MAXITROL®

SC40-SM2 Series Signal Conditioners

⚠ WARNING

Read these instructions carefully and completely before installing or operating. Failure to follow them could result in a fire or explosion causing property damage, personal injury, or loss of life. The product must be installed and operated according to all local regulations.

Service and installation must be performed by a trained/ experienced service technician.

DESCRIPTION

The SC40-SM2 Series signal conditioner, used with the E42, E52, and E62 Series modulating gas valves, is designed to modulate atmospheric indirect fired heaters that have a sectioned gas manifold and 2-speed inducer. The sectioned - or split - manifold design operates as two independent manifolds sharing a single 2-speed inducer. One manifold section is fully modulating and the other section operates as a 2-stage. Typical applications achieve a turndown of approximately 10:1.

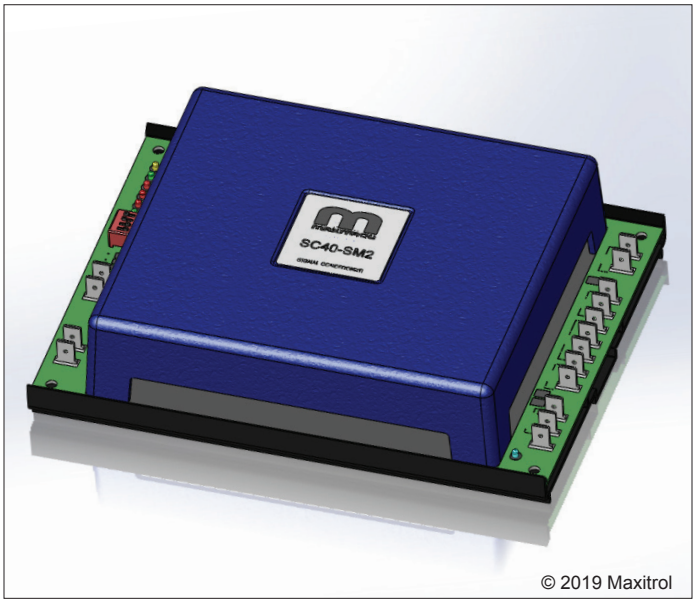

Figure 1: SC40-SM2 Series Signal Conditioner

SYSTEM FEATURES

SC40-SM2 Series Signal Conditioner

Controlled Start-Up

- Fixes the modulation output voltage and inducer state for a predetermined time after receiving EST input.

Inducer State

- Energizes/de-energizes on board SPDT relay setting inducer to low/high speed position.

Operating Stage

- Modulates E valve and sets stage relays based on control signal input.

Stage Transition

- Maintains 100% rate of modulated section during non-modulated section start-up.

Minimum Input Limits

- Limits minimum VDC to E Valve when non-modulated section stages are operating.

Air Flow Switch (AFS)

- *A model only:* Limits maximum modulation VDC and disables Relay 3 if 24 VDC AFS input is not present for a time greater than 3 seconds.

SYSTEM COMPONENTS

SC40-SM2 Series Signal Conditioner

E42, E2, E62 Series modulating gas valve

Acronyms

E	EXA Series Modulating Valve
EST	Electronic Start Trigger
NC	Normally Closed
NO	Normally Open
SPST	Single Pole Single Throw
SPDT	Single Pole Double Throw

SPECIFICATIONS

Dimensions:
Signal Conditioner: 7.5” L x 5.5” W x 2” H

Ambient Temperature Limits
Operating: -40° F to 150° F (-40° C to 66° C)
Non-operating: -50° F to 185° F (-46° C to 85° C)
RH: 95% non-condensing

Mounting
Snap Track, multipoise

Power Supply
24 VAC +10-15% (50/60 Hz), Class II Transformer
20 VA - Rating for Maxitrol electronics and modulating gas valve only.
Half-Wave Rectified
NOTE: Polarity is specified - Transformer can be externally grounded.

External Wiring
Gauge: 18-22 AWG, copper only
Connection: 1/4” male spade .032 thk

Relays
A: When relay 1, 2, or 3 common voltage input is externally supplied (dry contact), the voltage should not exceed 24 VAC, VDC nominal.
B: When relay 1, 2, or 3 common 24 VAC input is internally supplied, the circuit load through jumper J1, J2, or J3 should not exceed 1A.

Rated load: 2 A Max. @ 24 VAC (Resistive load)
Max switching capacity: 50 VA (Resistive load)

Temperature Control (TC) Signal Input
0 - 10 VDC, 2 - 10 VDC
Impedance 100k ohms (nominal)
0 - 20 mA, 4 - 20 mA
Impedance 500k ohms (nominal)

EXA Modulating Gas Valve
Power: 24 VAC, VDC
Rated load: 0.3 A max
Control Voltage: 0-10 VDC (Polarity Sensitive)
100 k Ω Input Impedence

Relay - Trigger Adjustment (TC Signal)
Nominal +/- 10%
Relay 1: 25%
Relay 2: 50%
Relay 3: 75%

Relay - Trigger Span Adjustment (TC Signal)
1 - 5% centered around Trigger

EST Input
24 VAC continuous source (must share common with 24 VAC power)
NOTE: Commonly tied to gas valve 24 VAC input

Start-up Timer
5 - 55 seconds

Start-up Modulator Voltage
1 - 10 VDC

Stage 3 Delay - Modulated Section Hold
5 - 30 seconds

Stage 3, 4 Minimum Voltage Adjustment
0.5 - 5 VDC

AFS Fault Voltage (A Suffix Only)
1 - 10 VDC

Reliability/Durability
100% duty cycle

SHUNT JUMPER AND DIP SWITCH SETTINGS

Table 1: DIP Switch Settings

TC INPUT	DIP Switch (SW1) Settings			
	1	2	3	4
0 - 10 VDC	OFF	ON	OFF	Set to ON to *disable* AFS Function (SC40-SM2A)
2 - 10 VDC	OFF	OFF	ON	
0 - 20 mA	ON	ON	OFF	
4 - 20 mA	ON	OFF	ON	

Table 2: Jumper Settings

J1	Connects T2 to T5	24 VAC - shunt installed Dry contact - no shunt
J2	Connects T2 to T8	
J3	Connects T9 to T10	

ADJUSTMENTS

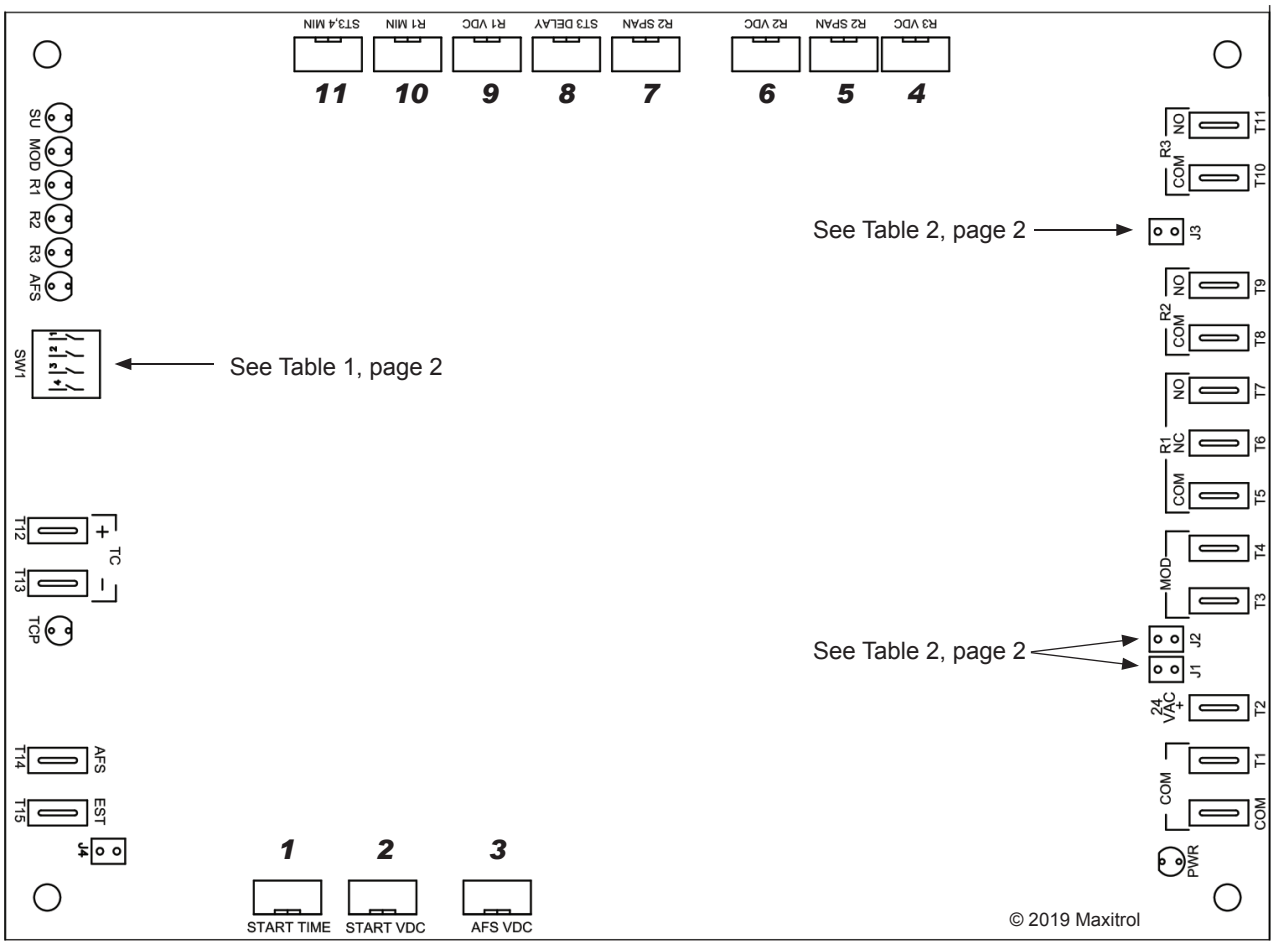

Figure 2: SC40-SM2 Trimpot, LED, Dip Switch and Jumper Locations

Setting			
1	Start Time	**7**	Relay 2 Deadband
2	Start Voltage	**8**	Stage 3 Time Delay
3	AFS Limit (“A” Suffix)	**9**	Relay 1 Trigger
4	Relay 3 Trigger	**10**	Relay 1 Deadband
5	Relay 3 Deadband	**11**	Stage 3, 4 MIN Voltage
6	Relay 2 Trigger		

NOTE: Turn trimpot clockwise to increase, counterclockwise to decrease

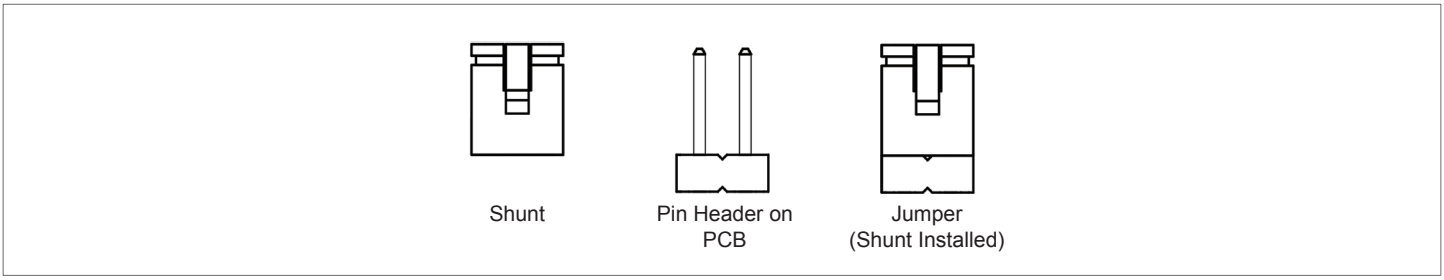

Figure 3: Shunt Jumper

WIRING DIAGRAM

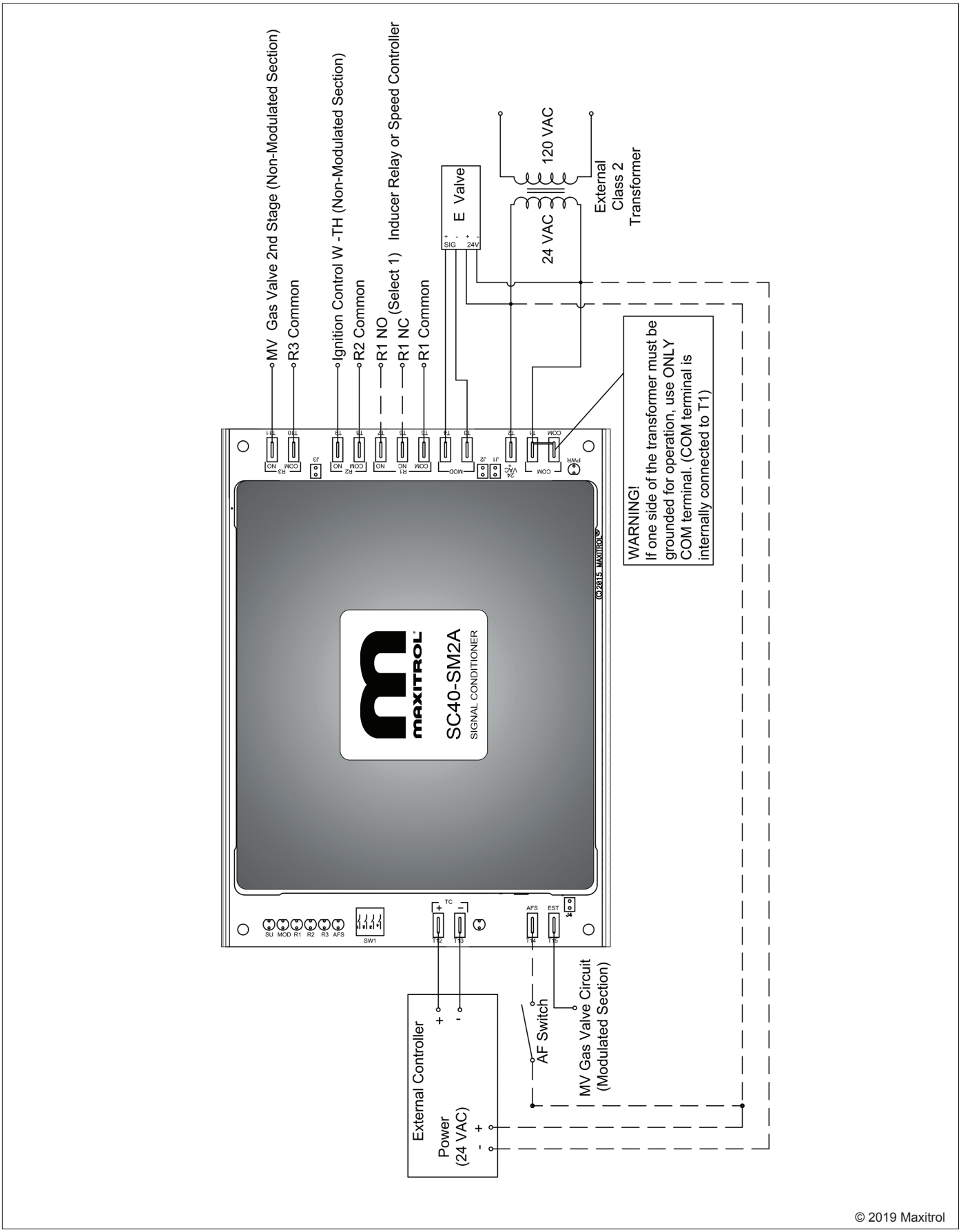

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Figure 4: SC30-SM2 Wiring Diagram

PCB CONNECTIONS

No	PCB Label		Description	Notes
COM	COM		Power Common	Internally connected to T1
T1			Power Common	Polarity sensitive
T2	24 VAC	+	Power Input	
T3	EXA	-	0 - 10 VDC	Modulation Voltage, Polarity Sensitive
T4		+		
T5	R1	COM	Relay 1 - SPDT	24 VAC - internally (J1)
T6		NC		Inducer Speed Stage
T7		NO		
T8	R2	COM	Relay 2 - NO	24 VAC - internally (J2)
T9		NO		Ignition Control W - TH, Non-Modulated Section
T10	R3	COM	Relay 3 - NO	24 VAC - internally (J3)
T11		NO		Gas Valve (MV) 2nd Stage, Non-Modulated Section
T12	TC	+	TC Input	Control signal, polarity sensitive
T13		-		
T14	AFS		Air Flow Switch	24 VAC input (A model), shares COM ground
T15	EST		Electronic Start Trigger	24 VAC - Start trigger, shares COM ground

NOTE: COM, T1, and T13 are internally connected.

LED STATUS INDICATORS

Status	PCB Label	Color
Main Power	PWR	Blue
Start Up	SU	Yellow
Modulation	MOD	Green
Relay 1 energized	R1	Red
Relay 2 energized	R2	Red
Relay 3 energized	R3	Red
AFS	AFS	Green
TC Polarity	TCP	Red

OPERATION

CALL FOR HEAT MODE

- Thermostat relay is energized (completes W input).
- SC40-SM2 is powered with 24 VAC.
- E Valve is powered with 24 VAC.
- Inducer Relay (R1) is de-energized, inducer operates in high speed.

LEDs: PWR, AFS (A model)

BURNER START UP MODE

EST receives 24 VAC input from the ignition control gas valve (MV) circuit.

- Timer starts and modulation voltage is fixed.
- Inducer relay remains de-energized, inducer operates in high-speed stage.

NOTE: The system remains in this mode throughout Start Up Timer duration, regardless of the TC input.

LEDs: PWR, SU, AFS (A Model)

OPERATIONAL MODE

- Start up Timer expires.
- TC control signal now determines the mode.
  - See “TC Polarity LED” if TCP LED is lit.

LEDs: PWR, MOD,
R1, R2, R3 - Lit when energized
AFS (A Model)

Table 3: Temperature Controller Input to SC40-SM2

TC Input Signal	Mode			Approx % of total*
	Modulated	Non-Modulated	Inducer	
0 - 25%	Low - Mid	Off	Low	10% - 30%
25 - 50%	Mid - High	Off	High	30% - 50%
50 - 75%	Low - High	Low	High	50% - 75%
75 - 100%	Low - High	High	High	75% - 100%

* Percentages are approximations of what one would expect to achieve

OPERATION

OPERATION: (see Table 3, page 6)

Stage I Minimum to 30% of total rate.**
- TC Input: 0 - 25% (nominal).
- Modulated Section is operational.
- Modulation Voltage 0 - 4.5 VDC
- Inducer operates in low-speed mode.

LEDs: PWR, MOD, R1, AFS (A Model)

Stage II 30% to 50% of total rate.**
- TC Input: 25 - 50% (nominal).
- Modulated Section is operational.
- Modulation Voltage 4.5 - 10 VDC
- Inducer operates in high-speed mode.

LEDs: PWR, MOD, AFS (A Model)

Stage II to Stage III Transition
- Relay R2 is energized.
- Modulated section remains at 100% for preset time after R2 is energized to allow non-modulated section to become operational.

Stage III 50% to 75% of total rate.**
- TC Input: 50 - 75% (nominal).
- Modulated Section is operational.
- Relay 2 is energized.
- Non-Modulated Section is operational and operates in low stage (approx 60% of non-modulated section).
- Modulation Voltage is 1* - 10 VDC.

LEDs: PWR, MOD, R2, AFS

Stage IV 75% to 100% of total rate.**
- TC input: 75 – 100% (nominal).
- Modulated Section is operational.
- NO Stage IV Relay (R3) is energized. Gas valve switches to high stage (100% of non-modulated section).
- Modulation Voltage is 1* - 10 VDC.

LEDs: PWR, MOD, R2, R3, AFS

AFS (A Suffix Only) Models
- Operating Condition #1
  Relay 1 is energized and 24 VAC input is present or not present.
  Result: Normal operation of Stage I.

- Operating Condition #2
  Relay 1 is de-energized and 24 VAC input is present.
  Result: Normal operation of all stages.

- Operating Condition #3
  Relay 1 is de-energized and 24 VAC input is not present for duration greater than 3 seconds.
  Result:
  - AFS Fault.
  - VDC output to valve is fixed to user-selected voltage.
  - Relay 2 operation dependent on TC input. Relay 3 de-energized regardless of TC input.
  - VDC output remains fixed, even if the 24 VAC AFS signal is re-established, until reset.

- Resetting AFS Fault
  Perform one of the following:
  - Cycle main power
  - Cycle EST input
  - Energize Relay 1 with TC input

AFS Fault Override: Set SW1-4 to “ON”

AFS LED
- Lit when 24 VAC input is present or SW1-4 is “ON”.

TC Polarity (TCP) LED
- Lit LED indicates TC input polarity is reversed.

NOTE: LED will **NOT** be lit when TC polarity is correct or the TC input voltage, regardless of polarity, is less than 1 VDC.

* Adjustable min VDC
** Percentages are approximations of what one would expect to achieve

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