User's Guide

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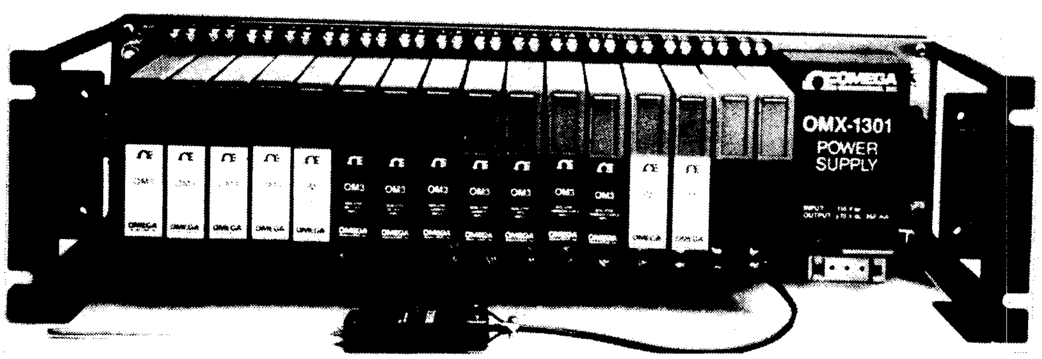

OM3 Series
Signal Conditioners

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1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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CHAPTER 1

INTRODUCTION – SCOPE OF THE MANUAL

The intent of this manual is to serve as a guide to the proper configuration and operation of OMEGA's OM3 Series Subsystem as well as present the functional theory and specifications. A separate section is devoted to custom calibration and interfaces to user equipment. Appendices are included which contain accessories and custom ranging information.

1.1 GENERAL DESCRIPTION

The OM3 Series Signal Conditioning I/O Subsystem provides a low cost, versatile method of interconnecting real-world analog signals to a data acquisition, monitoring or control system. It is designed to interface directly to sensor or analog signals such as thermocouple, RTD, strain gage, frequency inputs, wideband mV and V, LVDT or AD590/AC2626 solid state temperature sensor outputs or millivolt or process current signals and convert the inputs to standardized analog outputs compatible with high level analog I/O subsystems.

The OM3 Series Subsystem consists of a 19″ relay rack compatible universal mounting backplane and a family of plug in (up to 16 per rack) input and output signal conditioning modules. Eight and four channel backplanes are also available. Each backplane incorporates screw terminals for sensor inputs and current outputs and tracks for high level single ended outputs to the connector which interfaces with the user's equipment.

The high performance of the OM3 Series Subsystem is assured by high quality signal conditioning featuring 130V or 220V rms input protection, galvanic isolation, high common mode rejection, filtering, low drift, rugged packaging, and, when required, sensor excitation. A wide zero suppression capability and easy field calibration are available with a unique plug-on ranging card.

The input and output modules are offered in both isolated (±1500V peak) and nonisolated versions. The input modules feature complete signal conditioning circuitry optimized for specific sensors or analog signals and provide high level analog output. Each input module provides two simultaneous outputs: 0 to +10V (or ±10V) to the system connector and 4-20mA (or 0-20mA) to the output screw terminals. Output modules accept high level single ended voltage signals and provide an isolated or nonisolated 4-20mA (or 0-20mA) process signal. All modules feature a universal pin-out and may be readily "mixed and matched" and interchanged without disrupting field wiring.

Each backplane contains the provision for a subsystem power supply. The OM3 Series Subsystem can be powered either from a common dc/dc or ac power supply mounted on each backplane or from an externally provided dc power supply. Two LEDs are used to indicate that power is being applied.

1.1.1 FM APPROVAL/THE OM3 SERIES

The OM3 Series Signal Conditioning Subsystem is approved by Factory Mutual for use in Class I, Division 2, Groups A, B, C and D locations. This approval certifies that the OM3 Series is suitable for use in locations where a hazardous concentration of flammable gas exists only under unlikely conditions of operation. Equipment of this type is called "nonincendive" and needs no special enclosure or other physical safeguards.

1.2 APPLICATIONS

The OMEGA® OM3 Series Signal Conditioning Subsystem is designed to provide a versatile and convenient solution to signal conditioning problems in measurement and control applications. Some typical uses are in mini- and microcomputer based systems, standard data acquisition systems, programmable controllers, analog recorders, dedicated control systems, and other applications where monitoring and control of temperature, pressure, flow, position and analog signals are required. Since each input module features two simultaneous outputs, the voltage output can be used to provide an input to a microprocessor based data acquisition and control system while the current output can be used for analog transmission, operator interface, or an analog backup system. Figure 1.2.1 is a functional diagram of the OM3 Series Subsystem.

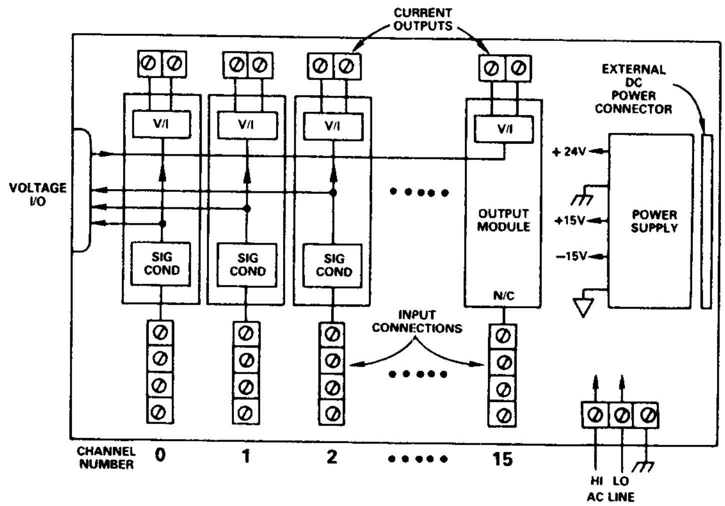


Figure 1.2.1 OM3 Series System Functional Block Diagram

1.3 DESCRIPTION OF OM3 MODULES

The OM3 input modules are single channel analog input conditioners that plug into sockets on the backplane. The choice of a specific OM3 module depends on the type of input signal and also whether an isolated or nonisolated interface is required (refer to Table 1.3.1). The choice of the OM3 output module depends on whether an isolated or nonisolated process current signal is required. Each module is identical in size (3.150″ × 0.775″ × 3.395″) and has the same pin out. The transfer function provided by each input module is:

Input – specified sensor measurement range

Output – 0 to +10V or ±10V dc
4-20mA or 0-20mA, nonisolated with respect to voltage output

The transfer function provided by each output module is:

Input – 0 to +10V or ±10V
Output – 4-20mA or 0-20mA

All modules include a printed circuit board incorporating electronic circuitry housed in a protective plastic shell. The shell contains provisions for securing each module to the backplane.

INPUT MODULES

Input Type/Span	Voltage Output	Current Output	Nonisolated Modules	Isolated Modules	
dc, ±10mV, ±50mV, ±100mV	±10V	4-20mA/0-20mA	OM3-MV	OM3-IMV	OM3-WBV-MV
dc, ±1V, ±5V	±10V	4-20mA/0-20mA	OM3-MV	OM3-IV	OM3-WBV-V
dc, ±10V	±10V	4-20mA/0-20mA	OM3-V	OM3-IV	OM3-WBV-V
dc, 4-20mA, 0-20mA	0-10V	4-20mA/0-20mA	OM3-I	OM3-II	
Thermocouple Types J, K, T, E, R, S, B	0-10V	4-20mA/0-20mA		OM3-ITC	OM3-LTC
100Ω Platinum RTD, 2, 3, 4 wire α = 0.00385 (linearized)	0-10V	4-20mA/0-20mA	OM3-P3	OM3-IP	
100Ω Platinum RTD, Kelvin 4-wire α = 0.00385 (linearized)	0-10V	4-20mA/0-20mA	OM3-P4		
10Ω Copper RTD, 2 or 3 wire	0–10V	4-20mA/0-20mA		C	
120Ω Nickel RTD, 2, 3, or 4 wire	0–10V	4-20mA/0-20mA		N	
Strain Gage ±30mV, ±100mV	±10V	4-20mA/0-20mA	OM3-S OM3-WBS		
LVDT 4, 5, 6 wire or RVDT 4, 5 6 wire	±10V	4-20mA/0-20mA	OM3-LV		
AD590/AC2626 Solid State Temperature Transducer	0-10V	4-20mA/0-20mA	OM3-A-590		
ac, 0–50mV rms, 0–100mV rms	0–10V	4-20mA/0-20mA		OM3-ACV-MV	
ac, 0–10V rms	0–10V	4-20mA/0-20mA		OM3-ACV-10V	
ac, 0–150V rms, 0–250V rms	0–10V	4-20mA/0-20mA		OM3-ACV-150V,250V	
Frequency 0–25Hz, 0–300Hz	0–10V	4-20mA/0-20mA		OM3-IFI	
Frequency 0–1500Hz, 0–3000Hz, 0–25kHz	0–10V	4-20mA/0-20mA		OM3-IFI-K	

Table 1.3.1 Module Selection Table

The modules are available in several factory calibrated input ranges. Each input module includes separate screwdriver adjustable zero and span potentiometers for both the voltage output and the current output which can be used for fine calibration within the chosen range. The voltage and current adjustments are independent and noninteractive which allows for precise calibration of both outputs. Each output module has two adjustable zero and span potentiometers for fine calibration of the output current. Each potentiometer has an adjustment range of ±5% span.

1.4 WIDE ZERO SUPPRESSION CAPABILITY

A wide zero suppression capability and easy field recalibration are available with a unique plug-on ranging card (OMX1310). If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-II-P) and the plug-on ranging card, OMX1310. This card houses user supplied resistors that determine the zero and span of the desired range. The RTD modules accept an additional resistor that is used for linearization of the input signal, while the thermocouple module uses an additional resistor to set the cold junction compensation level. This feature allows the user to provide zero suppression of up to and beyond 100% of the input range and provide a wide range of span modification. The capability allows the user to map any portion of the input signal to the full output span. For example, a user who wants to measure temperature with a thermocouple in the range of 800-900°C can use this ranging card for greater system resolution in that 100°C temperature span. This tremendous flexibility should satisfy virtually any requirement. The resistor values are determined by equations defined for each module. See the appropriate data page for each module within the User's Manual for further details. Special ranges can also be factory configured. Analog Devices will provide the function when a model 3B_ _ – CUSTOM is ordered with the desired range.

1.5 APPLICATION EXAMPLE

An example of how the OM3 Series Subsystem might be used with an analog I/O subsystem in a measurement and control application is diagrammed in Figure 1.5.1. The sensor, which could be a thermocouple, is connected directly to the input screw terminals. The high level voltage output of the input module is compatible with any high level multiplexer or analog-to-digital converter which converts the data to the digital form that the microprocessor requires. The digital output of the microprocessor is connected to a digital-to-analog converter which provides a high level voltage output. The output module converts this high level voltage output to a process current which can be used to drive an actuator or any other control element.

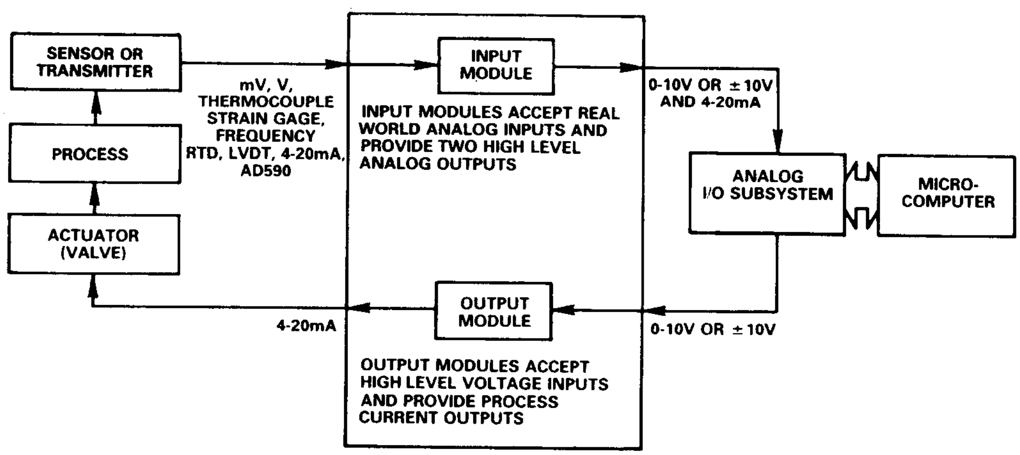


Figure 1.5.1 Function Block Diagram of a Typical Measurement and Control Application Using the OM3 Series Subsystem

1.6 BACKPLANE FUNCTIONAL DESCRIPTION

The three backplane models: OM3-BP-16, OM3-BP-8, and OM3- BP-4 are designed for sixteen, eight, and four channels respectively, which offers users the flexibility to match the size of a system to specific applications. The sixteen channel backplane can be mounted in 19″ x 5.25″ panel space while all backplanes can be surface mounted or mounted in a NEMA enclosure.

1.7 POWER SUPPLY

The OM3 Series Subsystem can operate from a common ac power supply or dc/dc (+24V input) power supply mounted in the subsystem or an externally provided ±15V or +24V supply. The power supply is bussed to all signal conditioners in the system. Several power supplies are available to satisfy various current requirements.

CHAPTER 2

GENERAL INPUT MODULE SPECIFICATIONS

FEATURES

Complete Signal Conditioning Function Per Module
Wide Variety of Sensor Inputs
Thermocouples, RTDs, Strain Gages, Frequency Inputs, LVDT, AD590/AC2626
Dual High Level Outputs
Voltage: 0 to +10V or ±10V
Current: 4-20mA/0-20mA
Mix and Match Input Capability
Sensor Signals, mV, V, 4-20mA, 0-20mA
High Accuracy: ±0.1%
Low Drift: ±1μV/°C
Reliable Transformer Isolation:
±1500V CMV
160dB CMR
Meets IEEE-STD 472: Transient Protection (SWC)
Input Protection: 130V or 220V rms Continuous
Reliable Pin and Socket Connections
Low Cost Per Channel

2.1 INPUT MODULE

Each input module is a single channel signal conditioner that plugs into a socket on the backplane and accepts its signal from the input screw terminals. All input modules provide input protection, amplification and filtering of the input signal, accuracy of ±0.1%, low drift of 1μV/°C, and feature two high level analog outputs that are compatible with most process instrumentation. The isolated input modules also provide ±1500V of CMV isolation.

The choice of a specific OM3 module depends on the type of input signal and also whether an isolated or nonisolated interface is required. Input modules are available to accept millivolt, volt, process current, thermocouple, RTD, strain gage, frequency, LVDT and AD590 inputs. The voltage output of each module is available from the voltage I/O connector while the current output is available on the output screw terminals.

The transfer function provided by each input module is:

Input – specified sensor measurement range
Output – 0 to +10V dc or ±10V
4-20mA, nonisolated with respect to voltage output
(0-20mA output programmed by a jumper option on the module)

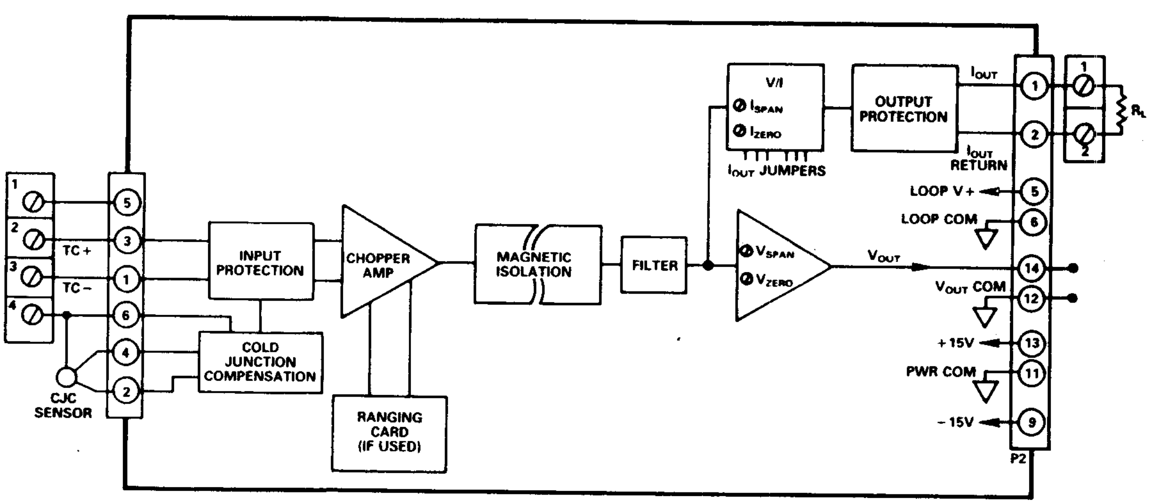


Figure 2.1.1 Model OM3-ITC Functional Block Diagram

For example, Figure 2.1.1 shows a functional diagram for the Model OM3-ITC isolated thermocouple signal conditioner. The input signal is filtered, amplified and has cold junction compensation applied before the isolation barrier. Reliable magnetic isolation is used to provide isolation protection. The outputs of the module are isolated from the input (up to ±1500V peak) and calibrated for 0 to +10V (voltage output) and 4-20mA (current output) which corresponds to the specified input span.

GENERAL INPUT MODULE SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	Isolated Modules	Nonisolated Modules
Inputs	Per Selection Table	*
Outputs[1]	0 to +10V @ 5mA or ±10V @ ±5mA	*
	4-20mA or 0-20mA @ R_L = 0 to 850Ω[2]	
Accuracy[3]	±0.1% span	*
Nonlinearity[4]	±0.01% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Zero	±1μV/°C for G>100 (RTI)	*
Span	±0.0025% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Common Mode Voltage, Input to Output	±1500V pk max	±6.5V[5]
Common Mode Rejection @ 50Hz or 60Hz 1kΩ Source Unbalance[6]	160dB	90dB[5]
Normal Mode Rejection @ 50Hz or 60Hz[7]	60dB	60dB
Differential Input Protection[8]	220V rms, cont.	130V rms, cont.
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms, cont.	*
Zero and Span Adjustment Range[9]	±5% of span	*
Input Transient Protection	Meets IEEE-STD 472 (SWC)	N/A
Input Resistance	15MΩ	100MΩ
Bandwidth[10]	3Hz(−3dB) or 10kHz(−3dB)	3Hz(−3dB) or 20kHz(−3dB)
Power Supply[11]	±15V dc, +24V dc	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES

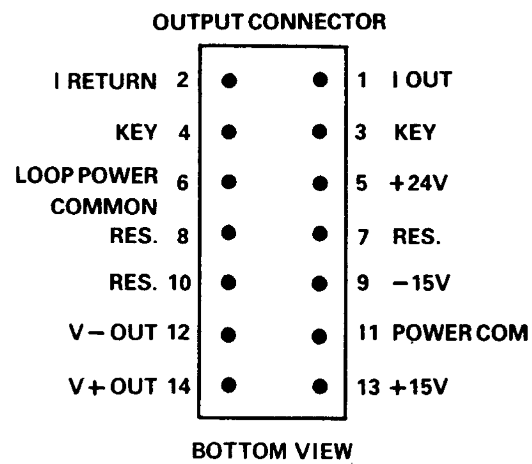
1. Voltage output range is determined by the module input range while the current output range is user selectable. Model OM3-LTC does not have a current output.
2. For a 0-20 mA range, a typical minimum output current is 10μA.
3. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error. OM3-ACV-MV and OM3-ACV-V have a ±0.5% accuracy. OM3-LV has ±0.1% accuracy when calibrated.
4. RTD Models OM3-P3, OM3-P4, OM3-IP and LVDT Model OM3-LV have a linearization conformity error of ±0.05%.
5. Models OM3-A-590, OM3-P3, OM3-P4, OM3-S and OM3-LV each have the common mode voltage determined by the internal excitation circuitry.
6. Only applies to units with 3Hz bandwidth. Models OM3-WBS, OM3-WBV-MV, OM3-WBV-V have a CMR of 100dB.
7. Only applies to units with 3Hz bandwidth.
8. Includes excitation circuitry for models OM3-A-590, OM3-P3, OM3-P4, OM3-S, OM3-LV, OM3-WBS and OM3-IP.
9. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310. Model OM3-LV has a gain adjustment range of 256:1 and an output referred zero suppression range of ±5V.
10. Model OM3-WBS has a 20kHz bandwidth; models OM3-WBV-MV and OM3-WBV-V have a 10kHz bandwidth; model OM3-LV has a 100Hz bandwidth.
11. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as isolated modules.
Specifications subject to change without notice.

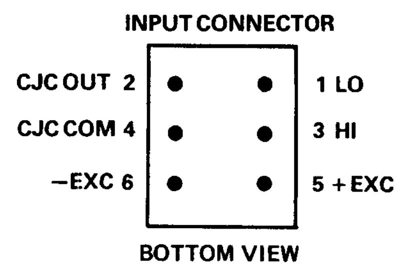
If a special input range is desired, it can be provided with the externally programmable version of the desired module, the plug-on ranging card, and user supplied resistors. See the discussion of the module of interest within the User's Manual for further details.

Each input module has two user programmable jumper options. One option allows the user to program the current output to be proportional to either the 0 to + 10V output or a − 10V to + 10V output. The second option allows the user to determine if the current output is 4-20mA or 0-20mA. All modules are shipped from the factory configured so that the current output is proportional to the 0 to + 10V output and each current output is 4-20mA. If the push-on jumpers are changed, the zero and full scale points will shift by approximately 0.25% of span and will need to be recalibrated to remove this error.

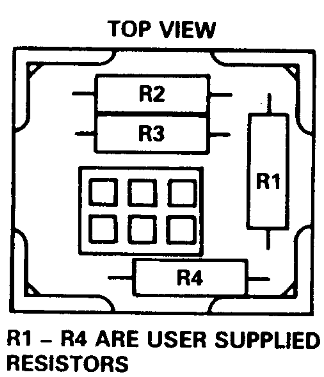
The current output of all input modules requires a grounded return. The grounded return of the current output can only be used for the return of ONE MODULE. Two or more modules SHOULD NOT BE connected to the same RETURN terminal. If several current loops are to be returned with one ground, that connection should be made to the Loop Common on the DC POWER connector.



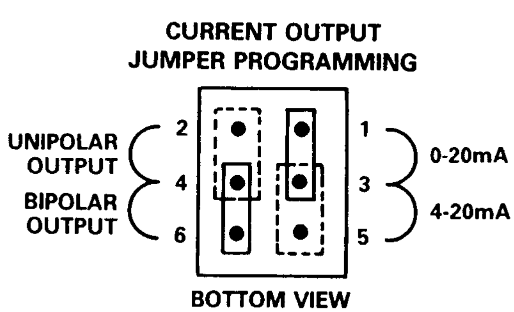
Output Connector



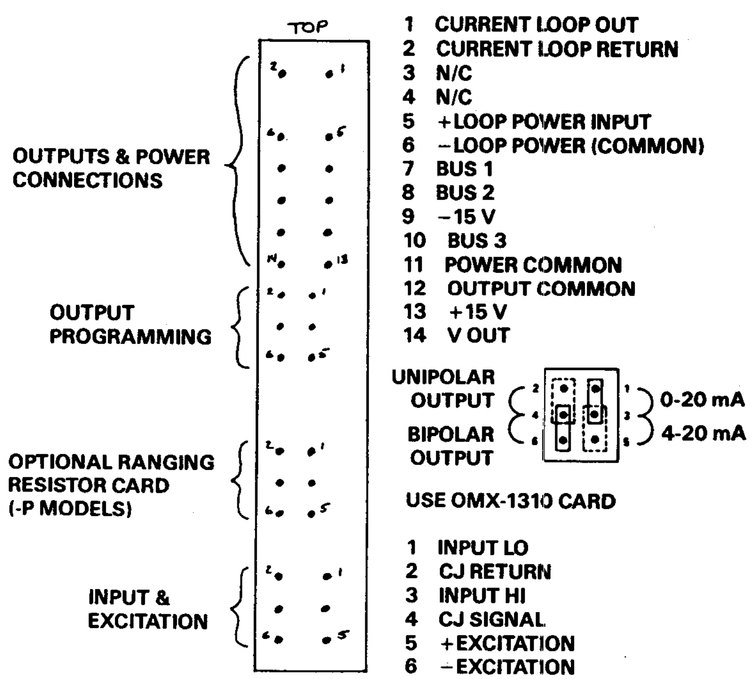
Input Connector



Ranging Card



Jumper Options



Bottom of OM3 Module Pinout

Figure 2.1.2 Input Module Connectors

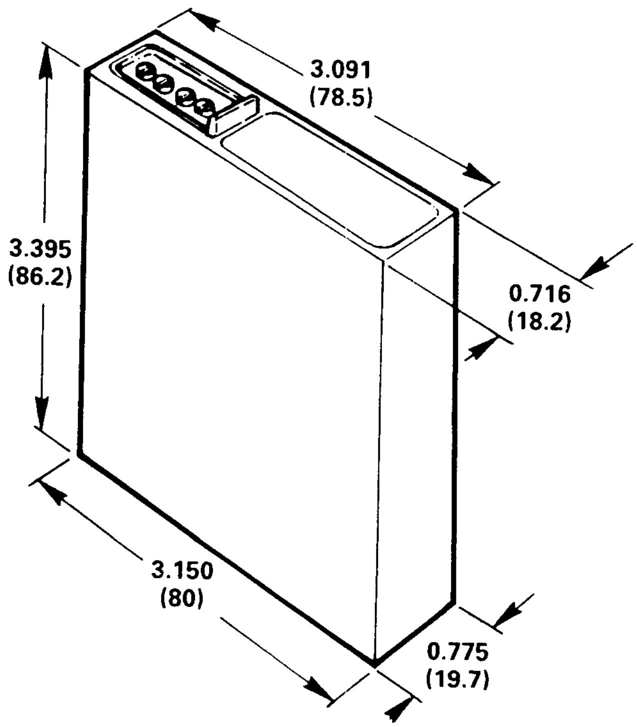
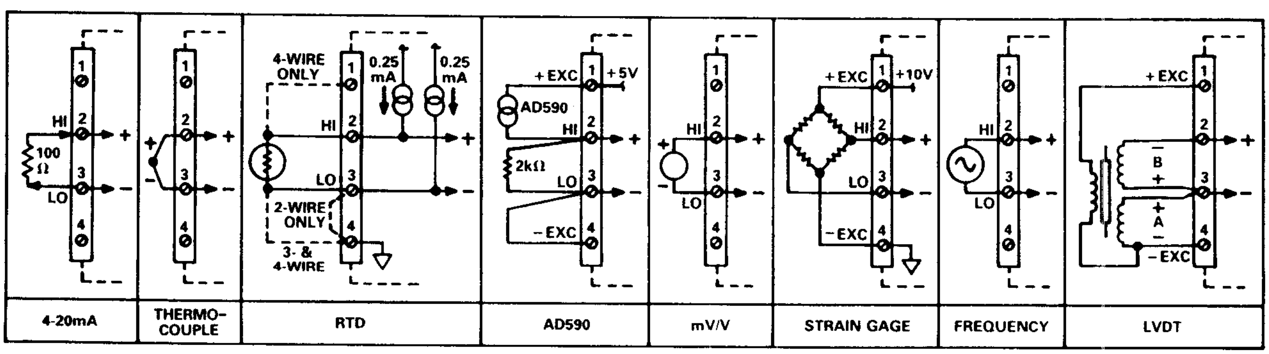


Figure 2.1.3 Module Outline Dimensions (Dimensions shown in inches and (mm)).



INPUT CONNECTIONS:
ALL INPUT CONNECTIONS USE #6-32 SCREW TERMINALS,
COMPATIBLE WITH 14 AWG WIRE.

Figure 2.1.4 Module Input Connections

2.1.1 MODELS OM3-MV and OM3-V

FEATURES

Accepts Millivolt and Volt Inputs

OM3-MV: ±10mV to ±5V

OM3-V: ±10V

FUNCTIONAL DESCRIPTION

Model OM3-MV is a nonisolated voltage input device that is designed to accept a wide range of input voltages, ranging from ±10mV to ±5V. Model OM3-V is a nonisolated high level voltage input device that is designed to accept ±10V.

Figure 2.1.1.1 shows a functional diagram for models OM3-MV and OM3-V. Input protection of up to 130V is provided on the input screw terminals. The signal is then amplified and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment through screw terminal connections.

Both models OM3-MV and OM3-V require a ground return for the input connections to return the bias current to ground.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Connect model OM3-MV (OM3-V) as shown in Figure 2.1.1.1 with $R_L = 250\Omega$.
2. Apply $V_{IN} = 0$ volts, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the measured voltage across $R_L = +1V \pm 4mV$.
3. Apply $V_{IN} = +$ Full Scale, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and adjust I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the measured voltage across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for $I_{OUT} = 0mA \pm .020mA$ in Step 2 and I_S for $I_{OUT} = 20mA \pm .020mA$ in Step 3. (A typical minimum output current is 10μA with 0-20mA operation).

If the current output is to be proportional to a −10V to +10V output instead of a 0 to +10V output, I_Z should be adjusted for a − Full Scale input in Step 2.

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-MV-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

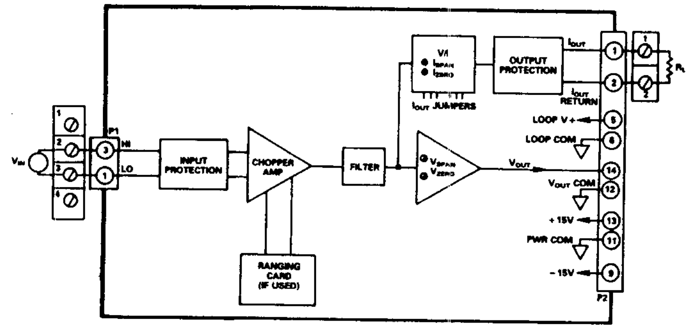


Figure 2.1.1.1 OM3-MV and OM3-V Functional Block Diagram

The basic transfer function of both the OM3-MV and OM3-V is:

$$V_O = G \times (V_{IN} - V_Z)$$

Where
- V_O = Output Voltage
- G = Gain
- V_{IN} = Input Voltage
- V_Z = Zero Suppression Voltage

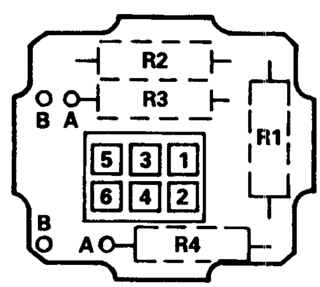
GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_1, which forms part of an internal divider and is determined from the following relation:

OM3-MV: $$R_1 = \frac{10k\Omega}{G-1}$$

OM3-V: $$R_1 = \frac{1k\Omega}{G-0.1}$$

Gain G is a ratio of the change of output to the input change that produced it. Model OM3-V is an OM3-MV with a 10x normal mode input attenuator. The attenuation is done before the zero suppression or gain, which causes a change in these relations. If there is to be no zero suppression, R_2 should be a jumper and R_3 should be left open. These resistors should be installed as indicated in Figure 2.1.1.2.



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION
R_1	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor
R_3	Open	Zero Suppression Resistor
R_4	Open	Open

Figure 2.1.1.2 OM3-MV and OM3-V Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-MV	OM3-V
Inputs	±10mV to ±5V	±10V
Outputs	±10V @ 5mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]	*
Maximum Current Output Range	0–31mA	*
Accuracy[2]	±0.1% span	*
Nonlinearity	±0.01% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Zero	±1μV/°C[3]	30μV/°C
Span	±0.0025% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Common Mode Voltage, Input to Output	±6.5V	*
Common Mode Rejection @ 50Hz or 60Hz 1kΩ Source Unbalance	90dB[4]	70dB
Normal Mode Rejection @ 50Hz or 60Hz	60dB	*
Differential Input Protection	130V rms, cont.	*
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms, cont.	*
Zero and Span Adjustment Range[5]	±5% of span	*
Response Time to 90% Span	0.2sec	*
Input Resistance	100MΩ	400kΩ
Input Bias Current	3nA	*
Input Noise	0.2μV rms at 10Hz bandwidth	*
Output Noise	50μV rms in 100kHz bandwidth	*
Bandwidth	3Hz(−3dB)	*
Power Supplies[6]		
±15V Input Supplies Range (Rated Operation)	±(11.5V to 16.5V)	*
Supply Rejection	±0.01% span/V	*
Supply Current	±10mA	*
+24V Loop Supply Range	+12V to +30V	*
Supply Rejection	0.0002% span/V	*
Supply Current	27mA (at +FS)	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Models OM3-V-1, and OM3-V-5 have zero drift values of 3μV/°C and 15μV/°C respectively.
4. Models OM3-MV-100, OM3-V-1, and OM3-V-5 have CMR values of 85dB, 80db and 75dB respectively.
5. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
6. +24Vdc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-MV.
Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-MV-P	Externally Programmable
OM3-MV-10	−10 to +10 mV
OM3-MV-50	−50 to +50mV
OM3-MV-100	−100 to +100mV
OM3-V-P	Externally Programmable
OM3-V-1	−1 to +1V
OM3-V-5	−5 to +5V
OM3-V-10	−10 to +10V

ZERO SUPPRESSION VOLTAGE

For the OM3-MV, the zero suppression voltage, V_Z, can be set for any value between −6.35V and +6.35V through the use of R_2 and R_3 while V_Z can be set to any value from −63.5V to +63.5V for model OM3-V. V_Z is determined from the following relations:

OM3-MV

$$V_Z = 6.35V \times \frac{R_2}{R_2 + R_3}$$

OM3-V

$$V_Z = 63.5V \times \frac{R_2}{R_2 + R_3}$$

with the sign of V_Z determined by the choice of location A (positive) or location B (negative) for R_3 (see Figure 2.1.1.3). The total resistance of (R_2 + R_3) should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. (For the 3B11, the 63.5V term is a function of the 10× attenuation of the input signal. The internal voltage reference is 6.35V and high watt resistors are not required for zero suppression). Using 10kΩ as the total value, R_2 and R_3 are determined from the following relations:

OM3-MV

$$R_2 = \frac{V_Z}{6.35V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

OM3-V

$$R_2 = \frac{V_Z}{63.5V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

REF:

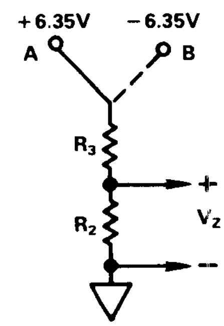


Figure 2.1.1.3 OM3-MV and OM3-V Zero Suppression Resistors

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. For the OM3-MV, the maximum input voltage for normal linear operation at either the HI or LO input terminal is ±6.6V with respect to output (system) common. For the OM3-V, a similar relation applies after the input signal has been attenuated by a factor of 10. These relations are shown below:

$$\text{OM3-MV: } V_{CM} + V_{NM} \leq 6.6$$

$$\text{OM3-V: } V_{CM} + \frac{V_{NM}}{10} \leq 6.6$$

The range of the module's voltage output adjustment is at least ±0.5V at the module output and can therefore correct any input offset error of less than 0.5V/Gain for the OM3-MV and 5V/Gain for the OM3-V. If possible the resistors used should be 1% tolerance, 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.2 MODELS OM3-I AND OM3-II

FEATURES
Accepts Process Current Inputs
(4-20mA or 0-20mA)
Reliable Transformer Isolation (OM3-II)
±1500V CMV
160dB CMR
Meets IEEE-STD 472: Transient Protection (SWC)

FUNCTIONAL DESCRIPTION

Model OM3-II is an isolated current input device that is designed to accept a process current (4-20mA or 0-20mA). The OM3-I offers a functionally equivalent design without input to output isolation.

Figure 2.1.2.1 shows a functional diagram for the model OM3-II. The model OM3-I offers the same functional characteristics as the OM3-II but does not include isolation circuitry. A current sensing resistor, supplied with each module, is connected to screw terminals 2 and 3.

Input protection of up to 220V is provided for the OM3-II (130V for the OM3-I) on the input screw terminals. The signal is then amplified and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Transformer coupling is used to achieve stable, galvanic isolation between input and output. Both the voltage and current output can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment through screw terminal connections.

Model OM3-I requires a ground return for the input connection to return the bias current to ground.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Connect model OM3-I (OM3-II) as shown in Figure 2.1.2.1 with $R_L = 250\Omega$.
2. Apply $I_{IN} = 4mA$, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the measured voltage across $R_L = +1V \pm 4mV$.
3. Apply $I_{IN} = 20mA$, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the measured voltage across $R_L = +5V \pm 4mV$.

If a 0-20mA input is used, I_{IN} should be 0mA in step 2. If a 0-20mA output is desired, I_Z should be adjusted for 0mA ±0.020mA in step 2 and I_S should be adjusted for I_{OUT} = 20mA ±0.020mA in step 3 (a typical minimum output current is 10µA with 0-20mA operation).

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e. OM3-II-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

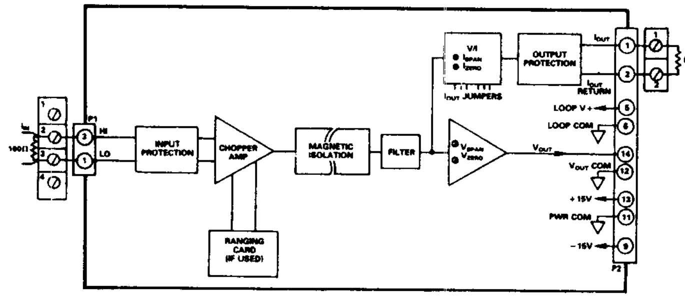


Figure 2.1.2.1 OM3-II Functional Block Diagram

The basic transfer function of both the OM3-I and OM3-II is:

$$V_O = G(V_{IN} - V_Z)$$

Where

V_O = Output Voltage
G = Gain
V_{IN} = $I_{IN}(100\Omega)$
V_Z = $I_Z(100\Omega)$
I_{IN} = Input Current
I_Z = Zero Suppression Current

These relations assume the use of the 100Ω resistor supplied with each module.

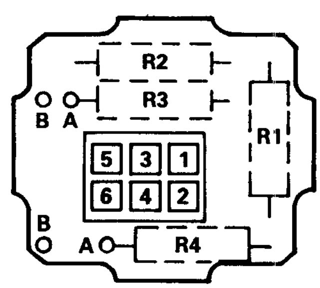
GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_1, which forms part of an internal divider and is determined from the following relation:

OM3-I: $R_1 = \frac{10k\Omega}{G-1}$

OM3-II: $R_1 = \frac{40k\Omega}{G-2}$

Gain G is a ratio of the change of output to the input change that produced it. If there is to be no zero suppression, R_2 should be a jumper and R_3 should be left open. These resistors should be installed as indicated in Figure 2.1.2.2.



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION
R_1	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor
R_3	Open	Zero Suppression Resistor
R_4	Open	Open

Figure 2.1.2.2 OM3-I and OM3-II Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-II	OM3-I
Inputs	4-20mA, 0-20mA	*
Outputs	0 to +10V @ 5mA	*
	4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]	
Maximum Current Output Span	0–31mA	*
Accuracy[2]	±0.1% span	*
Nonlinearity	±0.01% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Zero	±0.0025% span/°C	30μV/°C
Span	±0.0025% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Common Mode Voltage, Input to Output	±1500V pk max	±6.5V
Common Mode Rejection @ 50Hz or 60Hz 1kΩ Source Unbalance	160dB	90dB
Normal Mode Rejection @ 50Hz or 60Hz	60dB	*
Differential Input Protection	220V rms, cont.	130V rms, cont.
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms, cont.	*
Zero and Span Adjustment Range[3]	±5% of span	*
Response Time to 90% Span	0.2sec	*
Input Transient Protection	Meets IEEE-STD 472 (SWC)	N/A
Input Resistance	15MΩ	100MΩ
Input Bias Current	3nA	*
Input Noise	0.2μV rms at 10Hz bandwidth	*
Output Noise	50μV rms in 100kHz bandwidth	*
Bandwidth	3Hz (−3dB)	*
Power Supplies[4]		
±15V Input Supplies Range (Rated Operation)	±(11.5V to 16.5V)	*
Supply Rejection	±0.01% span/V	*
Supply Current	±10mA	*
+24V Loop Supply Range	+12V to +30V	*
Supply Rejection	0.0002% span/V	*
Supply Current	27mA (at +FS)	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
4. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-II.
Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-II-P	Externally Programmable
OM3-II-4/20	4 to 20mA, isolated
OM3-II-0/20	0 to 20mA, isolated
OM3-I-P	Externally Programmable
OM3-I-4/20	4 to 20mA, nonisolated
OM3-I-0/20	0 to 20mA, nonisolated

ZERO SUPPRESSION VOLTAGE

For the OM3-I, the zero suppression term, I_Z, can be set for any value between −63.5mA and +63.5mA through the use of R_2 and R_3 while I_Z can be set to any value from −31.75mA to +31.75mA for model OM3-II. I_Z is determined from the following relations:

$$\text{OM3-I:}\quad I_Z = 0.0635 \times \frac{R_2}{R_2 + R_3} \quad (I_Z \text{ in Amps})$$

$$\text{OM3-II:}\quad I_Z = 0.03175 \times \frac{R_2}{R_2 + R_3} \quad (I_Z \text{ in Amps})$$

with the sign of I_Z determined by the choice of location A (positive) or location B (negative) for R_3 (see Figure 2.1.2.3). The total resistance of (R_2 + R_3) should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. Using 10kΩ as the total value, R_2 and R_3 are determined from the following relations:

OM3-I

$$R_2 = \frac{100\Omega \cdot I_Z}{6.35V} \times 10k\Omega \quad (I_Z \text{ in Amps})$$

$$R_3 = 10k\Omega - R_2$$

OM3-II

$$R_2 = \frac{100\Omega \cdot I_Z}{3.175V} \times 10k\Omega \quad (I_Z \text{ in Amps})$$

$$R_3 = 10k\Omega - R_2$$

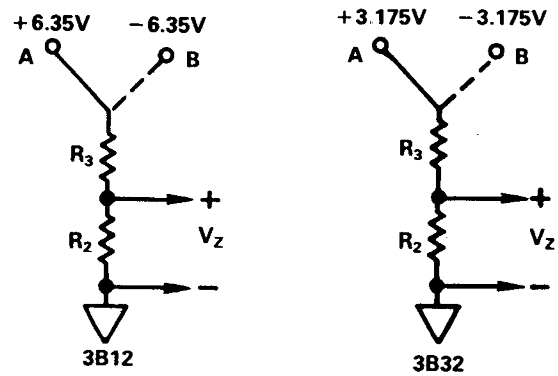


Figure 2.1.2.3 OM3-I and OM3-II Zero Suppression Resistors

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. For the OM3-I, the maximum input at either the HI or LO input terminal is ±6.6V with respect to output (system) common, which implies a 66mA current through the 100Ω resistor. The supplied resistor is 1/8W which means a higher watt resistor should be used if this much current is required. The maximum input current for the OM3-I is 30mA. The range of both module's voltage output adjustment is at least ±0.5V at the module output and can therefore correct any input offset error of less than 0.5V/Gain or 5mA/Gain with the 100Ω external resistor. If possible the resistors used should be 1% tolerance, 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.3 MODEL OM3-A-590

FEATURES
Accepts AD590/AC2626 Input

FUNCTIONAL DESCRIPTION

The OM3-A-590 is designed to interface with Analog Devices' AD590 temperature transducer. The OM3-A-590 is a nonisolated device that accommodates the AD590 temperature measurement range of −55°C to +130°C. Figure 2.1.3.1 shows a functional diagram for model OM3-A-590. A current sensing resistor, supplied with each module, is connected to screw terminals 2 and 3. Sensor excitation of up to +6V is provided by the modules. Input protection of up to 130V for the input and excitation screw terminals is provided in each device. The signal is then amplified and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V input protection, interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

The OM3-A-590 is factory calibrated to operate over most of the full range of the AD590 (−55°C to +130°C) and provides zero and span accuracy of ±0.1% span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage and current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Connect model OM3-A-590 as shown in Figure 2.1.3.1 with $R_L = 250\Omega$.
2. Apply $I_{IN} = 218.15\mu A$, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the measured voltage access $R_L = +1V \pm 4mV$.
3. Apply $I_{IN} = 403.15\mu A$, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the measured voltage access $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired, I_Z should be adjusted for 0mA ±0.020mA in step 2 and I_S should be adjusted for I_{OUT} = 20mA ±0.020mA in step 3 (A typical minimum output current is 10μA with 0-20mA operation).

The AD590 provides an output of 1μA/°K and the value of I_{IN} above is determined by the relation °K = °C +273.15. Thus for the AD590 range, −55°C = 218.15°K and +130°C = 403.15°K. The calibration is most readily accomplished with a current source and the AD590 could be used if it can be maintained at both reference temperatures.

The AD590 is available in many accuracy grades with calibration errors ranging from ±0.5°C to ±10.0°C. It is recommended that the higher quality grades be used (grades K, L or M) to assure that the OM3-A-590 can be properly calibrated for system zero if desired. The accuracy of the OM3-A-590 does not include sensor error.

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-A-590-P and OMX1310 which houses user supplied resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

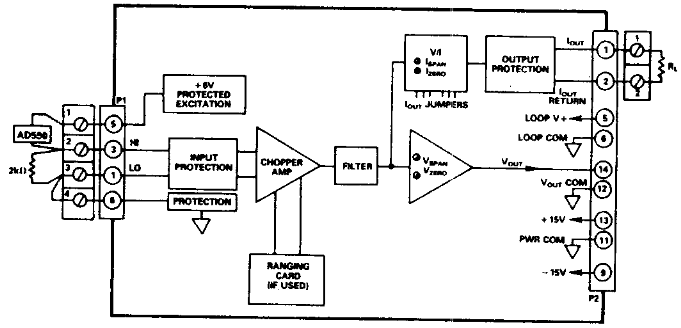


Figure 2.1.3.1 OM3-A-590 Functional Block Diagram

The OM3-A-590 is designed for use with AD590/AC2626 temperature sensors, whose output is 1μA per degree Kelvin. This current is converted to a voltage of 2mV per °K by a 2kΩ sensing resistor supplied with the OM3-A-590. The OM3-A-590 processes this signal exactly as would a OM3-MV, and the same rules for computing ranging components apply. However, it may be more convenient to work directly with the endpoint temperatures needed for an application. Use the following procedure:

1. Convert all temperatures to °K.
   To convert from °C to °K add 273.
   To convert from °F to °K, multiply by 5/9 and add 255.2.
   To convert from °R to °K, multiply by 5/9
2. Compute the values for the gain setting resistors, R_1 and the zero suppression resistors R_2 and R_3A. If a 0V to +10V output span is desired, the relations are:

   Gain Setting Resistor: $$R_1 = \frac{\Delta T}{5000 - \Delta T} \times 10k\Omega$$

   Zero Suppression Resistors: $$R_2 = T_{LO} \times 3.15\Omega$$ $$R_3A = 10k\Omega - R_2$$

   Where T_{LO} is the Kelvin temperature that is to read $0V_{OUT}$ and ΔT is the total temperature from T_{LO} to the temperature that is to read $+10V_{OUT}$.
3. If an output range of other than 0 to +10V is desired, the following relations should be used:

   Gain Setting Resistor: $$R_1 = \frac{\Delta T}{500\Delta V - \Delta T} \times 10k\Omega$$

   Zero Suppression Resistors: $$R_2 = \frac{T_{LO}\,\Delta V - V_{LO}\Delta T}{\Delta V} \times 3.15\Omega$$ $$R_3A = 10k\Omega - R_2$$

Where T_{LO} is the Kelvin temperature at the low end of the measurement range that is to produce an output of V_{LO}

T_{HI} is the Kelvin temperature at the high end of the measurement range that is to produce an output of V_{HI}.

ΔT is the total temperature range ($T_{HI} - T_{LO}$)

ΔV is the total output span ($V_{HI} - V_{LO}$)

SPECIFICATIONS
(typical @ +25°C and ±15V, +24V dc power)

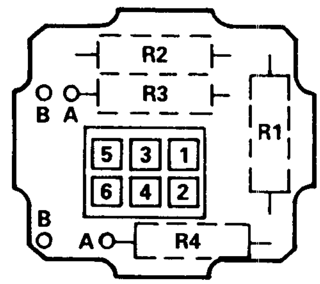
Model	OM3-A-590
Inputs	AD590 (−55°C to +130°C)
Outputs	0 to +10V @ 5mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]
Maximum Current Output Span	0–31mA
Accuracy[2]	±0.1% span
Nonlinearity	±0.01% span
Stability vs. Ambient Temperature	
Voltage Output	
Zero	±0.01°C/°C
Span	±0.0025% reading/°C
Current Output (w.r.t. Voltage Output)	
Zero	±0.0025% span/°C
Span	±0.0025% reading/°C
Normal Mode Rejection @ 50Hz or 60Hz	60dB
Differential Input Protection[3]	130V rms, cont.
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130V rms, cont.
Zero and Span Adjustment Range[4]	±5% of span
Response Time to 90% Span	0.2sec
Input Resistance	100MΩ
Input Bias Current	3nA
Excitation Voltage	+6V
Input Noise	0.2μV rms at 10Hz bandwidth
Output Noise	50μV rms in 100kHz bandwidth
Bandwidth	3Hz (−3dB)
Power Supplies[5]	
±15V Input Supplies Range	
(Rated Operation)	±(11.5V to 16.5V)
Supply Rejection	±0.01% span/V
Supply Current	±12mA
+24V Loop Supply Range	+12V to +30V
Supply Rejection	0.0002% span/V
Supply Current	27mA (at +FS)
Size	3.150″ × 0.775″ × 3.395″
Environmental	
Temperature Range, Rated Performance	−25°C to +85°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Includes excitation circuitry.
4. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
5. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

Specifications subject to change without notice.

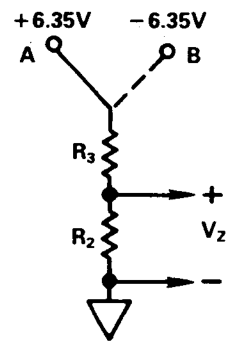
MODEL	INPUT RANGE
OM3-A-590-P	Externally Programmable
OM3-A-590	−55 to 130°C

4. R_3 should always go in location A. The total resistance of $R_2 + R_3$ should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. If there is no zero suppression, (−273°K = 0V), R_2 should be a jumper and R_3 left open (see Figure 2.1.3.3.).



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION
R_1	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor
R_{3A}	Open	Zero Suppression Resistor
R_4	Open	Open

Figure 2.1.3.2 OM3-A-590 Custom Ranging



R_3 should always go in location A.

Figure 2.1.3.3 OM3-A-590 Zero Suppression Resistors

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. For the OM3-A-590, the maximum input at either the HI or LO input terminal is ±6.6V with respect to output (system) common, which implies a 3.3mA current through the 2kΩ resistor. The range of the modules voltage output adjustment is at least ±0.5V at the module output and can therefore correct any error less than 0.5V/Gain or 250μA/Gain with the 2kΩ external resistor.* If possible, the resistors used should be 1% tolerance 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

*With the AD590, there is 273°K of zero suppression for any range beginning at 0°C. This large amount of zero suppression limits the amount of gain that can be taken so that in general a practical temperature range may be 100°C.

2.1.4 MODELS OM3-P3 AND OM3-P4

FEATURES

Accepts RTD Inputs
Linearized Outputs
Sensor Excitation Provided
Low Conformity Error
Low Lead Resistance Effect

FUNCTIONAL DESCRIPTION

The OM3-P3 and OM3-P4 are designed to accept a platinum RTD (Resistance Temperature Detector) input from the input screw terminals. The OM3-P3 accepts inputs from 2 or 3 wire RTDs while the OM3-P4 is specifically designed for 4 wire RTDs where high accuracy is required. The OM3-P3 provides automatic lead wire compensation to eliminate the effect of lead resistance from 3 wire sensors with an accuracy of ±0.02°C/Ω. The OM3-P4 provides automatic lead wire compensation for 4 wire sensors with an accuracy of ±0.00001°C/Ω. The RTD signal is internally linearized in each model to provide an output that is linear with temperature.

Figure 2.1.4.1 shows a functional diagram for models OM3-P3 and OM3-P4. A sensor excitation current of .25mA is provided by each module. Input protection of up to 130V for the input and excitation circuitry is provided. The signal is then amplified, linearized, and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Connect model OM3-P3 (OM3-P4) as shown in Figure 2.1.4.1. with R_L = 250Ω. Substitute a resistance standard for the RTD.
2. Determine the minimum and maximum resistance values of the platinum RTD from standard resistance/temperature tables. (For example, a measurement range of 0 to 100°C for a 100Ω platinum RTD corresponds to a resistance range of 100.00Ω to 138.50Ω.)
3. Connect the required minimum input resistance standard, adjust V_Z for V_{OUT} = 0V ±10mV and I_Z for I_{OUT} = 4mA ±0.016mA or the measured voltage across R_L = +1V ±4mA.
4. Connect the required maximum input resistance standard, adjust V_S for V_{OUT} = +10V ±20mV and I_S for I_{OUT} = 20mA ±0.016mA or the measured voltage across R_L = +5V ±4mV.

If a 0-20mA output is desired, I_Z should be adjusted for I_{OUT} = 0mA ±0.020mA in step 2 and I_S should be adjusted for I_{OUT} = 20mA ±0.020mA in step 3. (A typical minimum output current is 10μA with 0-20mA operation).

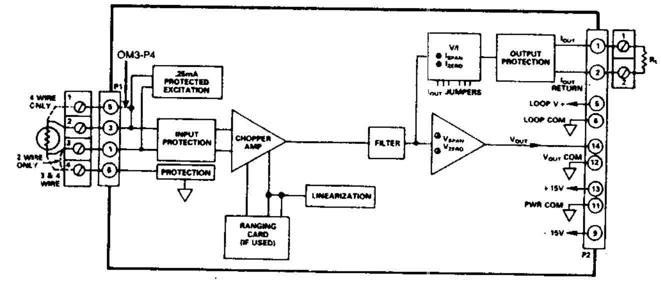


Figure 2.1.4.1 OM3-P3 and OM3-P4 Functional Block Diagram

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-P3-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

The ranging relations are identical for the OM3-P3 and OM3-P4. Ranging applications can be divided into two categories, depending on whether the module's internal linearizing circuit is used. If internal linearization is required, the following procedure applies:

1. The module's output voltage must always be positive since the linearizing circuit is active only for $V_O > 0$. The relations assume the use of a 0 to +10V output span. Other output ranges are possible, contact the factory for information on any other positive output range.
2. Any type of RTD can be used provided that its resistance does not exceed 10kΩ in the range of interest and its temperature characteristic is concave down. While virtually all RTDs have these properties, the conformity errors specified for these models apply specifically to 100Ω platinum RTDs following the European curve (α = 0.00385). Conformity errors for other RTD types can be supplied by the factory.
3. Ranging component values are found from:

Gain Setting Resistor: $R_1 = \dfrac{20k\Omega}{G - 1}$

Zero Suppression Resistor: OM3-P4: $R_2 = R_Z$ OM3-P3: $R_3A = R_Z$

Linearization Resistor: $R_4A = \dfrac{Q - 1}{2 - Q} \times 20k\Omega$

Where Gain $G = 40k\Omega \times \left(\dfrac{1}{\Delta R_{MS}} - \dfrac{1}{\Delta R_{FS}} \right)$

R_Z = Resistance of the RTD at the temperature T_{MIN} that is to give V_O = 0V

$Q = \dfrac{\Delta R_{FS}}{\Delta R_{MS}}$ (a measure of nonlinearity)

ΔR_{FS} is the change in resistance from T_{MIN} to T_{MAX}, which will give V_O = +10V

ΔR_{MS} is the change in resistance from T_{MIN} to T_{MID}, which will give V_O = +5V

Figure 2.1.4.2 graphically shows the RTD values needed for ranging the OM3-P3 and OM3-P4 while Figure 2.1.4.3 depicts the mounting locations of the ranging resistors.

If internal linearization is not required, then the following procedure applies:

1. Output voltages at the endpoints of the span may be anywhere in the range of −10V to +10V.

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-P3	OM3-P4
Inputs	100Ω Platinum RTD, 2 or 3 wire, α = 0.00385	100Ω Platinum RTD, 4 wire, α = 0.00385
Outputs	0 to +10V @ 5mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]	*
Maximum Current Output Range	0–31mA	*
Accuracy[2]	±0.1% span	*
Nonlinearity	±0.05% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Zero	±0.005% °C/°C	*
Span	±0.0025% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Lead Resistance Effect	±0.02°C/Ω	±0.00001 °C/Ω
Sensor Excitation Current	0.25mA	*
Normal Mode Rejection @ 50Hz or 60Hz	60dB	*
Differential Input Protection[3]	130V rms, cont.	*
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms, cont.	*
Zero and Span Adjustment Range[4]	±5% of span	*
Response Time to 90% Span	0.2sec	*
Input Resistance	100MΩ	*
Input Bias Current	3nA	*
Input Noise	0.2μV rms at 10Hz bandwidth	*
Output Noise	50μV rms in 100kHz bandwidth	*
Bandwidth	3Hz(−3dB)	*
Power Supplies[5]		
±15V Input Supplies Range		
(Rated Operation)	±(11.5V to 16.5V)	*
Supply Rejection	±0.01% span/V	*
Supply Current	±20mA	*
+24V Loop Supply Range	+12V to +30V	*
Supply Rejection	0.0002% span/V	*
Supply Current	27mA (at +FS)	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Includes excitation circuitry.
4. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
5. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-P3.
Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-P3-P	Externally Programmable
OM3-P3-N100	−100 to +100°C
OM3-P3-100	0 to 100°C
OM3-P3-200	0 to 200°C
OM3-P3-600	0 to 600°C
OM3-P4-P	Externally Programmable
OM3-P4-N100	−100 to +100°C
OM3-P4-100	0 to 100°C
OM3-P4-200	0 to 200°C
OM3-P4-600	0 to 600°C

2. Any type of RTD can be used provided that its resistance does not exceed 10kΩ in the measurement range of interest.

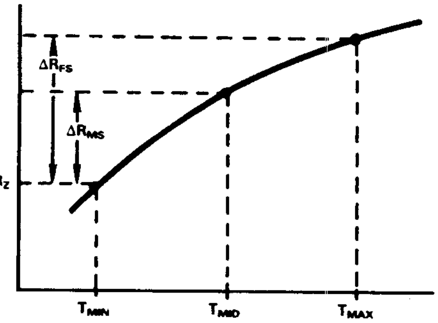
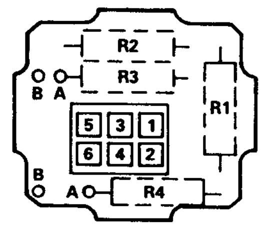


Figure 2.1.4.2 RTD Values Needed for Ranging Models OM3-P3 and OM3-P4.



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION	GAIN, ZERO SUPPRESSION AND LINEARIZATION
R_1	Gain Resistor	Gain Resistor	Gain Resistor
R_2*	Jumper	Zero Suppression Resistor	Zero Suppression Resistor
R_3	Open	Open	Open
R_4	Open	Open	Linearization Resistor

*Zero Suppression for 3B14 Uses R_{3A}.

Figure 2.1.4.3 3B14 and 3B15 Custom Ranging

3. Ranging components are computed from:

$$\text{Gain Setting Resistor: } R_1 = \frac{\Delta R_{FS}}{4000\ V_{FS} - \Delta R_{FS}} \times 20k\Omega$$

Zero Suppression
Resistor: OM3-P4: $R_2 = R_Z$ OM3-P3: $R_{3A} = R_{ZA} = R_Z$

Where R_Z = Resistance of the RTD at the temperature that is to give $V_O = 0V$
V_{FS} = Positive full scale output voltage desired
ΔR_{FS} = Change in RTD resistance from R_Z to the full scale temperature.

The fact that R_Z is set to the zero volt output point does not mean that negative outputs will not be meaningful; it just provides the simplest relation. Once R_1 and R_Z are determined, the output voltage at any RTD temperature can be found, given the RTD's resistance at that temperature (R_{RTD}), from the following relation:

$$V_O = (R_{RTD} - R_Z) \times 0.25mA \times G_V$$

$$\text{where } G_V = \frac{20k\Omega}{R_1} + 1$$

This relation is the general transfer function for the modules when linearization is not used.

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. The maximum RTD value that can be used with these modules is 10kΩ. The range of the module's voltage output adjustment is at least ±0.5V at the module output and can therefore correct any error less than 0.5V/Gain. If possible the ranging resistors used should be 1% tolerance, 10ppm while the linearization resistor can be a 50ppm part. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.5 MODEL OM3-S

FEATURES
Accepts Strain Gage Input
Provides Bridge Excitation

FUNCTIONAL DESCRIPTION

The OM3-S is designed to accept inputs from full four arm bridge strain gage-type transducers on the input screw terminals. The OM3-S provides a constant +10V excitation and can be used with 300Ω to 1000Ω strain gage bridges. The module has a fixed 3Hz bandwidth to eliminate high frequency noise.

Figure 2.1.5.1 shows a functional diagram for the model OM3-S. A constant bridge excitation voltage +10V is provided on screw terminals 1 and 4. Input protection of up to 130V for the input and excitation circuitry is provided. The signal is then amplified and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment.

Model OM3-S requires a ground return for the input connection to return the bias current to ground.

FINE CALIBRATION

The OM3-S is factory calibrated for a strain gage with a ±30mV span and provides a zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive procedure is recommended:

1. Connect model OM3-S as shown in Figure 2.1.5.1 with $R_L = 250\Omega$.
2. Apply $V_{IN} = 0$ volts, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the voltage measured across $R_L = +1V \pm 4mV$.
3. Apply $V_{IN} = +30mV$, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the voltage measured across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for $I_{OUT} = 0mA \pm 0.020mA$ in step 2 and I_S for $I_{OUT} = 20mA \pm 0.020mA$ in step 3. (A typical minimum output current is 10μA with 0-20mA operation).

If the current output is to be proportional to a −10V to +10V output instead of a 0 to +10V output, I_Z should be adjusted for a −30mV input in step 2.

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-S-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

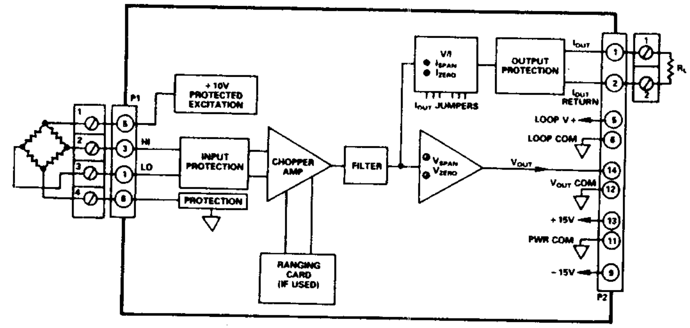


Figure 2.1.5.1 OM3-S Functional Block Diagram

The basic transfer function of the OM3-S:

$$V_O = G \times (V_{IN} - V_Z)$$

Where
V_O = Output Voltage
G = Gain
V_{IN} = Input Voltage
V_Z = Zero Suppression Voltage

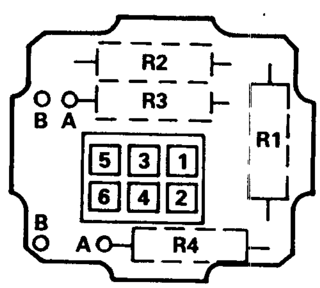
GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_1, which forms part of an internal divider and is determined from the following relation:

OM3-S

$$R_1 = \frac{10k\Omega}{G - 1}$$

Gain G is a ratio of the change of output to the input change that produced it. If there is to be no zero suppression, R_2 should be a jumper and R_3 should be left open. These resistors should be installed as indicated in Figure 2.1.5.2.



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION
R_1	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor
R_3	Open	Zero Suppression Resistor
R_4	Open	Open

Figure 2.1.5.2 OM3-S Custom Ranging

ZERO SUPPRESSION VOLTAGE

The zero suppression voltage, V_Z, can be set for any value between −6.35V and +6.35V through the use of R_2 and R_3 and is determined from the following relations:

$$V_Z = 6.35V \times \frac{R_2}{R_2 + R_3}$$

with the sign of V_Z determined by the choice of location A (positive) or location B (negative) for R_3 (see Figure 2.1.5.3). The total resistance of $(R_2 + R_3)$ should be approximately

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-S
Inputs	3mV/V
Outputs	±10V @ ±5mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]
Maximum Current Output Range	0–31mA
Accuracy[2]	±0.1% span
Nonlinearity	±0.01% span
Stability vs. Ambient Temperature	
Voltage Output	
Zero	±1 μV/°C (RTI)
Span	±0.0030% reading/°C
Current Output (w.r.t. Voltage Output)	
Zero	±0.0025% span/°C
Span	±0.0025% reading/°C
Bridge Excitation	+10V
Bridge Resistance Range	300Ω to 1kΩ
Normal Mode Rejection @ 50Hz or 60Hz	60dB
Differential Input Protection[3]	130V rms, cont.
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130V rms, cont.
Zero and Span Adjustment Range[4]	±5% of span
Response Time to 90% Span	0.2sec
Input Resistance	100MΩ
Input Bias Current	3nA
Input Noise	0.2μV rms at 10Hz bandwidth
Output Noise	50μV rms in 100kHz bandwidth
Bandwidth	3Hz (−3dB)
Power Supplies[5]	
±15V Input Supplies Range	
(Rated Operation)	±(12.7V to 16.5V)
Supply Rejection	±0.01% span/V
Supply Current	+45mA, −10mA
+24V Loop Supply Range	+12V to +30V
Supply Rejection	0.0002% span/V
Supply Current	27mA (at +FS)
Size	3.150" × 0.775" × 3.395"
Environmental	
Temperature Range, Rated Performance	−25°C to +85°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Includes excitation circuitry.
4. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
5. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-S-P	Externally Programmable
OM3-S-3	10V Excitation

Figure 2.1.5.3 OM3-S Zero Suppression Resistors

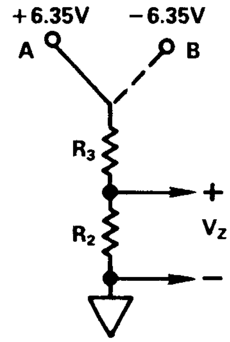


Figure 2.1.5.3 OM3-S Zero Suppression Resistors

10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. Using 10kΩ as the total value, R_2 and R_3 are determined from the following relations:

$$R_2 = \frac{V_Z}{6.35V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. The allowable input voltage for the OM3-S is 0 to +12V. The range of the module's voltage output adjustment is at least ±0.5V at the module output and can therefore correct any error less than 0.5V/Gain. If possible the resistors used should be 1% tolerance, 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.6 MODEL OM3-LV

FEATURES
Accepts LVDT or RVDT Input
Provides Complete LVDT Conditioning
Provides 1kHz to 10kHz AC Excitation
100Hz Bandwidth
High Accuracy: ±0.1%
Low Drift: ±0.01%/°C

FUNCTIONAL DESCRIPTION

The OM3-LV is a wideband input module that is designed to accept signals from 4, 5 or 6 wire LVDT or RVDT transducers. The OM3-LV provides an ac excitation of 1-5V rms at frequencies ranging from 1kHz to 10kHz.

Figure 2.1.6.1 shows a block diagram for the OM3-LV. The ac excitation is provided on terminals 1 and 4. The amplitude and frequency of the ac excitation can be specified when ordered or can be configured externally with the OMX1310 custom ranging card. Input protection of up to 130V is provided for the input and excitation circuitry. The signal is amplified to give the high level voltage output and automatically synchronously demodulated to correct for any phase shift errors from the primary to the secondaries of the LVDT, eliminating the need for a phase adjustment.

Unlike other OM3 Series modules, all of the gain and zero suppression is accomplished with a screwdriver through the sliding door on top of the module. The gain adjustment has a 256:1 adjustment range which is accomplished with a combination of a digital gain set rotary switch for coarse adjustment and a fine trim potentiometer for precise calibration. The zero suppression is output referred and can adjust the output over ±5V from the center setting. After the voltage output is calibrated, the 130VAC protected current output can be independently adjusted over a ±5% span range for zero and span with front panel accessible potentiometers. The current output is provided on screw terminal connections.

Historically, users of LVDTs have had to contend with various error terms. For example, quadrature voltages or null voltages are caused by interwinding capacitance and winding assymmetries. This error term is a residual ac voltage that appears at the differential output of the LVDT. It is called quadrature because it appears as a 90° out of phase voltage to the output signal. Another source of error is a fixed phase shift from the primary to the secondary of the LVDT. This error is often accounted for by synchronizing the demodulator on a phase shifted version of the excitation. In this approach the user must manually trim the phase of the demodulator and hope that the phase relationship does not shift with time or temperature.

The OM3-LV uses a unique approach to compensate for these errors. The two secondary windings are identified as A and B in Figure 2.1.6.1, with the normal output being A − B. The function A + B is a voltage that is in phase with the secondaries and nearly invariant with the core displacement. Since this term is much larger than the quadrature voltage, it can be used to drive the demodulator directly. The OM3-LV generates the A + B term by manipulating the A and A − B outputs. This approach automatically compensates for any phase error between the primary and secondaries of the LVDT and eliminates the need for a phase adjustment. It also rejects any residual quadrature voltages automatically. The OM3-LV is the complete solution for your LVDT needs.

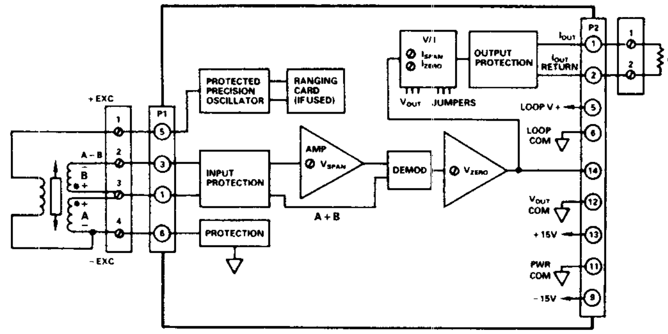


Figure 2.1.6.1 OM3-LV Functional Block Diagram

The OM3-LV has the flexibility to address the broad array of LVDTs available with its extensive gain and zero adjustment range. The AC excitation is limited to a 20mA rms load which sets a lower circuit primary impedance of 50Ω for a 1V excitation and 250Ω for a 5V excitation. If the primary impedance of the LVDT is below 50Ω, the impedance of the LVDT can be increased by increasing the excitation frequency. This excitation capability addresses the vast majority of the LVDTs on the market.

CALIBRATION

Each model, with the exception of the OM3-LV-P, is set up by the factory for a specified excitation voltage and frequency. The voltage output must be trimmed before the current output, because the large dynamic range of adjustment is accomplished in the voltage stage. Once the voltage output is calibrated, the current output can be independently adjusted. The following procedure is recommended:

1. Connect model OM3-LV as shown in Figure 2.1.6.1 with R_L = 250Ω, leaving the +EXC wire disconnected.
2. Adjust V_Z for V_O = 0V ± 10mV
3. Connect the LVDT +EXC lead and adjust the mounting scheme so the voltage output is 0V ±100mV. If minimal response to core position is noticed, first turn the rotary switch clockwise until full displacement of the core causes a change of several volts at the output. The dot is at minimum gain. Gain increases in the direction of the arrow on the face of the switch. This centers the LVDT core travel for maximum linearity.
4. Alternately position the core at both ends of travel and adjust the rotary switch to be close to the desired output span. Fine tune the span with the gain adjustment potentiometer. Each stop on the rotary switch represents a doubling of gain. Any gain in between two stops can be achieved by using the potentiometer.
5. Adjust V_Z when the core position is at center to 0V ± 10mV. Adjust I_Z = 4mA ±0.016mA or the voltage measured across R_L = 1V ±4mV.
6. Place the LVDT in the desired full scale output position and adjust I_Z for I_{OUT} = 20mA ±0.016mA or the voltage measured occurs R_L = 5V ±4mV.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for I_{OUT} = 0mA ±0.020mA in step 5 and I_S for I_{OUT} = 20mA ±0.020mA in step 6. A typical minimum output current is 10μA with 0-20mA operation.

If the current output is to be proportional to a −10V to +10V output instead of 0 to +10V output, I_Z should be adjusted for a −Full Scale input in step 5.

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-LV
Inputs	20mV rms - 5V rms
Outputs[1]	±10V @ ±5mA and 4-20mA or 0-20mA @ R_L = 850Ω
Maximum Current Output for Input Overload	40mA
Accuracy, when Calibrated[2]	±0.1% Span
Nonlinearity	±0.05% Span
Stability vs. Ambient Temperatures	
Voltage Output[3]	
Zero	±0.005% Span/°C
Span	±0.01% Span/°C
Current Output (w.r.t. Voltage Output)	
Zero	±0.0025% Span/°C
Span	±0.0025% Reading/°C
LVDT Excitation	
Excitation Voltage	1V rms - 5V rms
Excitation Tolerance	±10%
Excitation Frequency	1kHz - 10kHz ±15%
Excitation Drive	Up to 20mA rms min
Excitation Harmonic Distortion	<0.5%
Differential Input Protection[4]	130V rms, Continuous
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130V rms, Continuous
Voltage Zero Adjustment Range	±5V
Voltage Span Adjustment Range	256:1
Current Zero/Span Adjustment Range	±5% of Span
Bandwidth[5]	100Hz
Response Time to 90% Span	5ms
Input Resistance	100MΩ
Input Bias Current	1μA
Power Supplies[6]	
±15V Input Supplies Range (Rated Operation)	±(13V to 18V)
Supply Rejection	±0.03% Span/V
Supply Current[7]	±65mA max plus LVDT Current
+24V Loop Supply Range	+13.5V to +30V
Supply Rejection	0.001% Span/V
Supply Current	27mA (at +F.S.)
Size	3.150" × 0.775" × 3.395"
Environmental	
Temperature Range, Rated Performance	−25°C to +85°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C Noncondensing
RFI Susceptability	±0.5% Span Error 5W @ 400mHz @ 3ft.

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Includes excitation drift.
4. Includes excitation circuitry.
5. Bandwidth can be set for up to 1/10 the excitation frequency when ordering OM3-LV-CUSTOM.
6. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.
7. Typical number is ±40mA per module plus ±5mA for LVDT drive current. Supply current requirements for LVDT current is 75% of the LVDT rms current.

Specifications subject to change without notice.

MODEL	EXCITATION VOLTAGE & FREQUENCY
OM3-LV-P	Externally Programmable
OM3-LV-25	3Vrms @ 2.5kHz
OM3-LV-50	5Vrms @ 5kHz
OM3-LV-75	5Vrms @ 7.5kHz
OM3-LV-100	1Vrms @ 10kHz

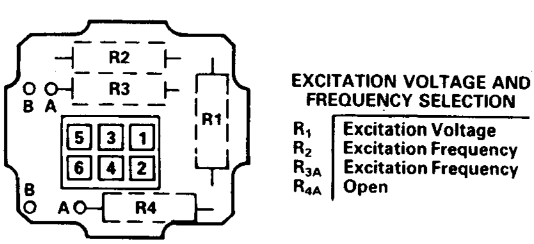


Figure 2.1.6.2 3B17 Custom Ranging

MULTIPLE LVDT INSTALLATIONS

LVDTs are AC devices and have potential to cause interference between units. Careful installation may eliminate this in many cases. For a complete discussion of wiring practices in multiple LVDT installations, refer to Appendix B1.

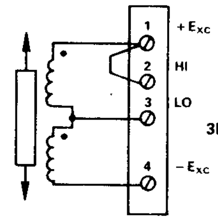
SYNCHRONIZING MULTIPLE LVDTs

The OM3-LV has the ability to synchronize its excitation with other OM3-LVs. For an extended discussion of that feature, please refer to Appendix B2.

DIFFERENTIAL COIL CONDITIONING

The OM3-LV-D is a version of the OM3-LV designed to address differential coil applications. The functional description and specifications are identical to the OM3-LV.

The OM3-LV-D must be connected as shown in the diagram below:



And, because the OM3-LV-D differential coil input module is intolerant of capacitive loads across the excitation terminal greater than 100pF, any capacitor across the entire differential coil must be removed.

CUSTOM CONFIGURATION

A powerful custom-ranging capability is provided with a plug-on ranging card, OMX1310. If a special excitation voltage or frequency is desired it can be provided by ordering the externally programmable version (OM3-LV-P) and the OMX1310 which houses the user supplied resistors that determine the excitation voltage and frequency of the new range. If possible, the excitation voltage resistor should be 1% tolerance, 10 ppm. The frequency resistors need only be 100 ppm. See Appendix A for a detailed discussion of limits of the ranging card. The excitation ranging flexibility and the wide calibration capability available with a standard OM3-LV together provide the flexibility needed for the complete signal conditioning solution to virtually any LVDT requirement. The bandwidth of all standard OM3-LV's that leave the factory is 100Hz. A factory configured OM3-LV-CUSTOM can have a bandwidth frequency. A special range can also be factory configured with the excitation voltage settable between 1V and 5V and the excitation frequency can vary between 1kHz and 10kHz. Consult the factory for details.

EXCITATION VOLTAGE SETTING RELATION

With the OMX1310, the excitation voltage amplitude is set by R1 which is determined from the following relation:

$$R1 = \frac{10k\Omega \times V\ rms}{7 - V\ rms}$$

V rms is the desired rms amplitude of the oscillation, and it can be selected for any value between 1V and 5V. The accuracy of the excitation is ±10% with a harmonic distortion of less than 0.5%.

EXCITATION FREQUENCY RELATION

The excitation frequency can be set for any value between 1kHz and 10kHz by resistors R_2 and R_3A. These values are determined by the equation below:

$$R_2, R_3A = \frac{10^9}{f \times 6.3}$$

where f is the desired frequency of oscillation. These resistors should be installed as indicated in Figure 2.1.6.2.

2.1.7 MODEL OM3-WBS

FEATURES
Accepts Strain Gage Input
20kHz Bandwidth
Provides Bridge Excitation
Dual High Level Outputs
- **Voltage: ±10V**
- **Current: 4-20mA/0-20mA**

High Accuracy: ±0.1%
Low Drift: ±3µV/°C
Input Protection: 130V rms Continuous
Reliable Pin and Socket Connections

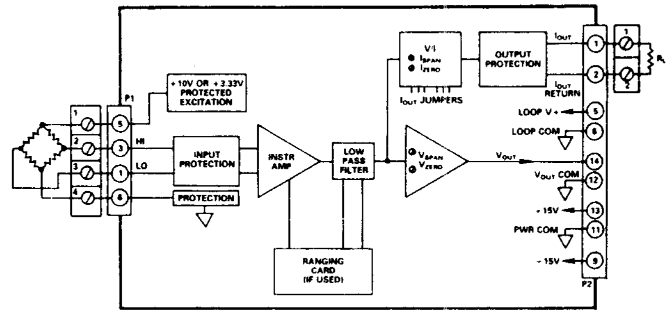


Figure 2.1.7.1 OM3-WBS Functional Block Diagram

FUNCTIONAL DESCRIPTION

The OM3-WBS is a wideband input module that is designed to accept signals from full four arm bridge strain gage-type transducers on the input screw terminals. The OM3-WBS provides a switch selectable excitation of +3.3V or +10.0V and can be used with 1000Ω to 100Ω strain gage bridges. The module has a 20kHz bandwidth to interface to dynamic signals.

Figure 2.1.7.1 shows a block diagram for the model OM3-WBS. A regulated bridge excitation of either +3.3V or +10.0V is provided on screw terminals 1 and 4. Input protection of up to 130V is provided for the input and excitation circuitry. The signal is amplified to give the high level voltage output. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment through screw terminal connections.

Model OM3-WBS requires a ground return for the input connection to return the bias current to ground.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. The excitation voltage should be used in the calibration setup since it has a ±2% tolerance. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive procedure is recommended:

1. Connect model OM3-WBS as shown in Figure 2.1.7.1 with $R_L = 250\Omega$.
2. Apply $V_{IN} = 0$ volts, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the voltage measured across $R_L = +1V \pm 4mV$.
3. Apply $V_{IN} = +$Full Scale, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the voltage measured across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for $I_{OUT} = 0mA \pm 0.020mA$ in step 2 and I_S for $I_{OUT} = 20mA \pm 0.020mA$ in step 3. (A typical minimum output current is 10µA with 0-20mA operation).

If the current output is to be proportional to a −10V to +10V output instead of a 0 to +10V output, I_Z should be adjusted for a −Full Scale input in step 2.

CUSTOM CALIBRATION

A powerful custom ranging capability is provided with a plug-on ranging card, OMX1310. If a special gain is desired, it can be provided by ordering the externally programmable version of the desired module and the OMX1310 which houses a user supplied resistor that determines the span of the new range. If desired, the 20kHz bandwidth can be reduced with user supplied capacitors installed in the OMX1310. A special range can also be factory configured. Consult the factory for details.

The basic transfer function of the OM3-WBS is:

$$V_O = G \times V_{IN}$$

Where
V_O = Output Voltage
G = Gain
V_{IN} = Input Voltage

There is no provision for zero suppression beyond the ±5% available with the zero potentiometers.

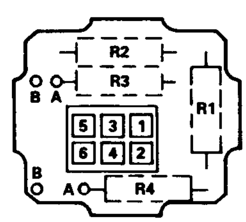
GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_3A which is determined from the following:

OM3-WBS

$$R_3A = \frac{200k\Omega}{G}$$

Gain G is a ratio of the change of output to the input change that produced it. If there is to be no bandwidth reduction, R_4A and R_1 should be left open. The gain-setting resistor should be installed as indicated in Figure 2.1.7.2.



	GAIN SELECTION ONLY	GAIN SELECTION AND BANDWIDTH REDUCTION
R_1	Open	Filter Capacitor, C_2
R_2	Open	Open
R_3A	Gain Resistor	Gain Resistor
R_4A	Open	Filter Capacitor, C_1

Figure 2.1.7.2 OM3-WBS Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-WBS
Inputs	
OM3-WBS-30	±30mV at 3mV/V Sensitivity
OM3-WBS-10	±10mV at 3mV/V Sensitivity
Outputs	±10V @ ±2mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]
Maximum Current for Input Overload	31mA
Accuracy[2]	±0.1% span
Nonlinearity	±0.01% span
Stability vs. Ambient Temperature	
Voltage Output	
Zero	±3μV/°C (RTI)
Span	±0.0025% reading/°C
Current Output (w.r.t. Voltage Output)	
Zero	±0.0025% span/°C
Span	±0.0025% reading/°C
Excitation Voltage	±0.0015%/°C
Bridge Excitation (User Selectable)	+10V, +3.33V
Excitation Tolerance	±2%
Bridge Resistance Range @V_{EXC} = +10.0V	300Ω to 1kΩ
Bridge Resistance Range @V_{EXC} = +3.33V	100Ω to 10kΩ
Common Mode Voltage, Input to Output	±10V
Common Mode Rejection @ 50Hz or 60Hz 1kΩ Source Unbalance	100dB
Differential Input Protection[3]	130V rms, Continuous
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130V rms, Continuous
Zero and Span Adjustment Range[4]	±5% of span
Bandwidth	20kHz
Response Time to 90% Span	24μs
Input Resistance	100MΩ
Input Bias Current	25nA
Power Supplies[5]	
±15V Input Supplies Range (Rated Operation)	±(13.5V to 16.5V)
Supply Rejection	±0.01% span/V
Supply Current	+50mA, −15mA
+24V Loop Supply Range	+13.5V to +30V
Supply Rejection	0.0002% span/V
Supply Current	27mA (at +FS)
Size	3.150" × 0.775" × 3.395"
Environmental	
Temperature Range, Rated Performance	−25°C to +85°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Includes excitation circuitry.
4. Custom calibration may be accomplished with a custom ranging card, OMX1310.
5. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-WBS-P	Externally Programmable
OM3-WBS-30	±30mV
OM3-WBS-10	±10mV

FREQUENCY RESPONSE

Model OM3-WBS standard bandwidth is 20kHz. The bandwidth can be set for any value less than 20kHz using the OMX1310. The required capacitors, C_1 and C_2, are determined from the following relations:

$C_1 = 8.4\mu F/F_C$
$C_2 = 4.2\mu F/F_C$

Note: For values of C_1 below 3nF, reduce C_1 by 320pF and C_2 by 160pF.

where F_C is the desired cutoff frequency. Bipolar capacitors capable of withstanding ±10V should be used. The space limitations of the OMX1310 must be considered when choosing the required capacitors. These capacitors are to be installed in the positions designated as R_4A and R_1 respectively as indicated in Figure 2.1.7.2. The OMX1310 can be used to reduce the bandwidth in factory ranged units.

EXCITATION VOLTAGE SELECTION

The excitation voltage is selected by dip switches accessible behind the sliding door on the front of the module, just below the zero and span trim potentiometers. The switch settings for the excitation voltage are indicated in Table 2.1.7.1. No other combinations of switch settings are useful.

When the excitation terminals are open-circuited and the 3.33V excitation voltage is selected, the actual terminal voltage will rise to over 8V. This is not a harmful effect, but must be considered when the product is being tested. A load as small as 0.25mA will bring the voltage down to its specified value.

Excitation Voltage	Switch 1	Switch 2
10.0V	OFF	ON
3.33V	ON	OFF

Table 2.1.7.1 OM3-WBS Excitation Voltage Switch Selections

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. The allowable input voltage for the OM3-WBS is ±10V. The range of the module's voltage output adjustment is at least +0.5V at the module output and can, therefore, correct any input offset error of less than 0.5V/Gain. If possible, the resistor should be 1% tolerance, 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.8 MODELS OM3-IMV AND OM3-IV

FEATURES

Accepts Millivolt and Volt Inputs

OM3-IMV ±10mV to ±100mV

OM3-IV ±1V to ±10V

Reliable Transformer Isolation

±1500V CMV

160dB CMR

Meets IEEE-STD 472: Transient Protection (SWC)

FUNCTIONAL DESCRIPTION

Model OM3-IMV is an isolated millivolt input device that is designed to accept millivolt signals ranging from ±10mV to ±100mV. Model OM3-IV is an isolated voltage input device that is designed to accept voltage signals ranging from ±1V to ±10V. Figure 2.1.8.1 shows a functional diagram for models OM3-IMV and OM3-IV. Input protection of up to 220V is provided on the input screw terminals. The signal is then amplifed and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Transformer coupling is used to achieve stable, galvanic isolation between input and output. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has a 130V output protection, interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Connect model OM3-IMV (OM3-IV) as shown in Figure 2.1.8.1 with R_L = 250Ω.
2. Apply V_{IN} = 0 volts, adjust V_Z for V_{OUT} = 0V ±10mV and I_Z for I_{OUT} = 4mA ±0.016mA or the measured voltage across R_L = +1V ±4mV.
3. Apply V_{IN} = + Full Scale adjust V_S for V_{OUT} = +10V ±10mV and I_S for I_{OUT} = 20mA ±0.016mA or the measured voltage across R_L = +5V ±4mV.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for I_{OUT} = 0mA ±0.020mA in step 2 and I_S for I_{OUT} = 20mA ±0.020mA in step 3. (A typical minimum output current is 10μA with 0-20mA operation).

If the current output is to be proportional to a −10V to +10V output instead of a 0 to +10V output, I_Z should be adjusted for a − Full Scale input in step 2.

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-IMV-P) and the OMX1310 which houses user supplied

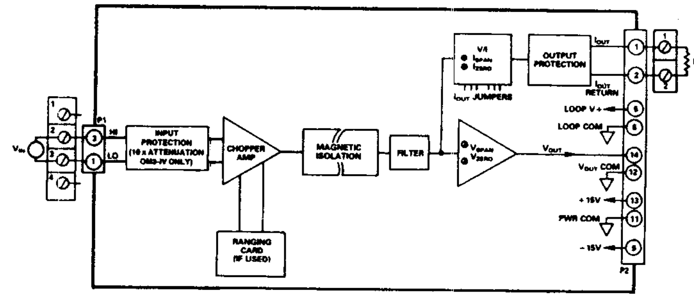


Figure 2.1.8.1 3B30 and 3B31 Functional Block Diagram

resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

The basic transfer function of both the OM3-IMV and OM3-IV is:

$$V_O = G \times (V_{IN} - V_Z)$$

Where
- V_O = Output Voltage
- G = Gain
- V_{IN} = Input Voltage
- V_Z = Zero Suppression Voltage

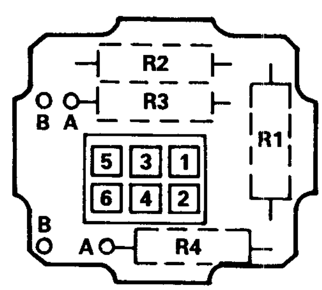
GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_1, which forms part of an internal divider and is determined from the following relation:

OM3-IMV: $R_1 = \frac{40k\Omega}{G-2}$

OM3-IV: $R_1 = \frac{4k\Omega}{G-0.2}$

Gain G is a ratio of the change of output to the input change that produced it. Model OM3-IMV is an OM3-IV with a 10 x normal mode input attenuator. The attenuation is done before zero suppression or gain, which causes a change in these relations. If there is to be no zero suppression, R_2 should be a jumper and R_3 should be left open. These resistors should be installed as indicated in Figure 2.1.8.2.



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION
R_1	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor
R_3	Open	Zero Suppression Resistor
R_4	Open	Open

Figure 2.1.8.2 OM3-IMV and OM3-IV Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-IMV	OM3-IV
Inputs	±10mV to ±100mV	±1V to ±10V
Outputs	±10V @ ±5mA	*
	4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]	
Maximum Current Output Range	0–31mA	*
Accuracy[2]	±0.1% span	*
Nonlinearity	±0.01% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Zero	±1μV/°C (RTI)	±0.0025% span/°C
Span	±0.0025% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Common Mode Voltage, Input to Output	±1500V pk max	*
Common Mode Rejection @ 50Hz or 60Hz 1kΩ Source Unbalance	160dB	160dB[3]
Normal Mode Rejection @ 50Hz or 60Hz	60dB	*
Differential Input Protection	220V rms, cont.	*
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms, cont.	*
Zero and Span Adjustment Range[4]	±5% of span	*
Response Time to 90% Span	0.2sec	*
Input Transient Protection	Meets IEEE-STD 472 (SWC)	*
Input Resistance	15MΩ	650kΩ
Input Bias Current	3nA	*
Input Noise	0.2μV rms at 10Hz bandwidth	*
Output Noise	50μV rms in 100kHz bandwidth	*
Bandwidth	3Hz (−3dB)	*
Power Supplies[5]		
±15V Input Supplies Range (Rated Operation)	±(11.5V to 16.5V)	*
Supply Rejection	±0.01% span/V	*
Supply Current	±10mA	*
+24V Loop Supply Range	+12V to +30V	*
Supply Rejection	0.0002% span/V	*
Supply Current	27mA (at +FS)	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES

1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Models OM3-V-5 and OM3-V-10 have CMR values of 150dB and 145dB respectively.
4. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
5. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-IMV.
Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-MV-P	Externally Programmable
OM3-MV-10	−10 to +10 mV
OM3-MV-50	−50 to +50mV
OM3-MV-100	−100 to +100mV
OM3-V-P	Externally Programmable
OM3-V-1	−1 to +1V
OM3-V-5	−5 to +5V
OM3-V-10	−10 to +10V

ZERO SUPPRESSION VOLTAGE

The zero suppression voltage, V_Z, can be set for any value between −3.175V and +3.175V for the OM3-IMV and −31.75V to +31.75V for OM3-IV through the use of R_2 and R_3 and is determined from the following relations:

OM3-IMV

$$V_Z = 3.175V \times \frac{R_2}{R_2 + R_3}$$

OM3-IV

$$V_Z = 31.75V \times \frac{R_2}{R_2 + R_3}$$

with the sign of V_Z determined by the choice of location A (positive) or location B (negative) for R_3 (see Figure 2.1.8.3). The total resistance of ($R_2 + R_3$) should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. (For the OM3-IV, the 31.75V term is a function of the 10× attenuation of the input signal. The internal voltage reference is 3.175V and high watt resistors are not required for zero suppression). Using 10kΩ as the total value, R_2 and R_3 are determined from the following relations:

OM3-IMV

$$R_2 = \frac{V_Z}{3.175V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

OM3-IV

$$R_2 = \frac{V_Z}{31.75V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

REF:

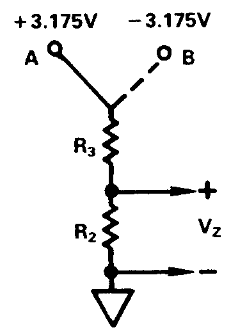


Figure 2.1.8.3 OM3-IMV and OM3-IV Zero Suppression Resistors

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. For the OM3-IMV, the maximum differential input voltage for normal linear operation is ±1V. For the OM3-IV, the maximum differential input voltage for normal linear operation is ±20V. The range of the voltage output adjustment is at least ±0.5V at the module output and can therefore correct any input offset error of less than 0.5V/Gain for the OM3-IMV and 5V/Gain for OM3-IV. If possible the resistors used should be 1% tolerance, 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.9 MODEL OM3-IP

FEATURES

- **Accepts RTD Inputs**
- **Linearized Outputs**
- **Sensor Excitation Provided**
- **Reliable Transformer Isolation**
  - **±1500V CMV**
  - **160dB CMR**
  - **Meets IEEE-STD 472: Transient Protection (SWC)**
- **Low Conformity Error**
- **Low Lead Resistance Effect**

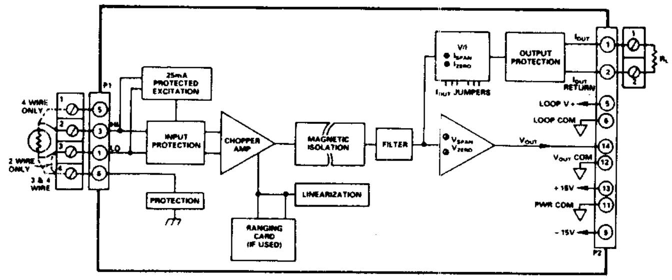


Figure 2.1.9.1 OM3-IP Functional Block Diagram

FUNCTIONAL DESCRIPTION

The OM3-IP accepts inputs from 2, 3, or 4 wire 100Ω platinum RTDs (Resistance Temperture Detectors). Modules for 2 or 3 wire 10Ω copper RTDs, and 2, 3, or 4 wire 120Ω nickel RTDs are also available. Automaic lead wire compensation eliminates the effect of lead resistance from 3 wire sensors with an accuracy of ±0.02°C/Ω. Platinum and nickel RTD signals are internally linearized. Copper RTDs are linear devices.

Figure 2.1.9.1 shows a functional diagram for model OM3-IP. A sensor excitation current is provided for each module: 0.25mA for platinum and nickel RTDs, 1.0mA for copper RTDs. Input protection of up to 220V for the input and excitation circuitry is provided. The signal is then amplified, linearized, and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Transformer coupling is used to achieve stable galvanic isolation between input and output. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

The OM3-IP is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Connect model OM3-IP as shown in Figure 2.1.9.1 with $R_L = 250\Omega$. Substitute a resistance standard for the RTD.
2. Determine the minimum and maximum resistance values of the RTD from standard resistance/temperature tables. (For example, a measurement range of 0 to 100°C for a 100Ω platinum RTD corresponds to a resistance range of 100.00Ω to 138.50Ω.)
3. Connect the required minimum input resistance standard, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the measured voltage across $R_L = +1V \pm 4mV$.
4. Connect the required maximum input resistance standard, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the measured voltage across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired, I_Z should be adjusted for 0mA ±0.020mA in step 2 and I_S should be adjusted for $I_{OUT} = 20mA \pm 0.020mA$ in step 3. (A typical minimum output current is 10μA with 0-20mA operation).

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. A special input range can be provided by ordering the externally programmable version of the desired module (i.e., OM3-IP-P) and the OMX1310 which houses user supplied resistors that determine the new range. A special range can also be factory configured. Consult the factory for details.

For platinum and nickel RTD applications where internal linearization is required, the following relations determine the values of the custom ranging components. These relations assume the use of a 0 to +10V output span. Contact the factory for information on any other output range.

Linearization Resistor:

OM3-IP $$R_4A = \left[\frac{Q-1}{(2-Q)\times 1.7} - 1\right] \times 25k\Omega$$

Nickel RTD $$R_4A = \left[\frac{Q-1}{(Q-2)\times 1.85} - 1\right] \times 28.3k\Omega$$

Gain Setting Resistor: $$R_1 = 20k\Omega\left(\frac{G}{1-G}\right)$$

Zero Suppression Resistor: $$R_3A = R_Z$$

Where $Q = \dfrac{\Delta R_{FS}}{\Delta R_{MS}}$ (a measure of nonlinearity)

R_Z = Resistance of the RTD at the temperature T_{MIN} that is to give $V_O = 0V$

$$G = \frac{\Delta R_{FS}}{2\times 10^4}\left(\frac{1}{Q-1}\right)$$

ΔR_{FS} is the change in resistance from T_{MIN} to T_{MAX}, which will give $V_O = +10V$

ΔR_{MS} is the change in resistance from T_{MIN} to T_{MID}, which will give $V_O = +5V$

Figure 2.1.9.2 graphically shows the RTD values needed for ranging the OM3-IP while Figure 2.1.9.3 depicts the mounting locations of the ranging resistors.

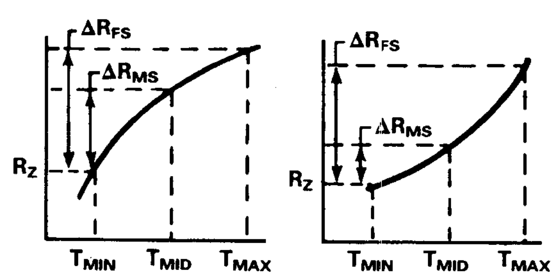


Figure 2.1.9.2 RTD Values Needed for Ranging

SPECIFICATIONS

(typical @ + 25°C and ± 15V, + 24V dc power)

Model	OM3-IP
Inputs	100Ω Platinum RTD 2, 3, or 4 wire, α = 0.00385 (Model OM3-IP);
2 or 3 Wire	10Ω Copper RTD, 2 or 3 Wire Models
	120Ω Nickel RTD, 2, 3, or 4 Wire Models also available
Outputs	0 to + 10V @ 5mA
	4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]
Maximum Current Output Range	0–31mA
Accuracy[2]	± 0.1% span
Nonlinearity	± 0.05% span
Stability vs. Ambient Temperature	
Voltage Output	
Zero	± 0.02 °C/°C
Span	± 0.0025% reading/°C
Current Output (w.r.t. Voltage Output)	
Zero	± 0.0025% span/°C
Span	± 0.0025% reading/°C
Common Mode Voltage, Input to Output	± 1500V pk max
Common Mode Rejection @ 50Hz or 60Hz	
1kΩ Source Unbalance	160dB
Normal Mode Rejection @ 50Hz or 60Hz	60dB
Sensor Excitation Current (100Ω Pt, 120Ω Ni)	0.25mA
(10Ω Cu)	1.0mA
Lead Resistance Effect (100Ω Pt, 120Ω Ni)	± 0.02°C/Ω
(10Ω Cu)	± 0.2°C/Ω
Differential Input Protection[3]	220V rms, cont.
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130V rms, cont.
Zero and Span Adjustment Range[4]	± 5% of span
Response Time to 90% Span	0.2sec
Input Resistance	15MΩ
Input Bias Current	3nA
Input Noise	0.2µV rms at 10Hz bandwidth
Output Noise	50µV rms in 100kHz bandwidth
Bandwidth	3Hz(− 3dB)
Power Supplies[5]	
± 15V Input Supplies Range	
(Rated Operation)	± (11.5V to 16.5V)
Supply Rejection	± 0.01% span/V
Supply Current	± 10mA
+ 24V Loop Supply Range	+ 12V to + 30V
Supply Rejection	0.0002% span/V
Supply Current	27mA (at + FS)
Size	3.150" × 0.775" × 3.395"
Environmental	
Temperature Range, Rated Performance	− 25°C to + 85°C
Storage Temperature Range	− 55°C to + 85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing
RFI Susceptibility	± 0.5% span error, 5W @ 400MHz @ 3 ft.

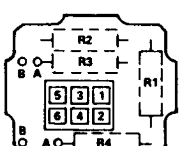
NOTES

1. For a 0-20 mA range, a typical minimum output current is 10µA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Includes excitation circuitry.
4. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
5. + 24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ± 15V is all that is required.

Specifications subject to change without notice.

MODEL*	INPUT RANGE
OM3-IP-P	Externally Programmable
OM3-IP-N100	− 100 to + 100°C
OM3-IP-100	0 to 100°C
OM3-IP-200	0 to 200°C
OM3-IP-600	0 to 600°C

* 120Ω Nickel and 10Ω Copper Models also available



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION	GAIN, ZERO SUPPRESSION AND LINEARIZATION
R_1	Gain Resistor	Gain Resistor	Gain Resistor
R_2	Open	Open	Open
R_3A	Jumper	Zero Suppression Resistor	Zero Suppression Resistor
R_4A	Open	Open	Linearization Resistor

Figure 2.1.9.3 OM3-IP Custom Ranging

For copper RTDs, or for platinum or nickel RTD applications which do not require internal linearization, the following custom ranging procedure applies:

1. Output voltages at the endpoints of the span may be anywhere in the range of − 10V to + 10V.
2. Ranging components are computed from:

Gain Setting Resistor:

OM3-IP, also Nickel 3B34-N-00

$$R_1 = \frac{\Delta R_{FS}}{2000\ V_{FS} - \Delta R_{FS}} \times 20k\Omega$$

Copper

$$R_1 = \frac{\Delta R_{FS}}{500\ V_{FS} - \Delta R_{FS}} \times 20k\Omega$$

Zero Suppression Resistor: $R_{3A} = R_Z$

Where R_Z = Resistance of the RTD at the temperature that is to give $V_O = 0V$

V_{FS} = Positive full scale output voltage desired

ΔR_{FS} = Change in RTD resistance from R_Z to the full scale temperature.

The fact that R_Z is set to the zero volt output point does not mean that negative outputs will not be meaningful; it just provides the simplest relation. Once R_1 and R_Z are determined, the output voltage at any RTD temperature can be found, given the RTD's resistance at that temperature (R_{RTD}), from the following relation for the OM3-IP or the Nickel Model:

$$V_O = (R_{RTD} - R_Z) \times 0.25mA \times G_V$$

For the Copper Model, the relation is:

$$V_O = (R_{RTD} - R_Z) \times 1.0mA \times G_V$$

In both cases: $$G_V = \left(\frac{20k\Omega}{R_1} + 1\right) \times 2 = \frac{40k\Omega}{R_1} + 2$$

These relations are the general transfer functions for the modules when linearization is not used.

The ranging card can be used to create a wide variety of special transfer functions with virtually any type RTD. RTDs with a concave down temperature characteristic should be conditioned with OM3-IP. RTDs with a concave up temperature characteristic should be conditioned with the Nickel. Any type RTD can be used with nonlinearized custom ranging.

LIMITS

There are practical limits that must be observed when ranging the OM3-IP. The maximum RTD value in the measurement range of interest must not exceed 10kΩ for the OM3-IP and Nickel Model or 2.5kΩ for the Copper Model. The range of the voltage output adjustment is at least ± 0.5V at the module output and can therefore correct any error less than 0.5V/Gain. If possible the ranging resistors used should be 1% tolerance, 10ppm while the linearization resistor can be a 50ppm part. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.10 MODEL OM3-ITC

FEATURES

Accepts J,K,T,E,R,S or B Thermocouple Inputs
Reliable Transformer Isolation
- **±1500V CMV**
- **160dB CMR**
- **Meets IEEE-STD 472: Transient Protection (SWC)**

Internal Cold Junction Compensation
Open Thermocouple Detection

FUNCTIONAL DESCRIPTION

The OM3-ITC accepts its signal from type J, K, T, E, R, S, and B thermocouples and provides two high level outputs that are proportional to the input signal.

Figure 2.1.10.1 shows a functional diagram for the model OM3-ITC. Input protection of up to 220V is provided for the input circuitry. Cold Junction Compensation with an initial accuracy of ±0.5°C is performed in each unit with the external sensor provided on all channels of the OM3 Series backplane. The signal is amplified and filtered to give the high level voltage outputs. Chopper based amplification is used to assure low drift and excellent long term stability. Transformer coupling is used to achieve stable galvanic isolation between input and output. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers. The current output, which has 130V output protection, interfaces with user equipment through screw terminal connections.

DOWNSCALE OPEN INPUT DETECTION

The OM3-ITC provides upscale open thermocouple detection when used under normal operation. Downscale open thermocouple detection can be provided by installing a 220MΩ resistor across screw terminals 2 and 4. This resistor could be a 0.25W carbon comp and need not be a tight tolerance (±20%). The addition of this resistor reverses the input bias current which provides downscale open input detection.

FINE CALIBRATION

The OM3-ITC is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. Cold junction sensors, with an initial accuracy of ±0.5°C are provided on each backplane channel. If greater accuracy is desired, the modules should be calibrated in the actual backplane channel that they will be installed in. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive adjustment procedure is recommended:

1. Make connections as shown in Figure 2.1.10.1 with R_L = 250Ω. Use a precision millivolt source.
2. Measure the ambient temperature of the screw terminal block and determine the millivolt output for the thermocouple type being used from standard millivolt/temperature tables. This value will be inverted and added to the millivolt span of the thermocouple being simulated.
3. Determine the zero and full scale points for the measurement range from standard millivolt/temperature tables, and add to the number determined in step 2.

Example: Type J 0°C – 500°C

Zero and full scale values:	0mV to +27.388mV
Output at ambient temperature:	1.277mV (invert sign)
Corrected zero and span values:	−1.277mV to +26.111mV

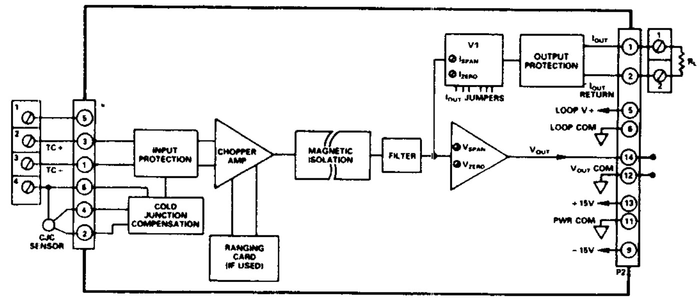


Figure 2.1.10.1 OM3-ITC Functional Block Diagram

4. Apply V_{IN} for the minimum input signal (determined in step 3), adjust V_Z for V_{OUT} = 0V ±10mV and I_Z for I_{OUT} = 4mA ±0.016mA or the measured voltage across R_L = +1V ±4mV.
5. Apply V_{IN} for the maximum input signal (determined in step 3), adjust V_S for V_{OUT} = +10V ±10mV and I_S for I_{OUT} = 20mA ±0.016mA or the measured voltage across R_L = +5V ±4mV.

If a 0-20mA output is desired, I_Z should be adjusted for I_{OUT} = 0mA ±0.020mA in step 4 and I_S should be adjusted for I_{OUT} = 20mA ±0.020mA in step 5. (A typical minimum output current is 10μA with 0-20mA operation).

The OM3-ITC might also be calibrated using an ice bath setup.

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e., OM3-ITC-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. A special range can also be factory configured. Consult the factory for details.

The basic transfer function of the OM3-ITC can be expressed as:

$$V_O = G \times (V_{IN} - V_Z)$$

Where

V_O	=	Output Voltage
G	=	Gain
V_{IN}	=	Input Voltage
V_Z	=	Zero Suppression Voltage

The output voltages for a given temperature span and thermocouple type are available from standard tables, and these values should be substituted in the above equation.

GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_1, which forms part of an internal divider and is determined from the following relation:

$$R_1 = \frac{40k\Omega}{G-2}$$

Gain G is a ratio of the change of output to the input change that produced it. If there is to be no zero suppression, (i.e., 0°C = 0mV = 0V output) then R_2 should be a jumper and R_3 should be left open. Refer to the cold junction compensation section for the value for R_4B. These resistors should be installed as indicated in Figure 2.1.10.2.

SPECIFICATIONS

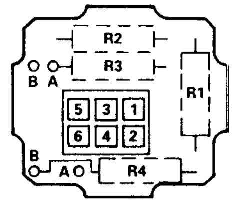
(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-ITC
Inputs	Thermocouple Types J, K, T, E, R, S, B
Outputs	0 to +10V @ 5mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]
Accuracy[2]	±0.1% span
Nonlinearity	±0.01% span
Stability vs. Ambient Temperature	
Voltage Output	
Zero	±0.02°C/°C
Span	±0.0025% reading/°C
Current Output (w.r.t. Voltage Output)	
Zero	±0.0025% span/°C
Span	±0.0025% reading/°C
Common Mode Voltage, Input to Output	±1500V pk max
Common Mode Rejection @ 50Hz or 60Hz 1kΩ Source Unbalance	160dB
Normal Mode Rejection @ 50Hz or 60Hz	60dB
Differential Input Protection	220V rms, cont.
Voltage Output Protection	Continuous Short to Ground
Current Output Protection	130V rms, cont.
Zero and Span Adjustment Range[3]	±5% of span
Response Time to 90% Span	0.2sec
Input Transient Protection	Meets IEEE-STD 472 (SWC)
Input Resistance	15MΩ
Input Bias Current	15nA
Input Noise	0.2μV rms at 10Hz bandwidth
Open Input Response	Upscale
Open Input Detection Time	10sec
Output Noise	50μV rms in 100kHz bandwidth
Bandwidth	3Hz (−3dB)
Cold Junction Compensation	
Initial Accuracy[4]	±0.5°C
vs Temperature[5] (+5°C to +45°C)	±0.5°C
Power Supplies[6]	
±15V Input Supplies Range (Rated Operation)	±(11.5V to 16.5V)
Supply Rejection	±0.01% span/V
Supply Current	±12mA
+24V Loop Supply Range	+12V to +30V
Supply Rejection	0.0002% span/V
Supply Current	27mA (at +FS)
Size	3.150" × 0.775" × 3.395"
Environmental	
Temperature Range, Rated Performance	−25°C to +85°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
4. When used with CJC sensor provided on OM3 Series backplanes.
5. Compensation error contributed by ambient temperature changes.
6. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-ITC-P	Externally Programmable
OM3-ITC-J	J −100 to +760°C
OM3-ITC-K	K −100 to +1350°C
OM3-ITC-T	T −100 to +400°C
OM3-ITC-E	E 0 to 900°C
OM3-ITC-R	R 0 to 1750°C
OM3-ITC-S	S 0 to 1750°C
OM3-ITC-B	B 0 to 1800°C



	GAIN SELECTION ONLY	GAIN AND ZERO SUPPRESSION	GAIN, ZERO SUPPRESSION AND COLD JUNCTION COMPENSATION
R_1	Gain Resistor	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor	Zero Suppression Resistor
R_3	Open	Zero Suppression Resistor	Zero Suppression Resistor
R_4B	Open	Open	CJC Resistor

Figure 2.1.10.2 OM3-ITC Custom Ranging

ZERO SUPPRESSION VOLTAGE

The zero suppression voltage, V_Z, can be set for any value between −3.175V and +3.175V through the use of R_2 and R_3 and is determined from the following relations:

$$V_Z = 3.175V \times \frac{R_2}{R_2 + R_3}$$

with the sign of V_Z determined by the choice of location A (positive) or location B (negative) for R_3, (see Figure 2.1.9.3). The total resistance of (R_2 + R_3) should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. Using 10kΩ as the total value, R_2 and R_3 are determined from the following relations:

$$R_2 = \frac{V_Z}{3.175V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

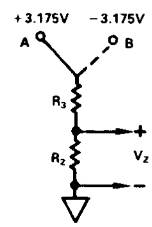


Figure 2.1.10.3 OM3-ITC Zero Suppression Resistors

COLD JUNCTION COMPENSATION SELECTION

The OM3-ITC incorporates internal cold junction compensation circuitry which is used with the external sensors incorporated in the OM3 Series backplanes. The calibration of this circuitry is accomplished with a resistor installed in position R_4B. The values for thermocouple types J, K, T, E, R, S and B are defined below; if another type is required, consult the factory for the required resistor value.

TC Type	J	K	T	E	R	S	B
R_4B	210Ω	165Ω	165Ω	243Ω	23.7Ω	23.7Ω	Jumper (0Ω)

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. The maximum differential input voltage for normal linear operation is ±1V. The range of the voltage output adjustment is at least ±0.5V at the module output and can therefore correct any error of less than 0.5V/Gain. If possible the resistors used should be 1% tolerance, 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.11 MODELS OM3-WBV-MV AND OM3-WBV-V

FEATURES
Accepts Inputs from ±10mV to ±10V Inputs
10kHz Bandwidth
Dual High Level Outputs
Voltage: ±10V
Current: 4-20mA/0-20mA
High Accuracy: ±0.1%
Low Drift: ±2μV/°C
Reliable Transformer Isolation
±1500V CMV, CMR=100dB
Meets IEEE-472: Transient Protection (SWC)
Input Protection: 220V rms Continuous
Reliable Pin and Socket Connections

FUNCTIONAL DESCRIPTION

The OM3-WBV-MV is an isolated wideband millivolt input module that is designed to accept signals from ±10mV to ±100mV. Model OM3-WBV-V is an isolated wideband voltage input module that is designed to accept voltage input signals ranging from ±1V to ±10V. Each model has a 10kHz bandwidth to interface to dynamic signals.

Figure 2.1.11.1 shows a functional diagram for models OM3-WBV-MV and OM3-WBV-V. Input protection of up to 220V rms is provided on the input screw terminals. Transformer coupling is used to achieve stable galvanic isolation between input and output. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with front panel accessible potentiometers. The current output, which has 130V rms output protection, interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive procedure is recommended:

1. Connect model OM3-WBV-MV (OM3-WBV-V) as shown in Figure 2.1.11.1 with $R_L = 250\Omega$.
2. Apply $V_{IN} = 0$ volts, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the voltage measured across $R_L = +1V \pm 4mV$.
3. Apply $V_{IN} = +$Full Scale, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the voltage measured across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for $I_{OUT} = 0mV \pm 0.020mA$ in step 2 and I_S for $I_{OUT} = 20mA \pm 0.020mA$ in step 3. (A typical minimum output current is 10μA with 0-20mA operation.)

If the current output is to be proportional to a −10V to +10V output instead of a 0 to +10V output, I_Z should be adjusted for a −Full Scale input in step 2.

CUSTOM CALIBRATION

A powerful custom ranging capability is provided with a plug-on ranging card, OMX1310. If special gain is desired, it can be provided by ordering the externally programmable version of the desired module and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. Special ranges can also be factory configured. Consult the factory for details.

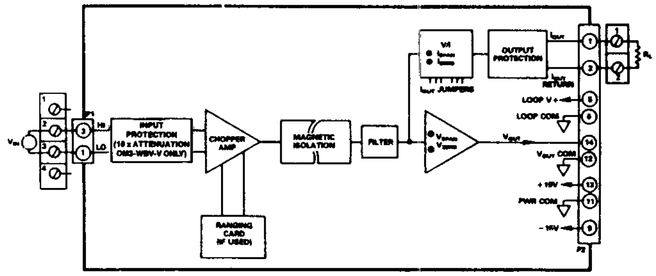


Figure 2.1.11.1 OM3-WBV-MV and OM3-WBV-V Functional Block Diagram

The basic transfer function of both the OM3-WBV-MV and OM3-WBV-V is:

$$V_O = G \times (V_{IN} - V_Z)$$

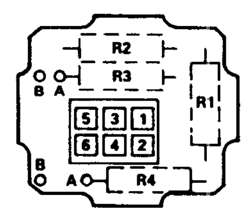
Where
V_O = Output Voltage
G = Gain
V_{IN} = Input Voltage
V_Z = Zero Suppression Voltage

GAIN SETTING RELATION

With OMX1310, the gain G is set by R_1, which is determined from the following relations:

OM3-WBV-MV	OM3-WBV-V
$R_1 = \frac{400k\Omega}{G-4}$	$R_1 = \frac{40k\Omega}{G-0.4}$

Gain G is a ratio of the change of output to the input change that produced it. Model OM3-WBV-MV is an OM3-WBV-V with a 10 X normal mode input attenuator. The attenuation is done before the zero suppression and gain. If there is to be no zero suppression, R_2 should be a jumper and R_3 should be left open. These resistors should be installed as indicated in Figure 2.1.11.2.



	GAIN SELECTION	GAIN AND ZERO SUPPRESSION
R_1	Gain Resistor	Gain Resistor
R_2	Jumper	Zero Suppression Resistor
R_3	Open	Zero Suppression Resistor
R_4	Open	Open

Figure 2.1.11.2 OM3-WBV-MV and OM3-WBV-V Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-WBV-MV	OM3-WBV-V
Inputs	±10mV to ±1V	±1V to ±10V
Outputs	±10V @ ±2mA 4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]	*
Accuracy[2]	±0.1% span	*
Nonlinearity	±0.02% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Input Zero	±2μV/°C (RTI)	±10μV/°C
Output Zero	±25μV/°C	*
Span	±0.0025% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Common Mode Voltage, Input to Output	±1500V pk max	*
Common Mode Rejection @ 50Hz or 60Hz		
1kΩ Source Unbalance	100dB	85dB
Differential Input Protection	220V rms, cont.	*
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms, cont.	*
Zero and Span Adjustment Range[3]	±5% of span	*
Bandwidth (−3dB)	10kHz	*
Response Time to 90%	55μs	*
Input Resistance	200MΩ	250kΩ
Input Bias Current	5nA	*
Input Noise		
(dc − 1MHz; R_S = 10kΩ)	5μV rms	*
Output Ripple and Noise	25mV pk to pk	*
Power Supplies[4]		
±15V Input Supplies Range	±(12V to 16.5V)	*
Supply Rejection	±0.01% span/V	*
Supply Current	±10mA	*
+24V Loop Supply Range	+12V to +30V	*
Supply Rejection	0.0002% span/V	*
Supply Current	27mA (at +FS)	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 40°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Custom calibration may be accomplished with a custom ranging card, OMX1310.
4. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-WBV-MV.
Specifications subject to change without notice.

Model	Range
OM3-WBV-P	Externally Programmable
OM3-WBV-10MV	−10 to +10mV
OM3-WBV-50MV	−50 to +50mV
OM3-WBV-100MV	−100 to +100mV
OM3-WBV-P	Externally Programmable
OM3-WBV-1V	−1 to +1V
OM3-WBV-5V	−5 to +5V
OM3-WBV-10V	−10 to +10V

FREQUENCY RESPONSE

The standard bandwidth of the OM3-WBV-MV and OM3-WBV-V is 10kHz. This frequency response is determined by a two pole filter. A third pole is available to reduce the frequency response of custom ranged units if desired. These modules can be configured at the factory with a 100Hz minimum bandwidth.

ZERO SUPPRESSION VOLTAGE

The zero suppression voltage, V_Z, can be set for any value between −3.175V and +3.175V for OM3-WBV-MV and −31.75V to +31.75V for OM3-WBV-V through the use of R_2 and R_3 and is determined from the following relations:

OM3-WBV-MV

$$V_Z = 3.175V \times \frac{R_2}{R_2 + R_3}$$

OM3-WBV-V

$$V_Z = 31.75V \times \frac{R_2}{R_2 + R_3}$$

with the sign of V_Z determined by the choice of location A (positive) or location B (negative) for R_3 (see Figure 2.1.11.3). The total resistance of ($R_2 + R_3$) should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating in the resistors. (For the OM3-WBV-V, the 31.75V term is a function of the 10× attenuation of the input signal. The internal voltage reference is 3.175V so standard 100mW resistors are suitable for zero suppression.) Using 10kΩ as the total value, R_2 and R_3 are determined from the following relations:

OM3-WBV-MV

$$R_2 = \frac{V_Z}{3.175V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

OM3-WBV-V

$$R_2 = \frac{V_Z}{31.75V} \times 10k\Omega$$

$$R_3 = 10k\Omega - R_2$$

REF:

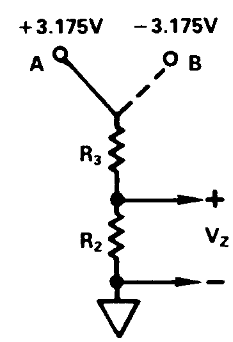


Figure 2.1.11.3 OM3-WBV-MV and OM3-WBV-V Zero Suppression Resistors

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. For the OM3-WBV-MV, the maximum differential input voltage for normal linear operation is ±2.5V. For the OM3-WBV-V, the maximum differential input voltage for normal linear operation is ±25V. The range of the voltage output adjustment is at least ±0.5V at the module output and can therefore correct any input offset error of less than 0.5V/Gain for the OM3-WBV-MV and 5V/Gain for OM3-WBV-V. If possible, the resistors used should be 1% tolerance, 10ppm. see Appendix A for detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.12 MODELS OM3-ACV-MV, OM3-ACV-10V AND OM3-ACV-150V/250V

FEATURES
Accepts 20mV to 550V ac Inputs
Dual High Level Outputs
- **Voltage: 0 to +10V**
- **Current: 4-20mA/0-20mA**

High Accuracy: ±0.5%
Low Drift: 50ppm/°C
Reliable Transformer Isolation
- **±1500V CMV, CMR = 100dB**
- **Meets IEEE-472: Transient Protection (SWC)**

Input Protection: 220V rms Continuous (550V rms for OM3-ACV-150V/250V)
Reliable Pin and Socket Connections

FUNCTIONAL DESCRIPTION

Models OM3-ACV are designed to accept ac sinewave input signals. Model OM3-ACV-P accepts signals ranging from 20mV to 1V rms, model OM3-ACV-P2 accepts signals ranging from 1V to 50V rms and model OM3-ACV-P3 accepts inputs ranging from 50V rms to 550V rms.

Figure 2.1.12.1 shows a functional block diagram for OM3-ACV models. Input protection of up to 220V rms (550V rms for model OM3-ACV-150V, 250V) is provided on the input screw terminals. Each module uses an ac averaging technique. The input signal is rectified, filtered and scaled to give an rms reading for a sine-wave input. This scaling is not accurate for other input waveforms. Transformer coupling is used to achieve stable, galvanic isolation between input and output. Both the voltage and current outputs can be independently adjusted over a ±5% span range for zero and span with front panel accessible potentiometers. The current output, which has 130V rms output protection, interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.5% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage output and the current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive procedure is recommended:

1. Connect the unit as shown in Figure 2.1.12.1 with $R_L = 250\Omega$.
2. Apply $V_{IN} = 0$ volts, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the measured voltage across $R_L = +1V \pm 4mV$.
3. Apply $V_{IN} = +$Field Scale, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ or the voltage measured across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired for a 0 to +10V output, adjust I_Z for $I_{OUT} = 0mA \pm 0.020mA$ in Step 2 and I_S for $I_{OUT} = 20mA \pm 0.020mA$ in Step 3. (A typical minimum output current is 10µA with 0-20mA operation.)

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A powerful custom ranging capability is provided with a plug-on ranging card, OMX1310. If a special range is desired,

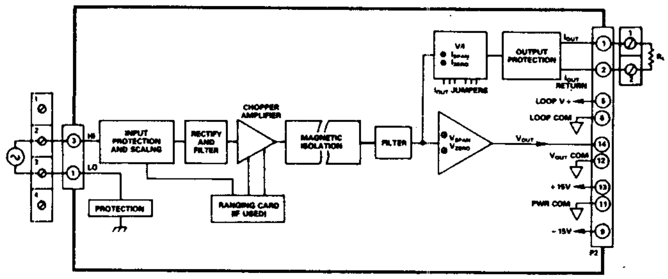


Figure 2.1.12.1 OM3-ACV Functional Block Diagram

it can be provided by ordering the externally rangable version of the desired module (i.e., OM3-ACV-MV-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. Special ranges can also be factory configured. Consult the factory for details.

The basic transfer function of the OM3-ACV is:

$$V_O = G(V_{IN} - V_Z)$$

where
- V_O = Output Voltage
- G = Gain
- V_{IN} = Input Voltage (rms)
- V_Z = Zero Suppression Voltage (rms)

Gain G is the ratio of the change of output to the input change that produced it.

SCALING RELATIONS

With the OMX1310, the gain is set by R_1 and R_4B. R_1 is used to control the scaling of input in each of these three models while R_4B determines the gain from the rectifier on. R_1 is determined from the following relations:

OM3-ACV-MV

$$R_1 = \frac{20k\Omega}{\frac{1}{KV_m} - 1}$$

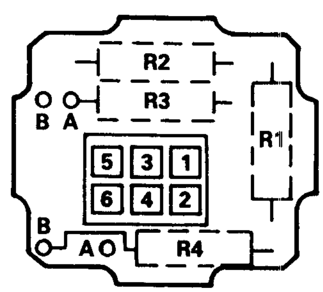
OM3-ACV-10V

$$R_1 = \frac{20k\Omega}{\frac{50}{KV_m} - 1}$$

OM3-ACV-150V, 250V

$$R_1 = \frac{20k\Omega}{\frac{550}{KV_m} - 1}$$

Where $K = V\,av/V\,rms = 0.900$ for sinusoids
V_m = full scale rms input voltage



	SCALING SELECTION ONLY	SCALING AND ZERO SUPPRESSION
R_1	Input Scaling Resistor	Input Scaling Resistor
R_2	Jumper	Zero Suppression Resistor
R_3	Open	Open
R_4B	Output Scaling Resistor	Output Scaling Resistor

Figure 2.1.12.2 OM3-ACV Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-ACV-MV	OM3-ACV-10V	OM3-ACV-150V, 250V
Inputs, 50Hz–400Hz	20mV to 1V	1V to 50V	50V to 550V
Outputs	0-10V @ 5mA	*	*
	4-20mA or 0-20mA @R_L = 0 to 850Ω[1]	*	*
Accuracy[2]	±0.5% span	*	*
Stability vs. Ambient Temperature			
Voltage Output			
Zero	±0.005% span/°C	*	*
Span	±0.005% reading/°C	*	*
Current Output (wrt Voltage Output)			
Zero	±0.0025% span/°C	*	*
Span	±0.0025% reading/°C	*	*
Common-Mode Voltage			
Input to Output	±1500V peak max	*	*
Common-Mode Rejection			
@ 50Hz or 60Hz, 1kΩ source unbalance	100dB	*	*
Differential Input Protection	220V rms, continuous	*	550V rms, continuous
Voltage Output Protection	Continuous Short to Ground	*	*
Current Output Protection	130V rms, continuous	*	*
Zero and Span Adjustment Range[3]	±5% of span	*	*
Bandwidth[4]	3Hz	*	*
Response Time to 90% Span	0.2 sec	*	*
Input Transient Protection	Meets IEEE-STD-472 (SWC)	*	*
Input Resistance	100MΩ	250kΩ	1MΩ
Input Bias Current	1nA	5nA	3nA
Output Noise	50μV rms on 100kHz Bandwidth	*	*
Power Supplies[5]			
±15V Input Supplies Range (Rated Operation)	±(11.5V to 16.5V)	*	*
Supply Rejection	±0.01% span/V	*	*
Supply Current	+10mA, −10mA	*	*
+24V Loop Supply	+12V to +30V	*	*
Supply Rejection	0.002% span/V	*	*
Supply Current	27mA (at +FS)	*	*
Size	3.150″ × 0.775″ × 3.395″	*	*
Environmental			
Temperature Range, Rated Performance	−25°C to +85°C	*	*
Storage Temperature Range	−55°C to +85°C	*	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C Noncondensing	*	*
RFI Susceptibility	0.5% span error 5W @ 400MHz @ 3 feet	*	*

NOTES
1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Custom calibration may be accomplished with a custom ranging card, OMX1310.
4. Bandwidth represents a response to a change in amplitude.
5. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-ACV.
Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-ACV-P	Externally Programmable (20mV-1V rms)
OM3-ACV-50MV	0 to +50mV rms
OM3-ACV-P2	Externally Programmable (1V-50V rms)
OM3-ACV-10V	0 to +10V rms
OM3-ACV-P3	Externally Programmable (50V-550V rms)
OM3-ACV-150V	0 to +150V rms
OM3-ACV-250V	0 to +250V rms

The difference between these three models is in the input scaling. The scaling is done before the zero suppression or gain so that the maximum value presented to the rectifier is 1V rms. The signal is processed the same from this point on in each of the three models. R_4B is determined from the following relation, which is the same for all models:

$$R_4B = \frac{40k\Omega}{G1-2} \qquad \text{where } G1 = \frac{10V}{1-\frac{V_z}{V_m}}$$

(10V represents the module's output span.)

If there is to be no zero suppression, R_2 should be a jumper. These resistors should be installed as indicated in Figure 2.1.12.2.

ZERO SUPPRESSION VOLTAGE

The zero suppression voltage, V_Z, can be set for any value between 0 and 1.23V. Since the signal varies from 0 to 1V dc at the amplifier input, a zero suppression voltage of 0 to 1V dc corresponds linearly to a 0–100% of full scale zero suppression.

The zero suppression resistor, R_2, is determined from the following relations for all three models:

$$R_2 = \frac{10k\Omega\ (V_z/V_m)}{1.23 - V_z/V_m}$$

R_2 should be installed as indicated in Figure 2.1.12.2.

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits that must be observed. The allowable input voltages are 20mV–1V rms for the OM3-ACV-P, 1-50V rms for the OM3-ACV-P2, and 50-550V rms for the OM3-ACV-P3. The range of the modules voltage output adjustment is at least ±0.5V at the module output and can, therefore, correct any input offset error of less than 0.5V/Gain for the OM3-ACV-MV, 25V/Gain for the OM3-ACV-10V, and 275V/Gain for the OM3-ACV-150V, 250V. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.13 MODELS OM3-IFI AND OM3-IFI-K

FEATURES
Accepts Frequency Inputs
Dual High Level Outputs
Voltage: 0 to +10V
Current: 4-20mA/0-20mA
High Accuracy: ±0.1%
Low Drift: ±500µV/°C
Reliable Transformer Isolation
±1500V CMV
Meets IEEE-472: Transient Protection (SWC)
Input Protection: 220V rms Continuous
Reliable Pin and Socket Connections

FUNCTIONAL DESCRIPTION

Model OM3-IFI is an isolated frequency input module that is designed to accept full scale frequency signals ranging from 25Hz to 1100Hz. Model OM3-IFI-K is an isolated frequency input module that is designed to accept full scale frequency signals ranging from 520Hz to 25kHz. The OM3-IFI has a 15ms debounce option that is factory installed for ranges less than 30Hz. Both modules have a user selectable threshold of either 0V or 1.6V, and an internal pull-up resistor for use with switch closure inputs.

Figure 2.1.13.1 shows a functional block diagram for models OM3-IFI and OM3-IFI-K. Input protection of up to 220V rms is provided on the four input screw terminals. The input signal is compared to the selected threshold and hysteresis and the comparator's output frequency is converted to a voltage. The signal is then amplified and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Transformer coupling is used to achieve stable, galvanic isolation between input and output. Both the voltage and current outputs can be independently adjusted over a ±5% span range from zero and span with the front panel accessible potentiometers. The current output which has 130V output protection interfaces with user equipment through screw terminal connections.

FINE CALIBRATION

Each model is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of both the voltage and current output. The two outputs are adjusted independently and are noninteractive. The following nonrecursive procedure is recommended:

1. Connect model OM3-IFI (OM3-IFI-K) as shown in Figure 2.1.13.1 with $R_L = 250\Omega$.
2. Apply $F_{IN} = 0Hz$, adjust V_Z for $V_{OUT} = 0V \pm 10mV$ and I_Z for $I_{OUT} = 4mA \pm 0.016mA$ or the measured voltage across $R_L = +1V \pm 4mV$.
3. Apply F_{IN} = Full Scale, adjust V_S for $V_{OUT} = +10V \pm 10mV$ and I_S for $I_{OUT} = 20mA \pm 0.016mA$ on the measured voltage across $R_L = +5V \pm 4mV$.

If a 0-20mA output is desired, adjust I_Z for $I_{OUT} = 0mA \pm 0.020mA$ in Step 2 and I_S for $I_{OUT} = 20mA \pm 0.020mA$ in Step 3. (A typical minimum output current is 10µA with 0-20mA operation).

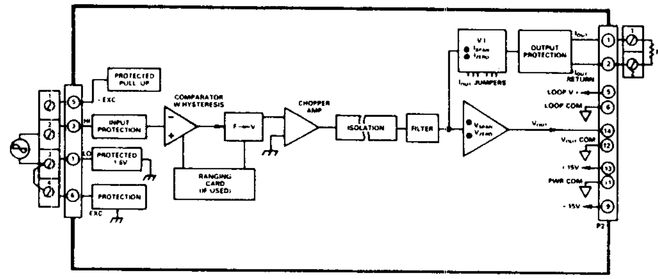


Figure 2.1.13.1 OM3-IFI and OM3-IFI-K Functional Block Diagram

OPTIONAL ZERO SUPPRESSION/CUSTOM CALIBRATION

A wide zero suppression capability and easy field calibration are available with a plug-on ranging card, OMX1310. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (e.g., OM3-IFI-P) and the OMX1310 which houses user supplied resistors that determine the zero, span and hysteresis of the new range. A special range can also be factory configured. Analog Devices will provide the function when a model OM3—CUSTOM is ordered with the desired range.

The basic transfer function of both the OM3-IFI and OM3-IFI-K is:

$$V_O = G \times (F_{IN} - F_Z)$$

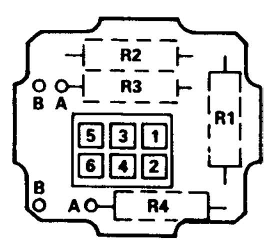
When
V_O = Output Voltage
G = Gain (V/Hz)
F_{IN} = Input Frequency
F_Z = Zero Suppression Frequency

GAIN SETTING RELATION

With the OMX1310, the gain G is set by R_1 which is determined from the following relation:

OM3-IFI	OM3-IFI-K
$R_1 = G \times 1.18 \times 10^6$	$R_1 = G \times 2.60 \times 10^7$

Gain G is a ratio of the change of output to the input change that produced it. If there is to be no zero suppression, R_2 should be left open. If a hysteresis of 4V is acceptable, R_4A should be left open. If no hysteresis is desired, install a jumper in R_4A. The gain resistor R_1 should be installed as indicated in Figure 2.1.13.2.



	GAIN SELECTION	GAIN AND ZERO SUPPRESSION	GAIN, ZERO SUPPRESSION AND HYSTERESIS
R_1	Gain Resistor	Gain Resistor	Gain Resistor
R_2	Open	Zero Suppression Jumper	Zero Suppression Resistor
R_3	Open	Open	Open
R_4A	Jumper	Jumper	Hysteresis Resistor

Figure 2.1.13.2 OM3-IFI and OM3-IFI-K Custom Ranging

SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-IFI	OM3-IFI-K
Inputs (Min and Max Span)	25Hz–1100Hz	520Hz–25kHz
Input Voltage Level	10mV–220V rms	*
Outputs	0–10V @ 5mA	*
	4-20mA or 0-20mA @ R_L = 0 to 850Ω[1]	*
Maximum Current Output for Input Overload	31mA	*
Accuracy[2]	±0.1% span	*
Nonlinearity	±0.02% span	*
Stability vs. Ambient Temperature		
Voltage Output		
Zero	500μV/°C	*
Span	±0.0050% reading/°C	*
Current Output (w.r.t. Voltage Output)		
Zero	±0.0025% span/°C	*
Span	±0.0025% reading/°C	*
Common-Mode Voltage, Input to Output	±1500V peak max	*
Differential Input Protection	220V rms continuous	*
Voltage Output Protection	Continuous Short to Ground	*
Current Output Protection	130V rms continuous	*
Zero and Span Adjustment Range[3]	±5% span	*
Input Transient Protection	Meets IEEE-STD 472 (SWC)	*
Input Resistance		
(Small Signal)	15MΩ	*
(Large Signal, V_{IN}>4V)	82kΩ	
Input Bias Current	3nA	*
Output Ripple	10mV rms @10% span max	*
Output Noise	75μV rms at 100kHz	*
Power Supplies[4]		
±15V Input Supplies Range (Rated Operation)	±(11.5V to 16.5V)	*
Supply Rejection	±0.01% span/V	*
Supply Current	±16mA	±19mA
+24V Loop Supply Range	+13.5V to +30V	*
Supply Rejection	0.0002% span/V	*
Supply Range	27mA (at +FS)	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

NOTES

1. For a 0-20 mA range, a typical minimum output current is 10μA.
2. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
3. Custom calibration may be accomplished with a custom ranging card, OMX1310.
4. +24V dc power is only needed for driving the current output at up to 850Ω. If only voltage output is used, or a current output load of 400Ω or less is desired, ±15V is all that is required.

*Specifications same as OM3-IFI.
Specifications subject to change without notice.

MODEL	INPUT RANGE
OM3-IFI-P1	Externally Programmable (min. span 25Hz, Max. span 1100Hz)
OM3-IFI-25	0 to 25Hz
OM3-IFI-300	0 to 300Hz
OM3-IFI-P2	Externally Programmable (Min. span 520Hz; Max span 25kHz)
OM3-IFI-1.5K	0 to 1.5kHz
OM3-IFI-3K	0 to 3kHz
OM3-IFI-25K	0 to 25kHz

ZERO SUPPRESSION FREQUENCY

The zero suppression frequency, F_Z, can be set for any value up to 80% of the desired input span through the use of R_2. Zero suppression is limited by temperature drift. Values larger than 80% of the input span will have a larger amount of temperature drift. The value for R_2 is determined from the following relations:

OM3-IFI OM3-IFI-K

$$R_2 = \frac{1.52 \times 10^7}{F_Z} \qquad R_2 = \frac{3.33 \times 10^8}{F_Z}$$

HYSTERESIS SELECTION

A standard OM3-IFI or OM3-IFI-K is shipped with zero hysteresis since a jumper is installed on the range carrier pins. If the jumper is removed, there will be nominally ±4V (±20%) of hysteresis. If less hysteresis is desired, it can be accomplished with the following equation:

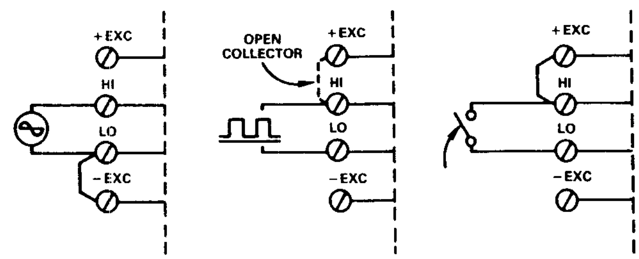
OM3-IFI OM3-IFI-K

$$R_4A = \frac{10^6 \times V_H}{4 - V_H} \qquad R_4A = \frac{10^6 \times V_H}{4 - V_H}$$

where V_H is the desired hysteresis. V_H can be set for any value between 0 and 4V with a ±20% tolerance.

THRESHOLD SELECTION

The threshold is determined by user wiring on the input screw terminals. If the input signal is a zero crossing voltage input, the LO input screw terminal must be tied to the −EXC screw terminal to implement a 0V threshold (see Figure 2.1.13.3a). When the LO input is not connected to the −EXC terminal (as in Figure 2.1.13.3b), the threshold is 1.6V which is useful for TTL level inputs. For open collector outputs, an internal pull-up resistor is provided at the +EXC screw terminal. The pull-up resistor, and 1.6V threshold are used with switch closure inputs (Figure 2.1.13.3c).



a. Zero Crossing Threshold *b. 1.6V Threshold* *c. 1.6V Threshold with Contact Excitation*

Figure 2.1.13.3 Threshold Selection

RESPONSE TIME

Response time is a function of the frequency range. The table below indicates the time required to reach 90% of the output span for a step change input to the minimum and maximum ranges of the OM3-IFI and OM3-IFI-K. Other ranges will have response times in between these extremes.

Model	Range	Response Time
OM3-IFI	0–25Hz	1.6sec
OM3-IFI	0–1.1kHz	0.6sec
OM3-IFI-K	0–520Hz	0.07sec
OM3-IFI-K	0–25kHz	0.03sec

LIMITS

The ranging card can be used to create a wide range of special transfer functions, but there are practical limits to be observed. The OM3-IFI-K can accept ranges between 25kHz and 50kHz with a gradual decrease in linearity. A 0 to 30kHz range has 0.02% nonlinearity, 0-40kHz has 0.12% nonlinearity and a 0-50kHz range has 0.5% nonlinearity. The OM3-IFI and OM3-IFI-K offer input protection up to 220V and will operate normally up to that value. However, the user may want to externally attenuate large signals to reduce the noise level below the available hysteresis. The range of the module's output adjustment is at least ±0.5V at the module output and can, therefore correct any error of less than 0.5V/Gain. If possible, the resistors should be 1% tolerance 10ppm. See Appendix A for a detailed discussion of limits, error contributions, and temperature effects of the ranging card.

2.1.14 MODEL OM3-LTC

FEATURES

Accepts J, K, T, E, R, S or B Thermocouple Inputs
Provides Linearized 0-10V Output
Reliable Transformer Isolation
±1500V CMV
160dB CMR
Meets IEEE-STD-472: Transient Protection (SWC)
Internal Cold Junction Compensation
Open Thermocouple Detection

FUNCTIONAL DESCRIPTION

The OM3-LTC accepts it's signal from type J, K, T, E, R, S, and B thermocouples and provides a 0 to +10V output. The input signal is internally linearized to provide an output which is linear with temperature. Figure 2.1.14.1 shows a functional diagram for the model OM3-LTC. Input protection of up to 220V is provided for the input circuitry. Cold Junction Compensation with an initial accuracy of ±0.5°C is performed in each unit with the external sensor provided on all channels of the OM3 Series backplane. The signal is amplified and filtered to give the high level voltage output. Chopper based amplification is used to assure low drift and excellent long term stability. Transformer coupling is used to achieve stable galvanic isolation between input and output. The voltage output can be adjusted over a ±5% span range for zero and span with the front panel accessible potentiometers.

DOWNSCALE OPEN INPUT DETECTION

The OM3-LTC provides upscale open thermocouple detection when used under normal operation. Downscale open thermocouple detection can be provided by installing a 220MΩ resistor across screw terminals 2 and 4. This resistor could be 0.25W carbon comp and need not be a tight tolerance (±20%). The addition of this resistor reverses the input bias current which provides downscale open input detection.

FINE CALIBRATION

The OM3-LTC is factory calibrated for a specified range to provide zero and span accuracy of ±0.1% of span. Cold junction sensors, with an initial accuracy of ±0.5°C, are provided on each backplane channel. If greater accuracy is desired, the modules should be calibrated in the actual backplane channel that they will be installed in. User accessible zero and span trim potentiometers providing a ±5% adjustment range permit precise field calibration of the voltage output. The following nonrecursive adjustment procedure is recommended:

1. Make connections as shown in Figure 2.1.14.1. Use a precision millivolt source.
2. Measure the ambient temperature of the screw terminal block and determine the millivolt output for millivolt/temperature tables. This value will be inverted and added to the millivolt span of the thermocouple being simulated.
3. Determine the zero and full scale points for the measurement range from standard millivolt/temperature tables, and add to the number determined in step 2.

   Example: Type J 0-500°C

Zero and full scale values:	0mV to +27.388mV
Output at ambient temperature:	1.277mV (invert sign)
Corrected zero and span values:	−1.277mV to +26.111mV

4. Apply V_{IN} for the minimum input signal (determined in step 3), adjust V_Z for V_{OUT} = 0V ±10mV.
5. Apply V_{IN} for the maximum input signal (determined in step 3), adjust V_S for V_{OUT} = +10V ±10mV.

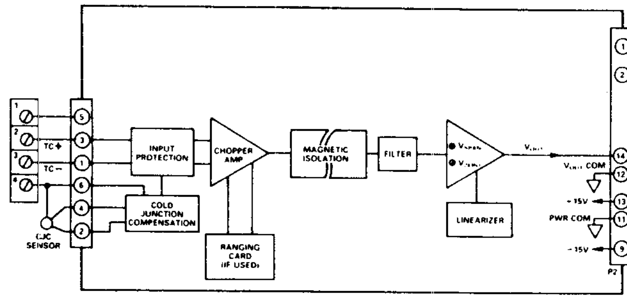


Figure 2.1.14.1 OM3-LTC Functional Block Diagram

5. Apply V_{IN} for the maximum input signal (determined in step 3), adjust V_S for V_{OUT} = +10V ±10mV.

The OM3-LTC may also be calibrated using an ice bath setup.

OPTIONAL ZERO SUPPRESSION/ CUSTOM CALIBRATION

The OM3-LTC-CUSTOM is recommended for the user needing an OM3-LTC with special ranging. This is a factory configured unit in which the factory will install the resistors needed for zero, span, and cold junction compensation as well as the fifteen separate components needed for linearization. (Consult the factory for details.)

OPTIONAL CURRENT OUTPUT

A current output can be provided for the OM3-LTC by installing an OM3-VI or OM3-IVI in an adjacent channel and installing a jumper on the backplane that connects the OM3-LTC output to the Current Output Module's (either OM3-IV or OM3-IVI) input. If utilizing this feature with the OM3-IV Non-Isolated Current Output Module, the OM3-LTC will have a current output capability comparable to that of the OM3-ITC Thermocouple Module. If, on the other hand, the OM3-IVI Isolated Current Output Module is used, the user would be provided with two levels of ±1500 CMV isolation: an isolated current output from an isolated input module.

If the Optional Current Output feature is desired, it is implemented by using wire wraps or jumpers on the appropriate pins of the jumper posts located near the voltage I/O connectors. Figure 2.1.14.2 defines the channel pairs that can have this feature.

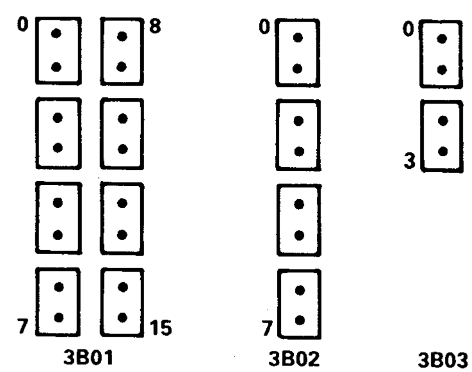


Figure 2.1.14.2 Adjacent Channels That Can Be Connected

SPECIFICATIONS
(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-LTC
Inputs	Thermocouple Types J, K, T, E, R, S, B
Outputs	0 to +10V @ 5mA
Accuracy[1]	See ordering information
Stability vs. Ambient Temperature	
Voltage Output	
Zero	±0.02 °C/°C
Span	±0.0025% reading/°C
Common Mode Voltage, Input to Output	±1500V pk max
Common Mode Rejection @ 50Hz or 60Hz	
1k Source Unbalance	160dB
Normal Mode Rejection @ 50Hz or 60Hz	60dB
Differential Input Protection	220V rms, cont.
Voltage Output Protection	Continuous Short to Ground
Zero and Span Adjustment Range[2]	±5% of span
Response Time to 90% Span	0.2sec
Input Transient Protection	Meets IEEE-STD 472 (SWC)
Input Resistance	15MΩ
Input Bias Current	15nA
Input Noise	0.2μV rms at 10Hz bandwidth
Open Input Response	Upscale
Open Input Detection Time	10sec
Output Noise	100μV rms in 100kHz bandwidth
Bandwidth	3Hz(−3dB)
Cold Junction Compensation	
Initial Accuracy[3]	±0.5°C
vs Temperature[4] (+5°C to +45°C)	±0.5°C
Power Supplies	
±15V Input Supplies Range	
(Rated Operation)	±(11.5V to 16.5V)
Supply Rejection	±0.01% span/V
Supply Current	+16mA, −14mA
Size	3.150″ × 0.775″ × 3.395″
Environmental	
Temperature Range, Rated Performance	−25°C to +85°C
Storage Temperature Range	−55°C to +85°C
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C noncondensing
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.

NOTES
1. Accuracy spec includes the combined effects of repeatability, hysteresis and linearity. Does not include sensor or signal source error.
2. A wide range of zero suppression and custom calibration may be accomplished with a custom ranging card, OMX1310.
3. When used with CJC sensor provided on OM3 Series backplane.
4. Compensation error contributed by ambient temperature changes.

Specifications subject to change without notice.

MODEL	INPUT & RANGE	
OM3-LTC-J1	J	0 to 760°C
OM3-LTC-J2	J	−100 to 300°C
OM3-LTC-K1	K	0 to 1000°C
OM3-LTC-k2	K	0 to 500°C
OM3-LTC-T1	T	−100 to 400°C
OM3-LTC-T2	T	0 to 200°C
OM3-LTC-E	E	0 to 1000°C
OM3-LTC-R	R	500 to 1750°C
OM3-LTC-S	S	500 to 1750°C
OM3-LTC-B	B	500 to 1800°C

2.2 OUTPUT MODULES

FEATURES

High Level Voltage Input (0-10V, ±10V)
Process Current Output (4-20mA/0-20mA)
High Accuracy: ±0.1%
Reliable Transformer Isolation
±1500V CMV
90dB CMR
Meets IEEE-STD 472: Transient Protection (SWC)
Output Protection: 130V or 220V rms Continuous
Reliable Pin and Socket Connections
Low Cost per Channel

APPLICATIONS

Process Control, Factory Automation, Energy Management, Data Acquisition, and Control Systems.

OUTPUT MODULE

General Description

Each output module accepts a high level analog signal from the Voltage I/O Connector and provides a current output on the output screw terminals. The output modules can be powered from an external +24V with a load of up to 850Ω. If desired, +15V can be used to power the output modules with a smaller load (up to 400Ω). Each output module features high accuracy of ±0.1%. If isolation is required, the OM3-IVI provides ±1500V peak of common mode voltage isolation protection.

The transfer function provided by each output module is:

Input: 0 to +10V or ±10V
Output: 4 to 20mA/0-20mA

Figure 2.2.1 shows a functional diagram for the model OM3-IVI isolated voltage to current converter. Each unit is plugged into an OM3 Series backplane, which provides the power for each module. The input signal drives a voltage to current converter through the isolation barrier. Transformer coupling is used to achieve stable galvanic isolation. The current output can be adjusted over a ±5% span range for zero and span with front panel accessible potentiometers. Output protection of up to 220V (130V for the OM3-VI) is provided for the current outputs.

Model OM3-IVI has been specifically designed for high accuracy applications in process control and monitoring systems to offer complete galvanic isolation and protection against damage from transients and fault voltage in transmitting information between subsystems or separated system elements. It provides total ground isolation and transient protection when interfacing D/A converters to standard 4-20mA current loops. This requirement is common in microcomputer-based control systems.

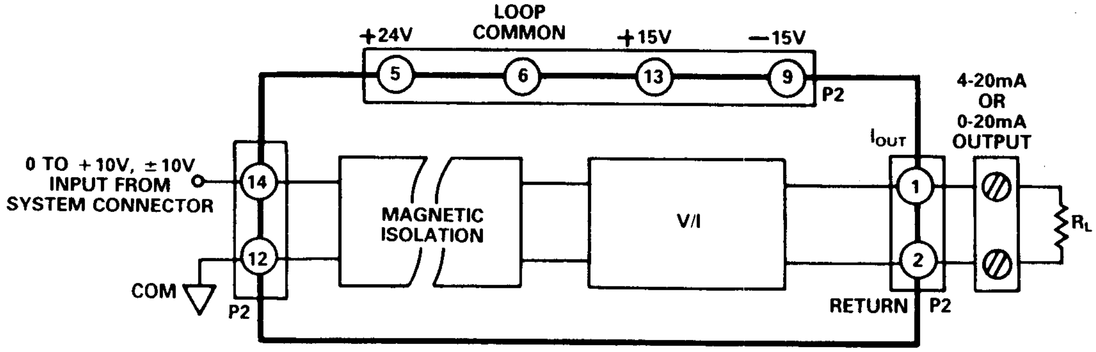


Figure 2.2.1 Model OM3-IVI Isolated Voltage to Current Converter Functional Block Diagram

Each output module has two user programmable jumper options. One option allows the user to program the current output to be proportional to either a 0 to +10V span input or a −10V to +10V input.

The second option allows the user to set the current output to 4-20mA or 0-20mA. All output modules are shipped from the factory so that the current output is proportional to the 0 to +10V input and all current outputs are 4-20mA.

FINE CALIBRATION

The OM3-IV and OM3-IVI are factory calibrated to ±0.1% of span for a 0 to +10V input. If field calibration is required, the following nonrecursive procedure is recommended:

1. Connect the OM3-IVI (OM3-IV) as indicated in Figure 2.2.1 with $R_L = 250\Omega$
2. Apply $V_{IN} = 0V$ and adjust I_Z so that $I_O = 4mA \pm 0.016mA$ or the voltage measured across $R_L = 1V \pm 4mV$.
3. Apply $V_{IN} = +10V$ and adjust I_S so that $I_O = 20mA \pm 0.016mA$ or the voltage measured across $R_L = 5V \pm 4mV$.

If a 0-20mA output is desired, I_O should be adjusted for 0mA ±0.020mA in step 2 and 20mA ±0.020mA in step 3 (a typical minimum output current is 10μA with 0-20mA operation).

GENERAL OUTPUT MODULE SPECIFICATIONS

(typical @ +25°C and ±15V, +24V dc power)

Model	OM3-IVI, Isolated	OM3-IV, Nonisolated
Inputs	0 to +10V, ±10V	*
Outputs	4-20mA or 0-20mA @ R_L = 0 to 850Ω	*
Accuracy[1]	+0.1% span	*
Nonlinearity	±0.01%	*
Stability vs. Ambient Temperature		
Zero	±0.0025% span/°C	*
Span	±0.002% reading/°C	*
Common Mode Voltage, Output to Input and Power Supply	±1500V pk max	N/A
Common Mode Rejection	90dB	N/A
Normal Mode Output Protection	220V rms, Continuous	130V rms, Continuous
Zero and Span Adjustment Range	±5% of span	*
Output Transient Protection	Meets IEEE-STD 472 (SWC)	N/A
Input Resistance	10kΩ	*
Power Supply[2]	±15V dc, +24V dc	*
Maximum Input Voltage Without Damage	±20V	*
Size	3.150" × 0.775" × 3.395"	*
Environmental		
Temperature Range, Rated Performance	−25°C to +85°C	*
Storage Temperature Range	−55°C to +85°C	*
Relative Humidity Conforms to MIL Spec 202	0 to 95% @ 60°C, noncondensing	*
RFI Susceptibility	±0.5% span error, 5W @ 400MHz @ 3 ft.	*

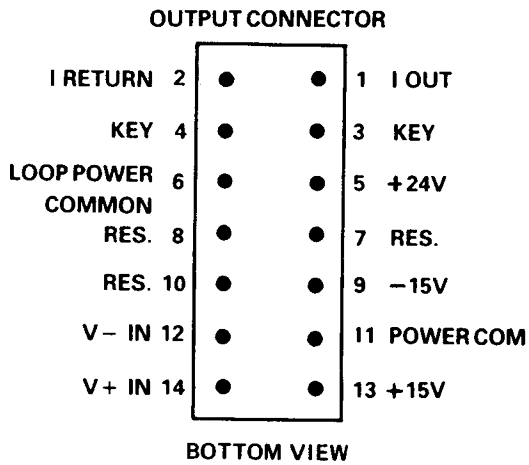
NOTES

[1] Accuracy spec includes combined effects of repeatability, hysteresis and linearity.

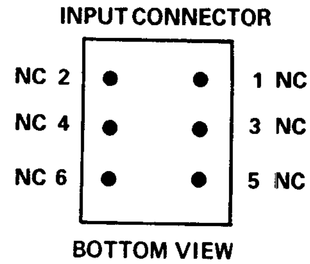
[2] +24V dc supply is only needed for driving loads of up to 850Ω. +15V dc can be used for driving a 400Ω maximum load.

*Specifications same as OM3-IVI.

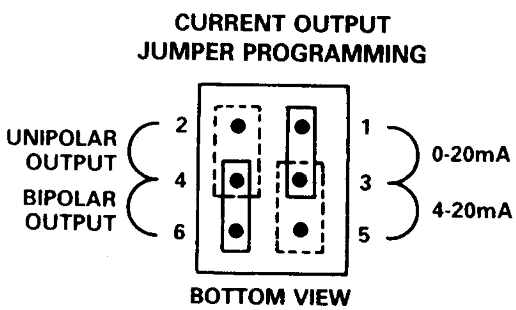
Specifications subject to change without notice.



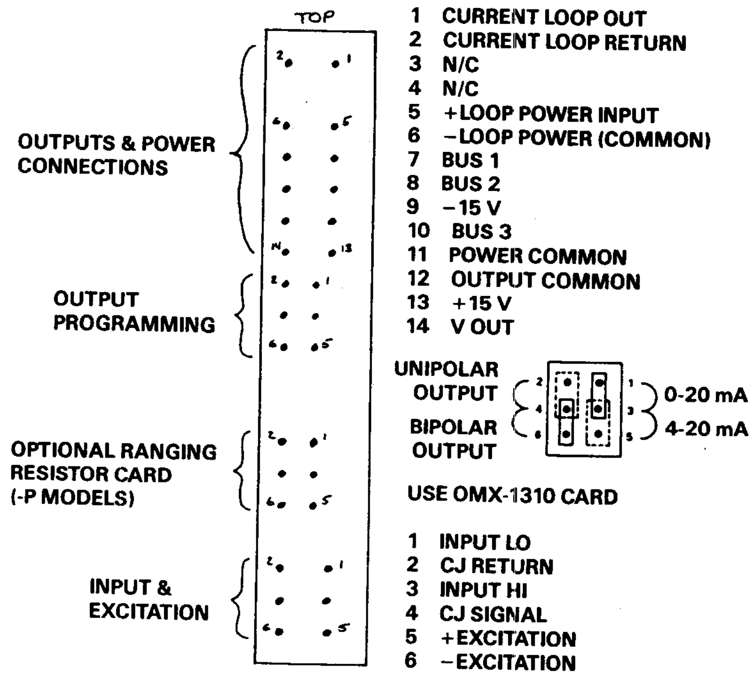
Output Connector



Input Connector



Jumper Options



Bottom of OM3 Module Pinout

Figure 2.2.2 Output Module Connectors

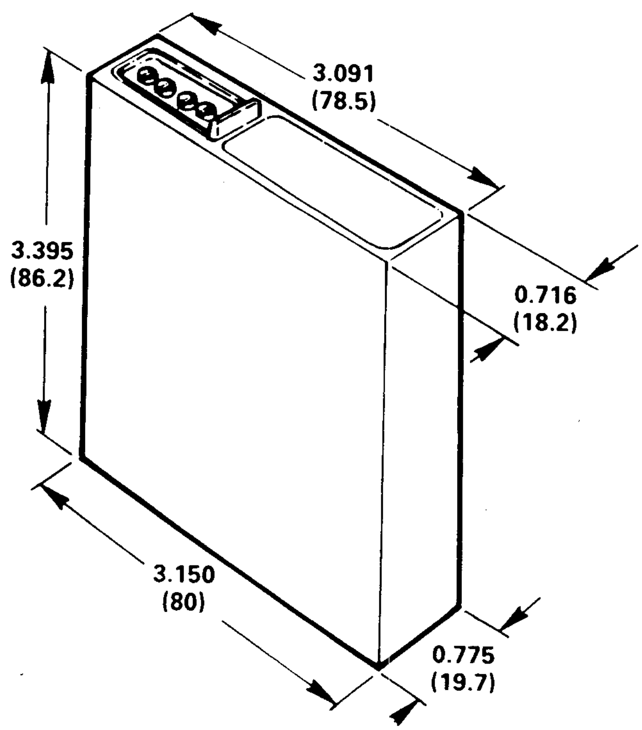


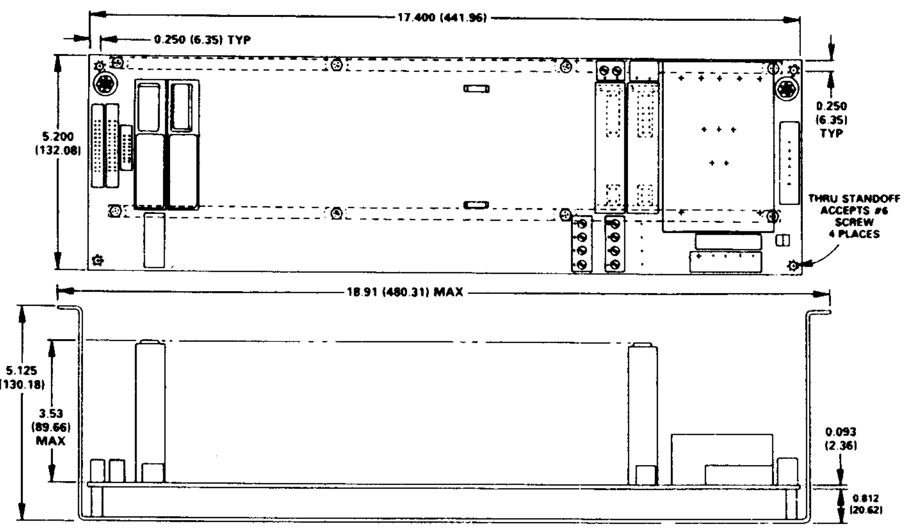
Figure 2.2.3 Output Module Dimensions
Dimensions shown in inches and (mm).

2.3 BACKPLANE FUNCTIONAL DESCRIPTION

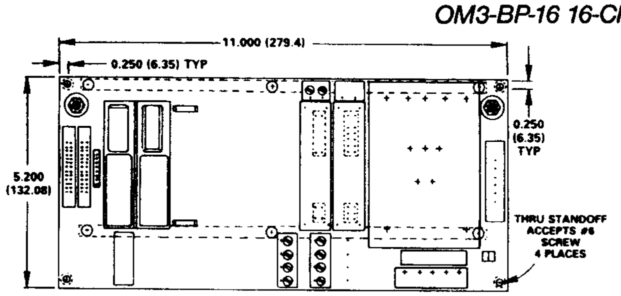
The OM3 Series Signal Conditioning Subsystem consists of a family of backplanes, input modules, output modules and power supplies. The three backplane models, OM3-BP-16, OM3-BP-8 and OM3-BP-4 are designed for 16, 8 and 4 channels, respectively, to offer users the flexibility to match the size of a system to specific applications. The sixteen channel backplane can be mounted in a 19" X 5.25" panel space. Several mounting options are offered, including rack, surface, and NEMA enclosure mounting.

The OM3-BP-16 backplane can accommodate up to 16 signal conditioning modules. Modules can be mixed and matched in the backplane to provide the desired number of channels for a specific function. Each channel has four screw terminals for input connections. These connections satisfy all transducer inputs and provide transducer excitation when necessary. A cold junction sensor is supplied on each channel to accommodate thermocouple modules. Each channel has two screw terminals for the output connections for the 4-20mA output. Two 26-pin system connectors provide high level voltage I/O for all channels.

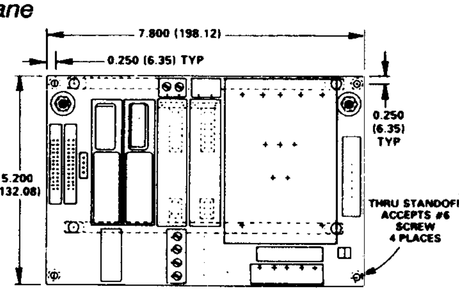
The OM3 Series Subsystem offers high density packaging to conserve mounting space and can be easily tailored to fit the user's needs. All modules feature a universal pin out which assures interchangeability. The plug-in design allows easy reconfiguration.



OM3-BP-16 16-Channel Backplane



OM3-BP-8 8-Channel Backplane



OM3-BP-4 4-Channel Backplane

Figure 2.3.1 Backplane Outline Dimensions
Dimensions shown in inches and (mm).

BACKPLANE SPECIFICATIONS

Model	OM3-BP-16	OM3-BP-8	OM3-BP-4
Channels	16	8	4
Power Supply Options[1]			
External Power Requirements	± 15V	*	*
	+ 24V	*	*
AC Power Supply[2]	100, 115, 220,	*	*
	240V ac	*	*
DC Power Supply[3]	+ 24V	*	*
Cold Junction Sensor	Provided on each Channel	*	*
Power Indicator	LEDs indicate ± 15V and + 24V power applied	*	*
Physical			
Size (with modules)	17.400″ × 5.200″ × 4.373″	11.000″ × 5.200″ × 4.373″	7.800″ × 5.200″ × 4.373″
Fuse	220V Fuse at 500mA (5mm × 20mm)	*	*

NOTES
1. Actual Power Supply requirements are a function of the quantity and types of module used (see Table 2.4.1).
2. AC Power Supplies include OMX1300 and OMX1301. Each is offered in one domestic and three foreign versions. Refer to Power Supply Specifications.
3. OMX1302 is an optional dc Power Supply.

* Specifications same as OM3-BP-16.
Specifications subject to change without notice.

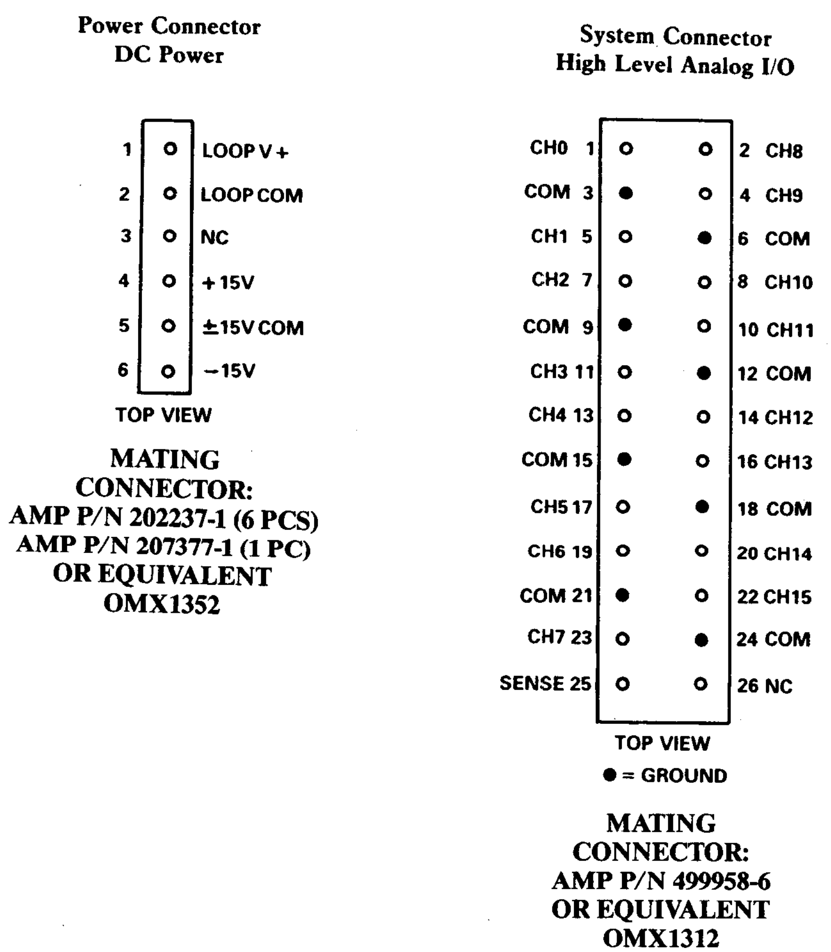


Figure 2.3.2 Backplane Pin Designations (OM3-BP-16, OM3-BP-8, OM3-BP-4)

2.4 POWER SUPPLY

The OM3 Series Subsystem can operate from an ac power supply or dc/dc (+24V input) power supply mounted on the backplane or external ±15V and +24V supplies can be used. The power supply is bussed to all signal conditioners on the backplane. Supply current is a function of the modules that are actually used (see Table 2.4.1). The power supply outputs listed in the Specifications cover most cases. Each power supply operates over a −25°C to +71°C temperature range.

If the user wishes to use a +15V supply for current output, the +15V can be strapped to the loop power on connector P3 (see Figure 4.3.1). With this arrangement, the load resistance on current outputs is limited to 400Ω max.

If +24V is supplied from an external source, a dc/dc converter (OMX1302) can be used to supply ±15V to the backplane. The current loop power is provided from the +24V source which must be capable of handling the desired number of current loop outputs.

If both +24V and ±15V are supplied from an external source, the power supply requirements must be satisfied for the desired number of modules.

Model	+15V dc Current	−15V dc Current	+24V dc Current
OM3-MV	10mA	10mA	27mA
OM3-V	10mA	10mA	27mA
OM3-I	10mA	10mA	27mA
OM3-A-590	12mA	12mA	27mA
OM3-P3	20mA	20mA	27mA
OM3-P4	20mA	20mA	27mA
OM3-S	45mA	10mA	27mA
OM3-LV	65mA*	65mA*	27mA
OM3-WBS	50mA	15mA	27mA
OM3-VI	4mA	4mA	27mA
OM3-IMV	10mA	10mA	27mA
OM3-IV	10mA	10mA	27mA
OM3-II	10mA	10mA	27mA
OM3-IP	10mA	10mA	27mA
OM3-ITC	12mA	12mA	27mA
OM3-IVI	5mA	5mA	35mA
OM3-WBV-MV	10mA	10mA	27mA
OM3-WBV-V	10mA	10mA	27mA
OM3-ACV-MV	10mA	10mA	27mA
OM3-ACV-10V	10mA	10mA	27mA
OM3-ACV-150V, 250V	10mA	10mA	27mA
OM3-IFI	16mA	16mA	27mA
OM3-IFI-K	19mA	19mA	27mA
OM3-LTC	16mA	14mA	N/A

*Typical number is 40mA per module plus ±5mA for LVDT drive current. Supply current requirements for LVDT current is 75% of the LVDT rms current.

Table 2.4.1 Module Power Requirements

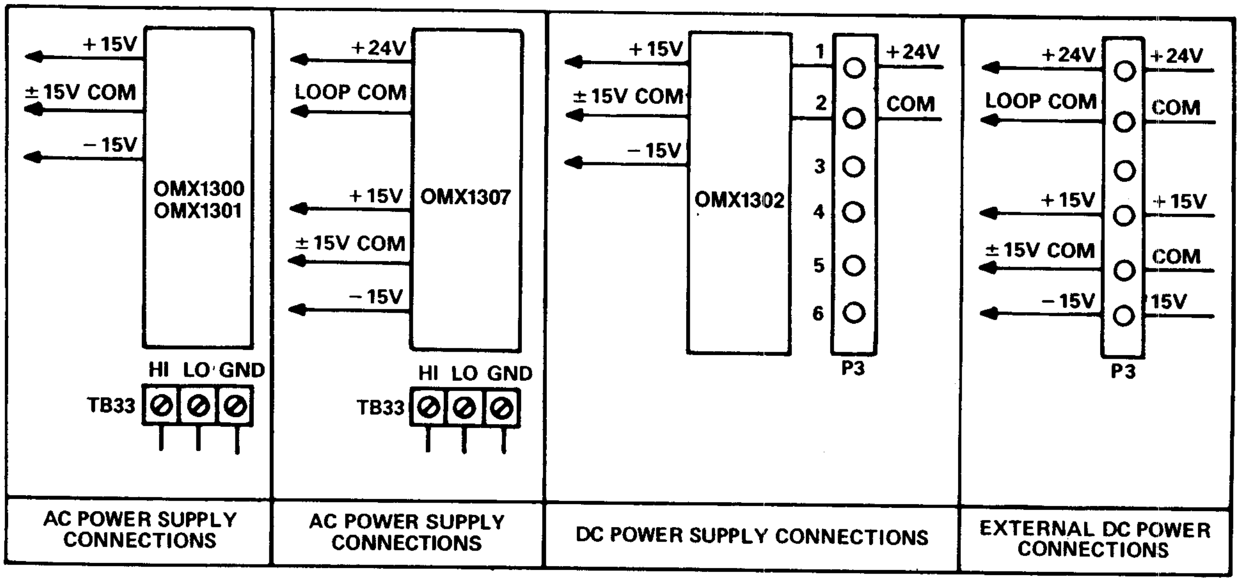


Figure 2.4.1 Power Supply Connections

POWER SUPPLY SPECIFICATIONS

Model	OMX1300	OMX1301	OMX1302	OMX1307
Input Voltage	105-125V ac, 50Hz to 400Hz 205-240V ac, 50Hz to 400Hz (OMX1300E) 90-110V ac, 50Hz to 400Hz (OMX1300F) 220-260V ac, 50Hz to 400Hz (OMX1300H)	105-125V ac, 50Hz to 400Hz 205-240V ac, 50Hz to 400Hz (OMX1301E) 90-110V ac, 50Hz to 400Hz (OMX1301F) 220-260V ac, 50Hz to 400Hz (OMX1301H)	22.3V-26.4V	105-125V ac, 50Hz to 400Hz 205-240V ac, 50Hz to 400Hz (OMX1307E)
Output Voltage	±15V	±15V	±15V	+15V, −15V, +24V*
Output Current	±200mA	±350mA	±190mA	+800mA, −225mA, +350mA
Operating Temperature	−25°C to +71°C	−25°C to +71°C	−25°C to +71°C	−25°C to +71°C
Storage Temperature	−25°C to +85°C	−25°C to +85°C	−40°C to +100°C	−25°C to +85°C
Dimensions (inches)	3.5 × 2.5 × 1.25	3.5 × 2.5 × 1.62	2.0 × 2.0 × 0.38	4.0 × 2.8 × 3.4

NOTE
*The +24V output is unregulated.

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CHAPTER 3

INSTALLATION

The OM3 Series Signal conditioning I/O Subsystem is designed to be installed in any convenient location suitable for general purpose electronic equipment. Operating ambient temperature should be within −25°C to +85°C (−13°F to +185°F) for satisfactory performance of the complete system. If the equipment is going to be used in a harsh or unfavorable environment, it may be necessary to install it inside a protective enclosure. It is recommended that the backplane be mounted and wired before the modules are installed. If a plug-in module requires calibration, refer to the calibration instructions for the particular module.

(PLEASE NOTE: The OM3 Series is approved by Factory Mutual for use in Class I, Division 2, Groups A, B, C, and D locations when meeting the installment requirements shown in the drawing in Appendix C.)

3.0 BACKPLANE MOUNTING

Four 6-32 × 1″ screws and through standoffs at the four corners of each backplane are provided for mounting purposes. Figure 3.0.1 shows the location of the mounting standoffs.

Securing the backplane with the four corner screws should be sufficient for most applications. If additional rigidity is required on the OM3-BP-16 and OM3-BP-8, they can also be secured with the through standoffs found on the center of each backplane (see Figure 3.0.1). The additional 6-32 x 1″ screws are provided with the OM3-BP-16 and OM3-BP-8.

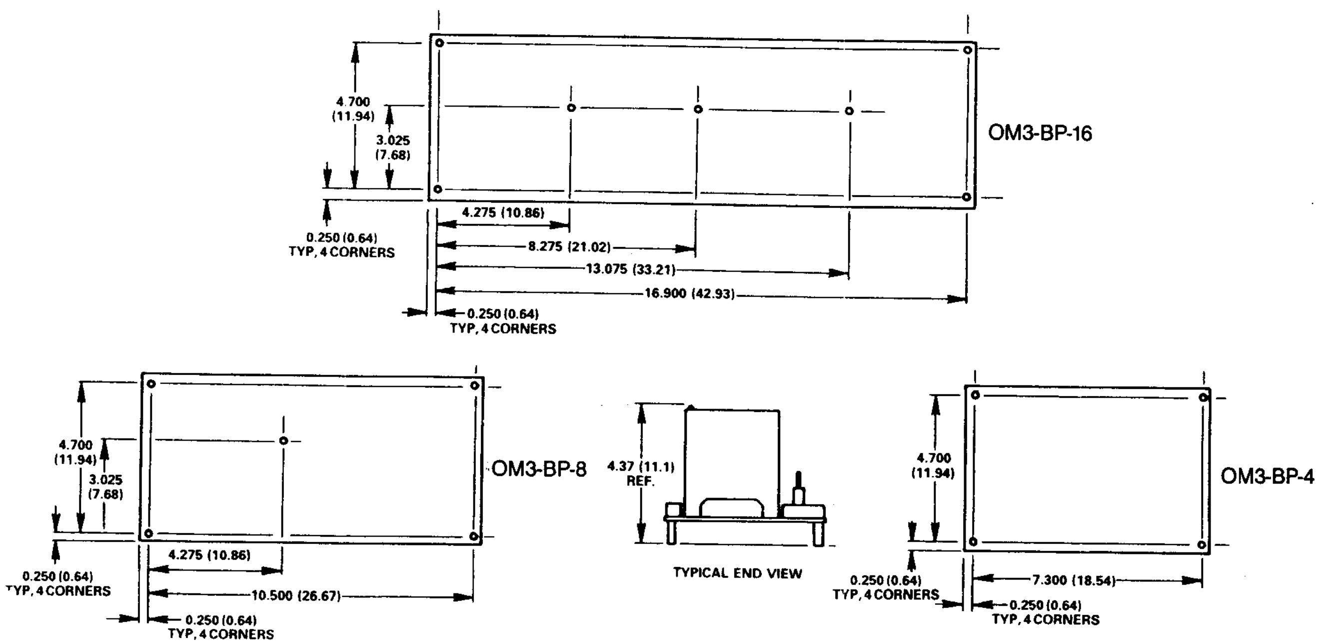


Figure 3.0.1 Backplane Mounting Dimensions

3.1 19″ RACK MOUNT KIT (OMX1330)

The OMX1330 includes a two piece metal device that is designed for mounting the OM3 Series Subsystem in a 19″ rack. The bottom plate has threaded inserts for mounting each of the three backplanes using the four screws (6-32 × 1″ long) that are shipped with each backplane. The top piece provides a rigid module holddown and is secured to the bottom piece with two quarter-turn fasteners. Figure 3.1.1 provides the location of the mounting holes on the bottom plate. Figure 3.1.2 is an assembly drawing for the OMX1330 option. The backplane is readily fitted to the base plate by sliding it in from the side under the protruding metal used for stiffening. If a power supply is to be secured from the back of the backplane, it should be secured to the backplane before the backplane is mounted to the OMX1330. If an interface board (i.e. OMX1324) is to be mounted on the OMX1330, it should be connected before the OMX1330 is placed in a rack.

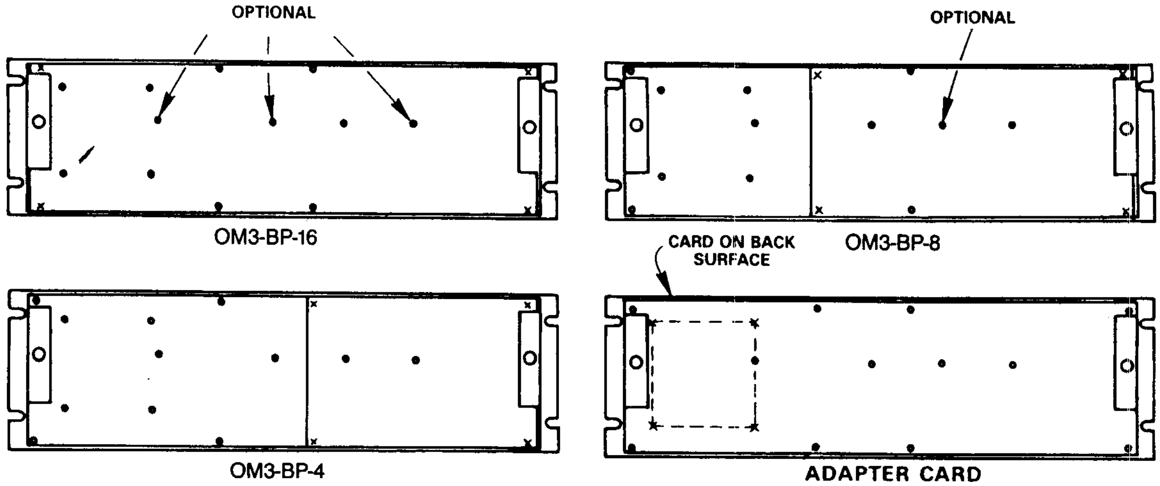


Figure 3.1.1 Rack Mount Options

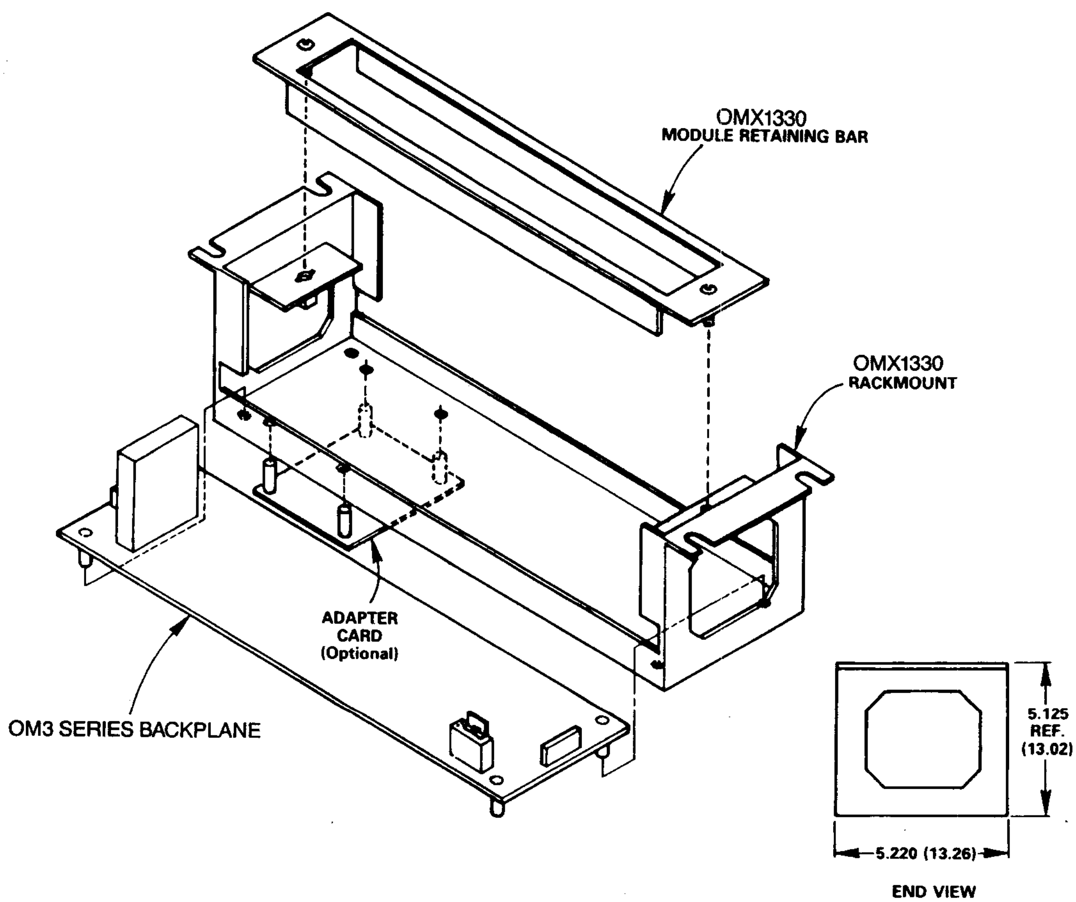
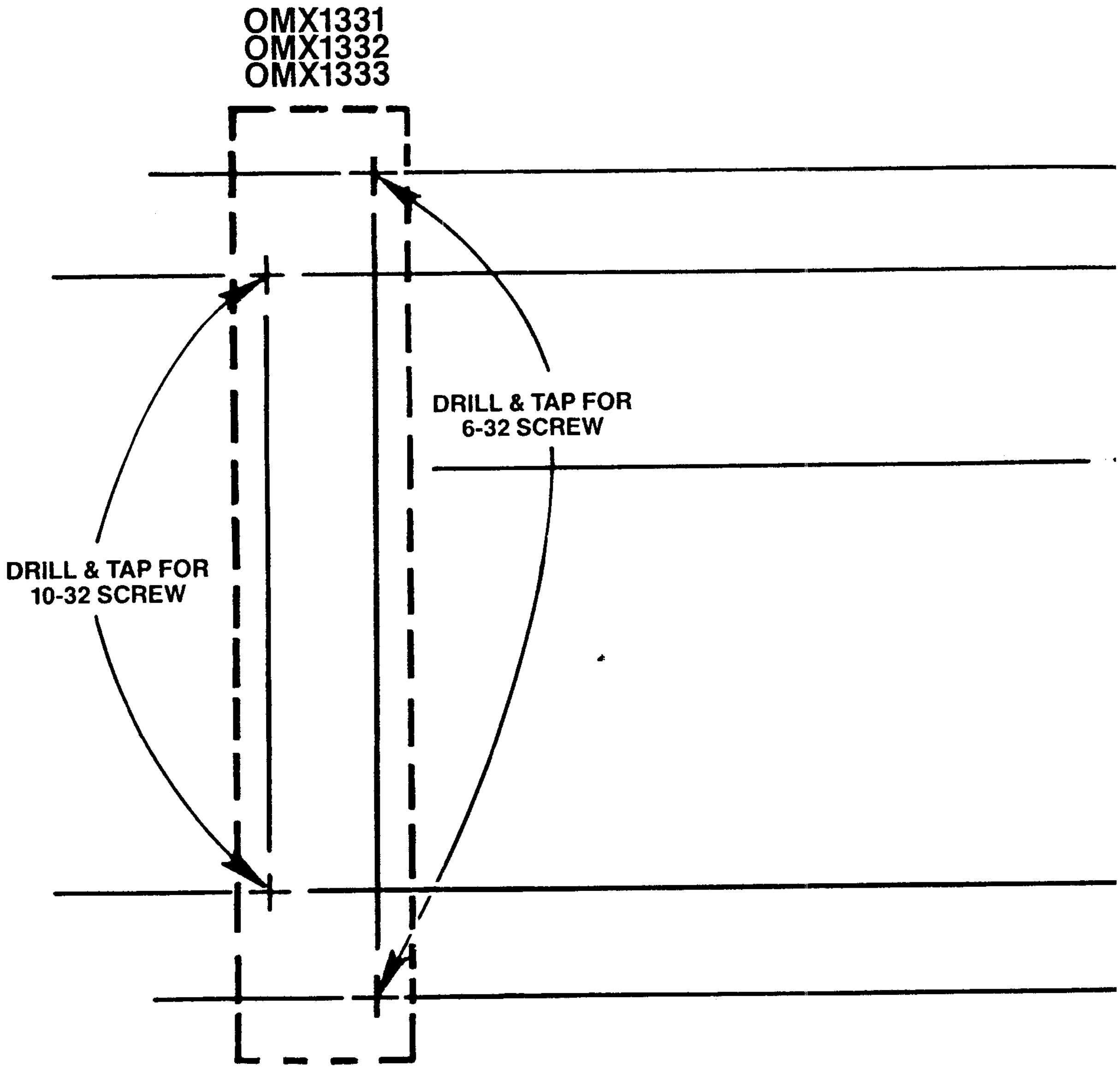


Figure 3.1.2 Rack Mount Assembly

3.2 OM3 SERIES SURFACE MOUNT KITS (OMX1331, OMX1332, OMX1333)

The OMX1331, OMX1332, and OMX1333 are surface mount kits that are designed for the sixteen (OM3-BP-16), eight (OM3-BP-8), and four (OM3-BP-4) channel backplanes respectively. These accessories allow for easy panel and NEMA enclosure mounting. The OMX1331 will mount the OM3-BP-16 in an 18.824" x 5.375" area. The OMX1332 will mount the OM3-BP-8 in a 12.42" x 5.375" area, and the OMX1333 will mount the OM3-BP-4 in a 9.22" x 5.375" area. A backplane and appropriate accessory are mounted to any surface by drilling and tapping the appropriate eight holes (four 6-32 and four 10-24). If additional rigidity is required on the OM3-BP-16 or OM3-BP-8, they can also be secured by drilling and tapping additional holes for 6-32 screws to pick up the through standoffs on the center of each backplane. Figure 3.2.1 is a drill template that can be removed from the User's Manual, taped to the mounting surface and used as a guide or drilling the holes.


OMX1331
OMX1332
OMX1333
DRILL & TAP FOR
6-32 SCREW
DRILL & TAP FOR
10-32 SCREW

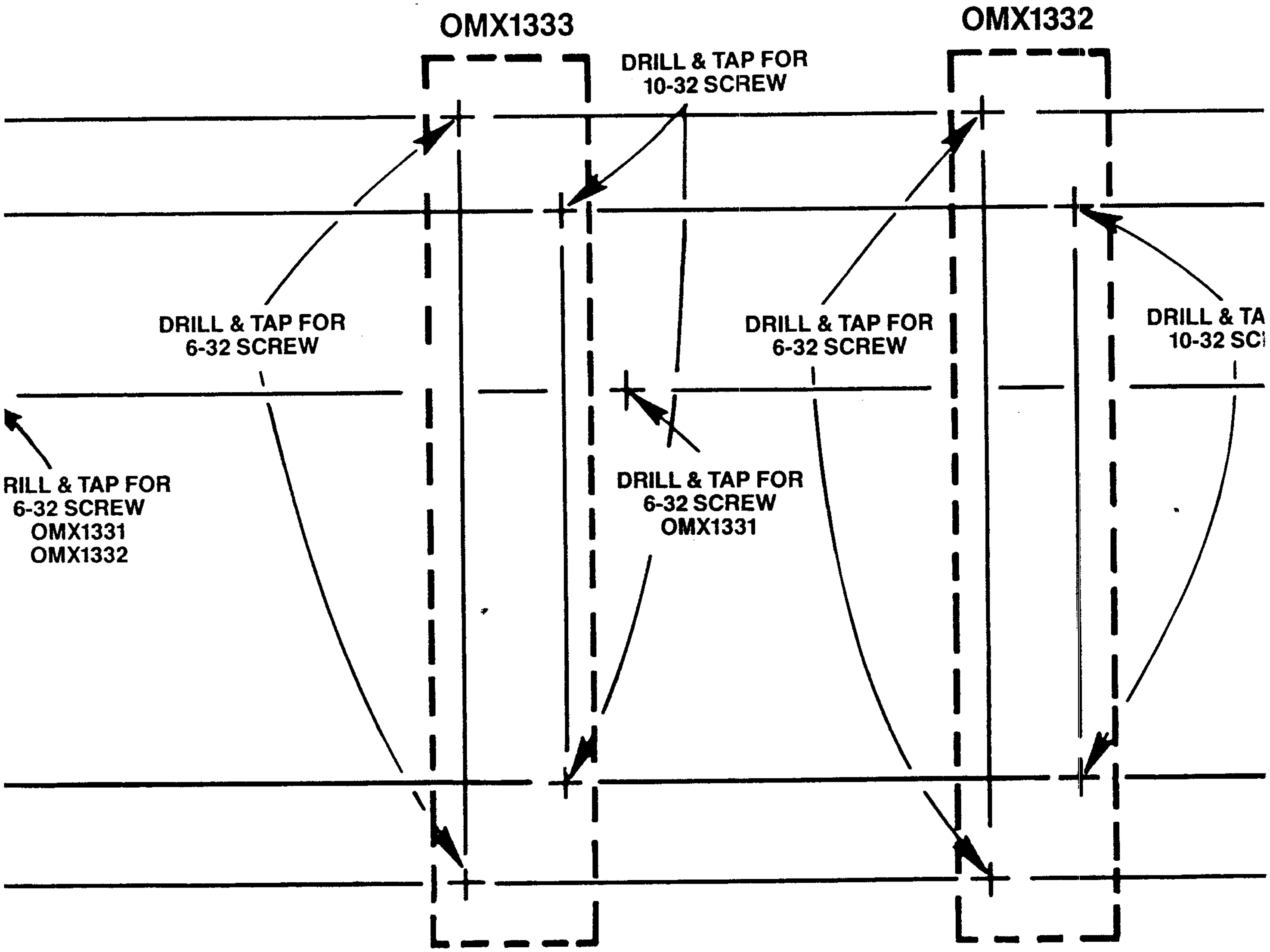

OMX1333
OMX1332
DRILL & TAP FOR
10-32 SCREW
DRILL & TAP FOR
6-32 SCREW
DRILL & TAP FOR
6-32 SCREW
DRILL & TA
10-32 SC
RILL & TAP FOR
6-32 SCREW
OMX1331
OMX1332
DRILL & TAP FOR
6-32 SCREW
OMX1331

Figure 3.2.1

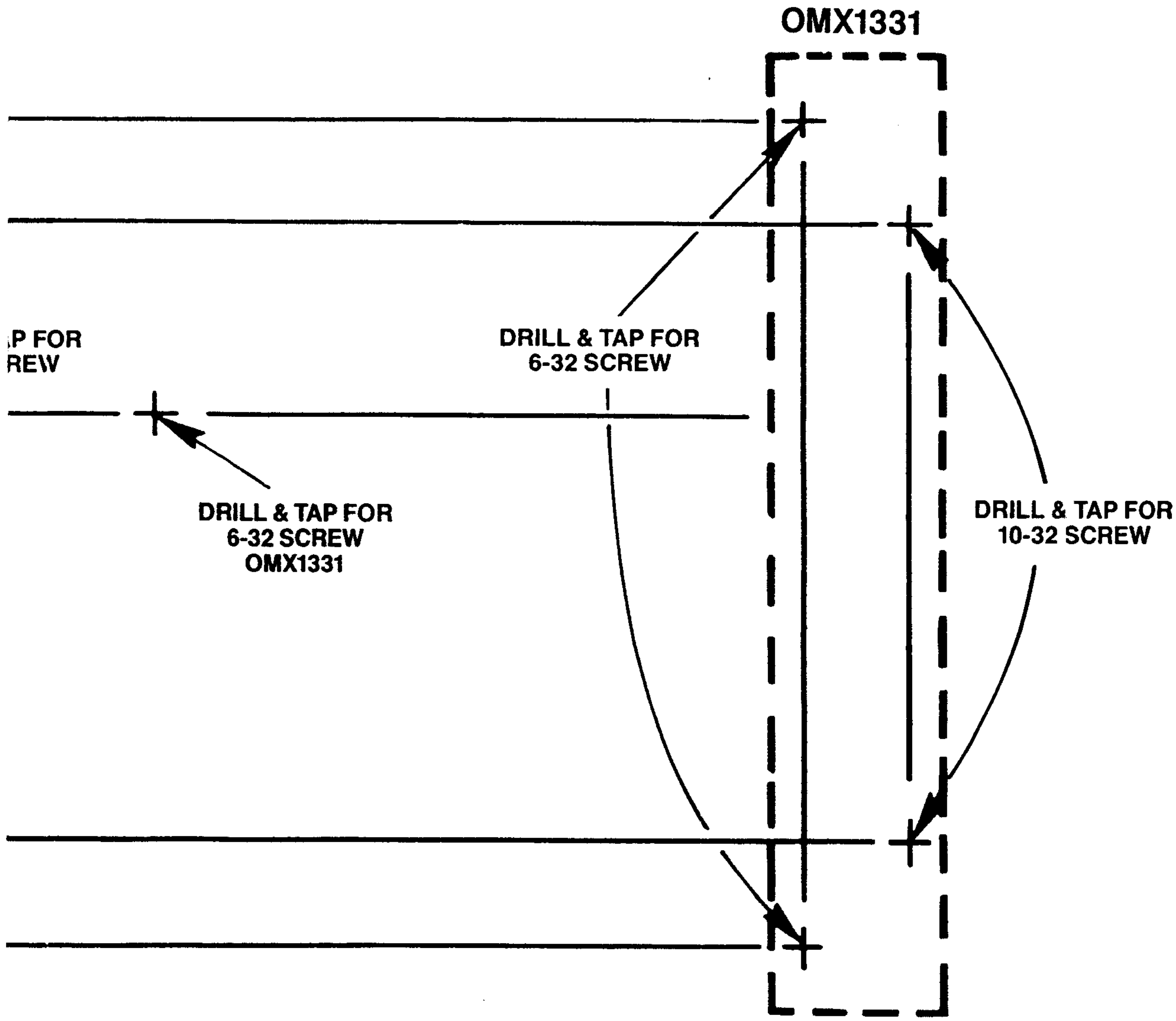
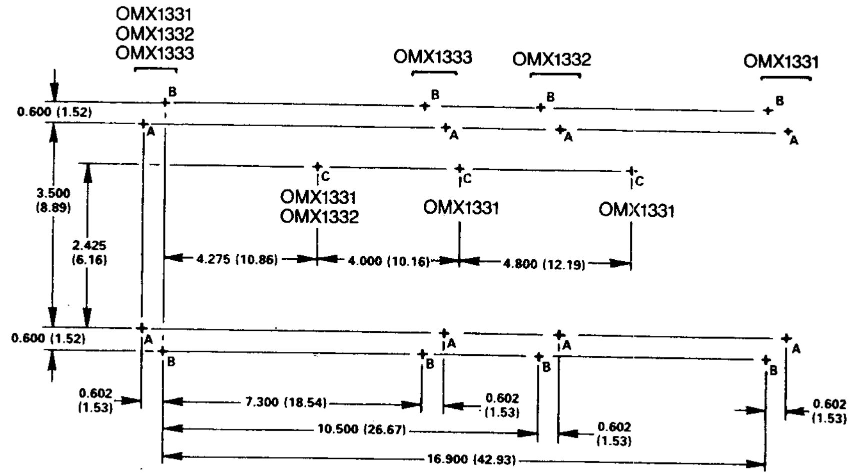

OMX1331
ꞏP FOR
REW
DRILL & TAP FOR
6-32 SCREW
DRILL & TAP FOR
6-32 SCREW
OMX1331
DRILL & TAP FOR
10-32 SCREW

Figure 3.2.2 shows the mounting location for each of the three accessories, and Figure 3.2.3 shows an assembly drawing for the OMX1331 surface mount option.

Mount the backplane first using four 6-32 x 1" screws provided. (On OM3-BP-16 and OM3-BP-8, additional screws may be inserted for additional rigidity.) Insert a module in the left-most position and the right-most position. Attach the module retaining bar to the two end brackets with the quarter turn fasteners as shown in Figure 3.2.3. Place the holddown assembly over the backplane so that the two modules fit up inside of the module retaining bar. Attach the end brackets to the mounting surface using the four 10-24 screws provided and flat washers. Remove the module retaining bar and install modules as desired.



1. Holes Marked "A" Are to Secure End Brackets. Drill and Tap for 10-24 Screw. Use Flat Washers Under the Screw Heads #25 Drill (0.1495 inches) is Recommended for 10-24 Tap
2. Holes Marked "B" Are for Securing Corner Standoffs of OM3 Series Backplanes with 6-32 x 1" Screws Provided Drill and Tap for 6-32 Screw. #36 Drill (0.1065 Inches) is Recommended for 6-32 Tap.
3. Holes Marked "C" Are Optional Mounting for OMX1331 and OMX1332. Use 6-32 x 1" Screws Provided. Drill and Tap for 6-32 Screw. #36 Drill (0.1065 Inches) is Recommended for 6-32 Tap.

Figure 3.2.2 Surface Mount Dimensions

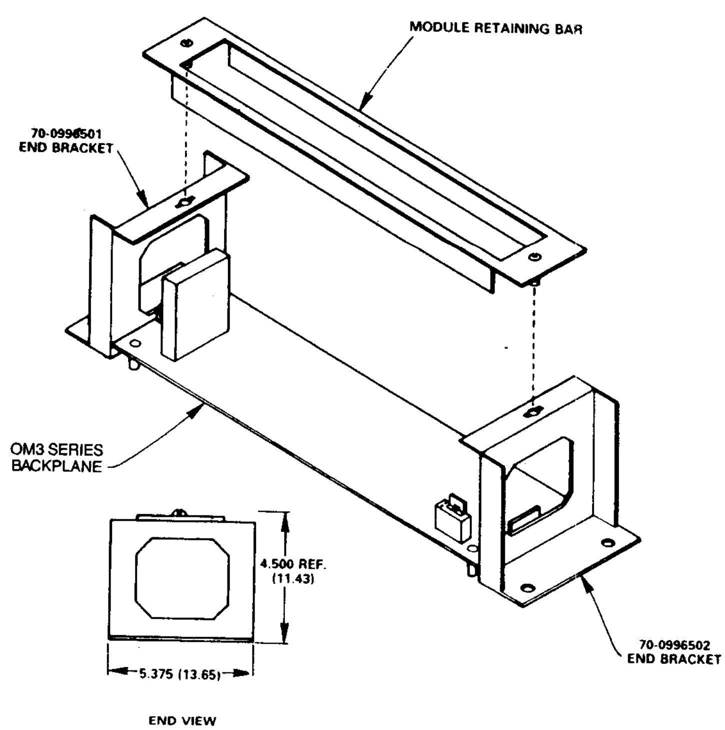


Figure 3.2.3 Surface Mount Assembly

3.3 POWER SUPPLY INSTALLATION

Each power supply comes with a retainer clip and required hardware that can be used to secure the power supply to any backplane. This feature allows each power supply to be removed from the backplane without disturbing the mounted backplane. If desired, the ac power supplies can be secured to the backplane from the back with #4 screws and a large diameter washer. The clip mounting is diagrammed in Figure 3.3.1.

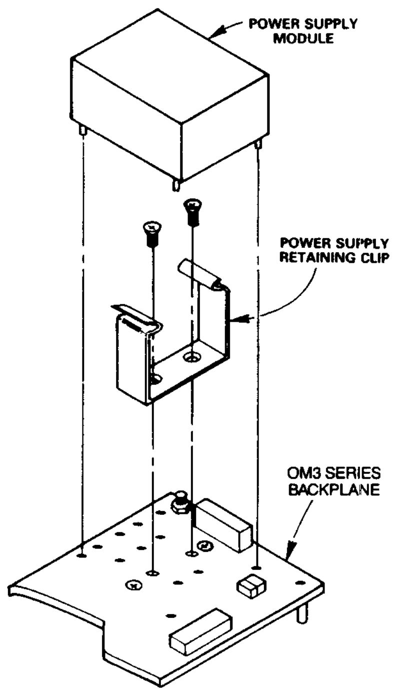


Figure 3.3.1 Power Supply Installation

3.4 ELECTRICAL CONNECTIONS

The wiring discussion is divided into three areas: power connections, field terminations, and user equipment termination.

Power Connections: The OM3 Series Subsystem can operate from an ac power supply, a dc/dc power supply or an externally provided ±15V and +24V supply. If an ac power (i.e. OMX1300, OMX1301) is used, it should be secured to the backplane with the retainer clip or holddown screws as discussed in Section 3.3. The input wiring is connected to TB33 as indicated in Figure 3.4.1. The wiring of the ac power connector is most readily accomplished by removing the two corner screws that secure the yellow safety cover to the connector. This enables the cover to be easily removed so that the ac terminals are accessible.

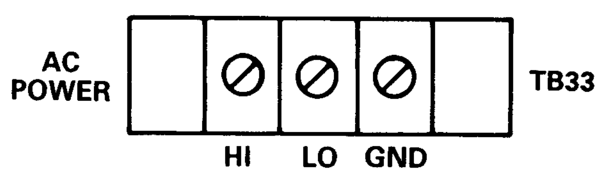


Figure 3.4.1 AC Power Connections

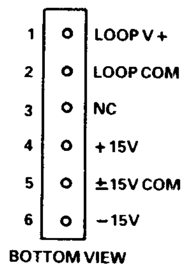
The OMX1340-D power cord can be used with the ac connector and plugged into a standard wall outlet (the OMX1340-C version is available for the European continental plug). If a different cable is used, proper wiring practice should be used so that no wiring is exposed.

It is recommended that the yellow safety cover be reinstalled after the ac power connector is wired so that no ac wiring is exposed.

If a dc/dc converter (OMX1302) or external power is used, the wiring is brought to connector P3. This connector is compatible with an AMP mating connector or equivalent (see Figure 3.4.2). The OMX1341 dc power cord can be used to interface the OM3 Series to any external dc power source. If a user supplied cable is used, proper wiring practice should be employed to ensure that no wiring is exposed.

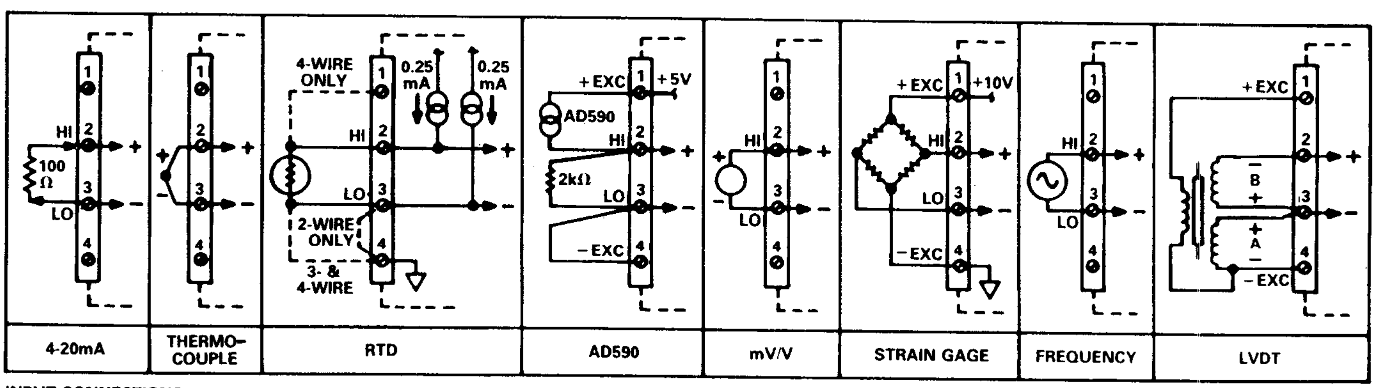
Note that if +15V is to be used to supply loop power, a jumper should be installed between pins 1 and 4 on the dc power connector (see Figure 4.3.1).

Power Connector
DC Power

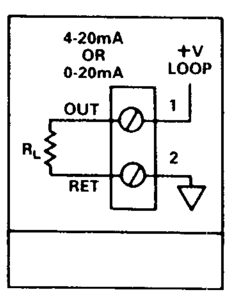


MATING
CONNECTOR:
AMP P/N 202237-1 (6 PCS)
AMP P/N 207377-1 (1 PC)
OR EQUIVALENT
OMX1352

Figure 3.4.2 DC Power Connector



INPUT CONNECTIONS:
ALL INPUT CONNECTIONS USE #6-32 SCREW TERMINALS,
COMPATIBLE WITH 14 AWG WIRE.



OUTPUT CONNECTIONS:
ALL OUTPUT CONNECTIONS USE
#6-32 SCREW TERMINALS,
COMPATIBLE WITH 14 AWG WIRE.

Figure 3.4.3 Screw Terminal Connections

Field Terminations: All screw terminal connections are indicated in Figure 3.4.3. Input terminals numbered 1, 2, 3, and 4 correspond to the markings on each backplane. The output connectors each are marked 1 and 2 where 1 represents the current loop out and 2 represents the return. Calibration information may be found by referring to the instructions for the appropriate module. All input and output connections can accommodate 14-20 gauge wire.

Models OM3-MV, OM3-V, OM3-I, OM3-S and OM3-WBS (when used with external excitation) all require a ground return for the input connections to return the bias current to ground. The remaining nonisolated units do not require this since the input signal is grounded internal to the module. The isolated input modules do not require a return to ground since the input signal is floating.

User Equipment Terminations: All channels are single ended and share a common reference to all other channels and to the power supply common. The pinout of the system connector is shown in Figure 3.4.4. The OM3 Series backplanes are readily interfaced to any user equipment by means of a universal interconnection board (OMX1324).

System Connector
High Level Analog I/O

CH 0	1	o	o	2	CH 8
COM	3	●	o	4	CH 9
CH 1	5	o	●	6	COM
CH 2	7	o	o	8	CH 10
COM	9	●	o	10	CH 11
CH 3	11	o	●	12	COM
CH 4	13	o	o	14	CH 12
COM	15	●	o	16	CH 13
CH 5	17	o	●	18	COM
CH 6	19	o	o	20	CH 14
COM	21	●	o	22	CH 15
CH 7	23	o	●	24	COM
SENSE	25	o	o	26	NC

BOTTOM VIEW
● = GROUND

MATING
CONNECTOR:
AMP P/N 499958-6
OR EQUIVALENT
OMX1312

Figure 3.4.4 Voltage I/O Connector

Figure 3.4.6 is a drill template that can be removed from the User's Manual and used for mounting any 5″ × 4.5″ interface board (see page following 3-7). Each board can be mounted on the back of the OMX1330 Rack Mount Kit, the side of a cabinet, NEMA box, or any other convenient surface. The OMX1315, a 2 foot, 26-pin cable that plugs into one of the system connectors and plugs into a 26-pin connector on the interface board, can be used with any interface board. The cable(s) from the interface board to the user equipment are also available as separate accessories.

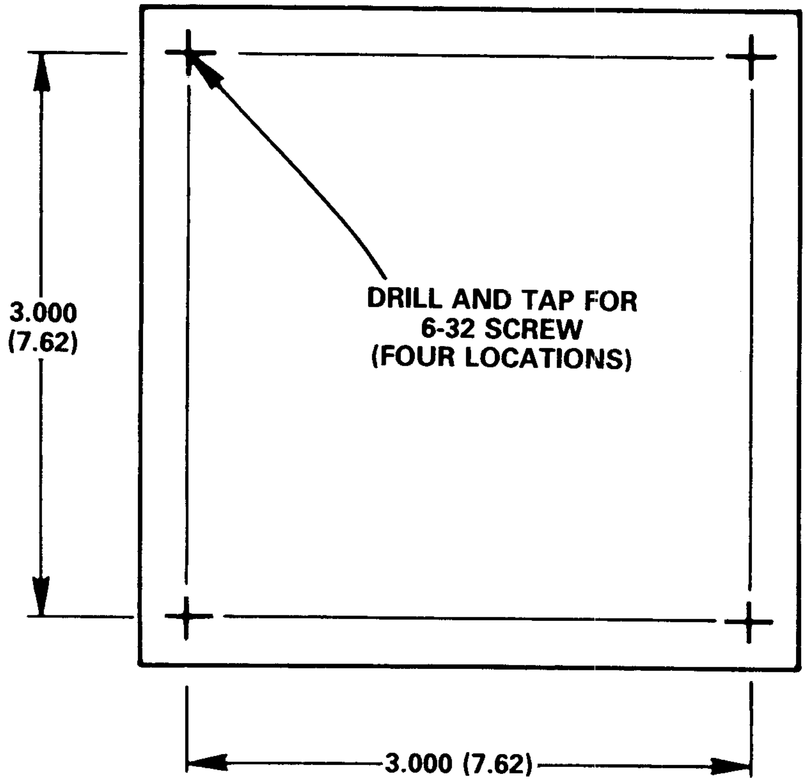


Figure 3.4.5 Interface Boards Surface Mount Dimensions

3.5 MODULE INSTALLATION

Before modules are installed, the proper jumper configuration must be chosen and the ranging card, OMX1310, must be installed if used. Alignment marks are provided on the inside of the case skirt to aid the installation of the OMX1310. When ready, the modules are plugged into the appropriate slot on the backplane. Each module and backplane is keyed to assure each module is plugged in properly. Each backplane location has two plastic clips that help align and retain the modules when they are plugged in. If a more rigid holddown is desired, a rack mount (OMX1330) or surface mount (OMX1331, OMX1332, OMX1333) option may be used.

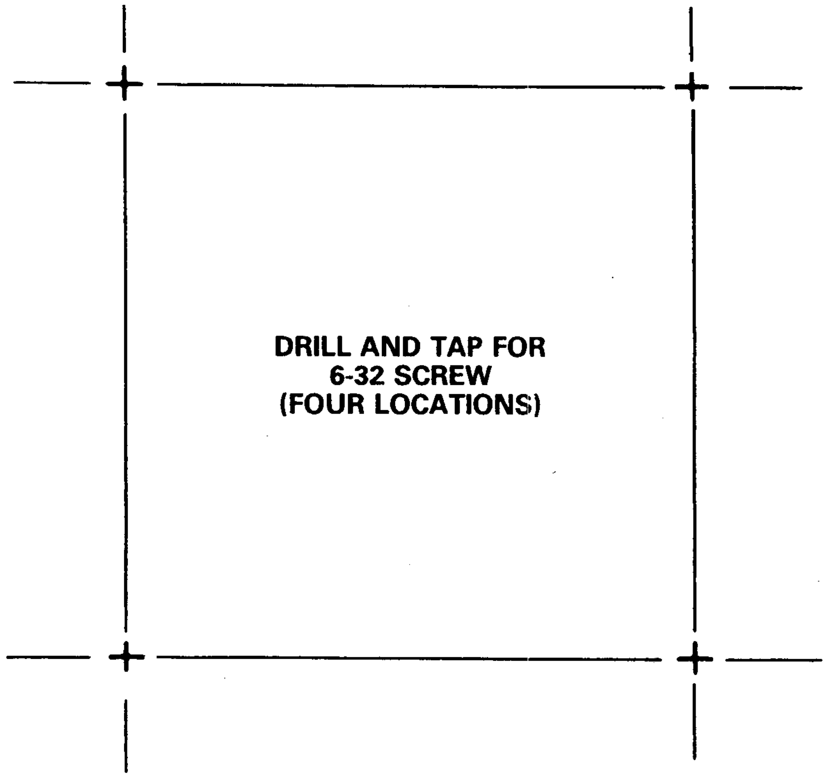


Figure 3.4.6 Interface Boards Surface Mount Drill Template

CHAPTER 4
OPERATION

This section discusses the various options available to the user with the OM3 Series Subsystem. These features must be understood to assure that each system is properly configured.

4.1 BACKPLANE JUMPER OPTIONS

Each backplane has a power supply jumper option that must be addressed. This jumper, marked W4, provides the capability of tying the ±15V power supply common to the +24V power supply common. If the +24V power supply is used, its common must be tied to the ±15V common. All backplanes are shipped with this jumper installed. If the two commons are connected externally, W4 should be disconnected on the backplane to help prevent ground loops.

Each backplane is configured with W2 installed for external voltage sensing (See Figure 5.1). This allows the OM3 Series Subsystem to be used with interface boards measuring in a pseudo-differential mode to provide higher noise rejection. In this mode, pin 25 of connectors P1 and P2 is used as a common point for all voltage outputs. The common pins on P1 and P2 (See Figure 2.3.2) are connected to the ±15V power supply common on the OM3 Series Backplane and may be used as signal common in a single ended measurement system. Optionally, W1 and W3 can be installed and W2 removed to force pin 25 to power supply common.

A third option available to the user provides the capability of directing the voltage output of any input module to an adjacent output module. This feature could be used to provide an isolated current output from an isolated input module, which gives two levels of ±1500V CMV isolation. If this feature is desired, it is implemented by using wire wraps or jumpers on the appropriate pins of the jumper posts located near the voltage I/O connectors. Figure 4.1.1 defines the channel pairs that can have this feature.

Each backplane has been keyed to prevent modules from being improperly plugged in. The keys and plastic module retainer clips assure that all modules will be properly plugged in.

Each backplane contains two voltage I/O connectors that are identical electrically. Both connectors may be useful when using an OM3 Series Backplane for both analog input and analog output when the data acquisition system has separate input and output connectors.

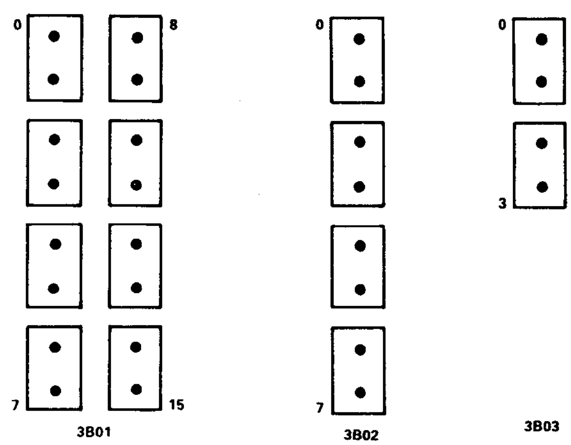


Figure 4.1.1 Adjacent Channels That Can Be Connected

4.1.1 SURGE WITHSTAND CAPABILITY

The OM3 Series isolated modules have been designed to meet the IEEE Standard for transient voltage protection (IEEE-STD 472). The Surge Withstand Capability can be tested with not less than 50 2.5KV bursts per second. A test duration of 2 seconds is widely accepted. A rise time of 20KV/µs is specified. Since I = C dv/dt and a typical module capacitance to ground is 10pF, each module could see 200mA of surge current. The OM3 Series backplanes, which have been designed to accommodate up to 16 channels of this surge current, have a large ground plane and two large ground lugs that should be used with heavy cabling to return the surge current to earth ground in systems requiring surge withstand capability.

4.1.2 ±15V AND +24V LOOP POWER COMMONS

The OM3 Series backplanes are shipped with the ±15V common tied to the +24V loop common with jumper W4. If the commons of the two supplies are tied externally, this connection W4 should be disconnected to avoid ground loops within the subsystem. If it is desired that the commons of the ±15V and +24V loop supply be different, because of the existing hardware, the commons can vary by several volts and still operate. The precise relationship is defined in Figure 4.1.2.1 where the area between the limits defines the allowed differences between the power commons. The +15V supply can be used to power the current outputs if desired. The only limitation when using the +15V to power a current loop is that the output load must be 400Ω or less.

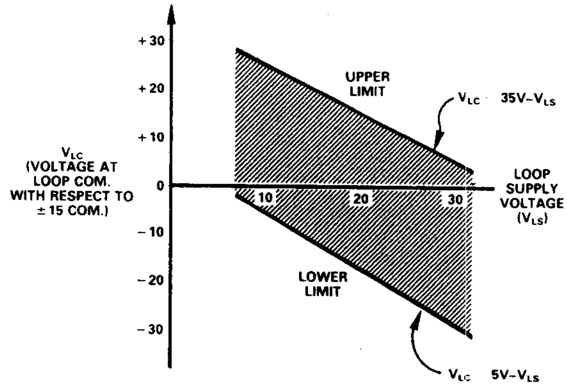


Figure 4.1.2.1 Relationship Between ±15V and Loop Power Supply Commons

4.2 UNIVERSAL INTERFACE BOARDS

Two universal interface boards are available to help satisfy any interconnection. The OMX1324 accepts the 26 pin connector from the OM3 Series Backplanes and provides 26 screw terminals for interconnecting to any analog I/O subsystem. This interface board might be used with programmable controllers and is diagrammed in Figure 4.2.1.1.

OUTLINE DIMENSION

Dimensions shown in inches and (mm).

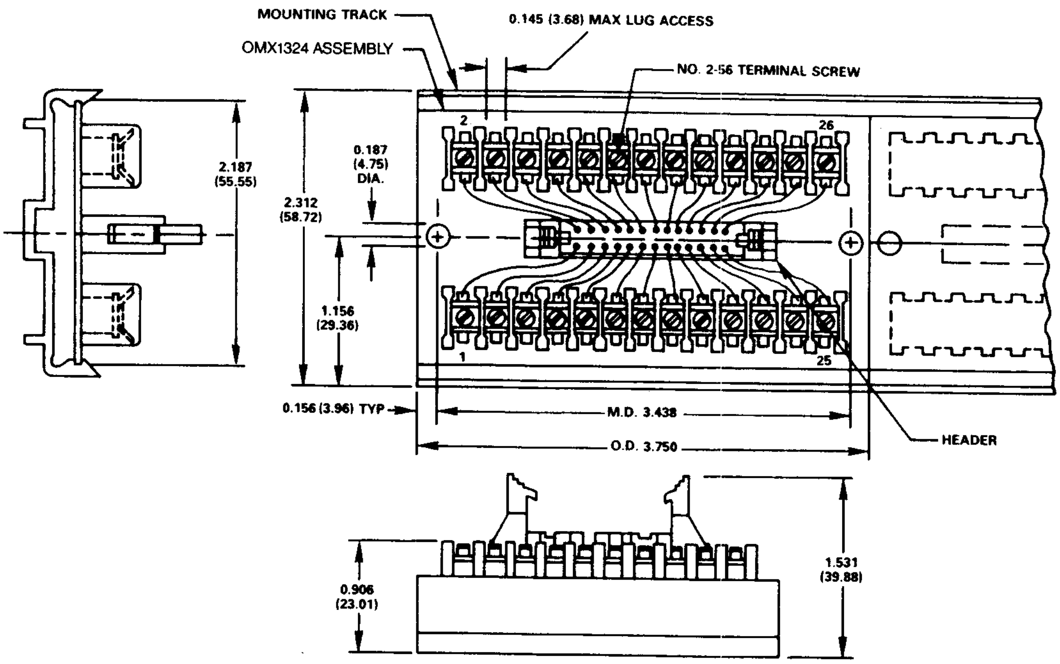


Figure 4.2.1.1 OMX1324

The OMX1324 can be mounted in snap track if desired or could be mounted to the back of the OMX1330 Rack Mount Kit. Standoffs are included with the OMX1324 and should be used if the OMX1324 is to be mounted on the back of the OMX1330 Rack Mount Kit.

The OMX1325 accepts up to two 26-pin connectors from OM3 Series backplanes and has four patterns of holes that accommodate flat cable connectors up to 50 pins each. The OMX1325 (Figure 4.2.1.2) mates with the appropriate connectors required to interface with any user's equipment. The OMX1325 will accept any standard flat cable connector with 0.1" spacing and has plated through holes for the necessary custom connections.

Cables and connectors are offered to interface with the interface boards.

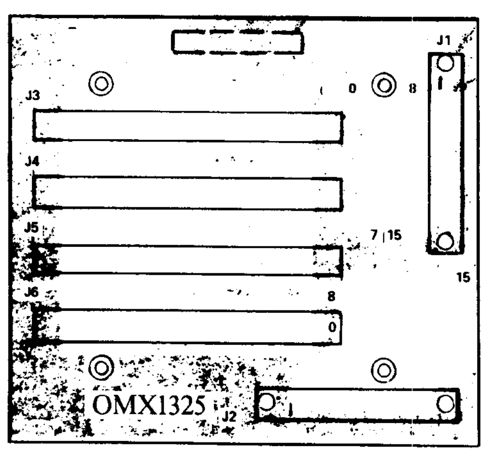


Figure 4.2.1.2 OMX1325

4.3 CURRENT OUTPUT CONSIDERATIONS

4.3.1 POWER CONSIDERATIONS

Loads of up to 850Ω can be used if an external +24V is supplied. If the user wishes to use a +15V supply for current output, the +15V can be strapped to the loop power on connector P3 (see Figure 4.3.1). With this arrangement, the load resistance on current outputs is limited to 400Ω max. Note also that this approach will require an additional 27mA per module from the backplane power supply.

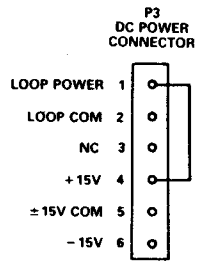


Figure 4.3.1 Jumper Strapping +15V Power to Loop Power

4.3.2 CURRENT OUTPUT LOAD CONFIGURATION

The nonisolated current outputs (all modules except OM3-IVI) are configured for a loop output and a grounded return. The typical configuration is shown in Figure 4.3.2 with the output dropped across the load resistor and connected to the RETURN screw terminal. Since the RETURN screw terminal is grounded, a perfectly acceptable connection would be to an external system ground (Figure 4.3.3). This connection will offer the user an additional 1V compliance. In most cases, the screw terminal connection will be the preferred connection.

The grounded return of the current output can only be used for the return of one module. Two or more modules should not be connected to the same RETURN terminal. If several current loops are to be returned with one ground, that connection should be made to the common on the Loop power connector.

The isolated current output module (OM3-IVI) should use the RETURN screw terminal since it is floating with respect to ground.

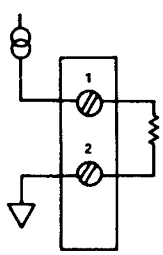


Figure 4.3.2 Preferred Current Output Load Connection

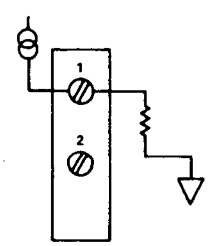


Figure 4.3.3 Optional Current Output Load Connection (nonisolated outputs only)

4.4 MODULE OPERATION

This section covers the options and features that are available with each module. The appropriate module section in Chapter 2 should also be reviewed.

4.4.1 MODULE JUMPERS

Each module has two push-on jumper options. All modules are shipped from the factory configured for 4-20mA output and the current output is proportional to 0 to +10V output. If a 0-20mA output is desired and/or the current output is to be proportional to a -10V to +10V output, these parameters can be readily changed. If the push-on jumpers are changed, the zero and full scale points will shift by approximately 0.25% of span and will need to be recalibrated to remove this error. The details are defined in Section 2.1 for input modules and Section 2.2 for output modules.

4.4.2 MODULE CALIBRATION

Each module has adjustment potentiometers that provide a ±5% adjustment range. If fine calibration or minor range variations are desired, it can be accomplished by the calibration procedure defined for each module (see the calibration section of the appropriate module in Section 2). All units are shipped with a zero and span accuracy of ±0.1% of span.

4.4.3 CUSTOM RANGING (ZERO SUPPRESSION)

A wide zero suppression capability and easy field ranging are available with the OMX1310 plug-on ranging card. If a special input range is desired, it can be provided by ordering the externally programmable version of the desired module (i.e. OM3-II-P) and the OMX1310 which houses user supplied resistors that determine the zero and span of the new range. This feature allows the user to provide zero suppression of up to and beyond 100% of the input range and provide a very wide range of span modification. The capability allows the user to map any portion of the input signal to the full output span. See the Custom Ranging section of the appropriate module in Section 2 to determine the required resistor values. The error contributions and temperature effects of custom ranging are discussed in Appendix A.

4.4.4 MODULES COLOR CODING

The top labels of each module have been color coded to differentiate isolated units from nonisolated ones and input modules from output units. The colors of the labels are defined as:

ISOLATED INPUT – white lettering on a black background

NONISOLATED INPUT – black lettering on a white background

ISOLATED OUTPUT – white lettering on a red background

NONISOLATED OUTPUT – black lettering on a yellow background

4.4.5 MODULE CONSTRUCTION

All module cases are made from a thermoplastic resin which has a fire retardent rating of 94V-0 and is designed for use from −55°C to +85°C. Each module's printed circuit board is 0.031 inch thick glass epoxy and the module's pins are gold plated contacts with a nickel undercoat.

4.5 INDIVIDUAL MODULE MOUNTING KIT

The OMX1345 individual module mounting kit is to be used when a user defined backplane is substituted for an OM3 Series backplane. Figure 4.5.2 shows the outline of an OM3 Series module when plugged into an OM3 Series backplane, and gives the dimensions of the mating connectors and retaining clips and the spacing between them. 0.200″ minimum spacing is required between the input conductors and 0.400″ minimum spacing is used between input and output conductors. This spacing is required to maintain the 1500V CMV isolation provided by the isolated OM3 modules. The dimensions of the figure should be considered when individual module mounting is desired.

The pinout of the input modules is defined in Section 2.1 and the pinout for the output modules is defined in Section 2.2.

Each OMX1345 comes with a transistor-resistor pair that is to be used as a cold junction compensation sensor in thermocouple applications. This sensor is to be installed as indicated in Figure 4.5.1. The cold junction sensor will give an initial accuracy of ±0.5°C.

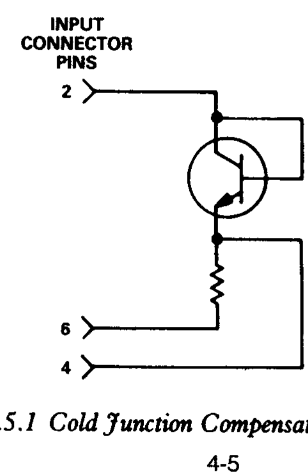


Figure 4.5.1 Cold Junction Compensation Connections

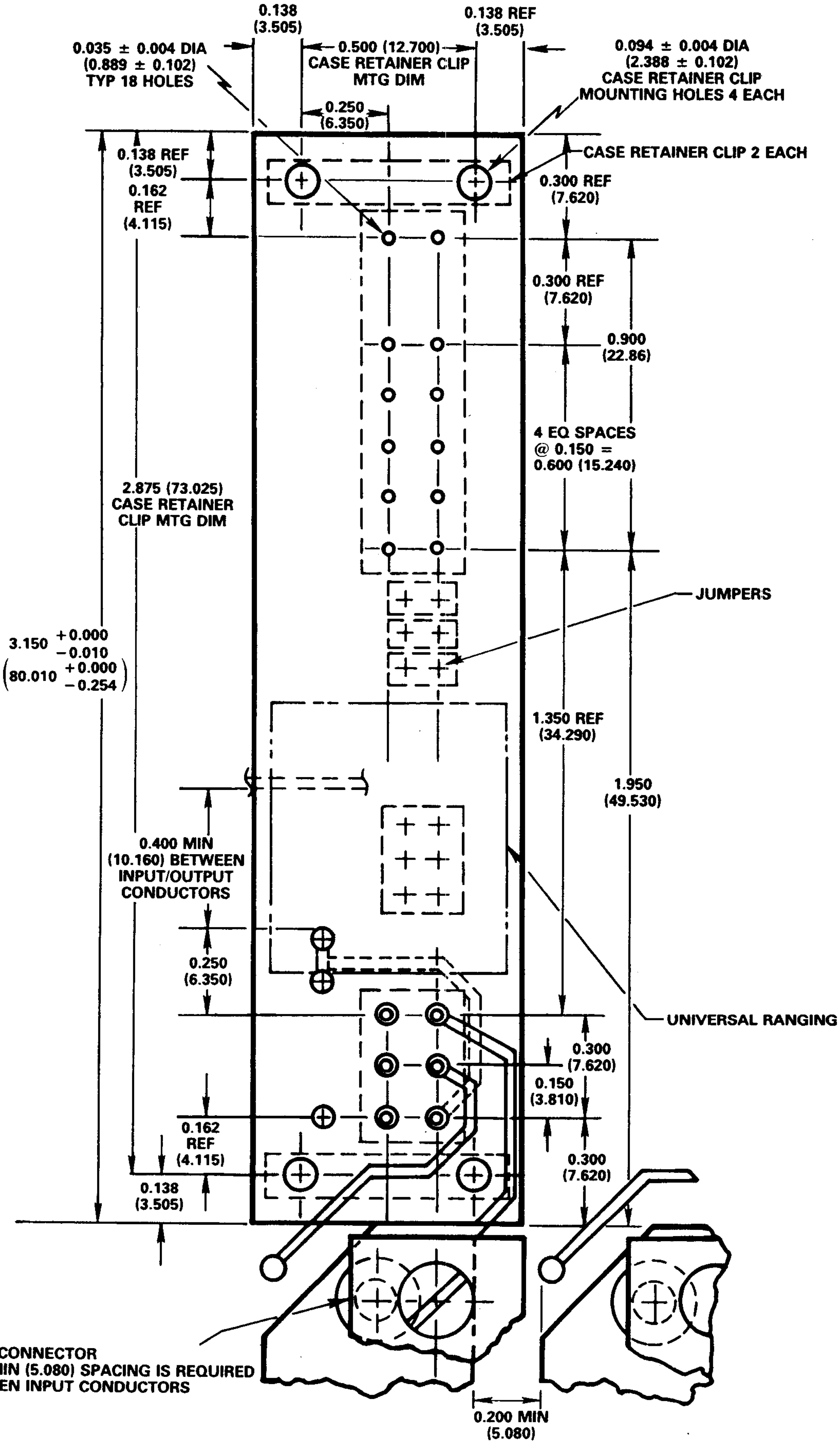
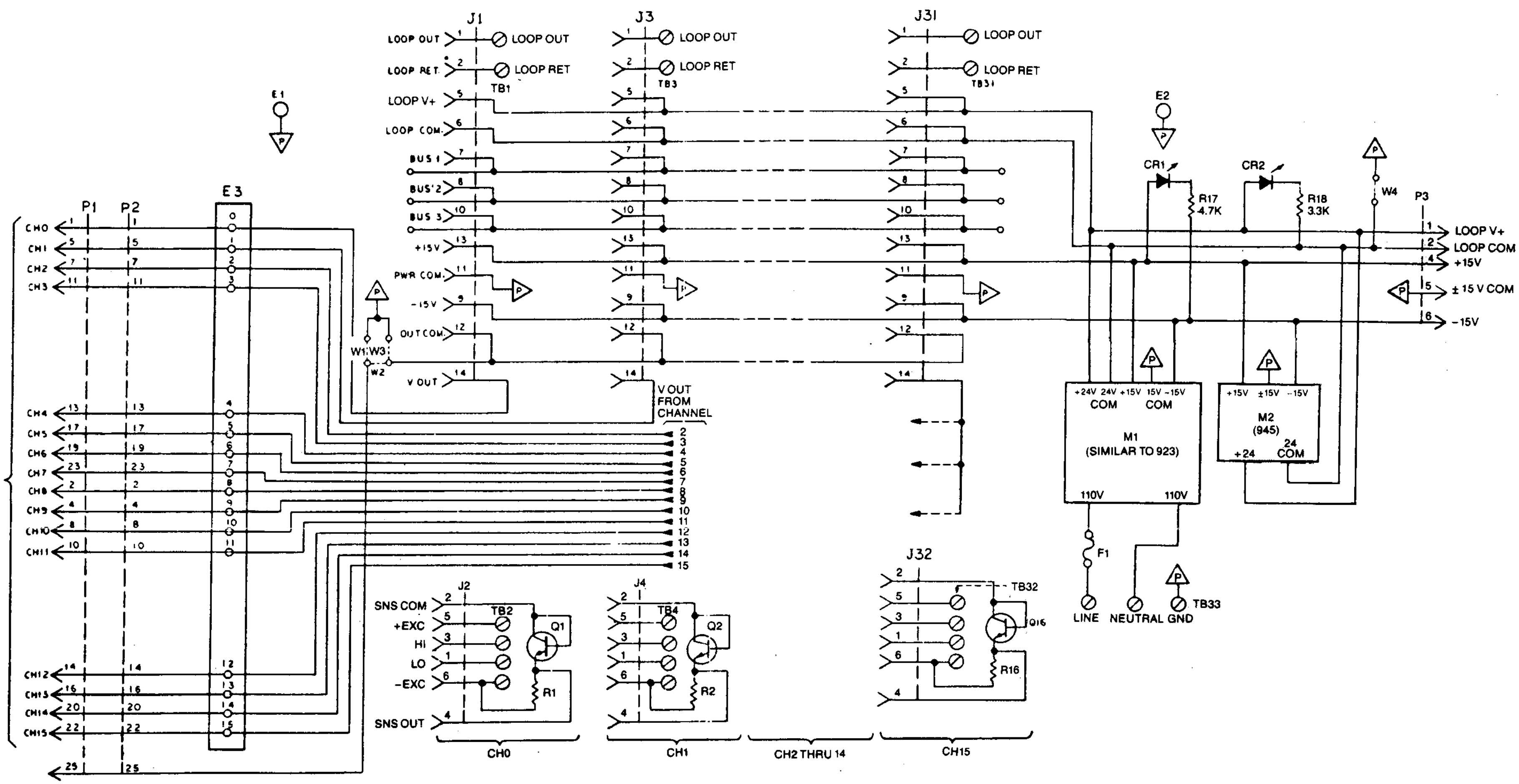


Figure 4.5.2 Individual Module Mounting Dimensions
Dimensions shown in inches and (mm).



VOLTAGE OUT/IN

Figure 5.1 OM3-BP-16 Schematic

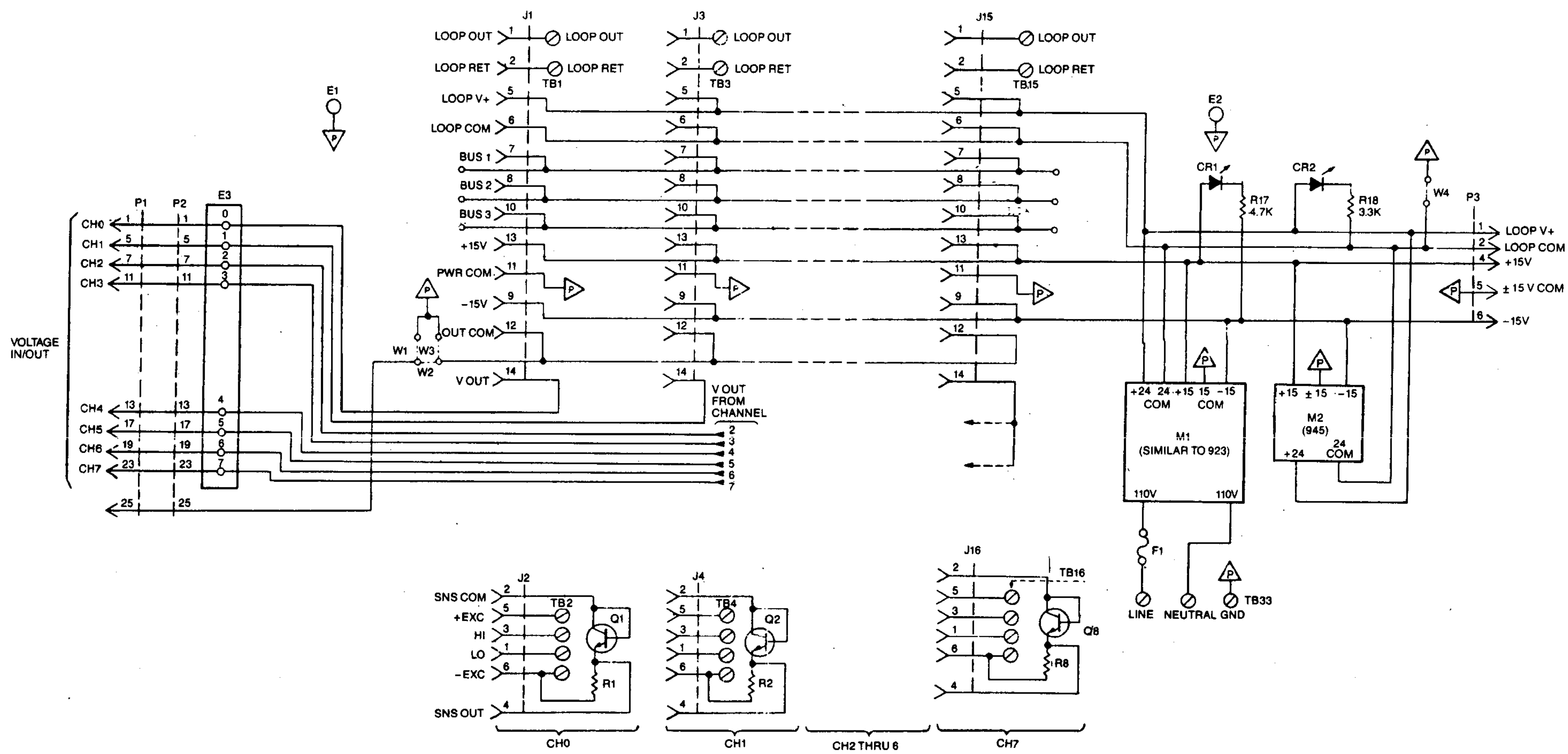


Figure 5.2 OM3-BP-8 Schematic

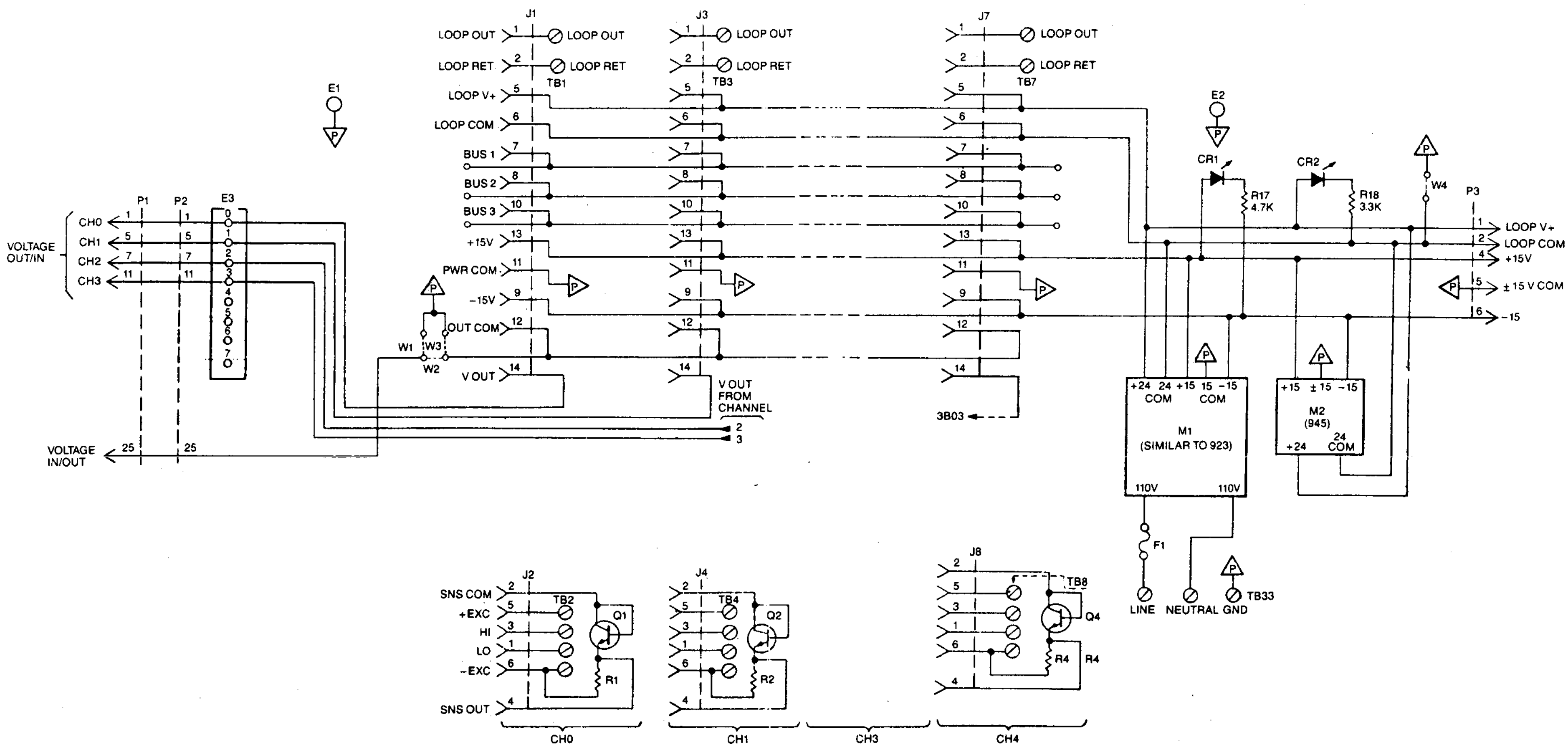


Figure 5.3 OM-BP-4 Schematic

APPENDIX A

CUSTOM RANGING

Wide zero suppression and easy field ranging are available with the OMX1310 plug-on ranging card and the externally programmable version of the desired input module. The OMX1310 houses user supplied resistors that determine the zero and span of the custom range. This section discusses custom ranging and its error contributions, temperature effects, and limitations.

APPENDIX A1

CUSTOM RANGING mV, V, mA, THERMOCOUPLE, STRAIN GAGE, FREQUENCY AND AD590 MODELS

For the purposes of custom ranging, the OM3 Series modules can be discussed in three categories; the RTD models, the LVDT model, and all others. The basic transfer function of all modules other than the RTD and LVDT modules can be characterized as:

$$V_O = G \times (V_{IN} - V_Z)$$

Where
- V_O = Output Voltage
- G = Gain
- V_{IN} = Input Voltage
- V_Z = Zero Suppression Voltage

This equation applies directly to millivolt and voltage input models (OM3-MV, OM3-V, OM3-S, OM3-WBS, OM3-IMV, OM3-IV, OM3-WBV-MV, OM3-WBV-V) and indirectly to the thermocouple input model (OM3-ITC) the current input models (OM3-I, OM3-A-590, OM3-II) and the ac input models (OM3-ACV-MV, OM3-ACV-10V, OM3-ACV-150V, 250V). For the OM3-ITC, the input temperature must be converted to a voltage with an external sensing resistor. For the ac input devices, a scale factor must be considered.

The OM3-LTC cannot be externally custom ranged because of the complexity of the linearization circuitry. An OM3-LTC-CUSTOM can be factory configured to satisfy a special range.

The transfer function for the frequency input models (OM3-IFI, OM3-IFI-K) is:

$$V_O = G \times (F_{IN} - F_Z)$$

Where
- V_O = Output Voltage
- G = Gain (V/Hz)
- F_{IN} = Input Voltage
- F_Z = Zero Suppression Voltage

GAIN SETTING RELATIONS

With the OMX1310, the gain G is set by R_1 (R_3A for OM3-WBS), which forms part of an internal divider and is determined from the following:

Models:	OM3-MV,OM3-I, OM3-A-590,OM3-S	OM3-V	OM3-IMV, OM3-II, OM3-ITC	OM3-IV
Relations:	$R_1 = \frac{10k\Omega}{G-1}$	$R_1 = \frac{1k\Omega}{G-0.1}$	$R_1 = \frac{40k\Omega}{G-2}$	$R_1 = \frac{4k\Omega}{G-0.2}$

Models:	OM3-WBS	OM3-WBV-MV	OM3-WBV-V
Relations:	$R_3A = \frac{200k\Omega}{G}$	$R_1 = \frac{400k\Omega}{G-4}$	$R_1 = \frac{40k\Omega}{G-0.4}$

Models:	OM3-IFI	OM3-IFI-K
Relations:	$R_1 = G \times 1.18 \times 10^6$	$R_1 = G \times 2.60 \times 10^7$

For the ac input modules, the gain is set by R_1 and R_4B. R_1 is used to control the scaling of input in each of these three models while R_4B determines the gain from the rectifier on. R_1 is determined from the following relations:

OM3-ACV-MV	OM3-ACV-10V	OM3-ACV-150V, 250V
$R_1 = \frac{20k\Omega}{\frac{1}{KV_m} - 1}$	$R_1 = \frac{20k\Omega}{\frac{50}{KV_m} - 1}$	$R_1 = \frac{20k\Omega}{\frac{550}{KV_m} - 1}$

Where $K = V\,av/V\,rms = 0.900$ for sinusoids
V_m = full scale rms input voltage

The difference between these three models is in the input scaling. The scaling is done before the zero suppression or gain so that the maximum value presented to the rectifier is 1V rms. The signal is processed the same from this point on in each of the three models. R_4B is determined from the following relation, which is the same for all models:

$$R_4B = \frac{40k\Omega}{G1-2} \qquad \text{where } G1 = \frac{10V}{1 - \frac{V_z}{V_m}}$$

(10V represents the module's output span.)

ZERO SUPPRESSION VOLTAGE

The zero suppression voltage, V_Z, can be set for any value between −6.35V and +6.35V for nonisolated models (−63.5V to +63.5V for model OM3-V and −3.175V and +3.175V for isolated models (−31.75V to +31.75V for model OM3-IV and OM3-WBV-V). There is no zero suppression for the OM3-WBS. The ac input modules are discussed separately at the end of this section. The relations for V_Z are defined below:

Models:	OM3-MV, OM3-I, OM3-A-590, OM3-S	OM3-V	OM3-IMV, OM3-II, OM3-ITC, OM3-WBV-MV, OM3-LTC
Relations:	$V_Z = \frac{R_2}{R_2 + R_3} \times 6.35V$	$V_Z = \frac{R_2}{R_2 + R_3} \times 63.5V$	$V_Z = \frac{R_2}{R_2 + R_3} \times 3.175V$

Model:	OM3-IV, OM3-WBV-V
Relations:	$V_Z = \frac{R_2}{R_2 + R_3} \times 31.75V$

The sign of V_Z is defined by the mounting of R_3 in location A (positive) or B (negative). The total resistance of $R_2 + R_3$ should be approximately 10kΩ to avoid taking excessive current from the voltage reference or self heating of the resistors. (For the OM3-V and OM3-IV (OM3-WBV-V), the 63.5V and 31.75V terms are functions of the 10 x attenuation of the input signal. The internal references are 6.35V and 3.175V respectively, so ordinary 100mW resistors are suitable for zero suppression). Using 10kΩ as the total value, R_2 and R_3 are determined from the following:

Model:	OM3-MV, OM3-I,OM3-A-590, OM3-S	OM3-V	OM3-IMV, OM3-II, OM3-ITC, OM3-WBV-MV, OM3-LTC	OM3-IV, OM3-WBV-V
Relations:	$R_2 = \frac{V_Z}{6.35V} \times 10k\Omega$	$R_2 = \frac{V_Z}{63.5V} \times 10k\Omega$	$R_2 = \frac{V_Z}{3.175V} \times 10k\Omega$	$R_2 = \frac{V_Z}{31.75V} \times 10k\Omega$
	$R_3 = 10k\Omega - R_2$	$R_3 = 10k\Omega - R_2$	$R_3 = 10k\Omega - R_2$	$R_3 = 10k\Omega - R_2$

For the ac input modules, the zero suppression voltage, V_Z, can be set for any value between 0 and 1.23V. Since the signal varies from 0 to 1V dc at the amplifier input, a zero suppression voltage of 0 to 1V dc corresponds linearly to a 0–100% of full scale zero suppression.

The zero suppression resistor, R_2, is determined from the following relations for all three models:

$$R_2 = \frac{10k\Omega\,(V_z/V_m)}{1.23 - V_z/V_m}.$$

The zero suppression frequency, F_Z, can be set for any value up to 80% of the desired input span through the use of R_2. Zero suppression is limited by temperature drift. Values larger than 80% of the input span will have a larger amount of temperature drift. The value for R_2 is determined from the following relations:

OM3-IFI	OM3-IFI-K
$R_2 = \frac{1.52 \times 10^7}{F_Z}$	$R_2 = \frac{3.33 \times 10^8}{F_Z}$

ADDITIONAL CUSTOM RELATIONS

Model OM3-WBS's standard bandwidth is 20kHz. The bandwidth can be set for any value less than 20kHz using the AC1310. The required capacitors, C_1 and C_2, are determined from the following relations:

$C_1 = 8.4\mu F/F_C$
$C_2 = 4.2\mu F/F_C$

Note: For values of C_1 below 3nF, reduce C_1 by 320pF and C_2 by 160pF.

where F_C is the desired cutoff frequency. Bipolar capacitors capable of withstanding ±10V should be used. The space limitations of the OMX1310 must be considered when choosing the required capacitors. These capacitors are to be installed in the positions designated as R_4A and R_1 respectively. The OMX1310 can be used to reduce the bandwidth in factory ranged units.

Model OM3-ITC and OM3-LTC requires an additional resistor to set the cold junction compensation for the appropriate thermocouple type. These values are defined in Section 2.1.9 (OM3-ITC) and Section 2.1.12 (OM3-LTC).

A standard OM3-IFI or OM3-IFI-K is shipped with zero hysteresis since a jumper is installed on the range carrier pins. If the jumper is removed, there will be nominally ±4V (±20%) of hysteresis. If less hysteresis is desired, it can be accomplished with the following equation:

OM3-IFI	OM3-IFI-K
$R_4A = \frac{10^6 \times V_H}{4 - V_H}$	$R_4A = \frac{10^6 \times V_H}{4 - V_H}$

where V_H is the desired hysteresis. V_H can be set for any value between 0 and 4V with a ±20% tolerance.

APPENDIX A1.1

ERROR CONTRIBUTIONS

The tolerance of the references (typically better than ±2%) will directly affect all nonzero values of V_Z. The contribution of the resistors used will be the total tolerance error of the two resistors multiplied by the fraction $R_3/(R_2 + R_3)$. In practical terms, this amounts to . . .

. . . the total of the resistor tolerances for small V_Z.
. . . half the total resistor tolerance at $V_Z = 3V$.
. . . virtually no effect from resistors at $V_Z = 6V$.

Thus if V_Z is to be, for example, 100mV, the use of 1% tolerance resistors will result in a total possible error of ±4% of V_Z, or ±4mV (assumes a 2% error in the reference voltage). This error is as seen at the module input, independent of gain.

For models OM3-V and OM3-IV, a 10 x input attenuator is used to extend the input signal range of the basic amplifier in the OM3-MV and OM3-IMV respectively. The tolerance of the attenuator (2% max) must be considered with custom ranging and is additive to the above terms.

The range of the module's voltage output ZERO ADJUST is at least ±0.5V at the module output, and it can therefore correct any input offset error of less than 0.5V/G. Thus the ±4mV input offset in the example above can be adjusted to zero for any gain less than 125. If more gain is to be taken, it will be necessary to use more accurate resistors at R_2 and/or R_3 to guarantee that the offset can be zeroed.

The tolerance of the gain-setting resistor, R_1, affects the accuracy of the selected gain directly. Since the module's SPAN ADJUST pots have at least a ±5% adjustment range, the use of 1% tolerance resistors for R_1 will be sufficient.

APPENDIX A1.2

TEMPERATURE EFFECTS

The temperature drift of the zero suppression voltage V_Z will depend upon the temperature coefficients of the resistors used in the same way that accuracy depends upon tolerance; that is, the total drift of R_2 and R_3 will be seen through a multiplier of $R_3/(R_2 + R_3)$. As before, the practical effect of this is that the total of the resistor temperature coefficients will be seen for small values of V_Z; one-half the total will be seen for V_Z in the vicinity of 3V, and almost no drift will be contributed by the resistors for V_Z near 6V. Note that for the ac input modules, the top leg of the zero suppression divider (R_3) is an internal resistor, with a value of 10kΩ, 1% tolerance, and a drift of 10ppm/°C.

The reference voltages supplied by the module have a typical drift of less than 25ppm/°C. This drift will add directly to the resistor drift for any value of V_Z. Thus, for V_Z = 100mV as in the example above, the use of a pair of 50ppm/°C resistors will result in a total drift of 125ppm of V_Z per °C, or 12.5 microvolts per °C. This drift adds directly to the module's basic input offset drift. A lower value can, of course, be obtained by the use of better resistors for R_2 and R_3.

Temperature drift in the value of the gain-setting resistor, R_1, will directly affect the module's gain drift. Note, however, that the basic drift specifications for the modules include the effect of a gain-setting resistor drift of ± 10ppm/°C; rated performance will be obtained if the drift of R_1 is less than or equal to this value.

APPENDIX A2

CUSTOM RANGING RTD MODELS

RTD Ranging applications can be divided into two categories, depending on whether the module's internal linearizing circuit is used. If internal linearization is required, the following procedure applies:

1. **For models OM3-P3 and OM3-P4, the module's output voltage must always be positive since the linearizing circuit is active only for $V_O > 0$. The relations assume the use of a 0 to +10V output span. Other output ranges are possible, contact the factory for information on any other positive output range.**
2. **Any type of RTD can be used provided that its resistance does not exceed 10kΩ in the range of interest and its temperature characteristic is concave down. While virtually all RTDs have these properties, the conformity errors specified for these models apply specifically to 100Ω platinum RTDs following the European curve (α = 0.00385). Conformity errors for other RTD types can be supplied by the factory.**
3. **Ranging component values are found from:**

OM3-P3, OM3-P4

Gain Setting Resistor: $R_1 = \dfrac{20k\Omega}{G - 1}$

Zero Suppression Resistors: OM3-P3: R_3A = OM3-P4: $R_2 = R_Z$

Linearization Resistor: $R_4A = \dfrac{Q - 1}{2 - Q} \times 20k\Omega$

Where Gain $G = 40k\Omega \times \left(\dfrac{1}{\Delta R_{MS}} - \dfrac{1}{\Delta R_{FS}} \right)$

OM3-IP, (also Nickel RTD model)

$$R_1 = 20k\Omega \left(\frac{G}{1 - G} \right)$$

$$R_3A = R_Z$$

$$\text{OM3-IP } R_4A = \left[\frac{Q-1}{(2-Q) \times 1.7} - 1 \right] \times 25k\Omega$$

$$\text{Nickel RTD Model } R_4A = \left[\frac{Q-1}{(Q-2) \times 1.85} \right] \times 28.3k\Omega$$

$$G = \frac{\Delta R_{FS}}{2 \times 10^4} \left(\frac{1}{Q-1} \right)$$

R_Z = Resistance of the RTD at the temperature T_{MIN} that is to give V_O = 0V

$Q = \dfrac{\Delta R_{FS}}{\Delta R_{MS}}$ (a measure of nonlinearity)

*Since copper RTDs are linear devices, the OM3-Copper RTD model does not need a linearization resistor.

ΔR_{FS} is the change in resistance from T_{MIN} to T_{MAX}, which will give $V_O = +10V$
ΔR_{MS} is the change in resistance from T_{MIN} to T_{MID}, which will give $V_O = +5V$

If internal linearization is not required, then the following procedure applies:

1. Output voltages at the endpoints of the span may be anywhere in the range of $-10V$ to $+10V$.
2. Any type of RTD can be used provided that its resistance does not exceed 10kΩ in the measurement range of interest.
3. Ranging components are computed from:

OM3-P3, OM3-P4

Gain Setting Resistor: $R_1 = \frac{\Delta R_{FS}}{4000\ V_{FS} - \Delta R_{FS}} \times 20k\Omega$

OM3-IP (also Nickel RTD model)

$R_1 = \frac{\Delta R_{FS}}{2000\ V_{FS} - \Delta R_{FS}} \times 20k\Omega$

(Copper RTD Model)

$R_1 = \frac{\Delta R_{FS}}{500\ V_{FS} - \Delta R_{FS}} \times 20k\Omega$

Zero Suppression Resistors:

OM3-P3: $R_3A = R_Z$
OM3-P4: $R_2 = R_Z$

OM3-IP: $R_3A = R_Z$

Where R_Z = Resistance of the RTD at the temperature that is to give $V_O = 0V$
V_{FS} = Positive full scale output voltage desired
ΔR_{FS} = Change in RTD resistance from R_Z to the full scale temperature.

The fact that R_2 is set to the zero volt output point does not mean that negative outputs will not be meaningful; it just provides the simplest relation. Once R_1 and R_2 are determined, the output voltage at any RTD temperature can be found, given the RTDs resistance at that temperature (R_{RTD}), from the following relations:

OM3-P3, OM3-P4, OM3-IP, (and also Nickel RTD model)

$$V_O = (R_{RTD} - R_Z) \times 0.25mA \times G_V$$

(Copper RTD model)

$$V_O = (R_{RTD} - R_Z) \times 1.0mA \times G_V$$

where $G_V = \frac{20k\Omega}{R_1} + 1$ for OM3-P3 and OM3-P4 and $G_V = \frac{40k\Omega}{R_1} + 2$ for OM3-IP

APPENDIX A2.1

ERROR CONTRIBUTIONS

The tolerance of the resistor chosen for zero suppression and the mismatch of the current-sources (typically 0.2%) define the error introduced with zero suppression. As an example, if when using the OM3-IP the low end of a range is to be 100°C (which gives $R_Z = 175.84\Omega$ from standard tables), the use of a 1% tolerance resistor will result in a total possible error of ±1.2% or ±2.1Ω. This error is seen at the module input, independent of gain.

The range of the module's voltage output zero adjust is at least ±5.0% of the output span. Thus, the ±2.1Ω input offset in the example above can be adjusted to zero for any output span greater than 42Ω (approximately 110°C). If a smaller output span is desired, it will be necessary to use a more accurate resistor at R_2 to guarantee that the offset can be zeroed.

The tolerance of the gain-setting resistor, R_1, affects the accuracy of the selected gain directly. Since the modules SPAN ADJUST have at least a ±5% adjustment range, the use of 1% tolerance resistors for R_1 will be sufficient.

APPENDIX A2.2

TEMPERATURE EFFECTS

The temperature drift of the zero suppression resistor R_Z directly affects the module's input offset drift. Thus, if a 50ppm/°C resistor is used, the drift should be added directly to a module's input offset drift. A lower value can of course be obtained by the use of a better resistor.

Temperature drift in the value of the gain setting resistor, R_1, will directly affect the module's gain drift. Note, however, that the basic drift specification for the modules includes the effect of a gain-setting resistor drift of ± 10ppm/°C. Rated performance will be obtained if the drift of R_1 is less than or equal to this value.

APPENDIX A3

CUSTOM RANGING LVDT MODULE

The excitation voltage amplitude of the OM3-LV LVDT input module is set by R_1 which is determined from the following relation:

$$R_1 = \frac{10k\Omega \times V\ rms}{7 - V\ rms}$$

V rms is the desired rms amplitude of the oscillation, and it can be selected for any value between 1V and 5V. The accuracy of the excitation is ± 10% with a harmonic distortion of less than 0.5%.

Using resistors R_2 and R_3A, the excitation frequency can be set for any value between 1kHz and 10kHz. These values are determined by the equation below:

$$R_2,\ R_3A = \frac{10^9}{f \times 6.3}$$

where f is the desired frequency of oscillation.

Since the excitation voltage resistor is used to set the amplitude of the excitation, its drift is reflected directly in the output of the module. Therefore, the excitation voltage resistor should be 1% tolerance, 10ppm. The frequency setting resistors on the other hand need only be 100ppm, since the module is insensitive to changes in frequency.

APPENDIX A4

RANGING LIMITS

The range carrier can be used effectively to create a very wide range of special transfer functions, but there are practical limits which must be observed. The limits are of three fundamental types:

a. Module input restrictions. Independent of the amount of gain or zero suppression taken, the maximum voltage for normal, linear operation at either the HI or LO input terminal for the nonisolated units is:

OM3-MV, OM3-I, OM3-A-590	± 6.6V with respect to output (system) common
OM3-S	0 to + 12V with respect to output (system) common
OM3-LV*	± 10V peak with respect to output (system) common
OM3-WBS	± 11V with respect to output (system) common

For isolated units, the maximum differential voltage input is:

OM3-IMV, OM3-ITC, OM3-LTC	± 1V differential input
OM3-IV	± 20V differential input
OM3-II	± 2V differential input
OM3-WBV-MV	± 2.5V differential input
OM3-WBV-V	± 25V differential input

*The OM3-LV requires no zero or gain setting resistors.

For isolated ac input modules, the maximum ac voltage input is:

OM3-ACV-P	1V rms
OM3-ACV-P1	50 V rms
OM3-ACV-P2	550V rms

Model OM3-V has a 10 x input attenuator that affects its restriction. For this product, the sum of common mode voltage plus one tenth the normal mode voltage must be less than 6.6V. The RTD models (OM3-P3, OM3-P4, OM3-IP) will work for any RTD value less than 10kΩ (2.5kΩ for Copper

Frequency Input Models OM3-IFI and OM3-IFI-K offer input protection up to 220V and will operate normally up to that value. The OM3-IFI can accept range between 25kHz and 50kHz with a gradual decrease in linearity. A 0–30kHz range has 0.02% nonlinearity and a 0–50kHz range has 0.5% nonlinearity.

b. Adjustability of offset. As was mentioned above, the range of the voltage output ZERO pot is ±0.5 volts at the module output. Equivalently, it can correct for INPUT offsets of up to ±0.5V/G. The errors in V_Z can limit the maximum gain when zero suppression is used. When V_Z is zero (no zero suppression), the offset adjustment need only cover the module's input offset voltage (typically less than ±50 microvolts), so that gains up to 10000 are practical in many cases. Some exceptions are: the OM3-ITC and OM3-LTC, where CJC errors limit gain to about 4000; the OM3-WBS, whose larger input offset implies a gain limit of 5000; and the OM3-WBV-MV, where oscillation may occur for gains above 5000.

c. Noise. At the higher gains (beyond 1000) all of the noise seen at the module output is a reflection of the module's input noise seen through the chosen gain. Although the noise does not rise in proportion to gain (due to a gradual decrease in module bandwidth beyond G = 1000) there may well be a point beyond which system resolution is limited by noise rather than by the resolution of the data converter. There is, in general, no benefit in increasing gain beyond that point.

APPENDIX B1

MULTIPLE LVDT INSTALLATIONS

When multiple LVDTs are used in the same installation, good wiring practice is recommended to minimize interference between channels. This interference, which can occur when the difference in the LVDT excitation frequencies is smaller than the bandwidth of the module, can be virtually eliminated by keeping the wires from each LVDT as far apart as possible. It is best to use shielded cable, tying the shield to backplane common, and keeping the LVDT leads as short as possible.

Interference may still occur if the bodies of the LVDTs must be in close proximity to each other. To eliminate any interference, the oscillator of one OM3-LV can be used to excite several LVDTs.
The primary leads of all the LVDTs are connected in parallel to screws 1 and 4 of the module whose oscillator is to be used. The secondary leads are connected in the normal manner to their respective OM3-LVs. A jumper, OMX1344, must be installed between pins 1 and 3 of the optional ranging card connector of the modules whose excitation circuits are not being used to turn off those modules' oscillators (see Figure below). This technique is limited in that the sum of the primary currents of all the LVDTs connected to one OM3-LV must not exceed 20mA rms.

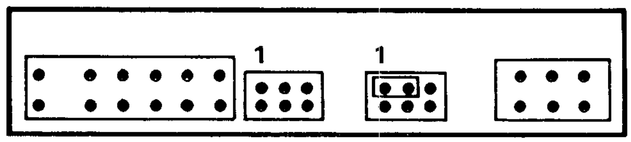


Figure B1. OM3-LV Module—Bottom View of Connectors.

APPENDIX B2

SYNCHRONIZING MULTIPLE LVDTs

It is possible to synchronize the oscillators of any number of OM3-LVs on the same backplane. All of the OM3-LVs to be synchronized must have the same nominal excitation voltage and frequency. An OMX1310 with a jumper soldered into position R3B (see Figure below) is placed on the ranging connector of each OM3-LV to be synchronized. This connects a control node of the excitation oscillator to Bus 3 on the 3B01, 3B02, 3B03, (16, 8 and 4 channel backplanes). Other OM3 modules may still be used on the same backplane, but only OM3-LVs with identical nominal excitation voltages and frequencies may be connected to the synchronization bus. User programmed units (i.e., OM3-LV-Ps) cannot be synchronized because the OMX1310 custom ranging card is required to provide the connection to the synchronization bus. The synchronization capability is available only on OM3-LVs with a date code of 8646 or higher.

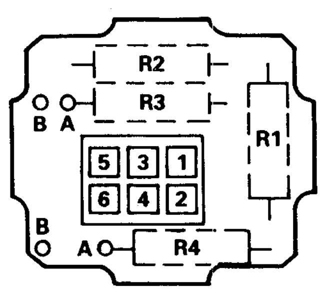


Figure B2. To Synchronize Like OM3-LVs, Solder Jumper in Position R3B

APPENDIX C

ACCESSORIES

Custom Ranging Card

Part Number	Description	Used With
OMX1310	Plug-on Card Requiring Customer Supplied Resistors	Any OM3 Input Module

Power Supply Kits

ADI P/N	Input Voltage	Output Voltage	Output Current*	Description
OMX1300**	115V ac	±15V	±200mA	AC Power Supply and Hold Down
OMX1301**	115V ac	±15V	±350mA	AC Power Supply and Hold Down
OMX1302	24V dc	±15V	±190mA	DC/DC Converter and Hold Down
OMX1307	115V ac	±15V	+800mA, −225mA	AC Power Supply and Hold Down
		+24V***	+350mA	

*Power supply current is a function of the actual modules used. See Table II in the OM3 Series data sheet for current requirements.
**Add "E", "F" or "H" suffix to model number for 220V ac, 100V ac or 240V ac input voltages, respectively.
***The +24V output is unregulated.

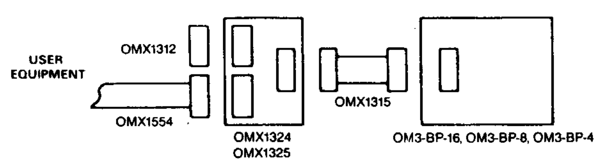
Power Cords

Part Number	Description	Used With
OMX1340-D	7 ft. Domestic Power Cord	OM3-BP-16, OM3-BP-8, OM3-BP-4
OMX1340-C	7 ft. Continental Power Cord	OM3-BP-16, OM3-BP-8, OM3-BP-4
OMX1341	6 ft. dc Power Cable	OM3-BP-16, OM3-BP-8, OM3-BP-4

Mounting Kits

ADI P/N	Description	Used With
OMX1330	19" Rack Mount Kit	OM3-BP-16, OM3-BP-8, OM3-BP-4
OMX1331	16-Channel Surface Mount Kit	OM3-BP-16
OMX1332	8-Channel Surface Mount Kit	OM3-BP-8
OMX1333	4-Channel Surface Mount Kit	OM3-BP-4

INTERCONNECTION ACCESSORIES



This diagram depicts how the OM3 Series may be interfaced to the user's equipment. The OMX1315 ribbon cable provides a direct electrical connection to all adapter boards. Two adaptor boards (OMX1324, OMX1325) are designed for universal connections. All adapter boards accept either connectors or ribbon cables that can interface with the user's equipment.

Cables

	Description	Used With
OMX1315	2′ 26-Pin Cable Assembly*	backplanes; interface boards
OMX1554	26-Pin Cable Connector with 3′ Cable	backplanes; interface boards

Connectors

	Description	Used With
OMX1312	26-Pin Female Mating Connector	backplanes; interface boards

Miscellaneous

	Description	Used With
OMX1342	**100Ω Current Sense Resistor (Spare**	OM3-I, OM3-II
OMX1343	**2kΩ Current Sense Resistor (Spare)**	OM3-A-590
OMX1344	**10 Jumpers (Spare)**	Any OM3 Module
OMX1345	**Individual Module Mounting Kit with CJC Sensor**	Any OM3 Module
OMX1350	**Blank Module (Includes PC Board, Case and Connector)**	**Custom Function with** OM3 Series
OMX1351	**Blank Module (Includes Case and Connector only)**	**Custom Function with** OM3 Series

UNIVERSAL ADAPTER BOARDS

The universal adapter boards are intended to provide connections to any external equipment. The OMX1324 has a 26-pin connector which accepts the high level voltage I/O from an OM3 Series backplane (the OMX1315 might be used for this purpose). User connections are then made to screw terminals on the OMX1324, which allows the OM3 Series to interface to any equipment with just a screw driver. The OMX1325 has two 26-pin connectors that can interface with two OM3 Series backplanes and has 4 patterns of holes that accommodate flat cable connectors of up to 50 pins each. The OMX1325 mates with the appropriate connectors required to interface with the users' equipment. The OMX1325 will accept any standard flat cable connector with 0.1″ spacing.

ADI P/N	Description
OMX1324	Universal Adapter with 26-Pin Connector in/ 26 Screw Terminals out
OMX1325	Universal Adapter with two 26-Pin Connectors in/ 4 patterns of 50 sockets out. Accommodates the necessary connectors for each application

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