



DJM2 control board.

Operation guide.

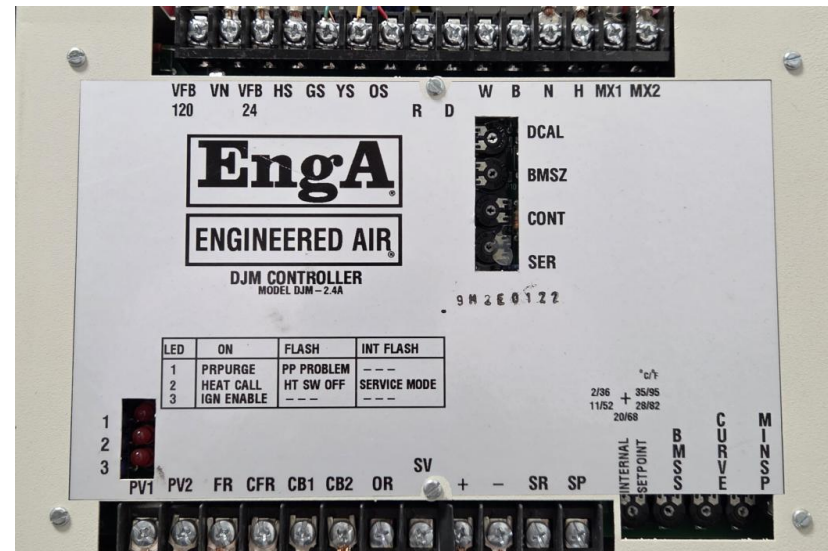


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DJM2 controller.

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DJM2 controller.

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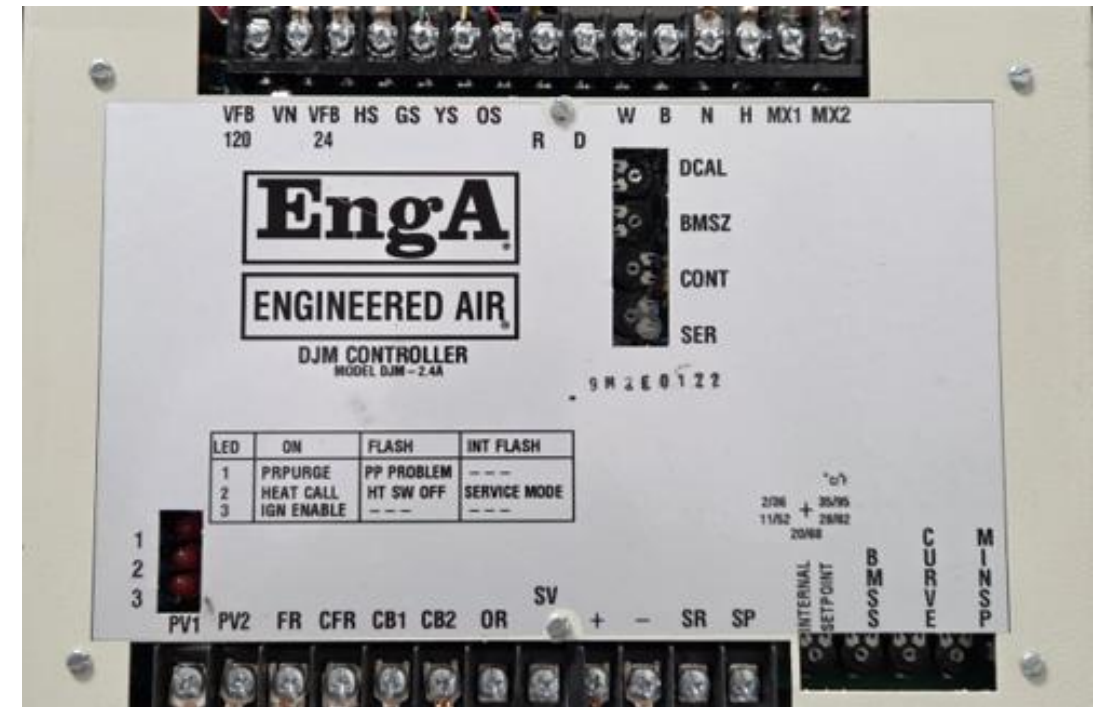
DJM2 controller.

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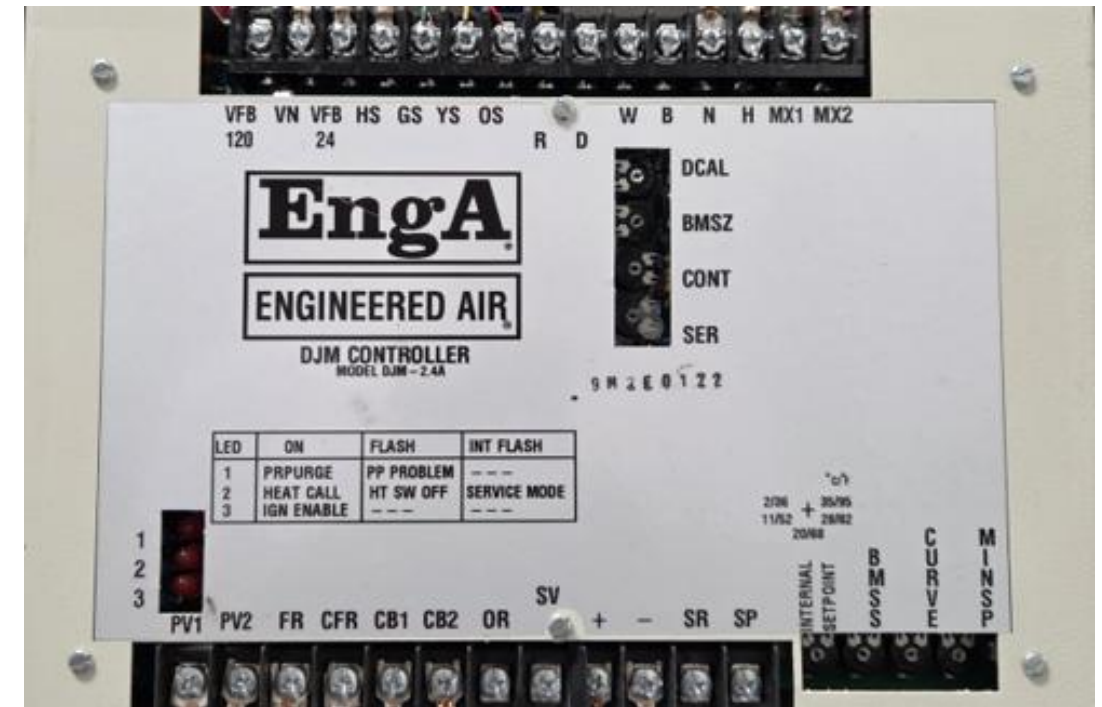
Introduction.

- Part of the TRAC family of controllers.
- Used with DJ(E,S,X) units up to 1.4MBH.
- Independent heating and ventilation controller.
- Can be controlled C-TRAC or BMS.



Introduction.

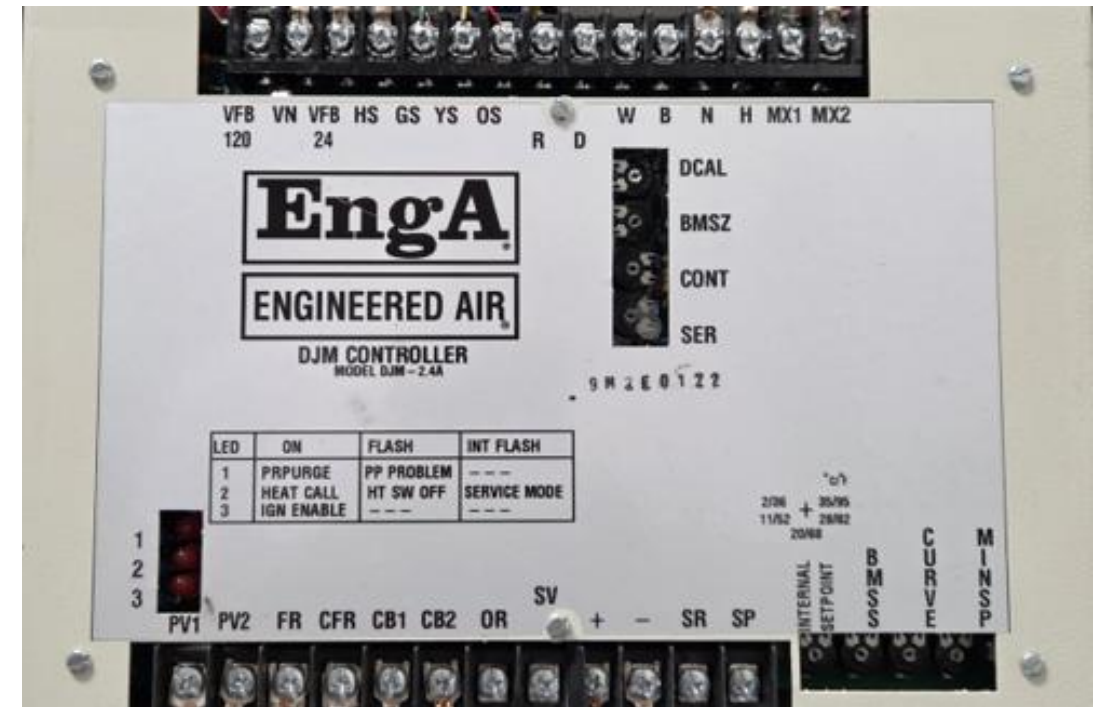
- Operating temperature:
-40 to 105°F (-40 to 40.6°C)
- Discharge setpoint:
50 to 95°F (10 to 35°C)
- Power supply: 24 Vac, 40va.
- Fuse Rating: 1.5 GDC slow-blow.



Function.

Two main functions.

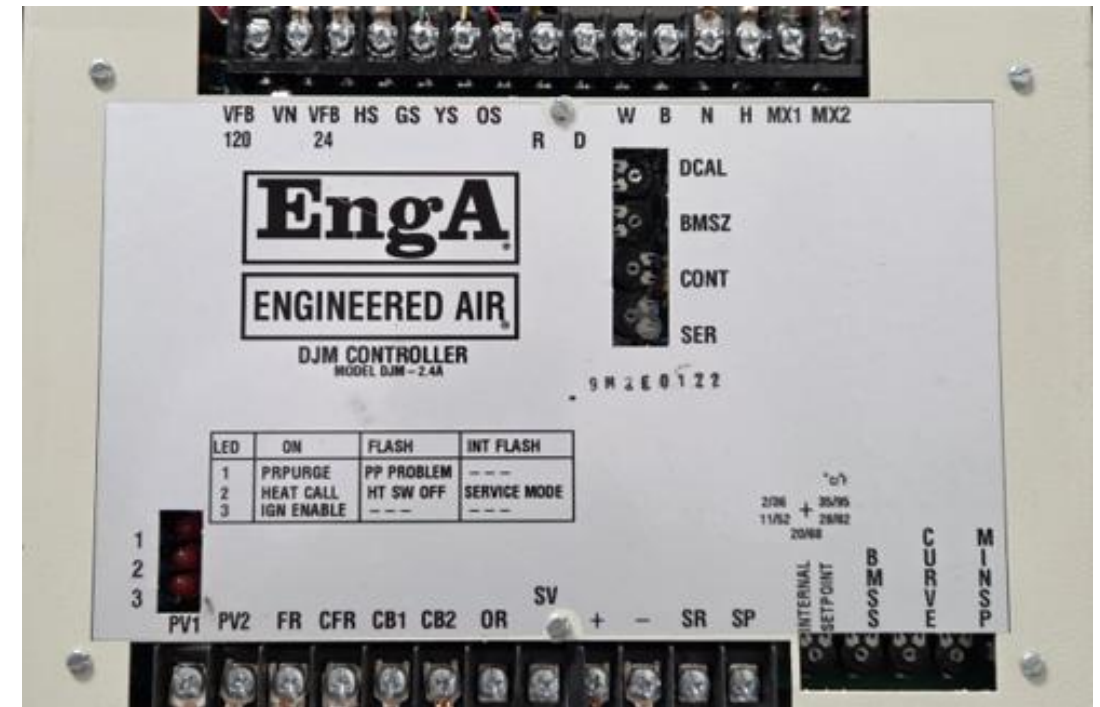
1. Burner management.
 2. Temperature control.
- Stand alone.
 - Optional discharge temperature reset functions.
 - P.I. control.
 - The DJM2 has no blower or damper control.
 - No low limit.



What is P.I. control?

P.I. control.

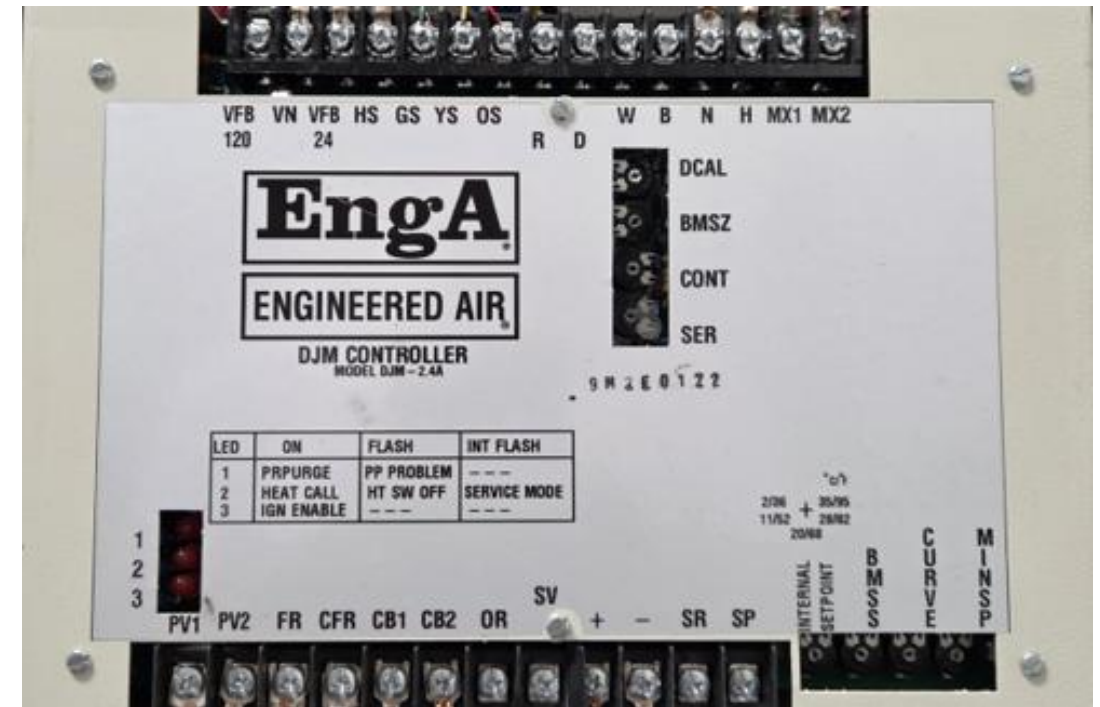
- P.I. stands for proportional and Integral control.
- What does that mean and how does it work?



What is P.I. control?

P.I. control.

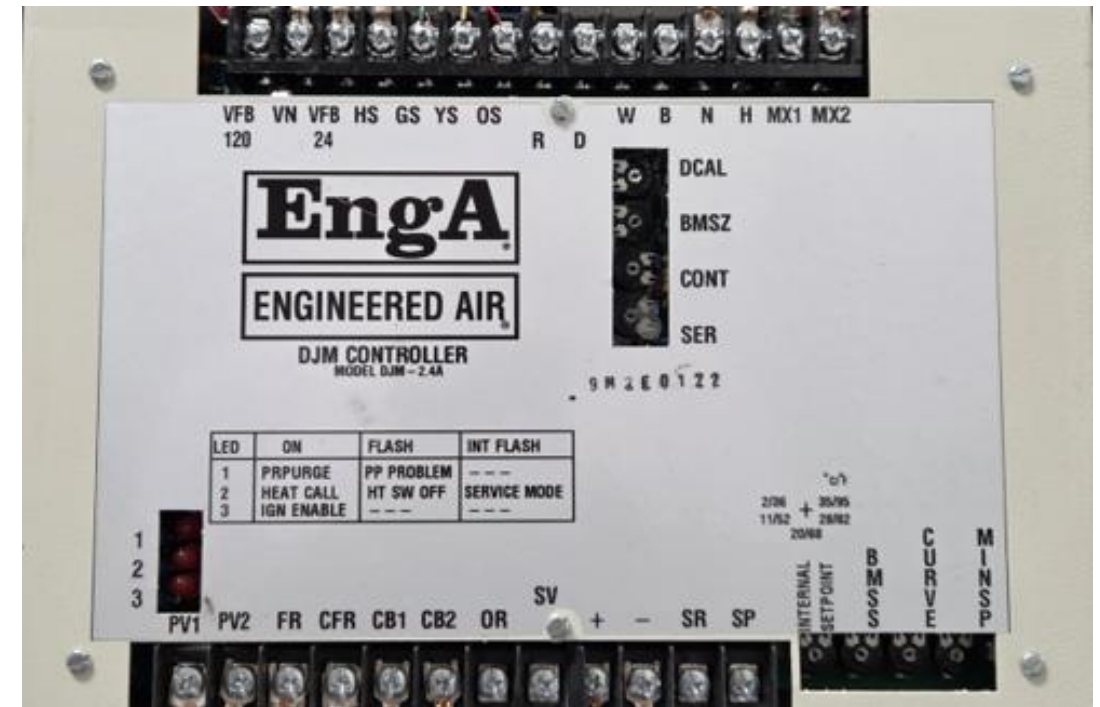
- A Proportional-Integral (P.I.) controller in a heating system continuously adjusts the heating output based on both the current temperature error (how far you are from the setpoint) and the accumulated error over time. This prevents the system from oscillating while eliminating the "droop" (steady-state offset) common in basic proportional systems.



What is P.I. control?

P.I. control.

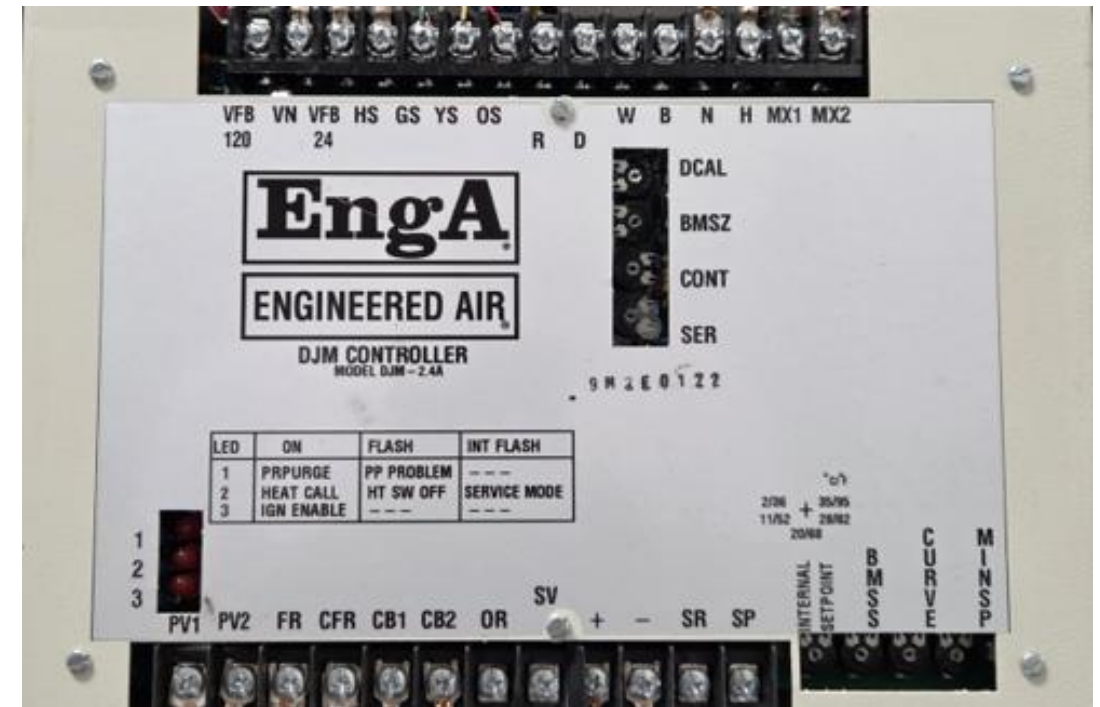
- P - Proportional: Acts as the "immediate reaction." The farther the current temperature is from the setpoint, the harder the unit works. As the temperature nears the setpoint, it scales back the signal to prevent overshooting.



What is P.I. control?

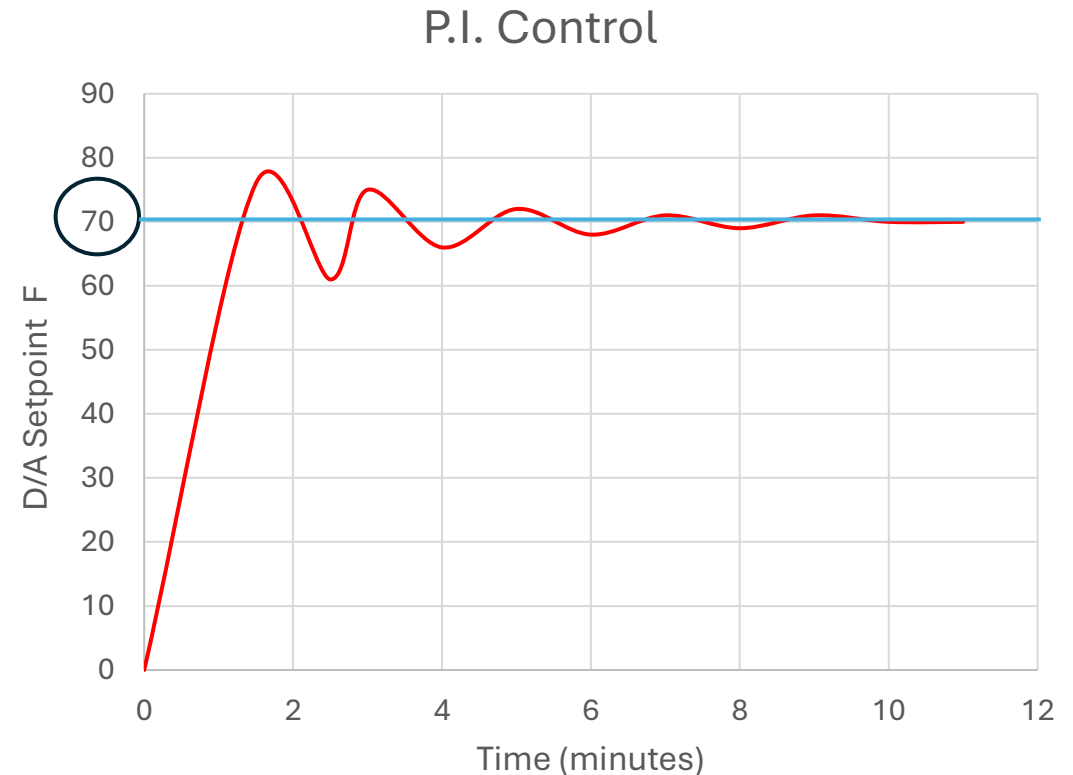
P.I. control.

- I - Integral: Acts as the "long-term memory." If the P-controller leaves the system stuck slightly below the setpoint temperature, the I-controller slowly accumulates that minor, lingering error over time. It continuously boosts the output until the temperature perfectly aligns with the setpoint.



What is P.I. control?

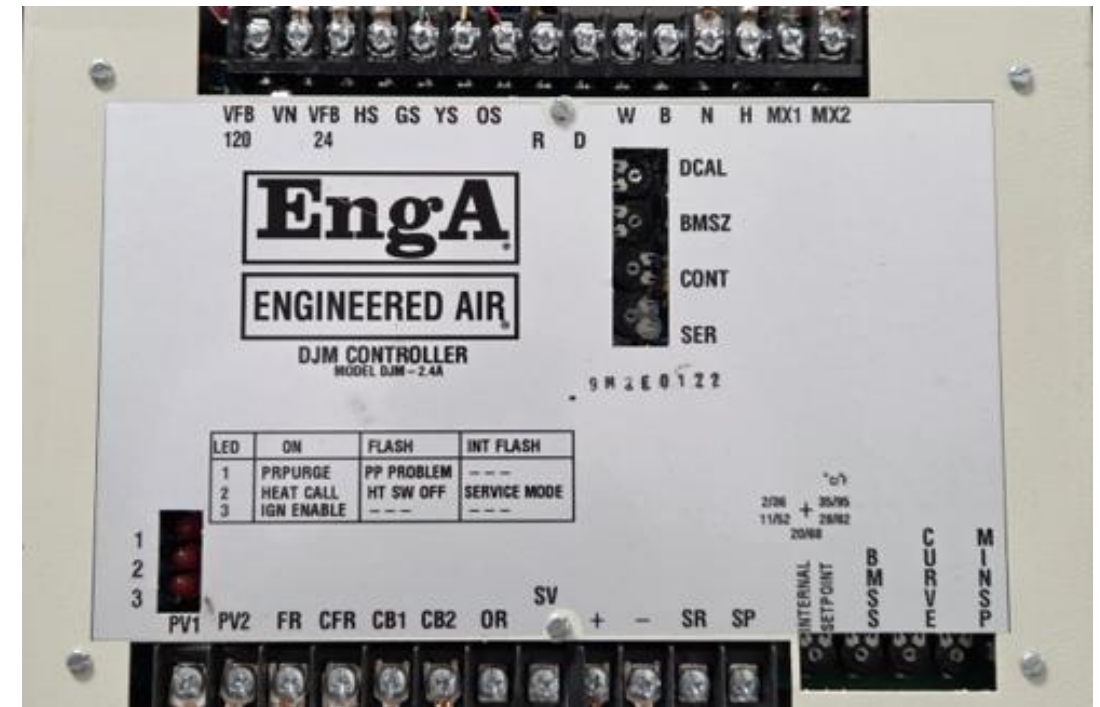
- On initial startup, the DJM2 brings the discharge temperature quickly to within 10°F of the calculated set point.
- Small output corrections to the gas valve are gradually made until the discharge air temperature is within 1.5°F from the setpoint.
- During cycling between low fire / off, there will be some temperature swings (less for high efficiency burner).



15:1 turndown ratio.

Turndown ratio.

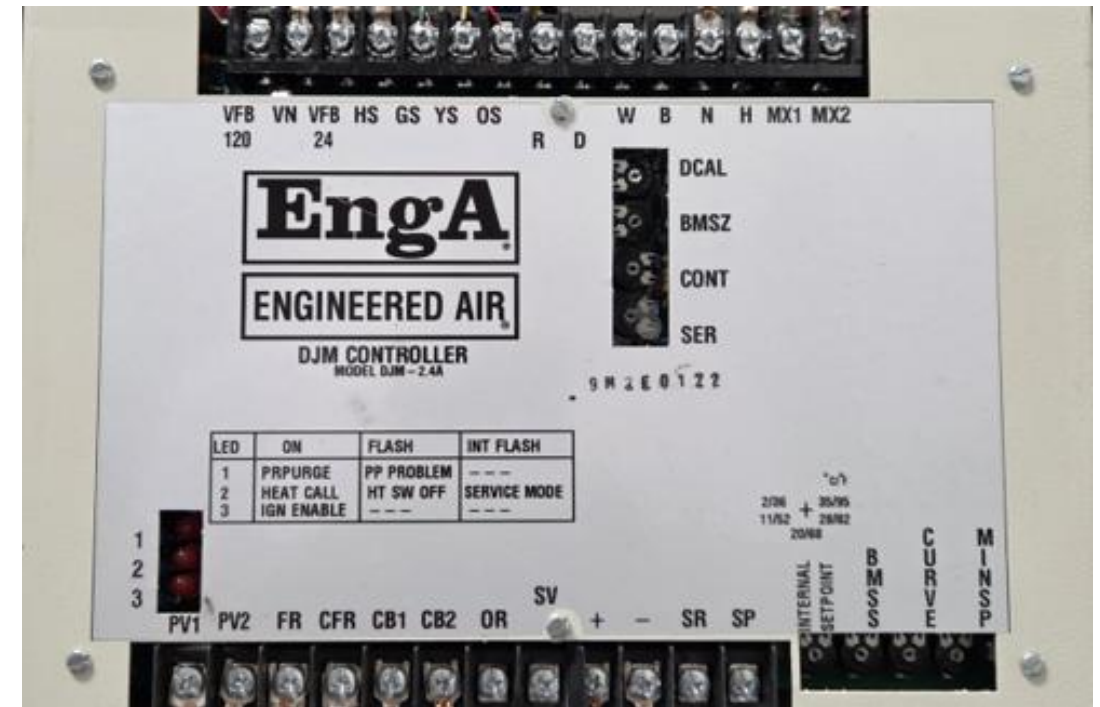
- The DJM2 control board has a turndown ratio of 15:1.
- What does that mean?



15:1 turndown ratio.

Turndown ratio.

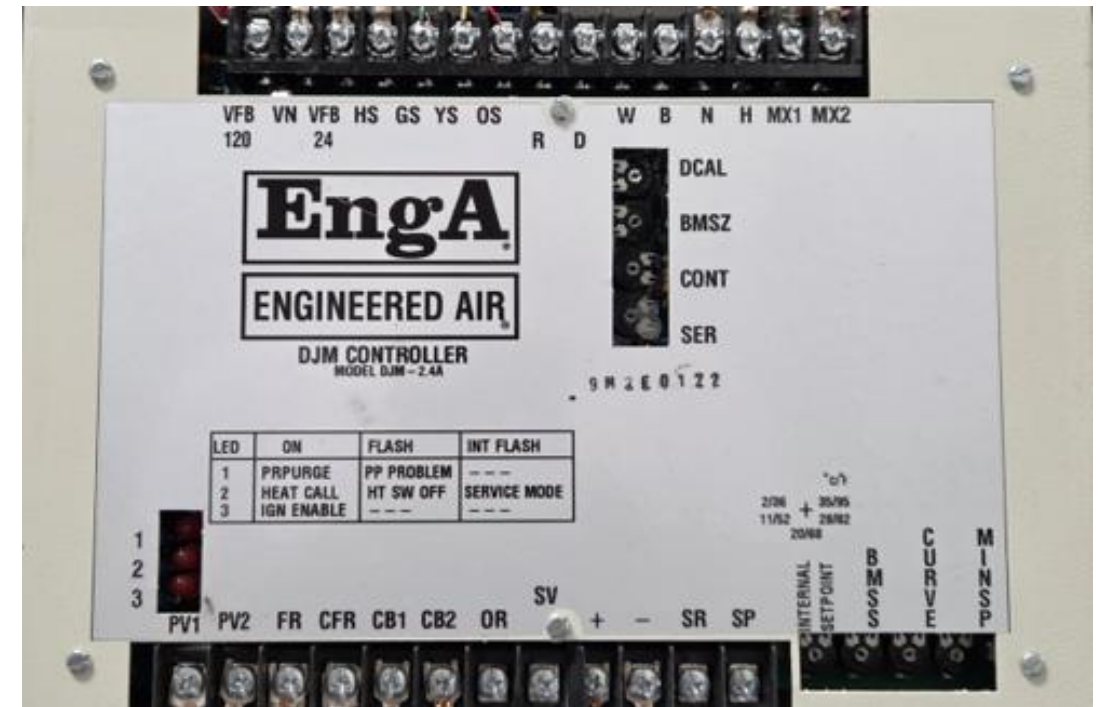
- A 15:1 turndown ratio means a heating appliance can reduce its maximum heat output to 1/15 (or roughly 6.7%) of its full capacity while still operating efficiently. For example, a 1,000,000 BTU/h DJ can modulate its output down to 66,666 BTU/h when less heat is required.



15:1 turndown ratio benefits.

Benefits.

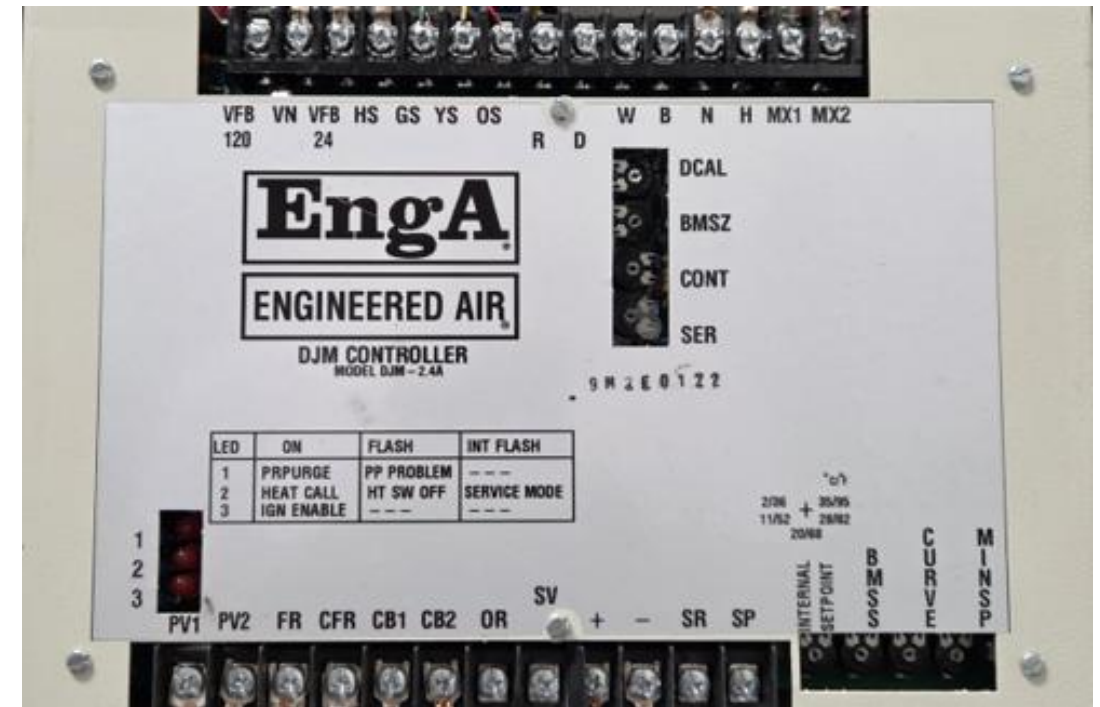
- **Prevents Short-Cycling:** Instead of constantly turning completely on and off (short-cycling) during mild weather, the appliance runs continuously at a lower firing rate.
- **Energy Efficiency:** Long, continuous burner operation reduces the energy lost during the appliance's pre-purge and post-purge ventilation cycles.
- **Less Wear and Tear:** Fewer mechanical start-ups put less stress on components, which can extend the lifespan of the equipment.
- **Consistent Temperature:** Because the heater is always lightly running, you experience more gradual, steady indoor temperature control rather than hot/cold swings.



How is the 15:1 turndown ratio achieved?

Turndown ratio.

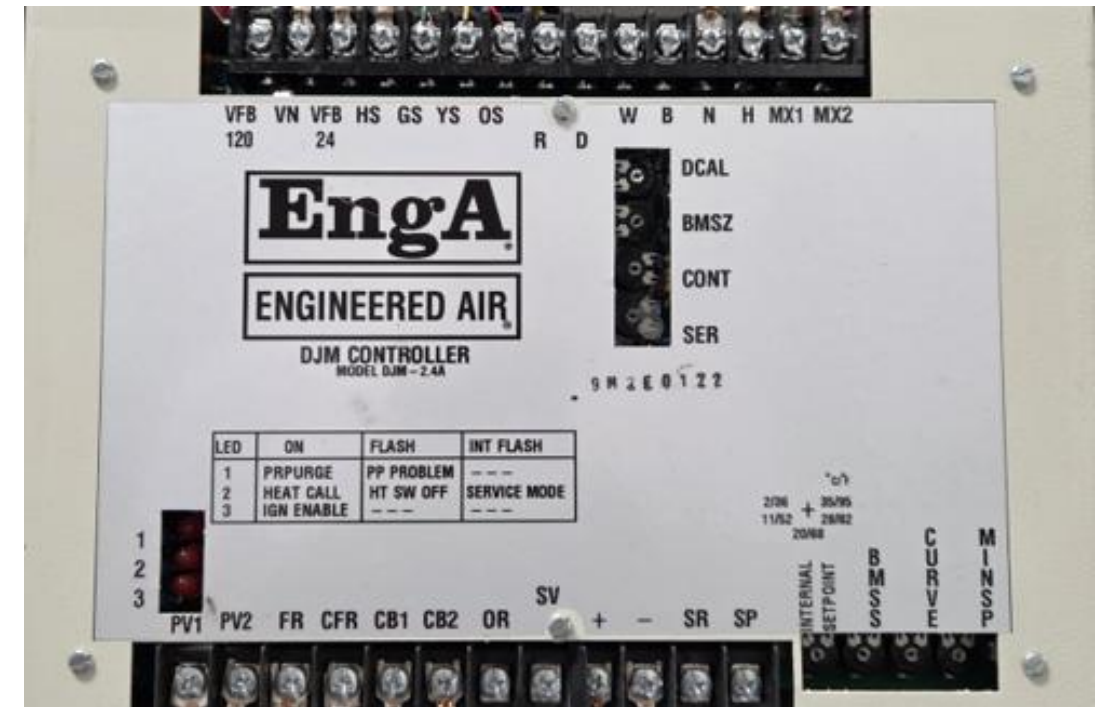
- The DJM2 modulates a variable speed combustion blower in conjunction with an electromagnetic modulating gas valve. The combustion blower speed and the gas valve's flow rate will be modulated to satisfy the discharge temperature requirements.



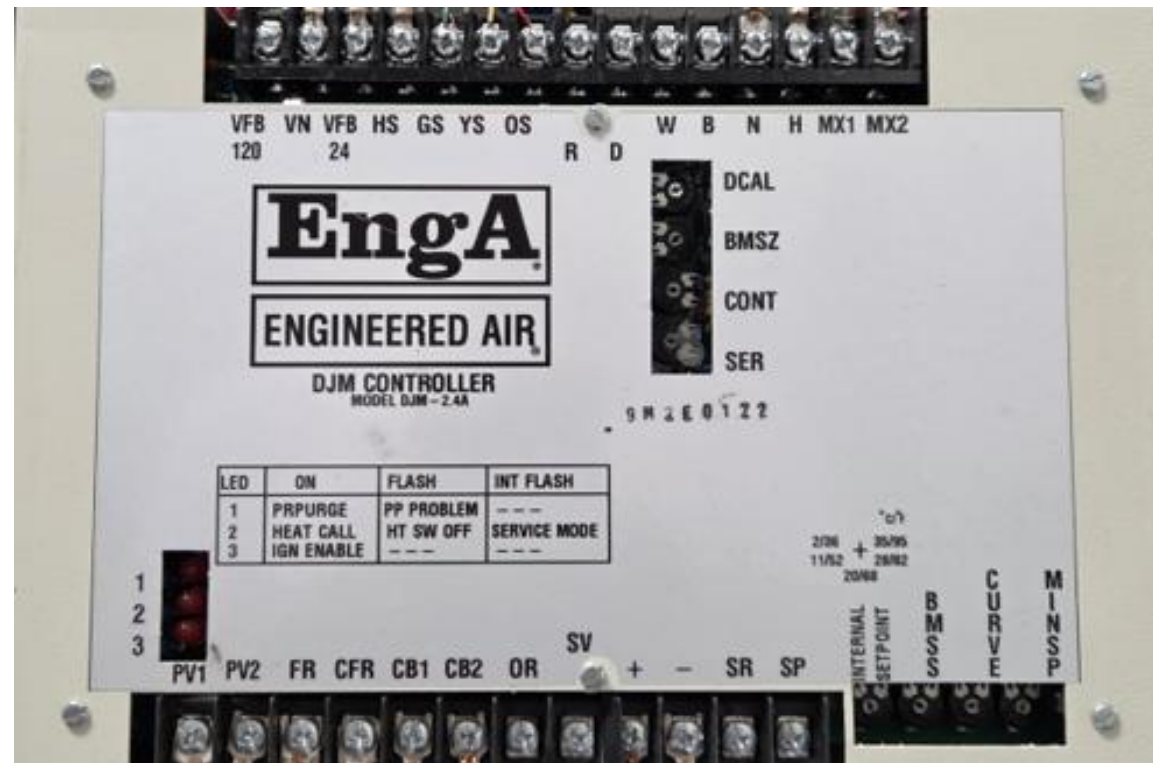
How is the 15:1 turndown ratio achieved?

Turndown ratio.

- The gas valves opening curves are programmed into the DJM2's logic. All the air and gas control is done electronically to simplify burner set up and eliminate the need to adjust troublesome mechanical air/fuel linkages.

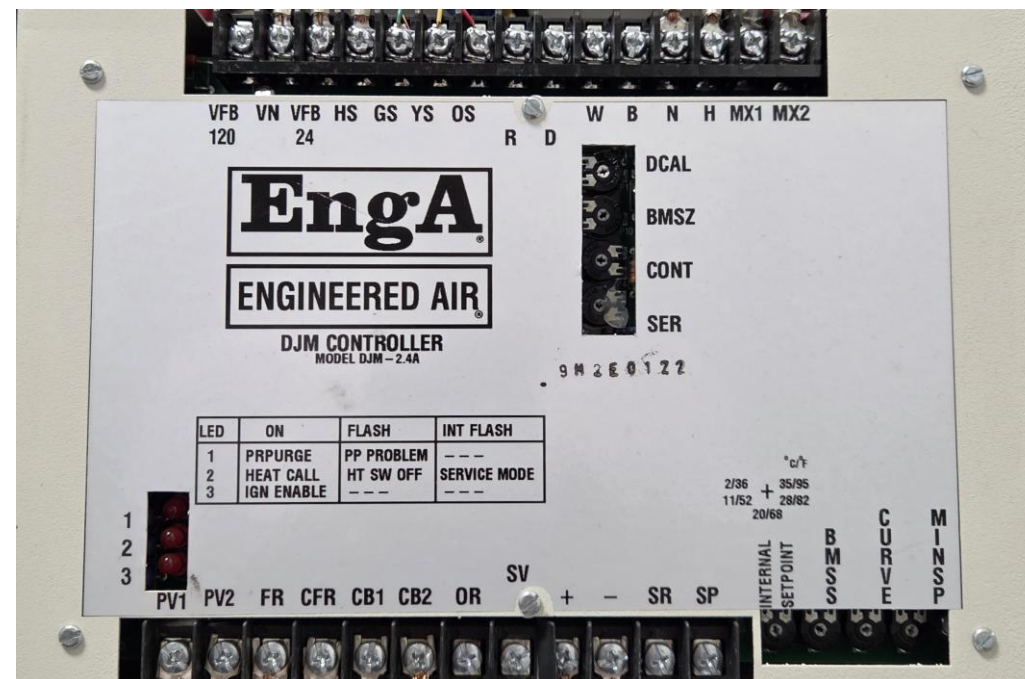


Navigating the DJM2 control board.



Terminal description.

Terminals	Description
VFB120,VN,VFB24	Main gas valve feedback
HS	Heat switch
GS,YS,OS	To speed sensor
R	T991 Common
D,W,B	D-W TS114 sensor B TD114 selector, D-B TE600 sensor
N	24 volt Neutral
H	24 volt power
MX1,MX2	Modulating DC volts Maxitrol
PV1,PV2	Ignition pilot valve
FR	Ignition control
CFR	Ignition control
CB1,CB2	Combustion fan
OR	Override(THST to B)
SV	Service (jumper to SR)
+/-	0-10vdc control
SR	0-10vdc control

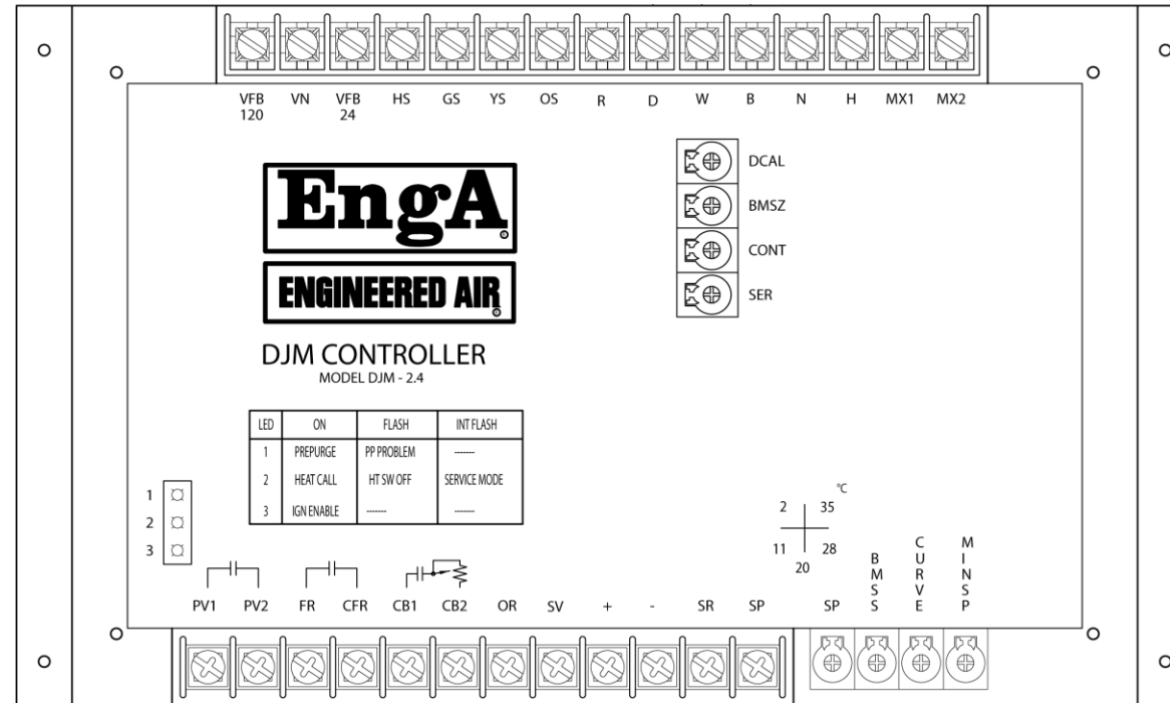


Terminal operation.

Terminals MX1 & MX2.

MX1 and MX2, Modulating valve output (DC volts).

Voltage can range from 0-13vdc, depending on modulating valve.



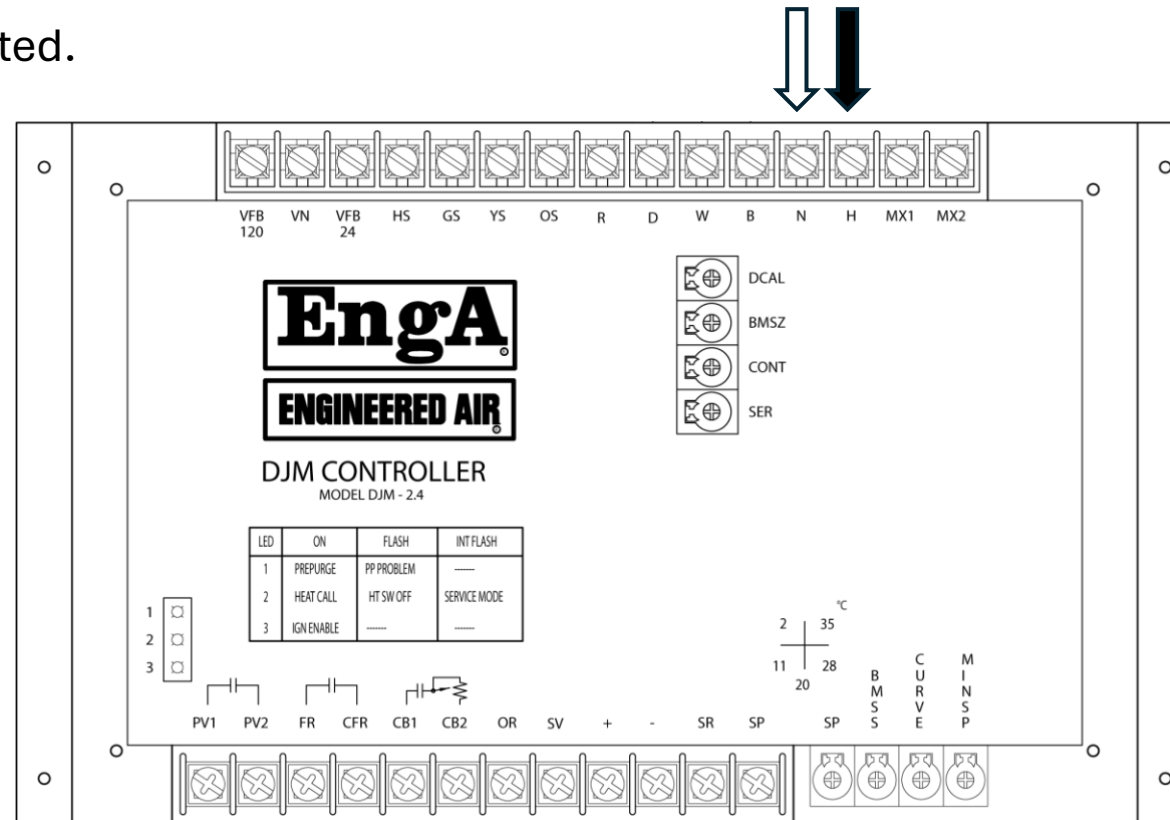
Terminal operation.

Terminals H and N.

Board power supply.

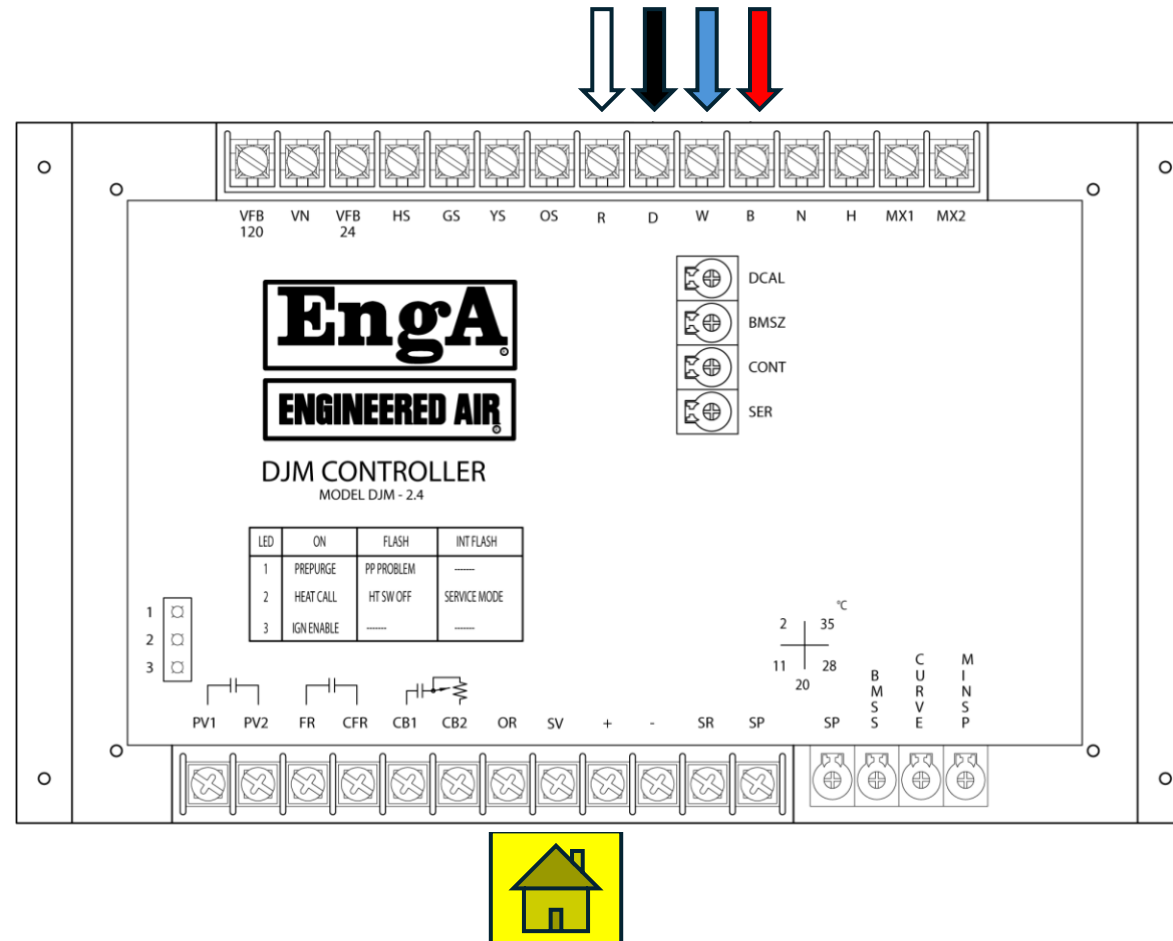
N, (NEUTRAL) 24vac isolated.

H, (HOT) 24vac isolated.



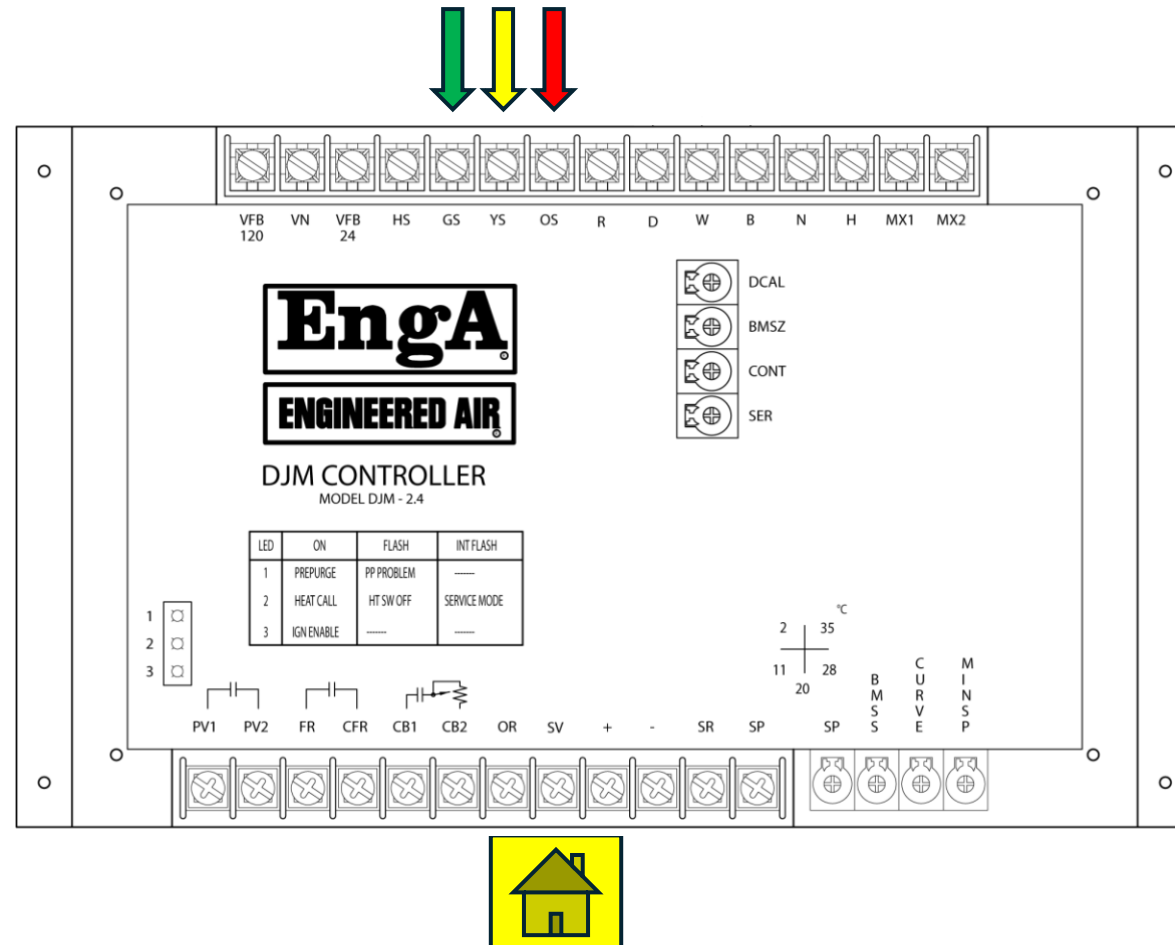
Terminal operation.

Terminals R,D,W,B
 R, T991 Common.
 D-W, Maxitrol TS114 sensor.
 W-B, Maxitrol Temp selector.
 D-B. TE6000 sensor.



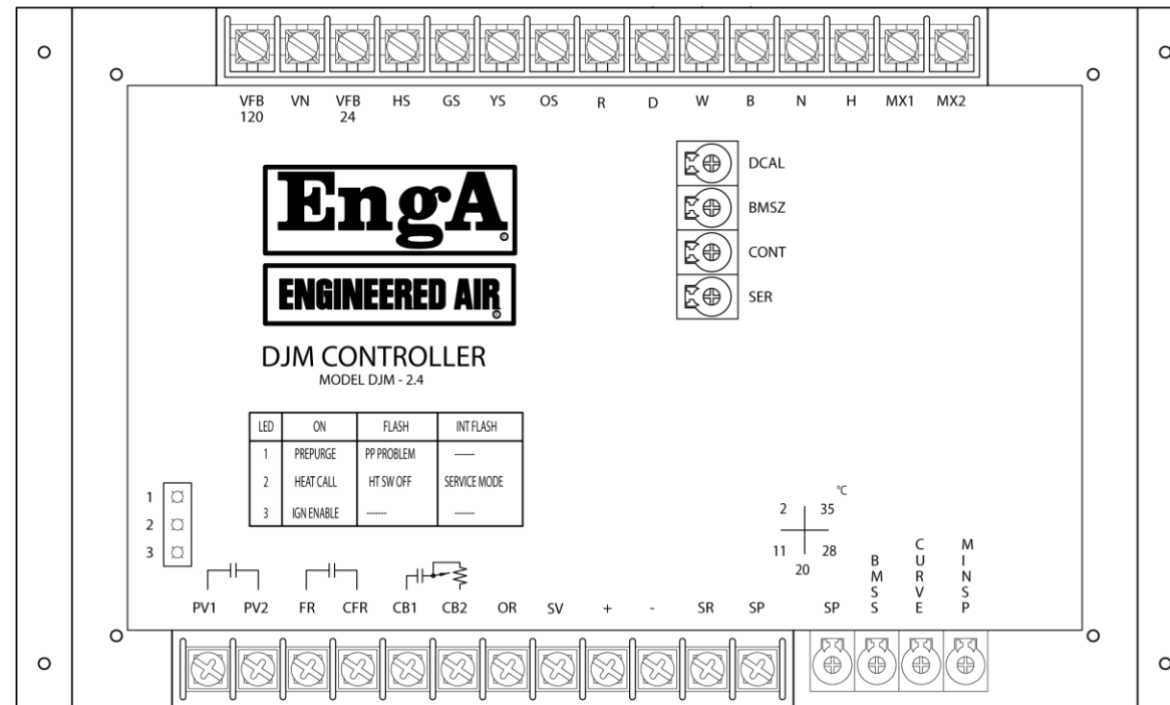
Terminal operation.

Terminals GS,YS,OS
Input from speed sensor.



Terminal operation.

Terminal HS, enable input.
Heat switch, 24vac.



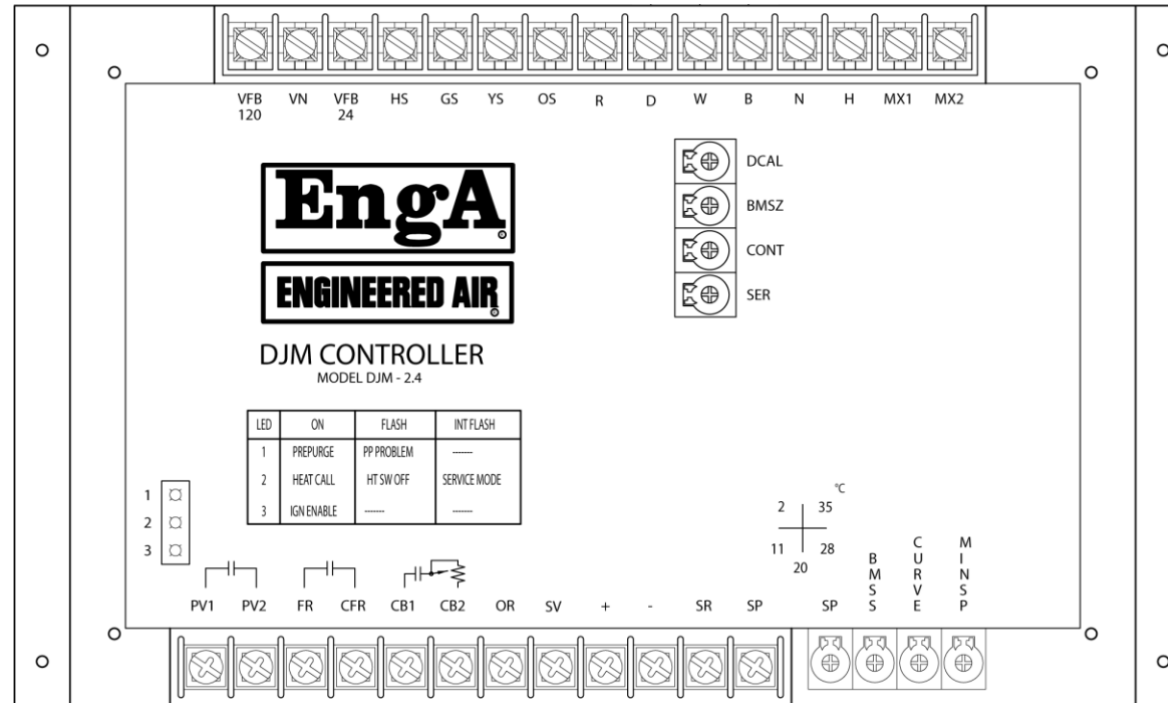
Terminal operation.

Terminals VFB120, VN, VFB24.

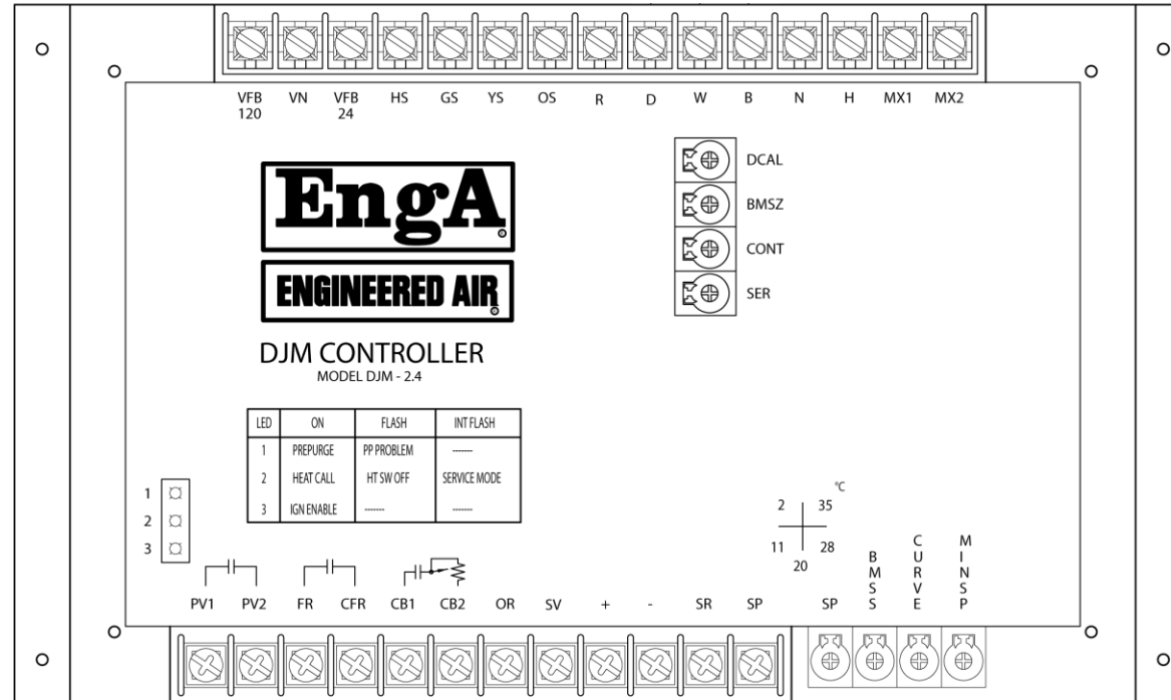
VFB120, Main gas valve feedback(SSOV) hot input for 120vac valves.

VFB24, Main gas valve feedback(SSOV) hot input for 24vac valves.

VN, Main gas valve feedback(SSOV) neutral input.



Terminal operation.



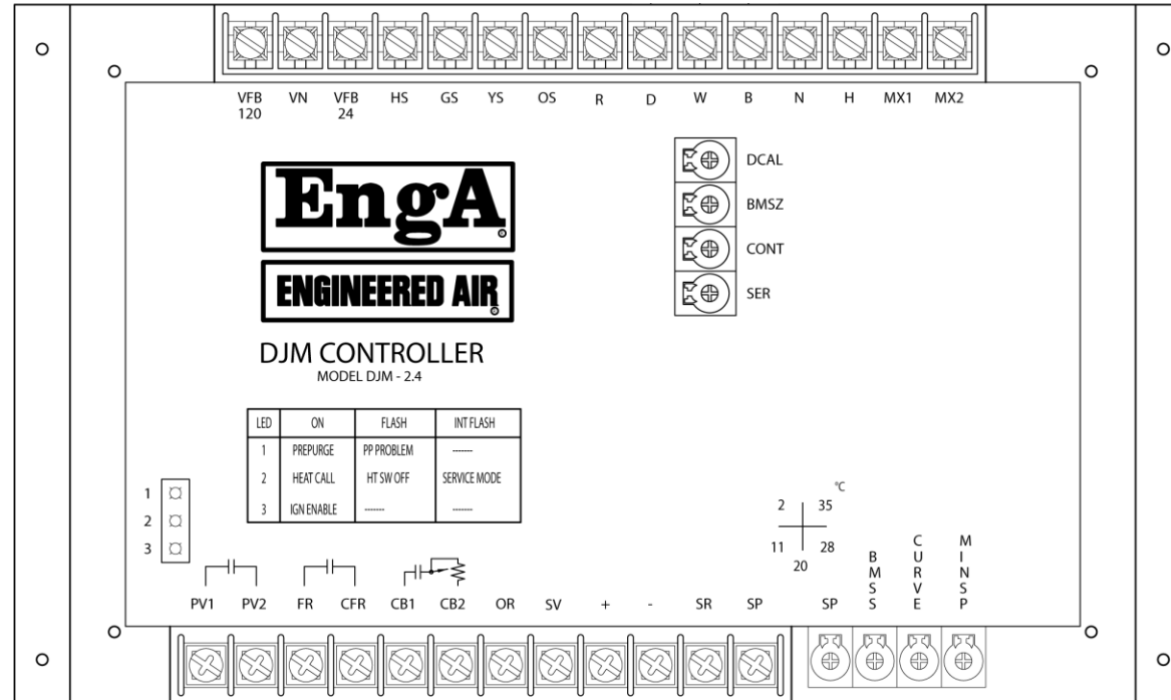
Terminals PV1 and PV2.

PV1, voltage from ignition controller.

PV2, voltage to pilot valve.



Terminal operation.



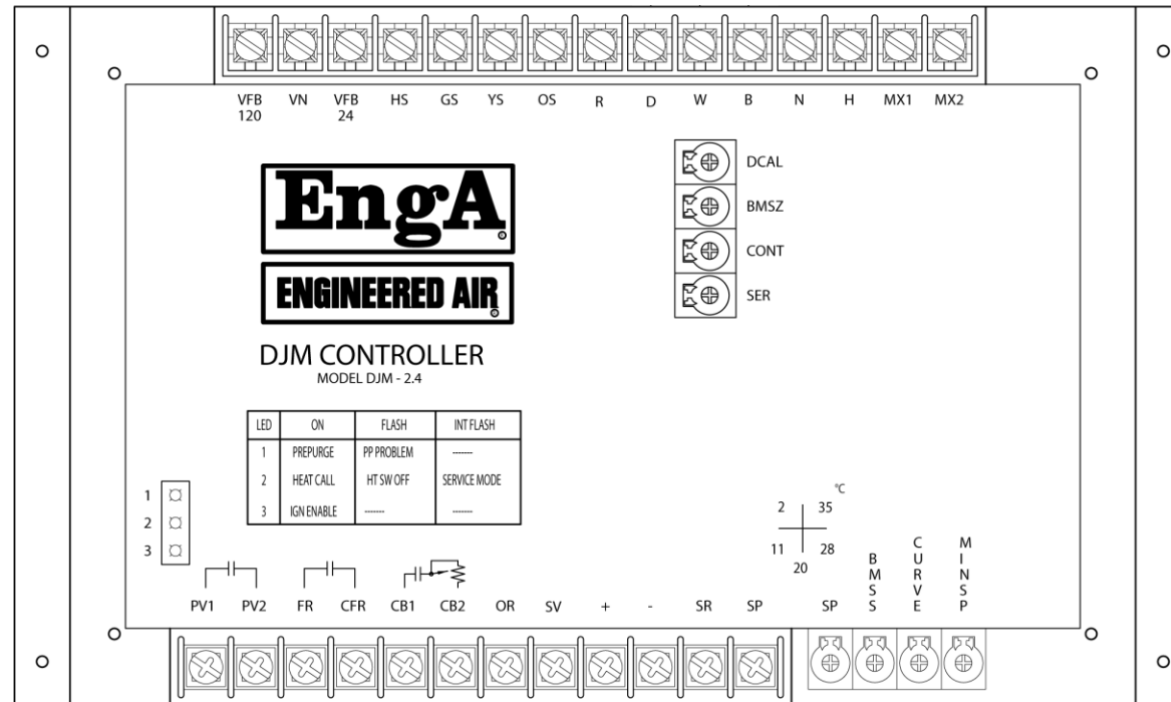
Terminals CFR & FR.

CFR, voltage input to DJM2.

FR, voltage output to ignition controller.



Terminal operation.



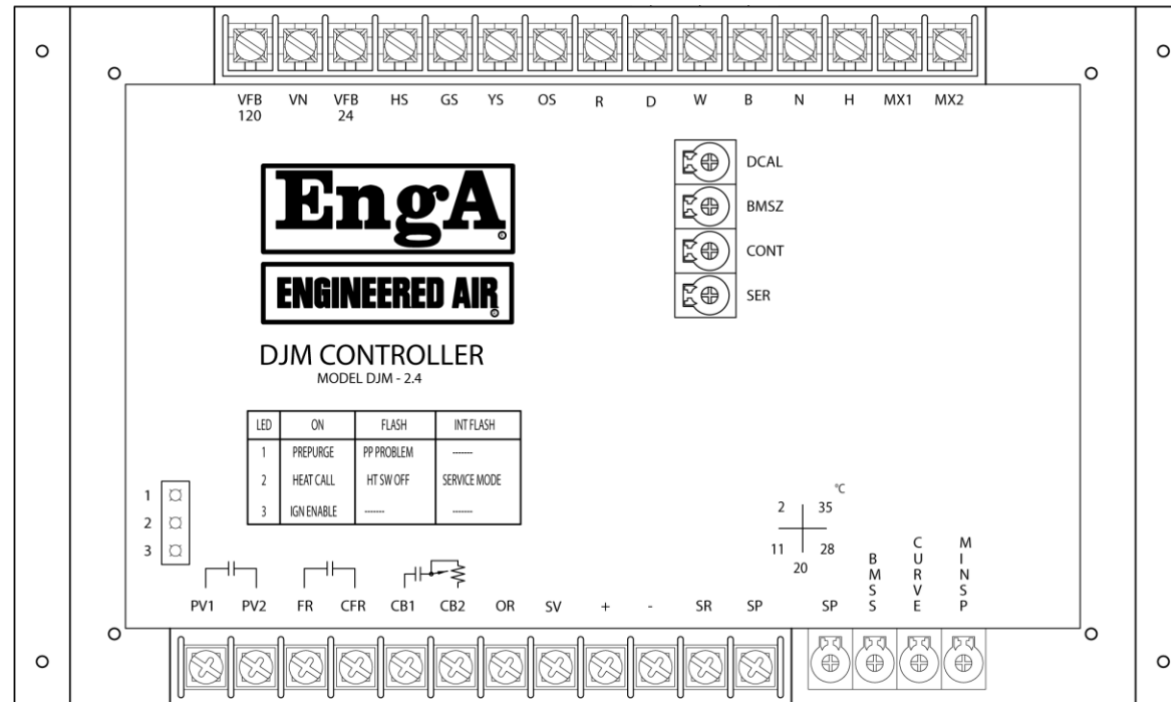
Terminals CB1 and CB2.

CB1 120vac input to DJM2. (Combustion blower).

CB2 120vac output to combustion blower.



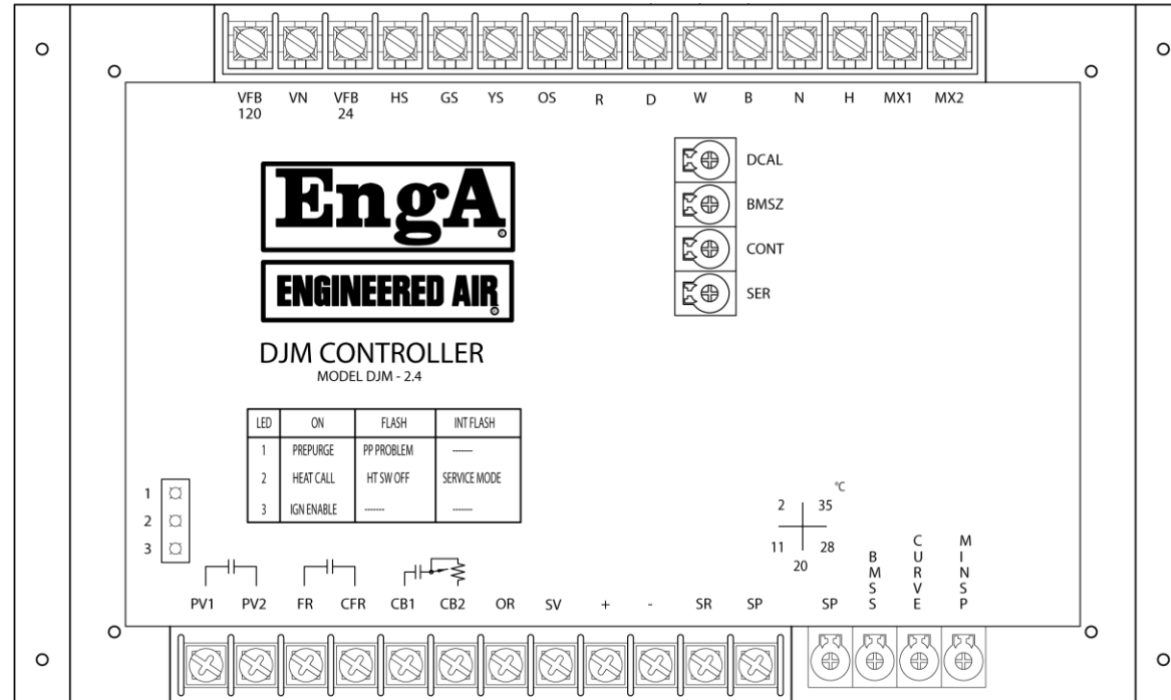
Terminal operation.



Terminal OR.
Thermostat override to force high fire.
OR and B must close.

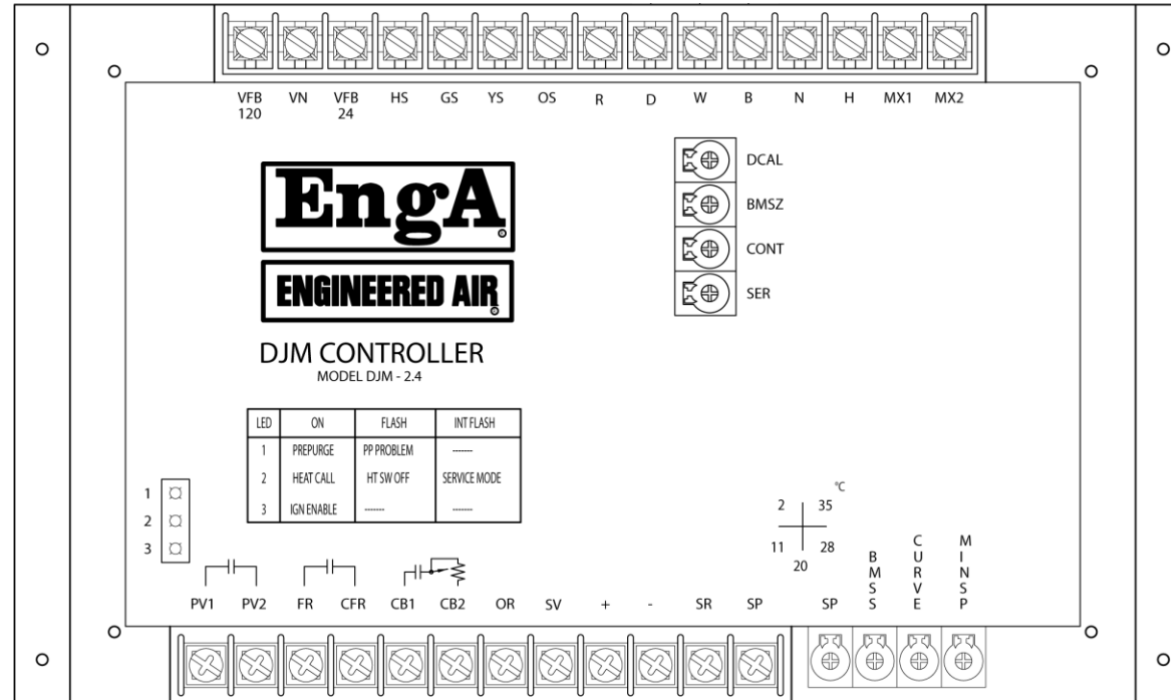


Terminal operation.



Terminals SV and SR.
Jumping SV to SR will place the DJM2 into service mode.

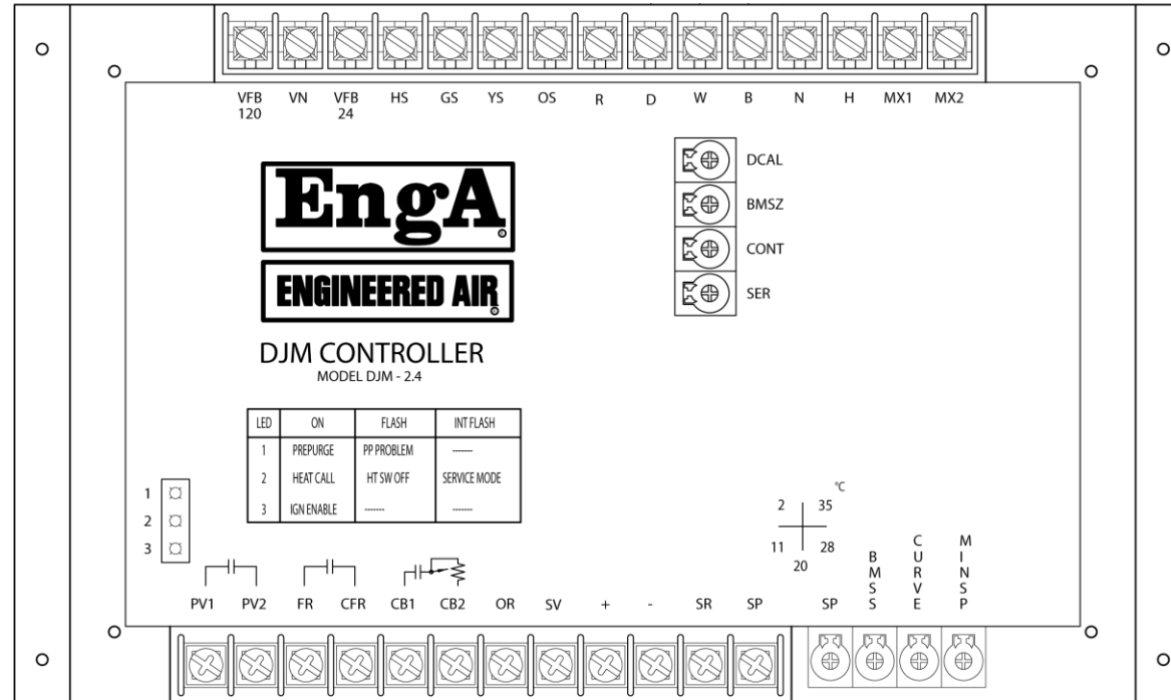
Terminal operation.



Terminals +/-.
0-10vdc input. Direct temperature control.



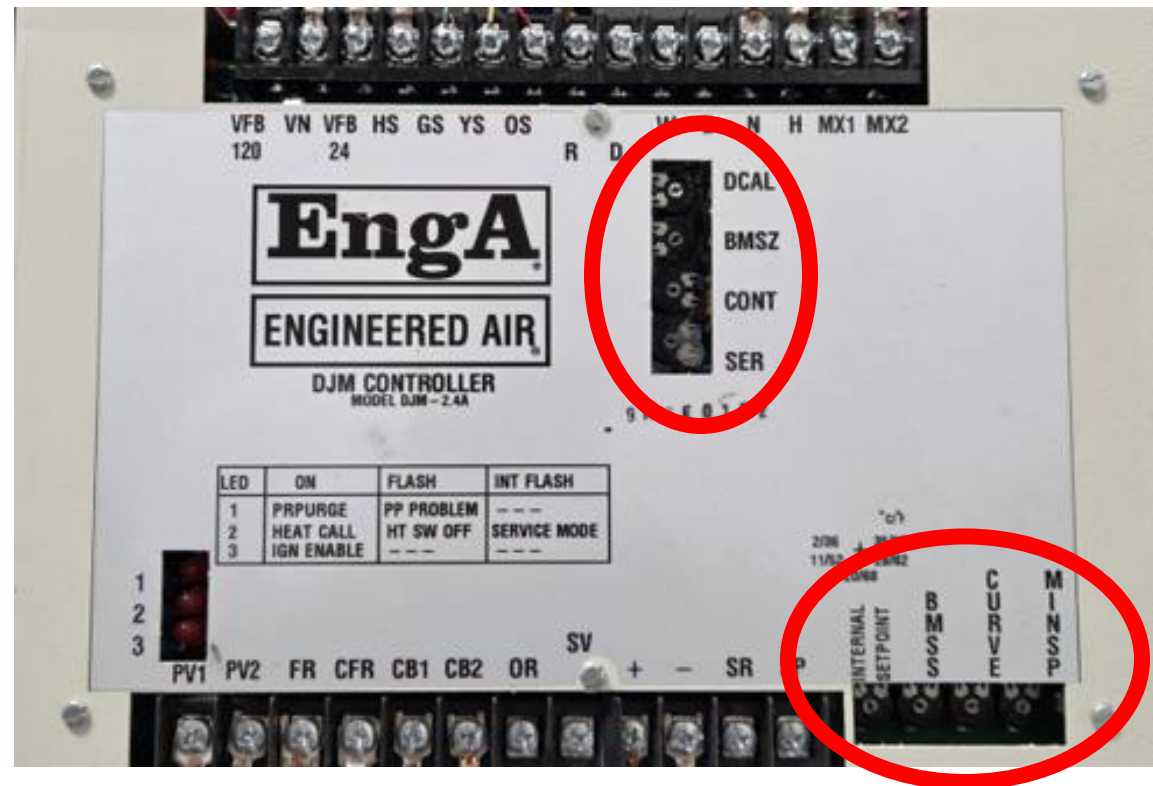
Terminal operation.



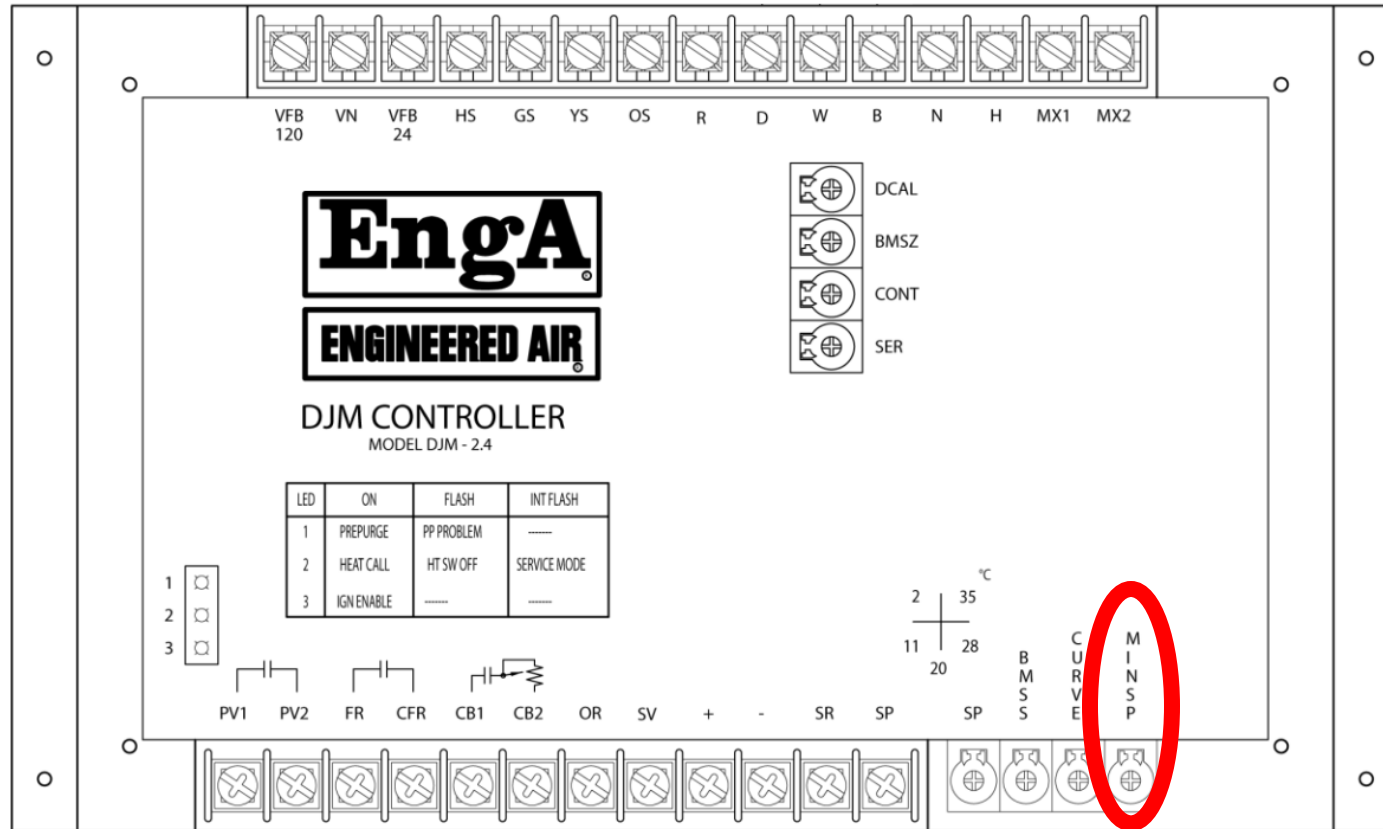
Terminal SP.
Internal setpoint when wired
with TE6000 on terminal D and B.



Adjustment pots.



Burner adjustment pots.

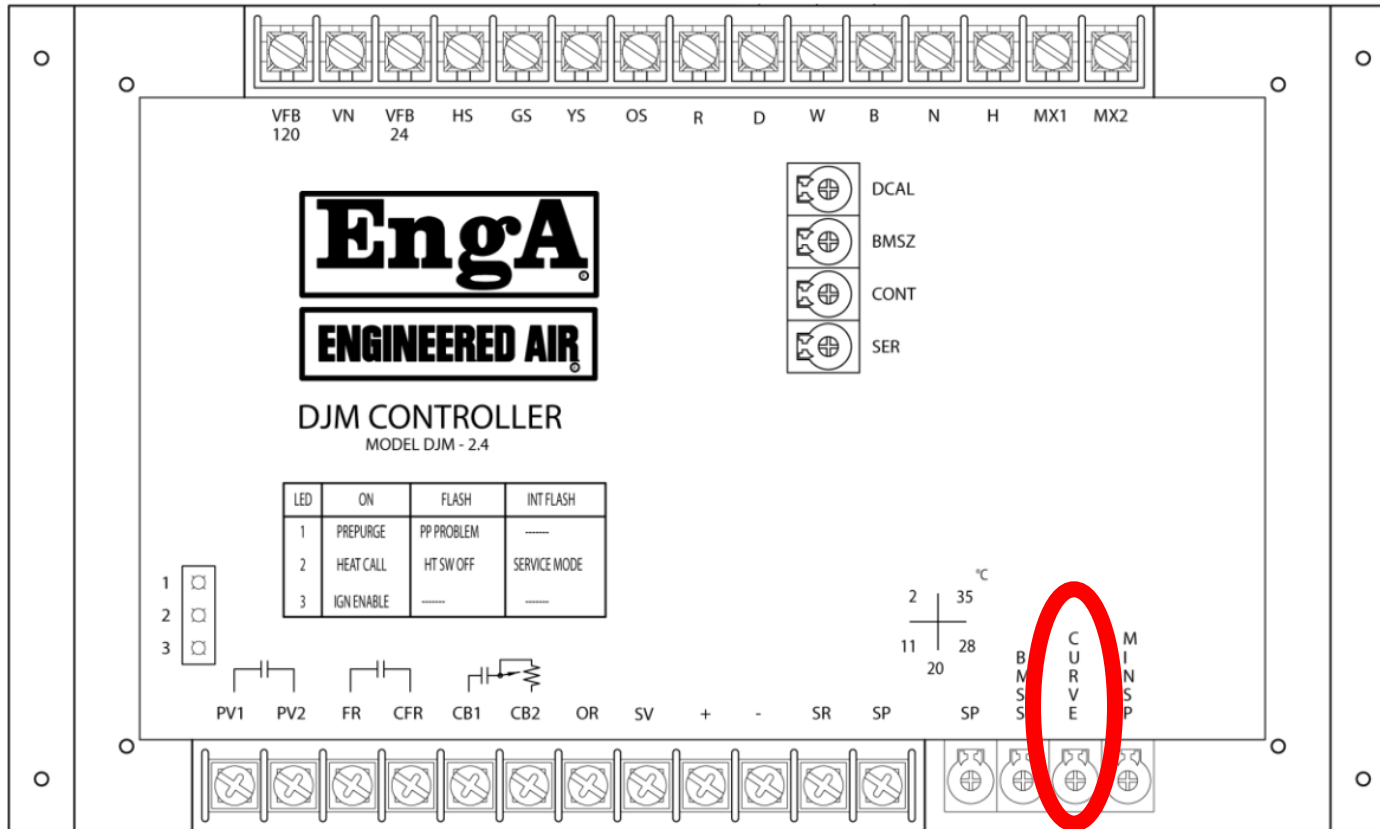


MINSP pot.(Minimum speed adjustment).

- The minimum speed pot is to be adjusted by a qualified service technician only.
- This pot should only be adjusted when using a combustion analyzer.
- This is the low fire combustion blower speed RPM adjustment pot.
- The minimum speed pot is used to adjust the combustion air at low fire.
- The low fire speed is adjustable from 1150 to 1400 RPM for high turndown.
- 1800 to 2000 for standard burner.
- Clockwise=slower.



Burner adjustment pots.

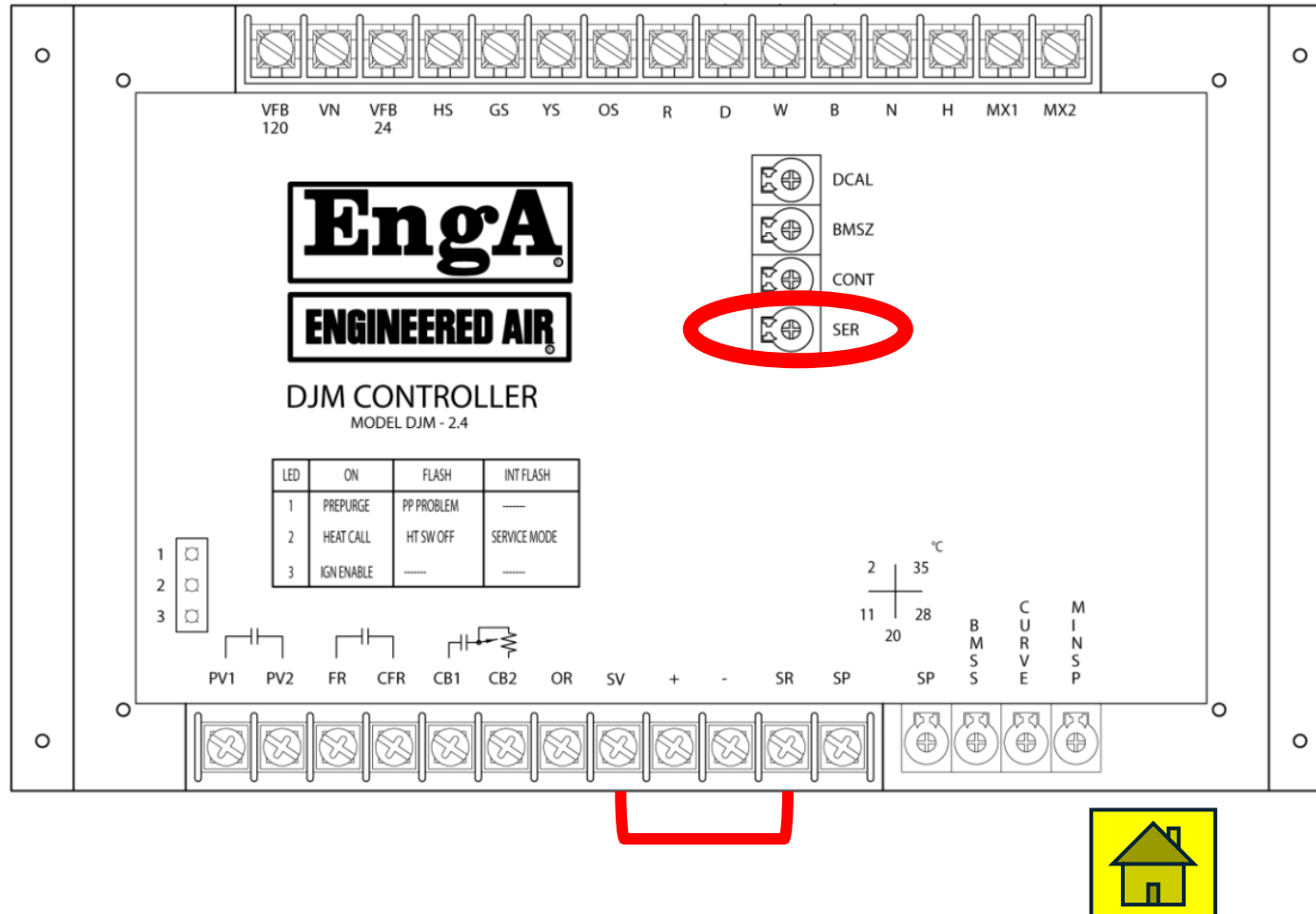


CURVE pot.

- The curve matching pot is to be adjusted by a qualified service technician only.
- This pot should only be adjusted when using a combustion analyzer.
- This is the curve matching gas valve adjustment pot.
- The curve matching pot is used to adjust the VDC to the modulating valve during combustion setup.



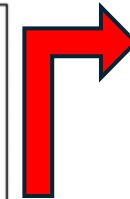
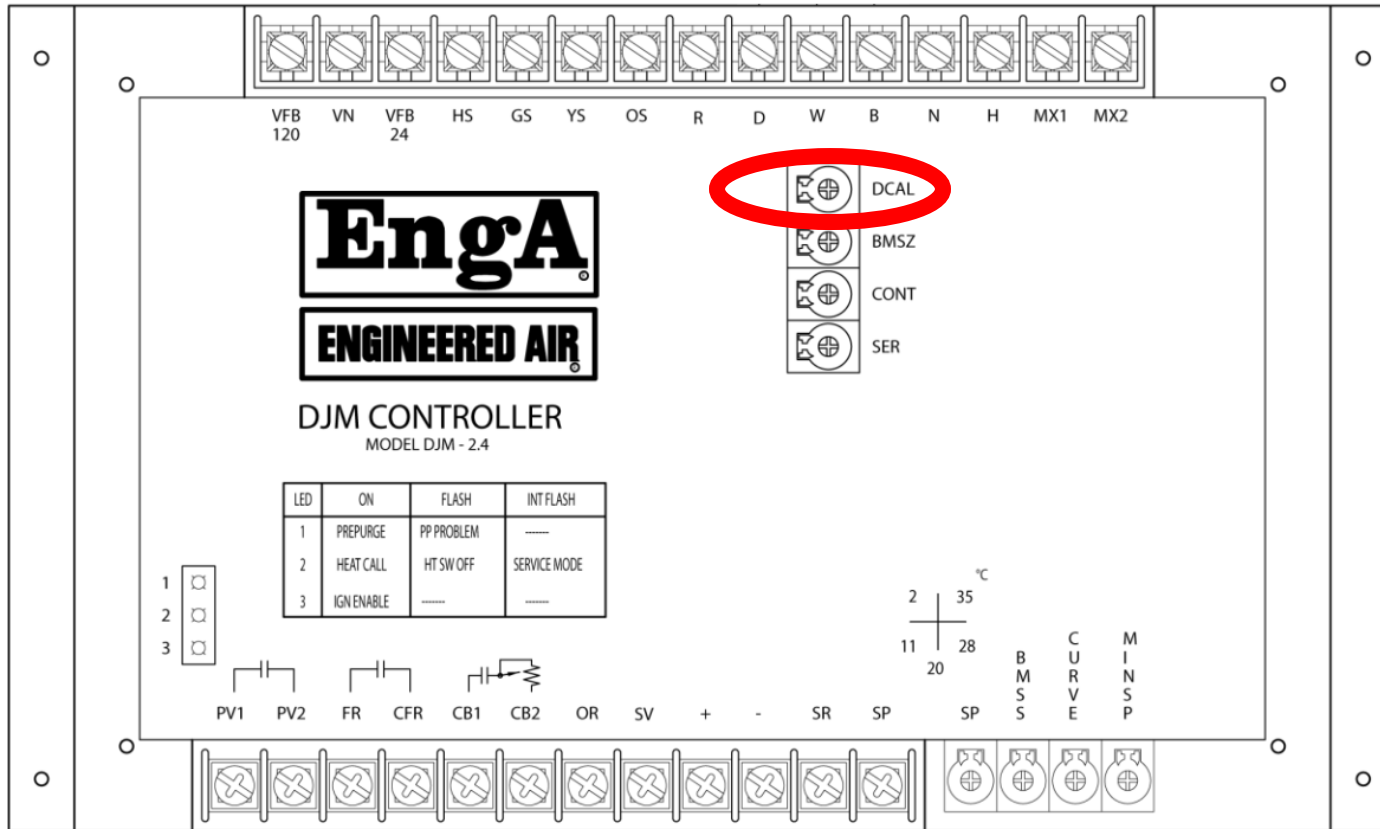
Burner adjustment pots.



SER. (Service pot).

- The service pot is to be adjusted by a qualified service technician only.
- This pot should only be adjusted when using a combustion analyzer.
- This is the service mode pot.
- The service pot is designed to allow the service technician to manually set the burner firing rate they choose. Terminal SV and SR must be jumped. (REMOVE jumper when done.)
- Rotating the pot fully clockwise will set the burner to HIGH FIRE.
- Rotating the pot fully counterclockwise will set the burner to LOW FIRE.

Temperature control adjustment pots.

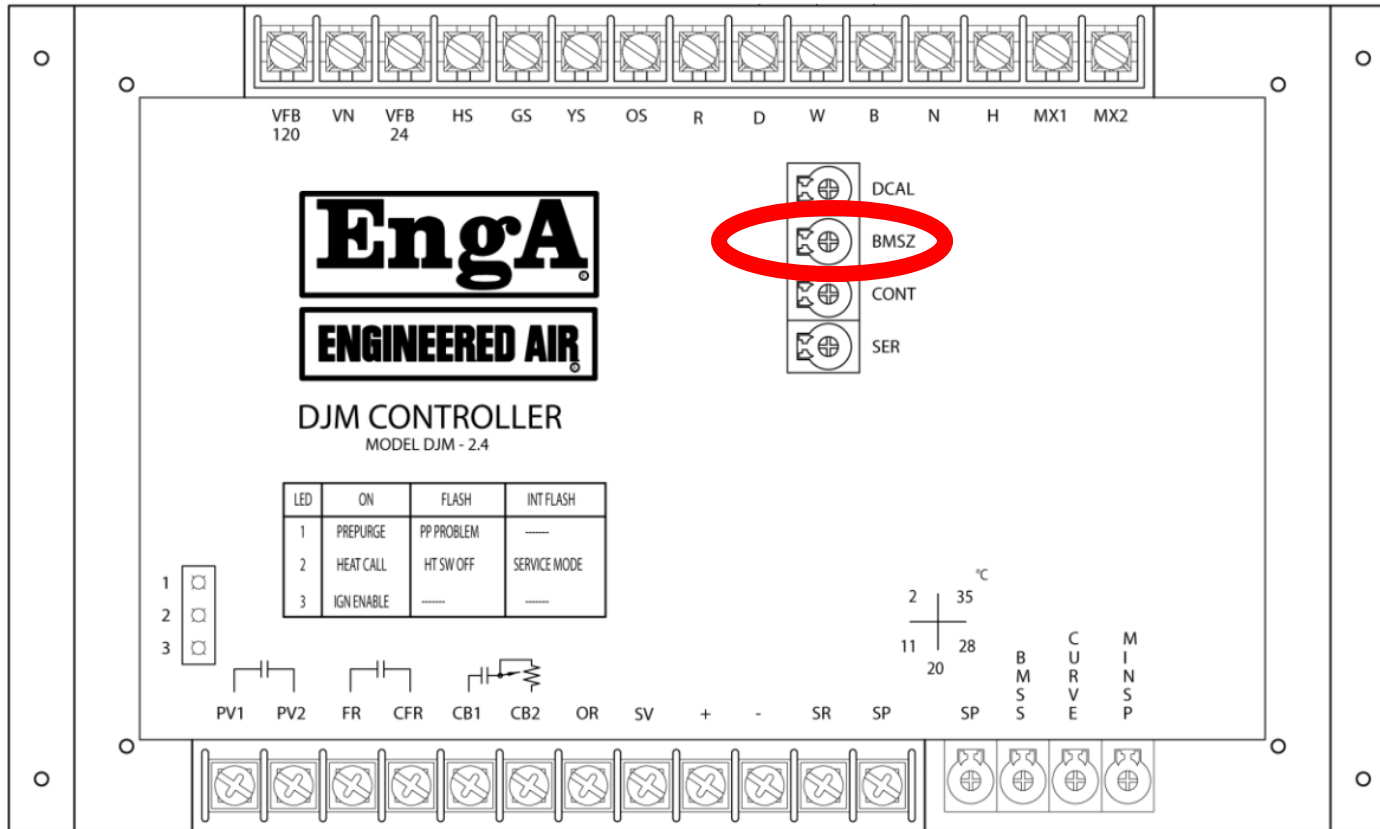


DCAL pot. (Discharge sensor calibration).

- This pot is used to calibrate the discharge air sensor.
- Turning the pot clockwise will set it colder.



Temperature control adjustment pots.

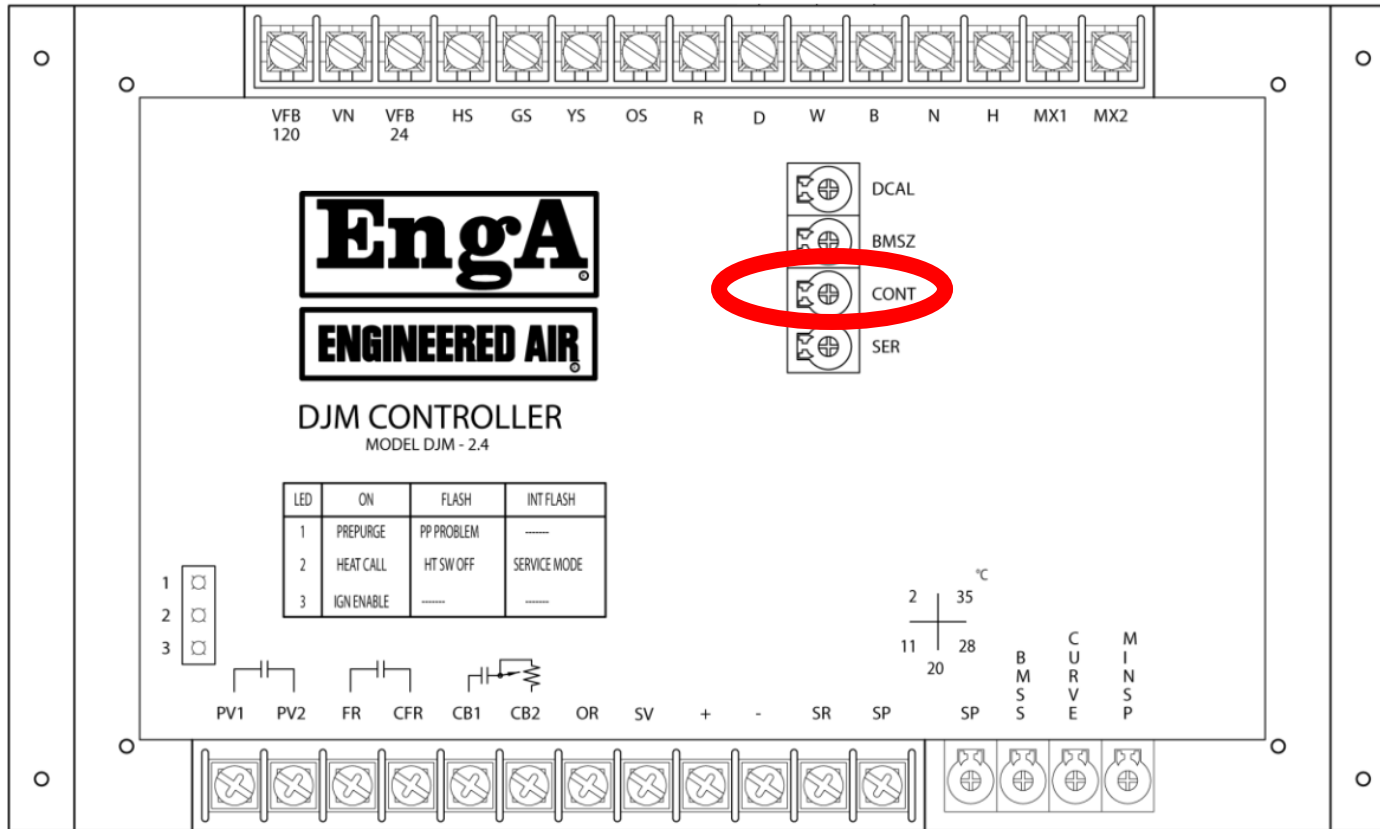


BMSZ pot. (BMS zero).

- This pot is used with a 0-10vdc to terminal +/-.
- Used in conjunction with BMSS and CONT pots.
- Calibrates the on and off point of the burner based on the signal.
- 3vdc heat light on.
- 2.5vdc heat light off.
- Refer to manual for setup procedure.



Temperature control adjustment pots.

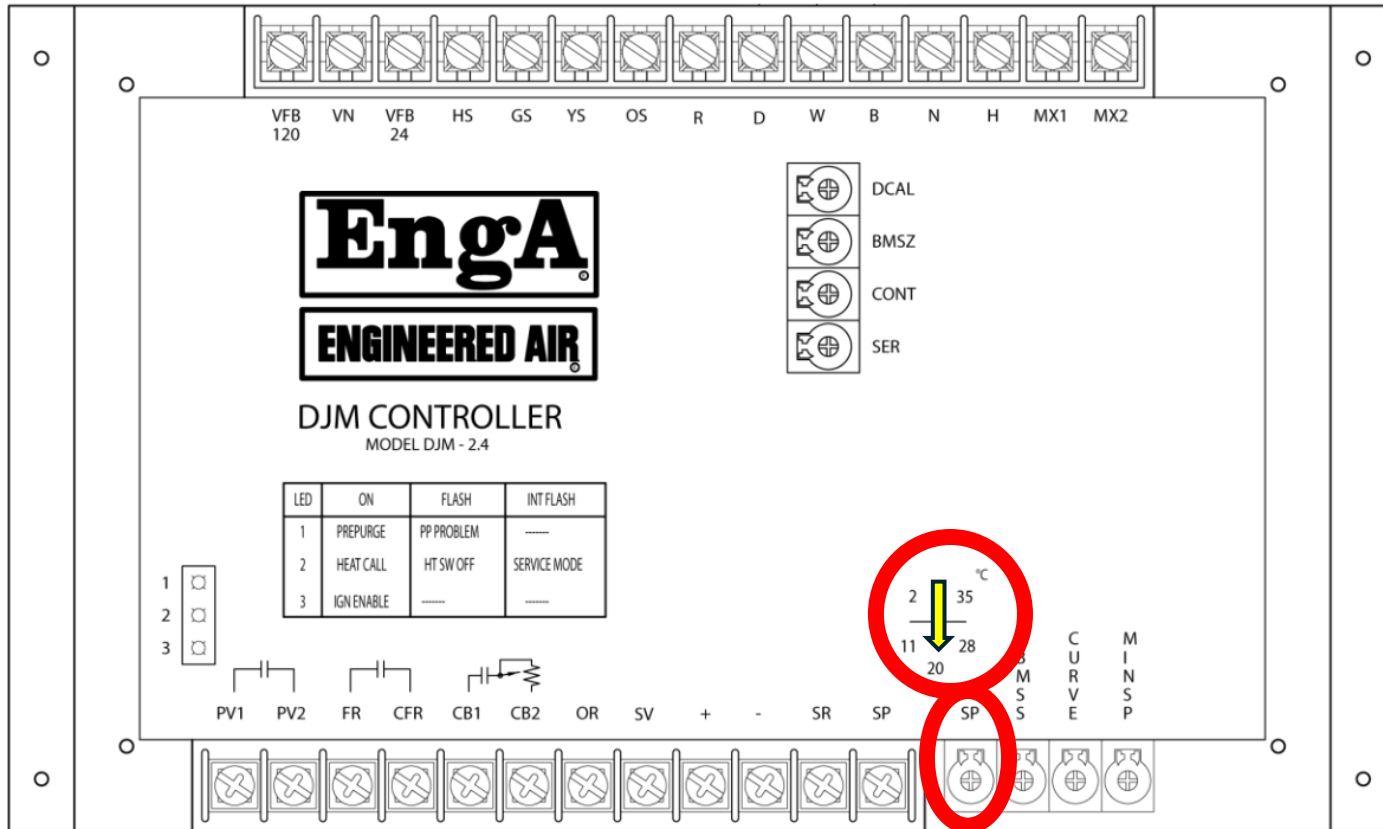


CONT pot. (Control type).

- This pot is used to setup the P.I.(proportional and integral) control
- Used in conjunction with BMSS and BMSZ pots.
- Counterclockwise= full proportional.
- Clockwise= adds integral.
- Refer to manual for setup procedure.



Temperature control adjustment pots.

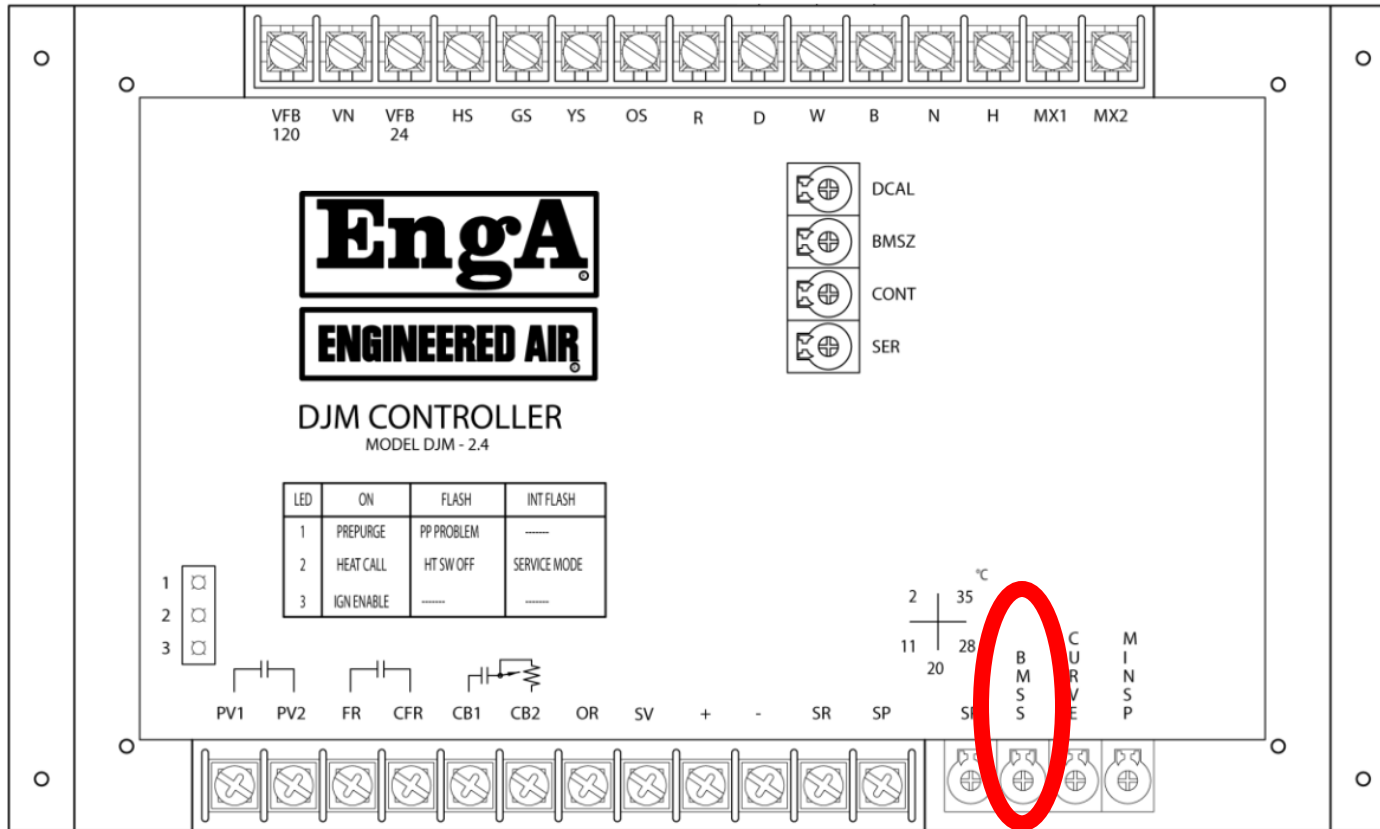


SP pot. (Internal setpoint).

- This pot is used to set the internal setpoint.
- TE6000 sensor must be wired to terminals D and B.
- Pot indication setting on DJM2 label.
- Setpoint range from 35°F to 95°F.



Temperature control adjustment pots.



BMS pot. (Internal setpoint).

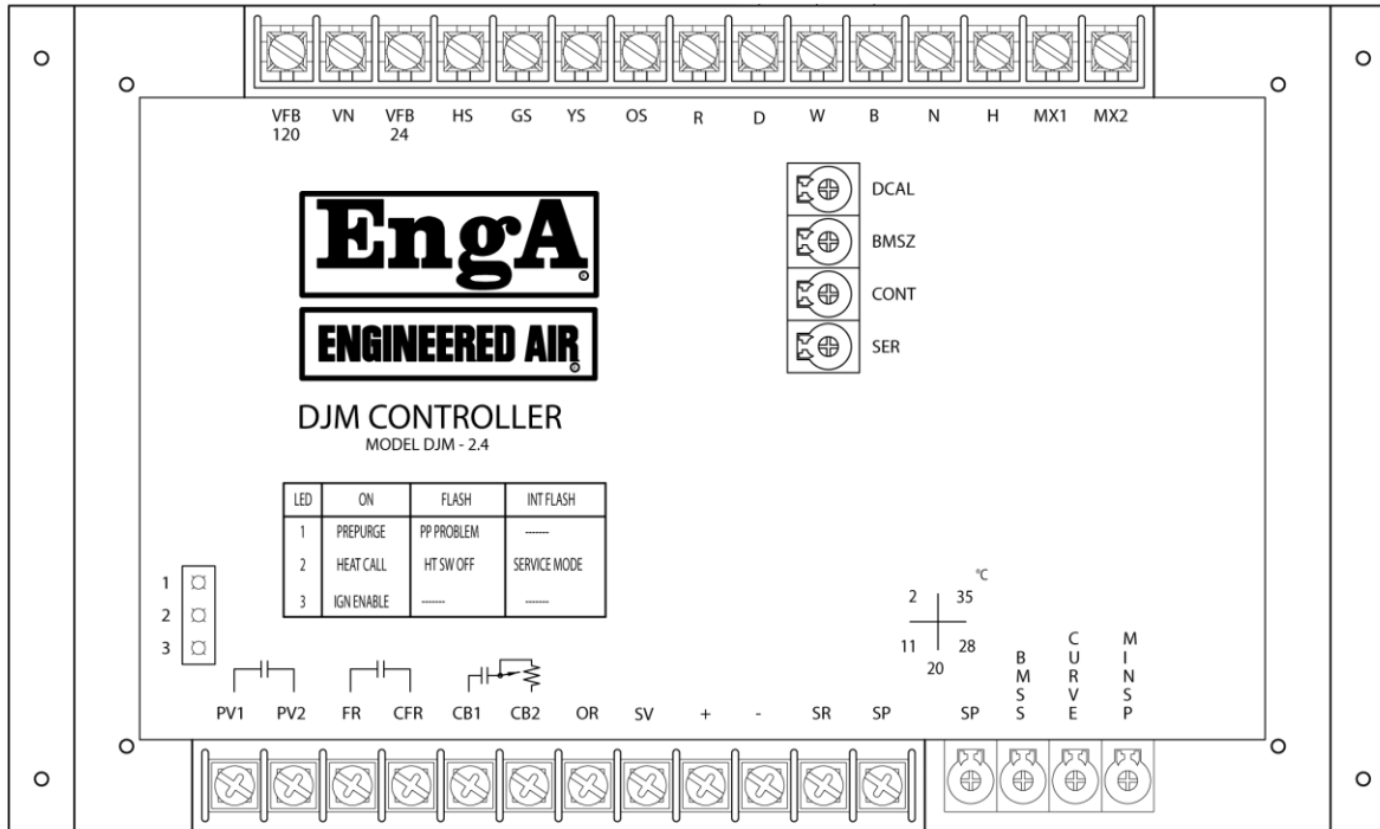
- This pot is used with a 0-10vdc to terminal +/-.
- Used in conjunction with BMSZ and CONT pots.
- Calibrates the on point of the burner based on the signal.
- 3vdc heat light on.
- Refer to manual for setup procedure.



Temperature control.



Temperature control.



Temperature control.

- The DJM2 is designed to be a discharge air temperature control.
- Stand alone temperature control (not modified by a remote signal, also know as 'reset').
- Stand alone control can be achieved 4 ways.
- 1, The internal setpoint pot(SP).
- 2, Maxitrol TS114sensor and TD114 setpoint.
- 3, Honeywell T991A 135ohm slide wire control.
- 4, Direct voltage or current input.



Internal setpoint pot unit function page.

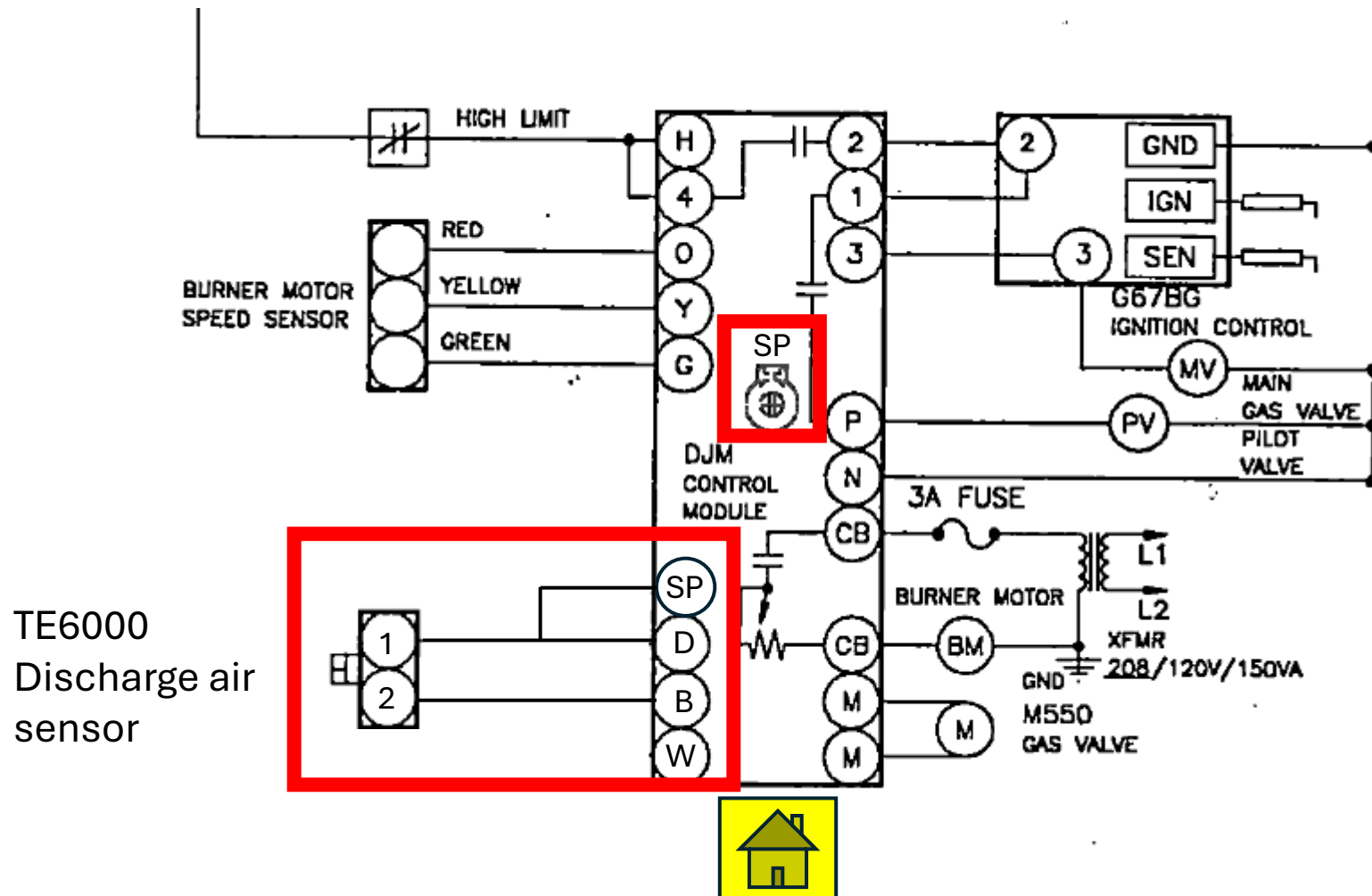
UNIT FUNCTION

Disconnect switch 'on', service switch 'on', fire alarm contacts(by others) 'closed' (jumper if not required).

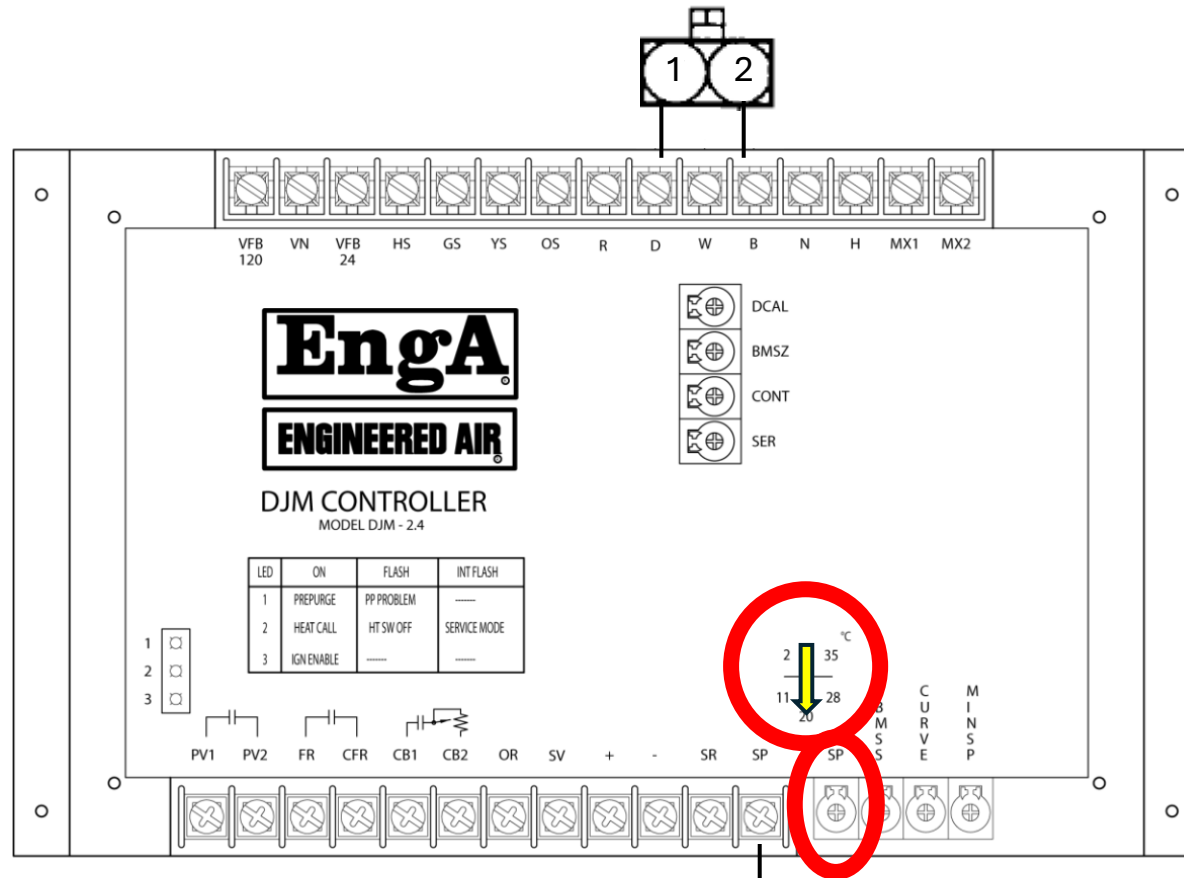
Unit on/off switch 'on', outside air damper opens. Blowers will delay on and run continuously. The DJM controller with an integral reference setpoint fixed at 75°F (23.9°C) will modulate the gas flow and combustion air to maintain the required discharge air temperature.



Internal setpoint pot unit wiring page.



Internal setpoint pot temperature control.



To terminal D



Temperature control.

- To enable the internal setpoint dial, terminals SP and D must be jumped.
- A TE6000 sensor must be wired to terminals D and B.

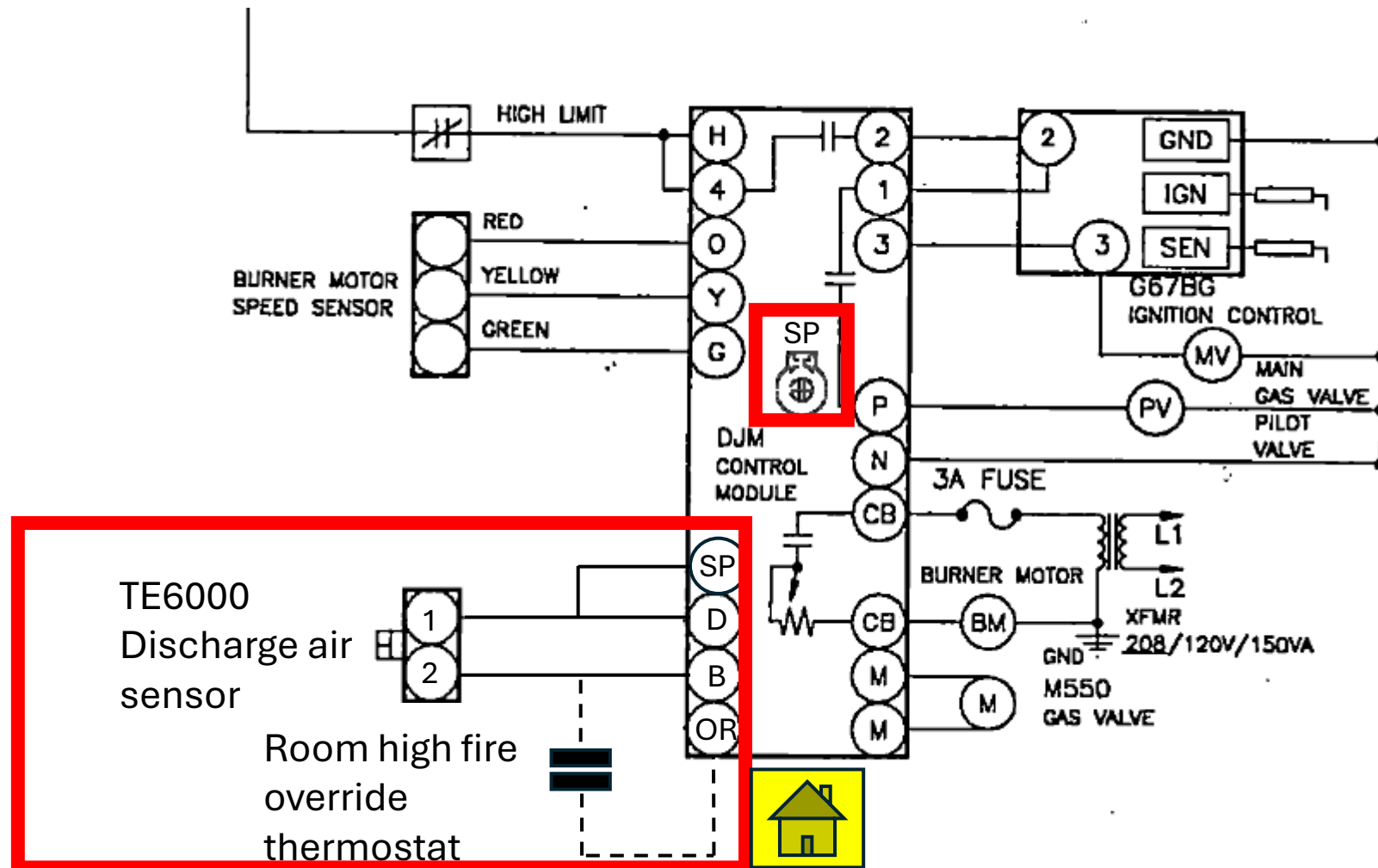
Internal setpoint pot with override unit function page.

UNIT FUNCTION

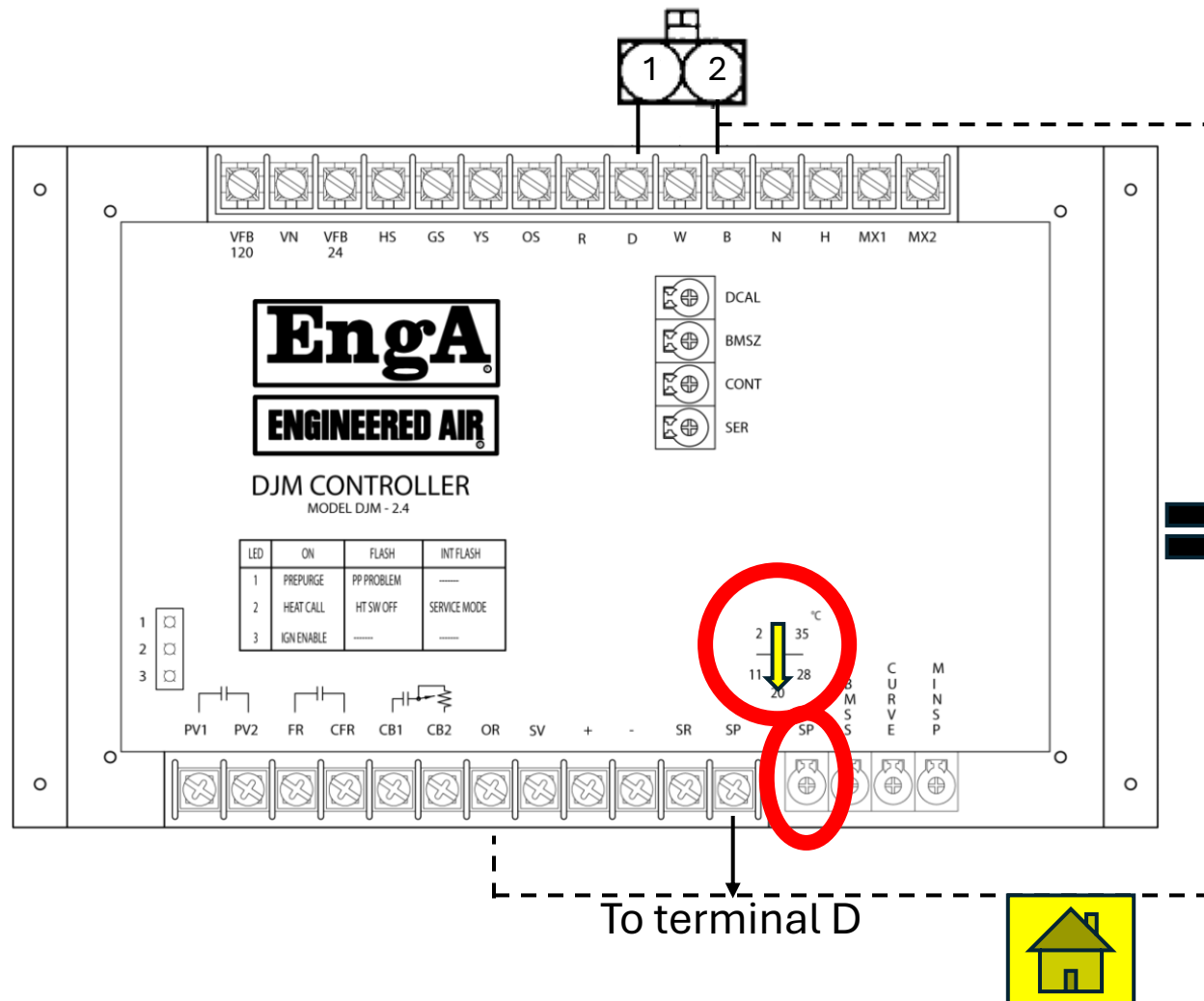
- NON FUSED DISCONNECT SWITCH ON. SERVICE SWITCH ON. FIRE ALARM CONTACT (BY OTHERS; JUMPER IF NOT REQUIRED) MADE. UNIT ON/OFF CONTACT (BY OTHERS) MADE. DAMPER OPENS TO 100% OUTSIDE AIR. BLOWER DELAYS ON AND RUNS CONTINUOUSLY. MODULATING BURNER MAINTAINS CONSTANT DISCHARGE AIR TEMPERATURE AT 60 F (15.6 C) AND C/W ROOM OVERRIDE.



Internal setpoint pot with override unit wiring page.



Internal setpoint pot with override temperature control.



Temperature control.

- To enable the internal setpoint dial, terminals SP and D must be jumped.
- A TE6000 sensor must be wired to terminals D and B.
- Room stat override wired between terminals B and OR.

Room high fire
override thermostat.

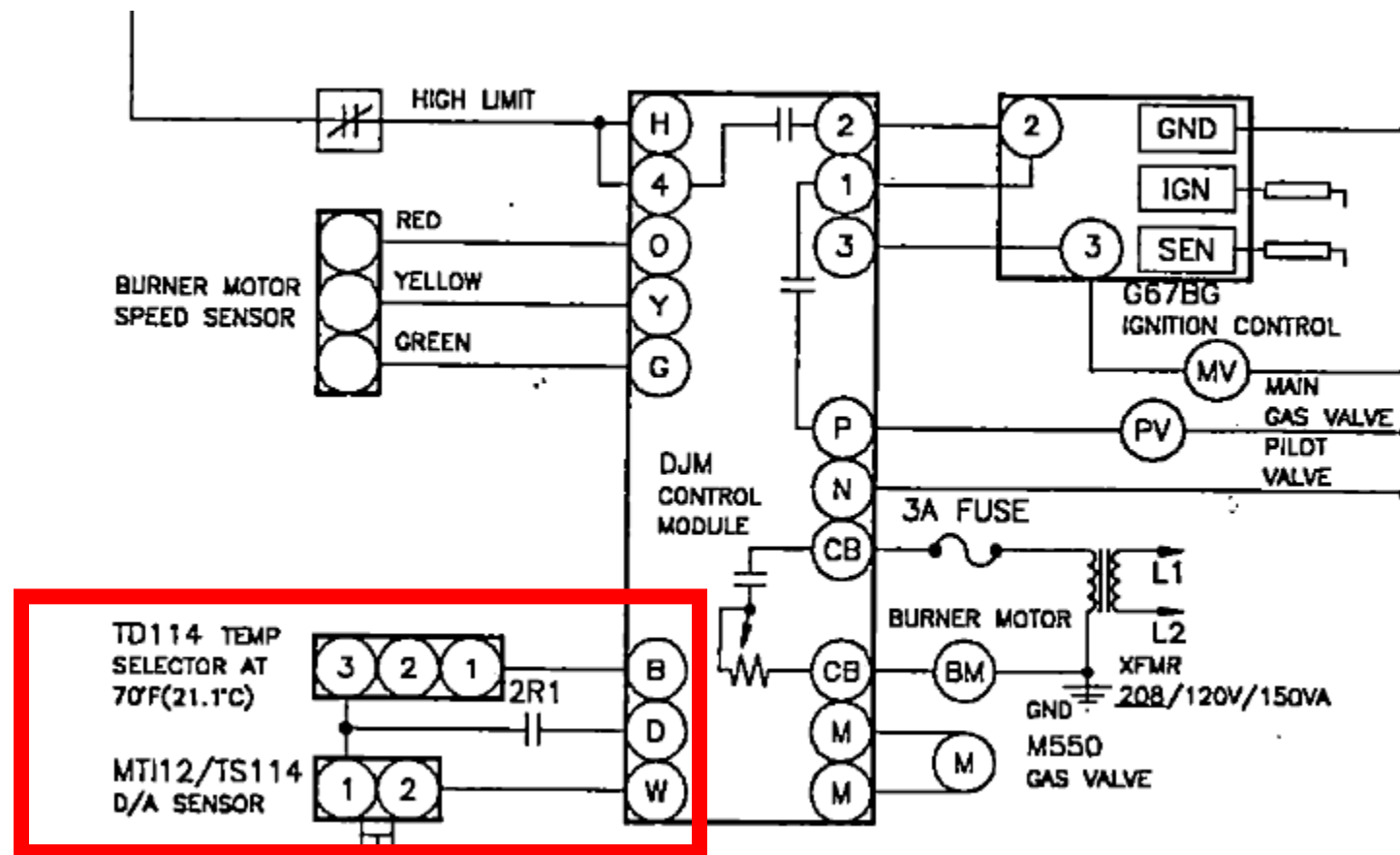
Maxitrol temperature control unit function page.

UNIT FUNCTION

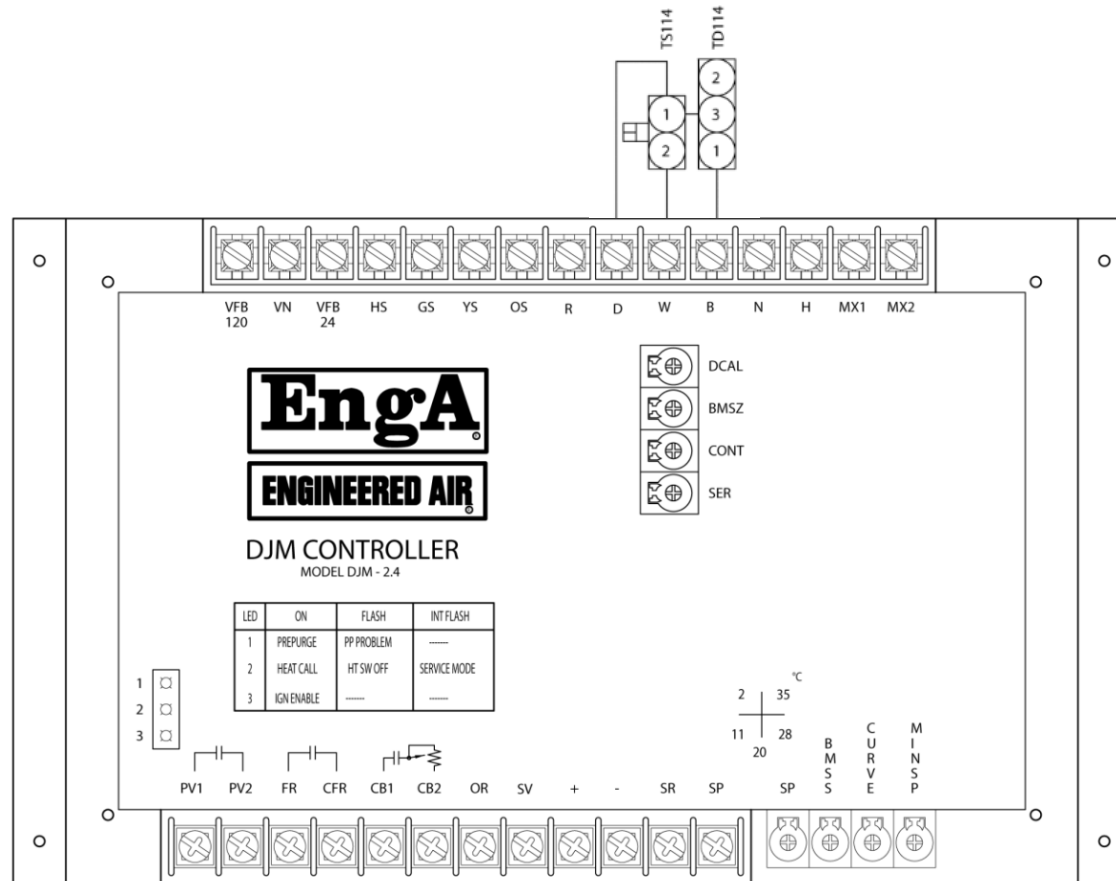
- NON FUSED DISCONNECT (BY OTHERS) 'ON'; SERVICE SWITCH 'ON'; ON/OFF CONTACT (BY OTHERS) 'ON'
- OUTSIDE AIR DAMPERS OPEN TO 10 %; DELAYED SUPPLY AIR AND RETURN AIR BLOWER OPERATION
- BURNER FIRES DJM MODULATES GAS AND COMBUSTION AIR TO MAINTAIN DISCHARGE AIR TEMP @ 70F (21.1C



Maxitrol temperature control unit wiring page.



Maxitrol temperature control.



Temperature control.

- To enable the Maxitrol temperature control, a Maxitrol TS114 sensor and Maxitrol TD114 temperature selector, must be wired to terminals D,W,B.



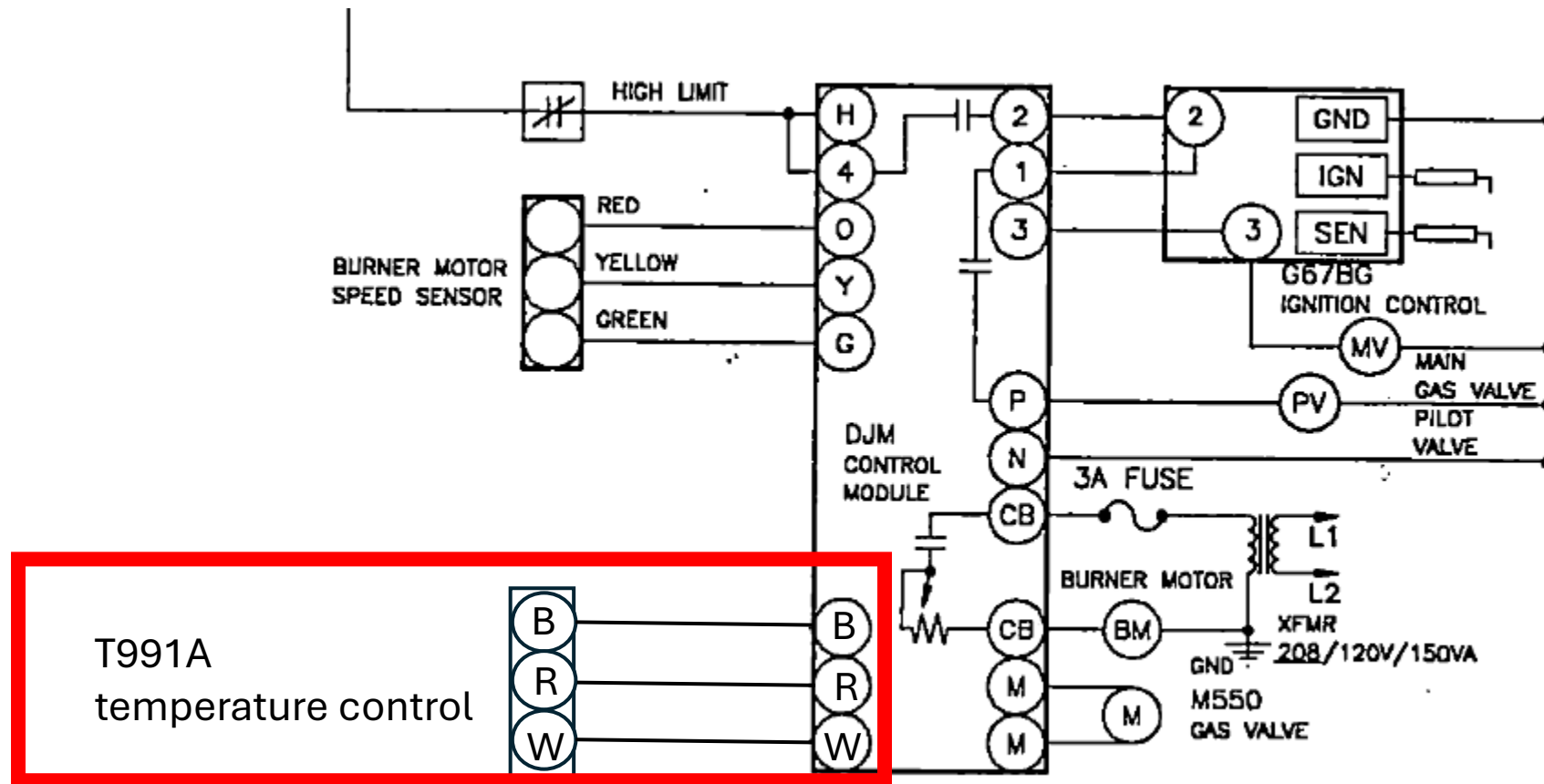
T991A 135ohm control unit function page.

UNIT FUNCTION

- NON FUSED DISCONNECT (BY OTHERS) 'ON'; SERVICE SWITCH 'ON'; ON/OFF CONTACT (BY OTHERS) 'ON'
- OUTSIDE AIR DAMPERS OPEN TO 10 %; DELAYED SUPPLY AIR AND RETURN AIR BLOWER OPERATION
- BURNER FIRES DJM MODULATES GAS AND COMBUSTION AIR TO MAINTAIN DISCHARGE AIR TEMP @ 70F (21.1C

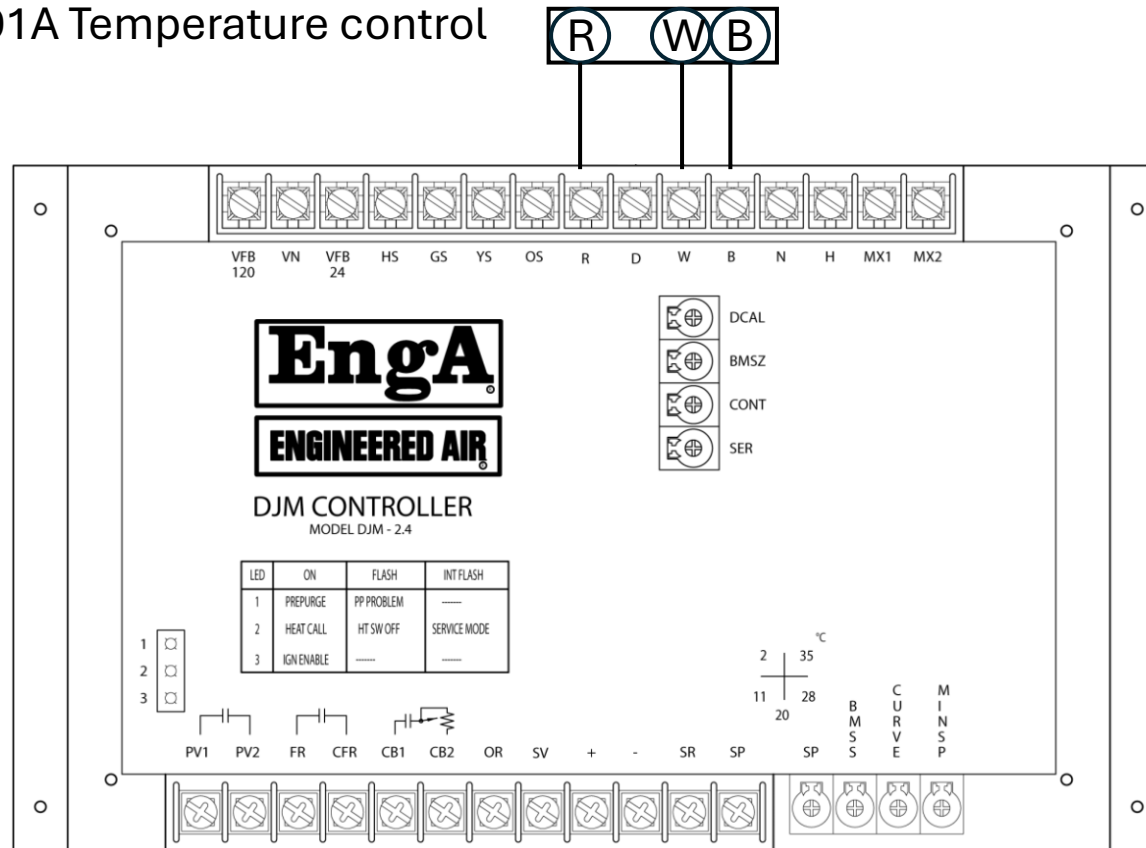


T991A 135ohm control unit wiring page.



T991A 135ohm temperature control.

T991A Temperature control



Temperature control.

- To enable the T991A Honeywell control; the control must be wired as shown.



Direct voltage or current control unit function page.

UNIT FUNCTION

Non-fused disconnect switch unit mtd. "On"; Service switch unit mtd. "On"; Fire alarm contact (by others) "made" (jumper if not required).

Unit On/Off contact from remote panel "On".

Outside air dampers open to 100% O/A. Supply air blower delay on then run continuously.

Heat/Auto/Cool switch in "Cool" position: (Heating is locked out).

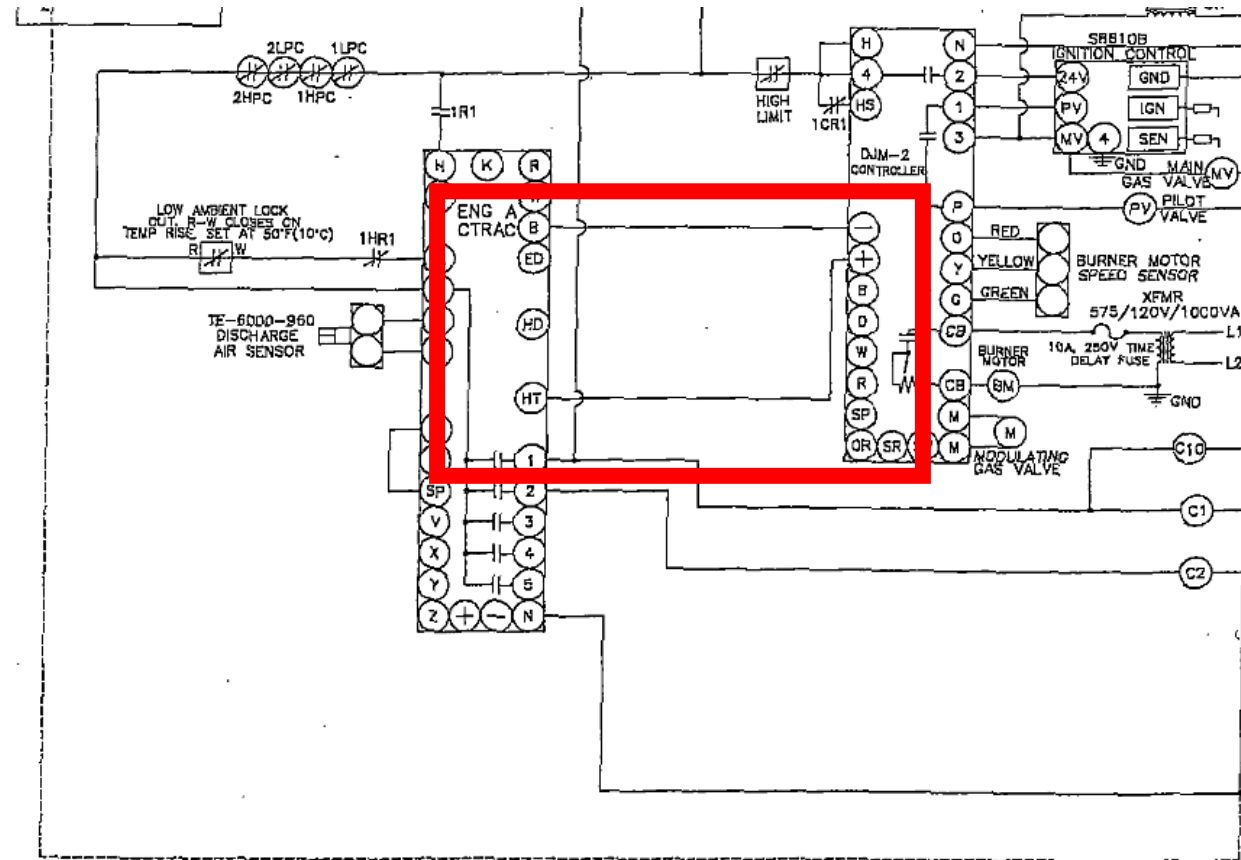
CTrac controller set point at 70°F (21.1°C) cycles 2 stages of mechanical cooling.

Heat/Auto/Cool switch in "Heat" position: (Cooling is locked out).

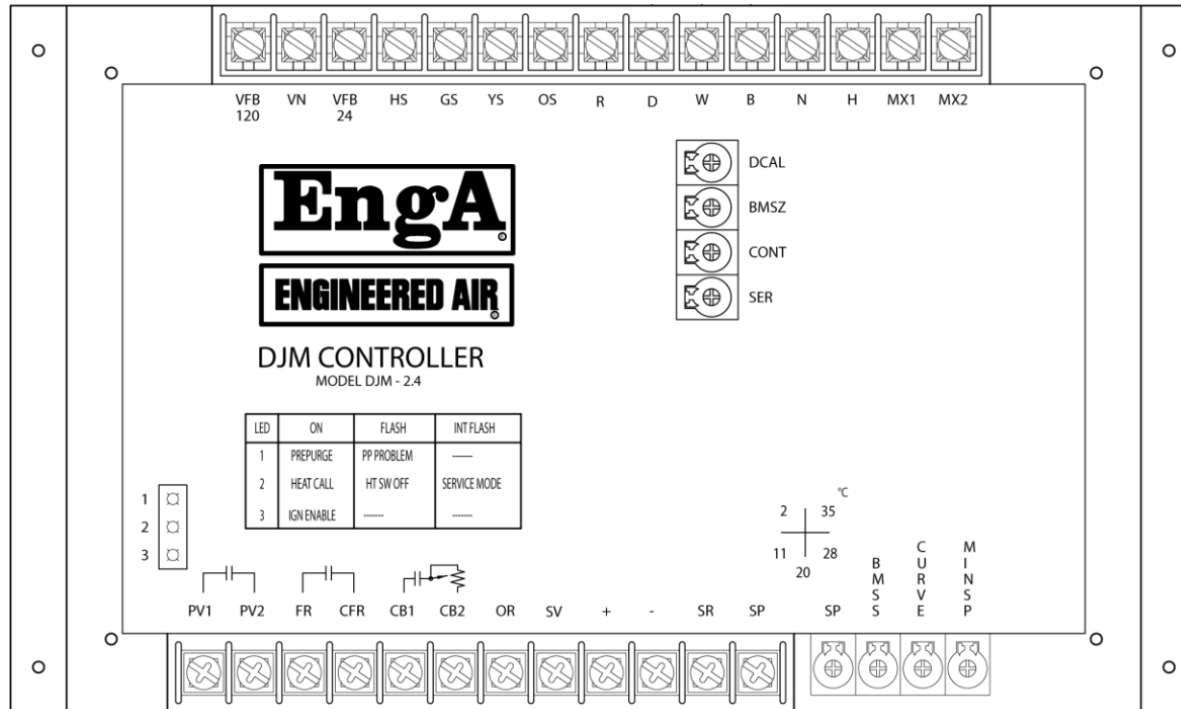
DJM-2 heating controller modulates gas flow and combustion air to maintain discharge air set point.



Direct voltage or current control unit wiring page.



Direct voltage or current control.



Temperature control.

- To enable direct voltage or current control to the DJM2 from BMS or C-TRAC, connect the signal wire to terminals +/- on the DJM2.
- Follow setup procedure in the manual.
- 680ohm resistor required across terminals +/- for current control.

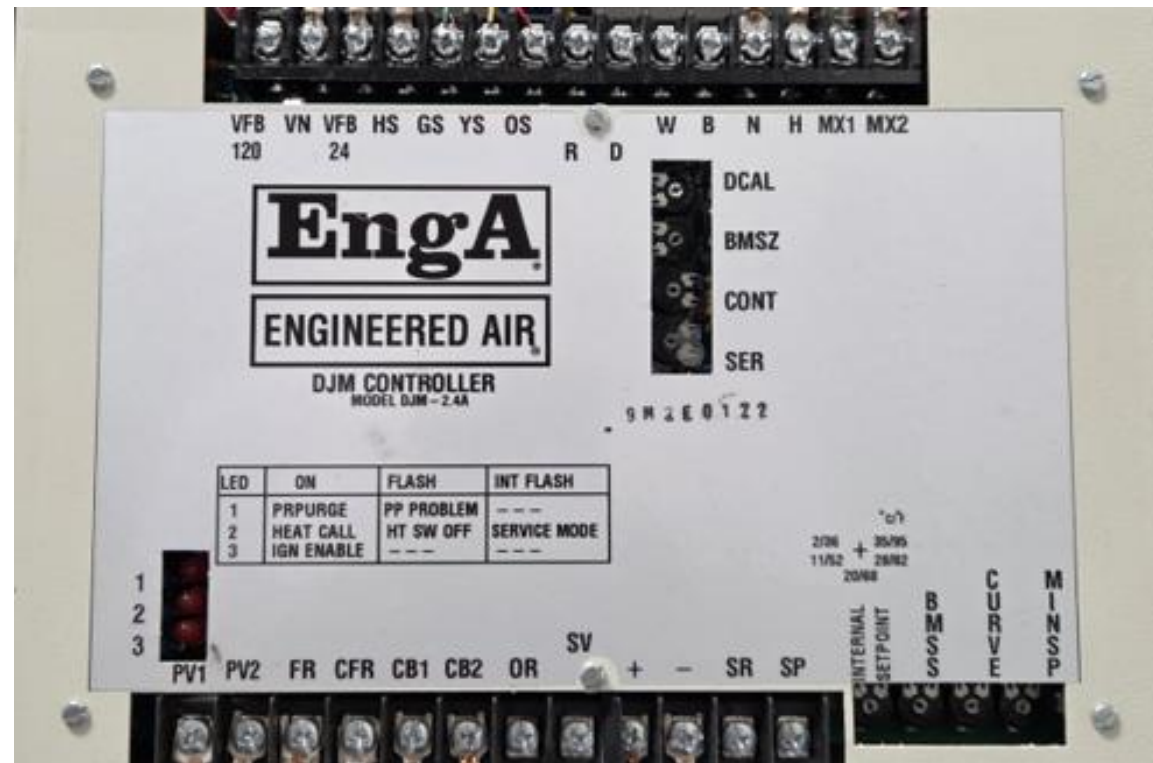


Terminals +/-.

Voltage or current input. Direct temperature control.



Air side operation.



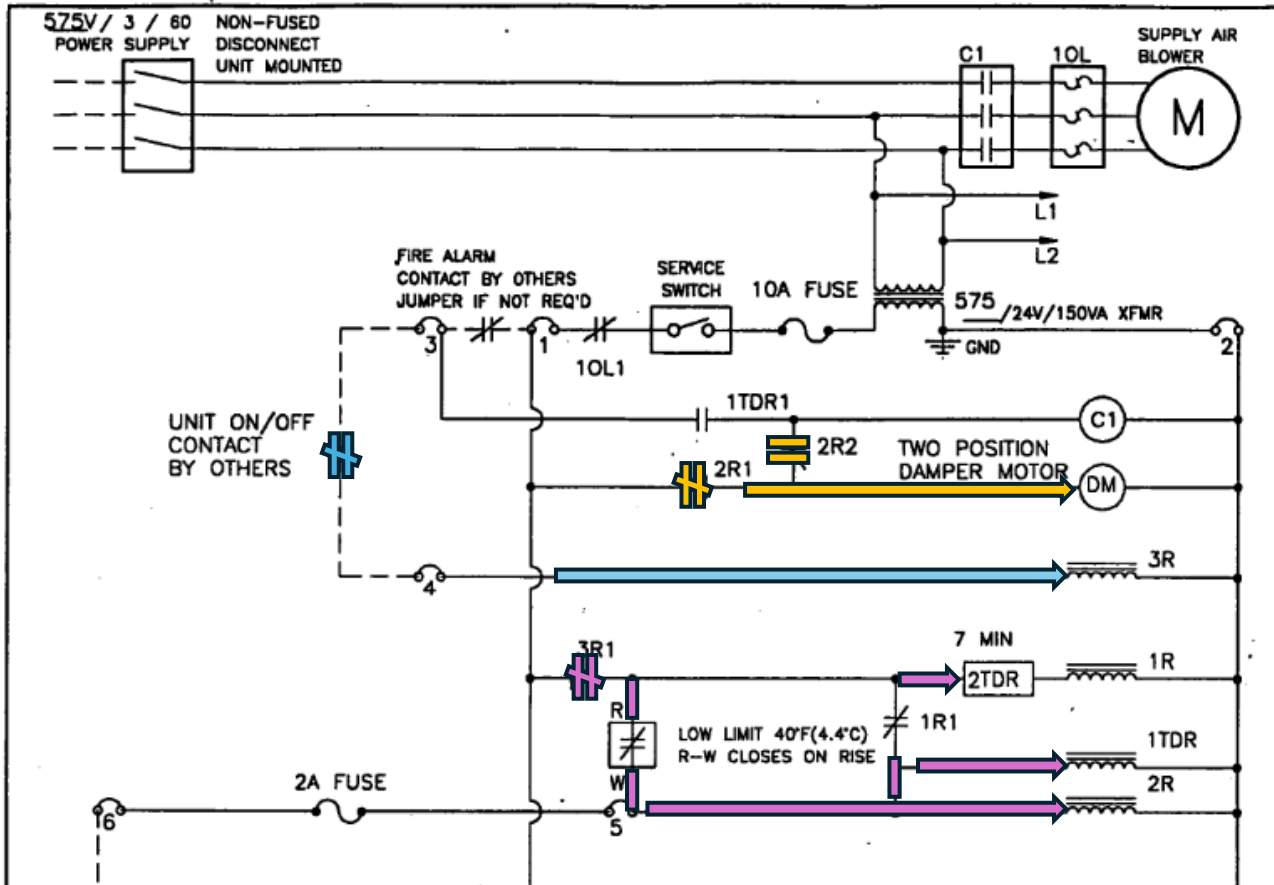
Blower strategies day mode.

Day and night operation.

- All day and night operation is controlled by external controls to the DJM2.
- Night mode operation is covered in the
- C-TRAC/DJM operation guide.



Blower operation day mode.



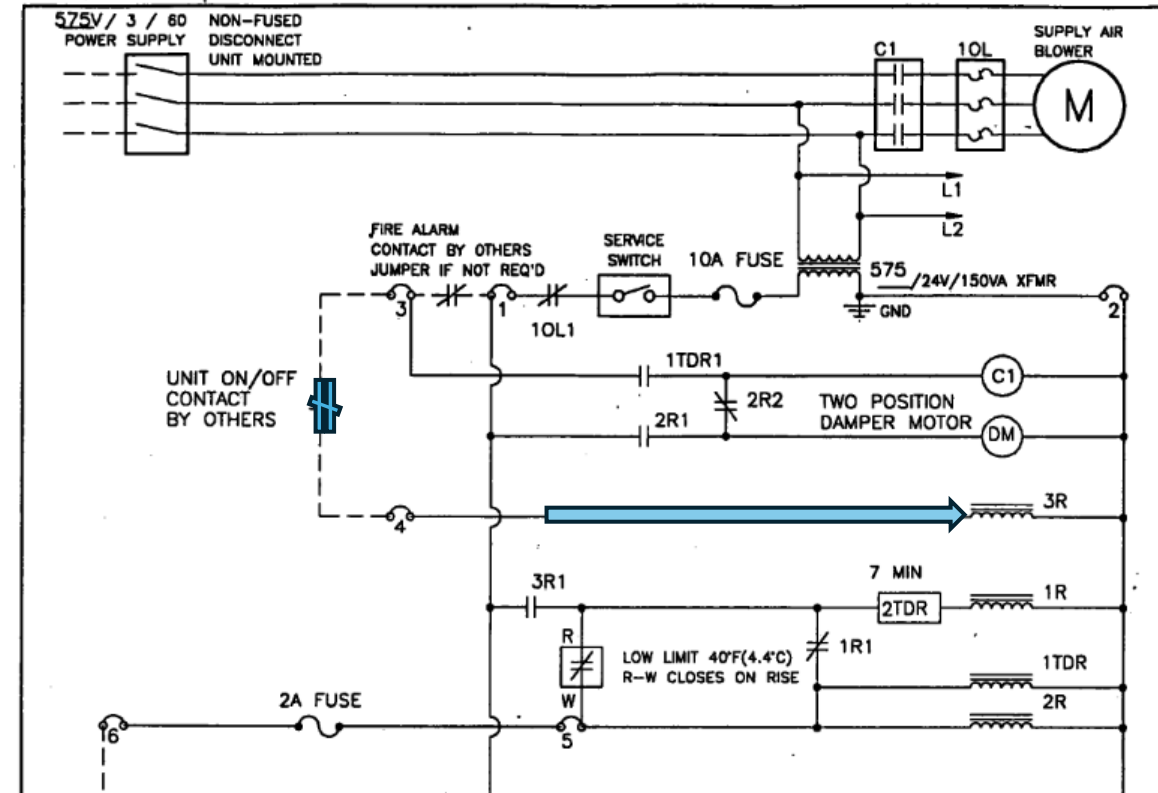
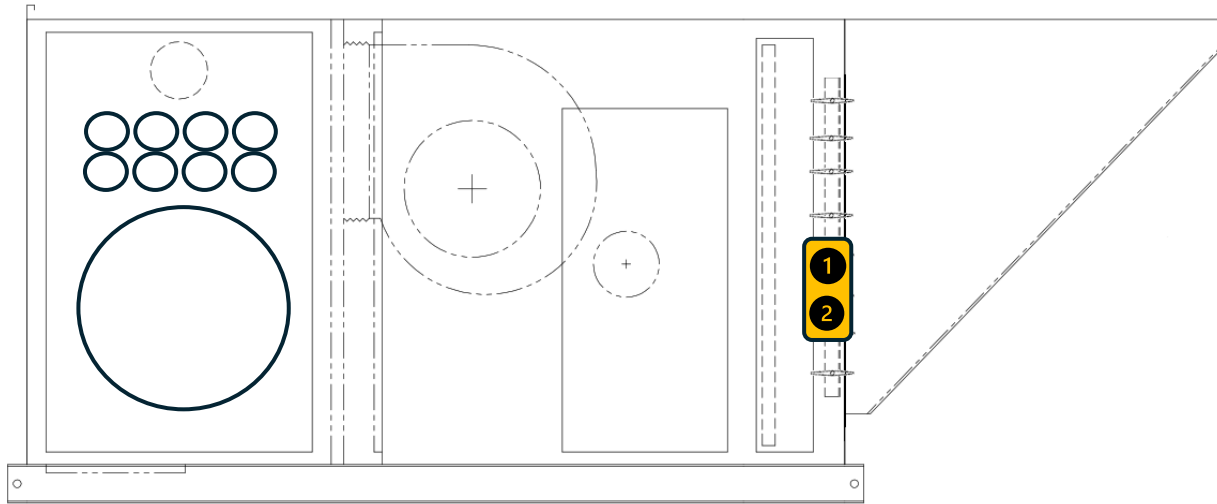
Day mode (No heat call).

Ventilation mode.

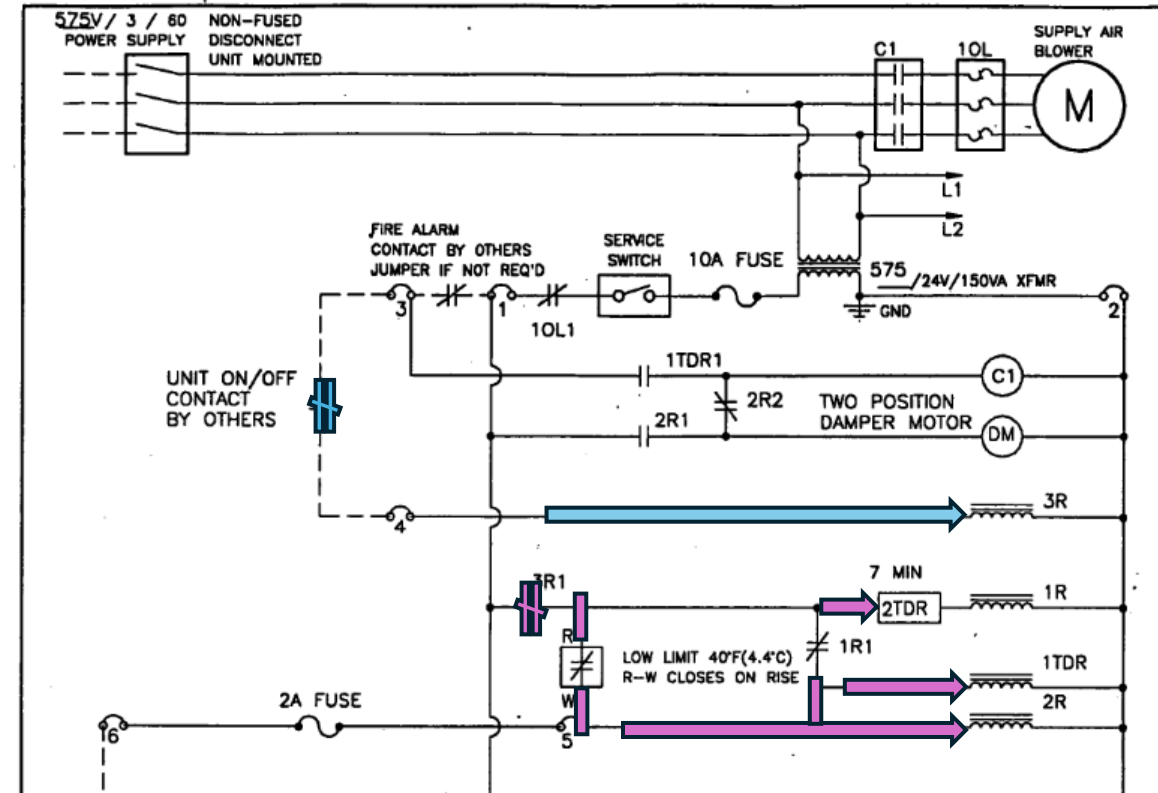
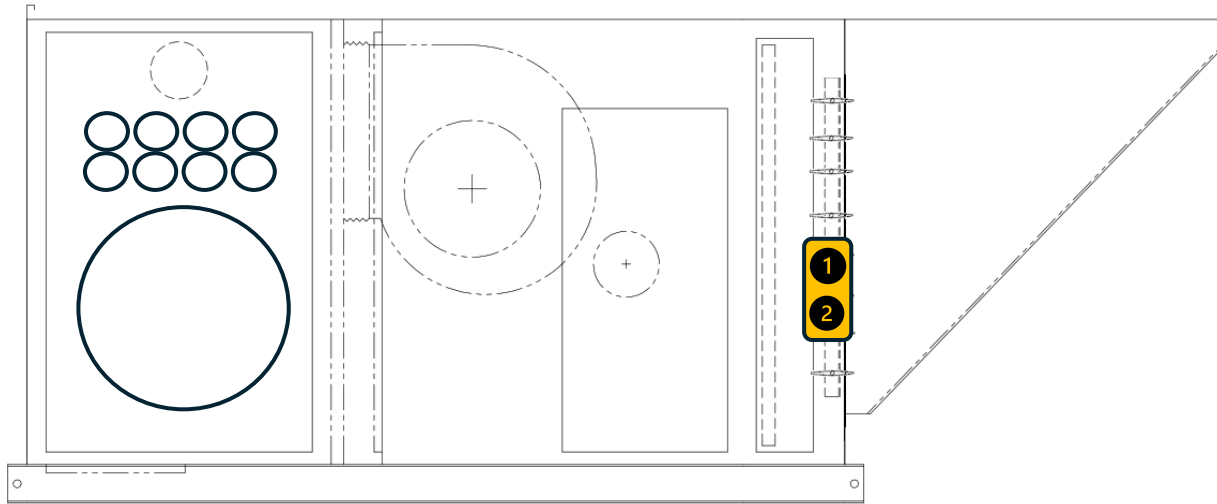
1. Unit ON/OFF contacts close, powering 3R relay.
2. 3R1 contact closes, and powers 2R relay and 1TDR relay through the external low limit. The 45 second 1TDR timer starts and the 7minute 2TDR timer starts.
3. 2R1 contact closes and 2R2 contact opens; the damper motor is powered, and the dampers start to open.



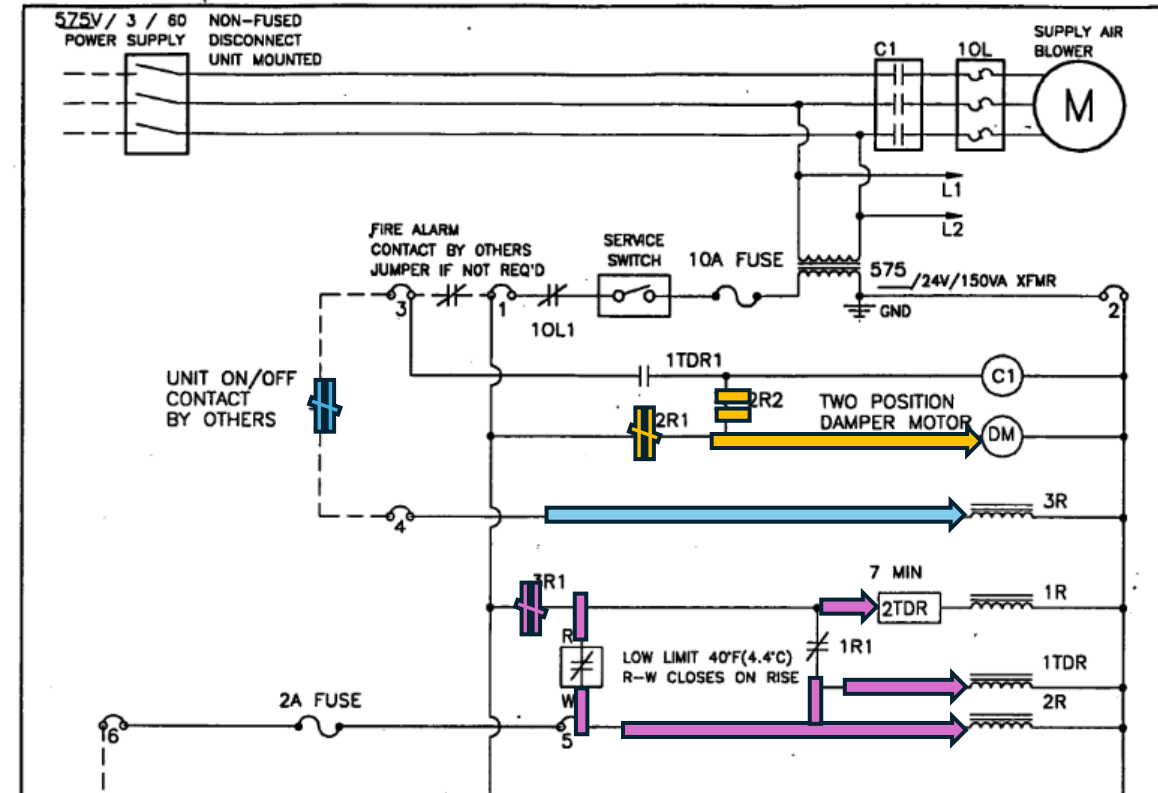
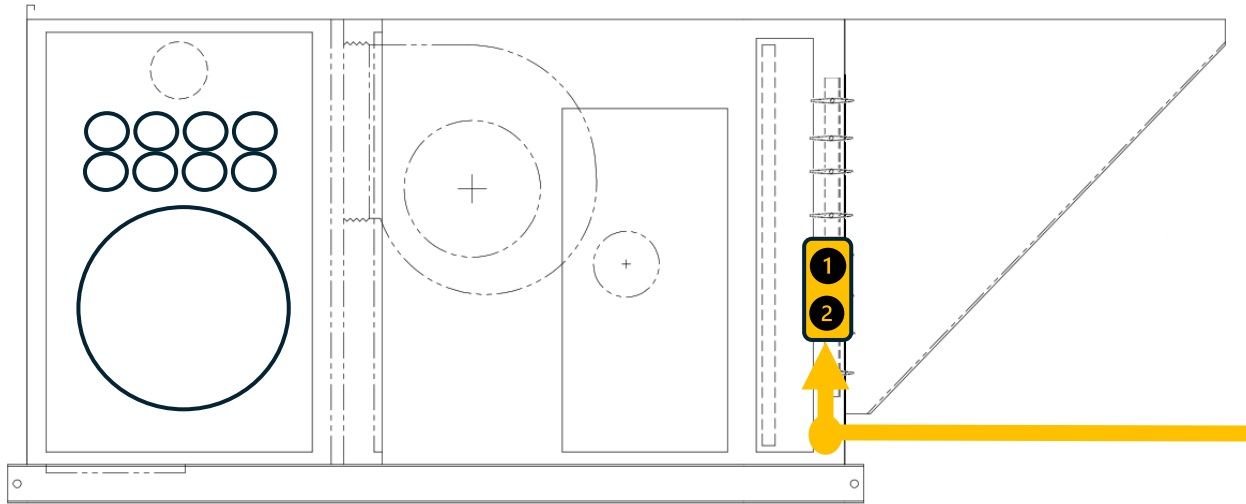
Blower operation day mode.



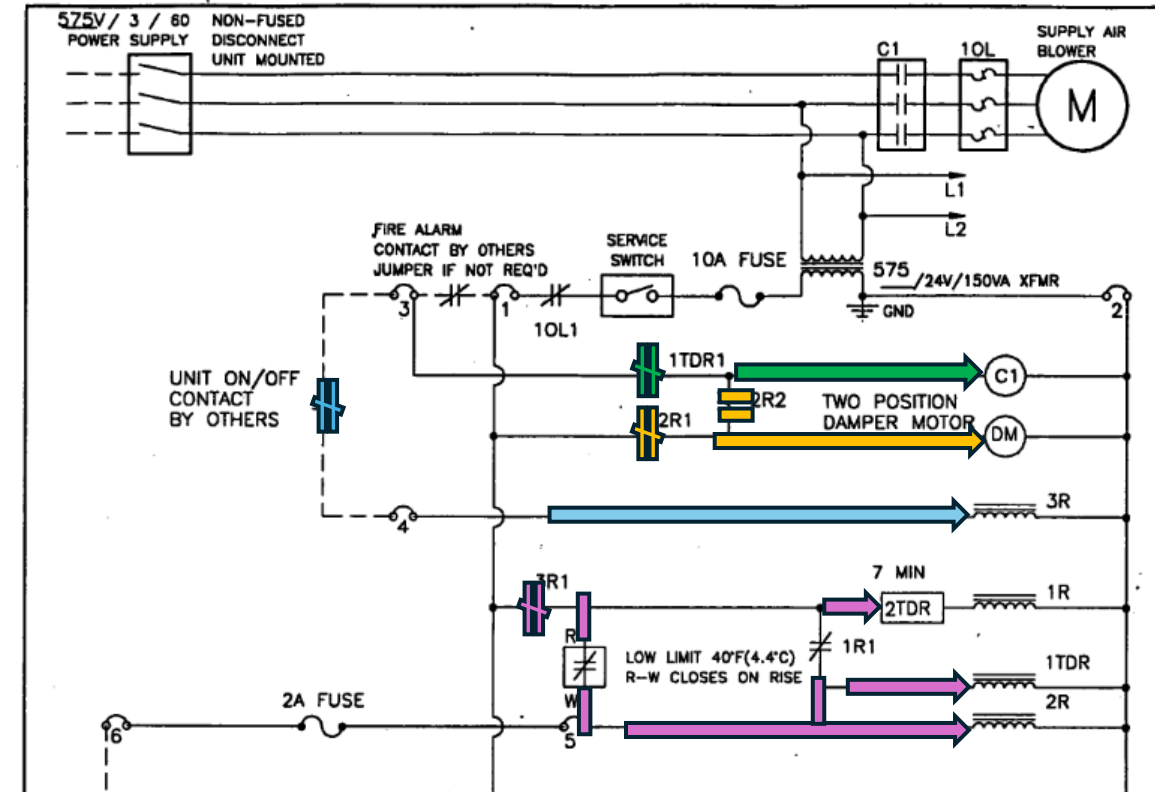
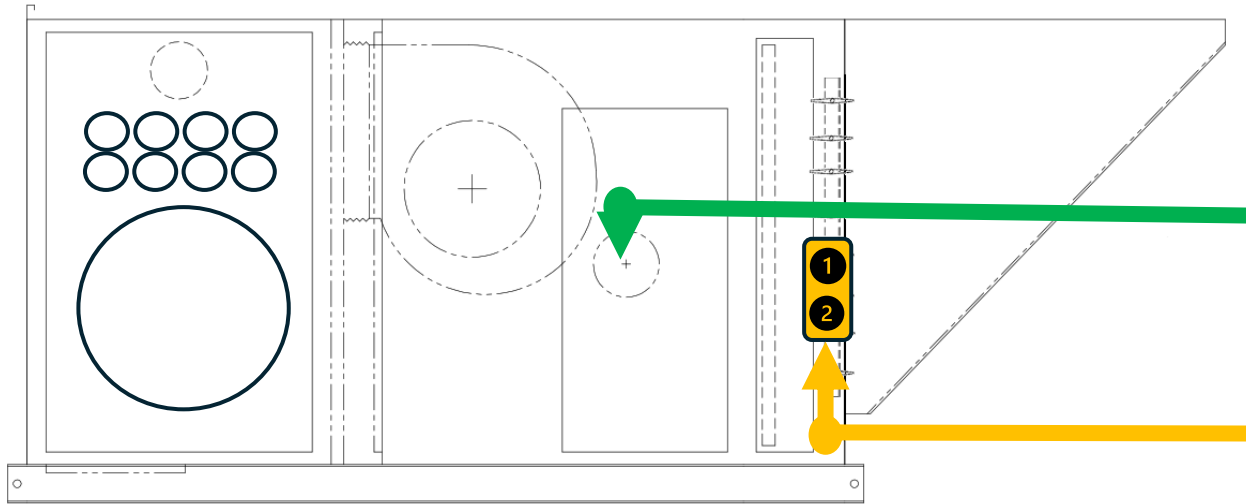
Blower operation day mode.



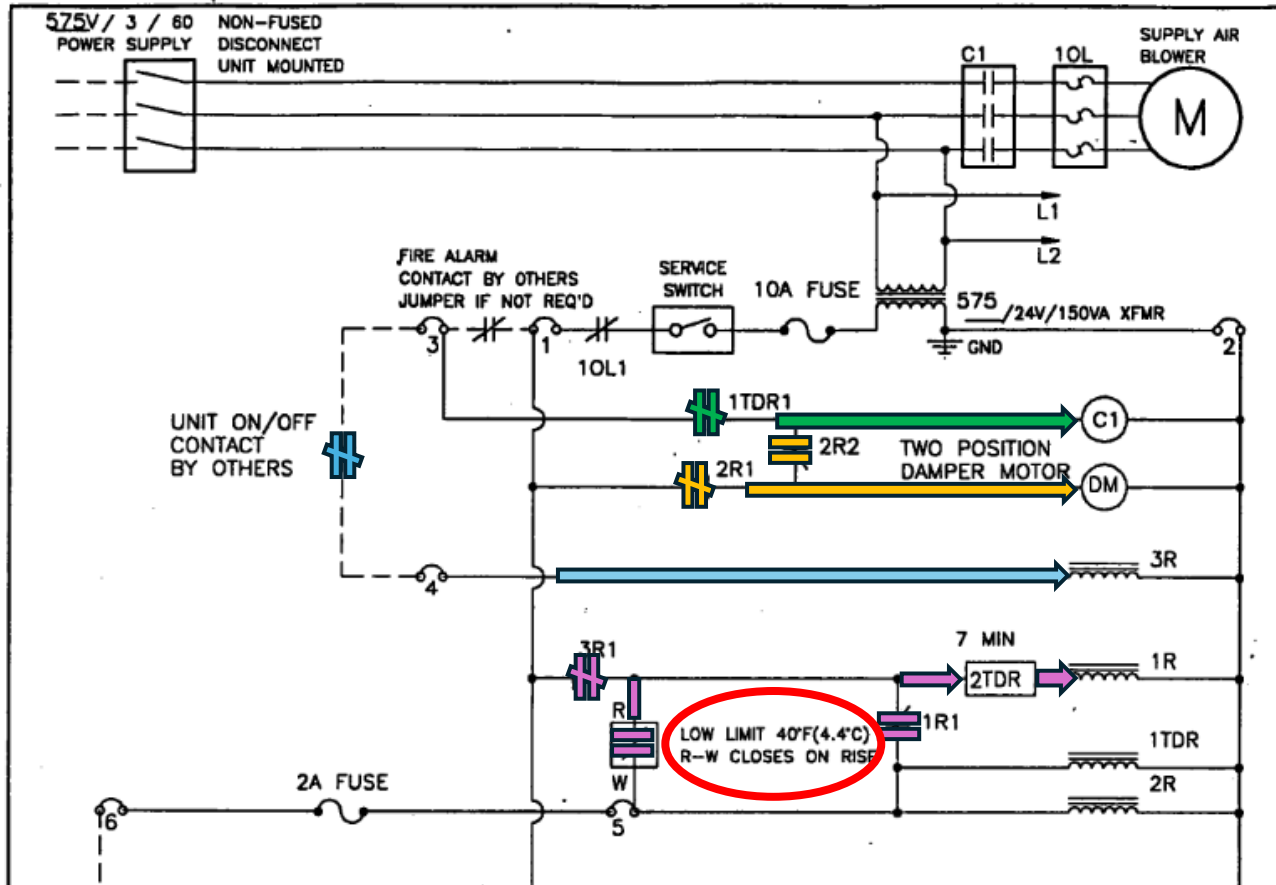
Blower operation day mode.



Blower operation day mode.



External low limit operation.

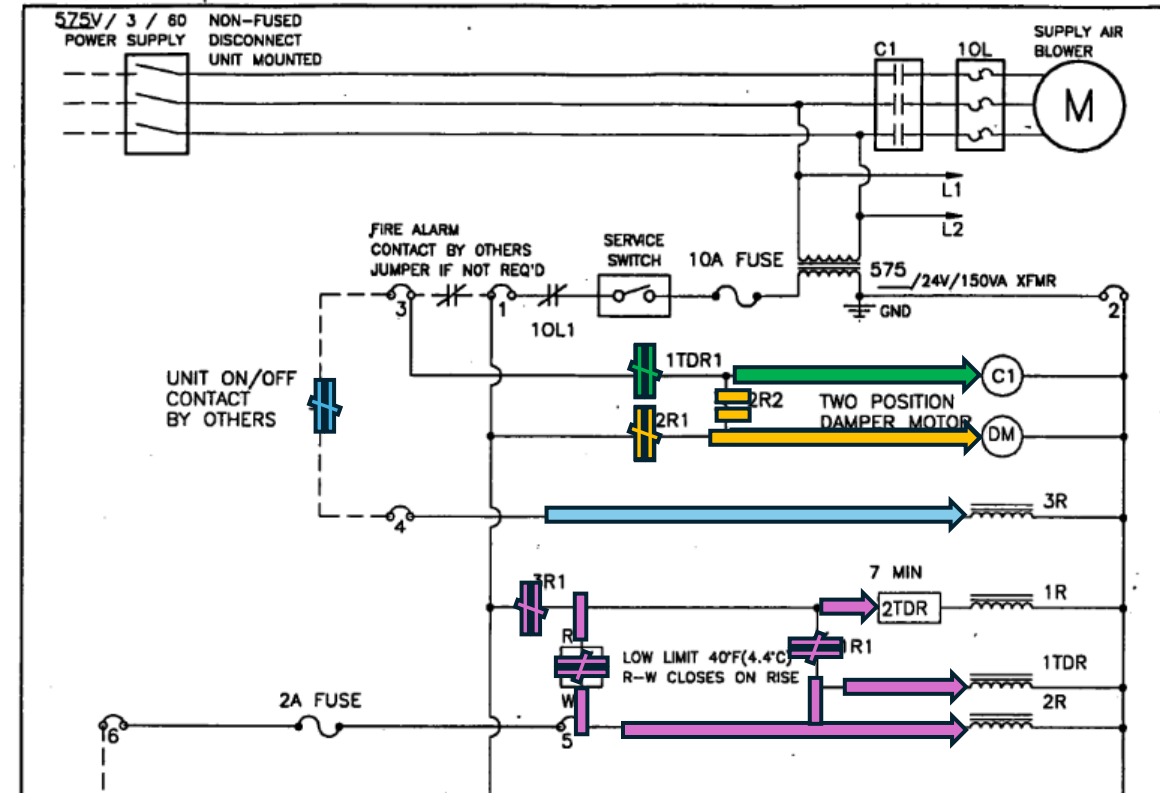
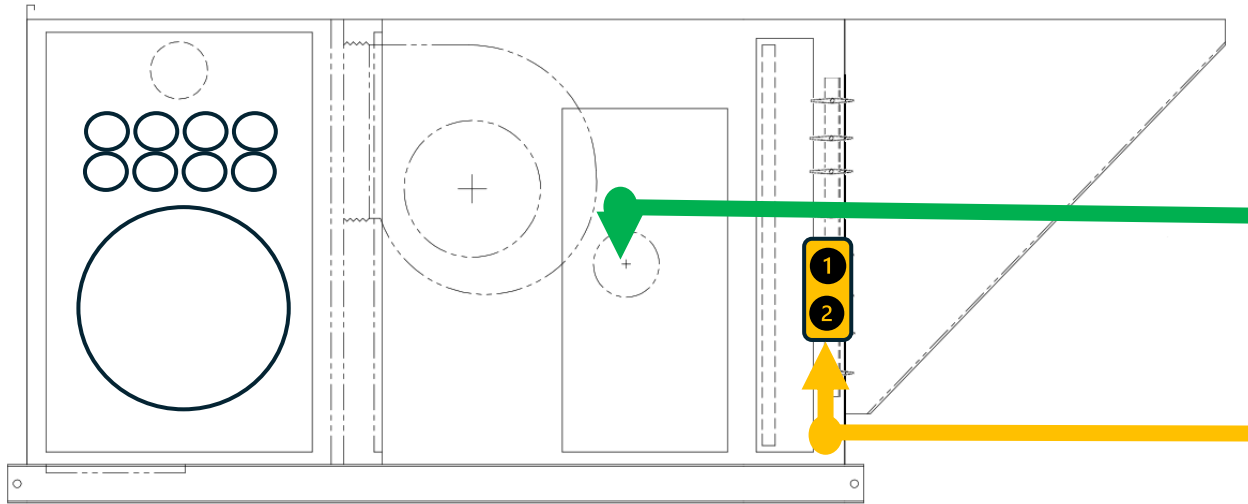


Day mode.

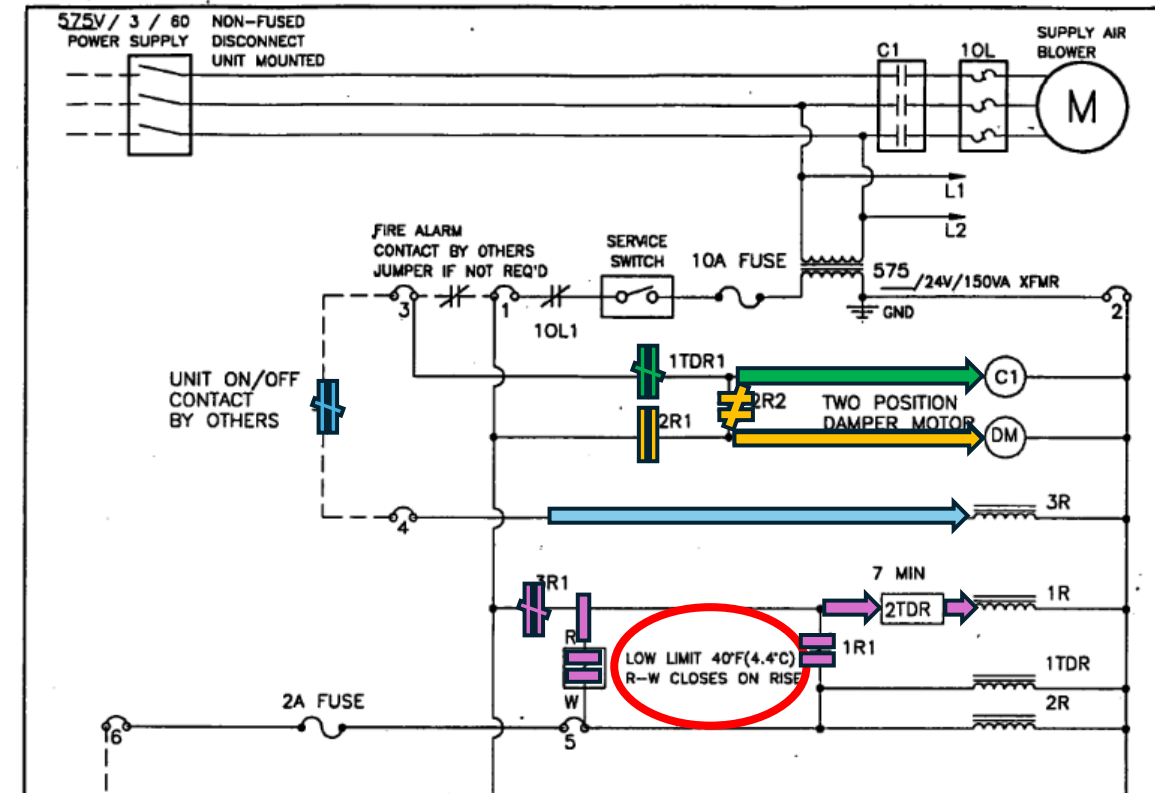
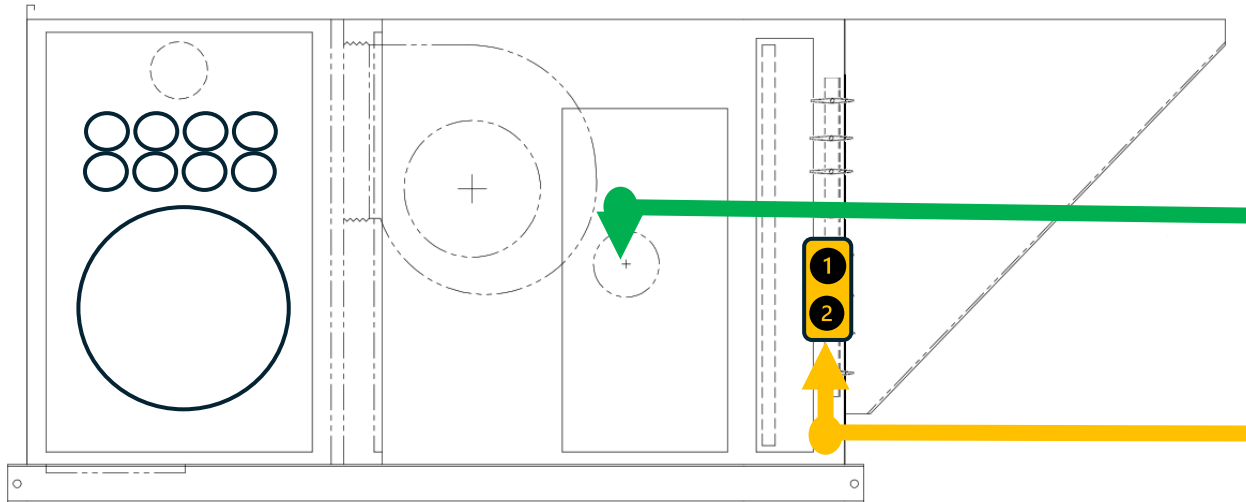
1. Dampers are open and the supply air blower is running.
2. After the 7-minute timer expires, 1R relay will be powered, and 1R1 contacts will open.
3. If the discharge temperature drops below 40°F (4.4°C), the internal contacts on the low limit will open and remove power from 2R and 1TDR relays.



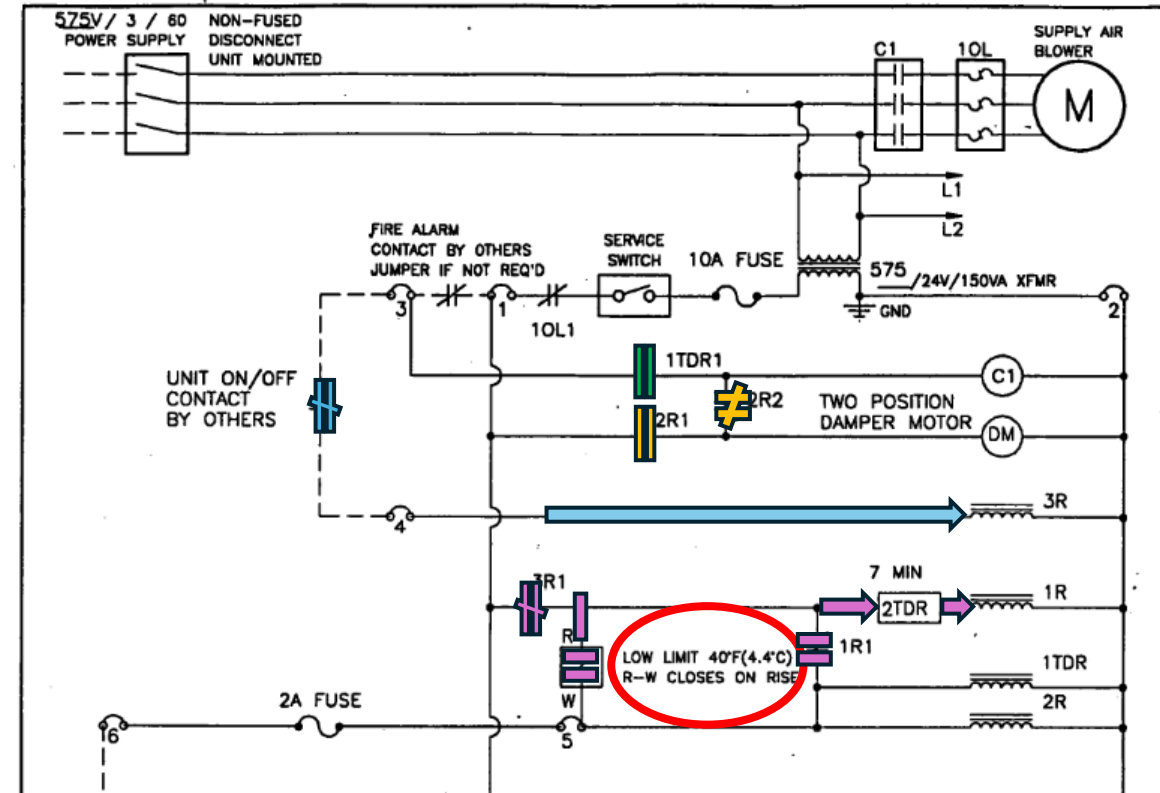
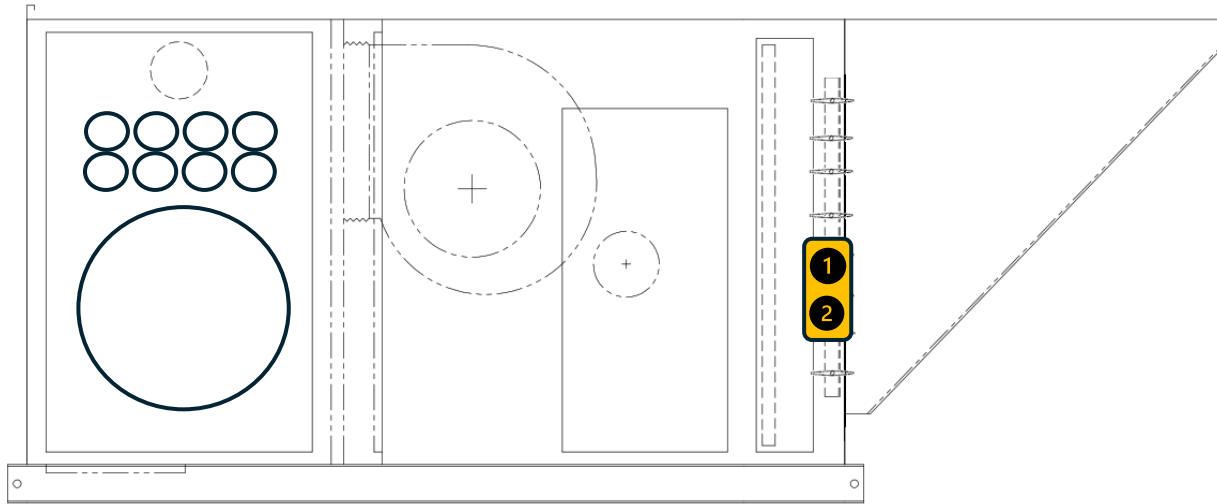
External low limit operation.



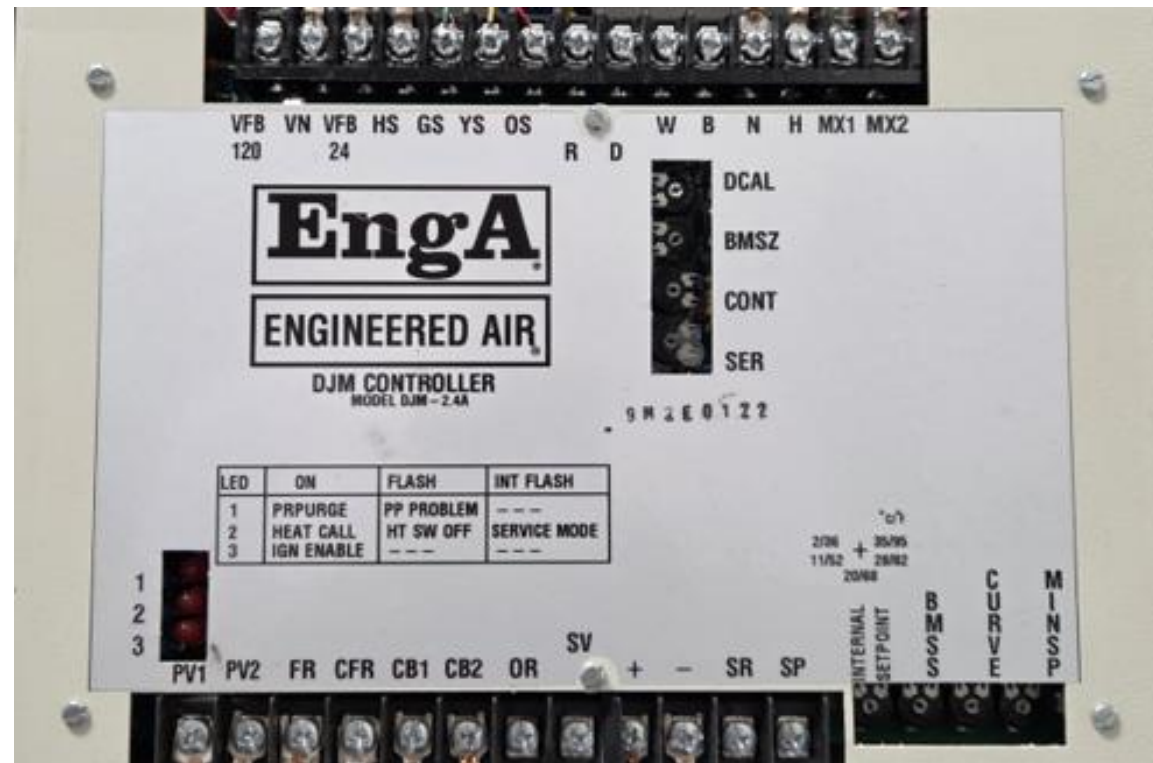
External low limit operation.



External low limit operation.



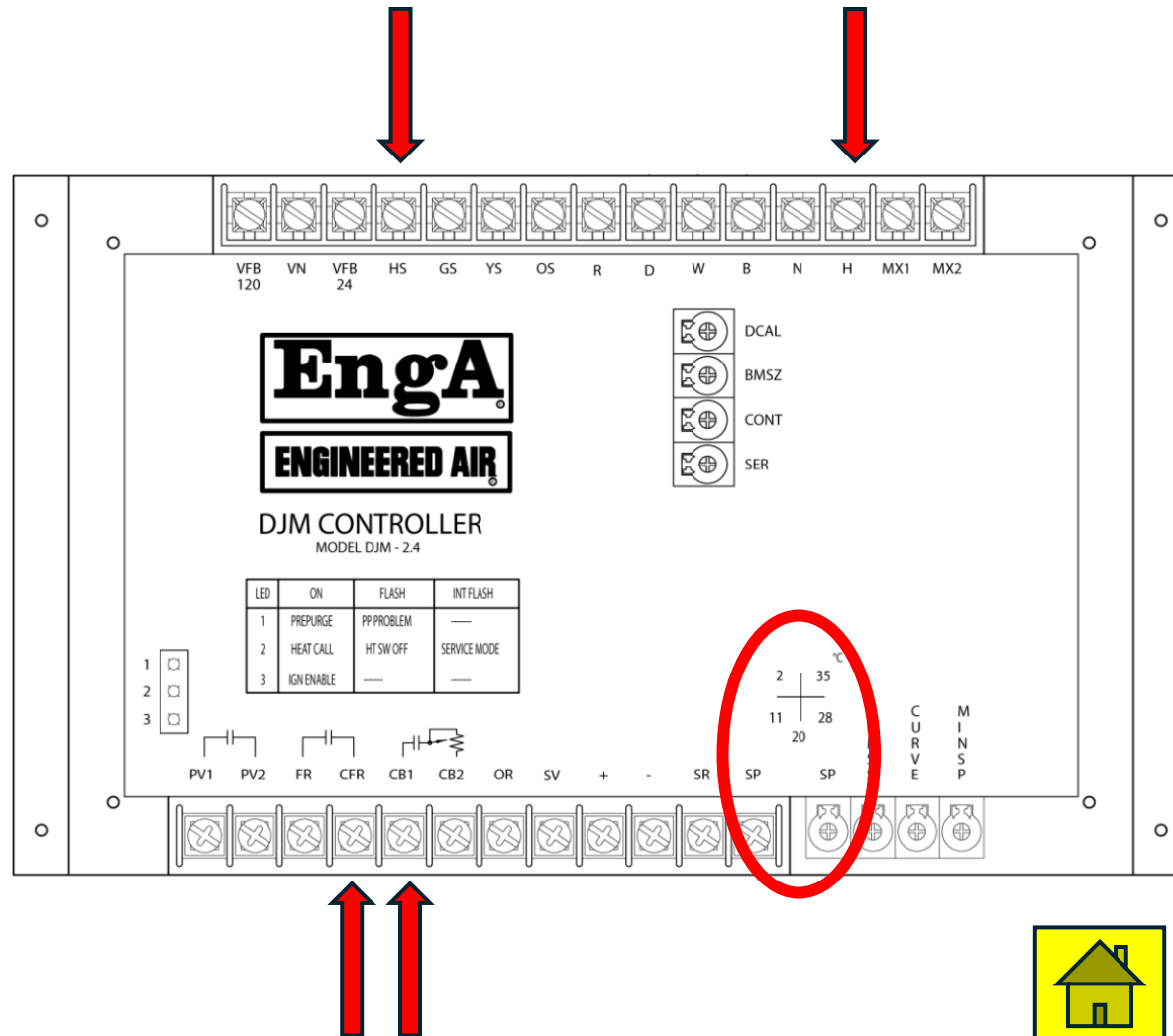
Burner side operation.



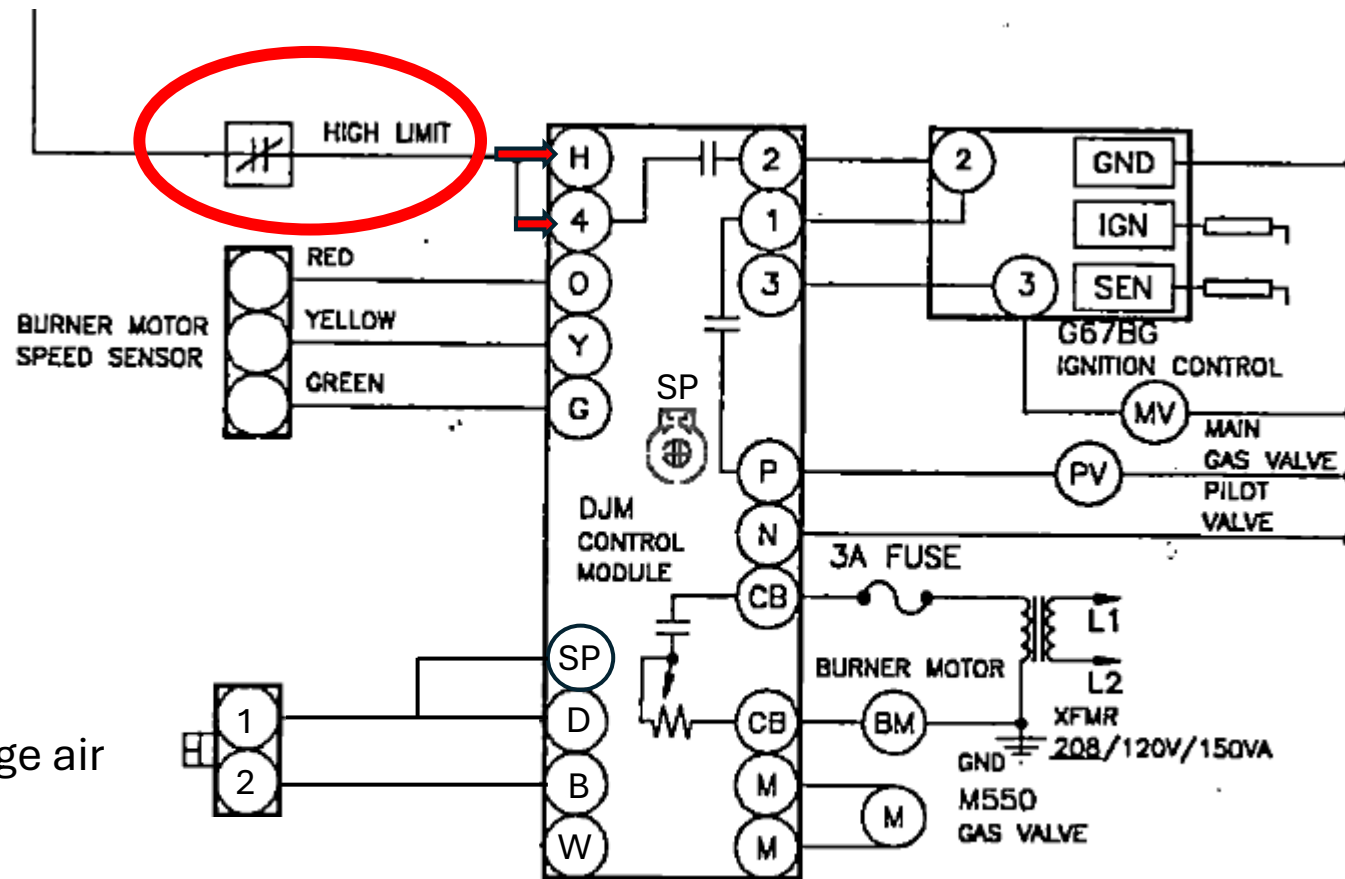
Basic burner operation.

Basic burner operation.

1. All safeties in series with terminal CFR must be closed.
2. Terminals H and HS powered by 24vac input.
3. Discharge temperature must be lower than the discharge air setpoint.
4. Burner sequence starts.



Burner sequence.



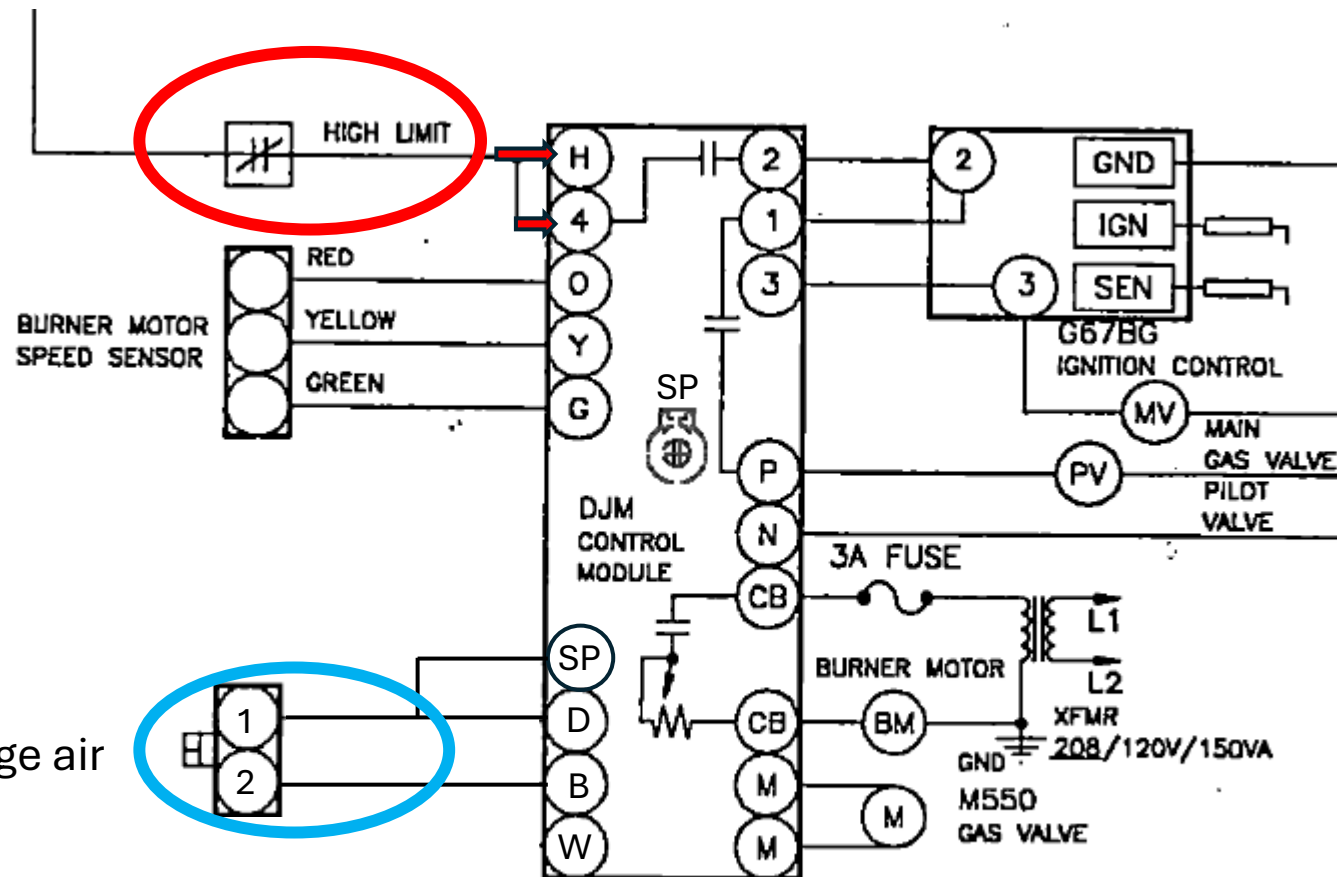
Basic burner operation.

1. All safeties in series with terminals 4(CFR) and H must be closed.
2. Terminals H and 4(CFR) powered by 24vac input.

TE6000
Discharge air
sensor



Burner sequence.

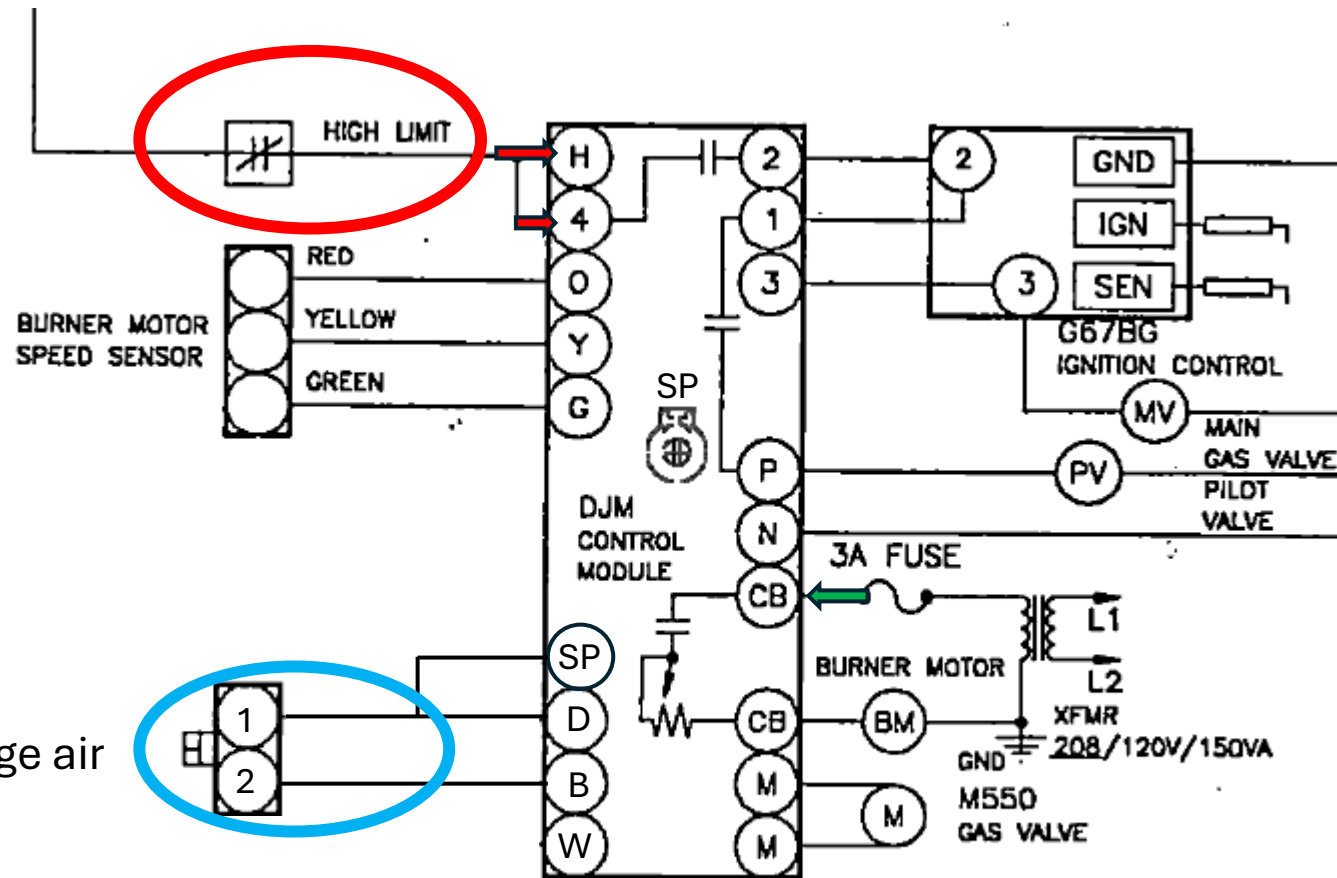


Basic burner operation.

1. All safeties in series with terminals 4(CFR) and H must be closed.
2. Terminals H and 4(CFR) powered by 24vac input.
3. Discharge temperature must be lower than the discharge air setpoint.



Burner sequence.

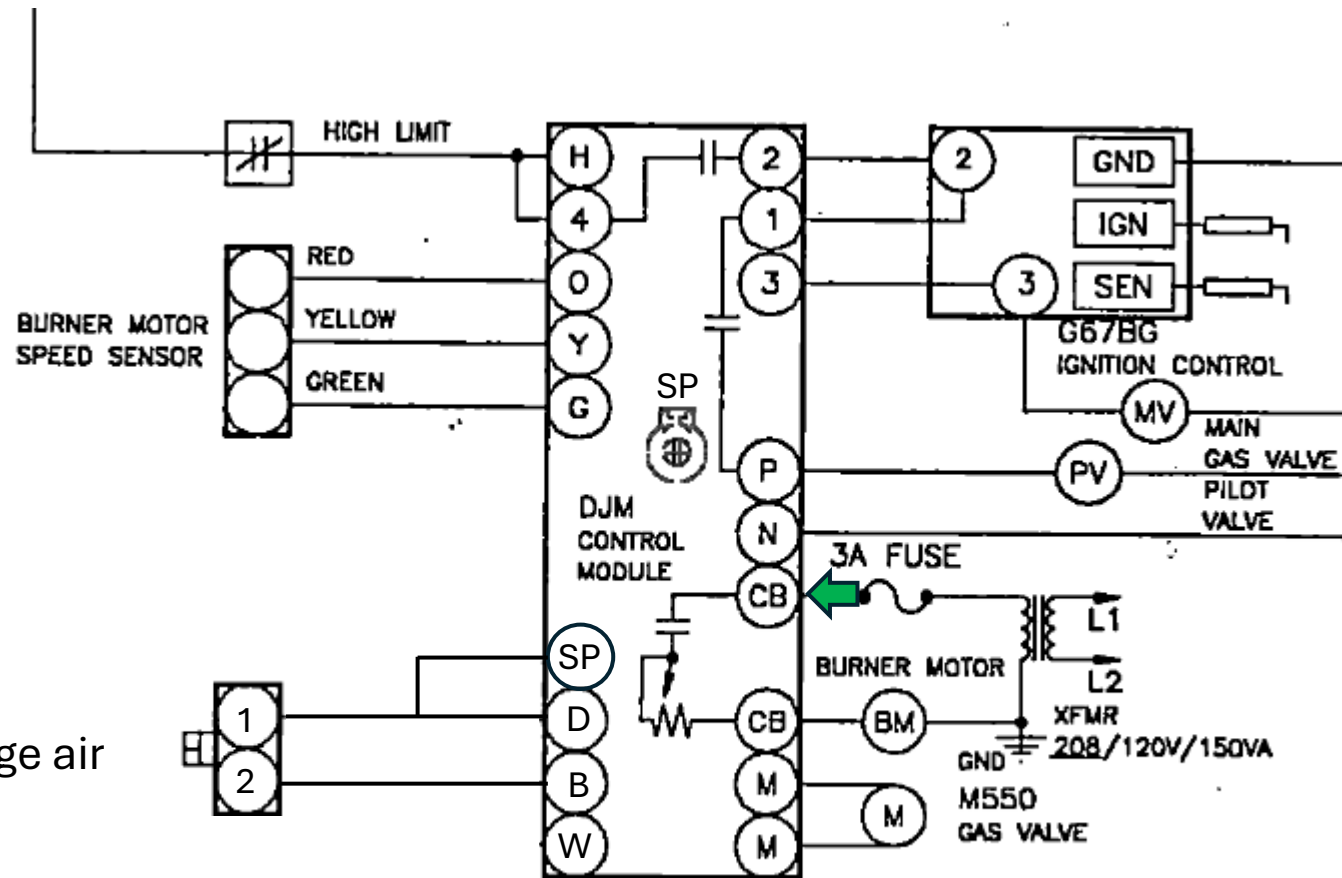


Basic burner operation.

1. All safeties in series with terminals 4(CFR) and H must be closed.
2. Terminals H and 4(CFR) powered by 24vac input.
3. Discharge temperature must be lower than the discharge air setpoint.
4. Burner sequence starts.



Ignition sequence.



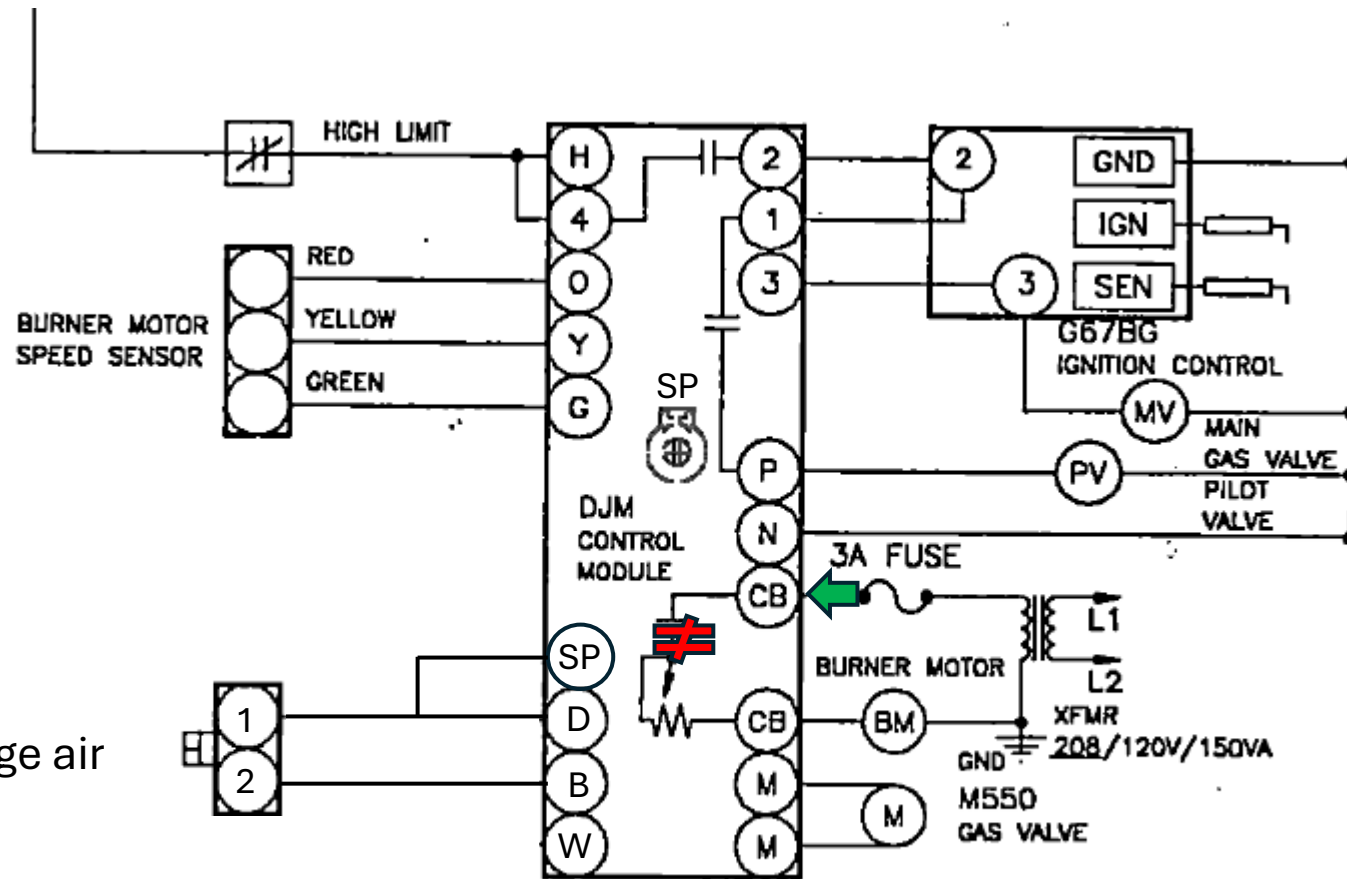
Ignition sequence.

1. Terminal CB is powered by 120vac.

TE6000
Discharge air
sensor



Ignition sequence.



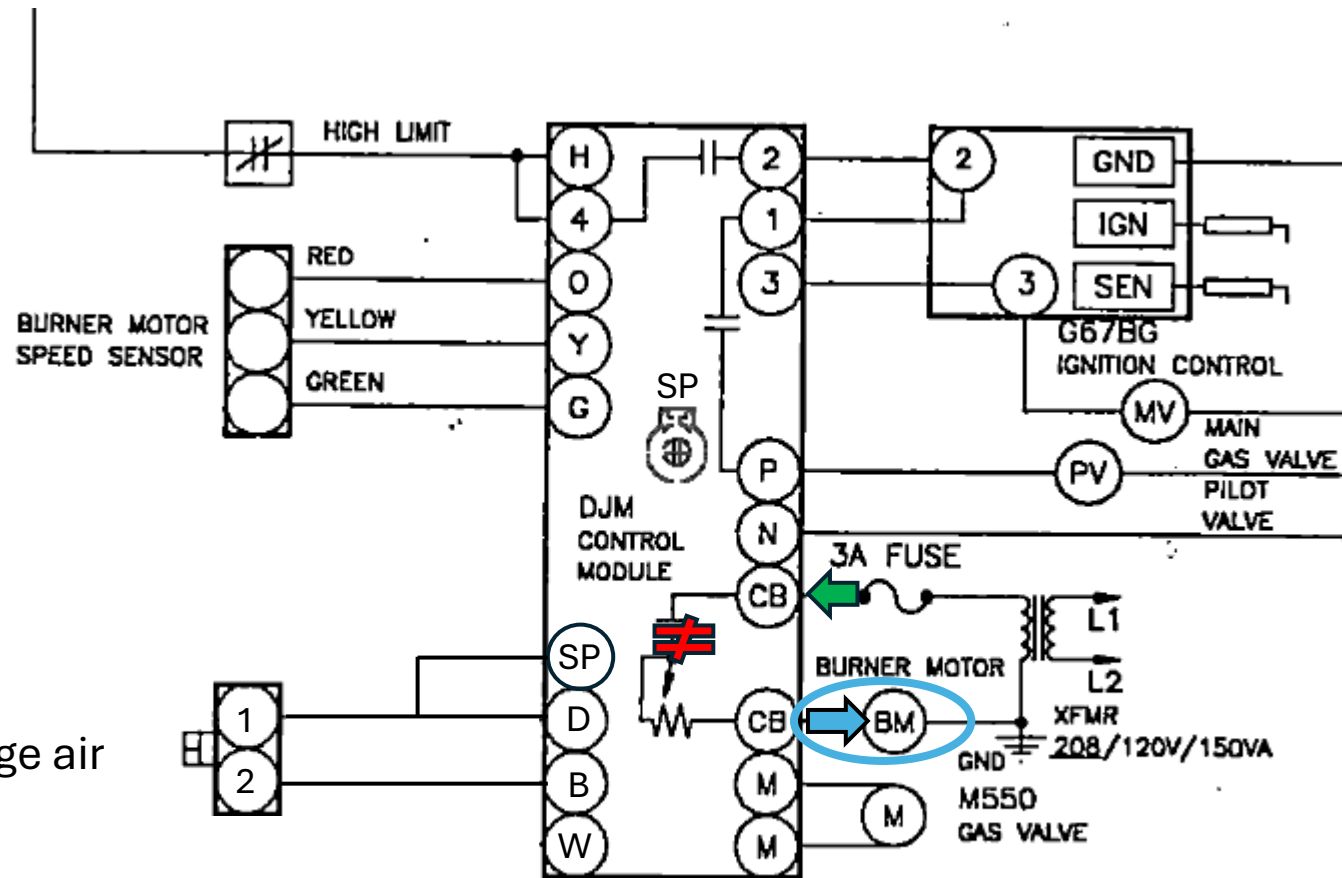
Ignition sequence.

1. Terminal CB is powered by 120vac.
2. Contacts between CB and CB close.

TE6000
Discharge air
sensor



Ignition sequence.



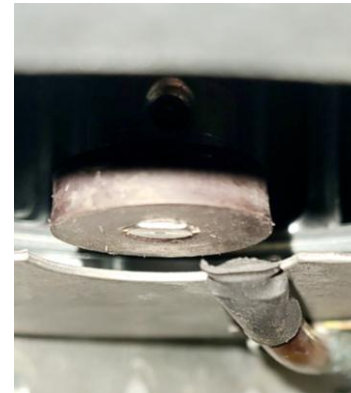
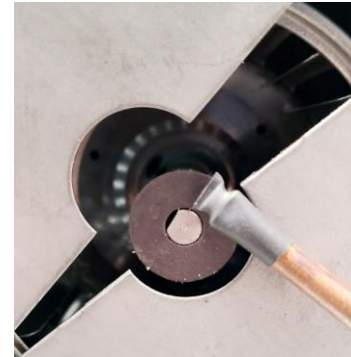
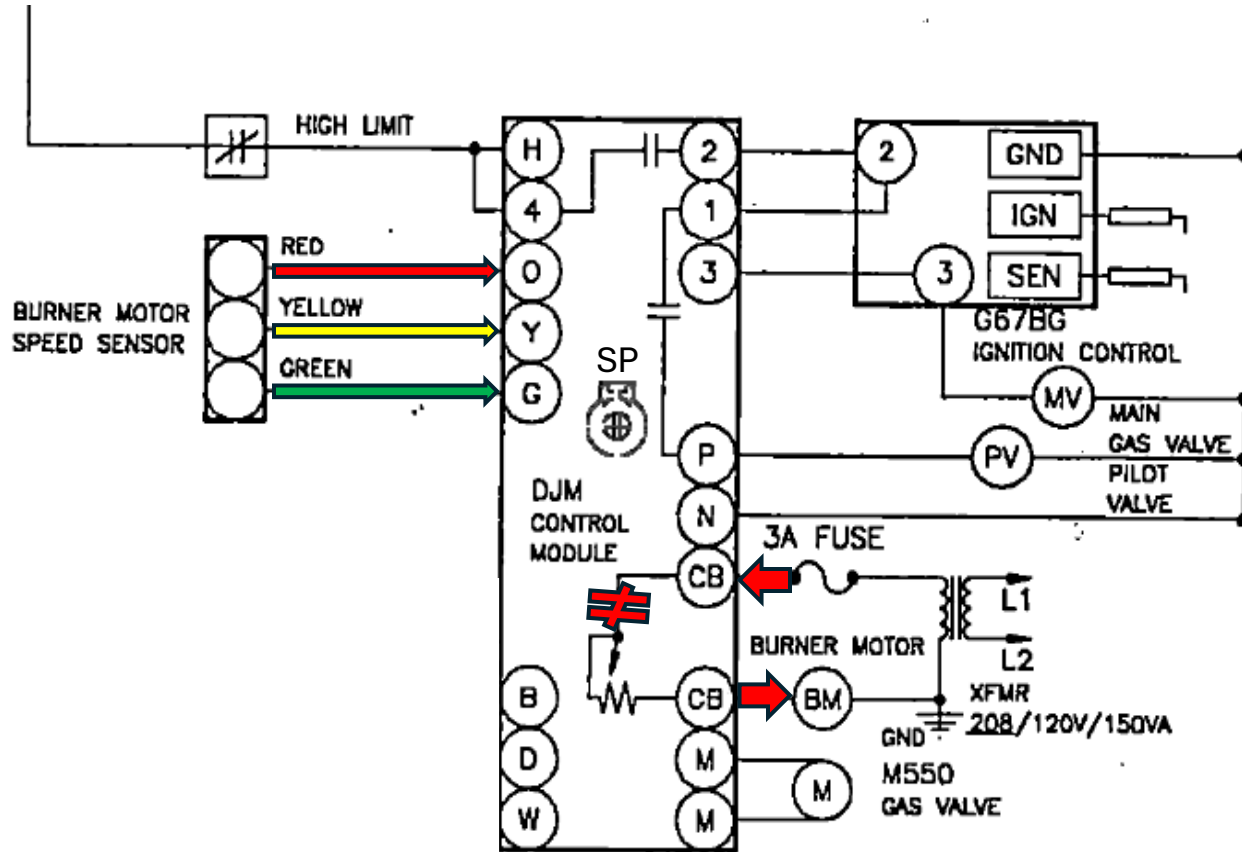
Ignition sequence.

1. Terminal CB is powered by 120vac.
2. Contacts between CB and CB close.
3. The burner motor starts.
4. The DJM2 is in pre purge.

TE6000
Discharge air
sensor



Ignition sequence.

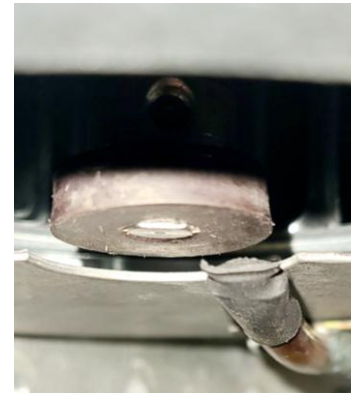
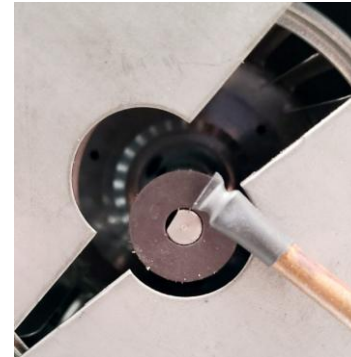
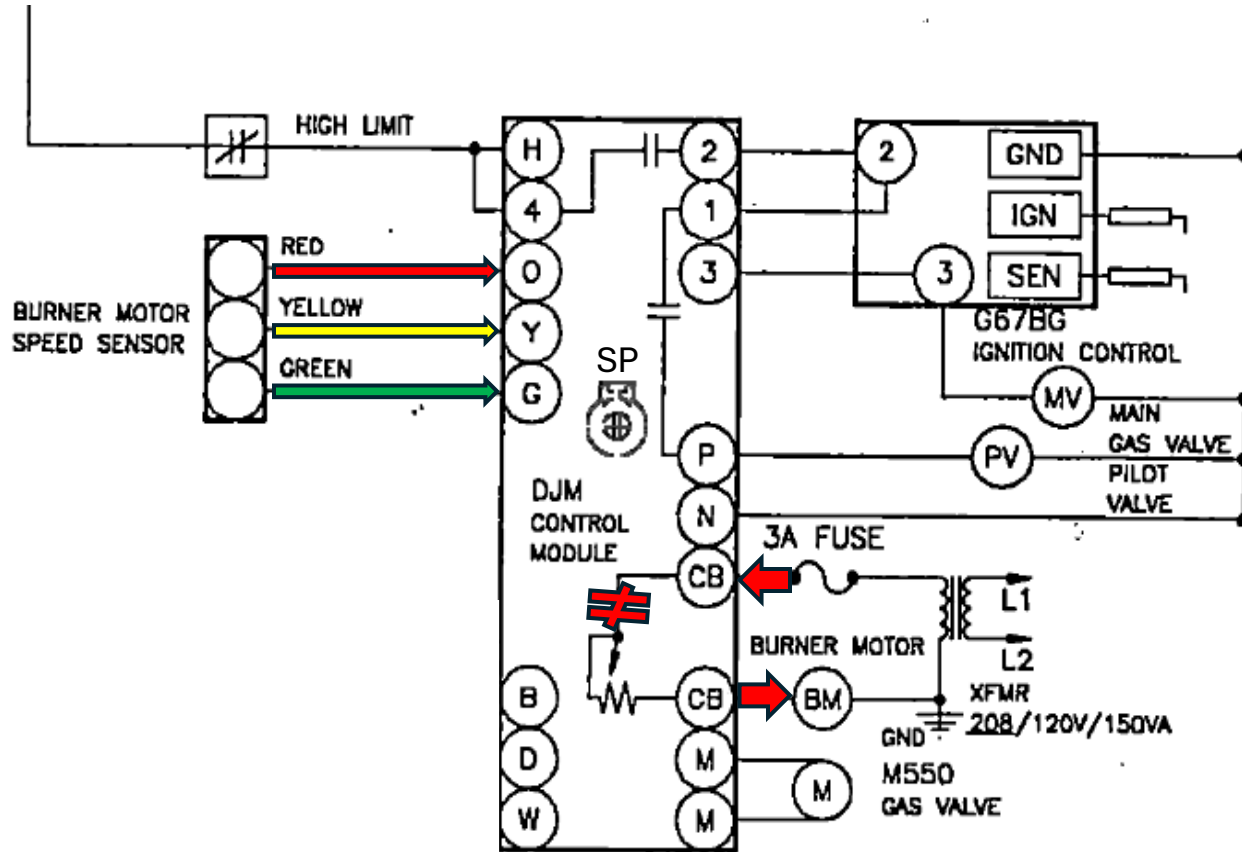


Ignition sequence.

1. Burner motor speed is 3400RPM or close to 57HZ.
2. Once the burner motor is at full speed, the burner motor speed sensor will look for a stable signal from the spinning magnet at the end of the motor shaft.
3. If the signal is stable, the pre purge will last for 50 seconds.



Ignition sequence.

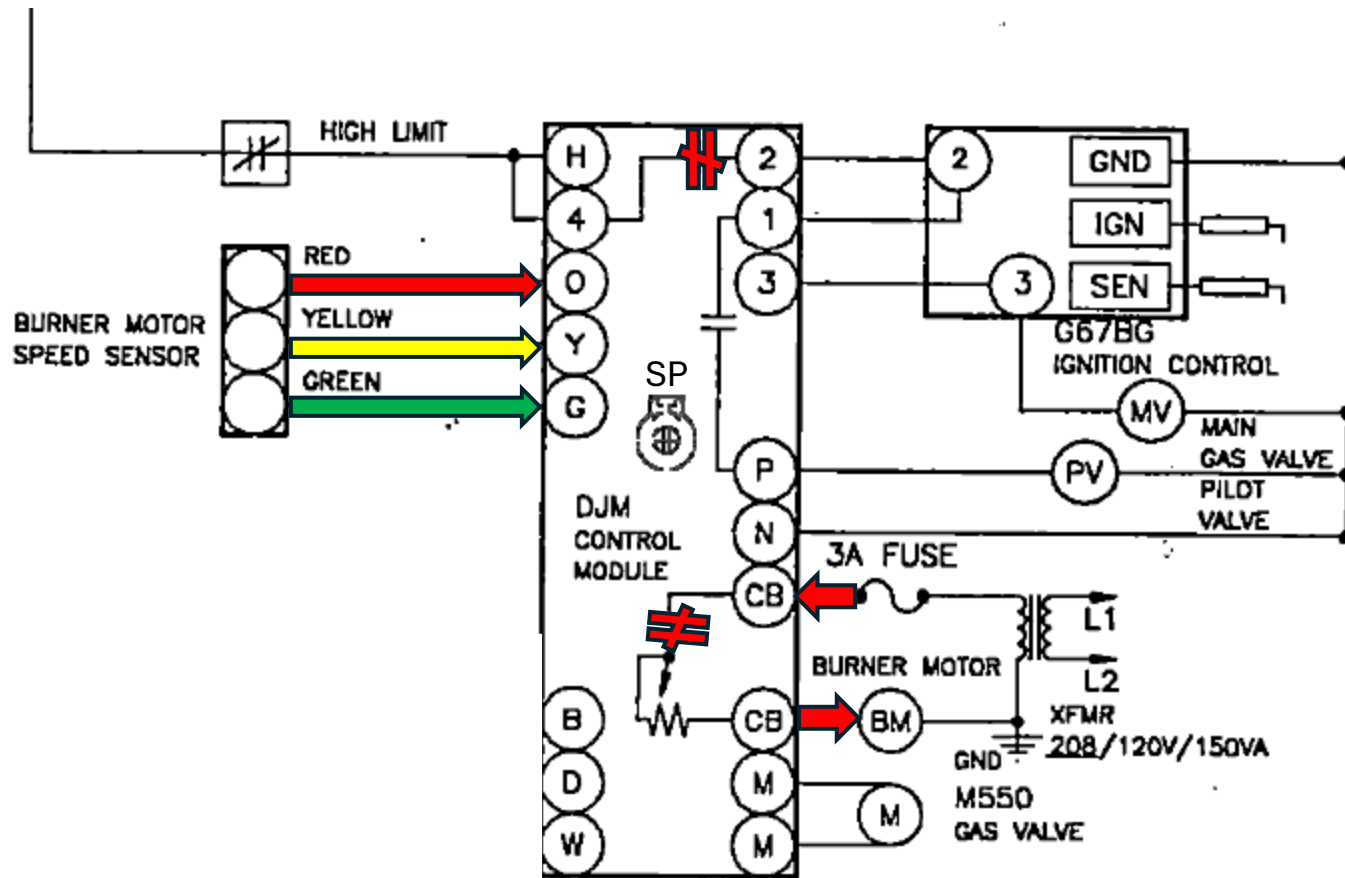


Ignition sequence.

1. Once the 50 second pre purge is done, the burner motor will slow down to light off speed.
2. Light off speed is 2300RPM or 38HZ



Ignition sequence.

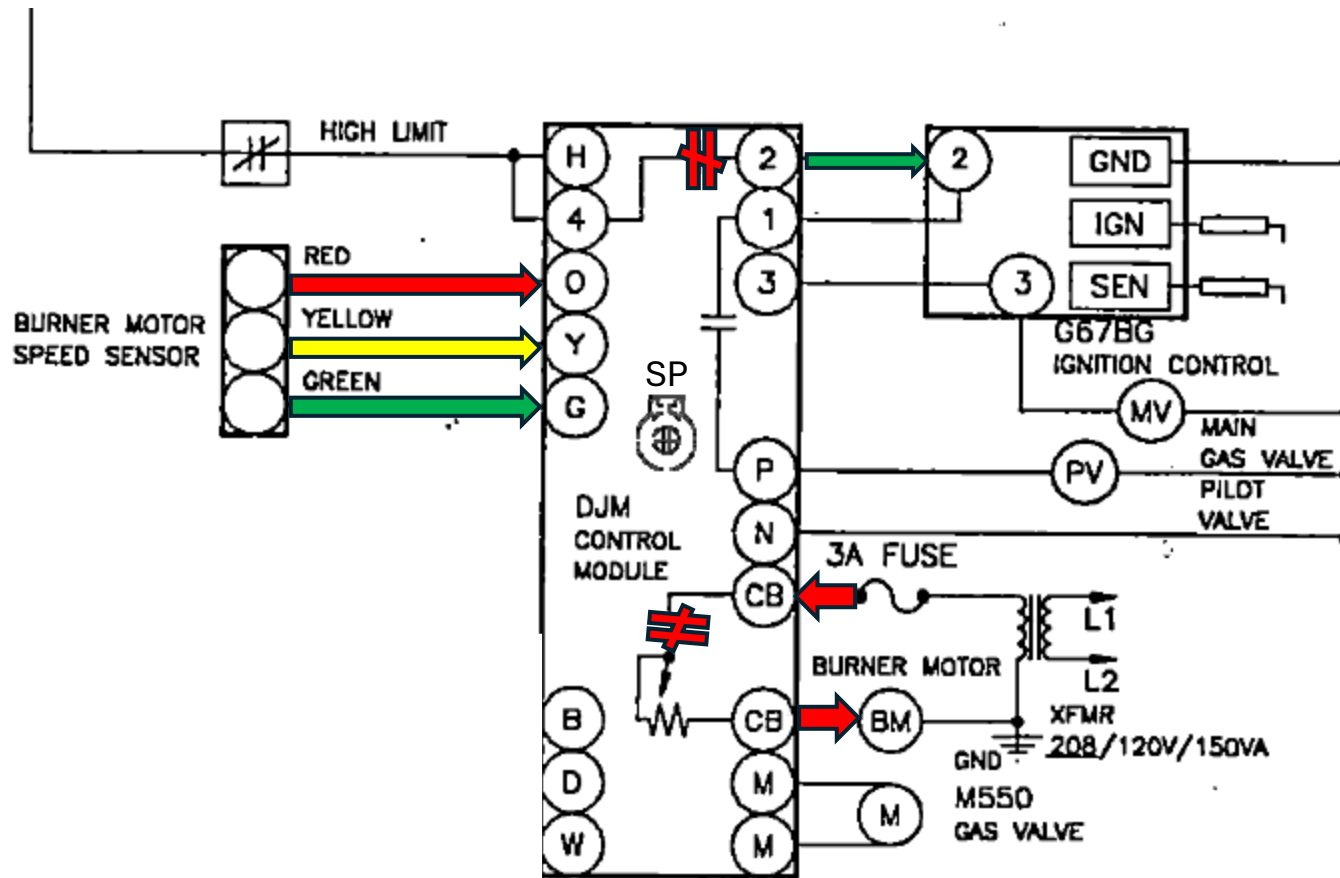


Ignition sequence.

1. Once the burner motor is at 38HZ, the contacts between terminals 4(CFR) and 2(FR) close.



Ignition sequence.

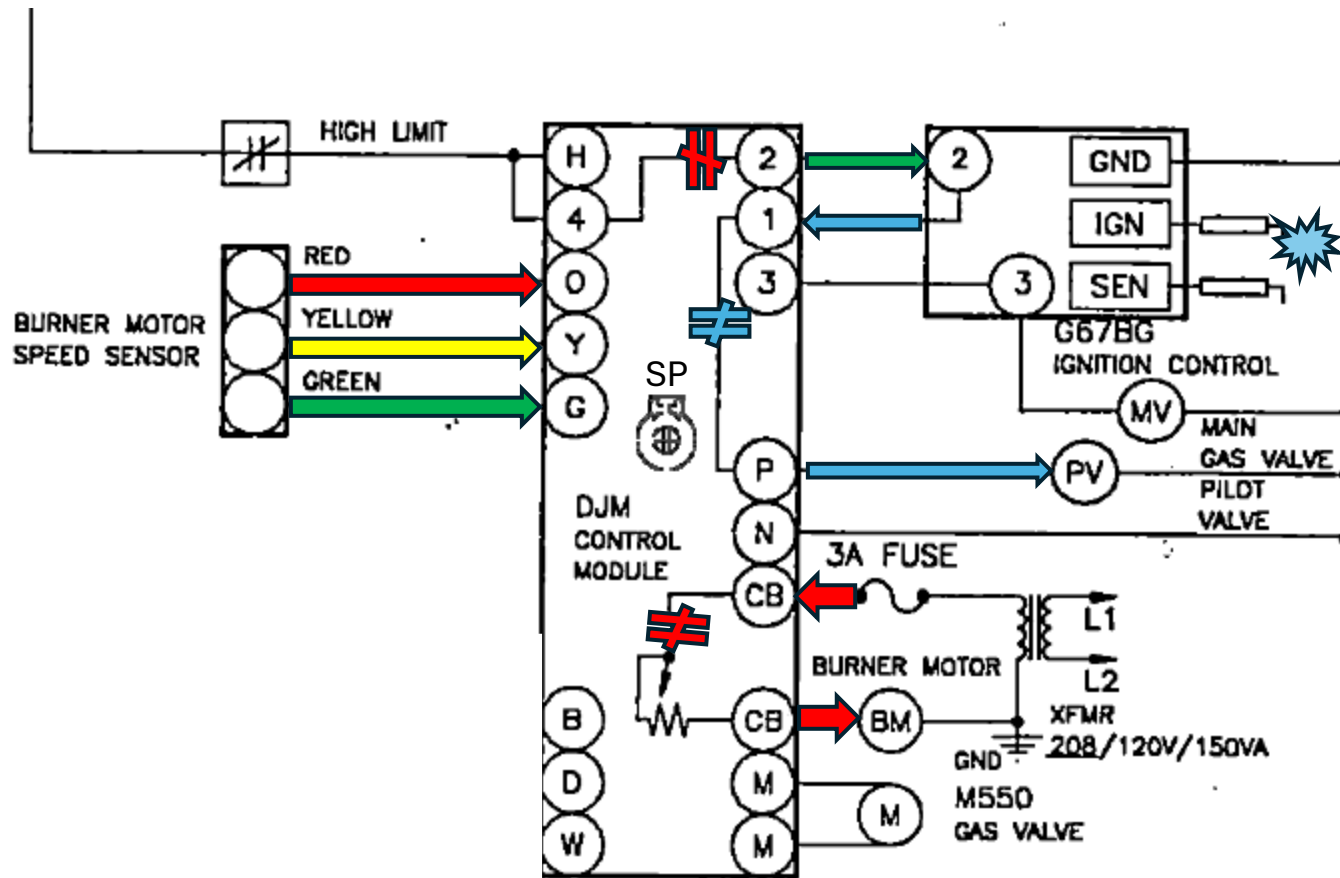


Ignition sequence.

1. Once the burner motor is at 38HZ, the contacts between terminals 4(CFR) and 2(FR) close.
2. Terminal 2(FR) will then power terminal 2(TH) on the ignition controller.



Ignition sequence.

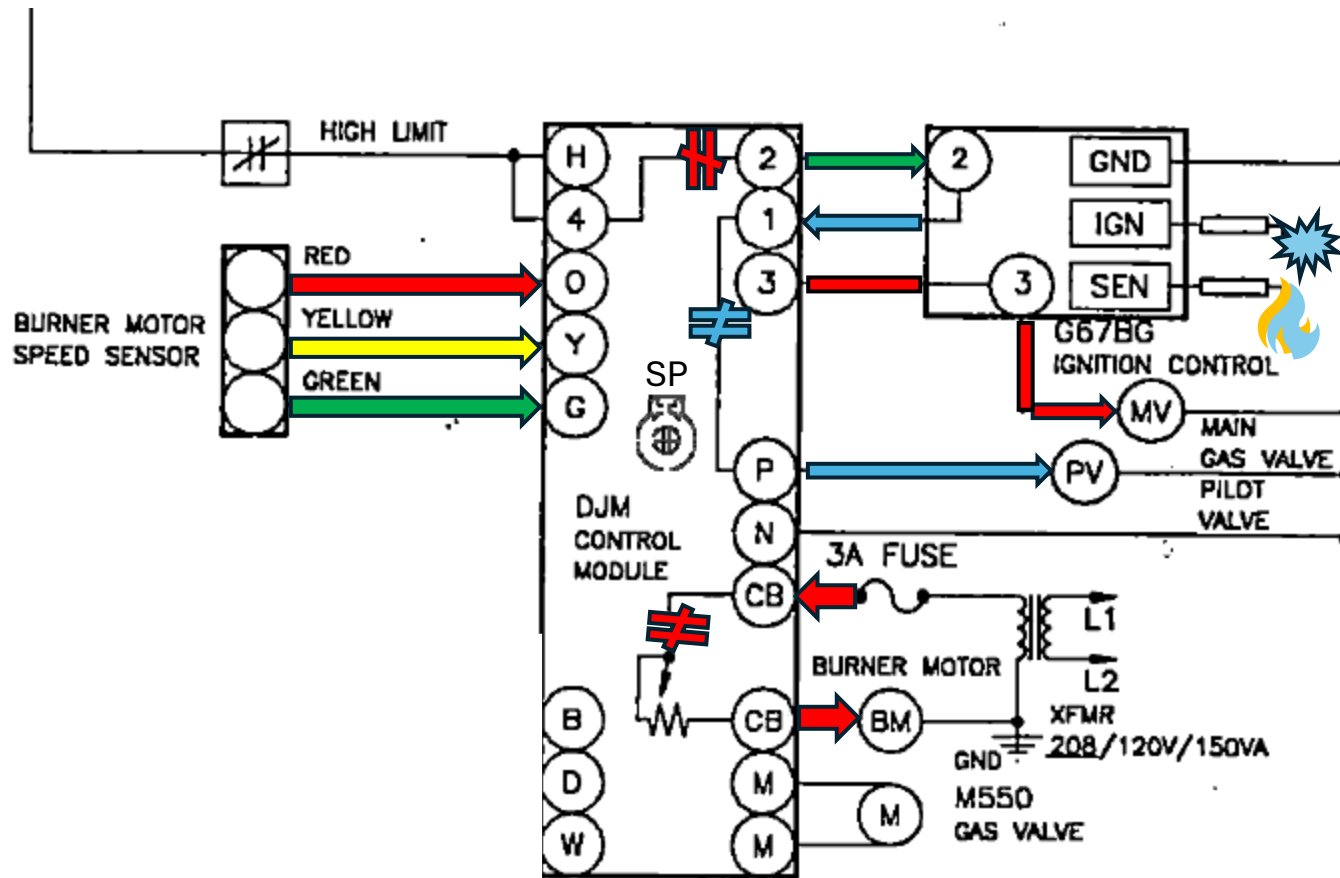


Ignition sequence.

1. Once the burner motor is at 38HZ, the contacts between terminals 4(CFR) and 2(FR) close.
2. Terminal 2(FR) will then power terminal 2(TH) on the ignition controller.
3. The ignition controller then produces a spark at terminal IGN, at the same time terminal 2(PV1) on the ignition controller powers terminal 1(PV1) on the DJM2, the DJM2 then closes the internal contacts to terminal P(PV2), P(PV2) then powers the pilot valve which will open and allow the flow of gas to the pilot box where the ignition spark is present.



Ignition sequence.

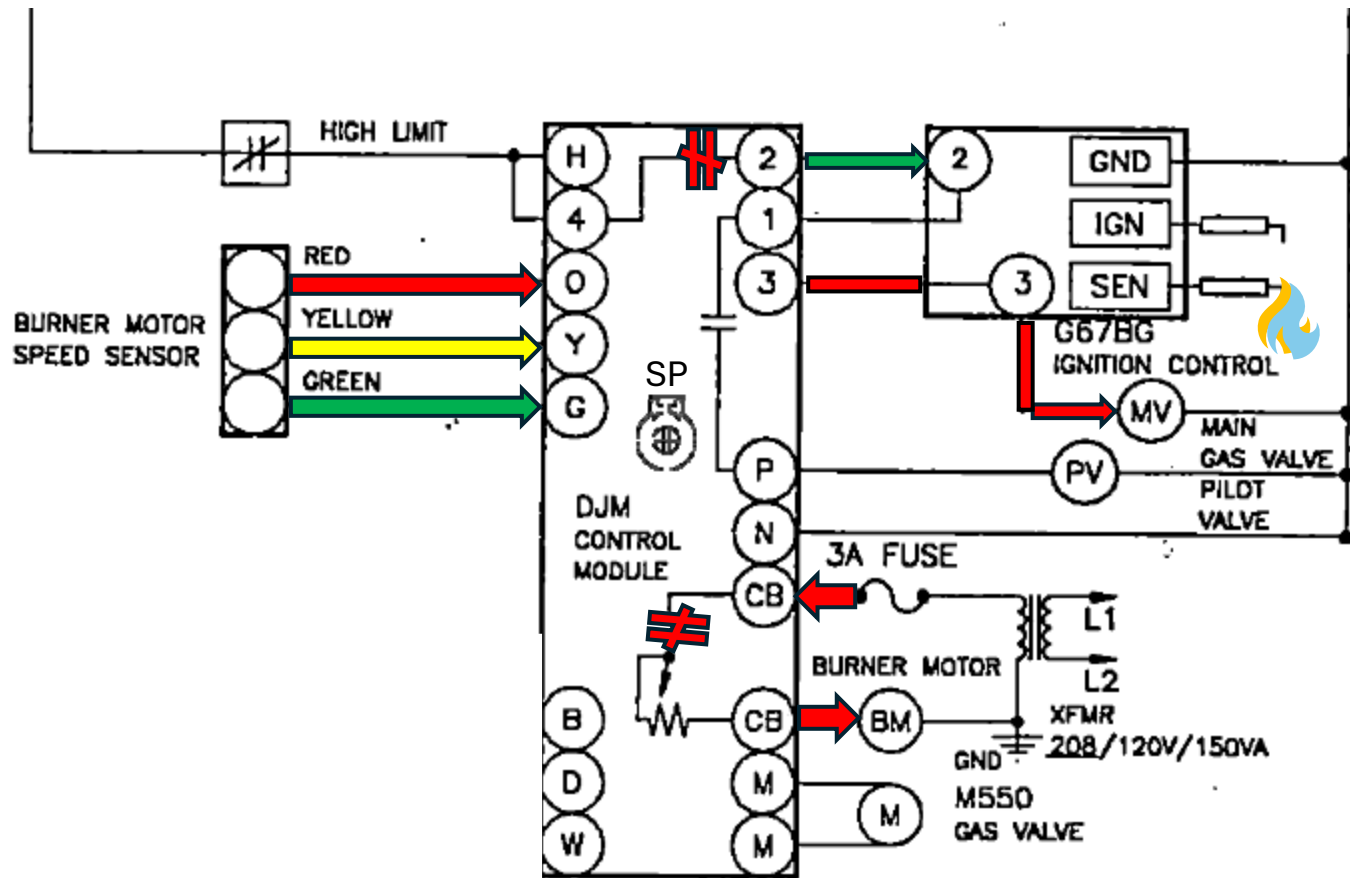


Ignition sequence.

1. Once the ignition controller senses pilot flame on terminal S1(SEN) (0.7vdc and higher) the ignition controller will close its internal contacts and send power from terminal 3(MV1) on the ignition controller to the main gas valve and terminal VFB24 or VFB 120 on the DJM2 board.



Ignition sequence.

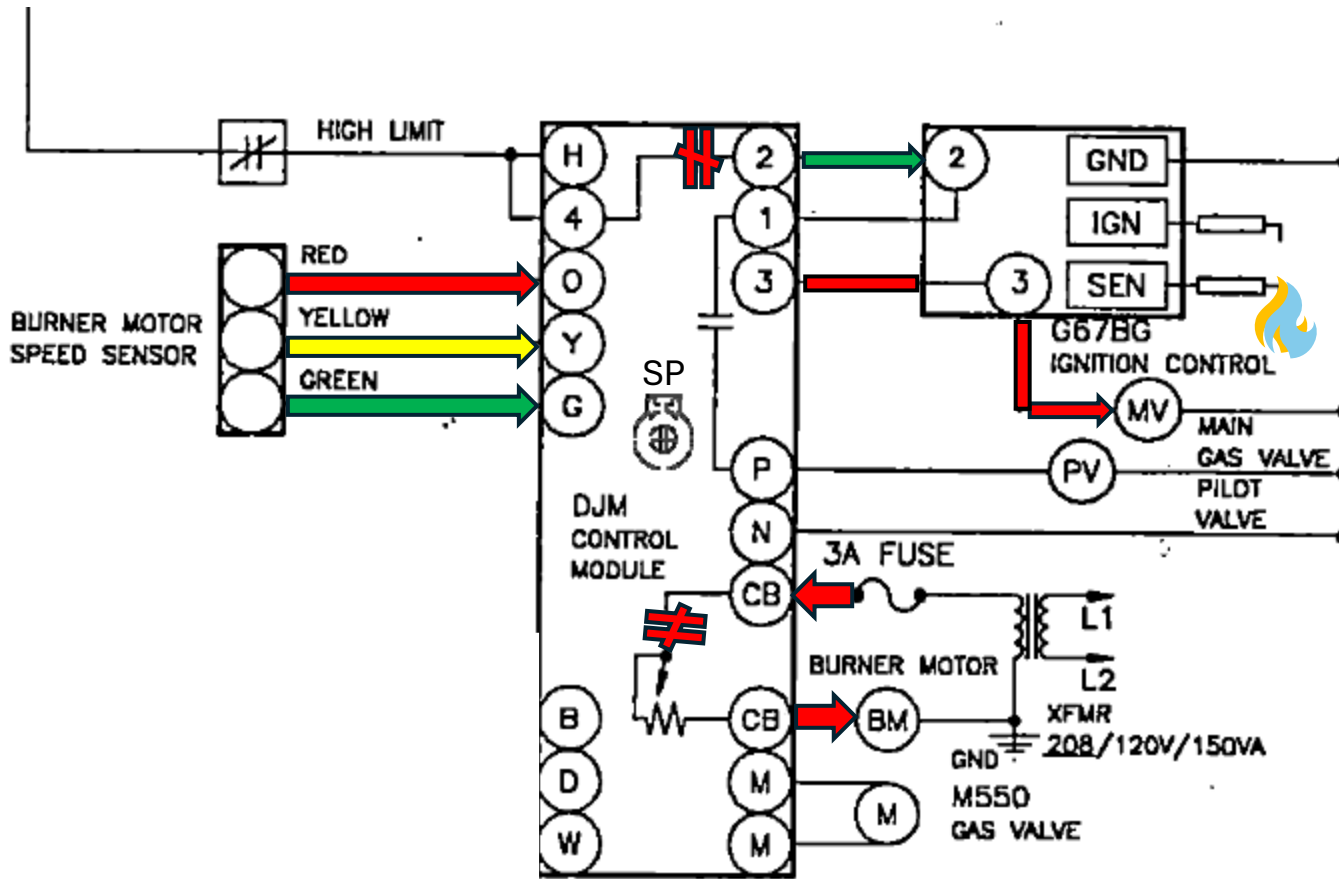


Ignition sequence.

1. Now that the ignition controller is sensing main flame, the spark stops and P(PV1) is deenergized and the pilot valve closes.



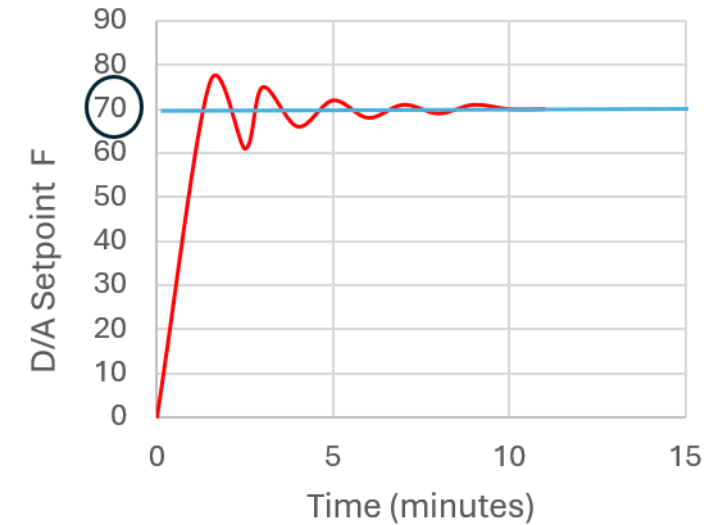
Ignition sequence.



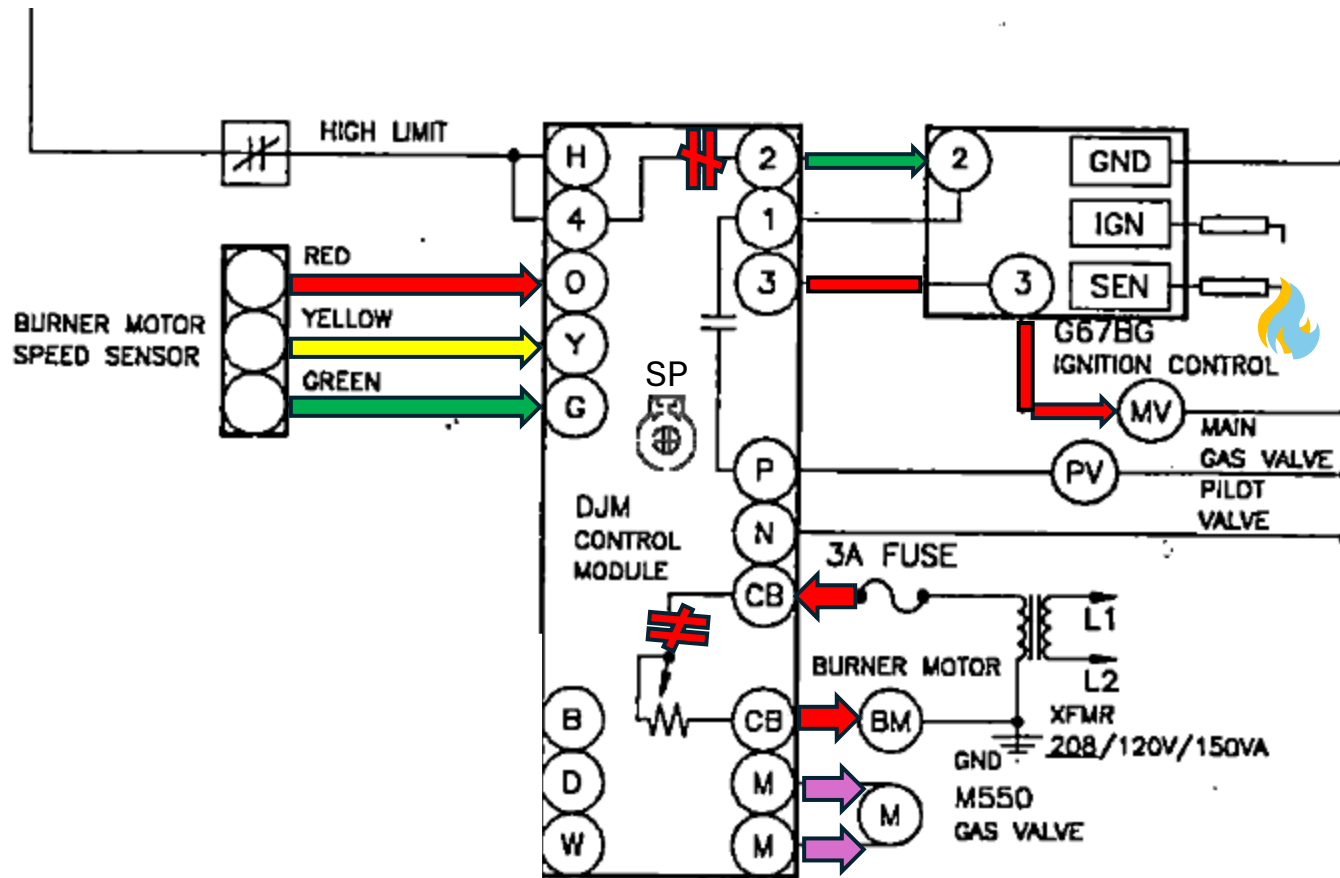
Ignition sequence.

1. The DJM2 logic now takes over to control the temperature. (P.I. control)

P.I. Control



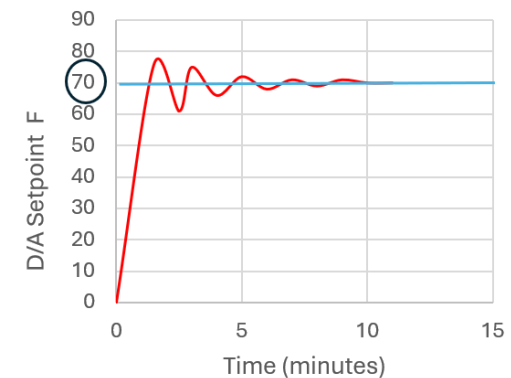
Ignition sequence.



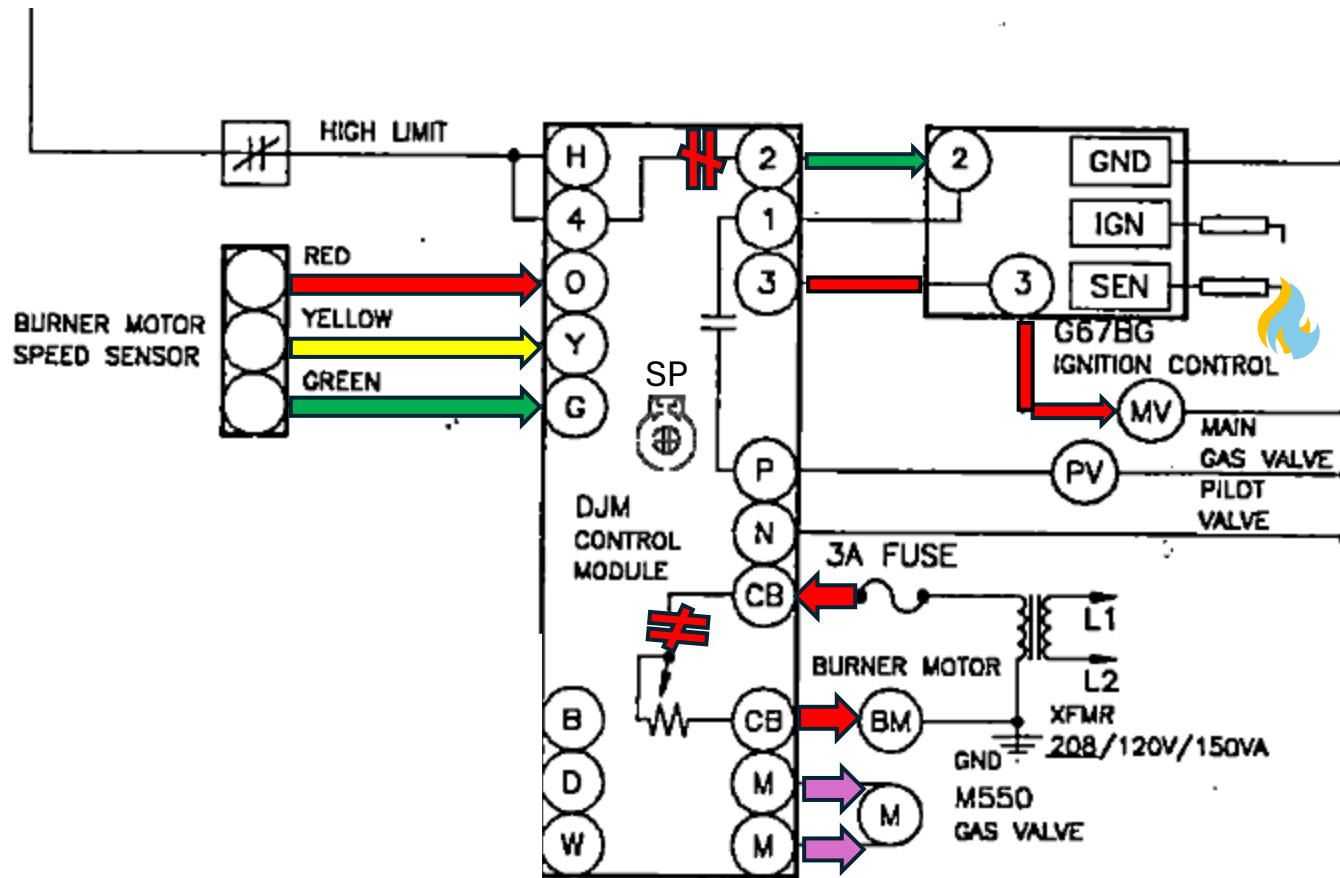
Ignition sequence.

1. Based on how far the discharge temperature is away from the discharge setpoint; the burner motor speed will increase and at the same time, the VDC output on terminals M(MX1) and M(MX2) will increase allowing more gas to flow to the burner.

P.I. Control



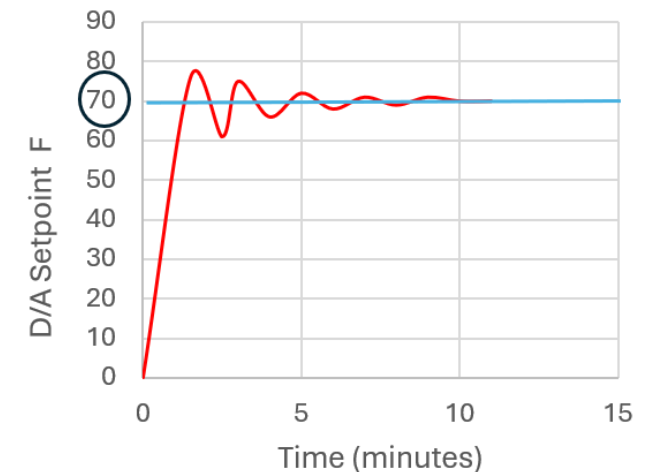
Burner operation sequence.



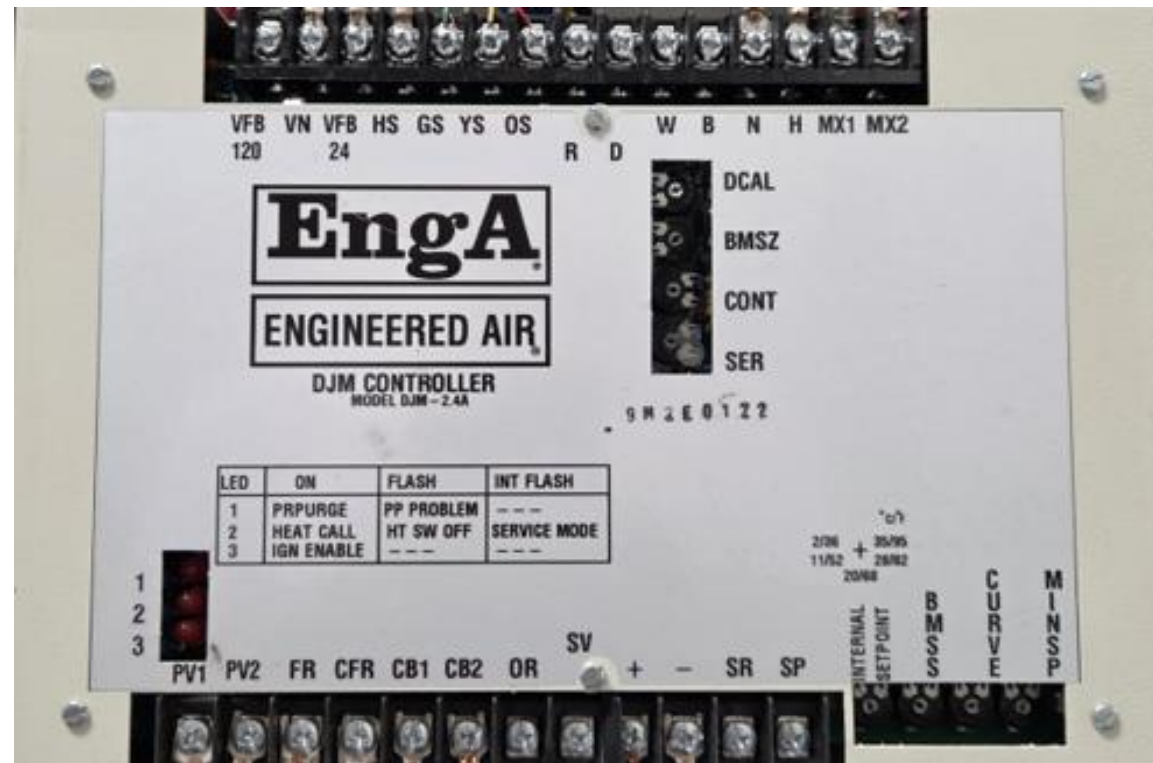
Burner sequence.

- Now with the main burner lit, the DJM2 will vary the combustion air and modulate the gas flow to maintain the final calculated discharge setpoint.

P.I. Control



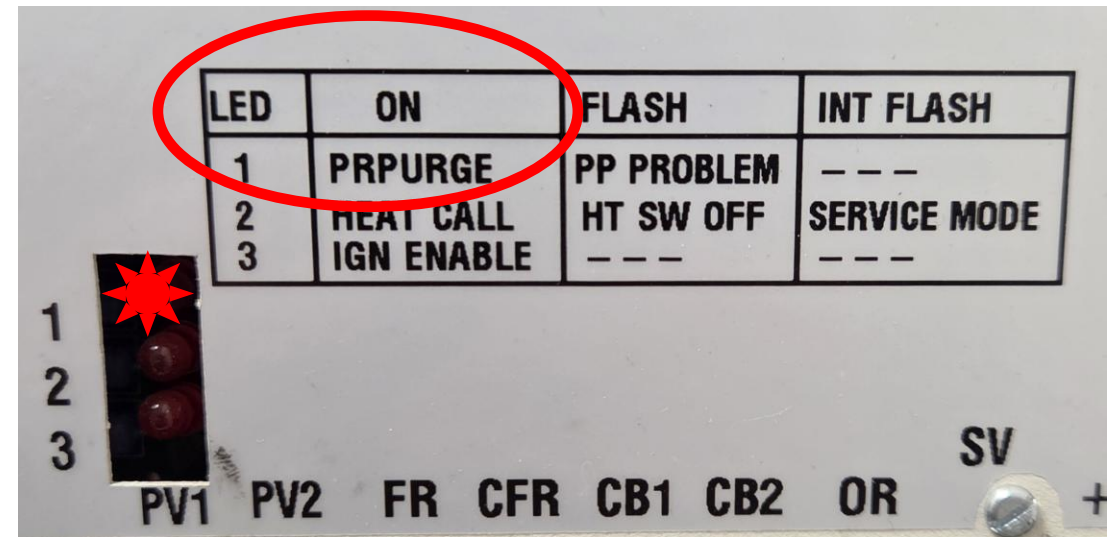
Indication and diagnostic lights.



Pre Purge indication.

Cause.

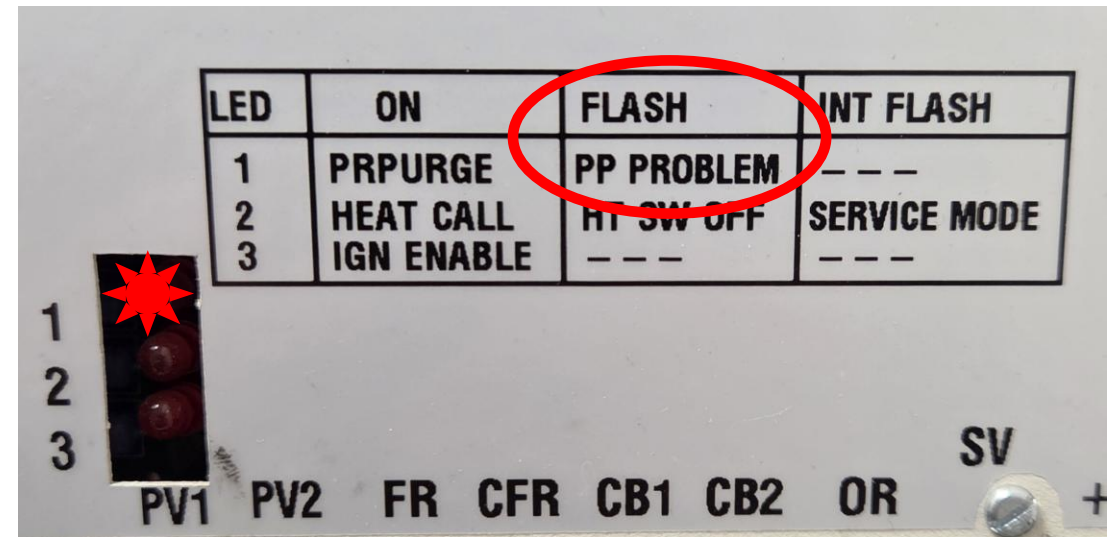
- The 50 second pre purge timer is active.



Pre Purge problem indication.

Cause.

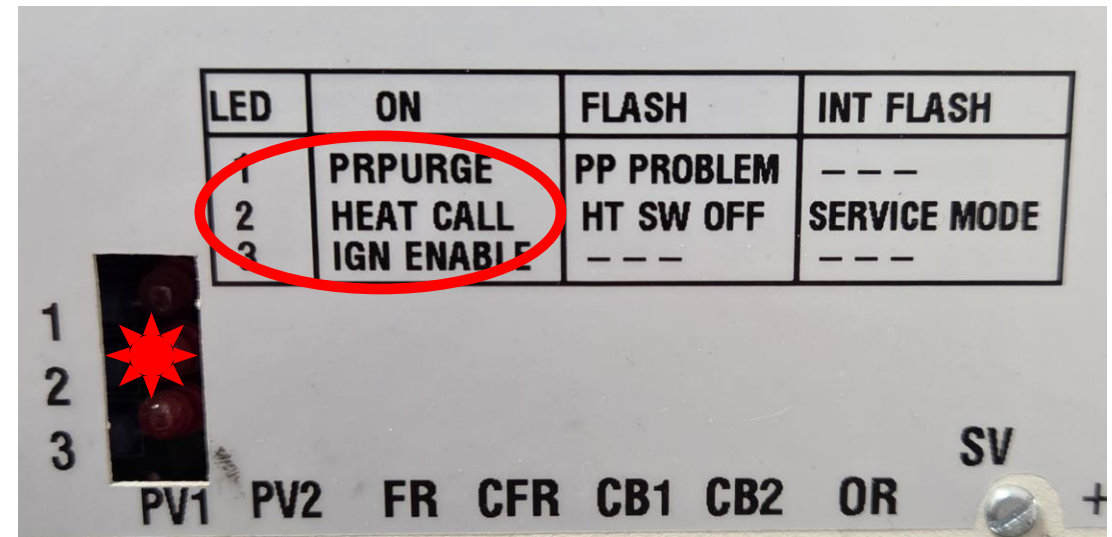
- Pre Purge problem. The DJM2 is not receiving a correct signal from the hall effect tachometer sensor, into terminals YS,OS,GS.



Heat call indication.

Cause.

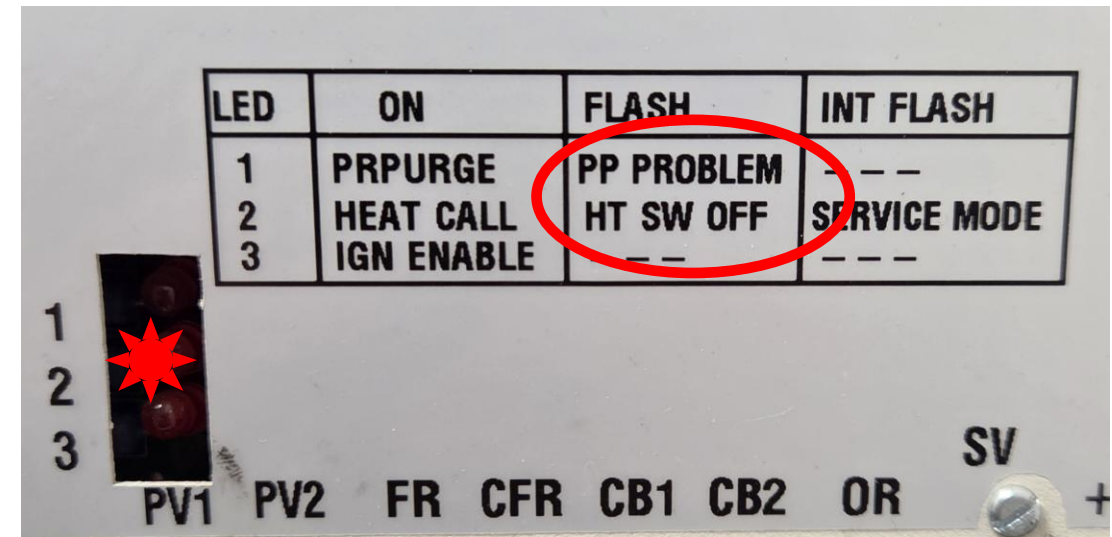
- The discharge sensor is below the calculated setpoint and the DJM2 has initiated the heating sequence.



Heat switch open indication.

Cause.

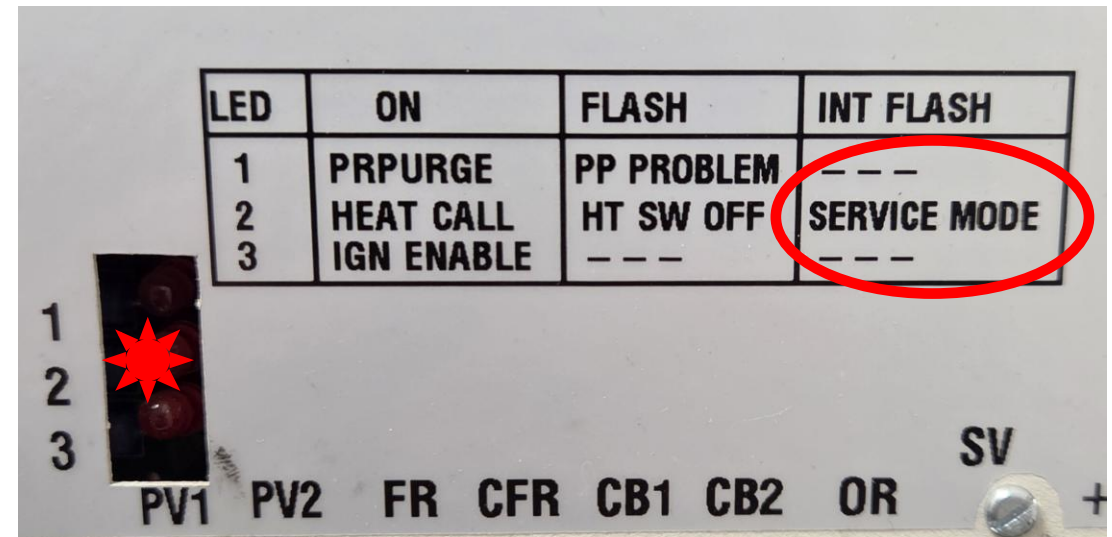
- There is a call for heating, however the heating has been disabled from no input into terminal HS. (24vac)



Service mode indication.

Cause.

- Terminals SV and SR are jumped.
The unit is in service mode.



Ignition enabled indication.

Cause.

- The flame relay or ignition control device is energized. The ignition control device now has the responsibility to light the pilot flame, prove pilot flame, and energize the main gas valve.

