Ectron CORPORATION

MODEL 416

RUGGEDIZED
CONDITIONER-AMPLIFIER

Model 416 front view.
See specifications for size.

GENERAL

The Model 416 is a transducer conditioner with a precision instrumentation amplifier for use in poor environmental conditions. Designed for use with almost any transducer, this conditioner-amplifier provides outstanding performance despite temperature extremes and high levels of shock and vibration.

Featuring complete ohmic isolation between the signal input, output, excitation, power supply, and case, it is a solid-state chopper-stabilized differential dc amplifier with an internal excitation voltage supply. The high input impedance permits operation with a large variety of signal sources; and the low output impedance allows operation into highly reactive loads, telemetry equipment and most recording and/or storage devices.

Model 416 rear view, with mating DAM-15S connector

STANDARD FEATURES

- **The Model 416 conditioner-amplifier comes standard with the following features:**
- **Ruggedized for environmental extremes.**
- **±10-V amplifier output.**
- **±40-mV input zero suppression.**
- **Continuous gain in a 1-2-5 sequence from 10 to >2500.**
- **Customer-selectable excitation voltage.**
- **EMI/RFI filtering on all connector pins.**
- **Operation from any dc voltage from +10.5 to +32 V dc.**
- **All units 100% temperature tested over full operating range.**

OPTIONAL FEATURES

There are two options for the Model 416:

- **Option B**
  The output is limited to 0 to +5 V.
- **Option G**
  The gain sequence is changed to binary (2-4-8 sequence) with gains from 16 to >2500.

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All specifications apply with a fixed source resistance of 0 to 500 Ω in any unbalance over the temperature range of –25°C to +85°C unless otherwise specified. The following specifications are the maximum deviation allowed from ideal unless otherwise noted.

RTI = Referred to Input
RTO = Referred to output

INPUT

CONFIGURATION
True differential with guard, transformer isolated. Can operate from isolated source.

IMPEDANCE: ≥ 1 MΩ

SIGNAL SOURCE
Normal-mode voltage (without damage)
±17 V dc or peak ac maximum.
Common-mode voltage (operating)
±100 V dc or peak ac.
Common-mode rejection (CMR)

Dc, 100-Ω unbalance:	≥ 140 dB.
Ac, 60 Hz, balanced:	≥ 120 dB.
Ac, 60 Hz, 100-Ω unbalance:	≥ 100 dB.
Ac, 400 Hz, balanced:	≥ 100 dB.
Ac, 400 Hz, 100-Ω unbalance:	≥ 90 dB.

NOISE

Noise specifications are stated with a statistical confidence of 3 sigma in peak voltage when measured in a first-order bandpass circuit with a lower frequency limit of 0.1 Hz and an upper limit as stated:

Frequency	RTI	RTO
10 Hz	≤ 1 µV	≤ 1 mV
300 kHz	≤ 5 µV	≤ 2.5 mV

GAIN

CONFIGURATION
Decade
Continuous gain from 10 to > 2500.
Screwdriver-adjustable front-panel rotary-gain-switch steps of 10, 20, 50, 100, 200, 500, and 1000.
Vernier (always active): ×1 to > ×2.5.
Binary (Option G)
Continuous gain from 16 to >2560.
Screwdriver-adjustable front-panel rotary-gain-switch steps of 16, 32, 64, 128, 256, 512, and 1024.
Vernier (always active): ×1 to > ×2.5.

ACCURACY
±0.2% typical with gain-vernier potentiometer fully counterclockwise.

STABILITY
Time (200 hours) ±0.02%.
Temperature ±0.005%/°C.

DYNAMIC RESPONSE

FREQUENCY RESPONSE (5-pole Butterworth)

Dc to 3 kHz:	±5%.
Dc to 5 kHz:	–3 ±1 dB.

LINEARITY
±0.04% of full-scale output maximum deviation from the best straight line through zero.

OVERLOAD RECOVERY
≤ 5 ms recovery from a "10 × full scale" input (up to the maximum normal-mode voltage allowed) to 0 V ±0.1% of the rated full-scale output.

ZERO

STABILITY
Time (200 hours)
±4 µV RTI ±200 µV RTO.
Temperature
±1 µV/°C RTI ±50 µV/°C RTO.
Dynamic temperature (20°C step change)
±8 µV RTI ±400 µV RTO.
Power-line change (30%)
±0.5 µV RTI ±200 µV RTO.

ADJUSTMENT RANGE (Affects amplifier input)
More than ±40 mV RTI.

CONTROLS
Coarse: 20-turn potentiometer.
Fine: 20-turn potentiometer with a nominal range of ±1 mV RTI.

OUTPUT

ISOLATION
The output is isolated by transformer from the input and power supply. The output-to-case voltage can be up to ±50 V dc or peak ac. The capacitance from output low to case and to power common is 0.22 µF.

LINEAR RANGE
Voltage
Standard:
From –10.0 V to +10.0 V.
Option B: From 0 V to +5.0 V (–0.8 V to +6 V maximum).
Current: 10 mA minimum.

IMPEDANCE
At dc: ≤ 1 Ω.
At 5 kHz: ≤ 2 Ω.

CAPACITIVE LOAD
The output will be stable under all normal signal conditions with a capacitive load of up to 0.02 µF.

PROTECTION
No damage will occur with a continuous short on the output.

EXCITATION VOLTAGE

VOLTAGES AVAILABLE
5, 7, or 10 V dc (set at the factory).

ACCURACY: ±1%.

OUTPUT CURRENT
≥ 100 mA with input power from 10.5 to 15 V dc, then decreasing linearly to 50 mA with input power of 32 V dc.
Current Limit
Output current limit is 120 mA nominal with < 10% change over full temperature range.

REGULATION
Load: ±0.1% no load to full load.
Power: ±0.05% for a line variation of 30%.

NOISE
≤ 1 mV rms, 0.1 Hz to 1 MHz.

TEMPERATURE COEFFICIENT
±0.005%/°C.

ISOLATION
Excitation low is connected directly to input-power common.

INPUT POWER

RANGE: ≥ 10.5 to ≤ 32 V dc.

OVERVOLTAGE PROTECTION
+60 V: For 15 s maximum.
–50 V: Continuous.

CURRENT
Model 416: 80 mA nominal, + excitation load + 1.2 times amplifier load.
Noise: The maximum current noise reflected back to the source is 5 mA peak as measured across a 1-Ω resistor in a 1-MHz bandwidth.
Maximum fault current: 230 mA.

PHYSICAL PROPERTIES

STORAGE TEMPERATURE
–60°C to +125°C.

OPERATING TEMPERATURE
–25°C to +85°C.

RELATIVE HUMIDITY
< 90% noncondensing.

ALTITUDE
No limit with adequate heat dissipation.

STATIC ACCELERATION
100 g.

SHOCK (6-ms sawtooth):
100 g.

VIBRATION
0.12" DA (5 to 55 Hz).
20 g (55 Hz to 2 kHz).

EMI/RFI PROTECTION
Filters are provided in all connector leads.

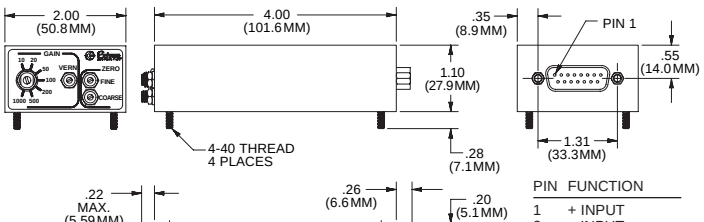
DIMENSIONS

Height	Width	Depth
50.8 mm (2")	28 mm (1.1")	101.6 mm (4")

WEIGHT
Conditioner-amplifier
255 g (9 oz) nominal.
Mating connector and hardware
16 g (0.6 oz) nominal.

MOUNTING FORCE (Four 4-40 studs):
6 inch-pounds maximum.

CONNECTOR
DAM-15P (Mate, DAM-15S with hood, cable clamp, and captive screws included).



PIN	FUNCTION
1	+ INPUT
2	– INPUT
3	NOT USED
4	OUTPUT HI
5	NOT USED
6	EXCITATION HI
7	NOT USED
8	POWER HI
9	GUARD
10	NOT USED
11	OUTPUT LO
12	NOT USED
13	CASE GROUND
14	EXCITATION LO
15	POWER LO

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