is on if it detects a fault. A latched off output channel remains off until you reset it explicitly.

If you want to set the module to *auto-recover* when the fault is corrected, you need to use the Advantys configuration software to set this parameter to *auto-recover*.

The fault recovery mode is set at the module level; you cannot configure one channel to *latched off* and the other to *auto-recover*. Once the module is operational, an output channel on which a fault has been detected implements the specified recovery mode. The other healthy channel continues to operate.

Resetting a Latched-off Output

When an output channel has been latched off because of fault detection, it does not recover until two things happen:
- the error has been corrected
- you explicitly reset the channel

To reset a latched-off output channel, you must send it a value of 0. The 0 value resets the channel to a standard off condition and restores its ability to respond to control logic (turn on and off). If the output channel polarity is configured for logic reverse, you must send a value of 1 to perform this reset action. Provide the reset logic in your application program.

Note: When resetting a latched-off output, a minimum delay of 10 seconds occurs before the fault is cleared.

Auto-recovery

When the module is configured to auto-recover, a channel that has been turned off because of fault detection starts operating again as soon as the fault is corrected. No user intervention is required to reset the channels. If the fault was transient, the channel may reactivate itself without leaving any history of the short circuit having occurred.

Note: During auto-recovery, a minimum delay of 10 seconds occurs before the fault is cleared.

Output Polarity

By default, the polarity on both output channels is *logic normal*, where:
- an output value of 0 indicates that the physical actuator is off (or the output signal is low)
- an output value of 1 indicates that the physical actuator is on (or the output signal is high)

The output polarity on one or both channels may optionally be configured for *logic reverse*, where:
- an output value of 1 indicates that the physical actuator is off (or the output signal is low)
- an output value of 0 indicates that the physical actuator is on (or the output signal is high)

To change an output polarity parameter from the default to reverse or back to the normal from reverse, you need to use the Advantys configuration software.

You can configure the output polarity on each output channel independently:

Step	Action	Result
1	Double-click on the STB EHC 3020 module you want to configure in the island editor.	The selected STB EHC 3020 module opens in the software module editor.
2	Expand the settings by clicking on the + sign next to *Output settings* in the *Parameter name* column.	*Polarity* is now visible under *Output settings*.
3	Expand the settings by clicking on the + sign next to *Polarity* in the *Parameter name* column.	Rows for *Channel 1* and *Channel 2* appear under *Polarity*.
4a	To change the settings at the module level, select the integer that appears in the *Value* column of the *Polarity* row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have *logic normal* polarity and 3 means that both channels have *logic reverse* polarity.	When you select the *Polarity* value, the max/min values of the range appear at the bottom of the module editor screen. When you accept a new value for *Polarity*, the values associated with the channels change. For example, if you choose an output polarity value of 2, *Channel 1* has logic normal polarity and *Channel 2* has logic reverse polarity.

Step	Action	Result
4b	To change the settings at the channel level, double-click on the channel values you want to change, then select the desired settings from the pull-down menu.	When you accept a new value for a channel setting, the value for the module in the *Polarity* row changes. For example, if you set channel 1 to *Normal* and channel 2 to *Reverse*, the *Polarity* value changes to 2.

Fallback Modes

The output channels have a predefined, known state to which they go when the module goes out of service (for example, when communications are lost). This is known as the channel's *fallback state*. You may configure fallback states for each channel individually. Fallback configuration is accomplished in two steps:

- first by configuring fallback modes for each channel
- then (if necessary) configuring the fallback states

All output channels have a fallback mode—either *predefined state* or *hold last value*. When a channel has *predefined state* as its fallback mode, it can be configured with a fallback state, either 1 or 0. When a channel has *hold last value* as its fallback mode, it stays at its last known state when communication is lost— it cannot be configured with a predefined fallback state.

By default, the fallback mode for both channels is the *predefined state*. To change the fallback mode to *hold last value*, use the Advantys configuration software:

Step	Action	Result
1	Double-click on the STB EHC 3020 module you want to configure in the island editor.	The selected STB EHC 3020 module opens in the software module editor.
2	Expand the *+ Output settings* fields by clicking on the + sign.	*Fallback mode* is now visible under *Output settings*.
3	Expand the *+ Fallback mode* row further by clicking on the + sign.	Rows for *Channel 1* and *Channel 2* appear under *Fallback mode*.
4a	To change the settings *at the module level*, select the integer that appears in the *Value* column of the *Fallback mode* row and enter a hexadecimal or decimal integer in range 0 to 3, where 0 means both channels adopt the *hold last value* setting, and 3 means that both channels go to a *predefined state*.	When you select the *Fallback mode* value, the max./min. values of the range appear at the bottom of the module editor screen. When you accept a new value for *Fallback mode*, the values associated with the channels change. For example, if you configure a fallback mode value of 2, *Channel 1* is *hold last value* and *Channel 2* is *predefined state*.
4b	To change the settings *at the channel level*, double click on the channel values you want to change, then select the desired settings from the pull-down menu.	When you accept a new value for a channel setting, the value for the module in the *Fallback mode* row changes. For example, if you set *Channel 1* to *hold last value* and *Channel 2* to *predefined*, the *Fallback mode* value changes to 2.

Fallback States

If an output channel's fallback mode is *predefined state*, you may configure that channel to either turn on or turn off when communication between the module and the fieldbus master is lost. By default, both channels are configured to go to 0 as their fallback states:

- If the output polarity of a channel is *logic normal*, 0 indicates that the predefined fallback state of the output is *off*.
- If the output polarity of a channel is *logic reverse*, 0 indicates that the predefined fallback state of the output is *on*.

> **Note:** If an output channel has been configured with *hold last value* as its fallback mode, any value that you try to configure as a *Predefined Fallback Value* is ignored.

To modify a fallback state from the *hold last value* setting, or to revert back to the default from an on setting, use the Advantys configuration software:

Step	Action	Result
1	Make sure that the *+ Fallback mode* value for the channel you want to configure is *1* (*Predefined state*).	If the *+ Fallback mode* value for the channel is *0* (hold last value), any value entered in the associated *Predefined fallback* value row is ignored.
2	Expand the *+ Predefined fallback* value row further by clicking on the + sign.	Rows for channel 1 and channel 2 appear.
3a	To change a setting *at the module level*, select the integer that appears in the *Value* column of the *Fallback mode* row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have 0 as their predefined fallback value and 3 means that both channels have 1 as their predefined fallback value.	When you select the value associated with *Predefined fallback value*, the max/min values of the range appear at the bottom of the module editor screen. When you accept a new *Predefined fallback value*, the values associated with the channels change. For example, suppose that the fallback mode for both channels is *predefined state* and the polarity setting for each channel is *logic normal*. If you configure a value of 2 as the *Predefined fallback value*, *Channel 2* will have a fallback state of 1 (actuator on) and *Channel 1* will have a fallback state of 0 (actuator off).
3b	To change a setting *at the channel level*, double click on the channel values you want to change, then select the desired setting from the pull-down menu. You can configure a fallback state of either 0 or 1 for each channel on the module.	When you accept a new value for a channel setting, the value for the module in the *Fallback mode* row changes. For example, if you configure channel 2 to 1 and leave channel 1 on 0, the *Predefined fallback* value changes from 0 to 2.

2.5 STB EHC 3020 Process Image

STB EHC 3020 Data and Status for the Process Image

Representing Input and Output Data

The STB EHC 3020 sends a representation of its operating state to the NIM. The NIM stores this information in 16-bit Modbus registers. The NIM keeps a record of input and output data for the STB EHC 3020 in separate blocks in the process image. This information indicates the operating state of the module. The data used to update the module is written to and read from the NIM by the fieldbus master. The information in the input and output status blocks is provided by the module itself.

The information in the process image can be monitored by the fieldbus master or, if you are not using a basic NIM, by an HMI panel connected to the NIM's CFG port. The specific Modbus registers used by the STB EHC 3020 module are based on its physical location on the island bus.

Input Process Image Data Registers

The input data process image is part of a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. Each input module on the island bus is represented in this data block.

The input data for the STB EHC 3020 module is represented by six contiguous registers in this block:
- I/O data
- I/O status
- counter status
- compare status
- current value
- capture value

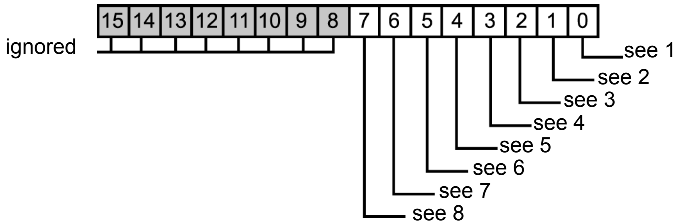
These registers are discussed individually below.

Note: The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus.

I/O Data

The first STB EHC 3020 register in the input block of the process image is the I/O data register. The four least significant bits (LSBs) in this register indicate the status of the physical inputs to the module. The next 4 bits represent an echo of the output data:

STB EHC 3020 I/O Data Register



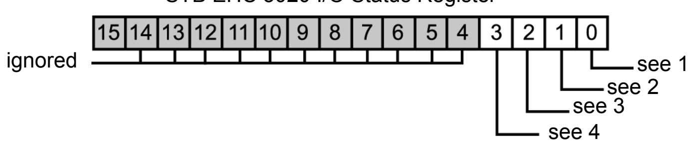
1 input IN A—Input IN A is on when this bit is set.
2 input IN B—Input IN B is on when this bit is set.
3 input EN—Input EN is on when this bit is set.
4 input RST—Input RST is on when this bit is set.
5 echo output 1—Output OUT1 is on when this bit is set (echo data).
6 echo output 2—Output OUT2 is on when this bit is set (echo data).
7 output function 1 result—the result of the function when the function enable bit is set (otherwise 0)
8 output function 2 result—the result of the function when the function enable bit is set (otherwise 0)

Note: If reverse polarity is on, the output will be the opposite of the echo bits. These bits can come from the direct bits (see direct bit) or from the outputs of a function block.

I/O Status

The second STB EHC 3020 register in the input block of the process image is the I/O status register. The four LSBs indicate whether a fault has been reported in the module's onboard error input filtering and short-circuit power protection. The fault might be field power absent or a short circuit on the island's sensor bus:

STB EHC 3020 I/O Status Register

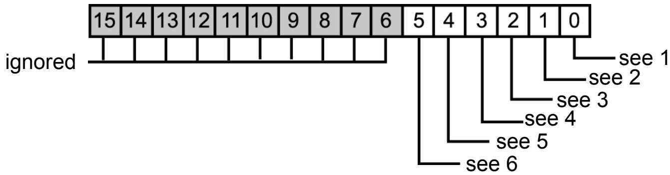


1 There is a short circuit in OUT1 when this bit is set.
2 There is a short circuit in OUT2 when this bit is set.
3 sensor power fault—24 VDC power is off or shorted when this bit is set.
4 actuator power fault—24 VDC power is off or shorted when this bit is set.

Counter Status

The third STB EHC 3020 register in the input block of the process image is the counter status register. The six LSBs in this register indicate the status of the counting function of the module:

STB EHC 3020 Counter Status Register



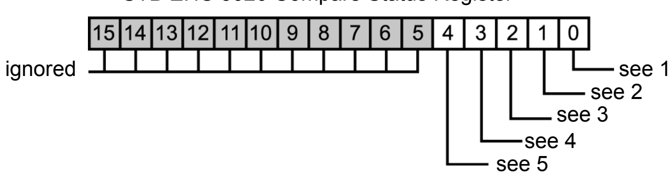
1 run—The counter is running when this bit is set (one-shot counting mode only)
2 modulo event—A modulo event has occurred when this bit is set. This bit remains set until it is explicitly reset by the user using Reset Sync and modulo bit in the direct register (modulo (loop) counting mode only). (See the direct register elsewhere in this topic.)
3 sync event—A sync event has occurred when this bit is set. This bit remains set until it is explicitly reset by the user using Reset Sync and modulo bit. (See the direct register elsewhere in this topic.) This bit is available only in the one-shot and module counting modes.
4 validity bit—The counter value is valid when this bit is set. In all modes, the validity bit turns off when sensor power is off. Refer to the functional description for a particular counting mode for more information about the behavior of the validity bit. (See note below.)
5 upper limit count—This bit is set when current value is above 65535 (16-bit register limit overflow). This bit is used in frequency, event counting, period evaluation, and up and down counting modes.
6 lower limit count—This bit is set when current value is below 0. This bit is only used in the up and down counting mode.

Note: When the validity bit is high, data in the current value and compare status registers have valid values. Capture could be done in modulo mode using the sync input. Your application program should not use the counter current value and the compare status register values when the validity bit is low.

Compare Status

The fourth STB EHC 3020 register in the input block of the process image is the compare status register. The five LSBs in this register indicate the status of the compare function of the module:

STB EHC 3020 Compare Status Register



1 counter low—The current value is below the lower threshold value when this bit is set.
2 counter in window—The counter value is greater than or equal to the lower threshold and less than or equal to the upper threshold when this bit is set.
3 counter high—The current value is above the upper threshold value when this bit is set.
4 capture low—The capture value is below the lower threshold value when this bit is set (modulo mode only).
5 capture in window—The capture value is greater than or equal to the lower threshold and less than or equal to the upper threshold when this bit is set (modulo mode only).

Current Value

The fifth STB EHC 3020 register in the input block of the process image is the current value register. The current value is stored in this 16-bit unsigned data register. The updating of this register is dependent upon the selected counting mode.

Capture Value

The sixth STB EHC 3020 register in the input block of the process image is the capture value register. This 16-bit unsigned value represents the counter value at synchronization. This value is always sent to the process image, but is only applicable in the modulo (loop) counting (see *p. 70*) mode.

Output Process Image Data Registers

The NIM keeps a record of output data in a separate block of registers in the process image. The output data process image is part of a block of 4096 Modbus registers (in the range 40001 through 44096) that represent the data returned by the fieldbus master. Each output module on the island bus is represented in this data block.

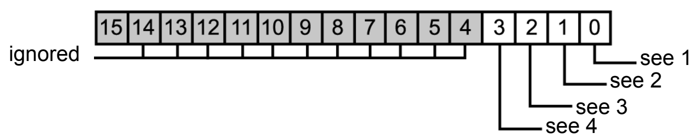
The output data for the STB EHC 3020 module is represented by five contiguous registers in this block:
- output data
- input validation
- direct
- upper threshold
- lower threshold

These registers are discussed individually below.

Output Data

The first STB EHC 3020 register in the output block of the process image is the output data register. The four LSBs indicate the most current on/off states of the module's two output channels and their corresponding enable bits:

STB EHC 3020 Output Data Register



1 output 1—Output OUT1 is on when the fieldbus master sets this bit.
2 output 2—Output OUT2 is on when the fieldbus master sets this bit.
3 output function 1 enable—
Output function 1 is enabled when the fieldbus master sets this bit.
4 output function 2 enable—
Output function 2 is enabled when the fieldbus master sets this bit.

Note: If reverse polarity is configured, outputs OUT1 and OUT2 are off (or disabled) when the corresponding bit is set.

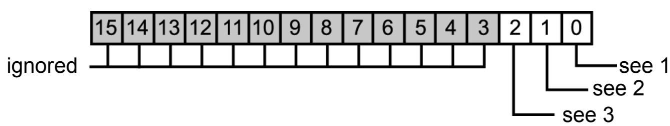
Note: When using the output blocks, make sure that the fieldbus master is not currently controlling the outputs in the output data register (see *p. 100*).

Input Validation

The second STB EHC 3020 register in the output block of the process image is the input validation register. When a physical input is used for IN B, EN, or RST, the fieldbus master must set a corresponding input validation bit in this register. Do not set the corresponding direct bit if you set the validation bit.

The three LSBs indicate the most current on/off states of three of the module's four input channels:

STB EHC 3020 Input Validation Register

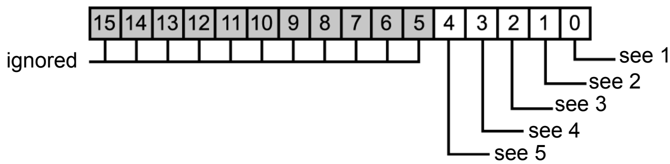


1 input validation IN B (sync)—input validation bit for input IN B (sync) (this bit is not required for the up-down counting mode)
2 input validation enable—input validation bit for input EN
3 input validation reset—input validation bit for input RST

Direct

The third STB EHC 3020 register in the output block of the process image is the direct register. Data in this register is sent by the fieldbus master. The first three bits correspond to the input bits IN B, EN, and RST. You can use these three bits if you want to control IN B (sync), EN, and RST with the fieldbus master instead of with the input channel. Do not set the corresponding validation bit if you use the direct bit. The four LSBs are defined as follows:

STB EHC 3020 Direct Register



1 counter sync—The counter is synchronized on the rising edge of this bit. Unlike the hardware input IN B, this bit only operates on the rising edge.
2 counter enable—The counter is enabled while this bit is high.
3 counter reset—In up and down counting mode, the current value is set to a preset value and the counter starts counting. Upper and lower limit count bits are also reset on the rising edge of this bit.
4 compare enable—The output functions are enabled when the fieldbus master sets this bit and disabled when this bit is not set.
5 reset sync and modulo—On the rising edge of this bit, the sync and modulo event bits are reset.

Upper Threshold

The fourth STB EHC 3020 register in the output block of the process image holds the upper threshold value. It is a 16-bit unsigned value that is controlled by the fieldbus master. In order for the counter to use this value, the communication mode must be set to *by output data*. This word has a different meaning in the one-shot (see *p. 66*) and modulo (see *p. 70*) counting modes

Lower Threshold

The last STB EHC 3020 register in the output block of the process image holds the lower threshold value. It is a 16-bit unsigned value that is controlled by the fieldbus master. In order for the counter to use this value, the communication mode must be set to *by output data*.

Advantys Power Distribution Modules

3

At a Glance

Overview

The island bus uses special-purpose PDMs to distribute field power to the I/O modules in its segment(s). There are two classes of PDMs, those that distribute:

- 24 VDC power to digital and analog I/O that operate with DC-powered field devices
- 115 or 230 VAC to digital I/O modules that operate with AC-power field devices

All PDMs distribute sensor and actuator power, provide PE resistance for the I/O modules they support and provide over-current protection. Within each class are standard and basic PDM models.

What's in this Chapter?

This chapter contains the following sections:

3.1 STB PDT 3100 24 VDC Power Distribution Module

At a Glance

Overview

This section provides you with a detailed description of the STB PDT 3100 PDM—its functions, physical design, technical specifications, and power wiring requirements.

What's in this Section?

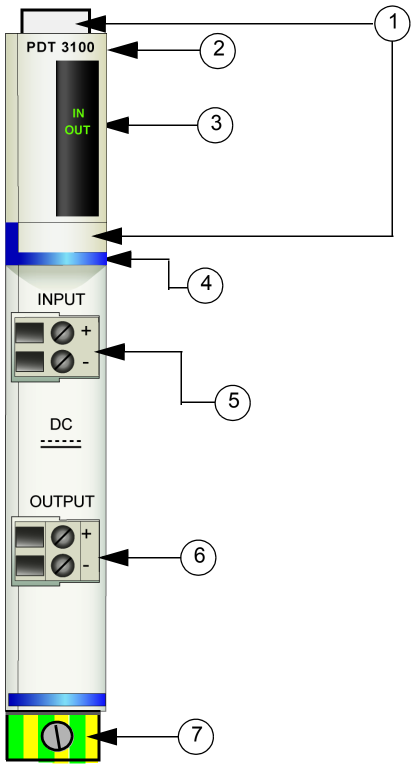
This section contains the following topics:

STB PDT 3100 Physical Description

Physical Characteristics

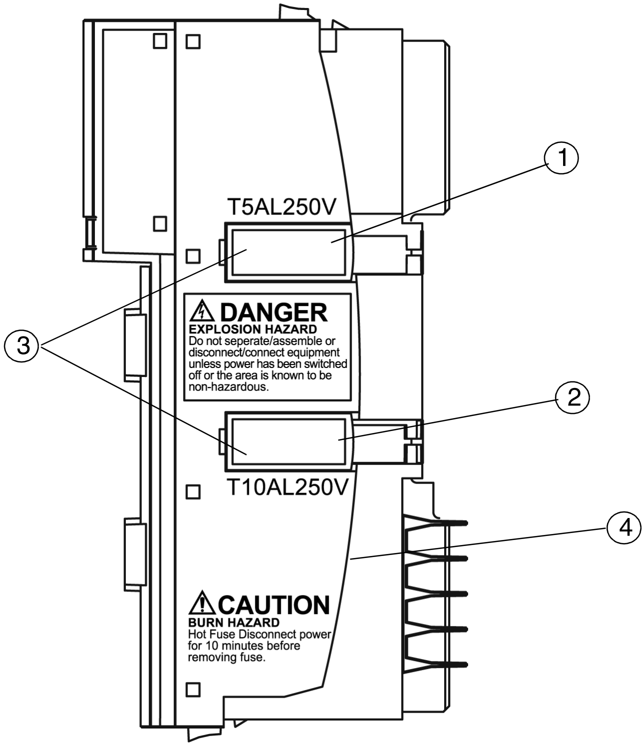
The STB PDT 3100 is a standard module that distributes field power independently over the island's sensor bus to the input modules and over the island's actuator bus to the output modules. This PDM requires two DC power inputs from an external power source. 24 VDC source power signals are brought into the PDM via a pair of two-pin power connectors, one for sensor power and one for actuator power. The module also houses two user-replaceable fuses that independently protect the island's sensor power bus and actuator power bus.

Front and Side Panel Views



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED array
4 dark blue identification stripe, indicating a DC PDM
5 input field power connection receptacle (for the sensor bus)
6 output field power connection receptacle (for the actuator bus)
7 PE captive screw clamp on the PDM base

The fuses for the sensor power and actuator power are housed in slots on the right side of the module:



1 housing door for the 5 A sensor power fuse
2 housing door for the 10 A actuator power fuse
3 notches in the two doors
4 burn hazard statement

⚠ CAUTION
BURN HAZARD - HOT FUSE
Disconnect power for 10 minutes before removing fuse.
Failure to follow these instructions can result in injury or equipment damage.

The two red plastic doors house a pair of fuses:

- a 5 A fuse protects the input modules on the island's sensor bus
- a 10 A protects the output modules on the island's actuator bus

The marking on the side of the module describes a simple precaution you need to take before replacing a fuse (see *p. 113*) to prevent burns:

Ordering Information

The module can be ordered as part of a kit (STB PDT 3100 K), which includes:

- one STB PDT 3100 power distribution module
- one STB XBA 2200 (see *p. 131*) PDM base
- two alternative sets of connectors:
  - two 2-terminal *screw type* connectors, keying pins included
  - two 2-terminal *spring clamp* connectors, keying pins included
- a 5 A, 250 V time-lag, low-breaking-capacity (glass) fuse to protect the input modules on the island's sensor bus
- a 10 A, 250 V time-lag, glass fuse to protect the output modules on the island's actuator bus

Individual parts may also be ordered for stock or replacement as follows:

- a standalone STB PDT 3100 power distribution module
- a standalone STB XBA 2200 PDM base
- a bag of screw type connectors (STB XTS 1130) or spring clamp connectors (STB XTS 2130)
- the STB XMP 5600 fuse kit, which contains five 5 A replacement fuses and five 10 A replacement fuses

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 kit for inserting the module into the base (to make sure that an AC PDM is not inadvertently placed on the island where an STB PDT 3100 PDM belongs)
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For installation instructions and other details, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

Dimensions

width	module on a base	18.4 mm (0.72 in
height	module only	125 mm (4.92 in)
	on a base*	138 mm (5.43 in)
depth	module only	65.1 mm (2.56 in)
	on a base, with connectors	75.5 mm (2.97 in) worst case (with screw clamp connectors)
* PDMs are the tallest modules in an Advantys STB island segment. The 138 mm height dimension includes the added height imposed by the PE captive screw clamp on the bottom of the STB XBA 2200 base.		

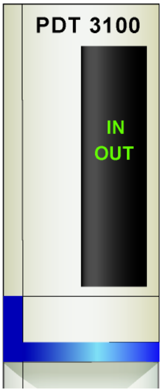
STB PDT 3100 LED Indicators

Overview

The two LEDs on the STB PDT 3100 are visual indications of the presence of sensor power and actuator power. The LED locations and their meanings are described below.

Location

The two LEDs are located on the top front bezel of the module, directly below the model number:



Indications

The following table defines the meaning of the two LEDs (where an empty cell indicates that the pattern on the associated LED doesn't matter):

IN	OUT	Meaning
on		sensor (input) field power is present
off		The module either: ● is not receiving sensor field power ● has a blown fuse ● has failed
	on	actuator (output) field power is present
	off	The module either: ● is not receiving sensor field power ● has a blown fuse ● has failed

Note: The power required to illuminate these LEDs comes from the 24 VDC power supplies that provide the sensor bus and actuator bus power. These LED indicators operate regardless of whether or not the NIM is transmitting logic power.

STB PDT 3100 Source Power Wiring

Summary

The STB PDT 3100 uses two two-pin source power connectors that let you connect the PDM to one or two 24 VDC field power source(s). Source power for the sensor bus is connected to the top connector, and source power for the actuator bus is connected to the bottom connector. The choices of connector types and wire types are described below, and a power wiring example is presented.

Connectors

Use a set of either:

- Two STB XTS 1130 *screw type* field wiring connectors
- Two STB XTS 2130 *spring clamp* field wiring connectors

Both connector types are provided in kits of 10 connectors/kit.

These power wiring connectors each have two connection terminals, with a 5.08 mm (0.2 in) pitch between pins.

Power Wire Requirements

Individual connector terminals can accept one power wire in the range 1.29 ... 2.03 mm^2 (16 ... 12 AWG). When 1.29 mm^2 (16 AWG) power wire is used, two wires can be connected to a terminal.

We recommend that you strip at least 10 mm from the wire jackets to make the connections.

Safety Keying

Note: The same screw type and spring clamp connectors are used to deliver power to the STB PDT 3100 PDM and to the STB PDT 2100 PDM. To avoid accidentally connecting VAC power to a VDC module or vice versa, Schneider offers an optional STB XMP 7810 safety keying pin kit for the PDMs.
Refer the *Advantys STB System Planning and Installation Guide* (890 USE 171) for a detailed discussion of keying strategies.

Power Wiring Pinout

The top connector receives 24 VDC source power for the sensor bus, and the bottom connector receives 24 VDC source power for the actuator bus.

Pin	Top Connector	Bottom Connector
1	+24 VDC for the sensor bus	+24 VDC for the sensor bus
2	-24 VDC sensor power return	-24 VDC actuator power return

Source Power

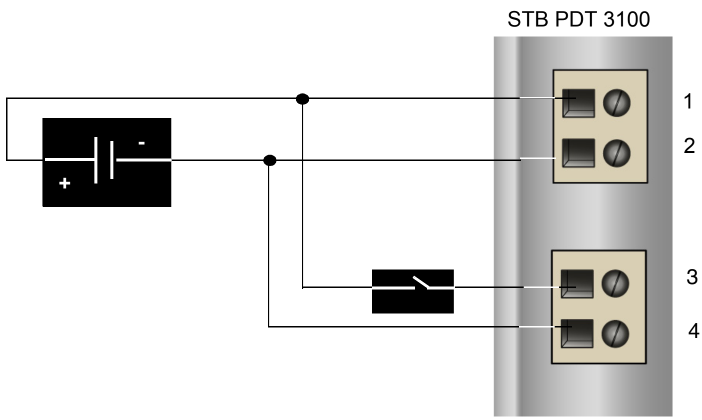
The STB PDT 3100 PDM requires source power from at least one independent, SELV-rated 19.2 ... 30 VDC power supply.

Sensor power and actuator power are isolated from one another on the island. You may provide source power to these two buses via a single power supply or by two separate power supplies.

Refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171) for a detailed discussion of external power supply selection considerations.

Sample Wiring Diagrams

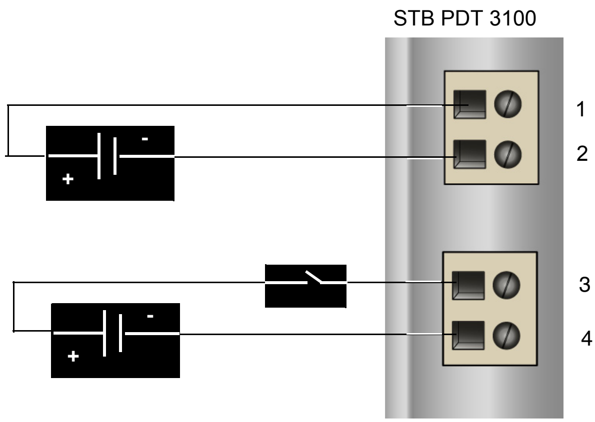
This example shows the field power connections to both the sensor bus and the actuator bus coming from a single 24 VDC SELV power supply.



1 +24 VDC sensor bus power
2 -24 VDC sensor power return
3 +24 VDC actuator bus power
4 -24 VDC actuator power return

The diagram above shows a protection relay, which you may optionally place on the +24 VDC power wire to the actuator bus connector. A protection relay enables you to disable the output devices receiving power from the actuator bus while you test the input devices that receive power from the sensor bus. For a detailed discussion and some recommendations, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

This example shows field power for the sensor bus and field power for the actuator bus being derived from separate SELV power supply sources.



1 +24 VDC sensor bus power
2 24 VDC sensor power return
3 +24 VDC actuator bus power
4 -24 VDC actuator power return

An optional protection relay is shown on the +24 VDC power wire to the actuator bus connector.

STB PDT 3100 Field Power Over-current Protection

Fuse Requirements

Input modules on the sensor bus and output modules on the actuator bus are protected by fuses in the STB PDT 3100 PDM. The sensor bus is protected by a 5 A fuse and the actuator bus is protected by an 10 A fuse. These fuses are accessible and replaceable via two side panels on the PDM.

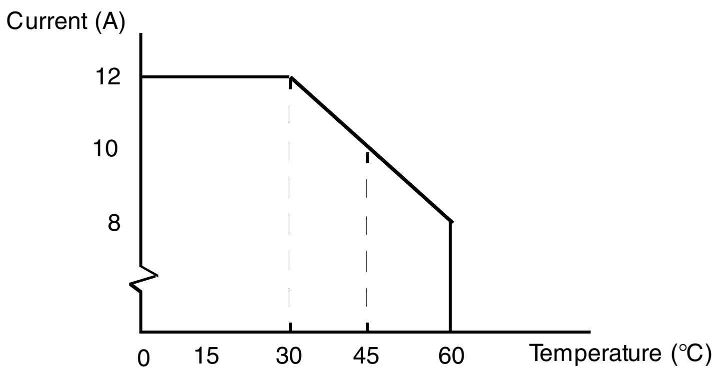
Recommended Fuses

- Overcurrent protection for the input modules on the sensor bus needs to be provided by a 5 A time-lag fuse such as the Wickmann 1951500000.
- Overcurrent protection for the output modules on the actuator bus needs to be provided by a 10 A time-lag fuse such as the Wickmann 1952100000.

Performance Considerations

The maximum combined module current - the sum of actuator current and sensor current - depends upon the island's ambient temperature, as displayed in the following diagram:

Maximum Current (A) to Temperature (°C)



For example:

- At 60 °C, total maximum combined module current is 8 A.
- At 45 °C, total maximum combined module current is 10 A.
- At 30 °C, total maximum combined module current is 12 A.

At any temperature, the maximum actuator current is 8 A, and the maximum sensor current is 4 A.

Accessing the Fuse Panels

The two panels that house the actuator bus protection fuse and the sensor bus protection fuse are located on the right side of the PDM housing (see *p. 105*). The panels are red doors with fuse holders inside them. The 5 A sensor power fuse is in the top door. The 10 A actuator power fuse is in the bottom door.

Replacing a Fuse

Before you replace a fuse in the STB PDT 3100, remove the power sources to the actuator bus and sensor bus.

⚠ CAUTION

BURN HAZARD - HOT FUSE

Disconnect power for 10 minutes before removing fuse.

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

Step	Action	Notes
1	After you have removed the power connectors from the module and let the unit cool down for 10 minutes, pull the PDM from its base. Push the release buttons at the top and bottom of the PDM and pull it from the base.	
2	Insert a small flathead screwdriver in the slot on the left of the fuse panel door and use it to pop the door open.	The slot is molded to protect the tip of the screwdriver from accidentally touching the fuse.
3	Remove the old fuse from the fuse holder inside the panel door, and replace it with another fuse or with a fuse bypass plug.	Make sure that the new fuse is the same type as the old one.
4	Optionally, you may repeat steps 3 and 4 to replace the fuse in the other panel.	
5	Snap the panel door(s) shut and plug the PDM back into its base. Then plug the connectors back into the receptacles, close the cabinet and reapply field power.	

The Protective Earth Connection

PE Contact for the Island

One of the key functions of a PDM, in addition to distributing sensor and actuator power to the I/O modules, is the provision of protective earth (PE) to the island. On the bottom of each STB XBA 2200 PDM base is a captive screw in a plastic block. By tightening this captive screw, you can make a PE contact with the island bus. Every PDM base on the island bus should make PE contact.

How PE Contact Is Made

PE is brought to the island by a heavy-duty cross-sectional wire, usually a copper braided cable, 4.2 mm^2 (10 gage) or larger. The wire needs to be tied to a single grounding point. The ground conductor connects to the bottom of the each PDM base and is secured by the PE captive screw.

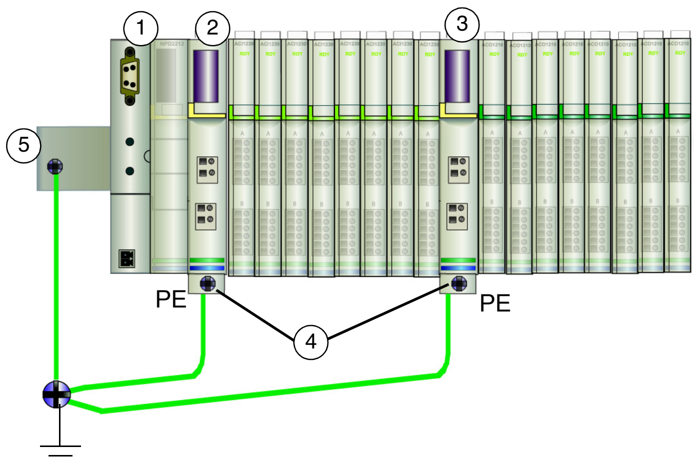
Local electrical codes take precedence over our PE wiring recommendations.

Handling Multiple PE Connections

It is possible that more than one PDM will be used on an island. Each PDM base on the island will receive a ground conductor and distribute PE as described above.

Note: Tie the PE lines from more than one PDM to a single PE ground point in a star configuration. This will minimize ground loops and excessive current from being created in PE lines.

This illustration shows separate PE connections tied to a single PE ground:



1 the NIM
2 a PDM
3 another PDM
4 captive screws for the PE connections
5 FE connection on the DIN rail

STB PDT 3100 Specifications

Table of Technical Specifications

The STB PDT 3100 module's technical specifications are described in the following table.

<table>
<tr><td colspan="2">description</td><td>24 VDC power distribution module</td></tr>
<tr><td colspan="2">module width</td><td>18.4 mm (0.72 in)</td></tr>
<tr><td colspan="2">module height in its base</td><td>137.9 mm (5.43 in)</td></tr>
<tr><td colspan="2">PDM base</td><td>STB XBA 2200</td></tr>
<tr><td colspan="2">hot swapping supported</td><td>no</td></tr>
<tr><td colspan="2">nominal logic power current consumption</td><td>0 mA</td></tr>
<tr><td colspan="2">sensor/actuator bus voltage range</td><td>19.2 ... 30 VDC</td></tr>
<tr><td colspan="2">reverse polarity protection</td><td>yes, on the actuator bus</td></tr>
<tr><td rowspan="4">module current field</td><td rowspan="2">for outputs</td><td>8 A rms max @ 30° C (86° F)</td></tr>
<tr><td>5 A rms max @ 60° C (140° F)</td></tr>
<tr><td rowspan="2">for inputs</td><td>4 A rms max @ 30° C (86° F)</td></tr>
<tr><td>2.5 A rms max @ 60° C (140° F)</td></tr>
<tr><td rowspan="2">overcurrent protection</td><td>for inputs</td><td>user-replaceable 5 A time-lag fuse from an STB XMP 5600 fuse kit</td></tr>
<tr><td>for outputs</td><td>user-replaceable 10 A time-lag fuse from an STB XMP 5600 fuse kit</td></tr>
<tr><td colspan="2">bus current</td><td>0 mA</td></tr>
<tr><td colspan="2">voltage surge protection</td><td>yes</td></tr>
<tr><td colspan="2">PE current</td><td>30 A for 2 min</td></tr>
<tr><td rowspan="2">status reporting</td><td rowspan="2">to the two green LEDs</td><td>sensor bus power present</td></tr>
<tr><td>actuator bus power present</td></tr>
<tr><td rowspan="2">voltage-detect threshold</td><td>LED turns on</td><td>at 15 VDC (+/- 1 VDC)</td></tr>
<tr><td>LED turns off</td><td>less than15 VDC (+/- 1 VDC)</td></tr>
<tr><td colspan="2">storage temperature</td><td>-40 to 85°C</td></tr>
<tr><td colspan="2">operating temperature range*</td><td>0 to 60°C</td></tr>
<tr><td colspan="2">agency certifications</td><td>refer to the Advantys STB System Planning and Installation Guide, 890 USE 171</td></tr>
<tr><td colspan="3">*This product supports operation at normal and extended temperature ranges. Refer to the Advantys STB System Planning and Installation Guide, 890 USE 171 for a complete summary of capabilities and limitations.</td></tr>
</table>

3.2 STB PDT 3105 24 VDC Basic Power Distribution Module

At a Glance

Overview

This section provides you with a detailed description of the STB PDT 3105 PDM—its functions, physical design, technical specifications, and power wiring requirements.

What's in this Section?

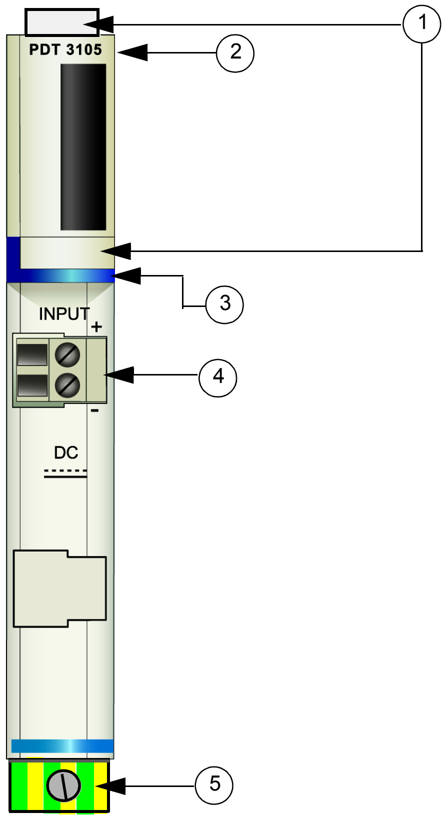
This section contains the following topics:

STB PDT 3105 Physical Description

Physical Characteristics

The STB PDT 3105 is a basic Advantys STB module that distributes sensor power and actuator power over a single power bus to the I/O modules in a segment. This PDM mounts in a special size 2 base. It requires a 24 VDC source power input from an external power source, which is brought into the PDM via a two-pin power connector. The module also houses a user-replaceable fuse that protects the island's I/O power bus.

Front and Side Panel Views



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 dark blue identification stripe, indicating a DC PDM
4 I/O field power connection
5 PE captive screw clamp on the PDM base

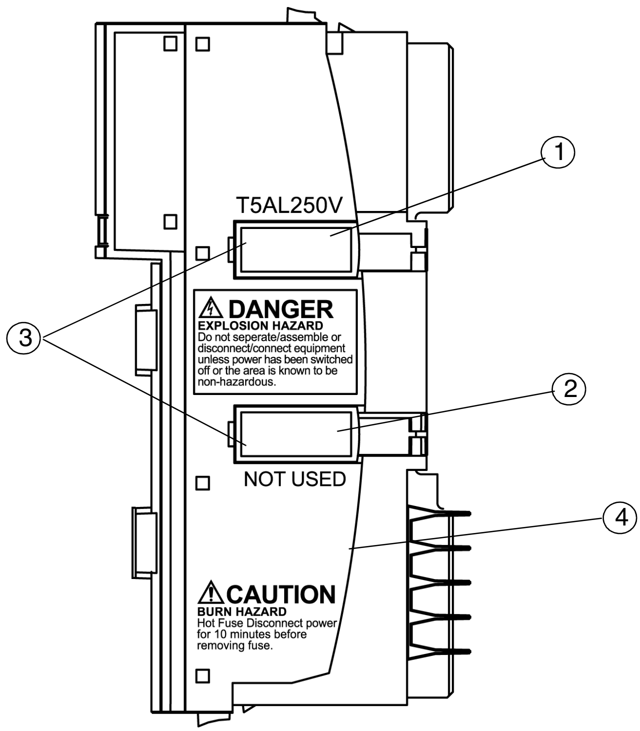
⚠ CAUTION

BURN HAZARD - HOT FUSE

Disconnect power for 10 minutes before removing fuse.

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

The following illustration shows the right side of the module, where the user-replaceable fuse is housed:



1 housing door for the 5 A fuse
2 this slot is not used
3 notches in the two doors
4 burn hazard statement

The marking on the side of the module describes a simple precaution you need to take before replacing a fuse (see *p. 113*) to prevent burns:

Ordering Information

The module can be ordered as part of a kit (STB PDT 3105 K), which includes:

- one STB PDT 3105 power distribution module
- one STB XBA 2200 (see *p. 131*) PDM base
- two alternative sets of connectors:
  - one 2-terminal *screw type* connector, keying pins included
  - one 2-terminal *spring clamp* connector, keying pins included
- a 5 A, 250 V time-lag, low-breaking-capacity (glass) fuse to protect the input and output modules

Individual parts may also be ordered for stock or replacement as follows:

- a standalone STB PDT 3105 power distribution module
- a standalone STB XBA 2200 PDM base
- a bag of screw type connectors (STB XTS 1130) or spring clamp connectors (STB XTS 2130)
- the STB XMP 5600 fuse kit, which contains five 5 A replacement fuses and five 10 A replacement fuses

Note: Do not use the 10 A fuses in the STB PDT 3105 module.

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 kit for inserting the module into the base (to make sure that an AC PDM is not inadvertently placed on the island where an STB PDT 3105 PDM belongs)
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For installation instructions and other details, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

Dimensions

width	module on a base	18.4 mm (0.72 in
height	module only	125 mm (4.92 in)
	on a base*	138 mm (5.43 in)
depth	module only	65.1 mm (2.56 in)
	on a base, with connectors	75.5 mm (2.97 in) worst case (with screw clamp connectors)
* PDMs are the tallest modules in an Advantys STB island segment. The 138 mm height dimension includes the added height imposed by the PE captive screw clamp on the bottom of the STB XBA 2200 base.		

STB PDT 3105 Source Power Wiring

Summary

The STB PDT 3105 uses a two-pin source power connector that let you connect the PDM to a 24 VDC field power source. The choices of connector types and wire types are described below, and a power wiring example is presented.

Connectors

Use either:

- an STB XTS 1130 *screw type* field wiring connector
- an STB XTS 2130 *spring clamp* field wiring connector

Both connector types are provided in kits of 10 connectors/kit.

These power wiring connectors each have two connection terminals, with a 5.08 mm (0.2 in) pitch between pins.

Power Wire Requirements

Individual connector terminals can accept one power wire in the range 1.29 ... 2.03 mm^2 (16 ... 12 AWG). When 1.29 mm^2 (16 AWG) power wire is used, two wires can be connected to a terminal.

We recommend that you strip at least 10 mm from the wire jackets to make the connections.

Safety Keying

> **Note:** The same screw type and spring clamp connectors are used to deliver power to the STB PDT 3105 PDM and to the STB PDT 2100 and STB PDT 2105 PDMs. To avoid accidentally connecting VAC power to a VDC module or vice versa, Schneider offers an optional STB XMP 7810 safety keying pin kit for the PDMs. Refer the *Advantys STB System Planning and Installation Guide* (890 USE 171) for a detailed discussion of keying strategies.

Power Wiring Pinout

The connector receives 24 VDC source power for the sensor bus, and the bottom connector receives 24 VDC source power for the actuator bus.

Pin	Connection
1	+24 VDC I/O power
2	-24 VDC return

Source Power

The STB PDT 3105 PDM requires source power from an independent, SELV-rated 19.2 ... 30 VDC power supply. Refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171) for a detailed discussion of external power supply selection considerations.

Sample Wiring Diagrams

This example shows the field power connections to both the sensor bus and the actuator bus coming from a single 24 VDC SELV power supply.

1 +24 VDC I/O power
2 -24 VDC return

For a detailed discussion and some recommendations, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

STB PDT 3105 Field Power Over-current Protection

Fuse Requirements

I/O modules are protected by a 5 A fuse in the STB PDT 3105 PDM. The fuse is accessible and replaceable via a side panel on the PDM.

Recommended Fuses

Overcurrent protection for the input and output modules on the island bus needs to be provided by a 5 A time-lag fuse such as the Wickmann 1951500000.

Performance Considerations

When the island is operating at an ambient temperature of 60 degrees C (140 degrees F), the fuse can pass 4 A continuously.

Accessing the Fuse Panels

Two panels are located on the right side of the PDM housing (see *p. 117*). The top panel houses the active protection fuse and the other is not used. The top panel has a fuse holder inside it.

Replacing a Fuse

Before you replace a fuse in the STB PDT 3105, remove the power source.

⚠ CAUTION

BURN HAZARD - HOT FUSE

Disconnect power for 10 minutes before removing fuse.

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

Step	Action	Notes
1	After you have removed the power connector from the module and let the unit cool down for 10 minutes, pull the PDM from its base. Push the release buttons at the top and bottom of the PDM and pull it from the base.	
2	Insert a small flathead screwdriver in the slot on the left of the fuse panel door and use it to pop the door open.	The slot is molded to protect the tip of the screwdriver from accidentally touching the fuse.
3	Remove the old fuse from the fuse holder inside the panel door, and replace it with another fuse.	Make sure that the new fuse is a 5 A fuse. **Note** 10 A fuses are provided in the fuse kit, but they should not be used with an STB PDT 3105 module.
4	Snap the panel door(s) shut and plug the PDM back into its base. Then plug the connectors back into the receptacles, close the cabinet and reapply field power.	

STB PDT 3105 Protective Earth Connection

PE Contact for the Island Bus

One of the key functions of a PDM, in addition to distributing sensor and actuator power to the I/O modules, is the provision of PE to the island. On the bottom of each STB XBA 2200 PDM base is a captive screw in a plastic block. By tightening this captive screw, you can make a PE contact with the DIN rail. Every PDM base on the island bus should make PE contact.

How PE Contact Is Made

PE is brought to the island by a heavy-duty cross-sectional wire, usually a copper braided cable, 4.2 mm^2 (10 gauge) or larger. The wire needs to be tied to a single grounding point. The ground conductor connects to the bottom of the each PDM base and is secured by the PE captive screw.

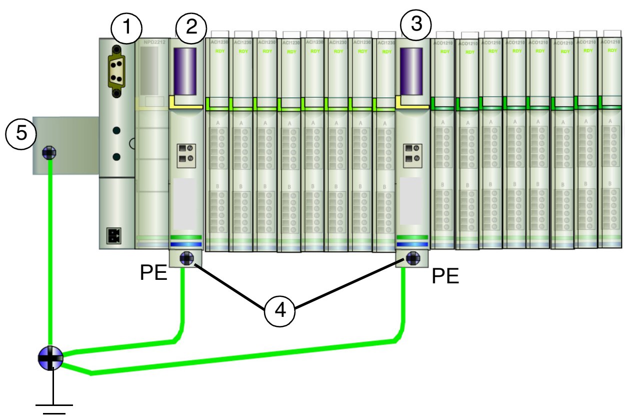
Local electrical codes take precedence over our PE wiring recommendations.

Handling Multiple PE Connections

It is possible that more than one PDM will be used on an island. Each PDM base on the island will receive a ground conductor and distribute PE as described above.

Note: Tie the PE lines from more than one PDM to a single PE ground point in a star configuration. This will minimize ground loops and excessive current from being created in PE lines.

This illustration shows separate PE connections tied to a single PE ground:



1 the NIM
2 a PDM
3 another PDM
4 captive screws for the PE connections
5 FE connection on the DIN rail

STB PDT 3105 Specifications

Table of Technical Specifications

description	basic 24 VDC power distribution module
module width	18.4 mm (0.72 in)
module height in its base	137.9 mm (5.43 in)
PDM base	STB XBA 2200
hot swapping supported	no
nominal logic power current consumption	0 mA
I/O power bus voltage range	19.2 ... 30 VDC
reverse polarity protection	on the outputs only
module current field	4 A max
overcurrent protection for sensor and actuator power	user-replaceable 5 A time-lag fuse
	one fuse ships with the PDM; replacements are available in an STB XMP 5600 fuse kit
bus current	0 mA
voltage surge protection	yes
PE current	30 A for 2 min
storage temperature	-40 to 85°C
operating temperature	0 to 60°C
agency certifications	refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171*

STB Module Bases

4

At a Glance

Overview

The physical communications bus that supports the island is constructed by interconnecting a series of base units and snapping them on a DIN rail. Different Advantys modules require different types of bases, and it is important that you install bases in the proper sequence as you construct the island bus. This chapter provides you with a description of each base type.

What's in this Chapter?

This chapter contains the following topics:

Advantys Bases

Summary

There are six different base units. When interconnected on a DIN rail, these bases form the physical backplane onto which the Advantys modules are mounted. This physical backplane also supports the transmission of power, communications and PE across the island bus.

Base Models

The table below lists the bases by model number, size and types of Advantys modules that they support.

Base Model	Width	Modules Supported
STB XBA 1000	13.9 mm (0.58 in)	size 1 Advantys input and output modules
STB XBA 2000	18.4 mm (0.72 in)	size 2 Advantys input and output modules and the STB XBE 2100 CANopen extension module
STB XBA 2200 (see *p. 131*)	18.4 mm (0.72 in)	All Advantys PDM modules
STB XBA 2300	18.4 mm (0.72 in)	STB XBE 1200 BOS island bus extension modules
STB XBA 2400	18.4 mm (0.72 in)	STB XBE 1000 EOS island bus extension modules
STB XBA 3000 (see *p. 127*)	27.8 mm (1.09 in)	size 3 Advantys specialty modules

Note: You must insert the correct base in each location on the island bus to support the desired module type. Notice that there are three different size 2 (18.4 mm) bases. Make sure that you choose and install the correct one at each position on the island bus.

STB XBA 3000 I/O Base

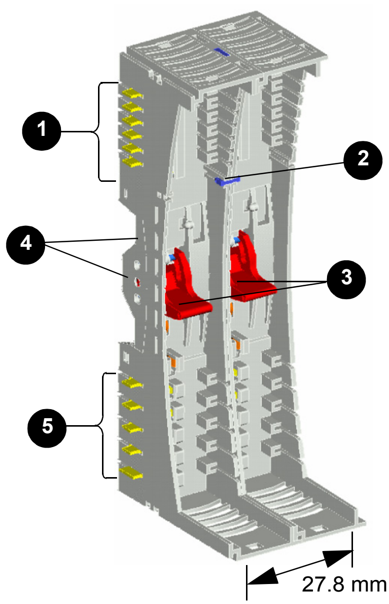
Summary

The STB XBA 3000 I/O base is 27.8 mm (1.1 in) wide. provides the physical connections for a size 3 input and output module on the island bus. These connections let you communicate with the NIM over the island bus and hot swap the module when the island bus is operational. They also enable the module to receive:

- logic power from the NIM or from a BOS module
- sensor power (for inputs) or actuator power (for outputs) from the PDM

Physical Overview

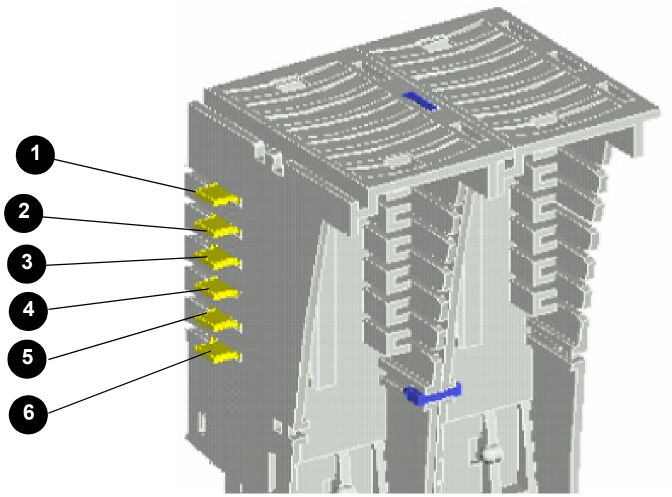
The following illustration shows some of the key components an STB XBA 3000 base:



1 six island bus contacts
2 size 3 security pin
3 DIN rail lock/release latches
4 DIN rail contacts
5 five field power distribution contacts

The Island Bus Contacts

The six contacts located in a column at the top of the I/O base provide logic power (see *p. 20*) and island bus communications connections between the module and the island backplane. They are as follows:



In the primary segment of the island bus, the signals that make these contacts come from the NIM. In extension segments, these signals come from an STB XBE 1000 BOS extension module:

Contacts	Signals
1	not used
2	the common ground contact
3	the 5 VDC logic power signal generated by the power supply in either the NIM (in the primary segment) or a BOS module (in an extension segment)
4 and 5	used for communications across the island bus between the I/O and the NIM—contact 4 is positive (+ve), and contact 5 is negative (-ve).
6	connects the module in the base to the island's address line. The NIM uses the address line to validate that the expected module is located at each physical address.

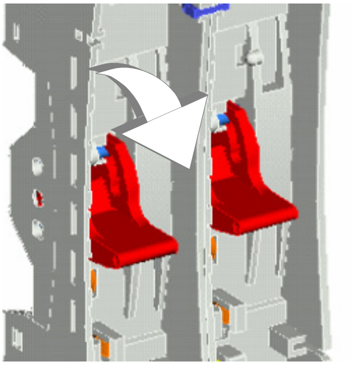
The Size 3 Module Security Pin

The STB XBA 3000 I/O base looks very much like a pair of interlocked STB XBA 1000 I/O bases. It is designed, however, to house only size 3 I/O modules. The security pin located in the center front of the base above the two lock/release latches prevents you from inadvertently installing two size 1 modules in the base.

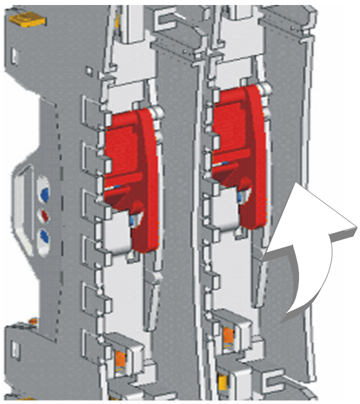
The Lock/ Release Latch

Two latches in the center front of the STB XBA 3000 base each have two positions, as shown below:

Release positions



Lock positions



The latches need to be in their release positions while the base is being inserted on the DIN rail and when it is being removed from the DIN rail. They need to be in their lock positions when the base has been pushed and snapped into place on the rail before the module is inserted into the base.

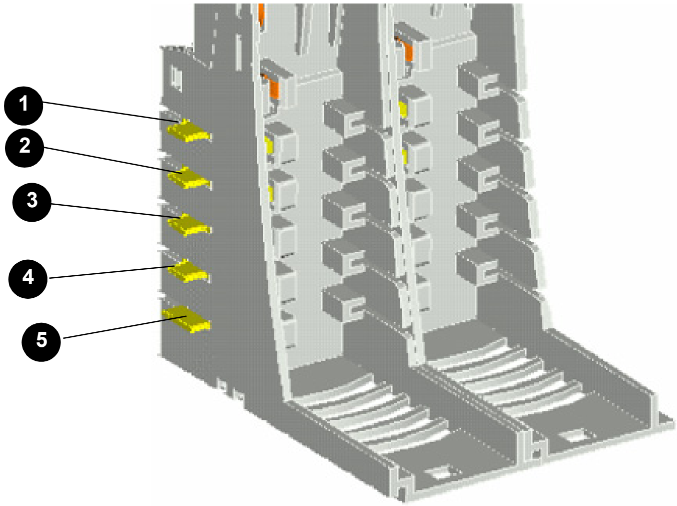
The DIN Rail Contacts

One of the functions of the DIN rail is to provide the island with functional earth. Functional earth provides the island with noise immunity control and RFI/EMI protection.

When an STB XBA 3000 I/O base is snapped onto the DIN rail, four contacts on the back of the rail provide functional ground connections between the rail and the I/O module that will be seated on the base.

The Field Power Distribution Contacts

The five contacts located in a column at the bottom of the STB XBA 3000 base provide field power and protective earth (PE) connections to the I/O module. They are as follows:



Field power (sensor power for inputs and actuator power for outputs) is distributed across the island bus to the STB XBA 3000 bases by a PDM:

Contacts	Signals
1 and 2	when the module inserted in the base has input channels, contacts 1 and 2 deliver sensor bus power to the module
3 and 4	when the module inserted in the base has output channels, contacts 3 and 4 deliver actuator bus power to the module
5	PE is established via a captive screw on the PDM base units (see *p. 135*) and is delivered to the Advantys STB I/O module via contact 5

If the module in the STB XBA 3000 base supports only input channels, contacts 3 and 4 are not used. If the module in the STB XBA 1000 base supports only output channels, contacts 1 and 2 are not used.

STB XBA 2200 PDM Base

Summary

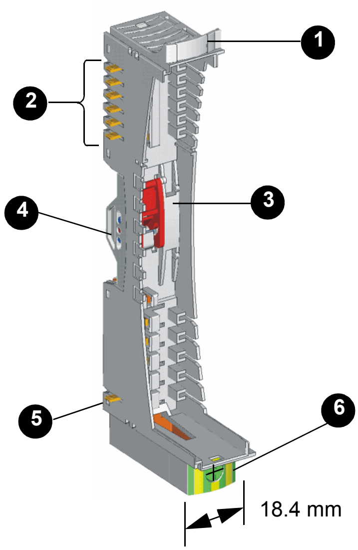
The STB XBA 2200 PDM base is 18.4 mm (0.72 in) wide. It is the mounting connection for any PDM(s) on the island bus. It allows you to easily remove and replace the module from the island for maintenance. It also enables the PDM to distribute sensor bus power to input modules and actuator power to output modules in the voltage group of I/O modules supported by that NIM.

A plastic block at the bottom of the base houses a PE captive screw (see *p. 135*), which should be used to make protective earth connections for the island. This captive screw block gives the PDM an added height dimension of 138 mm (5.44 in). As a result, the PDMs are always the tallest Advantys modules in an island segment.

Note: The STB XBA 2200 is designed only for PDMs. Do not attempt to use this base for other size 2 Advantys modules such as STB I/O modules or island bus extension modules.

Physical Overview

The following illustration shows an STB XBA 2200 PDM base and highlights some of its key physical components.



1 user-customizable label
2 six island bus contacts
3 DIN rail lock/release latch
4 DIN rail contact
5 PE contact
6 PE captive screw

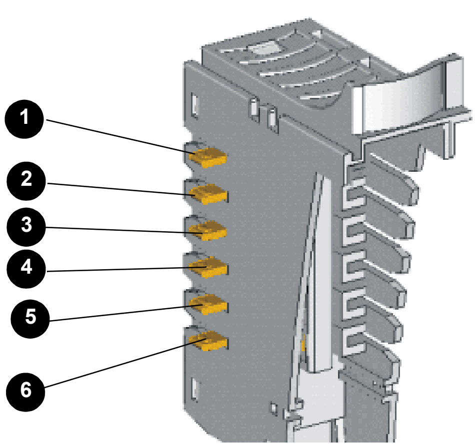
The Label Tab

A label can be positioned on the tab shown above in item 1 to help identify the module that will reside at this base unit's island bus location. A similar label can be placed on the PDM itself so that they can be matched up properly during the island installation.

Labels are provided on an STB XMP 6700 marking label sheet, which can be ordered at no charge from your Scneider Electric service provider.

The Island Bus Contacts

The six contacts located in a column at the top of the I/O base allow island bus logic power and communication signals flow through the PDM downstream to the I/O modules:



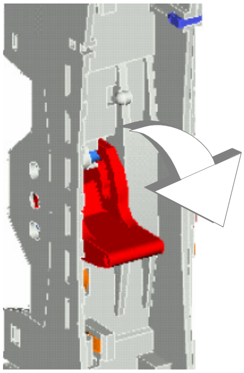
1 not used
2 common ground contact
3 5 VDC logic power contact
4 island bus communications + contact
5 island bus communications - contact
6 address line contact

The STB PDT 3100 and STB PDT 2100 PDMs are non-addressable modules, and they do not use the island's logic power or communication buses. The six island bus contacts at the top of the base are used for 5 V ground and for LED power.

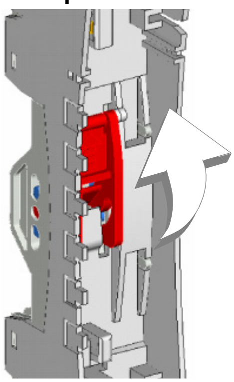
The Lock/ Release Latch

The latch in the center front of the STB XBA 2200 base has two positions, as shown below:

Release position



Lock position



The latch needs to be in release position while the base is being inserted on the DIN rail and when it is being removed from the DIN rail. It needs to be in lock position when the base has been pushed and snapped into place on the rail before the module is inserted into the base.

The DIN Rail Contacts

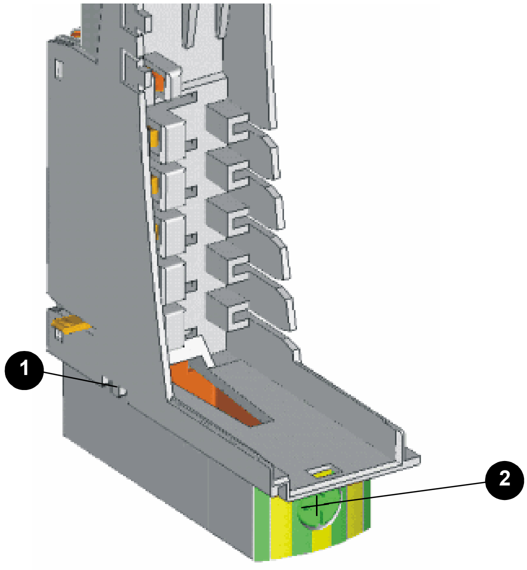
One of the roles of the DIN rail is to provide the island with functional earth. Functional earth provides the island with noise immunity control and RFI/EMI protection.

When a PDM base is snapped onto the DIN rail, two contacts on the back of the rail provide the functional ground connection between the rail and the PDM that will be seated on the base.

Protective Earth

One of the key functions of a PDM, in addition to distributing sensor and actuator power to the I/O modules, is the provision of protective earth to the island. PE is essentially a return line across the bus for fault currents generated at a sensor or actuator device in the control system.

A captive screw at the bottom of the STB XBA 2200 base secures a PE wire to the island:



1 The PE contact
2 The PE captive screw

PE is brought to the island by an insulated ground conductor, usually a copper wire that is tied to a single grounding point on the cabinet. The ground conductor is secured by the PE captive screw.

The STB XBA 2200 base distributes PE to the island via a single contact located at the bottom left side of the base (item 2 above). The PDM base distributes PE to its right and left along the island bus.

The single contact on the bottom left of the base is one of the ways to discriminate the STB XBA 2200 from other size 2 bases. The PDM base does not need the four field power contacts on its bottom left side—the PDM takes field power from an external power supply via two power connectors on the front of the module and distributes that power downstream to the I/O modules it supports.

The Protective Earth Connection

PE Contact for the Island

One of the key functions of a PDM, in addition to distributing sensor and actuator power to the I/O modules, is the provision of protective earth (PE) to the island. On the bottom of each STB XBA 2200 PDM base is a captive screw in a plastic block. By tightening this captive screw, you can make a PE contact with the island bus. Every PDM base on the island bus should make PE contact.

How PE Contact Is Made

PE is brought to the island by a heavy-duty cross-sectional wire, usually a copper braided cable, 6 mm^2 or larger. The wire needs to be tied to a single grounding point. The ground conductor connects to the bottom of the each PDM base and is secured by the PE captive screw.

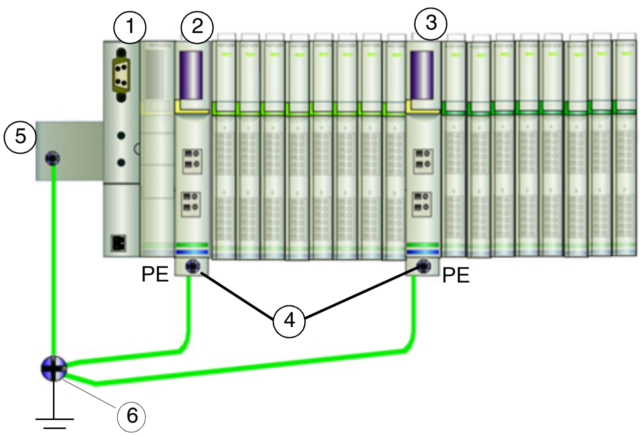
Local electrical codes take precedence over our PE wiring recommendations.

Handling Multiple PE Connections

It is possible that more than one PDM will be used on an island. Each PDM base on the island will receive a ground conductor and distribute PE as described above.

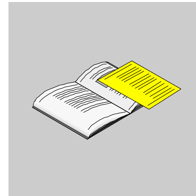
> **Note:** Tie the PE lines from more than one PDM to a single PE ground point in a star configuration. This will minimize ground loops and excessive current from being created in PE lines.

This illustration shows separate PE connections tied to a single PE ground:



1 the NIM
2 a PDM
3 another PDM
4 captive screws for the PE connections
5 FE connection on the DIN rail
6 PE ground point

Appendices



Overview

IEC Symbols

This appendix illustrates the IEC symbols used in the field wiring examples in this book and some of the installation examples in the *Advantys STB Planning and Installation Guide* (890 USE 171).

What's in this Appendix?

The appendix contains the following chapters:

IEC Symbols

A

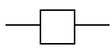
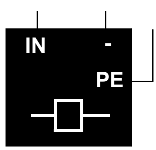
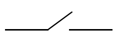
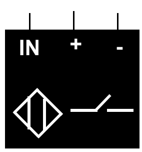
IEC Symbols

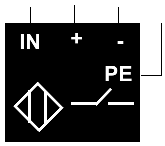
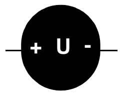
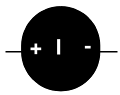
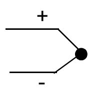
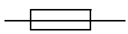
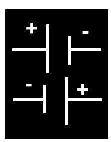
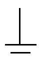
Introduction

The following table contains illustrations and definitions of the common IEC symbols used in describing the Advantys STB modules and system.

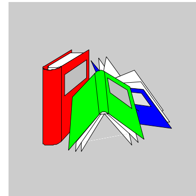
List of Symbols

Here are some common IEC symbols used in the field wiring examples throughout this book:

Symbol	Definition
	two-wire actuator/output
	three-wire actuator/output
	two-wire digital sensor/input
	three-wire digital sensor/input

Symbol	Definition
	four-wire digital sensor/input
	analog voltage sensor
	analog current sensor
	thermocouple element
	fuse
	VAC power
	VDC power
	earth ground

Glossary



!

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 error 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.

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), or . . .
- edit the **Device Name** setting in the NIM's embedded web server pages

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 error.

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 fails.

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, error, and 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 will send a 1 to the controller when its field sensor turns on. If the polarity is *reverse*, an input channel will send 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 errors in the event that a request fails.

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 fails or is removed from its location on the Island bus, the Island will go into 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, error 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 will turn its actuator on when the master controller sends it a 1. If the polarity is *reverse*, an output channel will turn 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 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, error 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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