Description
The Action Pak model AP1680/90 single/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. Both models offer 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 AP1680/90 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 single/dual setpoint AP1680/90 provides the following relay outputs:
- **AP1680** Single Trip (DPDT, 5A)
- **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 AP1680/90 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:

<table>
<thead>
<tr>
<th></th>
<th>AP1680</th>
<th>AP1690</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>0-500mV</td>
<td>0-500mV</td>
</tr>
<tr>
<td>Output</td>
<td>Single</td>
<td>Dual</td>
</tr>
<tr>
<td>Trip</td>
<td>HI</td>
<td>A: HI, B: LO</td>
</tr>
<tr>
<td>Latching</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Failsafe</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Deadband</td>
<td>0.25%</td>
<td>A/B: 0.25%</td>
</tr>
<tr>
<td>Power</td>
<td>120VAC</td>
<td>120VAC</td>
</tr>
</tbody>
</table>

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.
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.

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: AP1680/90 Input Ranges

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Current</th>
<th>Input Range Selector</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mV</td>
<td>10mA</td>
<td>w1 w2</td>
</tr>
<tr>
<td>200mV</td>
<td>20mA</td>
<td>w1 w2</td>
</tr>
<tr>
<td>500mV</td>
<td>50mA</td>
<td>w1 w2</td>
</tr>
<tr>
<td>1V</td>
<td>100mA</td>
<td>w1 w2</td>
</tr>
<tr>
<td>2V</td>
<td></td>
<td>w1 w2</td>
</tr>
<tr>
<td>5V</td>
<td></td>
<td>w1 w2</td>
</tr>
<tr>
<td>10V</td>
<td></td>
<td>w1 w2</td>
</tr>
<tr>
<td>20V</td>
<td></td>
<td>w1 w2</td>
</tr>
<tr>
<td>50V</td>
<td></td>
<td>w1 w2</td>
</tr>
<tr>
<td>100V</td>
<td></td>
<td>w1 w2</td>
</tr>
<tr>
<td>200V</td>
<td></td>
<td>w1 w2</td>
</tr>
</tbody>
</table>

Table 3: AP1680/90 Input Jumper Settings

<table>
<thead>
<tr>
<th>Input</th>
<th>Input Jumper Selector (W1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td></td>
</tr>
</tbody>
</table>
Mounting
All Action Paks feature plug-in installation. Model AP1680/90 uses an 11-pin base and either molded socket M011 or DIN rail socket MD11.

Dimensions
Dimensions are in millimeters (inches)

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.
Specifications

Inputs:

Voltage Input
Range: 100mV to 200VAC
Impedance: >100K Ohms
Overvoltage: 300VAC, max.

Current Input
Range: 10mA to 100mA AC
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: ±0.01%/%, max.
Temperature: ±0.025% of full scale/°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°C)
Soak: 90% for 24 hours (@65°C)

Temperature Range:
Operating: 0 to 60°C (32 to 140°F)
Storage: -15 to 70°C (5 to 158°F)

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

Relay Contacts:
AP1680 DPDT (2 Form C) per setpoint
AP1690 SPDT (1 Form C) per setpoint
Current Rating (resistive):
120VAC: 5A; 240VAC: 2A; 28VDC: 5A
Material: Gold flash over silver alloy
Electrical Life: 10³ operations at rated load
Note: External relay contact protection is required for use with inductive loads.
See Relay Protection section.

Latch Reset Time:
5 seconds

Weight:
AP1680: 0.62lbs
AP1690: 0.64lbs

Agency Approvals:
CSA certified per standard C22.2
File No.LR42272-54.
UL recognized per standard UL 805
File No. E99775

Ordering Information
Specify:
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 = (-)

Contact are in the “normal” state when the relay is de-energized.

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