Hoffman|Controls

Installation & Operating Instructions

744-HC and 744-HCP Series Step Controllers

Description

The 744-HC and 744-HCP Series are "first on/last off" electronic Step Controllers. They are available in 2, 4, or 6 stages, with S.P.D.T. (Form C) isolated pilot duty relays. Three Controllers may be sequenced providing up to 18 stages. The Step Controllers are assembled and mounted in a track with cover.

The 744-HC Series is capable of accepting any of five electric/electronic input signals; 10K (65°–85°F), Temperature Sensing IC (30°–160°), 1–20V DC, 1–20 mA and 0–135 Ohms. In addition, the 744-HC Series comes with an on-board setpoint and remote sensor. Each input signal has a designated terminal block location on the PC board.

The 744-HCP Series features an on-board pneumatic transducer that directly accepts a 0–15 psi pneumatic input.

The control incorporates two (0.6–14V DC) internal (heating/cooling) ramps that span the input signal ranges. Any stage may be located on either the heating or cooling ramp. This eliminates the requirement for a separate span adjustment on each ramp. All stages are N.O./N.C. (Form-C) isolated output relays, each with a dedicated common terminal.

Application

All 744-H and 744-HCP Series Step Controllers are factory programmed and calibrated (see Table 1).

Typical Applications

- Compressors, or compressors and unloaders.
- Pumps • Blowers • Fans • Boilers
- Electric heating elements (circuits)

The Controller is designed to be installed in a typical control panel protected from the weather. Installations should be condensation free and between –30°F to 167°F. Do not install on a vibrating surface or in an airtight compartment.

The installer must provide 24V AC power and select an input signal that will utilize the factory standard calibration. The input signal selected must be within the precalibrated spans depicted in the 744-HC & 744-HCP Calibration Curves.

NOTE

744-HC and 744-HCP will accept two input signals simultaneously, with only one exception; 1–20V DC and 1–20 mA. This feature allows each application to utilize two separate inputs to control the proportional output of the load.

Factory Standard Calibration – Table 1

Input Signal Range	Input Signal at Set Point &	Offset From Set Point/ Between Stages
65 – 85°F	°F Selected	0.7°F
30 – 160°F	°F Selected	2.0°F
10 – 135 Ohms	70 Ohms	8.0 Ohms
1 – 10V DC	5 Volts DC	1.2 Volts DC
1 – 10 mA	5 mA	1.2 mA
9 – 13 psi	2 psi	0.5 psi

Differential Stage Settings – Table 2

Analog Input Signals	Input Signal Ranges	Multiplier X1 Factory Std.	X2 Opt.	X3 Opt.
10K	65°–85°	0.4°	1.0°	1.5°
Temp. Sens. IC	30°–160°	1.4°	2.5°	4°
Ohms	10–135 Ohms	5 Ohms	11 Ohms	17 Ohms
Volts DC	1–20V	0.76 V	1.7 V	2.7 V
mA	1–20 mA	0.76 mA	1.7 mA	2.5 mA
psi	0–15 psi	0.45 psi	0.85 psi	1.3 psi

Differential (Hysteresis) – signal change from "turn on" to "turn off". Differential affects "turn off" only.

Field Calibration

If the factory standard programming and calibration of stages is not acceptable, field calibration will be required.

The 744-HC Series Step Controller is designed to allow the user to reprogram and recalibrate the controller's functions as required for any application.

The following information must be determined before field calibration may begin.

1. What are the total number of **stages required**?

   Heating _____ Cooling _____

   Note: If more than six (6) stages of heat and/or cool are required see 744-HC & 744-HCP Series Master & Slave Interconnect Wiring diagrams.

2. What is the required **input signal value** for setpoint in Ohms, VDC, mA, or psi? _____.

   (When HCC 906 Series Thermostat(s)/Sensors are used, input signal re-zeroing is not required.)

3. What is the required value (Ohms, VDC, mA or psi) for **the span** (from setpoint) for the stages required?

   Heating signal span value _____.
   Cooling signal span value _____.

4. What is the required **differential (hysteresis)** for each stage on each heating/cooling ramp?

   Heating differential _____ per stage.
   Cooling differential _____ per stage.

Field Calibration Instructions

Refer to Figure 1, "744-HC Step Controller Illustrated with 3 Stages Heat Followed by 3 Stages Cooling".

Step #1 — Labeling Relays

Stages are identified (left to right) "A" through "F". All Controller stages are factory set and programmed. Labeling those stages being used is required. Reprogramming the sequence and mode tabs may be necessary to obtain the required quantity of heating and/or cooling stages for the application.

A. Place heat (H1, H2, etc.) or cool (C1, C2, etc.) yellow labels on all relays "A" through "F" to identify the function of each stage. Always group all heating or cooling stages together, in sequence, from left to right.

B. If heating stages are required, attach H1, H2, etc. to the first (far left) and successive relays, until all heating relays are labeled.

C. If cooling stages are required, attach C1, C2, etc. in sequence to remaining unlabeled relays.

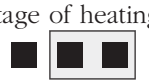
NOTE

Do not label relays that are not used.

Step #2 — Programming 1st Stage Sequence Tabs

Proceed to Step #3 when using factory programmed tabs for the first stage of heating or cooling. If not, all sequence tabs must be reset.

A. The first row of tabs are sequencing tabs. Install tab (adjacent to L.E.D.) on *CENTER-RIGHT* post position only for the first stage of heating and/or cooling.

1 Sequence Tab 

B. The 2nd, 3rd, 4th, etc. stages of heating and/or cooling tabs should be installed in the *CENTER-LEFT* position.

1 Sequence Tab 

C. Storage Position – For all stages not being used install tabs in the storage position.

1 Sequence Tab 

Step #3 — Mode Tabs (2nd row of tabs) Dedicating Heat or Cool Stages

Proceed to Step #4 when using factory installed heat & cool mode tabs. If not, all mode tabs must be reset.

Install each tab in its appropriate Heat or Cool position.

Center/Right — Heating **Center/Left — Cooling**

Install all unused mode tabs in the storage position.

Storage Position 

Step #4 **— Re-zero Set Point**

Re-zero of the thermistor (10K) input is not necessary. If re-zero is required of the setpoint for Ohms, VDC, mA or psi input signal, proceed with Step #4; otherwise proceed to Step #5.

Heat Re-zero

A. Connect DVM to "H" and "COM" (Voltage Ramp) test posts and supply the required input signal (setpoint) in Ohms, VDC, mA or psi to the Controller.

B. Adjust the Heat Zero pot until 0.6V-DC (Heat Ramp Volts) is observed on the DVM. H

Cool Re-zero Set Point

A. Relocate DVM to "C" and "COM" (Voltage Ramp) test posts and supply the required input signal (setpoint) in Ohms, VDC, mA or psi to the Controller.

B. Adjust the Cool Zero pot until 0.6V DC (Cool Ramp Volts) is observed on the DVM.

Setpoint has now been re-zeroed to the new values selected for heating and cooling setpoints.

NOTE

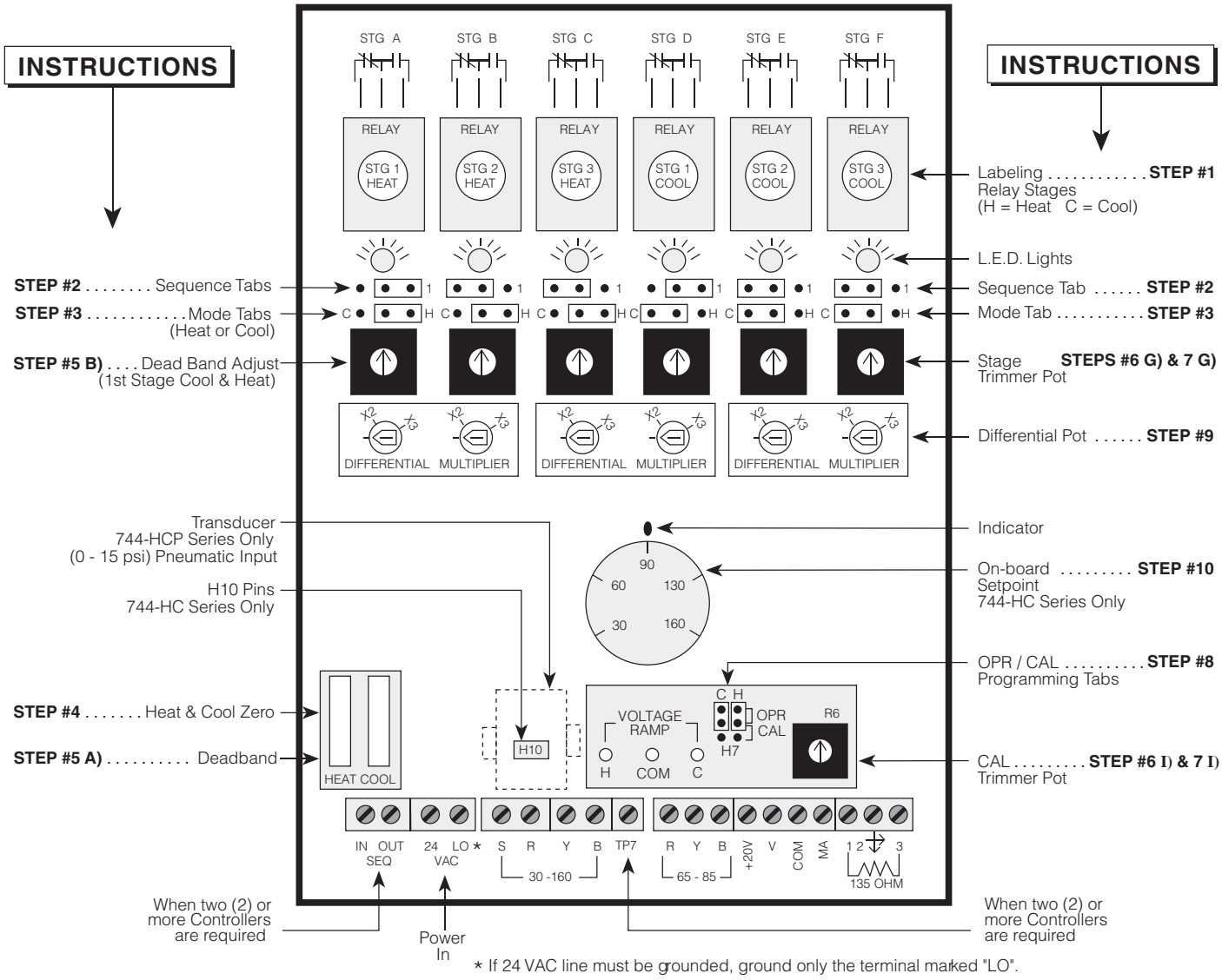
A "synchronization delay" (normal occurrence) may be observed between the illumination of an L.E.D. and the engagement of the associated relay.

Step #5 — Dead Band

Proceed to Step #6 when using factory preset deadband. If not, there are two methods available for recalibrating deadband.

Method 1:
Dead band may be obtained by re-zeroing each input signal (heat or cool) as required.

Method 2:
Dead band may be obtained by separating the first heat and cool stage on their separate internal ramps (See Step #6 and/or #7 with 744-HC and 744-HCP Calibration Curves).



744-6HC Step Controller Illustrated with 3 Stages Heat and 3 Stages Cooling
Figure 1

Step #6 — Recalibrating Heat Stages

Proceed to Step #7 when using factory preset heating stages. If not, all stage trimmer pots must be recalibrated.

A. Select appropriate Input Signal vs. Ramp Volts DC Calibration Curve.

B. Determine the input signal value required for each heating stage and the corresponding ramp volts DC (See 744-HC, HCP Calibration Curves literature).

C. Install the "H" tab to the "CAL" position at the H7 location. The "C" tab should be removed or placed in the storage position.

D. Reset all heat stage trimmer pots fully CCW.

E. Install DVM on "H" and "COM" (Voltage Ramp) test posts.

F. Adjust "CAL" trimmer pot (R6) to the Heat Ramp Volts, determined in b., for the first stage of heat.

G. Adjust Stage "A" (first stage) trimmer pot CW while observing Stage A L.E.D. STOP adjusting trimmer pot when L.E.D. turns ON. Repeat this step as necessary to reach an accurate adjustment.

H. Repeat Step #6 A. through G. for each heat stage used (Stage "B", Stage "C" etc.).

I. After calibration of the heating stages, slowly adjust CAL trimmer pot (R6) from full CW to full CCW to energize and de-energize stages.

IMPORTANT

If the stages do not de-energize in the following order, repeat Steps #6A. through G.

- Last stage must de-energize first.
- The first stage must de-energize last.
- Each stage from the last to the first must de-energize sequentially.

Step #7 — Recalibrating Cool Stages

Proceed to Step #8 when using factory preset cooling stages. If not, all stage trimmer pots must be recalibrated.

A. Select appropriate Input Signal vs. Ramp Volts (see 744-HC, HCP Calibration Curves).

B. Determine the required input value for each cool stage and the corresponding Ramp Volts.

C. Install the "C" tab to the "CAL" position at H7 location. Remove the "H" tab or place it in the storage position.

D. Reset all cool stage trimmer pots fully CCW.

E. Install DVM on "C" and "COM" (Voltage Ramp) test posts.

F. Adjust CAL trimmer pot (R6) to the Cool Ramp as determined in B. above, for the first stage of cooling.

G. Adjust Stage "A" (first stage) trimmer pot CW while observing Stage "A" L.E.D. STOP adjusting trimmer pot when L.E.D. turns ON. Repeat this step as necessary to reach an accurate adjustment.

H. Repeat Steps A. through G. above for each heat stage used (Stage "B", Stage "C", etc.).

I. After calibration of cooling stages, slowly adjust CAL trimmer pot (R6) from full CW to full CCW to energize and de-energize stages.

IMPORTANT

If the stages do not de-energize in the following order, repeat Steps #7A. through G.

- Last stage must de-energize first.
- The first stage must de-energize last.
- Each stage from the last to the first must de-energize sequentially.

Step #8 — CAL & OPR Tab Installation

Remove both the "H" and "C" tabs from the H7 location. Install the "H" and "C" tabs in the "OPR" position. The input signal is now controlling staging.

Step #9 — Recalibrating Differentials Trimmers

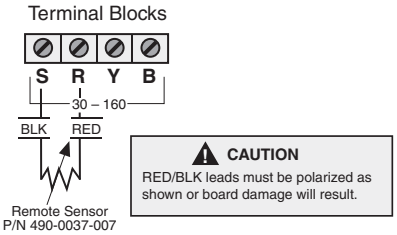
A. When factory programmed (standard) differential values are not acceptable, recalibration of the hysteresis is required.

B. Differential values listed in Table 2 are multipliers, and may be set to any multiplier value for any stage from the 1X (standard) up to 3X. Setting values between multipliers is acceptable.

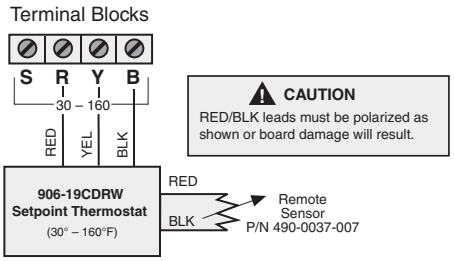
Step #10 — (30°–160°F) Temperature Sensing IC

Two options available:

Option 1: Use the on-board setpoint furnished on the 744-HC Series with a Remote Sensor (P/N 490-0037-007). Install a jumper on H10 pins (see Figure 1), located just above 30°–160°F terminal blocks (744-HC Series only). Terminate Sensor as shown.



Option 2: Use the 906-19CDRW Thermostat with Remote Sensor. Remove jumper from H10 pins on the 744-HC Series (see Figure 1). Terminate Thermostat as shown.



Input Combination Table 3

(4 Inputs Max — Highest Δ Input Will Control Operation)

Inputs	30° – 160°F	65° – 85°F	* (+)V – (–)LO	* (–)LO – (+)MA	135 Ohm	15 psi
30° – 160°F	N/A	X	X	*	X	N/A
30° – 160°F	N/A	X	*	X	X	N/A
65° – 85°F	X	N/A	X	*	X	N/A
65° – 85°F	X	N/A	*	X	X	N/A
(+)V – (–)LO	X	X	N/A	*	X	N/A
(–)LO – (+)MA	X	X	*	N/A	X	N/A
135 Ohm	X	X	X	*	N/A	N/A
135 Ohm	X	X	*	X	N/A	N/A
15 psi	N/A	N/A	N/A	N/A	N/A	only input

* "V" and "MA" input may ***never*** be used in combination with one another. Either may be used in combination with other input(s).

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