Application Note 1030:
MVZ/PVA Electric Heater Configuration, Electric Heat Kit Information & ETC setup

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Introduction

The MVZ/PVA vertical air handling unit is the first unit designed to be used with a Mitsubishi Electric Heat Kit (EH##-MPA-S/M/L) as opposed to a third party auxiliary heater. As such the unit's default settings have been modified to ensure that the Electric Heat Kit will operate effectively out of the box. These settings can be modified as desired to fit specific applications. As the default, the Electric Heat Kit is designed to operate based on drop in space temperature (default) or drop in ambient temp during normal heat pump operation. Supplemental default functions include Electric Heat Kit operation during error mode. The broad scope of error modes includes operation at ambient temperatures below the condensing unit's heating cut-out temperature.

This document is meant as a supplement to the MVZ/PVA installation & service manuals as well as the Electric Heat Kit installation manual. For additional details please consult these manuals.

MVZ/PVA Initial Settings

The unit is setup from the factory assuming that an Electric Heat Kit will be installed. This is done to provide emergency heat operation (operation during system error*1) and to prevent damage to the heater. Modes are changed via an MA style controller. Function settings are changed via the MHK1.

*1: Not applicable to communication error, return air thermistor error or motor error

Fan Settings (Default):

No CN4Y jumper, Mode 23 (function setting 123) set to **2**, Mode 25 (function setting 125) set to **1** (Default):

Fan operates in extra low fan speed during thermo-off (modifiable). Fan operates at speed indicated at controller during thermo-on. Fan operates at high fan speed when Electric Heat Kit is enabled (overrides fan speed setting at controller). The fan is always stopped during defrost operation.

By setting the Mode No. 23 in the Function Table in section 9-1, the following patterns of fan control will become possible.

Fan control patterns

CN4Y for FAN control (PAC-YU25HT)	Mode(function) No.23(123)	Fan in defrost	Fan(All modes other than defrost)	Factory setting
Disabled (CN4Y cannot be used with this unit)	1	STOP(Heater OFF)	Set(Heater ON*2)	-
	2	STOP(Heater OFF)	High*1(Heater ON*2)	○

*1 While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller.
*2 While the heater output is on in the Function Table in section 9-1, the heater will be ON except when the unit is in communication error, return air thermistor error and motor error.

⚠ *** If a heater is installed in the duct, do not use Panel heater connector. By doing so, the fan will turn off when the heater is on, which may result in fire.**

Fan Speed Setting During Heating Thermo-OFF:

Table 3.Controller Settings for Fan Operation

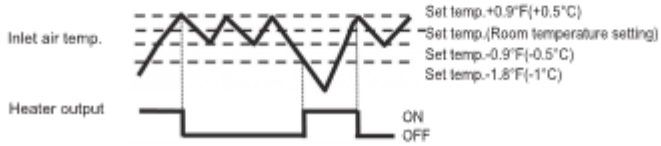
Mode	Indoor Unit Fan Operation		Setup function for MHK1 (PAR-21)	Setting	Mode no. MHK1 (PAR-21)	Setting	Controller Initial setting
	Heating Thermo - OFF	[DEFROST] or [ERROR]					
Fan control	Very low	Very low	123 (23)	2	125 (25)	1	O
	Stop	Remote controller setting	123 (23)	2	125 (25)	2	·
	Remote controller setting	Remote controller setting	123 (23)	2	125 (25)	3	·

Note: If stopping fan during heating thermo-off or cooling thermo-off it is recommended to sense at the wall controller as opposed to the unit's return air thermistor.

Heater Comfort Mode (Default):

Mode 23 (function setting 123) set to **2**, Mode 11 (function setting 111) set to **1** (Default):
During defrost CN24 is de-energized during error CN24 is energized.

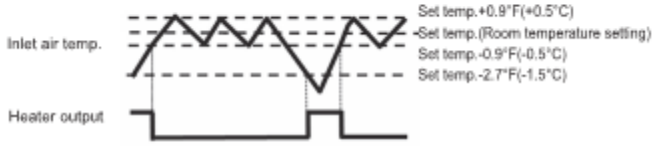
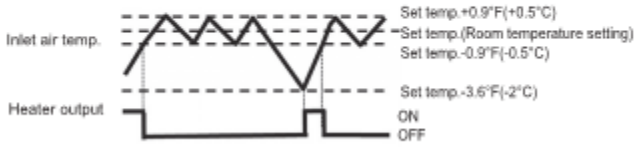
1st stage enabled at -1.8F
2nd stage enabled at -2.7F
1st & 2nd stage disabled at set point

Heater control			DIP switch setting		Initial setting
Pattern	Output	Details	SW3-2	SW3-4	
#2 (Enable heater comfort mode)	1st	Heater OFF Inlet air temp.≥ set temp. +0.9°F(+0.5°C) Heater ON Inlet air temp.< set temp. -0.9°F(-0.5°C) · The fan will stop and the heater will turn off when [DEFROST] is displayed.  	OFF	ON	O
	2nd	Heater OFF Inlet air temp.≥ set temp. +0.9°F(+0.5°C) Heater ON Inlet air temp.< set temp. -1.8°F(-1°C) · The fan will stop and the heater will turn off when [DEFROST] is displayed.  			

Heater Economy Mode:

Mode 23 (function setting 123) set to **2**, Mode 11 (function setting 111) set to **2**:
During defrost CN24 is de-energized during error CN24 is energized.

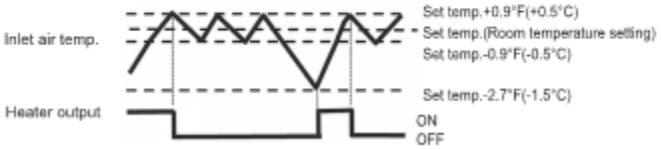
1st stage enabled at -3.6F
2nd stage enabled at -4.5F
1st & 2nd stage disabled at -1.8F

<table>
<tr><td colspan="3">Heater control</td><td>DIP switch setting</td><td>Initial setting</td></tr>
<tr><td>Pattern</td><td>Output</td><td>Details</td><td>SW3-2</td><td>SW3-4</td><td></td></tr>
<tr><td rowspan="2">#3 (Enable heater economy mode)</td><td>1st</td><td>Heater OFF
Inlet air temp.≥ set temp.-0.9°F(-0.5°C)
Heater ON
Inlet air temp.< set temp. -2.7°F(-1.5°C)
· The fan will stop and the heater will turn off when [DEFROST] is displayed.
 
</td><td>ON</td><td>ON</td><td>–</td></tr>
<tr><td>2nd</td><td>Inlet air temp.≥ set temp.-0.9°F(-0.5°C)
Heater ON
Inlet air temp.< set temp. -3.6°F(-2°C)
· The fan will stop and the heater will turn off when [DEFROST] is displayed.
 
</td><td></td><td></td><td></td></tr>
</table>

Heater Basic Control Mode (Single Stage Operation):

Mode 23 (function setting 123) set to **1**: During defrost CN24 is de-energized during error CN24 is de-energized.

1st stage enabled at -4.5F
1st stage disabled at set point

Heater control			DIP switch setting		Initial setting
Pattern	Output	Details	SW3-2	SW3-4	
#1 (Enable heater basic control)	1st	Heater OFF Inlet air temp. ≥ set temp.+0.9°F(+0.5°C) Heater ON Inlet air temp.< set temp. -2.7°F(-1.5°C) · The fan will stop and the heater will turn off when [DEFROST] or [ERROR] is displayed.  	–	OFF	–

If an Electric Heat Kit is not used the PVFY installation manual recommends that Mode 23 (function setting 123) be set to **1** such that CN24 is de-energized during error.

MVZ/PVA Required Changes When Using Electric Heat Kit

The approximate pressure drop attributed to the Electric Heat Kit is 0.20inWG. When calculating the duct pressure drop 0.20inWG should be added to the cumulative system pressure drop. The MVZ/PVA units have a default static pressure setting of 0.50inWG (Mode 8 (function setting 108) set to **2**, Mode 10 (function setting 110) set to **1**). The maximum static pressure setting is 0.80inWG; therefore, the maximum ESP due to the ductwork cannot exceed 0.60inWG. Again, the unit will operate at high fan speed any time the Electric Heat Kit is operating. Consult the MVZ/PVA engineering manuals for the units' fan curves at different static pressure settings.

Vertical, Horizontal Left, Horizontal Right External Static Pressure Setting

External Static Pressure	Setting No. of Mode/Function 08/108	Setting No. of Mode/ Function 10/110 (Factory Setting)
0.3 in. WG [75Pa]	1	1
0.5 in. WG [125Pa] **(Factory Setting)**	2	1
0.8 in. WG [200Pa]	3	1

Downflow External Static Pressure Setting

External Static Pressure	Setting No. of Mode/Function 08/108	Setting No. of Mode/Function 10/110
0.3 in. WG [75Pa]	1	2
0.5 in. WG [125Pa] **(Factory Setting)**	2	2
0.8 in. WG [200Pa]*	3	2

*MVZ-A36 in Downflow External Static pressure: 0.60
*PVA-A42 in Downflow External Static pressure: 0.70

Electric Heat Kits

Basic Information:

Depending on the size of the unit and additional heat needed there will be either a single stage or two stages of backup heat. The electric heater model numbers denote the kW rating e.g. a EH03-MPA-S is a 3kW small chassis electric heater.

		Electric Heat Kit							
		EH03-MPA-S	EH05-MPA-S	EH08-MPA-S	EH08-MPA-M	EH10-MPA-M	EH10-MPA-L	EH15-MPAS-L	EH17-MPAS-L
Stages (1st, 2nd)		3	5	4+4	4+4	5+5	5+5	7.5+7.5	8.75+8.75
Air Handler Model	MVZ-A12AA4	o	o						
	MVZ-A18AA4	o	o	o					
	MVZ-A24AA4	o	o	o					
	MVZ-A30AA4				o	o			
	MVZ-A36AA4				o	o			
	PVA-A30AA4				o	o			
	PVA-A36AA4						o	o	
	PVA-A42AA4						o	o	o

Electrical Specs:

The heaters are powered separately from the PVFY unit and require 208/240V single phase electrical service. Electrical specifications can be seen below. The units include the necessary relays and wiring harnesses to integrate the unit with CN24-1 and CN24-2 (if 2 stages are present).

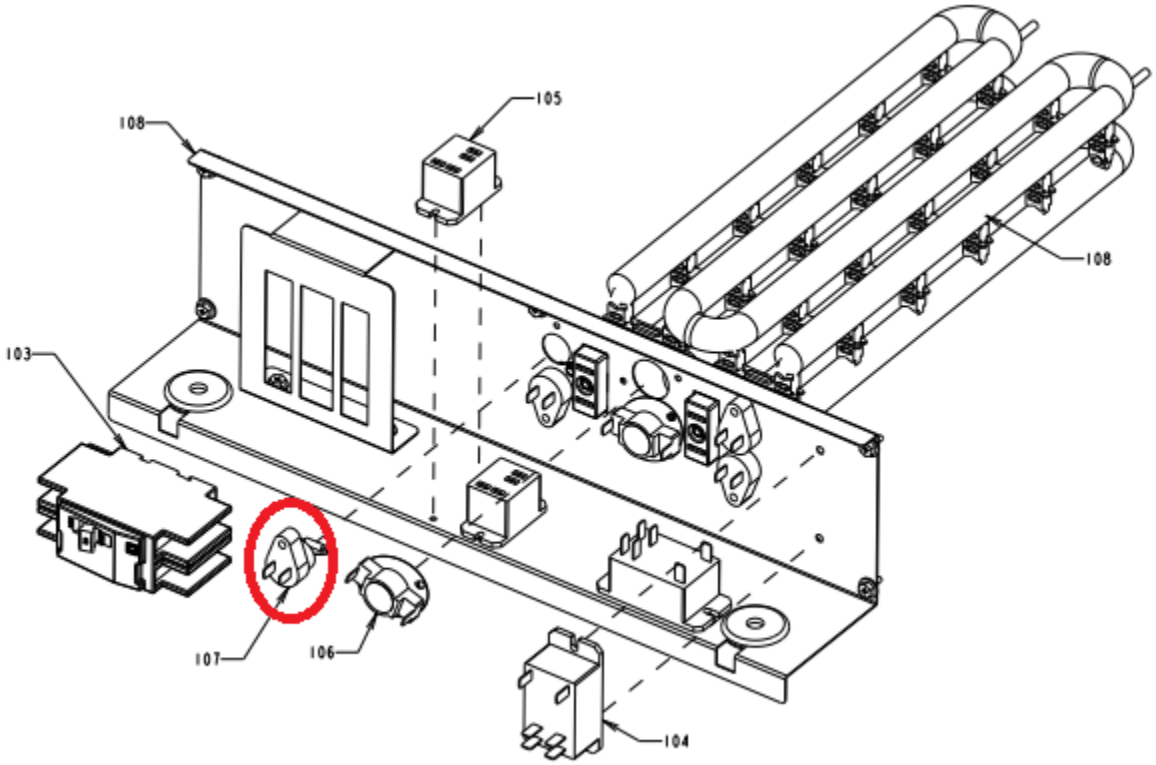
Electric Heat Part Number	Heater kW 208V/240V		Heater Amps1 208V/240V	MCA1[1] 208V/240V	MOP1[1] 208V/240V	Htr & Mtr Amps2[2] 208V/240V	MCA2[2] 208V/240V	MOP2[2] 208V/240V	Factory Installed Circuit Breaker
EH03-MPA-S	2.3/3.0		10.8/12.5	13.5/15.6	15/20	13.2/14.9	16.5/18.6	20/20	20
EH05-MPA-S	3.8/5.0		18.1/20.8	22.6/26	25/30	20.5/23.2	25.6/29	30/30	30
EH08-MPA-S	6.0/8.0		28.9/33.3	36.1/41.7	40/45	31.3/35.7	39.1/44.7	40/45	45
EH08-MPA-M	6.0/8.0		28.9/33.3	36.1/41.7	40/45	32.2/36.6	40.2/45.8	45/50	50
EH10-MPA-M	7.5/10.0		36.1/41.7	45.1/52.1	50/60	39.4/45	49.3/56.2	50/60	60
EH10-MPA-L	7.5/10.0		36.1/41.7	45.1/52.1	50/60	40.6/46.2	50.8/57.7	60/60	60
EH15-MPAS-L	11.3/15.0	Circuit 1	27.1/31.2	33.9/39.1	35/40	31.6/35.8	39.5/44.7	40/45	45
		Circuit 2	27.1/31.2	33.9/39.1	35/40	27.1/31.2	33.9/39.1	35/40	40
EH17-MPAS-L	13.2/17.5	Circuit 1	31.6/36.5	39.5/45.6	40/50	36.1/41	45.1/51.2	45/60	60
		Circuit 2	31.6/36.5	39.5/45.6	40/50	31.6/36.5	39.5/45.6	40/50	50

1. Heater amps; no motor
2. Heater and motor amps (connect air handler power supply to largest circuit breaker)
3. 60Hz
4. Unit tested at 0.60 in WG external static pressure
5. Minimum installation clearance to combustible material – 0"
6. Maximum outlet air temperature 200° F

Safeties:

The Electric Heat Kits have built in circuit breakers for overload scenarious and to function as a local disconnect. The units also have multiple built in fusable links rated at a maximum temperature. These are one time use and replacable as individual components.

No.	Part No.	Part Name	Spec.	EH03-MPA-S	EH05-MPA-S	EH08-MPA-S	EH08-MPA-M	EH10-MPA-M	EH10-MPA-L	EH15-MPAS-L	EH17-MPAS-L	Notes for models	Revision info.
107	0200-218-001P	FUSIBLE LINK 117C									4	thermal fuse	
107	0200-200-001P	FUSIBLE LINK 110C				4						thermal fuse	
107	0200-196-001P	FUSIBLE LINK 104C						2		4		thermal fuse	
107	0200-150-001P	FUSIBLE LINK 98C					4		2			thermal fuse	
107	0200-086-001P	FUSIBLE LINK 93C			1							thermal fuse	
107	0200-221-001P	FUSIBLE LINK 72C		2								thermal fuse	

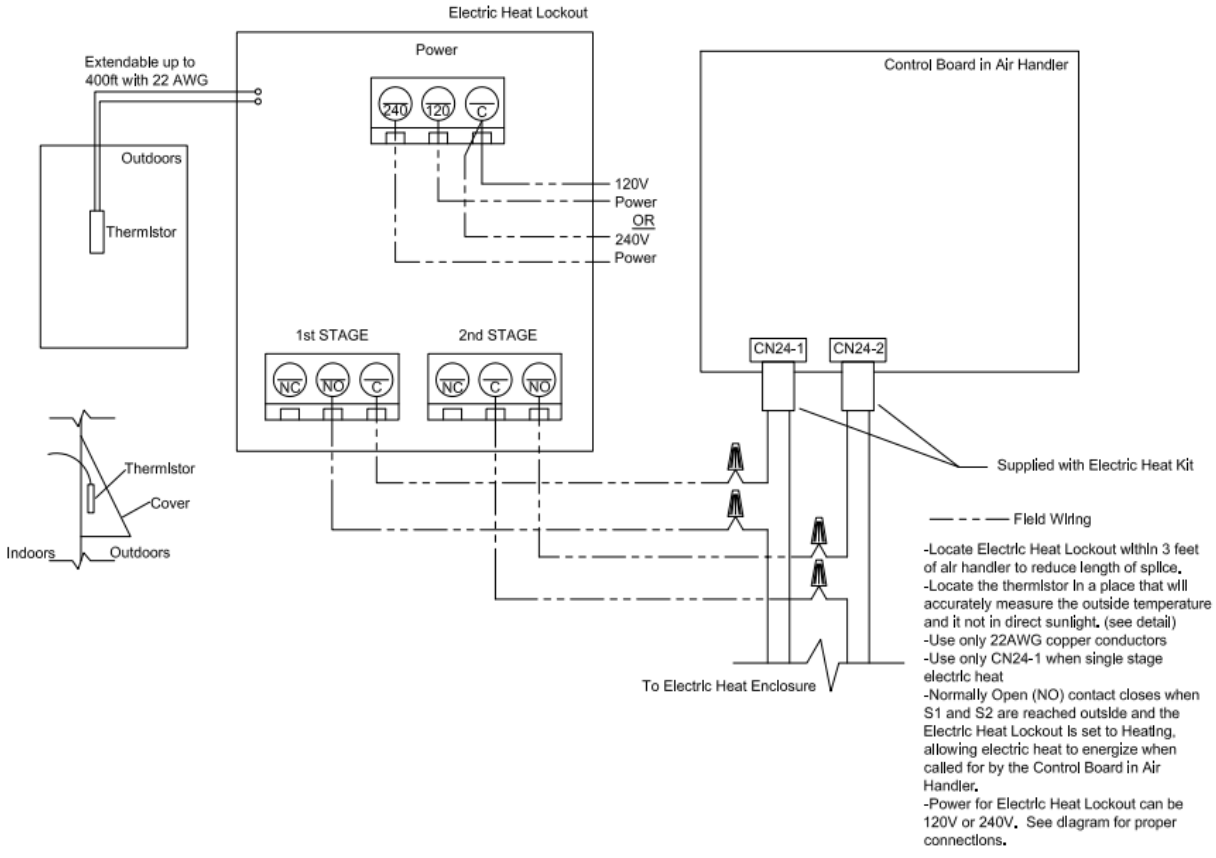


Electric Heat Lockout – ETC-211000-MIT

The Electric Heater Kit's operation is not locked out by default i.e. the heater will energize anytime the space temperature drops -1.8F below the set temp (default value, value is adjustable based on heater control mode). If an ambient temperature lockout is desired the ETC-211000-MIT accessory can be utilized.

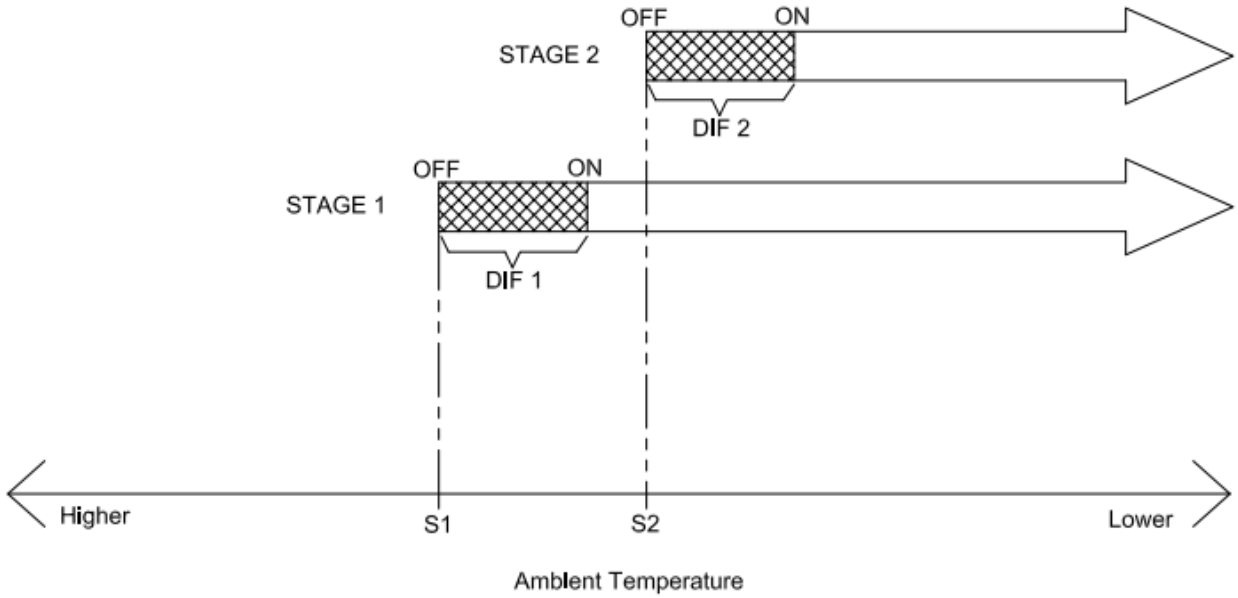
The ETC kit comes with a control module and ambient temperature sensor module. The control module accessory requires 120 or 208/240V single phase power for operation. The ambient temperature sensor module comes with an 8' cable which can be extended to 800' with 22 AWG or larger copper cable to avoid added resistance. The control module is designed to be installed indoors, within 3' of the AHU to reduce the length of the splice. The ambient temperature sensor should be mounted outside, on the north side of the building (to reduce direct sunlight) and above the snow line.

Wiring Diagram



Controller Setup

The controller has 2 ambient temperature settings, one for Stage 1 (S1) and one for Stage 2 (S2). In addition, each stage has a selectable temperature differential associated with it.



Example:
S1 = 32F, DIF 1 = 3F
S2 = 25F, DIF 2 = 3F

Given the above parameters, stage 1's normally open contact within the control module will close at 29F (32F – 3F) which allows the first stage of electric heat to turn on if there is a demand (if the space temp is 1.8F below the set temperature of the controller). Stage 2's normally open contact within the control module will close at 22F (25F – 3F) which allows the second stage of electric heat to turn on if there is a demand (if the space temp is 2.7F below the set temperature of the controller).

It's important to note that the ETC solely uses ambient temperature for the enabling/disabling of the 2 stages of electric heat. If the heat pump goes into an error condition the 2 stages of electric heat **WILL NOT ENABLE UNLESS THE AMBIENT TEMPERATURE(S) SET IN THE ETC ALLOW**.

Typical Application

Example:
Structure heat loss is "55,000 Btu/h at -10˚ F" outdoor design temperature
PUZ-HA36 Hyper Heat Outdoor unit with a PVA-36 multi-position air handler
10 KW (34,120 Btu/h) Electric heat with two stages of 5 KW (17,060 Btu/h) each

The best way to set the outdoor electric heat lockout is to do a load calculation and load profile as shown below. This will provide the most energy efficient operation and homeowner comfort. As usual, calculate the structure heat loss at the local outdoor design temperature. In this example, the heating loss is 55,000 Btu/h at an outdoor design temperature of -10°F. This is shown at the point “L”. Plot a line from there to the outdoor temperature of "70˚ F" with no heat loss. This is the load profile of the structure.

Next, plot the capacity of the heat pump as shown below including the derate at lower outdoor temperatures. The point where these lines cross will show where the first stage electric heat should be allowed to energize at point (“A”). Plot the electric heating capacity for the first stage electric heat as shown. The point where this line crosses the load line (“B”) indicates where the second stage electric heat should be allowed to energize. In this example the first stage electric heat (CN24-1) should be allowed to energize at approximately "12˚ F" outdoor temperature. The second stage electric heat (CN24-2) should be allowed to energize at approximately "-5˚ F" outdoor temperature. If there is only one stage of electric heat, only (CN24-1) needs to be set at point (“A”)