



AP1690 (Single/Dual Trip, 2 SPDT, 5A)

# Action PAK® AP1690

## AC Input, Field Configurable Limit Alarms

Provides Relay Contact Closures  
at a Preset AC Input Level



- Field Configurable Input Ranges for AC Voltage or Current
- Exclusive “Dynamic Deadband” Prevents False Trips
- Setpoints Programmable HI or LO
- Selectable Failsafe/Latching Operation
- Selectable 120/240VAC Input Power

### Description

The Action Pak model AP1690 dual setpoint limit alarm offers flexible, wide ranging AC input and relay output capability. Voltage spans from 100mV to 200VAC and current spans from 10mA to 100mA AC can be field configured. For current input spans of 1 to 5 Amps a 0.1W (0.1%) shunt resistor (Model #C006) is available. The AP1690 offers configurable latching, failsafe, and HI/LO operation. The unit also includes 0.25% to 50% adjustable deadband and selectable 120/240VAC power.

### Diagnostic LED

The Model AP1690 is equipped with a dual function diagnostic LED. The green center LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the center LED is off, check line power and the wiring connection. If the input signal is above 100% full scale, the LED will flash at approximately 8Hz.

### Output Selection

The dual setpoint AP1690 provides the following relay outputs:

**AP1690**                      Single/Dual Trip (2 SPDT, 5A)

Setpoints are top accessed multi-turn potentiometers or option "P" provides top mounted ten-turn clock face dials.

### Operation

The field configurable AP1690 limit alarm setpoints can be configured for HI, LO, latching or failsafe trip operation. Non-latching HI and LO setpoints have respective HI and LO deadbands. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The non-latching trip will reset only when the process falls below the HI deadband or rises above the low deadband (see figure 1). To reset a latched setpoint the signal must be in the safe region and the line power turned off for at least 5 seconds. For proper deadband operation, the HI setpoint must always be set above the LO setpoint.

In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, the relays go to the trip condition when power fails.

### Dynamic Deadband

The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This effectively results in a “dynamic deadband” – based on time – in addition to the normal deadband.

### Options

**U**    Urethane coating of internal circuitry for protection from corrosive atmospheres.

**P**    Top Mounted, 10-Turn Clockface Dials for setpoint adjustment.

**C620**    Factory calibration of input range, setpoints and output relays. Not available with option P.

### Configuration

The factory presets are as follows:

Input	0-500mV
Output	Dual, SPDT
Trip	A: HI, B: LO
Latching	No
Failsafe	No
Deadband	A/B: 0.25%
Power	120VAC

For other input ranges, remove the 4 base screws and case to access the configuration switches.

Replace the cover before applying power.

Refer to Figure 4 for switch locations.

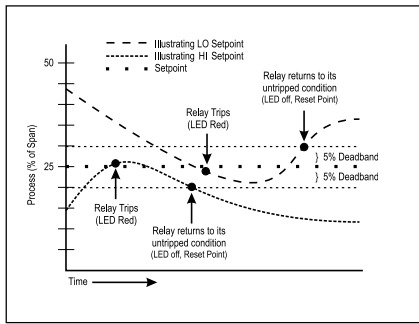
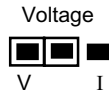


Figure 1: Limit alarm operation and effect of deadband.

## Input

1. Position input jumper "W1" for voltage or current inputs.



2. Using Table 1, set DIP switches "S1-S6" and jumper "W2" for the desired maximum setpoint input. Round desired maximum input values to the next highest range (e.g., 0-120V = 200V range).

## Output

1. Configure the Mode Selector for the required function. See Figure 5.

## Power

1. Configure the AC jumpers for either 120 or 240VAC operation. See Figure 6.

## Calibration

Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1-2 hours for warmup and thermal equilibrium of the system.

**Setpoint:** Set deadband at its minimum (factory default - fully CCW) before adjusting the setpoint. With the specified trip voltage or current input applied, adjust setpoint until the relay trips. For HI trip calibration, start below the desired trip.

**Deadband:** Set deadband to its minimum (factory default - fully CCW). Set setpoint to desired trip. Adjust voltage or current input until relay trips. Readjust deadband to 50% (fully CW). Set voltage or current input to desired deadband position. Slowly adjust deadband until relay untrips.

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within specifications):

a) Setpoint A: Type (HI/LO); Units (mA, mV, V); Deadband (%)

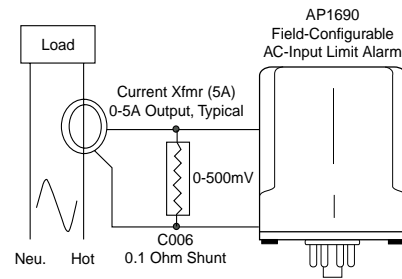
b) Setpoint B : Type (HI/LO); Units (mA, mV, V); Deadband (%)

c) Latching (ON/OFF)

d) Failsafe (ON/OFF)

Note that if a deadband entry is not specified, the default entry will be used.

## Typical Application



Load monitoring using a current transformer and the AP1690

## Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figure 2 & 3). Place all protection devices directly across the load and minimize lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

Table 1: AP1690 Input Ranges

Voltage	Current	Input Range Selector
100mV	10mA	SW1:  W2:
200mV	20mA	SW1:  W2:
500mV	50mA	SW1:  W2:
1V	100mA	SW1:  W2:
2V		SW1:  W2:
5V		SW1:  W2:
10V		SW1:  W2:
20V		SW1:  W2:
50V		SW1:  W2:
100V		SW1:  W2:
200V		SW1:  W2:

Table 3: AP1690 Input Jumper Settings

Input	Input Jumper Selector (W1)
Voltage	
Current	

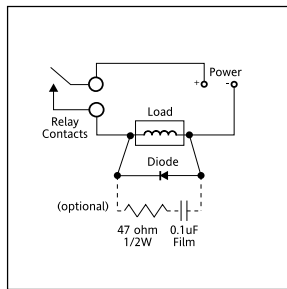


Figure 2: DC Inductive Loads

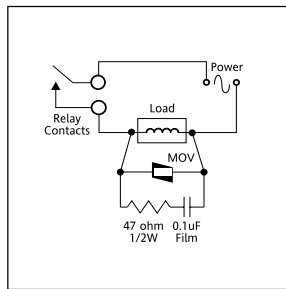
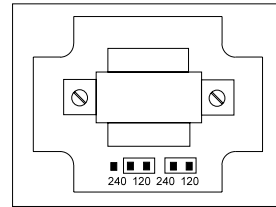
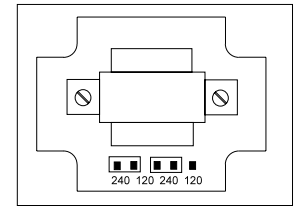


Figure 3: AC Inductive Loads



120 VAC Operation



240 VAC Operation

Figure 4: 120/240 VAC Selection

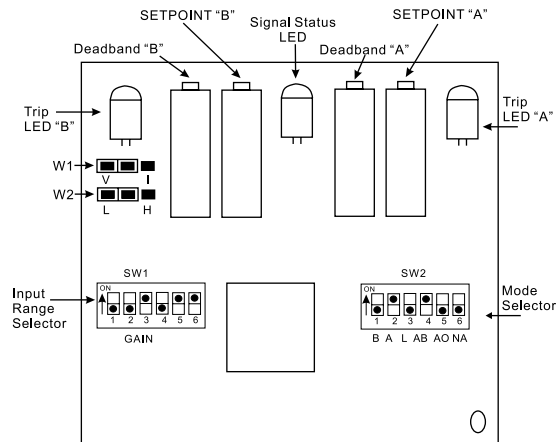


Figure 5: AP1690-2000 Factory Calibration 0-500mV, Dual HI/LO, Non-Latching, Non-Failsafe.

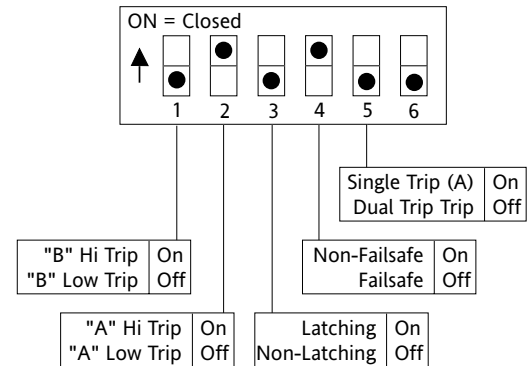


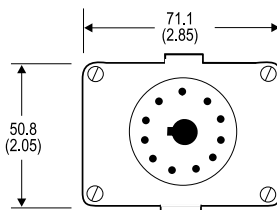
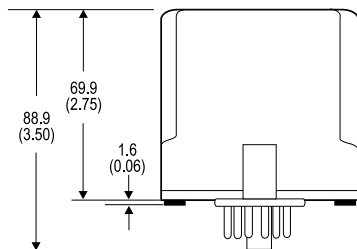
Figure 6: Mode Selection Dual Trip/A: HI, B: LO, Non-Latching, Non-Failsafe

## Mounting

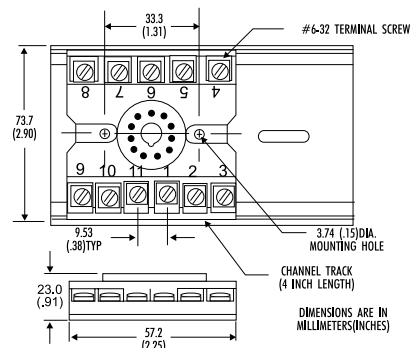
All Action Paks feature plug-in installation. Model AP1690 uses an 11-pin base and either molded socket M011 or DIN rail socket MD11.

## Dimensions

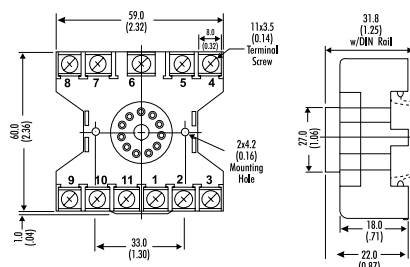
Dimensions are in millimeters (inches)



Mark III



M011 (Track/Surface)



MD11 (DIN Rail)

## Specifications

### Inputs:

Voltage Input  
Range: 100mV to 200VAC  
Impedance: >100K Ohms  
Overvoltage: 300VAC, max.  
Current Input  
Range: 10mA to 100mAAC  
Impedance: 20 Ohms, typical  
Overcurrent: 200mA AC, 60V peak, max  
Frequency Range: DC 40-400Hz,  
factory calibrated at 60Hz  
Common Mode (Input to Ground):  
1000V, max

### LED Indications:

Input Range (Green)  
>100% input: 8Hz flash (approx)  
Setpoint (Red):  
Tripped: Solid red  
Safe: Off

### Limit Differentials (Deadbands):

0.25% to 50% of selected span

### Response Time:

Dynamic Deadband:  
Relay status will change when proper  
setpoint/process condition exists  
uninterrupted for 100msec.  
Normal Mode (analog filtering):  
<250msec, (10-90%)

### Setpoint:

Effectivity:  
Setpoints are adjustable over 100% of the  
selected input span.  
Repeatability (constant temp):  
0.1% of selected input span

### Stability:

Line Voltage:  $\pm 0.01\%/%$ , max.  
Temperature:  $\pm 0.025\%$  of full scale/ $^{\circ}\text{C}$ , max.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1000VDC between contacts, input & power

### ESD Susceptibility:

Meets IEC 801-2, Level 2 (4KV)

### Humidity:

Operating: 15 to 95% (@45 $^{\circ}\text{C}$ )  
Soak: 90% for 24 hours (@65 $^{\circ}\text{C}$ )

### Temperature Range:

Operating: 0 to 60 $^{\circ}\text{C}$  (32 to 140 $^{\circ}\text{F}$ )  
Storage: -15 to 70 $^{\circ}\text{C}$  (5 to 158 $^{\circ}\text{F}$ )

### Power:

Consumption: 2W typical, 5W max  
Standard:  
Selectable 120/240VAC ( $\pm 10\%$ , 50-60Hz)

### Relay Contacts:

1 SPDT (1 Form C) per setpoint  
Current Rating (resistive):  
120VAC: 5A; 240VAC: 2A; 28VDC: 5A  
Material: Gold flash over silver alloy  
Electrical Life: 10<sup>5</sup> operations at rated load  
*Note: External relay contact protection is  
required for use with inductive loads.  
See Relay Protection section.*  
Mechanical Life: 10<sup>7</sup> operations

### Latch Reset Time:

5 seconds

### Weight:

0.64lbs

### Agency Approvals:

UL recognized per standard UL 805  
(File No. E99775)

## Ordering Information

### Specify:

1. Model: **AP1690-2000**
2. Options: U, P (see text)
3. Line Power (see specs.) (All power supplies are transformer isolated  
from the internal circuitry)
4. **C006** (0.1ohm shunt for 1 to 5Amp current inputs).
5. C620 Custom Calibration? (see Options)

### Accessories:

M801-0000 Retaining Spring  
M011-A 11 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD11-0000 11 pin DIN Mount Socket

## Pin Connections

- 1 AC Power (Hot)
- 2 No Connection
- 3 AC Power (Neu)
- 4 Input (+)
- 5 Input (-)
- 6 (A) N.O.
- 7 (A) C
- 8 (A) N.C.
- 9 (B) N.O.
- 10 (B) C
- 11 (B) N.C.

### Key:

N.O. = Normally Open  
C = Common  
N.C. = Normally Closed  
DC Power: Pin 1 = (+)  
Pin 3 = (-)

\*Contacts are in the "normal" state when the  
relay is de-energized.



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## Factory Assistance

For additional information on calibration, operation and installation  
contact our Technical Services Group:

**703-669-1318**

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