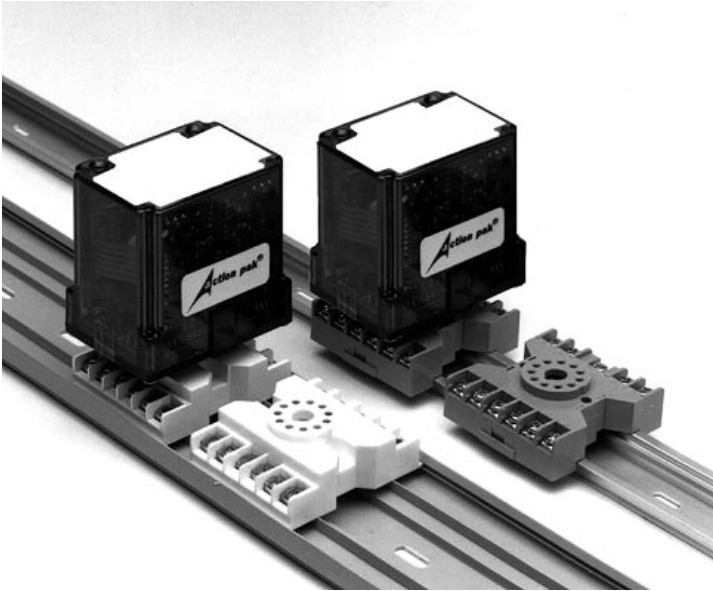


# Action Pak®

## DC Input, Limit Alarms

### Models AP1000 Through AP1024



**Provides Relay Contact Closure(s) at a Preset DC Input Level**

- Exclusive “Dynamic Deadband” Prevents False Trips
- “Failsafe” Operation Available
- DC Signal Alarm/Control Applications
- Voltage/Current Input Protection
- Single, Latching or Dual Setpoint
- AC Line Powered (DC optional)
- Three Year Warranty

#### GENERAL DESCRIPTION

Limit alarms are setpoint controllers that regulate industrial processes or detect process problems. The Action Pak 1000 Series Limit Alarms are compact, electronic plug-in modules that receive a DC input (Input range is factory-set) and compare that input to a field adjustable setpoint.

Note, all models except the AP1000 and AP1020 are obsolete and have been replaced with wide ranging versions. For wide ranging DC input limit alarms offering field-configurable input ranges and functions refer to Action Instrument's Models AP1080/1090.

#### OUTPUT SELECTION

The three modes of DC input Limit Alarms reflect three styles of output selection:

**AP1000-AP1004** Single (Hi) Trip, Non-Latching (DPDT, 5A)

**AP1010-AP1014** Single (Hi) Trip, Latching (DPDT, 5A)

**AP1020-AP1024** Dual (Hi/Lo) Trip, Non-Latching (SPDT, 5A)

#### OPERATION

The Single and Latching units are normally HI Trips and the internal relays

are normally energized when the input is below the setpoint. When setpoint is exceeded, the relay de-energizes to provide a tripped condition. This tripped condition then resets when the input is again below setpoint. The normally energized relay provides “failsafe” operation; a power failure results in a tripped condition.

The Dual alarm is normally de-energized when the input is between the setpoints. If the input rises above the HI setpoint or falls below the LO setpoint, the HI or LO relay energizes. The relay returns to its de-energized state when the input is again between the setpoints.

The normally de-energized relay provides “non-failsafe” operation; a power failure will not result in a tripped condition. For failsafe operation on dual alarms, specify option “R”. For proper deadband operation, the HI setpoint must always be set above the LO setpoint.

#### LATCHING OPERATION

Action's series of limit alarms allow for latching operation which holds the relays in a “tripped condition” until reset by the user. To unlatch a single limit alarm, the input must re-cross into the “safe (untripped) area” and a momen-

tary switch closed across pins 16 and 20. To unlatch a dual alarm (option H), the input must re-cross into the safe area and the power must be momentarily interrupted.

All AP1000 Series Limit Alarms are equipped with top-mounted LED(s) for trip status indication. LED(s) turn ON in a tripped condition (refer to model AP1080/AP1090 for wide-ranging alarms).

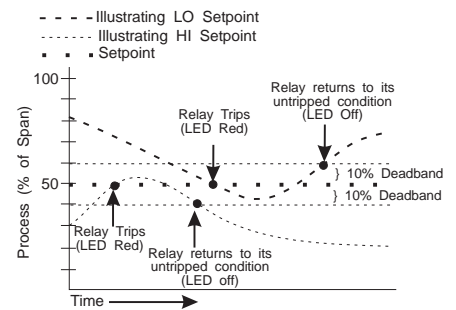


Figure 1: Limit alarm operation and effect of deadband(s)

## DYNAMIC/NORMAL DEADBANDS

LSI circuitry prevents false trips by repeatedly sampling the input. The input must remain above the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall below the setpoint 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.

Normal deadband is the amount of input change required to reset the limit alarm to an untripped condition. Deadband is measured from the point of trip, and expressed as a percentage of the input span. Single and Dual trip limit alarms have adjustable deadband(s) from 0.25% to 100% of span and are normally set at 0.25% (see figure 1). Latching alarms do not have deadband adjustments.

## SETPOINT ADJUSTMENT

The three modes of DC input Limit Alarms have five styles of setpoint adjustment:

- AP10X0** Top-Accessed, 1-Turn Screw(s)
- AP10X1** Top-Mounted, Single-Turn Dial(s)
- AP10X2** Remote Dial connection(s) (1K-100K ohms)
- AP10X3** DC-Programmable, 0-1V
- AP10X4** Top-Mounted, 10-Turn Clockface Dial(s)

With all Action Pak limit alarms, the setpoint is adjustable over the entire input span.

## OPTIONS

- CS** Canadian Standards Association Certification (20-pin base units not CSA certified).
- H** Latching Operation (Dual-limit mode only).
- M** Top-Accessed Fifteen-Turn screw(s) (1XX0 only).
- R** Reverse Sense (reverses relay energizing operation). Failsafe operation for Dual-Limit, Non-Failsafe for Single-Limit.
- T** Transmitter Outputs. 0-1VDC SP(s) and PR outputs
- T2** Transmitter Output (4-20mA on PR output)

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres
- X** LO or LO/LO Alarm (relay(s) trip when input falls below setpoint, see figure 1)
- Y** HI/HI Alarm (both relay(s) trip when input rises above setpoint, Dual-limit alarms only)

## CALIBRATION

**Setpoint:** Set Deadband at its minimum (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 with the Setpoint above the desired trip. For LO trip calibration, start below the desired trip.

**Deadband:** Set deadband to its minimum (fully CCW). Set setpoint to desired trip. Adjust voltage/current input until relay trips. Readjust deadband to 100% (fully CW). Set voltage/current input to desired deadband position. Slowly adjust deadband until relay untrips. Single deadband potentiometer on Dual alarms adjusts both deadbands (Note: deadband not available with Option H).

**Transmitter Outputs:** With the specified minimum input applied, adjust zero for 0.00V/4.00mA at the transmitter output. With the specified maximum input applied, adjust span for 1.00V/20.00mA. Repeat for best accuracy (Note: outputs are not isolated from input).

**Factory Assistance:** For additional information on calibration, operation and installation please contact Action's Technical Services Group. Call toll-free:

**800-767-5726**

## RELAY PROTECTION

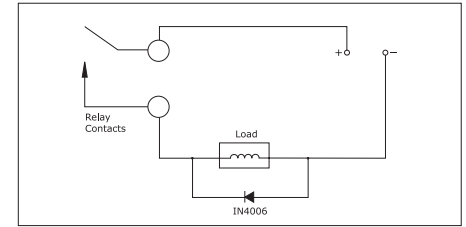
Note: For maximum relay life with inductive loads, external protection is required. For DC inductive loads, place a diode across the load (1N4006 or equivalent) with cathode to (+) and anode to (-), see figure 2. For AC inductive loads, place a MOV across the load, see figure 3.

## INPUT RANGES

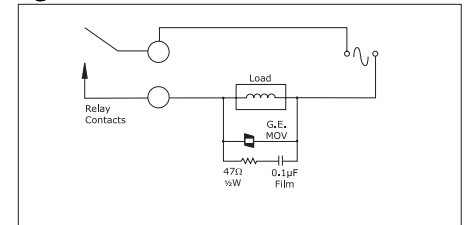
Table 1 lists all the available standard DC input ranges for limit alarm models

AP1000 through AP1024. For better resolution, non-standard ranges are also available within the limits shown in table 2.

**Figure 2: DC Inductive Loads**



**Figure 3: AC Inductive Loads**



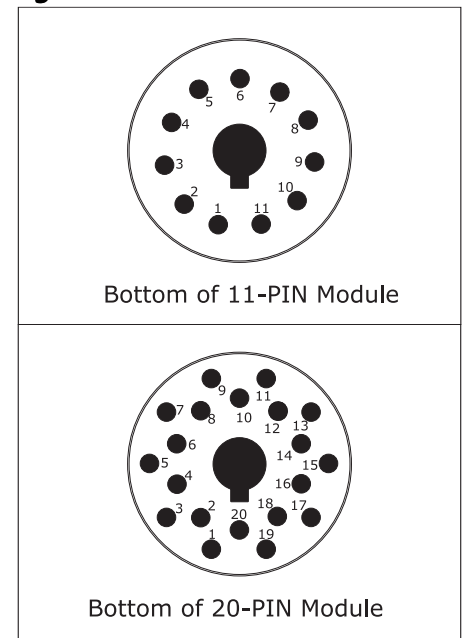
**Table 1: AP1000-AP1024 Standard Inputs**

Current:	0-1mA	0-20mA	4-20mA	10-50mA
Voltage:	0-50mV	0-100mV	0-500mV	
	0-1V	0-2V	0-5V	1-5V
	0-10V	0-100V	0-200V	
	±50mV	±2mV	±5mV	

**Table 2: AP1000-AP1024 Inputs Limits**

Minimum Span		Maximum Output	
Voltage	Current	Voltage	Current
10mV	100µA	500V	100mA

**Figure 4: PIN Locations**



# PIN CONNECTIONS\*

<b>1000,1001,1004</b> <b>1020,1021,1024</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 Input + 5 Input - 6 N.O. Set 1 or 7 C HI/Dual 8 N.C. 9 N.O. Set 2 or 10 C LO/Dual 11 N.C. <b>KEY:</b> N.O. = Normally Open C = Common N.C. = Normally Closed Proc = Process Xmtr = Transmitter CCW = Counterclockwise W = Wiper CW = Clockwise SP = Setpoint	<b>1000T,1001T,1004T</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 No Connection 6 No Connection 7 No Connection 8 SP Xmtr - 9 Input + 10 Xmtr Common 11 Input - 12 Proc Xmtr + 13 N.O. 14 C Set 1 15 N.C. 16 No Connection 17 N.O. 18 C Set 2 19 N.C. 20 No Connection	<b>1002</b> <b>(1002T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 SP Pot CCW 6 SP Pot W 7 SP Pot CW (8 SP Xmtr +) 9 Input + (10 Xmtr Common) 11 Input - (12 Proc Xmtr +) 13 N.O. 14 C Set 1 15 N.C. 16 No Connection 17 N.O. 18 C Set 2 19 N.C. 20 No Connection	<b>1003</b> <b>(1003T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 SP - 6 SP + 7 No Connection (8 SP Xmtr +) 9 Input + (10 Xmtr Common) 11 Input - (12 Proc Xmtr +) 13 N.O. 14 C Set 1 15 N.C. 16 No Connection 17 N.O. 18 C Set 2 19 N.C. 20 No Connection	<b>1010,1011, 1014</b> <b>(1010T,1011T,1014T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 No Connection 6 No Connection 7 No Connection (8 SP Xmtr +) 9 Input + (10 Xmtr Common) 11 Input - (12 Proc Xmtr +) 13 N.O. 14 C Set 1 15 N.C. 16 Latch Reset 17 N.O. 18 C Set 2 19 N.C. 20 Latch Reset
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<b>1012</b> <b>(1012T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 SP Pot CCW 6 SP Pot W 7 SP Pot CW (8 SP Xmtr +) 9 Input + (10 Xmtr Common) 11 Input - (12 Proc Xmtr +) 13 N.O. 14 C Set 1 15 N.C. 16 Latch Reset 17 N.O. 18 C Set 2 19 N.C. 20 Latch Reset	<b>1013</b> <b>(1013T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 SP - 6 SP + 7 No Connection (8 SP Xmtr +) 9 Input + (10 Xmtr Common) 11 Input - (12 Proc Xmtr +) 13 N.O. 14 C Set 1 15 N.C. 16 Latch Reset 17 N.O. 18 C Set 2 19 N.C. 20 Latch Reset	<b>1020T,1021T,1024T</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 No Connection 6 No Connection 7 No Connection 8 No Connection 9 Input + 10 Proc Xmtr + 11 Input - 12 LO SP Xmtr + 13 N.O. 14 C LO Set 15 N.C. 16 HI SP Xmtr + 17 N.O. 18 C HI Set 19 N.C. 20 Xmtr Common	<b>1022</b> <b>(1022T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 LO SP Pot CW 5 LO SP Pot W 6 SP Pots CCW 7 HI SP Pot W 8 HI SP Pot CW 9 Input + (10 Proc Xmtr +) 11 Input - (12 LO SP Xmtr +) 13 N.O. 14 C LO Set 15 N.C. (16 HI SP Xmtr +) 17 N.O. 18 C HI Set 19 N.C. (20 Xmtr Common)	<b>1023</b> <b>(1023T)</b> 1 AC Power (Hot) 2 Shield (Gnd) 3 AC Power (Neu) 4 No Connection 5 LO SP + 6 SP Common 7 HI SP + 8 No Connection 9 Input + (10 Proc Xmtr +) 11 Input - (12 LO SP Xmtr +) 13 N.O. 14 C LO Set 15 N.C. (16 HI SP Xmtr +) 17 N.O. 18 C HI Set 19 N.C. (20 Xmtr Common)
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- \* Contacts are in the "normal" state when the relay is de-energized. **Notes:** 1. Option T2 pinout (all units): Pin 12 - Process Transmitter (+) Pin 10 - Process Transmitter (-)
2. DC Power: Pin 1 = (+) / Pin 3 = (-)      3. To reset Latch on 1010-1014, short pins (16) & (20)

**Table 3: AP1000-AP1024 Feature Selection**

	Alarm Type				Setpoint Adjustment				
	Single (HI) Trip	Dual (HI/LO) Trip	Latching (DPDT, 5A)	Non-Latching (SPDT,5A)	Top-Accessed Single-Turn Screw	Top-Mounted Single-Turn Dial	Remote Dial Connection	DC-Programmable	Top-Mounted 10-Turn Dial
AP1000 (SP)	X			X	X				
AP1001 (OP)	X			X		X			
AP1002 (OP)	X			X			X		
AP1003 (OP)	X			X				X	
AP1004 (OP)	X			X					X
AP1010 (OP)	X		X		X				
AP1011 (OP)	X		X			X			
AP1012 (OP)	X		X				X		
AP1013 (OP)	X		X					X	
AP1020 (SP)		X	H-opt.	X	X				
AP1021 (OP)		X	H-opt.	X		X			
AP1022 (OP)		X	H-opt.	X			X		
AP1023 (OP)		X	H-opt.	X				X	
AP1024 (OP)		X	H-opt.	X					X

(SP) Indicates supplemental product status. Consult factory for price and availability.  
 (OP) Obsolete product status. Consult factory for new replacement version.

## SPECIFICATIONS

### Input Impedance

Voltage Input

100mV-500V spans: >100K  $\Omega$

10-100mV spans: > 1M  $\Omega$

Current Input

< 500mV drop at F.S. input

### Input Protection

Normal Mode

Voltage Input

500mV-500V spans: Withstand

1000% of span, 600V max.

10-500mV spans: Withstand

$\pm 5V$ , max.

Current Input

Withstands 500% of span, up to 2A max.

Common Mode

Withstands 600VDC or

300VAC max.

### Response Time

Dynamic Deadband

Relay status will change when proper setpoint/process condition exists uninterrupted for 100mSec

Normal Mode (Analog Filtering)

50mSec

### Setpoint

Repeatability: 0.1% (constant temperature)

### Stability

Line Voltage:  $\pm 0.01\%$ /% max.

Temperature:  $\pm 0.05\%$  of span/ $^{\circ}C$ , typical,  $\pm 0.08\%$  of span/ $^{\circ}C$  max.

### Common Mode Rejection

60 Hz: 120dB

DC: 140dB

### Temperature Range

Operating: 0 to 60 $^{\circ}C$  (32 to 140 $^{\circ}F$ )

Storage: -20 to 85 $^{\circ}C$  (-4 to 185 $^{\circ}F$ )

### Power

Consumption: 2.5W typical, 4W max.

Standard: 120VAC ( $\pm 10\%$ , 50-400Hz)

Available: 240 VAC ( $\pm 10\%$ , 50-400Hz)

## Relay Contacts

Current Rating (resistive)

120VAC: 5A

240VAC: 2A

28VDC: 5A

Material: Silver-Cadmium Oxide

Electrical Life:  $10^5$  operations at rated load

Mechanical Life:  $10^7$  operations

Note: External relay contact protection is required for use with inductive loads, see figures 2 & 3

## Transmitter Outputs (Option T/T2)

Option T (0-1V):

Output Impedance: 50 ohm

Output Drive: 2mA max.

Option T2 (4-20mA):

Output Impedance: > 100K ohms

Output Compliance: 10VDC

Linearity

$\pm 0.25\%$  of span typical,  $\pm 0.50\%$  of span max.

## MOUNTING

All Action Paks feature plug-in installation, using either molded socket (M0XX) or Din Rail (MD11), sockets. The Limit Alarm Series uses either an 11-pin or a 20-pin base, depending on the style of setpoint adjustment and the included options.

## ORDERING INFORMATION

### Specify:

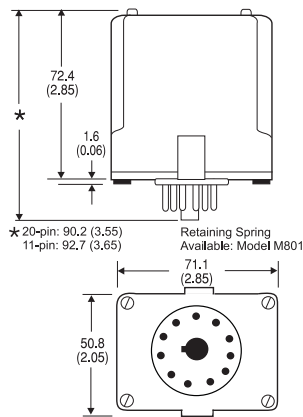
1. Model: AP1000 through AP1024
2. Options: CS, H, M, R, T, T2, U, X, Y (see text)
3. Input Range (see tables 1,2)
4. Line Power (see specs)

(All power supplies are transformer-isolated from the internal circuitry)

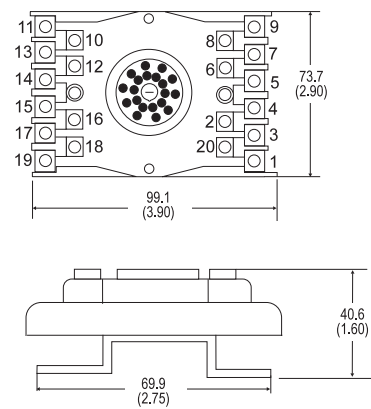


## DIMENSIONS

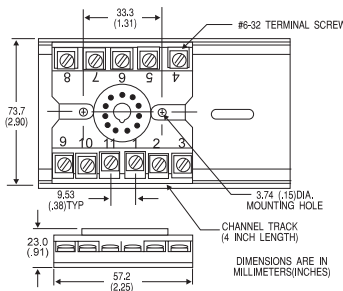
Dimensions are in Millimeters (Inches)



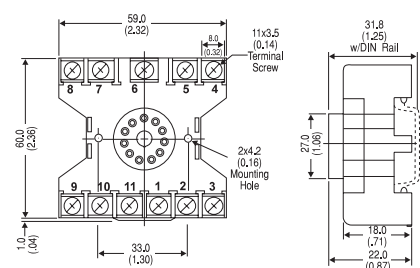
## M020 (Track)



## M011 (Track/Surface)



## MD11 (DIN Rail)



All Prices and Specifications subject to change without notice

For order entry, applications or customer service assistance, call toll-free 800-767-5726

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