# Advantys STB
# Hardware Components
# Reference Guide

890USE17200 Version 1.0

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# Table of Contents

# Safety Information

## Important Information

**NOTICE**

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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, serious injury, or equipment damage.

**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**

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to ensure 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.

No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

# About the Book

## At a Glance

**Document Scope**

This document describes the physical and functional characteristics of the I/O modules, power distribution modules, island bus extension modules and module accessories in the Advantys STB family of products.

**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 |
|---|---|
| The Advantys STB System Planning and Installation Guide | 890USE17100 |
| The Advantys STB Profibus DP Network Interface Applications Guide | 890USE17300 |
| The Advantys STB INTERBUS Network Interface Applications Guide | 890USE17400 |
| The Advantys STB DeviceNet Network Interface Applications Guide | 890USE17500 |
| The Advantys STB CANopen Network Interface Applications Guide | 890USE17600 |
| The Advantys STB Ethernet Modbus TCP/IP Network Interface Applications Guide | 890USE17700 |
| The Advantys STB Modbus Plus Network Interface Applications Guide | 890USE17800 |
| The Advantys STB Fipio Network Interface Applications Guide | 890USE17900 |
| The Advantys Configuration Software Quick Start User Guide | 890USE18000 |

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**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*.
Advantys STB allows you to extend an island bus to multiple segments of I/O on one or more DIN rails. It allows you to position the I/O as close as possible to the sensors and actuators they control. Using bus extension cables and modules, an island bus can be stretched to distances up to 15 m (49.21 ft).

## Types of I/O Modules on an Advantys STB System

**Summary**

An island can support up to 32 I/O modules. The modules can be:
- standard 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 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 three 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 a typical segment of island modules.
- A preferred module will require its own power supply. It will not get logic power from the island bus.
- To place preferred modules in you island, you must use the Advantys configuration software.

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.

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. 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**

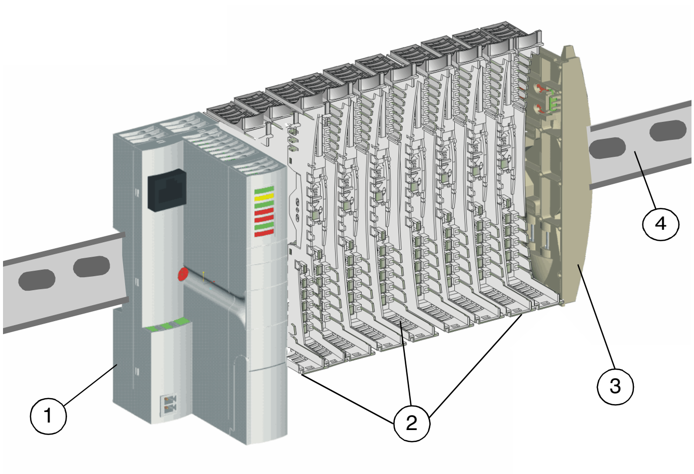
Every island bus begins with a primary segment. The primary segment consists of the island's NIM and a set of interconnected module bases attached to a DIN rail. The PDMs and Advantys STB I/O module mount in these bases on the DIN rail. The NIM is always the first (leftmost) module in the primary segment.

## 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 *Communications Across the Island, p. 33*) 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 four major 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 is the interface to the configuration software, which is used to initialize and parameterize the island modules
- 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 on which the island will operate. Choose the NIM that allows your island to operate on the desired fieldbus protocol. Each NIM is documented in its own user manual.

**The PDM**

The second module on the primary segment is a PDM. There are two types of PDMs:

- an STB PDT 3100 PDM, which distributes 24 VDC field power to the I/O modules in a segment
- an STB PDT 2100 module, which distributes either 115 VAC or 230 VAC field power to the I/O modules in a segment

There is a variety of I/O modules available, but they all fall into three voltage groups:

- I/O that supports *24 VDC* field sensors and actuators
- I/O that supports *115 VAC* field sensors and actuators
- I/O that supports *230 VAC* field sensors and actuators

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.

**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 (115/230 VAC digital I/O and relay modules) |
| STB XBA 2200 | 18.4 mm (0.72 in) | the size 2 base that supports DC and AC 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**

A 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 can terminate at the end of the primary segment or it can be extended. Extensions may be to more segments of STB I/O, to one or more preferred modules (See *Preferred Modules, p. 15*) and/or to one or more standard CANopen devices (See *Types of I/O Modules on an Advantys STB System, p. 15*).

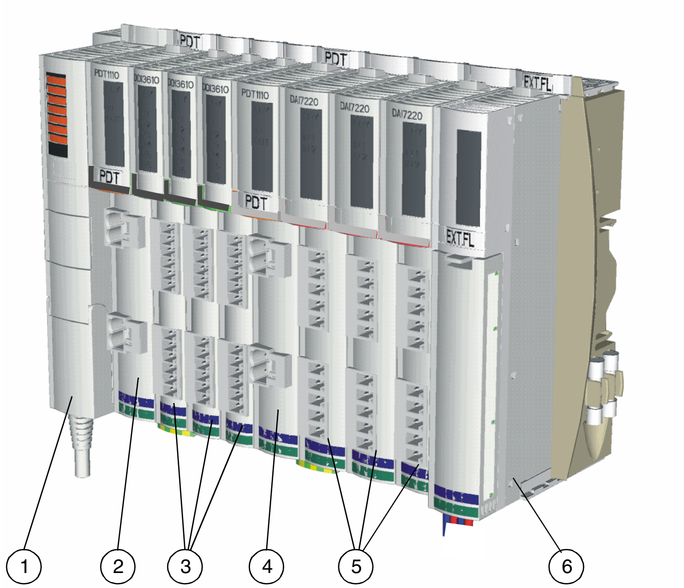
The island bus must be terminated with a 120 Ω terminator resistor. If the last module on the island bus is an Advantys STB I/O module, use an STB XMP 1100 terminator plate at the end of the segment.

If the island bus is extended to another segment of Advantys STB modules or to a preferred module, 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, 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.

**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.

## The Roles of a Network Interface Module

**Key Features**

The NIM is a multifaceted and necessary part of every island bus. It provides:
- the gateway between the I/O on the island and the fieldbus master
- the interface for the Advantys configuration software
- a built-in power supply that provides logic power to I/O modules in the primary segment

**Logic Power**

The NIM has an internal power supply that converts 24 VDC to 5 VDC which supplies 1.2 A of current for logic power across the primary segment of the island bus. The I/O modules in the segment can draw up to 1.2 A of current. If your I/O modules use more than 1.2 A of logic power, you must install one or more extension segments on your island. Refer to the module specifications in the following chapters for the nominal current consumption of each STB I/O module.

**The CFG Port**

The CFG port is an RS232 port that can be used to connect the island to:
- a computer running the Advantys configuration software
- an RS232-based HMI panel

Either of these devices can be connected to the island via the NIM using an STB XCA 4002 cable—a 2 m (6.23 ft) cable with a female eight-pin HE-13 connector on the NIM end and a female nine-pin SUB-D connector on the external device end.

**The Advantys Configuration Software**

The use of the Advantys configuration software is optional—Advantys STB modules are shipped with factory-default settings that allow them to function without the need for user configuration.

To configure preferred modules and/or standard CANopen devices, you must use the Advantys configuration software.

The configuration software provides several important options. The software allows you to modify the operating parameters of the I/O modules. For example, you can change the fallback value of your output modules, classify certain application-critical I/O modules as mandatory and select various optional operating modes for some of the special modules. You can also use the software to create reflex actions.

The Advantys configuration software functions as both an offline and online tool. Configuration tasks are performed offline. Other tasks—such as monitoring and application debugging—can be done in online mode.

The Advantys configuration software is also a valuable planning tool, with powerful support for tasks such as:

- Estimating power supply requirements on the island
- Determining your overall I/O budget and placing modules in the correct physical locations on the island backplane
- Managing your state RAM usage

## Logic Power Flow

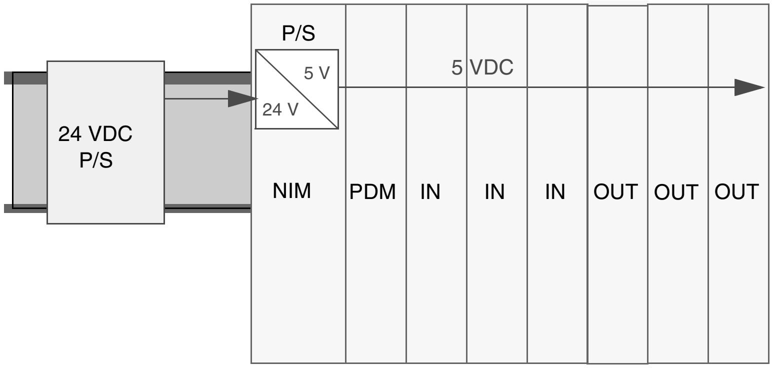
**Summary**

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, and one is built into the STB XBE 1200 BOS modules to support any extension segments.

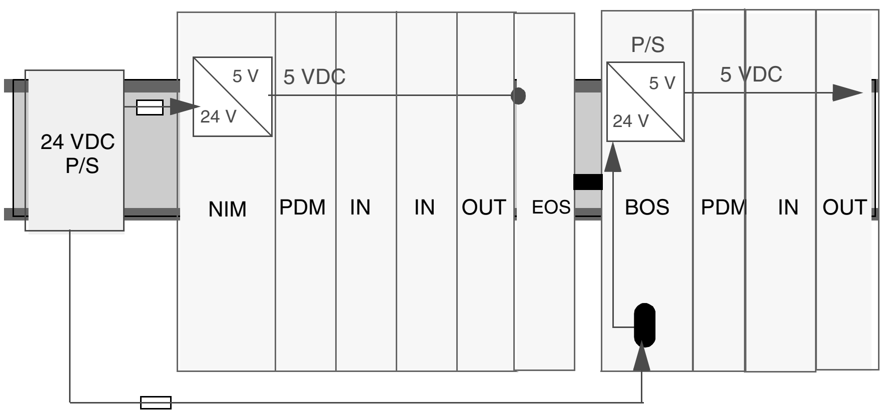
These power supplies require an external SELV rated 24 VDC power source, which is usually mounted in the enclosure with the island.

**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 will need to place some of the modules in one or more extension segment(s). You will need to install an EOS module 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 in a segment on the island bus. It sends separate isolated power signals to the input modules (along the island's sensor bus) and to the output modules (along the island's actuator bus). It protects the input modules with a 5 A time-lag fuse, and it protects the output modules with a 10 A time-lag fuse. The PDM also provides a protective earth (PE) connection for the island.

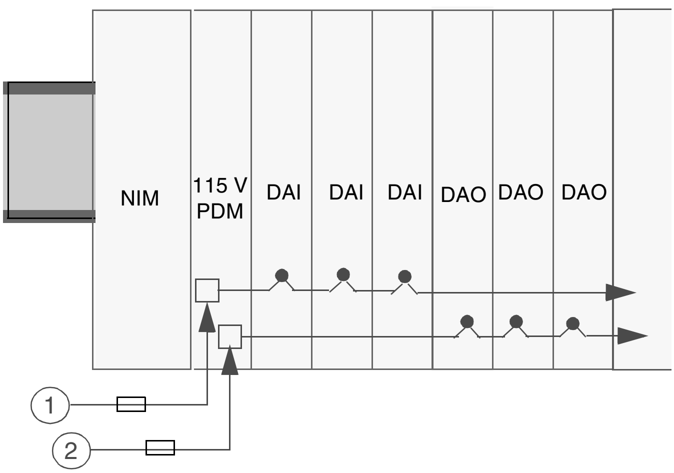
### Voltage Groupings

I/O modules with different voltage requirements need to be isolated from each other in an island segment. They fall into three types of voltage groups. The following table lists these voltage groups, the types of Advantys STB I/O modules that exist in each group, and the type of PDM that needs to be used to support each group.

| Voltage Group | Advantys STB I/O Module Types | PDM Model to be Used |
|---|---|---|
| 24 VDC | analog I/O | STB PDT 3100 |
| | 24 VDC digital I/O | |
| 115 VAC | 115 VAC digital I/O | STB PDT 2100 |
| 230 VAC | 230 VAC digital I/O | STB PDT 2100 |

### PDM Placement

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 an 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

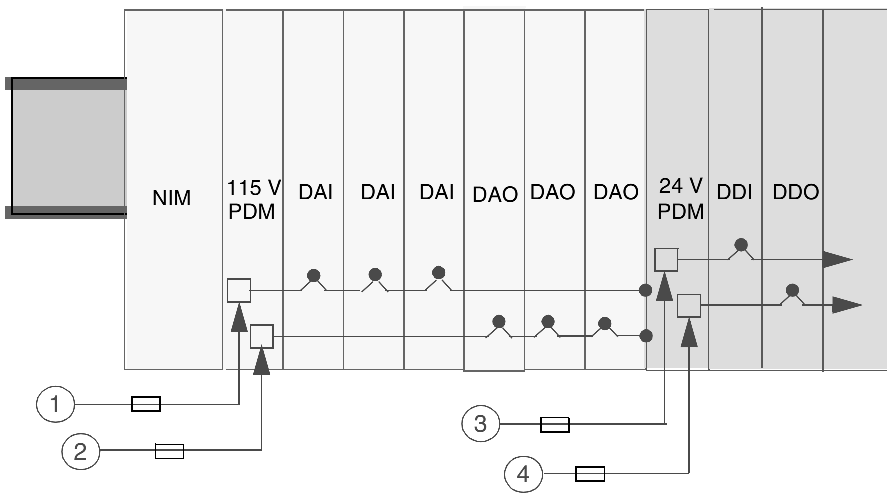
Sensor power (to the input modules) is brought to the island via a two-pin connector on the PDM. Actuator power (to the output modules) is brought to the island via another two-pin connector on the PDM. The field power traverses independently across the two power buses.

The PDM ships with one 5 A time-lag fuse that protects the input modules and one 10 A time-lag fuse that protects the output modules. Additional fuses available in an STB XMP 5600 PDM fuse kit.

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 an STB PDT 3100 module) is required 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 voltag 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

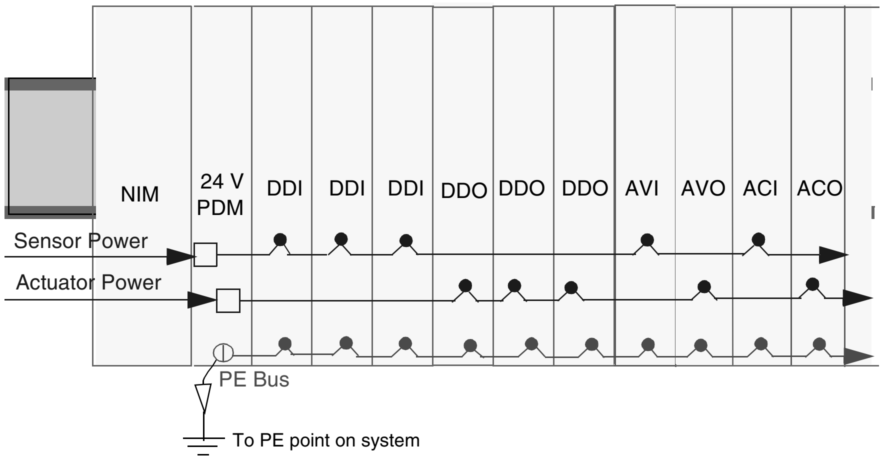
**2** 115 VAC actuator power signal to the PDM

**3** 24 VDC sensor power signal to the PDM

**4** 24 VDC actuator power signal to the PDM

**PE Grounding**

The PDM(s) also establish PE connections that protect the I/O modules on the sensor and actuator buses. A captive screw terminal on the bottom of the PDM base makes contact with pin 12 (See *Field Power Distribution Contacts, p. 35*) 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 (see *The Protective Earth Connection, p. 365*).



## Sensor Power and Actuator Power Distribution on the Island Bus

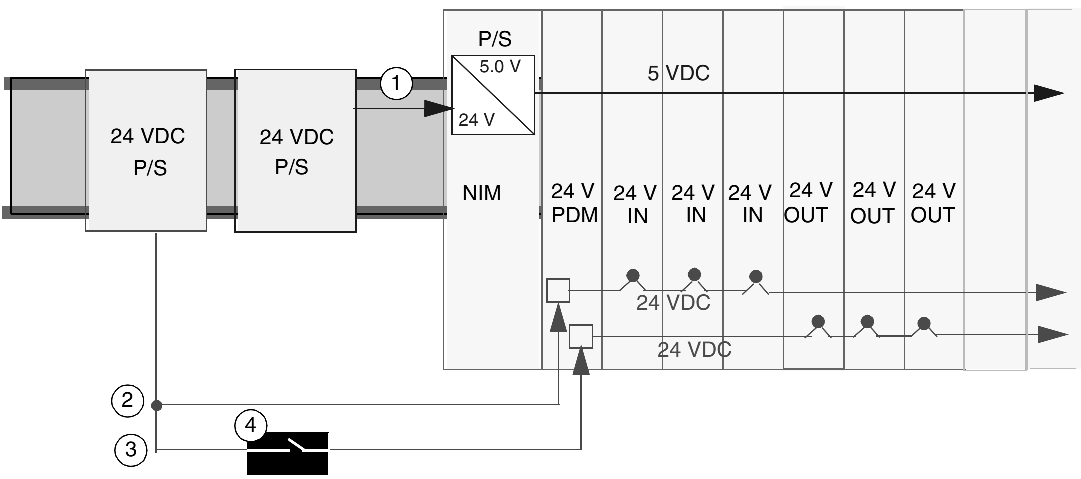
**Summary**

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 module.

- 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. It must be a SELV rated 24 VDC power source.
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 (See *Logic Power, p. 22*) and for field power to the PDM:



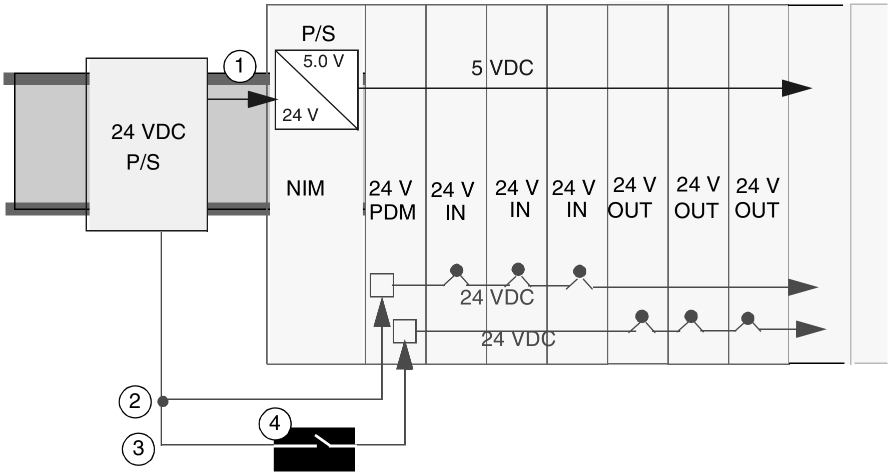

**1** 24 VDC signal to the NIM's logic power supply

**2** 24 VDC signal to the island's sensor bus

**3** 24 VDC signal to the island's actuator bus

**4** optional protection 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

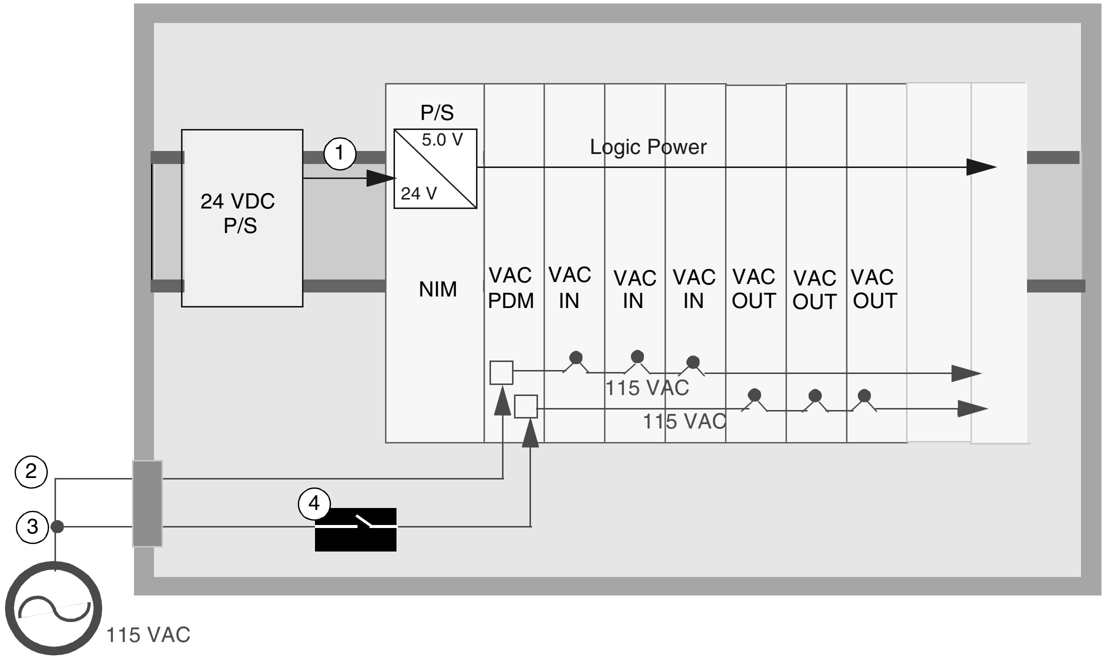
**2** 24 VDC signal to the island's sensor bus

**3** 24 VDC signal to the island's actuator bus

**4** optional protection relay on the actuator bus

**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 AC power distribution:



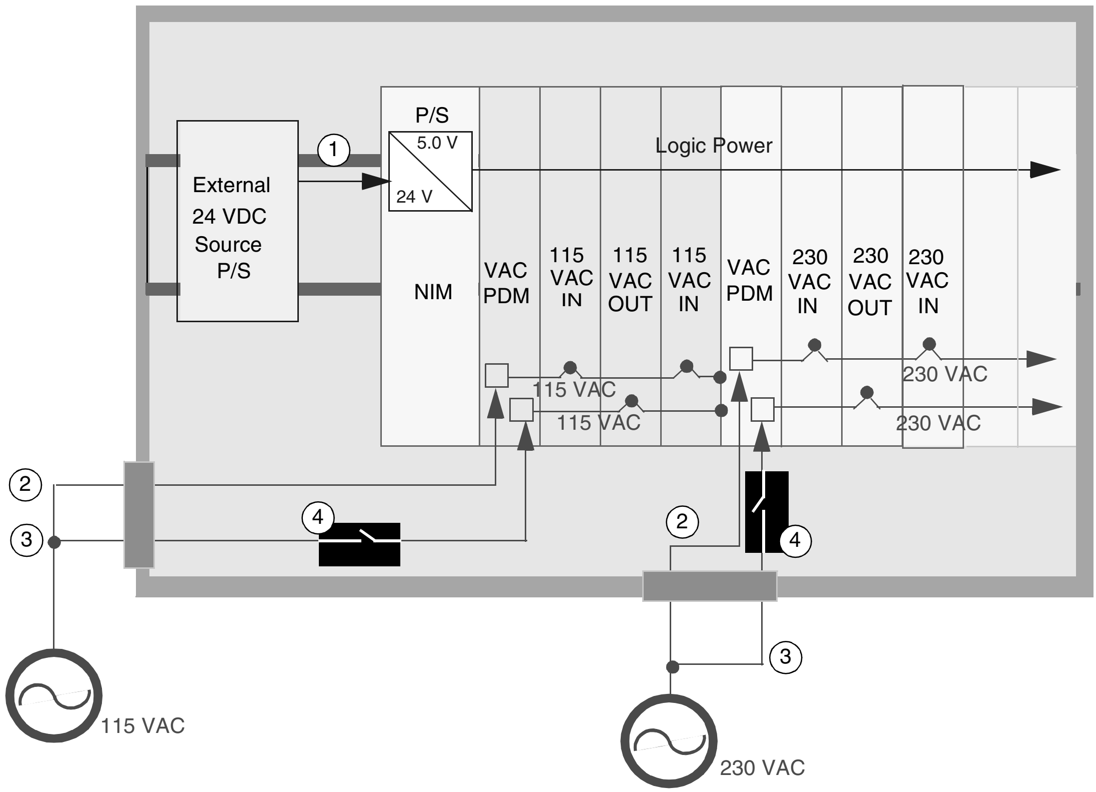

**1** 24 VDC signal to the NIM's logic power supply

**2** 115 VAC signal to the island's sensor bus

**3** 115 VAC signal to the island's actuator bus

**4** optional protection 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 island's sensor bus

**3** 115 VAC signal to the island's actuator bus

**4** optional protection relay on the actuator bus

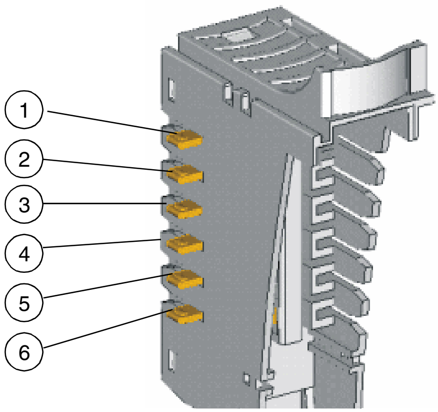
## Communications Across the Island

**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

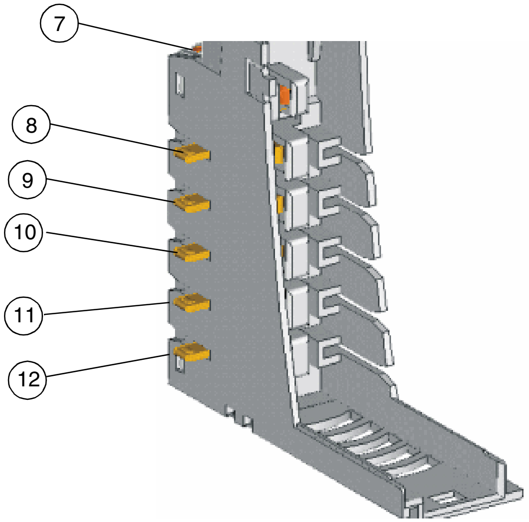
**6** address line contact

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 |
| 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. |

# An Overview of the Advantys STB I/O Modules

# 2

## At a Glance

**Overview**

The tables on the following pages list the I/O modules in the Advantys STB family.

**What's in this Chapter?**

This chapter contains the following topics:

## An Overview of the Advantys STB I/O Modules

**Summary**

The Advantys STB input and output modules include:
- digital input and output modules
- relay output modules
- analog input and output modules
- special modules

The modules are characterized briefly in the following tables. Detailed descriptions of the individual modules are provided in the chapters that follow.

## Digital Input Modules

Characteristics of the Advantys STB digital input modules are described in the following table:

| Model | Sink Voltage | Number of Channels | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB DDI 3230 | 24 VDC | two | I/O base: | STB XBA 1000 | IEC type 2 inputs |
| | | | PDM: | STB PDT 3100 | short-circuit protection |
| | | | field wiring connectors: | STB XTS 1100 screw type | two-, three- and four-wire device support |
| | | | | STB XTS 2100 spring clamp | filter time constant configurable to 0.2 ms |
| STB DDI 3420 | 24 VDC | four | I/O base: | STB XBA 1000 | IEC type 1+ inputs |
| | | | PDM: | STB PDT 3100 | short-circuit protection |
| | | | field wiring connectors: | STB XTS 1100 | two- and three-wire device support |
| | | | | STB XTS 2100 | filter time constant configurable to 0.5 ms |
| STB DDI 3610 | 24 VDC | six | I/O base: | STB XBA 1000 | IEC type 1 inputs |
| | | | PDM: | STB PDT 3100 | short-circuit protection |
| | | | field wiring connectors: | STB XTS 1100 | two-wire device support |
| | | | | STB XTS 2100 | filter time constant fixed at 1.0 ms |
| STB DAI 5230 | 115 VAC | two | I/O base: | STB XBA 2000 | 47 ... 63 Hz |
| | | | PDM: | STB PDT 2100 | IEC type 1 inputs |
| | | | field wiring connectors: | STB XTS 1110 screw type | two- and three-wire device support |
| | | | | STB XTS 2110 spring clamp | |
| STB DAI 7220 | 230 VAC | two | I/O base: | STB XBA 2000 | 47 ... 63 Hz |
| | | | PDM: | STB PDT 2100 | IEC type 1 inputs |
| | | | field wiring connectors: | STB XTS 1110 | two- and three-wire device support |
| | | | | STB XTS 2110 | |

**Digital Output Modules**

Characteristics of the Advantys STB digital output modules are described in the following table:

| Model | Source Voltage | Number of Channels | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB DDO 3200 | 24 VDC | two | I/O base: | STB XBA 1000 | 0.5 A/channel maximum load current |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 screw type | over-current protection |
| | | | | STB XTS 2100 spring clamp | two- and three-wire device support |
| STB DDO 3230 | 24 VDC | two | I/O base: | STB XBA 1000 | 2 A/channel maximum load current |
| | | | PDM: | STB PDT 3100 ; an external power supply may be used instead | |
| | | | field wiring connectors: | STB XTS 1100 | over-current protection |
| | | | | STB XTS 2100 | two- and three-wire device support |
| STB DDO 3410 | 24 VDC | four | I/O base: | STB XBA 1000 | 0.5 A/channel maximum load current |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 | over-current protection |
| | | | | STB XTS 2100 | two-wire device support |
| STB DDO 3600 | 24 VDC | six | I/O base: | STB XBA 1000 | 0.5 A/channel maximum load current |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 | over-current protection |
| | | | | STB XTS 2100 | two-wire device support |

| Model | Source Voltage | Number of Channels | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB DAO 8210 | 115/<br>230 VAC | two | I/O base: | STB XBA 2000 | 1.0 A/channel maximum load current |
| | | | PDM: | STB PDT 2100 | |
| | | | field wiring connectors: | STB XTS 1110 screw type | two-, three- and four-wire device supports |
| | | | | STB XTS 2110 spring clamp | requires external fusing |

## Relay Output Modules

Characteristics of the Advantys STB relay output modules are described in the following table:

| Model | Number of Relays | Relay Type | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB DRC 3210 | two | form C relay output | I/O base: | STB XBA 2000 | 2 A/relay load current @ 30 degrees C |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1110 screw type | 24 V coil |
| | | | | STB XTS 2110 spring clamp | requires external fusing |
| STB DRA 3290 | two | form A/B relay output | I/O base: | STB XBA 2000 | 3.5 A/relay load current |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1110 | 24 V coil |
| | | | | STB XTS 2110 | requires external fusing |

**Analog Input Modules**

Characteristics of the Advantys STB analog input modules are described in the following table:

| Model | Number of Channels | Input Types | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB AVI 1270 | two | voltage | I/O base: | STB XBA 1000 | +/-10 V inputs from the analog sensors |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 screw type | 11-bit + sign data resolution |
| | | | | STB XTS 2100 spring clamp | analog components isolated from the island's sensor bus |
| STB ACI 1230 | two | current | I/O base: | STB XBA 1000 | 0 ... 20 mA inputs from the analog sensors |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 | |
| | | | | STB XTS 2100 | 12-bit data resolution |
| | | | | | analog components isolated from the island's sensor bus |
| STB ART 0200 | two | user-configurable to support RTD, thermocouple or mV devices | I/O base: | STB XBA 1000 | 15-bit + sign data resolution |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 | channel-to-channel isolation |
| | | | | STB XTS 2100 | |

**Note:** To make the analog input modules CE compliant, you must run shielded wires from the field sensors and you must clamp the shields to functional earth. An STB XSP 3000 EMC kit is available for this purpose. Use and installation details are provided in the *Advantys System Planning and Installation Guide* (890 USE 171).

**Analog Output Modules**

Characteristics of the Advantys STB analog output modules are described in the following table:

| Model | Number of Channels | Output Types | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB AVO 1250 | two | voltage | I/O base: | STB XBA 1000 | user-selectable for:<br>● 0 ... 10 V output<br>● +/-10 V outputs |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 screw type | 12-bit or 12 bit + sign data resolution |
| | | | | STB XTS 2100 spring clamp | short-circuit protection |
| | | | | | analog components isolated from the island's actuator bus |
| STB ACO 1210 | two | current | I/O base: | STB XBA 1000 | 0 ... 20 mA outputs |
| | | | PDM: | STB PDT 3100 | |
| | | | field wiring connectors: | STB XTS 1100 | 12-bit data resolution |
| | | | | STB XTS 2100 | short-circuit protection |
| | | | | | analog components isolated from the island's actuator bus |

**Note:** To make the analog output modules CE compliant, you must run shielded wires to the field actuators and you must clamp the shields to functional earth. An STB XSP 3000 EMC kit is available for this purpose. For details for use and installation, refer to the *Advantys System Planning and Installation Guide* (890 USE 171).

**Special Modules**

Characteristics of the Advantys STB special modules are described in the following table:

| Model | Number of Channels | I/O Types | Module Accessories | | Features and Characteristics |
|---|---|---|---|---|---|
| STB EPI 1145 | 16 in | | I/O base: | | Tego HE10 parallel interface |
| | 8 out | | PDM: | | 500 mA |
| | | | field wiring connectors: | | |
| STB EPI 2145 | 12 in | | I/O base | | Ultima pre-wiring parallel interface |
| | 8 out | | PDM: | | 500 mA |
| | | | field wiring connectors: | | |
| STB EHC 3020 | | | I/O base: | | incremental counter |
| | | | PDM: | | 40 kHz |
| | | | field wiring connectors: | | |

## Advantys STB I/O Modules

**Summary**

A detailed functional description of each I/O module is provided later in this book. The following discussion provides some basic criteria for identifying the modules you need to use in your installation.

**Distinguishing One I/O Module from Another**

There are two visual characteristics that allow you to quickly distinguish one I/O module from another—the model number on the top front panel and the color-coded stripe below the LED array. Each STB I/O module has a unique seven-character model number displayed on the top of the module's face. The color stripes are a useful way to distinguish one type of module from another—for example, a digital from an analog or an input from an output.

**Color stripe Table**

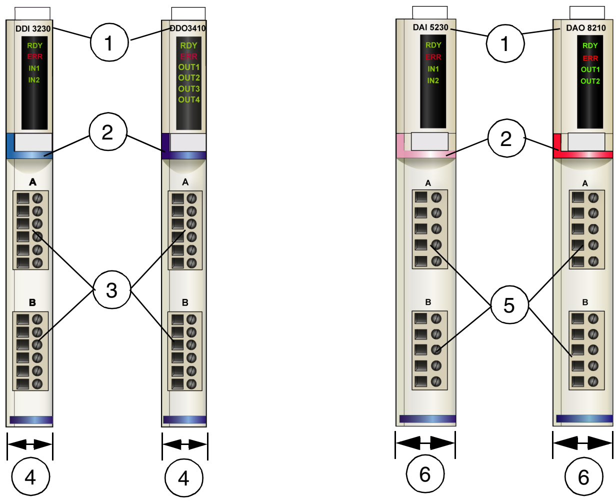
Here is a table of I/O module color codes:

| Module type | Details | Color |
|---|---|---|
| Digital | 24 VDC input | Light blue |
| | 24 VDC output | Dark blue |
| | 115/230 VAC input | Pink |
| | 115/230 VAC output | Red |
| Relay | 24 VDC to switch all 24 VDC, 115 VAC, and 230 VAC devices | Black |
| Analog | Input, current or voltage | Light green |
| | Output, current or voltage | Dark green |

## Digital I/O Modules

A wide assortment of digital I/O modules is available in the Advantys STB family. Some support 24 VDC field devices, and others support 115 and/or 230 VAC field devices. Some modules support two input or output channels, others support four or more channels.

The following illustration shows four typical digital I/O modules and some of their distinguishing physical characteristics:




**1** The model number label

**2** The color-coded stripe

**3** Six-terminal field wiring connectors

**4** 13.9 mm (0.58 in) module width

**5** Five-terminal field wiring connectors

**6** 18.4 mm (0.72 in) module width

**The model number**

The first three characters in the seven-character model number are alphabetical characters that indicate the following:

| Position | Character | Meaning |
|---|---|---|
| first (leftmost) | *D* | The module is digital |
| second | *D* or *A* | *D* if the module supports VDC field devices |
| | | *A* if the module supports VAC field devices |
| third | *I* or *O* | *I* if the module is an input |
| | | *O* if the module is an output |

For example, if the module is labelled *DDI*, it is a digital DC input module. If it is labelled *DAO*, it is a digital AC output module.

With respect to the four-digit numeric in the module number, the second digit from the left is the important digit, indicating the number of channels supported by the module. For example, a *DDO 3230* is a two-channel VDC output module, and a *DDI 3610* is a six-channel VDC input module.

**The color-coded stripe**

The color-coded stripe gives you a quick visual indication of whether the module is:

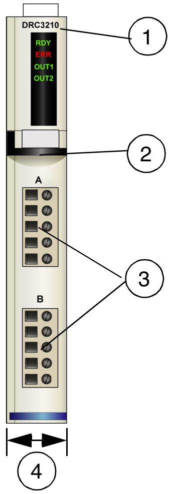
- A digital module
- An input or an output module
- A VAC or a VDC module

The colors indicate the following:

| Digital Module Type | Color Stripe |
|---|---|
| 24 VDC input | Light blue |
| 24 VDC output | Dark blue |
| 115/230 VAC input | Pink |
| 115/230 VAC output | Red |

**Relay Modules**

The relay modules are special implementations of the digital output modules. The coil they use runs on island's 24 VDC, so it needs to be installed in a 24 VDC voltage group. The field devices that it switches, however, may be 24 VDC, 115 VAC or 230 VAC. A relay output module fits in a size 2 (18.4 mm wide) I/O base:




**1** The model number label

**2** The color-coded stripe

**3** Five-terminal field wiring connectors

**4** 18.4 mm (0.72 in) module width

**Note:** Because relays can be used to switch high voltages, they have five-terminal field wiring connectors. This is different from most other modules that mount in a 24 VDC voltage group, which use six-terminal field wiring connectors. The five-terminal connectors provide the 5.08 mm (0.2 in) spacing between terminals that is necessary for supporting a high voltage device.

**The model number**

The first three characters in the seven-character model number are alphabetical characters that indicate the following:

| Position | Character | Meaning |
|---|---|---|
| first (leftmost) | *D* | The module is digital |
| second | *R* | The module is a relay |
| third | *A* or *C* | *A* if the module is a form A relay |
| | | *C* if the module is a form C relay |

For example, if the module is labelled *DRC*, it is a digital relay module with a form C relay.

With respect to the four-digit numeric in the module number, the second digit from the left is the important digit, indicating the number of channels supported by the module. For example, a *DRC 3210* is a two-relay module.

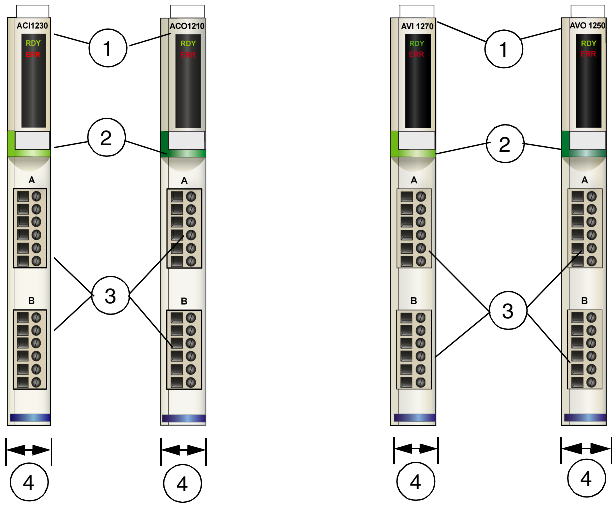
**The color-coded stripe**

Relay output modules have a black color-coded stripe on their front panels.

## Analog I/O Modules

The Advantys STB analog I/O modules are designed to support current and/or voltage driven field equipment. Each module provides two or more input or output channels.

The following illustration shows four typical analog I/O modules and some of their distinguishing physical characteristics:




**1** The model number label

**2** The color-coded stripe

**3** Six-terminal field wiring connectors

**4** 13.9 mm (0.58 in) module width

**The model number**

The first three characters in the seven-character model number are alphabetical characters that indicate the following:

| Position | Character | Meaning |
|---|---|---|
| first (leftmost) | *A* | The module is analog |
| second | *C* or *V* | *C* if the module supports current-driven field devices |
| | | *V* if the module supports voltage-driven field devices |
| third | *I* or *O* | *I* if the module is an input |
| | | *O* if the module is an output |

For example, if the module is labelled *ACI*, it is an analog current input module. If the module is labelled *AVO*, it is an analog voltage output module.
With respect to the four-digit numeric in the module number, the second digit from the left is the important digit, indicating the number of analog channels supported by the module. For example, a *AVO 1250* is a two-channel output module.

**The color-coded stripe**

The color-coded stripe gives you a quick visual indication of whether the module is an analog input or analog output module. It does not differentiate between current and voltage modules.

- An analog input module has a light green color stripe
- An analog output module has a dark green color stripe

## Operating Environment

**Types of 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* 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.

## Environmental Requirements

This equipment meets agency certification for UL, CSA, CE and FM class 1 div 2. 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 |
| isolation voltage | ref. EN61131-2 | 2000 VDC field-to-bus for 24 VDC |
| | | 3250 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 | 0 ... 60° C (32 ... 140° F) | |
| storage temperature | -40 ... +85° C (-40 ... +185° F) | |
| operating humidity | 95% relative humidity @ 60° C (noncondensing) | |
| nonoperating humidity | 95% relative humidity @ 85° C (noncondensing) | |
| supply voltage variation, interruption, shut-down and start-up | IEC 61000-4-11 | |
| damped oscillatory wave | IEC 61000-4-12 | |
| sinusoidal vibration | 5 ... 20 Hz with 6.35 mmDA | |
| | 20 ... 500 Hz with 5 g | |
| shock | ref. IEC88, part 2-27 | 30 g half sine |
| operating altitude | 2000 m (2187 yd) | |
| transport altitude | 3000 m (3281 yd) | |
| free-fall | ref. EN61131-2 | 1 m (1.09 yd) |

## 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 |
| pulse-modulated field | ref. EN61131-2 |

## 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 Advantys STB Digital Input Modules

# 3

## At a Glance

**Overview**

This chapter describes in detail the features of the digital input modules in the Advantys STB family.

**What's in this Chapter?**

This chapter contains the following sections:

# 3.1 STB DDI 3230 Digital 24 VDC Sink Input Module (two-channel, four-wire, IEC type 2, 0.2 ms-configurable, short-circuit protected)

## At a Glance

### Overview

This section provides a detailed description of the Advantys STB DDI 3230 digital input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

### What's in this Section?

This section contains the following topics:

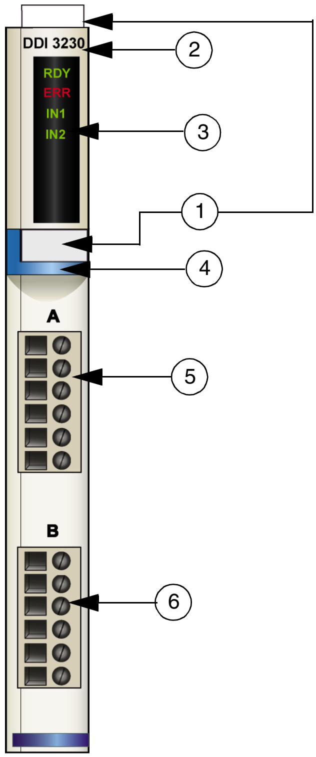
## STB DDI 3230 Physical Description

**Physical Characteristics**

The STB DDI 3230 is an Advantys STB two-channel digital input module that reads inputs from 24 VDC sensor devices and provides power to the sensors. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Sensor 1 is wired to the top connector and sensor 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** light blue identification stripe, indicating a digital DC input module

**5** sensor 1 connects to the top field wiring connector

**6** sensor 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module requires 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB DDI 3230 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

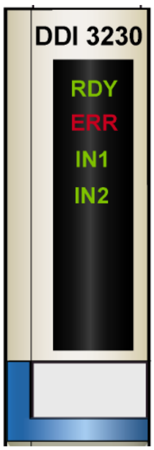
## STB DDI 3230 LED Indicators

**Purpose**

The four LEDs on the STB DDI 3230 module provide visual indications of the operating status of module and its two digital input channels. The LED locations and their meanings are described below.

**LED Locations**

The four LEDs are positioned in a column on the top front of the module directly below the model number. The figure below shows their locations:



**Indications**

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

<table>
<tr><th>RDY</th><th>ERR</th><th>IN1</th><th>IN2</th><th>Meaning</th><th>What to Do</th></tr>
<tr><td>off</td><td>off</td><td rowspan="3"></td><td rowspan="5"></td><td>The module is either not receiving logic power or has failed.</td><td>Check power</td></tr>
<tr><td>flicker*</td><td>off</td><td>Auto-addressing is in progress.</td><td rowspan="7"></td></tr>
<tr><td rowspan="5">on</td><td rowspan="5">off</td><td>The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational</td></tr>
<tr><td>on</td><td>Input 1 has applied voltage to its sensor.</td></tr>
<tr><td>off</td><td>Voltage is absent on input channel 1.</td></tr>
<tr><td></td><td>on</td><td>Input 2 has applied voltage to its sensor.</td></tr>
<tr><td></td><td>off</td><td>Voltage is absent on input channel 2.</td></tr>
<tr><td rowspan="2">on</td><td rowspan="2">on</td><td>on</td><td>on</td><td>The watchdog has timed out.</td><td rowspan="2">Cycle power, restart the communications</td></tr>
<tr><td colspan="3">Note that the green input LEDs will be on even though the power is absent from the input channels when a watchdog time-out occurs.</td></tr>
<tr><td>blink 1**</td><td></td><td colspan="2" rowspan="4"></td><td>The module is in pre-operational mode.</td><td></td></tr>
<tr><td rowspan="3"></td><td>flicker*</td><td>Field power absent or a PDM short circuit detected.</td><td>Check power</td></tr>
<tr><td>blink 1**</td><td>A nonfatal error has been detected.</td><td>Cycle power, restart the communications</td></tr>
<tr><td>blink 2***</td><td>The island bus is not running.</td><td>Check network connections, replace NIM</td></tr>
<tr><td colspan="6">* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.</td></tr>
<tr><td colspan="6">** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.</td></tr>
<tr><td colspan="6">*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.</td></tr>
</table>

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported immediately.

## STB DDI 3230 Field Wiring

**Summary**

The STB DDI 3230 module uses two six-terminal field wiring connectors. Sensor 1 is wired to the top connector, and sensor 2 is wired to the bottom connector. The choices of connector types and field wire types are described below, and a field wiring example is presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Sensors**

The STB DDI 3230 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two-, three-, or four-wire sensors that draw current up to 100 mA at 30 degrees C or 50 mA/channel at 60 degrees C. The module has IEC type 2 inputs designed to 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 two- or three-wire proximity switches.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wires in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Local electrical codes take precedence over our recommended wire size for the protective earth (PE) connections on pin 6.

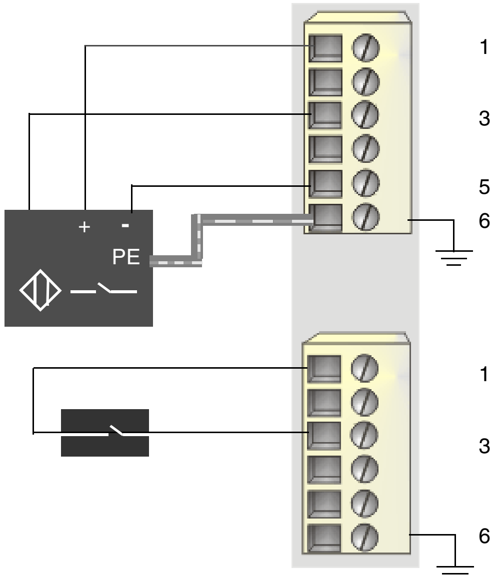
**Field Wiring Pinout**

The top connector supports the input from sensor 1, and the bottom connector supports the input from sensor 2:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | +24 VDC from sensor bus for field device accessories | +24 VDC from sensor bus for field device accessories |
| 2 | +24 VDC from sensor bus for field device accessories | +24 VDC from sensor bus for field device accessories |
| 3 | input from sensor 1 | input from sensor 2 |
| 4 | field power return (to the module) | field power return (to the module) |
| 5 | field power return (to the module) | field power return (to the module) |
| 6 | protective earth | protective earth |

**Sample Wiring Diagram**

The following field wiring example shows two sensors connected to the STB DDI 3230 module:




**1** +24 VDC for sensor 1 (top) and for sensor 2 (bottom)

**3** input from sensor 1 (top) and sensor 2 (bottom)

**5** field power return to the module from sensor 1

**6** protective earth connection for actuator 1 (top)

The four-wire sensor on the top connector has a PE connection that is tied to the PE connection on the PDM base through pin 6.

## STB DDI 3230 Functional Description

**Functional Characteristics**

The STB DDI 3230 is a two-channel module that handles digital input data from two 24 VDC field sensors. Using the Advantys configuration software, you can customize the following operating parameters on the module:

- an input filter time constant for the module
- *logic normal* or *logic reverse* input polarity for each channel on the module

**Input Filter Time Constant**

By default, the module filters the two input channels for 1.0 ms on-to-off and 1.0 ms off-to-on. If you want to change this input filtering value, you need to use the Advantys configuration software.

The following filter time constants may be configured:

- 0.2 ms (+/-0.1 ms)
- 0.5 ms (+/-0.1 ms)
- 1.0 ms (+/-0.1 ms)
- 2.0 ms (+/-0.1 ms)
- 4.0 ms (+/-0.1 ms)
- 8.0 ms (+/-0.1 ms)
- 16.0 ms (+/-0.1 ms)

Advantys STB products are designed to perform reliably at 1 ms in normal operating environments (See *Operating Environment, p. 52*). If your island is operating in a harsher environment, you may set the filter time constant above 1 ms. In this case, performance will be slower.

If your application requires faster performance and if the island is operating in a low-noise environment, you may set the filter time constant below 1 ms. However, performance reliability cannot be guaranteed when the filter time is below 1 ms.

**WARNING**

**UNINTENDED EQUIPMENT OPERATION**

Operating with a filter time constant that is faster than 1 ms makes the system more susceptible to power transients and environmental noise. Qualify the behavior of your system if you set the filter time to 0.2 ms or 0.5 ms.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

To configure the input filter time constant:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDI 3230 module you want to configure in the island editor. | The selected STB DDI 3230 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Filter Time Constant** row, select the desired time constant. | |

The input filter time constant is configured at the module level. One parameter value is set, and it applies to both input channels.

**Input Polarity**

By default, the polarity on both input channels is *logic normal*, where:
- 0 indicates that the physical sensor is off (or the input signal is low)
- 1 indicates that the physical sensor is on (or the input signal is high)

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

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

You can configure input polarity values independently for each input channel:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDI 3230 you want to configure in the island editor. | The selected STB DDI 3230 module opens in the software module editor. |
| 2 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Input Polarity** appears. |
| 3 | Expand the **+ Input Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | To change the settings *at the module level*, select the integer that appears in the **Value** column of the **Input Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have normal polarity and 3 means that both channels have reverse polarity. | Notice that when you select the **Input Polarity** value, the max/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new value for **Input Polarity**, the values associated with the channels change.<br>For example, if you choose an input polarity value of 2, **Channel 1** has normal polarity and **Channel 2** = has reverse polarity. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Input Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Input Polarity** value changes to 2. |

## STB DDI 3230 Data and Status for the Process Image

**Representing Digital Input Data and Status**

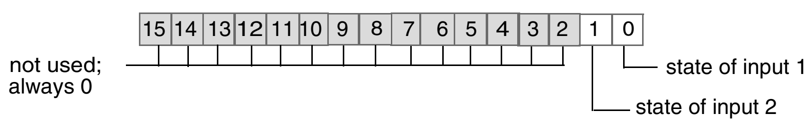
The STB DDI 3230 sends a representation of the operating state of its input channels to the NIM. The NIM stores this information in two 16-bit registers—one for data and one for error-detection status. The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.
The input data process image is part of a block of 4096 registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB DDI 3230 module is represented by two contiguous registers in this block—the data register followed by the status register. The specific registers used in the block are determined by the module's physical location on the island bus.

> **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 transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus,

**Input Data Register**

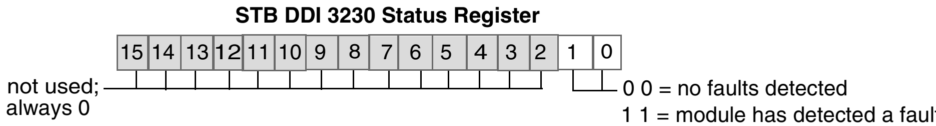
The first STB DDI 3230 register in the input block of the process image is the data register. The least significant bit (LSB) in the represents the on/off state of input 1, and the bit to its immediate left represents the on/off state of input 2:

**STB DDI 3230 Data Register**



**Input Status Register**

The second STB DDI 3230 register in the input block of the process image is the status register. The STB DDI 3230 performs on-board error input filtering and short circuit power protection. The two LSBs in the status register indicate whether or not the module has detected a fault. The fault might be field power absent or a short circuit on the island's sensor bus:




| |
|---|
| **Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.<br>Field power faults that are local to the input module are reported immediately. |

## STB DDI 3230 Specifications

**Table of Technical Specifications**

The STB DDI 3230 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 24 VDC IEC type 2 sink input |
| number of input channels | | two |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000<br>(See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| input protection | | resistor-limited |
| isolation | field-to-bus | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | the module is internally protected from damage |
| nominal logic bus current consumption | | 70 mA |
| nominal sensor bus current consumption | | 30 mA, with no load |
| input voltage | on | +11 ... 30 VDC |
| | off | -3 ... +5 VDC |
| input current | on | 6 mA min. |
| | off | 2 mA max. |
| absolute maximum input | continuous | 30 VDC |
| | for 1.3 ms | 56 VDC, decaying pulse |
| input filter time constant | default | 1.0 ms (+/-0.1 ms) |
| | user-configurable settings* | 0.2 ms (+/-0.1 ms)<br>0.5 ms (+/-0.1 ms)<br>1.0 ms (+/-0.1 ms)<br>2.0 ms (+/-0.1 ms)<br>4.0 ms (+/-0.1 ms)<br>8.0 ms (+/-0.1 ms)<br>16.0 ms (+/-0.1 ms) |
| input response time | on-to-off | 625 µs @ 0.2 ms input filter time |
| | off-to-on | 610 µs @ 0.2 ms input filter time |
| polarity of the individual input channels | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reversed*, configurable by channel |
| | | *logic normal*, configurable by channel |

| | | |
|---|---|---|
| sensor bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | yes |
| field power requirements | field power voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 5 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 3.2 STB DDI 3420 Digital 24 VDC Sink Input Module (four-channel, three-wire, IEC type 1+, 0.5 ms-configurable, short-circuit protected)

## At a Glance

### Overview

This section provides you with a detailed description of the Advantys STB DDI 3420 digital input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

### What's in this Section?

This section contains the following topics:

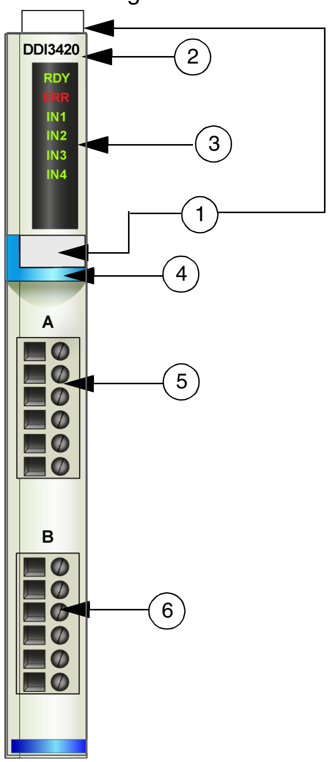
## STB DDI 3420 Physical Description

**Physical Characteristics**

The STB DDI 3420 is an Advantys STB four-channel digital input module that reads inputs from 24 VDC sensor devices and provides power to the sensors. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Sensors 1 and 2 are wired to the top connector, and sensors 3 and 4 are wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** light blue identification stripe, indicating a digital DC input module

**5** sensors 1 and 2 connect to the top field wiring connector

**6** sensors 3 and 4 connect to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module requires 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Dimensions**

The STB DDI 3420 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

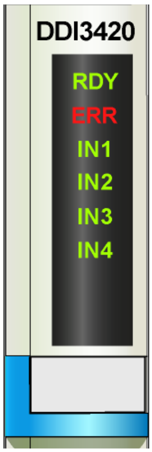
## STB DDI 3420 LED Indicators

**Overview**

The six LEDs on the STB DDI 3420 module provide visual indications of the operating status of the module and its four digital input channels. The LED locations and their meanings are described below.

**Location**

The six LEDs are positioned in a column at the top of the STB DDI 3420 digital input module. The figure below shows their location:



**Indications**

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

| RDY | ERR | IN1 | IN2 | IN3 | IN4 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|
| off | off | | | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | | | Auto-addressing is in progress. | |
| on | off | | | | | The module has achieved all of the following:<br>• it has power<br>• it has passed its confidence tests<br>• it is operational | |
| | | on | | | | Input 1 has applied voltage to its sensor. | |
| | | off | | | | Voltage is absent on input channel 1. | |
| | | | on | | | Input 2 has applied voltage to its sensor. | |
| | | | off | | | Voltage is absent on input channel 2. | |
| | | | | on | | Input 3 has applied voltage to its sensor. | |
| | | | | off | | Voltage is absent on input channel 3. | |
| | | | | | on | Input 4 has applied voltage to its sensor. | |
| | | | | | off | Voltage is absent on input channel 4. | |
| on | on | on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green input LEDs will be on even though the power is absent from the input channels when a watchdog time-out occurs. | | | | | |
| blink 1** | | | | | | The module is in pre-operational mode. | |
| | flicker* | | | | | Field power absent or a PDM short circuit detected. | Check power |

| RDY | ERR | IN1 | IN2 | IN3 | IN4 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|
| | blink 1** | | | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | | | The island bus is not running. | Check network connections, replace NIM |
| * | flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms. | | | | | | |
| ** | blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes. | | | | | | |
| *** | blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | | | | |

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported immediately.

## STB DDI 3420 Field Wiring

**Summary**

The STB DDI 3420 module uses two six-terminal field wiring connectors. Sensors 1 and 2 are wired to the top connector, and sensors 3 and 4 are wired to the bottom connector. The choices of connector types and field wire types are described below, and a field wiring example is presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in kits of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in kits of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Sensors**

The STB DDI 3430 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two- or three-wire sensors that draw current up to 100 mA/channel at 60 degrees C or 50 mA/channel at 30 degrees C. The module has IEC type 1+ inputs designed to work with sensor signals from mechanical switching devices such as relay contacts, push buttons (in normal-to-moderate environmental conditions), three-wire proximity switches 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 1.2 mA

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 mm$^2$ (24 ... 16 AWG).

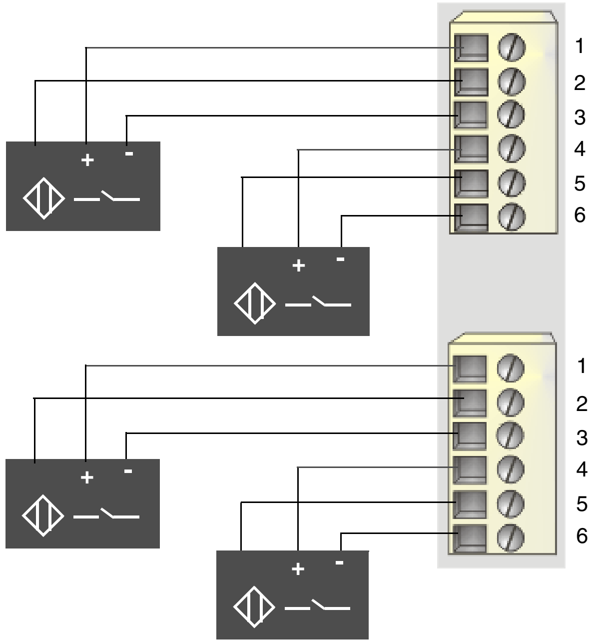
**Field Wiring Pinout**

The top connector supports sensors 1 and 2, and the bottom connector supports sensors 3 and 4:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | +24 VDC from sensor bus for field device accessories | +24 VDC from sensor bus for field device accessories |
| 2 | input from sensor 1 | input from sensor 3 |
| 3 | field power return (to the module) | field power return (to the module) |
| 4 | +24 VDC from sensor bus for field device accessories | +24 VDC from sensor bus for field device accessories |
| 5 | input from sensor 2 | input from sensor 4 |
| 6 | field power return (to the module) | field power return (to the module) |

**Sample Wiring Diagram**

The following field wiring example shows four three-wire sensors connected to the STB DDI 3420:




**1** +24 VDC for sensor 1 (top and for sensor 3 (bottom)

**2** input from sensor 1 (top) and sensor 3 (bottom)

**3** field power return from sensor 1 (top) and sensor 3 (bottom)

**4** +24 VDC for sensor 2 (top and for sensor 4 (bottom)

**5** input from sensor 2 (top) and sensor 4 (bottom)

**6** field power return from sensor 2 (top) and sensor 4 (bottom)

## STB DDI 3420 Functional Description

**Functional Characteristics**

The STB DDI 3420 is a four-channel module that handles digital input data from four 24 VDC field sensors. Using the Advantys configuration software, you can customize the following operating parameters on the module:

- an input filter time constant for the module
- *logic normal* or *logic reverse* input polarity for each channel on the module

## Input Filter Time Constant

By default, the module filters each input channel for 1.0 ms on-to-off and 1.0 ms off-to-on. If you want to increase or lower the input filtering value, you need to use the Advantys configuration software.

The following user-configurable input filtering times are available:

- 0.5 ms (+/-0.25 ms)
- 1.0 ms (+/-0.25 ms)
- 2.0 ms (+/-0.25 ms)
- 4.0 ms (+/-0.25 ms)
- 8.0 ms (+/-0.25 ms)
- 16.0 ms (+/-0.25 ms)

Advantys STB products are designed to perform reliably at 1 ms in normal operating environments (See *Operating Environment, p. 52*). If your island is operating in a harsher environment, you may set the filter time constant above 1 ms. In this case, performance will be slower.

If your application requires faster performance and if the island is operating in a low-noise environment, you may set the filter time constant below 1 ms. However, performance reliability cannot be guaranteed when the filter time is below 1 ms.

**WARNING**

**UNINTENDED EQUIPMENT OPERATION**

Operating with a filter time constant that is faster than 1 ms makes the system more susceptible to power transients and environmental noise. Qualify the behavior of your system if you set the filter time to 0.5 ms.

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

To configure the input filter time constant:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDI 3420 you want to configure in the island editor. | The selected STB DDI 3420 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Filter Time Constant** row, select the desired time constant. | |

The input filter time constant is configured at the module level. One parameter value is set, and it applies to all four input channels.

## Input Polarity

By default, the polarity on all four input channels is *logic normal*, where:

- 0 indicates that the physical sensor is off (or the input signal is low)
- 1indicates that the physical sensor is on (or the input signal is high)

The input polarity on one or more of the channels may optionally be configured for *logic reverse*, where:

- 1 indicates that the physical sensor is off (or the input signal is low)
- 0 indicates that the physical sensor is on (or the input signal is high)

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

You can configure input polarity values independently on each input channel:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDI 3420 you want to configure in the island editor. | The selected STB DDI 3420 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Input Polarity** appears. |
| 4 | Expand the **+ Input Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3** and **Channel 4** appear. |
| 5a | To change the polarity settings *at the module level*, select the integer that appears in the **Value** column of the **Input Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 15 (0x0 to 0xF), where 0 means both channels have normal polarity and 0xF means that all four channels have reverse polarity. | Notice that when you select the **Input Polarity** value, the max/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new integer value for **Input Polarity**, the values associated with the channels change.<br>For example, if you choose an input polarity value of 6, **Channel 1** and **Channel 4** will be 0, while **Channel 2** and **Channel 3** will be 1. |
| 5b | To change the polarity settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new integer value for a channel setting, the value for the module in the **Input Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Input Polarity** value changes to 2. |

## STB DDI 3420 Data and Status for the Process Image

**Representing Digital Input Data and Status**

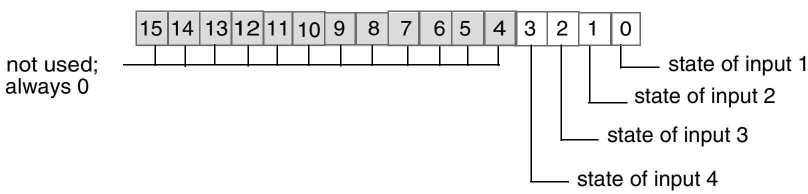
The STB DDI 3420 sends a representation of the operating state of its input points to the NIM. The NIM stores this information in two 16-bit registers—one for data and one for error-detection status. The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.
The input data process image is part of a block of 4096 registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB DDI 3420 module is represented by two contiguous registers in this block—the data register followed by the status register. The specific registers used are based on the module's physical location on the island bus.

**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 transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus,

**Input Data Register**

The first STB DDI 3420 register in the input block of the process image is the data register. The least significant bit (LSB) in the represents the on/off state of input 1, and the three bits to its immediate left represent the on/off states of inputs 2, 3, and 4 respectively:

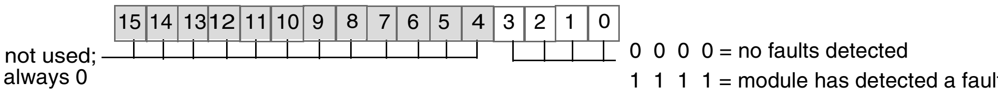
**STB DDI 3420 Data Register**



**Input Status Register**

The second STB DDI 3420 register in the input block of the process image is the status register. The STB DDI 3420 provides on-board error input filtering and short circuit power protection. The four LSBs indicate whether or not the module has detected a fault. The fault might be field power absent or a short circuit on the island's sensor bus:

**STB DDI 3420 Status Register**




> **Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
> Field power faults that are local to the input module are reported immediately.

## STB DDI 3420 Specifications

**Table of Technical Specifications**

The module’s technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 24 VDC IEC type 1+ sink input |
| number of input channels | | four |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| input protection | | resistor-limited |
| isolation | field-to-bus | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | the module is internally protected from damage |
| nominal logic bus current consumption | | 60 mA |
| nominal sensor bus current consumption | | 0 mA, with no load |
| input voltage | on | 11 ... 30 VDC |
| | off | -3 ... +5 VDC |
| input current | on | 2.5 mA min. |
| | off | 1.2 mA max. |
| absolute maximum input | continuous | 30 VDC |
| | for 1.3 ms | 56 VDC, decaying pulse |
| input filter time constant | default | 1.0 ms (+/-0.25 ms) |
| | user-configurable settings* | 0.5 ms (+/-0.25 ms))<br>1.0 ms (+/-0.25 ms)<br>2.0 ms (+/-0.25 ms)<br>4.0 ms (+/-0.25 ms)<br>8.0 ms (+/-0.25 ms)<br>16.0 ms (+/-0.25 ms) |
| input response time | on-to-off | 1.35 ms @ 05 ms input filter time |
| | off-to-on | 925 µs @ 0.5 ms input filter time |
| polarity of the individual input channels | default | *logic normal* on all channels |
| | user-configurable settings* | *logic reversed*, configurable by channel |
| | | *logic normal*, configurable by channel |
| sensor bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |

| | | |
|---|---|---|
| over-current protection for accessory power | | yes |
| field power requirements | field power voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 5 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 3.3 STB DDI 3610 Digital 24 VDC Sink Input Module (six-channel, two-wire, IEC type 1, fixed 1 ms)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DDI 3610 digital input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

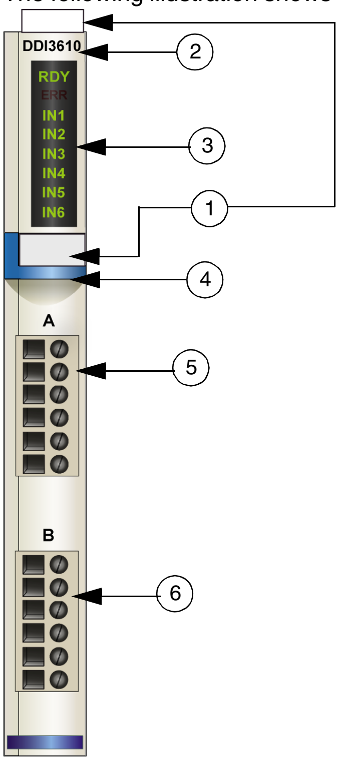
## STB DDI 3610 Physical Description

**Physical Characteristics**

The STB DDI 3610 is an Advantys STB six-channel digital input module that reads inputs from 24 VDC sensor devices and provides power to the sensors. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Sensors 1, 2 and 3 are wired to the top connector, and sensors 4, 5 and 6 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** light blue identification stripe, indicating a digital DC input module

**5** sensors 1 ... 3 connect to the top field wiring connector

**6** sensors 4 ... 6 connect to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:

- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module requires 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) .

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:

- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB DDI 3610 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

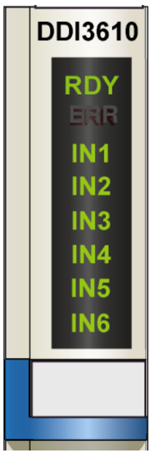
## STB DDI 3610 LED Indicators

**Overview**

The eight LEDs on the STB DDI 3610 module are visual indications of the operating status of the module and its six digital input channels. The LED locations and their meanings are described below.

**Location**

The eight LEDs are positioned in a column on the top front of the STB DDI 3610 digital input module. The figure below shows their location:



**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 | ERR | IN1 | IN2 | IN3 | IN4 | IN5 | IN6 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|---|---|
| off | off | | | | | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | | | | | Auto-addressing is in progress. | |
| on | off | | | | | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | | | | | Input 1 has applied voltage to its sensor. | |
| | | off | | | | | | Voltage is absent on input channel 1. | |
| | | | on | | | | | Input 2 has applied voltage to its sensor. | |
| | | | off | | | | | Voltage is absent on input channel 2. | |
| | | | | on | | | | Input 3 has applied voltage to its sensor. | |
| | | | | off | | | | Voltage is absent on input channel 3. | |
| | | | | | on | | | Input 4 has applied voltage to its sensor. | |
| | | | | | off | | | Voltage is absent on input channel 4. | |
| | | | | | | on | | Input 5 has applied voltage to its sensor. | |
| | | | | | | off | | Voltage is absent on input channel 5. | |
| | | | | | | | on | Input 6 has applied voltage to its sensor. | |
| | | | | | | | off | Voltage is absent on input channel 6. | |

| RDY | ERR | IN1 | IN2 | IN3 | IN4 | IN5 | IN6 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|---|---|
| on | on | on | on | on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green input LEDs will be on even though the power is absent from the input channels when a watchdog time-out occurs. | | | | | | | |
| blink 1** | | | | | | | | The module is in pre-operational mode. | |
| | flicker* | | | | | | | Field power absent or a PDM short circuit detected. | Check power |
| | blink 1** | | | | | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | | | | | The island bus is not running. | Check network connections, replace NIM |
| * | flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms. | | | | | | | | |
| ** | blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes. | | | | | | | | |
| *** | blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | | | | | | |

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported immediately.

## STB DDI 3610 Field Wiring

**Summary**

The STB DDI 3610 module uses two six-terminal field wiring connectors. Sensors 1, 2 and 3 are wired to the top connector, and sensors 4, 5 and 6 are wired to the bottom connector. The choices of connector types and field wire types are described below, and a field wiring example is presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Sensors**

The STB DDI 3610 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two-wire sensors.
The module has IEC type 1 inputs that support sensor signals from mechanical switching devices such as relay contacts and push buttons operating in normal environmental conditions.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 .to 16 AWG).

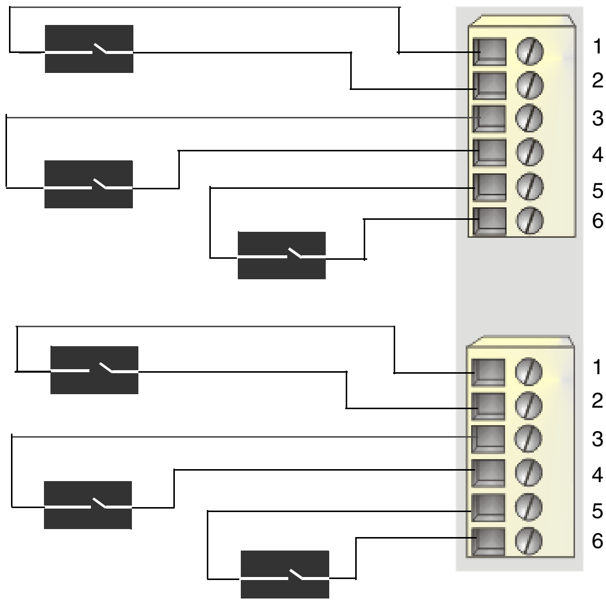
**Field Wiring Pinout**

The top connector supports digital sensors 1, 2 and 3; the bottom connector supports digital sensors 4, 5 and 6:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | +24 VDC sensor bus power | +24 VDC sensor bus power |
| 2 | input from sensor 1 | input from sensor 4 |
| 3 | +24 VDC sensor bus power | +24 VDC sensor bus power |
| 4 | input from sensor 2 | input from sensor 5 |
| 5 | +24 VDC sensor bus power | +24 VDC sensor bus power |
| 6 | input from sensor 3 | input from sensor 6 |

## Sample Wiring Diagram

The following illustration shows a field wiring example where six two-wire switches are connected to the STB DDI 3610:




**1** +24 VDC to sensor 1 (top) and to sensor 4 (bottom)

**2** input from sensor 1 (top) and sensor 4 (bottom)

**3** +24 VDC to sensor 2 (top) and to sensor 5 (bottom)

**4** input from sensor 2 (top) and sensor 5 (bottom)

**5** +24 VDC to sensor 3 (top) and to sensor 6 (bottom)

**6** input from sensor 3 (top) and sensor 6 (bottom)

## STB DDI 3610 Functional Description

### Functional Characteristics

The STB DDI 3610 is a six-channel module that handles digital input data from six 24 VDC field sensors. Using the Advantys configuration software, you can customize each channel for *logic normal* or *logic reverse* input polarity.

### Input Polarity

By default, the polarity on all six input channels is *logic normal*, where:
- 0 indicates that the physical sensor is off (or the input signal is low)
- 1 indicates that the physical sensor is on (or the input signal is high)

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

To change an input polarity parameter from the default or back to the normal from reverse, you need to use the Advantys configuration software.
You can configure input polarity values independently for each input channel:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDI 3610 you want to configure in the island editor. | The selected STB DDI 3610 module opens in the software module editor. |
| 2 | Choose the format in which you want your values to be displayed by either checking or unchecking t he **Hexadecimal** checkbox (at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Input Polarity** appears. |
| 4 | Expand the **+ Input Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3**, **Channel 4**, **Channel 5** and **Channel 6** appear. |
| 5a | To change the polarity settings *at the module level*, select the integer that appears in the **Value** column of the **Input Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 63 (0x0 0x3F), where 0 means that all six channels have normal polarity and 0x3F means that all six channels have reverse polarity. | Notice that when you select the **Input Polarity** value, the maxi/min values of the range appear at the bottom of the module editor screen.<br>Notice that when you accept a new integer value for **Input Polarity**, the values associated with the channels change.<br>For example, if you choose an input polarity value of 0x2F, the value for **Channel 5** will be 0 and the values of the other five channels will be 1. |
| 5b | To change the polarity settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new integer value for a channel setting, the value for the module in the **Input Polarity** row changes.<br>For example, if you set channel 5 to 0 and the values of the other five channel to 1, the **Input Polarity** value changes to 0x2F. |

## STB DDI 3610 Data for the Process Image

**Representing Digital Input Data**

The STB DDI 3610 sends a representation of the operating state of its input channels to the NIM. The NIM stores this information in two 16-bit registers—one for data and one for error-detection status. The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.

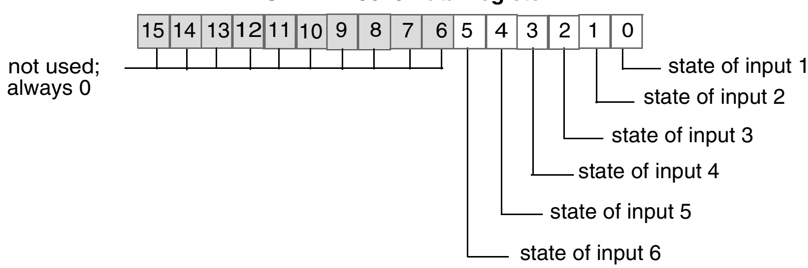
The input data process image is part of a block of 4096 registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB DDI 3610 module is represented by two contiguous registers in this block—the data register followed by the status register. The specific registers used in the block are determined by the module's physical location on the island bus.

> **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 transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus,

**Input Data Register**

The first STB DDI 3610 register in the input block of the process image is the data register. The least significant bit (LSB) represents the on/off state of input 1, and the five bits to its immediate left represent the on/off states of inputs 2, 3, 4, 5 and 6, respectively:

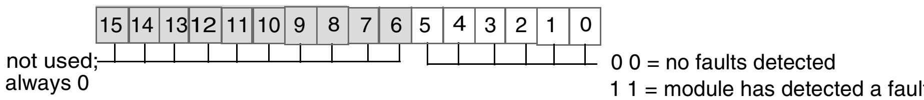
**STB DDI 3610 Data Register**



**Input Status Register**

The second STB DDI 3610 register in the input block of the process image is the status register. The STB DDI 3610 provide on-board error input filtering and short circuit power protection. The six LSBs indicate whether or not the module has detected a fault. The fault might be field power absent or a short circuit on the island's sensor bus:

**STB DDI 3610 Status Register**




> **Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
> Field power faults that are local to the input module are reported immediately.

## STB DDI 3610 Specifications

**Table of Technical Specifications**

The STB DDI 3610 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 24 VDC IEC type 1 sink input |
| number of input channels | | six |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000<br>(See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| input protection | | resistor-limited |
| isolation voltage | field-to-bus | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | the module is internally protected from damage |
| maximum logic bus current consumption | | 70 mA |
| nominal sensor bus current consumption | | 0 mA, with no load |
| input voltage | on | +15 ... 30 VDC |
| | off | -3 ... +5 VDC |
| input current | on | 2 mA min. |
| | off | 0.5 mA max. |
| absolute maximum input | continuous | 30 VDC |
| | for 1.3 ms | 56 VDC, decaying pulse |
| input filter time constant | | 1.0 ms |
| input response time | on-to-off | 1.74 ms |
| | off-to-on | 1.21 ms |
| polarity of the individual input channels | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reversed*, configurable by channel |
| | | *logic normal*, configurable by channel |
| field power requirements | field power voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| * Requires the Advantys configuration software. | | |

# 3.4 STB DAI 5230 Digital 115 VAC Input Module (two-channel, three-wire, IEC type 1)

## At a Glance

### Overview

This section provides you with a detailed description of the Advantys STB DAI 5230 digital input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

### What's in this Section?

This section contains the following topics:

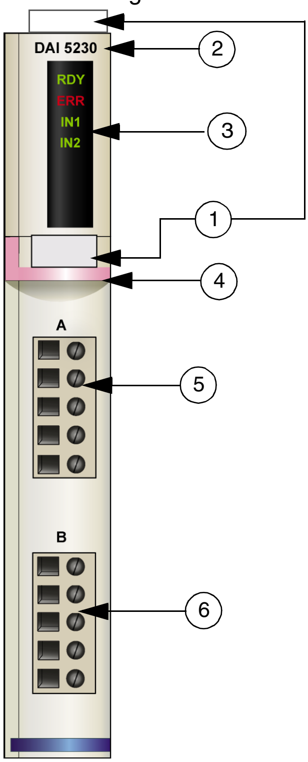
## STB DAI 5230 Physical Description

**Physical Characteristics**

The STB DAI 5230 is an Advantys STB two-channel digital input module that reads inputs from 115 VAC sensor devices and provides power to the sensors. The module mounts in a size 2 I/O base and uses two five-terminal field wiring connectors. Sensor 1 is wired to the top connector, and sensor 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** pink identification stripe, indicating a digital AC input module

**5** sensor 1 connects to the top field wiring connector

**6** sensor 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) I/O base
- a pair of five-terminal field wiring connectors, either STB XTS 1110 screw type connectors or STB XTS 2110 spring clamp connectors

The module requires 115 VAC from the island's sensor bus, and needs to be supported by an STB PDT 2100 PDM (See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB DAI 5230 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 18.4 mm (0.72 in) |
| **height** | module only | 125 mm (4.92 in) |
| | on a base | 128.25 mm (5.05 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) |

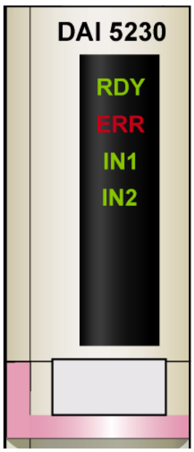
## STB DAI 5230 LED Indicators

**Purpose**

The four LEDs on the STB DAI 5230 module provide visual indications of the operating status of the module and its two digital input channels. Their locations and meanings are described below.

**Location**

The four LEDs are located in a column on the top of the front bezel of the module, directly below the model number:



**Indications**

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

<table>
<tr><th>RDY</th><th>ERR</th><th>IN1</th><th>IN2</th><th>Meaning</th><th>What to Do</th></tr>
<tr><td>off</td><td>off</td><td rowspan="3"></td><td rowspan="5"></td><td>The module is either not receiving logic power or has failed.</td><td>Check power</td></tr>
<tr><td>flicker*</td><td>off</td><td>Auto-addressing is in progress.</td><td rowspan="6"></td></tr>
<tr><td rowspan="5">on</td><td rowspan="5">off</td><td>The module has achieved all of the following:<br>• it has power<br>• it has passed its confidence tests<br>• it is operational</td></tr>
<tr><td>on</td><td>Input 1 has applied voltage to its sensor.</td></tr>
<tr><td>off</td><td>Voltage is absent on input channel 1.</td></tr>
<tr><td rowspan="2"></td><td>on</td><td>Input 2 has applied voltage to its sensor.</td></tr>
<tr><td>off</td><td>Voltage is absent on input channel 2.</td></tr>
<tr><td rowspan="2">on</td><td rowspan="2">on</td><td>on</td><td>on</td><td>The watchdog has timed out.</td><td rowspan="2">Cycle power, restart the communications</td></tr>
<tr><td colspan="3">Note that the green input LEDs will be on even though the power is absent from the input channels when a watchdog time-out occurs.</td></tr>
<tr><td rowspan="3">blink 1**</td><td colspan="3"></td><td>The module is in pre-operational mode.</td><td></td></tr>
<tr><td>blink 1**</td><td rowspan="2" colspan="2"></td><td>A nonfatal error has been detected.</td><td>Cycle power, restart the communications</td></tr>
<tr><td>blink 2***</td><td>The island bus is not running.</td><td>Check network connections, replace NIM</td></tr>
<tr><td colspan="6">* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.</td></tr>
<tr><td colspan="6">** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.</td></tr>
<tr><td colspan="6">*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.</td></tr>
</table>

## STB DAI 5230 Field Wiring

**Summary**

The STB DAI 5230 module uses two five-terminal field wiring connectors. Sensor 1 is wired to the top connector, and sensor 2 is wired to the bottom connector. The choices of connector types and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:
- two STB XTS 1110 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2110 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have five connection terminals, with a 5.08 mm (0.2 in) pitch between each pin.

**Field Sensors**

The STB DAI 5230 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two-, three-, or four-wire sensors that draw current up to 100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C.
The module has IEC type 1 inputs that support sensor signals from mechanical switching devices such as relay contacts and push buttons operating in normal environmental conditions.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Local electrical codes take precedence over our recommended wire size for the protective earth (PE) connection on pin 5.

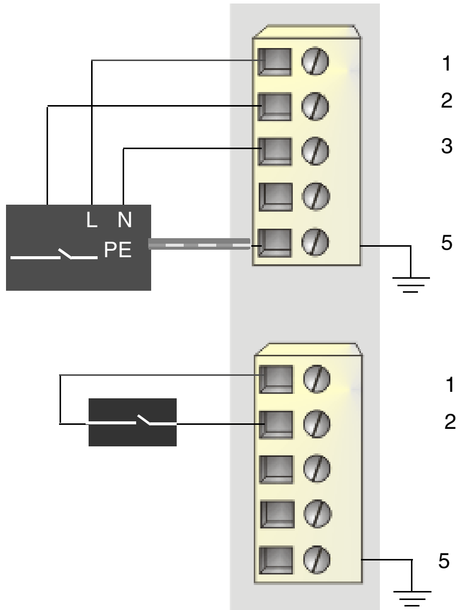
**Field Wiring Pinout**

The top connector supports sensor 1, and the bottom connector supports sensor 2:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | 115 VAC sensor bus power (L) | 115 VAC sensor bus power (L) |
| 2 | input from sensor 1 | input from sensor 2 |
| 3 | field power neutral (to the module) | field power neutral (to the module) |
| 4 | field power neutral (to the module) | field power neutral (to the module) |
| 5 | protective earth | protective earth |

**Sample Wiring Diagram**

The following field wiring example shows two sensors connected to an STB DAI 5230 module:




**1** 115 VAC (L) to sensor 1 (top) and to sensor 2 (bottom)

**2** input from sensor 1 (top) and from sensor 2 (bottom)

**3** field power neutral from sensor 1

**6** PE connection point for field device (top)

The four-wire sensor on the top connector has a PE connection that is tied to the PE connection on the PDM base through pin 5.

## STB DAI 5230 Functional Description

**Functional Characteristics**

The STB DAI 5230 is a two-channel module that handles digital input data from two 115 VAC field sensors. Each channel is user-configurable for *logic normal* or *logic reverse* input polarity.

**Input Polarity**

By default, the polarity on both input channels is *logic normal*, where:
- 0 indicates that the physical sensor is off (or the input signal is low)
- 1indicates that the physical sensor is on (or the input signal is high)

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

To change an input polarity parameter from the default or back to the normal from reverse, you need to use the Advantys configuration software.
You can configure input polarity values independently for each input channel:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DAI 5230 you want to configure in the island editor. | The selected STB DAI 5230 module opens in the software module editor. |
| 2 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Input Polarity** appears. |
| 3 | Expand the **+ Input Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | To change the polarity settings *at the module level*, select the integer that appears in the **Value** column of the **Input Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have normal polarity and 3 means that both channels have reverse polarity. | Notice that when you select the **Input Polarity** value, the maxi/min values of the polarity range appear at the bottom of the module editor screen.<br>When you accept a new integer value for **Input Polarity**, the values associated with the channels change.<br>For example, if you choose an input polarity value of 2, **Channel 1** = 0 and **Channel 2** = 1. |
| 4b | To change the polarity settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new integer value for a channel setting, the value for the module in the **Input Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Input Polarity** value changes to 2. |

## STB DAI 5230 Data and Status for the Process Image

**Representing Digital Input Data**

The STB DAI 5230 sends a representation of the operating state of its input channels to the NIM. The NIM stores this information in one 16-bit register. The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.

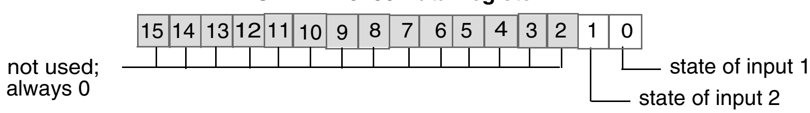
The input data process image is part of a block of 4096 registers (in the range 45392 through 49487) reserved in the NIM's memory. The specific registers used in the block are determined by the module's physical location on the island bus.

> **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 transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus,

**Input Data Register**

The first STB DAI 5230 register in the input block of the process image is the data register. The least significant bit (LSB) in the represents the on/off state of input 1, and the bit to its immediate left represents the on/off state of input 2:

**STB DAI 5230 Data Register**



## STB DAI 5230 Specifications

**Table of Technical Specifications**

The STB DAI 5230 module’s technical specifications are listed in the following table.

| | | |
|---|---|---|
| description | | 115 VAC IEC type 1 (47 ... 63 Hz) input |
| number of input channels | | two |
| module width | | 18.4 mm (0.72 in) |
| I/O base | | STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) |
| hot swapping supported | | yes |
| input surge protection | | metal oxide varistor |
| isolation voltage | field-to-bus | 1780 VAC for 1 min |
| nominal logic bus current consumption | | 50 mA |
| nominal sensor bus current consumption | | 0 mA, with no load |
| sensor bus power to field | | 200 mA @ 30 degrees C |
| sensor power limit | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| current field | | 60 mA |
| input voltage | on | 74 ... 132 VAC |
| | off | 0 ... 20 VAC |
| input current | on | 4 mA min. |
| | off | 2 mA max. |
| absolute maximum input | continuous | 132 VAC |
| | for one cycle | 200 VAC |
| input response time | on-to-off | 1.5 line cycles |
| | off-to-on | 1.5 line cycles |
| polarity of the individual input channels | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reversed*, configurable by channel |
| | | *logic normal*, configurable by channel |
| field power requirement | field power voltage | 115 VAC |
| | PDM model | STB PDT 2100 (See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*) |
| power protection | | 5 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 3.5 STB DAI 7220 Digital 230 VAC Input Module (two-channel, three-wire, IEC type 1)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DAI 7220 digital input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

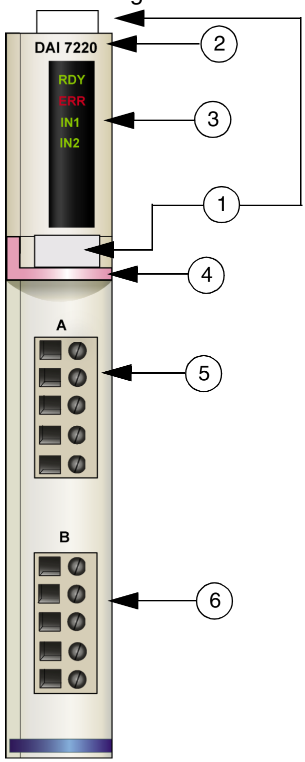
## STB DAI 7220 Physical Description

**Physical Characteristics**

The STB DAI 7220 is an Advantys STB two-channel digital input module that reads inputs from 230 VAC sensor devices and provides power to the sensors. The module mounts in a size 2 I/O base and uses two five-terminal field wiring connectors. Sensor 1 is wired to the top connector, and sensor 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** pink identification stripe, indicating a digital AC input module

**5** sensor 1 connects to the top field wiring connector

**6** sensor 2 connects to the bottom field wiring connector

## Module Accessories

The following accessories need to be used with the module:
- an STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) I/O base
- a pair of five-terminal field wiring connectors, either STB XTS 1110 screw type connectors or STB XTS 2110 spring clamp connectors

The module requires 230 VAC from the island's sensor bus, and needs to be supported by an STB PDT 2100 PDM (See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

## Module Dimensions

The STB DAI 7220 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 18.4 mm (0.72 in) |
| **height** | module only | 125 mm (4.92 in) |
| | on a base | 128.25 mm (5.05 in) |
| **depth** | module only | 65.1 mm (2.56 in) |
| | on a base, with connectors | 75.5 mm (2.97 in) worst case<br>(with screw clamp connectors) |

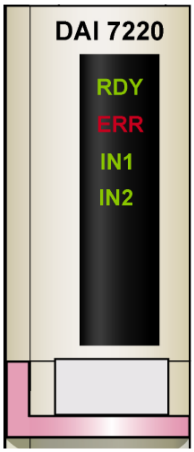
## STB DAI 7220 LED Indicators

**Purpose**

The four LEDs on the STB DAI 7220 module are visual indicators of the operating status of the module and its two digital input channels. The LED locations and their meanings are described below.

**Location**

The four LEDs are positioned in a column on the top front of the STB DAI 7220 digital input module. The figure below shows their location:



## Indications

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

| RDY | ERR | IN1 | IN2 | Meaning | What to Do |
|---|---|---|---|---|---|
| off | off | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | Auto-addressing is in progress. | |
| on | off | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | Input 1 has applied voltage to its sensor. | |
| | | off | | Voltage is absent on input channel 1. | |
| | | | on | Input 2 has applied voltage to its sensor. | |
| | | | off | Voltage is absent on input channel 2. | |
| on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green input LEDs will be on even though the power is absent from the input channels when a watchdog time-out occurs. | | | |
| blink 1** | | | | The module is in pre-operational mode. | |
| | blink 1** | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | The island bus is not running. | Check network connections, replace NIM |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

## STB DAI 7220 Field Wiring

**Summary**

The STB DAI 7220 module uses two five-terminal field wiring connectors. Sensor 1 is wired to the top connector, and sensor 2 is wired to the bottom connector. The choices of connector types and field wire types are described below, and a field wiring example is presented.

**Connectors**

Use a set of either:
- two STB XTS 1110 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2110 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have five connection terminals, with a 5.08 mm (0.2 in) pitch between each pin.

**Field Sensors**

The STB DAI 7220 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two-, three-, or four-wire sensors that draw current up to 100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C.
The module has IEC type 1 inputs that support sensor signals from mechanical switching devices such as relay contacts and push buttons operating in normal environmental conditions.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Local electrical codes take precedence over our recommended wire size for the protective earth (PE) connection on pin 5.

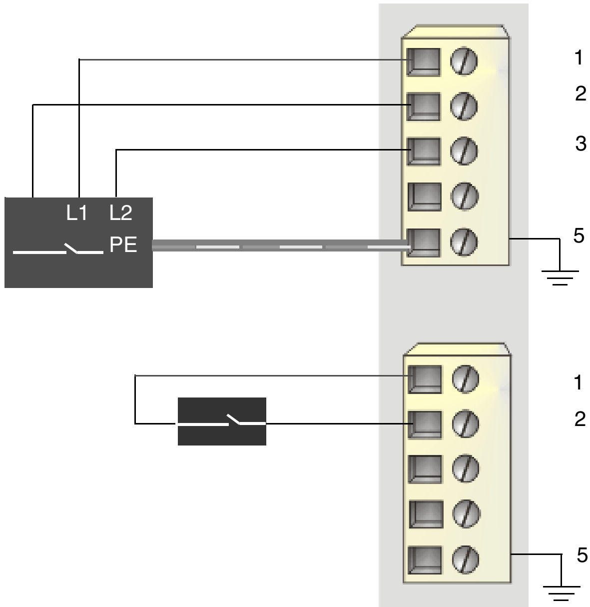
**Field Wiring Pinout**

The top connector supports digital input channel 1, and the bottom connector supports digital input channel 2:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | 230 VAC sensor bus power (L1) | 230 VAC sensor bus power (L1) |
| 2 | input from sensor 1 | input from sensor 2 |
| 3 | field power neutral or L2 (to the module) | field power neutral or L2 (to the module) |
| 4 | field power neutral or L2 (to the module) | field power neutral or L2 (to the module) |
| 5 | protective earth | protective earth |

**Sample Wiring Diagram**

The following field wiring example shows two sensors connected to an STB DAI 7220 module:




**1** 230 VAC (L1) to sensor 1 (top) and to sensor 2 (bottom)

**2** input from sensor 1 (top) and from sensor 2 (bottom)

**3** field power neutral or L2 from sensor 1

**5** PE connection point for sensor 1 (top)

The four-wire sensor on the top connector has a PE connection that is tied to the PE connection on the PDM base through pin 5.

## STB DAI 7220 Functional Description

### Functional Characteristics

The STB DAI 7220 module is a two-channel module that handles digital input data from two 230 VAC field sensors. Using the Advantys configuration software, you can customize each channel for *logic normal* or *logic reverse* input polarity.

### Input Polarity

By default, the polarity on both input channels is *logic normal*, where:
- 0 indicates that the physical sensor is off (or the input signal is low)
- 1 indicates that the physical sensor is on (or the input signal is high)

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

To change an input polarity parameter from the default or back to the normal from reverse, you need to use the Advantys configuration software.
You can configure input polarity values independently for each input channel:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DAI 7220 you want to configure in the island editor. | The selected STB DAI 7220 module opens in the software module editor. |
| 2 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Input Polarity** appears. |
| 3 | Expand the **+ Input Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | To change the polarity settings *at the module level*, select the integer that appears in the **Value** column of the **Input Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have normal polarity and 3 means that both channels have reverse polarity. | When you select the **Input Polarity** value, the maxi/min values of the polarity range appear at the bottom of the module editor screen.<br>When you accept a new integer value for **Input Polarity**, the values associated with the channels change.<br>For example, if you choose an input polarity value of 2, **Channel 1** = 0 and **Channel 2** = 1. |
| 4b | To change the polarity settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new integer value for a channel setting, the value for the module in the **Input Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Input Polarity** value changes to 2. |

## STB DAI 7220 Data for the Process Image

**Representing Digital Input Data**

The STB DAI 7220 sends a representation of the operating state of its input channels to the NIM. The NIM stores this information in one 16-bit register.The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.

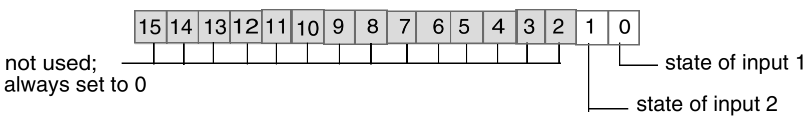
The input data process image is part of a block of 4096 reserved registers (in the range 45392 through 49487) in the NIM's memory. The specific registers used in the block are determined by the module's physical location on the island bus.

> **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 transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus,

**Input Data Register**

The first STB DAI 7220 register in the input block of the process image is the data register. The least significant bit (LSB) in the register represents the on/off state of input 1, and the bit to its immediate left represents the on/off state of input 2:

**STB DAI 7220 Data Register**



## STB DAI 7220 Specifications

**Table of Technical Specifications**

The STB DAI 7220 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 230 VAC IEC type 1 (47 ... 63 Hz) input |
| number of input channels | | two |
| module width | | 18.4 mm (0.72 in) |
| I/O base | | STB XBA 2000<br>(See *STB XBA 2000 I/O Base, p. 351*) |
| hot swapping supported | | yes |
| input surge protection | | metal oxide varistor |
| isolation voltage | field-to-bus | 1780 VAC for 1 min |
| nominal logic bus current consumption | | 50 mA |
| nominal sensor bus current consumption | | 0 mA, with no load |
| sensor bus power to field | | 200 mA @30 degrees C |
| sensor power limit | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| input voltage | on | +159 ... 265 VAC |
| | off | 0 ... 40 VAC |
| input current | on | 4 mA min. |
| | off | 2 mA max. |
| absolute maximum input | continuous | 265 VAC |
| | for one cycle | 400 VAC |
| input response time | on-to-off | 1.5 line cycles |
| | off-to-on | 1.5 line cycles |
| polarity of the individual input channels | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reversed*, configurable by channel |
| | | *logic normal*, configurable by channel |
| field power requirements | field power voltage | 230 VAC |
| | PDM model | STB PDT 2100<br>(See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*) |
| power protection | | 5 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# The Advantys STB Digital Output Modules

# 4

## At a Glance

**Overview**

This chapter describes in detail the features of the digital output modules in the Advantys STB family.

**What's in this Chapter?**

This chapter contains the following sections:

# 4.1 STB DDO 3200 Digital 24 VDC Source Output Module (two-channel, 0.5 A, over-current protected)

## At a Glance

**Overview**

This section provides a detailed description of the Advantys STB DDO 3200 digital output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

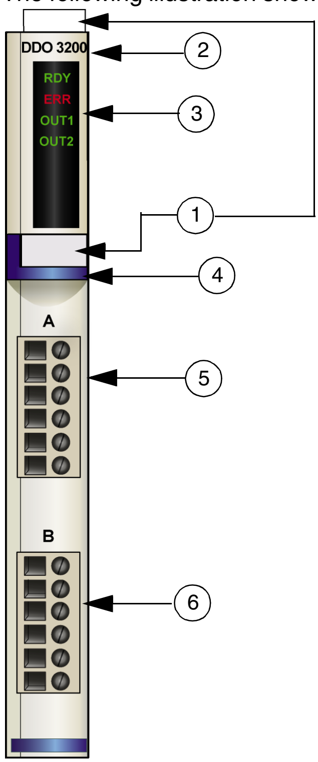
## STB DDO 3200 Physical Description

**Physical Characteristics**

The STB DDO 3200 is an Advantys STB two-channel digital output module that writes outputs to 24 VDC actuator devices and provides power to the actuators. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Actuator 1 is wired to the top connector, and actuator 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** dark blue identification stripe, indicating a digital VDC output module

**5** actuator 1 connects to the top field wiring connector

**6** actuator 2 connects to the bottom field wiring connector

## Module Accessories

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module requires 24 VDC from the island's actuator bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

## Module Dimensions

The STB DDO 3200 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

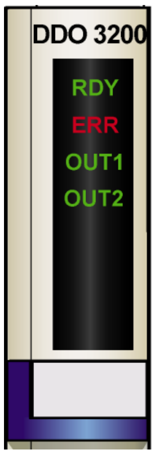
## STB DDO 3200 LED Indicators

**Overview**

The four LEDs on the STB DDO 3200 module provide visual indications of the operating status of the module and its two digital output channels. The LED locations and their meanings are described below.

**Location**

The four LEDs are positioned in a column on the top front of the module directly below the model number. The figure below shows their locations:



**Indications**

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

| RDY | ERR | OUT1 | OUT2 | Meaning | What to Do |
|---|---|---|---|---|---|
| off | off | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | Auto-addressing is in progress. | |
| on | off | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | Output 1 has applied voltage to its actuator. | |
| | | off | | Voltage is absent on output channel 1. | |
| | | | on | Output 2 has applied voltage to its actuator. | |
| | | | off | Voltage is absent on output channel 2. | |
| on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green output LEDs will be on even though the power is absent from the output channels when a watchdog time-out occurs. | | | |
| blink 1** | | | | The module is in pre-operational mode or in its fallback state. | |
| | flicker* | | | Field power absent or a short circuit detected at the actuator. | Check power |
| | blink 1** | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |
| * flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms. | | | | | |
| ** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes. | | | | | |
| *** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | | | |
| **** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | | | |

## STB DDO 3200 Field Wiring

**Summary**

The STB DDO 3200 module uses two six-terminal field wiring connectors. Actuator 1 is wired to the top connector, and actuator 2 is wired to the bottom connector. The choices of connector types and field wire types are described below, and a field wiring example is presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors, available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Actuators**

The STB DDO 3200 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two- or three-wire actuators such as solenoids, contactors, relays, alarms or panel lamps that draw current up to 100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C.

**Note:** If you are using this module to provide operating power to a large inductive load (at or near a maximum of 0.5 H), make sure that you turn the field device off before removing the field power connector from the module. The output channel on the module may be damaged if you remove the connector while the field device is on.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 mm$^2$ (24 ... 16 AWG).

**External Fusing**

The STB DDO 3200 does not provide electronic over-current protection for the field power. To achieve over-current protection, you should place external fuses in-line on pin 1 or 2.
If you do not use fuses, an over-current condition could damage the module and blow the 10 A fuse in the PDM.
Use a 0.5 A, 250 V 5 x 20 mm time-lag fuse such as the Wickmann 1910500000.

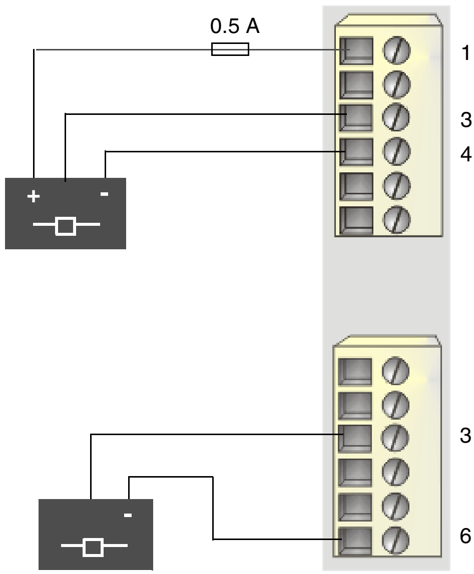
## Field Wiring Pinout

The top connector supports actuator 1, and the bottom connector supports actuator 2:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | +24 VDC from actuator bus for field device accessories | +24 VDC from actuator bus for field device accessories |
| 2 | +24 VDC from actuator bus for field device accessories | +24 VDC from actuator bus for field device accessories |
| 3 | output to actuator 1 | output to actuator 2 |
| 4 | field power return | field power return |
| 5 | field power return | field power return |
| 6 | field power return | field power return |

## Sample Wiring Diagram

The following field wiring example shows two actuators connected to the STB DDO 3200 module:




**1** +24 VDC for actuator 1

**3** output to actuator 1 (top) and actuator 2 (bottom)

**4** field power return from actuator 1

**6** field power return from actuator 2

## STB DDO 3200 Functional Description

**Functional Characteristics**

The STB DDO 3200 is a two-channel module that sends digital 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 state for each channel on the module

**Fault Recovery Responses**

The module can detect a short circuit on the actuator bus or an overcurrent fault on an output channel when the channel is turned on. If a fault is detected on either channel, the module will do one of the following:
- automatically latch off the channel, or
- automatically recover and resume operation on the channel when the fault is corrected

The factory default setting is *latched off*, where the module turns off an output channel that is on if it detects a fault and keeps the channel 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:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3200 module you want to configure in the island editor. | The selected STB DDO 3200 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Fault Recovery Response** row, select the desired response mode. | Two choices appear in the pull-down menu—**Latched Off** and **Auto Recovery**. |

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

**Resetting a Latched-off Output**

When an output channel has been latched off because of fault detection, it will 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. You need to provide the reset logic in your application program.

**Auto-recovery**

When the module is configured to auto-recover, a channel that has been turned off because of fault detection will start 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.

**Output Polarity**

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

To change an output polarity parameter from the default 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 DDO 3200 you want to configure in the island editor. | The selected STB DDO 3200 module opens in the software module editor. |
| 2 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Output Polarity** appears. |
| 3 | Expand the **+ Output Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | To change the settings *at the module level*, select the integer that appears in the **Value** column of the **Output 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 **Output Polarity** value, the max/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new value for **Output Polarity**, the values associated with the channels change.<br>For example, if you choose an output polarity value of 2, **Channel 1** has logic normal polarity and **Channel 2** has logic reverse polarity. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Output Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Output Polarity** value changes to 2. |

## Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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 a *predefined state*. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3200 module you want to configure in the island editor. | The selected STB DDO 3200 module opens in the software module editor. |
| 2 | Expand the **+ Fallback Mode Settings** fields by clicking on the **+** sign. | A row called **+ Fallback Mode** appears. |
| 3 | Expand the **+ Fallback Mode** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 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 the range 0 to 3, where 0 means both channels hold their last values 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.<br>When you accept a new value for **Fallback Mode**, the values associated with the channels change.<br>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 value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, 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** will be ignored.

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to 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 will be ignored. |
| 2 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | A row called **+ Predefined Fallback Value** appears. |
| 3 | Expand the **+ Predefined Fallback Value** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | 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.<br>When you accept a new **Predefined Fallback Value**, the values associated with the channels change.<br>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 fallback state of 0 (actuator off). |
| 4b | To change a setting *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). 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.<br>For example, if you configure channel 2 to a state of 1 and leave channel 1 at 0, the **Predefined Fallback Value** value changes from 0 to 2. |

## STB DDO 3200 Data and Status for the Process Image

**Representing Digital Output Data and Status**

The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output module. The information in the status block is provided by the module itself.

This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB DDO 3200 module are based on its physical location on the island bus.

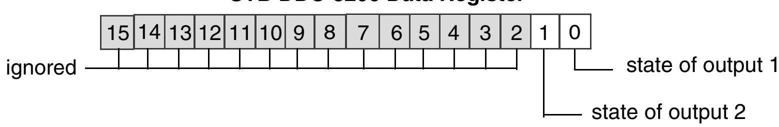
> **Note:** The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface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

**Output Data Register**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in this data block. The STB DDO 3200 uses one register in the output data block.

The STB DDO 3200's output data register displays the most current on/off states of the module's two output channels:

**STB DDO 3200 Data Register**




These values are written to the island bus by the fieldbus master.

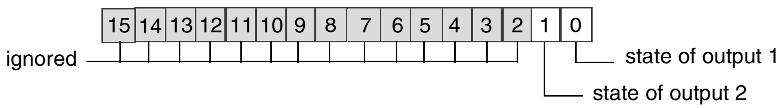
**Echo and Status Registers**

The echo output data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represents the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB DDO 3200 is represented by two contiguous registers in this block—one register that echoes the information in the output data register followed by one that displays the status of the output channels.

The first STB DDO 3200 register in the I/O status block is the module's *echo output data* register. This register represents the data that has just been sent to the output field devices by the STB DDO 3200 module:

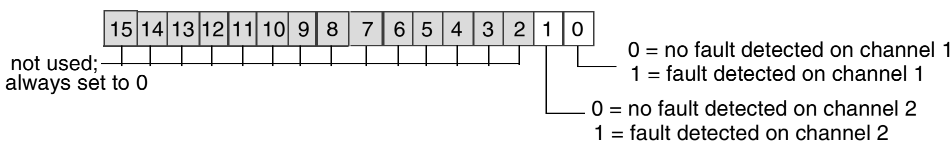
**STB DDO 3200 Echo Output Data Register**




Under normal operating conditions, the bit values in this register should be an exact replica of the bits in the output data register. A difference between the bit values in the output data register and the echo register could result from an output channel used for a reflex action, where the channel is updated directly by the output module instead of by the fieldbus master.

The next contiguous register is the STB DDO 3200's status register. It indicates whether or not a fault condition has been detected on either of the module's two output channels. The fault might be field power absent or actuator power shorted:

**STB DDO 3200 Status Register**



## STB DDO 3200 Specifications

**Table of Technical Specifications**

The STB DDO 3200 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 24 VDC, 0.5 A source output |
| number of output channels | | two |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| output protection (internal) | | transient voltage suppression |
| short circuit protection | | per channel |
| short circuit feedback | | per channel |
| isolation voltage | field-to-bus | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | internal protection on the module |
| fault recovery response | default | channels latched off—requires user reset |
| | user-configurable settings* | auto-recovery |
| | | latched off |
| nominal logic bus current consumption | | 60 mA |
| nominal actuator bus current consumption | | 16 mA, with no load |
| maximum load current | | 0.5 A/channel |
| minimum load current | | none |
| output response time | off-to-on | 620 µs @ 0.5 A load |
| | on-to-off | 575 µs @ 0.5 A load |
| output voltage | working | 19.2 ... 30 VDC |
| | absolute maximum | 56 VDC for 1.3 ms, decaying voltage pulse |
| | on-state drop/channel | 0.4 VDC max. |
| on-state leakage/channel | | 0.4 mA @ 30 VDC max. |
| maximum surge current | | 5 A/channel @ 500 µs (no more than six/min) |
| maximum load capacitance | | 50 µF |

| | | |
|---|---|---|
| maximum load inductance | | 0.5 H @ 4 Hz switch frequency<br>$L = 0.5 / I^2 \times F$<br>where:<br>L = load inductance (H)<br>I = load current (A)<br>F = switching frequency (Hz) |
| fallback mode | default | predefined fallback values on both channels |
| | user-configurable settings* | hold last value |
| | | predefined fallback value on one or both channels |
| fallback states (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 outputs | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reverse* on one or both channels |
| | | *logic normal* on one or both channels |
| actuator bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | none |
| external fusing | | 0.5 A time-lag fuses on pin 1 or 2 for accessory power over-current protection |
| field power requirements | field power voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 4.2 STB DDO 3230 Digital 24 VDC Source Output Module (two-channel, 2.0 A, over-current protected)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DDO 3230 digital output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.
This output module supports high-current actuators, and special field wiring capabilities are provided. If your actuators require field power, the +24 VDC should be delivered by an independent power supply connected directly to the actuator, not from the island's actuator bus. The implications of this alternative field wiring are described.

**What's in this Section?**

This section contains the following topics:

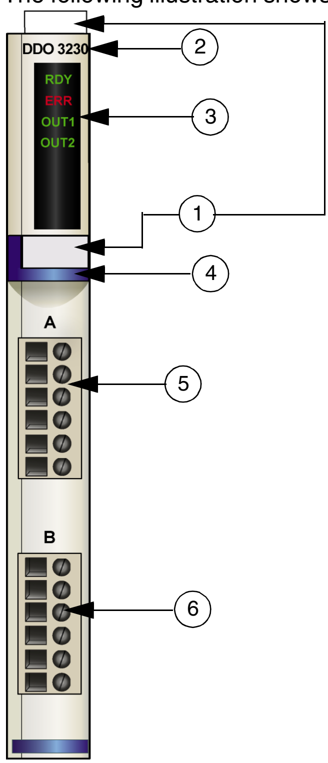
## STB DDO 3230 Physical Description

**Physical Characteristics**

The STB DDO 3230 is an Advantys STB two-channel digital output module that writes outputs to 24 VDC actuator devices that draw current up to 2.0 A each. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Actuator 1 is wired to the top connector, and actuator 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** dark blue identification stripe, indicating a digital VDC output module

**5** actuator 1 connects to the top field wiring connector

**6** actuator 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:

- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

Because the module supports field actuators with loads up to 2.0 A/channel, the module lets you connect directly to an external 24 VDC power supply for field power instead of using a PDM. You can also use the island's actuator bus for field power. In either case, use the module in conjunction with an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:

- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB DDO 3230 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

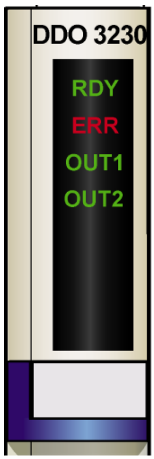
## STB DDO 3230 LED Indicators

**Overview**

The four LEDs on the STB DDO 3230 module are visual indications of the operating status of the module and its two digital output channels. The LED locations and their meanings are described below.

**Location**

The four LEDs are positioned in a column on the top front of the STB DDO 3230 digital output module. The figure below shows their location:



**Indications**

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

| RDY | ERR | OUT1 | OUT2 | Meaning | What to Do |
|---|---|---|---|---|---|
| off | off | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | Auto-addressing is in progress. | |
| on | off | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | Output 1 has applied voltage to its actuator. | |
| | | off | | Voltage is absent on output channel 1. | |
| | | | on | Output 2 has applied voltage to its actuator. | |
| | | | off | Voltage is absent on output channel 2. | |
| on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green output LEDs will be on even though the power is absent from the output channels when a watchdog time-out occurs. | | | |
| blink 1** | | | | The module is either in pre-operational mode or in its fallback state. | |
| | flicker* | | | Field power absent or a short circuit detected at the actuator. | Check power |
| | blink 1** | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

**** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

## STB DDO 3230 Field Wiring

**Summary**

The STB DDO 3230 module uses two six-terminal field wiring connectors. Actuator 1 is wired to the top connector, and actuator 2 is wired to the bottom connector. The choices of connector types and field wire types are described below, and some field wiring examples are presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Actuators**

The STB DDO 3230 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two- or three-wire actuators. The actuators may be high-power devices such as motor starters, valves or incandescent lamps that draw current up to 2.0 A/channel.
When field power is required for the actuators, the recommended procedure is to connect the field devices to an external 24 VDC power supply.

**Note:** If you are using this module to provide operating power to a large inductive load (at or near a maximum of 0.5 H), make sure that you turn the field device off before removing the field power connector from the module. The output channel on the module may be damaged if you remove the connector while the field device is on.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).

**External Fusing**

If you field-wire an STB DDO 3230 output module with an independent power supply instead of through a PDM, the overcurrent protection provided by the PDM (See *STB PDT 3100 Field Power Over-current Protection, p. 326*) is lost. You must provide external protection with a 2.5 A time-lag fuse (such as the Wickmann 1911250000).

**WARNING**

**FIRE HAZARD**

When an independent power supply is used, you must fuse each unprotected channel independently.

- Install a fuse between the external power supply and pin 2 on the unprotected field wiring connector(s).

**Failure to follow this precaution can result in death, serious injury, or equipment damage.**

**Field Wiring Pinout**

The top connector supports the actuator 1, and the bottom connector supports actuator 2. The module may be field wired in either of two ways:

- so that the module delivers field power to the actuators from the PDM
- so that the actuators get field power from an independent power source

Use pin 1 if field power comes from the island's actuator bus. Use pin 2 if an independent power supply is used for the actuators:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | +24 VDC actuator bus power | +24 VDC actuator bus power |
| 2 | independent power supply in | independent power supply in |
| 3 | output to actuator 1 | output to actuator 2 |
| 4 | independent power supply return | independent power supply return |
| 5 | field power return (to the module) | field power return (to the module) |
| 6 | field power return (to the module) | field power return (to the module) |

**Note:** If you are using the island's actuator bus for +24 VDC operating power:

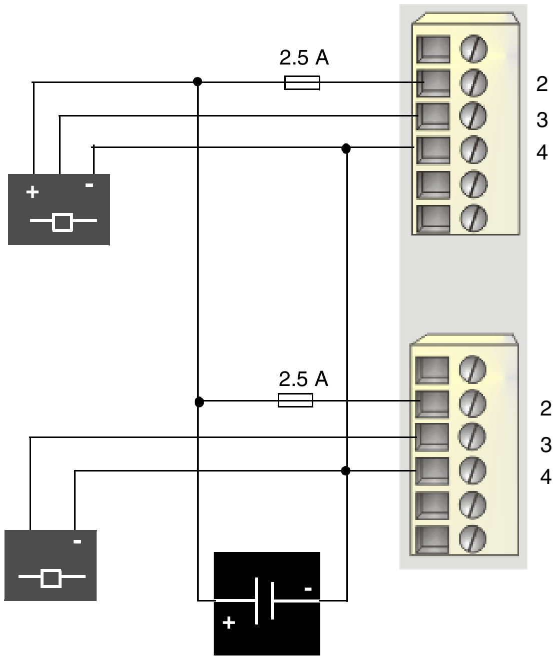
- externally jumper pin 1 to pin 2
- externally jumper pin 4 to pin 5
- use pin 6 as the field power return from the actuators

If you are using an independent power supply, use pin 2 as the +24 VDC line and pin 4 as the return line.

## Sample Wiring Diagrams

| | **WARNING** |
|---|---|
| ⚠ | **UNINTENDED EQUIPMENT OPERATION**<br>If you field-wire an STB DDO 3230 output module with an independent power supply instead of through a PDM, the mechanism in the PDM that protects the actuators from miswiring is no longer present.<br>● Make certain that you wire pins 2, 3 and 4 correctly as shown below.<br>A miswired field connection will cause the field actuator devices wired to this module to turn on as soon as field power is applied, even if logic control is not present.<br>**Failure to follow this precaution can result in death, serious injury, or equipment damage.** |

The following illustration shows two field actuators connected to the STB DDO 3230 module and receiving field power from an independent 24 VDC power supply instead of the PDM:

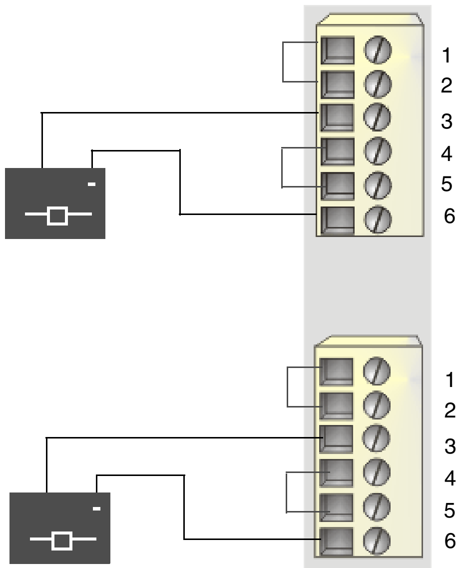



**2** +24 VDC from an independent power supply, with user-supplied external fuses (top and bottom)

**3** output to actuator 1 (top) and actuator 2 (bottom)

**4** power supply return from actuator 1 (top) and actuator 2 (bottom)

The following field wiring example shows two two-wire actuators wired to the STB DDO 3230 module. These devices do not use field power from the actuator bus. The jumpers between pins 1 and 2 and between pins 4 and 5 are required:




**1** +24 VDC field power from the PDM (top) jumpered to pin 2 (top and bottom)

**2** jumpered to pin 1 (top and bottom)

**3** output to actuator 1 (top) and actuator 2 (bottom)

**4/5** jumpered together (top and bottom)

**6** field power return from actuator 1 (top) and actuator 2 (bottom)

## STB DDO 3230 Functional Description

**Functional Characteristics**

The STB DDO 3230 module is two-channel module that sends digital 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 state for each channel on the module

**Fault Recovery Responses**

The module can detect an overcurrent situation on an output channel when the channel is turned on. If a fault is detected on either channel, the module will do one of the following:

- automatically latch off the channel, or
- automatically recover and resume operation on the channel when the fault is corrected

The factory default setting is *latched off*, where the module turns off an output channel that is on if it detects a fault and keeps the channel 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:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3230 you want to configure in the island editor. | The selected STB DDO 3230 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Fault Recovery Response** row, select the desired response mode. | Two choices appear in the pull-down menu—**Latched Off** and **Auto Recovery**. |

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

**Resetting a Latched-off Output**

When an output channel has been latched off because of fault detection, it will 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. You need to provide the reset logic in your application program.

**Auto-recovery**

When the module is configured to auto-recover, a channel that has been turned off because of a short circuit will start 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.

**Output Polarity**

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

To change an output polarity parameter from the default 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 DDO 3230 you want to configure in the island editor. | The selected STB DDO 3230 module opens in the software module editor. |
| 2 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Output Polarity** appears. |
| 3 | Expand the **+ Output Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | To change the settings *at the module level*, select the integer that appears in the **Value** column of the **Output Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have normal polarity and 3 means that both channels have reverse polarity. | When you select the **Output Polarity** value, the maxi/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new value for **Output Polarity**, the values associated with the channels change.<br>For example, if you choose an output polarity value of 2, **Channel 1** has normal polarity and **Channel 2** has reverse polarity. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Output Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Output Polarity** value changes to 2. |

## Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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 a predefined state. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3230 you want to configure in the island editor. | The selected STB DDO 3230 module opens in the software module editor. |
| 2 | Expand the **+ Fallback Mode Settings** fields by clicking on the **+** sign. | A row called **+ Fallback Mode** appears. |
| 3 | Expand the **+ Fallback Mode** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 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 the range 0 to 3, where 0 means both channels hold their last values 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.<br>When you accept a new value for **Fallback Mode**, the values associated with the channels change.<br>For example, if you choose a fallback mode value of 2, then **Channel 1** goes to hold last value and **Channel 2** goes to a predefined state. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, 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** will be ignored.

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to 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 will be ignored. |
| 2 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | A row called **+ Predefined Fallback Value** appears. |
| 3 | Expand the **+ Predefined Fallback Value** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | 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.<br>When you accept a new **Predefined Fallback Value**, the values associated with the channels change.<br>For example, if you choose a fallback state value of 2, then **Channel 2** will turn on as its fallback state. **Channel 1** will either turn off or be ignored, depending on its fallback mode setting. |
| 4b | To change a setting *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). 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.<br>For example, if you set channel 2 to 1 and leave channel 1 at 0, the **Predefined Fallback Value** value changes from 0 to 2. |

## STB DDO 3230 Data and Status for the Process Image

**Representing Digital Output Data and Status**

The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output module. The information in the status block is provided by the module itself.

This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB DDO 3230 module are based on its physical location on the island bus.

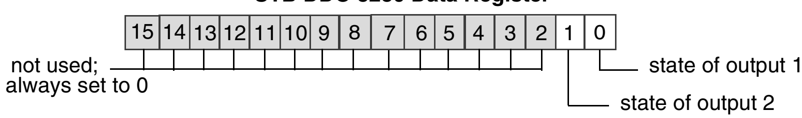
> **Note:** The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface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

**Output Data Register**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in this data block. The STB DDO 3230 uses one register in the output data block.

The STB DDO 3230's output data register displays the most current on/off states of the module's two output channels:

**STB DDO 3230 Data Register**




These values are written to the island bus by the fieldbus master.

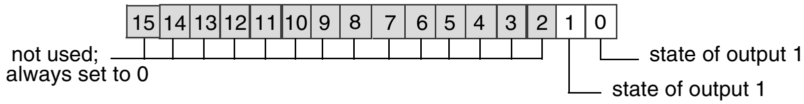
**Output Status Registers**

The input data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represents the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB DDO 3230 is represented by two contiguous registers—one register that echoes the output data register followed by one that displays the status of the output channels.

The first STB DDO 3230 register in the I/O status block is the module's *echo output data* register. This register represents the data that has just been sent to the output field devices by the STB DDO 3200 module.

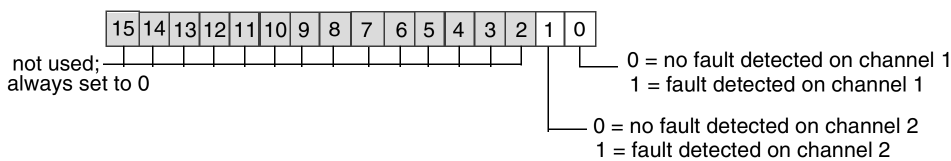
**STB DDO 3230 Echo Output Data Register**




Under most normal operating conditions, the bit values in this register should be an exact replica of the bits in the output data register. A difference between the bit values in the output data register and the echo register could result from an output channel used for a reflex action, where the channel is updated directly by the output module instead of by the fieldbus master.

The next contiguous register is the STB DDO 3230's status register. It indicates whether or not a fault condition has been detected on either of the module's two output channels. The fault would be either field power absent or actuator power shorted:

**STB DDO 3230 Status Register**



## STB DDO 3230 Specifications

### Table of Technical Specifications

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

| | | |
|---|---|---|
| description | | 24 VDC, 2.0 A source output |
| number of output channels | | two |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000<br>(See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| output protection (internal) | | transient voltage suppression |
| short circuit protection | | per channel |
| short circuit feedback | | per channel |
| isolation voltage | channel-to-channel | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | internal protection on the module |
| fault recovery response | default | channel latched off—requires user reset |
| | user-configurable settings* | auto-recovery |
| | | latched off |
| nominal logic bus current consumption | | 60 mA |
| nominal actuator bus current consumption | | 5 mA, with no load |
| maximum load current | | 2.0 A/channel |
| minimum load current | | none |
| output response time | off-to-on | 520 µs |
| | on-to-off | 720 µs |
| output voltage | working | 19.2 ... 30 VDC |
| | absolute maximum | 56 VDC for 1.3 ms, decaying voltage pulse |
| | on-state drop/ channel | 0.4 VDC max. |
| on-state leakage/channel | | 1.0 mA @ 30 VDC max. |
| maximum surge current | | 10 A/channel for 500 µs<br>(no more than six/min) |
| maximum load capacitance | | 50 µF |

| | | |
|---|---|---|
| maximum load inductance | | $L = 0.5/I^2 \times F$<br>where:<br>L = load inductance (H)<br>I = load current (A)<br>F = switching frequency (Hz) |
| fallback mode | default | predefined |
| | user-configurable settings* | hold last value |
| | | predefined fallback value on one or both channels |
| fallback states (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 outputs | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reverse* on one or both channels |
| | | *logic normal* on one or both channels |
| field power requirements | field power voltage | 24 VDC |
| | recommended source | external 24 VDC power supply |
| power protection | | recommendation: user-supplied 2.5 A time-lag fuses externally applied to each channel |
| * Requires the Advantys configuration software. | | |

# 4.3 STB DDO 3410 Digital 24 VDC Source Output Module (four-channel, 0.5 A, over-current protected)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DDO 3410 digital output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

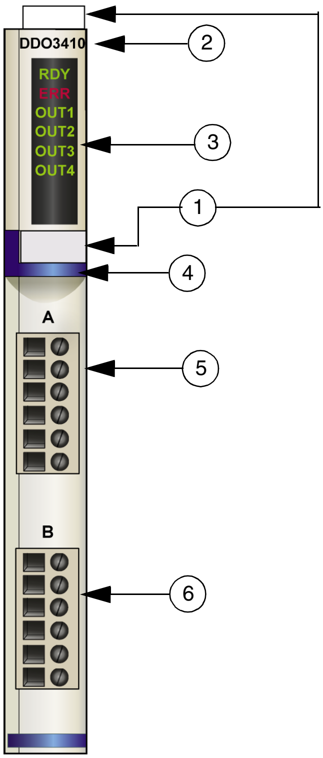
## STB DDO 3410 Physical Description

**Physical Characteristics**

The STB DDO 3410 is an Advantys STB four-channel digital input module that writes outputs to 24 VDC actuator devices and provides power to the actuators. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Actuators 1and 2 are wired to the top connector, and actuators 3 and 4 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** dark blue identification stripe, indicating a digital VDC output module

**5** actuator 1 connects to the top field wiring connector

**6** actuator 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module requires 24 VDC from the island's actuator bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).
Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.
Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB DDO 3410 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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<br>(with screw clamp connectors) |

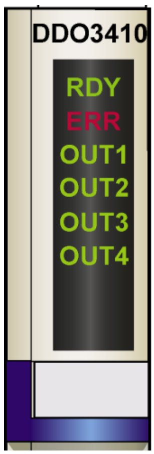
## STB DDO 3410 LEDs

**Overview**

The six LEDs on the STB DDO 3410 module are visual indicators of the operating status of the module and its four digital output channels. The LED locations and their meanings are described below.

**Location**

The six LED are positioned in a column on the top front of the STB DDO3410 digital output module. The figure below shows their locations:



## Indications

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

<table>
<tr><th>RDY</th><th>ERR</th><th>OUT 1</th><th>OUT 2</th><th>OUT 3</th><th>OUT 4</th><th>Meaning</th><th>What to Do</th></tr>
<tr><td>off</td><td>off</td><td rowspan="3"></td><td rowspan="5"></td><td rowspan="7"></td><td rowspan="9"></td><td>The module is either not receiving logic power or has failed.</td><td>Check power</td></tr>
<tr><td>flicker*</td><td>off</td><td>Auto-addressing is in progress.</td><td rowspan="10"></td></tr>
<tr><td rowspan="9">on</td><td rowspan="9">off</td><td>The module has achieved all of the following:<br>• it has power<br>• it has passed its confidence tests<br>• it is operational</td></tr>
<tr><td>on</td><td>Output 1 has applied voltage to its actuator.</td></tr>
<tr><td>off</td><td>Voltage is absent on output channel 1.</td></tr>
<tr><td rowspan="6"></td><td>on</td><td>Output 2 has applied voltage to its actuator.</td></tr>
<tr><td>off</td><td>Voltage is absent on output channel 2.</td></tr>
<tr><td rowspan="4"></td><td>on</td><td>Output 3 has applied voltage to its actuator.</td></tr>
<tr><td>off</td><td>Voltage is absent on output channel 3.</td></tr>
<tr><td rowspan="2"></td><td>on</td><td>Output 4 has applied voltage to its actuator.</td></tr>
<tr><td>off</td><td>Voltage is absent on output channel 4.</td></tr>
<tr><td rowspan="2">on</td><td rowspan="2">on</td><td>on</td><td>on</td><td>on</td><td>on</td><td>The watchdog has timed out.</td><td rowspan="2">Cycle power, restart the communications</td></tr>
<tr><td colspan="5">Note that the green output LEDs will be on even though the power is absent from the output channels when a watchdog time-out occurs.</td></tr>
<tr><td>blink 1**</td><td colspan="5"></td><td>The module is either in pre-operational mode or in its fallback state.</td><td></td></tr>
</table>

| RDY | ERR | OUT 1 | OUT 2 | OUT 3 | OUT 4 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|
| | flicker* | | | | | Field power absent or a short circuit detected at the actuator. | Check power |
| | blink 1** | | | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | | | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | | | | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

**** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

## STB DDO 3410 Field Wiring

**Summary**

The STB DDO 3410 module uses two six-terminal field wiring connectors. Actuators 1 and 2 are wired to the top connector, and actuators 3 and 4 are wired to the bottom connector. The choices of connector types and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Actuators**

The STB DDO 3410 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to four two-wire actuators such as solenoids, contactors, relays, alarms or panel lamps that draw current up to 0.5 A/channel.

**Note:** If you are using this module to provide operating power to a large inductive load (at or near a maximum of 0.5 H), make sure that you turn the field device off before removing the field power connector from the module. The output channel on the module may be damaged if you remove the connector while the field device is on.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 mm$^2$ (24 to 16 AWG).

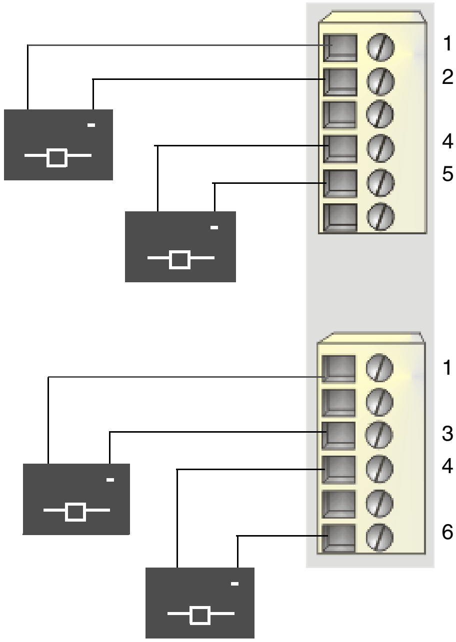
**Field Wiring Pinout**

The top connector supports digital output channels 1and 2; the bottom connector supports digital output channels 3 and 4:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | output to actuator 1 | output to actuator 3 |
| 2 | field power return | field power return |
| 3 | field power return | field power return |
| 4 | output to actuator 2 | output to actuator 4 |
| 5 | field power return | field power return |
| 6 | field power return | field power return |

**Sample Wiring Diagram**

The following field wiring example shows four actuators connected to the STB DDO 3410 module:




**1** output to actuator 1 (top) and actuator 3 (bottom)

**2** field power return from actuator 1 (top)

**3** field power return from actuator 3 (bottom)

**4** output to actuator 2 (top) and actuator 4 (bottom)

**5** field power return from actuator 2 (top)

**6** field power return from actuator 4 (bottom)

## STB DDO 3410 Functional Description

**Functional Characteristics**

The STB DDO 3410 module is a four-channel module that sends digital output data to four 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 state for each channel on the module

**Fault Recovery Responses**

The module can detect a short circuit on the actuator bus or an overcurrent fault on an output channel when the channel is turned on. If a fault is detected on either channel, the module will do one of the following:
- automatically latch off that channel plus another channel with which that channel is grouped, if that other channel is on, or
- automatically recover and resume operation on the channel group when the fault is corrected

The factory default setting is *latched off*, where the module turns off the output channels in a group when a short circuit or overcurrent condition is detected on any channel in that group. The channels will remain off until you reset them explicitly.
If you want to set the module to *auto-recover* when the fault is corrected, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3410 you want to configure in the island editor. | The selected STB DDO 3410 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Fault Recovery Response** row, select the desired response mode. | Two choices appear in the pull-down menu—**Latched Off** and **Auto Recovery**. |

The fault recovery parameter is set at the module level—you cannot configure one group of channels to latch off and another to auto-recover. The module will apply the fault recovery response the channels in two groups (two channels/group):
- group 1 comprises output channels 1 and 2
- group 2 comprises output channels 3 and 4

For example, suppose the module is configured to *latch off* a shorted output channel. If all four output channels are on and a short circuit occurs on output channel 1, both group 1 channels (output 1 and output 2) will be latched off. Channels 1 and 2 will remain latched off until they are reset, and channels 3 and 4 will continue to operate.
If a short circuit occurs on output 1 while output 2 is off, only output 1 will be latched off. Channel 1 will remain latched off until it is reset, and channels 2, 3 and 4 will continue to operate.

**Resetting a Latched-off Output**

When an output channel (or channel group) has been latched off because of fault detection, it will 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 both channels in a group have been latched off, you must reset both channels. You need to provide the reset logic in your application program.

**Auto-recovery**

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

**Output Polarity**

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

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

To change an output polarity parameter from the default 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 DDO 3410 you want to configure in the island editor. | The selected STB DDO 3410 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Output Polarity** appears. |
| 4 | Expand the **+ Output Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3** and **Channel 4** appear. |
| 5a | To change the settings *at the module level*, select the integer that appears in the **Value** column of the **Output Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 15 (0 to 0xF), where 0 means all channels have normal polarity and 0xF means that all four channels have reverse polarity. | When you select the **Output Polarity** value, the max/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new value for **Output Polarity**, the values associated with the channels change.<br>For example, if you choose an output polarity value of 4, **Channel 1** and **Channel 4** will have a value of 0 while **Channel 2** and **Channel 3** will have 1 as their value. |
| 5b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Output Polarity** row changes.<br>For example, if you set channels 1 and 4 to 0 and channels 2 and 3 to 1, the **Output Polarity** value changes to 4. |

**Fallback Modes**

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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 all four channels is a predefined state. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3410 you want to configure in the island editor. | The selected STB DDO 3410 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Fallback Mode Settings** fields by clicking on the **+** sign. | A row called **+ Fallback Mode** appears. |
| 4 | Expand the **+ Fallback Mode** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3** and **Channel 4** appear. |
| 5a | 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 the range 0 to 15 (0 to 0xF), where 0 means all four channels hold their last values and 0xF means that all four 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.<br>When you accept a new value for **Fallback Mode**, the values associated with the channels change.<br>For example, if you choose a fallback mode value of 6, **Channel 1** and **Channel 4** will be 0, while **Channel 2** and **Channel 3** will be 1. |
| 5b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 2 to 0 and leave the other three channels at 1, the **Fallback Mode** value changes to 0xD. |

## 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, all four 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** will be ignored.

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to 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 will be ignored. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | A row called **+ Predefined Fallback Value** appears. |
| 4 | Expand the **+ Predefined Fallback Value** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3** and **Channel 4** appear. |
| 5a | 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 15 (0 to 0xF), 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.<br>When you accept a new **Predefined Fallback Value**, the values associated with the channels change.<br>For example, if you choose a fallback state value of 6, **Channel 1** and **Channel 4** will be 0, while **Channel 2** and **Channel 3** will be 1. |
| 5b | To change a setting *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). 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 **Predefined Fallback Value** row changes.<br>For example, if you set channels 1, 3 and 4 to 1 and leave channel 2 at 0, the **Predefined Fallback Value** changes to 0xD. |

## STB DDO 3410 Data and Status for the Process Image

**Representing Digital Output Data and Status**

The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output module. The information in the status block is provided by the module itself.

This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB DDO 3410 module are based on its physical location on the island bus.

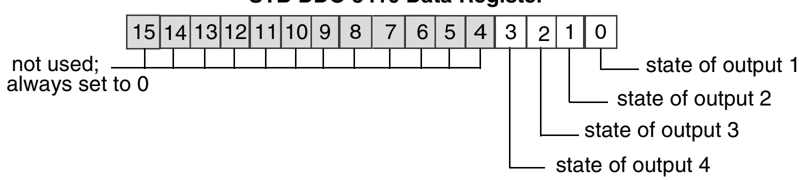
> **Note:** The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface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

**Output Data Register**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in this data block. The STB DDO 3410 uses one register in the output data block.

The STB DDO 3410's output data register displays the most current on/off states of the module's four output channels:

**STB DDO 3410 Data Register**




These values are written to the island bus by the fieldbus master.

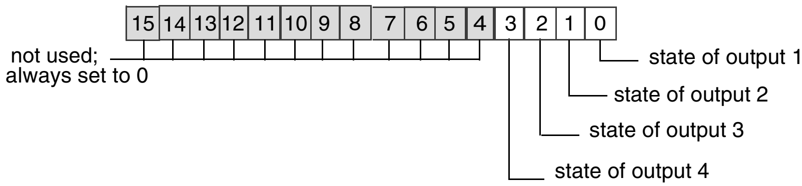
## Output Status Registers

The input data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represents the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB DDO 3410 is represented by two contiguous registers—one register that echoes the output data register followed by one that displays the status of the output channels.

The first STB DDO 3410 register in the I/O status block is the module's *echo output data* register. This register represents the data that has just been sent to the output field devices by the STB DDO 3410 module:

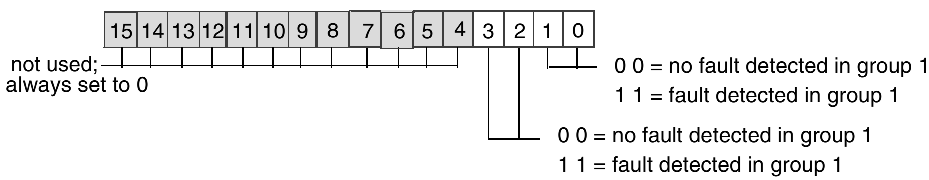
**STB DDO 3230 Echo Output Data Register**




Under most normal operating conditions, the bit values in this register should be an exact replica of the bits in the output data register. A difference between the bit values in the output data register and the echo register could result from an output channel used for a reflex action, where the channel is updated directly by the output module instead of by the fieldbus master.

The next contiguous register is the STB DDO 3410's status register. It indicates whether or not a fault condition has been detected on any of the module's four output channels.The fault might be field power absent or actuator power shorted:

**STB DDO 3410 Status Register**




Group 1 comprises outputs 1 and 2. Group 2 comprises outputs 3 and 4.

## STB DDO 3410 Specifications

**Table of Technical Specifications**

The STB DDO 3410 module's technical specifications are listed in the following table.

| | | |
|---|---|---|
| description | | 24 VDC, 0.5 A source output |
| number of output channels | | four |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| output protection (internal) | | transient voltage suppression |
| short circuit protection | | per channel |
| short circuit feedback | | per group: group 1 comprises channels 1 and 2; group 2 comprises channels 3 and 4 |
| isolation voltage | field-to-bus | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | internal protection on the module |
| fault recovery response | default | channel latched off; requires off-on command to reset |
| | user-configurable settings* | auto-recovery |
| | | latched off |
| nominal logic bus current consumption | | 80 mA |
| nominal actuator bus current consumption | | 10 mA, with no load |
| maximum load current | | 0.5 A/channel |
| minimum load current | | none |
| output response time | off-to-on | 560 µs @ 0.5 A load |
| | on-to-off | 870 µs @ 0.5 A load |
| output voltage | working | 19.2 ... 30 VDC |
| | absolute maximum | 56 VDC for 1.3 ms, decaying voltage pulse |
| | on-state drop/ channel | 0.4 VDC max. |
| on-state leakage/channel | | 0.4 mA @ 30 VDC max. |
| maximum surge current | | 5 A/channel for 500 µs (no more than six/ min) |
| maximum load capacitance | | 50 µF |

| | | |
|---|---|---|
| maximum load inductance | | 0.5 H @ 4 Hz switch frequency<br>$L = 0.5 / I^2 \times F$<br>where:<br>L = load inductance (H)<br>I = load current (A)<br>F = switching frequency (Hz) |
| fallback mode | default | predefined |
| | user-configurable settings* | hold last value |
| | | predefined fallback value on one or more channels |
| fallback states (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 outputs | default | *logic normal* on all four channels |
| | user-configurable settings* | *logic reverse* on one or more channels |
| | | *logic normal* on one or more channels |
| field power requirements | field power voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 4.4 STB DDO 3600 Digital 24 VDC Source Output Module (six-channel, 0.5 A, over-current protected)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DDO 3600 digital output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

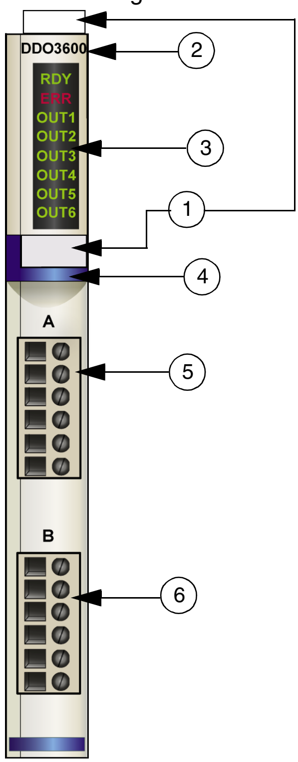
## STB DDO 3600 Physical Description

**Physical Characteristics**

The STB DDO 3600 is an Advantys STB six-channel digital output module that writes outputs to 24 VDC actuator devices and provides power to the actuators. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors. Actuators 1, 2 and 3 are wired to the top connector, and actuators 4, 5 and 6 are wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** dark blue identification stripe, indicating a digital VDC output module

**5** actuators 1 ... 3 connect to the top field wiring connector

**6** actuator 4 ... 6 connect to the bottom field wiring connector

## Module Accessories

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module requires 24 VDC from the island's actuator bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

## Module Dimensions

The STB DDO 3600 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

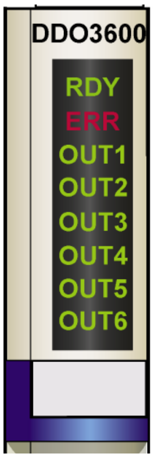
## STB DDO 3600 LED Indicators

**Overview**

The eight LEDs on the STB DDO 3600 module are visual indications of the operating status of the module and its six digital output channels. The LED locations and their meanings are described below.

**Location**

The eight LED indicators are positioned in a column at the top front of the STB DDO 3600 digital output module. The figure below shows their location:



**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 | ERR | OUT1 | OUT2 | OUT3 | OUT4 | OUT5 | OUT6 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|---|---|
| off | off | | | | | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | | | | | Auto-addressing is in progress. | |
| on | off | | | | | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | | | | | Output 1 has applied voltage to its actuator. | |
| | | off | | | | | | Voltage is absent on output channel 1. | |
| | | | on | | | | | Output 2 has applied voltage to its actuator. | |
| | | | off | | | | | Voltage is absent on output channel 2. | |
| | | | | on | | | | Output 3 has applied voltage to its actuator. | |
| | | | | off | | | | Voltage is absent on output channel 3. | |
| | | | | | on | | | Output 4 has applied voltage to its actuator. | |
| | | | | | off | | | Voltage is absent on output channel 4. | |
| | | | | | | on | | Output 5 has applied voltage to its actuator. | |
| | | | | | | off | | Voltage is absent on output channel 5. | |
| | | | | | | | on | Output 6 has applied voltage to its actuator. | |
| | | | | | | | off | Voltage is absent on output channel 6. | |

| RDY | ERR | OUT1 | OUT2 | OUT3 | OUT4 | OUT5 | OUT6 | Meaning | What to Do |
|---|---|---|---|---|---|---|---|---|---|
| on | on | on | on | on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green output LEDs will be on even though the power is absent from the output channels when a watchdog time-out occurs. | | | | | | | |
| blink 1** | | | | | | | | The module is either in pre-operational mode or in its fallback state. | |
| | flicker* | | | | | | | Field power absent or a short circuit detected at the actuator. | Check power |
| | blink 1** | | | | | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | | | | | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | | | | | | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

**** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

## STB DDO 3600 Field Wiring

**Summary**

The STB DDO 3600 module uses two six-terminal field wiring connectors. Actuators 1, 2 and 3 are wired to the top connector, and actuators 4, 5 and 6 are wired to the bottom connector. The choices of connector types and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors, available in a kit of 20 (model STB XTS 2100)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Actuators**

The STB DDO 3600 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two-wire actuators such as solenoids, contactors, relays, alarms or panel lamps that draw current up to 0.5 A/channel.

**Note:** If you are using this module to provide operating power to a large inductive load (at or near a maximum of 0.5 H), make sure that you turn the field device off before removing the field power connector from the module. The output channel on the module may be damaged if you remove the connector while the field device is on.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 mm$^2$ (24 to  16 AWG).

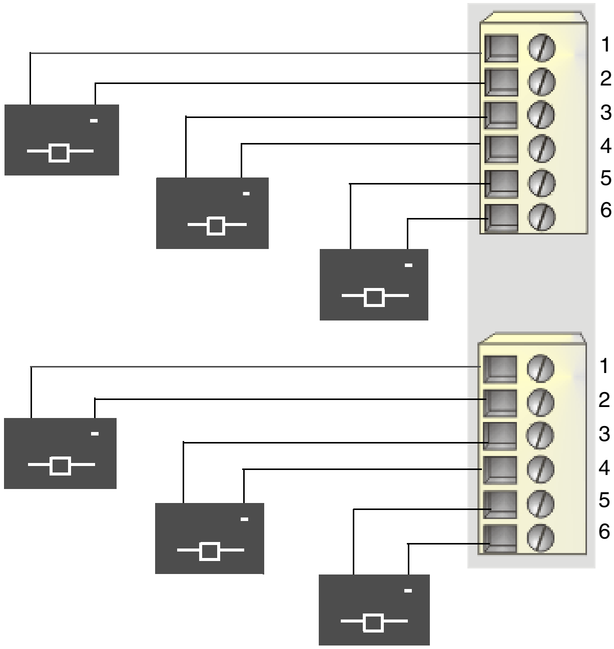
**Field Wiring Pinout**

The top connector supports digital input channels 1, 2, and 3; the bottom connector supports digital input channels 4, 5, and 6:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | output to actuator 1 | output to actuator 4 |
| 2 | field power return | field power return |
| 3 | output to actuator 2 | output to actuator 5 |
| 4 | field power return | field power return |
| 5 | output to actuator 3 | output to actuator 6 |
| 6 | field power return | field power return |

**Sample Wiring Diagram**

The following field wiring example shows six actuators connected to the STB DDO 3600 module:




**1** output to actuator 1 (top) and actuator 4 (bottom)

**2** field power return from actuator 1 (top) and actuator 4 (bottom)

**3** output to actuator 2 (top) and actuator 5 (bottom)

**4** field power return from actuator 2 (top) and actuator 5 (bottom)

**5** output to actuator 3 (top) and actuator 6 (bottom)

**6** field power return from actuator 3 (top) and actuator 6 (bottom)

## STB DDO 3600 Functional Description

### Functional Characteristics

The STB DDO 3600 is a six-channel module that sends digital output data to six 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 state for each channel on the module

### Fault Recovery Responses

The module can detect a short circuit on the actuator bus or an overcurrent fault on an output channel when the channel is turned on. If a fault is detected on either channel, the module will do one of the following:
- automatically latch off that channel plus another channel with which that channel is grouped, if that other channel is on, or
- automatically recover and resume operation on the channel group when the fault is corrected

The factory default setting is *latched off*, where the module turns off the output channels in a group when a short circuit or overcurrent condition is detected on any channel in that group. The channels will remain off until you reset them explicitly.
If you want to set the module to *auto-recover* when the fault is corrected, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3600 module you want to configure in the island editor. | The selected STB DDO 3600 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Fault Recovery Response** row, select the desired response mode. | Two choices appear in the pull-down menu—**Latched Off** and **Auto Recovery**. |

The fault recovery parameter is set at the module level—you cannot configure one group of channels to latch off and another to auto-recover. The module will apply the fault recovery response the channels in three groups (two channels/group):
- group 1 comprises output channels 1 and 2
- group 2 comprises output channels 3 and 4
- group 3 comprises output channels 5 and 6

For example, suppose the module is configured to *latch off* a shorted output channel. If all six output channels are on and a short circuit occurs on output channel 1, both group 1 channels (output 1 and output 2) will be latched off. Channels 1 and 2 will remain latched off until they are reset, and channels 3 through 6 will continue to operate.

If a short circuit occurs on output 1 while output 2 is off, only output 1 will be latched off. Channel 1 will remain latched off until it is reset, and channels 2 through 6 will continue to operate.

**Resetting a Latched-off Output**

When an output channel (or channel group) has been latched off because of fault detection, it will 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 both channels in the group have been latched off, you must reset both channels. You need to provide the reset logic in your application program.

**Auto-recovery**

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

**Output Polarity**

By default, the polarity on all six output channels is *logic normal*, where:

- 0 indicates that the physical actuator is off (or the output signal is low)
- 1indicates that the physical actuator is on (or the output signal is high)

The output polarity on one or more channels may optionally be configured for *logic reverse*, where:

- 1 indicates that the physical actuator is off (or the output signal is low)
- 0 indicates that the physical actuator is on (or the output signal is high)

To change an output polarity parameter from the default 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 DDO 3600 module you want to configure in the island editor. | The selected STB DDO 3600 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Output Polarity** appears. |
| 4 | Expand the **+ Output Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3**, **Channel 4**, **Channel 5** and **Channel 6** appear. |
| 5a | To change the settings *at the module level*, select the integer that appears in the **Value** column of the **Output Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 63 (0 to 0x3F), where 0 means all channels have normal polarity and 0x3F means that all six channels have reverse polarity. | When you select the **Output Polarity** value, the max/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new value for **Output Polarity**, the values associated with the channels change.<br>For example, if you choose an output polarity value of 0x2F, **Channel 2** will have normal polarity and the other five channels will have reverse polarity. |
| 5b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Output Polarity** row changes.<br>For example, if you set channels 2 and 3 to 1 and leave the other four channels at 0, the **Output Polarity** value changes to 0x18. |

## Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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 all six channels is a predefined state. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DDO 3600 module you want to configure in the island editor. | The selected STB DDO 3600 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Fallback Mode Settings** fields by clicking on the **+** sign. | A row called **+ Fallback Mode** appears. |
| 4 | Expand the **+ Fallback Mode** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3**, **Channel 4**, **Channel 5** and **Channel 6** appear. |
| 5a | 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 the range 0 to 63 (0 to 0x3F), where 0 means all six channels hold their last values and 0x3F means that all six 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.<br>When you accept a new value for **Fallback Mode**, the values associated with the channels change. For example, if you choose a fallback mode value of 0x2F, **Channel 2** will have a value of 0 and the other five channels will have 1 as their value. |
| 5b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 2 to 0 and leave the other five channels at 1, the **Fallback Mode** value changes to 0x2F. |

## 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, all four 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** will be ignored.

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to 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 will be ignored. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | A row called **+ Predefined Fallback Value** appears. |
| 4 | Expand the **+ Predefined Fallback Value** row further by clicking on the **+** sign. | Rows for **Channel 1**, **Channel 2**, **Channel 3**, **Channel 4**, **Channel 5** and **Channel 6** appear. |
| 5a | 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 63 (0 to 0x3F), where 0 means all six channels have 0 as their predefined fallback value and 0x3F means that all six 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.<br>When you accept a new **Predefined Fallback Value**, the values associated with the channels change.<br>For example, if you choose a fallback state value of 0x2F, **Channel 2** will have a value of 0 (off) and the other five channels will have 1 (on) as their value. |
| 5b | To change a setting *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). 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 **Predefined Fallback Value** row changes.<br>For example, if you set channel 2 to 0 and leave the other five channels at 1, the **Predefined Fallback Value** value changes to 0x2F. |

## STB DDO 3600 Data and Status for the Process Image

**Representing Digital Output Data and Status**

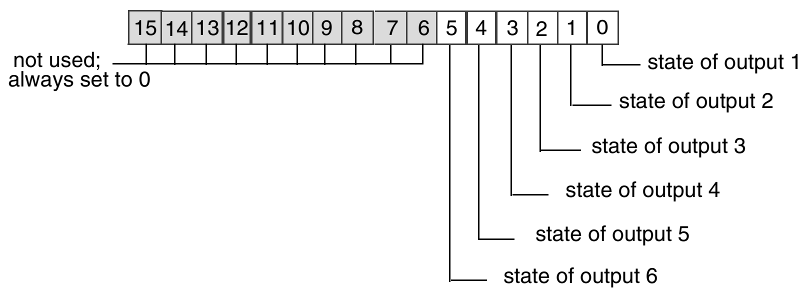
The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master ad is used to update the output module. The information in the status block is provided by the module itself.
This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB DDO 3600 module are based on its physical location on the island bus.

> **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.

**Output Data Register**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in a register in this data block. The STB DDO 3600 uses one register in the output data block.
The STB DDO 3600's output data register displays the most current on/off states of the module's six output channels:

**STB DDO 3600 Data Register**




These values are written to the island bus by the fieldbus master.

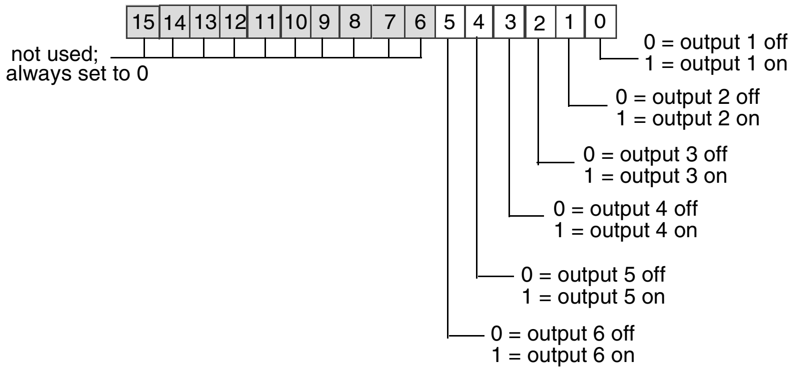
**Output Status Registers**

The echo output data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represents the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB DDO 3600 is represented by two contiguous registers—one register that echoes the output data register followed by one that displays the status of the output channels.

The first STB DDO 3600 register in the I/O status block is the module's *echo output data* register. This register represents the data that has just been sent to the output field devices by the STB DDO 3600 module.

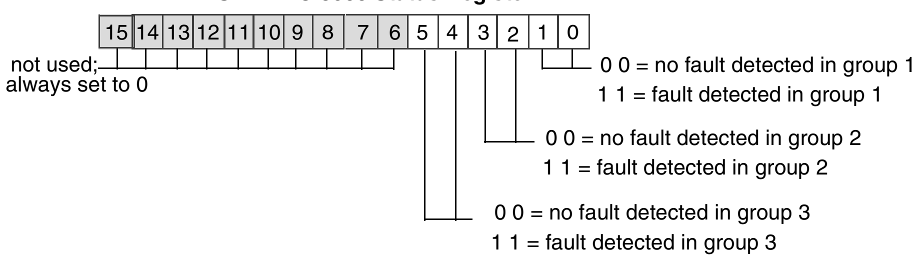
**STB DDO 3600 Echo Output Data Register**




Under most normal operating conditions, the bit values in this register should be an exact replica of the bits in the output data register. A difference between the bit values in the output data register and the echo register could result from an output channel used for a reflex action, where the channel is updated directly by the output module instead of by the fieldbus master.

The next contiguous register is the STB DDO 3600's status register. It indicates whether or not a fault condition has been detected on either of the module's two output channels. The fault might be field power absent or actuator power shorted:

**STB DDO 3600 Status Register**




Group 1 comprises outputs 1 and 2. Group 2 comprises outputs 3 and 4. Group 3 comprises outputs 5 and 6.

## STB DDO 3600 Specifications

**Table of Technical Specifications**

The STB DDO 3600 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 24 VDC, 0.5 A source output |
| number of output channels | | six |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000<br>(See *STB XBA 1000 I/O Base, p. 347*) |
| hot swapping supported | | yes |
| output protection (internal) | | transient voltage suppression |
| short circuit protection | | per channel |
| short circuit feedback | | per group: group 1 comprises channels 1 and 2) group 2 comprises channels 3 and 4 group 3 comprises channels 5 and 6 |
| fault recovery response | default setting | shorted channel latched off—requires user reset action |
| | user-configurable settings* | auto-recovery |
| | | latched off |
| isolation voltage | field-to-bus | 1500 VDC for 1 min |
| reverse polarity protection from a miswired PDM | | internal protection on the module |
| nominal logic bus current consumption | | 90 mA |
| nominal actuator bus current consumption | | 15 mA, with no load |
| maximum load current | | 0.5 A/channel |
| minimum load current | | none |
| output response time | off-to-on | 715 µs @ 0.5 A load |
| | on-to-off | 955 µs @ 0.5 A load |
| output voltage | working | 19.2 ... 30 VDC |
| | absolute maximum | 56 VDC for 1.3 ms, decaying voltage pulse |
| | on-state drop/ channel | 0.4 VDC max. |
| on-state leakage/channel | | 0.4 mA @ 30 VDC max. |
| maximum surge current | | 5 A/channel for 500 µs<br>(no more than six/min) |
| maximum load capacitance | | 50 µF |

| | | |
|---|---|---|
| maximum load inductance | | 0.5 H @ 4 Hz switch frequency<br>$L = 0.5 / I^2 \times F$<br>where:<br>L = load inductance (H)<br>I = load current (A)<br>F = switching frequency (Hz) |
| fallback mode | default | predefined fallback values on all six channels |
| | user-configurable settings* | hold last value |
| | | predefined fallback value on one or more channels |
| fallback states (when *predefined* is the fallback mode) | default | all six channels go to 0 |
| | user-configurable settings* | each channel configurable for 1 or 0 |
| polarity on individual outputs | default | *logic normal* on all six channels |
| | user-configurable settings* | *logic reverse* on one or more channels |
| | | *logic normal* on one or more channels |
| field power requirements | field power voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 4.5 STB DAO 8210 Digital 115/230 VAC Source Output Module (two-channel, 2 A)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DAO 8210 digital output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

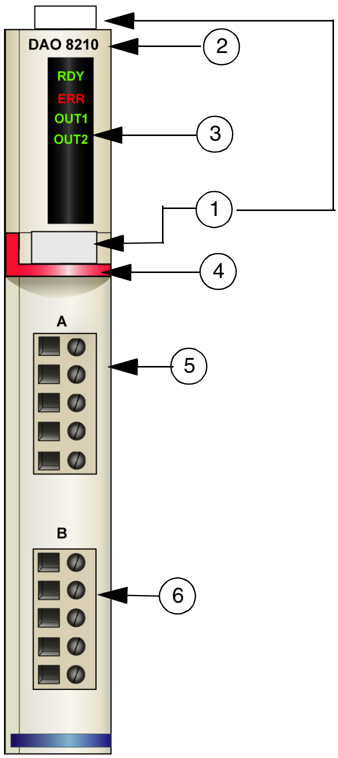
## STB DAO 8210 Physical Description

**Physical Characteristics**

The STB DAO 8210 is an Advantys STB two-channel digital output module that writes outputs to either 115 VAC or 230 VAC actuator devices and provides power to the actuators. The module mounts in a size 2 I/O base and uses two five-terminal field wiring connectors. Actuator 1 is wired to the top connector, and actuator 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** red identification stripe, indicating a digital AC output module

**5** actuator 1 connects to the top field wiring connector

**6** actuator 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) I/O base
- a pair of five-terminal field wiring connectors, either STB XTS 1110 screw type connectors or STB XTS 2110 spring clamp connectors

The module requires either 115 or 230 VAC from the island's actuator bus, and needs to be supported by an STB PDT 2100 PDM (See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB DAO 8210 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 18.4 mm (0.72 in) |
| **height** | module only | 125 mm (4.92 in) |
| | on a base | 128.25 mm (5.05 in) |
| **depth** | module only | 65.1 mm (2.56 in) |
| | on a base, with connectors | 75.5 mm (2.97 in) worst case<br>(with screw clamp connectors) |

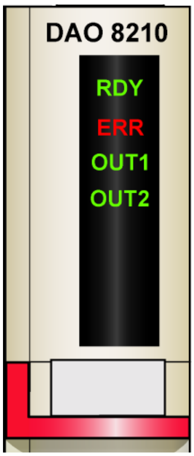
## STB DAO 8210 LED Indicators

**Purpose**

The four LEDs on the STB DAO 8210 module are visual indications of the operating status of the module and its two digital output channels. The LED locations and their meanings are described below.

**Location**

The four LEDs are positioned in a column on the top front of the STB DAO 8210 digital output module. The figure below shows their location:



**Indications**

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

| RDY | ERR | OUT1 | OUT2 | Meaning | What to Do |
|---|---|---|---|---|---|
| off | off | | | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | | | Auto-addressing is in progress. | |
| on | off | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | Output 1 has applied voltage to its actuator. | |
| | | off | | Voltage is absent on output channel 1. | |
| | | | on | Output 2 has applied voltage to its actuator. | |
| | | | off | Voltage is absent on output channel 2. | |
| on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green output LEDs will be on even though the power is absent from the output channels when a watchdog time-out occurs. | | | |
| blink 1** | | | | The module is either in pre-operational mode or in its fallback state. | |
| | blink 1** | | | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | | | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

**** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

## STB DAO 8210 Field Wiring

**Summary**

The STB DAO 8210 module uses two five-terminal field wiring connectors. Actuator 1 is wired to the top connector, and actuator 2 is wired to the bottom connector. Each output should be wired with an external fuse to protect the module from possible damage. The choices of connector types and field wire types are described below, and some field wiring considerations are presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have five connection terminals, with a 5.08 mm (0.2 in) pitch between each pin.

**Field Actuators**

The STB DAO 8210 is designed to handle high duty cycles and to control continuous-operation equipment. It supports field wiring to two-, three- or four-wire devices such as solenoids, contactors, relays, alarms or panel lamps.
When the module is operating at 30 degrees C, it supports two actuators that can draw current up to 2.0 A/channel. At 60 degrees C, it supports two actuators that can draw current up to 1.0 A/channel.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Local electrical codes take precedence over our recommended wire size for the protective earth (PE) connection on pin 5.

**External Fusing**

Two different external fuse types may be used:
- 5 A fuses for the outputs
- 0.5 A fuses for accessory power

Because of the triac used in this module, the 10 A fuse in the PDM will not provide over-current protection to the outputs. To achieve over-current protection on the outputs, you must place external fuses in-line on each output channel. Use a 5 A, 250 V 5 x 20 mm fuse such as the Wickmann 1911500000 on the wires that connect the field device to pin 2 on each connector.
The STB DAO 8210 does not provide electronic over-current protection when the actuator bus is supplying accessory power to a field device. To achieve over-current protection for accessories, you should place external fuses in-line on pin 1. If you do not use fuses, an over-current condition could damage the module and blow the 10 A fuse in the PDM. Use a 0.5 A, 250 V 5 x 20 mm time-lag fuse such as the Wickmann 1910500000.

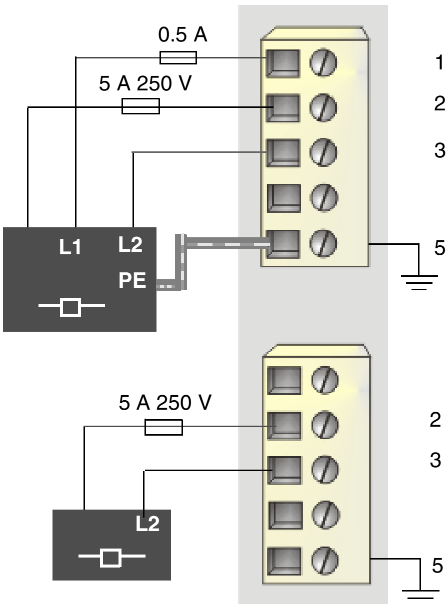
## Field Wiring Pinout

The top connector supports actuator 1, and the bottom connector supports actuator 2:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | actuator bus power (L1) | actuator bus power (L1) |
| 2 | output to actuator 1 (common with L1) | output to actuator 2 (common with L1) |
| 3 | field power neutral or L2 | field power neutral or L2 |
| 4 | field power neutral or L2 | field power neutral or L2 |
| 5 | protective earth | protective earth |

## Sample Wiring Diagram

The following field wiring example shows two actuators connected to an STB DAO 8210 output module, with user-installed external fuses on each channel connection:




**1** actuator bus power (L1) to actuator 1 (top)

**2** output to actuator 1 (top) and actuator 2 (bottom)

**3** L2 from actuator 1 (top) and field power neutral from actuator 2 (bottom)

**5** PE connection point for actuator 1 (top)

The four-wire actuator on the top connector has a PE connection that is tied to the PE connection on the PDM base through pin 5.

# STB DAO 8210 Functional Description

## Functional Characteristics

The STB DAO 8210 module is a two-channel module that sends digital output data to two field actuators that may be operating at either 115 or 230 VAC. Using the Advantys configuration software, you can customize the following operating parameters:
- *logic normal* or *logic reverse* output polarity for each channel on the module
- a fallback state for each channel on the module

## Output Polarity

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

To change an output polarity parameter from the default 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 DAO 8210 module you want to configure in the island editor. | The selected STB DAO 8210 module opens in the software module editor. |
| 2 | Expand the **+ Polarity Settings** fields by clicking on the **+** sign. | A row called **+ Output Polarity** appears. |
| 3 | Expand the **+ Output Polarity** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | To change the settings *at the module level*, select the integer that appears in the **Value** column of the **Output Polarity** row and enter a hexadecimal or decimal integer in the range 0 to 3, where 0 means both channels have normal polarity and 3 means that both channels have reverse polarity. | When you select the **Output Polarity** value, the max/min values of the range appear at the bottom of the module editor screen.<br>When you accept a new value for **Output Polarity**, the values associated with the channels change.<br>For example, if you choose an output polarity value of 2, **Channel 1** has normal polarity and **Channel 2** has reverse polarity. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Output Polarity** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Output Polarity** value changes to 2. |

**Fallback Modes**

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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 a predefined state. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DAO 8210 module you want to configure in the island editor. | The selected STB DAO 8210 module opens in the software module editor. |
| 2 | Expand the **+ Fallback Mode Settings** fields by clicking on the **+** sign. | A row called **+ Fallback Mode** appears. |
| 3 | Expand the **+ Fallback Mode** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 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 the range 0 to 3, where 0 means both channels hold their last values 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.<br>When you accept a new value for **Fallback Mode**, the values associated with the channels change.<br>For example, if you choose a fallback mode value of 2, then **Channel 1** goes to hold last value and **Channel 2** goes to a predefined state. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, 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** will be ignored.

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to 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 will be ignored. |
| 2 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | A row called **+ Predefined Fallback Value** appears. |
| 3 | Expand the **+ Predefined Fallback Value** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | 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.<br>When you accept a new **Predefined Fallback Value**, the values associated with the channels change.<br>For example, if you choose a fallback state value of 2, then **Channel 2** will turn on as its fallback state. **Channel 1** will either turn off or be ignored, depending on its fallback mode setting. |
| 4b | To change a setting *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). 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.<br>For example, if you set channel 2 to 1 and leave channel 1 at 0, the **Predefined Fallback Value** value changes from 0 to 2. |

## STB DAO 8210 Data for the Process Image

**Representing Digital Output Data**

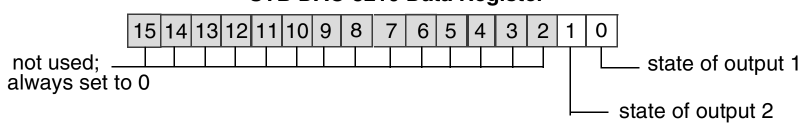
The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output module. The information in the status block is provided by the module itself.
This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB DAO 8210 module are based on its physical location on the island bus.

> **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.

**Output Data Register**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus has its data values represented in a register in this data block. The STB DAO 8210 uses one register in the output data block.
The STB DAO 8210's output data register displays the most current on/off states of the module's two output channels:

**STB DAO 8210 Data Register**

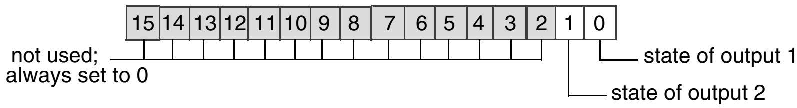



These values are written to the island bus by the fieldbus master.

**Output Status Registers**

The input data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represents the status of all the I/O modules (along with the data for the input modules) on the island bus.
The STB DAO 8210 is represented by one register that echoes the output data register.
This register represents the data that has just been sent to the output field devices by the STB DAO 8210 module:

**STB DAO 8210 Echo Output Data Register**




Under most normal operating conditions, the bit values in this register should be an exact replica of the bits in the output data register. A difference between the bit values in the output data register and the echo register could result from an output channel used for a reflex action, where the channel is updated directly by the output module instead of by the fieldbus master.

## STB DAO 8210 Specifications

### Table of Technical Specifications

The STB DAO 8210 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | 115/230 VAC source output |
| number of output channels | | two |
| module width | | 18.4 mm (0.72 in) |
| I/O base | | STB XBA 2000<br>(See *STB XBA 2000 I/O Base, p. 351*) |
| hot swapping supported | | yes |
| output surge protection | | metal oxide varistor and RC suppression |
| output voltage (rms) | working | 20 ... 265 VAC |
| | absolute maximum | 300 VAC for 10 s<br>400 VAC for 1 cycle |
| | on-state drop/channel | 1.5 VAC max. |
| off-state leakage/ channel | @ 230 VAC max. | 2.5 mA |
| | @ 115 VAC max. | 2.0 mA |
| maximum surge current (rms) | one cycle | 30 A/channel |
| | two cycles | 20 A/channel |
| nominal logic bus current consumption | | 70 mA |
| nominal actuator bus current consumption | | 0 mA, with no load |
| maximum load current (rms) | | 2 A/channel @ 30 degrees C |
| | | 1 A/channel @ 60 degrees C |
| external fusing for the outputs | | 5 A time-lag fuses |
| minimum load current (rms) | | 5 mA |
| Applied dV/dt | | 400 V/µs |
| output response time output turns on at AC voltage 0 crossing | off-to-on | 10.0 ms |
| | on-to-off | 10.5 ms |
| fallback mode | default | predefined |
| | user-configurable setting* | hold last value |
| | | predefined fallback value on one or both channels |
| fallback states (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 outputs | default | *logic normal* on both channels |
| | user-configurable settings* | *logic reverse* on one or both channels |
| | | *logic normal* on one or both channels |
| actuator bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | none |
| external fusing for accessories | | 0.5 A time-lag fuses |
| field power requirements | field power voltage | either 115 VAC or 230 VAC |
| | PDM model | STB PDT 2100 (See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*) |
| power protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# The Advantys STB Relay Modules

# 5

## At a Glance

**Overview**

This chapter describes in detail the features of the relay modules in the Advantys STB family.

**What's in this Chapter?**

This chapter contains the following sections:

# 5.1 STB DRC 3210 Relay Output Module (two-point, form C, 2 A, 24 V coil)

## At a Glance

**Overview**

This section provides you with a detailed description of the Advantys STB DRC 3210 relay output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

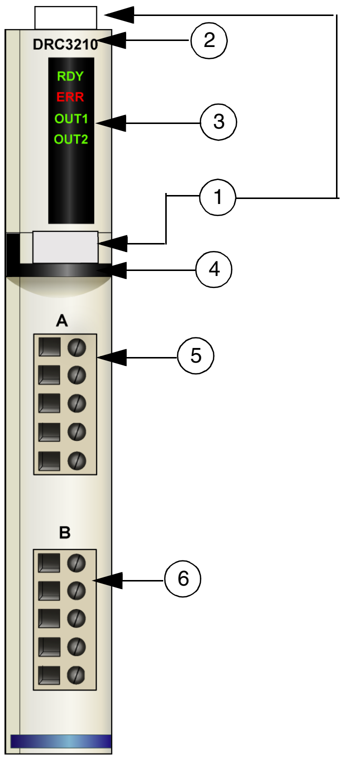
## STB DRC 3210 Physical Description

**Physical Characteristics**

The STB DRC 3210 is an Advantys STB form C relay module that switches 24 VDC, 115 VAC or 230 VAC field devices. Its coil runs on 24 VDC from the island's actuator bus. The module provides access to both the normally open (N.O.) and normally closed (N.C.) contacts of the internal relays. The module mounts in a size 2 I/O base and uses two five-terminal field wiring connectors. Field device 1 is wired to the top connector, and field device 2 is wired to the bottom connector.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels
**2** model name
**3** LED array
**4** black identification stripe, indicating a relay output module
**5** field device 1 connects to the top field wiring connector)
**6** field device 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) I/O base
- a pair of five-terminal field wiring connectors, either STB XTS 1110 screw type connectors or STB XTS 2110 spring clamp connectors

The module requires either 24 VDC from the island's actuator bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).
Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.
Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Dimensions**

The STB DRC 3210 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 18.4 mm (0.72 in) |
| **height** | module only | 125 mm (4.92 in) |
| | on a base | 128.25 mm (5.05 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) |

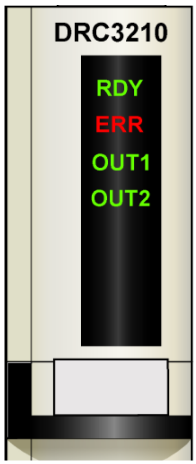
## STB DRC 3210 LED Indicators

**Overview**

The four LEDs on the STB DRC 3210 module are visual indications of the operating status of the module and its two relay outputs. The LED locations and their meanings are described below.

**Location**

The four LEDs are positioned in a column on the top of the STB DRC 3210 relay output module. The figure below shows their location:



## Indications

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

| RDY | ERR | OUT1 | OUT2 | Meaning | What to Do |
|---|---|---|---|---|---|
| off | off | | | The module is either not receiving power or has failed. | Check power |
| flicker* | off | | | Auto-addressing is in progress. | |
| on | off | | | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| | | on | | Relay 1 is energized. | |
| | | off | | Voltage is absent on relay 1. | |
| | | | on | Relay 2 is energized. | |
| | | | off | Voltage is absent on relay 2. | |
| on | on | on | on | The watchdog has timed out. | Cycle power, restart the communications |
| | | Note that the green output LEDs will be on even though the power is absent from the output channels when a watchdog time-out occurs. | | | |
| blink 1** | | | | The module is either in pre-operational mode or in its fallback state. | |
| on or blink 1** | blink 1** | | | A nonfatal error has been detected—e.g., a counter overflow. | Cycle power, restart communications |
| | blink 2*** | | | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | | | The relays on this module are operational while the rest of the island modules are in their fallback states—i.e., it is a reflex action module. | |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

**** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

# STB DRC 3210 Field Wiring

**Summary**

The STB DRC 3210 module uses two five-terminal field wiring connectors. Relay output 1 is wired from the top connector, and relay output 2 is wired from the bottom connector. The choices of connector types and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:
- two STB XTS 1110 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2110 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have five connection terminals, with a 5.08 mm (0.2 in) pitch between each pin.

**Field Devices**

The STB DRC 3210 module provides two form C relay outputs that can be independently field wired as N.O. and/or N.C. contacts The module is designed to handle high duty cycles and to control continuous-operation equipment. It can switch 24 VDC, 115 VAC, and/or 230 VAC field devices that draw up to 2 A/relay at 30 degrees C.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Local electrical codes take precedence over our recommended wire size for the protective earth (PE) connection on pin 5.

**External Fusing**

The STB DRC 3210 does not provide internal over-current protection. You must provide external fuse protection with 2.0 A time-lag fuses (such as the Wickmann 1911200000). If you do not use fuses, an over-current condition could damage the module. Place a fuse in series with each relay on the common line (pin 1).

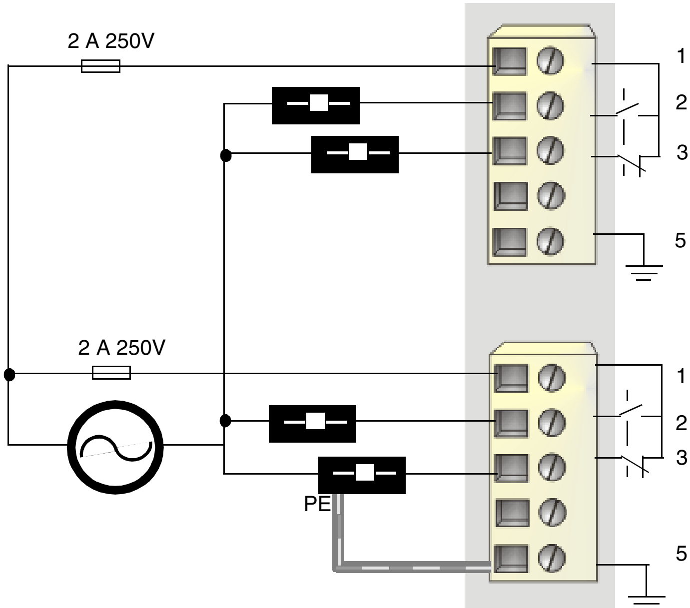
**Field Wiring Pinout**

The top connector supports relay 1, and the bottom connector supports relay 2. Field actuators can be wired as normally open (N.O.) or normally closed (N.C.). Two- and three-wire actuators are supported.
The table below shows the pinouts:

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | relay common 1 | relay common 2 |
| 2 | N.O. connection for relay 1 | N.O. connection for relay 2 |
| 3 | N.C. connection for relay 1 | N.C. connection for relay 2 |
| 4 | no connection | no connection |
| 5 | PE | PE |

## Sample Wiring Diagrams

The following field wiring example shows a N.O. device and a N.C. device wired to each connector:




**1** relay common connections

**2** N.O. connections

**3** N.C. connections

**5** PE connection point for field device (bottom)

The N.C. load on the bottom connector has a PE connection that is tied to the PE connection on the PDM base through pin 5.

## STB DRC 3210 Functional Description

**Functional Characteristics**

The STB DRC 3210 module provides two form C relay outputs that can be independently field wired as N.O. and/or N.C. contacts. Using the Advantys configuration software, you can customize the fallback states of the two relays.

**Fallback Modes**

When communications are lost between the relay module and the fieldbus master, the module's output relays must go to a known state where they will remain until communications are restored. This is known as the relay's *fallback state*. You may configure fallback states for each relay individually. Fallback configuration is accomplished in two steps:

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

All relay outputs have a fallback mode—either *predefined state* or *hold last value*. When a relay has *predefined state* as its fallback mode, it can be configured with a fallback state, either 1 or 0. When a relay 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 relays is a predefined state. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB DRC 3210 module you want to configure in the island editor. | The selected STB DDO 3200 module opens in the software module editor. |
| 2 | Expand the **+ Fallback Mode Settings** fields by clicking on the **+** sign. | A row called **+ Fallback Mode** appears. |
| 3 | Expand the **+ Fallback Mode** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 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 the range 0 to 3, where 0 means both relays hold their last values and 3 means that both relays 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.<br>When you accept a new value for **Fallback Mode**, the values associated with the channels change.<br>For example, if you choose a fallback mode value of 2, then **Channel 1** goes to hold last value and **Channel 2** goes to a predefined state. |
| 4b | To change the settings *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 1 to 0 and channel 2 to 1, the **Fallback Mode** value changes to 2. |

## Fallback States

If a relay'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:

- 0 indicates that the predefined fallback state of the relay is *de-energized*
- 1 indicates that the predefined fallback state of the relay is *energized*

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

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Make sure that the **Fallback Mode** value for the relay you want to configure is 1 (*predefined state*). | If the **Fallback Mode** value is 0 (*hold last value*), any value entered in the associated **Predefined Fallback Value** row will be ignored. |
| 2 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | A row called **+ Predefined Fallback Value** appears. |
| 3 | Expand the **+ Predefined Fallback Value** row further by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4a | 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 relays will turn off as their fallback state and 3 means that both relays will turn on as their predefined state. | 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.<br>When you accept a new **Predefined Fallback Value**, the values associated with the channels change.<br>For example, if you choose a fallback state value of 2, then **Channel 2** will turn on as its fallback state. **Channel 1** will either turn off or be ignored, depending on its fallback mode setting. |
| 4b | To change a setting *at the channel level*, double click on the channel value(s) you want to change, then select the desired setting(s) from the pull-down menu(s). Select 0 if you want the fallback state to be *relay de-energized*; select 1 if you want the fallback state to be *relay energized*. | When you accept a new value for a channel setting, the value for the module in the **Fallback Mode** row changes.<br>For example, if you set channel 2 to 1 and leave channel 1 at 0, the **Predefined Fallback Value** value changes from 0 to 2. |

## STB DRC 3210 Data for the Process Image

**Representing Relay Output Data**

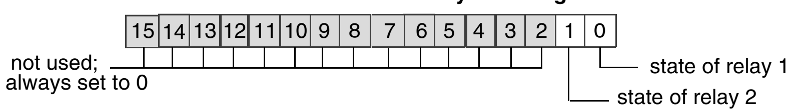
The NIM keeps a record of relay data in one block of registers in the process image and a record of relay status in another block of registers in the process image. Relay data is written to the output data block by the fieldbus master and is used to update the relay module. The information in the status block is provided by the module itself. This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB DRC 3210 module are based on its physical location on the island bus.

**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.

**Relay Data Register**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in this data block. The STB DRC 3210 uses one register in the output data block.
The STB DRC 3210's data register represents the energized/de-energized states of the two relays:

**STB DRC 3210 Relay Data Register**




These values are written to the island bus by the fieldbus master.

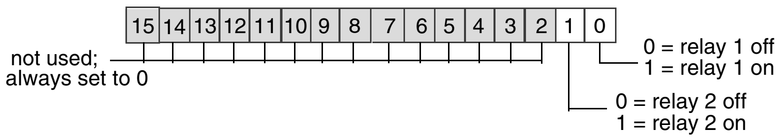
## Relay Status Registers

The echo output data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represents the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB DRC 3210 is represented by one register that echoes the relay data register.

This register represents the data that has just been sent to the field devices by the relay module.

**STB DRC 3210 Echo Relay Data Register**




Under most normal operating conditions, the bit values in this register should be an exact replica of the bits in the relay data register. A difference between the bit values in the output data register and the echo register could result from a relay channel used for a reflex action, where the channel is updated directly by the output module instead of by the fieldbus master.

## STB DRC 3210 Specification

**Table of Technical Specifications**

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

| | | |
|---|---|---|
| description | | form C N.O./N.C. contact relay pairs |
| number of relay channels | | two |
| module width | | 18.4 mm (0.72 in) |
| I/O base | | STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) |
| hot swapping supported | | yes |
| relay contact life | mechanical | 10,000,000 operations |
| | electrical | 10,000 operations (resistive load @ maximum voltage and current |
| output surge protection | | metal oxide varistor |
| output voltage | working DC | 5 ... 30 VDC |
| | working AC | 20 ... 250 VAC |
| isolation voltage | logic bus-to-actuator bus | 1500 VDC for 1 min |
| | point-to-point | 500 VAC for 1 min |
| | field-to-logic bus | 1780 VAC for 1 min |
| nominal logic bus current consumption | | 60 mA |
| nominal actuator bus current consumption | | 16 mA, with no load |
| maximum load current | | 2.0 A/relay |
| minimum load current | | 50 mA |
| output response time | off-to-on | 5.25 ms |
| | on-to-off | 6.75 ms |
| maximum surge current | | 20 A/relay capacitive load @ $t = 10$ ms |
| switching capability | | 600 VA resistive load |
| fallback mode | default | predefined |
| | user-configurable setting* | hold last value |
| | | predefined fallback value on one or both relays |
| fallback states (when *predefined* is the fallback mode) | default | both relays de-energized |
| | user-configurable settings* | each relay configurable for energized or de-energized |

| | | |
|---|---|---|
| field power requirements | coil voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| coil protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# The Advantys STB Analog Input Modules

# 6

## At a Glance

**Overview**

This chapter describes in detail the features of the analog input modules in the Advantys STB family.

**What's in this Chapter?**

This chapter contains the following sections:

# 6.1 STB AVI 1270 Analog Voltage Input Module (two-channel, isolated, +/-10 V, 11-bit + sign)

## At a Glance

**Overview**

This section provides you with a detailed description of the STB AVI 1270 analog input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

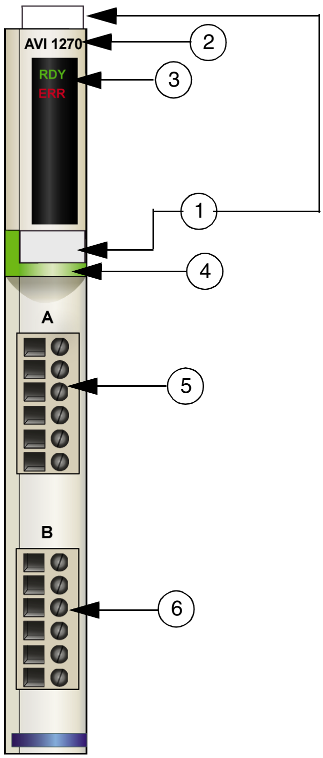
## STB AVI 1270 Physical Description

**Physical Characteristics**

The STB AVI 1270 is an Advantys STB two-channel analog input module that reads inputs from analog sensors that operate over the range -10 to +10 V. The analog portion of the module is isolated from the island's sensor bus to improve performance. To take advantage of this internal isolation feature, the sensors must be powered from an external power supply. If isolation is not required, you can use the module to deliver field power to the sensors—24 VDC for sensor 1 from the top connector, and 24 VDC for sensor 2 from the bottom connector. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels
**2** model name
**3** LED array
**4** light green identification stripe, indicating an analog input module
**5** sensor 1 connects to the top field wiring connector
**6** sensor 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:

- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module uses 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:

- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Module Dimensions**

The STB AVI 1270 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

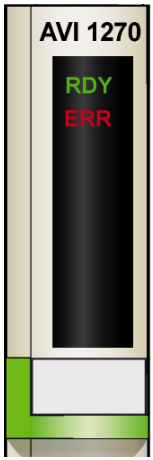
## STB AVI 1270 LED Indicator

**Purpose**

The two LEDs on the STB AVI 1270 provide visual indications of the module's operating status. Their location and 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):

| RDY | ERR | Meaning | What to Do |
|---|---|---|---|
| off | off | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | Auto-addressing is in progress. | |
| on | off | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| on | on | The watchdog has timed out. | Cycle power, restart the communications |
| blink 1** | | The module is in pre-operational mode. | |
| | flicker* | Field power absent, a PDM short circuit detected, or OVE/UVE. | Check power |
| | blink 1** | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | The island bus is not running. | Check network connections, replace NIM |

* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.

** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.

*** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes.

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported immediately.

## STB AVI 1270 Field Wiring

**Summary**

The STB AVI 1270 module uses two six-terminal field wiring connectors. Analog sensor 1 is wired to the top connector, and analog sensor 2 is wired to the bottom connector. The choices of connectors and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Sensors**

The STB AVI 1270 module handles analog input data from two +/-10 V single-ended analog field sensors. Data on each channel has a resolution of 11 bits plus the sign bit. The module is designed to support high duty cycles and to control continuous-operation equipment.
The module supports two-, three- and four-wire devices that produce current up to100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C. If you want to maintain the module's built-in isolation between the analog portion of the module and the island's sensor bus, you can make only two-wire connections.

**Note:** An open circuit in the input cabling will cause a voltage with an indeterminate value to be reported.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Shielded twisted-pair cable is recommended. The shield should be tied to an external clamp that is tied to protective earth.

**Field Wiring Pinout**

The top connector supports analog sensor 1, and the bottom connector supports analog sensor 2. Four field wires may be used on each connector—on pins 1, 3, 4 and 6.

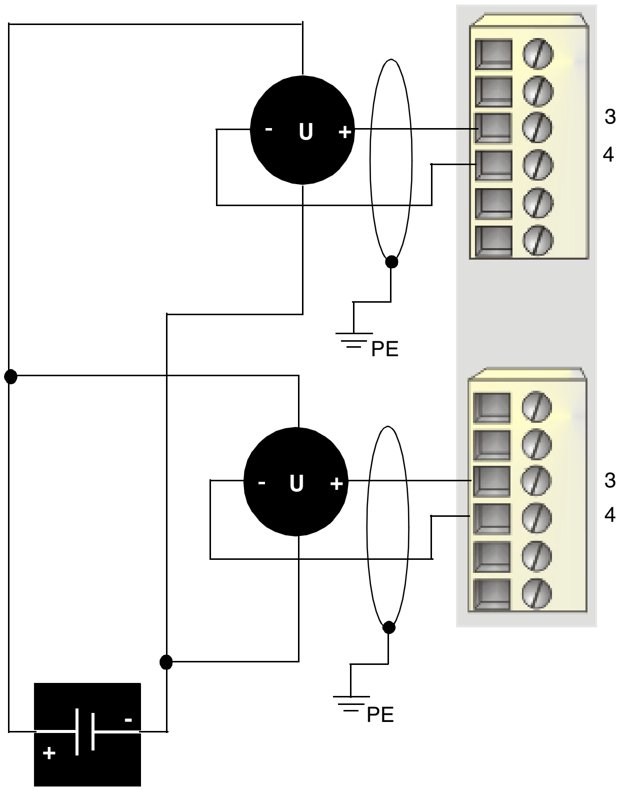
The connections on pin 1 and pin 6 are optional, and using these pins will defeat the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 2 and 5 of either connector:

| Pin | Top Connections | Bottom Connections |
|---|---|---|
| 1 | +24 VDC from sensor bus for field device accessories | +24 VDC from sensor bus for field device accessories |
| 2 | no connection | no connection |
| 3 | input from sensor 1 | input from sensor 2 |
| 4 | analog input return | analog input return |
| 5 | no connection | no connection |
| 6 | field power return (to the module) | field power return (to the module) |

The analog returns (pin 4) for each channel are internally connected—therefore there is no channel-to-channel isolation.

**Sample Wiring Diagrams**

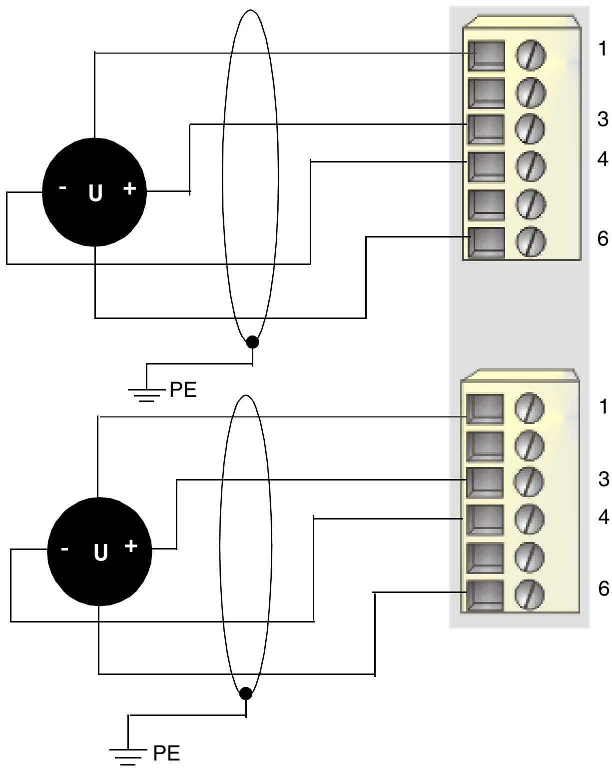
The following field wiring example shows how two isolated analog sensors can be wired to the STB AVI 1270 module. An external power supply is required to power the sensors:




**3** inputs from sensor 1 (top) and sensor 2 (bottom)

**4** returns from input 1 (top) and input 2 (bottom)

If you want to use 24 VDC from the island's sensor bus to power the analog field devices, this power can be delivered through the input module. To do this, use pins 1 and 6 as follows:




**1** +24 VDC for sensor 1 (top) and for sensor 2 (bottom)

**3** inputs from sensor 1 (top) and sensor 2 (bottom)

**4** returns from input 1 (top) and input 2 (bottom)

**6** field power return from sensor 1 (top) and sensor 2 (bottom)

Remember that using pins 1 and 6 will defeat the built-in isolation between the analog portion of the module and the island's sensor bus.

## STB AVI 1270 Functional Description

**Functional Characteristics**

The STB AVI 1270 module is a two channel module that handles analog input data from two +/-10 V single-ended analog field sensors. The following operating parameters are user-configurable:
- offset and maximum count on each analog input channel
- a sampling of analog input values used to average the signal

**Offset and Maximum Count**

You may apply an offset value to the low end of the operating voltage range and a maximum count to the high end of the voltage range. This feature allows you to calibrate the analog input channels to match your equipment.

Offset is configured as a signed integer. It may be a decimal or hexadecimal value in the range -8191 to +8191 (0xE001 to 0x1FFF), representing a voltage offset in the range -2.56 to +2.56 V. By default, the offset on both channels is 0 (indicating no offset applied).

Maximum count is configured as a decimal or hexadecimal value in the range 23 800 to 32 760, representing a voltage in the range 7.44 to 10.24 V. By default, the maximum count on both channels is 32 000 (indicating no gain applied).

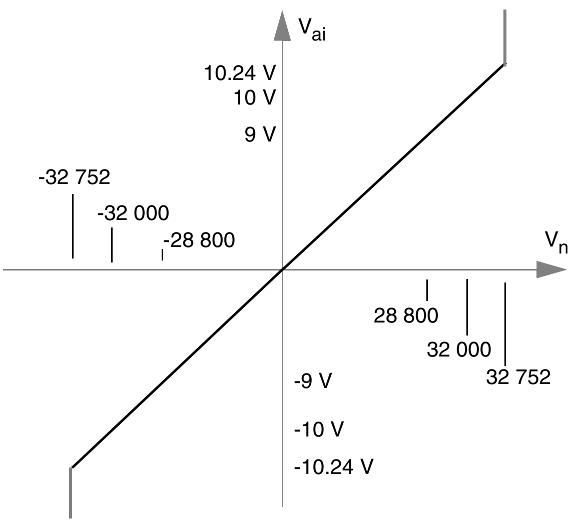
Offset and maximum count may be applied on each channel independently.

These parameters are provided only for sensor compensation, not for scaling. The module is able to measure over the physical range of -10 to +10 VDC. An offset adjustment will move the interpretation of 0, and a max count adjustment will move the interpretation of only the high end of the range.

An ideal linear voltage representation (one without offset or max count adjustments) is interpreted using the
formula:

$$V_n = 3200 \times V_{ai}$$

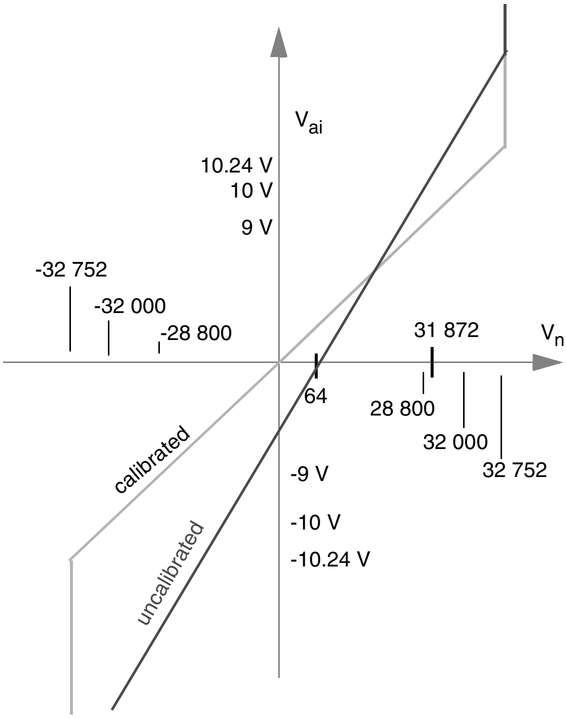
where $V_n$ is the numerical count and $V_{ai}$ is the analog input voltage:



However, in systems that require calibration, the formula may actually be:

$$V_n = a \times V_{ai} + b$$

(In a perfectly calibrated system, a = 32 000 and b = 0.)
For example, if you use the Advantys configuration software to calibrate an offset of +64 at 0 V and a max count 0f 31 872 at 10 V, the system could be represented as follows:




Here are some voltage representations after calibration with offset and max count:

| $V_{ai}$ | **Uncalibrated** | **Calibrated** |
|---|---|---|
| 0 V | 64 | 0 |
| 2.5 V | 8016 | 8000 |
| 5 V | 15 968 | 16 000 |
| 7.5 V | 23 920 | 24 000 |
| 10 V | 31 872 | 32 000 |

### Determining Offset and Maximum Count Values

To calibrate offset and maximum count for an analog channel:

| Step | Action | Result |
|---|---|---|
| 1 | Connect the Advantys configuration software to a physical island. | The software will be in online mode. |
| 2 | Double-click on the appropriate STB AVI 1270 module in the island editor. | The module editor for the selected STB AVI 1270 module will open. |
| 3 | Open the I/O Data Animation sheet, which can be accessed from the module editor in the Advantys configuration software when it is online. | |
| 4 | Apply 0 V to the appropriate field sensor and read the analog input channel's data in the I/O Data Animation sheet. | Ideally, the channel data should read 0. If this is true, then no offset adjustment is necessary. If the data value is not 0, make a note of it. |
| 5 | Now apply 10 V to the field sensor and read the analog input channel's data in the module's I/O Data Animation sheet. | Ideally, the channel data should read 32 000. If this is true, then no maximum count adjustment is necessary. If the data value is not 32 000, make a note of it. |
| 6 | If adjustments need to be made, take the Advantys configuration software offline. | |
| 7 | Double-click on the appropriate STB AVI 1270 module in the island editor. | The module editor for the selected STB AVI 1270 module will open. |
| 8 | Open the Properties sheet in the module editor. In the Offset value field, enter the data value that you read when 0 V was applied. In the Max. Count value field, enter the data value that you read when 10 V was applied. | |
| 9 | Save the new configuration parameters. | When the configuration is downloaded to the physical island, the new offset and maximum count parameters will be applied to the analog input channel. |

## Averaging

You may apply a filter that will smooth the curve of your analog inputs to the STB AVI 1270. The Advantys configuration software allows you to average over a specified number of samples. By default, the sampling rate is 1 (no averaging); you may a filtering average of up to eight samples. To configure an averaging sample:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB AVI 1270 module you want to configure in the island editor. | The selected STB AVI 1270 module opens in the software module editor. |
| 2 | In the **Value** column of the **Averaging** row, enter a decimal or hexadecimal value in the range 1 to 8. | When you select the **Averaging** value, the max/min values of the range appear at the bottom of the module editor screen. |

Averaging is applied at the module level, not on a per-channel basis.

## STB AVI 1270 Data and Status for the Process Image

**Representing the Analog Input Data**

The STB AVI 1270 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in four 16-bit registers—two data registers (one for each channel) and two status registers (one per channel). The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.

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. The STB AVI 1270 module is represented by four contiguous registers in this block, which appear in the following order:

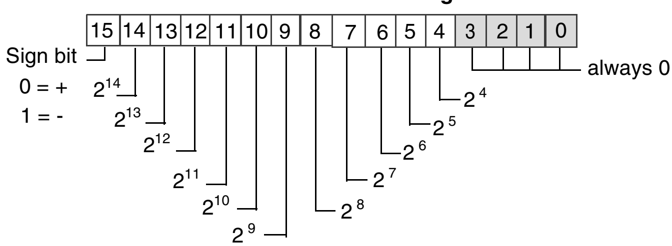
- The data in input channel 1
- the status of input channel 1
- the data in input channel 2
- the status of input channel 2

The specific registers used are based on the module's physical location on the island bus.

**Input Data Registers**

The first and third STB AVI 1270 registers in the input block of the process image are the data words. Each register represents the input voltage of a channel in the IEC data format. The data has 11-bit + sign resolution. The bit structure in each data register is as follows:

**STB AVI 1270 Data Register Format**



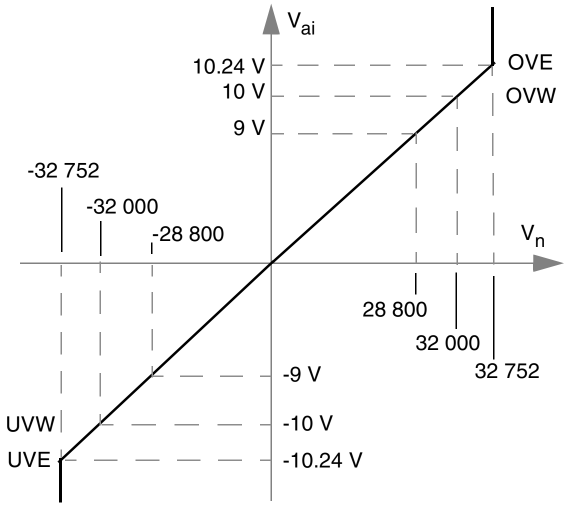

There are 12 significant bits in each data word—bits 15 through 4. They allow you to represent voltage data with integer values ranging from -32 752 to +32 752 in increments of 16. When the sign bit (bit 15) is 0, the value is positive; when bit 15 is 1, the value is negative.

In an ideal linear voltage representation (one without offset or max count settings (See *Offset and Maximum Count, p. 224*)), the value 32 000 represents 10 V and -32 000 represents -10 V. If the output value exceeds 32 000, the output channel reports an over-voltage warning (OVW). If the output value drops below -32 000, the output channel reports an under-voltage warning (UVW). If the output value reaches 32 752, an over-voltage error (OVE) is reported. If it drops to -32 752, an under-voltage error (UVE) is reported.

An ideal linear voltage representation (one without offset or max count settings (See *Offset and Maximum Count, p. 224*)) is interpreted using the formula:

$$V_n = 3200 \times V_{ai}$$

where *Vn* is the numerical count and *Vai* is the analog input voltage.

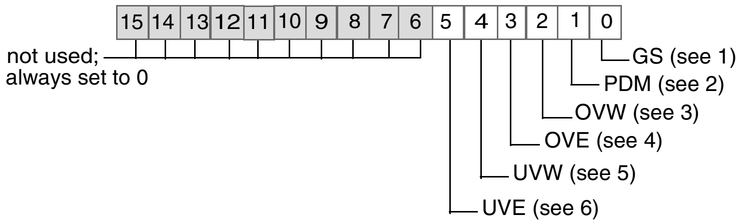



However due to use of manufacturing offset (and also user-configurable offset and max count, if used), an OVW may be generated before the reported count reaches 32000. Similarly, the reported count may be at 32 752, but you may not receive the expected OVE*Input Data Registers, p. 228*.

## Input Status Registers

The second and fourth STB AVI 1270 registers in the input block of the process image are the status registers for the two analog input channels. The six LSBs in each register represent the status of each input channel:

**STB AVI 1270 Status Register Format**




**1** Bit 0 is the global status (GS) bit for the input channel. It has a value of 0 when no errors have been detected. It has a value of 1 when bit 1, bit 3, and/or bit 5 has a value of 1.

**2** Bit 1 represents the status of PDM voltage on the island's sensor bus. It has a value of 0 when no PDM voltage errors are detected. It has a value of 1 if sensor power is absent. A PDM short turns on the GS bit (bit 0).

**3** Bit 2 represents the presence or absence of an OVW. It has a value of 0 when the voltage is less than or equal to 10 V. It has a value of 1 when the voltage is greater than 10 V. An OVW in the STB AVI 1270 does not turn on the GS bit (bit 0).

**4** Bit 3 represents the presence or absence of an OVE. It has a value of 0 when the voltage is less than 10.24 V and a value of 1 when the voltage equals 10.24 V. An OVE in the STB AVI 1270 turns on the GS bit (bit 0).

**5** Bit 4 represents the presence or absence of a UVW. It has a value of 0 when the voltage is greater than or equal to -10 V and a value of 1 when the voltage is below -10 V. A UVW in the STB AVI 1270 does not turn on the GS bit (bit 0).

**6** Bit 5 represents the presence or absence of a UVE. It has a value of 0 when the voltage is greater than -10.24 V) and a value of 1 when the voltage equals -10.24 V). A UVE in the STB AVI 1270 turns on the GS bit (bit 0).

> **Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
> Field power faults that are local to the input module are reported immediately.

## STB AVI 1270 Specifications

### Table of Technical Specifications

The STB AVI 1270 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | two single-ended analog voltage input channels |
| analog input voltage range | | +/- 10 V |
| resolution | | 11 bits + sign |
| returned data format | | IEC |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| nominal logic bus current consumption | | 60 mA |
| nominal sensor bus current consumption | | 30 mA, with no load |
| hot swapping supported | | yes |
| input response time | nominal | 5.0 ms both channels |
| isolation | field-to-bus | 1500 VDC for 1 min |
| | analog module-to-sensor bus | 500 VAC rms (when sensor bus is not used for field power |
| input filter | | single low-pass filter at a nominal 25 Hz |
| integral linearity | | +/- 0.2% of full scale, typical |
| differential linearity | | monotonic |
| absolute accuracy | | +/- 0.5% of full scale @ 25°C |
| temperature drift | | typically +/- 0.01% of full scale/ °C |
| input impedance | | 400 kΩ @ DC |
| source impedance | | 1 kΩ max. |
| maximum input voltage | | 50 VDC without damage |
| addressing requirement | | four words (two/channel) |
| offset calibration constant* | | configurable in the range -8191 ... +8191 (representing -2.56 ... +2.56 V) |
| maximum count* | | configurable in the range 23 800 ... 32 760 (representing 7.44 ... 10.24 V) |
| sensor bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | yes |

| | | |
|---|---|---|
| field power requirements | field voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 5 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 6.2 STB ACI 1230 Analog Current Input Module (two-channel, 12-bit single-ended, 0 ... 20 mA)

## At a Glance

**Overview**

This section provides you with a detailed description of the STB ACI 1230 analog input module—its physical design and functional capabilities.

**What's in this Section?**

This section contains the following topics:

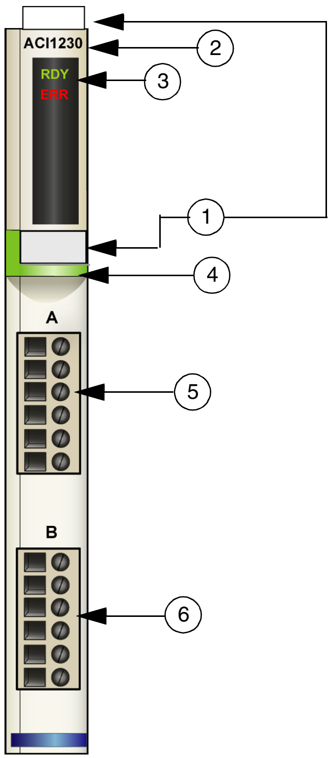
## STB ACI 1230 Physical Description

**Physical Characteristics**

The STB ACI 1230 is a single-ended two-channel analog current input module that reads inputs from analog sensors that operate over the range 0 to 20 mA. The analog portion of the module is isolated from the island's sensor bus to improve performance. To take advantage of this internal isolation feature, the sensors must be powered from an external power supply. If isolation is not required, you can use the module to deliver field power to the sensors—24 VDC for sensor 1 from the top connector, and 24 VDC for sensor 2 from the bottom connector. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels
**2** model name
**3** LED array
**4** light green identification stripe, indicating an analog input module
**5** sensor 1 connects to the top field wiring connector
**6** sensor 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module uses 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Dimensions**

The STB ACI 1230 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

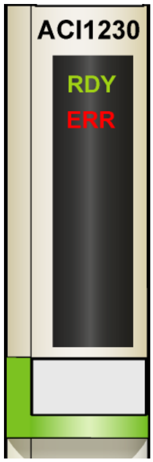
## STB ACI 1230 LED Indicator

**Purpose**

The two LEDs on the STB ACI 1230 provide visual indications of the module's operating status. Their location and meanings are described below.

**Location**

The 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):

| RDY | ERR | Meaning | What to Do |
|---|---|---|---|
| off | off | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | Auto-addressing is in progress. | |
| on | off | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| on | on | The watchdog has timed out. | Cycle power, restart the communications |
| blink 1** | | The module is in pre-operational mode. | |
| | flicker* | Field power absent or a PDM short circuit detected. | Check power |
| | blink 1** | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | The island bus is not running. | Check network connections, replace NIM |
| * flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms. | | | |
| ** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes. | | | |
| *** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | |

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported immediately.

## STB ACI 1230 Field Wiring

**Summary**

The STB ACI 1230 module uses two six-terminal field wiring connectors. Analog sensor 1 is wired to the top connector, and analog sensor 2 is wired to the bottom connector. The choices of connectors and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Sensors**

The STB ACI 1230 module handles analog input data from two 0 to 20 mA single-ended analog field sensors. Data on each channel has a resolution of 12 bits. The module is designed to support high duty cycles and to control continuous-operation equipment.

The module supports two-, three- and four-wire devices that produce current up to100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C. If you want to maintain the module's built-in isolation between the analog portion of the module and the island's sensor bus, you can make only two-wire connections.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).

Shielded twisted-pair cable is recommended. The shield should be tied to an external clamp that is tied to protective earth.

## Field Wiring Pinout

The top connector supports analog sensor 1, and the bottom connector supports analog sensor 2. Four field wires may be used on each connector—on pins 1, 2, 4 and 6.

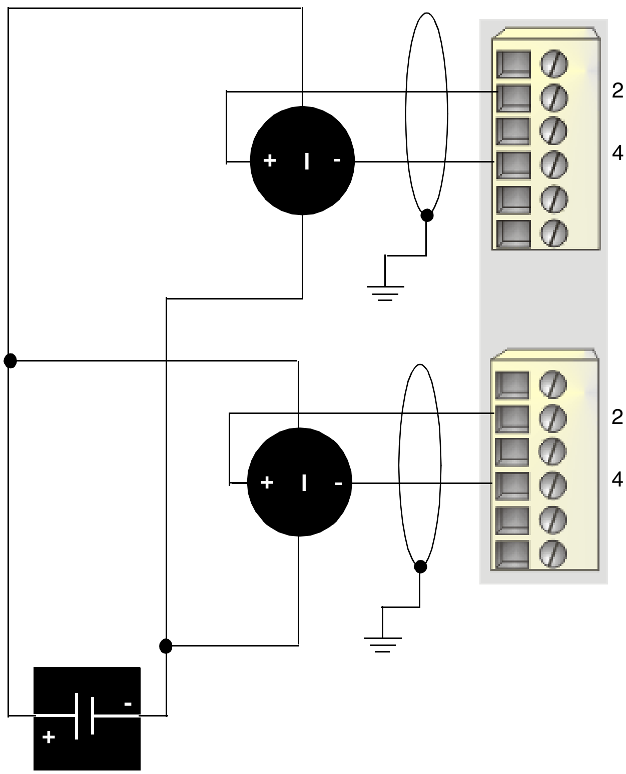
The connections on pins 1 and 6 are optional, and using these pins will defeat the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 3 and 5 of either connector:

| Pin | Top Connections | Bottom Connections |
|---|---|---|
| 1 | +24 VDC from sensor bus for field device accessories | +24 VDC from sensor bus for field device accessories |
| 2 | input from sensor 1 | input from sensor 2 |
| 3 | no connection | no connection |
| 4 | analog input return | analog input return |
| 5 | no connection | no connection |
| 6 | field power return (to the module) | field power return (to the module) |

The analog returns (pin 4) for each channel are internally connected—therefore there is no channel-to-channel isolation.

**Sample Wiring Diagrams**

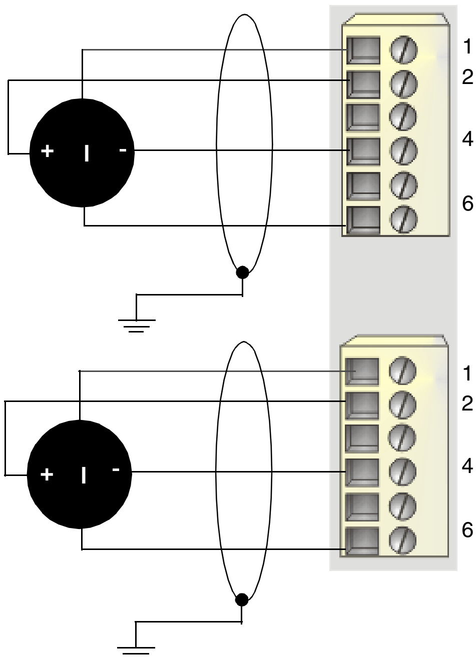
The following field wiring example shows how two isolated analog sensors can be wired to the STB ACI 1230 module. An external power supply is required to power the sensors:




**2** inputs from sensor 1 (top) and sensor 2 (bottom)

**4** returns from input 1 (top) and input 2 (bottom)

If you want to use 24 VDC from the island's sensor bus to power the analog field devices, this power can be delivered through the input module. To do this, use pins 1 and 6 as follows:




**1** +24 VDC for sensor 1 (top) and for sensor 2 (bottom)

**2** inputs from sensor 1 (top) and sensor 2 (bottom)

**4** returns from input 1 (top) and input 2 (bottom)

**6** field power return from sensor 1 (top) and sensor 2 (bottom)

Remember that using pins 1 and 6 will defeat the built-in isolation between the analog portion of the module and the island's sensor bus.

## STB ACI 1230 Functional Description

**Functional Characteristics**

The STB ACI 1230 module is a two channel module that handles analog input data from two field sensors operating in a 0 to 20 mA current range. The following operating parameters are user configurable:

- offset and maximum count on each analog input channel
- a sampling of analog input values used to average the signal

**Offset and Maximum Count**

You may apply an offset value to the low end of the operating current range and a maximum count to the high end of the current range. This feature allows you to calibrate the analog input channels to match your equipment.

Offset is configured as a signed integer. It may be a decimal or hexadecimal value in the range -8191 to +8191 (0xE001 to 0x1FFF), representing a current offset in the range -5.12 to +5.12 mA. By default, the offset on both channels is 0 (indicating no offset applied).

Maximum count is configured as a decimal or hexadecimal value in the range 23 800 to 32 760, representing a current in the range 14.88 to 20.48 mA. By default, the maximum count on both channels is 32 000 (indicating no gain applied).

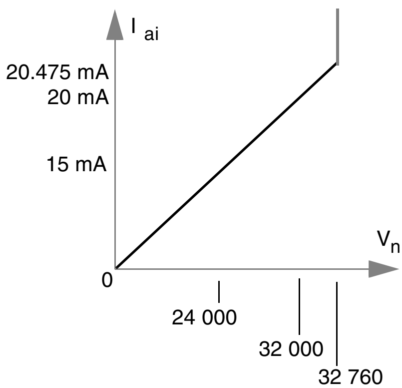
Offset and maximum count may be applied on each channel independently.

These parameters are provided only for sensor compensation, not for scaling. The module is able to measure over the physical range of 0 to 20 mA. An offset adjustment will move the interpretation of 0, and a max count adjustment will move the interpretation of only the high end of the range.

An ideal linear current representation (one without offset or max count adjustments) is interpreted using the formula:

$$V_n = 1600 \times I_{ai}$$

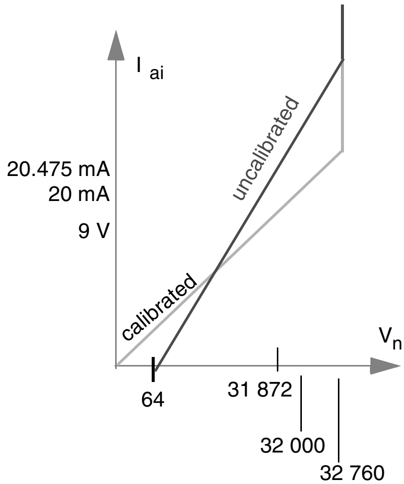
where $V_n$ is the numerical count and $I_{ai}$ is the analog input current:



However, in systems that require calibration, the formula may actually be:

$$V_n = a \times I_{ai} + b$$

(In a perfectly calibrated system, a = 32 000 and b = 0.)
For example,  you use the Advantys configuration software to calibrate an offset of +64 at 0 mA and a max count 0f 31 744 at 20 mA, the system could be represented as follows:




Here are some current representations after calibration with offset and max count:

| $I_{ai}$ | Uncalibrated | Calibrated |
|---|---|---|
| 0 mA | 64 | 0 |
| 5 mA | 7984 | 8000 |
| 10 mA | 15 904 | 16 000 |
| 15 mA | 23 824 | 24 000 |
| 20 mA | 31 744 | 32 000 |

### Determining Offset and Maximum Count Values

To apply offset and maximum count to an analog channel:

| Step | Action | Result |
|---|---|---|
| 1 | Connect the Advantys configuration software to a physical island. | The software will be in online mode. |
| 2 | Double-click on the appropriate STB ACI 1230 module in the island editor. | The module editor for the selected STB ACI 1230 module will open. |
| 3 | Open the I/O Data Animation sheet, which can be accessed from the module editor in the Advantys configuration software when it is online. | |
| 4 | Apply 0 mA to the appropriate field sensor and read the analog input channel's data in the I/O Data Animation sheet. | Ideally, the channel data should read 0. If this is true, then no offset adjustment is necessary. If the data value is not 0, make a note of it. |
| 5 | Now apply 20 mA to the field sensor and read the analog input channel's data in the module's I/O Data Animation sheet. | Ideally, the channel data should read 32 000. If this is true, then no maximum count adjustment is necessary. If the data value is not 32 000, make a note of it. |
| 6 | If adjustments need to be made, take the Advantys configuration software offline. | |
| 7 | Double-click on the appropriate STB ACI 1230 module in the island editor. | The module editor for the selected STB ACI 1230 module will open. |
| 8 | Open the Properties sheet in the module editor. In the Offset value field, enter the data value that you read when 0 mA was applied. In the Max. Count value field, enter the data value that you read when 20 mA was applied. | |
| 9 | Save the new configuration parameters. | When the configuration is downloaded to the physical island, the new offset and maximum count parameters will be applied to the analog input channel. |

## Averaging

You may apply a filter that will smooth the curve of your analog inputs to the STB ACI 1230. The Advantys configuration software allows you to average over a specified number of samples. By default, the sampling rate is 1 (no averaging); you may a filtering average of up to eight samples. To configure an averaging sample:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ACI 1230 module you want to configure in the island editor. | The selected STB ACI 1230 module opens in the software module editor. |
| 2 | In the **Value** column of the **Averaging** row, enter a decimal or hexadecimal value in the range 1 to 8. | When you select the **Averaging** value, the max/min values of the range appear at the bottom of the module editor screen. |

Averaging is applied at the module level, not on a per-channel basis.

## STB ACI 1230 Data and Status for the Process Image

**Representing the Analog Input Data**

The STB ACI 1230 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in four 16-bit registers—two data register (one for each channel) and two status registers (one per channel). The information can be read by the fieldbus master or by an HMI panel connected to the NIM's CFG port.

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. The STB ACI 1230 module is represented by four contiguous registers in this block, which appear in the following order:

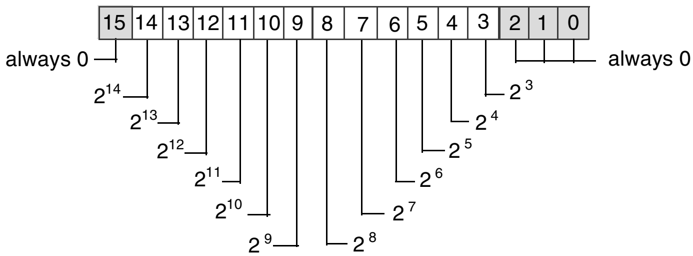
- The data in input channel 1
- the status of input channel 1
- the data in input channel 2
- the status of input channel 2

The specific registers used are based on the module's physical location on the island bus.

**Data Word Structure**

The first and third STB ACI 1230 registers in the input block of the process image are the data words. Each register represents the input voltage of a channel in the IEC data format. The data has 12-bit resolution. The bit structure in each data register is as follows:

**STB ACI 1230 Data Register Format**



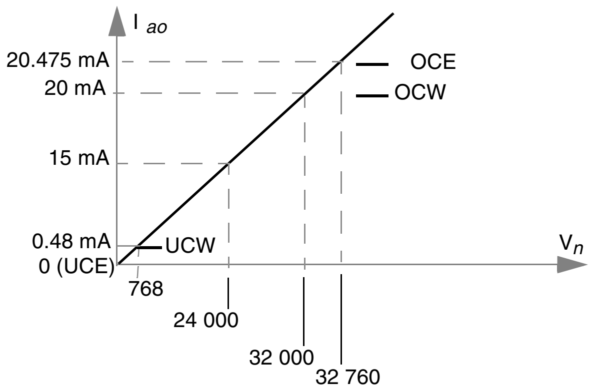

There are 12 significant bits in each data word—bits 14 through 3. They allow you to represent current data with integer values ranging from 0 to 32,760 in increments of eight.

The value 32 000 represents 20 mA. If the output value exceeds 32 000, the output channel reports an over-current warning (OCW). If the output value reaches 32 760, an over-current error (OCE) is reported. If the output value drops below 768, the output channel reports an under-current warning (UCW), and if the value goes to 0 the channel reports an under-current error (UCE).

Linear current representations can be interpreted using the formula:

$$V_n = 1600 \times I_{ai}$$

where V*n* is the numerical count and I*ai* is the analog input current.

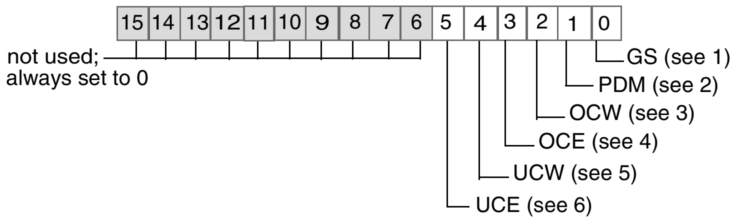



The sign bit (bit 15) is always 0, indicating that negative values are not represented. The three least significant bits in the data words are not used. Any values that might appear in these bits are ignored.

## Status Byte Structure

The second and fourth STB ACI 1230 registers in the input block of the process image are the status words. The STB ACI 1230 can detect and report current overflow conditions.
The six LSBs in each register represent the status of each input channel:

**STB ACI 1230 Status Register Format**




**1** Bit 0 represents global status (GS). It has a value of 0 when no errors have been detected. It has a value of 1 when bit 1 and/or bit 3 has a value of 1.

**2** Bit 1 represents the status of PDM voltage on the island's sensor bus. It has a value of 0 when no PDM voltage errors are detected. It has a value of 1 if sensor power has been shorted. A PDM short turns on the GS bit (bit 0).

**3** Bit 2 represents the presence or absence of an OCW. It has a value of 0 when the current is less than 20 mA. It has a value of 1 when the current is greater than 20 mA. An OCW in the STB ACI 1230 does not turn on the GS bit (bit 0).

**4** Bit 3 represents the presence or absence of an OCE. It has a value of 0 when the current is less than 20.475 mA and a value of 1 when the current reaches 20.475 mA. An OCE in the STB ACI 1230 turns on the GS bit (bit 0).

**5** Bit 4 represents the presence or absence of an UCW. It has a value of 0 when the current is greater than 0.48 mA and a value of 1 when the current falls to 0.48 mA. An OCE in the STB ACI 1230 does not turn on the GS bit (bit 0).

**6** Bit 5 represents the presence or absence of UCE. It has a value of 0 when the current is greater than 0 mA and a value of 1 when the current equals 0 mA.

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported immediately.

## STB ACI 1230 Specifications

### Table of Technical Specifications

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

| | | |
|---|---|---|
| description | | two single-ended analog current input channels |
| analog current range | | 0 ... 20 mA |
| resolution | | 12 bits |
| returned data format | | IEC |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| nominal logic bus current consumption | | 60 mA |
| nominal sensor bus current consumption | | 30 mA, with no load |
| hot swapping supported | | yes |
| input response time | nominal | 5.0 ms both channels |
| isolation | field-to-bus | 1500 VDC for 1 min |
| | analog module-to-sensor bus | 500 VAC rms (when sensor bus is not used for field power |
| input filter | | single low-pass filter at a nominal 25 Hz |
| integral linearity | | +/- 0.1% of full scale |
| differential linearity | | monotonic |
| absolute accuracy | | typically +/- 0.5% of full scale @ 25°C |
| temperature drift | | typically +/- 0.01% of full scale/ °C |
| over-range margin | | 2.4% |
| input impedance | | ≤ 300 Ω |
| maximum input current | | 25 mA, 50 VDC without damage |
| addressing requirement | | four words (two/channel) |
| offset calibration constant* | | configurable in the range 0 ... +8191 (representing 0 ... +5.12 mA) |
| maximum count* | | configurable in the range 23 800 ... 32 760 (representing 14.88 ... 20.48 mA) |
| sensor bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | yes |

| | | |
|---|---|---|
| field power requirements | field voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 5 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 6.3 STB ART 0200 Analog Multirange Input Module (two-channel, isolated, 14-bit, RTD/TC/mV)

## At a Glance

**Overview**

This section provides a detailed description of the STB ART 0200 analog input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

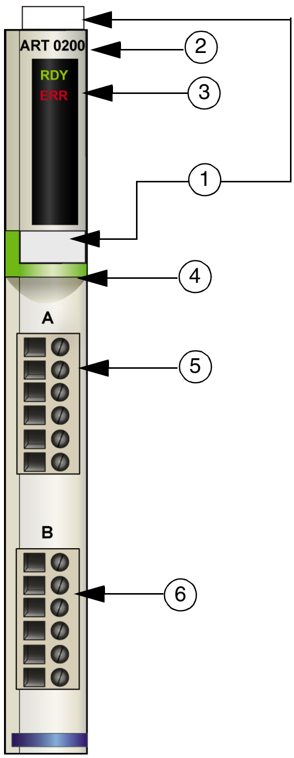
## STB ART 0200 Physical Description

**Physical Characteristics**

The STB ART 0200 is a multi-range two-channel analog input module. Each channel can be configured independently to support an RTD, thermocouple or mV analog sensor. By default, both channels support three-wire RTD sensors. You may reconfigure one or both channels using the Advantys configuration software. The STB ART 0200 takes 24 VDC from the island's sensor bus and passes power to two analog sensor devices. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** light green identification stripe, indicating an analog input module

**5** sensor 1 connects to the top field wiring connector

**6** sensor 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module uses 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Dimensions**

The STB ART 0200 has the following dimensions:

| | | |
|---|---|---|
| **width** | | 13.9 mm (0.58 in) |
| **height** | unassembled | 125 mm (4.92 in) |
| | on a base | 128.3 mm (5.05 in) |
| **depth** | unassembled | 64.1 mm (2.52 in) |
| | on a base, with connectors | 75.5 mm (2.97 in) worst case (with screw clamp connectors) |

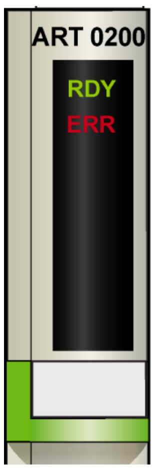
## STB ART 0200 LEDs

**Purpose**

The two LEDs on the STB ART 0200 module provide visual indications of the operating status of the module and its RDT or TC sensors. 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):

<table>
<tr><th>RDY</th><th>ERR</th><th>Meaning</th><th>What to Do</th></tr>
<tr><td>off</td><td>off</td><td>The module is either not receiving power or has failed.</td><td>Check power</td></tr>
<tr><td>flicker*</td><td>off</td><td>Auto-addressing is in progress.</td><td></td></tr>
<tr><td>on</td><td>off</td><td>The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational</td><td></td></tr>
<tr><td>on</td><td>on</td><td>The watchdog has timed out.</td><td>Cycle power, restart the communications</td></tr>
<tr><td rowspan="2">blink 1**</td><td></td><td>The module is in pre-operational mode.</td><td></td></tr>
<tr><td>blink 1**</td><td>Island bus controller error.</td><td>Replace the module.</td></tr>
<tr><td rowspan="4"></td><td rowspan="4">flicker*</td><td>Field power absent or a PDM short circuit detected.</td><td>Check power</td></tr>
<tr><td>Broken wire detected in RTD or TC mode.</td><td>Locate and repair wiring problem.</td></tr>
<tr><td>Measurement out of limits</td><td>Check configuration and application.</td></tr>
<tr><td>Internal error</td><td>Cycle power; if the problem remains replace the module.</td></tr>
<tr><td colspan="4">* flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms.</td></tr>
<tr><td colspan="4">** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes.</td></tr>
</table>

## STB ART 0200 Field Wiring

**Summary**

The STB ART 0200 module uses two six-terminal field wiring connectors. Analog sensor 1 is wired to the top connector, and analog sensor 2 is wired to the bottom connector. The choices of connectors and field wire types are described below, and some field wiring options are presented.

**Connectors**

Use a set of either:

- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These connectors each have six terminal connectors on them, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Sensors**

The STB ART 0200 allows each channel to be independently configured to support an RTD, a TC sensor or a mV sensor. An RTD may be a two-, three-, or four-wire sensor. TC and mV sensors must be two-wire devices.

If you are using channel 1 to support an RTD sensor, then do not use channel 2 for an externally cold-junction-compensated TC sensor. All other device combinations are valid.

**Field Wire Requirements**

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

- Shielded twisted-pair cable is recommended. The shield should be tied to an external clamp that is tied to functional earth on only one side of the cable and as close as possible to the module. Pin 6 (cable shield) should have *no connection*.
- In high-noise environments, double-shielded twisted-pair cable is recommended, with the inner shield tied to pin 6 and the outer shield tied to an external clamp that is tied to protective earth.

## Field Wiring Pinout

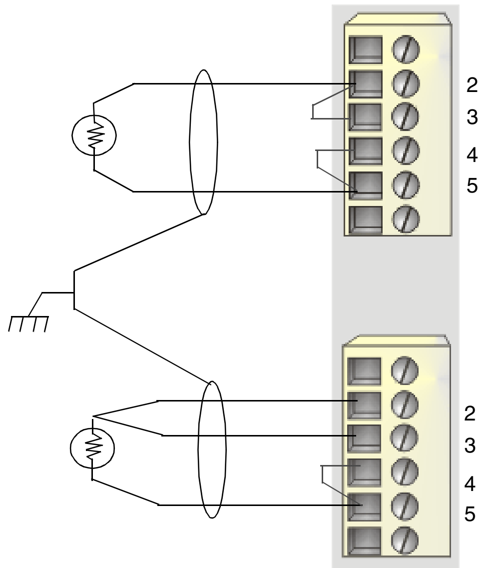
**Note:** Successful operation of the STB ART 0200 is determined by both the way the module is configured and the way it is field-wired. If you configure a channel to operate with one type of analog sensor (thermocouple, RTD or mV), you must also make the proper field connections to make the channel work properly. Similarly, you need to make sure that the module's configuration matches the field wiring. For example, if you have configured a channel to work with a thermocouple and have field-wired the module correctly, the channel will work properly. If you then disconnect the TC wiring, the module will detect a broken wire and stop communicating with that channel. If you then attempt to rewire the channel to support a different sensor type without changing the configuration, the module will not detect the new sensor.

The top connector supports sensor 1, and the bottom connector supports sensor 2. No connections are ever made on pin 1 of either connector:

| Pin | Top Connections | Bottom Connections |
|---|---|---|
| 1 | no connection | no connection |
| 2 | Always used for RTD + | Always used for RTD + |
| | RTD + connection for external cold-junction compensation on a TC sensor | |
| | no connection for TC or mV | no connection for TC or mV |
| 3 | TC + or mV + connection | TC + or mV + connection |
| | Either used or jumpered for a two-, three-, or four-wire RTD | Either used or jumpered for a two-, three-, or four-wire RTD |
| 4 | TC - or mV - connection | TC - or mV - connection |
| | Either used or jumpered for a two-, three-, or four-wire RTD | Either used or jumpered for a two-, three-, or four-wire RTD |
| 5 | Always used for RTD - | Always used for RTD - |
| | RTD - connection for external cold-junction compensation on a TC sensor | |
| | no connection for TC or mV | no connection for TC or mV |
| 6 | inner double-shield cable | cable shield |

**Sample RTD Wiring Diagrams**

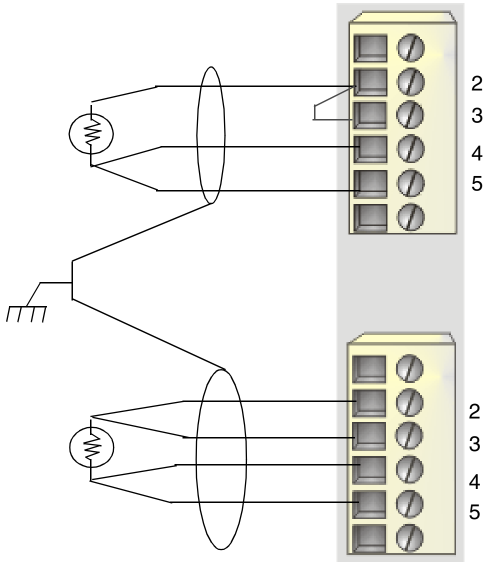
The following field wiring example shows a two-wire RTD and a three-wire RTD connected to the STB ART 0200:



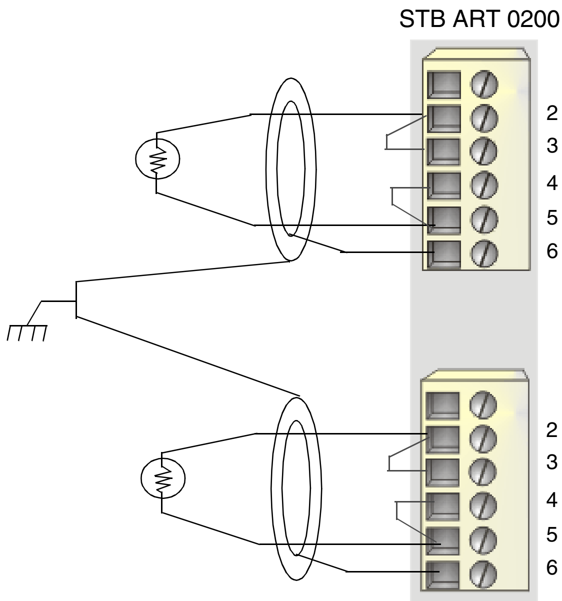

**top connector** two-wire RTD sensor

**bottom connector** three-wire RTD sensor

The next example shows three- and four-wire RTDs. The three-wire sensor on the top connector uses a jumper between pins 2 and 3. The four-wire RTD does not use jumpers:



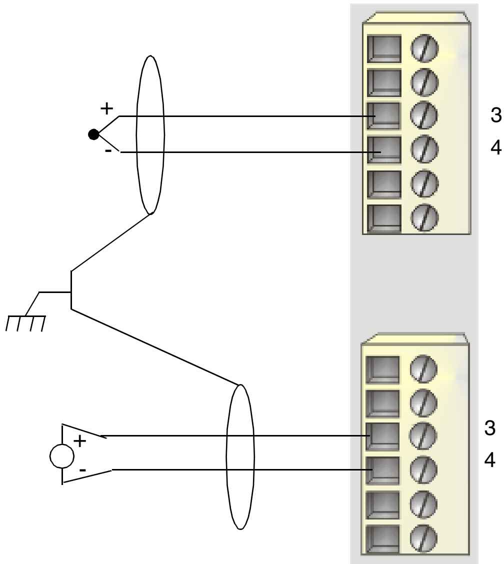
Double-shielded cable may be used with two-, three- or four-wire RTDs operating in high-noise environments. The example below shows a two-wire RTD set-up with double-shielded, twisted-pair cable:




When double-shielded twisted-pair cable is used, the inner shield is tied to pin 6. Pin 6 is not used when standard (single-shielded) twisted-pair cable is used.

## Sample mV and TC Wiring Diagram

The illustration below shows a TC sensor on the top connector and a mV sensor on the bottom connector. TC and mV applications make use of pins 3 and 4:

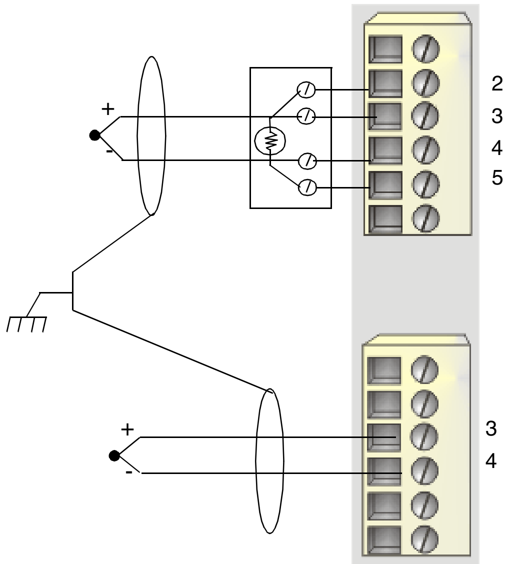



**top connector** thermocouple sensor

**bottom connector** mV sensor

**Wiring a TC with External Cold-junction Compensation**

When you apply external cold-junction compensation (See *Cold Junction Compensation for TC Sensors, p. 268*) to the module, you must use a two-wire RTD and connect it to pins 2 and 5 on the top connector. For optimum results, connect copper wires to pins 2 and 5 on the top connector and run them to an isothermal terminal block. Make the TC wiring connection to the terminal block and embed the RTD in the terminal block:




Cold-junction compensation is configured at the module level, and therefore it applies to any TC sensor(s) connected to the top and/or bottom connector on the STB ART 0200 module.

**Note:** When external cold-junction compensation is applied to the module, you may configure channel 1 to support a TC or mV sensor, but you should not configure it to support an RTD that senses process values.

## STB ART 0200 Functional Description

### Functional Characteristics

The STB ART 0200 is a two-channel analog input module with on-board diagnostics and a high degree of user configurability. Each channel can be configured independently to support a:
- RTD sensor
- thermocouple sensor
- mV sensor

Using the Advantys configuration software's module editor, you can change the operating parameters on each channel.

### Averaging

You may apply a filter that will smooth the curve of your analog inputs to the STB ART 0200. The Advantys configuration software allows you to average over a specified number of samples on a per/channel basis. By default, the sampling rate is 1 (no averaging); you may average up to eight samples. To configure an averaging sample::

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ART 0200 module you want to configure in the island editor. | The selected STB ART 0200 module opens in the software module editor. |
| 2 | Click on the **+** sign in front of the **Averaging** parameter. | Channel 1 and Channel 2 are displayed. |
| 3 | In the **Value** column of the Channel you want to configure, enter a decimal or hexadecimal value in the range 1 to 8. | When you select the Averaging value, the max/min values of the range appear at the bottom of the module editor screen. |
| 4 | Repeat step 3 if you want to apply averaging to the other channel. | |

## Frequency Rejection

The frequency rejection parameter sets the value for the maximum rejection (filtering) of power line induced noise. It is configured at the module level—the same frequency rejection value applies to both channels. This parameter applies to all three sensor types. The default value is 50 Hz. You can change the value to 60 Hz. To change the value:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ART 0200 module you want to configure in the island editor. | The selected STB ART 0200 module opens in the software module editor. |
| 2 | In the **Value** column, select the desired frequency rejection value from the pull-down menu. | The menu gives you two choices,*50 Hz* and *60 Hz*. |

## Temperature Unit

The temperature unit parameter specifies whether the temperature data for a channel will be reported in degrees C or degrees F. The default temperature unit value is degrees C. It is configured at the module level. The temperature unit applies to both channels (and to cold-junction compensation, if applicable). This parameter applies to RTD and TC sensor devices; it is ignored if the channel supports a mV sensor.To change the value:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ART 0200 module you want to configure in the island editor. | The selected STB ART 0200 module opens in the software module editor. |
| 2 | In the **Value** column, select the desired temperature unit value from the pull-down menu. | The menu gives you two choices, *degrees C* and *degrees F*. |

## Input Sensor Type

The input sensor type parameter defines the type of analog field device that each channel will support. By default, both channels support three-wire IEC Pt100 RTD sensors. You may change the input sensor type on a per/channel basis to be one of several types of TC, mV, or RTD devices.

If you are not using a sensor on one of the channels, you may configure it as type *none*. If you configure it as a particular sensor type and do not connect a physical device to the channel, the module will detect a broken wire and flash an error on the LED. Broken wire detection is not provided for mV sensors.

Use the following procedure to configure the input sensor type:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ART 0200 module you want to configure in the island editor. | The selected STB ART 0200 module opens in the software module editor. |
| 2 | Click on the **+** sign in front of the **Input sensor type** parameter. | Channel 1 and Channel 2 are displayed. |
| 3 | In the **Value** column, select the desired sensor type from the pull-down menu. | The menu gives you 16 choices, as listed below. |
| 4 | Repeat step 3 if you want to configure a sensor type for the other channel. | |

The 16 available input sensor types are:

| Input Sensor Type | | ORE | ORW | Normal Range | URW | URE |
|---|---|---|---|---|---|---|
| none | | N/A | N/A | N/A | N/A | N/A |
| +/- mV | | >/= 81.92 | > 80 | -80 ... +80 | < -80 | </= -81.92 |
| Pt100 RTD (IEC) | degrees C | >/= 850 | > 829.6 | -200 ... +850 | < -195.2 | </= -200 |
| | degrees F | >/= 1562 | > 1524.5 | -328 ... +1562 | < -320.1 | </= -328 |
| Pt1000 RTD (IEC) | degrees C | >/= 850 | > 829.6 | -200 ... +850 | < -195.2 | </= -200 |
| | degrees F | >/= 1562 | > 1524.5 | -328 ... +1562 | < -320.1 | </= -328 |
| Pt100 RTD (US/JIS) | degrees C | >/= 450 | > 439.2 | -100 ... +450 | < -97.6 | </= -100 |
| | degrees F | >/= 842 | > 821.8 | -148 ... +842 | < -144.4 | </= -148 |
| Pt1000 RTD (US/JIS) | degrees C | >/= 450 | > 439.2 | -100 ... +450 | < -97.6 | </= -100 |
| | degrees F | >/= 842 | > 821.8 | -148 ... +842 | < -144.4 | </= -148 |
| Ni100 RTD | degrees C | >/= 180 | > 175.7 | -60 ... +180 | < -58.6 | </= -60 |
| | degrees F | >/= 356 | > 347.5 | -76 ... +356 | < -74.2 | </= -76 |
| Ni1000 RTD | degrees C | >/= 180 | > 175.7 | -60 ... +180 | < -58.6 | </= -60 |
| | degrees F | >/= 356 | > 347.5 | -76 ... +356 | < -74.2 | </= -76 |
| Cu10 RTD | degrees C | >/= 260 | > 253.8 | -100 ...+260 | < -97.6 | </= -100 |
| | degrees F | >/= 500 | > 488.0 | -148 ...+500 | < -144.4 | </= -148 |
| J type TC | degrees C | >/= 760 | 741.8 | -200 ... +760 | < -195.2 | </= -200 |
| | degrees F | >/= 1400 | > 1366.4 | -328 ... +1400 | < -320.1 | </= -328 |
| K type TC | degrees C | >/= 1370 | > 1337.1 | -270 ... +1370 | < -263.5 | </= -270 |
| | degrees F | >/= 2498 | > 2438 | -454 ... +2498 | < -443.1 | </= -454 |
| E type TC | degrees C | >/= 1000 | > 976 | -270 ... +1000 | < -263.5 | </= -270 |
| | degrees F | >/= 1832 | > 1788 | -454 ... +1832 | < -443.1 | </= -454 |
| T type TC | degrees C | >/= 400 | > 390.4 | -270 ... +400 | < -263.5 | </= -270 |
| | degrees F | >/= 752 | > 734 | -454 ... +752 | < -443.1 | </= -454 |
| S type TC | degrees C | >/= 1665 | > 1625 | -50 ... +1665 | < -48.8 | </= -50 |
| | degrees F | >/= 3029 | > 2956.3 | -58 ... +3029 | < -56.6 | </= -58 |
| R type TC | degrees C | >/= 1665 | > 1625 | -50 ... +1665 | < -48.8 | </= -50 |
| | degrees F | >/= 3029 | > 2956.3 | -58 ... +3029 | < -56.6 | </= -58 |
| B type TC | degrees C | >/= 1820 | > 1776.3 | +130 ... 1820 | < 133 | </= 130 |
| | degrees F | >/= 3200 | > 3123.2 | +266 ... 3200 | < 272 | </= 266 |

- ORE is over-range error
- ORW is over-range warning
- URW is under-range warning
- URE is under-range error

### Wiring Type for RTD Sensors

If a channel is configured to support an RTD sensor, you can specify the number of wires for the device—two, three or four. This parameter is required for RTD sensors; it is ignored if the channel is not supporting an RTD sensor. By default, the parameter is set for three-wire devices on both channels. To change the parameter:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ART 0200 module you want to configure in the island editor. | The selected STB ART 0200 module opens in the software module editor. |
| 2 | Click on the **+** sign in front of the **Wiring type if RTD** parameter. | Channel 1 and Channel 2 are displayed. |
| 3 | In the **Value** column, select the desired wiring type from the pull-down menu. | The menu gives you three choices, *two-wire*, *three-wire* and *four-wire*. |
| 4 | Repeat step 3 if you want to configure a wiring type for the other channel. | |

### Cold Junction Compensation for TC Sensors

Cold-junction compensation helps to provide proper temperature measurement for TC sensors. It is a compensation applied to the junction between the copper connections on the module and the dissimilar metal in the TC sensor connections. Cold-junction compensation may be configured as an internal control or externally using one of several two-wire RTD choices. The parameter is set at the module level—both channels have the same value, but the value is ignored by any channel that is not configured to support a TC sensor:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ART 0200 module you want to configure in the island editor. | The selected STB ART 0200 module opens in the software module editor. |
| 2 | In the **Value** column, select the desired cold-junction compensation value from the pull-down menu. | The menu gives you eight choices, as listed below. |

The eight available cold-junction compensation values are:

| **Cold-junction Compensation Device** | | **Operating Range** |
|---|---|---|
| internal | | determined by the module's internal sensors |
| external Pt100 RTD (IEC) | degrees C | -200 ... +850 |
| | degrees F | -328 ... +1562 |
| external Pt1000 RTD (IEC) | degrees C | -200 ... +850 |
| | degrees F | -328 ... +1562 |
| external Pt100 RTD (US/JIS) | degrees C | -100 ... +450 |
| | degrees F | -148 ... +842 |
| external Pt1000 RTD (US/JIS) | degrees C | -100 ... +450 |
| | degrees F | -148 ... +842 |
| external Ni100 RTD | degrees C | -60 ... +180 |
| | degrees F | -76 ... +356 |
| external Ni1000 RTD | degrees C | -60 ... +180 |
| | degrees F | -76 ... +356 |
| external Cu10 RTD | degrees C | -100 ...+260 |
| | degrees F | -148 ...+500 |

**Note:** If you are using *external* cold-junction compensation, you need to connect the RTD sensor to the top field wiring connector (See *Field Wiring Pinout, p. 258*) on the STB ART 0200. You must connect the wires to pins 2 and 5 on the connector. Use only a two-wire RTD. Because cold-junction compensation is configured at the module level, the RTD will provide compensation for TC sensors that are connected on either the top or bottom connector (or both).
When external cold-junction compensation is applied to the module, you may configure channel 1 to support a TC or mV sensor, but you should not configure it to support an RTD that senses process values.

**Note:** With *internal* cold junction compensation, it takes approximately 45 min after power-up for the module's internal temperature to stabilize.

With the use of internal cold junction compensation, air movement inside the module should not exceed 0.1 m/s. Temperature variations outside the module should not exceed 10 degrees C/hour. The module must be positioned at least 100 mm away from any heat source.

## STB ART 0200 Data for the Process Image

**Introduction**

The STB ART 0200 sends a representation of the operating state of each analog input channel to the NIM. The NIM stores this information in five 16-bit registers—three for data and two for status. The information can be read by the Advantys configuration software or an HMI panel connected to the NIM's CFG port.

The input data process image is part of a block of 4096 registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB ART 0200 module is represented by five contiguous registers in this block, which appear in the following order:

- the data in input channel 1
- the status of input channel 1
- the data in input channel 2
- the status of input channel 2
- a cold-junction compensation data

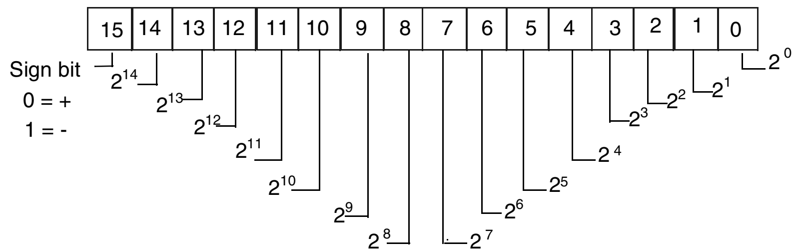
The specific registers used are based on the module's physical location on the island bus.

**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 transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface Module Application Guides. Separate guides are available for each supported fieldbus.

**Input Data Registers**

The first and third STB ART0200 registers in the input block of the process image are the data words. Each register represents either the temperature or the mV data of the associated channel. The data has15-bit + sign resolution. The bit structure for a data register is:

**STB ART 0200 Data Register Format**

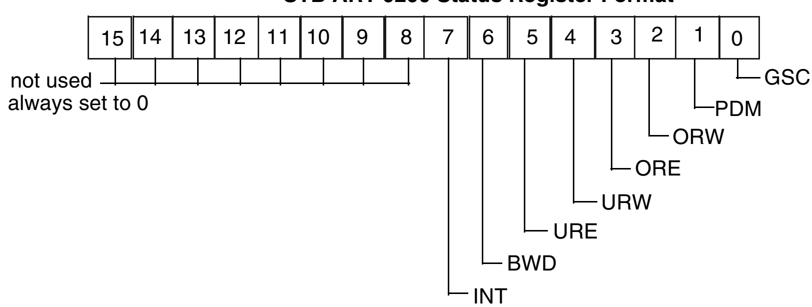



If a register holds temperature data, it represents it as degree C x 10 or degrees F x 10. For example, if the channel data is 74.9 degree C, the register representing that channel reads 749 (in decimal) or 0*x*2ED (in hexadecimal). You can configure degree C or degrees F in the module editor (See *Temperature Unit, p. 265*).
If a register hold mV data, it represents it as mV x 100. For example, if the channel data is 62.35 mV, the register reads 6235 (in decimal) or 0*x*185B (in hexadecimal).

**Input Status Registers**

The second and fourth STB ART 0200 registers in the input block of the process image are the channel status registers for the two analog input channels. The eight LSBs in each register represent the status of each input channel:

**STB ART 0200 Status Register Format**



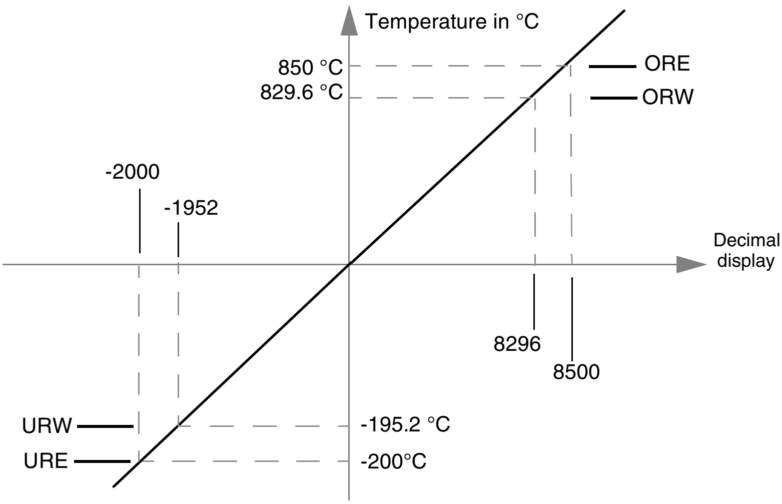
Bit meanings are described below:

| Bit | Indication | Meaning |
|---|---|---|
| 0 | global status channel (GSC) | The value is 0 when no errors have been detected. It is 1 when one or more of the bits1, 3, 5, 6 and 7 has a value of 1. |
| 1 | PDM voltage status on the sensor bus | The value is 0 when no PDM voltage errors are detected. It is 1 if sensor power is absent. A PDM short turns on the GSC bit (bit 0). |
| 2 | over-range warning (ORW) status | The value is 1 when the input sensor value is over the normal temperature or mV range (See *Input Sensor Type, p. 266*). An ORW does not turn on the GSC bit (bit 0). |
| 3 | over-range error (ORE) status | The value is 1 when the input sensor value is in the ORE temperature or mV range (See *Input Sensor Type, p. 266*). An ORE turns on the GSC bit (bit 0) |
| 4 | under-range warning (URW) status | The value is 1 when the input sensor value is in the URW temperature or mV range (See *Input Sensor Type, p. 266*). (A URW does not turn on the GSC bit (bit 0). |
| 5 | under-range error (URE) status | The value is 1 when the input sensor value is in the URE temperature or mV range (See *Input Sensor Type, p. 266*). A URE turns on the GSC bit (bit 0). |
| 6 | broken wire detection (BWD) status | The value is 1 when the channel is configured for an RTD or TC sensor and it detects a broken wire. if you have a mV sensor connected to the channel, BWD does not work. When the channel is configured for a TC sensor, the bit may also be set when external cold-junction compensation is used and a broken wire is detected in the RTD connection. In this case, the cold-junction compensation data will be near 0 and the TC data will be uncompensated. BWD turns on the GSC bit (bit 0). |
| 7 | internal module error (INT) status | Internal hardware/firmware error has been detected or differential between two internal sensors is in excess of 10 degrees C. |

**Note:** The detection of error conditions on the PDM input power connection may be delayed by as much as 15 ms from the event, depending on the sensor bus load, the system configuration and the nature of the fault.
Field power faults that are local to the input module are reported without delay.

**Note:** If the INT bit is set, you need to either cycle power or hot swap the module to reset the bit. If the bit does not reset, the module needs to be replaced.

The following example illustrates the key points reported to the status register temperature for an IEC Platinum Pt1000 RTD sensor. The temperature input data is shown in degrees C along the y-axis and in decimal format along the x-axis:




**Cold-junction Compensation Register**

Cold-junction compensation provides improved temperature measurement in TC mode. The STB ART 0200 sends the cold-junction compensation temperature value to the NIM and the fieldbus as the fifth register in the STB ART 0200 process image block. The data has15-bit + sign resolution.

The register represents temperature data as degree C x 10 or degrees F x 10. For example, if the compensation temperature is 74.9 degree C, the register representing that channel reads 749 (in decimal) or 0*x*2ED (in hexadecimal). You can configure degree C or degrees F in the module editor (See *Temperature Unit, p. 265*).

Cold-junction compensation can be effected by either internal or external compensation (See *Cold Junction Compensation for TC Sensors, p. 268*). The module has two internal sensors that can be used for internal cold-junction compensation. The two sensors calculate the compensation for each channel, and the module reports the average of the two sensed temperatures as compensation data to the process image.

External cold-junction compensation requires that you connect an external RTD device to the top connector on the module. The module uses the real temperature of the RTD for external cold-junction compensation. It reports the real temperature as compensation data to the process image.

# STB ART 0200 Specifications

**Summary**

Each channel on the STB ART 0200 can be configured independently to support an RTD sensor, a TC sensor or a mV sensor. The following four tables describe the module specifications. The first table lists general specifications that apply to the entire module. The three other tables describe specifications unique to the three input sensor types.

**General Specifications**

The general specifications for the STB ART 0200 are described in the following table:.

| | | |
|---|---|---|
| description | | two analog input channels individually configurable for RTD, thermocouple, or mV operations |
| data resolution | | 15 bits plus sign |
| conversion method | | Σ - Δ |
| operating mode | | self-scan |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| nominal logic bus current consumption | | 100 mA |
| nominal sensor bus current consumption | | 180 mA |
| hot swapping supported | | yes |
| isolation | field-to-bus | 1500 VAC for 1 min |
| | channel-to-channel | 500 VDC for 1 min |
| | channel-to-field power supply | 500 VDC for 1 min |
| input protection | | +/- 7.5 V maximum |
| input filter | | single low-pass filter @ nominal 25 Hz |
| cross-talk between channels | | not measurable |
| common mode rejection | | 50 or 60 Hz (100 dB typical) |
| differential mode rejection | | 50 or 60 Hz (60 dB typical) |
| over-range/under-range margins | | +/- 2.4% |
| addressing requirement | | five words (two/channel plus cold-junction compensation data) |
| field power requirements | field voltage | 24 VDC |
| | PDM | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 5 A time-lag fuse on the PDM |

**RTD Specifications**

RTD-specific specifications are described in the following table:

| | | | |
|---|---|---|---|
| temperature unit | default | degrees C | |
| | user configurable* | degrees C or degrees F | |
| data resolution | | increments of 0.1 degree (C or F) | |
| broken wire detection | | monitored independently on each channel | |
| RTD wiring types | default | three-wire | |
| | user configurable* | two-, three- or four-wire | |
| typical conversion times | three-wire devices | @ 50 Hz | 340 ms |
| | | @ 60 Hz | 300 ms |
| | two- or four-wire devices | @ 50 Hz | 200 ms |
| | | @ 60 Hz | 180 ms |
| RTD sensor types | default | IEC platinum Pt100 | -200 ... +850 degrees C |
| | | | -328 ... +1562 degrees F |
| | user-configurable* | IEC platinum Pt100 and Pt1000 | -200 ... +850 degrees C |
| | | | -328 ... +1562 degrees F |
| | | US/JIS platinum Pt100 and Pt1000 | -100 ... +450 degrees C |
| | | | -148 ... 842 degrees F |
| | | copper Cu10 | -100 ... +260 degrees C |
| | | | -148 ... +500 degrees F |
| | | nickel Ni100 and Ni1000 | -60 ... +180 degrees C |
| | | | -76 ... +356 degrees F |
| maximum wiring resistance | IEC Pt100 | four-wire | 50 Ω |
| | | two- or three-wire | 20 Ω |
| | IEC Pt1000 | four-wire | 500 Ω |
| | | two- or three-wire | 200 Ω |
| | US/JIS Pt100 | four-wire | 50 Ω |
| | | two- or three-wire | 20 Ω |
| | US/JIS Pt1000 | four-wire | 500 Ω |
| | | two- or three-wire | 200 Ω |
| | Ni100 | four-wire | 50 Ω |
| | | two- or three-wire | 20 Ω |
| | Ni1000 | four-wire | 500 Ω |
| | | two- or three-wire | 200 Ω |
| | Cu10 | four-wire | 50 Ω |
| | | two- or three-wire | 20 Ω |

| | | |
|---|---|---|
| absolute accuracy (RTD errors not included) | Pt @ 25° C (77° F) | +/- 1.0 degrees C |
| | | +/- 1.6 degrees F |
| | Cu @ 25° C (77° F) | +/- 4.0 degrees C |
| | | +/- 6 degrees F |
| | Ni @ 25° C (77° F) | +/- 1.0 degrees C |
| | | +/- 1.6 degrees F |
| | Pt @ 60° C (140° F) | +/- 2.0 degrees C |
| | | +/- 3.6 degrees F |
| | Cu @ 60° C (140° F) | +/- 4.0 degrees C |
| | | +/- 6 degrees F |
| | Ni @ 60° C (140° F) | +/- 1.0 degrees C |
| | | +/- 1.6 degrees F |
| * Requires the Advantys configuration software. | | |

## TC Specifications

TC specifications are described in the following table:

| | | | |
|---|---|---|---|
| temperature unit | default | degrees C | |
| | user configurable* | degrees C or degrees F | |
| data resolution | | increments of 0.1 degree (C or F) | |
| broken wire detection | | monitored independently on each channel | |
| TC sensor types | user-configurable* | type J | -200 ... +760 degrees C |
| | | | -328 ... +1400 degrees F |
| | | type K | -270 ... +1370 degrees C |
| | | | -454 ... +2498 degrees F |
| | | type E | -270 ... +1000 degrees C |
| | | | -328 ... +1832 degrees F |
| | | type T | -270 ... +400 degrees C |
| | | | -328 ... +752 degrees F |
| | | type S | -50 ... +1665 degrees C |
| | | | -58 ... +3029 degrees F |
| | | type R | -50 ... +1665 degrees C |
| | | | -58 ... +3029 degrees F |
| | | type B | +130 ... 1820 degrees C |
| | | | +266 ... 3200 degrees F |

| | | | |
|---|---|---|---|
| typical conversion times | with internal cold-junction compensation | @ 50 Hz | 230 ms |
| | | @ 60 Hz | 210 ms |
| | with external cold-junction compensation | @ 50 Hz | 400 ms |
| | | @ 60 Hz | 360 ms |
| accuracy (TC errors not included) | types J, K, E and T with internal cold junction compensation | +/- 7 degrees C nominal | |
| | | approximately 12.6 degrees F nominal | |
| | | +/- 5 degrees C @ 25 degrees C | |
| | | approximately 9 degrees F @ 77 degrees F | |
| | types S, R and B with internal cold junction compensation | +/- 10.5 degrees C nominal | |
| | | approximately 18.9 degrees F nominal | |
| | | +/- 7 degrees C @ 25 degrees C | |
| | | approximately 12.6 degrees F @ 77 degrees F | |
| | Note If external cold-junction compensation is applied using an isothermal block, overall accuracy can be better than doubled. For example, where a J-type TC sensor with internal cold-junction compensation has an accuracy of +/- 5 degrees at 25 degrees C, its accuracy with external cold-junction compensation is +/- 1.35 degrees at 25 degrees C (not including RTD error). | | |
| * Requires the Advantys configuration software. | | | |

## mV Specifications

Millivolt (mV) specifications are described in the following table.

| | | |
|---|---|---|
| range of the scale | | +/- 80 mV (2.4% over- or under-range) |
| data resolution | | increments of 0.01 mV |
| accuracy | | +/- 0.1% of full scale @ = 25 degrees C ambient temperature |
| | | +/- 0.15% of full scale max @ = 60 degrees C ambient temperature |
| typical conversion times | @ 50 Hz | 170 ms |
| | @ 60 Hz | 150 ms |
| input impedance | | 10 MΩ typical |

# The Advantys STB Analog Output Modules

# 7

## At a Glance

**Overview**

This chapter describes in detail the features of the analog output modules in the Advantys STB family.

**What's in this Chapter?**

This chapter contains the following sections:

# 7.1 STB AVO 1250 Analog Voltage Output Module (two-channel, bipolar-selectable, 11-bit + sign)

## At a Glance

**Overview**

This section provides you with a detailed description of the STB AVO 1250 analog output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

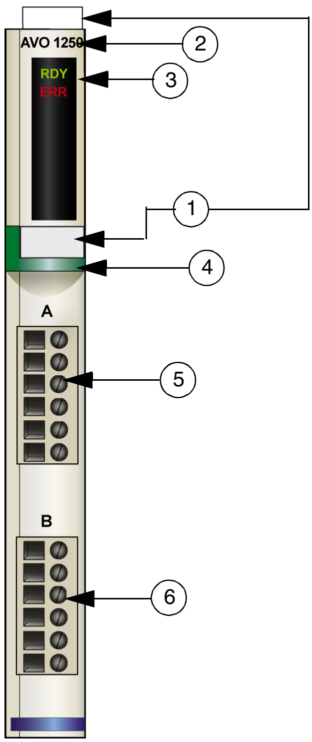
## STB AVO 1250 Physical Description

**Physical Characteristics**

The STB AVO 1250 is an Advantys STB two-channel analog voltage output module that writes outputs to analog actuators that operate over a user-selectable range of either 0 to10 V or -10 to +10 V. The analog portion of the module is isolated from the island's actuator bus to improve performance. To take advantage of this internal isolation feature, the actuators must be powered from an external power supply. If isolation is not required, you can use the module to deliver field power to the actuators—24 VDC for actuator 1 from the top connector, and 24 VDC for actuator 2 from the bottom connector. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels
**2** model name
**3** LED array
**4** dark green identification stripe, indicating an analog output module
**5** actuator 1 connects to the top field wiring connector
**6** actuator 2 connects to the bottom field wiring connector

## Module Accessories

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module uses 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).
Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.
Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

## Dimensions

The STB AVO 1250 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

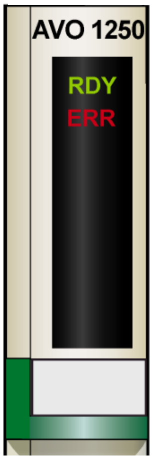
## STB AVO 1250 LED Indicator

**Purpose**

The two LEDs on the STB AVO 1250 provide visual indications of the module's operating status. Their location and meanings are described below.

**Location**

The LEDs are located on the top of the 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):

| RDY | ERR | Meaning | What to Do |
|---|---|---|---|
| off | off | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | Auto-addressing is in progress. | |
| on | off | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| on | on | The watchdog has timed out. | Cycle power, restart the communications |
| blink 1** | | The module is either in pre-operational mode or in its fallback state. | |
| | flicker* | Field power absent or a PDM short circuit detected. | Check power |
| | blink 1** | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |
| * flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms. | | | |
| ** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes. | | | |
| *** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | |
| **** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | |

## STB AVO 1250 Field Wiring

**Summary**

The STB AVO 1250 module uses two six-terminal field wiring connectors. Analog actuator 1 is wired to the top connector, and the analog actuator 2 is wired to the bottom connector. The choices of connectors and field wire types are described below, and some field wiring options are presented.

**Connector Types**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Actuators**

The STB AVO 1250 module handles analog output data from two 0 to 10 V or +/- 10 V single-ended analog field actuators. Data on each channel has a resolution of 12 bits or 12 bits plus sign. The module is designed to support high duty cycles and to control continuous-operation equipment.
The module allows you to connect to two-, three- and four-wire devices that can draw current up to 100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C. If you want to maintain the module's built-in isolation between the analog portion of the module and the island's actuator bus, you can make only two-wire connections.

**Field Wire Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Shielded twisted-pair wire is recommended. The shield should be tied to an external clamp that is tied to protective earth.

**Field Wiring Pinout**

The top connector supports analog actuator 1, and the bottom connector supports analog actuator 2. Four field wires may be used on each connector—on pins 1, 3, 4 and 6.

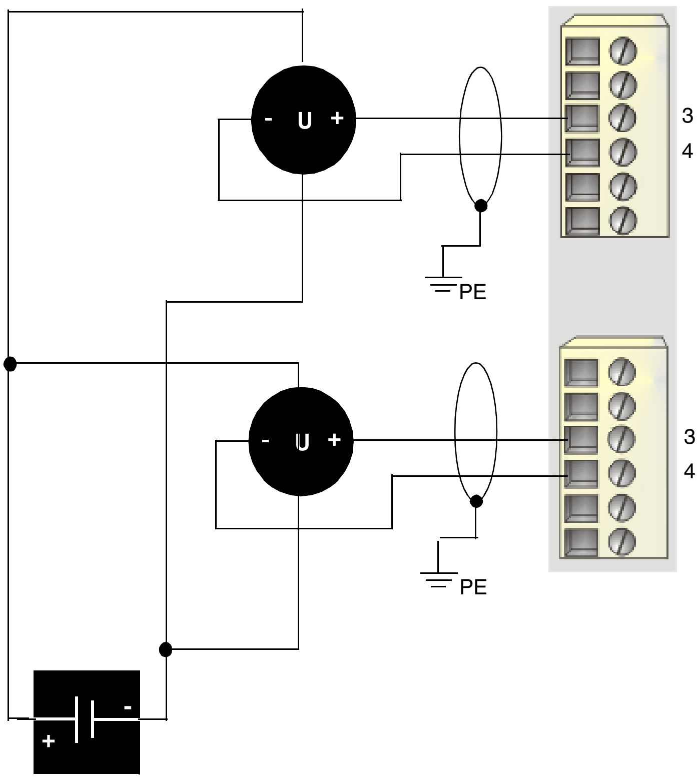
The connections on pin 1 and pin 6 are optional, and using these pins will defeat the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 2 and 5 of either connector:

| Pin | Top Connections | Bottom Connections |
|---|---|---|
| 1 | +24 VDC from actuator bus for field device accessories | +24 VDC from actuator bus for field device accessories |
| 2 | no connection | no connection |
| 3 | output to actuator 1 | output to actuator 2 |
| 4 | output channel return | output channel return |
| 5 | no connection | no connection |
| 6 | field power return (to the module) | field power return (to the module) |

The analog returns (pin 4) for each channel are internally connected—therefore there is no channel-to-channel isolation.

**Sample Wiring Diagrams**

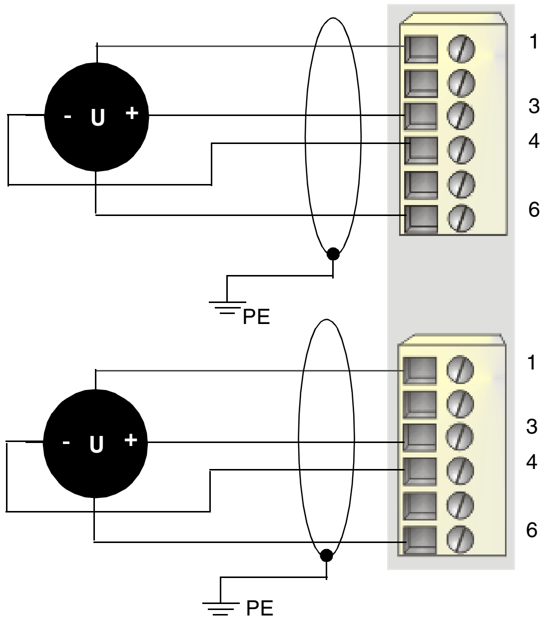
The following field wiring example shows how two isolated analog actuators can be wired to the STB AVO 1250 module. An external power supply is required to power the actuators:




**3** outputs to actuator 1 (top) and actuator 2 (bottom)

**4** field power returns from actuator 1 (top) and actuator 2 (bottom)

If you want to use 24 VDC from the island's actuator bus to power the analog field devices, this power can be delivered through the output module. To do this, use pins 1 and 6 as follows:




**1** +24 VDC for actuator 1 (top) and for actuator 2 (bottom)

**3** outputs to actuator 1 (top) and actuator 2 (bottom)

**4** returns from actuator 1 (top) and actuator 2 (bottom)

**6** field power return from actuator 1 (top) and actuator 2 (bottom)

Remember that using pins 1 and 6 will defeat the built-in isolation between the analog portion of the module and the island's actuator bus.

## STB AVO 1250 Functional Description

### Functional Characteristics

The STB AVO 1250 is a two-channel analog output module that sends data to two voltage field actuators. The following operating parameters are user-configurable:
- the voltage range of the module
- the module's analog output period
- the fallback states of the two analog output channels

### Voltage Range

The voltage range of the module is user-configurable for either:
- 0 to 10 V (with 12-bit resolution)
- +/- 10 V (with 11-bit + sign resolution)

By default, the range is 0 to 10 V. If you want to transfer signals in the +/- 10 V range or return to the default setting, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB AVO 1250 module you want to configure in the island editor. | The selected STB AVO 1250 module opens in the software module editor. |
| 2 | From the pull-down menu in the **Value** column of the **Voltage Range** row, select the desired voltage range. | Two choices appear in the pull-down menu—**0 to 10 VDC** and **-10 to +10 VDC**. |

The voltage range parameter is configurable at the module level—both output channels must operate over the same voltage range.

## Analog Output Period

If the data sent by the module to an analog output channel is not updated by the fieldbus master in a specified number of milliseconds, the module will refresh the old data held by the channel. The purpose of this update is to prevent the analog value from drifting in the event that there is a long interval between data updates. The interval between refreshes is defined as the *analog output period*. This period is user-configurable in the range 5 to 255 ms.

The analog output period is configurable as a decimal or hexadecimal value in the range 5 to 255 (0x5 to 0xFF). By default, the analog output period is 10 (0xA). If you want to configure a different period, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB AVO 1250 module you want to configure in the island editor. | The selected STB AVO 1250 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | In the **Value** column of the **Analog Output Period** row, enter the desired value. | When you select the **Analog Output Period** value, the max/min values of the range appear at the bottom of the module editor screen. |

The analog output period is set at the module level—you cannot configure different channels to refresh at different intervals.

**Fallback Modes**

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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, which can be any value in the valid range. 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 a *predefined state*. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB AVO 1250 module you want to configure in the island editor. | The selected STB AVO 1250 module opens in the software module editor. |
| 2 | Expand the **+ Fallback Mode** row by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 3 | From the pull-down menu in the **Value** column of the **Channel 1** and/or **Channel 1** row, select the desired fallback mode setting. | Two choices appear in the pull-down menus—**Predefined** and **Hod Last Value**. |

## Fallback States

If an output channel's fallback mode is *predefined state*, you may configure that channel to go to any value in the valid range.

- If your voltage range is 0 to 10 VDC, then the fallback state value may be configured as a decimal or hexadecimal integer in the range 0 to 32 000 (0 to 0x7D00).
- If your voltage range of -10 to +10 VDC, then the fallback state value may be configured as a decimal or hexadecimal integer in the range -32 000 to +32 000 (0x8300 to 0x7D00).

By default, both channels are configured to go to 0 VDC as their predefined fallback state.

**Note:** If an output channel has been configured with *hold last value* as its fallback mode, any value that you assign its fallback state parameter will be ignored.

To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Make sure that the **Fallback Mode** value for the channel you want to configure is *predefined state*. | If the **Fallback Mode** value for the channel is *hold last value*, any value entered in the associated **Predefined Fallback Value** row will be ignored. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4 | Double click on the channel value(s) you want to change, then type in the desired value(s). The max/min values of the range appear at the bottom of the module editor screen:<br>-32 000 to +32 000 (0x8300 to 0x7D00) | The software does not change the way it displays the minimum range value when your voltage range is 0 to 10 V. You should not enter a value less than 0 when your outputs are in this voltage range.<br>If you enter a negative predefined state value when the voltage range is 0 to 10 V, the fallback state of the affected channel will become 0. |

## STB AVO 1250 Data and Status for the Process Image

**Representing the Analog Output Data**

The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output module. The information in the status block is provided by the module itself.

This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB AVO 1250 module are based on its physical location on the island bus.

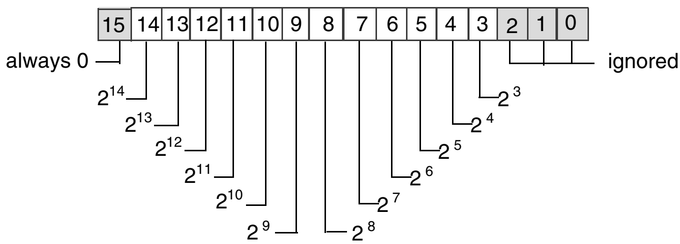
> **Note:** The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface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

**Output Data Registers**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in this data block. The STB AVO 1250 uses two contiguous registers in the output data block—the first for the data in channel 1 and the second for the data in channel 2.

The two output data registers represent the channel data in the IEC data format. If the data is in the range 0 to 10 V, the registers represent the data with 12-bit resolution:

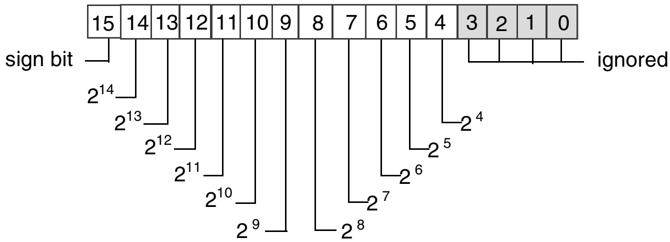
**0 to 10 V Data Register Format**




The value of each data word is represented in bits 14 through 3. They allow you to represent voltage data with integer values in the range 0 ... 32 752 in increments of 8. The value of bit 15 should always be 0. If bit 15 is 1, a negative value is sent—the output will be set to 0 VDC and an under-voltage error (UVE) will be returned.

If the data is in the range -10 to +10 V, the registers represent the data with 11-bit + sign resolution:

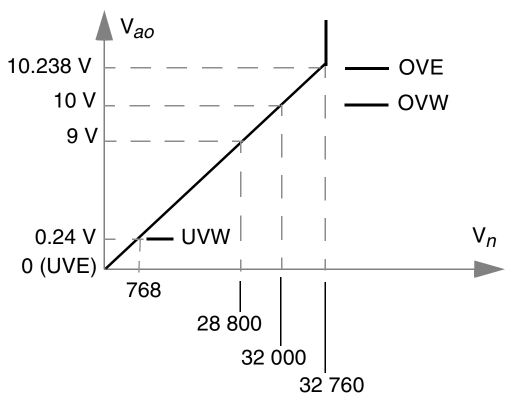
**-10 to +10 V Data Register Format**



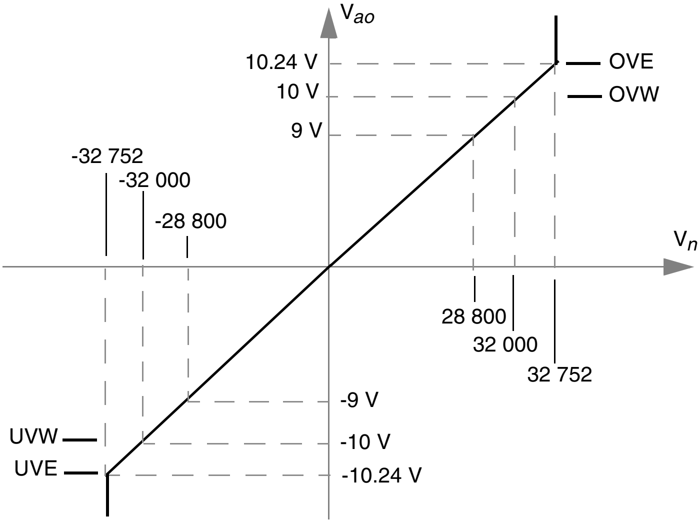

The value of each data word is represented in bits 15 through 4, allowing you to represent voltage data with integer values in the range -32 752 ... +32 752 in increments of 16. When the sign bit (bit 15) is 0, the value is positive; when bit 15 is 1, the value is negative.
The value 32 000 represents 10 V, and -32 000 represents -10 V. If the output value exceeds 32 000, the output channel reports an over-voltage warning (OVW). If the output value drops to -32 000 (in the +/-10 V range) or 768 (in the 0 to 10 V range), the output channel reports an under-voltage warning (UVW). If the output value goes up to 32 752 (in the +/-10 V range) or 32 760 (in the 0 to 10 V range), an over-voltage error (OVE) is reported. If it drops to -32 752 (in the +/-10 V range) or 0 (in the 0 to 10 V range) an under-voltage error (UVE) is reported.
Linear voltage representations can be interpreted using the formula:

$$V_n = 3200 \times V_{ao}$$

where V*n* is the numerical count and V*ao* is the analog output voltage. When the voltage range is from 0 to 10 VDC, voltage data is represented as follows:



When the voltage range is from -10 to +10 VDC, voltage data is represented as follows:



**Output Status Registers**

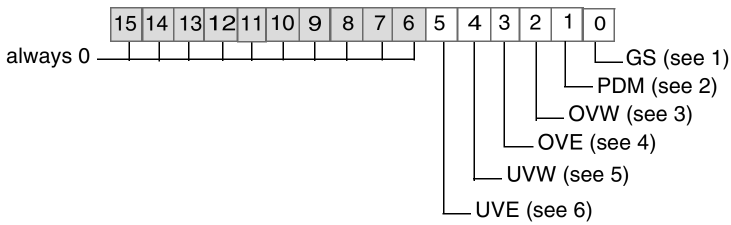
The input data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represent the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB AVO 1250 is represented by two contiguous registers—the first shows output status for channel 1 and the second shows output status for channel 2. The STB AVO 1250 can detect and report voltage overflow and voltage underflow conditions on each channel.

A voltage overflow occurs when the voltage of an input channel reaches 10.24 V (represented by the value 32 752 in the channel's data word). A voltage underflow can occur when the module is configured to operate at +/-10 V and when the voltage of an input channel reaches -10.24 V (represented by the value -32 752 in the channel's data word).

The six LSBs in each register represent the status of each output channel:

**STB AVO 1250 Status Register Format**




**1** Bit 0 represents global status (GS). It has a value of 0 when no errors have been detected. It has a value of 1 when bit 1 has a value of 1.

**2** Bit 1 represents the status of PDM voltage on the island's actuator bus. It has a value of 0 when no PDM voltage errors are detected. It has a value of 1 when power is shorted. A PDM short turns on the GS bit (bit 0).

**3** Bit 2 represents the presence or absence of an OVW. It has a value of 0 when the voltage is less than or equal to 10 V. It has a value of 1 when the voltage is greater than 10 V. An OVW does not turn on the GS bit (bit 0).

**4** Bit 3 represents the presence or absence of an over-voltage error (OVE). It has a value of 0 when the voltage is less than 10.24 V and a value of 1 when the voltage equals 10.24 V. An OVE does not turn on the GS bit (bit 0).

**5** Bit 4 represents the presence or absence of a UVW. If the module is configured for +/-10 V operations, it has a value of 0 when the voltage is greater than or equal to -10 V and a value of 1 when the voltage is below -10 V but above -10.24 V. If the module is configured for 0 to 10 V operations, it has a value of 0 when it is greater than or equal to 0.24 V and a value of 1 when the voltage is below 0.24 V but above 0 V. A UVW does not turn on the GS bit (bit 0).

**6** Bit 5 represents the presence or absence of a UVE. If the module is configured for +/-10 V operations, it has a value of 0 when the voltage is greater than -10.24 V and a value of 1 when the voltage equals -10.24 V.If the module is configured for 0 to 10 V operations, it has a value of 0 when it is greater than 0 V and a value of 1 when the voltage equals 0 V. A UVE does not turn on the GS bit (bit 0).

## STB AVO 1250 Specifications

**Table of Technical Specifications**

The STB AVO 1250 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | two single-ended analog voltage output channels |
| analog voltage range | default | 0 ... 10 V |
| | user-configurable setting* | -10 ... +10 V |
| resolution | @ 0 ... 10 V | 12 bits |
| | @ -10 ... +10 V | 11 bits + sign |
| returned data format | | IEC |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000<br>(See *STB XBA 1000 I/O Base, p. 347*) |
| nominal logic bus current consumption | | 80 mA |
| nominal actuator bus current consumption | | 50 mA, with no load |
| maximum output current | | 5 mA/channel |
| hot swapping supported | | yes |
| output response time | nominal | 3.0 ms plus settling time both channels |
| short-circuit protection on the outputs | | yes |
| output fault detection | | none |
| isolation | field-to-bus | 1500 VDC for 1 min |
| | analog module-to-actuator bus | 500 VAC rms (when actuator bus is not used for field power |
| integral linearity | | +/- 0.1% of full scale typical |
| differential linearity | | monotonic |
| absolute accuracy | | +/- 0.5% of full scale @ 25°C |
| temperature drift | | typically +/- 0.01% of full scale/ °C |
| capacitive load | | 1 µF |
| fallback mode | default | predefined |
| | user-configurable settings* | hold last value |
| | | predefined on one or both channels |

| | | |
|---|---|---|
| fallback states (when *predefined* is the fallback mode) | default setting | 0 V on both channels |
| | user-configurable settings* | when the voltage is 0 ... 10 V, integer values between 0 ... 32 000 on each channel |
| | | when the voltage is -10 ... +10 V, integer values between -32 000 ... +32 000 on each channel |
| addressing requirements | | two words of output data and two noncontiguous bytes of configuration data (for *voltage range* and *fallback state*) |
| actuator bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | yes |
| field power requirements | field voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

# 7.2 STB ACO 1210 Analog Current Output Module (two-channel, 12-bit, 0 ... 20 mA)

## At a Glance

**Overview**

This section provides you with a detailed description of the STB ACO 1210 analog output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

**What's in this Section?**

This section contains the following topics:

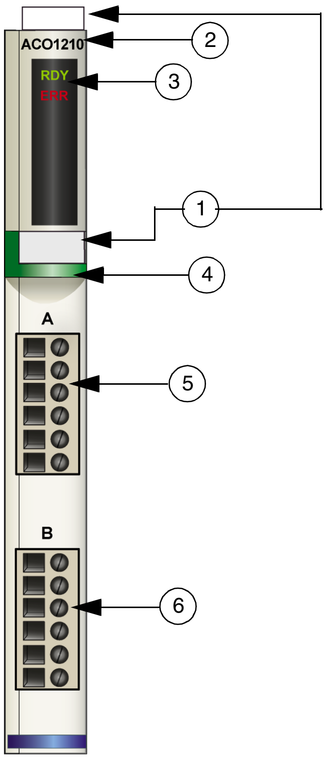
## STB ACO 1210 Physical Description

**Summary**

The STB ACO 1210 is an Advantys STB two-channel analog current output module that writes outputs to analog actuators that operate over a range of 0 to 20 mA. The analog portion of the module is isolated from the island's actuator bus to improve performance. To take advantage of this internal isolation feature, the actuators must be powered from an external power supply. If isolation is not required, you can use the module to deliver field power to the actuators—24 VDC for actuator 1 from the top connector, and 24 VDC for actuator 2 from the bottom connector. The module mounts in a size 1 I/O base and uses two six-terminal field wiring connectors.

**Front Panel View**

The following illustration shows a front view of the module mounted on an I/O base:




**1** locations for the STB XMP 6700 user-customizable labels
**2** model name
**3** LED array
**4** dark green identification stripe, indicating an analog output module
**5** actuator 1 connects to the top field wiring connector
**6** actuator 2 connects to the bottom field wiring connector

**Module Accessories**

The following accessories need to be used with the module:
- an STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) I/O base
- a pair of six-terminal field wiring connectors, either STB XTS 1100 screw type connectors or STB XTS 2100 spring clamp connectors

The module uses 24 VDC from the island's sensor bus, and needs to be supported by an STB PDT 3100 PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*).

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

Also available as options are two keying pin kits. You may use keying pins to assure correct installation of modules into their assigned bases, and connectors into their assigned receptacles. The keying kits are:
- the STB XMP 7700 kit for inserting the module into the base
- the STB XMP 7800 kit for inserting the field wiring connectors into the module

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Dimensions**

The STB ACO 1210 has the following dimensions:

| | | |
|---|---|---|
| **width** | module on a base | 13.9 mm (0.58 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) |

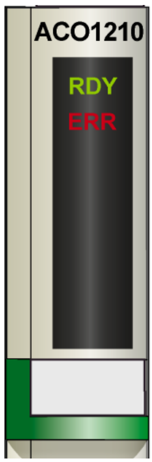
## STB ACO 1210 LED Indicators

**Purpose**

The two LEDs on the STB ACO 1210 provide visual indications of the module's operating status. Their location and meanings are described below.

**Location**

The LEDs are located on the top of the 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):

| RDY | ERR | Meaning | What to Do |
|---|---|---|---|
| off | off | The module is either not receiving logic power or has failed. | Check power |
| flicker* | off | Auto-addressing is in progress. | |
| on | off | The module has achieved all of the following:<br>● it has power<br>● it has passed its confidence tests<br>● it is operational | |
| on | on | The watchdog has timed out. | Cycle power, restart the communications |
| blink 1** | | The module is either in pre-operational mode or in its fallback state. | |
| | flicker* | Field power absent or a PDM short circuit detected. | Check power |
| | blink 1** | A nonfatal error has been detected. | Cycle power, restart the communications |
| | blink 2*** | The island bus is not running. | Check network connections, replace NIM |
| blink 3**** | | The output channels on this module are operational while the rest of the island modules are in their fallback states. This condition could occur if the module is used in a reflex action. | |
| * flicker—the LED flickers when it is repeatedly on for 50 ms then off for 50 ms. | | | |
| ** blink 1—the LED blinks on for 200 ms then off for 200 ms. This pattern is repeated until the causal condition changes. | | | |
| *** blink 2—the LED blinks on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | |
| **** blink 3—the LED blinks on for 200 ms, off for 200 ms, on for 200 ms, off for 200 ms, on again for 200 ms then off for 1 s. This pattern is repeated until the causal condition changes. | | | |

## STB ACO 1210 Field Wiring

**Summary**

The STB ACO 1210 module uses two six-terminal field wiring connectors. Analog actuator 1 is wired to the top connector, and the analog actuator 2 is wired to the bottom connector. The choices of connectors and field wire types are described below, and some field wiring options are presented.

**Connector Types**

Use a set of either:
- two STB XTS 1100 *screw type* field wiring connectors (available in a kit of 20)
- two STB XTS 2100 *spring clamp* field wiring connectors (available in a kit of 20)

These field wiring connectors each have six connection terminals, with a 3.8 mm (0.15 in) pitch between each pin.

**Field Actuators**

The STB ACO 1210 module handles analog output data from two 0 ... 20 mA single-ended analog field actuators. Data on each channel has a resolution of 12 bits. The module is designed to support high duty cycles and to control continuous-operation equipment.
The module allows you to connect to two-, three- and four-wire devices that can draw current up to 100 mA/channel at 30 degrees C or 50 mA/channel at 60 degrees C. If you want to maintain the module's built-in isolation between the analog portion of the module and the island's actuator bus, you can make connections only to a two-wire device.

**Field Wiring Requirements**

Individual connector terminals accept one field wire. Use wire sizes in the range 0.5 ... 1.5 $mm^2$ (24 ... 16 AWG).
Shielded twisted-pair wire is recommended. The shield should be tied to an external clamp that is tied to protective earth.

## Field Wiring Pinouts

The top connector supports analog actuator 1, and the bottom connector supports analog actuator 2. Four field wires may be used on each connector—on pins 1, 2, 4 and 6.

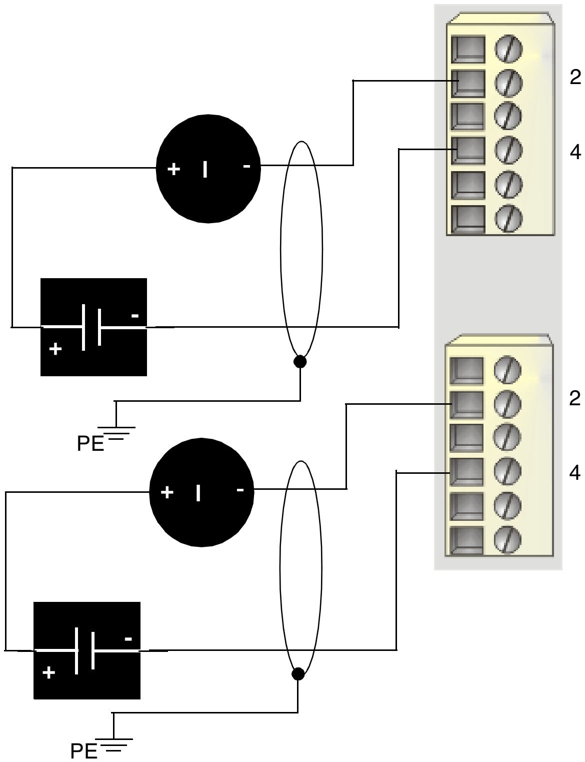
The connections on pin 1 and pin 6 are optional, and using these pins will defeat the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 3 and 5 of either connector:

| Pin | Top Connections | Bottom Connections |
|---|---|---|
| 1 | +24 VDC from actuator bus for field device accessories | +24 VDC from actuator bus for field device accessories |
| 2 | output to actuator 1 | output to actuator 2 |
| 3 | no connection | no connection |
| 4 | analog output return | analog output return |
| 5 | no connection | no connection |
| 6 | field power return (to the module) | field power return (to the module) |

The analog returns (pin 4) for each channel are internally connected—therefore there is no channel-to-channel isolation.

**Sample Wiring Diagrams**

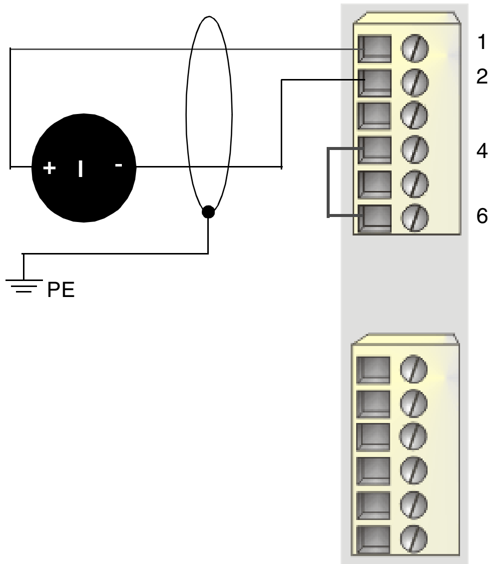
The following field wiring example shows how two isolated analog actuators can be wired to the STB ACO 1210 module. Two separate external power supplies are needed to make sure that the proper current is delivered to each actuator:




**2** outputs to actuator 1 (top) and actuator 2 (bottom)

**4** field power returns from actuator 1 (top) and actuator 2 (bottom)

If you want to use 24 VDC from the island's actuator bus to power an analog field device, this power can be delivered through the output module. To do this, use pins 1 and 6 as follows




**1** +24 VDC for actuator 1

**2** output to actuator 1

**4 and 6** close the power loop by sending the field power return to the module return

Remember that using pins 1 and 6 will defeat the built-in isolation between the analog portion of the module and the island's actuator bus.

## STB ACO 1210 Functional Description

**Functional Characteristics**

The STB ACO 1210 module is a two-channel analog output module that sends data to two field actuators. The following operating parameters are user-configurable:
- the module's analog output period
- the fallback states of the two analog output channels

**Analog Output Period**

If the data to an analog output channel is not updated by the fieldbus master in a specified number of milliseconds, the module will refresh the old data held by the channel. The purpose of this update is to prevent the analog value from drifting in the event that there is a long interval between data updates. The interval between refreshes is defined as the *analog output period*. This period is user-configurable in the range 5 to 255 ms.
The analog output period is configurable as a decimal or hexadecimal value in the range 5 to 255 (0x5 to 0xFF). By default, the analog output period is 10 (0xA). If you want to configure a different period, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ACO 1210 module you want to configure in the island editor. | The selected STB ACO 1210 module opens in the software module editor. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | In the **Value** column of the **Analog Output Period** row, enter the desired value. | Notice that when you select the **Analog Output Period** value, the max/min values of the range appear at the bottom of the module editor screen. |

The analog output period is set at the module level—you cannot configure different channels to refresh at different intervals.

## Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channels must go to a known state where they will remain until communications are restored. 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, which may be any value in the valid range. 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 a *predefined state*. If you want to change the fallback mode to *hold last value*, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Double click on the STB ACO 1210 module you want to configure in the island editor. | The selected STB ACO 1210 module opens in the software module editor. |
| 2 | Expand the **+ Fallback Mode** row by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 3 | From the pull-down menu in the **Value** column of the **Channel 1** and/or **Channel 1** row, select the desired fallback mode setting. | Two choices appear in the pull-down menus—**Predefined** and **Hod Last Value**. |

## Fallback States

If an output channel's fallback mode is *predefined state*, you may configure that channel to go to any value in the range 0 to 32 000 (0 to 0x7D00), where 0 represents 0 mA and 32 000 represents 20 mA.
By default, both channels are configured to go to 0 VDC as their predefined fallback state.

**Note:** If an output channel has been configured with *hold last value* as its fallback mode, any value that you assign its fallback state parameter will be ignored.

The data resolves to 12 bits. This means that the decimal or hexadecimal value returned to you will be an increment of 8. If you enter a value that is not an increment of 8, the system will round down to the next increment of 8. For example, if you enter a value of 35 (0x23), the module will resolve to a value of 32 (0x20).
If you enter a value less than 0, the output will be set to 0 and an under-current error will be returned (See *Output Status Registers, p. 313*).
To modify a fallback state from its default setting or to revert back to the default from an on setting, you need to use the Advantys configuration software:

| Step | Action | Result |
|---|---|---|
| 1 | Make sure that the **Fallback Mode** value for the channel you want to configure is *predefined state*. | If the **Fallback Mode** value for the channel is *hold last value*, any value entered in the associated **Predefined Fallback Value** row will be ignored. |
| 2 | Choose the data display format by either checking or unchecking the **Hexadecimal** checkbox at the top right of the editor. | Hexadecimal values will appear in the editor if the box is checked; decimal values will appear if the box is unchecked. |
| 3 | Expand the **+ Predefined Fallback Value Settings** fields by clicking on the **+** sign. | Rows for **Channel 1** and **Channel 2** appear. |
| 4 | Double click on the channel value(s) you want to change, then type in the desired value(s).<br>-32 000 to +32 000 (0x8300 to 0x7D00) | The software displays the max/min values of the range at the bottom of the module editor screen. |

## STB ACO 1210 Data and Status in the Process Image

**Representing the Analog Output Data**

The NIM keeps a record of output data in one block of registers in the process image and a record of output status in another block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output module. The information in the status block is provided by the module itself.

This process image information can be monitored by the fieldbus master or by an HMI panel connected to the NIM's CFG port. The specific registers used by the STB ACO 1210 module are based on its physical location on the island bus.

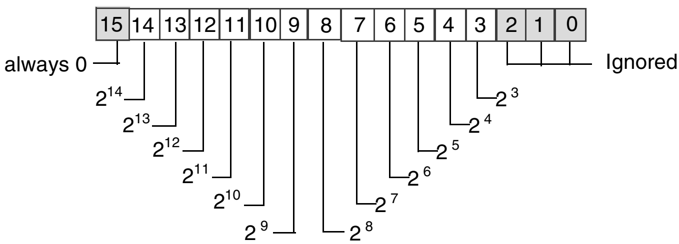
> **Note:** The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface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

**Output Data Registers**

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. Each output module on the island bus is represented in this data block. The STB ACO 1210 uses two contiguous registers in the output data block—the first for the data in channel 1 and the second for the data in channel 2.

The STB ACO 1210's two output data registers represent the channel data in the IEC data format. The data has 12-bit resolution. The bit structure in each of the two data words is as follows:

**STB ACO 1210 Data Register Format**

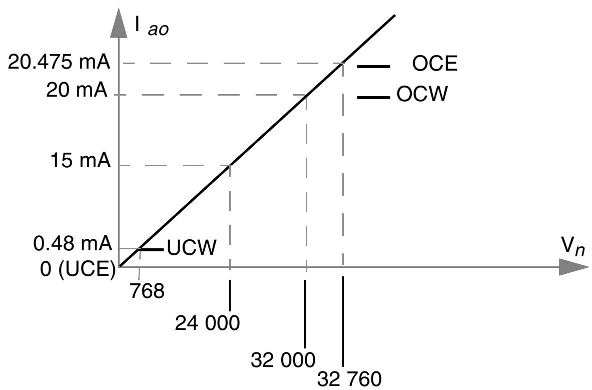



There are 12 significant bits in each data word—bits 14 through 3. They allow you to represent current data with integer values ranging from 0 to 32,760 in increments of eight.

The value 32 000 represents 20 mA. If the output value exceeds 32 000, the output channel reports an over-current warning (OCW). If the output value reaches 32 760, an over-current error (OCE) is reported. If the output value drops below 768, the output channel reports an under-current warning (UCW), and if the value goes to 0 the channel reports an under-current error (UCE).
Linear current representations can be interpreted using the formula:

$$V_n = 1600 \times I_{ao}$$

where V*n* is the numerical count and I*ao* is the analog output current.

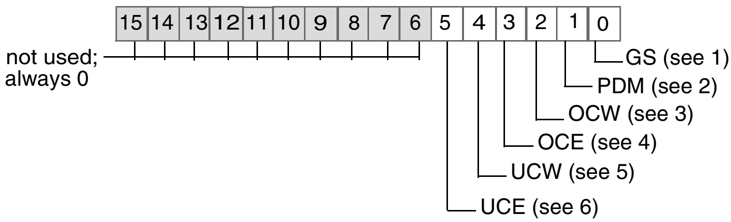


**Output Status Registers**

The input data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45 392 through 49 487) that represent the status of all the I/O modules (along with the data for the input modules) on the island bus.

The STB ACO 1210 is represented by two contiguous registers—the first shows output status for channel 1 and the second shows output status for channel 2. The six LSBs in each register represent the status of each input channel:

**STB ACO 1210 1230 Status Register Format**




**1** Bit 0 is the global status (GS) bit for the output channel. It has a value of 0 when no errors have been detected. It has a value of 1 when bit 1 has a value of 1.

**2** Bit 1 represents the status of PDM voltage on the island's actuator bus. It has a value of 0 when no PDM voltage errors are detected. It has a value of 1 if actuator power has been shorted. A PDM short turns on the GS bit (bit 0).

**3** Bit 2 represents the presence or absence of an OCW. It has a value of 0 when the current is less than 20 mA. It has a value of 1 when the current is greater than 20 mA. An OCW in the STB ACO 1210 does not turn on the GS bit (bit 0).

**4** Bit 3 represents the presence or absence of an OCE. It has a value of 0 when the current is less than 20.475 mA and a value of 1 when the current reaches 20.475 mA. An OCE in the STB ACO 1210 does not turn on the GS bit (bit 0).

**5** Bit 4 represents the presence or absence of an UCW. It has a value of 0 when the current is greater than 0.48 mA and a value of 1 when the current falls to 0.48 mA. An OCE in the STB ACO 1210 does not turn on the GS bit (bit 0).

**6** Bit 5 represents the presence or absence of an UCE. It has a value of 0 when the current is greater than 0 and a value of 1 when the current is 0. An OCE in the STB ACO 1210 does not turn on the GS bit (bit 0).

## STB ACO 1210 Specifications

**Table of Technical Specifications**

The STB ACO 1210 module's technical specifications are described in the following table.

| | | |
|---|---|---|
| description | | two single-ended nonisolated analog current output channels |
| analog current range | | 0 ... 20 mA |
| resolution | | 12 bits |
| returned data format | | IEC |
| module width | | 13.9 mm (0.58 in) |
| I/O base | | STB XBA 1000 (See *STB XBA 1000 I/O Base, p. 347*) |
| nominal logic bus current consumption | | 80 mA |
| nominal actuator bus current consumption | | 50 mA, with no load |
| maximum output current | | 20 mA/channel |
| settling time | | 900 μs to +/- 0.1% of the final value |
| output response time | nominal | 3.0 ms plus settling time both channels |
| short-circuit protection on the outputs | | yes |
| fault detection | | none |
| isolation | field-to-bus | 1500 VDC for 1 min |
| | analog module-to-actuator bus | 500 VAC rms (when actuator bus is not used for field power |
| integral linearity | | +/- 0.1% of full scale typical |
| differential linearity | | monotonic |
| absolute accuracy | | +/- 0.5% of full scale @ 25°C |
| temperature drift | | typically +/- 0.01% of full scale/ °C |
| external loop supply | | 19.2 ... 30 VDC (from the 24 VDC PDM) |
| fallback mode | default | predefined |
| | user-configurable setting* | hold last value |
| fallback states (when *predefined* is the fallback mode) | default | 0 mA on both channels |
| | user-configurable settings* | integer values between 0 ... 32 000 on each channel, representing a state between 0 ... 20 mA |
| addressing requirement | | two words for output data plus one for the *power-down state* configuration parameter |

| | | |
|---|---|---|
| actuator bus power for accessories | | 100 mA/channel @ 30 degrees C |
| | | 50 mA/channel @ 60 degrees C |
| over-current protection for accessory power | | yes |
| field power requirements | field voltage | 24 VDC |
| | PDM model | STB PDT 3100 (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) |
| power protection | | 10 A time-lag fuse on the PDM |
| * Requires the Advantys configuration software. | | |

**Note:** The field actuators or inputs driven by these nonisolated output channels must be independent (isolated). Cross-channel errors can be generated if nonisolated inputs or actuators are used.

# Advantys Power Distribution Modules

# 8

## At a Glance

**Overview**

The island bus uses special-purposes PDMs to distribute power along two separate buses—a sensor bus to the input modules and an actuator bus to the output modules.

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

Each of these two PDMs distributes sensor and actuator power, provides PE resistance for the I/O modules it supports, and provides over-current protection.

**What's in this Chapter?**

This chapter contains the following sections:

# 8.1 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:

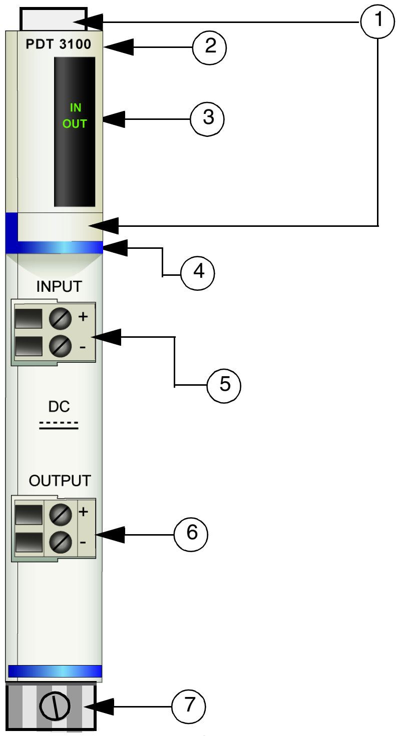
# STB PDT 3100 Physical Description

**Physical Characteristics**

The STB PDT 3100 module distributes sensor power and actuator power to input and output modules in an island segment. It 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. The PDM mounts in a special size 2 base. It 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.

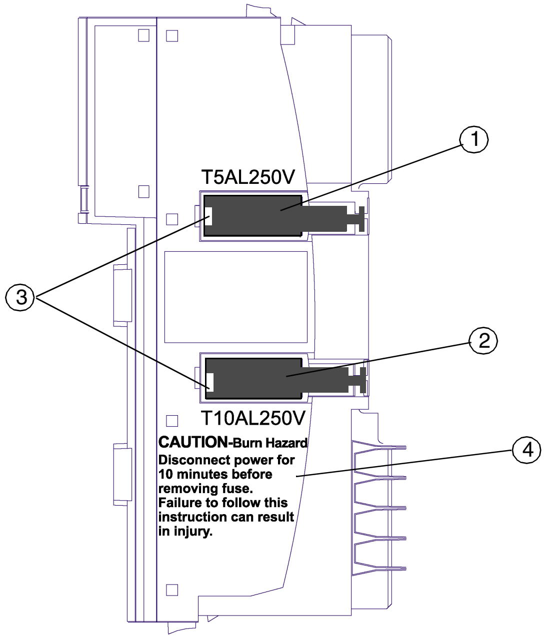
**Front and Side Panel Views**

The following illustration shows a front view of the PDM mounted on a base:




**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 following illustration shows the right side of the module, where the fuses for the sensor power and actuator power are housed:




**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

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

If a fuse is blown, it can be replaced with a fuse from the STB XMP 5600 fuse kit. The marking on the side of the module describes a simple precaution you need to take before replacing a fuse (See *Replacing a Fuse, p. 328*) to prevent burns:

| | |
|---|---|
| | **CAUTION** |
| ⚠ | **BURN HAZARD - HOT FUSE**<br>Disconnect power for 10 minutes before removing fuse.<br>**Failure to follow this precaution can result in injury or equipment damage.** |

**Module Accessories**

The following accessories need to be used with the PDM:
- an STB XBA 2200 PDM base
- a pair of STB XTS 1130 screw type connectors or STB XTS 2130 spring clamp connectors
- 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

The PDM, the base, and two fuses (one 5 A fuse and one 10 A fuse) are shipped together.
A replacement PDM base unit may be ordered as model number STB XBA 2200.
Replacement fuses are available in an STB XMP 5600 fuse kit. Five 5 A replacement fuses and five 10 A replacement fuses are provided in the kit.
Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.
The STB XBA 2200 PDM base is molded to prevent any size 2 modules other than PDMs from being inserted in them. For additional protection, you may want to use the optional STB XMP 7700 keying pin kit to make sure that an AC PDM (See *STB PDT 2100 Standard 115/230 VAC Power Distribution Module, p. 331*) is not inadvertently placed on the island where an STB PDT 3100 PDM belongs.
You may also want to use the optional STB XMP 7800 keying pin kit to define the top and bottom power wire-to-power receptacle connections. These keys can help avoid inadvertent reverse polarity power connections. Before connecting power to your PDM, ensure that all the I/O modules receiving field power from the PDM are 24 VDC modules. You may use a keying pin strategy to prevent the accidental installation of an AC module in a DC base.
For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

**Dimensions**

The STB PDT 3100 has following 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. | | |

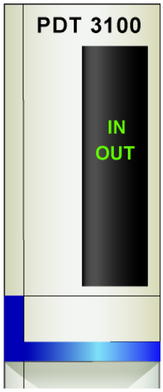
## STB PDT 3100 LED Indicators

**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:<br>● is not receiving sensor field power<br>● has a blown fuse<br>● has failed |
| | on | actuator (output) field power is present |
| | off | The module either:<br>● is not receiving sensor field power<br>● has a blown fuse<br>● 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.

**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**

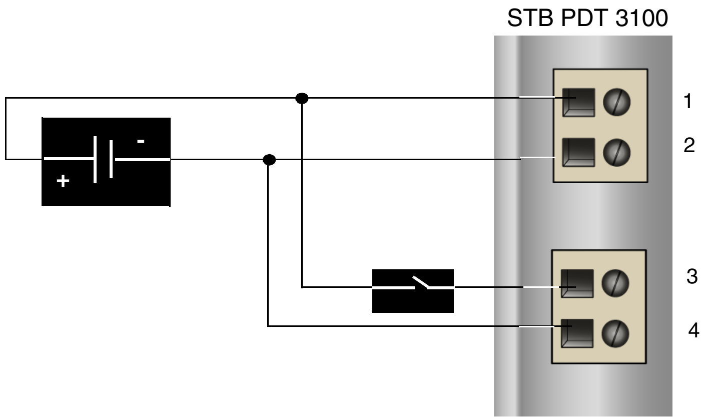
The STB PDT 3100 PDM requires source power from at least one independent, SELV-rated 19.2 ... 30 VDC power supply.

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

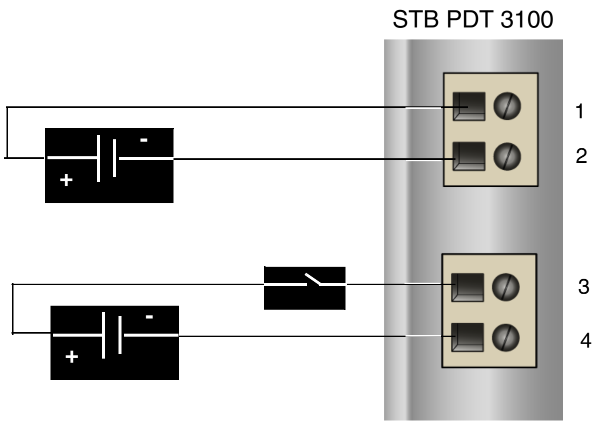
**2** -24 VDC sensor power return

**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**

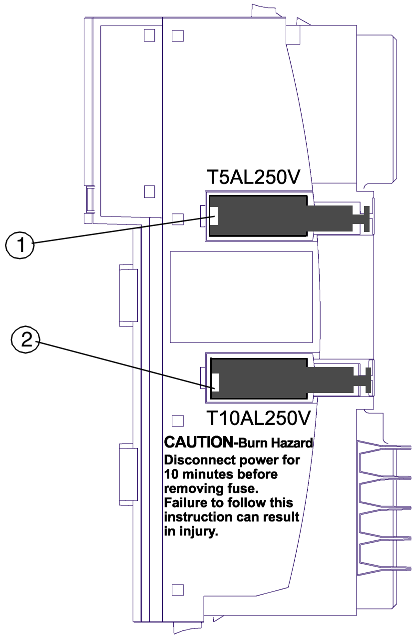
- Overcurrent protection for the input modules on the sensor bus needs to be provided by a 5 A time-lag fuse such as the Wickmann 1951500000.
- Overcurrent protection for the output modules on the actuator bus needs to be provided by a 10 A time-lag fuse such as the Wickmann 1952100000.

**Performance Considerations**

When the island is operating at an ambient temperature of 30 degrees C (86 degrees F), the fuses can pass 8 A continuously on the actuator bus and 4 A continuously on the sensor bus.
When the island is operating at an ambient temperature of 60 degrees C (140 degrees F), the fuses can pass 5 A continuously on the actuator bus and 2.5 A continuously on the sensor bus.

**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. The panels are red doors with fuse holders inside them:




**1** housing door for the 5 A sensor power fuse

**2** housing door for the 10 A actuator power fuse

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** <br> Disconnect power for 10 minutes before removing fuse. <br> **Failure to follow this precaution 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

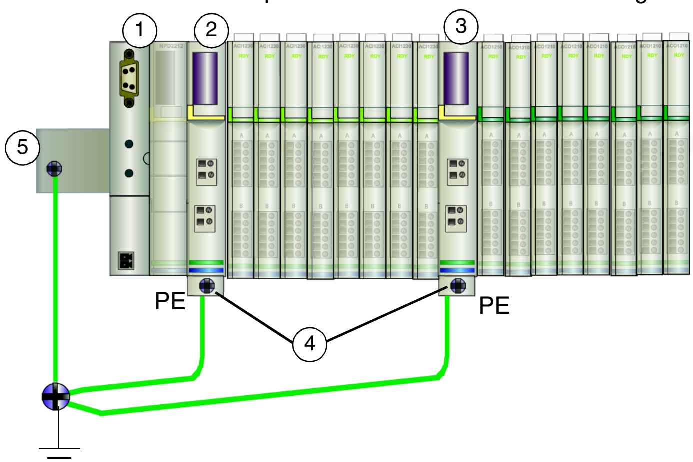
PE is brought to the island by a heavy-duty cross-sectional wire, usually a copper braided cable, 4.2 $mm^2$ (10 gage) or larger. The wire needs to be tied to a single grounding point. The ground conductor connects to the bottom of the each PDM base and is secured by the PE captive screw.
Local electrical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

| | | |
|---|---|---|
| description | | 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 |
| sensor/actuator bus voltage range | | 19.2 ... 30 VDC |
| reverse polarity protection | | yes, on the actuator bus |
| module current field | for outputs | 8 A rms max @ 30° C (86° F) |
| | | 5 A rms max @ 60° C (140° F) |
| | for inputs | 4 A rms max @ 30° C (86° F) |
| | | 2.5 A rms max @ 60° C (140° F) |
| overcurrent protection | for inputs | user-replaceable 5 A time-lag fuse from an STB XMP 5600 fuse kit |
| | for outputs | user-replaceable 10 A time-lag fuse from an STB XMP 5600 fuse kit |
| bus current | | 0 mA |
| voltage surge protection | | yes |
| PE current | | 30 A for 2 min |
| status reporting | to the two green LEDs | sensor bus power present |
| | | actuator bus power present |
| voltage-detect threshold | LED turns on | at 15 VDC (+/- 1 VDC) |
| | LED turns off | less than15 VDC (+/- 1 VDC) |

# 8.2 STB PDT 2100 Standard 115/230 VAC Power Distribution Module

## At a Glance

### Overview

This section provides you with a detailed description of the STB PDT 2100 PDM—its functions, physical design, technical specifications, and power wiring requirements.

### What's in this Section?

This section contains the following topics:

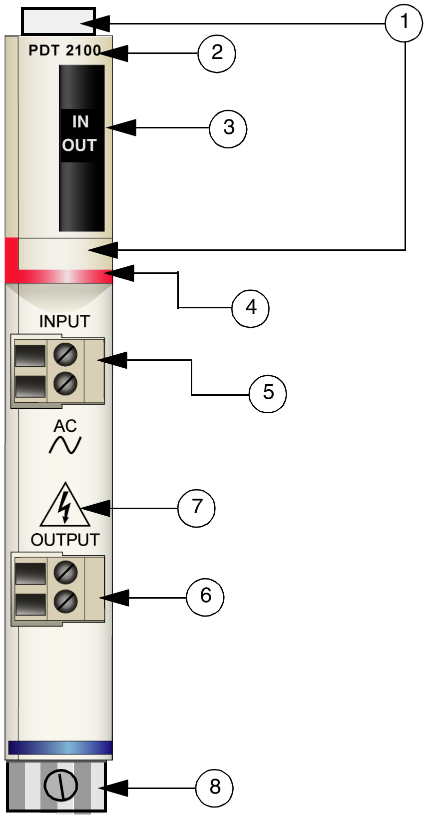
## STB PDT 2100 Physical Description

**Physical Characteristics**

The STB PDT 2100 is a module distributes sensor and actuator field power to either 115 VAC or 230 VAC I/O modules across an island segment. It 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. The PDM mounts in a special size 2 base. It requires two AC power inputs from external power source. Source power signals (either 115 VAC or 230 VAC) 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.

**Note:** If there is a mix of 115 VAC and 230 VAC modules in a segment, each voltage group needs to be supported by a separate STB PDT 2100 PDM.

**Front Panel View** The following illustration shows a front view of the PDM mounted on a base.




**1** locations for the STB XMP 6700 user-customizable labels

**2** model name

**3** LED array

**4** red identification stripe, indicating an AC PDM

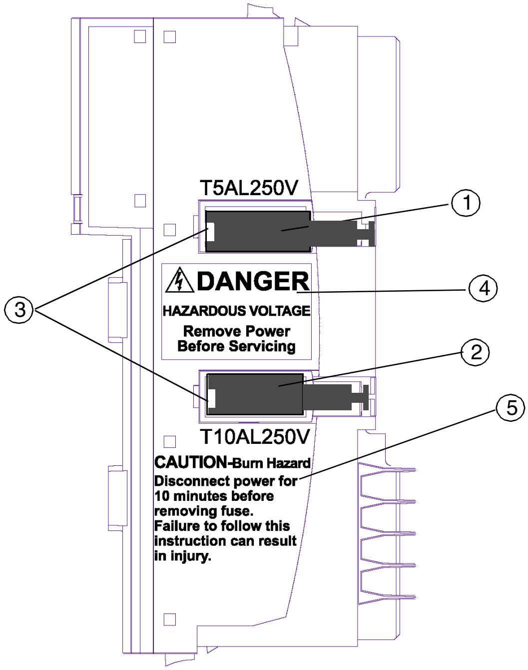
**5** input field power connection receptacle (for the sensor bus)

**6** output field power connection receptacle (for the actuator bus)

**7** electric shock hazard symbol

**8** PE captive screw clamp on the PDM base

The following illustration shows the right side of the module, where the fuses for the sensor power and actuator power are housed:




**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** electric shock hazard statement

**5** burn hazard statement

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

If a fuse is blown, it can be replaced with a fuse from the STB XMP 5600 fuse kit.

| | |
|---|---|
| | **DANGER** |
| ⚠ | **HAZARDOUS VOLTAGE**<br>Remove power before servicing.<br>**Failure to follow this precaution will result in death, serious injury, or equipment damage.** |

The marking on the side of the module describes a simple precaution you need to take before replacing a fuse (See *Replacing a Fuse, p. 328*) to prevent burns:

**CAUTION**

**BURN HAZARD - HOT FUSE**

Disconnect power for 10 minutes before removing fuse.

**Failure to follow this precaution can result in injury or equipment damage.**

**Module Accessories**

The following accessories need to be used with the PDM:
- an STB XBA 2200 PDM base
- a pair of STB XTS 1130 screw type connectors or STB XTS 2130 spring clamp connectors
- 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

The PDM, the base, and two fuses (one 5 A fuse and one 10 A fuse) are shipped together.

A replacement PDM base unit may be ordered as model number STB XBA 2200.

Replacement fuses are available in an STB XMP 5600 fuse kit. Five 5 A replacement fuses and five 10 A replacement fuses are provided in the kit.

Optionally, you may apply STB XMP 6700 user-customizable labels to the module and the base as part of your island assembly plan.

The STB XBA 2200 PDM base is molded to prevent any size 2 modules other than PDMs from being inserted in them. For additional protection, you may want to use the optional STB XMP 7700 keying pin kit to make sure that a DC PDM (See *STB PDT 3100 24 VDC Power Distribution Module, p. 318*) is not inadvertently placed on the island where an STB PDT 2100 PDM belongs.

You may also want to use the optional STB XMP 7800 keying pin kit to define the top and bottom power wire-to-power receptacle connections. These keys can help avoid inadvertent reverse polarity power connections. Before connecting power to your PDM, ensure that all the I/O modules receiving field power from the PDM are 24 VDC modules. You may use a keying pin strategy to prevent the accidental installation of an AC module in a DC base.

For more details on the labels and the keying pin kits, refer to the *Advantys STB System Planning and Installation Guide* (890 USE 171).

## Dimensions

The STB PDT 3100 has following 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. | | |

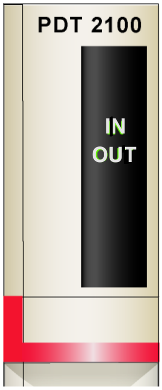
## STB PDT 2100 LED Indicators

**Overview**

The two LEDs on the STB PDT 2100 are visual indications of the presence of sensor power and actuator power. The LED locations and their meanings are described below.

**Location**

Two yellow 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 | | turns on at 70 VAC, indicating power for the sensor bus |
| off | | The module either:<br>● receiving less than 50 VAC<br>● has a blown fuse<br>● has failed |
| | on | turns on at 70 VAC, indicating power for the actuator bus |
| | off | The module either:<br>● receiving less than 50 VAC<br>● has a blown fuse<br>● has failed |

**Note:** The power required to illuminate these LEDs comes from the AC 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 2100 Source Power Wiring

### Summary

The STB PDT 2100 uses two two-pin power entry connectors that let you connect the PDM to one or two AC field power source(s). Field power may be either 115 or 230 VAC. 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.

### 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 a kit of optional safety keying pins.

Refer the *Advantys STB System Planning and Installation Guide* (890 USE 171) for a detailed discussion of keying strategies.

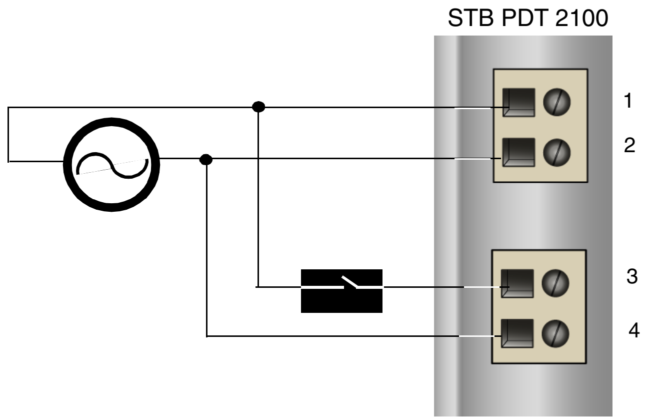
### Power Wiring Pinout

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

| Pin | Top Connector | Bottom Connector |
|---|---|---|
| 1 | +115/230 VAC for the sensor bus | +115/230 VAC for the actuator bus |
| 2 | -115/230 VAC sensor power return | -115/230 VAC actuator power return |

**Sample Wiring Diagram**

This example shows the field power connections to both the sensor bus and the actuator bus coming from an AC power source:




**1** +AC sensor bus power

**2** -AC sensor power return

**3** +AC actuator bus power

**4** -AC actuator power return

The diagram above shows a protection relay, which you may optionally place on the +AC 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).

## STB PDT 2100 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 2100 PDM. The sensor bus is protected by a 5 A fuse and the actuator bus is protected by a 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 lag-time fuse such as the Wickmann 1951500000.
- Overcurrent protection for the output modules on the actuator bus needs to be provided by a 10 A lag-time fuse such as the Wickmann 1952100000.

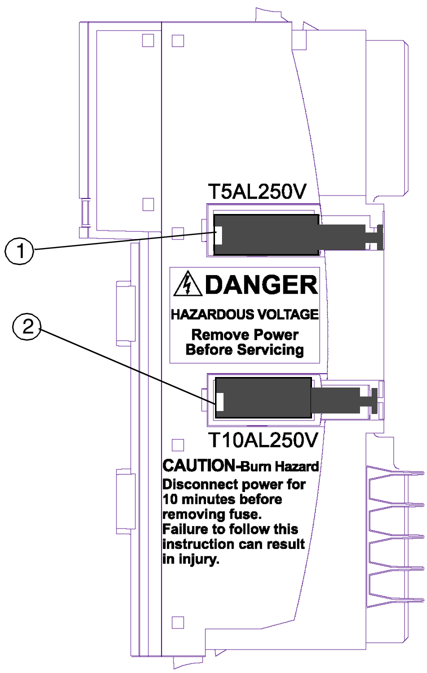
**Performance Considerations**

When the island is operating at an ambient temperature of 30 degrees C (86 degrees F), the fuses can pass 10 A continuously on the actuator bus and 5 A continuously on the sensor bus.
When the island is operating at an ambient temperature of 60 degrees C (140 degrees F), the fuses can pass 5 A continuously on the actuator bus and 2.5 A continuously on the sensor bus.

## Accessing the Fuse Panels

| | |
|---|---|
| ⚠ | **DANGER** |
| | **HAZARDOUS VOLTAGE** |
| | Remove power before servicing. |
| | **Failure to follow this precaution will result in death, serious injury, or equipment damage.** |

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. The panels are red doors with fuse holders inside them:




**1** housing door for the 5 A sensor power fuse

**2** housing door for the 10 A actuator power fuse

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 2100, you need to remove the power sources to the actuator bus and sensor bus.

| | |
|---|---|
| | **CAUTION** |
| | **BURN HAZARD - HOT FUSE**<br>Disconnect power for 10 minutes before removing fuse.<br>**Failure to follow this precaution 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 side 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. | If you are replacing one fuse with another, 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. | |

## 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**

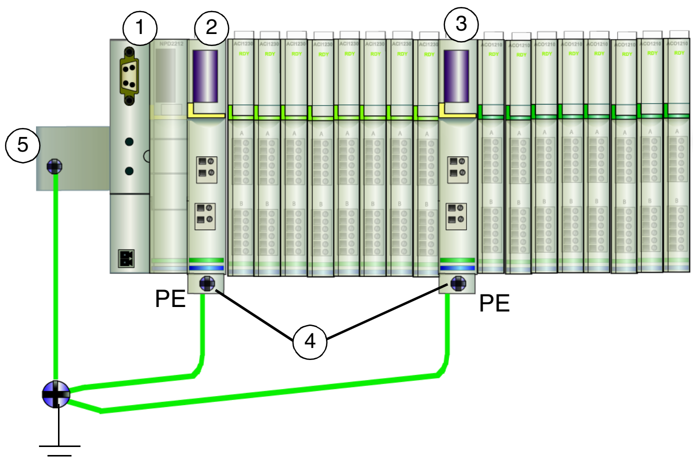
PE is brought to the island by a heavy-duty cross-sectional wire, usually a copper braided cable, 4.2 $mm^2$ (10 gage) or larger. The wire needs to be tied to a single grounding point. The ground conductor connects to the bottom of the each PDM base and is secured by the PE captive screw.
Local electrical 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 2100 Specifications

**Table of Technical Specifications**

The STB PDT 2100 module's technical specifications are described in the following table.

<table>
<tr><td colspan="2">description</td><td>115 or 230  VAC 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" rowspan="2">sensor/actuator bus voltage range</td><td>85 ... 264 VAC</td></tr>
<tr><td>AC sources should be the same phase reference</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>10 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>5 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">PE current</td><td>30 A for 2 min</td></tr>
<tr><td colspan="2">voltage surge protection</td><td>yes</td></tr>
<tr><td rowspan="2">status reporting</td><td rowspan="2">to the two yellow 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>70 VAC (+/- 5 VAC)</td></tr>
<tr><td>LED turns off</td><td>50 VAC (+/- 5 VAC)</td></tr>
</table>

# STB Module Bases

# 9

## 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 (See *STB XBA 1000 I/O Base, p. 347*) | 13.9 mm (0.58 in) | size 1 Advantys input and output modules |
| STB XBA 2000 (See *STB XBA 2000 I/O Base, p. 351*) | 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 *STB XBA 2200 PDM Base, p. 360*) | 18.4 mm (0.72 in) | All Advantys PDM modules |
| STB XBA 2300 (See *STB XBA 2300 Beginning-of-Segment Base, p. 366*) | 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 *STB XBA 3000 I/O Base, p. 356*) | 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.

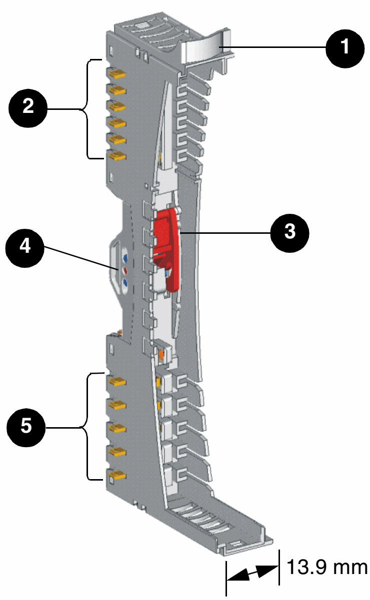
# STB XBA 1000 I/O Base

**Summary**

The STB XBA 1000 I/O base is 13.9 mm (0.58 in) wide. It provides the physical connections for a size 1 input or 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 1000 base:




**1** user-customizable label tab

**2** six island bus contacts

**3** DIN rail lock/release latch

**4** DIN rail contact

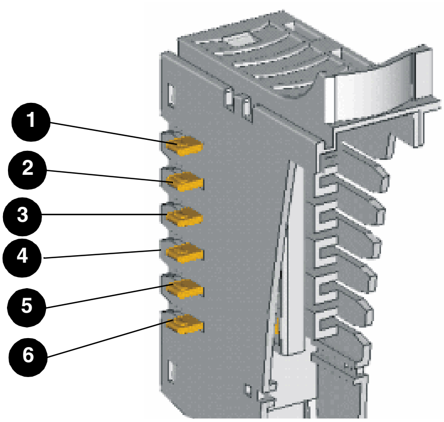
**5** five field power distribution contacts

**The Label Tab**

A label can be positioned on the tab shown above in item 1. The label helps identify the specific module that will reside at this base unit's island bus location. A similar label can be placed on the module 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 from your Schneider Electric service provider.

**The Island Bus Contacts**

The six contacts located at the top left side of the STB XBA 1000 base provide logic power and island bus communications connections between the module and the island bus:



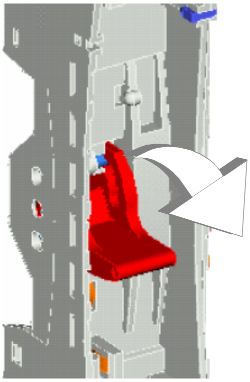

In the primary segment of the island bus, the signals that make these contacts come from the NIM. In extension segments, these signals come from an STB XBE 1000 BOS extension module:

| 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. |

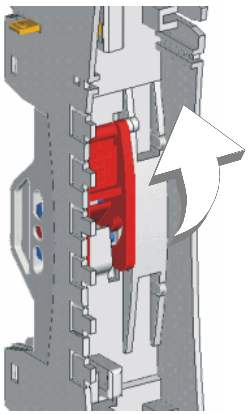
**The Lock/ Release Latch**

The latch in the center front of the STB XBA 1000 base has two positions, as shown below:

**Release position**



**Lock position**



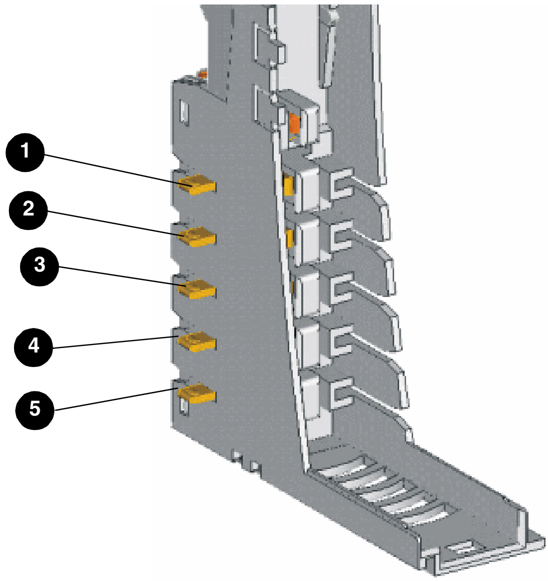
The latch needs to be in release position while the base is being inserted on the DIN rail and when it is being removed from the DIN rail. It needs to be in lock position when the base has been pushed and snapped into place on the rail before the module is inserted into the base.

**The DIN Rail Contacts**

One of the 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 I/O base is snapped onto the DIN rail, two contacts on the back of the rail provide the earth ground connection 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 1000 I/O base provide field power and a protective earth (PE) connections to the I/O module:




Field power (sensor power for inputs and actuator power for outputs) is distributed across the island bus to the STB XBA 1000 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 *The Protective Earth Connection, p. 365*) and is delivered to the Advantys STB I/O module via contact 5 |

If the module in the STB XBA 1000 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 2000 I/O Base

**Summary**

The STB XBA 2000 I/O base is 18.4 mm (0.72 in) wide. It provides the physical connections for a size 2 input or 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:

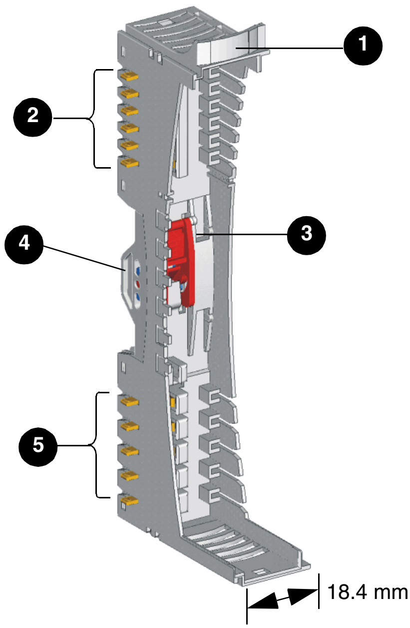
- logic power from the NIM or from a BOS module
- sensor power (for inputs) or actuator power (for outputs) from the PDM

The base also support an STB XBE 2100 CANopen extension module on the island bus.

**Note:** The STB XBA 2000 is designed only for the size 2 modules described above. Do not use this base for other size 2 Advantys modules such as the PDMs, EOS modules or BOS modules.

**Physical Overview**

The following illustration shows some of the key components an STB XBA 2000 base:




**1** user-customizable label tab

**2** six island bus contacts

**3** DIN rail lock/release latch

**4** DIN rail contact

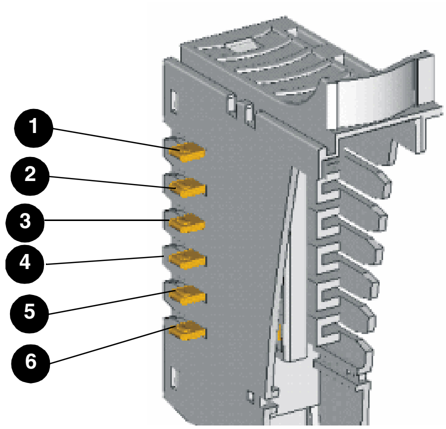
**5** five field power distribution contacts

**The Label Tab**

A label can be positioned on the tab shown above in item 1. The label helps identify the specific module that will reside at this base unit's island bus location. A similar label can be placed on the module 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 from your Schneider Electric service provider.

## The Island Bus Contacts

The six contacts located in a column at the top of the I/O base provide logic power and island bus communications connections between the module and the island bus:



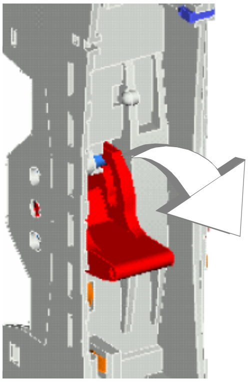

In the primary segment of the island bus, the signals that make these contacts come from the NIM. In extension segments, these signals come from an STB XBE 1000 BOS extension module:

| 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. |

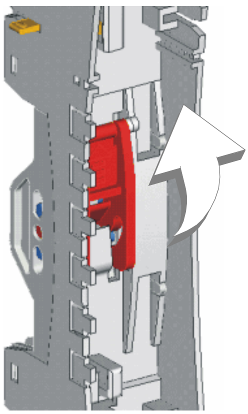
**The Lock/ Release Latch**

The latch in the center front of the STB XBA 2000 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.

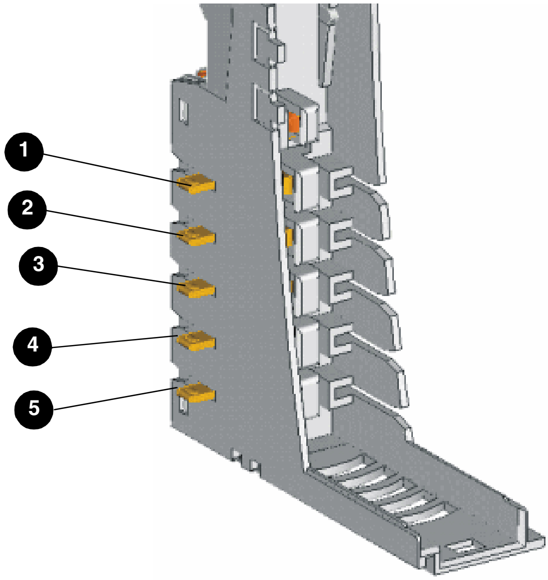
**The DIN Rail Contacts**

One of the 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 I/O base is snapped onto the DIN rail, two contacts on the back of the rail provide the earth ground connection 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 2000 base provide AC or DC field power and a 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 PDT 2100 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 *The Protective Earth Connection, p. 365*) and is delivered to the Advantys STB I/O module via contact 5 |

If the module in the STB XBA 2000 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 3000 I/O Base

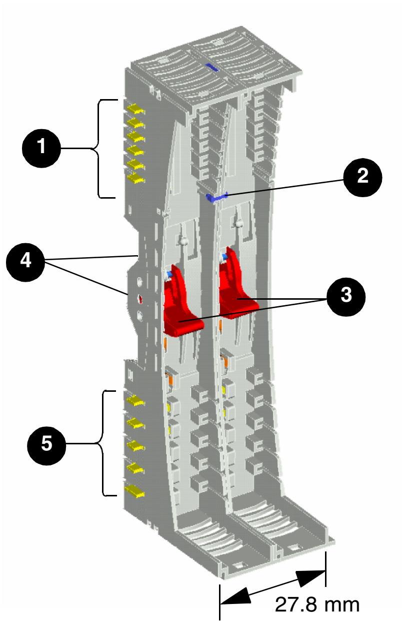
**Summary**

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

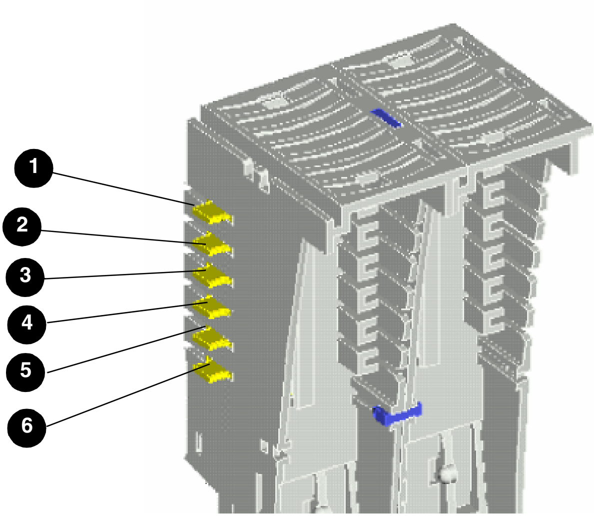
**3** DIN rail lock/release latches

**5** 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 *Logic Power Flow, p. 24*) 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. |

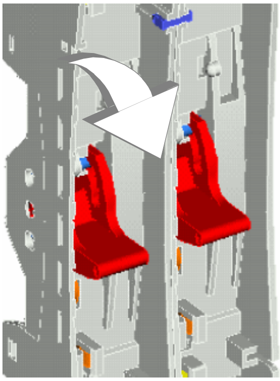
## The Size 3 Module Security Pin

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.

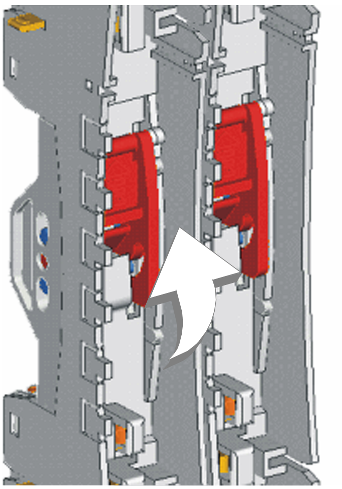
**The Lock/ Release Latch**

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

**Release positions**



**Lock positions**



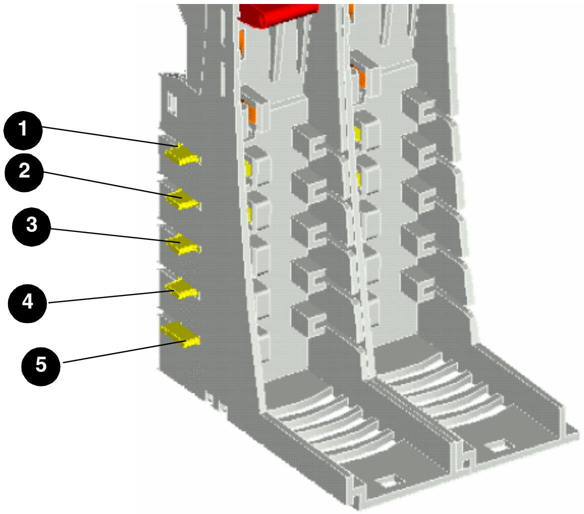
The latches need to be in their release positions while the base is being inserted on the DIN rail and when it is being removed from the DIN rail. They need to be in their lock positions when the base has been pushed and snapped into place on the rail before the module is inserted into the base.

**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 *The Protective Earth Connection, p. 365*) 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

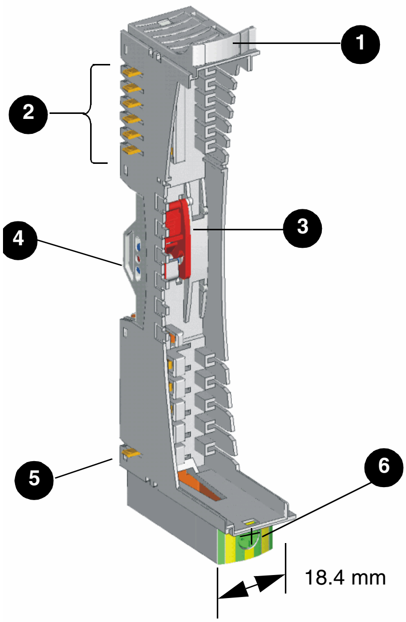
**Summary**

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 *The Protective Earth Connection, p. 365*), 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

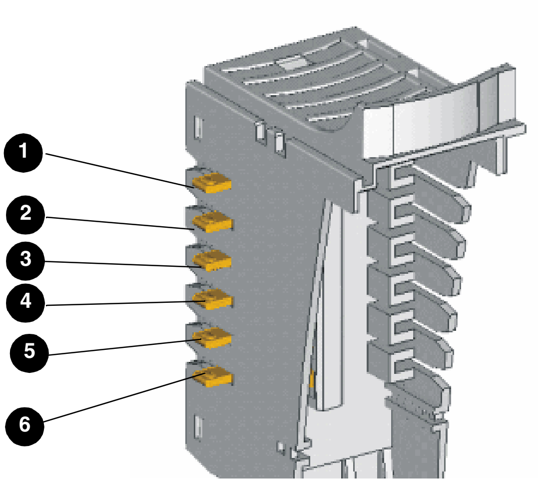
**The Label Tab**

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

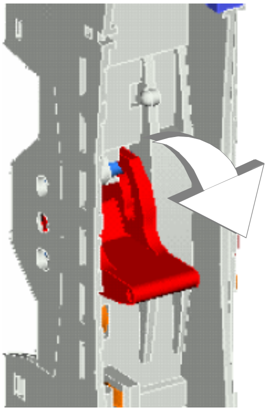
**6** address line contact

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.

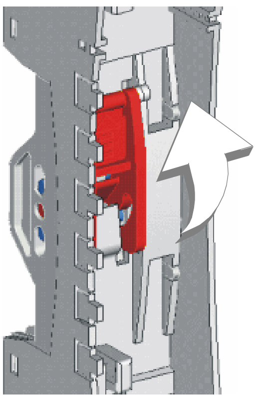
**The Lock/ Release Latch**

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.

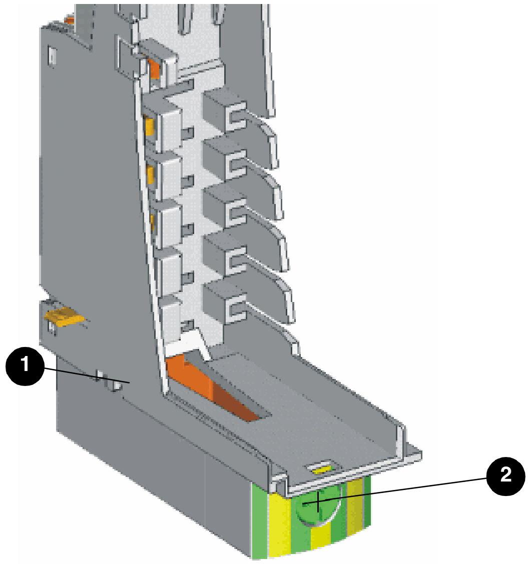
**The DIN Rail Contacts**

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**

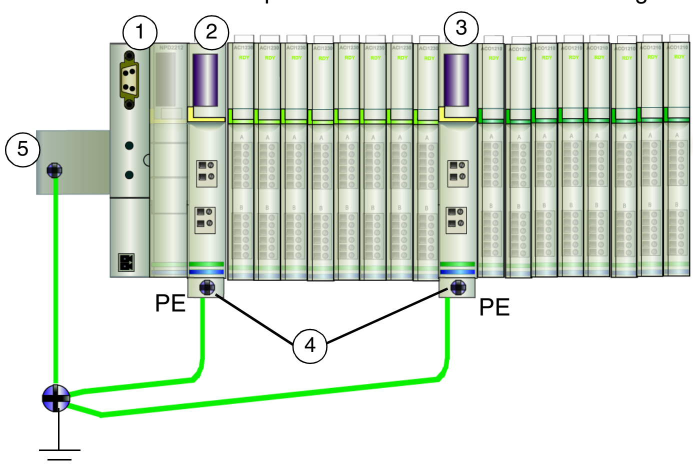
PE is brought to the island by a heavy-duty cross-sectional wire, usually a copper braided cable, 4.2 $mm^2$ (10 gage) or larger. The wire needs to be tied to a single grounding point. The ground conductor connects to the bottom of the each PDM base and is secured by the PE captive screw.
Local electrical 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 XBA 2300 Beginning-of-Segment Base

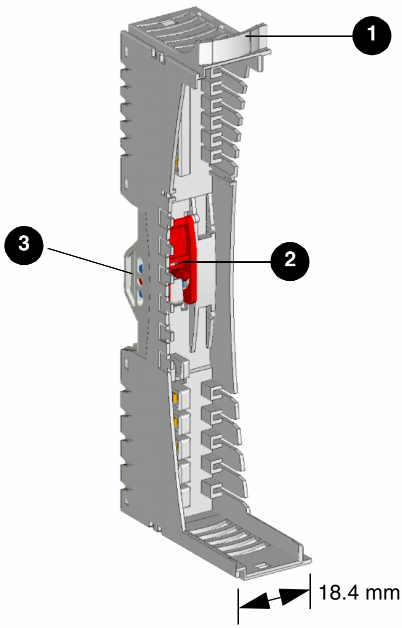
**Summary**

The STB XBA 2300 base is 18.4 mm (0.72 in) wide. It provides the physical connections for an STB XBE 1200 BOS extension module. The base provides the physical connection point for a module on the island bus and allows you to easily remove and replace the module for maintenance.
This base must be installed in the first (leftmost) position of an extension segment. It enables the BOS module to send logic power to the I/O modules in the extension segment, and it supports island bus communications between the I/O modules in the extension segment and the NIM in the primary segment.

**Note:** The STB XBA 2000 is designed only for STB XBE 1000 BOS modules. Do not attempt to use this base for other size 2 Advantys modules such as the PDMs, EOS modules or I/O modules.

**Physical Overview**

The following illustration shows some of the key components an STB XBA 2300 base:




**1** user-customizable label tab

**2** DIN rail lock/release latch

**3** DIN rail contact

> **Note:** Notice the absence of logic and field power contacts along the left side of the STB XBA 2300 base. This is one way you can discriminate between an STB XBA 2300 base and other size 2 bases. Because a BOS module mounts in the leftmost location on an extension segment, it does not use any left-side contacts.

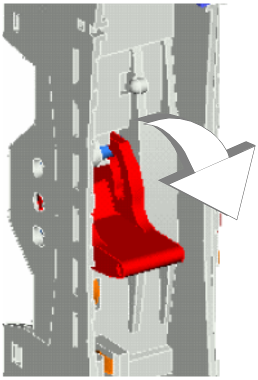
**The Label Tab**

A label can be positioned on the tab shown above in item 1 to help identify the specific Advantys I/O module that will reside at this base unit's island bus location. A similar label can be placed on the module 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 Schneider Electric service provider.

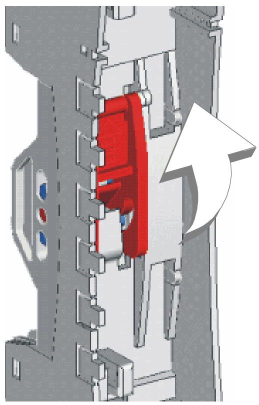
**The Lock/ Release Latch**

The latch in the center front of the STB XBA 2300 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 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 I/O 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 I/O module that will be seated on the base.

## STB XBA 2400 End-of-segment Base

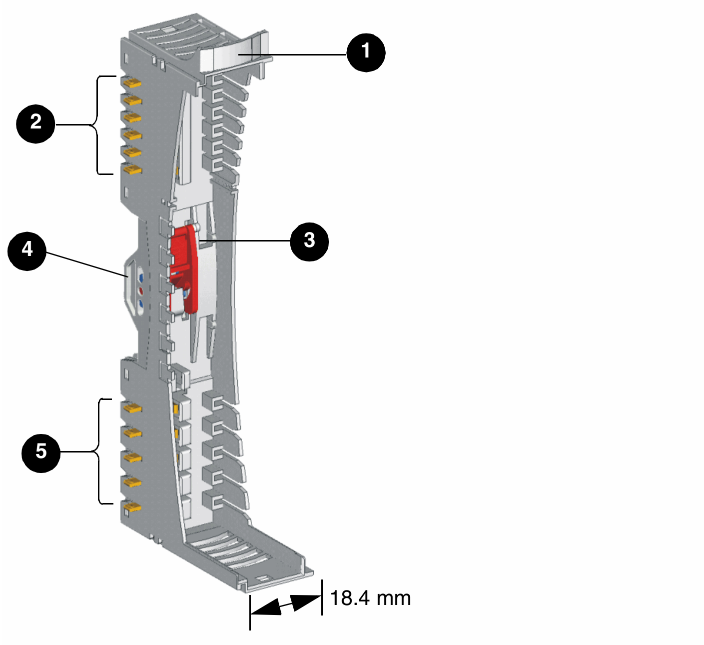
**Summary**

The STB XBA 2400 EOS base is 18.4 mm (0.72 in) wide. It provides the physical connections for a any EOS modules used on the island bus. If this base is used, it is always the last (rightmost) base in a segment. By definition, this segment is not at the end of the island bus, so the terminator plate is never connected to it.
The base has two set of contacts on its left side. These contacts receive logic power from the NIM or BOS module at the beginning of the segment and allow the EOS module to pass island bus communication signals to the next segment or preferred module on the island bus. The base does not make any contacts on its right side.

**Note:** The STB XBA 2400 is designed only for EOS modules. Do not attempt to use this base for other size 2 Advantys modules such as I/O, PDMs or BOS modules.

**Physical Overview**

The following illustration shows some of the key components an STB XBA 2400 base:




**1** user-customizable label tab

**2** six island bus contacts

**3** DIN rail lock/release latch

**4** DIN rail contact

**5** five field power contacts

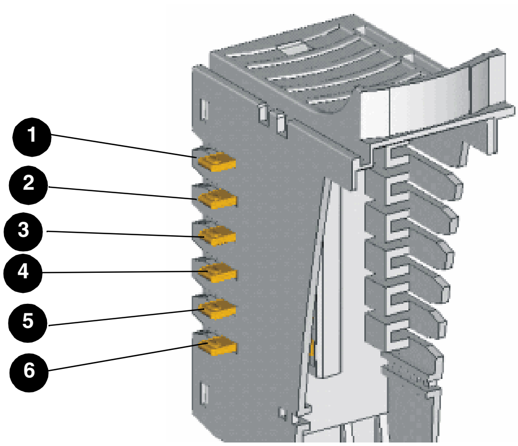
**The Label Tab**

A label can be positioned on the tab shown above in item 1. The label helps identify the specific module that will reside at this base unit's island bus location. A similar label can be placed on the module 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 from your Schneider Electric service provider.

**The Island Bus Contacts**

The six contacts located in a column at the top of the EOS base provide logic power and island bus communications connections between the module and the island bus:



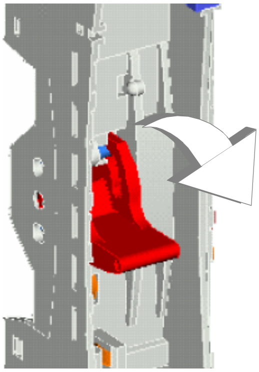

In the primary segment of the island bus, the signals that make these contacts come from the NIM. In extension segments, these signals come from an STB XBE 1000 BOS extension module:

| 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 to pass island bus communications between the NIM and the EOS module. The EOS module then passes communications to/from the next segment or preferred module on the island—contact 4 is positive (+ve), and contact 5 is negative (-ve). |
| 6 | passes the address line to the next segment or preferred module on the island bus |

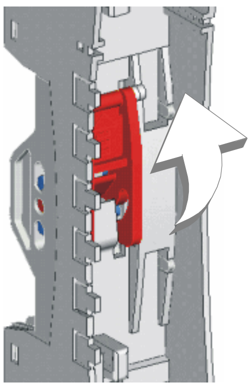
**The Lock/ Release Latch**

The latch in the center front of the STB XBA 2400 base has two positions, as shown below:

**Release position**



**Lock position**



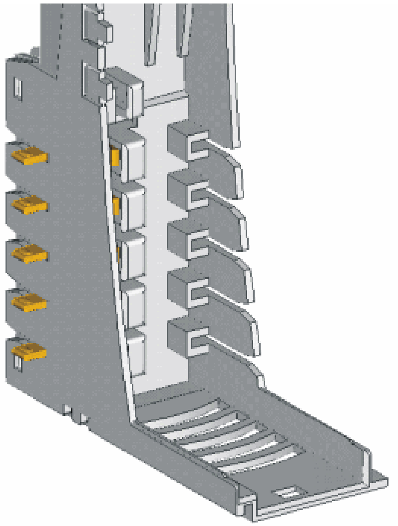
The latch needs to be in release position while the base is being inserted on the DIN rail and when it is being removed from the DIN rail. It needs to be in lock position when the base has been pushed and snapped into place on the rail before the module is inserted into the base.

**The DIN Rail Contacts**

One of the 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 I/O base is snapped onto the DIN rail, two contacts on the back of the rail provide the earth ground connection between the rail and the I/O module that will be seated on the base.

**The Field Power Distribution Contacts**

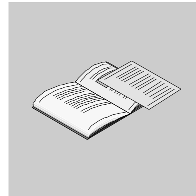
The five contacts located at the bottom of the STB XBA 2400 base are not used:



Field power (sensor power for inputs and actuator power for outputs) is distributed across the island bus to the STB PDT 2100 PDM:

| Contacts | Signals |
|---|---|
| 1, 2 3 and 4 | not used |
| 5 | PE is established via a captive screw on the PDM base units (See *The Protective Earth Connection, p. 365*) and is delivered to the Advantys STB I/O module via contact 5 |

# 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**

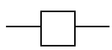
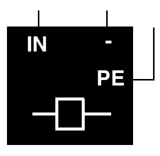
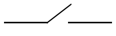
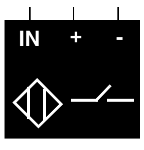
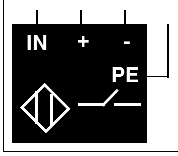
## IEC Symbols

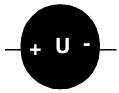
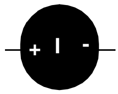
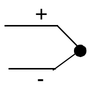
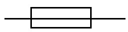
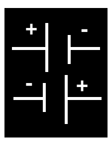
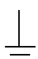
**Introduction**

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 |
|   | four-wire digital sensor/input |

| **Symbol** | **Definition** |
|---|---|
|  | analog voltage sensor |
|  | analog current sensor |
|  | thermocouple element |
|  | fuse |
|  | VAC power |
|  | VDC power |
|  | earth ground |

# Glossary

## !

**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—i.e., 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—i.e., 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** *address resolution protocol.* IP's network layer protocol 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

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

**BOS** *beginning of segment.* When more than one segment of I/O modules is used in an island, an STB XBE 1200 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.

**bus arbitrator** A master on a Fipio network.

## C

**CAN** *controller area network.* The CAN 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 standard CANopen device to the island bus.

**CI** *command interface.*

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

**COB** *communication object.* A 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.

**COMS** *island bus scanner.*

**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

**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 role 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.

## E

**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** *end of segment.* When more than one segment of I/O modules is used in an island, an STB XBE 1000 EOS module is installed in the last position in every segment except the final segment on the island. Its job is to extend island bus communications and send 24 VDC for logic power to the next segment.

**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.0

**Ethernet II** A frame format in which the header specifies the packet type, Ethernet II is the default frame format for STB NIP 2212 communications.

## F

**fallback state** A safe 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 eight words and equal to or less than thirty-two 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 eight 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 one 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.

**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 in operation.

**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 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. IEC 1131 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 1+ input** Type 1+ digital inputs support sensor signals from mechanical switching devices such as relay contacts, push buttons (in normal-to-moderate environmental conditions), three-wire proximity switches 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 0.8 mA

**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 two- or three-wire proximity switches.

**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.

**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.

## 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.

**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. The network interface module's built-in power supply provides 5 V logic power to the Advantys STB I/O modules as well as 24 V source power, as needed, to the support I/O modules. The NIM also has an RS-232 interface that is the connection point for the Advantys configuration software.

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

## O

**object dictionary** Sometimes called the "object directory," this part of the CANopen device model is a map to the internal structure of CANopen devices (according to CANopen profile DS-401). A given device's object dictionary 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 structure through the CANopen fieldbus, you can predict its network behavior and, therefore, build a distributed application that implements it.

**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 separately 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.

**preferred module** An I/O module that functions as an auto-addressable node 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 STB XBE 1000 EOS module and a length of STB XCA 100*x* bus extension cable. It can be extended to another preferred module or back into a standard island segment. If it is the last device on the island, it must be terminated with a 120 Ω terminator.

**premium network interface** An Advantys STB network interface module designed at a relatively high cost to support high module densities, high transport data capacity (e.g., for web servers), and more diagnostics on the island bus.

**prioritization** Prioritization is an optional feature that allows you to selectively identify digital input modules to be scanned more frequently during the NIM's logic scan of the island bus.

**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 physical location. 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 two-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** The execution of a simple, logical command function configured locally at 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 one 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 Modbus TCP/IP NIM. A role name is created either as a combination of a numeric rotary switch setting and the STB NIP 2212 part number or by modifying text on the Configure Role Name web page. After the STB NIP 2212 is configured with a valid role name, the DHCP server will use 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.

**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 one 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 one segment and may have as many as seven 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 segment, that function is filled by a NIM. In an extension segment, that function is filled by an STB XBE 1200 BOS module.

**SELV** *safety extra low voltage.* A secondary circuit designed and protected so that the voltage between any two accessible parts (or between one 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. Two conditions are imperative to the success of this design technique—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 wide and 128.25 mm 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 wide and 128.25 mm 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 wide and 128.25 mm high.

**slice I/O** An I/O module design that combines a small number of channels (usually between two and six) 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 network interface** An Advantys STB network interface module designed at moderate cost to support the kind of configuration capabilities and throughput capacity suitable for most standard applications on the island bus.

**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. Three types of standard profiles are available—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 two-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.

## 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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