Advantys STB

Analog I/O Modules

Reference Guide

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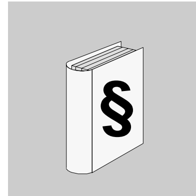
Safety Information



Important Information

NOTICE

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

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

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

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

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

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

PLEASE NOTE

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

About the Book

At a Glance

Document Scope

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

Validity Note

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

Related Documents

Title of Documentation	Reference Number
Advantys STB Digital I/O Modules Reference Guide	31007720 (E), 31007721 (F), 31007722 (G), 31007723 (S), 31007724 (I)
Advantys STB Counter Modules Reference Guide	31007725 (E), 31007726 (F), 31007727 (G), 31007728 (S), 31007729 (I)
Advantys STB Special Modules Reference Guide	31007730 (E), 31007731 (F), 31007732 (G), 31007733 (S), 31007734 (I)
Advantys STB System Planning and Installation Guide	890 USE 171 0x
Advantys STB Standard Profibus DP Network Interface Applications Guide	890 USE 173 0x

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

Product Related Warnings

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

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

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

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

User Comments

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The Advantys STB Architecture: Theory of Operation

1

At a Glance

Overview

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

What's in this Chapter?

This chapter contains the following topics:

Advantys STB Islands of Automation

System Definition

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

Open Fieldbus Choices

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

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

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

Granularity

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

Mechatronics

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

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

Environmental Considerations

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

Types of Modules on an Advantys STB Island

Summary

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

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

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

Advantys STB Modules

The core set of Advantys STB modules comprises:

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

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

Preferred Modules

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

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

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

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

Standard CANopen Devices

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

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

Island Segments

Summary

An Advantys STB system starts with a group of interconnected devices called the *primary segment*. This first segment is a mandatory piece of an island. Depending on your needs and on the type of NIM you are using (see *p. 18*), the island may optionally be expanded to additional segments of Advantys STB modules, called *extension segments* and to non-STB devices such as preferred modules and/or standard CANopen devices.

The Primary Segment

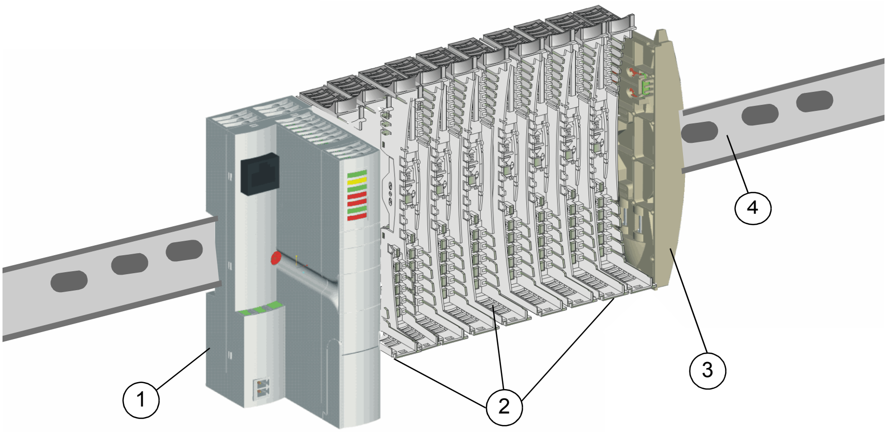
Every island bus begins with a primary segment. The primary segment consists of the island's NIM and a set of interconnected module bases attached to a DIN rail. The PDMs and Advantys STB I/O module mount in these bases on the DIN rail. The NIM is always the first (leftmost) module in the primary segment.

The Island Bus

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

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

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

PDMs

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

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

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

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

The Bases

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

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

Base Model	Base Width	Advantys STB Modules It Supports
STB XBA 2100	18.4 mm (0.72 in)	the size 2 base that supports an auxiliary power supply
STB XBA 2200	18.4 mm (0.72 in)	the size 2 base that supports the PDMs
STB XBA 2300	18.4 mm (0.72 in)	the size 2 base that supports BOS modules
STB XBA 2400	18.4 mm (0.72 in)	the size 2 base that supports EOS modules
STB XBA 3000	28.1 mm (1.06 in)	the size 3 base that supports many of the special modules

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

I/O

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

The Last Device on the Primary Segment

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

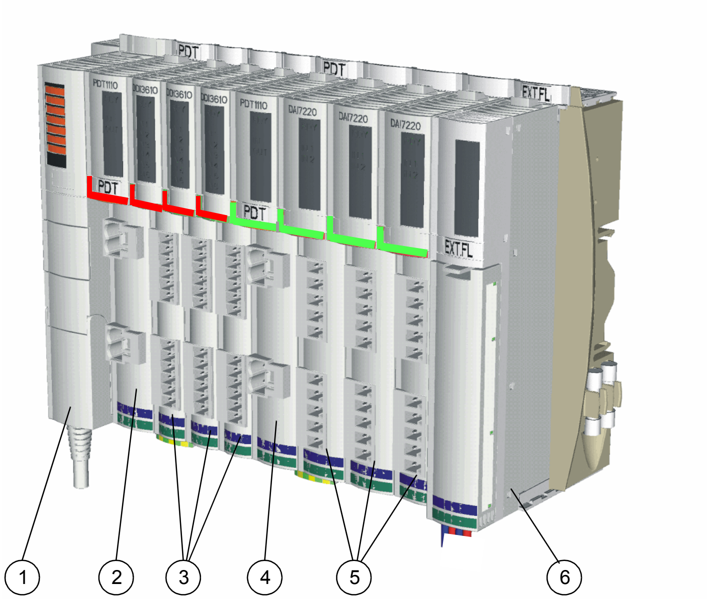
If the island bus is extended to another segment of Advantys STB modules or to a preferred module (see *p. 19*), you need to install an STB XBE 1000 EOS bus extension module in the last position of the segment that will be extended. Do not apply 120 Ω termination to the EOS module. The EOS module has an IEEE 1394-style output connector for a bus extension cable. The extension cable carries the island's communications bus and auto-addressing line to the extension segment or to the preferred module.

If the island bus is extended to a standard CANopen device (see *p. 18*), you need to install an STB XBE 2100 CANopen extension module in the rightmost position of the segment and apply 120 Ω termination to island bus after the CANopen extension module—use the STB XMP 1100 terminator plate. You must also provide 120 Ω termination on the last CANopen device that is installed on the island bus.

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

An Illustrative Example

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



1 The NIM resides in the first location. One and only one NIM is used on an island.
2 A 115/230 VAC STB PDT 2100 PDM, installed directly to the right of the NIM. This module distributes AC power over two separate field power buses, a sensor bus and an actuator bus.
3 A set of digital AC I/O modules installed in a voltage group directly to the right of the STB PDT 2100 PDM. The input modules in this group receive field power from the island's sensor bus, and the output modules in this group receive AC field power from the island's actuator bus.
4 A 24 VDC STB PDT 3100 PDM, which will distribute 24 VDC across the island's sensor and actuator buses to a voltage group of 24 VDC I/O modules. This PDM also provides isolation between the AC voltage group to its left and the DC voltage group to its right.
5 A set of analog and digital I/O modules installed directly to the right of the STB PDT 3100 PDM.
6 An STB XBE 1000 EOS extension module installed in the last location in the segment. Its presence indicates that the island bus will be extended beyond the primary segment and that you are not using a basic NIM.

Logic Power Flow

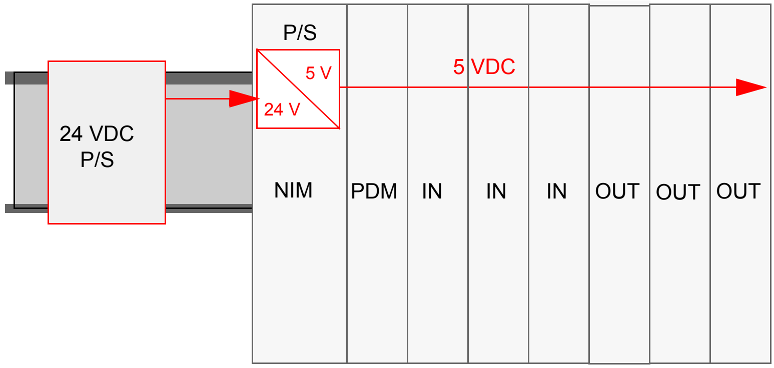
Summary

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

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

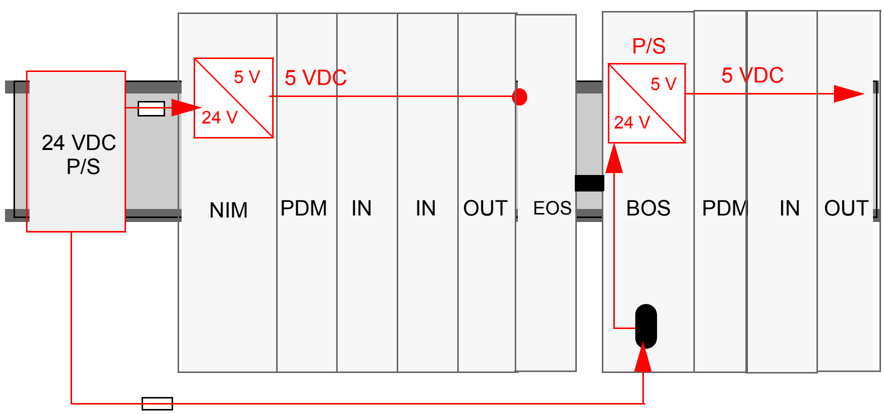
Logic Power Flow

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



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

Here is an illustration of the extension segment scenario:



The Power Distribution Modules

Functions

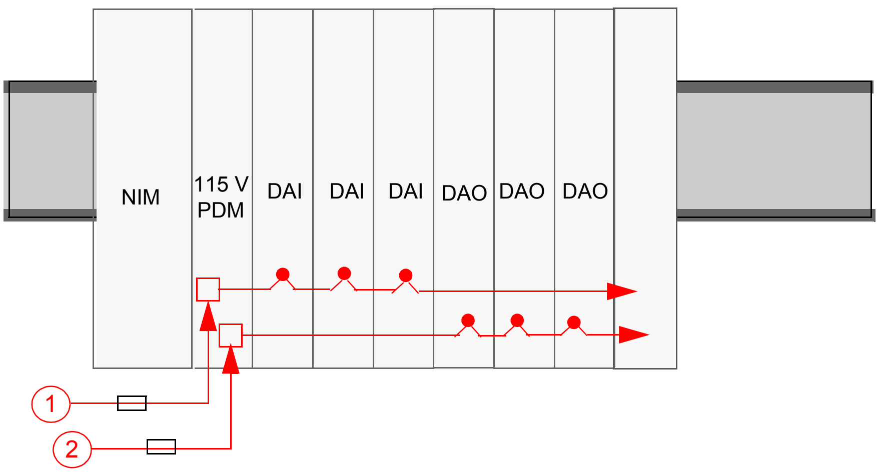
A PDM distributes field power to a set of Advantys STB I/O modules on the island bus. The PDM sends field power to the input and output modules in a segment. Depending on the PDM module you are using, it may distribute sensor power and actuator power on the same or on separate power lines across the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

Voltage Groupings

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

Standard PDM Power Distribution

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



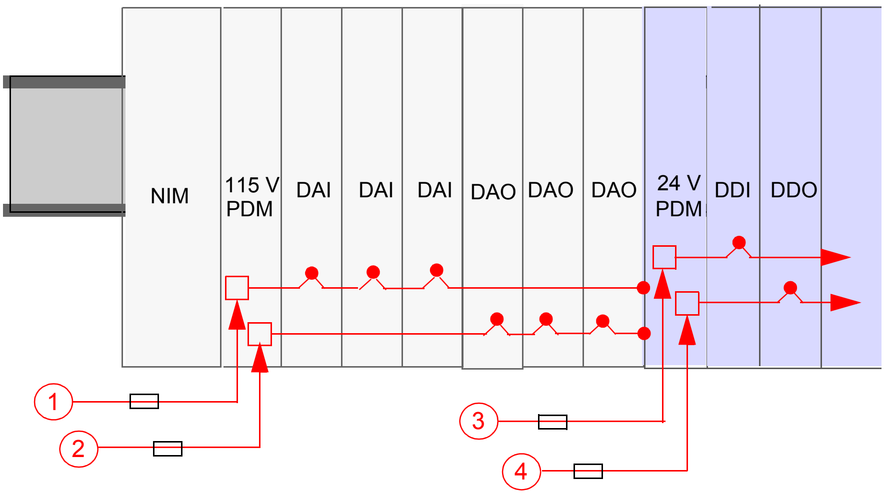
1 115 VAC sensor power signal to the PDM
2 115 VAC actuator power signal to the PDM

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

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

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

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

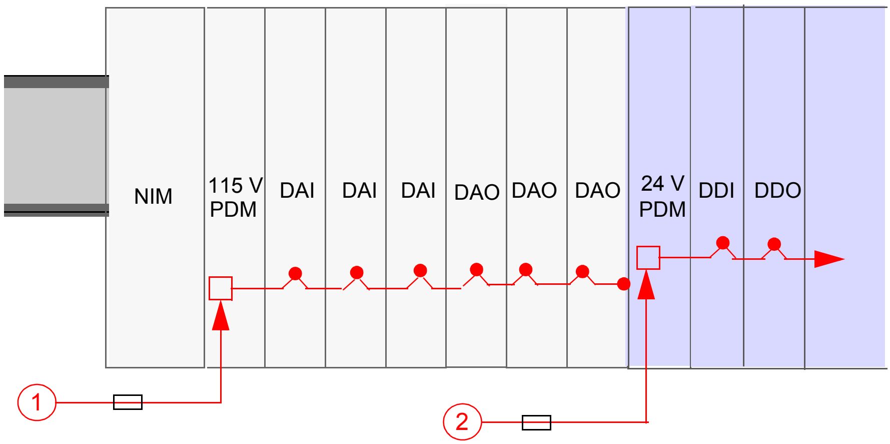


1 115 VAC sensor power signal to the PDM
2 115 VAC actuator power signal to the PDM
3 24 VDC sensor power signal to the PDM
4 24 VDC actuator power signal to the PDM

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

Basic PDM Power Distribution

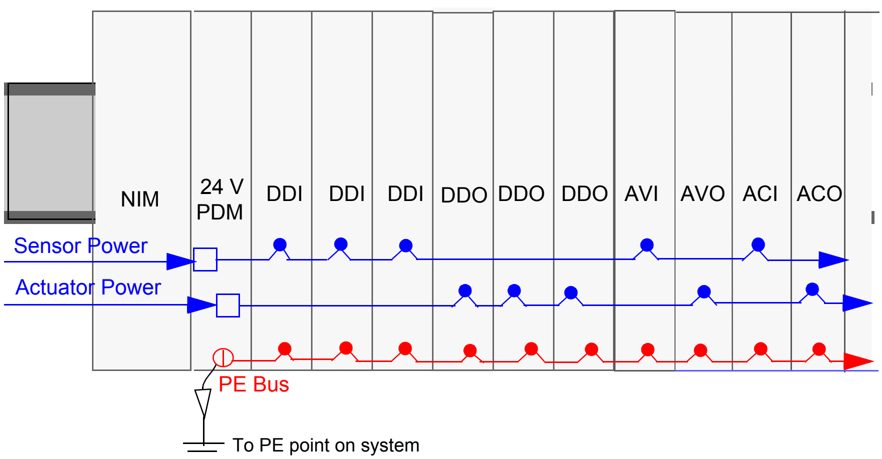
If your island uses basic PDMs instead of standard PDMs, then actuator power and sensor power are sent over a single power line:



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

PE Grounding

A captive screw terminal on the bottom of the PDM base makes contact with pin 12 (see *p. 34*) on each I/O base, establishing an island PE bus. The screw terminal on the PDM base meets IEC-1131 requirements for field power protection. The screw terminal should be wired to the PE point on your system.



Sensor Power and Actuator Power Distribution on the Island Bus

Summary

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

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

24 VDC Field Power Distribution

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

⚠ CAUTION

IMPROPER GALVANIC ISOLATION

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

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

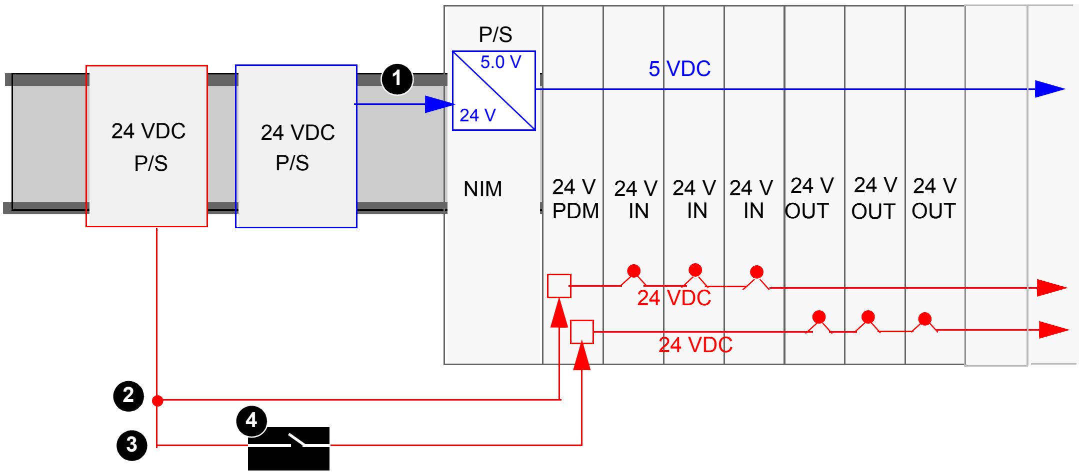
⚠ CAUTION

COMPROMISED DOUBLE INSULATION

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

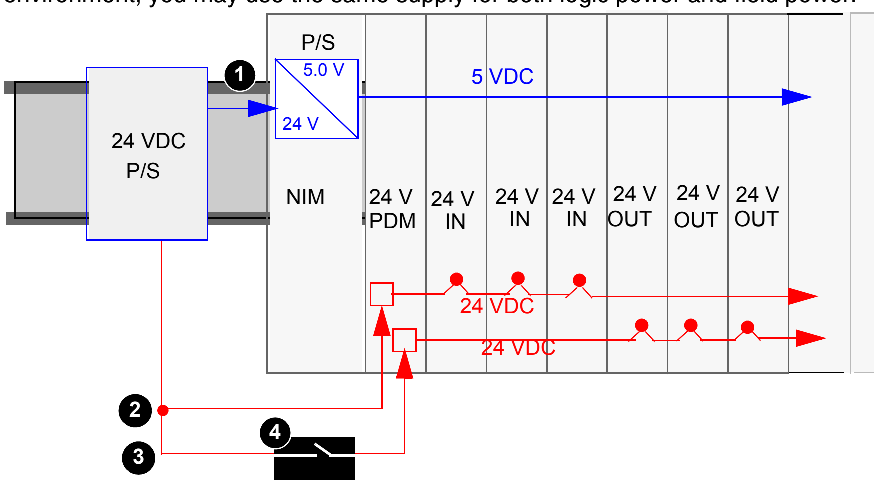
Failure to follow these instructions can result in injury or equipment damage.

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



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

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

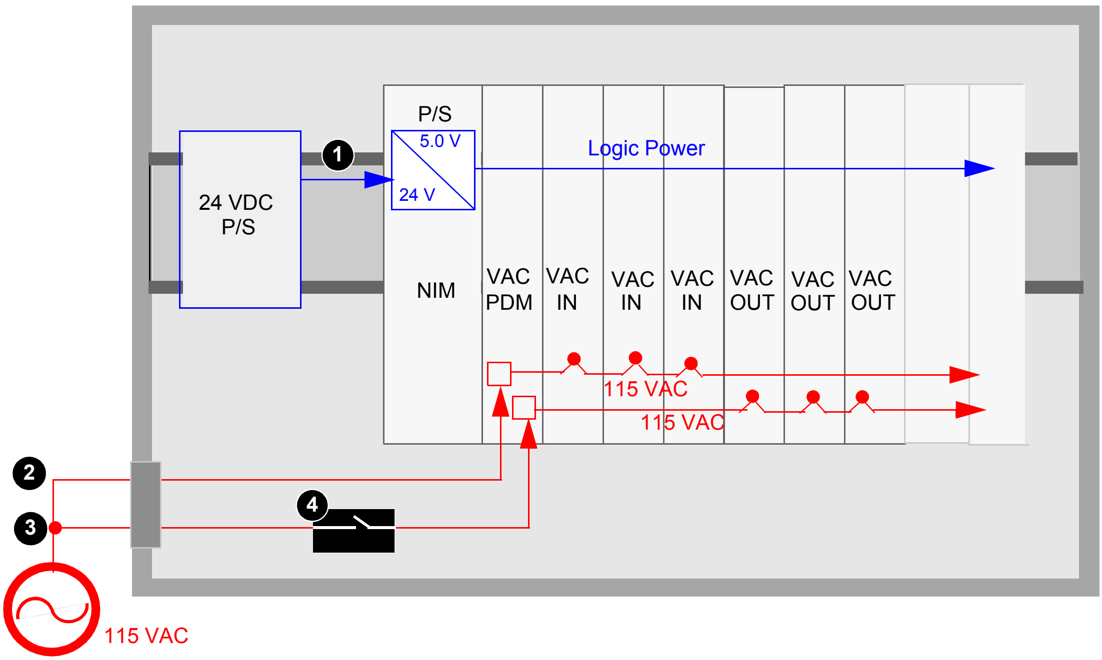


1 24 VDC signal to the NIM’s logic power supply
2 24 VDC signal to the segment’s sensor bus
3 24 VDC signal to the segment’s actuator bus
4 optional relay on the actuator bus

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

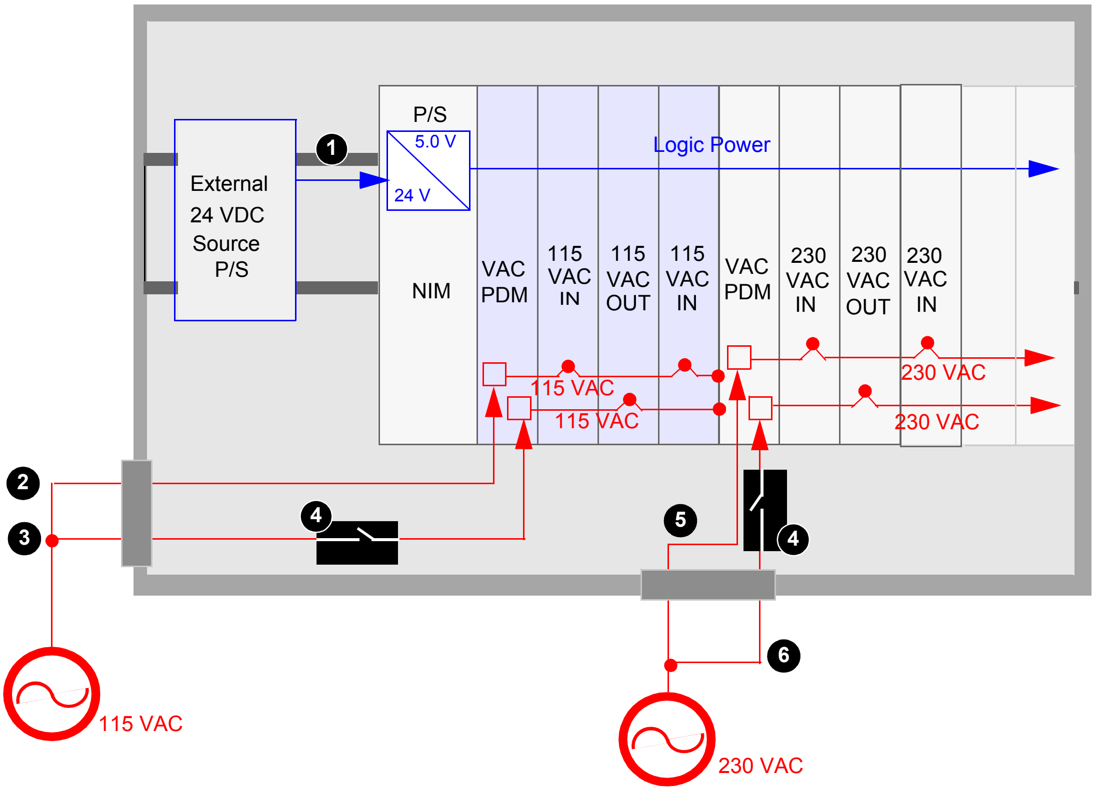
115 and 230 VAC Field Power Distribution

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



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

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



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

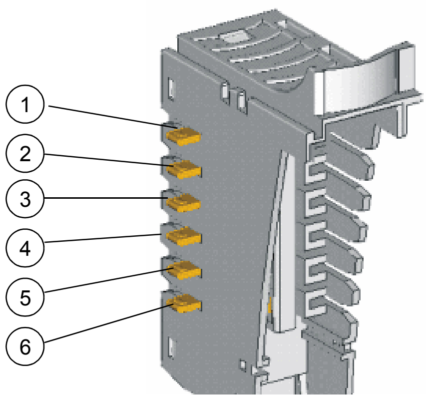
Communications Across the Island

Island Bus Architecture

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

Logic Side Contacts

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



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

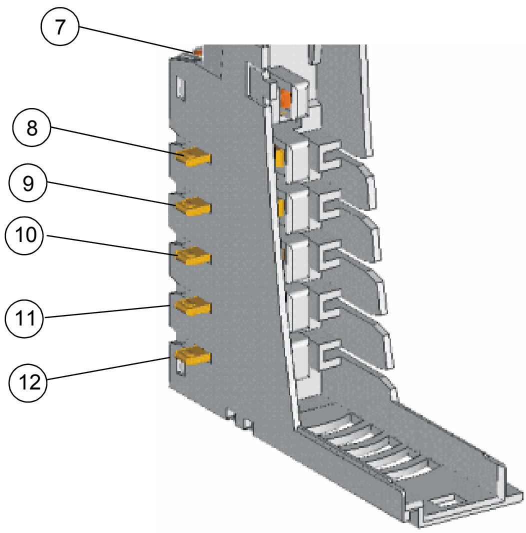
The following table lists the way the logic-side contacts are implemented on the different base units.

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

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

Field Power Distribution Contacts

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



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

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

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

Operating Environment

Environmental Specifications

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

Enclosure

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

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

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

Requirements

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

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

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

Electromagnetic Susceptibility

The following table lists the electromagnetic susceptibility specifications:

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

Radiated Emission

The following table lists the emission specification ranges:

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

The Advantys STB Analog Input Modules

2

At a Glance

Overview

This chapter describes the features of the standard and basic Advantys STB analog input modules.

What's in this Chapter?

This chapter contains the following sections:

2.1 STB AVI 1255 Analog Voltage Input Module (two-channel, 0 ... 10 V, 10-bit, single-ended)

At a Glance

Overview

This section provides you with a detailed description of the STB AVI 1255 analog input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

What's in this Section?

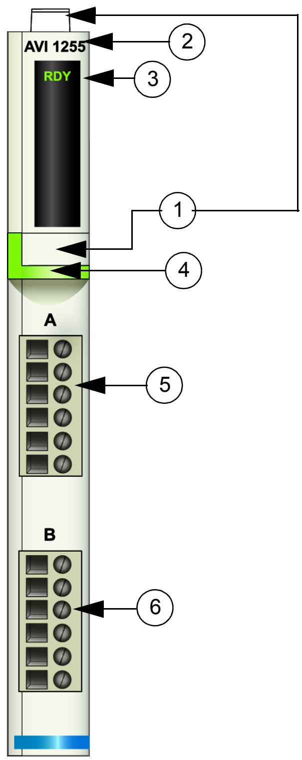
This section contains the following topics:

STB AVI 1255 Physical Description

Physical Characteristics

The STB AVI 1255 is a basic Advantys STB two-channel analog input module that reads inputs from analog sensors that operate over the range 0 to +10 V. The analog portion of the module is isolated from the island's field power 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.

Front Panel View



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED
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

Ordering Information

The module can be ordered as part of a kit (STB AVI 1255 K), which includes:

- one STB AVI 1255 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVI 1255 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Module 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)

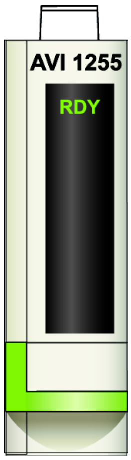
STB AVI 1255 LED Indicator

Purpose

The LEDs on the STB AVI 1255 provide a visual indication of the module's operating status.

Location

The LED is located on the top front bezel of the module, directly below the model number:



Indications

RDY	Meaning	What to Do
off	The module is either not receiving logic power or has failed.	Check power
flicker*	Auto-addressing is in progress.	
on	The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational	
blink 1**	The module is in pre-operational mode.	
*	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.	

STB AVI 1255 Field Wiring

Summary

The STB AVI 1255 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.

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 1255 module handles analog input data from two 0 to 10 V single-ended analog field sensors. Data on each channel has a resolution of 10 bits. The module supports two-, three- and four-wire devices that draw current up 100 mA/ module.

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 causes 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 functional earth.

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

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 them defeats the built-in isolation between the analog portion of the module and the island's field power bus. No connections are made on pins 2 and 5 of either connector:

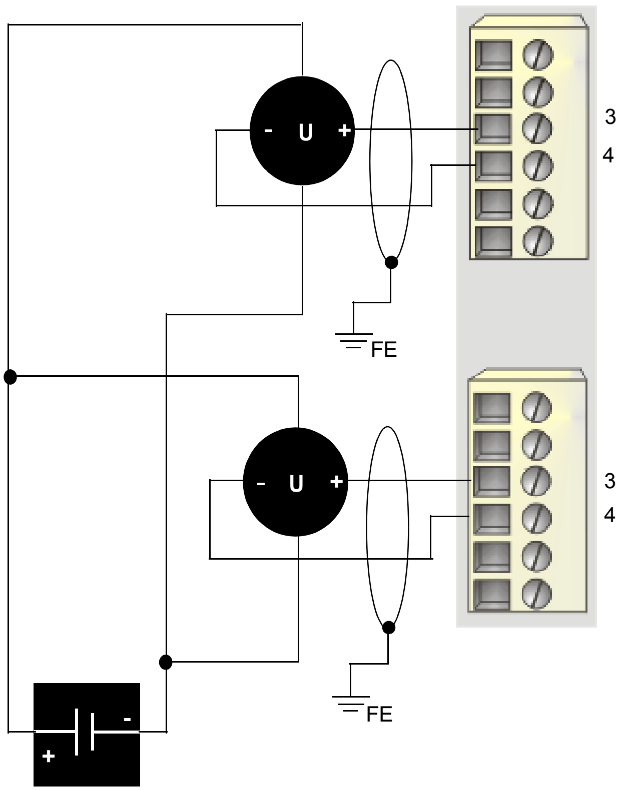
Pin	Top Connections	Bottom Connections
1	+24 VDC from field power bus for field device accessories	+24 VDC from field power bus for field device accessories

Pin	Top Connections	Bottom Connections
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.

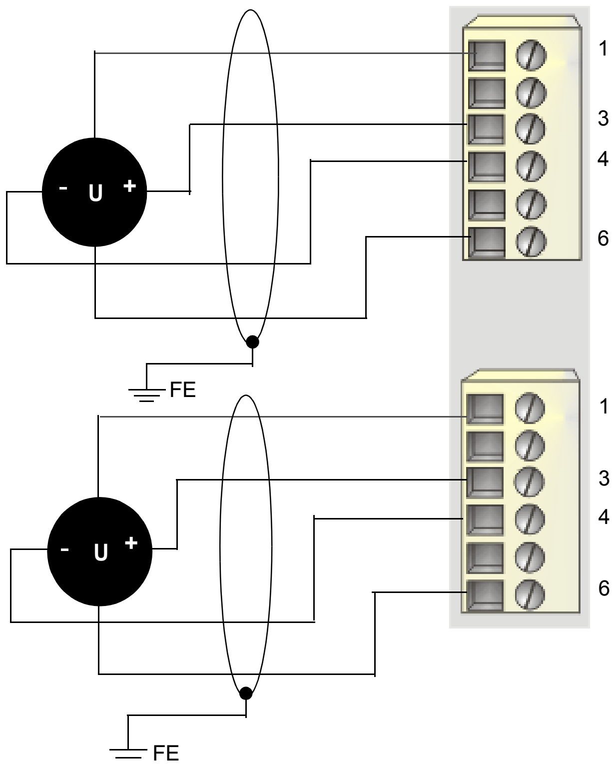
Sample Wiring Diagrams

The following field wiring example shows how two single-ended analog sensors can be wired to the STB AVI 1255 module. An external power supply is required to power the single-ended 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 field power bus for the single-ended 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 defeats the built-in isolation between the analog portion of the module and the island's field power bus.

STB AVI 1255 Functional Description

Functional Characteristics

The STB AVI 1255 module is a two-channel module that handles analog input data from two 0 ... 10 V single-ended analog field sensors. It does not support user-configurable operating parameters or reflex actions.

STB AVI 1255 Data for the Process Image

Representing the Analog Input Data

The STB AVI 1255 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in two 16-bit registers—one data register for each channel. The information can be read by the fieldbus master. If you are not using a basic NIM, the information can also be read by an HMI panel connected to the NIM's CFG port.

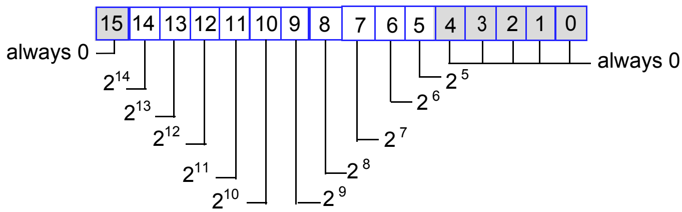
The input data process image is part of a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB AVI 1255 module is represented by two contiguous registers in this block. The specific registers used are based on the module's physical location on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

Input Data Registers

Each STB AVI 1255 data register represents the input voltage of a channel in the IEC data format. The data has 10-bit resolution. The bit structure in each data register is as follows:

STB AVI 1255 Data Register Format

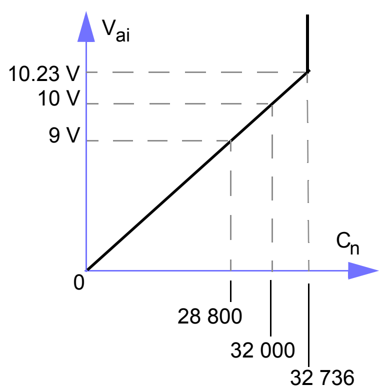


There are 10 significant bits in each data word—bits 14 through 5. They allow you to represent voltage data with integer values ranging from 0 to +32 736 in increments of 32. A value 32 000 represents an input of 10 V.

Linear voltage is interpreted using the formula:

$$V_{ai} = C_n / 3200$$

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



A value above 32 000 does not produce an over-range indication.

STB AVI 1255 Specifications

Table of Technical Specifications

description		two single-ended analog voltage input channels
analog input voltage range		0 ... 10 V
resolution		10 bits
returned data format		IEC
module width		13.9 mm (0.58 in)
I/O base		STB XBA 1000 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		30 mA
nominal field power bus current consumption		225 mA, with no load
hot swapping supported*		NIM-dependent**
reflex actions supported		no
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		+/- 0.75% of full scale @ 25°C
temperature drift		typically +/- 0.01% of full scale/ °C
operating temperature range		0 to 60°C
storage Temperature		--40 to 85°C
input impedance		400 kΩ @ DC
source impedance		1 kΩ max.
maximum input voltage		50 VDC without damage
addressing requirement		two words (one data word/channel)
sensor bus power for accessories		100 mA/module
over-current protection for accessory power		yes
field power requirements		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
agency certifications		refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*

*ATEX applications prohibit hot swapping-refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
**Basic NIMs do not allow you to hot swap I/O modules.

2.2 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?

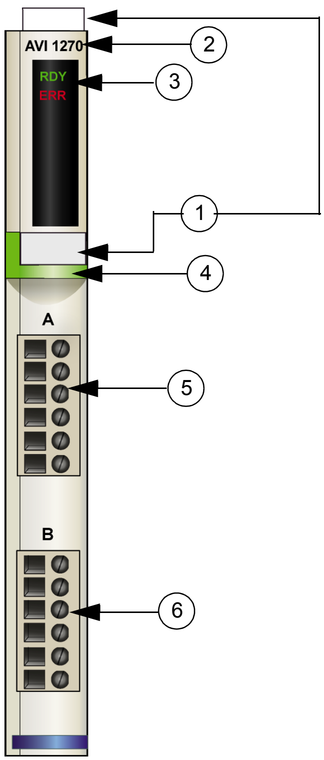
This section contains the following topics:

STB AVI 1270 Physical Description

Physical Characteristics

The STB AVI 1270 is a standard 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



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

Ordering Information

The module and related components can be ordered as follows:

- a standalone STB AVI 1270 analog input module
- a standalone STB XBA 1000 (see *p. 391*) size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Module 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)

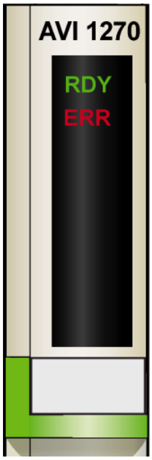
STB AVI 1270 LED Indicator

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: ● it has power ● it has passed its confidence tests ● 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 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 draw current up to:

- 100 mA/channel at 30 degrees C
- 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.

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

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.

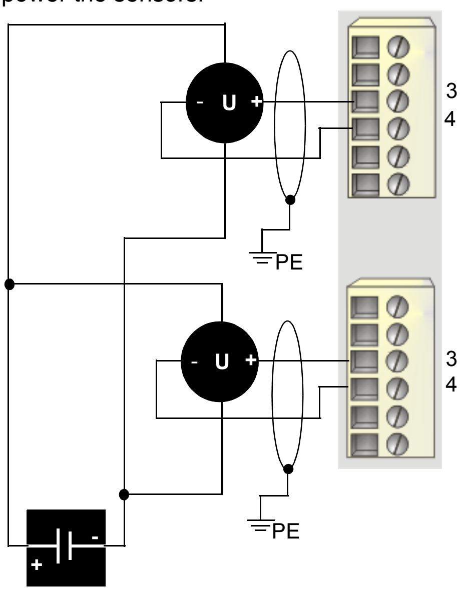
The connections on pin 1 and pin 6 are optional, and using these pins will defeat the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 2 and 5 of either connector:

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.

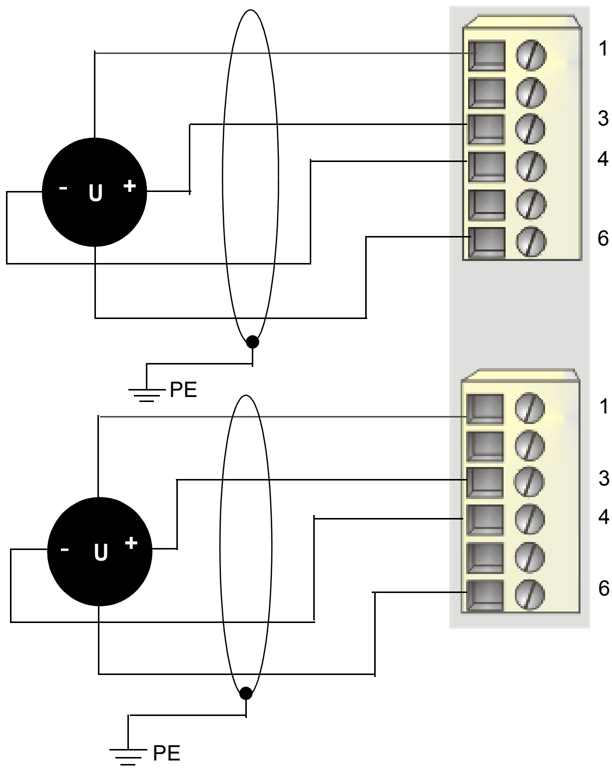
Sample Wiring Diagrams

The following field wiring example shows how two single-ended 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

Using the RTP feature in your NIM, you can access the value of the following parameters:

- Offset
- Maximum Count
- Averaging

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

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

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).

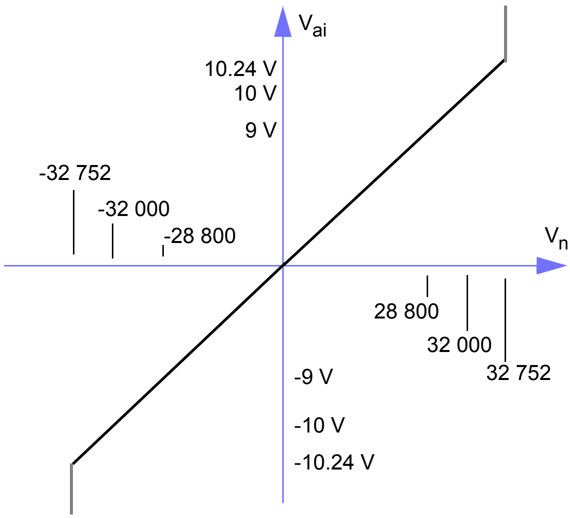
Offset and maximum count may be applied on each channel independently.

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:

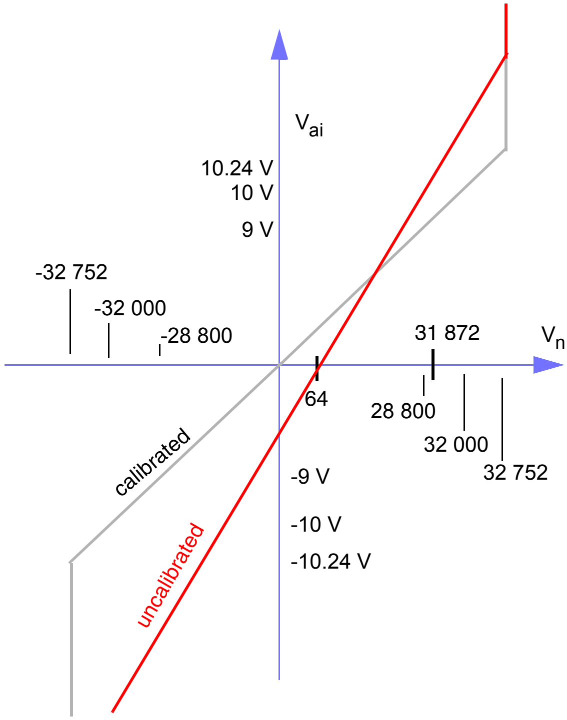


However, in systems that require calibration, the formula may actually be:

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

(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

Offset and RTP:

The offset parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2
Data Bytes 2 (high byte) & 1 (low byte)	-8191 to +8191

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2
Data Bytes 2 (high byte) & 1 (low byte)	23800 to 32767

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.

Step	Action	Result
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 values of the analog inputs reported by the STB AVI 1270. The Advantys configuration software allows you to average over a specified number of samples. By default, the number of samples averaged is one (no averaging); you may a average over 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.

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

Length	2
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	0
Data Byte 1	1 to 8

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, if you are not using a basic NIM, 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

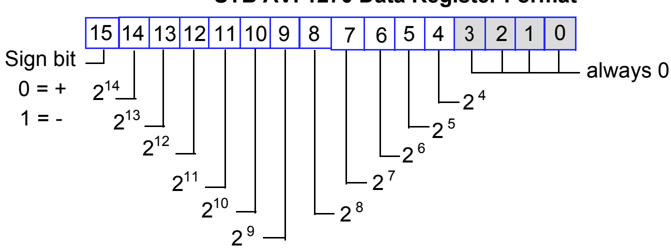
The specific registers used are based on the module's physical location on the island bus.

> **Note:** When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

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



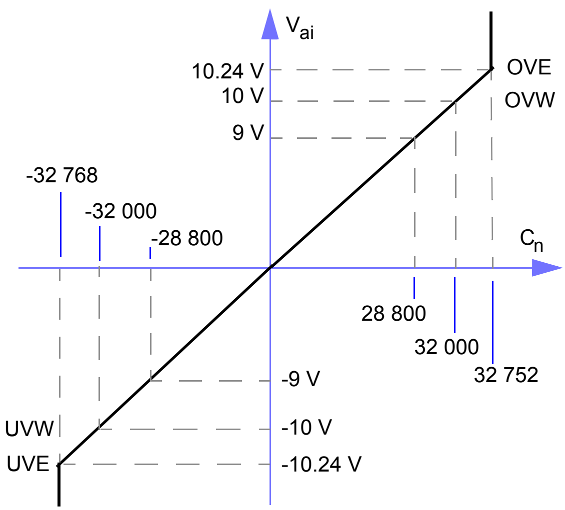
There are 12 significant bits in each data word—bits 15 through 4. They allow you to represent voltage data with integer values ranging from -32 768 to +32 752 in increments of 16. When the sign bit (bit 15) is 0, the value is positive; when bit 15 is 1, the value is negative.

In an ideal linear voltage representation (one without offset or max count settings (see *p. 59*)), the value 32 000 represents an input of 10 V and -32 000 represents an input of -10 V. If the input value exceeds 10 V, the input channel reports an over-voltage warning (OVW). If the input value drops below -10 V, the input channel reports an under-voltage warning (UVW). If the input value reaches 10.24 V, an over-voltage error (OVE) is reported. If it drops to -10.24 V, an under-voltage error (UVE) is reported.

An ideal linear voltage representation (one without offset or max count settings (see *p. 59*)) is interpreted using the formula:

$$V_{ai} = C_n / 3200$$

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

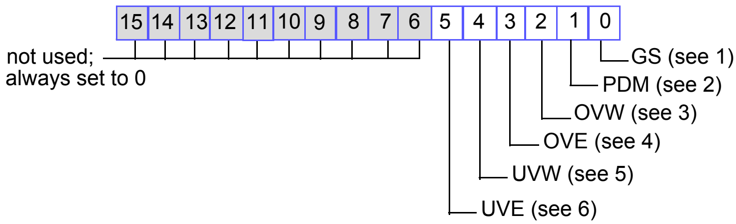


However due to use of manufacturing offset (and also user-configurable offset and max count, if used), an OVW may be generated before the reported count reaches 32000. Similarly, the reported count may be at 32 752, but you may not receive the expected OVE.

Input 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 error 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 or exceeds 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 is less than or equal to -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

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 *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		30 mA
nominal sensor bus current consumption		225 mA, with no load
hot swapping supported*		NIM-dependent**
reflex actions supported		as inputs only
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
operating temperature range		0 to 60°C
storage temperature		-40 to 85°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[1]		configurable in the range -8191 ... +8191 (representing -2.56 ... +2.56 V)
maximum count[1]		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	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
agency certifications	refer to Advantys STB System Planning and Installation Guide, 890 USE 171
*ATEX applications prohibit hot swapping-refer to *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.	
[1]Requires the Advantys configuration software.	

2.3 STB AVI 1275 Analog Voltage Input Module (two-channel, +/-10 V, 9-bit + sign)

At a Glance

Overview

This section provides you with a detailed description of the STB AVI 1275 analog input module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

What's in this Section?

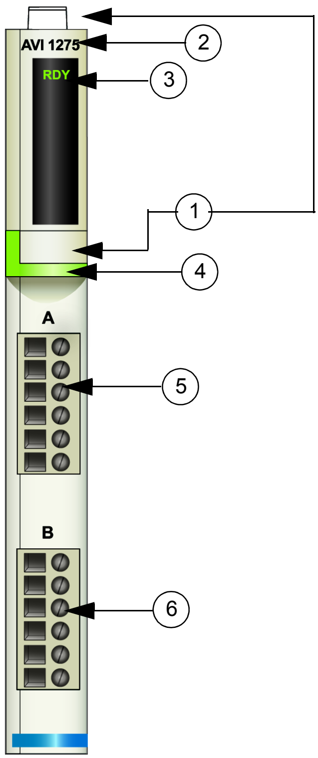
This section contains the following topics:

STB AVI 1275 Physical Description

Physical Characteristics

The STB AVI 1275 is a basic 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.

Front Panel View



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED
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

Ordering Information

The module can be ordered as part of a kit (STB AVI 1275 K), which includes:

- one STB AVI 1275 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVI 1275 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Module 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)

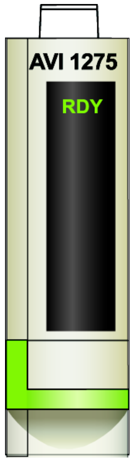
STB AVI 1275 LED Indicator

Purpose

The LED on the STB AVI 1275 provides a visual indication of the module's operating status.

Location

The LED is located on the top front bezel of the module, directly below the model number:



Indications

RDY	Meaning	What to Do
off	The module is either not receiving logic power or has failed.	Check power
flicker*	Auto-addressing is in progress.	
on	The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational	
blink 1**	The module is in pre-operational mode.	
*	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.	

STB AVI 1275 Field Wiring

Summary

The STB AVI 1275 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.

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 1275 module handles analog input data from two +/-10 V single-ended analog field sensors. Data on each channel has a resolution of 9 bits plus the sign bit. The module supports two-, three- and four-wire devices that draw current up to 100 mA/module.

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 causes 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 functional earth.

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

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.

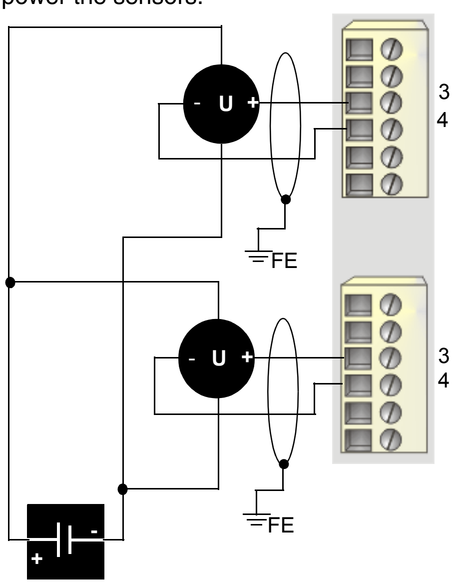
The connections on pin 1 and pin 6 are optional, and using them defeats the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 2 and 5 of either connector:

Pin	Top Connections	Bottom Connections
1	+24 VDC from field power bus for field device accessories	+24 VDC from field power 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.

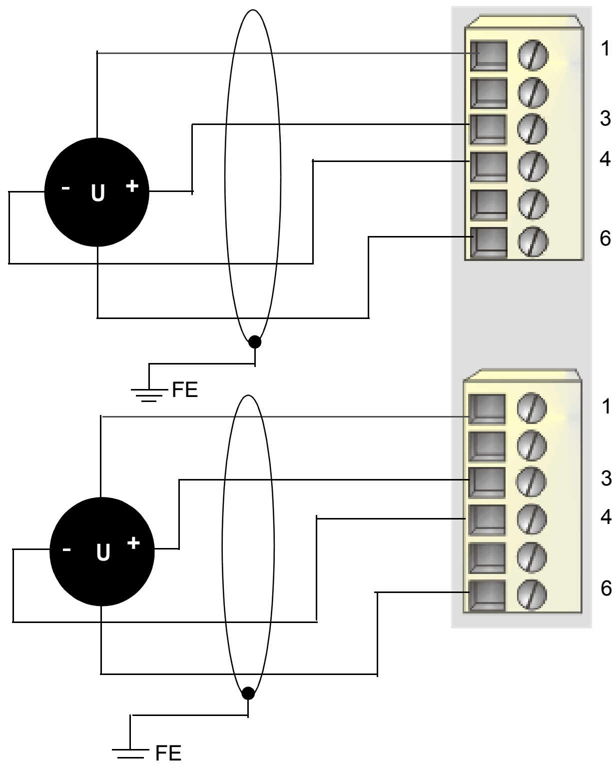
Sample Wiring Diagrams

The following field wiring example shows how two analog single-ended sensors can be wired to the STB AVI 1275 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 field power bus for the single-ended 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 defeats the built-in isolation between the analog portion of the module and the island's field power bus.

STB AVI 1275 Functional Description

Functional Characteristics

The STB AVI 1275 module is a two channel module that handles analog input data from two +/-10 V single-ended analog field sensors. It does not support user-configurable operating parameters or reflex actions.

STB AVI 1275 Data for the Process Image

Representing the Analog Input Data

The STB AVI 1275 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in two 16-bit registers—one data register for each channel. The information can be read by the fieldbus master. If you are not using a basic NIM, the information can also be read by an HMI panel connected to the NIM's CFG port.

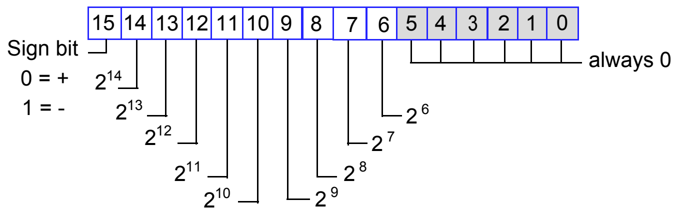
The input data process image is part of a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB AVI 1275 module is represented by two contiguous registers in this block. The specific registers used are based on the module's physical location on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

Input Data Registers

Each STB AVI 1275 data register represents the input voltage of a channel in the IEC data format. The data has 9-bit + sign resolution. The bit structure in each data register is as follows:

STB AVI 1275 Data Register Format

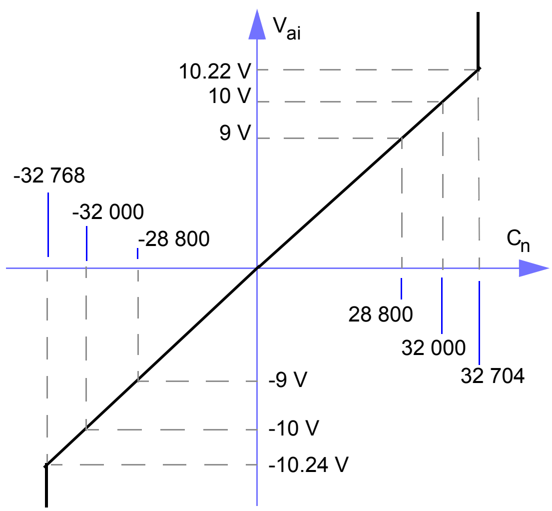


There are 10 significant bits in each data word—bits 15 through 6. They allow you to represent voltage data with integer values ranging from -32 768 to +32 704 in increments of 64. A value 32 000 represents +10 V and a value of -32 000 represents -10 V. When bit 15 is 0, the value is positive; when bit 15 is 1, the value is negative.

Linear voltage is interpreted using the formula:

$$V_{ai} = C_n / 3200$$

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



Values greater than 32 000 and less than -32 000 do not produce out-of-range indications.

STB AVI 1275 Specifications

Table of Technical Specifications

description		two single-ended analog voltage input channels
analog input voltage range		+/- 10 V
resolution		9 bits + sign
returned data format		IEC
module width		13.9 mm (0.58 in)
I/O base		STB XBA 1000 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		30 mA
nominal sensor bus current consumption		30 mA, with no load
hot swapping supported*		NIM-dependent**
reflex actions supported		no
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		+/- 0.75% of full scale @ 25°C
temperature drift		typically +/- 0.01% of full scale/ °C
operating temperature range		0 to 60°C
storage temperature		-40 to 85°C
input impedance		400 kΩ @ DC
source impedance		1 kΩ max.
maximum input voltage		50 VDC without damage
addressing requirement		two words (one data word/channel)
sensor bus power for accessories		100 mA/module
over-current protection for accessory power		yes
field power requirements		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
agency certifications		refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to*Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.		

2.4 STB ACI 0320 Analog Current Input Module (four-channel, 15-bit + sign differential, 4 ... 20 mA or 0 ... 20 mA)

At a Glance

Overview

This section provides you with a detailed description of the STB ACI 0320 analog input module—its physical design and functional capabilities.

What's in this Section?

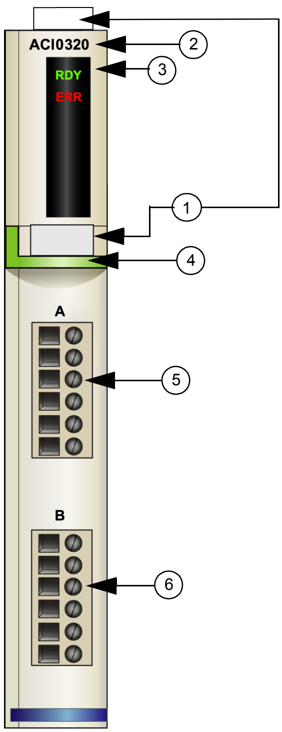
This section contains the following topics:

STB ACI 0320 Physical Description

Physical Characteristics

The STB ACI 0320 is a four-channel, differential analog current input module that reads inputs from analog sensors operating in the range of 4 to 20 mA (default) or 0 to 20 mA. The analog input channels have 200 VDC channel-to-channel isolation, and 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 loop power supply. The module mounts in a size 2 I/O base and uses two six-terminal field wiring connectors.

Front Panel View



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 sensors 1 and 2 connect to the top field wiring connector
6 sensors 3 and 4 connect to the bottom field wiring connector

Ordering Information

The module can be ordered as part of a kit (STB ACI 0320 K), which includes:

- one STB ACI 0320 analog input module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACI 0320 analog input module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

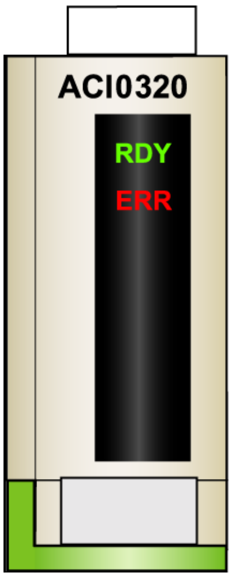
STB ACI 0320 LED Indicator

Purpose

The two LEDs on the STB ACI 0320 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	on	The watchdog has timed out.	Cycle power; restart the communications.
on	off	The module has achieved all of the following: ● it has power ● it passed its confidence tests ● it is operational	
on	flicker*	An over-current error is detected.	Check wiring and field device.
	flicker*	A broken wire is detected.	Check wiring.
		Field power is absent	Check power.
		A PDM short circuit is detected.	
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.

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 0320 Field Wiring

Summary

The STB ACI 0320 module uses two six-terminal field wiring connectors. Analog sensors 1 and 2 are wired to the top connector, and analog sensors 3 and 4 are 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 0320 module handles analog input data from four 4 to 20 mA or 0 to 20 mA differential analog field sensors. Data on each channel has a resolution of 15 bits + sign.

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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

Field Wiring Pinout

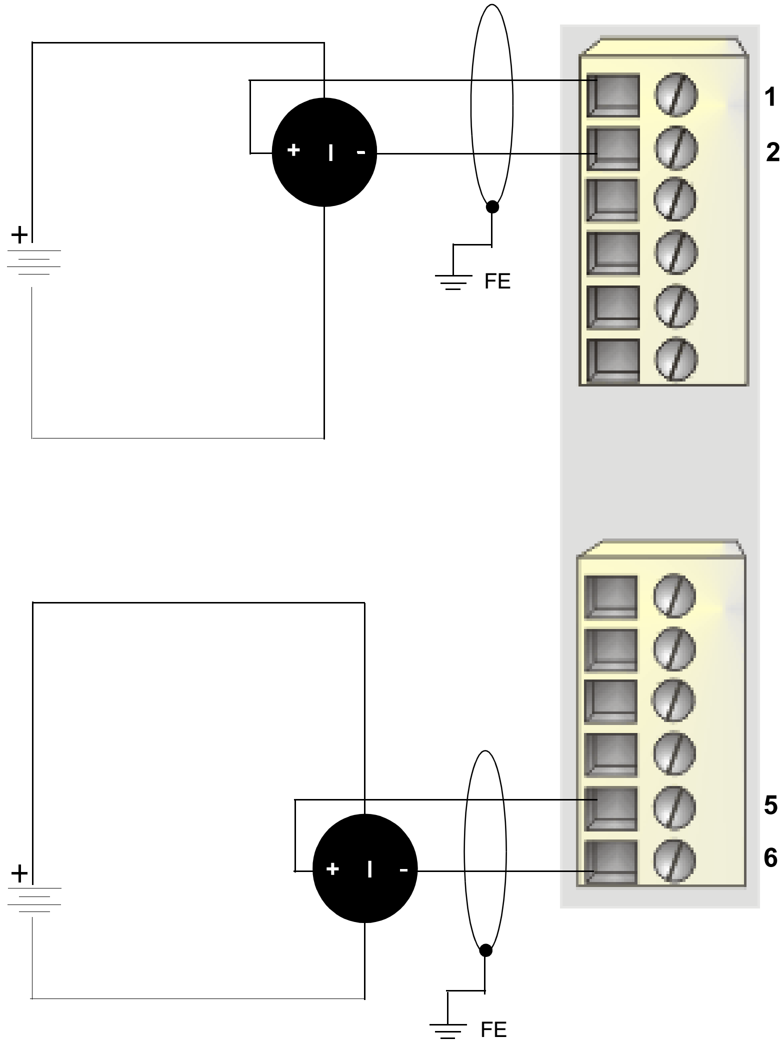
The top connector supports analog sensors 1 and 2. The bottom connector supports analog sensors 3 and 4.

No connections are made on pins 3 and 4 of either connector.

Pin	Top Connections	Bottom Connections
1	current in 1 +	current in 3 +
2	current in 1 -	current in 3 -
3	no connection	no connection
4	no connection	no connection
5	current in 2 +	current in 4 +
6	current in 2 -	current in 4 -

Sample Wiring Diagrams

The following field wiring example shows how two isolated analog sensors can be wired to the STB ACI 0320 module. An external power supply is required to power the sensors.



1 input from sensor 1 (top)
2 return to sensor 1 (top)
5 input from sensor 4 (bottom)
6 return to sensor 4 (bottom)

STB ACI 0320 Functional Description

Functional Characteristics

The STB ACI 0320 module is a four-channel module that handles analog input data from up to four field sensors operating in a 4 to 20 mA (default) or 0 to 20 mA current range. The following operating parameters are user configurable:

- analog input range
- analog input data format
- offset
- maximum count
- averaging
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameters:

- offset
- maximum count
- averaging

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

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

Range

You may configure the operating range of the STB ACI 0320 on a per-channel basis.

- 4 to 20 mA (default)
- 0 to 20 mA

Input Data Format

By default, the data format is signed values with 15-bit resolution.

If you are using the Advantys configuration software, you can change the data format to unsigned values with 16-bit resolution.

The input data format that you use affects the offset and maximum count value ranges available to you.

Offset and Maximum Count

You can apply an offset value to the low end of the operating current range and a maximum count to the high end of the operating current range. Offset and maximum count can be applied on each channel independently. This feature allows you to calibrate the analog input channels to match your equipment.

These parameters are provided only for sensor compensation, not for scaling. The module is able to measure over the physical range of 4 to 20 mA or 0 to 20 mA. An offset adjustment will move the interpretation of the low end of the range, and a max count adjustment will move the interpretation of only the high end of the range.

Offset

If you are using a signed input data format, an offset can be configured as a decimal or hexadecimal value in the range -767 to +767 (0xFD01 to 0x02FF).

If you are using an unsigned input data format, an offset can be configured as a decimal or hexadecimal value in the range 0 to 1535 (0x05FF).

In either case, the value represents a current offset in the range 4 mA ± 0.38 mA (*for the 4 to 20 mA operating range*) and 0 mA ± 0.48mA (*for the 0 to 20 mA operating range*).

By default, the offset on both channels is 0 (indicating no offset applied).

Maximum Count

If you are using a signed input data format, a maximum count can be configured as a positive decimal or hexadecimal value in the range 31 233 to 32 767 (0x7A01 to 0x7FFF).

If you are using an unsigned input data format, a maximum count can be configured as a decimal or hexadecimal value in the range 62 465 to 65 535 (0xF401 to 0xFFFF).

In either case, the value represents a current in the range 20 ± 0.38 mA (*for the 4 to 20 mA operating range*) and 20 ± 0.48 mA (*for the 0 to 20 mA operating range*).

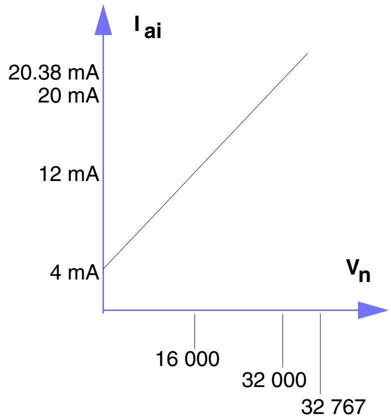
By default, the maximum count on both channels is 32 000 signed or 64 000 unsigned (indicating no gain applied).

In the 4 to 20 mA operating range, an ideal linear current representation (one without offset or max count adjustments) is interpreted using the formula:

- $V_n = (I_{ai} - 4\text{ mA}) \times 2\,000$ for a signed input data range
- $V_n = (I_{ai} - 4\text{ mA}) \times 4\,000$ for an usigned input data range

where V_n is the numerical count and I_{ai} is the analog input current

Here is a graphical representation of ideal linear current for a signed input data range:

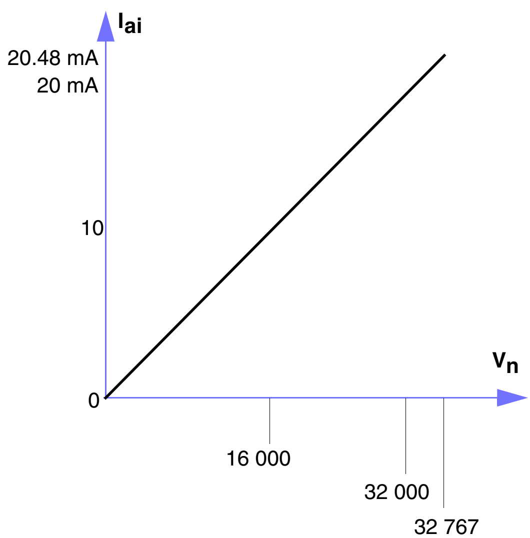


In the 0 to 20 mA operating range, an ideal linear current representation (one without offset or max count adjustments) is interpreted using the formula:

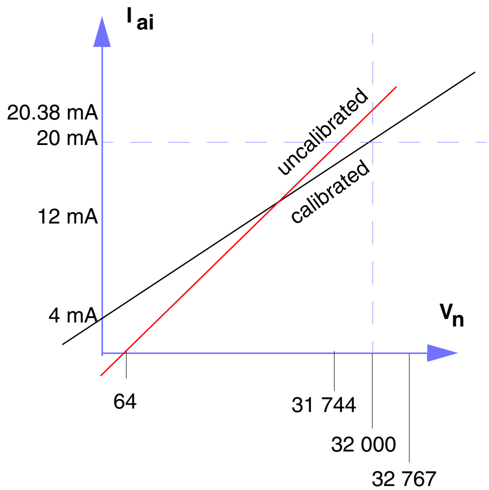
- $V_n = I_{ai}$ x 1 600 (I_{ai} in mA) for a signed input data range
- $V_n = I_{ai}$ x 3 200 (I_{ai} in mA) for an unsigned input data range

where V_n is the numerical count and I_{ai} is the analog input current

Here is a graphical representation of ideal linear current for a signed input data range:



For example, if you use the Advantys configuration software to calibrate an offset of +64 at 4 mA and a max count of 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 Data**	**Offset Value**	**Calibrated Data**
signed	4 mA	64	64	0
	20 mA	31 744	31 744	32 000
unsigned	4 mA	128	128	0
	20 mA	63 488	63 488	64 000

Offset and RTP:

The offset parameter is represented as a 15-bit + sign number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2 3 for channel 3 4 for channel 4
Data Bytes 2 (high byte) & 1 (low byte)	-767 to +767 (0*x*FD01 to 0*x*02FF)

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2 3 for channel 3 4 for channel 4
Data Bytes 2 (high byte) & 1 (low byte)	31 233 to 32 767 (0*x*7A01 to 0*x*7FFF)

Applying 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 the appropriate STB ACI 0320 module in the island editor.	The module editor for the selected STB ACI 0320 module will open.
3	Open the I/O Data Animation sheet from either from the Online drop down menu or the I/O Image Animation button on the Island toolbar.	
4	Apply 4 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, no offset adjustment is needed. If the data value is not 0, make a note of the actual data value.
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 for signed input data or 64 000 for unsigned input data. If this is true, no maximum count adjustment is needed. If the data value is different, make a note of the actual data value.
6	If adjustments need to be made, take the Advantys configuration software offline.	
7	Open the Properties sheet in the module editor. In the Offset value field, enter the data value that you read in step 4. In the Max. Count value field, enter the data value that you read in step 5.	

Step	Action	Result
8	Save the new configuration parameters.	When the configuration is downloaded to the physical island, the new offset and maximum count parameters are applied to the analog input channel and your 4 and 20 mA readings should be 0 and 32 000, respectively.

Averaging

You may apply a filter that will smooth the values of the analog inputs reported by the STB ACI 0320. The Advantys configuration software allows you to average over a specified number of samples. Averaging is applied on a per-channel basis.

By default, the number samples averaged is one (no averaging); you may have a filtering average over up to 80 samples. To configure an averaging sample:

Step	Action	Result
1	Double click the STB ACI 0320 module you want to configure in the island editor.	The selected STB ACI 0320 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 80 (0*x*50).	When you select the **Averaging** value, the max/min values of the range appear at the bottom of the module editor screen.

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

Length	1
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2 3 for channel 3 4 for channel 4
Data Byte 1	1 to 80 (0*x*01 to 0*x*50)

Channel Operation (Enable/Disable)

The STB ACI 0320 has an input channel enable/disable on a per-channel basis. You can disable the unused inputs. By default, all inputs are enabled upon auto configuration. When you disable a channel, its input is set to minimum input current. The status byte and channel data return all zeros when the channel is disabled, and the fault indicator does not blink.

- channel enable (default)
- channel disable

STB ACI 0320 Data and Status for the Process Image

Representing the Analog Input Data

The STB ACI 0320 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in eight registers—four data registers (one for each channel) and four status registers (one for each channel). The information can be read by the fieldbus master or, if you are using a standard NIM, 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 0320 module is represented by eight contiguous registers in this block, which appear in the following order:

- 1st register = channel 1 data (16 bits)
- 2nd register = channel 1 status (8 bits)
- 3rd register = channel 2 data (16 bits)
- 4th register = channel 2 status (8 bits)
- 5th register = channel 3 data (16 bits)
- 6th register = channel 3 status (8 bits)
- 7th register = channel 4 data (16 bits)
- 8th register = channel 4 status (8 bits)

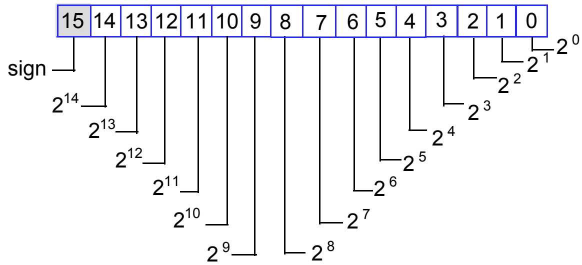
The specific registers used are based on the module's physical location on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

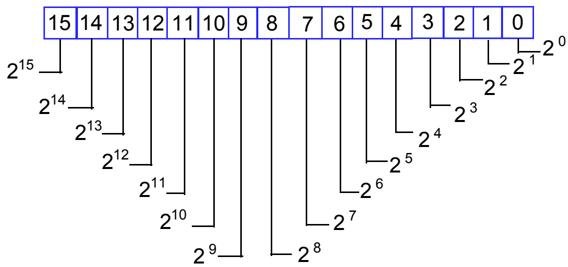
Data Word Structure

The first, third, fifth, and seventh registers in the input block of the process image are the data words. Each register represents the input current of a channel in the IEC data format. The bit structure in each data register is as follows:

Signed Input Data Register Format



Unsigned Input Data Register Format



Each data word allows you to represent analog input current data with either signed integer values ranging from -767 to 32 767 or with unsigned integer values in the range 0 to 65 535.

In the operating range 0 to 20 mA, do not use negative values. If the input data format is configured for signed integers, the sign bit (bit 15) is always 0.

The value 0 represents 0 mA or 4 mA, depending on the range selected. The value of either +32 000 (signed) or 64 000 (unsigned) represents 20 mA. Errors and warnings are reported in both operating ranges at the following counts:

Type of Error or Warning	4 to 20 mA Range (default)			0 to 20 mA Range		
	Current	Signed Count	Unsigned Count	Current	Signed Count	Unsigned Count
OCE	20.38 mA	32 767	65 534	20.48 mA	32 767	65 534
OCW	> 20 mA	32 001	64 001	> 20 mA	32 001	64 001
UCE	< 3.62 mA	-767	N/A	0	0	0
UCW	< 4 mA	-1	N/A	< 0.48 mA	767	1535
BWE	< 1 mA	N/A	N/A	N/A		

Type of Error or Warning	4 to 20 mA Range (default)			0 to 20 mA Range		
	Current	Signed Count	Unsigned Count	Current	Signed Count	Unsigned Count
OCE over-current error **OCW** over-current warning **UCE** under-current error **UCW** under-current warning **BWE** broken wire error						

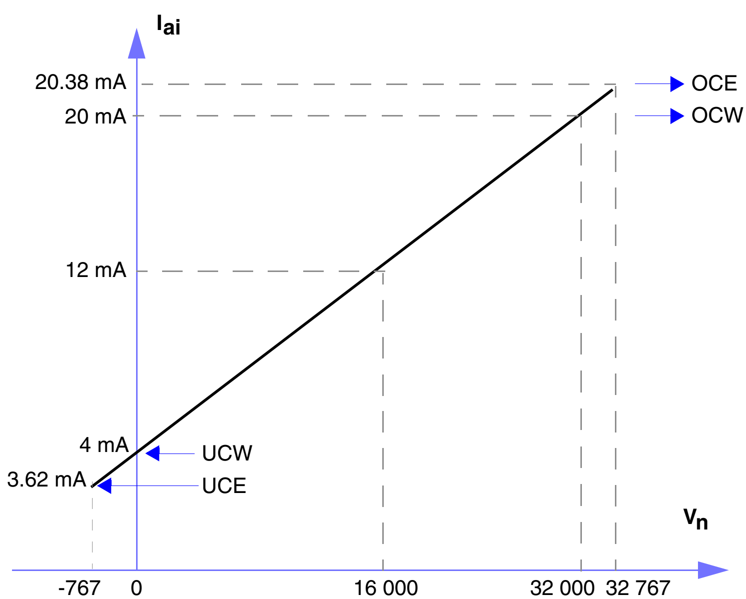
Note: Errors and warnings are based on count values, not current values. The current values in the table above are ideal values.

In the 4 to 20 mA operating range, linear current representations can be interpreted using the formula, where V_n is the numerical count and I_{ai} is the analog input current:

V_n = (I_{ai} - 4 mA) x 2 000 for the signed input data format

V_n = (I_{ai} - 4 mA) x 4 000 for the unsigned input data format

Here is an example in signed input data format:

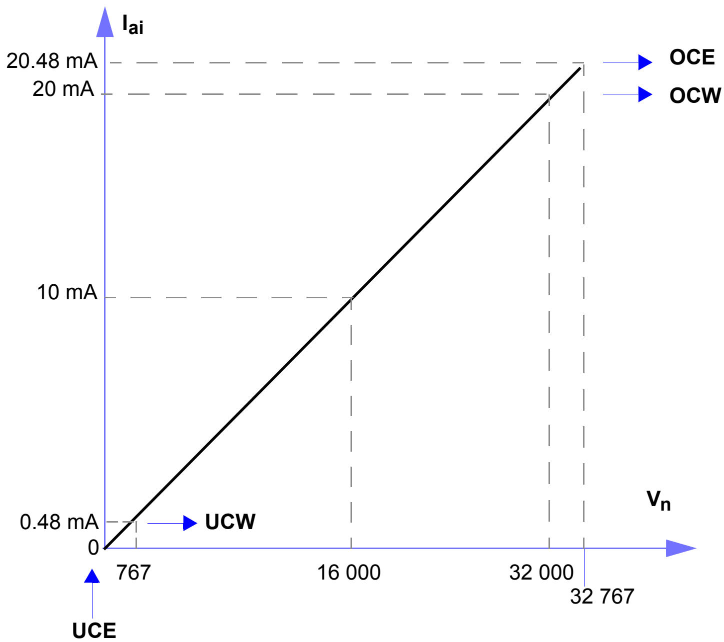


In the 0 to 20 mA operating range, linear current representations can be interpreted using the formula, where V_n is the numerical count and I_{ai} is the analog input current:

$V_n = I_{ai} \times 1\,600$ (I_{ai} in mA) for the signed input data format

$V_n = I_{ai} \times 3\,200$ (I_{ai} in mA) for the unsigned input data format

Here is an example in signed input data format:

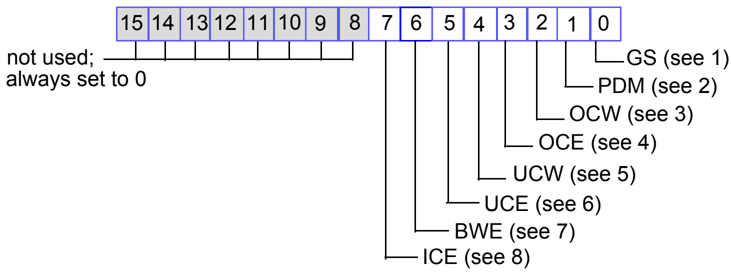


Status Byte Structure

The second, fourth, sixth, and eighth registers in the input block of the process image are the status words. The STB ACI 0320 can detect and report current overflow conditions.

The six LSBs in each register represent the status of each input channel:

STB ACI 0320 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 and/or bit 6 and/or bit 7 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 when the isolated field side voltage is not within range. A PDM error turns on the GS bit (bit 0).

3 Bit 2 represents the presence or absence of an OCW. See current level definitions in the preceding table. AN OCW does not turn on the GS bit (bit 0).

4 Bit 3 represents the presence or absence of an OCE. See current level definitions in the preceding table. An OCE turns on the GS bit (bit 0).

5 Bit 4 represents the presence or absence of a UCW. See current level definitions in the preceding table. A UCW does not turn on the GS bit (bit 0).

6 Bit 5 represents the presence or absence of a UCE. See current level definitions in the preceding table. A UCE does not turn on the GS bit (bit 0).

7 Bit 6 represents the presence or absence of a BWE. This error is present when the input channel has a broken wire. A BWE turns on the GS bit (bit 0).

8 Bit 7 represents an internal communications error (ICE). This error will turn on the GS bit (bit 0).

Note: When the global status bit (GS) is on, the channel data value may not be valid.

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 0320 Specifications

Technical Specifications

description		four differential analog current input channels
analog current range	default	4 to 20 mA
	user-configurable	0 to 20 mA
resolution	default	15 bits + sign
	user-configurable	16 bits unsigned
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		95 mA
nominal sensor bus current consumption		150 mA
hot swapping supported*		NIM-dependent**
reflex actions supported		for 2 inputs only, channels 1 & 2
profile ID		15 hex
input response time	nominal	8 ms for all channels
	maximum	13 ms for all channels
isolation	field-to-bus	1500 VDC for 1 min
	channel-to-channel	200 VDC
	analog module sensor bus	500 VDC
input filter		digital filter of 985 Hz @ -3 dB
integral linearity		± 0.05% of full scale
differential linearity		monotonic
absolute accuracy		typically ± 0.3% of full scale @ 25°C and ± 0.4% maximum of full scale
temperature drift		typically ± 0.005% of full scale/ °C
operating temperature range***		0 to 60°C
storage temperature		--40° to 85°C
over-range margin		2.4%
under-range margin (4 to 20 mA range only)		2.4%
input impedance		≤ 300 Ω
maximum input current		25 mA

addressing requirement	8 words total: • 4 words for data • 4 words for status
common mode rejection	≥ 80 dB @ 60 Hz
common mode voltage	≤ 100 VDC or 100 VAC peak
cross talk between channels	≥ 80 dB
field power requirements	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.	
***This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171 00* for a complete summary of capabilities and limitations.	

2.5 STB ACI 1225 Analog Current Input Module (two-channel, 10-bit single-ended, 4 ... 20 mA)

At a Glance

Overview

This section provides you with a detailed description of the STB ACI 1225 analog input module—its physical design and functional capabilities.

What's in this Section?

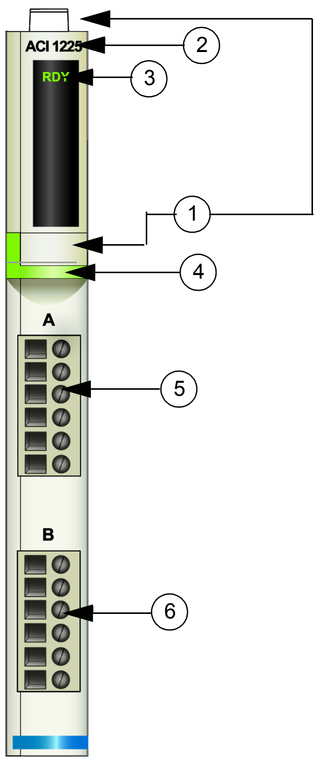
This section contains the following topics:

STB ACI 1225 Physical Description

Physical Characteristics

The STB ACI 1225 is a basic Advantys STB single-ended two-channel analog current input module that reads inputs from analog sensors that operate over the range 4 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.

Front Panel View



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED
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

Ordering Information

The module can be ordered as part of a kit (STB ACI 1225 K), which includes:

- one STB ACI 1225 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACI 1225 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

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)

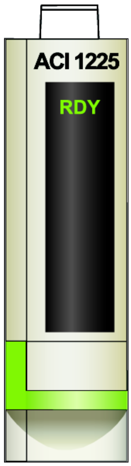
STB ACI 1225 LED Indicator

Purpose

The LED on the STB ACI 1225 provides a visual indication of the module's operating status. Its location and meanings are described below.

Location

The LED is located on the top front bezel of the module, directly below the model number:



Indications

RDY	Meaning	What to Do
off	The module is either not receiving logic power or has failed.	Check power
flicker*	Auto-addressing is in progress.	
on	The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational	
blink 1**	The module is in pre-operational mode.	

* 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.

STB ACI 1225 Field Wiring

Summary

The STB ACI 1225 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.

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 1225 module handles analog input data from two 4 to 20 mA single-ended analog field sensors. Data on each channel has a resolution of 10 bits. The module supports two-, three- and four-wire devices that draw current up to 100 mA/module.

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 functional earth.

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

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 them defeats the built-in isolation between the analog portion of the module and the island's field power bus. No connections are made on pins 3 and 5 of either connector:

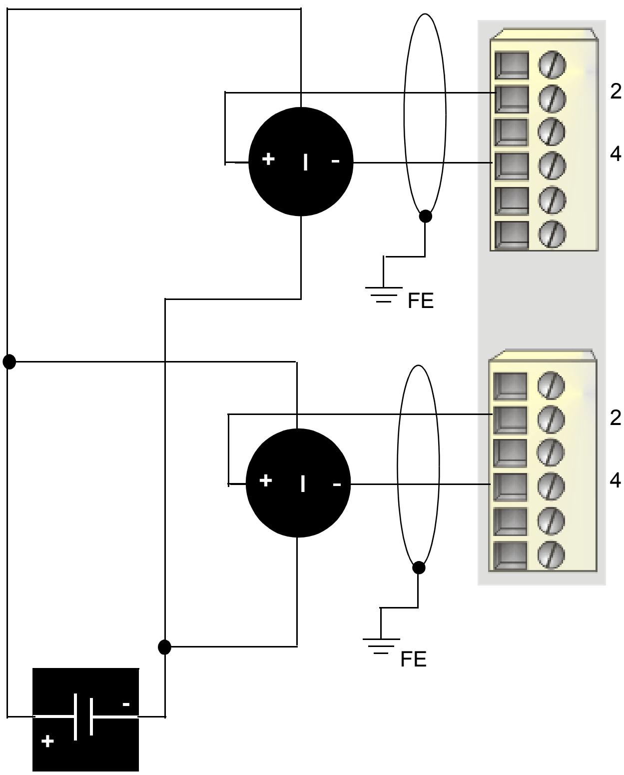
Pin	Top Connections	Bottom Connections
1	+24 VDC from field power bus for field device accessories	+24 VDC from field power bus for field device accessories
2	input from sensor 1	input from sensor 2
3	no connection	no connection
4	analog input return	analog input return
5	no connection	no connection

Pin	Top Connections	Bottom Connections
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.

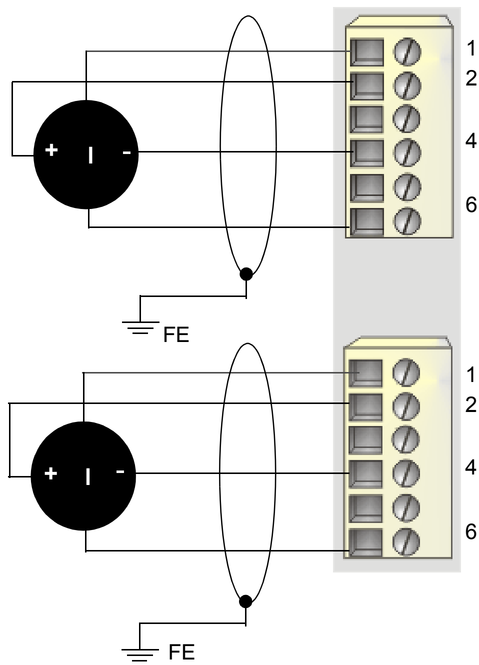
Sample Wiring Diagrams

The following field wiring example shows how two isolated single-ended analog sensors can be wired to the STB ACI 1225 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 field power bus for the single-ended 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 defeats the built-in isolation between the analog portion of the module and the island's field power bus.

STB ACI 1225 Functional Description

Functional Characteristics

The STB ACI 1225 module is a two channel module that handles analog input data from two field sensors operating in a 4 to 20 mA current range. It does not support user-configurable operating parameters or reflex actions.

STB ACI 1225 Data for the Process Image

Representing the Analog Input Data

The STB ACI 1225 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in two 16-bit registers—one data register for each channel. The information can be read by the fieldbus master. If you are not using a basic NIM, the information can also be read by an HMI panel connected to the NIM's CFG port.

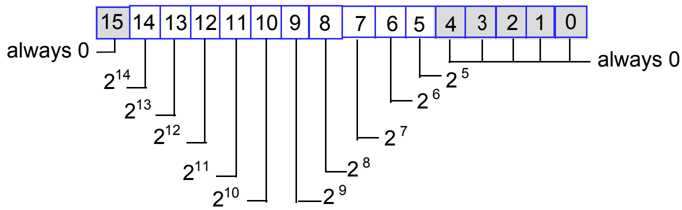
The input data process image is part of a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB ACI 1225 is represented by two contiguous registers in this block. The specific registers used are based on the module's physical location on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

Data Word Structure

Each STB ACI 1225 data register represents the input voltage of a channel in the IEC data format. The data has 10-bit resolution. The bit structure in each data register is as follows:

STB ACI 1225 Data Register Format

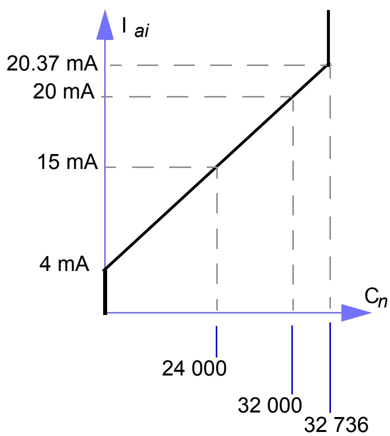


There are 10 significant bits in each data word—bits 14 through 5. They allow you to represent current data with integer values ranging from 0 to 32,736 in increments of 32. A value 32 000 represents an input of 20 mA. A value of 0 represents an input less than or equal to 4 mA.

Linear current representations can be interpreted using the formula:

$$I_{ai} = (C_n + 8000) / 2000$$

where C*n* is the numerical count and I*ai* is the analog input current.



Values greater than 32 000 do not produce over-range indications.

STB ACI 1225 Specifications

Table of Technical Specifications

description		two single-ended analog current input channels
analog current range		4 ... 20 mA
resolution		10 bits
returned data format		IEC
module width		13.9 mm (0.58 in)
I/O base		STB XBA 1000 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		30 mA
nominal field power bus current consumption		225 mA, with no load
hot swapping supported*		NIM-dependent**
reflex actions supported		no
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 20 Hz
integral linearity		+/- 0.2% of full scale
differential linearity		monotonic
absolute accuracy		typically +/- 0.75% of full scale @ 25°C
temperature drift		typically +/- 0.01% of full scale/ °C
operating temperature range)		0 to 60°C
storage temperature)		-40 to 85°C
over-range margin		2.4%
input impedance		≤ 300 Ω
maximum input current		25 mA, 50 VDC without damage
addressing requirement		two words (one data word/channel)
sensor bus power for accessories		100 mA/module
over-current protection for accessory power		yes
field power requirements		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
agency certifications		refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.		

2.6 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?

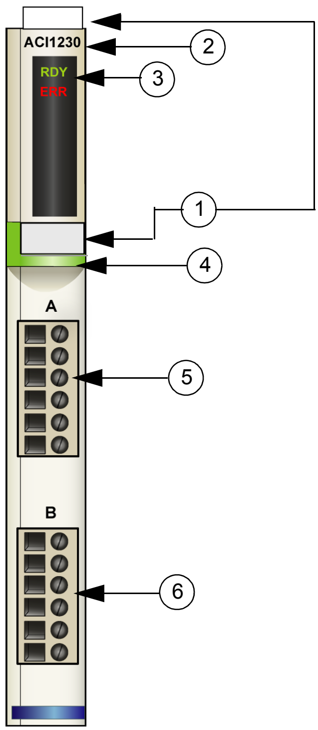
This section contains the following topics:

STB ACI 1230 Physical Description

Physical Characteristics

The STB ACI 1230 is a standard Advantys STB analog current input module with two single-ended analog channels that read inputs from analog sensors operating in 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



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

Ordering Information

The module can be ordered as part of a kit (STB ACI 1230 K), which includes:

- one STB ACI 1230 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACI 1230 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

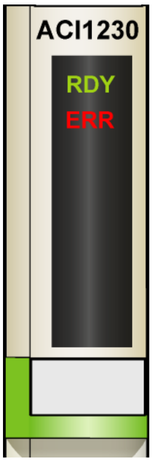
STB ACI 1230 LED Indicator

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: ● it has power ● it has passed its confidence tests ● 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 draw 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.

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

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:

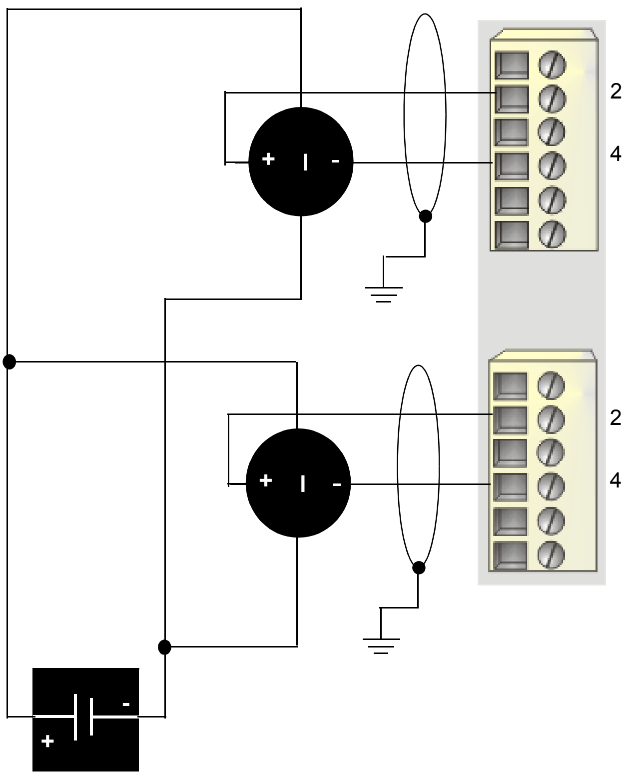
Pin	Top Connections	Bottom Connections
1	+24 VDC from sensor bus for field device accessories	+24 VDC from sensor bus for field device accessories
2	input from sensor 1	input from sensor 2

Pin	Top Connections	Bottom Connections
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.

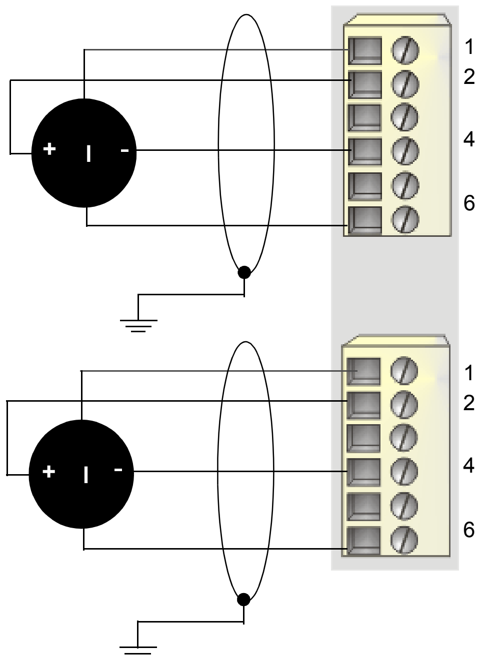
Sample Wiring Diagrams

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

Using the RTP feature in your NIM, you can access the value of the following parameters:

- Offset
- Maximum Count
- Averaging

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

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

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).

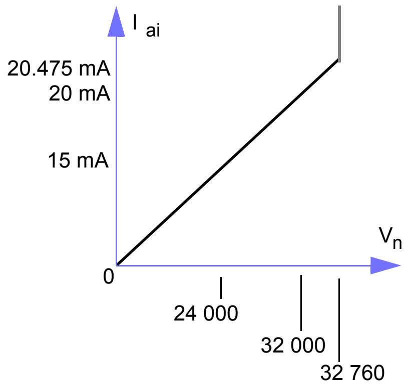
Offset and maximum count may be applied on each channel independently.

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:

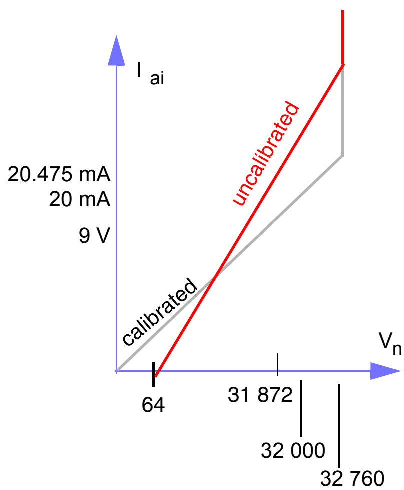


However, in systems that require calibration, the formula may actually be:

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

(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

Offset and RTP:

The offset parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2
Data Bytes 2 (high byte) & 1 (low byte)	-8191 to +8191

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2
Data Bytes 2 (high byte) & 1 (low byte)	23800 to 32767

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 values of the analog inputs reported by the STB ACI 1230. The Advantys configuration software allows you to average over a specified number of samples. By default, the number samples averaged is one (no averaging); you may a filtering average over 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.

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

Length	2
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	0
Data Byte 1	1 to 8

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, if you are not using a basic NIM, 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

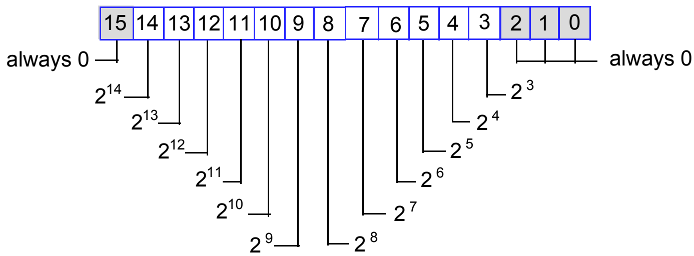
The specific registers used are based on the module's physical location on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

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 current 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



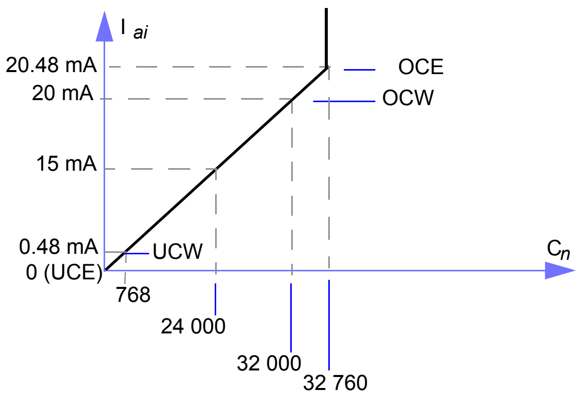
There are 12 significant bits in each data word—bits 14 through 3. They allow you to represent current data with integer values ranging from 0 to 32,760 in increments of eight.

The value 32 000 represents 20 mA. If the input value exceeds 20 mA, the input channel reports an over-current warning (OCW). If the input value reaches 20.48 mA, an over-current error (OCE) is reported. If the input value drops below 0.48 mA, the input channel reports an under-current warning (UCW), and if the value is less than or equal to 0 the channel reports an under-current error (UCE).

Linear current representations can be interpreted using the formula:

$$I_{ai} = C_n / 1600$$

where C*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.

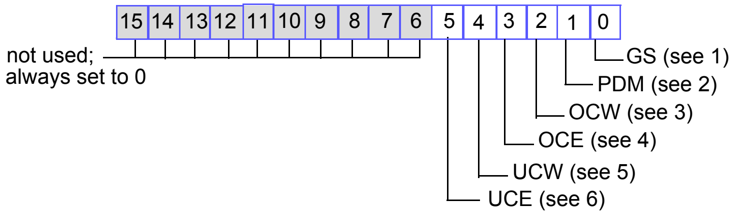
The three least significant bits in the data words are always 0.

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 or equal to 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 20.48 mA and a value of 1 when the current is greater than or equal to 20.48 mA. An OCE in the STB ACI 1230 turns on the GS bit (bit 0).

5 Bit 4 represents the presence or absence of a UCW. It has a value of 0 when the current is greater than or equal to 0.48 mA and a value of 1 when the current is less than 0.48 mA. A UCW in the STB ACI 1230 does not turn on the GS bit (bit 0).

6 Bit 5 represents the presence or absence of a UCE. It has a value of 0 when the current is greater than 0 mA and a value of 1 when the current is less than or equal to 0 mA. A UCE in the STB ACI 1230 does not turn 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 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 *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		30 mA
nominal sensor bus current consumption		225 mA, with no load
hot swapping supported*		NIM-dependent**
reflex actions supported		as inputs only[1]
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
operating temperature range***		0 to 60°C
storage temperature		--40 to 85°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 coun		configurable in the range 23 800 ... 32 760 (representing 14.88 ... 20.48 mA)
sensor bus power for accessories		100 mA/channel @ 30°C
		50 mA/channel @ 60°C

over-current protection for accessory power	yes
field power requirements	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* ** Basic NIMs do not allow you to hot swap I/O modules.	
*** This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.	
[1]Requires the Advantys configuration software.	

2.7 STB ACI 8320 Analog Current Input Module (four-channel, Hart tolerant, 15-bit + sign differential, 4 ... 20 mA or 0 ... 20 mA)

At a Glance

Overview

This section provides you with a detailed description of the STB ACI 8320 analog input module—its physical design and functional capabilities.

What's in this Section?

This section contains the following topics:

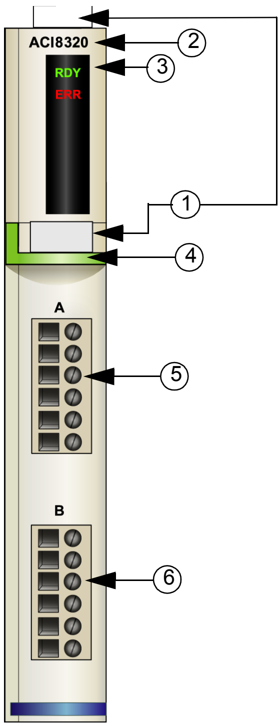
STB ACI 8320 Physical Description

Physical Characteristics

The STB ACI 8320 is a four-channel, Hart tolerant, differential analog current input module that reads inputs from analog sensors operating in the range of 4 to 20 mA (default) or 0 to 20 mA. The module does not corrupt the Hart data that is communicated on the same cable as the analog inputs. It mounts in a size 2 I/O base and uses two six-terminal field wiring connectors.

The analog input channels have 200 VDC channel-to-channel isolation. 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, power the sensors from an external loop power supply.

Front Panel View



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 sensors 1 and 2 connect to the top field wiring connector
6 sensors 3 and 4 connect to the bottom field wiring connector

Ordering Information

The module can be ordered as part of a kit (STB ACI 8320 K), which includes:

- one STB ACI 8320 analog input module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACI 8320 analog input module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

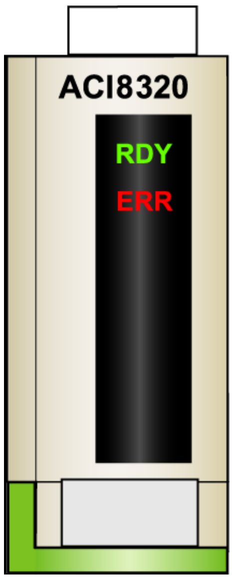
STB ACI 8320 LED Indicator

Purpose

The two LEDs on the STB ACI 8320 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	on	The watchdog has timed out.	Cycle power; restart the communications.
on	off	The module has achieved all of the following: ● it has power ● it passed its confidence tests ● it is operational	
on	flicker*	An over-current error is detected.	Check wiring and field device.
	flicker*	A broken wire is detected.	Check wiring.
		Field power is absent	Check power.
		A PDM short circuit is detected.	
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.		

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 8320 Field Wiring

Summary

The STB ACI 8320 module uses two six-terminal field wiring connectors. Analog sensors 1 and 2 are wired to the top connector, and analog sensors 3 and 4 are 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 8320 module handles analog input data from four 4 to 20 mA differential analog field sensors. Data on each channel has a resolution of 15 bits + sign.

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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

Field Wiring Pinout

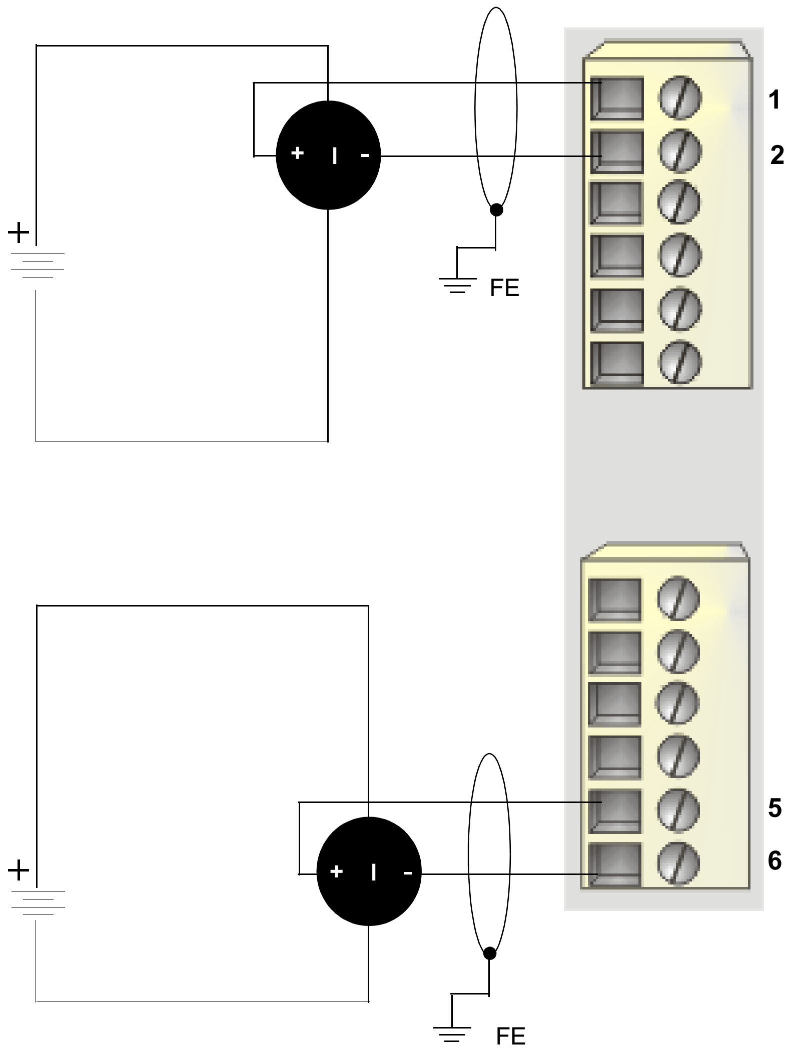
The top connector supports analog sensors 1 and 2. The bottom connector supports analog sensors 3 and 4.

No connections are made on pins 3 and 4 of either connector.

Pin	Top Connections	Bottom Connections
1	current in 1 +	current in 3 +
2	current in 1 -	current in 3 -
3	no connection	no connection
4	no connection	no connection
5	current in 2 +	current in 4 +
6	current in 2 -	current in 4 -

Sample Wiring Diagrams

The following field wiring example shows how two isolated analog sensors can be wired to the STB ACI 8320 module. An external power supply is required to power the sensors.



1 input from sensor 1 (top)
2 return to sensor 1 (top)
5 input from sensor 4 (bottom)
6 return to sensor 4 (bottom)

STB ACI 8320 Functional Description

Functional Characteristics

The STB ACI 8320 module is a four-channel module that handles analog input data from four field sensors operating in a 4 to 20 mA (default) or 0 to 20 mA current range. The following operating parameters are user configurable:

- analog input range
- analog input data format
- offset
- maximum count
- averaging
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameters:

- offset
- maximum count
- averaging

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

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

Range

You may configure the operating range of the STB ACI 8320 on a per-channel basis.

- 4 to 20 mA (default)
- 0 to 20 mA

Input Data Format

By default, the data format is signed values with 15-bit resolution.

If you are using the Advantys configuration software, you can change the data format to unsigned values with 16-bit resolution.

The input data format that you use affects the offset and maximum count value ranges available to you.

Offset and Maximum Count

You can apply an offset value to the low end of the operating current range and a maximum count to the high end of the operating current range. Offset and maximum count can be applied on each channel independently. This feature allows you to calibrate the analog input channels to match your equipment.

These parameters are provided only for sensor compensation, not for scaling. The module is able to measure over the physical range of 4 to 20 mA or 0 to 20 mA. An offset adjustment will move the interpretation of the low end of the range, and a max count adjustment will move the interpretation of only the high end of the range.

Offset

If you are using a signed input data format, an offset can be configured as a decimal or hexadecimal value in the range -767 to +767 (0xFD01 to 0x02FF).

If you are using an unsigned input data format, an offset can be configured as a decimal or hexadecimal value in the range 0 to 1535 (0x05FF).

In either case, the value represents a current offset in the range 4 mA ± 0.38 mA (*for the 4 to 20 mA operating range*) and 0 mA ± 0.48mA (*for the 0 to 20 mA operating range*).

By default, the offset on both channels is 0 (indicating no offset applied).

Maximum Count

If you are using a signed input data format, a maximum count can be configured as a positive decimal or hexadecimal value in the range 31 233 to 32 767 (0x7A01 to 0x7FFF).

If you are using an unsigned input data format, a maximum count can be configured as a decimal or hexadecimal value in the range 62 465 to 65 535 (0xF401 to 0xFFFF).

In either case, the value represents a current in the range 20 ± 0.38 mA (*for the 4 to 20 mA operating range*) and 20 ± 0.48 mA (*for the 0 to 20 mA operating range*).

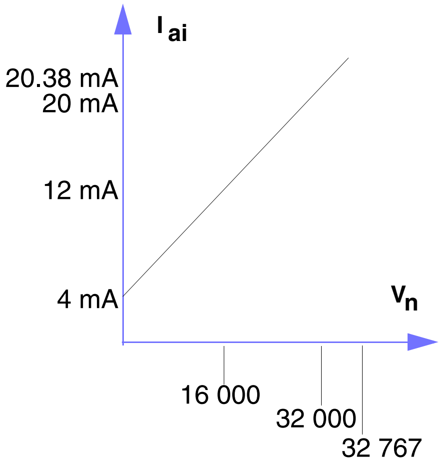
By default, the maximum count on both channels is 32 000 signed or 64 000 unsigned (indicating no gain applied).

In the 4 to 20 mA operating range, an ideal linear current representation (one without offset or max count adjustments) is interpreted using the formula:

- $V_n = (I_{ai} - 4\text{ mA}) \times 2\,000$ for a signed input data range
- $V_n = (I_{ai} - 4\text{ mA}) \times 4\,000$ for an usigned input data range

where V_n is the numerical count and I_{ai} is the analog input current

Here is a graphical representation of ideal linear current for a signed input data range:

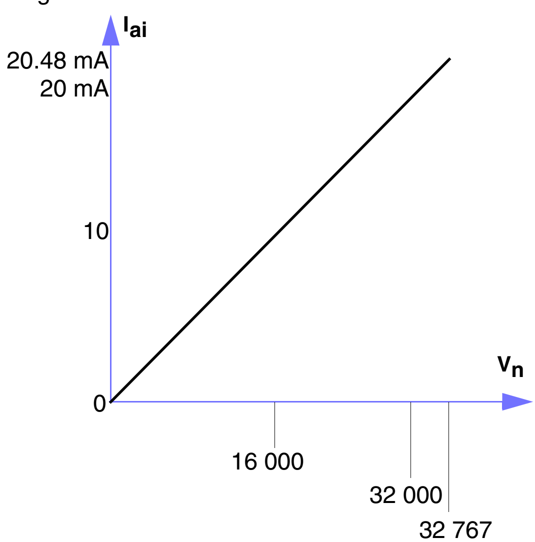


In the 0 to 20 mA operating range, an ideal linear current representation (one without offset or max count adjustments) is interpreted using the formula:

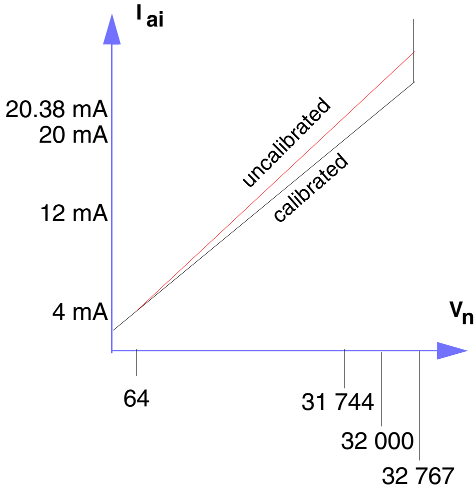
- $V_n = I_{ai} \times 1\,600$ (I_{ai} in mA) for a signed input data range
- $V_n = I_{ai} \times 3\,200$ (I_{ai} in mA) for an unsigned input data range

where V_n is the numerical count and I_{ai} is the analog input current

Here is a graphical representation of ideal linear current for a signed input data range:



For example, if you use the Advantys configuration software to calibrate an offset of +64 at 4 mA and a max count of 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**	
	signed data	**unsigned data**	**signed data**	**unsigned data**
4 mA	64	128	64	128
20 mA	31 744	63 488	31 744	63 488

Offset and RTP:

The offset parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2 3 for channel 3 4 for channel 4
Data Bytes 2 (high byte) & 1 (low byte)	-767 to +767

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2 3 for channel 3 4 for channel 4
Data Bytes 2 (high byte) & 1 (low byte)	31 233 to 32 767

Applying 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 the appropriate STB ACI 8320 module in the island editor.	The module editor for the selected STB ACI 8320 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 4 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 the actual data value.
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 the actual data value.
6	If adjustments need to be made, take the Advantys configuration software offline.	
7	Double-click the appropriate STB ACI 8320 module in the island editor.	The module editor for the selected STB ACI 8320 module will open.
8	Open the Properties sheet in the module editor. In the Offset value field, enter the data value that you read in step 4. In the Max. Count value field, enter the data value that you read in step 5.	

Step	Action	Result
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 values of the analog inputs reported by the STB ACI 8320. The Advantys configuration software allows you to average over a specified number of samples. Averaging is applied on a per-channel basis.

By default, the number samples averaged is one (no averaging); you may have a filtering average over up to 80 samples. To configure an averaging sample:

Step	Action	Result
1	Double click the STB ACI 8320 module you want to configure in the island editor.	The selected STB ACI 8320 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 80 (50 H).	When you select the **Averaging** value, the max/min values of the range appear at the bottom of the module editor screen.

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

Length	1
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2 3 for channel 3 4 for channel 4
Data Byte 1	1 to 80

Channel Operation (Enable/Disable)

The STB ACI 8320 has an input channel enable/disable on a per-channel basis. You can disable the unused inputs. By default, all inputs are enabled upon auto configuration. When you disable a channel, its input is set to minimum input current. The status byte and channel data return all zeros when the channel is disabled, and the fault indicator does not blink.

- channel enable (default)
- channel disable

STB ACI 8320 Data and Status for the Process Image

Representing the Analog Input Data

The STB ACI 8320 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in eight registers—four data registers (one for each channel) and four status registers (one for each channel). The information can be read by the fieldbus master or, if you are using a standard NIM, 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 8320 module is represented by eight contiguous registers in this block, which appear in the following order:

- 1st register = channel 1 data (16 bits)
- 2nd register = channel 1 status (8 bits)
- 3rd register = channel 2 data (16 bits)
- 4th register = channel 2 status (8 bits)
- 5th register = channel 3 data (16 bits)
- 6th register = channel 3 status (8 bits)
- 7th register = channel 4 data (16 bits)
- 8th register = channel 4 status (8 bits)

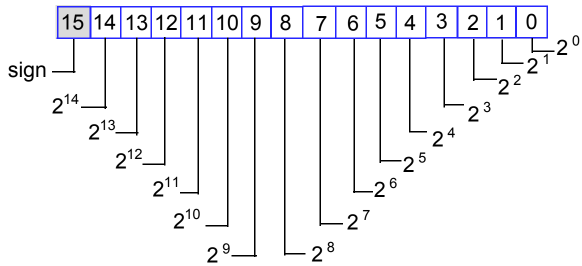
The specific registers used are based on the module's physical location on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

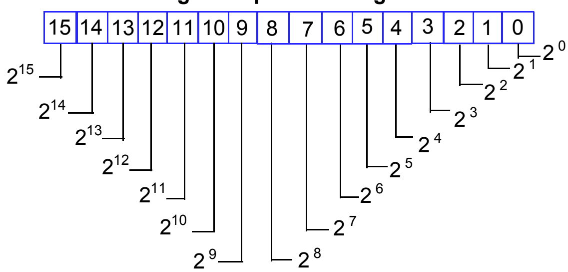
Data Word Structure

The first, third, fifth, and seventh registers in the input block of the process image are the data words. Each register represents the input current of a channel in the IEC data format. The bit structure in each data register is as follows:

Signed Input Data Register Format



Unsigned Input Data Register Format



Each data word allows you to represent analog input current data with either signed integer values ranging from -32 767 to 32 767 or with unsigned integer values in the range 0 to 65 534.

In the operating range 0 to 20 mA, do not use negative values. If the input data format is configured for signed integers, the sign bit (bit 15) is always 0.

The value 0 represents 0 mA or 4 mA, depending on the range selected. The value of either +32 000 (signed) or 64 000 (unsigned) represents 20 mA. Errors and warnings are reported in both operating ranges at the following counts:

Type of Error or Warning	4 to 20 mA Range (default)			0 to 20 mA Range		
	Current	Signed Count	Unsigned Count	Current	Signed Count	Unsigned Count
OCE	20.38 mA	32 767	65 534	20.48 mA	32 767	65 534
OCW	> 20 mA	32 001	64 001	> 20 mA	32 001	64 001
UCE	< 3.62 mA	(767	N/A	0	0	0
UCW	< 4 mA	-1	N/A	< 0.48 mA	767	1535
BWE	< 1 mA	N/A	N/A	N/A		

Type of Error or Warning	4 to 20 mA Range (default)			0 to 20 mA Range		
	Current	Signed Count	Unsigned Count	Current	Signed Count	Unsigned Count
OCE over-current error **OCW** over-current warning **UCE** under-current error **UCW** under-current warning **BWE** broken wire error						

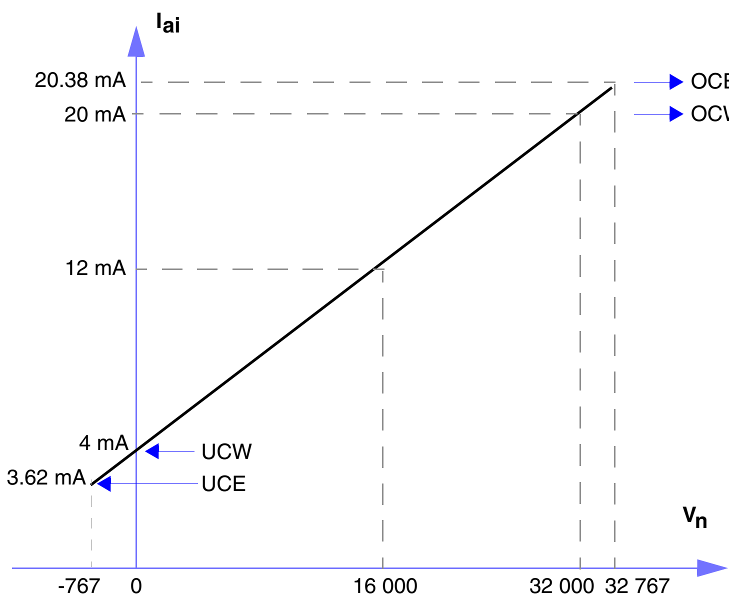
Note: Errors and warnings are based on count values, not current values. The current values in the table below are ideal values.

In the 4 to 20 mA operating range, linear current representations can be interpreted using the formula, where V_n is the numerical count and I_{ai} is the analog input current:

$$V_n = (I_{ai} - 4\text{ mA}) \times 2\,000 \text{ for the signed input data format}$$

$$V_n = (I_{ai} - 4\text{ mA}) \times 4\,000 \text{ for the unsigned input data format}$$

Here is an example in signed input data format:

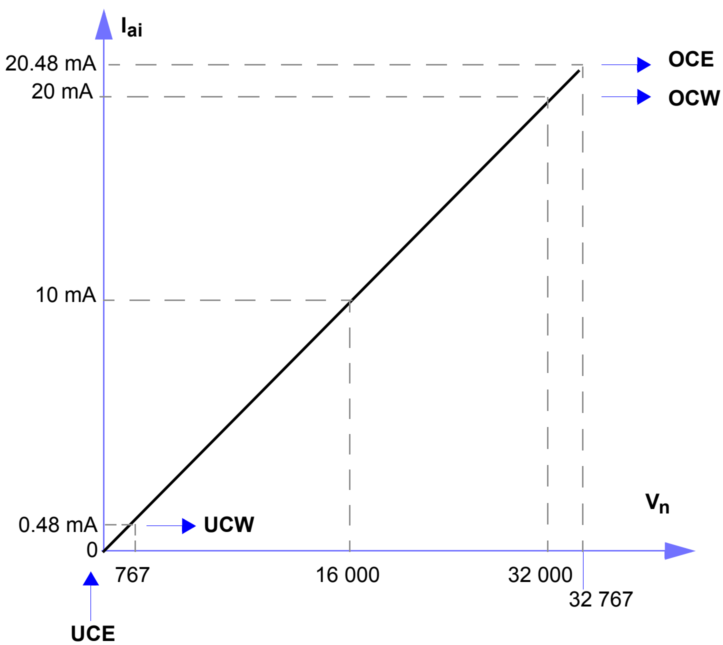


In the 0 to 20 mA operating range, linear current representations can be interpreted using the formula, where V_n is the numerical count and I_{ai} is the analog input current:

$V_n = I_{ai} \times 1\,600$ (I_{ai} in mA) for the signed input data format

$V_n = I_{ai} \times 3\,200$ (I_{ai} in mA) for the unsigned input data format

Here is an example in signed input data format:

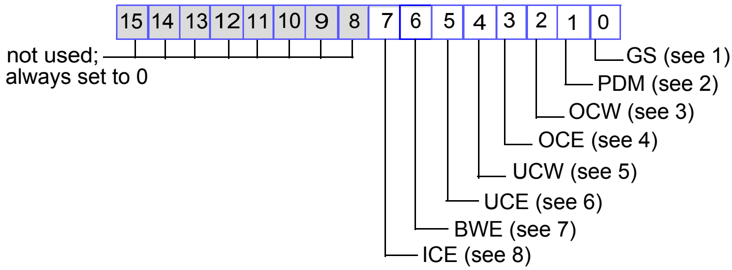


Status Byte Structure

The second, fourth, sixth, and eighth registers in the input block of the process image are the status words. The STB ACI 8320 can detect and report current overflow conditions.

The six LSBs in each register represent the status of each input channel:

STB ACI 8320 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 and/or bit 6 and/or bit 7 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 when the isolated field side voltage is not within range. A PDM error turns on the GS bit (bit 0).

3 Bit 2 represents the presence or absence of an OCW. See current level definitions in the preceding table. AN OCW does not turn on the GS bit (bit 0).

4 Bit 3 represents the presence or absence of an OCE. See current level definitions in the preceding table. An OCE turns on the GS bit (bit 0).

5 Bit 4 represents the presence or absence of a UCW. See current level definitions in the preceding table. A UCW does not turn on the GS bit (bit 0).

6 Bit 5 represents the presence or absence of a UCE. See current level definitions in the preceding table. A UCE does not turn on the GS bit (bit 0).

7 Bit 6 represents the presence or absence of a BWE. This error is present when the input channel has a broken wire. A BWE turns on the GS bit (bit 0).

8 Bit 7 represents an internal communications error (ICE). This error will turn on the GS bit (bit 0).

Note: When the global status bit (GS) is on, the channel data value may not be valid.

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 8320 Specifications

Table of Technical Specifications

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

description		four differential analog current input channels with Hart tolerance
analog current range	default	4 to 20 mA
	user-configurable	0 to 20 mA
resolution	default	15 bits + sign
	user-configurable	16 bits unsigned
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		95 mA
nominal sensor bus current consumption		150 mA
hot swapping supported*		NIM-dependent**
reflex actions supported		for 2 inputs only, channels 1 & 2
profile ID		55 hex
input response time	nominal	80 ms for all channels
	maximum	110 ms for all channels
isolation	field-to-bus	1500 VDC for 1 min
	channel-to-channel	200 VDC
	analog module sensor bus	500 VDC
input filter		digital filter of 30 Hz @ -3 dB
integral linearity		± 0.05% of full scale
differential linearity		monotonic
absolute accuracy		typically ± 0.3% of full scale @ 25°C and ± 0.4% maximum of full scale
temperature drift		typically ± 0.005% of full scale/ °C
operating temperature range***		0 to 60°C
storage temperature		-40 to 85°C
over-range margin		2.4%
under-range margin (4 to 20 mA range only)		2.4%
input impedance		≤ 300 Ω

maximum input current	25 mA
addressing requirement	8 words total: ● 4 words for data ● 4 words for status
common mode rejection	≥ 80 dB @ 60 Hz
common mode voltage	≤ 100 VDC or 100 VAC peak
cross talk between channels	≥ 80 dB
field power requirements	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
Hart Protocol tolerance	Tolerant with Hart communications networks, and does not impact the integrity of the Hart Protocol.
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.	
***This product supports operation at normal and extended temperature ranges. Refer to *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.	

2.8 STB ART 0200 Analog Multirange Input Module (two-channel, isolated, 16-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?

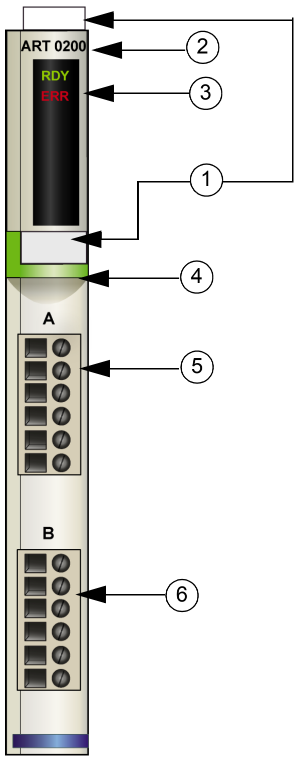
This section contains the following topics:

STB ART 0200 Physical Description

Physical Characteristics

The STB ART 0200 is a standard Advantys STB two-channel analog input module that can support RTD, thermocouple or mV analog sensors. Each channel can be configured independently. 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.

Front Panel View



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

Ordering Information

The module can be ordered as part of a kit (STB ART 0200 K), which includes:

- one STB ART 0200 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ART 0200 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width		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)

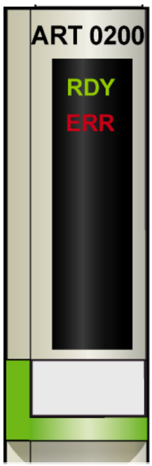
STB ART 0200 LEDs

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):

RDY	ERR	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: ● it has power ● it has passed its confidence tests ● it is operational	
on	on	The watchdog has timed out.	Cycle power, restart the communications
blink 1**		The module is in pre-operational mode.	
	blink 1**	Island bus controller error.	Replace the module.
	flicker*	Field power absent or a PDM short circuit detected.	Check power
		Broken wire detected in RTD or TC mode.	Locate and repair wiring problem.
		Measurement out of limits	Check configuration and application.
		Internal error	Cycle power; if the problem remains replace the 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.		

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.

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

Field Wiring Pinout

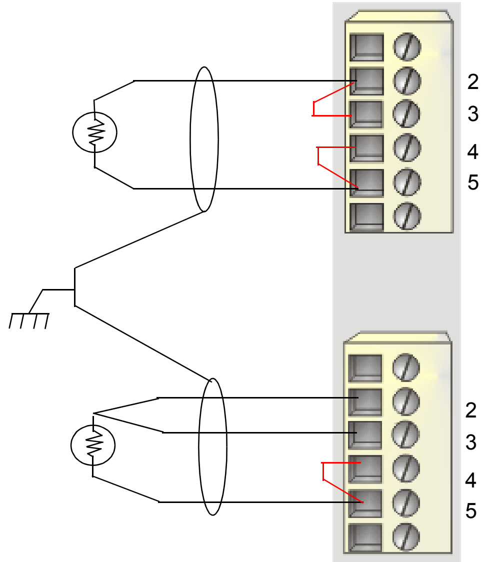
> **Note:** Successful operation of the STB ART 0200 is determined by both the way the module is configured and the way it is field-wired. If you configure a channel to operate with one type of analog sensor (thermocouple, RTD or mV), you must also make the proper field connections to make the channel 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

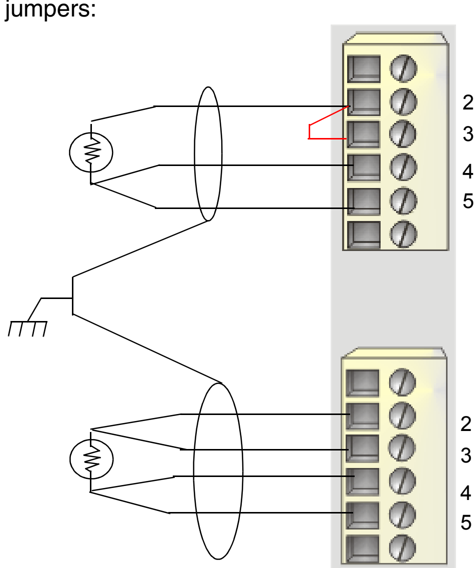
Sample RTD Wiring Diagrams

The following field wiring example shows a two-wire RTD and a three-wire RTD connected to the STB ART 0200:



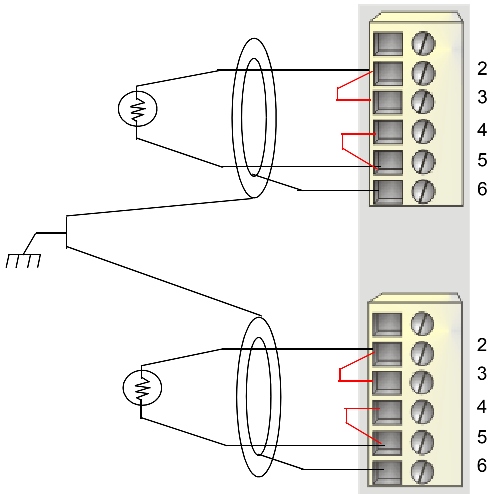
top connector two-wire RTD sensor
bottom connector three-wire RTD sensor

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:

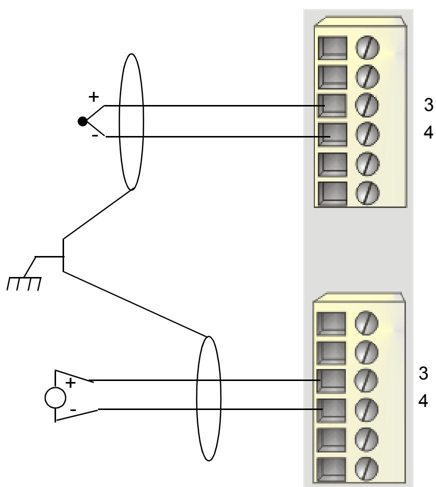
STB ART 0200



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

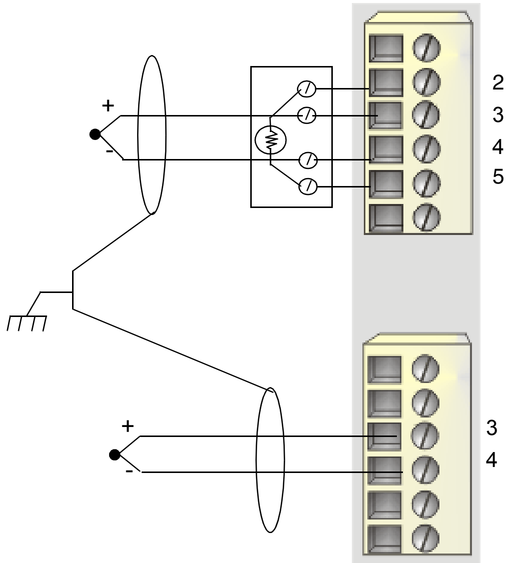
The illustration below shows a TC sensor on the top connector and a mV sensor on the bottom connector. TC and mV applications make use of pins 3 and 4:



top connector thermocouple sensor
bottom connector mV sensor

Wiring a TC with External Cold-junction Compensation

When you apply external cold-junction compensation (see *p. 163*) 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.

Using the RTP feature in your NIM, you can access the value of the following parameter:

- Averaging

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

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

Averaging

You may apply a filter that will smooth the values of the analog inputs reported by 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 number of samples averaged is one (no averaging); you may average over up to eight samples. To configure the number of samples to average over:

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.	-

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

Length	1
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	1 for channel 1 2 for channel 2
Data Byte 1	1 to 8

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

Input Sensor Type		ORE	ORW	Normal Range	URW	URE
J type TC	degrees C	>/= 1200	1171.9.8	-210 ... +1200	< -205.1	</= -210
	degrees F	>/= 2192	> 2140.6	-346 ... +2192	< -337.9	</= -346
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	>/= 1768	> 1726.6	-50 ... +1768	< -48.8	</= -50
	degrees F	>/= 3214.4	> 3139.1	-58 ... +3214	< -56.6	</= -58
R type TC	degrees C	>/= 1768	> 1726.6	-50 ... +1768	< -48.8	</= -50
	degrees F	>/= 3214.4	> 3139.1	-58 ... +3214	< -56.6	</= -58
B type TC	degrees C	>/= 1820	> 1726.6	+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

These are the following thermocouple ranges for type J, R, and S thermocouples for modules with an SV less than or equal to 1.59.

Input Sensor Type		ORE	ORW	Normal Range	URW	URE
J	degrees C	>/= 760	> 741.8	-200 ... +760	< -195.2	</= -200
	degrees F	>/= 1400	> 1366.4	-328 ... +1400	< -320.1	</= -328
R	degrees C	>/= 1665	> 1625	-50 ... +1665	< -48.8	</= -50
	degrees F	>/= 3029	> 3029	-58 ... +3029	< -56.6	</= -58
S	degrees C	>/= 1665	> 1625	-50 ... +1665	< -48.8	</= -50
	degrees F	>/= 3029	> 3029	-58 ... +3029	< -56.6	</= -58

- 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

Cold-junction Compensation Device		Operating Range
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 *p. 155*) 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, if you are not using a basic NIM, 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 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.

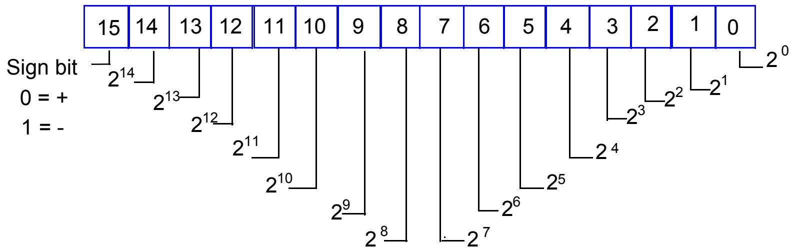
Note: The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transmitted to the master in a fieldbus-specific format. For fieldbus-specific format descriptions, refer to one of the Advantys STB Network Interface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

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable to index *6423*, subindex *1* in order to receive the input data. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

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



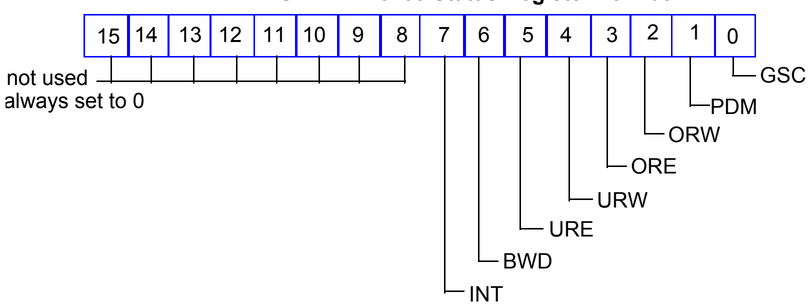
If a register holds temperature data, it represents it as degree C x 10 or degrees F x 10. For example, if the channel data is 74.9 degrees C, the register representing that channel reads 749 (in decimal) or 0*x*2ED (in hexadecimal). You can configure degree C or degrees F in the module editor (see *p. 160*).

If a register holds 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



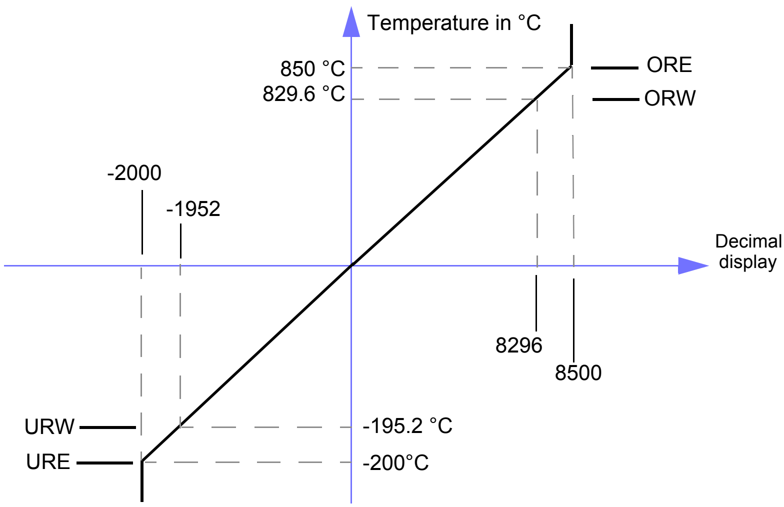
Bit meanings are described below:

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 *p. 161*). 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 *p. 161*). 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 *p. 161*). (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 *p. 161*). 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 degrees C, the register representing that channel reads 748 (in decimal) or 0*x*1F2 (in hexadecimal). You can configure degrees C or degrees F in the module editor (see *p. 160*).

Cold-junction compensation can be effected by either internal or external compensation (see *p. 163*). 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.

General Specifications

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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 *p. 391*)
operating voltage range		19.2 to 30 VDC
bus current consumption		30 mA
nominal sensor bus current consumption		170 mA
hot swapping supported*		NIM-dependent**
reflex actions supported		as inputs only[1]
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		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
operating temperature range***		0 to 60°C
storage temperature		-40 to 85°C

agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to Advantys STB System Planning and Installation Guide, 890 USE 171 **Basic NIMs do not allow you to hot swap I/O modules.	
***This product supports operation at normal and extended temperature ranges. Refer to the Advantys STB System Planning and Installation Guide, 890 USE 171 for a complete summary of cabalities and limitations.	
[1]Requires the Advantys configuration software.	

RTD Specifications

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)	+/- 0.5 degrees C	
		+/- 0.9 degrees F	
	Cu @ 25° C (77° F)	+/- 2.0 degrees C	
		+/- 3.6 degrees F	
	Ni @ 25° C (77° F)	+/- 0.5 degrees C	
		+/- 9.0 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)	+/- 1.6 degrees C	
		+/- 1.6 degrees F	
* Requires the Advantys configuration software.			

TC Specifications

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	-210 ... +1200 degrees C
			-346 ... +2192 degrees F
		type K	-270 ... +1370 degrees C
			-454 ... +2498 degrees F
		type E	-270 ... +1000 degrees C
			-454 ... +1832 degrees F

		type T	-270 ... +400 degrees C
			-454 ... +752 degrees F
		type S	-50 ... +1768 degrees C
			-58 ... +3214.4 degrees F
		type R	-50 ... +1768 degrees C
			-58 ... +3214.4 degrees F
		type B	+130 ... 1820 degrees C
			+266 ... 3200 degrees F
maximum error (TC error not included	with internal cold-junction compensation	type J	5.1 degrees @ 25 degrees C
			9.18 degrees @ 77 degrees F
		type K	4 degrees @ 25 degrees C
			7.2 degrees @ 77 degrees F
		type E	4.6 degrees @ 25 degrees C
			8.28 degrees @ 77 degrees F
		type T	4.4 degrees @ 25 degrees C
			7.92 degrees @ 77 degrees F
		type S	4.1 degrees @ 25 degrees C
			7.38 degrees @ 77 degrees F
		type R	3.6 degrees @ 25 degrees C
			6.48 degrees @ 77 degrees F
		type B	4.6 degrees @ 25 degrees C
			8.28 degrees @ 77 degrees F
	with external cold-junction compensation	all types (RTD errors not included)	1.75 degrees @ 25 degrees C
			3.15 degrees @ 77 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
* Requires the Advantys configuration software.			

mV Specifications

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

2.9 STB ACI 1400 Analog Current Input Module (eight-channel, single-ended Inputs, 15-bit + sign, 4 ... 20 mA or 0 ... 20 mA)

At a Glance

Overview

This section provides you with a detailed description of the STB ACI 1400 analog input module—its physical design and functional capabilities.

What's in this Section?

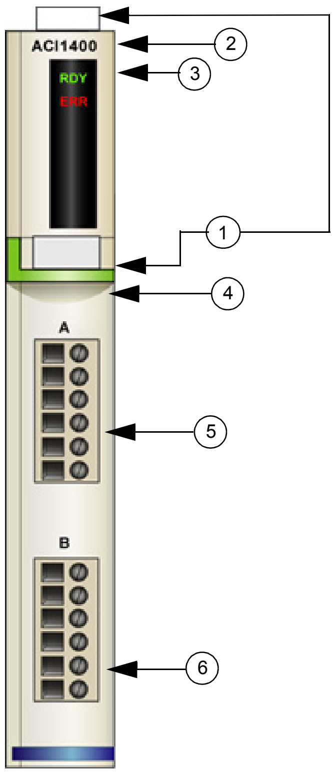
This section contains the following topics:

STB ACI 1400 Physical Description

Physical Characteristics

The STB ACI 1400 is an eight-channel, single-ended analog current input module that reads inputs from analog sensors operating in the range of 4 to 20 mA (default) or 0 to 20 mA. The module converts the analog signal to a digital value with 15-bit + sign resolution, and communicates that value to the control system. The module mounts in a size 2 I/O base and uses two six-terminal field wiring connectors.

Front Panel View



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 sensors 1, 2, 3, and 4 connect to the top field wiring connector
6 sensors 5, 6, 7, and 8 connect to the bottom field wiring connector

Ordering Information

The module can be ordered as part of a kit (STB ACI 1400 K), which includes:

- one STB ACI 1400 analog input module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACI 1400 analog input module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

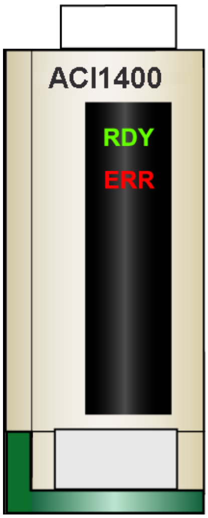
STB ACI 1400 LED Indicator

Purpose

The two LEDs on the STB ACI 1400 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	on	The watchdog has timed out.	Cycle power; restart the communications.
on	off	The module has achieved all of the following: ● it has power ● it passed its confidence tests ● it is operational	
on	flicker*	An over-current error is detected.	Check wiring and field device.
	flicker*	A broken wire is detected.	Check wiring.
		Field power is absent	Check power.
		A PDM short circuit is detected.	
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.		

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 1400 Field Wiring

Summary

The STB ACI 1400 module uses two six-terminal field wiring connectors. Analog sensors 1, 2, 3, and 4 are wired to the top connector, and analog sensors 5, 6, 7, and 8 are 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.

> **Note:** If you are wiring two return lines directly into one pin on the connectors, you need to use STB XTS 1100 screw type field wiring connectors, as illustrated in the field wiring examples that follow.

Field Sensors

The STB ACI 1400 module support eight single-ended 2-wire analog sensors. It handles analog inputs in the ranges of 4 to 20 mA or 0 to 20 mA. Data on each channel has a resolution of 15 bits + sign.

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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

> **Note:** If you are wiring two return lines directly into one pin on the connectors, you need to use stranded wires that are no larger than 0.8 mm^2 (18 AWG). Both wires must be the same wire gauge.

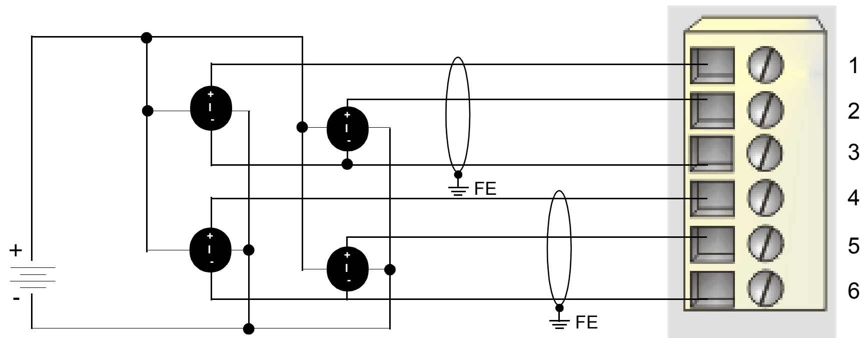
Field Wiring Pinout

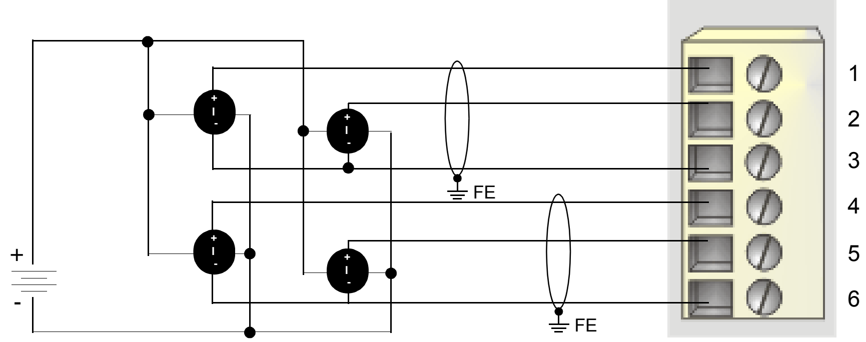
The top connector supports analog sensors 1, 2, 3, and 4. The bottom connector supports analog sensors 5, 6, 7, and 8.

Pin	Top Connections	Bottom Connections
1	current in 1	current in 5
2	current in 2	current in 6
3	return	return
4	current in 3	current in 7
5	current in 4	current in 8
6	return	return

Sample Wiring Diagrams

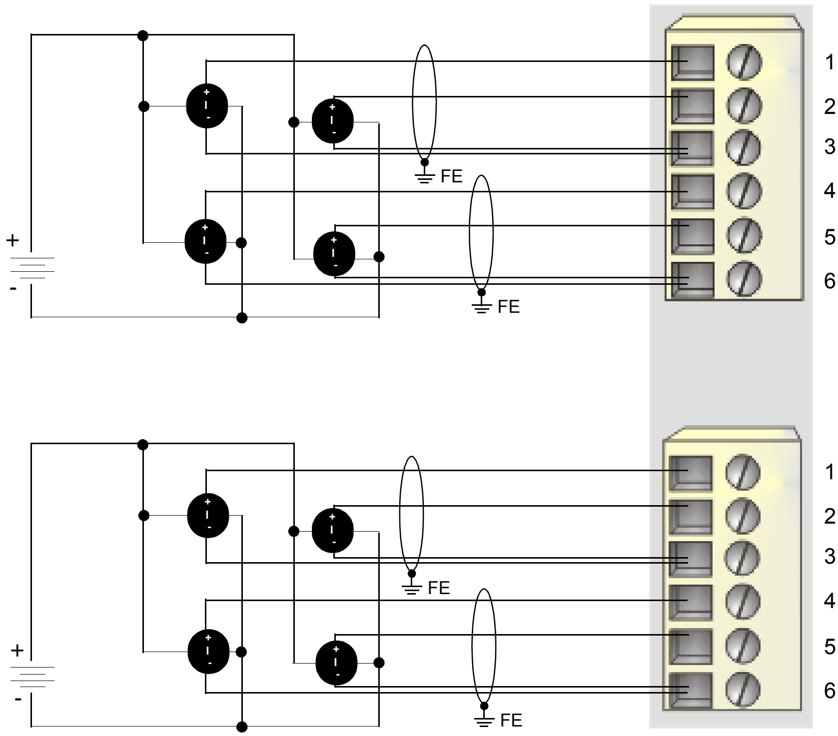
The following field wiring examples show how eight analog sensors can be wired to the STB ACI 1400 module. For both examples, an external power supply is required to power the sensors.





Notice that the return lines for the sensors are connected in external junction boxes so that two returns are brought into pins 3 and 6 on both connectors with a single wire.

In the following example, two return wires are brought into pins 3 and 6 on each connector. With this wiring configuration, a maximum wire size of 0.8 mm^2 (18 AWG) stranded wire must be used for the return connections, and STB XTS 1100 screw type wiring connectors must be used. Both return wires must be of the same wire gauge.



STB ACI 1400 Functional Description

Functional Characteristics

The STB ACI 1400 module is an eight-channel module that handles analog input data from eight field sensors operating in a 4 to 20 mA (default) or 0 to 20 mA current range. The following operating parameters are user configurable:

- offset
- maximum count
- averaging
- range
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameters:

- offset
- maximum count
- averaging

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

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

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 operating 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 -767 to +767 (0xFD01 to 0x2FF), representing a current offset of:

- +/–0.38 mA for the 4 to 20 mA operating range
- +/–0.48mA for the 0 to 20 mA operating range

By default, the offset on both channels is 0.

Maximum count is configured as a decimal or hexadecimal value in the range 31 233 to 32 767, representing a current offset of:

- +/–0.38 mA for the 4 to 20 mA operating range
- +/–0.48mA for the 0 to 20 mA operating range

By default, the maximum count on both channels is 32 000 (0x7D00).

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 4 to 20 mA or 0 to 20 mA. An offset adjustment is performed on the low end of the range, and a max count adjustment is performed on the high end of the range.

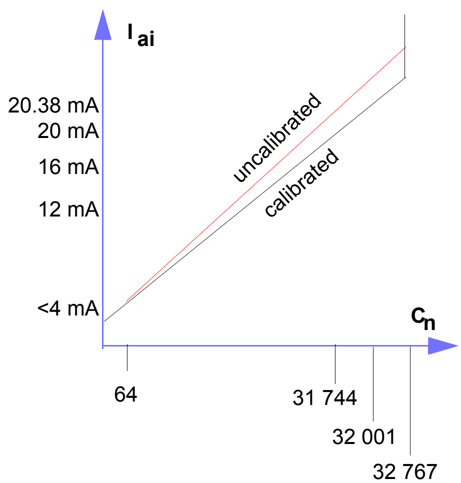
Operating Range 4 to 20 mA

In the 4 to 20 mA operating range, an ideal linear representation of analog input current (one with default offset and maximum count) is given by the following formula:

$$C_n = (I_{ai} - 4\text{ mA}) \times 2000$$

where C_n is the numerical count and I_{ai} is the analog input current.

For example, if you use the Advantys configuration software to calibrate an offset of +64 at 4 mA and a max count of 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
4 mA	64	0
16 mA	23 824	24 000
20 mA	31 744	32 000

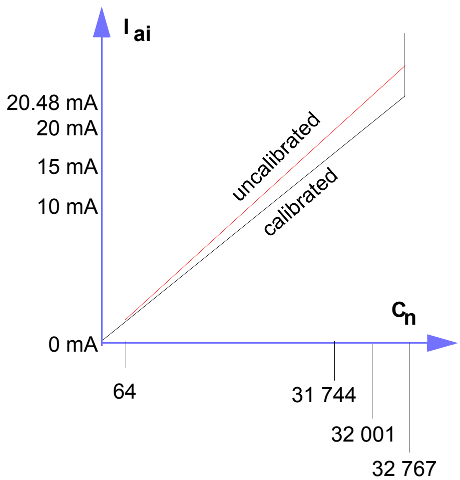
Operating Range 0 to 20 mA

In the 0 to 20 mA operating range, an ideal linear representation of analog input current (one with default offset and maximum count) is given by the following formula:

$$C_n = I_{ai} \times 1600$$

where C_n is the numerical count and I_{ai} is the analog input current.

For example, if you use the Advantys configuration software to calibrate an offset of +64 at 0 mA and a max count of 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
15 mA	23 824	24 000
20 mA	31 744	32 000

Offset and RTP:

The offset parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
	5 for channel 5
	5 for channel 6
	7 for channel 7
	8 for channel 8
Data bytes 2 (high byte) and 1 (low byte)	-767 to +767 (0xFD01 to 0x2FF)

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
	5 for channel 5
	5 for channel 6
	7 for channel 7
	8 for channel 8
Data bytes 2 (high byte) and 1 (low byte)	31 233 to 32 767 (0x7A01 to 0x7FFF)

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 STB ACI 1400 module in the island editor.	The module editor for the selected STB ACI 1400 module will open.
3	Open the I/O Image **Data Animation** sheet, which can be accessed from the module editor in the Advantys configuration software when it is online.	
4	Apply a value corresponding to the minimum input (0 mA or 4 mA depending on the selected range), and read the analog input channel's data in the I/O Image **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 the actual data value.
5	Apply a value corresponding to maximum input (20 mA) and read the analog input channel's data in the module's I/O Image **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 the actual data value.
6	If adjustments need to be made, take the Advantys configuration software offline.	
7	Double-click on the STB ACI 1400 module in the island editor.	The module editor for the selected STB ACI 1400 module will open.
8	Open the **Properties** sheet in the module editor. In the Offset value field, enter the data value that you read in step 4. In the Max. Count value field, enter the data value that you read in step 5.	
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 values of the analog inputs reported by the STB ACI 1400. The Advantys configuration software allows you to average over a specified number of samples. By default, the number samples averaged is one (no averaging); you may have a filtering average over up to 80 samples. To configure an averaging value:

Step	Action	Result
1	Double click the STB ACI 1400 module you want to configure in the island editor.	The selected STB ACI 1400 module opens in the software module editor.

Step	Action	Result
2	In the **Configured Value** column of the **Averaging** row, enter a decimal or hexadecimal value in the range 1 to 80 (0x50).	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 on a per-channel basis.

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

Length	1
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
	5 for channel 5
	6 for channel 6
	7 for channel 7
	8 for channel 8
Data Byte 1	1 to 80 (0x50)

Range

You may configure the operating range of the STB ACI 1400 on a per-channel basis.
- 4 to 20 mA (default)
- 0 to 20 mA

Channel Operation (Enable/Disable)

The STB ACI 1400 has an input channel enable/disable on a per-channel basis. You can disable the unused inputs. By default, all inputs are enabled. When you disable a channel, its input is set to minimum input current. The status byte and channel data return all zeros, and the fault indicator does not blink for channel-dependent errors.
- channel enable (default)
- channel disable

Note: The module detects PDM error and flashes the ERR LED even if all eight channels are disabled.

STB ACI 1400 Data and Status for the Process Image

Representing the Analog Input Data

The STB ACI 1400 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in 16 registers—8 data registers (one for each channel) and 8 status registers (one for each channel). The information can be read by the fieldbus master or, if you are using a standard NIM, by an HMI panel connected to the NIM's CFG port.

The input data process image is a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB ACI 1400 module is represented by 16 contiguous registers in this block, which appear in the following order:

- 1st register = channel 1 data (16 bits)
- 2nd register = channel 1 status (8 bits)
- 3rd register = channel 2 data (16 bits)
- 4th register = channel 2 status (8 bits)
- 5th register = channel 3 data (16 bits)
- 6th register = channel 3 status (8 bits)
- 7th register = channel 4 data (16 bits)
- 8th register = channel 4 status (8 bits)
- 9th register = channel 5 data (16 bits)
- 10th register = channel 5 status (8 bits)
- 11th register = channel 6 data (16 bits)
- 12th register = channel 6 status (8 bits)
- 13th register = channel 7 data (16 bits)
- 14th register = channel 7 status (8 bits)
- 15th register = channel 8 data (16 bits)
- 16th register = channel 8 status (8 bits)

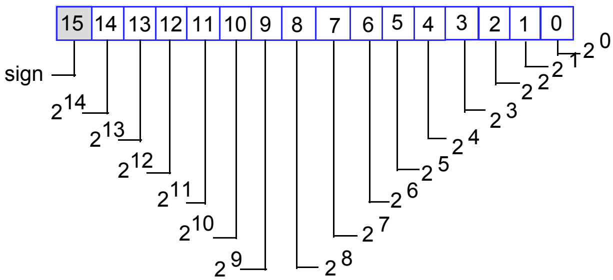
The specific registers used are based on the module's logical address on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable object (index 6423, subindex 0) to a value of 1. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

Data Word Structure

The first, third, fifth, seventh, ninth, eleventh, thirteenth, and fifteenth registers in the module's input process image are the data words. Each register represents the input current of a channel in the IEC data format. The data has 15-bit + sign resolution. The bit structure in each data register is as follows:

STB ACI 1400 Data Register Format



All 16 bits in the register are significant. They allow you to represent analog input currents with all the integer values in the range -32 768 to +32 767.

In the 0 to 20 mA operating range, the sign bit (bit 15) is always 0, indicating that negative current values are not read.

The value 0 represents 0 mA or 4 mA, depending on the range selected. The value 32 000 represents 20 mA. Errors and warnings are reported at the following counts.

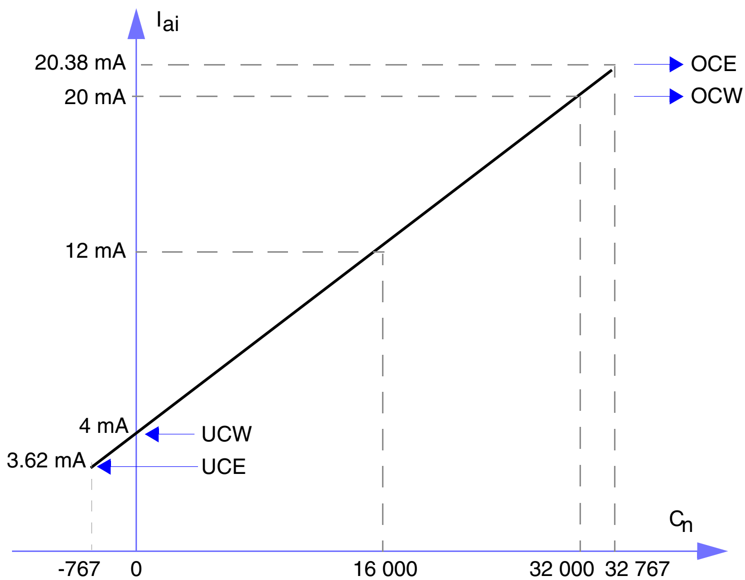
Note: Errors and warnings are based on count values, not physical values. The current values in the table below are ideal values.

Error	4 to 20 mA Range (default)	0 to 20 mA Range
OCE (over current error)	20.38 mA (32 767)	20.48 mA (32 767)
OCW (over current warning)	> 20 mA (32 001)	> 20 mA (32 001)
UCW (under current warning)	< 4 mA (-1)	< 0.48 mA (767)
UCE (under current error)	<= 3.62 mA (-767)	0 (0)
BWE (broken wire error)	<1 mA (-767 is still displayed))	N/A (N/A)

In the 4 to 20 mA operating range, an ideal linear representation of analog input current (one with default offset and maximum count) is given by the following formula:

$$C_n = (I_{ai} - 4\ mA) \times 2000$$

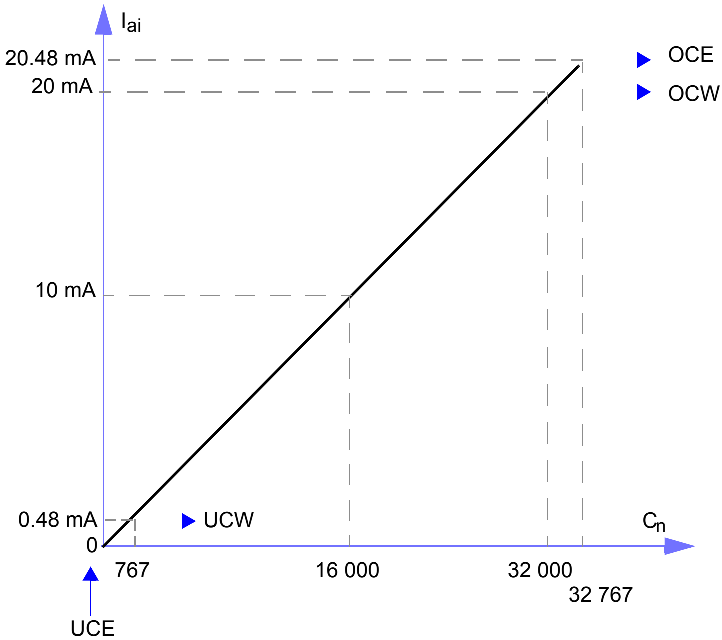
where C_n is the numerical count and I_{ai} is the analog input current.



In the 0 to 20 mA operating range, an ideal linear representation of analog input current (one with default offset and maximum count) is given by the following formula:

$$C_n = I_{ai} \times 1600$$

where C_n is the numerical count and I_{ai} is the analog input current.

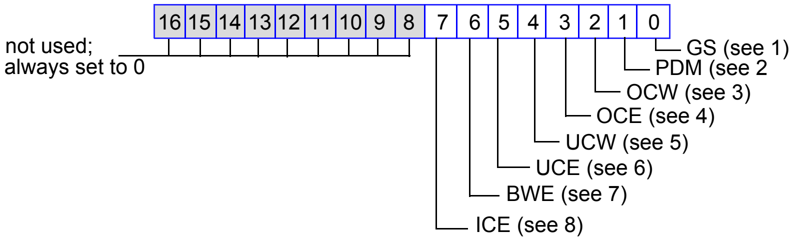


Status Byte Structure

The second, fourth, sixth, eighth, tenth, twelfth, fourteenth, and sixteenth registers in the module's input process image are the status words. The STB ACI 1400 can detect and report current overflow conditions.

The eight least significant bits (LSB) in each register represent the status of each input channel:

STB ACI 1400 Status Register Format



1 Bit 0 represents global status (GS). It has a value of 0 when no errors are detected. It has a value of 1 when bit 1 and/or bit 3 and/or bit 6 and/or bit 7 has a value of 1.
2 Bit 1 represents the status of the PDM voltage on the island's sensor bus. It has a value of 1 when PDM error has been detected. A PDM error turns on the GS bit (bit 0).
3 Bit 2 represents the presence or absence of an OCW. An OCW does not turn on the GS bit (bit 0).
4 Bit 3 represents the presence or absence of an OCE. An OCE turns on the GS bit (bit 0).
5 Bit 4 represents the presence or absence of a UCW. A UCW does not turn on the GS bit (bit 0).
6 Bit 5 represents the presence or absence of a UCE. A UCE does not turn on the GS bit (bit 0).
7 Bit 6 represents the presence or absence of a broken wire error (BWE). A BWE turns on the GS bit (bit 0). Valid only in the 4 to 20 mA range.
8 Bit 7 represents an internal communications error (ICE). This error turns on the GS bit (bit 0).

Note: When the global status bit is on, the channel data value may not be valid.

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 1400 Specifications

Table of Technical Specifications

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

description		eight single-ended analog current input channels
analog current range		4 to 20 mA (default)
		0 to 20 mA
resolution		15 bits + sign
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		90 mA
nominal sensor bus current consumption		150 mA
hot swapping supported		NIM-dependent*
reflex actions supported		no
profile ID		0x47
input response time	nominal	16 ms for all channels
	maximum	22 ms for all channels
input filter		low pass filter with -3 dB cutoff at 985 Hz
integral linearity		± 0.08% of full scale
differential linearity		monotonic
absolute accuracy		typically ± 0.4% of full scale @ 25°C and ± 0.45% maximum of full scale
temperature drift		typically ± 0.005% of full scale/ °C
operating temperature range**		0 to 60°C
storage temperature		-40 to 85°C
over-range margin		2.4%
under-range margin (4 to 20 mA range only)		2.4%
input impedance		≤ 250 Ω
maximum input current		25 mA with no damage
addressing requirement	16 input words total	8 words for data
		8 words for status
isolation	field-to-bus	1500 VDC for 1 minute
	analog module to sensor bus	500 VDC

field power requirements	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
broken wire detection	4 to 20 mA range (only)
*Basic NIMs do not allow you to hot swap I/O modules.	
**This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.	

2.10 STB AVI 1400 Analog Voltage Input Module (eight-channel, single-ended inputs, 15-bit + sign, +1 ... 5 VDC, 0 ... 5 VDC, 0 ... 10 VDC, +/-5 VDC, or +/-10 VDC)

At a Glance

Overview

This section provides you with a detailed description of the STB AVI 1400 analog input module—its physical design and functional capabilities.

What's in this Section?

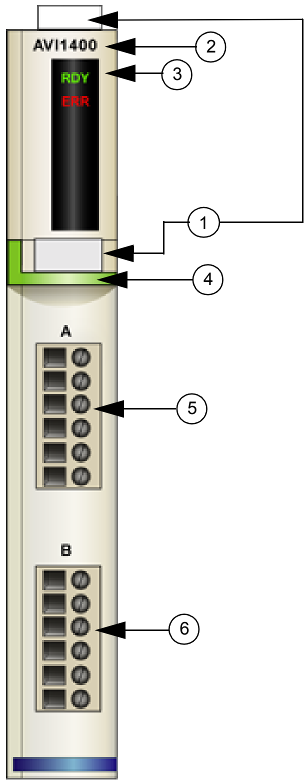
This section contains the following topics:

STB AVI 1400 Physical Description

Physical Characteristics

The STB AVI 1400 is an eight-channel, single-ended analog voltage input module that reads inputs from analog sensors operating in the range of +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC or +/-10 VDC (default). The module converts the analog signal to a digital value with 15-bit + sign resolution, and communicates the value to the control system. The module mounts in a size 2 I/O base and uses two six-terminal field wiring connectors.

Front Panel View



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 sensors 1, 2, 3, and 4 connect to the top field wiring connector
6 sensors 5, 6, 7, and 8 connect to the bottom field wiring connector

Ordering Information

The module can be ordered as part of a kit (STB AVI 1400 K), which includes:

- one STB AVI 1400 analog input module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVI 1400 analog input module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

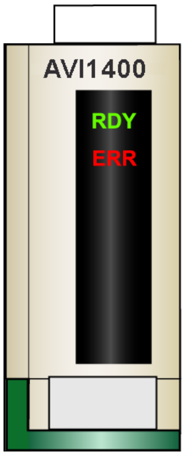
STB AVI 1400 LED Indicator

Purpose

The two LEDs on the STB AVI 1400 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	on	The watchdog has timed out.	Cycle power; restart the communications.
on	off	The module has achieved all of the following: ● it has power ● it passed its confidence tests ● it is operational	
on	flicker*	An over-voltage error is detected.	Check wiring and field device.
	flicker*	Field power is absent	Check power.
		A PDM short circuit is detected.	
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.		

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 1400 Field Wiring

Summary

The STB AVI 1400 module uses two six-terminal field wiring connectors. Analog sensors 1, 2, 3, and 4 are wired to the top connector, and analog sensors 5, 6, 7, and 8 are 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.

Note: If you are wiring two return lines directly into one pin on the connectors, you need to use STB XTS 1100 screw type field wiring connectors, as illustrated in the field wiring examples that follow.

Field Sensors

The STB AVI 1400 module supports eight single-ended 2-wire analog sensors. It handles analog inputs ranging from +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, or +/-10 VDC (default). Data on each channel has a resolution of 15 bits + sign.

Note: An open circuit in the input cabling causes 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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

Note: If you are wiring two return lines directly into one pin on the connectors, you need to use stranded wires that are no larger than 0.8 mm^2 (18 AWG). Both wires must be the same wire gauge.

Field Wiring Pinout

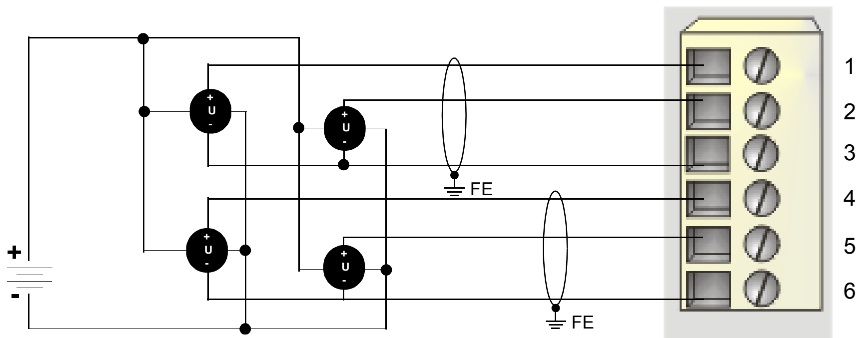
The top connector supports analog sensors 1, 2, 3, and 4. The bottom connector supports analog sensors 5, 6, 7, and 8.

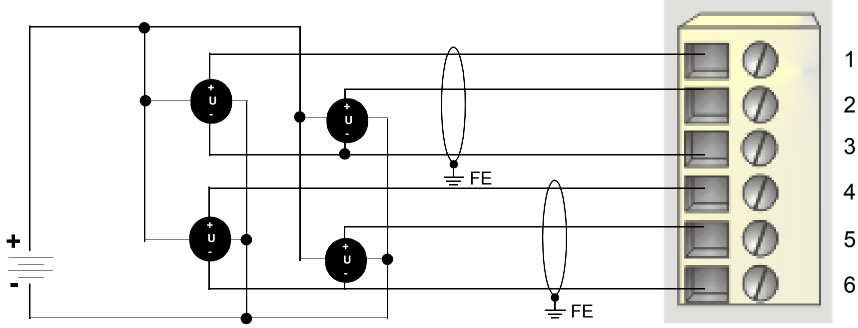
.

Pin	Top Connections	Bottom Connections
1	voltage in 1	voltage in 5
2	voltage in 2	voltage in 6
3	return	return
4	voltage in 3	voltage in 7
5	voltage in 4	voltage in 8
6	return	return

Sample Wiring Diagrams

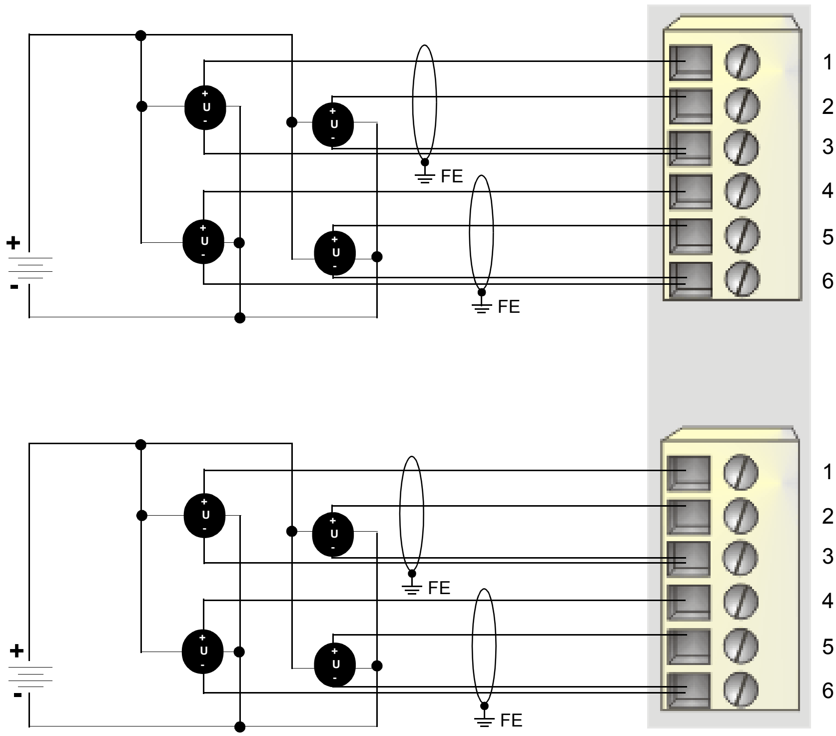
The following field wiring examples show how eight analog sensors can be wired to the STB AVI 1400 module. For both examples, an external power supply is required to power the sensors.





Notice that the return lines for the sensors are connected in external junction boxes so that two returns are brought into pins 3 and 6 on both connectors with a single wire.

In the following example, two return wires are brought into pins 3 and 6 on each connector. With this wiring configuration, a maximum wire size of 0.8 mm^2 (18 AWG) stranded wire must be used for the return connections, and STB XTS 1100 screw type wiring connectors must be used. Both return wires must be of the same wire gauge.



STB AVI 1400 Functional Description

Functional Characteristics

The STB AVI 1400 module is an eight-channel module that handles analog inputs from eight field sensors operating in the range of +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, or +/-10 VDC range. The following operating parameters are user configurable:

- offset
- maximum count
- averaging
- range
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameters:

- offset
- maximum count
- averaging

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

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

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 operating 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 -767 to +767(0xFD01 to 0x2FF), representing a voltage offset of:

- +/-0.24 VDC when the range is 0 to 10 VDC or +/-10 VDC
- +/-0.12 VDC when the range is 0 to 5 VDC or +/-5 VDC
- +/-0.1 VDC when the range is 1 to 5 VDC

By default, the offset on both channels is 0.

Maximum count is configured as a decimal or hexadecimal value in the range 31 233 to 32 767 (0x7A01 to 0x7FFF), representing a voltage offset of:

- +/-0.24 VDC when the range is 0 to 10 VDC or +/-10 VDC
- +/-0.12 VDC when the range is 0 to 5 VDC or +/-5 VDC
- +/-0.1 VDC when the range is 1 to 5 VDC

By default, the maximum count on both channels is 32 000 (0x7D00).

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

These parameters are provided only for sensor compensation, not for scaling. An offset adjustment will move the interpretation of the low end of the range, and a max count adjustment will move the interpretation of only the high end of the range.

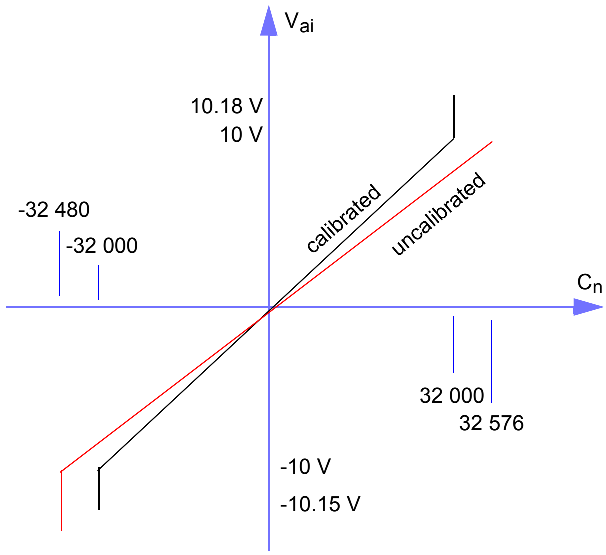
An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = (V_{ai} - 1\ V) * 8000$

where C_n is the numerical count and V_{ai} is the analog input voltage.

Operating Range +/-10 VDC

For example, in the +/-10 VDC operating range, if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 32 576 at +10 VDC, the system could be represented as follows:

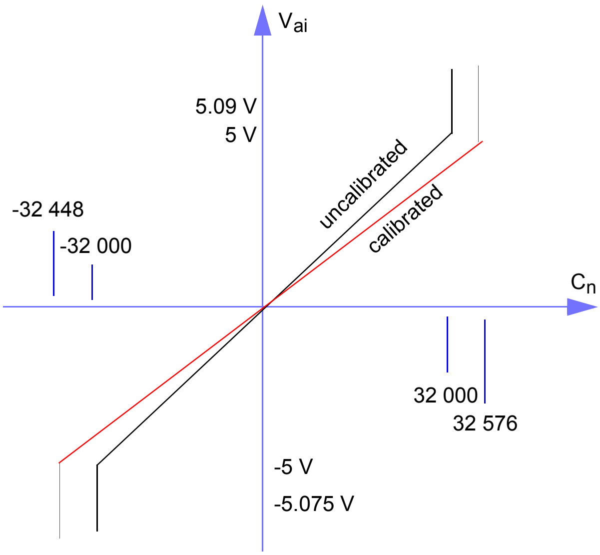


Here are some voltage representations after calibration with offset and max count:

V_{ai}	Uncalibrated	Calibrated
-10 VDC	-32 448*	-32 000*
0 VDC	64	0
+10 VDC	32 576	+32 000
* For the STB AVI 1400 module, the calibration of the negative value is determined by extending the linear equation determined by the offset at 0 VDC and the max count at +10 VDC.		

Operating Range +/-5 VDC

In the +/- 5 VDC operating range, if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 32 576 at +5 VDC, the system could be represented as follows:

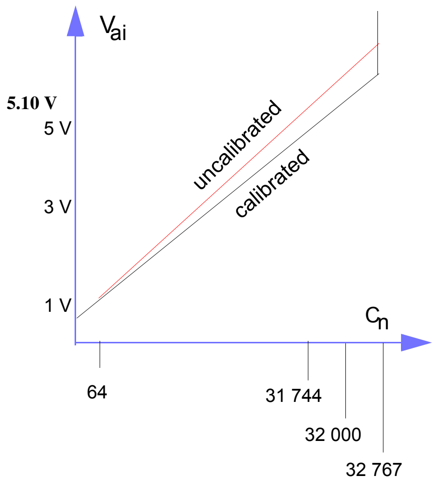


Here are some voltage representations after calibration with offset and max count:

V_{ai}	**Uncalibrated**	**Calibrated**
-5 VDC	-32 448*	-32 000*
0 VDC	64	0
+5 VDC	32 576	+32 000
* For the STB AVI 1400 module, the calibration of the negative value is determined by extending the linear equation determined by the offset at 0 VDC and the max count at +5 VDC.		

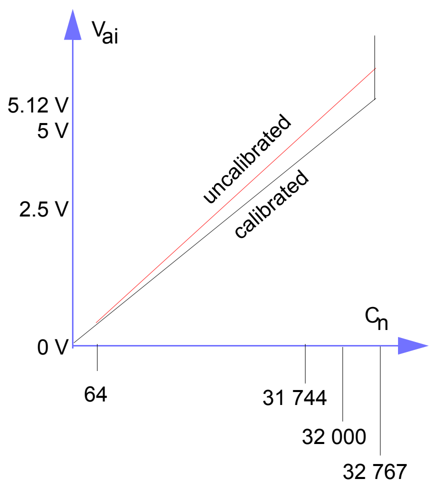
Operating Range +1 to 5 VDC

If you use the Advantys configuration software to calibrate an offset of 64 at 1 VDC and a max count of 31 744 at 5 VDC, the system could be represented as follows:



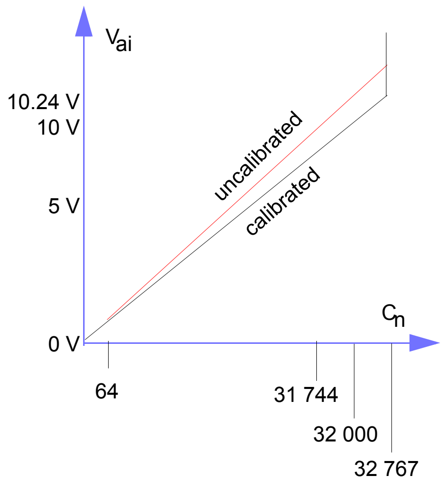
Operating Range 0 to 5 VDC

In the operating range of 0 to 5 VDC if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 31 744 at 5 VDC, the system could be represented as follows:



Operating Range 0 to 10 VDC

In the operating range of 0 to 10 VDC if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 31 744 at 10 VDC, the system could be represented as follows:



Offset and RTP:

The offset parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
	5 for channel 5
	6 for channel 6
	7 for channel 7
	8 for channel 8
Data Bytes 2 (high byte) & 1 (low byte)	-767 to +76 7 (0xFD01 to 0x2FF)

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
	5 for channel 5
	6 for channel 6
	7 for channel 7
	8 for channel 8
Data Bytes 2 (high byte) & 1 (low byte)	31 233 to 32 767 (0x7A01 to 0x7FFF))

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 STB AVI 1400 module in the island editor.	The module editor for the selected STB AVI 1400 module will open.
3	Open the I/O Image **Data Animation** sheet, which can be accessed from the module editor in the Advantys configuration software when it is online.	
4	Apply a value corresponding to the minimum input (0 VDC or 1 VDC, depending on the selected range), and read the analog input channel's data in the I/O Image **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 the actual data value.
5	Apply a value corresponding to the maximum input (5 VDC or 10 VDC, depending on the selected range), and read the analog input channel's data in the module's I/O Image **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 the actual data value.

Step	Action	Result
6	If adjustments need to be made, take the Advantys configuration software offline.	
7	Double-click on the STB AVI 1400 module in the island editor.	The module editor for the selected STB AVI 1400 module will open.
8	Open the **Properties** sheet in the module editor. In the Offset value field, enter the data value that you read in step 4. In the Max. Count value field, enter the data value that you read in step 5.	
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 smooths the values of the analog inputs reported by the STB AVI 1400. The Advantys configuration software allows you to average over a specified number of samples. By default, the number samples averaged is one (no averaging); you may have a filtering average over up to 80 samples. To configure an averaging sample:

Step	Action	Result
1	Double click the STB AVI 1400 module you want to configure in the island editor.	The selected STB AVI 1400 module opens in the software module editor.
2	In the **Configured Value** column of the **Averaging** row, enter a decimal or hexadecimal value in the range 1 to 80 (0x50).	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 on a per-channel basis.

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

Length	1
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
	5 for channel 5
	6 for channel 6
	7 for channel 7
	8 for channel 8
Data Byte 1	1 to 80 (0x50)

Range

You may configure the operating range of the STB AVI 1400 on a per-channel basis.
- +1 to 5 VDC
- 0 to 5 VDC
- 0 to 10 VDC
- +/-5 VDC
- +/-10 VDC

Channel Operation (Enable/Disable)

The STB AVI 1400 has an input channel enable/disable on a per-channel basis. You can disable the unused inputs. By default, all inputs are enabled upon auto configuration. The status byte and channel data return all zeros when the channel is disabled, and the fault indicator does not blink.
- channel enable (default)
- channel disable

Note: The module detects PDM error and flashes the ERR LED even if all eight channels are disabled..

STB AVI 1400 Data and Status for the Process Image

Representing the Analog Input Data

The STB AVI 1400 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in sixteen registers—eight data registers (one for each channel) and eight status registers (one for each channel). The information can be read by the fieldbus master or, if you are using a standard NIM, by an HMI panel connected to the NIM's CFG port.

The input data process image is a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB AVI 1400 module is represented by sixteen contiguous registers in this block, which appear in the following order:

- 1st register = channel 1 data (16 bits)
- 2nd register = channel 1 status (8 bits)
- 3rd register = channel 2 data (16 bits)
- 4th register = channel 2 status (8 bits)
- 5th register = channel 3 data (16 bits)
- 6th register = channel 3 status (8 bits)
- 7th register = channel 4 data (16 bits)
- 8th register = channel 4 status (8 bits)
- 9th register = channel 5 data (16 bits)
- 10th register = channel 5 status (8 bits)
- 11th register = channel 6 data (16 bits)
- 12th register = channel 6 status (8 bits)
- 13th register = channel 7 data (16 bits)
- 14th register = channel 7 status (8 bits)
- 15th register = channel 8 data (16 bits)
- 16th register = channel 8 status (8 bits)

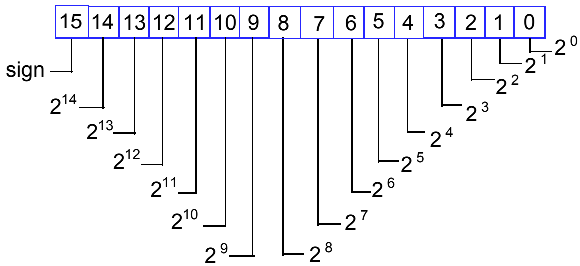
The specific registers used are based on the module's logical address on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable object (index 6423, subindex 0) to a value of 1.For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

Data Word Structure

The first, third, fifth, seventh, ninth, eleventh, thirteenth, and fifteenth registers in the module's input process image are the data words. Each register represents the input current of a channel in the IEC data format. The data has 15-bit + sign resolution. The bit structure in each data register is as follows:

STB AVI 1400 Data Register Format



All 16 bits in each data word are significant. They allow you to represent analog input voltages with all the integer values ranging from -32 768 to 32 767.

For the 1 to 5 VDC, 0 to 5 VDC, and 0 to 10 VDC operating ranges, the sign bit (bit 15) is always 0, indicating that negative voltage values are not read.

> **Note:** Errors and warnings are based on count values, not physical values. The current values in the tables below are ideal values.

Data Formats +1 to 5 VDC and 0 to 5 VDC

Error	+1 to 5 VDC Range	0 to 5 VDC Range
OVE (over voltage error)	5.10 VDC (32 767)	5.12 VDC (32 767)
OVW (over voltage warning)	> 5 VDC (32 001)	> 5 VDC (32 001)
UVW (under voltage warning)	< 1 VDC (-1)	< 0.12 VDC (767)
UVE (under voltage error)	<= 0.91 VDC (-767)	0 VDC (0)

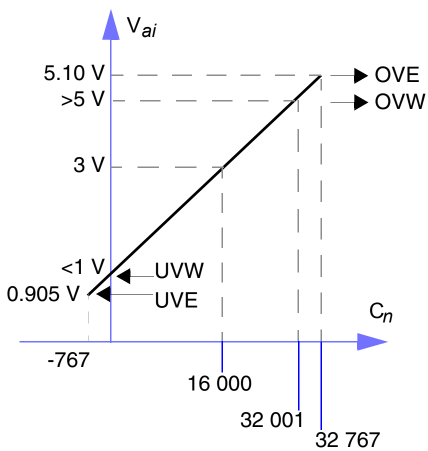
In an ideal linear voltage representation for +1 to 5 VDC range (one with default offset or max count settings (see *p. 203*)), a value of 32 001 represents an over voltage warning (OVW). If the input value is less than or equal to -1, the module will report an under voltage warning (UVW). When the input value reaches 32 767, an over voltage error (OVE) occurs. When the input value reaches -767, an under voltage error (UVE) occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = (V_{ai} - 1) \times 8000$

where C_n is the numerical count and V_{ai} is the analog input voltage.



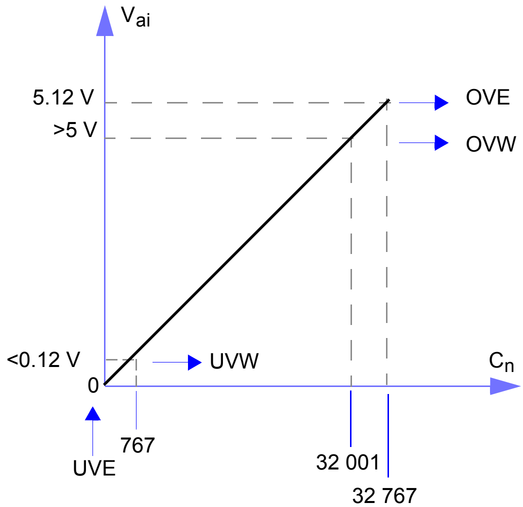
In an ideal linear voltage representation for 0 to 5 VDC range (one with default offset or max count settings (see *p. 203*)), a value of 32 001 represents an OVW. If the input value is less than or equal to 767, the module reports a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches 0, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 6400$

where C_n is the numerical count and V_{ai} is the analog input voltage.



Data Format 0 to 10 VDC

Error	0 to 10 VDC Range
OVE (over voltage error)	10.24 VDC (32 767)
OVW (over voltage warning)	> 10 VDC (32 001)
UVW (under voltage warning)	< 0.24 VDC (767)
UVE (under voltage error)	0 VDC (0)

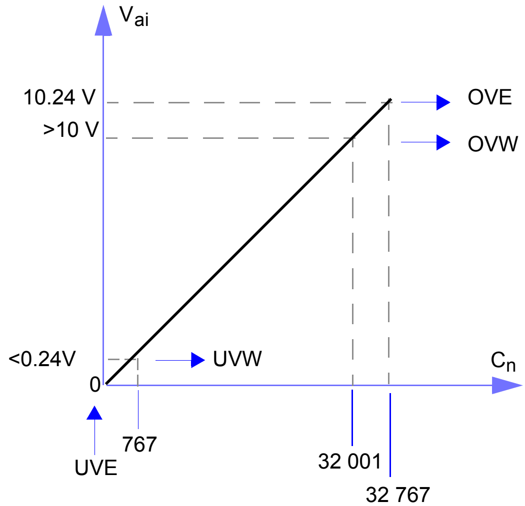
In an ideal linear voltage representation for 0 to 10 VDC range (one with default offset or max count settings (see *p. 203*)), a value of 32 001 represents an OVW. If the input value is less than or equal to 767, the module reports a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches 0, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 3200$

where C_n is the numerical count and V_{ai} is the analog input voltage.



Data Formats +/-5 VDC and +/-10 VDC

Error	+/-5 VDC Range	+/-10 VDC Range
OVE (over voltage error)	5.12 VDC (32 767)	10.24 VDC (32 767)
OVW (over voltage warning)	>-5 VDC (32 001)	> 10 VDC (32 001)
UVW (under voltage warning)	< 5 VDC (-32 001)	< 10 VDC (-32 001)
UVE (under voltage error)	-5.12 VDC (-32 768)	-10.24 VDC (-32 768)

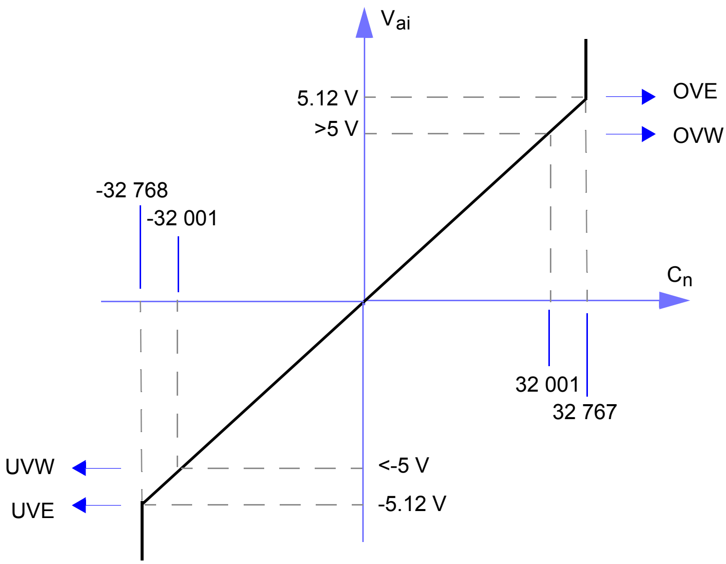
In an ideal linear voltage representation for +/-5 VDC range (one with default offset or max count settings (see *p. 203*)), a value of 32 001 represents an OVW. If the input value is less than or equal to -32 001, the module reports a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches -32 767, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 6400$

where C_n is the numerical count and V_{ai} is the analog input voltage.



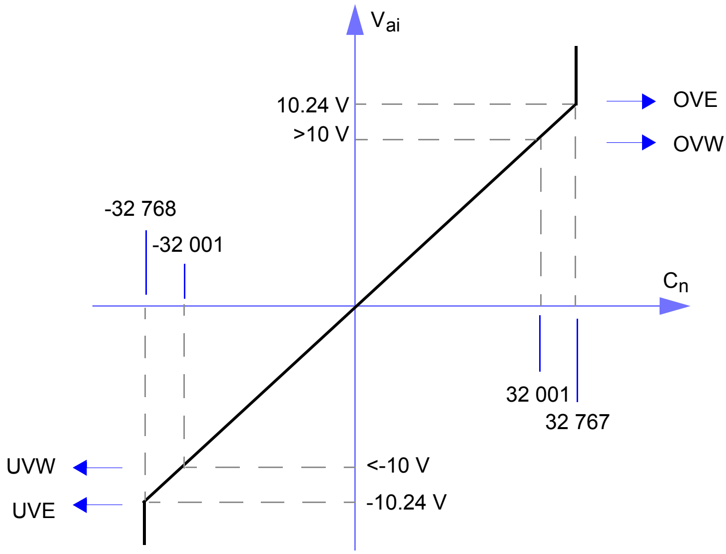
In an ideal linear voltage representation for +/-10 VDC range (one with default offset or max count settings (see *p. 203*)), a value of 32 001 represents an OVW. If the input value is less than or equal to -32 001, the module reports a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches -32 768, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 3200$

where C_n is the numerical count and V_{ai} is the analog input voltage.

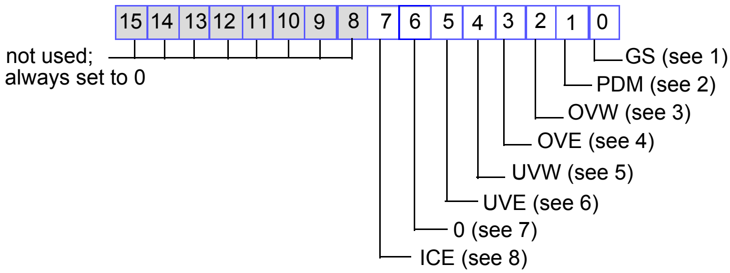


Status Byte Structure

The second, fourth, sixth, eighth, tenth, twelfth, fourteenth, and sixteenth registers in the module's input process image are the status words. The STB AVI 1400 can detect and report voltage overflow conditions.

The eight least significant bits (LSB) in each register represent the status of each input channel:

STB AVI 1400 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 are detected. It has a value of 1 when bit 1 and/or bit 3 and/or bit 5 and/or bit 7 has a value of 1.
2. Bit 1 represents the status of the PDM voltage on the island's sensor bus. It has a value of 0 when no PDM voltage errors are detected. A PDM error turns on the GS bit (bit 0).
3. Bit 2 represents the presence or absence of an OVW. An OVW does not turn on the GS bit (bit 0).
4. Bit 3 represents the presence or absence of an OVE.An OVE turns on the GS bit (bit 0).
5. Bit 4 represents the presence or absence of a UVW. A UVW does not turn on the GS bit (bit 0).
6. Bit 5 represents the presence or absence of a UVE. A UVE turns on the GS bit (bit 0) on the +/-10 VDC and +/-5 VDC ranges. The UVE does not turn on the GS bit (bit 0) on the 0 5 VDC, 0 to 10 VDC and +1 to 5 VDC ranges.
7. Bit 6 not used; always 0.
8. Bit 7 represents the presence or absence an internal communication error (ICE). This error turns on the GS bit (bit 0).

> **Note:** When the global status bit (GS) is on, the channel data value may not be valid.

> **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 1400 Specifications

Table of Technical Specifications

description		eight single-ended analog voltage input channels
analog voltage range		+1 to 5 VDC
		0 to 5 VDC
		0 to 10 VDC
		+/- 5 VDC
		+/-10 VDC (default)
resolution		15 bits + sign
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		90 mA
nominal sensor bus current consumption		150 mA
hot swapping supported		NIM-dependent*
reflex actions supported		no
profile ID		0x46
input response time	nominal	16 ms for all channels
	maximum	22 ms for all channels
input filter		low pass filter with -3 dB cutoff at 985 Hz
integral linearity		± 0.08% of full scale
differential linearity		monotonic
absolute accuracy		typically ± 0.4% of full scale @ 25°C and ± 0.45% maximum of full scale
temperature drift		typically ± 0.005% of full scale/ °C
over-range margin		2.4%
operating temperature range**		0 to 60°C
storage temperature		-40 to 85°C
under-range margin (+1 to 5 V, +/- 5 V, or +/- 10 V)		2.4%
input impedance		> 1 MΩ
minimum input voltage		-12 VDC
maximum input voltage		+12 VDC

addressing requirement	16 input words total	8 words for data
		8 words for status
isolation	field-to-bus	1500 VDC for 1 minute
	analog module to sensor bus	500 VDC
field power requirements		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
*Basic NIMs do not allow you to hot swap I/O modules.		
**This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.		

2.11 STB AVI 0300 Analog Voltage Input Module (four-channel, isolated inputs, 15-bit + sign, +1 ... 5 VDC, 0 ... 5 VDC, 0 ... 10 VDC, +/-5 VDC, or +/-10 VDC)

At a Glance

Overview

This section provides you with a detailed description of the STB AVI 0300 analog input module—its physical design and functional capabilities.

What's in this Section?

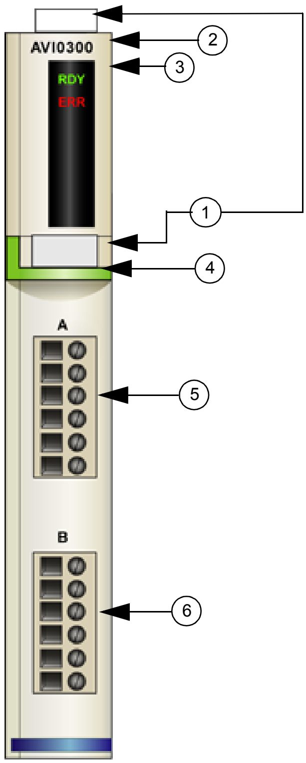
This section contains the following topics:

STB AVI 0300 Physical Description

Physical Characteristics

The STB AVI 0300 is a four-channel differential analog voltage input module that reads inputs from analog sensors operating in the range of +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC or +/-10 VDC (default). The module converts the analog signal to a digital value with 15-bit + sign resolution, and communicates that value to the control system. The analog input channels have 200 VDC channel-to-channel isolation. The analog portion of the module is isolated from the island's sensor bus to improve noise immunity. The module mounts in a size 2 I/O base and uses two six-terminal field wiring connectors.

Front Panel View



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 sensors 1 and 2 connect to the top field wiring connector
6 sensors 3 and 4 connect to the bottom field wiring connector

Ordering Information

The module can be ordered as part of a kit (STB AVI 0300 K), which includes:

- one STB AVI 0300 analog input module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVI 0300 analog input module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

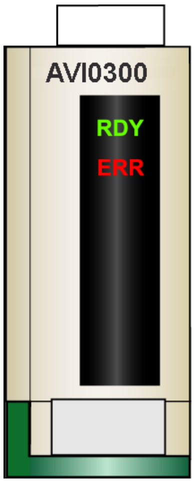
STB AVI 0300 LED Indicator

Purpose

The two LEDs on the STB AVI 0300 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	on	The watchdog has timed out.	Cycle power; restart the communications.
on	off	The module has achieved all of the following: ● it has power ● it passed its confidence tests ● it is operational	
on	flicker*	An over-voltage error is detected.	Check wiring and field device.
	flicker*	Field power is absent	Check power.
		A PDM short circuit is detected.	
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.

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 0300 Field Wiring

Summary

The STB AVI 0300 module uses two six-terminal field wiring connectors. Analog sensors 1 and 2 are wired to the top connector. Analog sensors 3 and 4 are 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 0300 module supports four isolated 2-wire analog sensors. It handles analog inputs in the following voltage ranges: +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, or +/-10 VDC. Data on each channel has a resolution of 15 bits + sign.

Note: An open circuit in the input cabling causes 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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

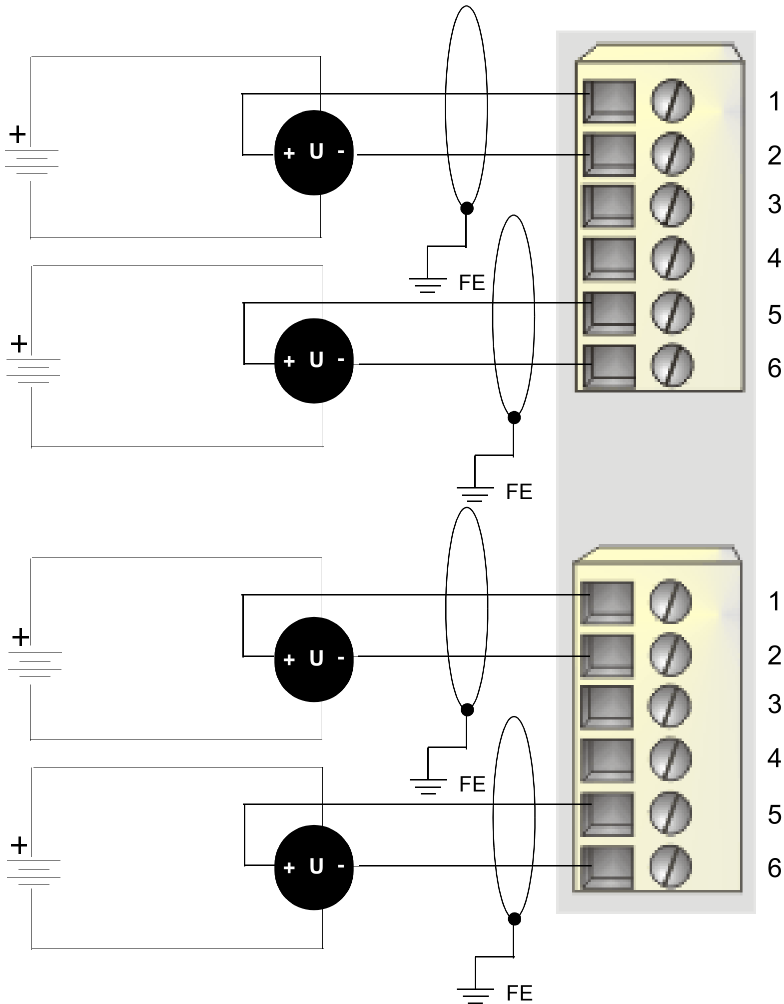
Field Wiring Pinout

No connections are made on pins 3 and 4 of either connector.

Pin	Top Connections	Bottom Connections
1	voltage in 1+	voltage in 3+
2	voltage in 1 -	voltage in 3-
3	no connection	no connection
4	no connection	no connection
5	voltage in 2+	voltage in 4+
6	voltage in 2-	voltage in 4-

Sample Wiring Diagrams

The following field wiring example shows how four isolated analog sensors can be wired to the STB AVI 0300 module. An external power supply is required to power the sensors.



STB AVI 0300 Functional Description

Functional Characteristics

The STB AVI 0300 module is a four-channel module that handles analog inputs from four field sensors operating in the +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, or +/-10 VDC range. The following operating parameters are user configurable:

- offset
- maximum count
- averaging
- range
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameters:

- offset
- maximum count
- averaging

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

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

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 operating voltage range. This feature allows you to calibrate the analog input channels to match your field device.

Offset is configured as a signed integer. It may be a decimal or hexadecimal value in the range -767 to +767(0xFD01 to 0x2FF), representing a voltage offset of:

- +/-0.24 VDC when the range is 0 to 10 VDC or +/-10 VDC
- +/-0.12 VDC when the range is 0 to 5 VDC or +/-5 VDC
- +/-0.1 VDC when the range is 1 to 5 VDC

By default, the offset on both channels is 0.

Maximum count is configured as a decimal or hexadecimal value in the range 31 233 to 32 767 (0x7A01 to 0x7FFF), representing a voltage offset of:

- +/-0.24 VDC when the range is 0 to 10 VDC or +/-10 VDC
- +/-0.12 VDC when the range is 0 to 5 VDC or +/-5 VDC
- +/-0.1 VDC when the range is 1 to 5 VDC

By default, the maximum count on both channels is 32 000 (0x7D00).

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 +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, and +/-10 VDC. An offset adjustment is performed on the low end of the range, and a max count adjustment is performed on the high end of the range.

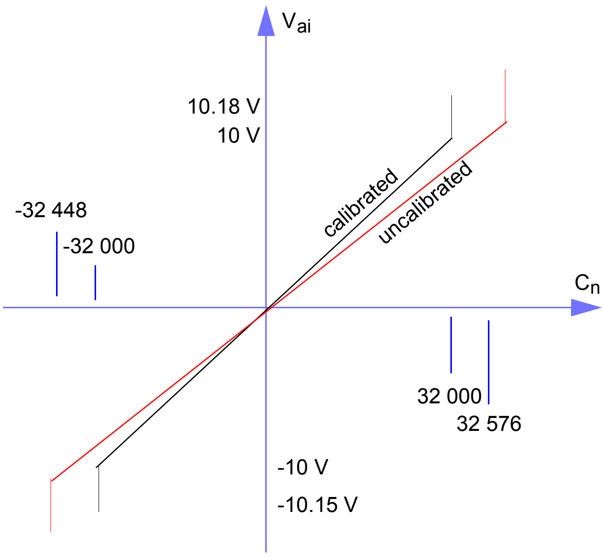
An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = (V_{ai} - 1\ V) * 8000$

where C_n is the numerical count and V_{ai} is the analog input voltage.

Operating Range +/-10 VDC

For example, in the +/-10 VDC operating range, if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 32 576 at +10 VDC, the system could be represented as follows:

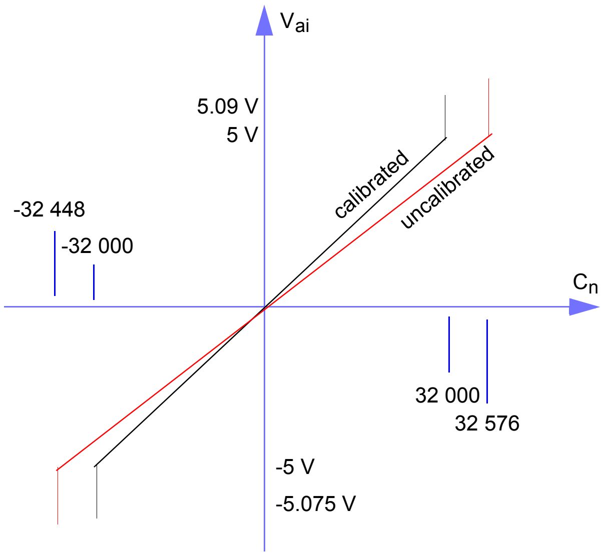


Here are some voltage representations after calibration with offset and max count:

V_{ai}	**Uncalibrated**	**Calibrated**
-10 VDC	-32 448*	-32 000*
0 VDC	64	0
+10 VDC	32 576	+32 000
* For the STB AVI 0300 module, the calibration of the negative value is determined by extending the linear equation determined by the offset at 0 VDC and the max count at +10 VDC.		

Operating Range +/-5 VDC

In the +/- 5 VDC operating range, if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 32 576 at +5 VDC, the system could be represented as follows:

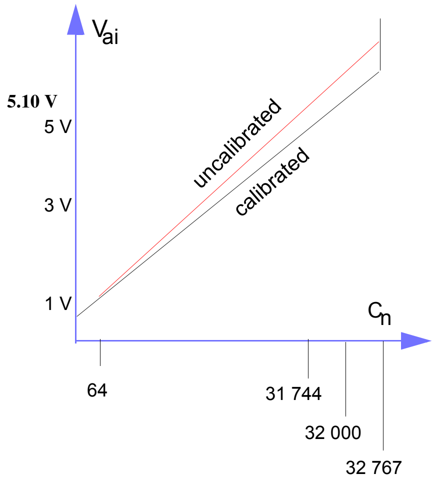


Here are some voltage representations after calibration with offset and max count:

V_{ai}	Uncalibrated	Calibrated
-5 VDC	-32 448*	-32 000*
0 VDC	64	0
+5 VDC	32 576	+32 000
* For the STB AVI 0300 module, the calibration of the negative value is determined by extending the linear equation determined by the offset at 0 VDC and the max count at +5 VDC.		

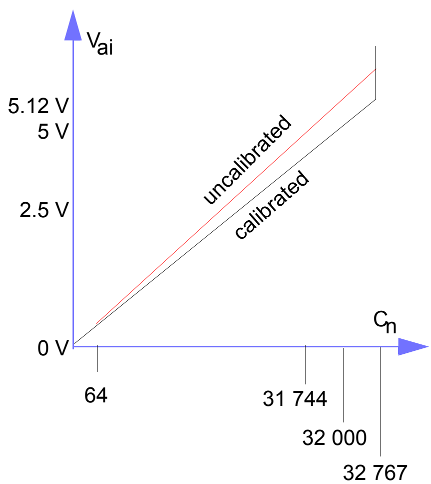
Operating Range +1 to 5 VDC

If you use the Advantys configuration software to calibrate an offset of 64 at 1 VDC and a max count of 31 744 at 5 VDC, the system could be represented as follows:



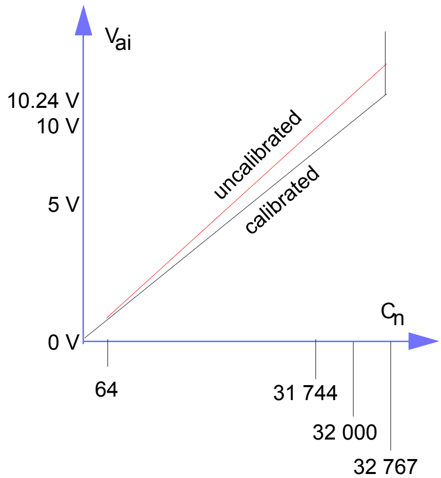
Operating Range 0 to 5V

In the operating range of 0 to 5 VDC if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 31 744 at 5 VDC, the system could be represented as follows:



Operating Range 0 to 10 VDC

In the operating range of 0 to 10 VDC if you use the Advantys configuration software to calibrate an offset of 64 at 0 VDC and a max count of 31 744 at 10 VDC, the system could be represented as follows:



Offset and RTP:

The offset parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x00
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
Data Bytes 2 (high byte) & 1 (low byte)	-767 to +76 7 (0xFD01 to 0x2FF)

Maximum Count and RTP:

The maximum count parameter is represented as a signed 16-bit number. To access it using RTP, write the following values to the RTP request block:

Length	2
Index (low byte)	0x01
Index (high byte)	0x24

Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
Data Bytes 2 (high byte) & 1 (low byte)	31 233 to 32 767 (0x7A01 to 0x7FFF))

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 STB AVI 0300 module in the island editor.	The module editor for the selected STB AVI 0300 module will open.
3	Open the I/O Image **Data Animation** sheet, which can be accessed from the module editor in the Advantys configuration software when it is online.	
4	Apply a value corresponding to minimum input (0 VDC or 1 VDC, depending on the selected range), and read the analog input channel's data in the I/O Image **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 the actual data value.
5	Apply a value corresponding to maximum input (5 VDC or 10 VDC, depending on the selected range), and read the analog input channel's data in the module's I/O Image **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 the actual data value.
6	If adjustments need to be made, take the Advantys configuration software offline.	
7	Double-click on the STB AVI 0300 module in the island editor.	The module editor for the selected STB AVI 0300 module will open.
8	Open the **Properties** sheet in the module editor. In the Offset value field, enter the data value that you read in step 4. In the **Maximum Count** value field, enter the data value that you read in step 5.	
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 smooths the values of the analog inputs reported by the STB AVI 0300. The Advantys configuration software allows you to average over a specified number of samples. By default, the number samples averaged is one (no averaging); you may have a filtering average over up to 80 samples.

Step	Action	Result
1	Double click the STB AVI 0300 module you want to configure in the island editor.	The selected STB AVI 0300 module opens in the software module editor.
2	In the **Configured Value** column of the **Averaging** row, enter a decimal or hexadecimal value in the range 1 to 80 (0x50).	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 on a per-channel basis.

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

Length	1
Index (low byte)	0x02
Index (high byte)	0x24
Sub-index	1 for channel 1
	2 for channel 2
	3 for channel 3
	4 for channel 4
Data Byte 1	1 to 80 (0x50)

Range

You may configure the operating range of the STB AVI 0300 on a per-channel basis.
- +1 to 5 VDC
- 0 to 5 VDC
- 0 to 10 VDC
- +/-5 VDC
- +/-10 VDC

+/-10 VDC is the default operating range.

Channel Operation (Enable/Disable)

The STB AVI 0300 has an input channel enable/disable on a per-channel basis. You should disable the unused inputs. By default, all inputs are enabled. When you disable a channel, the status byte and channel data return all zeros—the fault indicator does not blink due to channel-specific errors.
- channel enable (default)
- channel disable

Note: The module detects PDM error and flashes the ERR LED even if all four channels are disabled.

STB AVI 0300 Data and Status for the Process Image

Representing the Analog Input Data

The STB AVI 0300 sends a representation of the operating states of its input channels to the NIM. The NIM stores this information in eight registers—four data registers (one for each channel) and four status registers (one for each channel). The information can be read by the fieldbus master or, if you are using a standard NIM, by an HMI panel connected to the NIM's CFG port.

The input data process image is a block of 4096 Modbus registers (in the range 45392 through 49487) reserved in the NIM's memory. The STB AVI 0300 module is represented by eight contiguous registers in this block, which appear in the following order:

- 1st register = channel 1 data (16 bits)
- 2nd register = channel 1 status (8 bits)
- 3rd register = channel 2 data (16 bits)
- 4th register = channel 2 status (8 bits)
- 5th register = channel 3 data (16 bits)
- 6th register = channel 3 status (8 bits)
- 7th register = channel 4 data (16 bits)
- 8th register = channel 4 status (8 bits)

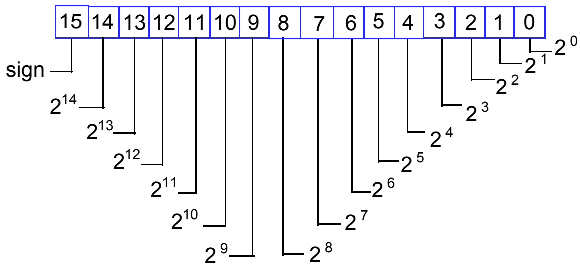
The specific registers used are based on the module's logical address on the island bus.

Note: When this module is used with the STB NCO 2212 or STB NCO 1010 CANopen NIMs, you must set the analog global interrupt enable object (index 6423, subindex 0) to a value of 1. For more information on analog global interrupt enable, see the *Advantys STB Standard CANopen Network Interface Module Applications Guide* (890 USE 176) or the *Advantys STB Basic CANopen Network Interface Module Applications Guide* (890 USE 193).

Data Word Structure

The first, third, fifth, and seventh registers in the module's input process image are the data words. Each register represents the input current of a channel in the IEC data format. The data has 15-bit + sign resolution. The bit structure in each data register is as follows:

STB AVI 0300 Data Register Format



All 16 bits in each data word are significant. They allow you to represent analog input voltages with all the integer values ranging from -32 768 to +32 767.

For the 1 to 5 VDC, 0 to 5 VDC, and 0 to 10 VDC operating ranges, the sign bit (bit 15) is always 0, indicating that negative voltage values are not read.

Note: Errors and warnings are based on count values, not physical values. The current values in the tables below are ideal values.

Data Formats for 1 to 5 VDC and 0 to 5 VDC:

Error	+1 to 5 VDC Range	0 to 5 VDC Range
OVE (over voltage error)	5.10 VDC (32 767)	5.12 VDC (32 767)
OVW (over voltage warning)	>5 VDC (32 001)	>5 VDC (32 001)
UVW (under voltage warning)	<1 VDC (-1)	<0.12 VDC (767)
UVE (under voltage error)	<0.91 VDC (-767)	0 VDC (0)

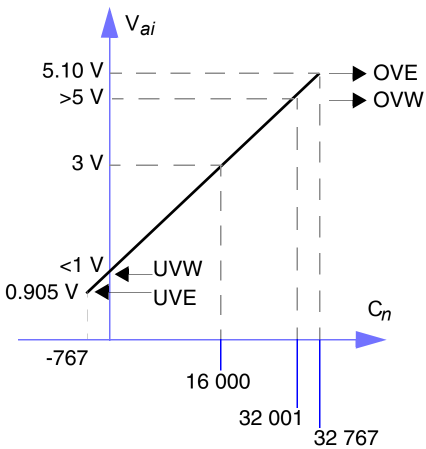
In an ideal linear voltage representation for +1 to 5 VDC range (one with the default offset or max count settings (see *p. 228*)), a value of 32 001 represents an OVW. If the input value is less than or equal to -1, the module reports a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches -767, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = (V_{ai} - 1\ V) * 8000$

where C_n is the numerical count and V_{ai} is the analog input voltage.



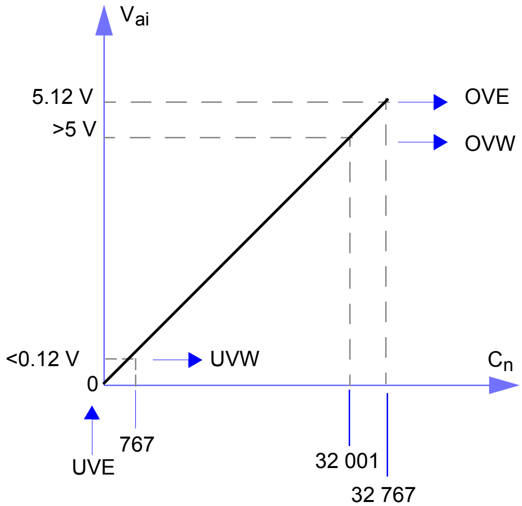
In an ideal linear voltage representation for 0 to 5 VDC range (one with default offset or max count settings (see *p. 228*)), a value of 32 001 represents an OVW. If the input value is less than or equal to 767, the module will report a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches 0, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 6400$

where C_n is the numerical count and V_{ai} is the analog input voltage.



Data Format for 0 to 10 VDC:

Error	**0 to 10 VDC Range**
OVE (over voltage error)	10.24 VDC (32 767)
OVW (over voltage warning)	>10 VDC (32 001)
UVW (under voltage warning)	<0.24 VDC (767)
UVE (under voltage error)	0 VDC (0)

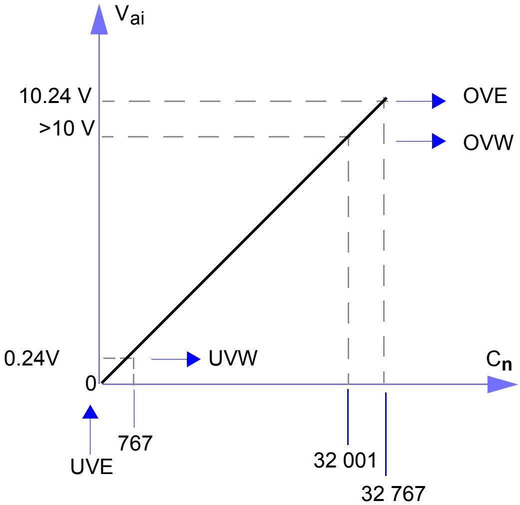
In an ideal linear voltage representation for 0 to 10 VDC range (one with default offset or max count settings (see *p. 228*)), a value of 32 001 represents an OVW. If the input value is less than or equal to 767, the module will report a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches 0, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 3200$

where C_n is the numerical count and V_{ai} is the analog input voltage.



Data Formats for +/-5 VDC and +/-10 VDC

Error	+/-5 VDC Range	+/-10 VDC Range
OVE (over voltage error)	5.12 VDC (32 767)	10.24 VDC (32 767)
OVW (over voltage warning)	>5 VDC (32 001)	> 10 VDC (32 001)
UVW (under voltage warning)	<-5 VDC (-32 001)	< -10 VDC (-32 001)
UVE (under voltage error)	-5.12 VDC (-32 768)	-10.24 VDC (-32 768)

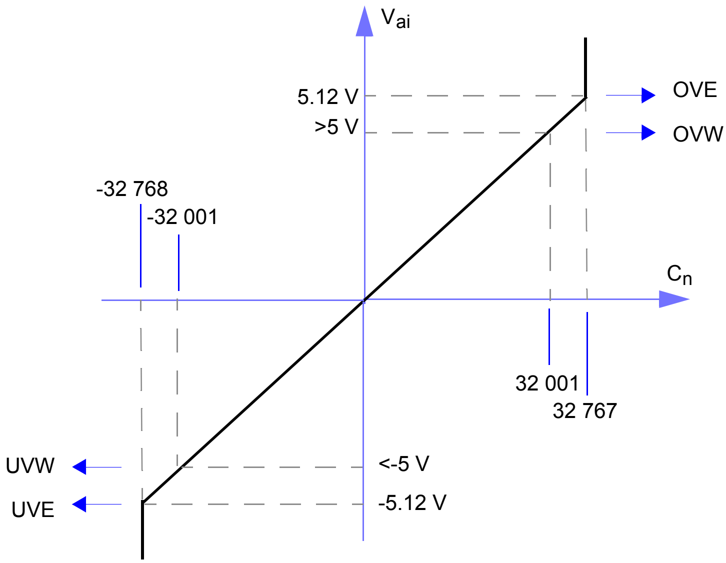
In an ideal linear voltage representation for +/-5 VDC range (one with default offset or max count settings (see *p. 228*)), a value of 32 001 represents an OVW. If the input value is less than or equal to -32 001, the module will report a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches -32 767, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear representation of analog input voltage (one with default offset and maximum count) is given by the following formula:

$C_n = V_{ai} \times 6400$

where C_n is the numerical count and V_{ai} is the analog input voltage.



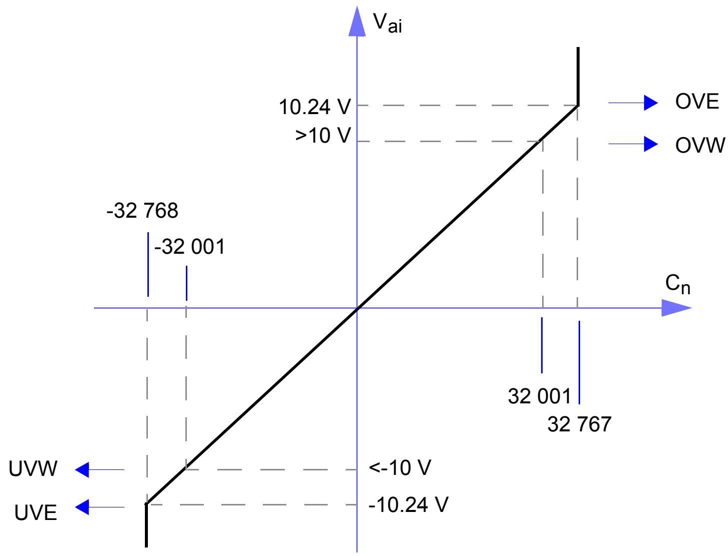
In an ideal linear voltage representation for +/-10 VDC range (one with default offset or max count settings (see *p. 228*)), a value of 32 001 represents an OVW. If the input value is less than or equal to -32 001, the module will report a UVW. When the input value reaches 32 767, an OVE occurs. When the input value reaches -32 767, a UVE occurs.

However due to user-configurable offset and max count, if used, an OVW may be generated before the reported count reaches 32 001. Similarly, the reported count may be at 32 767, but you may not receive the expected OVE.

An ideal linear voltage representation (one with default offset or max count settings) is given by the formula:

$C_n = V_{ai} \times 3200$

where C_n is the numerical count and V_{ai} is the analog input voltage.

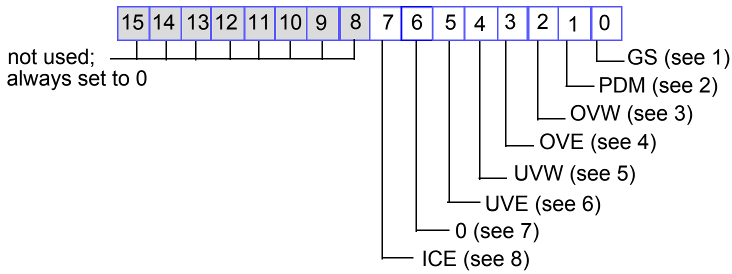


Status Byte Structure

The second, fourth, sixth, and eighth registers in the module's input process image are the status words. The STB AVI 0300 can detect and report voltage overflow conditions, as well as other errors.

The eight least significant bits (LSB) in each register represent the status of each input channel:

STB AVI 0300 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 are detected. It has a value of 1 when bit 1 and/or bit 3 and/or bit 5 and/or bit 7 have a value of 1.

2 Bit 1 represents the status of the PDM voltage on the island’s sensor bus. It has a value of 0 when no PDM voltage errors are detected. A PDM error turns on the GS bit (bit 0).

3 Bit 2 represents the presence or absence of an OVW. An OVW does not turn on the GS bit (bit 0).

4 Bit 3 represents the presence or absence of an OVE.An OVE turns on the GS bit (bit 0).

5 Bit 4 represents the presence or absence of a UVW. An UVW does not turn on the GS bit (bit 0).

6 Bit 5 represents the presence or absence of a UVE. A UVE turns on the GS bit (bit 0) when the voltage range is +/-10 VDC or +/-5 VDC; a UVE does not turn on the GS bit (bit 0) when the voltage range is 0 to 5 VDC, 0 to 10 VDC, or +1 to 5 VDC.

7 Bit 6 not used; always 0.

8 Bit 7 represents the presence or absence an internal communication error (ICE). This error turns on the GS bit (bit 0).

Note: When the GS bit is on, the channel data value may not be valid.

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 0300 Specifications

Table of Technical Specifications

description		four isolated analog voltage input channels
analog voltage range		+1 to 5 VDC
		0 to 5 VDC
		0 to 10 VDC
		+/- 5 VDC
		+/-10 VDC (default)
resolution		15-bit plus sign
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		90 mA typical
nominal sensor bus current consumption		150 mA typical
hot swapping supported		NIM-dependent*
reflex actions supported[1]		for 2 inputs only, channels 1 and 2
profile ID		0x75
input response time	nominal	8 ms for all channels
	maximum	13 ms for all channels
input filter		low pass filter with -3 dB cutoff at 985 Hz
integral linearity		±0.05% of full scale
differential linearity		monotonic
absolute accuracy		typically ± 0.3% of full scale @ 25°C and ±0.4% maximum of full scale
common mode rejections		>/=80 dB @ 60 Hz
common mode voltage		</=100 VDC or 100 VAC peak
crosstalk rejection between channels		>80 dB
temperature drift		typically ±0.005% of full scale/ °C
over-range margin		2.4%
operating temperature range**		0 to 60°C
storage temperature		-40 to 85°C
under-range margin		2.4%
input impedance		>1 MΩ

minimum input voltage		-12 VDC
maximum input voltage		+12 VDC
addressing requirement	8 input words total	4 words for data
		4 words for status
isolation	field-to-bus	1500 VDC for 1 minute
	channel-to-channel	200 VDC
	analog module to sensor bus	500 VDC
field power requirements		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
*Basic NIMs do not allow you to hot swap I/O modules.		
**This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.		
[1]Requires Advantys configuration software		

The Advantys STB Analog Output Modules

3

At a Glance

Overview

This chapter describes the features of the standard and basic Advantys STB analog output modules.

What's in this Chapter?

This chapter contains the following sections:

3.1 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?

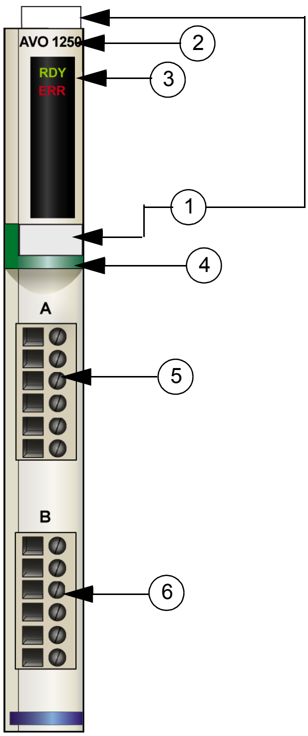
This section contains the following topics:

STB AVO 1250 Physical Description

Physical Characteristics

The STB AVO 1250 is a standard 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



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

Ordering Information

The module can be ordered as part of a kit (STB AVO 1250 K), which includes:

- one STB AVO 1250 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVO 1250 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

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)

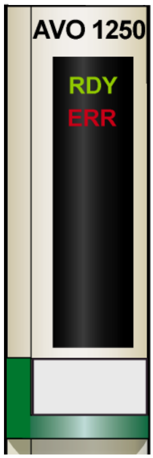
STB AVO 1250 LED Indicator

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: ● it has power ● it has passed its confidence tests ● 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.

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

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:

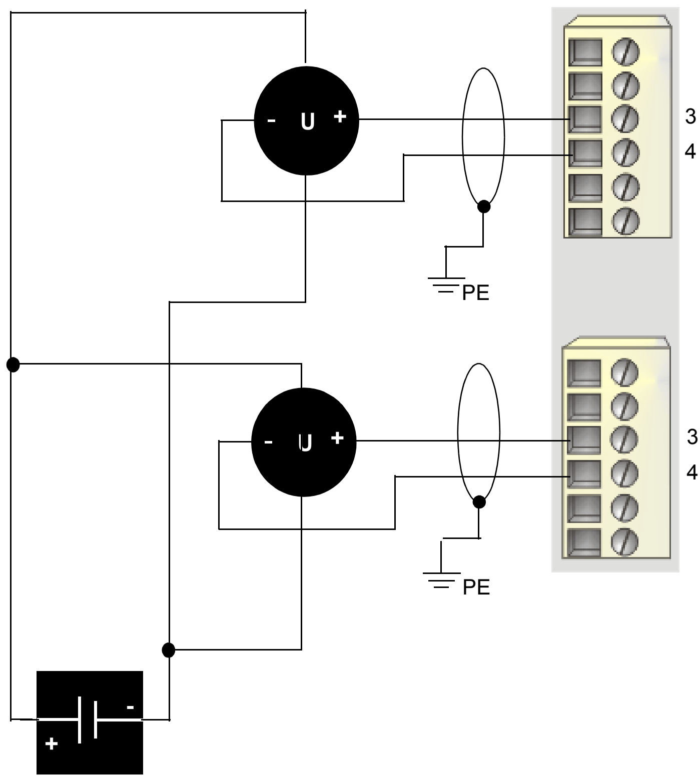
Pin	Top Connections	Bottom Connections
1	+24 VDC from actuator bus for field device accessories	+24 VDC from actuator bus for field device accessories

Pin	Top Connections	Bottom Connections
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.

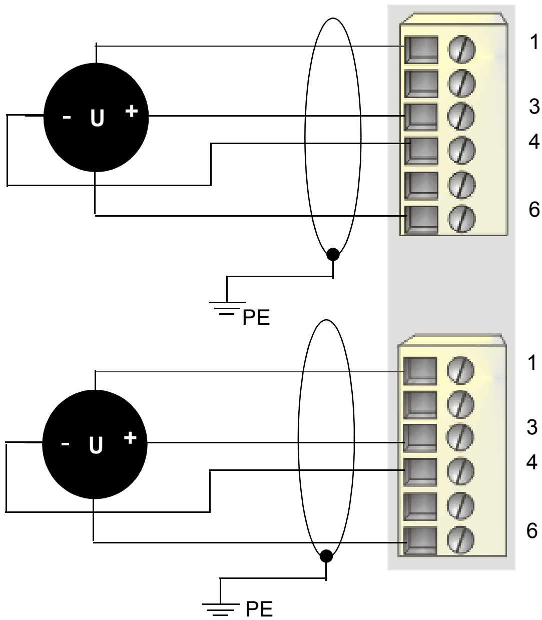
Sample Wiring Diagrams

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

Using the RTP feature in your NIM, you can access the value of the following parameter:

- Analog Output Period

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

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

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.

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

Length	1
Index (low byte)	0x10
Index (high byte)	0x23
Sub-index	0
Data Byte 1	5 to 255

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: -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. 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, if you are not using a basic NIM, 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.

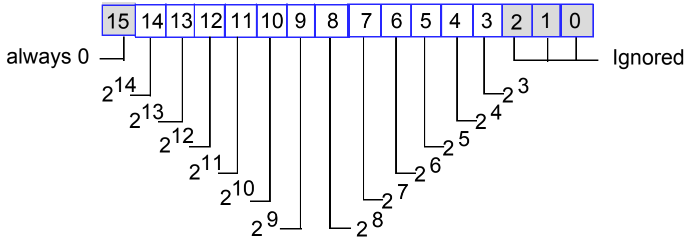
Output Data Registers

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.

When the module is configured to operate over a voltage range of 0 to 10 V, the data has a resolution of 12 bits:

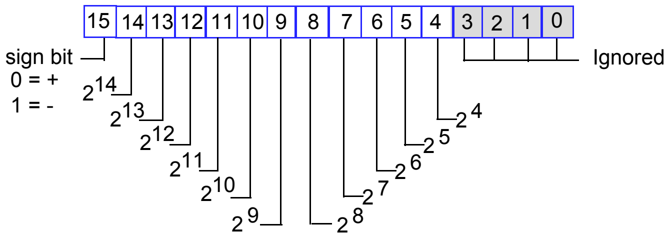
STB AVO 1250 Data Register Format for 0 to 10 V



In this case, you can represent voltage data with integer values in the range 0... +32 760 in increments of 8. The value of bit 15 should always be 0. If a negative value is sent, the output will be set to 0 VDC and an under-voltage error will be returned. The value 32 000 produces a 10 V output, and the value 0 produces a 0 V output. If the output value is set to 32 760 or greater, an over-voltage error (OVE) is reported.

When the module is configured to operate over a voltage range of -10 to +10 V, the data has a resolution of 11 bits plus sign bit:

STB AVO 1250 Data Register Format for -10 to +10 V

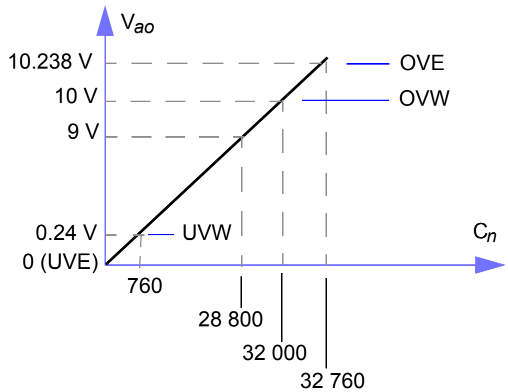


In this case, you can represent voltage data with integer values in the range -32 768... +32 752 in increments of 16. The value +32 000 produces a 10 V output, and -32 000 produces a -10 V output. If the value exceeds +32 000, the output channel reports an over-voltage warning (OVW). If the output value drops below -32 000, the output channel reports an under-voltage warning (UVW). If the output value goes up to +32 752, an over-voltage error (OVE) is reported, and if it drops to -32 768 an under-voltage error (UVE) is reported.

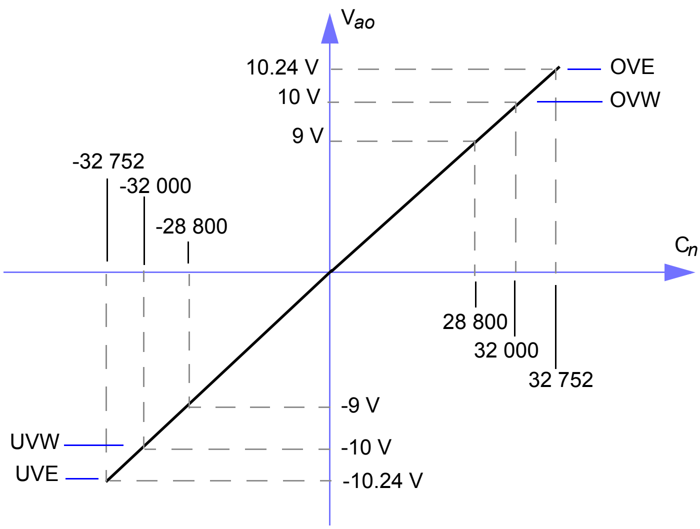
Linear voltage representations can be interpreted using the formula:

$$C_n = 3200 \times V_{ao}$$

where C*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

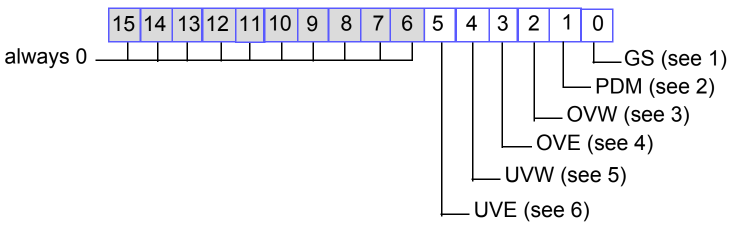
The input data and I/O status process image is a reserved block of 4096 16-bit registers (in the range 45392 through 49487) that represent the status of all the I/O modules (along with the data for the input modules) on the island bus.

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 output channel is set to 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 output channel is set to -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 numerical count is greater than 32 000. 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 numerical count is less than 32 752 and a value of 1 when the voltage equals 32 752. 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 numerical is greater than or equal to -32 000 and a value of 1 when the count is below -32 000 but above -32 752. A UVW does not turn on the GS bit (bit 0).
5 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 numerical count is greater than -32 752 and a value of 1 when the voltage equals -32 752. A UVE does not turn on the GS bit (bit 0).

STB AVO 1250 Specifications

Table of Technical Specifications

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 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		45 mA
nominal actuator bus current consumption		260 mA, with no load
maximum output current		5 mA/channel
hot swapping supported*		NIM-dependent**
reflex actions supported		two maximum
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
operating temperature range***		0 to 60°C
storage temperature		-40 to 85°C
capacitive load		1 μF
fallback mode	default	predefined
	user-configurable settings[1]	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[1]	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		from a 24 VDC PDM
power protection		time-la fuse on the PDM
agency certifications		refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.		
***This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.		
[1]Requires the Advantys configuration software.		

3.2 STB AVO 1255 Analog Voltage Output Module (two-channel, 0 to 10 V, 10-bit)

At a Glance

Overview

This section provides a detailed description of the STB AVO 1255 analog output module—its functions, physical design, technical specifications and field wiring requirements.

What's in this Section?

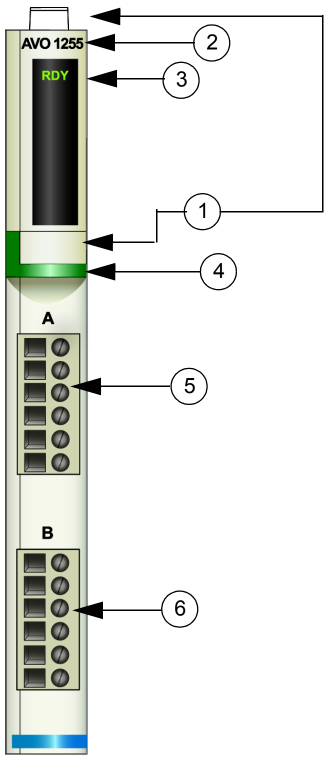
This section contains the following topics:

STB AVO 1255 Physical Description

Physical Characteristics

The STB AVO 1255 is a basic Advantys STB two-channel analog voltage output module that writes outputs to analog actuators that operate over a range of 0 to10 V. The analog portion of the module is isolated from the island's field power bus to improve performance. To take advantage of this internal isolation feature, power the actuators 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.

Front Panel View



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED
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

Ordering Information

The module can be ordered as part of a kit (STB AVO 1255 K), which includes:

- one STB AVO 1255 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVO 1255 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

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)

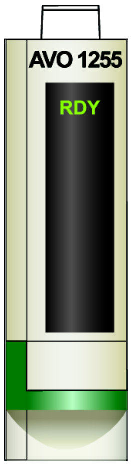
STB AVO 1255 LED Indicator

Purpose

The LED on the STB AVO 1255 provides a visual indication of the module's operating status.

Location

The LED is located on the top of the front bezel of the module, directly below the model number:



Indications

RDY	Meaning	What to Do
off	The module is either not receiving logic power or has failed.	Check power
flicker*	Auto-addressing is in progress.	
on	The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational	
blink 1**	The module is either in pre-operational mode or in its fallback state.	
* 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.		

STB AVO 1255 Field Wiring

Summary

The STB AVO 1255 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.

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 1255 module handles analog output data from two 0 to 10 V single-ended analog field actuators. Data on each channel has a resolution of 10 bits. The module allows you to connect to two-, three- and four-wire actuators that can draw current up to 100 mA/module.

If you want to maintain the module's built-in isolation between the analog portion of the module and the island's field power 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 functional earth.

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

Field Wiring Pinout

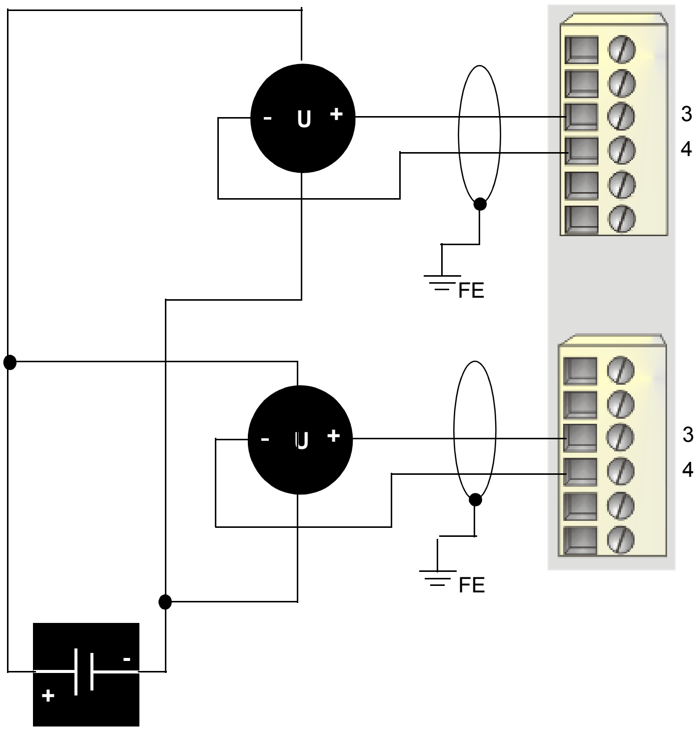
The connections on pin 1 and pin 6 are optional, and using them defeats the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 2 and 5:

Pin	Top Connections	Bottom Connections
1	+24 VDC from the island's field power bus for field device accessories	+24 VDC from the island's field power 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.

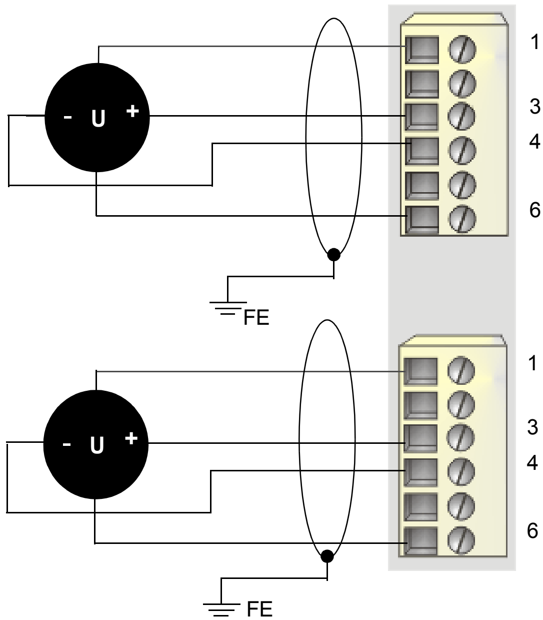
Sample Wiring Diagrams

The following field wiring example shows how two isolated single-ended analog actuators can be wired to the STB AVO 1255 module. An external power supply is required:



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 field power bus to power the single-ended analog field devices, 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 defeats the built-in isolation between the analog portion of the module and the island's actuator bus.

STB AVO 1255 Functional Description

Functional Characteristics

The STB AVO 1255 is a two-channel analog module that sends output data to two voltage field actuators. It does not support user-configurable operating parameters or reflex actions.

Operating Parameters

The voltage range of the module is 0 to 10 V, with 10-bit resolution.

When communications are lost between the output module and the fieldbus master, the module's output channels go to a known state where they will remain until communications are restored. This is known as the channel's *fallback state*. Both output channels go to a predefined fallback state of 0 VDC.

STB AVO 1255 Data for the Process Image

Representing the Analog Output Data

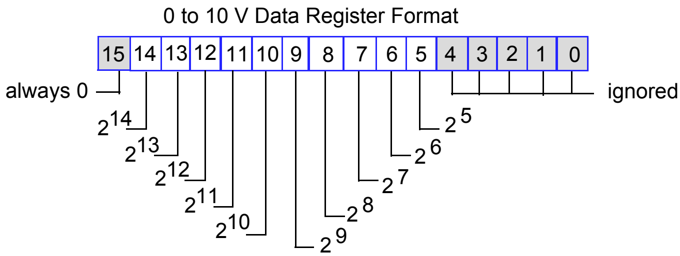
The NIM keeps a record of output data in a block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output modules. This information can be monitored by the fieldbus master. If you are not using a basic NIM, the information may also be monitored by an HMI panel connected to the NIM's CFG port.

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. An STB AVO 1255 is represented by two contiguous registers in the output data block. The specific registers used by an STB AVO 1255 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

Each STB AVO 1255 data register represents the output voltage of a channel in the IEC data format. The data has 10-bit resolution. The bit structure in each data register is as follows:

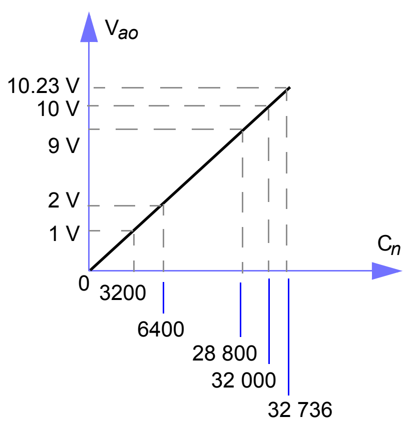


There are 10 significant bits in each data word—bits 14 through 5. They allow you to represent voltage data with integer values ranging from 0 to 32,736 in increments of 32. A value 32 000 results in an output of 10 V. If the sign bit (bit 15) is set, the output is set to 0 V.

Linear voltage representations can be interpreted using the formula:

$$C_n = 3200 \times V_{ao}$$

where C*n* is the numerical count and V*ao* is the analog output voltage. Voltage data is represented as follows:



Values greater than 32 000 do not produce over-range indications.

STB AVO 1255 Specifications

Table of Technical Specifications

description		two single-ended analog voltage output channels
analog voltage range		0 ... 10 V
resolution		10 bits
returned data format		IEC
module width		13.9 mm (0.58 in)
I/O base		STB XBA 1000 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		45 mA
nominal actuator bus current consumption		260 mA, with no load
maximum output current		5 mA/channel
hot swapping supported*		NIM-dependent**
reflex actions supported		no
output response time	nominal	3.0 ms plus settling time for both channels
short-circuit protection on the outputs		yes
output fault detection		none
isolation	field-to-bus	1500 VDC for 1 min
	module-to-field power 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
operating temperature range		0 to 60°C
storage temperature		-40 to 85°C
capacitive load		1 μF
fallback mode		predefined
fallback states		0 V on both channels
addressing requirements		two words of output data
actuator bus power for accessories		100 mA/module
over-current protection for accessory power		yes
field power requirements		from a 24 VDC PDM

power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* ** Basic NIMs do not allow you to hot swap I/O modules.	

3.3 STB AVO 1265 Analog Voltage Output Module (two-channel, -10 to +10 V, 9-bit + sign)

At a Glance

Overview

This section provides a detailed description of the STB AVO 1265 analog output module—its functions, physical design, technical specifications and field wiring requirements.

What's in this Section?

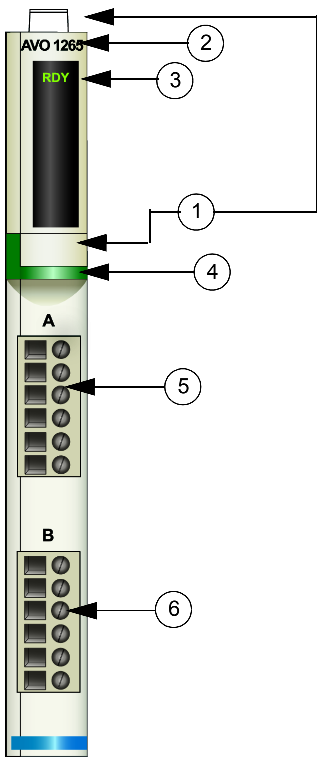
This section contains the following topics:

STB AVO 1265 Physical Description

Physical Characteristics

The STB AVO 1265 is a basic Advantys STB two-channel analog voltage output module that writes outputs to analog actuators that operate over a range of -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.

Front Panel View



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

Ordering Information

The module can be ordered as part of a kit (STB AVO 1265 K), which includes:

- one STB AVO 1265 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVO 1265 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

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)

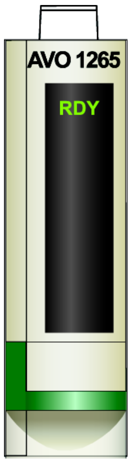
STB AVO 1265 LED Indicator

Purpose

The LED on the STB AVO 1265 provides a visual indication of the module's operating status.

Location

The LED is located on the top of the front bezel of the module, directly below the model number:



Indications

RDY	Meaning	What to Do
off	The module is either not receiving logic power or has failed.	Check power
flicker*	Auto-addressing is in progress.	
on	The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational	
blink 1**	The module is either in pre-operational mode or in its fallback state.	
* 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.		

STB AVO 1265 Field Wiring

Summary

The STB AVO 1265 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.

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 1265 module handles analog output data from two +/- 10 V single-ended analog field actuators. Data on each channel has a resolution of 9 bits plus sign.

The module allows you to connect to two-, three- and four-wire devices. 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. The actuators can draw current up to 100 mA/module.

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 functional earth.

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

Field Wiring Pinout

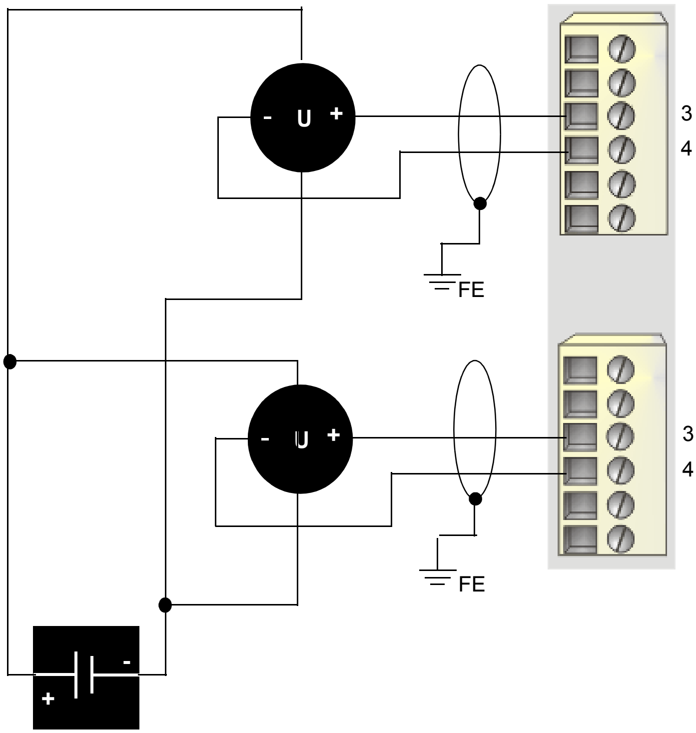
The connections on pin 1 and pin 6 are optional, and using them defeats the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 2 and 5 of either connector:

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.

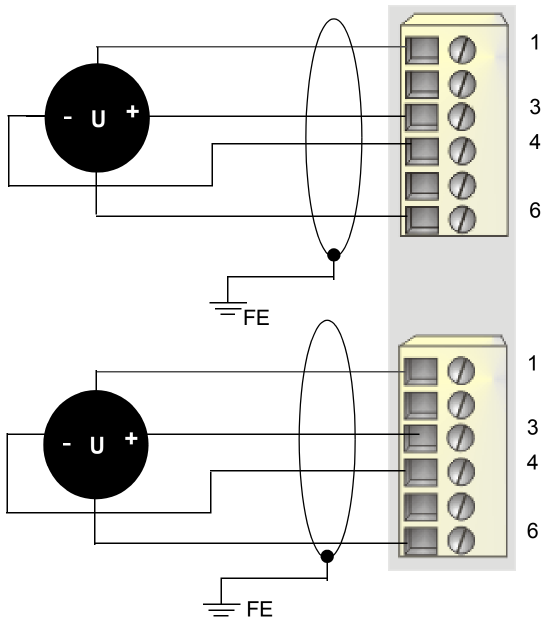
Sample Wiring Diagrams

The following field wiring example shows how two isolated single-ended analog actuators can be wired to the STB AVO 1265 module. An external power supply is required:



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 single-ended analog field devices, 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 defeats the built-in isolation between the analog portion of the module and the island's actuator bus.

STB AVO 1265 Functional Description

Functional Characteristics

The STB AVO 1265 is a two-channel analog output module that sends data to two voltage field actuators. It does not support user-configurable operating parameters or reflex actions.

Operating Parameters

The voltage range of the module is +/-10 V, with 9-bit plus sign resolution.

When communications are lost between the output module and the fieldbus master, the module's output channels go to a known state where they remain until communications are restored. This is known as the channel's *fallback state*. Both output channels go to a predefined fallback state of 0 VDC.

STB AVO 1265 Data 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. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output modules. This information can be monitored by the fieldbus master. If you are not using a basic NIM, the information may also be monitored by an HMI panel connected to the NIM's CFG port.

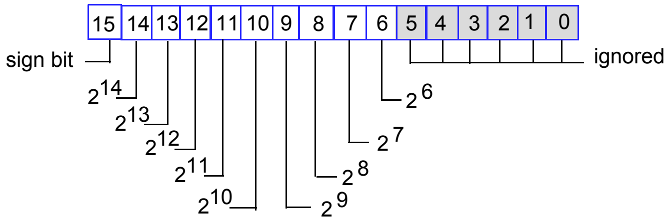
The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. An STB AVO 1265 is represented by two contiguous registers in the output data block. The specific registers used by an STB AVO 1265 module 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

Each STB AVO 1265 data register represents the output voltage data in the IEC data format. The data has 9-bit + sign resolution:

-10 to +10 V Data Register Format

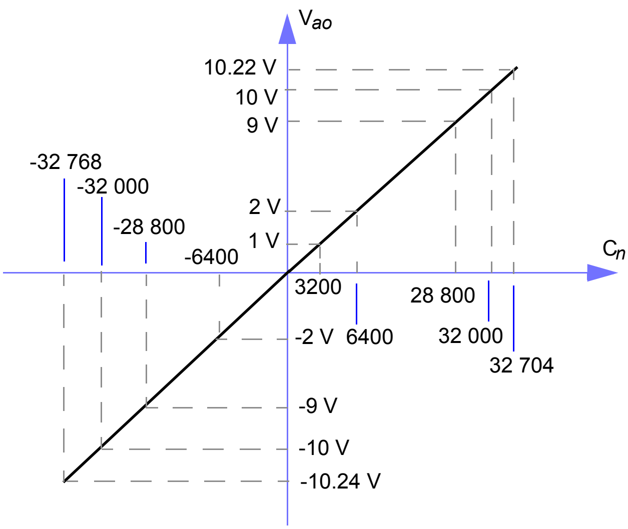


The value of each data word is represented in bits 15 through 6, The bits represent voltage data as integer values in the range -32 768 ... +32 704 in increments of 64. When the sign bit (bit 15) is 0, the value is positive; when bit 15 is 1, the value is negative.

Linear voltage representations can be interpreted using the formula:

$$C_n = V_{ao} \times 3200$$

where C*n* is the numerical count and V*ao* is the analog output voltage. Voltage data is represented as follows:



Values greater than 32 000 and less than -32 000 do not produce out-of-range indications.

STB AVO 1265 Specifications

Table of Technical Specifications

description		two single-ended analog voltage output channels
analog voltage range		-10 ... +10 V
resolution		9 bits + sign
returned data format		IEC
module width		13.9 mm (0.58 in)
I/O base		STB XBA 1000 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		45 mA
nominal actuator bus current consumption		260 mA, with no load
maximum output current		5 mA/channel
hot swapping supported*		NIM-dependent**
reflex actions supported		no
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
operating temperature range		0 to 60°C
storage temperature		-40 to 85°C
capacitive load		1 μF
fallback mode		predefined
fallback states		0 V on both channels
addressing requirements		two words of output data)
actuator bus power for accessories		100 mA/module
over-current protection for accessory power		yes
field power requirements		from a 24 VDC PDM

power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* ** Basic NIMs do not allow you to hot swap I/O modules.	

3.4 STB ACO 0220 Analog Current Output Module (two-channel, 15-bit + sign, 4 ... 20 mA)

At a Glance

Overview

This section provides a detailed description of the STB ACO 0220 analog output module—its functions, physical design, technical specifications, and field wiring requirements.

What's in this Section?

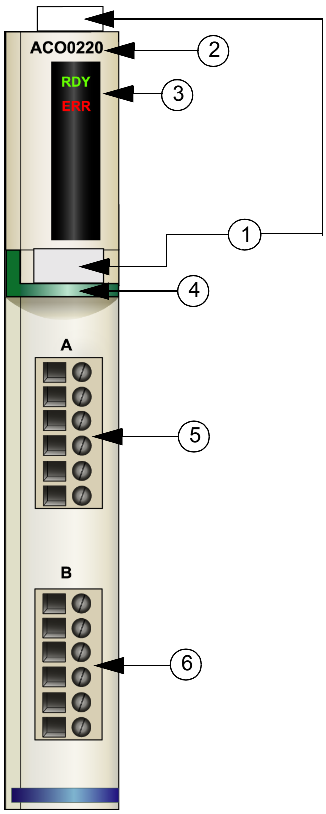
This section contains the following topics:

STB ACO 0220 Physical Description

Summary

The STB ACO 0220 is a standard Advantys STB two-channel analog sink/source output module that writes outputs to analog actuators that operate over a range of 4 to 20 mA. The analog portion of the module is isolated from the island's actuator bus to improve performance. The two channels are isolated from each other. The module also provides two isolated, short-circuit protected loop power supplies, which allow a two-wire connection to the actuator.

Front Panel View



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

Ordering Information

The module can be ordered as part of a kit (STB ACO 0220 K), which includes:

- one STB ACO 0220 analog input module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACO 0220 analog input module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

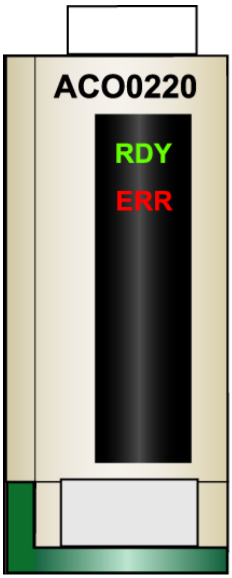
STB ACO 0220 LED Indicator

Purpose

The LED on the STB ACO 0220 provides a visual indication of the module's operating status.

Location

The LED is located on the top of the front bezel of the module, directly below the model number.



Indications

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: ● it has power ● it passed its confidence tests ● it is operational	
on	on	The watchdog has timed out.	Cycle power; restart the communications.
on	flicker*	A broken wire is detected.	Check wiring.
blink 1**		The module is either in pre-operational mode or in its fallback state.	
	flicker*	Loop power is absent.	Check power.
	blink 1**	A nonfatal error is 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, then 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 0220 Field Wiring

Summary

The STB ACO 0220 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.

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 0220 module provides analog output data to two 4 to 20 mA analog field actuators. Data on each channel has a resolution of 15 bit + sign.

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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

Field Wiring Pinout

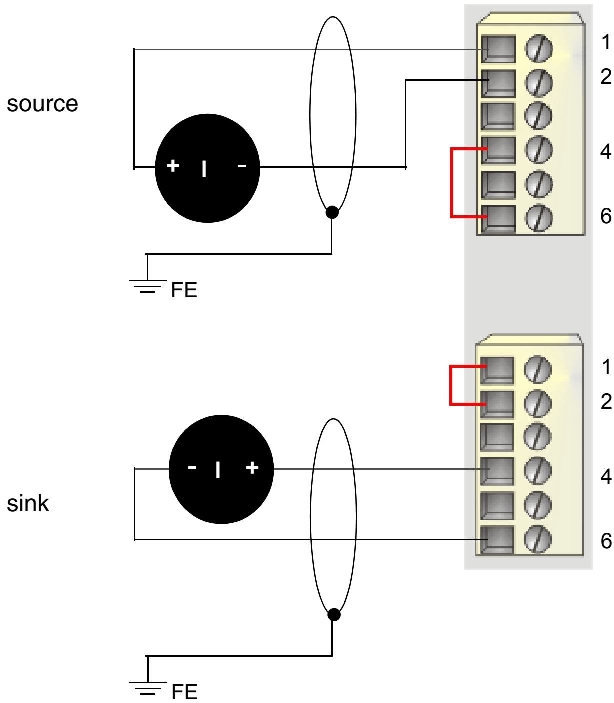
The top connector supports analog actuator 1, and the bottom connector supports analog actuator 2. Four field wires may be used on each connector—on pins 1, 2, 4 and 6.

Each connector provides a power supply for the analog current loop. These are minimally isolated from the channel and fully isolated from each other.

Pin	Top Connections	Bottom Connections
1	+24 VDC loop supply	+24 VDC loop supply
2	output to actuator 1	output to actuator 2
3	no connection	no connection
4	output channel return	output channel return
5	no connection	no connection
6	loop power return (to the module)	loop power return (to the module)

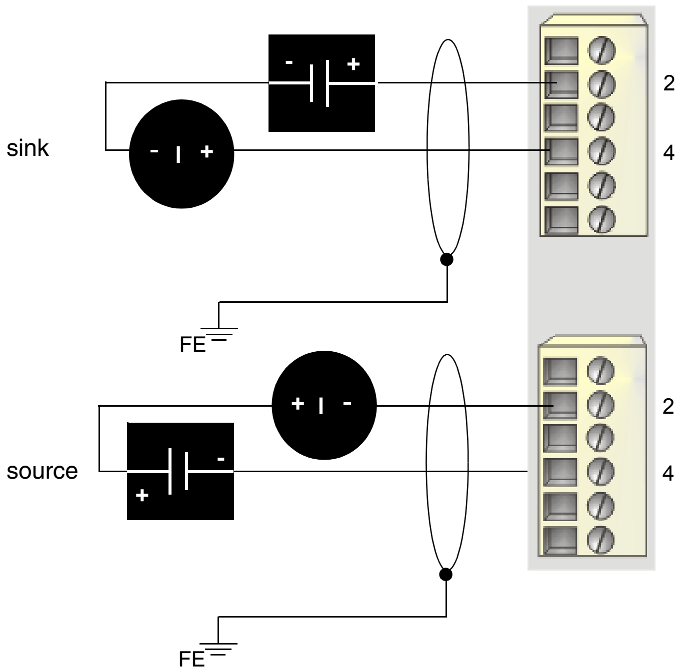
Sample Wiring Diagrams

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 loop supply
2 output to actuator 1
4 output channel return
6 loop power return (to the module)

The following field wiring example shows how two isolated analog actuators can be wired to the STB ACO 0220 module using external power supplies.



2 outputs to actuator 1 (top) and actuator 2 (bottom)
4 loop power returns from actuator 1 (top) and actuator 2 (bottom)

Recommended Loop Power Supplies

To guarantee EMC performance, in accordance with European Directives (CE, 89/336/EEC, EN61131-2:2003) when using an external loop supply, you must use one of the following Telemecanique power supplies.

- ABL7 RE 2403
- ABL7 RE 2405
- ABL7 RP 2410

While the module will function using any 24 VDC loop supply, we cannot guarantee the module will comply to the European EMC directive (CE) for operation in a noisy environment. We strongly recommend that you use the built-in loop supply for this reason.

STB ACO 0220 Functional Description

Functional Characteristics

The STB ACO 0220 module is a two-channel analog output module that sends data to two current field actuators. It supports user-configurable operating parameters and reflex actions. The following operating parameters are user-configurable:

- analog output data format
- analog output period
- predefined fallback value
- channel settings
- fallback mode settings

Using the RTP feature in your NIM, you can access the value of the analog output period.

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

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

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 refreshes the old data held by the channel. This update keeps the analog value from drifting during 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 the STB ACO 0220 module you want to configure in the island editor.	The selected STB ACO 0220 module opens in the software module editor.
2	Choose the data display format by either selecting or clearing the **Hexadecimal** check box at the top right of the editor.	Hexadecimal values will appear in the editor if the check box is selected; decimal values will appear if the check box is cleared.
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.

This parameter is represented as an unsigned 8-bit number. To access this parameter using RTP, the following values to the RTP request block.

Length	1
Index (low byte)	0x10
Index (high byte)	0x23
Sub-index	0
Data Byte 1	5 to 255

Output Data Format

By default, the data format is signed values with 15-bit resolution.

If you are using the Advantys configuration software, you can change the data format to unsigned values with 16-bit resolution.

The output data format that you use affects the range of values available for a predefined fallback state.

Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channels go to a known state where they 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:

1. configure the fallback modes for each channel
2. configure 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 the STB ACO 0220 module you want to configure in the island editor.	The selected STB ACO 0220 module opens in the software module editor.
2	Click the **+** sign to expand the **+ Fallback Mode** row.	Rows for **Channel 1** and **Channel 2** appear.
3	Select the desired fallback mode setting in the **Value** list in the **Channel 1** and/or **Channel 2** row.	Two choices appear in the list: ● **Predefined** ● **Hold 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 you are using an unsigned output data format, the valid range is -1 000 to 32 767 ((0*x*FC18 to 0*x*7FFF), where 0 represents 4 mA and 32 000 represents 20 mA. (A value of -1000 represents 3.28 mA, and a value of 32 767 represents 20.384 mA.)
- If you are using a signed output data format, the valid range is 0 to 65 535 (0*x*0000 to 0*x*FFFF), where 0 represents 4 mA and 64 000 represents 20 mA. (A value of 65 535 represents 20.384 mA; you cannot drive the current below 4 mA when the signed data format is used.)

By default, both output channels go to a predefined fallback state of 4 mA.

> **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** 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 selecting or clearing the **Hexadecimal** check box at the top right of the editor.	Hexadecimal values will appear in the editor if the check box is selected; decimal values will appear if the check box is cleared.
3	Click the **+** sign to expand the **+ Predefined Fallback Value Settings** fields.	Rows for **Channel 1** and **Channel 2** appear.
4	Double-click the channel value(s) you want to change. Then type in the desired decimal or hexidecimal value(s) to represent the current.	The software displays the max/min values of the range at the bottom of the module editor screen. The displayed values are data format-dependent

Channel Operation (Enable/Disable)

The STB ACO 0320 has an output channel enable/disable on a per-channel basis. You can disable the unused outputs. By default, all outputs are enabled upon auto configuration. When you disable a channel, its output is set to minimum output current, and any data written to the output register is ignored. The status byte returns all zeros when the channel is disabled, and the fault indicator does not blink.

- channel enable (default)
- channel disable

STB ACO 0220 Data 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. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output modules. This information can be monitored by the fieldbus master. If you are not using a basic NIM, the information may also be monitored by an HMI panel connected to the NIM's CFG port.

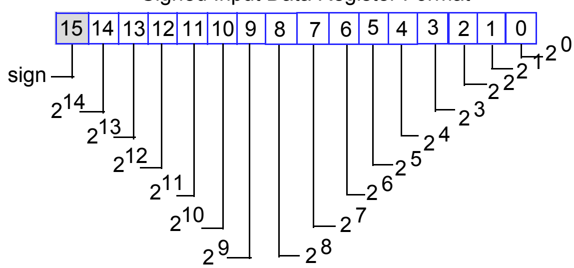
The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data sent by the fieldbus master. An STB ACO 0220 is represented by two contiguous registers in the output data block. The specific registers used by an STB ACO 0220 module 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.

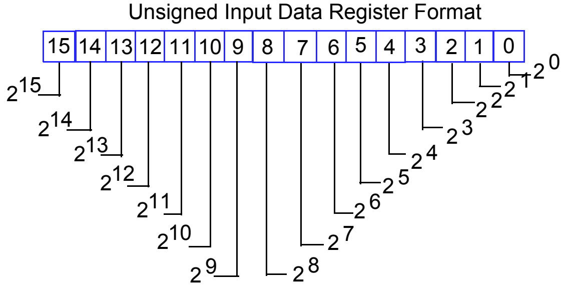
Output Data Registers

Each STB ACO 0220 output data register represents the output data in the IEC data format.

Signed Input Data Register Format



Unsigned Input Data Register Format



Each data word allows you to represent analog output current data with either signed integer values ranging from -32 767 to 32 767 or with unsigned integer values in the range 0 to 65 534.

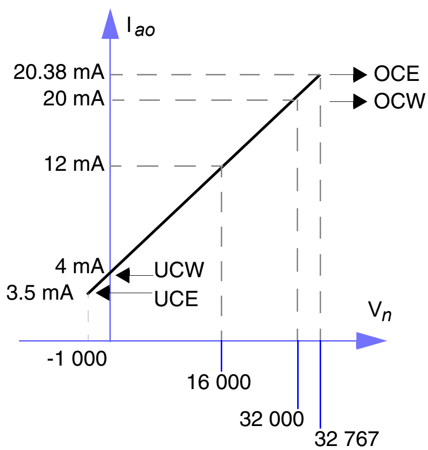
Linear current representations can be interpreted using the formula:

$$I_{ao} = \left(\frac{V_n}{2000}\right) + 4 \text{ for signed data}$$

$$I_{ao} = \left(\frac{V_n}{4000}\right) + 4 \text{ for unsigned data}$$

where V*n* is the numerical count and I*ao* is the analog output current.

Here is an example in signed output data format



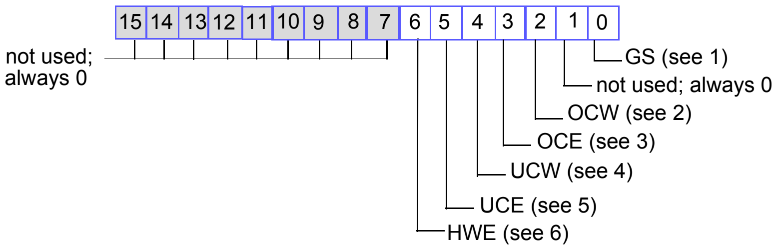
Values greater than 32 000 produce over-range indications.

Output Status Registers

The I/O status process image is a reserved block of 4 096 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 0220 is represented by two contiguous registers. The first shows the status for channel 1, and the second shows the status for channel 2. The six LSBs in each register represent the status of each output channel.

STB ACO 0220 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 6 has a value of 1.
2. Bit 2 represents the presence or absence of an over current warning (OCW). It has a value of 0 when a signed data value is less than or equal to 32 000 or an unsigned data value less than or equal to 64 000; it has a value of 1 when a signed data value is greater than 32 000 or an unsigned data value is greater than 64 000. An OCW does not turn on the GS bit (bit 0).
3. Bit 3 represents the presence or absence of an over current error (OCE). It has a value of 0 when a signed data value is less than 32 767 or an unsigned data value is less than 65 535; it has a value of 1 when a signed data value reaches 32 767 or an unsigned value reaches 65 535. An OCE does not turn on the GS bit (bit 0).
4. Bit 4 represents the presence or absence of an under current warning (UCW). UCW indications can be generated only when the signed output data format is used. It has a value of 0 when the data value is greater than or equal to 0 and a value of 1 when the data value is less than 0. A UCW does not turn on the GS bit (bit 0).
5. Bit 5 represents the presence or absence of an under current error (UCE). UCE indications can be generated only when the signed output data format is used. It has a value of 0 when the data value is greater than -1 000 and a value of 1 when the data value is less than or equal to -1 000. A UCE does not turn on the GS bit (bit 0).
6. Bit 6 represents the physical status of output channel (HWE). It has a value of 0 when no hardware errors are detected and a value of 1 if there is a broken wire or the channel is not powered. An HWE turns on the GS bit (bit 0).

STB ACO 0220 Specifications

Table of Technical Specifications

description		two isolated analog sink/source output channels
analog current range		4 ... 20 mA
resolution	default	15-bit + sign
	user configurable	16-bit unsigned
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		210 mA
nominal field power bus current consumption		150 mA, when using both loop supplies
maximum output current		20.38 mA/channel
hot swapping supported*		NIM-dependent**
reflex actions supported		yes
profile ID		49 hex
settling time		8 ms to +/- 0.1% of the final value
output response time	nominal	4 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 VDC
	channel-to-channel	200 VDC
	loop supply-to-actuator bus	500 VDC
integral linearity		+/- 0.05% of full scale typical
differential linearity		monotonic
absolute accuracy		typically 0.3% of full scale @ 25°C and 0.4% maximum of full scale
temperature drift		typically +/- 0.01% of full scale/ °C
operating temperature range***		0 to 60°C
storage temperature		-40 to 85°C
external loop supply (see *p. 295*)		19.2 ... 30 VDC

internal loop supply	24 VDC +/- 20% 25mA max per channel
over-current protection for internal loop supply	yes
fallback mode	predefined (default)
fallback states	user-defined data value (default = 0)
addressing requirement	two words for output data
field power requirements	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.	
***This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.	

3.5 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?

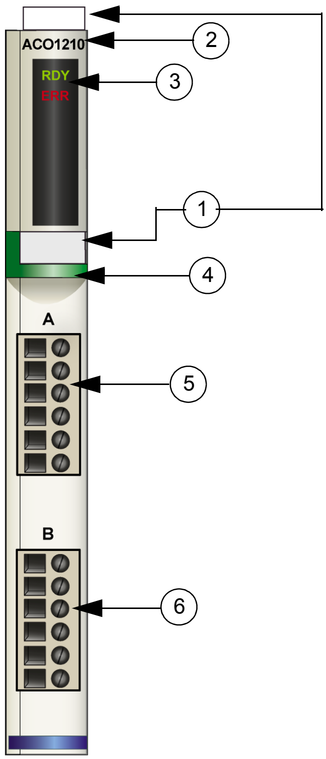
This section contains the following topics:

STB ACO 1210 Physical Description

Summary

The STB ACO 1210 is a standard 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.

Front Panel View



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

Ordering Information

The module can be ordered as part of a kit (STB ACO 1210 K), which includes:

- one STB ACO 1210 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACO 1210 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

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)

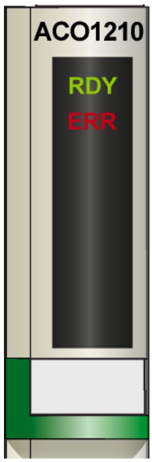
STB ACO 1210 LED Indicators

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: ● it has power ● it has passed its confidence tests ● 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
- 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 functional earth.

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

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.

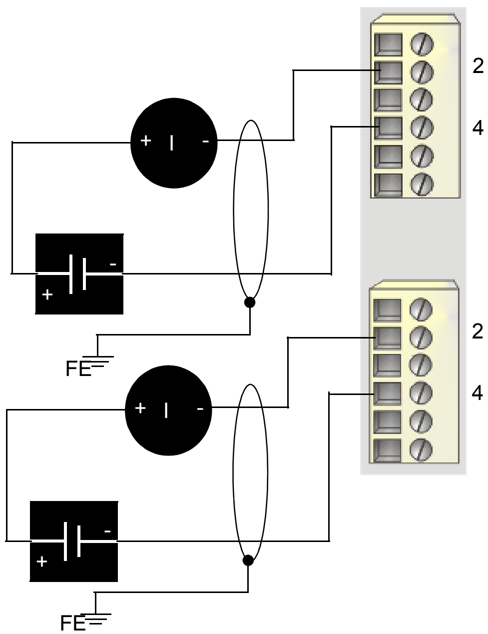
The connections on pin 1 and pin 6 are optional, and using these pins will defeat the built-in isolation between the analog portion of the module and the island's sensor bus. No connections are made on pins 3 and 5 of either connector:

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.

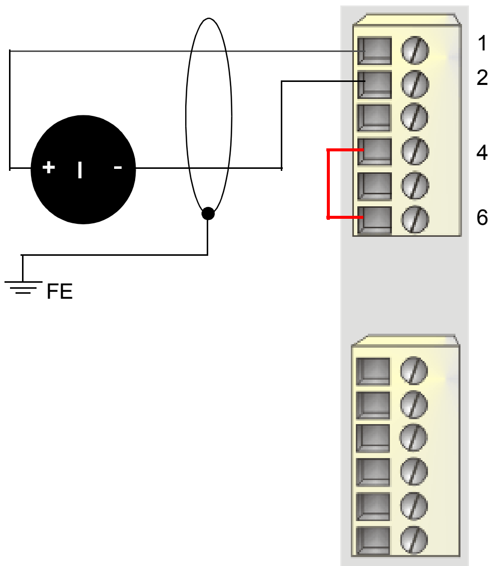
Sample Wiring Diagrams

The following field wiring example shows how two isolated single-ended 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 a single-ended 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

Using the RTP feature in your NIM, you can access the value of the following parameter:

- Analog Output Period

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

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

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.

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

Length	1
Index (low byte)	0x10
Index (high byte)	0x23
Sub-index	0
Data Byte 1	5 to 255

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 *p. 317*).

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). -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, if you are not using a basic NIM, 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.

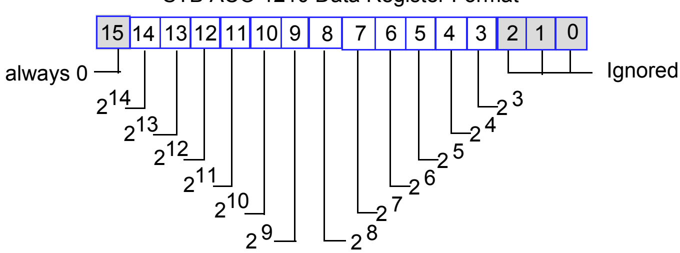
> **Note:** The data format illustrated below is common across the island bus, regardless of the fieldbus on which the island is operating. The data is also transferred to and from the master in a fieldbus-specific format. For fieldbus-specific descriptions, refer to one of the Advantys STB Network Interface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



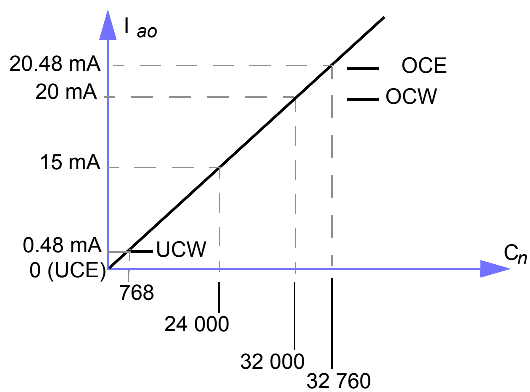
There are 12 significant bits in each data word—bits 14 through 3. They allow you to represent current data with integer values ranging from 0 to 32,760 in increments of eight.

The value 32 000 results in a 20 mA output. If the value exceeds 32 000, the output channel reports an over-current warning (OCW). If the value reaches 32 760, an over-current error (OCE) is reported. If the 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:

$$C_n = I_{ao} \times 1600$$

where C*n* is the numerical count and I*ao* is the analog output current.

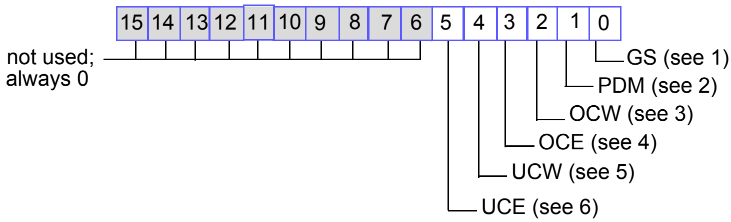


Output Status Registers

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 or equal to a numerical count of 32 000. It has a value of 1 when the current is greater than 32 000. 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 a numerical count of 32 760 and a value of 1 when the current is set to 32 760. 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 or equal to a numerical count of 768 and a value of 1 when the current is less than 768. 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

description		two single-ended 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 *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		40 mA
nominal actuator bus current consumption		90 mA, with no load
maximum output current		20 mA/channel
hot swapping supported*		NIM-dependent**
reflex actions supported		two maximum
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
operating temperature		0 to 60°C
storage temperature		-40 to 85°C
external loop supply		19.2 ... 30 VDC (from the 24 VDC PDM)
fallback mode	default	predefined
	user-configurable setting[1]	hold last value

fallback states (when *predefined* is the fallback mode)	default	0 mA on both channels
	user-configurable settings[1]	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		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
explosive & maritime environment applications		ATEX and FM Class 1, Div. 2 certified, @ 0 to 60°C with an operating voltage of 19.2 to 30 VDC
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.		
[1]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.

3.6 STB ACO 1225 Analog Current Output Module (two-channel, 10-bit, 4 ... 20 mA)

At a Glance

Overview

This section provides a detailed description of the STB ACO 1225 analog output module—its functions, physical design, technical specifications and field wiring requirements.

What's in this Section?

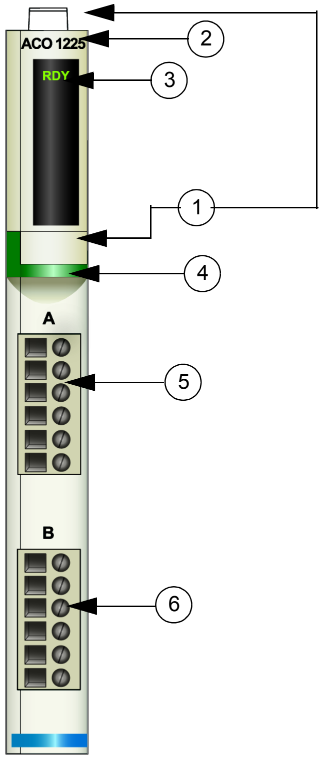
This section contains the following topics:

STB ACO 1225 Physical Description

Summary

The STB ACO 1225 is a basic Advantys STB two-channel analog current output module that writes outputs to analog actuators that operate over a range of 4 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, power the actuators 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.

Front Panel View



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

Ordering Information

The module can be ordered as part of a kit (STB ACO 1225 K), which includes:

- one STB ACO 1225 analog input module
- one size 1 STB XBA 1000 (see *p. 391*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACO 1225 analog input module
- a standalone STB XBA 1000 size 1 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

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)

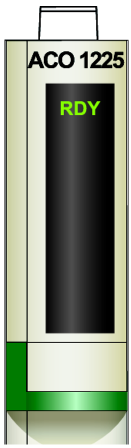
STB ACO 1225 LED Indicator

Purpose

The LED on the STB ACO 1225 provides a visual indication of the module's operating status.

Location

The LED is located on the top of the front bezel of the module, directly below the model number:



Indications

RDY	Meaning	What to Do
off	The module is either not receiving logic power or has failed.	Check power
flicker*	Auto-addressing is in progress.	
on	The module has achieved all of the following: ● it has power ● it has passed its confidence tests ● it is operational	
blink 1**	The module is either in pre-operational mode or in its fallback state.	

* 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.

STB ACO 1225 Field Wiring

Summary

The STB ACO 1225 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.

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 1225 module handles analog output data from two 4 to 20 mA single-ended analog field actuators. Data on each channel has a resolution of 10 bits. The module allows you to connect to two-, three- and four-wire devices that can draw current up to 100 mA/module.

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 functional earth.

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

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, 2, 4 and 6.

The connections on pin 1 and pin 6 are optional, and using them defeats 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.

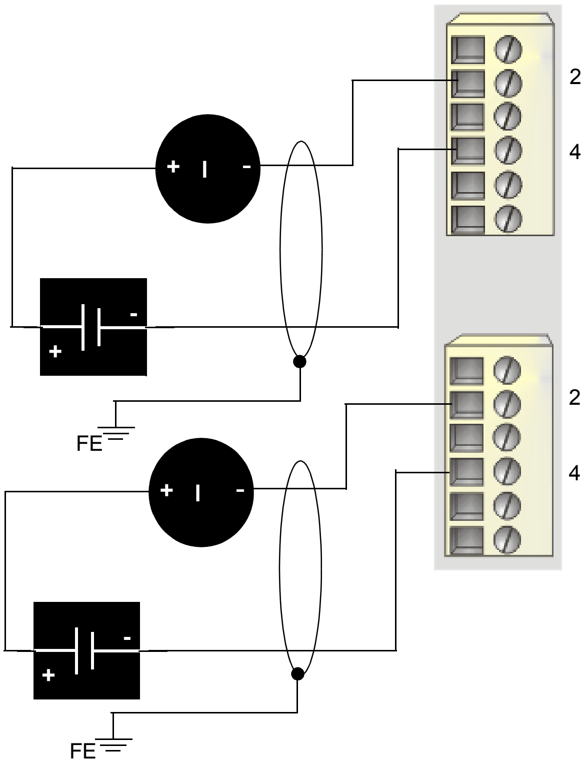
Pin	Top Connections	Bottom Connections
1	+24 VDC from actuator bus for field device accessories	+24 VDC from actuator bus for field device accessories
2	output to actuator 1	output to actuator 2
3	no connection	no connection
4	output channel return	output channel return
5	no connection	no connection

Pin	Top Connections	Bottom Connections
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.

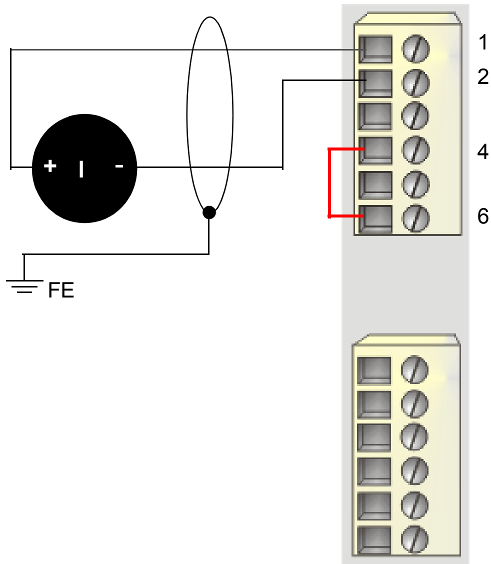
Sample Wiring Diagrams

The following field wiring example shows how two isolated single-ended analog actuators can be wired to the STB ACO 1225 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 the single-ended 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)
2 outputs to actuator 1 (top) and actuator 2 (bottom)
4 and 6 close the power loop by sending the field power return to the module return

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

STB ACO 1225 Functional Description

Functional Characteristics

The STB ACO 1225 module is a two-channel analog output module that sends data to two current field actuators. It does not support user-configurable operating parameters or reflex actions.

Operating Parameters

The current range of the module is 4 to 20 mA, with 10-bit resolution.

Note: At startup before the module becomes operational, the outputs are at 0 mA.

When communications are lost between the output module and the fieldbus master, the module's output channels go to a known state where they remain until communications are restored. This is known as the channel's *fallback state*. Both output channels go to a predefined fallback state of 4 mA.

STB ACO 1225 Data 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. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output modules. This information can be monitored by the fieldbus master. If you are not using a basic NIM, the information may also be monitored by an HMI panel connected to the NIM's CFG port.

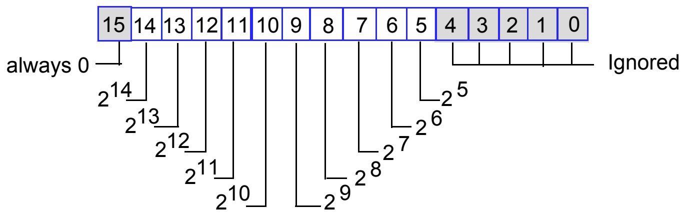
The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data returned by the fieldbus master. An STB ACO 1225 is represented by two contiguous registers in the output data block. The specific registers used by an STB ACO 1225 module 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

Each STB ACO 1225 output data register represents the output data in the IEC data format. The data has 10-bit resolution:

STB ACO 1225 Data Register Format

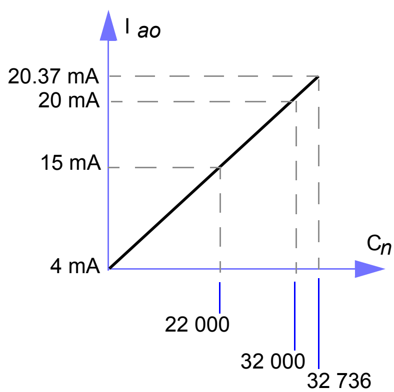


The value of each data word is represented in bits 14 through 5. The bits represent current data as integer values in the range 0 to 32,736 in increments of 32. A value 32 000 results in a 20 mA output, and a value of 0 results in a 4 mA output.

Linear current representations can be interpreted using the formula:

$$C_n = (2000 \times I_{ao}) - 8000$$

where C*n* is the numerical count and I*ao* is the analog output current.



Values greater than 32 000 do not produce over-range indications.

STB ACO 1225 Specifications

Table of Technical Specifications

description		two single-ended nonisolated analog current output channels
analog current range		4 ... 20 mA
resolution		10 bits
returned data format		IEC
module width		13.9 mm (0.58 in)
I/O base		STB XBA 1000 (see *p. 391*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		40 mA
nominal field power bus current consumption		90 mA, with no load
maximum output current		20 mA/channel
hot swapping supported*		NIM-dependent**
reflex actions supported		no
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
operating temperature range		0 to 60°C
storage temperature		-40 to 85°C
external loop supply		19.2 ... 30 VDC (from the 24 VDC PDM)
fallback mode		predefined
fallback states		4 mA on both channels
addressing requirement		two words for output data

actuator bus power for accessories	100 mA/module
over-current protection for accessory power	yes
field power requirements	from a 24 VDC PDM
power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.	

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.

3.7 STB ACO 0120 Analog Current Output Module (one-channel, 15-bit + sign, 4 ... 20 mA)

At a Glance

Overview

This section provides you with a detailed description of the STB ACO 0120 analog output module—its functions, physical design, technical specifications, field wiring requirements, and configuration options.

What's in this Section?

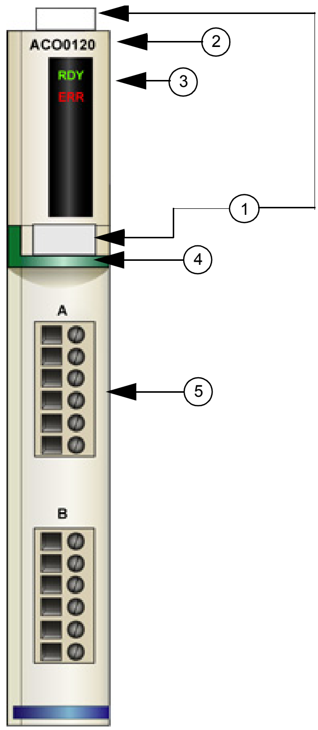
This section contains the following topics:

STB ACO 0120 Physical Description

Summary

The STB ACO 0120 is a standard Advantys STB isolated one-channel analog sink/ source output module that operates over a range of 4 to 20 mA. The analog portion of the module is isolated from the island's actuator bus to improve performance. The module also provides an isolated, short-circuit protected loop power supply that allows a two-wire connection to the actuator.

Front Panel View



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 connects to the top field wiring connector

Ordering Information

The module can be ordered as part of a kit (STB ACO 0120 K), which includes:

- one STB ACO 0120 analog output module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB ACO 0120 analog output module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

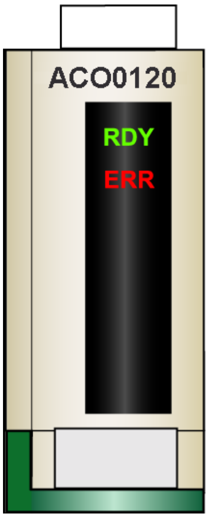
STB ACO 0120 LED Indicator

Purpose

The LED on the STB ACO 0120 provides a visual indication of the module's operating status.

Location

The LED is 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: ● it has power ● it passed its confidence tests ● it is operational	
on	on	The watchdog has timed out.	Cycle power; restart the communications.
on	flicker*	A broken wire is detected.	Check wiring.
blink 1**		The module is in pre-operational mode.	
	flicker*	Loop power is absent.	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.

STB ACO 0120 Field Wiring

Summary

The STB ACO 0120 module uses one six-terminal field wiring connector. This analog actuator is wired to the top connector.

Connector Types

Use either:

- an STB XTS 1100 *screw type* field wiring connector (available in a kit of 20)
- an STB XTS 2100 *spring clamp* field wiring connector (available in a kit of 20)

The field wiring connector has six connection terminals, with a 3.8 mm (0.15 in) pitch, between each pin.

Field Actuators

The STB ACO 0120 module supports a one channel analog actuator. It handles outputs in the range of 4 to 20 mA. Data on this channel has a resolution of 15 bit + sign.

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 required to meet CE. (See the *Advantys STB System Planning and Installation Guide* (890 USE 171) for an illustrated example of an island segment with an EMC kit making the analog I/O modules CE compliant.) The shield should be tied to an external clamp that is tied to functional earth.

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

Field Wiring Pinout

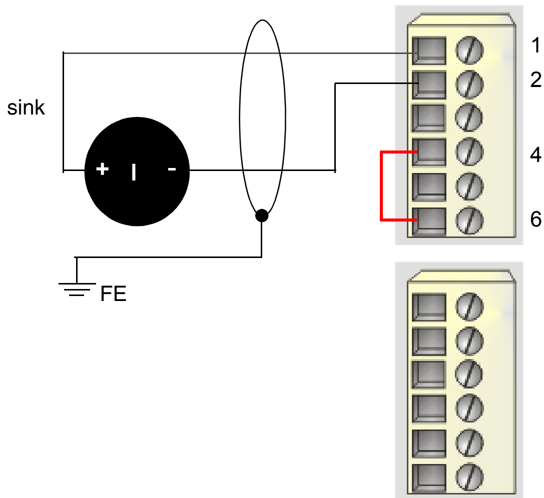
The top connector supports the analog actuator. Pins 3 and 5 are not used.

Pin	Top Connections	Bottom Connections
1	+24 VDC loop supply	no connection
2	output to actuator	no connection
3	no connection	no connection
4	output channel return	no connection
5	no connection	no connection
6	loop power return (to the module)	no connection

Sample Wiring Diagrams

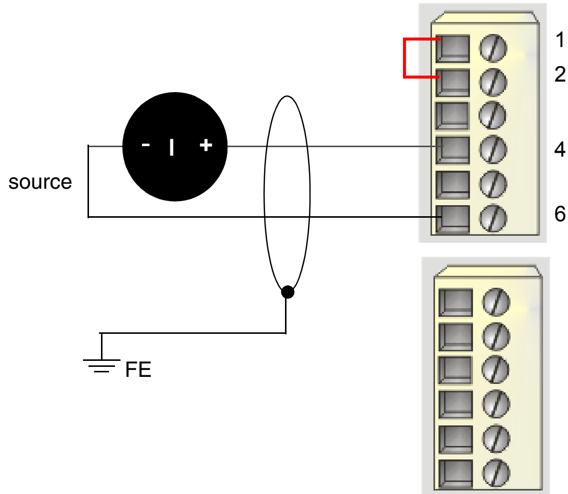
The actuator may be powered either from a built-in loop supply (24 VDC from the island's actuator bus through the output module) or from an external loop supply. For ease of wiring and cost considerations, we recommend that you use the built-in loop supply.

When you use a built-in loop supply, the pin assignments differ depending on whether you wire the actuator as a sink or source load. For a sink load, use pins 1 and 2 on the module's top connector, with a jumper across pins 4 and 6:



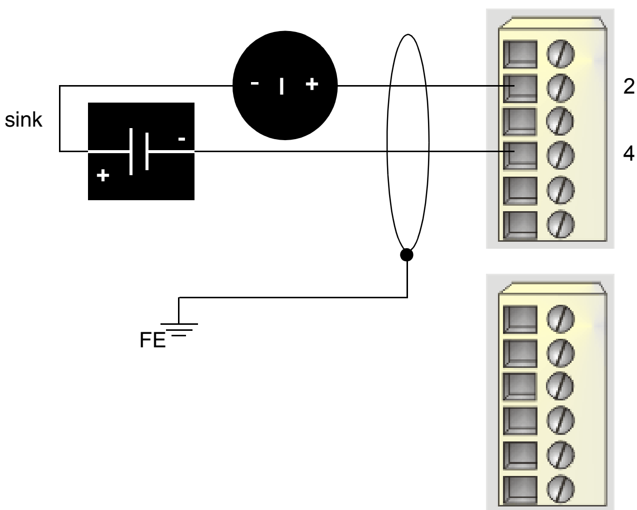
1 +24 VDC loop supply
2 output to actuator

For a source load, use pins 4 and 6, with a jumper across pins 1 and 2:

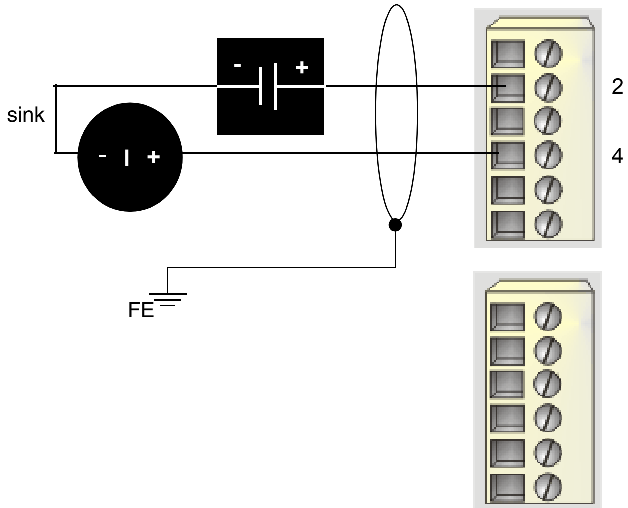


4 output channel return
6 loop power return to the module

When you use an external power supply, the isolated analog actuator can be wired as a sink or source load using pins 2 and 4 on the module's top connector. For a sink load, wire the actuator as follows:



For a source load, wire the actuator as follows:



2 outputs to actuator
4 loop power returns from actuator

Recommended Loop Power Supplies

The STB ACO 0120 module has been tested with the following Telemecanique power supplies as external loop supplies to validate compliance with European Directives (CE, 89/336/EEC, EN61131-2:2003) for EMC performance:

- ABL7 RE 2403
- ABL7 RE 2405
- ABL7 RP 2410

The module can function using any 24 VDC loop supply, but other supplies have not been tested for compliance with the European EMC directive (CE) for operation in a noisy environment.

STB ACO 0120 Functional Description

Functional Characteristics

The STB ACO 0120 module is an isolated one-channel analog output module that sends outputs to the field actuator. It supports user-configurable operating parameters and reflex actions. The following operating parameters are user-configurable:

- analog output period
- fallback modes
- fallback states
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameter:

- analog output period

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

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

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. By default, the analog output period is 10. If you want to configure a different period, you need to use the Advantys configuration software.

Step	Action	Result
1	Double-click the STB ACO 0120 module you want to configure in the island editor.	The selected STB ACO 0120 module opens in the software module editor.
2	Choose the data display format by either selecting or clearing the **Hexadecimal** check box at the top right of the editor.	Hexadecimal values will appear in the editor if the check box is selected; decimal values will appear if the check box is cleared.
3	In the **Configured Value** column of the **Analog Output Period** row, enter the desired value.	Notice that when you select the **Analog Output Period** value, the min/max values of the range appear at the bottom of the module editor screen.

This parameter is represented as an unsigned 8-bit number. To access this parameter using RTP, the following values to the RTP request block.

Length	1
Index (low byte)	0x10
Index (high byte)	0x23
Sub-index	0
Data Byte 1	5 to 255

Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channel goes to a known state where it remains until communication is restored. This known state is the channel's *fallback state*. Fallback configuration is accomplished in two steps:

1. configure the fallback mode for the channel
2. configure the fallback state

This output channel has a fallback mode—either *predefined state* or *hold last value*. When the 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.

By default, the fallback mode for the channel is 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 the STB ACO 0120 module you want to configure in the island editor.	The selected STB ACO 0120 module opens in the software module editor.
2	Click the **+** sign to expand the **Fallback Mode** row.	The row for **Channel 1** appears.
3	Select the desired fallback mode setting in the **Configured Value** list in the **Channel 1** row.	Two choices appear in the list: • **Predefined** • **Hold Last Value**

Predefined Fallback Values

If the output channel's fallback mode is predefined state, you may configure the channel to go to any value in the range -1 000 to 32 767, where 0 represents 4 mA and 32 000 represents 20 mA.

By default, the output channel goes to a predefined fallback value of 4 mA.

> **Note:** If the output channel has been configured with *hold last value* as its fallback mode, any value that you assign its fallback state parameter is set to zero.

To modify the fallback state from its default setting or to revert back to the default, 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** for the channel is *hold last value*, the **Predefined Fallback Value** is set to 0.
2	Click the **+** sign to expand the **Predefined Fallback Value settings** fields.	The row for **Channel 1** appears.
3	Choose the data display format by either selecting or clearing the **Hexadecimal** check box at the top right of the editor.	Hexadecimal values will appear in the editor if the check box is selected; decimal values will appear if the check box is cleared.
4	Double-click the channel value you want to change. Type in the desired value.	The software displays the min/max value of the range at the bottom of the module editor screen.

Channel Operation (Enable/Disable)

The STB ACO 0120 output channel has an enable/disable feature. By default, the output is enabled. When you disable the channel, its output is set to minimum output current, and any data written to the output register is ignored. The status byte returns all zeros when the channel is disabled, and the fault indicator does not blink.

- channel enable (default)
- channel disable

> **Note:** If the channel is disabled and the PDM power is removed, the ERR LED does not flash.

STB ACO 0120 Data in the Process Image

Representing the Analog Output Data

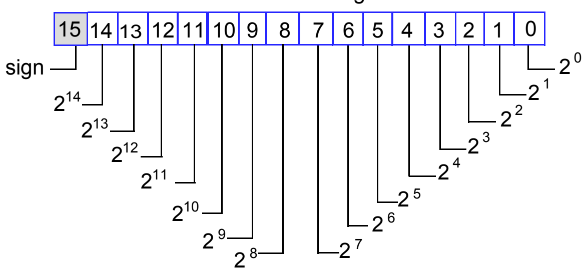
The NIM keeps a record of output data in one block of registers in the process image. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output modules. This information can be monitored by the fieldbus master. If you are not using a basic NIM, the information may also be monitored by an HMI panel connected to the NIM's CFG port.

The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data sent by the fieldbus master. An STB ACO 0120 is represented by one register in the output data block. The specific register used by an STB ACO 0120 module is based on its logical address on the island bus.

Output Data Registers

Each STB ACO 0120 output data register represents the output data in the IEC data format. The data has 15 bit + sign resolution.

STB ACO 0120 Data Register Format



All 16 bits in the data word are significant. They allow you to represent analog output current data with all the integer values in the range -1 000 to 32 767.

The value 0 represents 4 mA. The value 32 000 represents 20 mA. Errors and warnings are reported in both operating ranges at the following counts.

Note: Errors and warnings are based on count values, not current values. The current values in the table below are ideal values.

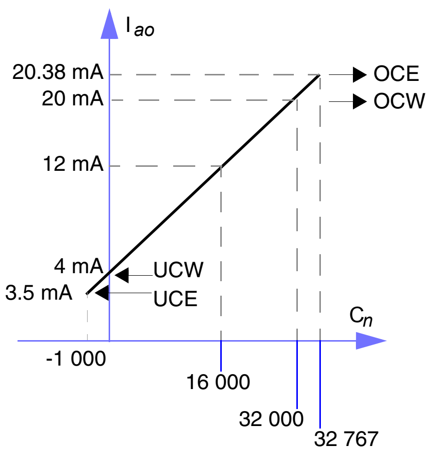
Error	**4 to 20 mA Range**
OCE (over current error)	20.38 mA (32 767)
OCW (over current warning)	> 20 mA (32 001)
UCW (under current warning)	< 4 mA (0)
UCE (under current error)	<= 3.5 mA (-1000)

The value of the data word is represented in bits 14 through 0. The bits represent current data as integer values in the range 0 to 32 767. A value of 32 000 results in a 20 mA output, and a value of 0 results in a 4 mA output.

Output current value (in mA) is given by the following formula:

$$I_{ao} = \left(\frac{C_n}{2000}\right) + 4$$

where C_n is the numerical count and I_{ao} is the analog output current.



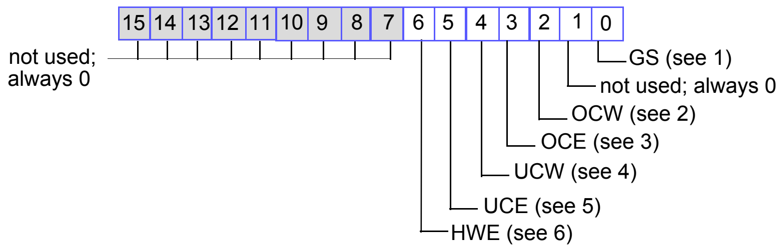
Values greater than 32 000 produce over-range indications.

Output Status Registers

The I/O status process image is located in 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 0120 is represented by one register. This shows the status for the channel. The seven LSBs in the register represents the status of the output channel.

STB ACO 0120 Status Register Format



1. Bit 0 represents global status (GS). It has a value of 0 when no errors are detected. It has a value of 1 when bit 6 has a value of 1.
2. Bit 2 represents the presence or absence of an OCW. It has a value of 0 when the data value is less than or equal to 32 000 and a value of 1 when the data value is greater than 32 000. An OCW does not turn on the GS bit (bit 0).
3. Bit 3 represents the presence or absence of an OCE. It has a value of 0 when the data value is less than 32 767 and a value of 1 when the data value reaches 32 767. An OCE does not turn on the GS bit (bit 0).
4. Bit 4 represents the presence or absence of a UCW. It has a value of 0 when the data value is greater than or equal to 0 and a value of 1 when the data value is less than 0. A UCW does not turn on the GS bit (bit 0).
5. Bit 5 represents the presence or absence of a UCE. It has a value of 0 when the data value is greater than -1 000 and a value of 1 when the data value is less than or equal to -1 000. A UCE does not turn on the GS bit (bit 0).
6. Bit 6 represents the physical status of output channel. It has a value of 0 when no hardware errors (HWEs) are detected and a value of 1 if there is a broken wire or the channel is not powered. An HWE turns on the GS bit (bit 0).

STB ACO 0120 Specifications

Table of Technical Specifications

description		one current output channel
analog current range		4 ... 20 mA
resolution		15-bit + sign
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		210 mA
nominal field power bus current consumption		150 mA
minimum output current		3.5 mA
maximum output current		20.38 mA
hot swapping supported*		NIM-dependent**
reflex actions supported		yes[1]
profile ID		0x4B
settling time		8 ms to +/- 0.1% of the final value
output response time	nominal	4 ms plus settling time
short-circuit protection on the outputs		yes
fault detection		yes
isolation	field-to-bus	1500 VDC for 1 min
	analog module-to-actuator bus	500 VDC
	loop supply-to-actuator bus	500 VDC
integral linearity		+/- 0.05% of full scale typical
differential linearity		monotonic
absolute accuracy		typically 0.3% of full scale @ 25°C and 0.4% maximum of full scale
temperature drift		typically +/- 0.01% of full scale/ °C
operating temperature range***		0 to 60°C
storage temperature		-40 to 85°C
external loop supply (see *p. 295*)		19.2 ... 30 VDC

internal loop supply	24 VDC +/- 20% 25mA max per channel
over-current protection for internal loop supply	yes
fallback mode	predefined (default)
fallback states	user-defined data value (default = 0)
	hold last value
addressing requirement	one output word for output data and one input word for status
field power requirements	built-in or external loop supply (see *p. 338*)
power protection	time-lag fuse on the PDM
agency certifications	refer to *Advantys STB System Planning and Installation Guide, 890 USE 171*
*ATEX applications prohibit hot swapping-refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* **Basic NIMs do not allow you to hot swap I/O modules.	
***This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.	
[1]Requires the Advantys configuration software.	

3.8 STB AVO 0200 Analog Voltage Output Module (two-channel, 15-bit plus sign, +1 ... 5 VDC, 0 ... 5 VDC, 0... 10 VDC, +/-5 VDC, or +/-10 VDC)

At a Glance

Overview

This section provides a detailed description of the STB AVO 0200 analog output module—its functions, physical design, technical specifications and field wiring requirements.

What's in this Section?

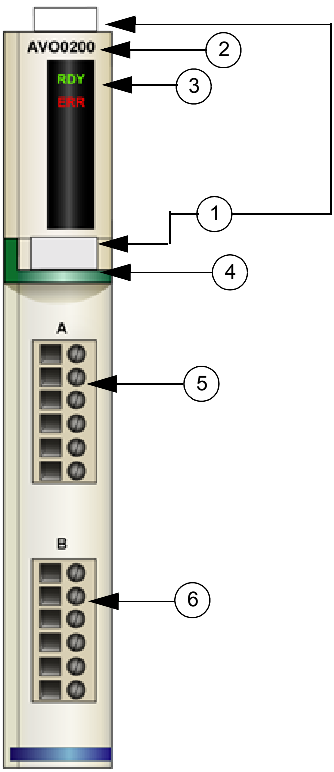
This section contains the following topics:

STB AVO 0200 Physical Description

Physical Characteristics

The STB AVO 0200 is a standard Advantys STB two-channel analog voltage output module that writes outputs to analog actuators that operate over a range of +1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, or +/-10 VDC (default). The analog portion of the module is isolated from the island's field power bus to improve performance.

Front Panel View



1 locations for the STB XMP 6700 user-customizable labels
2 model name
3 LED
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

Ordering Information

The module can be ordered as part of a kit (STB AVO 0200 K), which includes:

- one STB AVO 0200 analog output module
- one size 2 STB XBA 2000 (see *p. 395*) I/O base
- two alternative sets of connectors:
  - two 6-terminal *screw type* connectors
  - two 6-terminal *spring clamp* connectors

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

- a standalone STB AVO 0200 analog output module
- a standalone STB XBA 2000 size 2 base
- a bag of *screw type* connectors (STB XTS 1100) or *spring clamp* connectors (STB XTS 2100)

Additional optional accessories are also available:

- the STB XMP 6700 user-customizable label kit, which may be applied to the module and the base as part of your island assembly plan
- the STB XMP 7700 keying pin kit for inserting the module into the base
- the STB XMP 7800 keying pin kit for inserting the field wiring connectors into the module
- to meet CE compliance, use a grounding bar such as the one in the STB XSP 3000 EMC kit with your island installation

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

Dimensions

width	module on a base	18.4 mm (0.72 in)
height	module only	125 mm (4.92 in)
	on a base	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)

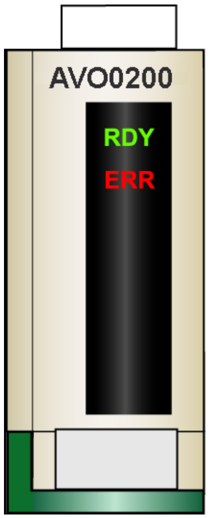
STB AVO 0200 LED Indicator

Purpose

The LED on the STB AVO 0200 provides a visual indication of the module's operating status.

Location

The LED is 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	on	The watchdog has timed out.	Cycle power; restart the communications.
on	off	The module has achieved all of the following: ● it has power ● it passed its confidence tests ● it is operational	
	flicker*	Field power is absent	Check power.
		A PDM short circuit is detected.	
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.		

Note: The detection of error conditions on the PDM output 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 AVO 0200 Field Wiring

Summary

The STB AVO 0200 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.

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 0200 module supports two 2-wire analog actuators. It handles analog outputs ranging from 1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC, +/-5 VDC, or +/-10 VDC. Data on each channel has a resolution of 15 bits plus sign.

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 functional earth.

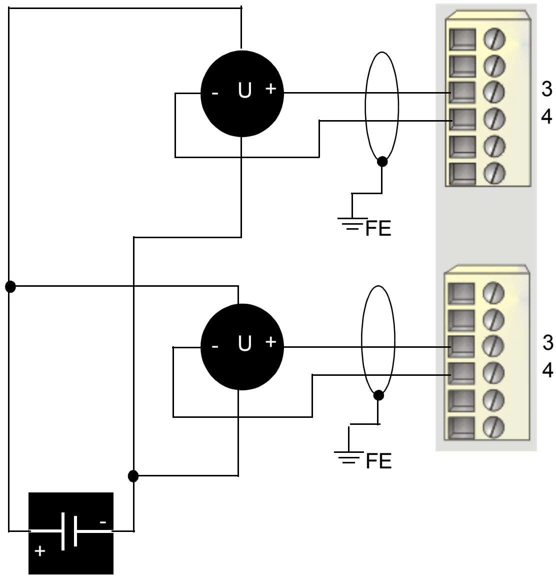
We recommend that you strip at least 9 mm from the wire's jacket for the module connection.

Field Wiring Pinout

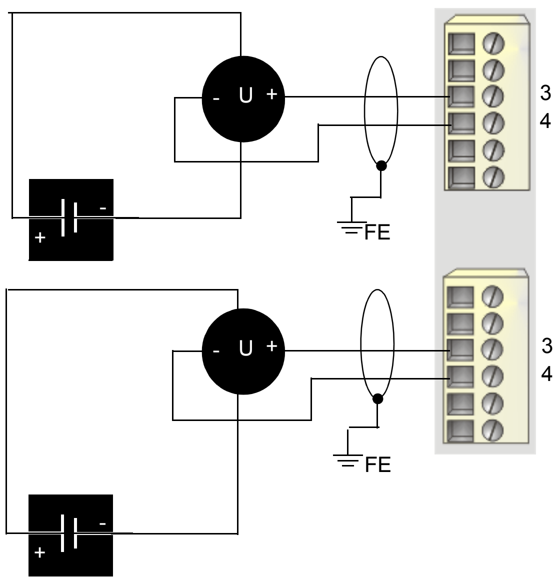
Pin	Top Connections	Bottom Connections
1	no connection	no connection
2	no connection	no connection
3	output to actuator 1	output to actuator 2
4	output channel return	output channel return
5	no connection	no connection
6	no connection	no connection

Sample Wiring Diagrams

The following field wiring example shows how two wire non-isolated analog actuators can be wired to the STB AVO 0200 module. An external power supply is required:



The following field wiring example shows how two wire isolated analog actuators can be wired to the STB AVO 0200 module. An external power supply is required for each channel:



STB AVO 0200 Functional Description

Functional Characteristics

The STB AVO 0200 module is a two-channel module that sends analog outputs to two voltage field actuators. It supports user-configurable operating parameters and reflex actions. The following operating parameters are user-configurable:

- analog output period
- fallback modes
- fallback states
- channel operation (enable/disable)

Using the RTP feature in your NIM, you can access the value of the following parameter:
- analog output period

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

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

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. By default, the analog output period is 10. If you want to configure a different period, you need to use the Advantys configuration software.

Step	Action	Result
1	Double-click the STB AVO 0200 module you want to configure in the island editor.	The selected STB AVO 0200 module opens in the software module editor.
2	Choose the data display format by either selecting or clearing the **Hexadecimal** checkbox at the top right of the editor.	Hexadecimal values appear in the editor if the checkbox is selected; decimal values appear if the checkbox is cleared.
3	In the **Configured Value** column of the **Analog Output Period** row, enter the desired value.	Notice that when you select the **Analog Output Period** value, the min/max values of the range appear at the bottom of the module editor screen.

This parameter is represented as an unsigned 8-bit number. To access this parameter using RTP, the following values to the RTP request block.

Length	1
Index (low byte)	0x10
Index (high byte)	0x23
Sub-index	0
Data Byte 1	5 to 255 (0xFF)

Fallback Modes

When communications are lost between the output module and the fieldbus master, the module's output channels go to a known state where they 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:

1. configure the fallback modes for each channel
2. configure 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 value, 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.

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 the STB AVO 0200 module you want to configure in the island editor.	The selected STB AVO 0200 module opens in the software module editor.
2	Click the **+** sign to expand the **Fallback Mode** row.	Rows for **Channel 1** and **Channel 2** appear.
3	Select the desired fallback mode setting in the **Configured Value** list in the **Channel 1** and **Channel 2** rows.	Two choices appear in the list: ● **Predefined** ● **Hold Last Value**

Predefined Fallback Values

For example, in the 1 to 5 VDC scale, if an output channel's fallback mode is a predefined state, you may configure that channel to go to any value in the range - 768 to 32 767, where 0 represents 1 VDC and 32 000 represents 5 VDC.

Both output channels go to a predefined fallback state of 1 VDC.

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 is set to zero.

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** for the channel is *hold last value*, any value entered in the associated **Predefined Fallback Value** row will be ignored.
2	Click the **+** sign to expand the **Predefined Fallback Value settings** fields.	Rows for **Channel 1** and **Channel 2** appear.
3	Choose the data display format by either selecting or clearing the **Hexadecimal** check box at the top right of the editor.	Hexadecimal values will appear in the editor if the check box is selected; decimal values will appear if the check box is cleared.
4	Double-click the channel value(s) you want to change. Then type in the desired value(s).	The software displays the min/max values of -32 768 and +32 767 at the bottom of the module editor screen.

Note: If you type a value that is out of range, e.g., a negative value when the range is 1 to 5 VDC, the system applies a fallback state of 0 to the output channel.

Channel Operation (Enable/Disable)

The STB AVO 0200 has an output channel enable/disable on a per-channel basis. You can disable the unused outputs. By default, all outputs are enabled. When you disable a channel, its output is set to 0 VDC, and any data written to the output register is ignored. The status byte returns all zeros when the channel is disabled, and the fault indicator does not blink.

- channel enable (default)
- channel disable

Note: If both channels are disabled when PDM power is removed, the ERR LED does not flash.

STB AVO 0200 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. Information in the output data block is written to the NIM by the fieldbus master and is used to update the output modules. This information can be monitored by the fieldbus master. If you are not using a basic NIM, the information may also be monitored by an HMI panel connected to the NIM's CFG port.

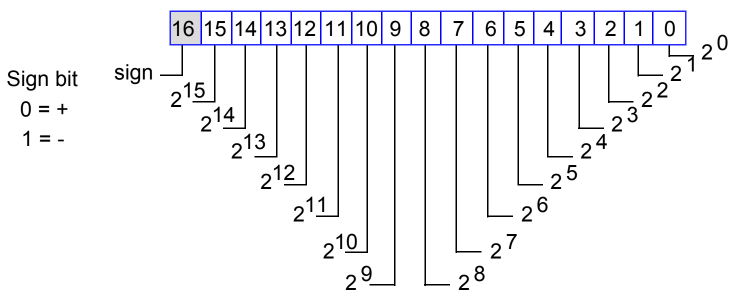
The output data process image is a reserved block of 4096 16-bit registers (in the range 40001 through 44096) that represents the data sent by the fieldbus master. An STB AVO 0200 is represented by two contiguous registers in the output data block. The specific registers used by an STB AVO 0200 module are based on its logical address 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

Each STB AVO 0200 output data register represents the output data in the IEC data format. The data has 15-bit + sign resolution.

STB AVO 0200 Data Register Format



> **Note:** Errors and warnings are based on count values, not current values. The current values in the table below are ideal values.

Data Formats 0 to 5 VDC and +1 to 5 VDC

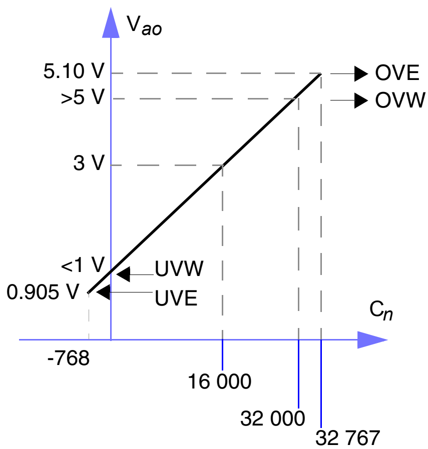
Error	+1 to 5 VDC Range	0 to 5 VVDC Range
OVE (over voltage error)	(32 767) 5.10 VDC	(32 767) 5.12 VDC
OVW (over voltage warning)	(32 001) >5 VDC	(32 001) >5 VDC
UVW (under voltage warning)	(-1) <1 VDC	(767) <0.12 VDC
UVE (under voltage error)	(-768) <=0.905 VDC	(0) 0 VDC

In an ideal linear voltage representation for +1 to 5 VDC range, a value of 32 001 represents an OVW. If the output value is less than or equal to - 1, the module reports a UVW. When the output value reaches 32 767, an OVE occurs. When the output value reaches - 767, a UVE occurs.

Output voltage (in V) is given by the following formula:

$V_{ao} = C_n/8000 + 1$

where C_n is the numerical count and V_{ao} is the analog output voltage.

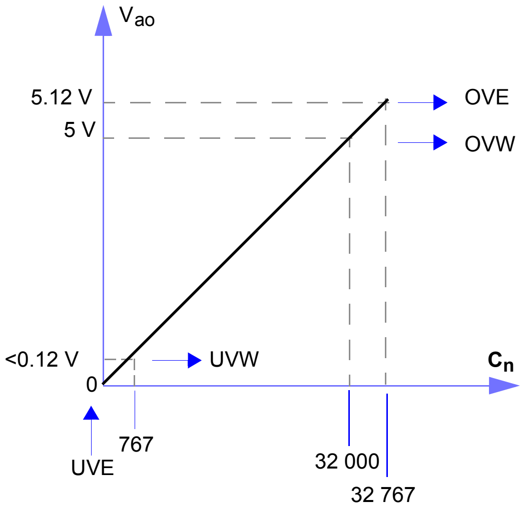


In an ideal linear voltage representation for 0 to 5 VDC range, a value of 32 001 represents an OVW. If the output value is less than or equal to 767, the module reports a UVW. When the output value reaches 32 767, an OVE occurs. When the output value reaches 0, a UVE occurs.

An ideal linear voltage representation is interpreted using the formula:

$V_{ao} = C_n/6400$

where C_n is the numerical count and V_{ao} is the analog output voltage.



Data Format 0 to 10 VDC

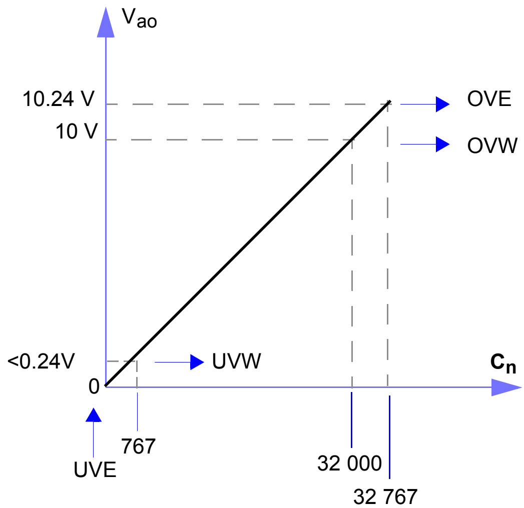
Error	0 to 10 VDC Range
OVE (over voltage error)	(32 767) 10.24 VDC
OVW (over voltage warning)	(32 001) >10 VDC
UVW (under voltage warning)	(767) <0.24 VDC
UVE (under voltage error)	(0) 0 VDC

In an ideal linear voltage representation for 0 to 10 VDC range, a value of 32 001 represents an OVW. If the output value is less than or equal to 767, the module reports a UVW. When the output value reaches 32 767, an OVE occurs. When the output value reaches 0, a UVE occurs.

An ideal linear voltage representation is interpreted using the formula:

$$V_{ao} = C_n/3200$$

where C_n is the numerical count and V_{ao} is the analog output voltage.



Data Formats +/-5 V and +/-10 VDC

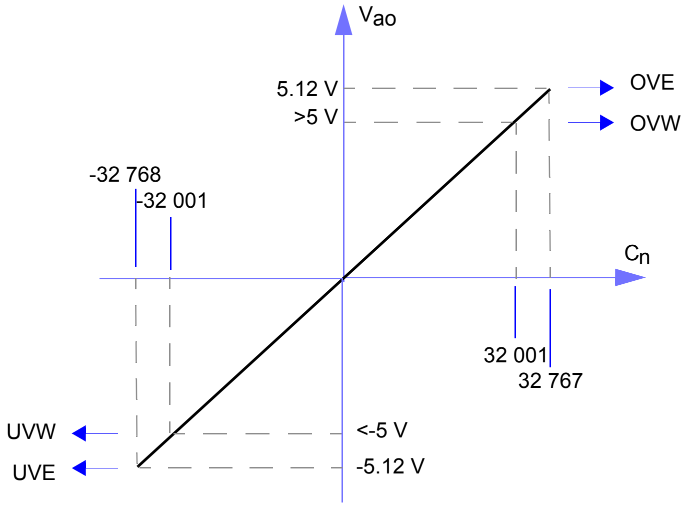
Error	+/-5 VDC Range	+/-10 VDC Range
OVE (over voltage error)	(32 767) 5.12 VDC	(32 767) 10.24 VDC
OVW (over voltage warning)	(32 001) >5 VDC	(32 001) >10 VDC
UVW (under voltage warning)	(-32 001) <5 VDC	(-32 001) <-10 VDC
UVE (under voltage error)	-(32 768) --5.12 VDC	(-32 768) -10.24 VDC

In an ideal linear voltage representation for +/- 5 V range, a value of 32 001 represents an over voltage warning (OVW). If the output value is less than or equal to -32 001, the module will report an under voltage warning (UVW). When the output value reaches 32 767, an over voltage error (OVE) occurs. When the output value reaches -32 768, an under voltage error (UVE) occurs.

An ideal linear voltage representation is interpreted using the formula:

$$V_{ao} = C_n/6400$$

where C_n is the numerical count and V_{ao} is the analog output voltage.

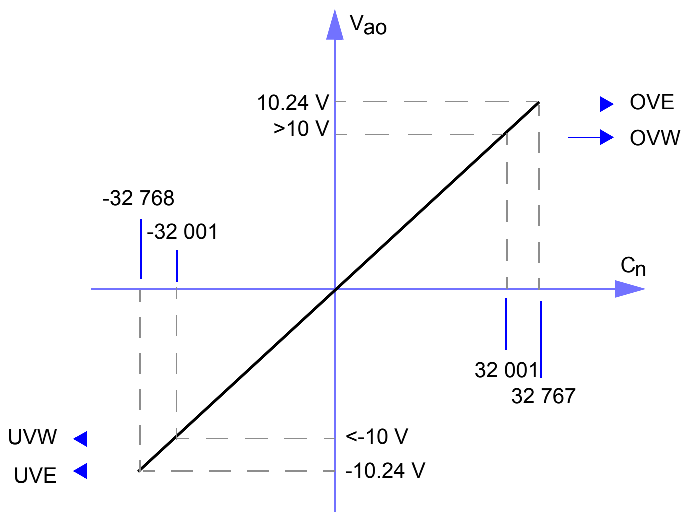


In an ideal linear voltage representation for +/-10 VDC range, a value of 32 001 represents an OVW. If the output value is less than or equal to -32 001, the module reports a UVW. When the output value reaches 32 767, an OVE occurs. When the output value reaches -32 768, a UVE occurs.

An ideal linear voltage representation is interpreted using the formula:

$V_{ao} = C_n/3200$

where C_n is the numerical count and V_{ao} is the analog output voltage.

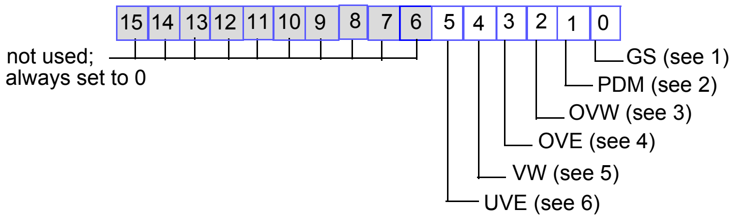


Output Status Registers

The I/O status process image is located in a reserved block of 4096 16-bit registers (registers 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 six LSBs in each register represent the status of each output channel:

STB AVO 0200 Status Register Format



1 Bit 0 represents global status (GS). It has a value of 0 when no errors are 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 1 when the PDM is powered. A PDM error turns on the GS bit (bit 0).).

3 Bit 2 represents the presence or absence of an OVW. An OVW does not turn on the GS bit (bit 0).

4 Bit 3 represents the presence or absence of an OVE. An OVE does not turn on the GS bit (bit 0).

5 Bit 4 represents the presence or absence of a UVW. An UVW does not turn on the GS bit (bit 0).

6 Bit 5 represents the presence or absence of a UVE. An UVE does not turn on the GS bit (bit 0).

Note: The detection of error conditions on the PDM output 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 output module are reported immediately.

STB AVO 0200 Specifications

Table of Technical Specifications

description		two isolated voltage output channels
analog voltage range		+1 to 5 VDC
		0 to 5 VDC
		0 to 10 VDC
		+/-5 VDC
		+/-10 VDC (default)
resolution		15-bit + sign
returned data format		IEC
module width		18.4 mm (0.72 in)
I/O base		STB XBA 2000 (see *p. 395*)
operating voltage range		19.2 to 30 VDC
logic bus current consumption		265 mA
nominal field power bus current consumption		150 mA
minimum load impedance		>= 1 000 Ω
hot swapping supported		NIM-dependent*
reflex actions supported		yes[1]
profile ID		0x48
settling time		8 ms to +/- 0.1% of the final value
output response time	nominal	4 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 VDC
	channel-to-channel	200 VDC
integral linearity		+/- 0.05% of full scale typical
differential linearity		monotonic
absolute accuracy		typically 0.3% of full scale @ 25°C and 0.4% maximum of full scale
temperature drift		typically +/- 0.01% of full scale/ °C
operating temperature range**		0 to 60°C
storage temperature		-40 to 85°C

fallback mode		predefined (default)
fallback states		user-defined data value (default = 0)
		hold last value
addressing requirement	four words	two output words for data
		two input words for status
field power requirements		from a 24 VDC PDM
power protection		time-lag fuse on the PDM
*Basic NIMs do not allow you to hot swap I/O modules.		
**This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of cabalities and limitations.		
[1]Requires the Advantys configuration software		

Advantys Power Distribution Modules

4

At a Glance

Overview

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

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

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

What's in this Chapter?

This chapter contains the following sections:

4.1 STB PDT 3100 24 VDC Power Distribution Module

At a Glance

Overview

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

What's in this Section?

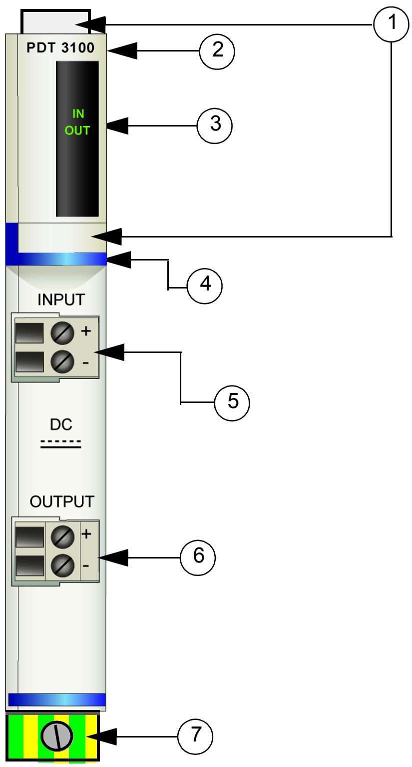
This section contains the following topics:

STB PDT 3100 Physical Description

Physical Characteristics

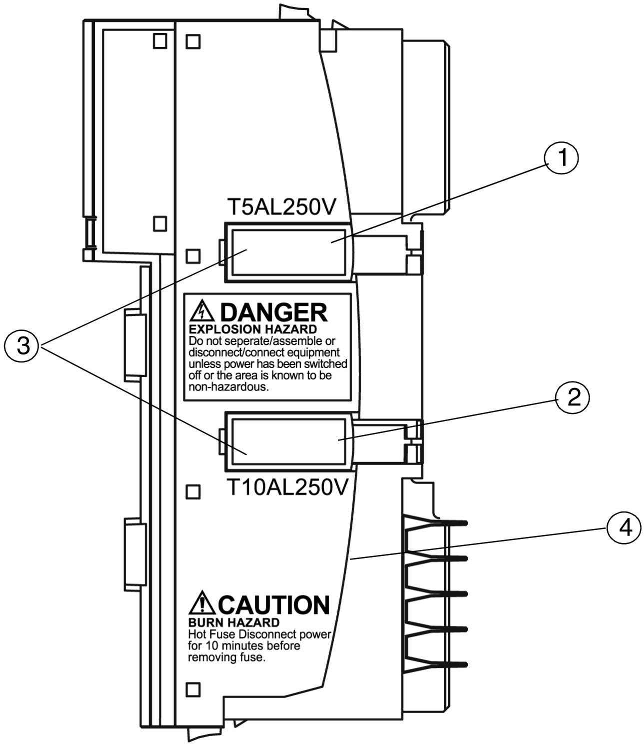
The STB PDT 3100 is a standard module that distributes field power independently over the island's sensor bus to the input modules and over the island's actuator bus to the output modules. This PDM requires two DC power inputs from an external power source. 24 VDC source power signals are brought into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

Front and Side Panel Views



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

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



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

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

The two red plastic doors house a pair of fuses:

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

The marking on the side of the module describes a simple precaution you need to take before replacing a fuse (see *p. 377*) to prevent burns:

Ordering Information

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

- one STB PDT 3100 power distribution module
- one STB XBA 2200 (see *p. 399*) PDM base
- two alternative sets of connectors:
  - two 2-terminal *screw type* connectors, keying pins included
  - two 2-terminal *spring clamp* connectors, keying pins included
- a 5 A, 250 V time-lag, low-breaking-capacity (glass) fuse to protect the input modules on the island's sensor bus
- a 10 A, 250 V time-lag, glass fuse to protect the output modules on the island's actuator bus

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

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

Additional optional accessories are also available:

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

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

Dimensions

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

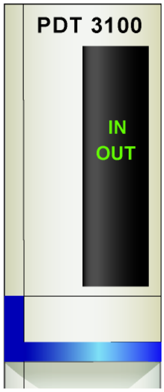
STB PDT 3100 LED Indicators

Overview

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

Location

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



Indications

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

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

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

STB PDT 3100 Source Power Wiring

Summary

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

Connectors

Use a set of either:

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

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

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

Power Wire Requirements

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

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

Safety Keying

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

Power Wiring Pinout

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

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

Source Power

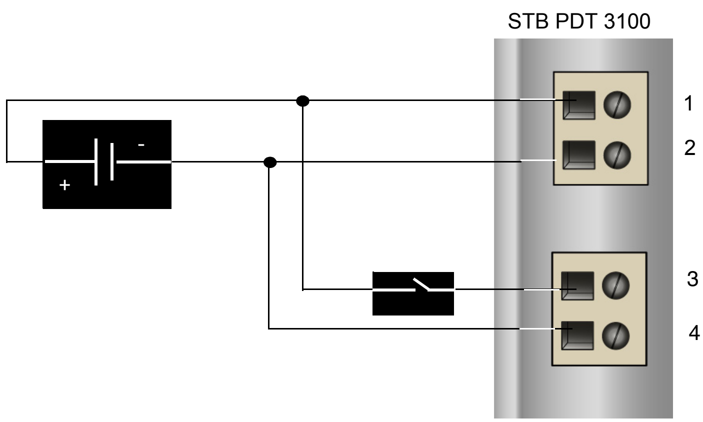
The STB PDT 3100 PDM requires source power from at least one independent, SELV-rated 19.2 ... 30 VDC power supply.

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

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

Sample Wiring Diagrams

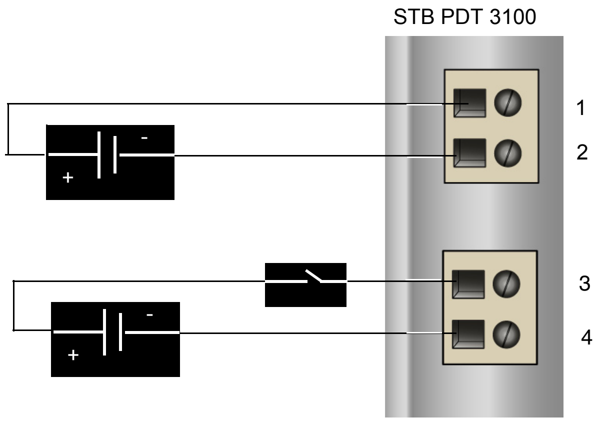
This example shows the field power connections to both the sensor bus and the actuator bus coming from a single 24 VDC SELV power supply.



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

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

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



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

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

STB PDT 3100 Field Power Over-current Protection

Fuse Requirements

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

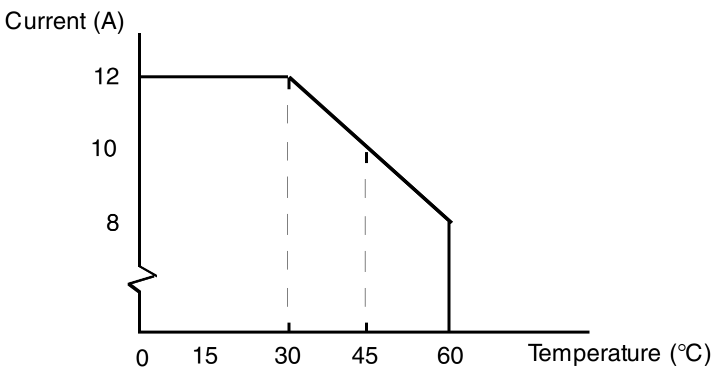
Recommended Fuses

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

Performance Considerations

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

Maximum Current (A) to Temperature (°C)



For example:

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

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

Accessing the Fuse Panels

The two panels that house the actuator bus protection fuse and the sensor bus protection fuse are located on the right side of the PDM housing (see *p. 369*). The panels are red doors with fuse holders inside them. The 5 A sensor power fuse is in the top door. The 10 A actuator power fuse is in the bottom door.

Replacing a Fuse

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

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

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

The Protective Earth Connection

PE Contact for the Island

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

How PE Contact Is Made

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

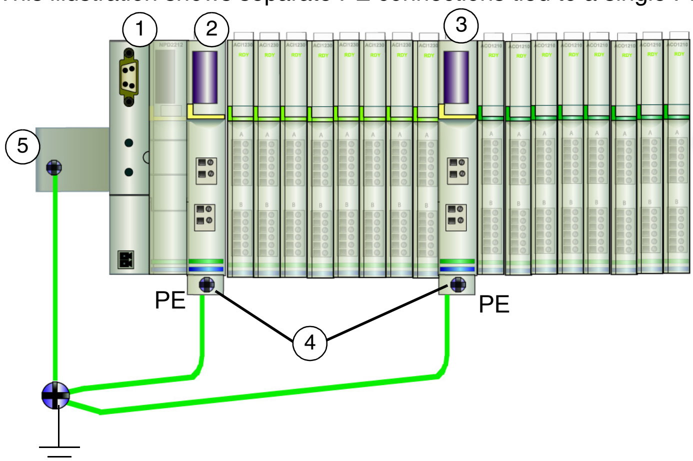
Local electrical codes take precedence over our PE wiring recommendations.

Handling Multiple PE Connections

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

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

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



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

STB PDT 3100 Specifications

Table of Technical Specifications

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

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)
storage temperature		-40 to 85°C
operating temperature range*		0 to 60°C
agency certifications		refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171*
*This product supports operation at normal and extended temperature ranges. Refer to the *Advantys STB System Planning and Installation Guide, 890 USE 171* for a complete summary of capabilities and limitations.		

4.2 STB PDT 3105 24 VDC Basic Power Distribution Module

At a Glance

Overview

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

What's in this Section?

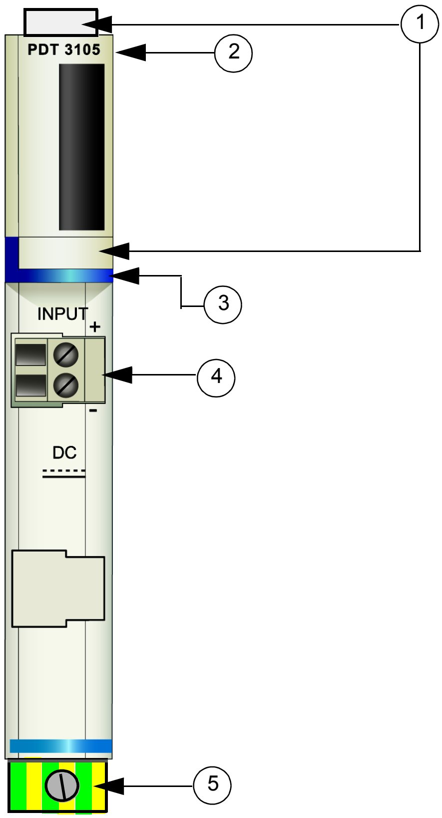
This section contains the following topics:

STB PDT 3105 Physical Description

Physical Characteristics

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

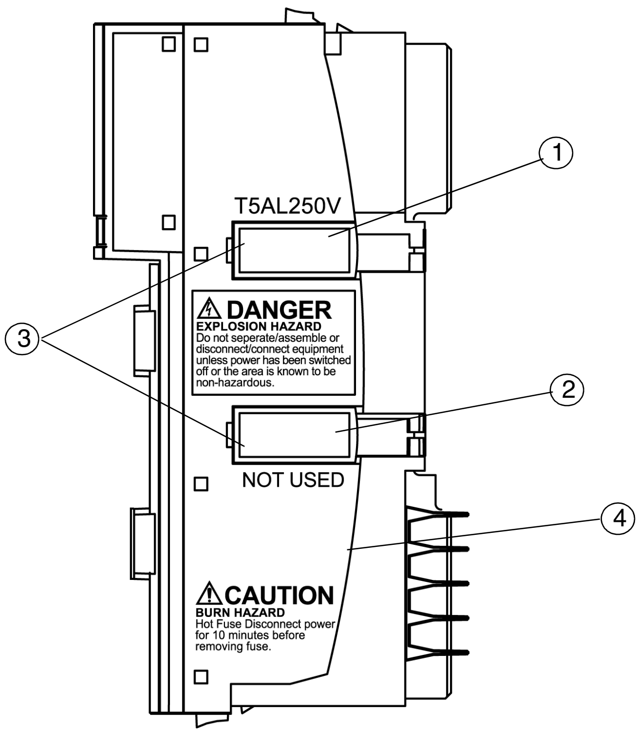
Front and Side Panel Views



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

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

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



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

The marking on the side of the module describes a simple precaution you need to take before replacing a fuse (see *p. 377*) to prevent burns:

Ordering Information

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

- one STB PDT 3105 power distribution module
- one STB XBA 2200 (see *p. 399*) PDM base
- two alternative sets of connectors:
  - one 2-terminal *screw type* connector, keying pins included
  - one 2-terminal *spring clamp* connector, keying pins included
- a 5 A, 250 V time-lag, low-breaking-capacity (glass) fuse to protect the input and output modules

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

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

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

Additional optional accessories are also available:

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

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

Dimensions

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

STB PDT 3105 Source Power Wiring

Summary

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

Connectors

Use either:

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

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

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

Power Wire Requirements

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

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

Safety Keying

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

Power Wiring Pinout

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

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

Source Power

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

Sample Wiring Diagrams

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

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

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

STB PDT 3105 Field Power Over-current Protection

Fuse Requirements

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

Recommended Fuses

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

Performance Considerations

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

Accessing the Fuse Panels

Two panels are located on the right side of the PDM housing (see *p. 381*). The top panel houses the active protection fuse and the other is not used. The top panel has a fuse holder inside it.

Replacing a Fuse

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

⚠ CAUTION

BURN HAZARD - HOT FUSE

Disconnect power for 10 minutes before removing fuse.

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

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

STB PDT 3105 Protective Earth Connection

PE Contact for the Island Bus

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

How PE Contact Is Made

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

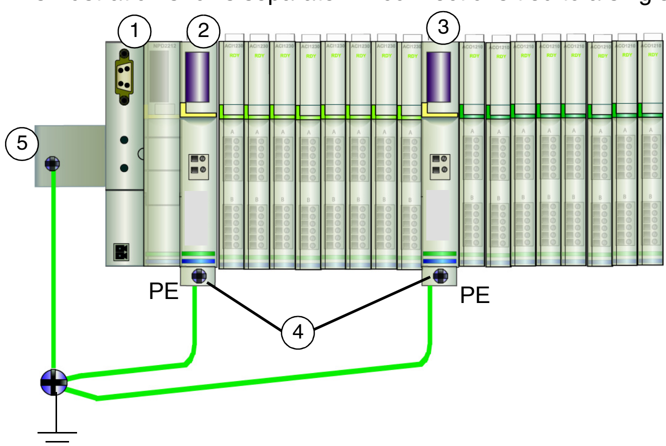
Local electrical codes take precedence over our PE wiring recommendations.

Handling Multiple PE Connections

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

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

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



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

STB PDT 3105 Specifications

Table of Technical Specifications

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

STB Module Bases

5

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 *p. 391*)	13.9 mm (0.58 in)	size 1 Advantys input and output modules
STB XBA 2000 (see *p. 395*)	18.4 mm (0.72 in)	size 2 Advantys input and output modules and the STB XBE 2100 CANopen extension module
STB XBA 2200 (see *p. 399*)	18.4 mm (0.72 in)	All Advantys PDM modules
STB XBA 2300	18.4 mm (0.72 in)	STB XBE 1200 BOS island bus extension modules
STB XBA 2400	18.4 mm (0.72 in)	STB XBE 1000 EOS island bus extension modules
STB XBA 3000	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

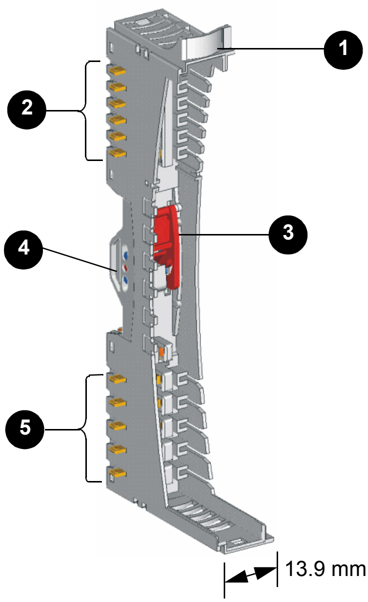
Summary

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

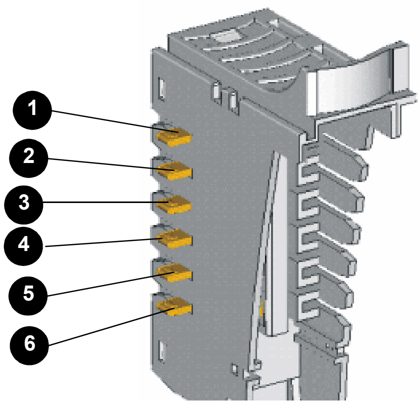
The Label Tab

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:



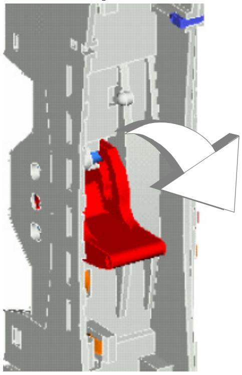
In the primary segment of the island bus, the signals that make these contacts come from the NIM. In extension segments, these signals come from an STB XBE 1000 BOS extension module:

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.

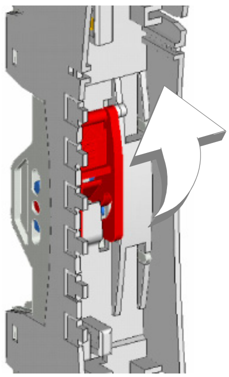
The Lock/ Release Latch

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.

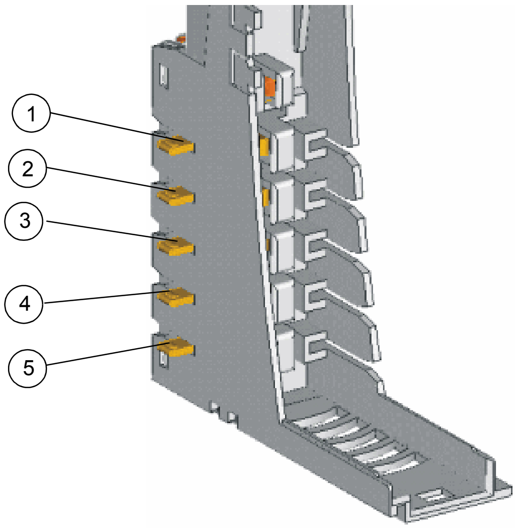
The DIN Rail Contacts

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 *p. 403*) 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:

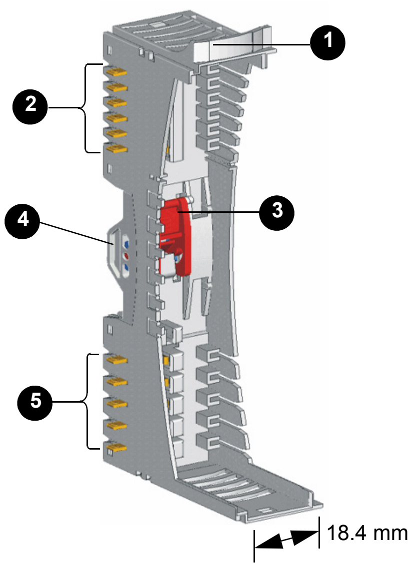
- logic power from the NIM or from a BOS module
- sensor power (for inputs) or actuator power (for outputs) from the PDM

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

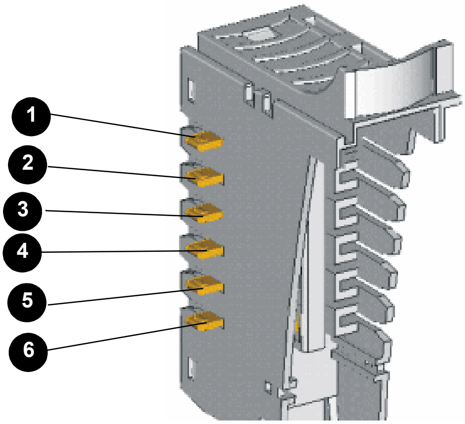
The Label Tab

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:



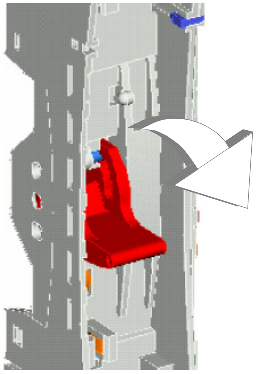
In the primary segment of the island bus, the signals that make these contacts come from the NIM. In extension segments, these signals come from an STB XBE 1000 BOS extension module:

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.

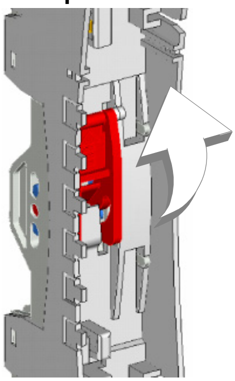
The Lock/ Release Latch

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.

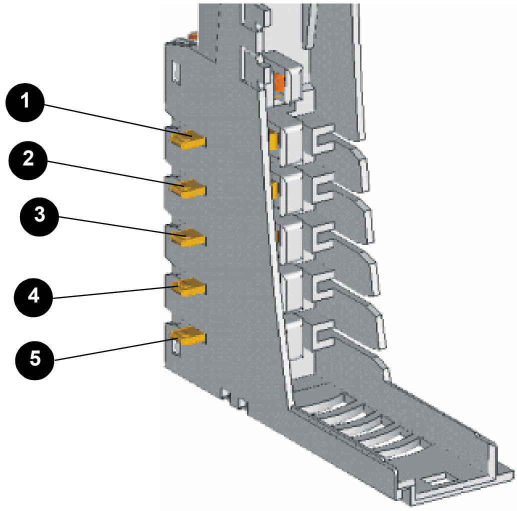
The DIN Rail Contacts

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 *p. 403*) 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 2200 PDM Base

Summary

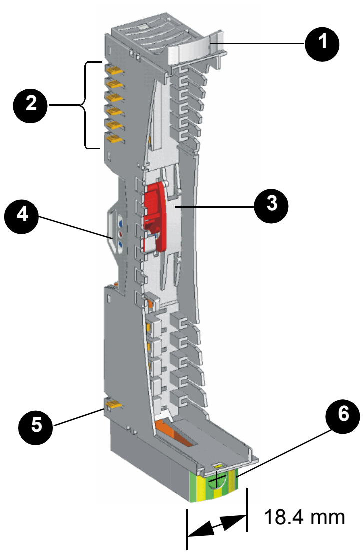
The STB XBA 2200 PDM base is 18.4 mm (0.72 in) wide. It is the mounting connection for any PDM(s) on the island bus. It allows you to easily remove and replace the module from the island for maintenance. It also enables the PDM to distribute sensor bus power to input modules and actuator power to output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

A plastic block at the bottom of the base houses a PE captive screw (see *p. 403*), which should be used to make protective earth connections for the island. This captive screw block gives the PDM an added height dimension of 138 mm (5.44 in). As a result, the PDMs are always the tallest Advantys modules in an island segment.

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

Physical Overview

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



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

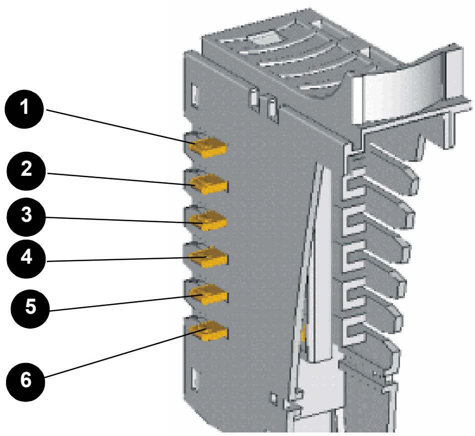
The Label Tab

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

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

The Island Bus Contacts

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



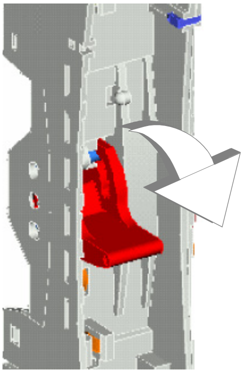
1 not used
2 common ground contact
3 5 VDC logic power contact
4 island bus communications + contact
5 island bus communications - contact
6 address line contact

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

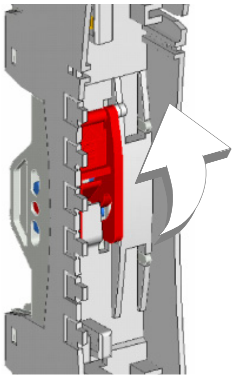
The Lock/ Release Latch

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

Release position



Lock position



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

The DIN Rail Contacts

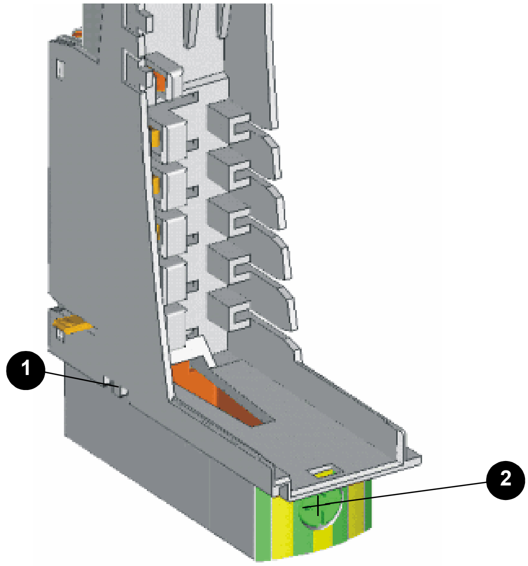
One of the roles of the DIN rail is to provide the island with functional earth. Functional earth provides the island with noise immunity control and RFI/EMI protection.

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

Protective Earth

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

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



1 The PE contact
2 The PE captive screw

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

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

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

The Protective Earth Connection

PE Contact for the Island

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

How PE Contact Is Made

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

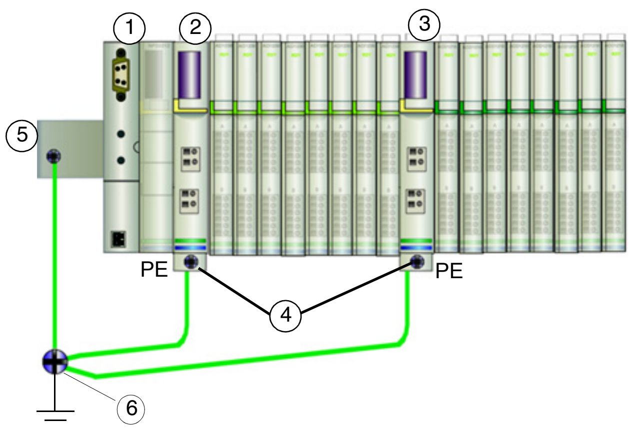
Local electrical codes take precedence over our PE wiring recommendations.

Handling Multiple PE Connections

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

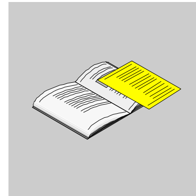
> **Note:** Tie the PE lines from more than one PDM to a single PE ground point in a star configuration. This will minimize ground loops and excessive current from being created in PE lines.

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



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

Appendices



Overview

IEC Symbols

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

What's in this Appendix?

The appendix contains the following chapters:

IEC Symbols

A

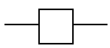
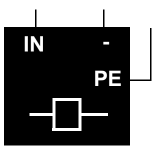
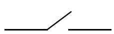
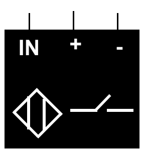
IEC Symbols

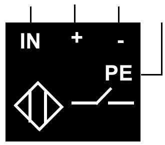
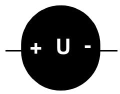
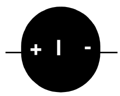
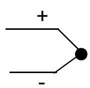
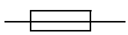
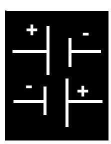
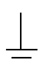
Introduction

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

List of Symbols

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

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

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

Glossary

!

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

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

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

A

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

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

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

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

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

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

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

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

B

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

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

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

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

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

bus arbitrator A master on a Fipio network.

C

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

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

CI This abbreviation stands for command interface.

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

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

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

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

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

D

DDXML Device Description eXtensible Markup Language

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

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

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

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

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

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

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

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

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

E

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

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

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

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

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

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

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

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

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

F

fallback state A known state to which an Advantys STB I/O module can return in the event that its communication connection fails.

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

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

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

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

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

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

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

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

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

G

gateway A program or hardware that passes data between networks.

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

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

H

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

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

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

I

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

IOS object *Island operation status object*. A special object that appears in the CANopen object dictionary when the remote virtual placeholder option is enabled in a CANopen NIM. It is a 16-bit word that reports the success of reconfiguration and start requests or records errors in the event that a request fails.

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

IP Rating Ingress Protection rating according to IEC 60529.
IP20 modules are protected against ingress and contact of objects larger than 12.5 mm. The module is not protected against harmful ingress of water.
IP67 modules are completely protected against ingress of dust and contact. Ingress of water in harmful quantity is not possible when the enclosure is immersed in water up to 1 m.

L

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

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

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

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

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

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

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

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

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

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

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

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

NEMA *National Electrical Manufacturers Association*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

size 1 base A mounting device, designed to seat an STB module, hang it on a DIN rail, and connect it to the Island bus. It is 13.9 mm (0.55 in.) wide and 128.25 mm (5.05 in.) high.

size 2 base A mounting device, designed to seat an STB module, hang it on a DIN rail, and connect it to the Island bus. It is 18.4 mm (0.73 in.) wide and 128.25 mm (5.05 in.) high.

size 3 base A mounting device, designed to seat an STB module, hang it on a DIN rail, and connect it to the Island bus. It is 28.1 mm (1.11 in.) wide and 128.25 mm (5.05 in.) high.

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

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

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

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

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

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

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

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

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

stepper motor A specialized DC motor that allows discrete positioning without feedback.

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

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

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.

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).

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

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

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

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

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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