

# FP-AO-200

## 8 Channel, 20 mA Loop Output Module



## Highlights

---

- Eight 0-20/4-20 mA outputs
- 0.5 mA over-range ability
- 12-bit resolution DACs
- Open current loop indicators
- 3,000 V input-to-output isolation
- Double insulated for 250 V safe working voltage
- Up to 1 kOhm load impedance (with 24 V loop supply)
- Short circuit protection
- -40° to +70° C operation

## Overview

---

The FP-AO-200 is a FieldPoint analog output module with eight 0-20/4-20 mA current loop outputs. You can use the FP-AO-200 to drive devices using process current loops of either the 0-20 mA or 4-20 mA standards. Hot plug and play operation, safety isolation, onboard diagnostics such as open loop detection, and over-ranging ability ensure that installation and maintenance are as trouble free as possible.

These operating instructions describe the installation, features, and characteristics of the FP-AO-200. For details on configuring and accessing the FP-AO-200 over a network, refer to the user manual for the particular FieldPoint network module you are using with the FP-AO-200.

# Module Installation

The FP-AO-200 mounts on a FieldPoint terminal base (FP-TB-xx) unit. The hot plug and play operation of the FP-AO-200 allows you to install it onto a powered terminal base without disturbing the operation of other modules or terminal bases. The FP-AO-200 receives operating power from the terminal base. Current loop power is externally supplied.

To install the FP-AO-200, refer to Figure 1 and follow these steps:

1. Slide the terminal base key to either position X (used for any module) or position 2 (used for the FP-AO-200 module).
2. Align the FP-AO-200 alignment slots with the guide rails on the terminal base.
3. Press firmly to seat the FP-AO-200 in the terminal base. The terminal base latch locks the FP-AO-200 into place when it is firmly seated.
4. Connect a current loop supply for the outputs to the V and C terminals of the terminal base.

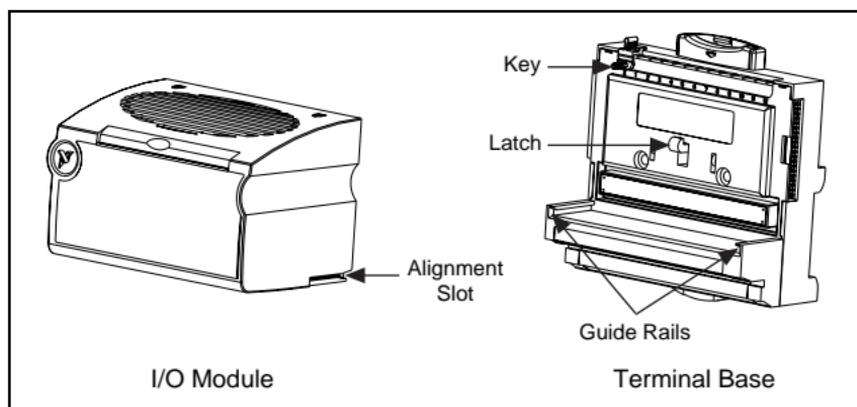
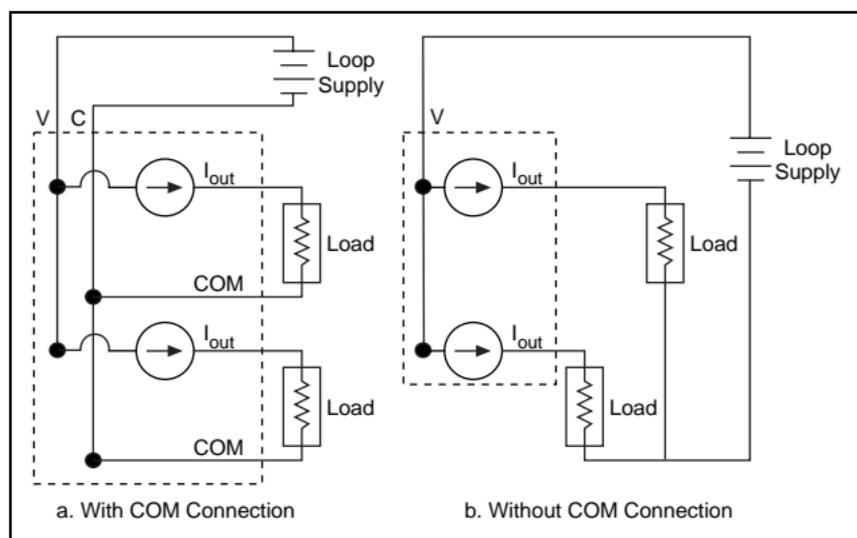


Figure 1. Module Installation Diagram

## Field Wiring

The FP-AO-200 sources current from an external loop supply to a load (or field device). The terminal base provides connections for both the external loop supply and for the eight output channels. Figures 2a and 2b show examples of these basic wiring connections. The positive terminal of the loop supply is connected to the V terminal; the negative (or common) terminal is connected to the C terminal. Each channel has an output terminal,  $I_{out}$ ; a common terminal, COM (internally connected to the C terminal);

and a supply terminal,  $V_{sup}$  (internally connected to the V terminal). As the figures show, connections to the C and COM terminals are not required but may be used to simplify wiring. You may use connections to the  $V_{sup}$  terminals to route power from the V terminal to devices which require supplementary power.



**Figure 2.** Basic Field Connections (Two channels shown)

Table 1 lists the terminal assignments for the signals associated with each channel.

**Table 1.** Terminal Assignments

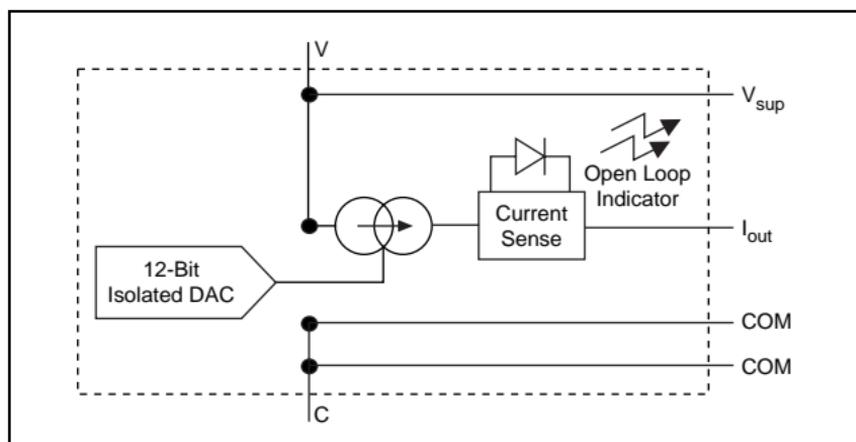
Channel	Terminal Numbers		
	$I_{out}$	COM	$V_{sup}$
0	1	2, 18	17
1	3	4, 20	19
2	5	6, 22	21
3	7	8, 24	23
4	9	10, 26	25
5	11	12, 28	27
6	13	14, 30	29
7	15	16, 32	31

# Current Output Circuit

The output circuit of the FP-AO-200 is a *sourcing* current output, which means that it is designed to *source* current provided by an external loop supply to a device or load capable of *sinking* this current to the common voltage of the loop supply. The FP-AO-200 can operate with an external loop supply from 5 to 24 VDC; however, this voltage dictates the maximum load impedance which the FP-AO-200 can drive. With a 24 VDC loop supply, each output can drive up to 1 kOhm of load impedance. With a 5 VDC loop supply, each output can only drive up to 100 Ohms. The FP-AO-200 detects and reports error conditions due to excessive loads or insufficient loop supplies. For more information, refer to the *Open Loop Detection* section in this document.

The FP-AO-200 updates the output channels as new values are sent to it by the network module. The time it takes to respond to a change on a single channel is between 3 and 6 ms. The response time to changes on all eight channels is 24 to 27 ms.

Figure 3 shows a diagram of the current output circuit of a single channel.



**Figure 3.** FA-AO-200 Current Output Circuit

The FP-AO-200 has several unique features that promote reliable operation, ease of use, and solid performance. These features are described below.

## Output Ranges

You may configure the output range of each channel independently for either 0-20 mA or 4-20 mA operation. The factory default power-up setting for each channel is 0-20 mA, with output set to 0 mA. The FP-AO-200 has a built in over-range capability of 0.5 mA in each of these ranges, thus the actual full scale ranges available are 0-20.5 mA and 3.5-20.5 mA. This extended range feature allows the FP-AO-200 to compensate for span and offset errors in field devices.

## Open Loop Detection

Each channel has a monitoring circuit which compares the actual output current to the desired output current. If the FP-AO-200 cannot source the desired output current for one or more channels, these monitoring circuits turn on a red **STATUS** LED for each affected channel and report this error condition to the network module. Generally, the cause for this error condition is an open current loop—either the load device or the loop supply is disconnected. However, this method of detection also catches errors caused by a load impedance that is too high, or a loop supply voltage that is too low, to provide the desired output current.

If the output of the an FP-AO-200 channel is set to 0 mA, the monitoring circuit does not register an error condition because the FP-AO-200 can always source zero current, even to an open loop. So, if any channels are unused and left unwired they should be left in the default state of 0 mA to prevent unnecessary (and possibly annoying) error indications.

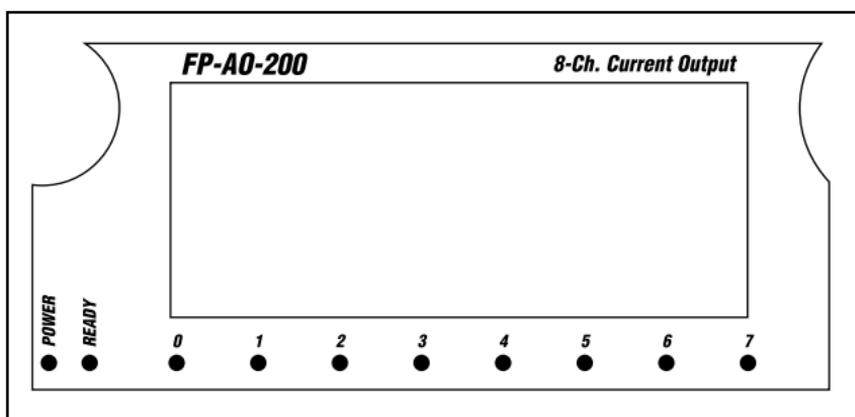
## Short Circuit Protection

Each output terminal  $I_{out}$  of the FP-AO-200 is protected against short circuits to any of the other terminals. One or more channel outputs can be short circuited indefinitely without causing damage or improper operation of other channels, as long as the maximum loop supply does not exceed 24 VDC. The outputs can withstand indefinite short circuits with loop supplies of more than 24 VDC (up to 36 VDC) without damage, but increasing internal temperatures due to such conditions may cause improper operation of other channels on the module.

# Status Indicators

---

Figure 4 shows the module label and status indicators. You can remove the insertable label to see wiring diagrams for the output channels.



**Figure 4.** Status Indicators

After the module has been inserted into a terminal base (and power is applied), the module runs an internal boot up sequence and self test. If this test passes, the green **POWER** indicator turns on and the FP-AO-200 informs the network module of its presence. When the network module recognizes the FP-AO-200, it sends initial configuration information to the FP-AO-200. After processing this initial information, the green **READY** indicator turns on and the FP-AO-200 is in its normal operating mode. In addition to the green **POWER** and **READY** indicators, each channel has a red, numbered, error status indicator. For more information, refer to the section on *Open Loop Detection* in this document.

## Isolation and Safety

---



**CAUTION:** *Read the following information before attempting to connect ANY circuits which may contain hazardous voltages to the FP-AO-200.*

This section describes the isolation of the FP-AO-200 and its compliance with international safety standards.

The field wiring connections of the FP-AO-200 are isolated from the backplane provided by the terminal base with an optical and galvanic isolation barrier designed and tested to provide protection against fault voltages of up to 3000 Vrms. In addition, the

FP-AO-200 provides *double insulation* (compliant to IEC 1010-1) for working common mode voltages of 250 Vrms. Safety standards (such as those published by UL and IEC) require the use of double insulation between hazardous voltages and any human-accessible parts or circuits. You should *never* attempt to use any isolation product between human accessible parts (such as DIN rails or monitoring stations) and circuits which may be at hazardous potentials under normal conditions, unless the product is specifically designed (as the FP-AO-200 is) for such an application.

Even when a product like the FP-AO-200 is used in applications with hazardous potentials, follow these guidelines to ensure a safe total system.

- The isolation of the FP-AO-200 is from input to output, not between channels on the same module. If any of the channels on a module are wired at a hazardous potential, ensure that all other devices or circuits connected to that module are properly insulated from human contact.
- Do not share the external loop supply voltages (V and C on the terminal base) with other devices (including other FieldPoint devices) unless those devices are also isolated from human contact.
- As with any hazardous voltage wiring, ensure that all wiring and connections meet with applicable electrical codes or common sense practices. Mount terminal bases in an area, position, or cabinet that prevents accidental or unauthorized access to wiring with hazardous voltages.
- The isolation of the FP-AO-200 is certified as double insulated for normal operating voltages of 250 Vrms. Do not use the FP-AO-200 as the sole isolating barrier between human contact and working voltages of more than 250 Vrms.

# Specifications

---

These specifications are typical for  $-40^{\circ}$  to  $+70^{\circ}$  C unless otherwise noted.

## Output Characteristics

Number of channels .....	8 single-ended
Resolution .....	12 bits, 1 in 4,096 ( $\sim 6 \mu\text{A/bit}$ )
Isolation .....	3,000 Vrms, input to output
Safety isolation, working voltage .....	250 Vrms channel to earth ground, designed per IEC 1010

## Current Output

Output Range .....	0-20 mA or 4-20 mA, programmable (0-21 mA or 3.5-21 mA with over-range)
Type .....	Current source, external loop power required
External Loop Power .....	5 to 24 VDC
Resistive load .....	up to 1 kOhm with 24 V loop supply, up to 100 Ohm with 5 V supply
Voltage Drop .....	3 V
Protection .....	Short-circuit and open-circuit
Default Power-on state .....	0 mA

## Accuracy

Absolute accuracy .....	0.2% FSR
Monotonicity .....	Guaranteed over temperature
Offset temperature coefficient .....	$50 \text{ nA}/^{\circ}\text{C}$
Gain temperature coefficient .....	$40 \text{ ppm}/^{\circ}\text{C}$

## Dynamic Characteristics

Max conversion rate .....	200 Updates/s
Slew rate .....	$0.4 \text{ mA}/\mu\text{s}$

## Physical

Indicators .....	Green <b>POWER</b> and <b>READY</b> indicators, 8 red open loop indicators
Weight.....	140 g (4.8 oz.)

## Power Requirements

Power from network module .....	350 mW
---------------------------------	--------

## Environment

Operating Temperature .....	-40 °C to +70 °C
Storage Temperature.....	-55 °C to + 100 °C
Relative Humidity.....	5% to 90% noncondensing

## CE Mark Compliance

This product meets applicable EU directive(s) as follows:

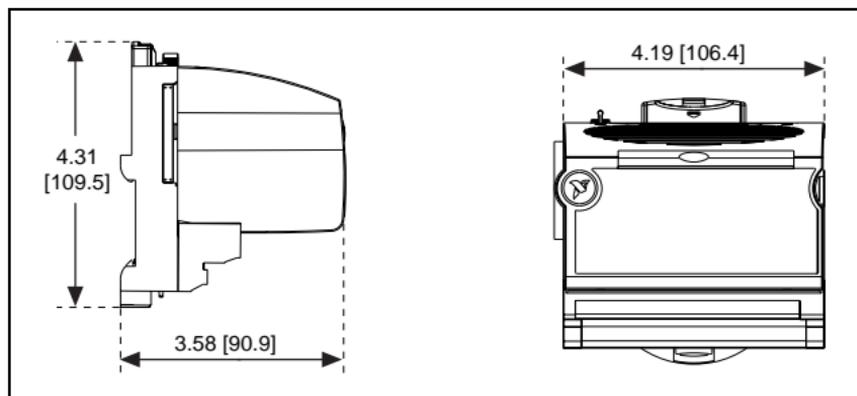
Safety isolation .....	EN 61010 (double insulation for 250 Vrms working isolation, installation category II)
------------------------	---

### EMC Directive

Immunity .....	EN 50082-1:1994
Emissions .....	EN 55011:1991 Group I Class A at 10 meters

## Mechanical Dimensions

Figure 5 shows the mechanical dimensions of the FP-AO-200 installed onto a terminal base.



**Figure 5.** Mechanical Dimensions







321634A-01

Jul97