JC Systems by TMC Services, Inc.

Model A2192 – Chamber Enhancer
With "SPLIT BAND SMART STAGING"™

- **SIMPLIFIES SETUP OF CHAMBERS WITH MULTIPLE STAGES OF HEATING / COOLING**

- **HI HEAT & HI COOL POWER RATIO ENABLE ACTION**
  Hi Heat / Cool are enabled based on the ration (%) the Lo Heat / Cool contributes to the total output.

- **SMOOTH LINEAR TRANSITION OF HI OUTPUT**
  Provides a smooth linear transition from the Lo to Hi output stages.

- **ELIMINATES DISCONTINUITY SEEN IN TIME DELAY STAGING**
  There are no uncontrollable power transitions on the Hi Cool / Heat when the controller demand transitions from less than 100% to 100% output demand.

- **MTO (COMPRESSOR TIME OUT) –** Fixed at 3 minutes.

- **TWO MTO ACTIONS PROVIDED** - PROM -CMTO (standard) or specify -CHMTO (optional)

  -CMTO: (PROM -024): Used on systems with independent cooling and De-humidify compressors (Cool Machine Time Out). Independent MTO outputs provided. The MTO is started whenever a cool signal (TB1-3) is received.
  Ext. de-humidify MTO is started whenever a signal is received on TB3-2, TB3-3 logic output and TB3-4 +5vdc are for SSR connection.

  -CHMTO: (PROM -025): Used on systems with a shared compressor for cooling and De-humidify (Cool or Humidity Machine Time Out). Either demand will start the MTO.
  The MTO is started whenever a cool (TB1-3) or de-humidify (TB3-2) signal is received. The Ext. de-humidify output (TB3-3) is disabled.

- **SELECT BYPASS FOR LO OR HI COOL**
  Lo / Hi Cool Bypass Select Jumper – ON for LO Cool, OFF for HI Cool.
  Bypass output is automatically disabled when the MTO times out.

- **EIGHT SOCKETED LOCATIONS**
  AC or DC plug-in solid state relays (SSR) for control and staging outputs.

- **INDEPENDENT SECOND CHANNEL INPUT / OUTPUTS ON TB3**

A2192 Chamber Enhancer mounted in Snap Track with optional SSR's. Mounting dimensions: 3" x 12"
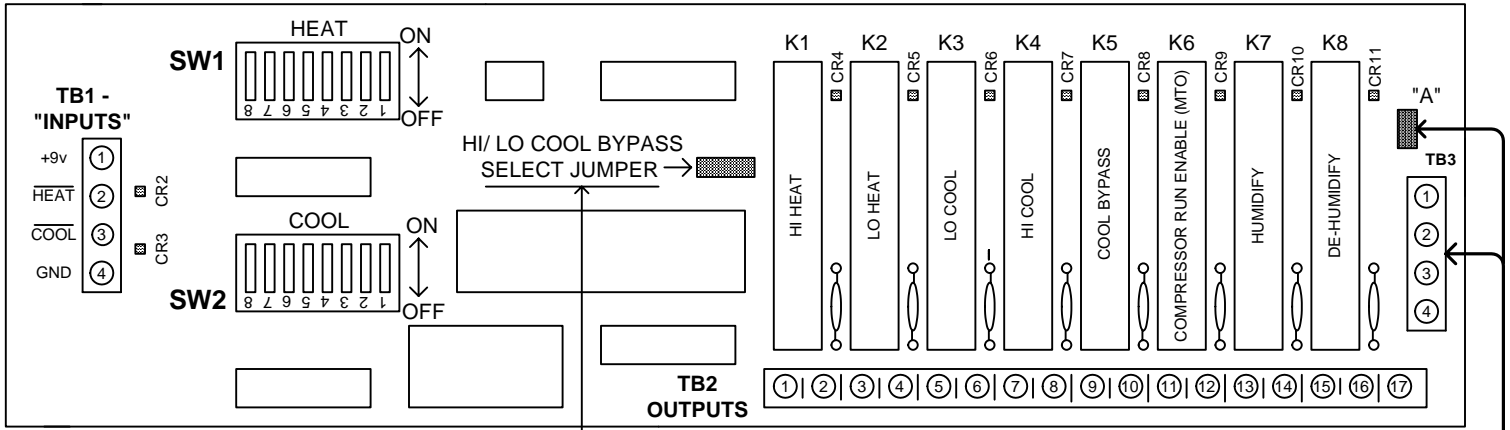
JC Systems A2192 Ver.III Chamber Enhancer with "Split Band Smart Staging"

TB1 - "INPUTS"

+9v	①
HEAT	②
COOL	③
GND	④

SW1 HEAT ON / OFF 8 7 6 5 4 3 2 1

SW2 COOL ON / OFF 8 7 6 5 4 3 2 1

HI/ LO COOL BYPASS SELECT JUMPER →

K1 K2 K3 K4 K5 K6 K7 K8

HI HEAT / LO HEAT / LO COOL / HI COOL / COOL BYPASS / COMPRESSOR RUN ENABLE (MTO) / HUMIDIFY / DE-HUMIDIFY

CR4 CR5 CR6 CR7 CR8 CR9 CR10 CR11

"A"

TB3

①
②
③
④

TB2 OUTPUTS ①②③④⑤⑥⑦⑧⑨⑩⑪⑫⑬⑭⑮⑯⑰

COOL BYPASS SELECT JUMPER: "ON" = LO STAGE BYPASS, "OFF" = HI STAGE BYPASS

MTO: Fixed at 3 minutes for both cool and de-humidify.
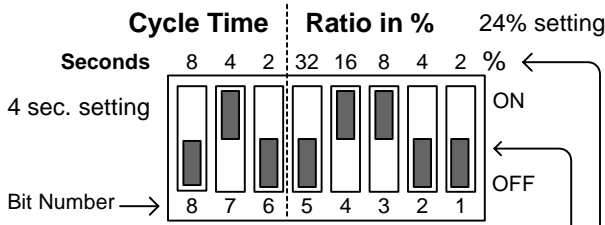
> **TB3:** Inputs for second channel of control.
> Pin 1 - Humidity
> Pin 2 - De-Humidify
>
> Outputs:
> Pin 3 - External MTO (De-Humidify)
> Pin 4 - +5vdc for external MTO SSR
>
> Jumper "**A**" must be installed for +5vdc on TB3 Pin 4

SW1: HEAT, SW2: COOL

Cycle Time | Ratio in % 24% setting

Seconds 8 4 2 | 32 16 8 4 2 %

4 sec. setting

Bit Number → 8 7 6 | 5 4 3 2 1

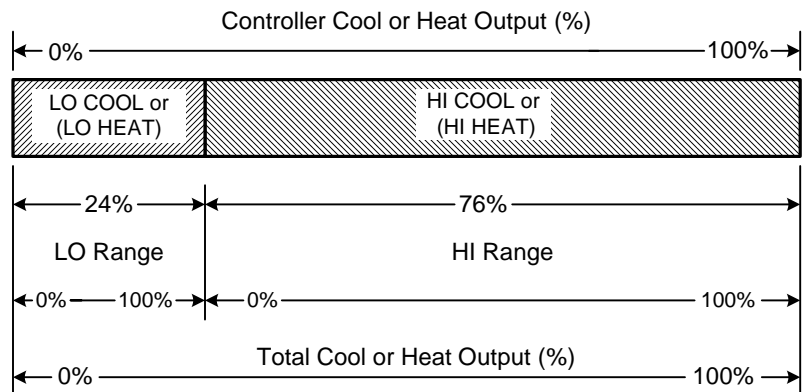| Bit settings: 5 4 3 2 1 (1 = ON, 0 = OFF)	% value of LO to total ratio (Heat or Cool)	
0 0 0 0 0	0	Disable HI
0 0 0 0 1	2	
0 0 0 1 0	4	
0 0 0 1 1	6	
0 0 1 0 0	8	
0 0 1 0 1	10	
0 0 1 1 0	12	
0 0 1 1 1	14	
0 1 0 0 0	16	
0 1 0 0 1	18	
0 1 0 1 0	20	
0 1 0 1 1	22	
0 1 1 0 0	24	(Shown)
0 1 1 0 1	26	
0 1 1 1 0	28	
0 1 1 1 1	30	
1 0 0 0 0	32	
1 0 0 0 1	34	
1 0 0 1 0	36	
1 0 0 1 1	38	
1 0 1 0 0	40	
1 0 1 0 1	42	
1 0 1 1 0	44	
1 0 1 1 1	46	
1 1 0 0 0	48	
1 1 0 0 1	50	
1 1 0 1 0	52	
1 1 0 1 1	54	
1 1 1 0 0	56	
1 1 1 0 1	58	
1 1 1 1 0	60	
1 1 1 1 1	62	

"Cycle Time"

Dip switch setting must match the controller's cycle time setting.
Range: 2 to 14 seconds in 2 second increments.
("0" defaults to 2 sec.)

"Ratio in %" (Heat or Cool)

Switch setting is determined by the % output the LO Heat or Cool contributes to the total (LO + HI) output. The example shows the LO output being 24% of the total output and the Hi output as 76% of the total output.

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The example below represents a LO to HI ratio of appx. 1:3.
A controller output of 0 to 24% produces 0 to 100% LO output.
A controller output of 24 to 100% produces 0 to 100% HI output.
The % output of the total Cooling or Heating is always equal to the % output demand of the controller.
This staging approach provides a constant system gain over the total controller proportional band, and smooth linear transitions from LO to HI ranges of Cooling or Heating.

Controller Cool or Heat Output (%)

← 0% ———————————— 100% →

LO COOL or (LO HEAT)	HI COOL or (HI HEAT)

← 24% → | ← 76% →

LO Range | HI Range

←0%—100%→ | ←0%————————100%→

Total Cool or Heat Output (%)

← 0% ———————————— 100%

FEATURES:
A2192 Ver. III with Split Band Smart Staging

- MTO (Machine Time Out): Two MTO actions are available.
  -CMTO (Std -024 prom) or -CHMTO (Optional - 025 prom)

  -CMTO: The MTO is fixed at 3 minutes. Relay K6.
    Automatically starts when a Cool input is received on TB1-3.
    Separate De-Humidify MTO logic output available on TB2-3, +5vdc on TB2-4.
    De-Humidify MTO starts when a De-Humidify signal is received on TB3-2.
    Fixed at 3 minutes.

  -CHMTO: The MTO is fixed at 3 minutes. Relay K6.
    Automatically starts when a Cool signal is received on TB1-3, or a De-Humidify signal is
    received on TB3-2. The separate De-Humidify MTO logic output is disabled.

- HI/LO Cool Bypass jumper selectable:
  Jumper SW3 OFF for HI Cool Bypass, ON for Lo Cool Bypass.

  Cool Bypass output disabled when MTO times out.
  You don't have to worry about the bypass valve coil getting too hot when the compressor is
  turned off.

- Cycle Time is entered on Heat Switch SW1 and Cool Switch SW2 as bits 6, 7 & 8 in two second
  increments. Bit 6 = 2 sec., bit 7 = 4 sec. & bit 8 = 8 sec..
  NOTE: Odd numbers may not be entered as a valid cycle time.
      Valid cycle times are 2, 4, 6, 8, 10, 12 & 14 seconds. The Cycle Time of the controller
      must agree with the setting on the A2192 (SW1 Heat or SW2 Cool).
      If all bits are off the default is 2 seconds.

- The value of the LO% output (where staged output starts) is selected on the lower five bits of the
  Heat switch (SW1) and the Cool switch (SW2). Each bit is weighted by a factor of two (2) as
  compared with the standard binary values. The % settings are shown on the back of the cover
  brochure.

  A switch setting of zero (0 0 0 0 0) for the "%" setting keeps the HI stage from turning on.
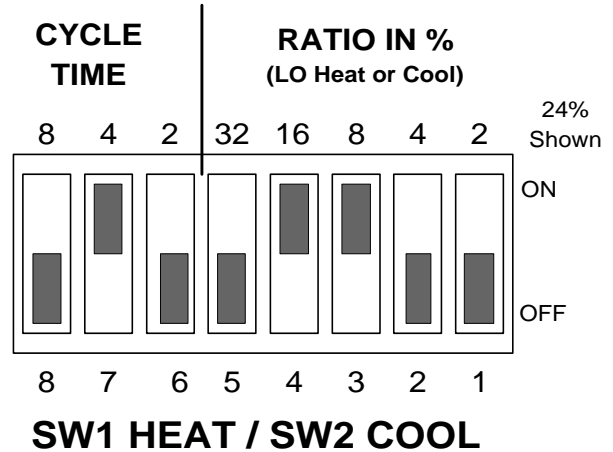 The LO output follows the controller demand.

A2192 Ver. III Split Band Smart Staging Module.

The Split Band Staging Module (SBS) is a microcomputer controlled heat and cool staging system that utilizes the Heat and Cool output from the JCS Models 600 (A) and 620(A) Programmer Controllers.

CYCLE TIME SETTINGS:

Set the Heat Cycle time (SW1 bits 6, 7 & 8), and the Cool Cycle time (SW2 bits 6, 7 & 8) to match the heat and cool cycle time setting of the controller.

Bit 6 ON = 2 seconds
Bit 7 ON = 4 seconds
Bit 8 ON = 8 seconds.

CYCLE TIME			RATIO IN % (LO Heat or Cool)				
8	4	2	32	16	8	4	2

24% Shown

ON / OFF

SW1 HEAT / SW2 COOL

8 7 6 5 4 3 2 1

Values for cycle time can be set from 2 seconds to 14 seconds in 2 second increments.

HIGH HEAT & HIGH COOL % (RATIO) SETTINGS:

CYCLE TIME			RATIO IN % (LO Heat or Cool)				
8	4	2	32	16	8	4	2

24% Shown

ON / OFF

8 7 6 5 4 3 2 1
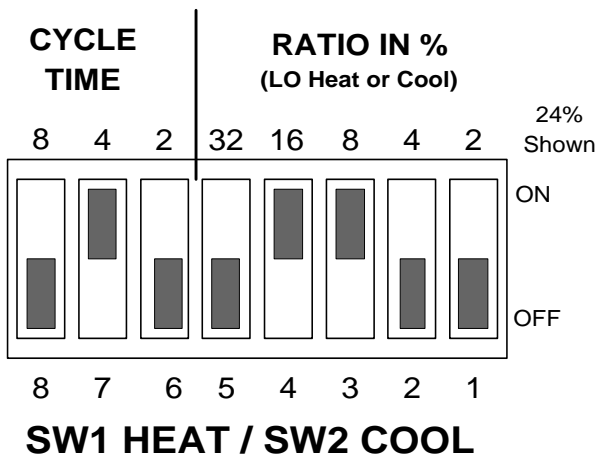
SW1 HEAT / SW2 COOL

The HI Heat and HI Cool Percent value are set on bits 1 thru bit 5 of Switch SW1 Heat, and SW2 Cool respectively with the bit values:

Bit 1 ON = 2%
Bit 2 ON = 4%
Bit 3 ON = 8%
Bit 4 ON = 16%
Bit 5 ON = 32%

.

Values for % (Ratio) can be set from 0% to 62% in 2% increments.

STAGED HEATING: (Fig.1 & Fig. 2)

The example in figure 1 shows: Lo Heat capacity is 40% of the total Chamber Heat Capability.
Hi Heat capacity is 60% of the total Chamber Heat Capability.
Then, a choice of 40% on SW1 (bits 3 and bits 5 ON) would insure that the Lo Heat proportional band would be the first 40% of the controller output.

The Lo heat output would start when the Controller output is greater than 0% and would increase linearly to 100% as the Controller output became 40%.

The Hi heat output would start when the Controller output is greater than 40% and would increase linearly to 100% as the Controller output became 100%.

If you were to Enter a controller Proportional band of 10 degrees, the effective Lo Heat proportional band would be equal to 40% of 10 degrees or 4 degrees.

The Corresponding Hi Heat Proportional band is then 6 degrees (10 minus 4 = 6).

Therefore the Heat gain would be constant over the total controller proportional band of 10 degrees.

The Hi heat output would not start until the Lo Heat output was at 100%.

Figure 2 is for the condition of Lo Heat = 50% of total heat capacity.

STAGED COOLING: (Fig. 3)

The lo cooling capability is typically much smaller than the Hi cooling. In a typical chamber system, the lo cooling might be 20 to 25% of the total Cooling capacity (small liquid compared to large liquid) valve.

24% of the total cooling would mean that the Hi cooling then has 76% of the total cooling capacity.

System Gain is a function of the controller and the transfer ratios between delta controller output and delta Cooling output.

The same controller output incremental change produces a much larger cooling effect if it is working the large liquid valve as compared to the incremental low cooling output.

This is another way of stating: for the same controller gain, the cooling system gain for large liquid valve operation is much greater than that of the small liquid.

Ideally, for easy system tuning, you would like to have the gain invariant with respect to High Liquid or Low Liquid control valve operation.

The 2192 Split Band Stager allows you to compensate for the difference in cooling capacity transfer-function utilizing Lo cool and Hi cool valves.

If the Lo Cool system is 24% of the total, just set the Hi Cool % Start Switch to 24 %. The 2192 Split Band Stager compensates for the difference in the Large Liquid and Small Liquid Cooling Capabilities.   (See Figure 3)

JC SYSTEMS SPLIT BAND SMART STAGING (HEATING 40% & 60%)

LO HEAT TO HI HEAT RATIO IS: 40% (LO) TO 60% (HI)

**LO HEAT OUTPUT STARTS AT 0% CONTROLLER OUTPUT (0% LO HEAT)
TO 40% CONTROLLER OUTPUT (100% LO HEAT)**

**HI HEAT OUTPUT STARTS AT 40% CONTROLLER OUTPUT (0% HI HEAT)
TO 100 % CONTROLLER OUTPUT (100% HI HEAT)**
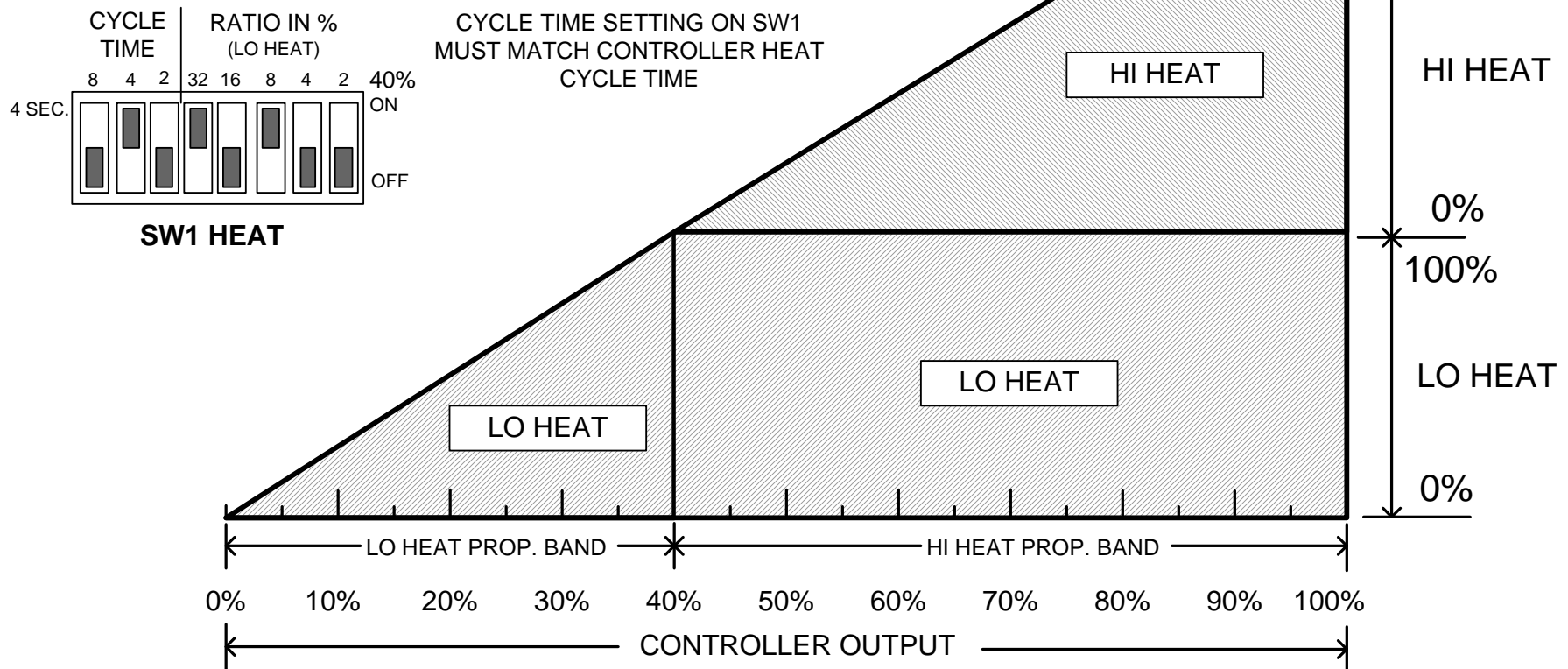
CONTROLLER HEAT CYCLE TIME SET FOR 4 SECONDS

CYCLE TIME	RATIO IN % (LO HEAT)
8 4 2	32 16 8 4 2

4 SEC.

40%
ON
OFF

SW1 HEAT

CYCLE TIME SETTING ON SW1
MUST MATCH CONTROLLER HEAT
CYCLE TIME

100%

HI HEAT

0%

100%

LO HEAT

0%

HI HEAT

LO HEAT

LO HEAT

LO HEAT PROP. BAND   HI HEAT PROP. BAND

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

CONTROLLER OUTPUT

Figure 1

JC SYSTEMS SPLIT BAND SMART STAGING (HEATING (50% & 50%)

LO HEAT TO HI HEAT RATIO IS: 50% (LO) TO 50% (HI)

LO HEAT OUTPUT STARTS AT 0% CONTROLLER OUTPUT (0% LO HEAT)
TO 50% CONTROLLER OUTPUT (100% LO HEAT)

HI HEAT OUTPUT STARTS AT 50% CONTROLLER OUTPUT (0% HI HEAT)
TO 100 % CONTROLLER OUTPUT (100% HI HEAT)

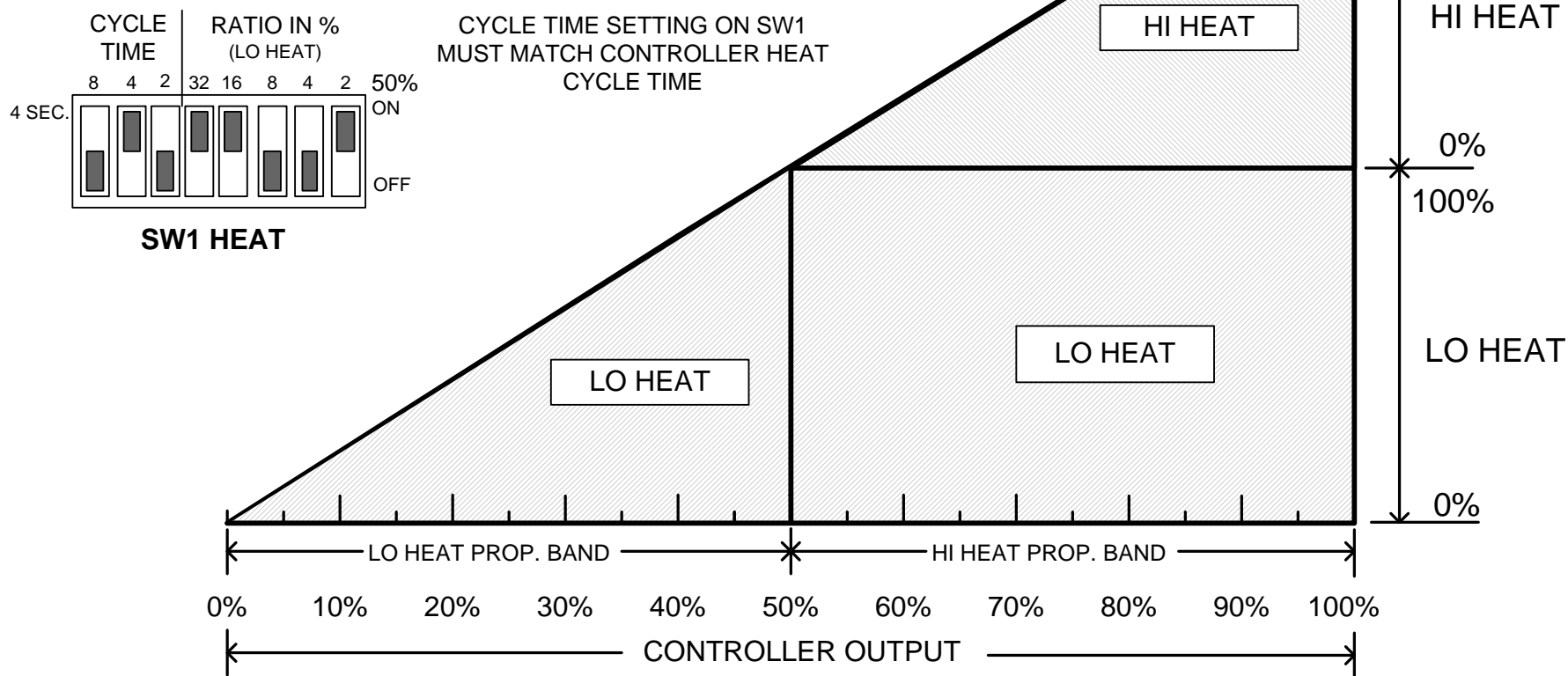**CONTROLLER HEAT CYCLE TIME SET FOR 4 SECONDS**

Figure 2

JC SYSTEMS SPLIT BAND SMART STAGING (COOLING 24% & 76%)

LO COOL TO HI COOL RATIO IS: 24% (LO) TO 76% (HI)

LO COOL OUTPUT STARTS AT 0% CONTROLLER OUTPUT (0% LO COOL)
TO 24% CONTROLLER OUTPUT (100% LO COOL)

HI COOL OUTPUT STARTS AT 24% CONTROLLER OUTPUT (0% HI COOL)
TO 100 % CONTROLLER OUTPUT (100% HI COOL)

CONTROLLER COOL CYCLE TIME SET FOR 4 SECONDS

CYCLE TIME SETTING ON SW2
MUST MATCH CONTROLLER HEAT
CYCLE TIME

CYCLE TIME

RATIO IN %
(LO COOL)

| 8 | 4 | 2 | 32 | 16 | 8 | 4 | 2 | 24% |

4 SEC.

ON

OFF

SW2 COOL

100%

HI COOL

HI COOL

0%

0%

100%

LO COOL

LO COOL

LO COOL

0%

LO COOL
PROP. BAND

HI COOL PROP. BAND

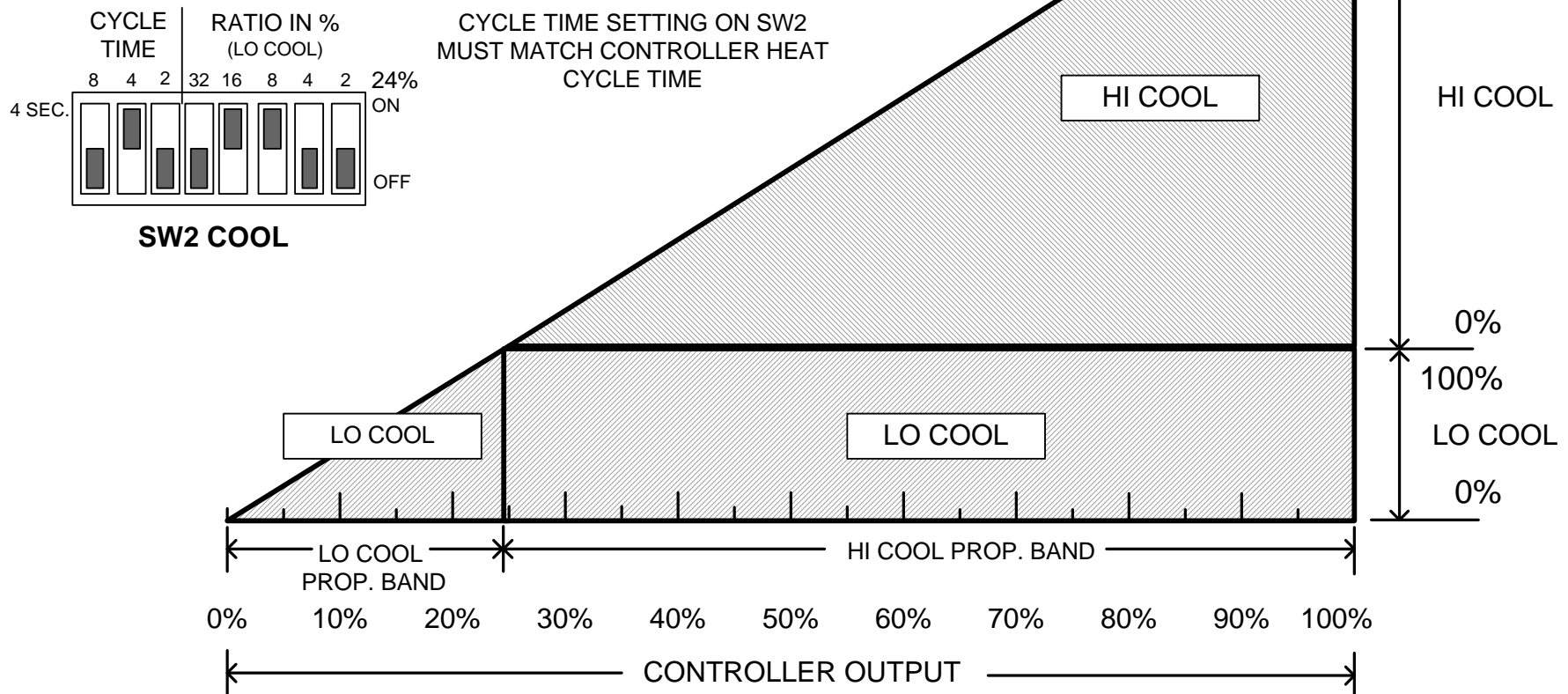0%   10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

CONTROLLER OUTPUT

Figure 3

JC Systems A2192 Version III - Chamber Enhancer

Figure 4

Document: A2192_Manual.pdf Revision: 3/9/2019