

	<a href="http://www.basler.com">www.basler.com</a> +1 618.654.2341 (USA) <a href="mailto:info@basler.com">info@basler.com</a>	Model	<b>AIOM-2</b>
		Description	<b>Analog I/O Module</b>

## Introduction

The AIOM-2 Analog I/O Module provides an additional four analog inputs, two resistance temperature detector (RTD) inputs, and eight analog outputs to an ECS2100 or DECS-2100 digital excitation control system. AIOM-2 analog inputs and outputs interface with external devices such as meters, RTDs, transducers, chart recorders, distributed control systems (DCS) and programmable logic controllers (PLC). An ECM/SIM or ECM-2 excitation control module polls each AIOM-2 for input status and controls AIOM-2 outputs through a fiber optic link. Up to two AIOM-2 modules can be connected in daisy chain configuration to provide a total of eight analog inputs, four RTD inputs, and sixteen analog outputs.

The metal enclosure of the AIOM-2 offers electric shock protection from incidental contact. An identical footprint and functional compatibility make for simple replacement of an AIOM with the AIOM-2.

## Specifications

### Power Supply Requirements

Voltage: +24 Vdc nominal (17–36 Vdc)  
Current: 0.5 Adc maximum

#### Pin Assignments

PS1: 21 (+), 22 (–), 23 (GND)  
PS2: 24 (+), 25 (–), 26 (GND)

### Analog Inputs

Inputs: 4  
Range: ±10 Vdc or 4 to 20 mAdc (switch selectable, see *Voltage/Current Input Mode Switch*)

#### Pin Assignments

CH1: 1 (V+), 2 (–), 3 (I+)  
CH2: 4 (V+), 5 (–), 6 (I+)  
CH3: 7 (V+), 8 (–), 9 (I+)  
CH4: 10 (V+), 11 (–), 12 (I+)

### Resistance Temperature Detector (RTD)

Type: 100 Ω platinum, 2- or 3-wire  
Monitoring Range: –15 to 235°C (5 to 455°F)

#### Pin Assignments

RTD1: 13 (C), 14 (+), 15 (–), 16 (GND)  
RTD2: 17 (C), 18 (+), 19 (–), 20 (GND)

### Analog Outputs

Outputs: 8  
Range: ±10 Vdc or 4 to 20 mAdc

#### Pin Assignments

OUT 1:	33 (+), 34 (–)	OUT 7:	40 (+), 41 (–)
OUT 2:	31 (+), 32 (–)	OUT 8:	38 (+), 39 (–)
OUT 3:	29 (+), 30 (–)		
OUT 4:	27 (+), 28 (–)		
OUT 5:	44 (+), 45 (–)		
OUT 6:	42 (+), 43 (–)		

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## Communication Interface

Type:	Fiber optic link
Connectors:	
Main:	F1 (TX), F2 (RX), F3 (CLK)
Redundant:	F4 (TX), F5 (RX), F6 (CLK)
AIOM:	F8 (TX), F7 (RX), F9 (CLK)

## CE and UKCA Compliance

This product has been evaluated and complies with the relevant essential requirements set forth by the EU legislation and UK Parliament as part of a system, not as a stand-alone device.

### EC Directives

- Low Voltage Directive (LVD) 2014/35/EU
- Electromagnetic Compatibility (EMC) 2014/30/EU
- Hazardous Substances (RoHS2) 2011/65/EU

### Harmonized Standards used for Evaluation

- IEC 62103:2003 (pertinent EMC sections)
- EN 62477-1:2012
- EN 61000-6-2:2005
- EN 61000-6-4:2007; with AMD 1:2011
- EN 50581:2012, Ed 12

## Environment

### Temperature

Operating:	−40 to 60°C (−40 to 140°F)
Storage:	−40 to 65°C (−40 to 149°F)
Ingress Protection Class:	IP20
Humidity:	0 to 95%, non-condensing

### Physical

Weight:	1.6 lb (0.7 kg)
Size (WxHxD):	5.82 x 6.81 x 2.82 inches (147.9 x 173 x 71.6 mm)

## FCC Requirements

This product complies with FCC 47 CFR Part 15.

## Installation

The AIOM-2 is typically preinstalled in the excitation control system. If replacement is necessary, carefully label and document each of the connections to the AIOM-2 in order to properly reconnect the new module. AIOM-2 connectors and indicators are illustrated in Figure 1. Locator letters in Figure 1 correspond to the lettered descriptions in Table 1. The AIOM-2 must be monitored and adjusted to fit the specific application at initial startup, whether it is a new unit or a replacement.

## AIOM-2 Connections

AIOM-2 connections consist of screw terminal connectors and fiber optic connectors.

### Screw Terminal Connectors

Connectors with screw-down compression terminals are used for the analog inputs, analog outputs, channel selection input, RTD inputs, and operating power inputs. The connectors, and the headers that they plug into, have a dovetailed edge that ensures proper connector orientation. Similar-sized connectors and headers are uniquely keyed to ensure that a connector mates only with the correct header to prevent damage to the AIOM-2. However, care must still be taken to ensure that the proper connector is inserted into the appropriate header. Connector screw terminals accept a maximum wire size of 12 AWG. The maximum screw torque is 5.3 in-lb or 0.6 N•m.

### Fiber Optic Connectors

Fiber optic connectors exchange an isolated, digital signal with the ECM-2 or ECM/SIM.

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## Retrofit Compatibility Mode Switch

The AIOM-2 module's four-position DIP switch, labeled I/O Mode, configures the AIOM-2 to operate as an AIOM. In this mode, only analog inputs 1 and 2, RTD input 1, and analog outputs 1 through 4 are enabled. This allows an AIOM-2 to directly replace an AIOM in a daisy chain of up to four AIOM modules communicating with an ECM-2 or up to three AIOM modules communicating with an ECM/SIM.

When any one switch is in the up position, the AIOM 2 operates normally. When all four switches are in the down position, the AIOM-2 operates as an AIOM.

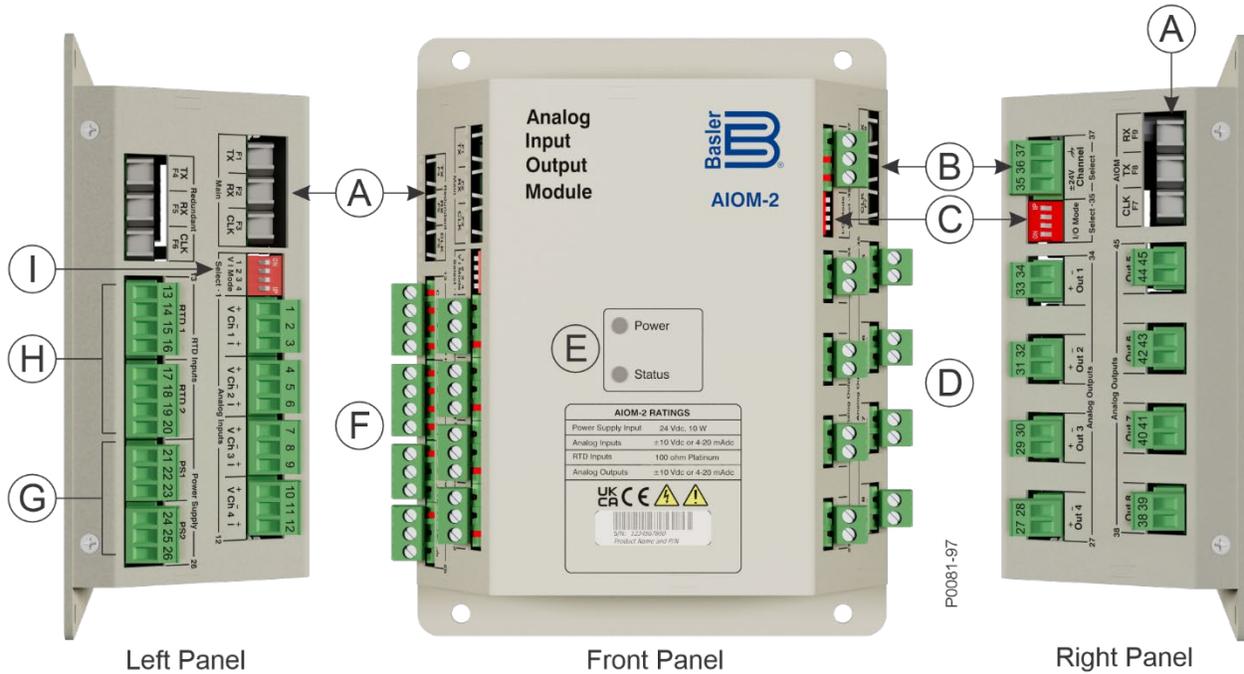


Figure 1. AIOM-2 Connectors and Indicators

Table 1. AIOM-2 Connector and Indicator Descriptions

Locator	Description
A	Fiber optic communication connectors. F1, F2, and F3 connect to the main channel ECM/SIM or ECM-2. F4, F5, and F6 connect to the redundant channel ECM/SIM or ECM-2. F7, F8, and F9 connect to a second AIOM-2.
B	Channel Select connector. Apply 0 or +24 Vdc for main channel control and -24 Vdc for redundant channel control.
C	I/O Mode switch. Configures retrofit compatibility mode. Any one switch in the up position sets normal AIOM-2 operation. All switches in the down position, sets AIOM operation (only inputs 1 and 2, RTD 1, and outputs 1 through 4 are enabled).
D	Analog output connectors. OUT 1 through OUT 8 supply $\pm 10$ Vdc or 4 to 20 mAdc.
E	Power and Status LED indicators. See <i>Monitoring</i> for more information.
F	Analog input connectors. CH1 through CH4 accept $\pm 10$ Vdc or 4 to 20 mAdc.
G	Power supply connectors. PS1 and PS2 accept +24 Vdc (17 to 36 Vdc)
H	RTD connectors. RTD1 and RTD2 accept 2-wire or 3-wire platinum 100 $\Omega$ RTDs.
I	V/I Mode switch. Configures voltage or current operation mode for the analog inputs.

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## Operation

The ECM or ECM-2 polls each AIOM-2 for the status of the four analog inputs and two RTD inputs and updates the status of the eight analog outputs.

Digital data is exchanged between the AIOM-2 modules and the ECM/SIM or ECM-2 over a fiber optic link which provides isolation and electrical noise mitigation. Each AIOM-2 creates a serial stream of data that consists of the binary status of the AIOM 2 module's inputs and the data retrieved from a downstream AIOM 2. The AIOM-2 extracts the data for its outputs and passes the remaining output data from the ECM or ECM-2 to the next AIOM-2 downstream.

A maximum of two AIOM-2 modules can be connected to an ECM/SIM or ECM-2 in daisy chain configuration using a bidirectional fiber optic link. See Figure 2 for AIOM 2 fiber optic connections. If two AIOM-2 modules are connected to an ECM/SIM control channel, only analog inputs 1 and 2, RTD input 1, and analog outputs 1 through 4 are enabled on the second AIOM-2.

The AIOM-2 communicates with main and redundant channel ECMs or ECM-2s. This saves space by requiring only one AIOM-2 (or pair of AIOM 2s) to accommodate both channels.

See Channel Selection Input below for details on main and redundant channel communication.

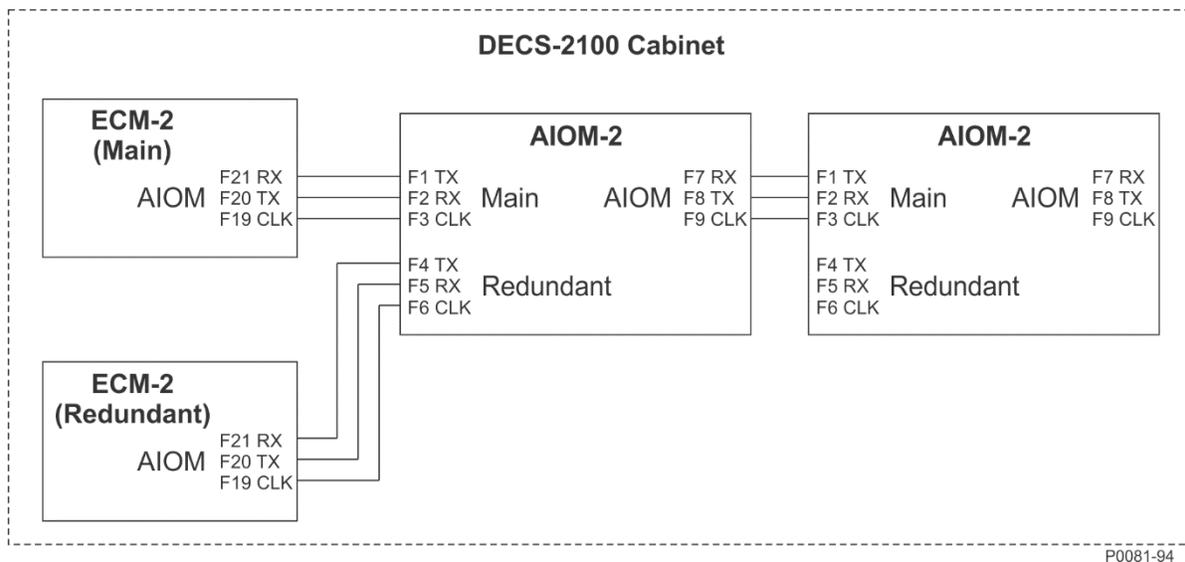


Figure 2. AIOM-2 Fiber Optic Connections

### Analog and RTD Inputs

The AIOM-2 has the capability to sense four analog inputs and two RTDs. These inputs are sampled simultaneously by stereo analog-to-digital converters with 16-bit resolution. Each input is isolated at 500 Vac from the power supply and the analog outputs.

The analog inputs may be switch configured to sense either  $\pm 10$  Vdc or 4 to 20 mAdc. Current mode (4 to 20 mAdc) input burden is less than  $75 \Omega$  per channel.

The RTDs may be connected in either two-wire or three-wire configuration. When two-wire RTDs are connected, short the "C" and "+" terminals.

These inputs are sampled by the ECM every 8 milliseconds and by the ECM-2 every 2 milliseconds. BESTCOMS™ Pro software can be used to connect the Analog I/O Module input data to any control logic block input in the ECM or ECM 2. These inputs are commonly used to provide temperature and hydrogen gas pressure feedback to the system for use in the recalibration/generator optimization functions.

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## Analog Outputs

Eight individually configurable analog outputs are provided on each module. Each output is isolated at 500 Vac from the other outputs, the power supply, the analog inputs, and the RTD inputs. The analog outputs may be configured to supply either  $\pm 10$  Vdc or 4-20 mAdc with 16-bit resolution. The voltage mode of operation requires a load larger than 1 k $\Omega$ . The current loop requires a receiver resistance of less than 800  $\Omega$ . The ECM/SIM updates the output status every 8 milliseconds and the ECM-2 updates the output status every 2 milliseconds. Using BESTCOMS*Pro* software, the analog output data can be connected to any control logic block output in the ECM or ECM-2. These outputs are commonly used to drive existing panel meters or to interface with DCS systems or chart recorders.

### Note

For units with hardware revision E or later, loss of communication causes outputs to revert to a high impedance state. For earlier revisions, outputs retain their state if communication is lost.

## Voltage/Current Input Mode Switch

The AIOM-2 module's four-position DIP switch, labeled V/I Mode, configures the analog inputs to operate in either voltage or current mode. When a switch is in the up position, the corresponding analog input is configured for voltage operation mode and when a switch is in the down position, the corresponding analog input is configured for current operation mode. Switch 1 configures analog input 1 (CH1), switch 2 configures analog input 2 (CH2), and so on.

## Operating Power

AIOM-2 operating power is provided through the redundant +24 Vdc PS1 and PS2 connectors. The power supply is isolated at 500 Vac from the analog inputs, RTD inputs, and analog outputs.

## Channel Selection Input

This input configures the AIOM-2 to communicate with the main or redundant channel ECM/SIM or ECM-2 depending on the voltage applied. Application of 0 Vdc or +24 Vdc at the Channel Selection input (pins 35 and 36) configures the AIOM-2 to communicate with the main channel ECM/SIM or ECM-2. Application of -24 Vdc at the Channel Selection input (pins 35 and 36) configures the AIOM-2 to communicate with the redundant channel ECM/SIM or ECM-2.

When the Channel Selection input is set for main channel control, an ECM/SIM or ECM-2 on the redundant channel may only poll analog input status and cannot operate analog outputs. Alternately, when the Channel Selection input is set for redundant channel control, an ECM/SIM or ECM-2 on the main channel may only poll analog input status and cannot operate analog outputs.

## Monitoring

AIOM-2 monitoring consists of two LED indicators located on the front panel. The green Power LED lights to indicate the presence of AIOM-2 operating power at either of the power supply inputs (PS1 or PS2). The green Status LED lights to indicate proper communication is established with an ECM/SIM or ECM-2.

## Verification

There are no user adjustments on the AIOM-2. Using a precision voltage source, multimeter, an ECM or ECM-2 and BESTCOMS*Pro*, the accuracy of the inputs across the full range may be verified by plotting the analog input versus the digital values displayed in BESTCOMS*Pro*. Likewise, the accuracy of the outputs may be verified by plotting the digital output value shown in BESTCOMS*Pro* versus the measured analog output. The RTD input may be verified by connecting a variable resistor to the input and plotting the measured resistance to the digital temperature (or resistance) value displayed in BESTCOMS*Pro*.

## Maintenance

This device contains long-life aluminum electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

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## Spare Parts

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A reasonable stock of spare parts minimizes downtime in the event of malfunction. When ordering spare parts, care should be taken to specify the style numbers (or other identification) which are printed on the nameplate. Careful documentation of the original connections is essential any time the AIOM-2 is removed. It is recommended that at least one AIOM 2 is stocked.

### Warning!

Bodily injury could result if contact is made with components in this apparatus which carry either line voltage or are subject to abnormally high voltages. References to the circuit diagrams, notably within other documentation disclose hazardous areas.

As with all electrical equipment, appropriate safety measures must be taken when dealing with excitation equipment. High voltage is present within the excitation cubicles; their magnitudes depend upon the particular system. Opening the sources (e.g., disconnecting device 41) does not completely disconnect the high voltages. As long as the machine is still physically connected to the system, there is a possibility that a safety hazard exists.

Every precaution must be taken when working at the excitation control switchgear to ensure that all high voltages are isolated and avoided by test personnel. In addition to the machine terminal voltage (460 Vac or greater) at the excitation transformer, there may be other sources of power entering the cubicles, such as 125/250 Vdc and/or 120/240 Vac used to feed certain devices. A good rule to follow is to assume that all connections are live and dangerous until proven otherwise and to avoid all body contact with any of these voltages.

## Glossary

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### AIOM-2, AIOM

Analog I/O Module. Provides additional analog inputs, RTD inputs, and analog outputs to an ECS2100 or DECS-2100 digital excitation control system.

### BCM-2

Bridge Control Module. The BCM-2 generates the gating pulses for the SCRs in a power bridge.

### BESTCOMS™ Pro

A Windows®-based PC application which connects to an ECM-2, FCIM, or BCM-2 for user programming and monitoring of excitation system functions. This software presents table and block diagram representations of the controller logic configuration.

### ECM

Exciter Control Module. This contains the excitation control, limiting, protection, and communication software. The ECM is used with the ECS2100 system.

### ECM-2

Excitation Control Module. This contains the excitation control, firing control, limiting, protection, and communication software. The ECM-2 is used with the DECS-2100 system.

### FCIM

Firing Control Interface Module, used only in ECS2100 excitation systems. Determines when to fire power bridge SCRs based on the ac source waveforms and firing angle commands from the ECM.

### SIM

Sensor Input Module, used only in ECS2100 excitation systems. Provides isolated signals from the PT, CT, AIOM-2, and DIOM-2 to the ECM.

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