Analog Output Module, 13-Bit, 8 or 12 Channels

Product Description

Analog output modules IC200ALG325 and BXIOAO8210 provide eight analog voltage outputs. Analog output modules IC200ALG327and BXIOAO12210 provide twelve analog voltage outputs. The output range for these modules can be either –10VDC to +10VDC (bipolar) or 0V to +10VDC (unipolar).

Analog output module IC200ALG326 provides eight 4mA to 20mA analog current-sourcing outputs. Analog output module IC200ALG328 provides twelve 4mA to 20mA analog current-sourcing outputs. Including a modest amount of overrange current, approximately 20.38mA of output current per channel is available to drive output loads.
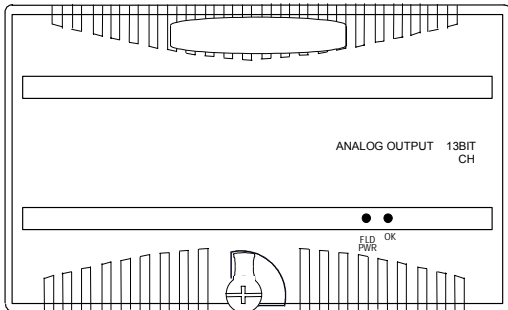
An external power supply is required for the outputs.

Intelligent processing for this module is performed by the CPU or Network Interface Unit.

LED Indicators

The green FLD PWR LED indicates the presence of user-side power for the analog field-side circuits.

The green OK LED is on when backplane power is present to the module.

Diagnostics

The module reports a Loss of User Side Power fault for field-side circuits.

Configuration Parameters

The module has a default output range, but is easily set up with a jumper to change the output range.

The module is also easily set up with a jumper for the outputs to either hold their last states or default if backplane power or communications are interrupted or the PLC is stopped. External user power must remain uninterrupted.

Outputs remain in their default or last state until the module receives different output data from the backplane, or until field power is removed.

Preinstallation Check

Carefully inspect all shipping containers for damage. If any equipment is damaged, notify the delivery service immediately. Save the damaged shipping container for inspection by the delivery service. After unpacking the equipment, record all serial numbers. Save the shipping containers and packing material in case it is necessary to transport or ship any part of the system

Module Characteristics

Channels	IC200ALG325, BXIOAO8210, IC200ALG326: 8 single ended, one group
	IC200ALG327, BXIOAO12210, IC200ALG328: 12 single-ended, one group
Module ID	IC200ALG325 / BXIOAO8210: FFFF9080 IC200ALG326: FFFF9480 IC200ALG327, BXIOAO12210: FFFF90C0 IC200ALG328: FFFF94C0
Isolation:	User input to logic (optical) and to frame ground: 250VAC continuous; 1500VAC for 1 minute Group to group: Not applicable Channel to channel: None
LED indicators	FLD PWR LED indicates field power is present OK LED indicates backplane power is present
Backplane current consumption	5V output: 50mA max.
Thermal derating	IC200ALG328 only: see diagram. Other modules, no derating.
Configuration parameters	Range, output default
Diagnostics	Loss of User Side Power

External Power Supply

IC200ALG325, BXIOAO8210	Range: +10 to +30VDC including ripple
	Current consumption: 102mA maximum
IC200ALG326	Range: +18 to +30VDC
	Current consumption: 2A inrush maximum, 100mA maximum (no load) 185mA maximum (all 8 outputs at full scale)
IC200ALG327, BXIOAO12210	Range: +18 to +30VDC including ripple
	Current consumption: 112mA maximum
IC200ALG328	Range: +18 to +30VDC
	Current consumption: 2A inrush maximum, 100mA maximum (no load) 270mA maximum (all 12 outputs at full scale)

Output Characteristics

Output voltage for IC200ALG325, BXIOAO8210, IC200ALG327, BXIOAO12210	-10.24 to +10.24VDC (bipolar range) 0 to +10.24VDC (unipolar range)
Output current for IC200ALG326, IC200ALG328	4 to 20mA (default) 0 to 20mA (configured with jumper)
Load characteristics for IC200ALG325, BXIOAO8210, IC200ALG327, BXIOAO12210	Resistive: 5000 Ohms minimum Capacitive: 1.0μF maximum
Load characteristics for IC200ALG326, IC200ALG328	Resistive: 0 to 800 Ohms maximum* Capacitive: 1.0μF maximum Inductive: 0.5H maximum
Accuracy at 25 degrees C** 0 to 60 degrees C	+/-0.3% typical of full scale, +/-0.5% maximum of full scale +/-1% maximum of full scale
Resolution	IC200ALG325, BXIOAO8210, IC200ALG327, BXIOAO12210: 1.25mV = 4 counts
	IC200ALG326, IC200ALG328: 4-20 mA: 5 counts = 2.5 μA (~12.7 bits) 0-20 mA: 4 counts = 2.5 μA (13 bits)
Update rate per module	IC200ALG325, BXIOAO8210: 10 mSec maximum
	IC200ALG326, IC200ALG327, BXIOAO12210: 15 mSec maximum
Channel-to-channel crosstalk rejection	70dB minimum
Output default	Configurable

* $R_{L(MAX)}$ = ($V_{FIELD\ PS}$ – 4V) / 20.38mA

**   In the presence of severe RF interference, (IEC 1000-4-3, 10V/m), accuracy may be degraded an additional +/-1%.

Field Wiring Terminals

Terminal assignments for the module are shown below.

Number	Connection	Number	Connection
A1	Shield Termination Point	B1	JMP 1 (Range)
A2	OUT AQ5	B2	Jumper (1-2) RTN
A3	RET (5-6)	B3	JMP 2 (Hold)
A4	OUT AQ6	B4	Shield Termination Point
A5	Shield Termination Point	B5	OUT AQ1
A6	OUT AQ7	B6	RTN (1-2)
A7	RTN (7-8)	B7	OUT AQ2
A8	OUT AQ8	B8	Shield Termination Point
A9	Shield Termination Point	B9	OUT AQ3
A10	* OUT AQ9	B10	RTN (3-4)
A11	* RTN (9-10)	B11	OUT AQ4
A12	* OUT AQ10	B12	Shield Termination Point
A13	* Shield Termination Point	B13	Shield Termination Point
A14	* OUT AQ11	B14	No connection
A15	* RTN (11-12)	B15	No connection
A16	* OUT AQ12	B16	No connection
A17	Shield Termination Point	B17	Field Return
A18	Shield Termination Point	B18	Field Power

* Connections for modules IC200ALG327, IC200ALG328, or BXIOAI12210 only.

Wiring Connections for Carriers with Two Rows of Terminals

The diagram below shows wiring connections for this module when installed on a carrier with two rows of terminals. Terminal A10 to A16 connections shown below are for modules IC200ALG327, IC200ALG328, or BXIOAO12210 only.
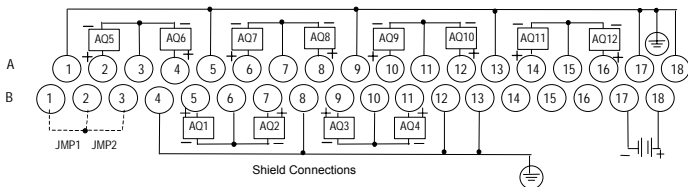
Wiring Connections for Carriers with Three Rows of Terminals

The next diagram shows wiring connections for this module when installed on a carrier with three rows of terminals. Terminal A10 to A16 connections shown below are for module IC200ALG327, IC200ALG328, or BXIOAO12210 only.
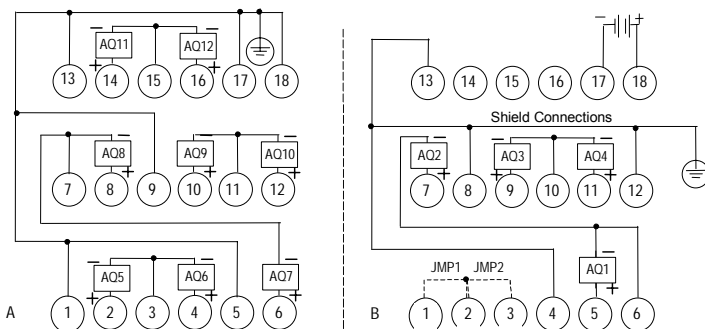
Jumper Selection

Jumpers on the carrier can be used to select the output range and output default mode.

Range Jumper

If no jumper is installed on pins B1 and B2, outputs are configured for their default range. Installing a jumper changes the range as shown below. This should only be done with field power and backplane power removed. The corresponding parameter in the module configuration must be adjusted accordingly.

Range Jumper	Range for IC200ALG325, BXIOAO8210, IC200ALG327, BXIOAO12210	Range for IC200ALG326, IC200ALG328
None	-10V to +10V	4mA to 20mA
JMP1	0V to +10V	0mA to 20mA

Hold Jumper

If no jumper is installed on pins B2 and B3, outputs hold their last state (the last commanded value from the backplane) if backplane power or communications are interrupted or the PLC is stopped. With a jumper installed, outputs default as shown below. This should only be changed with the field power and backplane power removed.

Hold Jumper	Default for IC200ALG325, BXIOAO8210, IC200ALG327, BXIOAO12210	Default for IC200ALG326, IC200ALG328
None	Hold Last State	Hold Last State
JMP2	0V	0 or 4mA

For current modules only, the Default Low End of Range value can be either 4mA or 0mA. The default depends on the PLC status, output current range selected, and whether the module is controlled by a PLC CPU or a Network Interface Unit (NIU) module. In some cases, the module will output 0mA instead of 4mA, even when configured for the 4-20mA range as shown in the following chart.
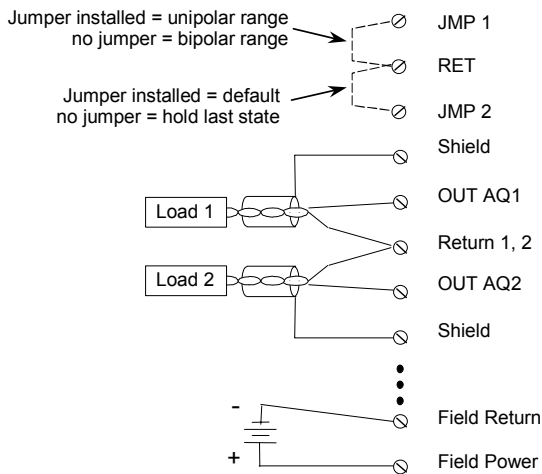
Status	Default to Low End of Range		Hold Last State (HLS)	
	0-20mA	4-20mA	0-20mA	4-20mA
Module is in PLC CPU Rack				
Run to Stop	0mA	0mA	HLS	HLS
Loss of Field Power	0mA	0mA	0mA	0mA
Loss of Backplane Power	0mA	0mA	HLS	HLS
Loss of Communication	N/A	N/A	N/A	N/A
Loss of Module	0mA	0mA	0mA	0mA
Loss of CPU/NIU Power	0mA	0mA	HLS	HLS
Module is in NIU Rack				
Run to Stop	0mA	4mA	HLS	HLS
Loss of Field Power	0mA	0mA	0mA	0mA
Loss of Backplane Power	0mA	0mA	HLS	HLS
Loss of Communication	0mA	4mA	HLS	HLS
Loss of Module	0mA	0mA	0mA	0mA
Loss of CPU/NIU Power	0mA	0mA	HLS	HLS

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Wiring Example

Jumper installed = unipolar range
no jumper = bipolar range → JMP 1

RET

Jumper installed = default
no jumper = hold last state → JMP 2

Shield

OUT AQ1

Load 1

Return 1, 2

Load 2

OUT AQ2

Shield

-

Field Return

+

Field Power

Cable Shield Connections

Shielded twisted pair cable is recommended for all of the analog channel connections.

If the module is installed on a Terminal-style I/O Carrier (IC200CHS001, 002, or 005) or a Compact Terminal-style I/O Carrier (IC200CHS022, 025), the cable shield can be connected directly to the carrier per the Field Wiring Table. An Auxiliary I/O Terminal Strip (IC200TBM001, 002, or 005) can also be added to the Terminal-style I/O Carriers to aid in grounding shields. Be sure to ground the Auxiliary I/O Terminal Strip as well if you plan to use it for this purpose.

If the module is installed on a Connector-style I/O Carrier (IC200CHS003), the cable shield can be connected directly to an Interposing Terminal (IC200CHS011, 012, 015). Be sure to ground the Interposing Terminal. It is recommended to use a shielded interposing cable as well between the Interposing Terminal and the Connector Base. A custom shielded cable can be made using the Connector kit (IC200ACC304). In addition, a custom shield braid can be wrapped around standard Interposing Cables (IC200CBL105, 110, 120, 230). If this approach is used be sure to ground the braid.

All cable shield connections should be connected to earth ground and be kept as short as practical. The power cable does not need to be shielded.

Operating Note

If hot insertion of a module is done improperly, the operation of other modules on the same backplane may be disrupted. See *Installing a Module on a Carrier* in the *VersaMax Modules Manual,* GFK-1504.

## Installation in Hazardous Locations

- EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C & D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY

- WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;

- WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES; AND

- WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

Scaling for Voltage Outputs

The charts below show analog scaling for modules IC200ALG325, BXIOAO8210, IC200ALG327, BXIOAO12210.

Count vs Output Voltage, Unipolar

The graph below shows the relationship between the output voltage measured at the field terminals and the data that is output by the module, when outputs are set up for the **unipolar range.**
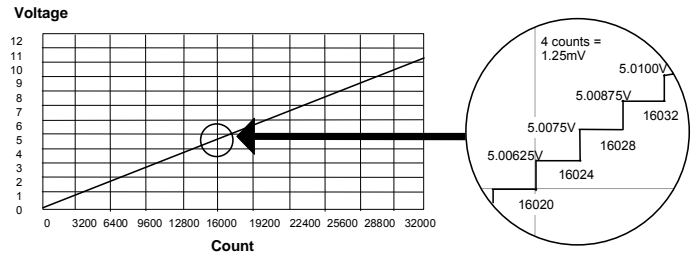
Voltage can be calculated using the following equation:

$$V_{out} = ((\text{analog counts} \times 10.24) / 32768)$$

The count value <u>must be a multiple of 4</u>. If the module receives a count value that is not a multiple of 4, it rounds the value down to the closest multiple of 4. For example:

Count	Voltage
16024	5.0075V
16026	5.0075V
16028	5.00875V

Count vs Output Voltage, Bipolar

The graph below shows the relationship between the output voltage measured at the field terminals and the data that is output by the module, when outputs are set up for the **bipolar range.**
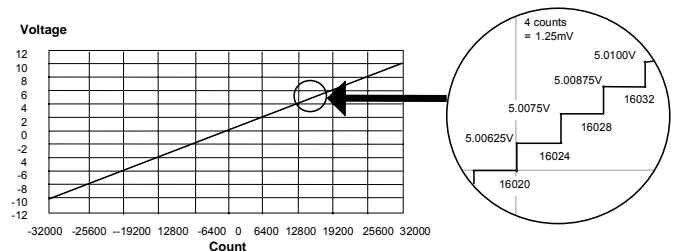
Voltage can be calculated using the following equation:

$$V_{out} = ((\text{analog counts} \times 20.48) / 65536)$$

The count value <u>must be a multiple of 4</u>. If the module receives a count value that is not a multiple of 4, it rounds the value down to the closest multiple of 4. For example:

Count	Voltage
16024	5.0075V
16026	5.0075V
16028	5.00875V

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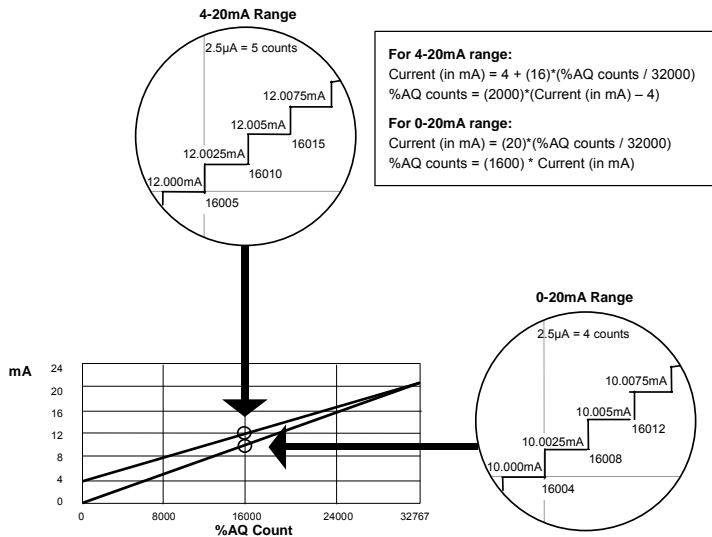## Scaling for Current Outputs

The diagrams below show scaling for analog outputs of modules IC200ALG326 and IC200ALG328.

In 0-20mA range mode, a current output signal value of 0mA corresponds to a %AQ value of 0 counts, and 20mA corresponds to a %AQ value of +32,000 counts. In 4-20mA range mode, a value of 0 %AQ counts corresponds to an output current of 4mA and a value of +32,000 %AQ counts corresponds to an output current of 20mA. If the module is installed in a PLC rack, it converts negative value commands to 0 mA regardless of range selected. If the module is controlled by a Network Interface Unit (NIU), it converts any negative value commands to the low end of range.

The illustration below shows the relationship between output signal strength and commanded %AQ counts. It depicts the step change in output current level for various command values. Not every command value results in a change in the output current level due to the module's resolution.

4-20mA Range

2.5µA = 5 counts

12.0075mA
12.005mA   16015
12.0025mA
12.000mA   16010
                  16005

For 4-20mA range:
Current (in mA) = 4 + (16)*(%AQ counts / 32000)
%AQ counts = (2000)*(Current (in mA) – 4)

For 0-20mA range:
Current (in mA) = (20)*(%AQ counts / 32000)
%AQ counts = (1600) * Current (in mA)

0-20mA Range

2.5µA = 4 counts

10.0075mA
10.005mA
                  16012
10.0025mA
10.000mA   16008
                  16004

4-20 mA Range Step Change Example

Count	Current
16000	12.0000 mA
16005	12.0025 mA
16008	12.0025 mA
16009	12.0025 mA
16010	12.0050 mA

Compatibility

This module is compatible with:

- PLC CPU firmware version 2.1 or later.
- VersaPro software version 2.0 or later.
- Ethernet NIU EBI001 firmware version 1.10 or later
- Genius NIU GBI001: firmware version 2.20 or later.
- Profibus NIU PBI001: firmware version 2.20 or later.
- DeviceNet NIU DBI001: not supported.

Product Version Information

Rev	Date	Description
IC200ALG325E BXIOAO8210E IC200ALG326E IC200ALG327E BXIOAO12210E IC200ALG328E	October 2008	Updated Power Supply OK signal circuitry.
IC200ALG325D BXIOAO8210D IC200ALG326D IC200ALG327D BXIOAO12210D IC200ALG328D	April 2005	Improvement to latching mechanism
IC200ALG325C IC200ALG326C IC200ALG327C IC200ALG328C	April 2004	Changed to V0 plastic for module housing.
IC200ALG325B IC200ALG326B IC200ALG327B IC200ALG328B	January 2004	ATEX approval for Group 2 Category 3 applications.
BXIOAO8210C BXIOAO12210C	January 2004	ATEX approval for Group 2 Category 3 applications. Changed to V0 plastic for module housing.
IC200ALG325A BXIOAO8210A IC200ALG326A IC200ALG327A BXIOAO12210A IC200ALG328A	April 2001	Initial product release

Thermal Derating: IC200ALG328

Of the modules covered in this document, only module IC200ALG328 has a thermal derating.

For module IC200ALG328, the number of channels that can be active at the same time depends on the ambient temperature, the external voltage, and the orientation of the module and DIN rail.

There is no thermal derating for this module at 24V. The chart below shows thermal deratings for this module, on certain carriers, at 30VDC with the module and DIN rail in the orientations shown. There is no derating at 30V in other orientation and carrier combinations.
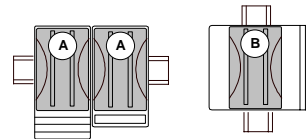
inactive channels should be distributed evenly across the total number of outputs. For example, the "A" orientation graph below reflects the derating with channels 1, 5, and 9 inactive.