DRG-AR-AC
AC Input, Field Configurable Limit Alarm

Instruction Sheet M2396/0796

DESCRIPTION

The DRG-AR-AC is a DIN rail mount, AC voltage or current input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. Input voltage spans from 100mV to 200VAC and input current spans from 10mA to 100mAAC can be field configured. For current input spans of 1 to 5 Amps a 0.1W (5W) shunt resistor should be used.

The DRG-AR-AC is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

DIAGNOSTIC LEDS

The DRG-AR-AC is equipped with three front panel LEDs. The first is a dual function LED labeled INPUT. This green LED indicates DC power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz.

Two red LEDs indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

OUTPUT

The DRG-AR-AC is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

OPERATION

The field configurable DRG-AR-AC limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints have a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the low deadband (see Figure 1). 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, a power failure results in an alarm state output.

DYNAMIC DEADBAND

LSI circuitry in the DRG-AR-AC prevents false trips by repeatedly sampling the input. The input must re

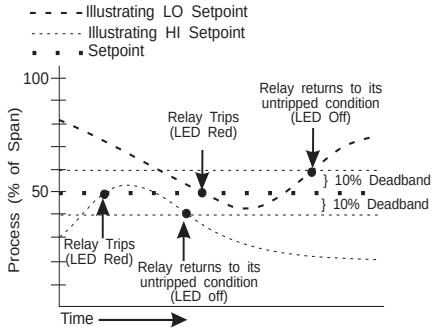


Figure 1: Limit alarm operation and effect of deadband(s).

main 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.

CONFIGURATION

Unless otherwise specified, the factory presets the Model DRG-AR-AC as follows:

Input:	Voltage
Range:	0-500mVAC
Output:	Dual, SPDT
Trip:	A:HI, B:LO
Failsafe:	No
Deadband:	A, B: 0.25%

The DC power input accepts any DC source between 9 and 30V, typically a 12V or 24VDC source is used.

For other I/O ranges, refer to Table 1 and Figure 4 to reconfigure switches SW2, SW3 and SW4 for the desired input type, range and function.

WARNING: *Do not attempt to change any switch settings with power applied. Severe damage will result!*

1. With DC power off, position input switch "SW1-9,10" for voltage or current.

2. Set position 1 through position 8 of input range switch "SW1" for the desired input range (see Table 1).

3. Set position 1 and 2 of function switch "SW2" to ON for a HI trip setpoint or OFF for a LO trip (see Figure 4).

4. Set position 4 of function switch "SW2" to ON for non-failsafe operation or OFF for failsafe operation (e.g. alarm trips when power fails).

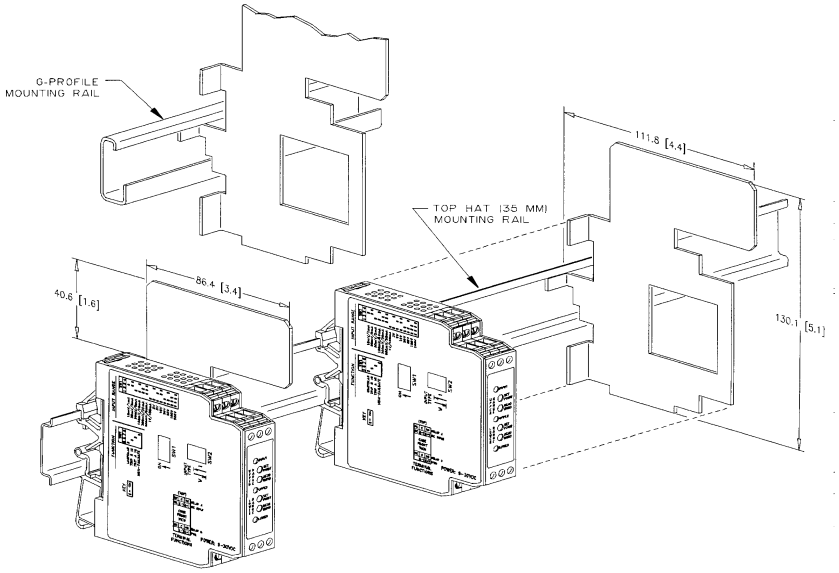
CALIBRATION

1. After configuring the dip switches, connect the input to a calibrated AC source and apply power. Refer to the terminal wiring (Figure 6).

NOTE: To maximize thermal stability, final calibration should be performed in the operation installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

2. Setpoint: set deadband at its minimum (fully counter clockwise) before adjusting the setpoint. With the desired trip voltage or current input applied, adjust setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (full clockwise). For LO trip calibration, start below the desired trip (full counter clockwise).

3. Deadband: Set deadband to its minimum (fully counter clockwise). Set the setpoint to desired trip. Adjust voltage/current input until relay trips. Readjust deadband to 5% (fully clockwise).Set voltage/current input signal to desired deadband position. Slowly adjust deadband until relay untrips



Note1: All DRG series modues are designed and tested to operate in ambient temperatures from 0 to 55°C, when mounted on a horizontal DIN rail. When five or more modules are mounted on a vertical rail, circulating air or model DRG-HS01 Heat Sink is recommended.

Table 1: G168 Input Range Selector-Switch Settings

KEY■ = ON

Voltage	Current	Input Range Selector SW1 1	2	3	4	5	6	7	8	9	10
100mV	10mA				■				■		
200mV	20mA				■		■		■		
500mV	50mA			■		■	■		■		
1V	100mA			■	■				■		
2V				■	■		■		■		
5V		■		■		■	■				
10V		■		■	■						
20V		■		■	■		■				
50V			■	■		■	■				
100V			■	■	■						
200V			■	■	■		■				
250V				■	■		■	■			
CURRENT											■
VOLTAGE										■	

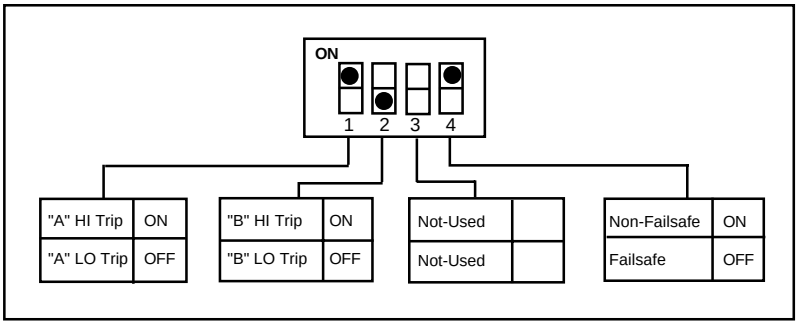


Figure 4: DRG-AR-AC Function Selection Switch-Settings (SW2) Factory Default Settings

RELAY PROTECTION AND EMI SUPPRESSION

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all 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 0.1µF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47Ω, 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).

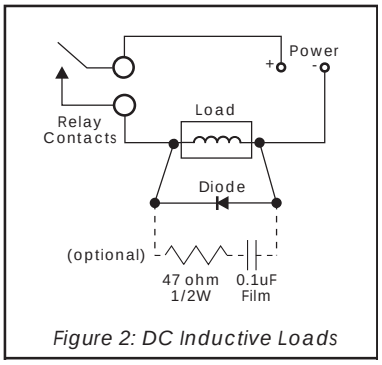


Figure 2: DC Inductive Loads

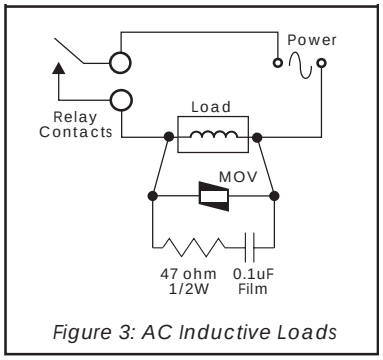


Figure 3: AC Inductive Loads

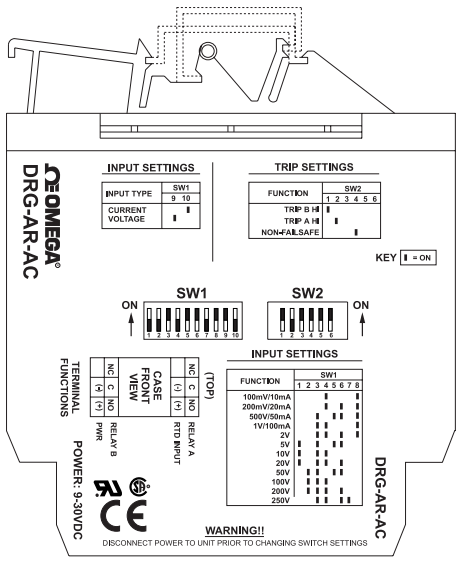


Figure 5: DRG-AR-AC Factory Calibration; 0-500mV, A-HI/B-LO, Non-Failsafe

Warning: Do not attempt to change any switch settings with power applied. Severe damage may occur!

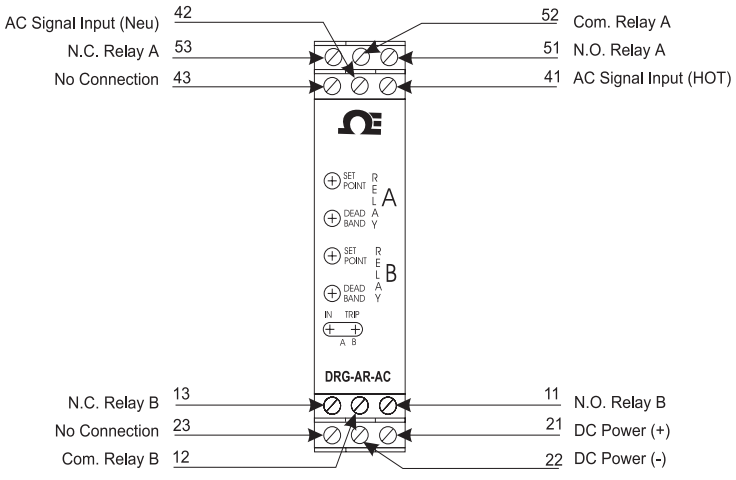


Figure 6: Wiring Diagram for DRG-AR-AC

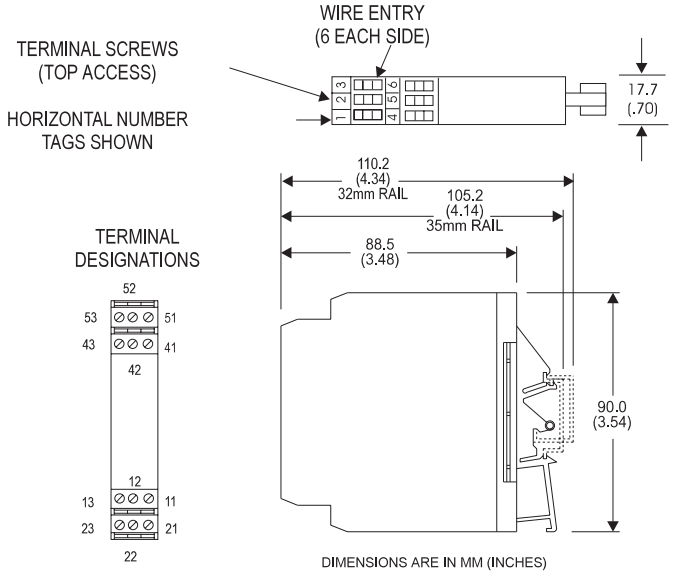


Figure 7: Mechanical Dimensions for DRG-AR-AC

SPECIFICATIONS

Inputs

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

Current Input
- Range: 10mA to 100mAAC
- Impedance: 20Ω, typical
- Overcurrent: 200mAAC, max.
- Overvoltage: 60V peak (protected by self resetting fuse)

Frequency Range: 40 to 400Hz

Common Mode (Input to Ground): 1800VDC, max.

LED Indicators

Input Range (Green)
- >110% input: 8Hz flash

Setpoint (Red)
- Tripped: Solid red
- Safe: Off

Limit Differentials (Deadbands)

>50mV/5mA: 0.25% to 5% of span

<50mV/5mA: 1% to 5% of span

Response Time

Dynamic Deadband: Relay status will change when proper setpoint/process condition exists for 100msec.

Normal Mode (analog filtering): <250mSec, (10-90%)

Setpoints

Effectivity: Setpoints are adjustable over 100% of the selected input span

Repeatability (constant temp.): 0.2% of full scale

Stability

Temperature: ±0.025% of full scale/°C, max.

Common Mode Rejection

DC to 60Hz: 120dB

Isolation

1800VDC between contacts, input and power

EMC Compliance (CE Mark)

Emissions: EN50081-1

Immunity: EN500-82-2

Safety: EN50178

Humidity (Non-Condensing)

Operating: 15 to 95% (@45°C)

Soak: 90% for 24hours (@65°C)

Temperature Range

Operating: 0 to 55°C (32 to 131°F)

Storage: -25 to 70°C (-13 to 158°F)

Power

Consumption: 1.5W typical, 2.5W max.

Supply Range: 9 to 30VDC, inverter isolated

In-rush Current: 300mA, max.

Relay Contacts

2 SPDT (2 form C) Relays

1 Relay per setpoint

Current Rating (resistive)
- 120VAC: 5A
- 240VAC: 2A
- 28VDC: 5A

Material: Silver-Cadmium Oxide

Electrical Life: 10^5 operations at rated load

Note: External relay contact protection is required for use with inductive loads (see Figures 2 & 3).

Mechanical Life: 10^7 operations

Wire Terminations

Screw terminals for 12-22 AWG

Agency Approvals

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272). **UL** recognized per standard UL508 (File No.E99775). CE Compliance per EMC directive 89/336/EEC and low voltage 73/23/EEC.

Mounting

32mm and 35mm DIN rail

PIN CONNECTIONS

11 N.O. Relay B
12 Com. Relay B
13 N.C. Relay B
21 DC Power (+)
22 DC Power (-)
23 No Connection
41 AC Signal Input (HOT)
42 AC Signal Input (Neu)
43 No Connection
51 N.O. Relay A
52 Com. Relay A
53 N.C. Relay A

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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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2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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DRG-AR-DC
DC Input, Field Configurable Limit Alarm

Instruction Sheet M2399/0796

DESCRIPTION

The DRG-AR-DC is a DIN rail mount, DC voltage or current input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. Input voltage spans from 10mV to 200V and input current spans from 1mA to 100mA can be field configured. Bipolar inputs are also accepted.

The DRG-AR-DC is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint, a 24VDC voltage source (isolated from line power) for transducer excitation, and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

DIAGNOSTIC LEDS

The DRG-AR-DC is equipped with three front panel LEDs. The green LED is a dual function LED labeled INPUT. This LED indicates line power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz. Below 0%, the flash rate is 4 Hz.

Two red LEDs indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

OUTPUT

The DRG-AR-DC is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

OPERATION

The field configurable DRG-AR-DC limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the low deadband (see Figure 1). 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, a power failure results in an alarm state output.

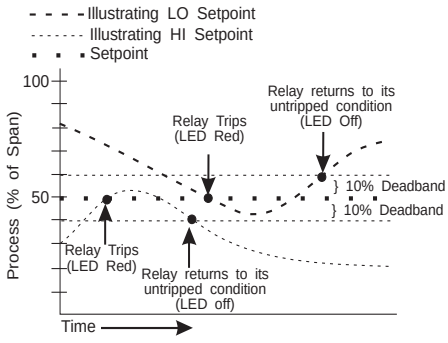


Figure 1: Limit alarm operation and effect of deadband(s).

DYNAMIC DEADBAND

LSI circuitry in the DRG-AR-DC prevents false trips by repeatedly sampling the input. 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.

CONFIGURATION

Unless otherwise specified, the factory presets the Model DRG-AR-DC as follows:

Input:	Current
Range:	0-20mA
Output:	Dual, SPDT
Trip:	A:HI, B:LO
Failsafe:	No
Deadband:	A, B: 0.25%

The DC power input accepts any DC source between 9 and 30V, typically a 12V or 24VDC source is used.

For other I/O ranges, refer to Table 1 and Figure 4. Reconfigure switche SW1 for the desired input type, range and function.

WARNING: *Do not attempt to change any switch settings with power applied. Severe damage will result!*

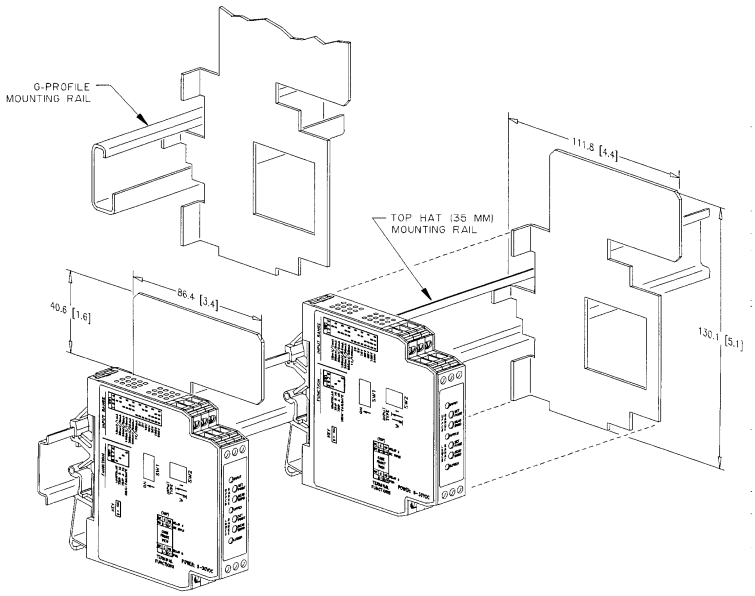
1. With DC power off, set positions 9 and 10 of switch "SW1" for current or voltage.

2. Set position 1 through position 4 of input range switch "SW1" for the desired input range (see Table 1).

3. Set position 5 of input range switch "SW1" to ON for unipolar (e.g. zero based, 0-20mA) range or OFF for bipolar (e.g. -100% offset, -20 to 20mA) range (see Figure 4).

4. Set position 6 and 7 of input range switch "SW1" to ON for a HI trip setpoint or OFF for a LO trip setpoint (see Figure 4).

5. Set position 8 of input range switch "SW1" to ON for non-failsafe operation or OFF for failsafe operation (e.g. alarm trips upon power failure).



Note1: All DRG Series modues are designed and tested to operate in ambient temperatures from 0 to 55° C, when mounted on a horizontal DIN rail. When five or more modules are mounted on a vertical rail, circulating air or model DRG-HS01 Heat Sink is recommended.

CALIBRATION

1. After configuring the DIP switches, connect the input to a calibrated DC source and apply power. Refer to the terminal wiring (Figure 7).

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

2. Setpoint: set deadband at its minimum (fully counter clockwise) before adjusting the setpoint. With the desired trip voltage or current input applied, adjust setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (full clockwise). For LO trip calibration, start below the desired trip (full counter
clockwise).

3. Deadband: Set deadband to its minimum (fully counter clockwise). Set the setpoint to desired trip. Adjust voltage/current input until relay trips. Readjust deadband to 5% (fully clockwise). Set voltage/current input signal to desired deadband position. Slowly adjust deadband until relay untrips.

RELAY PROTECTION AND EMI SUPPRESSION

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all 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 0.1µF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47Ω, 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: DRG-AR-DC Input Range switch settings (SW1 through 4)

KEY ▌ = ON

Voltage	Current	Input Range Selector (SW1) 1	2	3	4	9	10
10mV	1mA			▌			
20mV	2mA			▌	▌		
50mV	5mA		▌				
100mV	10mA		▌		▌		
200mV	20mA		▌	▌			
500mV	50mA		▌	▌	▌		
1V	100mA	▌					
2V		▌			▌		
5V		▌		▌			
10V		▌		▌	▌		
20V		▌	▌				
50V		▌	▌		▌		
100V		▌	▌	▌			
200V		▌	▌	▌	▌		
TYPE							
Current							▌
Voltage						▌	

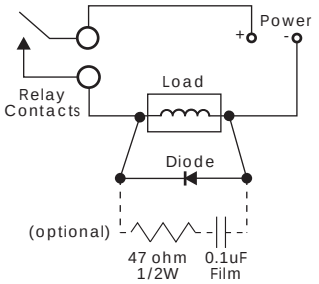


Figure 2: DC Inductive Loads

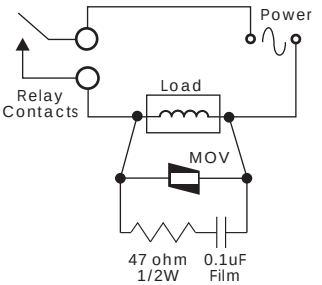


Figure 3: AC Inductive Loads

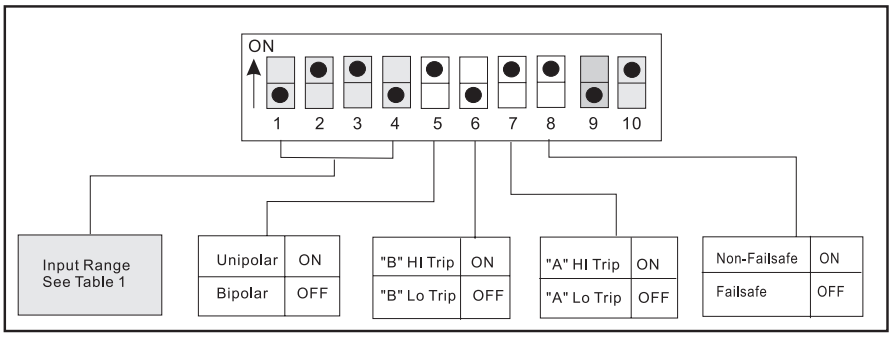


Figure 4: DRG-AR-DC Input Range/Function Selection (SW1) Factory Default Settings

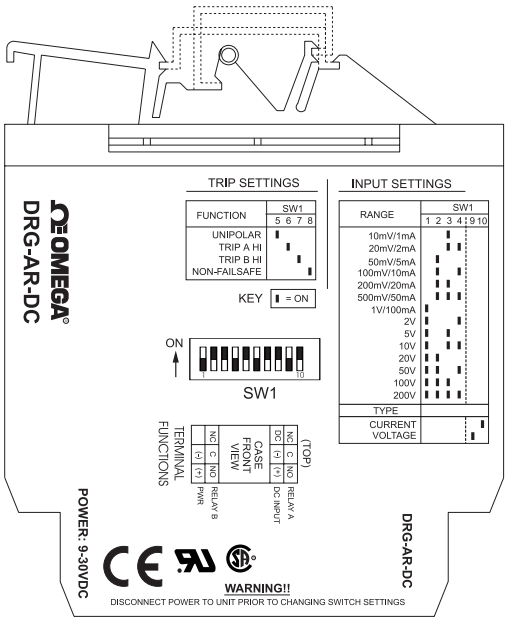


Figure 5: DRG-AR-DC Factory Calibration; 0-20mA, A-HI/B-LO, Non-Failsafe

Warning: Do not attempt to change any switch settings with power applied. Severe damage may occur!

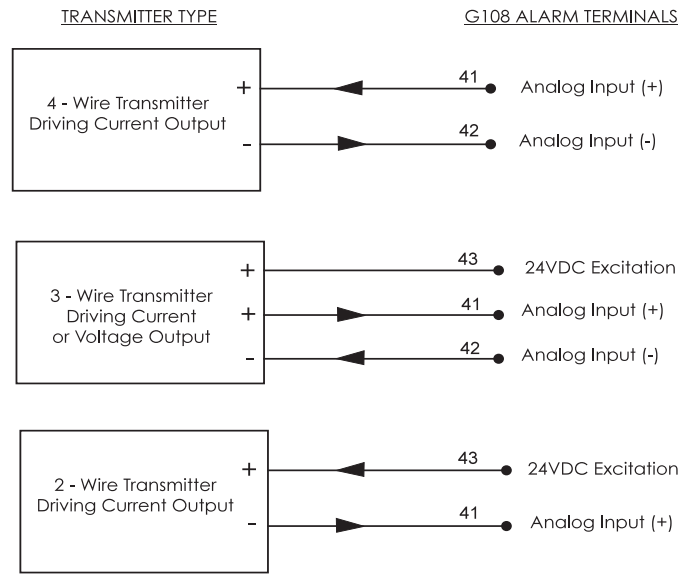


Figure 6: Typical connections of voltage or current inputs for DRG-AR-DC

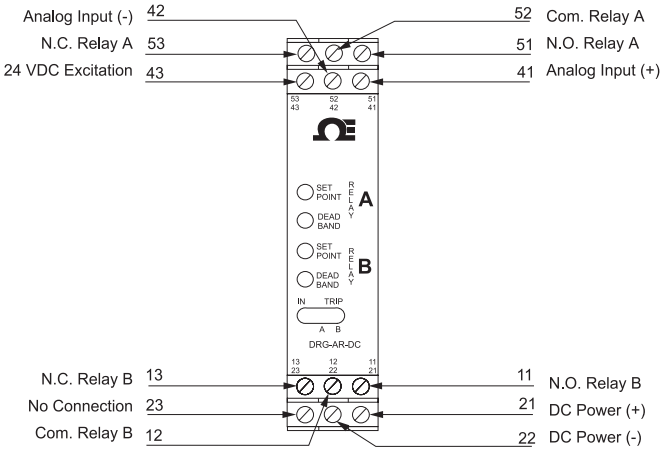


Figure 7: Terminal Wiring Diagram for DRG-AR-DC

DIMENSIONS

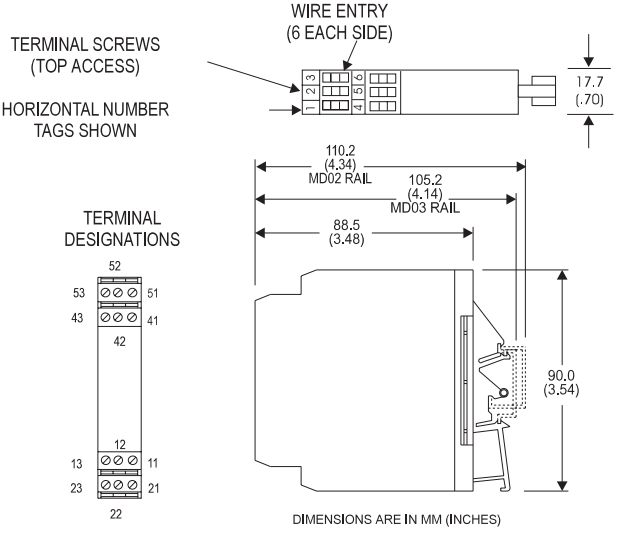


Figure 8: Mechanical Dimensions for DRG-AR-DC

SPECIFICATIONS

Inputs

Voltage Input
Range: 10mV to ±200V
Impedance: >100KΩ
Overvoltage: 200V rms, max.

Current Input
Range: 1mA to ±100mA
Impedance: 20Ω, typical
Overcurrent: 170mA rms, max.
Overvoltage: 60VDC
(protected by self resetting fuse)

Common Mode (Input to Ground):
1800VDC, max.

LED Indicators

Input Range (Green)
>110% input: 8Hz flash
<0% input: 4Hz flash

Setpoint (Red)
Tripped: Solid red
Safe: Off

Limit Differentials (Deadbands)

>50mV/5mA: 0.25% to 5% of span
<50mV/5mA: 1% to 5% of span

Response Time

Dynamic Deadband: Relay status will change when proper setpoint/process condition exists for 100msec.

Normal Mode (analog filtering):
<250mSec, (10-90%)

Setpoints

Effectivity: Setpoints are adjustable over 100% of the selected input span.

Repeatability (constant temp.):
>50mV/5mA: 0.1% of full scale
<50mV/5mA: 0.2% of full scale

Stability

Temperature: ±0.05% of full scale/°C, max.

Excitation Voltage

24VDC, 20mA, maximum

Common Mode Rejection

DC to 60Hz: 120dB

Isolation

1800VDC between contacts, input and power

EMC Compliance (CE Mark)

Emmissions: EN50081-1
Immunity: EN50082-2
Safety: EN50178

Humidity (Non-Condensing)

Operating: 15 to 95% (@45°C)
Soak: 90% for 24hours (@65°C)

Temperature Range[1]

Operating: 0 to 55°C (32 to 131°F)
Storage: -25 to 70°C (-13 to 158°F)

Power

Consumption: 1.5W typical, 2.5W max.

Supply Range: 9 to 30VDC, inverter isolated

In-rush Current: 300mA, max.

Relay Contacts

2 SPDT (2 form C) Relays
1 Relay per setpoint

Current Rating (resistive)
120VAC: 5A
240VAC: 2A
28VDC: 5A

Material: Silver-Cadmium Oxide

Electrical Life: 10^5 operations at rated load

Note: External relay contact protection is required for use with inductive loads (see Figures 2 & 3).

Mechanical Life: 10^7 operations

Wire Terminations

Screw terminations for 12-22 AWG

Agency Approvals

CSA certified per standard C22.2, No. 0-M91 and 142-M198 (File No.LR42272) **UL** recognized per standard per standard UL508 (File No.E99775). **CE** conformance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC (Input≤75VDC, only).

Mounting

32mm and 35mm DIN Rail

PIN CONNECTIONS

11 N.O. Relay B
12 Com. Relay B
13 N.C. Relay B
21 DC Power (+)
22 DC Power (-)
23 No Connection
41 Analog Input (+)
42 Analog Input (-)
43 (+) 24VDC Excitation

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3. Repair instructions and/or specific problems relative to the product

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DRG-AR-RTD
RTD Input, Field Configurable Limit Alarm
Instruction Sheet M2395/0796

DESCRIPTION
The DRG-AR-RTD is a DIN rail mount, RTD input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. There are up to eight temperature ranges available for each RTD type to ensure accuracy and maximize setpoint resolution.

The DRG-AR-RTD is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (1.0 to 5% of full scale input) for each setpoint and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

DIAGNOSTIC LEDS
The DRG-AR-RTD is equipped with three front panel LEDs. The first is a dual function LED labeled INPUT. This green LED indicates line power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and wiring connection. If the input signal is more than 110% of full scale, the LED will flash at 8 Hz. Below 0%, the flash rate is 4 Hz.

Two red LED's indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

OUTPUT
The DRG-AR-RTD is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

OPERATION
The field configurable DRG-AR-RTD limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband (see Figure 1). 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, a power failure results in an alarm state output.

DYNAMIC DEADBAND
LSI circuitry in the DRG-AR-RTD prevents false trips by repeatedly sampling the input. 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.

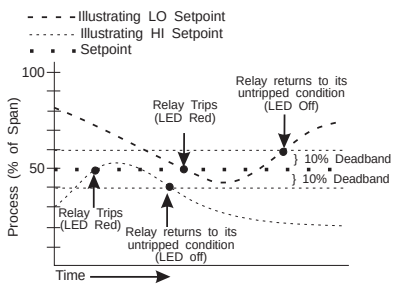


Figure 1: Limit alarm operation and effect of deadband(s).

CONFIGURATION
Unless otherwise specified, the factory presets the Model DRG-AR-RTD as follows:

Input:	Platinum (100Ω)
Range:	0 to 250°C
Output:	Dual, SPDT
Trip:	A:HI, B:LO
Failsafe:	No
Deadband:	A, B: 1.0%

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used.

For other I/O ranges, refer to Tables 1 through 3 and reconfigure switches SW1 and SW2 for the desired input type, range and function.

WARNING: Do not attempt to change any switch settings with power applied. Severe damage will result!

Input

1. With DC power off, position input switches 1 through 6 on "SW2" for RTD type (see Table 1).

2. Set position 1 through position 4 of input range switch "SW1" for the desired RTD type and input temperature range (Table 3).

3. Set position 5 and 6 of input range switch "SW1" to ON for a HI trip setpoint or OFF for a LO trip setpoint (Figure 4).

4. Set position 7 of input range switch "SW1" to ON for non-failsafe operation or OFF for failsafe operation (e.g. alarm trips upon power failure).

CALIBRATION

1. After configuring the DIP switches, connect the input to a calibrated RTD source or a resistance decade box and apply power. (Figure 6).

NOTE: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

2. Setpoint: set deadband at its minimum (fully counter clockwise) before adjusting the setpoint. With the desired trip RTD resistance input applied, adjust setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (full clockwise). For LO trip calibration, start below the desired trip (full counter clockwise).

3. Deadband: Set deadband to its minimum (fully counter clockwise). Set the setpoint to desired trip. Adjust RTD resistance input until relay trips. Readjust deadband to 5% (fully clockwise). Set RTD resistance input to desired deadband position. Slowly adjust deadband until relay untrips

Table 3: Input Range switch settings (SW1-1 through 4)

Pt 100, 500, 1000 (α :00385)	SW1 1 2 3 4	Resistance *Pt 100 (Ω)
0 to 50°C (32 to 122°F)	■ ■ ■	100 to 119.4
-50 to 50°C (-58 to 122°F)	■ ■	80.3 to 119.4
0 to 100°C (32 to 212°F)	■ ■	100 to 138.5
-100 to 100°C (-148 to 212°F)	■	60.2 to 138.5
0 to 250°C (32 to 482°F)	■ ■ ■	100 to 194.1
-200 to 250°C (-328 to 482°F)	■ ■	18.5 to 194.1
0 to 550°C (32 to 1022°F)	■ ■ ■	100 to 297.4
0 to 850°C (32 to 1562°F)	■ ■ ■ ■	100 to 390.3
Cu10	**1 2 3 4**	**Cu 10 (Ω)**
25 to 70°C (77 to 158°F)	■ ■ ■	10.0 to 11.74
-30 to 70°C (-22 to 158°F)	■ ■	7.876 to 11.74
25 to 120°C (77 to 248°F)	■ ■	10.0 to 13.67
-70 to 120°C (-94 to 248°F)	■	6.318 to 13.67
25 to 260°C (77 to 500°F)	■ ■ ■	10.0 to 19.116
-200 to 260°C (-328 to 500°F)	■ ■	1.058 to 19.116
Cu 100	**1 2 3 4**	**Cu 100 (Ω)**
25 to 75°C (77 to 167°F)	■ ■ ■	100.0 to 115.5
-25 to 75°C (-13 to 167°F)	■ ■	80.7 to 115.5
25 to150°C (77 to 302°F)	■ ■	100 to 148.3
-100 to 150°C (-148 to 302°F)	■	51.3 to 148.3
25 to 260°C (77 to 500°F)	■ ■ ■	100 to 191.2
-200 to 260°C (-328 to 500°F)	■ ■	10.6 to 191.2
Ni 120	**1 2 3 4**	**Ni 120 (Ω)**
-30 to 30°C (-22 to 86°F)	■ ■	99.4 to 142.1
-80 to 30°C (-112 to 86°F)	■	66.6 to 142.1
-30 to 100°C (-22 to 212°F)	■ ■ ■	99.4 to 200.6
-30 to 200°C (-22 to 392°F)	■ ■ ■	99.4 to 303.5
-30 to 320°C (-22 to 608°F)	■ ■ ■ ■	99.4 to 471.2
NiFe 604	**1 2 3 4**	**NiFe 604 (Ω)**
-40 to 0°C (-40 to 32°F)	■ ■ ■	499.1 to 604.0
-40 to 50°C (-40 to 122°F)	■ ■	499.1 to 751.8
-200 to 50°C (-328 to 122°F)	■	245.3 to 751.8
-200 to 100°C (-328 to 212°F)	■ ■	245.3 to 917.3
-200 to 240°C (-328 to 464°F)	■ ■	245.3 to 1475.6

**Note: Resistance values for Pt 500(Ω) and Pt 1000(Ω) are 5 and 10 times the resistance value of Pt100 (Ω), respectively.*

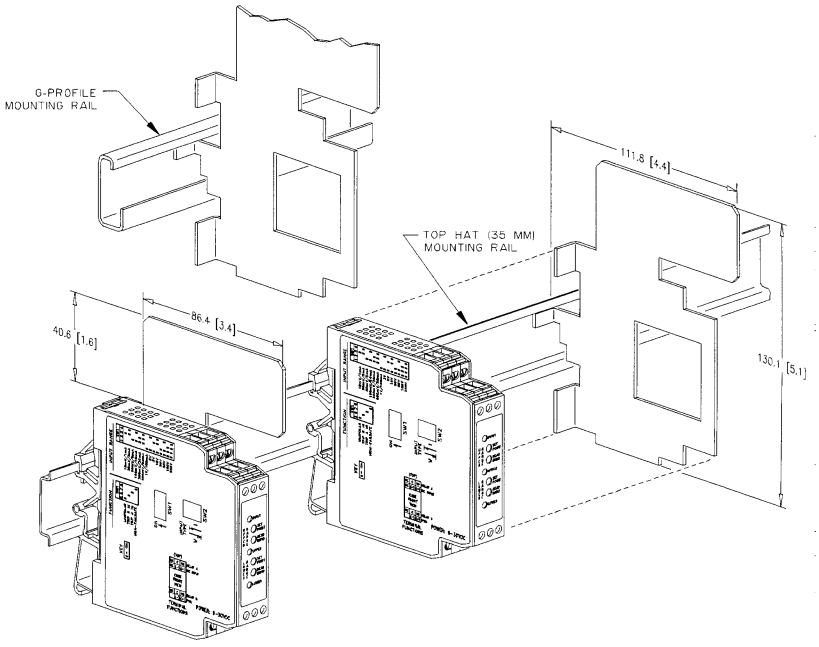
Table 1: RTD Input Type switch settings (SW2 - 1 through 6)

	SW2 1 2 3 4 5 6
Cu 10	■ ■ ■
Pt 100, Cu 100	■
Pt 500, NiFe 604	■ ■
Pt 1000	■
Ni 120	■

Table 2: Setpoint Function switch settings (SW1 - 5 through 8)

	SW1 5 6 7 8
TRIP B HI	■
TRIP A HI	■
NON-FAILSAFE	■

KEY ■ = ON



Note1: All DRG Series modues are designed and tested to operate in ambient temperatures from 0 to 55° C, when mounted on a horizontal DIN rail. When five or more modules are mounted on a vertical rail, circulating air or model DRG-HS01 Heat Sink is recommended.

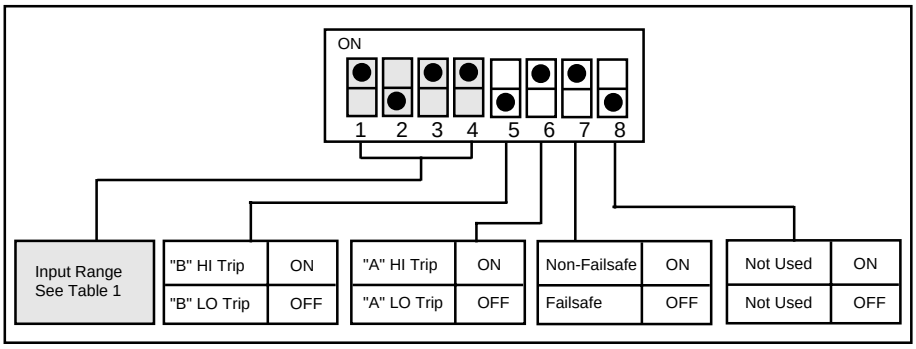


Figure 4: DRG-AR-RTD Input Range/Function Selection (SW1)
Factory Default Settings

RELAY PROTECTION AND EMI SUPPRESSION

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all 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 0.1µF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47Ω, 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).

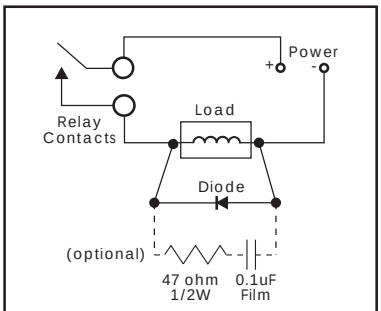


Figure 2: DC Inductive Loads

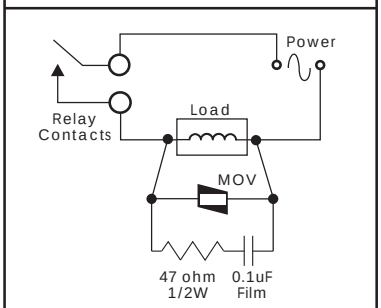


Figure 3: AC Inductive Loads

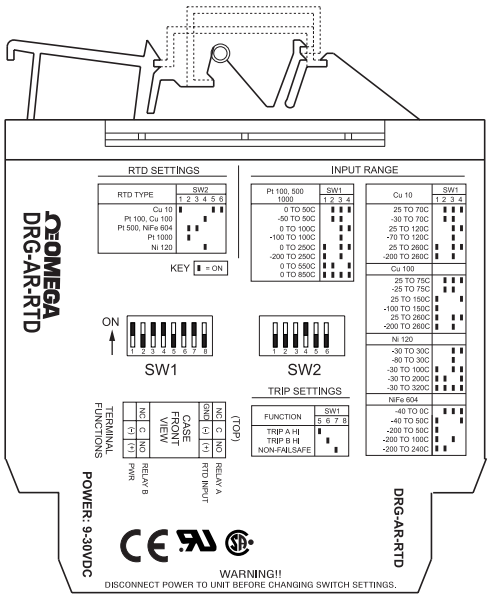


Figure 5: DRG-AR-RTD Factory Calibration; 0-250°C (Pt 100), A-HI/B-LO, Non-Failsafe

Warning: *Do not attempt to change any switch settings with power applied. Severe damage may occur!*

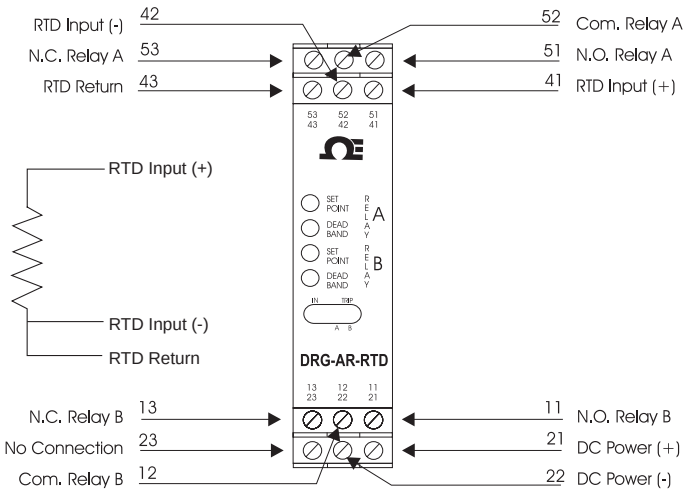


Figure 6: Wiring Diagram for DRG-AR-RTD

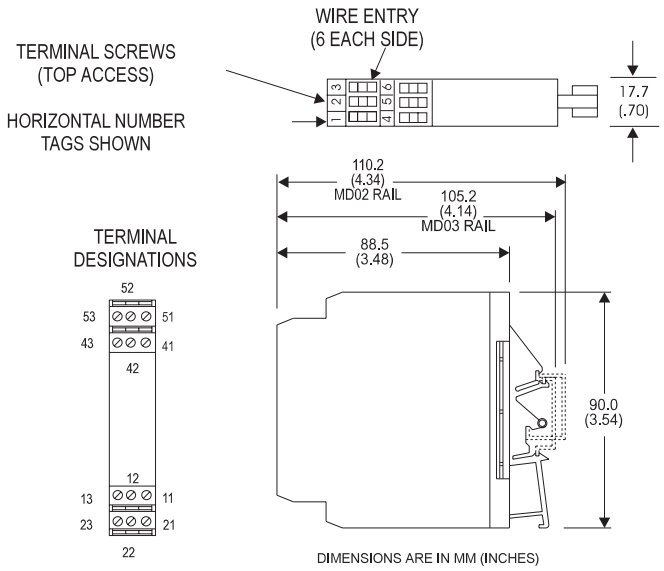


Figure 7: Mechanical Dimensions for DRG-AR-RTD

SPECIFICATIONS

Inputs
Sensor Types: Pt100, Pt500, Pt1000 (0.00385Ω/Ω/°C); Cu10, Cu100; Ni120, NiFe604
Sensor Connection: 3-wire.
Input Ranges: see table 1.

Excitation Current (Maximum)
<2mA for Pt100, Pt500, Pt1000, Ni120, Cu100 or NiFe604
<10mA for Cu10, Cu25.

Leadwire Resistance
40% of base sensor resistance or 100Ω (whichever is less), maximum per lead.

Leadwire Effect
Less than 1% of selected span over entire leadwire resistance range.

Input Protection
Normal Mode: Withstands ±5VDC.
Common Mode(Input to Ground): 1800VDC, max.

LED Indicators
Input Range (Green)
>110% input: 8Hz flash
<0% input: 4Hz flash
Setpoint (Red)
Tripped: Solid red
Safe: Off

Limit Differentials (Deadbands)
1.0% to 5% of span

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

Setpoints
Effectivity: Setpoints are adjustable over 100% of the selected input span
Repeatability (constant temp.): ±0.2% of full scale

Stability
Line Voltage: ±0.01%/%, max.
Temperature: ±0.05% of full scale/°C, max.

Common Mode Rejection
DC to 60Hz: 120dB
>60Hz: 100dB

Isolation
1800VDC between contacts, input and power

EMC Compliance (CE Mark)
Emissions: EN50081-1
Immunity: EN50082-2
Safety: EN50178

Humidity (Non-Condensing)
Operating: 15 to 95% (@45°C)
Soak: 90% for 24 hours (@65°C)

Temperature Range
Operating: -15 to 55°C (5 to 131°F)
Storage: -25 to 75°C (-13 to 158°F)

Power
Consumption: 1.5W typical, 2.5W max.
Supply Range: 9 to 30VDC, inverter isolated
In-rush Current: 300mA, max.

Relay Contacts
2 SPDT (2 form C) Relays
1 Relay per setpoint
Current Rating (resistive)
120VAC: 5A
240VAC: 2A
28VDC: 5A
Material: Silver-Cadmium Oxide
Electrical Life:10^5 operations at rated load
Note: External relay contact protection is required for use with inductive loads (see Figures 2 & 3).
Mechanical Life: 10^7 operations

Agency Approvals
CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272).**UL** recognized per standard UL508 (File No.E99775).**CE** Compliance per EMC directive 89/336/EEC and low voltage 73/23/EEC.

Mounting
32mm and 35mm DIN Rail

PIN CONNECTIONS

11 N.O. Relay B
12 Com. Relay B
13 N.C. Relay B
21 DC Power (+)
22 DC Power (-)
23 No Connection
41 RTD Input (+)
42 RTD Input (-)
43 RTD Return
51 N.O. Relay A
52 Com. Relay A
53 N.C. Relay A

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DRG-AR-TC
Field Configurable Limit Alarm

Instruction Sheet M2398/0796

DESCRIPTION

The DRG-AR-TC is a DIN rail mount, thermocouple input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. There are up to six temperature ranges available for each thermocouple type to ensure accuracy and maximize setpoint resolution. A bipolar input switch is provided for temperature ranges below 0°C.

The DRG-AR-TC is configurable as a single or dual setpoint alarm, with HI or LO trips, upscale or downscale thermocouple burnout detection and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

DIAGNOSTIC LEDS

The DRG-AR-TC is equipped with three front panel LEDs. The first is a dual function LED labeled INPUT. This green LED indicates DC power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check line power and wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz. Below 0%, the flash rate is 4 Hz.

Two red LED's indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

OUTPUT

The DRG-AR-TC is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable set point and deadband.

OPERATION

The field configurable DRG-AR-TC limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the low deadband (see Figure 1). 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, a power failure results in an alarm state output.

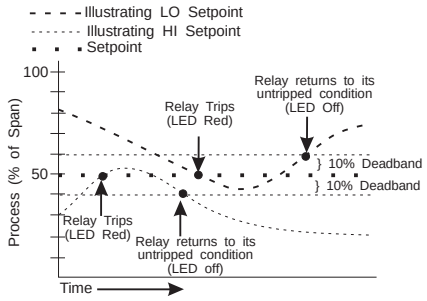


Figure 1: Limit alarm operation and effect of deadband(s).

DYNAMIC DEADBAND

LSI circuitry in the DRG-AR-TC prevents false trips by repeatedly sampling the input. 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.

CONFIGURATION

Unless otherwise specified, the factory presets Model DRG-AR-TC as follows:

Input:	J Type
Range:	0 to 350°C
Output:	Dual, SPDT
Trip:	A: HI, B: LO
Failsafe:	No
Deadband:	A, B: 0.25%

The DC power input accepts any DC source between 9 and 30V, typically a 12V or 24VDC source is used.

For other I/O ranges, refer to Table 1 and reconfigure switches SW1 and SW2 for the desired input type, range and function.

WARNING: *Do not attempt to change any switch settings with power applied. Severe damage will result!*

1. With DC power off, position switch SW1-1, 2, 3 and SW2-1 through 6 for the desired input range (Table 1).

2. Set positions 4 and 5 of function switch "SW1" to ON for a HI trip setpoint or OFF for a LO trip setpoint (Figure 4).

3. Set position 6 of function switch "SW1" to ON for non-failsafe operation or OFF for failsafe operation (e.g. alarm trips upon power failure).

4. Set positions 7 and 8 of function switch "SW1" to upscale or downscale burn-out.

CALIBRATION

1. After configuring the DIP switches, connect the input to a calibrated TC source and apply power. Refer to the terminal wiring (Figure 5).

NOTE: to maximize thermal stability, final calibration should be performed in the operation installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

2. Setpoint: set deadband at its minimum (fully counter clockwise) before adjusting the setpoint. With the desired trip thermocouple millivolt input applied, adjust setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (full clockwise). For LO trip calibration, start below the desired trip (full counter clockwise).

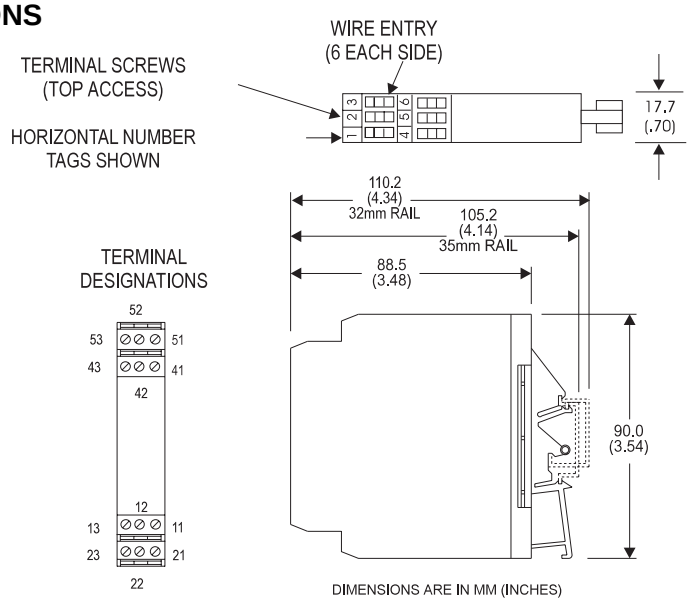
3. Deadband: Set deadband to its minimum (fully counter clockwise). Set the setpoint to desired trip. Adjust thermocouple millivolt input until relay trips. Readjust deadband to 5% (fully clockwise). Set voltage/ current input to desired deadband position. Slowly adjust deadband until relay untrips

Table 1: DRG-AR-TC Input Range Selector -Switch Settings

KEY: ■ = ON

TC TYPE	TEMP RANGE	SW1 1	SW1 2	SW1 3	SW2 1	SW2 2	SW2 3	SW2 4	SW2 5	SW2 6
B	0 to 1490°C 32 to 2714°F		■		■					■
B	0 to 1820°C 32 to 3308°F		■	■	■					■
E	0 to 150°C 32 to 302°F		■			■				■
E	0 to 290°C 32 to 554°F		■	■		■				■
E	0 to 660°C 32 to 1220°F	■				■				■
E	0 to 1000°C 32 to 1832°F	■		■		■				■
E	-270 to 150°C -454 to 302°F		■			■				
E	-270 to 290°C -454 to 554°F		■	■		■				
J	0 to 190°C 32 to 374°F		■						■	■
J	0 to 350°C 32 to 662°F		■	■					■	■
J	0 to 760°C 32 to 1400°F	■							■	■
J	-210 to 190°C -346 to 374°F		■						■	
J	-210 to 350°C -346 to 662°F		■	■					■	
K	0 to 250°C 32 to 482°F		■					■		■
K	0 to 480°C 32 to 896°F		■	■				■		■
K	0 to 1280°C 32 to 2336°F	■						■		■
K	0 to 1372°C 32 to 2502°F	■		■				■		■
K	-270 to 250°C -454 to 482°F		■					■		
K	-270 to 480°C -454 to 896°F		■	■				■		
R	0 to 970°C 32 to 1778°F		■				■			■
R	0 to 1690°C 32 to 3000°F		■	■			■			■
R	0 to 1760°C 32 to 3200°F	■					■			■
S	0 to1050°C 32 to 1922°F		■				■			■
S	0 to 1750°C 32 to 3182°F		■	■			■			■
T	0 to 210°C 32 to 410°F		■					■		■
T	0 to 390°C 32 to 734°F		■	■				■		■
T	-270 to 210°C -454 to 410°F		■					■		
T	-270 to 390°C -454 to 734°F		■	■				■		

DIMENSIONS



RELAY PROTECTION AND EMI SUPPRESSION

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all 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 0.1µF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47Ω, 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).

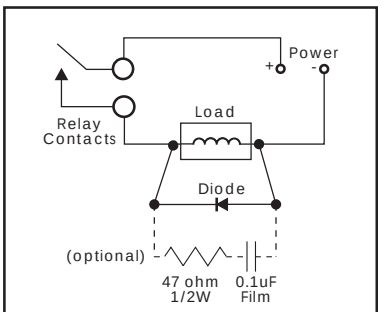


Figure 2: DC Inductive Loads

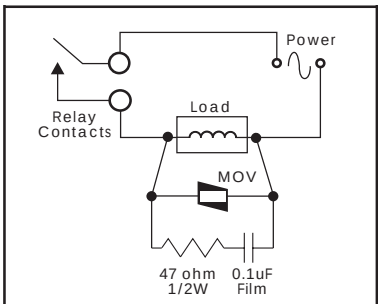


Figure 3: AC Inductive Loads

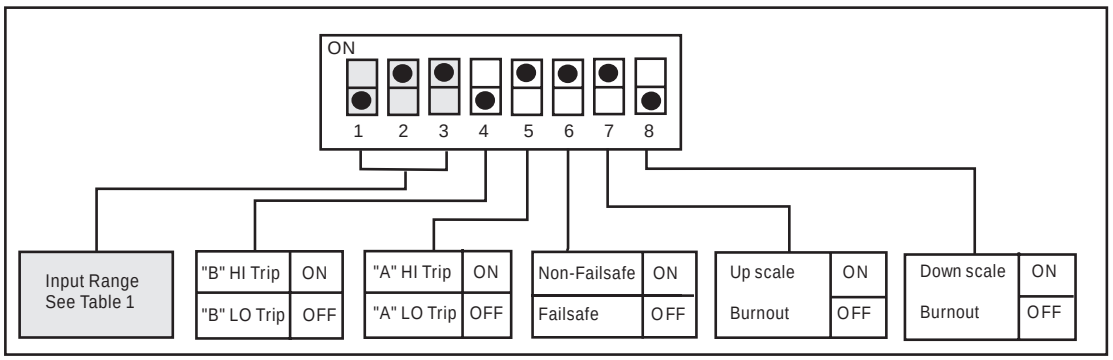


Figure 4: Input Range/Function Selection (SW1)
Factory Default Settings

WARNING: Do not attempt to change any switch settings with power applied. Severe damage may occur!

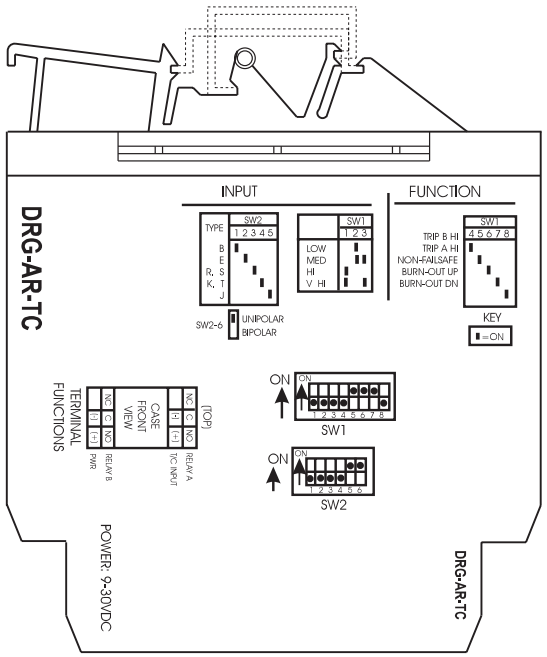


Figure 5: DRG-AR-TC Factory Calibration: J-Type, 0 to 350°C, A-HI/B-LO, non-failsafe

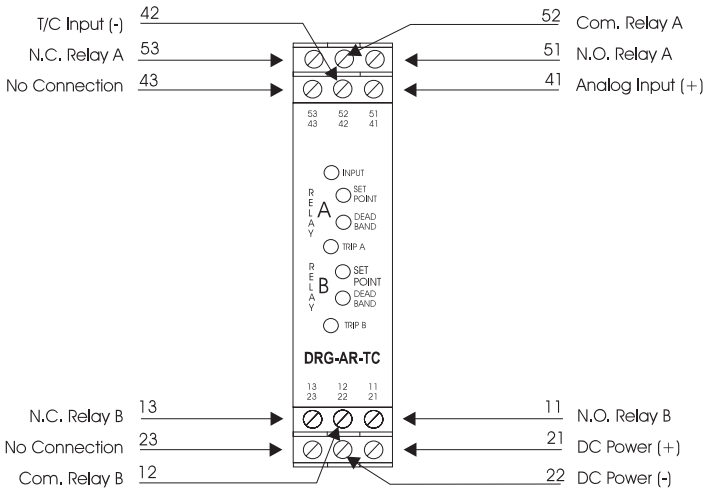


Figure 6: Wiring Diagram for DRG-AR-TC

SPECIFICATIONS

Inputs
Range: See Table 1
Impedance: >1 Megaohm
Input Bias Current (burnout detection): <1.5 microamp
Overvoltage: ±10V differential
Common Mode (Input to Ground): 1800VDC, max.

LED Indicators
Input Range (Green)
>110% input: 8Hz flash
<0% input: 4Hz flash
Setpoint (Red):
Tripped: Solid red
Safe: off

Limit Differentials (Deadbands)
0.25% to 5% of span

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

Setpoint
Effectivity: Setpoint(s) are adjustable over 100% of the selected input span
Repeatability (constant temp.):
0.2% for temp > 0°C
0.3% for temp < 0°C

Stability
Temperature: ±0.05% of full scale/°C, max.

Common Mode Rejection
DC to 60Hz: 120dB

Isolation
1800VDC between contacts, input and power

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

Humidity (Non-Condensing)
Operating: 15 to 95% (@45°C)
Soak: 90% for 24 hours (@65°C)

Temperature Range
Operating: 0 to 55°C (32 to 131°F)
Storage: -15 to 70°C (5 to 158°F)

Power
Consumption: 1.5W typical, 2.5W max.
Supply Range: 9 to 30 VDC, inverter isolated
In-rush Current: 300mA, max.

Relay Contacts
2 SPDT (2 Form C) Relays
1 Relay per setpoint
Current Rating (resistive)
120VAC: 5A
240VAC: 2A
28VDC: 5A
Material: Silver-Cadmium Oxide
Electrical Life: 10^5 operations at rated load
Note: External relay contact protection is required for use with inductive loads (see relay protection Figures 2 & 3).
Mechanical Life: 10^7 operations

Wire Termination
Screw terminations for 12-22 AWG

Agency Approvals
CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272) **UL** recognized per standard UL508 (File No.E99775)

Mounting
32mm and 35mm DIN Rail

PIN CONNECTIONS
11 N.O. Relay B
12 Com. Relay B
13 N.C. Relay B
21 DC Power (+)
22 DC Power (-)
23 No Connection
41 T/C Input (+)
42 T/C Input (-)
43 No Connection
51 N.O. Relay A
52 Com. Relay A
53 N.C. Relay A

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