EngA® ENGINEERED AIR®

INSTALLATION, OPERATION

AND MAINTENANCE MANUAL

FOR

DJM2.4

INDIRECT FIRED HEATING CONTROLLER

RECOGNIZED COMPONENT C ETL LISTED Intertek

RECOGNIZED COMPONENT ETL LISTED US Intertek

UNIT MODEL NO. __________________
UNIT SERIAL NO. __________________
SERVICED BY: ____________________
TEL. NO: __________________________

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SALES OFFICES ACROSS CANADA AND USA

Retain instructions with unit and maintain in a legible condition.
Please give model number and serial number when contacting
Engineered Air for information and/or parts.

www.engineeredair.com

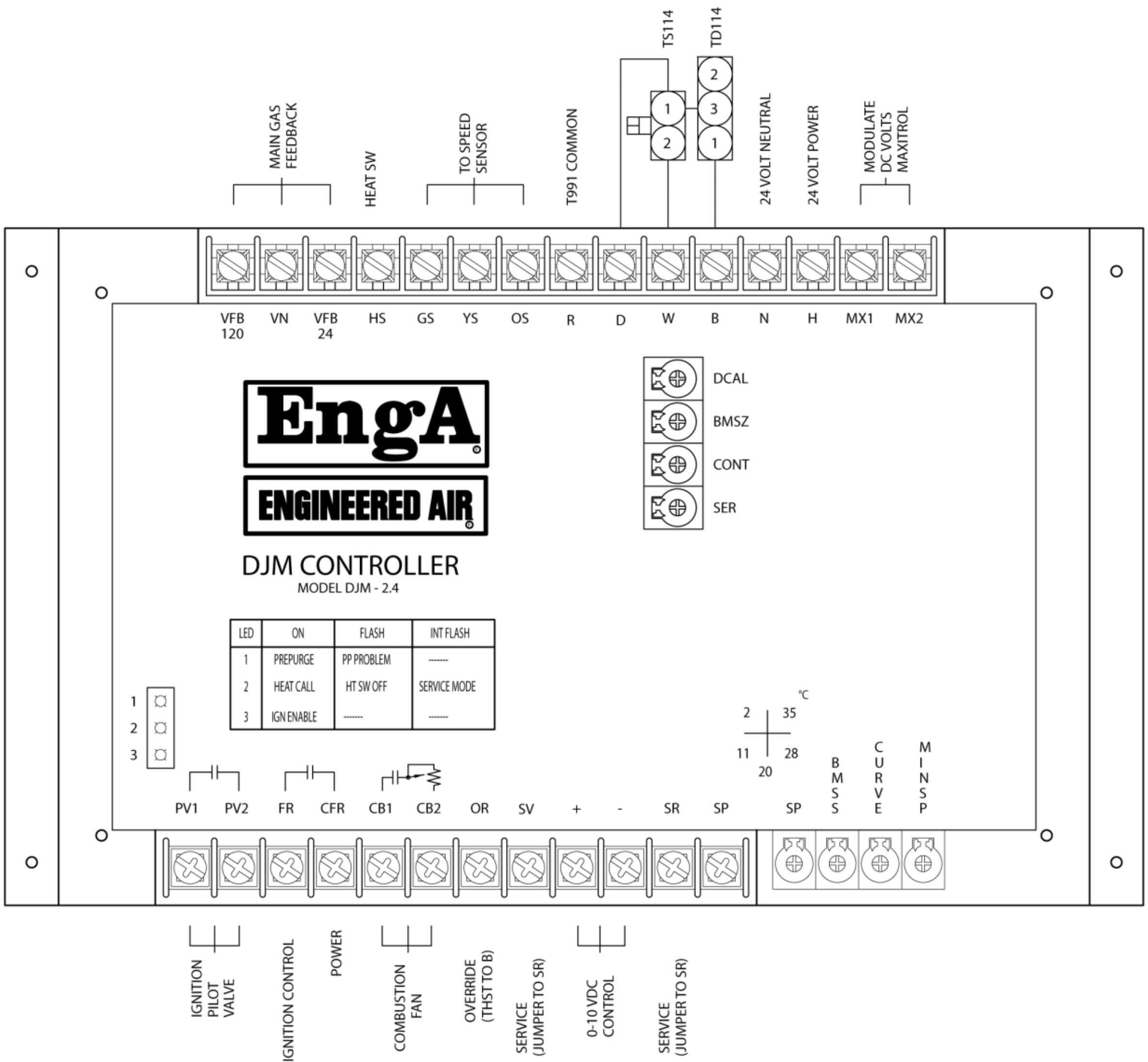
DJM2.4

If any errors or omissions are noted in this manual please contact Engineered Air – Calgary Service at (403) 287-2590 or Fax (403) 287-4799 or email service@engineeredair.com.

To ensure warranty is honored, only a qualified HVAC service person, who has received training on the DJM2.4, should be employed for service and troubleshooting. If further information is required please contact the nearest Engineered Air office.

Under no conditions (except for temporary copying) should the unit function description be removed from the unit. There are two copies provided with the unit. One is in an envelope for copying, then return it to the unit or store in a safe place. The other is attached to the control panel door and should never be removed. If a copy of the function for a particular unit is needed, contact Engineered Air with the unit serial number and DJM2 model number (ex model DJM-2.4).

Warning:	**This unit is connected to high voltages. Electrical shock or death could occur if instructions are not followed. This equipment contains moving parts that may start unexpectedly. All work should be performed by a qualified technician. Always disconnect and lock out power before servicing. DO NOT bypass any interlock or safety switches under any circumstances.**



DCAL	=	Discharge Calibration
BMSZ	=	Building Management System Zero Calibration
CONT	=	Control Type (Proportional is full CCW: add Integral CW: usual setting 8-9o'clock)
SER	=	ServIce Pot (To set up burner, CCW is low fire)
SP	=	Internal setpoint Pot 5(only in use if terminal "SP" is wired to TE6000)
BMSS	=	Building Mgnt. Sys. SPAN adjusment
CURVE	=	Curve Matching (adj. Mod. Valve volts, CW is more oxygen in flue)
MINSP	=	Minimum Speed (for low fire, CW is slower)

DJM 2.4 MODULE

DJM CONTROLLER

EngA ENGINEERED AIR

REVISIONS:	DEC 14 2005		
DATE:	DRN.BY:	CHKD.BY:	DRWG.NO.:
OCT 12/00	CC	WP	DJM-2

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MODEL DJM2.4

NOTE:	*In this manual references to DJM, DJM2 or DJM2.x refer to the model DJM2 in this manual. The DJM2 differs from the original DJM with the addition of status lights and the ability to control the "high turndown burner". The DJM2 also has an optically isolated 0-10 VDC input to accept a modulating heat signal from such devices such as the Engineered Air C-TRAC. In addition to original TS144/TD114 Maxitrol control, it can also accept a Johnson TE 6000 discharge air sensor that can be switched to service mode for easy burner/combustion set-up.*

TEMPERATURE CONVERSIONS

In this manual temperatures are listed in both degrees C (°C) and degrees F (°F). The conversion formulas between the two systems are as follows:

°F = (°C X 1.8) + 32

°C = (°F - 32) x 0.56

I. APPLICATION

The DJM2 is backward compatible to the original DJM. It can be operated in the following applications, which may not be suitable for the DJM3:

- The DJM2 can be totally controlled by the C-TRAC, METASYS or BMS.
- The DJM2 has no built-in low limit therefore it can be applied as "stairwell pressurisation in case of fire".
- The DJM2 is designed to replace the original DJM and has additional features to assist in troubleshooting.

II. SERVICE

To ensure warranty coverage and safe operation this equipment should only be serviced by qualified HVAC Technicians, Gas Fitter and other properly trained trades people. Before servicing this product, the service technician should be familiar with the following points in this guide:

Some DJM2's may have an override or a second control source connected to them. Refer to the wiring diagram to determine if more than one control source is wired to your DJM2's application. If a second control is connected refer to the sections titled "***Temperature Control***" *(Section XI)*, "***Proportional/Integral Setting***" *(Section VII)*, or "***High Fire Override***" *(Section VIII)* for more information.

Do not adjust pots unless you are familiar with operation, effect, and how to return to correct setting. This needs special equipment in some cases. Just noting where settings are will not allow return to the correct point on some sensitive pots.

Refer to the "***Burner Set Up***" *(Page 16)* to adjust combustion.

III. GENERAL

The DJM2.4 is a programmed logic controller designed for use with the Engineered Air DJ series of heaters. The DJM2.4 is designed to be backward compatible with the original DJM and DJM2 controllers. Like the original controllers, the DJM2.4 uses a variable speed combustion blower and an electro-mechanical modulating gas valve *(usually Maxitrol)*. The combustion blower speed and the gas valve's flow rate are modulated based on temperature requirements and the programmed operating curves programmed into the DJM2.4.

The major differences between the original DJM and the DJM2 are:

- Improved temperature control.
- Improved burner management logic.
- Built-in status lights to assist with trouble shooting.
- Ability to support the new high turndown burner *(See Burner Selection on page 16)*.
- Service Mode

NOTE:	*The DJM2.4 is a discharge temperature control. It is not primarily designed to have a reset signal attached to it. The discharge set point can not be reset from room, ambient, or BMS signals. It is not recommended but if a second control is connected to the DJM2.4 it will respond to the control with the greatest signal. If direct reset control is required, the DJM3 controller should be used.*

Basic Features

The basic features of the DJM2.4 include the following:

1. Proportional and Integral *(PI)* temperature control.
2. Can be used with the Johnson TE 6000 sensor and internal DJM2 set-point pot. It is not compatible with the TE 6100 room sensor/set-point.
3. Has a provision for a heat switch. *(Terminal HS needs 24 VAC from the same voltage source as H for heat to operate. Jump H to HS if no heat switch is in circuit.)*
4. Can be used with both standard and high turndown DJ burners simply by cutting a jumper wire. *(See Burner Selection on page 16)*.
5. Can be used with combustion blower motors up to 0.6 HP.

NOTE*:*	*The combustion fan motor is a special motor, and not just any motor will work. It is a 3450 RPM PSC motor designed for modulation with CW rotation shaft end.*

6. Easier burner set up and trouble shooting. Features such as diagnostic indicating lights, service pot, and test terminals are designed to assist service personnel.
7. To reduce ground isolation problems, optical isolation was added to the digital and BMS inputs.

IV. WIRING

Power supply to H and N is 24 VAC and the current draw of the DJM2.4 control itself is 20 VA. *(This does not include current draw of components attached to it such as burner motors, ignition controls, gas valves, etc.)*

Normally, the DJM2.4 is to be powered from the main control transformer. There are a few rules concerning input power to the DJM2.4 (Optically isolated power supply).

1. The voltage powering the main control transformer must come from the same two phases, which supplies 120 VAC to the combustion motor.
2. Power to terminals HS must come from the same source that powers terminal H.
3. Terminals VN (valve neutral) and VFB24 or VFB120 (valve feedback) must have a pair of wires coming from the gas valve as per the correct valve voltage.
4. It is best to keep high voltage wires such as those used on motors and spark ignition separate from low voltage wires such as used on speed sensors, temperature sensors, flame rod, etc. This is to avoid "voltage crosstalk" *(stray induced high voltage signals that can adversely affect electronic controls)*.

V. SYSTEM TIMINGS

Pre-purge = 50 seconds *(combustion blower must run 50 seconds before flame can be lit on initial heat call if no combustion fan is in operation immediately before heat call)*.

Maintained Purge = 4 minutes *(combustion blower runs after flame is turned off in case there is another heat call within 4 minutes of the previous calls completion. If heat call occurs while in maintain purge, the burner can re-light immediately)*.

VI. POTS

DCAL (Pot 1)	Discharge Calibration *(CW=colder)*
BMSZ (Pot 2)	BMS zero. *(CW=reduce)*
CONT (Pot 3)	Control type. *(CW=integral; CCW=proportional) (Usual setting for C-TRAC control is less than 9 o'clock)*
SER (Pot 4)	Service pot *(CW=high fire)*

IMPORTANT: *When operating in the service mode, the burner will not cycle off.(See section X.)*

SP (Pot 5)	Discharge set point. *(CW=colder)* Adjustment range = 35 to 95°F.
BMSS (Pot 6)	BMS span. *(CW = less gain)*

NOTE: *This adjustment is only used when a C-TRAC or other BMS type input signal is wired to DJM2.4 terminals "+ and -" (including Metasys). (See section XI)*

CURVE (Pot 7)	Curve matching. *(CW = Increase O2 reading)*
MINSP (Pot 8)	Combustion blower minimum speed. *(CW = slower)*
Pot 9 (not visible)	Tachometer calibration *(**Factory Set** for optimal light off speed (CW=faster)*
Pot 10 (not visible)	Tachometer calibration *(**Factory Set**)*

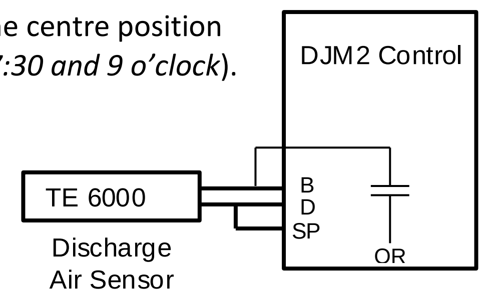
Proportional/Integral Setting (CONT Pot 3)

The DJM2.4 is a Proportional and Integral *(PI)* controller. This type of control system will provide stable temperature control with little deviation from set point. However when the DJM2.4 is used with BMS control, the host system may already have an elaborate PID control scheme which could react with the DJM2.4 PI control scheme. In this application, the DJM2.4 can be adjusted to provide proportional only control. Pot 3 can be adjusted to vary the effect of Proportional and Integral control schemes. When set in the full CCW position the control effect will be 95% proportional. When set at the full CW position, the proportional effect will be 25%. With different applications, slightly different settings may be required. Tests have indicated the best settings for various applications are:

- For use with Maxitrol TS114 or Johnson TE 6000-960 sensors this pot should be left in the centre position *(9 o'clock or less position).*
- For use with a building management control system, the pot should be set in the full CCW *(proportional*) position. *(This includes METASYS and similar controls*.)
- For use with the C-TRAC, the pot should be left set in the centre position or just slightly CCW from centre *(9 o'clock or between 7:30 and 9 o'clock*).

VII. HIGH FIRE OVERRIDE

The DJM2.4 has a terminal marked "OR". When terminal "OR" is jumpered to terminal "B" the unit will go to high fire. This is usually activated by room thermostat.



NOTE:	*This is a jumpered high fire condition. During this condition the DJM2.4 will not provide temperature control. If discharge temperatures exceed the setting of the L4064 Honeywell High Limit control (located where the supply air leaves the heat exchanger), the high limit will trip and turn the heat off.*

VIII. STATUS LIGHTS

There are 3 LED lights that have different meanings based on the rate of flashing. The different rates are defined as:

- ***ON*** *(Constant)*
- ***SLOW FLASH*** *(2 second rate)*

- ***IRREGULAR*** *(2 short* ***ON*** *flashes followed by a long off)*

LED 1 (Pre-Purge)

ON	The 50 second pre-purge timer is active.
OFF	The heat exchanger ignition pre-purge is completed or there is no call for heat.
SLOW FLASH	There is trouble with the combustion air blower tachometer. The DJM2.4 is receiving a tachometer signal that is not consistent with the combustion blower status. This can occur with a blown combustion fan fuse or failed combustion fan motor as well as a faulty Hall Effect speed sensor or a faulty magnet.

If the combustion blower ***is not running***, first check the Hall Effect speed sensor ensuring it has power and can respond to the magnet as described under "***Checking Speed Sensor***" on page 24. Next remove all three wires to terminals "OS, YS, and GS". If the motor starts, replace the speed sensor. If the combustion blower fails to start, check the combustion motor. Reconnect the speed sensor, fuse, and power.

If the combustion blower ***is running*** the tachometer signal is missing, weak, or grounded. With a digital AC voltmeter, measure the AC volts present on terminals "YS" to "GS". When the combustion blower is running there should be 4 to 6 VAC present. If the AC voltage ***is not present***, check the tachometer sensor to magnet gap. It should be 1/16 to 1/8 inch. If the gap is okay, replace the speed sensor. Further information found in section "***Checking Speed Sensor***" located on page 24. If the voltage is constantly 10 VDC and the sensor is located near the magnet then the sensor if faulty *(always "on")*.

> ***NOTE:*** *No part of the speed sensor's sensing element should be located over the metal blower motor shaft. (See diagram section XV.)*

If about 5 VAC voltage is present on YS and GS, note that the DJM2.4 is sensitive to the shape of the waveform produced by the Hall Effect speed sensor. A sensor with leakage to ground will provide a distorted waveform, which will cause the DJM2.4 to reject the signal.

Sometimes a bad magnet or Hall Effect speed sensor will produce an uneven waveform. Turning the magnet around and/or replacing the speed sensor will correct this problem.

Refer to "***Checking the Speed Sensor***" on page 24 for further information.

LED 2 (Heat Call)

OFF	There is no heat call.
ON	There is a valid heat call and the system is allowed to function normally if all systems downstream are operating correctly.

SLOW FLASH There is a heat call but the heat switch is open. *(HS terminal)*.

IRREGULAR FLASH Terminals SV and SR are jumpered. The unit is in service mode.

LED 3 (Flame Relay or Ignition Enabled)

OFF The flame relay or ignition control device is not energized.

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

IX. BASIC BURNER OPERATION

Blower and Dampers

The DJM2.4 has no control of the dampers and supply air blower. They will be controlled by devices external to the DJM2.4.

Burner

The basic burner-operating scheme is as follows.

1. Nothing happens until there is a call for heat and all the required heating operating conditions are met. *(Example: heat switch turned on.)*

> ***NOTE****:* *During Service Mode operation or safety operation, this step is ignored.*

2. When a heating call is received, before the combustion air blower is allowed to start, the combustion blower tachometer *(Hall effect speed sensor)* is checked for a false signal. If no signal is present, the combustion air blower is started.
3. After the combustion blower is started, the DJM waits until the blower reaches the correct pre-purge speed *(Approximately 3450 RPM)*.
4. When the correct speed is obtained, the pre-purge time delay is started. While the combustion fan is operating in the pre-purge mode, the heat exchanger is purged of any unwanted gases that may be present.
5. After the pre-purge cycle is complete, the combustion blower speed slows down to an intermediate ignition speed. *(For the standard round burner this is 2700 RPM, for the rectangular high turndown burner is 2300 RPM.)*
6. The DJM2.4 relay contacts across DJM2.4 terminals “CFR” and “FR” close to allow the flame relay or ignition control device to be energized. The flame relay or ignition control device lights the pilot by activating a spark and opening the pilot solenoid valve *(which receives it's power from the ignition control and the power passes through the DJM2.4 contacts "PV1" and "PV2")*. The ignition control proves the pilot flame and then energizes the main gas valve. At the same time the main gas valve is energized, a "feedback" signal is fed to the DJM2.4 on terminal "VFB24" or “VFB120” depending on the gas valve voltage.

> ***NOTE:*** *At all times the combustion blower speed is continuously monitored. If any problem is detected, the burner is shut off and the control logic goes to step 3.*

7. After the main flame has been established, the combustion blower speed may slow down to the low fire speed *(standard round burner 1850 RPM, high turndown rectangular burner is 1250 RPM at 10:1 turndown and 1150 RPM at 15:1 turndown)*. After about 10 seconds, the pilot solenoid contacts between DJM2 terminals "PV1" and "PV2" open and the AC power to the pilot valve from the flame relay is turned off.
8. After lighting, the combustion blower speed and the gas valve voltage will modulate to maintain the required discharge temperature while maintaining proper combustion.
9. If the heating demand is satisfied, the burner is cycled off. At this point, the combustion blower returns to the intermediate light off speed. This is referred to as a "maintain purge mode". *(2700 RPM for the standard burner or 2300 RPM for the high turndown burner.)*

> ***NOTE:*** *Opening the heat switch will also cycle the burner flame off. If this occurs, the combustion blower will be continue running for 1 to 4 minutes to cool the burner.*

10. If at any time the combustion blower tachometer senses an insufficient blower speed, the pre-purge timer is reset and the control logic goes to step 3.
11. If the discharge sensor initiates another call for heat within the next 4 minutes while the DJM2.4 is operating in its "maintain purge mode", the control logic goes to step 6 and the burner will re-light.
12. If there is no heat call within the 4 minute "maintain purge mode", the combustion blower is shut off. If another call for heat is initiated at this time, the control logic returns to step 1.

Service Mode

When DJM2.4 terminals "SV" and "SR" are jumpered, the DJM2.4 is placed into service mode. An irregular flashing on the *(centre)* LED Heat Call light indicates Service mode on the DJM2.4. When in service mode, the burner will be brought on and held on and will not cycle off. Adjusting pot 4 “SER” will allow complete manual control of the burner-firing rate from low to high fire. This operation is useful for troubleshooting or burner set-up.

Important Usage Notes Regarding the Service Pot and Service Mode

1. The unit must not be left in the service mode.
2. When leaving the unit make sure to remove the jumper from terminals SV and SR.
3. When in service mode, the burner will not cycle off.
4. An irregular flashing of LED 2 indicates that the DJM2 is in the service mode.
5. The supply fan contactor has to be powered on.

X. TEMPERATURE CONTROL – GENERAL OVERVIEW

The DJM2.4 is not ***designed*** for use with any application requiring reset signal such as Room, Ambient, or BMS Reset. It will only accept one temperature-controlling signal at a time.

The DJM2.4 control signal can come from ***ONE*** of the following sources.

- Maxitrol TS114 sensor and TD114 set point.

- Johnson TE 6000 sensor and built in internal set point. *(The DJM2.4 isn't compatible with Johnson's TE 6100 room thermostat/set point.)*
- 135-ohm slide wire electro-mechanical device.
- Direct voltage or current input from BMS, MEGATRAC, or C-TRAC.

If more than one signal source is connected, the DJM2.2 will only respond to the temperature control which is demanding the most heat. *(The control is from* ***one or the other****. It is not a calculated setting based on both sensors.)* For example, it is possible to have both the BMS direct voltage control and a Johnson TE 6000 sensor connected. In this application, the Johnson TE 6000 system could be set to operate with a set point of 45°F. As long as the discharge temperature is over 45°, the DJM2.4 will only respond to the BMS voltage input. However if the temperature drops below 45°F, the Johnson TE 6000 system will take over. In this application, the Johnson system will act as a modulating low limit. Also refer to Section VII Proportional/Integral Setting, Pot 3 cont.

Control Types

Usually a C-TRAC, METASYS, or other control system will control the DJM2.4. However the DJM2.4 can operate as a stand-alone device. This is usually only done when the DJM2.4 is being used to replace the older version DJM that is no longer being manufactured. Most new stand-alone applications will use the DJM3.

DJM2.4 Controlled by DCV (C-TRAC, Metasys, etc.)

The C-TRAC pots are set as per the normal factory recommended settings. To set the DJM2.4 controlled by a C-TRAC: See Section XVIII "DJM2 Slaving From C-TRAC" for more information.

- The C-TRAC pots are to be set as per the following assuming it is sitting horizontal *(the label "DJM2.4" is horizontal)*, then
- "CONT" *(Pot 3)* would normally be set at about the 9 o'clock position *(or midway on its stroke)*. If you wish to set it more accurately by using instruments then follow these steps:
  1. Slowly, starting from zero, increase the strength of the heat call signal onto the + and 👌 input terminals. Stop at about 3 VDC. Adjust the BMSS pot (6) until the heat light just comes on. If you cannot get the heat light to start, then adjust the BMSZ pot (2).
  2. After the above is complete, increase the heat call to a full call. A full heat call will have an input to the DJM2.4 + and 👌 terminals that is in excess of 8 VDC. If you are working with a burner that has just been started it may take 2 minutes to reach high fire with the 8 VDC signal due to internal control logic designed to reduce temperature overshoot by modulating the burner slowly.
  3. Then very slowly *(over a minimum of 15 seconds)* reduce the heat call to 2.5 VDC on the "+ and -" terminals. As you reach the area of 2.5 VDC the heat call light should cycle off. It may take some time depending on the setting of the "CONT" pot. If the light does not cycle off adjust the "CONT" pot to about the 7:00 o'clock position. If the light still does not cycle off, adjust the "BMSZ" pot 2 slowly until the heat call light just cycles off.
  4. Repeat the above steps to confirm operation.

XI. BMS CONTROL

See Section XII for information on BMS control wiring connections. Note the comments under the following headings if a BMS or other DCV control device is connected to the DJM2.

- "WIRING" *(See section IV)*
- "PROPORTIONAL/INTEGRAL SETTING" *(See section VI and X)*
- "TEMPERATURE CONTROL" *(See section XI)*
- "BMS CALIBRATION AND SET UP" *(See section XII and X)*

BMS can be wired into either of the following two sets of terminals.

BMS WIRED TO "R" AND "W" (Use Only on Retrofitting Old DJM)

If the DJM2 is to be directly controlled by a building management control system using current or voltage, and that signal is wired through a resistor network into terminals R and W, the control power to H and N MUST come from an isolated and ungrounded transformer. This resistor network is to reduce the input voltage to a 0-3.5 VDC signal. The control power to H and N must come from an isolated and ungrounded transformer. The power to terminals HS and 3 must come from the same power source as applied to terminal H. This will require an isolating relay be used. As the DJM2 also has a set of true 0-10 VDC input terminals, it is best to use them instead of this option (R and W terminals are not optically isolated).

BMS Wired Into "+" and "-" (Preferred Method)

If desired, the wiring may be changed such that the BMS or control voltage is wired to terminals "+ and -". These terminals are optically isolated and will eliminate the requirements for a separate ungrounded isolating transformer. The control providing the signal to the "+ and -" terminals needs to be a 0-10 VDC signal that has capability of a 20 ma or stronger drive.

For new installations we recommend using terminals "+ and -".

Remote wiring should be run using minimum size 22 ga shielded wire. For runs over 150 feet, the use of minimum wire size of 20 ga-shielded wire is recommended. The shield should be grounded at the controller end only. If the shield is grounded in more then one place then the shield is made useless between the two grounds. Input impedance is 500 ohms. If the control driving the DJM2 cannot output enough power to drive the DJM2, then resistor R19 *(680 ohms)* located on the back of the board *(near the +/- terminals)* will need to be cut. This will give 1500 ohm input impedance. Not being able to drive is recognized by seeing an output from the BMS to the DJM2 of 10 VDC when not connected but measuring much less at the DJM2 + and - terminals when connected.

For new installations we recommend using terminals "+ and -".

All DJM2 relay contacts are rated at 5 amps. The TRIAC output *(combustion blower)* will handle a 0.6 HP motor at 120 vac.

XII. BMS CALIBRATION AND SET UP

See section V about types of BMS control and set-up. If wired to a building

Comparison	
(VDC)	(MA)

management system the DJM2.4 has the ability to accept that as a control signal if wired into + and - terminals. This is similar to the above set up except the control source is different. *(If controlled by a BMS, there should be a discharge control device to stop discharge air temperatures exceeding 120°F to avoid high limit tripping. The BMS could reset its discharger signal from an override: e.g. room temperature.)*

0	0
2	3
4	8
5	10
6	12
8	16
10	20

The BMS voltage input can be wired two ways.

Method 1

(Old method used on original DJM controls and not recommended on the DJM2 unless it is desired to continue to use it when retrofitting an old DJM.) Uses an external 33,000-ohm series resistor and Ziener diode. This is the method used by the original DJM. This drops the 10-volt signal down to about 3.5 volts *(the signal used by the original DJM)*. Unless necessary to use method 1, it is best to use method 2 *(which is used on all new equipment. It is possible to use method 2 if converting from a DJM to a DJM2.4*).

Method 2

(Recommended for new designs) Uses no external components and has the input signal directly connected to terminals "+" and "-". Method 2 is optically isolated and is the preferred wiring method. As normally shipped from the factory, the DJM2.4 is configured to have an input impedance of 500-ohms on the "+ and -" terminals. At 10 VDC input the current would be 20 mA. If the host BMS system cannot source 20 mA, the input impedance can be increased to 1500-ohms by removing *(cutting)* resistor R19 *(680-ohms)*. This resistor is located next to terminals "+" and "-". To gain access to R19 to cut it, the DJM2.4 must be turned over.

BMS Calibration

Refer to instructions in above section **DJM2.4 Controlled by DCV** in section X, regarding pot settings and BMS calibration.

> ***NOTE:*** *These controls are calibrated at the factory and in most instances field calibration is not necessary.*

XIII. DISCHARGE SENSOR READOUTS, CALIBRATION, ETC.

If the DJM2 is being used as a ***stand-alone*** device, there are two possible devices used as a set point. They are a Maxitrol series 14 set-point dial TD114 *(which works in association with the Maxitrol TS114 discharge air temperature sensor)*, or the built in set point *(which is used with a Johnson TE 6000-960 discharge air sensor)*.

When the Maxitrol or Johnson controls are used the “DCAL” pot can be used for calibration. Set it to just turn the heat light on when the sensor and set point values match. Note additional information about the TE6000 and the Maxitrol systems following.

If both a discharge air sensor/set-point and BMS (used as an override) are connected to the DJM2.4, discharge calibration will be required as the discharge sensor will be acting as a modulating low limit when the BMS is not calling for override. It should be calibrated with the

BMS signal at zero. The BMS signal should be calibrated as noted in section X. If the DJM2.4 is being ***slaved*** to a C-TRAC, METASYS, or some other device, then there will not be a set point connected to the DJM2.4. The setpoint is at the master control; therefore no discharge sensor calibration is necessary.

TE6000 Sensor

If the system uses a TE 6000-960 sensor, it is wired with one side of the sensor to Terminal “B” and the other side of the senor wired to both Terminals “D” and “SP”, then it is necessary to use the set point on the DJM2.4. The set point is the small pot labelled “SP” *(pot 5)* and the setting is as indicated on the label.

Using the Johnson TE 6000 series control, the DJM2.4 utilizes pot 1 *(DCAL)* as the "***Discharge Calibration***" pot. Adjusting it CW = colder. With the burner-firing rate being stable *(no hunting or cycling)* accurately measure the discharge temperature ***at the discharge temperature sensor***. Connect a DC meter to DJM2.4 terminals "OR" *(positive)* and "W". Set the discharge set point to match the measured discharge temperature. Adjust pot 1 until the meter reading is 1.8 volts DC. Note information below.

A second calibration method for the TE6000 without a meter is:

Ensure there is no signal *(such as voltage on +/-)* that would call for a higher discharge than the temperature at the set point. Next, measure the temperature immediately next to the discharge air sensor. Adjust the set-point dial *(pot 5 labelled SP)* to the same value as that measured at the discharge sensor.

When this is complete adjust the DCAL *(Pot1)* until the heat light just goes off.

Sensor Resistance Chart for TE 6000-960

°C	°F	Resistance Ω		°C	°F	Resistance Ω		°C	°F	Resistance Ω
-40	-40	602-605		18.3	65	983		48.9	120	1234
-34.4	-30	633		20	68	996		54.4	130	1269
-28.9	-20	665		20.6	69	1000.7		60	140	1333
-23.3	-10	698		21.1	70	1005		65.5	150	1365
-17.8	0	732		23.9	75	1026.5		71.1	160	1437
-12.2	10	768		26.7	80	1048		76.7	170	1491
-8.7	20	804		29.4	85	1070		82.2	180	1546
-1.1	30	842		32.2	90	1092		87.7	190	1602
4.4	40	881		35.6	95	1116		93.3	200	1659
10	50	921		37.8	100	1139		98.8	210	1718
12.8	55	941.5		43.3	110	1186		100	212	1778

Reference resistance is 1035 ohms at 77°F. Resistance tolerances are ±0.05 to 0.15% at 77°F. Temperature range +32 to +104°F.

NOTE:	*Our design discharge temperature range is 30 to 140ºF, with about 55-75 being the usual set point.*

Maxitrol Discharge Sensor/Selector

If the system uses a Maxitrol set point, the set point is that indicated on the TD114 dial. There is also a calibration pot on the back of the Maxitrol dial. Its correct setting is such that the resistance across the Maxitrol terminals 1 and 3 should be 10,000 ohms with the set point at 77°F (25°C). The Maxitrol TS114 temperature sensor (calibrated to 10,000 ohms at 77 degrees also) changes about 40 ohms per °F. As the sensor gets hotter, the resistance falls. If there is a long wire run it may be best to calibrate the dial against a known sensor temperature due to wire resistance.

XIV. BURNER SET UP

Burner Selection

The DJM2.4 is designed for use with either the standard circular DJ burner or the rectangular shaped high turndown burner. Turn the board over to the backside. There is a jumper wire located next to terminal "PV1" on the bottom backside of the board. If the DJM2.4 is to be used with the high turndown burner this wire must be cut.

Combustion Set Up

The DJM2.4 is designed to operate with both the standard *(round burner plate)* and High Turndown *(rectangular)* Burners. Cutting a jumper wire located next to terminal “PV1” makes the selection. For high turndown burner operation, the jumper wire must be cut.

There are two pots located close to terminal SP, which affect the burner set up. These pots are to be adjusted only by a qualified service technician using proper combustion analysis equipment. Pot 7 *(second pot from the right)* is the curve matching pot. The curve matching pot is used to match the modulating gas valve opening curve and the combustion blower fan curve. There are three Maxitrol valves that can be used with the DJM2.4. Each of these gas valves has slightly different opening characteristics. The curve matching pot is to be adjusted to compensate for these differences.

Pot 8 *(first pot from the right-labelled MINSP)* is the low fire RPM adjustment pot. This pot is used to provide some adjustment to the low fire combustion air. The low fire motor speed is adjustable from 1150 to 1400 RPM *(high turndown)* and 1800 to 2000 *(standard burner)*. The recommended settings for the low fire speed are 1250 for the high turndown burner and 1830 for the standard burner.

NOTE:	*The light off RPM is fixed, non-adjustable. Adjusting the low fire speed will have not effect on the light off speed.*

Preview of Combustion Set Up

There are two burners available:

THE STANDARD *(or Round)* BURNER

- Limited to about 2.5:1 turndown.

- No jumper to be cut on DJM2.
- Light off speed about 2700 RPM.
- Modulation between 1850 and 3400 RPM.

THE HIGH TURNDOWN *(Rectangular)* BURNER

- Capable of 15:1 turndown.
- You must cut the jumper on the back of the DJM2 board. It is located next to terminal “P” on the bottom of the board.
- Light off speed about 2300 RPM.
- Modulation between 1150 and 3400 RPM.
- Note carefully which “M” series valve is in use.

FOR EITHER BURNER

- When measuring combustion, ensure probe of analyser inserts fully into the ***flue connection to the heat exchanger.*** Measuring at the flue outlet may be a diluted reading due to air mixing into the flue.
- First set up high fire
- Then set up low fire
- Adjust midrange firing *(curve matching pot)*
- Adjust pilot

> ***NOTE:*** *If combustion is not set correctly it can result improper burning which may produce products of combustion that smell, carbon and or an excessive amount of water in the flue. Care should be taken to set burners up properly. Note that temperature of the air and fuel may have a great affect on the set up you select. If both the combustion air and the fuel are at a constant temperature throughout the heating season, once combustion is set it should remain similar through the season. However, this usually only occurs on indoor units. Setting up an outdoor unit is not the same as setting up a unit or a boiler inside a building.*

When a unit is located outside, it is subject to different temperatures of combustion air and fuel through the season. These temperatures affect the densities, thus affecting the resulting combustion process. In some instances units that operate with 3% oxygen at -40° ambient temperatures will be found to operate at 9% oxygen on an 80°F day. How the gas line is run *(indoors or across the roof)* is the largest contributor to this problem.

It is better to have a burner that runs clean and doesn’t produce a lot of water from the flue throughout the season then to set up for best efficiency. Also we recommend that the probe for combustion analysis be placed directly into the heat exchanger outlet rather then in the flue. This is because air can enter into the bottom of the flue and dilute readings in the flue.

Refer also to “***Water and Ice from Combustion***” on page 32 regarding another problem with improper combustion set up.

High Turndown (Rectangular) Burner

HIGH FIRE SET UP

1. Place a jumper across the DJM2.4 terminals “SV and SR” to force the control into a manual firing mode.
2. Set manual firing pot labelled “SER” *(Pot 4 👌 located near the middle of the panel)* to high fire by turning it fully clockwise. Ensure adequate inlet fuel pressure. Adjust the high fire manifold pressure to that listed on the rating plate. Adjust the combustion air slider or inlet damper until the high fire O_2 reading is between 3.5 and 4.2%. Tighten the locking screw to keep the damper locked into this spot.

   Add another locking screw if the damper moves from its position.

LOW FIRE SET UP

- For both 10:1 and 15:1 turndown burners.

> ***NOTE:*** *Most high turndown DJ units will employ one of the following Maxitrol modulating DC volt gas valves.*

Series 20 - M520, M620.	These valves do not have high fire regulators. High fire pressure is set up at the appliance regulator.
Series 50 - M550, M650, ES350.	These valves do not have high fire regulators. High fire pressure is set up at the appliance regulator
ES345D-L	This valve has a built in high fire regulator. Used on DJ140 models

The above valves differ from each other in size, configuration, BTU capacity, physical layout, and low fire set up.

Check the unit you are working on to verify what type of modulating gas valve you have to ensure the correct combustion set up method is used.

Top Loading - Ensure that there is a ¼" aluminium tubing connected from the top of the modulating gas valve vent connection to the burner box. This is to guarantee that the varying burner box pressure allows the proper flow rate through the modulating gas valve. Also ensure that the small vent hole under the oval shaped cover is sealed off with silicone or Tremco tape. When doing combustion analysis it is important that the top of the valve be sealed by either reinstalling the cap after each adjustment, or placing your finger fully over the top to seal the open top on the valve. The reason for this requirement is that the valve is “top loaded” which means that the valve is having pressure from the combustion fan added to the top of the valve’s diaphragm thus increasing the gas flow through the valve, especially at higher flow.

Series 20/ M520 and M620 (High Turndown)

As these valves have 2 low fire adjustments the following procedure should be followed carefully:

1. Once the high fire pressure and combustion have been set up at point "B" above, turn the manual firing pot *(fully CCW)* to achieve low fire
2. Adjust the low fire RPM pot 8 *(MINSP)* until the low fire speed on the combustion fan motor is 1250 RPM ±10 RPM *(20.8Hz)* for 10:1 set up. *[1150 RPM ±5 (19.91 Hz) for 15:1 turndown.]* At this point the DC voltage reading at the modulating gas valve terminals should be 0 VDC.
3. Under the cover on the Maxitrol series 20 valve is an adjustment screw *(brass or silver)* that has a lock ring. Holding it in place, this lock ring uses a special tool *(two very small holes)* to loosen it.
4. The lock ring needs to be loosened first. Turn it fully CCW, now turn the slot screw in the centre of the lock ring *(spring activated low fire adjustment)* full CCW.

Caution:	*Do not over torque this screw at the top or bottom of its adjustment or it will break the "c-clip" inside the valve, thus allowing the spring to ride free.*

5. Adjust the low fire bypass screw at the bottom side of the valve body until the O_2 reading is between 16.0% to 16.5%. *(16.5 to 17.5% oxygen for 15:1 turndown.)* At these settings the turndown will be very close to 10:1. The maximum CO at low fire is 80 PPM.
6. Adjust the manual firing pot 4 SER up very slowly until the DC volts at the modulating gas valve terminals are about 2.25 VDC. If the voltage rises over 2.25 VDC while adjusting the manual pot, turn it down and start again from less than 1.5 VDC until 2.25 VDC is reached.
7. Check the O_2 reading again at this point. If the O_2 has increased, adjust the spring activated low fire adjustment on top of the valve until the O_2 reading is same as the low fire reading at 0 VDC *(you are correcting for valve hysteresis with this adjustment)*.

8. CURVE MATCHING PROCEDURE

Switch to high fire setting *(approximately 3450 RPM or 57.5 Hz)* for 1 minute. Adjust the manual firing pot 4 SER down very slowly until the combustion motor speed is about 3060 RPM *(51 Hz).* Let the burner stabilize for 2 minutes and re-check the O_2 reading. If the O_2 has dropped to less then the original high fire O_2 reading, adjust the curve matching pot *(labelled "CURVE", second from the right on the bottom row, pot 7)*. Adjusting the CW increases the O_2 reading. As the curve matching pot is adjusted the voltage to the gas valve changes.

9. If the curve matching pot is adjusted to the fully CW position and the O_2 reading is still not within 10% of the original High Fire O_2 reading, add a 180 ohm, 2 watt resistor across the modulating gas valve terminals and repeat above test until proper curve matching is achieved. *(A 150-ohm, 2-watt resistor may have to be used if O_2 level still does not rise to within 10% of original high fire O_2 reading.)*

   Switch burner to low fire again and re-check low fire, both at 0 VDC and 2.25 VDC. *(An addition of a resistor above may have changed the low fire setting if it was needed)*.

10. Lock the locking ring on the spring activated low fire adjustment screw. Failure to lock it may cause the screw to vibrate loose allowing low fire gas pressure to increase. This can

create sooting of burner parts and the heat exchanger. If the locking ring is missing, drop one drop of Loctite thread locker 222 onto the brass screw threads.

Series 50/M550, M650 AND ES350 (High Turndown)

These valves have only 1 low fire adjustment *(spring activated low fire)*.

NOTE:	*These valves are not used on 15:1 turndown.*

11. The high fire combustion set up is similar to the above except there is no low fire bypass adjustment on the bottom of these valves. You may simply set up low fire by turning the manual firing pot 4 SER to the low fire position *(1250-RPM ±10 RPM 20.8 Hz)*. Voltage to the series 50 valve should be 0 volts DC. Adjust the spring activated low fire adjustment at the top of the modulating gas valve *(small screw)* until an O_2 reading of 16.8% to 17.5 % is achieved.
12. Lock the low fire adjustment screw as described in point 7 above, and then adjust the curve matching pot 7 as in points 8 and 9 above.

Type ES345D-L (High Turndown)

As this valve has 2 low fire adjustments the following procedure should be applied.

NOTE:	*This valve can be used on 15:1 turndown.*

13. After high fire is set up as in “2” *(on Page 18)*, bring the unit to low fire by adjusting the DJM2 “Service” pot 4 *(SER)* fully CCW. Turn the ES345 low fire adjustment screw found under the valve cover near the wire terminals, fully CCW. Adjust DJM2 pot 8 *(MINSP)* until the combustion fan is turning 1250 RPM ±10 RPM *(20.8 Hz)* for 10:1 turndown, *[1195 RPM ±5 RPM for 15:1 turndown (19.91 Hz)]*. Voltage to the ES valve should be 0 volts DC. The low fire bypass adjustment on this valve is under the top cover on the large port and the adjustment inside it is marked:

    Increase ←→ Decrease

    After removing the cover, loosen the locking screw first before making adjustment. The low fire adjustment should be done at 0 VDC to the modulating gas valve terminals and the ***spring activated low fire brass screw*** turned fully CCW and the locking ring loosened off.
14. Bring voltage to gas valve at 2.25 VDC and adjust the ***spring activated low fire*** adjustment located in the head with the electric modulator *(smaller screw under cap)* to achieve the same O_2 reading as the one achieved at 0 VDC *(16.8% to 17.5% O_2)*. After this is complete then adjust the curve matching pot 7 curve as described in points 8 and 9 above.

Pilot Set Up *(High Turndown)*

1. On high turndown units, ensure air tube to pilot is free of debris and blockages and then set pilot pressure to 3.5" WC.
2. Pilot set up on high turndown burners is not as critical as there is not as much heat to damage the pilot assembly as on the regular round burner.

Standard (Round) Burner

Most standard turndown DJ units will employ one of the following Maxitrol modulating DC volt gas valves. Note that there is an orifice where the pilot gas line is connected to the pilot air tube. This orifice is sized to the BTU and altitude requirements of the burner. It must be free of dirt and burrs to operate properly. If there are problems lighting or proving the pilot that do not appear to be related to the ignition/flame supervision device then carefully clean and inspect this orifice from both the gas tube and air tube side. If a burr exists it is usually best to remove it by pushing it into the air tube from the gas tube with a small pin or orifice drill, then break it off by inserting a file or other object into the air tube.

Most standard turndown DJ units will employ one of the following Maxitrol modulating DC volt gas valves:

Series 20 - M520, M620	These valves do not have high fire regulators. High fire pressure is set up at the appliance regulator. If used on the standard burner, the low fire adjustment located on the bottom side of the valve is to be adjusted fully clockwise *(no bypass)*.
Series 50 - M550, M650, ES350	These valves do not have high fire regulators. High fire pressure is set up at the appliance regulator. This series of valve has been replaced with the M520/620 series.
ES345D-L	This valve has a built in high fire regulator.

High Fire Set Up

1. Place a jumper across the DJM2.4 terminals “SV and SR” to force the control into a manual firing mode.
2. Set manual firing pot #4 labelled “SER” *(located near the middle of the panel)* to high fire.
3. Ensure correct inlet fuel pressure. Adjust the high fire manifold pressure to that listed on the rating plate. Adjust the combustion air slider or inlet damper until the high fire O_2 reading is between 3.5 and 4.2%.

Low Fire Set Up

Standard Burner Low Fire Set Up 2.5:1 turndown

Low Fire Input is 40% of High Fire Input

The low fire procedure set up is similar to that for the high turndown burners noted above. Adjust pot 4 *(CONT)* to low fire CCW and follow the set up for the high turndown burner, except use the following values. The difference is the maximum allowable CO at low fire is 200 PPM. The low fire O_2 reading should be between 10.9% to 11.3%. The combustion slider is different than the high turndown slider. It is a plate that slides between the blower outlet and the burner box. The low fire RPM is adjusted using pot 8 *(MINSP)* to 1850 ±10 RPM *(30.5 Hz)*. Note that for this speed range the high turndown jumper on the back of the board is not to be cut.

After setting up the low fire, adjust the curve matching pot as described in points 8 and 9 above. Need of a resistor on the valve as described in the text above for the high turndown burner is greatly reduced on the standard burner.

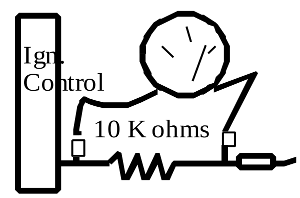
Pilot Set Up for DJ Series Standard Burners

Do not set up pilot until you are confident the burner is operating with correct air/fuel mixture. *(Set up high fire first.)*

1. Ensure the pilot tube is free of debris and blockages.

   Note that there is an orifice where the pilot gas line is connected to the pilot air tube. This orifice is sized to the BTU and altitude requirements of the burner. It must be free of dirt and burrs to operate properly. If there are problems lighting or proving the pilot that do not appear to be related to the ignition/flame supervision device then carefully clean and inspect this orifice from both the gas tube and air tube side. If a burr exists it is usually best to remove it by pushing it into the air tube from the gas tube with a small pin or orifice drill, then break it off by inserting a object into the air tube.

2. On standard round burners, set pilot as per the following procedure.



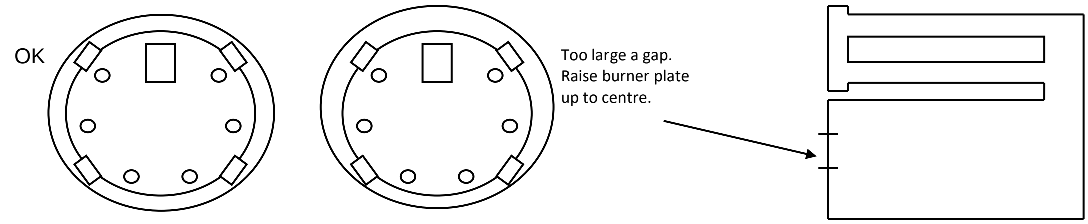
   - Install a 10,000-ohm resistor in series with the flame rod circuit.
   - Connect a DC voltmeter across the resistor.
   - The reading will be in millivolts if your meter does not auto scale.
   - Connect a manometer to the pilot line.
   - Run the burner on main flame for a few minutes to have the burner plate warm.
   - Leave the pilot on but turn the main gas off. *(You will have to jumper the DJM2.4 terminals PV1 and PV2 to do this and remove the wire from terminal VFB24 or VFB120 depending on the gas valves voltage.)*
   - As low pilot gas pressure can damage the ceramics, reduce the pilot gas pressure to 2.5 inches and immediately return it to a higher pressure. This is to ensure the pilot gas regular responds properly.
   - Adjust the pilot valve regulator to a pressure in excess of 4.5 inches pressure.
   - Slowly reduce the pilot gas pressure while watching both the pressure and the voltmeter. The millivolt reading should be increasing. At the point where it begins to fall you should stop reducing pressure and return to the high spot.

***NOTE**:*	*That the fall in pressure could only be as small as a couple of millivolts. This point should be between 4.5 and 2.5 inches pilot pressure.*

***NOTE**:*	*That some smaller burners DJ40 and smaller, may need to have a screw placed through the pilot air tube to reduce the amount of air to the pilot.*

This reading is used to determine the adjustment that will usually give the best pilot lighting and proving strength. However, care must be taken to not adjust the reading for pilot gas pressure below 2.5 inches water column pressure or you will break the pilot ceramics.

Next, visually observe the pilot flame. It should be visible at a minimum of 3 of the holes around the pilot. If the pilot cannot be seen then it is likely burning too deep into the pilot box. If this is occurring check that the gasket on the pilot assembly is forming a tight seal. Also ensure that the burner is located in the centre of the burner tube. If it is mounted too low then too much air can flow over the top of the burner and affect the pilot.



Propane Gas

Due to the quantity of fuel that can be drawn off a propane tank, it is often necessary to equip a propane fuel system with a vaporizer. The usual sign that a vaporizer is required is that the units fuel supply falls off as the line “freezes”. The user usually observes:

- Lack of temperature rise,
- Rumbling or shaking burner due to air/fuel mix,
- After turning the unit off for awhile the fuel line thaws and upon restarting it, all appears to be normal.

Combustion set up for propane fuels for either the high turndown or the standard burner are similar to the above. The only modification suggested is it may be desirable to increase the oxygen settings by 1 to 1.5% above those for natural gas.

High turndown burners operating on propane fuel will generally exhibit the following:

High Fire 3.5% O_2 will appear yellow from behind the burner. However, if you could view it from the other side of the burner you would see blue as the flame lengthens out.

Low Fire 16% O_2 The flame will likely be yellow. At 17% O_2 the flame will likely be blue and yellow.

Inlet/Manifold Pressure Settings

Manifold pressure settings that the unit was tested and clocked at in the factory are recorded on the unit rating plate. Any attempt to clock a unit in the field should be done with care as corrections for density *(altitude and station pressure)*, temperature, and the correction factor for the meter are often overlooked, leading to an incorrect conclusion.

Inlet gas pressures are recorded on the unit label. At high fire inlet gas pressure to the unit should not fall below 6.25" on units designed for 7" inlet pressure. If design is for 14" pressures should not fall below 12".

If design is for 11" propane gas, then inlet pressures should not fall below 10". Note that with propane fired units it may be necessary to equip the propane system with a properly sized vaporizer.

NOTE: *After set up is complete remove jumpers.*

XV. SPECIAL SERVICE NOTES

On Board Fuse

The DJM2.4 is equipped with a 2-amp fuse. This fuse is located on the bottom of the main board. If there is 24 VAC to terminals H and N and the DC voltage from terminals OS to GS is 0 VDC, check the fuse. *(10.5 to 11.0 VDC is normal.)* Control is slow to respond to temperature demand.

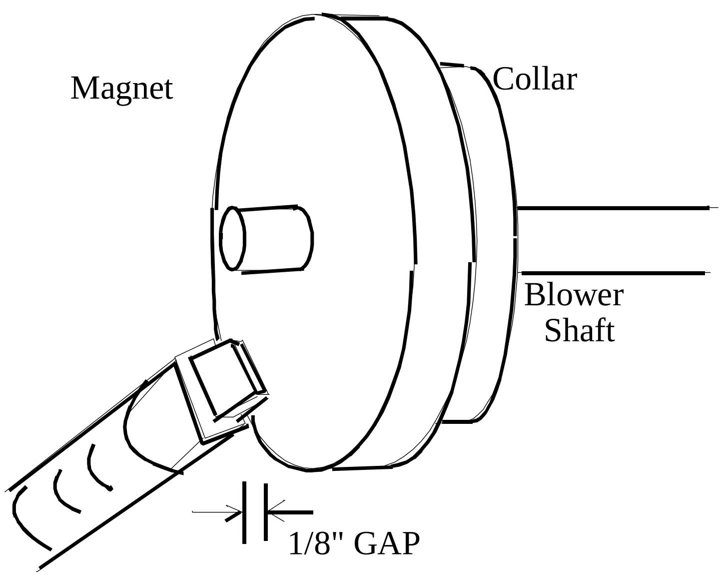
Rapid Change in Load or Set Point

Two Speed and VAV Applications

The DJM2.4 likes to see stable discharge air temperatures. If the set point is changed rapidly *(lowered)*, the DJM2.4 may take up to 3 minutes to fully respond. The same conditions apply to a load that is suddenly reduced. *(Vanes closing or low speed operation.)* Under these conditions the discharge temperature may rise. If a problem is encountered with the high limit tripping, consult the factory.

Checking Speed Sensor with the Fluke 80 Series Meter

Also refer to Section IX, Pre-Purge Status Light #1, for more information. The DJM2.4 has a Hall Effect speed sensor to allow the control to closely monitor the combustion fan speed. There is a fixed 10 VDC output from the DJM2.4 terminals “GS” and “OS” to the Hall Effect speed sensor if the DJM2.4 is powered. The speed sensor allows a return signal to be measured on the “YS” and “GS” terminals. If the fan is rotating above 500 RPM, the signal can be read as either an AC or DC voltage and it will be about 5 volts. This is because the fan is turning at a high rate of speed and your meter is averaging the reading. If the DJM2.4 has 24 volt power to it and the combustion fan motor has been disconnected from its power supply, turning the combustion fan slowly by hand will result in a reading of 0 - then 10 VDC repeating as the north and south poles of the magnet pass by the Hall Effect speed sensor. If the pre-purge problem light is flashing the above steps should be checked.



If the DJM2.4 indicates a pre-purge problem the problem can be analysed more completely using one of the Fluke 80 series meters. The DJM must see a near symmetrical square wave coming from the Hall Effect speed sensor or it will reject the sensor signal. This wave is formed as the magnet spins on the shaft with the north and south poles passing a Hall Effect speed sensor. This speed sensor is a very small electronic chip located under the shrink-wrap at the end of the copper tube. A simple method for estimating the wave form when the combustion fan is running at any place in the programmed burner control process is by setting the Fluke multi-meter to AC volts. Attach the meter to the DJM2 terminals “YS” and “GS”. Press the Hz button once. The number should read between 15 and 59 Hz depending on the speed of the fan *(which would be 3450 RPM or 59Hz if the unit were in pre-purge mode)*. If the reading is over 59 Hz the sensor may be grounding out as the motors maximum RPM should be 3450 RPM. Press the Hz button a second time and the meter is reading % duty cycle. This number indicates how symmetrical the waveform is, and should read close to 50% ±2.5%. If the number is outside those parameters the “***Pre-purge Problem***” light may be flashing. Check the sensor location and magnet quality. Occasionally poorly manufactured magnets produce an irregular magnetic field. Sometimes reversing the magnet on the shaft will correct this problem *(turning it around)*. Also refer to LED 1 for more information.

If the test is done only for voltage and it proves to be correct, there could still be a problem as the DJM.42 has a refined sensing circuit. This circuit is looking for the magnet to be split fairly evenly. The duty cycle test gives a reasonable view of the magnets split between north and south poles.

Speed Sensor Values

With the speed sensor disconnected from the DJM, the following are approximate values read with a fluke meter at 50ºF.

Scale @ Megaohms			*Scale on Diode*	
Positive Lead *(Red)*	Neutral Lead *(Black)*	Value *(Megaohms)*	Neutral Lead *(Black)*	Value
Red	Yellow Green	Infinite 25.2	Yellow Green	2.175 1.6
Yellow	Red Green	Infinite Infinite	Red Green	Infinite Infinite
Green	Red Yellow	Infinite 4.6	Red Yellow	Infinite 0.652

Pre-Purge Light Coming On (When Not Supposed To)

There can be three reasons for this:

1. A power spike is being picked up through the B, W, and G terminals. Make sure the DC wiring is not run common with the AC power wiring. If separating the wires does not cure the problem, shielded wire may have to be used.
2. Problem with the Hall Effect speed sensor.
3. Faulty DJM2.4.

Constant Heat Call Light, No Combustion Fan

If the heat call light is on and the pre-purge light off and there is no attempt to start or slow the combustion fan down to ignition speed, check if DJM2.4 terminal VFB24 or VFB120 depending on the gas valve has constant power on it. If the previous heat call did not have this signal removed after it was complete, it can result in the lockup as described. This would usually only occur if DJM2.4 terminal VFB24 OR VFB120 is powered by a relay contact that has stuck in a closed position.

The second possible cause could be a false or grounded tach signal. Try removing “OS, YS, and GS” wires. If the combustion fan doesn’t run, check the motor. If it now starts change the Hall Effect speed sensor.

Failed Operation or Solid State Control Contacts by Others

There have been a number of new controls introduced into the marketplace recently that allow a building to be controlled by a central computer *(BMS or Building Management System)*. Many of these devices use relays to switch external power devices on and off and their operation is fine. However, some of the new devices use “opto couplers” or “solid state contacts”. These devices will not interface properly with the DJM2.4 contacts “HS, or terminal VFB24/VFB120”. The solid state contacts allow enough “voltage leak” through them when they are in an off *(open)* position to cause the DJM2.4 to malfunction. Voltage leaks of 4 to 5 VACS are common. Only dry contacts should be tied to the DJM2.4 terminals unless instructed to do otherwise.

Air Balancing (Refer to next item)

Cold Discharge Temperature in Cold Weather

At the time of installation and air balancing, the air balancer in warmer weather often adjusts the unit’s airflow. If the unit is designed for “***Make-up Air***” *(outside air being drawn into the building and heated as it passes through the unit)* then the quantity of air being delivered into the space will vary considerably as the outside air temperature varies. This is due to air density, volumetric expansion due to heat and the fact that the fan is located before the heat exchanger. If the air balancer did not allow for the changes that will occur in air volume and density that will occur in colder weather while he is doing an air balance in mild weather then the unit will appear to be short of temperature rise on cold days.

The fan is a constant volume device and is located before the heat exchanger, so it is necessary to recognize what occurs as air expands while being heated passing over the heat exchanger. The change in air volume will be about a 20% increase as the air warms from minus 30ºF to plus 70ºF.

To better demonstrate with a rough example:

> Assume a unit specified to deliver 10,000 CFM is located in an area that reaches -30°F in the winter was being air balanced on a 75°F day to deliver 10,000 CFM with the heat off. The unit’s design temperature rise is 100°F from -30 to 70°F. It **should be** balanced to deliver about 8,200 CFM **on the 75° day** with the heat off. ***On a day that is -30***°, the fan will be delivering 8,200 CFM onto the heat exchanger, but as the air expands over the exchanger there is 10,000 CFM coming off of the unit. Temperature rise should meet the 100° design to give a discharge temperature of 70°. *(If the unit had been balanced to deliver 10,000 CFM on the 75° day, then, on the -30° day noted*

above, the temperature rise would only be about 80 degrees to give a final discharge temperature of about 50° at about 11,800 CFM at high fire.)

Improper Burning

- Plugged 12 AO6 vent orifice (*on units equipped with one on regulator*).
- Modulating valve sticks.
- Incorrect burner setup.

Improper Burning After Changing Combustion Motor Or Fan

If the fan is located at a different spot on the motor shaft, it changes the airflow pattern and quantity. The quantity is changed by the size of the gap changing around the fan inlet. This allows more or less air to "leak" from the fan discharge side back to the fan inlet.

Temperature Swings and Temperature Control Issues

If the DJM2.4 is a slave to a C-TRAC and temperature swings are evident, refer to notes in section XVIII about "DJM2.4 Slaving From C-TRAC" for proper control set up parameters.

Next, re discharge air temperature sensor location: Engineered Air mounts the discharge air temperature sensor in the unit at the time of manufacture. This has been successful in eliminating loss of sensors when they are shipped loose to be field mounted. In some applications due to air flow patterns created by many factors (including duct layout) this location may not represent an average duct temperature. Most discharge temperature sensors can be relocated into the duct work to correct problems of temperature stratification, etc.

Last but by no means least is the application of a BMS sensor in the discharge by a control contractor. Engineered Air suggests that both our sensor and the BMS sensor should be located within ½" of each other. If this is not done there can be great discrepency in the readings between the two sensors. Also if there is a discharge air temperature duct sensor from the BMS it should only be used to transfer the duct temperature to the computer screen and / or activate desired alarms. DO NOT --- repeat DO NOT program the BMS discharge duct temperature sensor to do any reset functions on Engineered Air controls that are operating in a discharge sensor mode. (controls such as C-TRAC, M-TRAC, G-TRAC, DJM, H-TRAC etc) BMS reset can only be performed from room, return air or ambient sensor locations.

Ignition Failure During Morning Start Up

What happens if ignition fails on morning start-up?

The following is a generalization of what the DJM2.4 lights do.

- If heat call light comes on:
  - Combustion fan starts, purge light comes on.
  - Purge cycle completes - purge light goes off.
  - Ignition enable light comes on.
- Now if ignition failure occurs:
  - Ignition enable light stays on.

- Combustion blower runs at light off speed unless power is turned off.
- If an external low limit is on the unit and it trips it will shut off the fan and the dampers, and usually leave power to the DJM although some units are designed to lock the DJM off also.

In either of the above situations, assuming that the original problem did not rectify itself you will have the supply fan off, the combustion fan on and the low limit tripped when you arrive at site. If you turn the unit service or remote on/off switch off for 30 seconds and then turn it back on, watch the lights as the ignition process retries. If the ignition or sensor problem still exists it should be evident within a few minutes.

Night Heat Function Problem When Slaved From C-TRAC

On the odd occasion when a night heat function is applied to a DJM that is slaved to a C-TRAC the following operation has been observed:

- Room stat calls for heat through the C-TRAC
- The C-TRAC outputs a heat call to the DJM and it completes firing the burner
- The auto fan switch starts the unit supply air fan
- Now the problem begins
- In a short time after the supply fan starts the auto fan switch cools and the fan shuts off
- The DJM during this time has modulated to low fire
- There is not enough heat produced to remake the auto fan switch, the DJM may continue to modulate at low fire depending on temperature conditions at the sensors.
- **Suggested resolution:**
- When C-TRAC terminal “K” is powered at night the coil of a relay is powered.
- The contacts of the relay are located between the DJM main gas feedback terminal and the coil of a camstat. The contacts of the camstat parallel the auto fan switch contacts.
- Only at night and when the burner is in operation does the camstat have power to start the supply fan and it will keep it in operation until after the heat call is completed and the camstat has timed out.

Ignition Problems

Check the condition of the pilot assembly. Check for damaged or dirty ceramics, proper gasket, and pilot set up. If you are still having problems lighting the burner, check the items itemized below.

If you have been having problems lighting the burner, check the following items:

1. If the combustion fan wheel or motor have been changed refer to the diagram just before section XVI below.
2. If the combustion has been set up, the ignition should be checked. Whenever the total air slider has been adjusted it affects how much air flows into the pilot air tube.
3. Occasionally some ignition control devices have the power to throw a spark through the

casing to the mounting screw near the spark connection, or through the back of the case. Mount the ignition control off the wall on insulated spacers and do not install a mounting screw next to the spark wire location.

4. Check the resistance of the flame and spark rod to the wire connector terminal on the rod. This should not exceed 2-ohms. If it does, replace the assembly.
5. Ensure that the ignition control and its transformer secondary are both adequately grounded. If there is not an adequate ground then there will be a weakened flame rod signal.
6. Some extreme cases of airborne electrical noise a special sheathing is available to shield heavy ignition spark wire. Please consult factory. It may be necessary to install a ground wire from burner ground terminal to chassis. Scrape the paint on chassis.
7. Spark gap should be set at 1/8 inch.
8. Check for cracked porcelains on the spark and flame rods. These have been found to be cracked in the area where they pass through the mounting plate also. You cannot see into this area and you can even have it feel tight. *(If possible it may be best to check it with an ignition device.)*
8. Ensure there are no burrs or dirt in the pilot line orifice and air tube. These items have often been found with dirt, rust, insulation, paper, etc., blocking them. This includes checking the short connector at the blower housing where the rubber tube attaches. Also ensure no capacitor mounting screw is blocking the inlet to the pilot tube.
9. Usually changing the pilot assembly will not have much of an affect on the pilot signal if both assemblies are in good condition and installed correctly.
10. Ensure the pilot assembly gasket is tightly installed to stop air leakage into the pilot area.
11. Standard *(round)* burner only. If the burner plate is not centered in the hole, it may allow too much of a gap over the top of the burner, thus increased airflow through the larger opening may roll onto the pilot box. Place a spacer under the burner plate to raise it into a centered position.
12. Due to the low capacities of some small units with standard *(round)* burners only, there may be too much air entering into the pilot air tube. It may be necessary to reduce this air quantity by placing a screw through the side of the combustion blower outlet in a manner that the screw also passes through the metal tube that the rubber hose connects to. This normally only occurs on units with an input of less then 300,000 BTUH. ***Some units have a screw mounted capacitor, ensure the screw does not obstruct the pilot tube's air path.***
13. If a BMS signal is applied, caution should be taken about removing the transformer grounds that may interfere with the BMS signal. It is possible that you may have disconnected the ignition control or ignition transformer ground.
14. Water and ice have been located in the pilot gas lines, in the pilot air tube, in the pilot box, and in the pilot gas orifice. Ensure these areas are free of moisture, locate the source and correct it.
15. Snow, ice, or water on the ignition control(s) can stop a pilot from igniting or proving. These devices and their associated parts must be kept clean and dry.

Regulator Gas Pressure Responses

On some indoor units the vent orifice fitting on the RV appliance regulator is to be vented to atmosphere. The field installed vent line should be sized adequately, especially on longer runs. If there is more than one regulator connected to a common run, which includes the main regulator and the line, is not adequately sized, changes in pressure on the RV diaphragms are applied to all regulators. This includes the main regulator so an erratic inlet pressure will result and cause improper combustion and also burner pulsating problems.

Some DJ unit manifolds have RV appliance regulators with a vent-limiting orifice, usually a brass orifice marked ‘12A06’. Ensure that this tiny orifice is free of dirt or debris. A plugged orifice will impede regulators opening flow and cause improper air/fuel mixtures.

Rumble During Light Off

The low fire combustion air quantity being too great usually creates this condition, or the low fire gas-firing rate is set too low. Always check the main gas inlet pressure first before making any adjustments. At high fire it should be a minimum of 6½ inches on units designed for 7-inch natural gas inlet pressure. *(Minimum 12 inches on 14-inch natural gas design and 11½ inches on propane units.)*

Rumble is usually not a problem with the rectangular shaped high turndown burner. On the standard burner it is possible to get small amount of rumble whenever a burner is lit after being cold for an extended period of time. After the first light it settles down. This is because the warm burner has a greater back pressure than the cold one; thus a lower air velocity occurs when the burner plate is warm.

One of the more common causes on the regular burners *(round burners)* is if the combustion blower light off speed is set too high. Check if the light off speed is too high with an accurate tachometer or by using a meter that measures hertz connected to the “YS and GS” terminals of the speed sensor. Light off speed is 2700 RPM *(45 Hz)*.

Another item that can create rumble on the standard *(round)* burner is if the turndown is adjusted too low. At low fire the standard *(round)* burner can only modulate to 40% of the high fire rate. This leaves too much air at low fire for the quantity of fuel. To correct increase the low fire manifold pressure to the proper firing rate. A rough rule of thumb for low fire manifold pressure is:

DJ40	0.6"
DJ60	0.6"
DJ100	0.8"

Ensure that these pressures are set with the modulating gas valve at low fire *(1.8 VDC on its terminals)* and the combustion fan running at 1800-1850 RPM.

Burner Staying On

The DJM2.4 is designed to maintain a stable discharge temperature. Depending upon pot 3 CONT *(PI)* setting, the DJM2.4 may not respond instantaneously to a sudden decrease in the discharge set point. After the burner has been steadily firing for an extended period of time, if the set point is suddenly lowered the burner may delay before cycling off. If this effect is undesirable, decrease the Integral effect as set on pot 3. This is done by rotating the pot CCW to full proportional.

> ***NOTE:*** *If the unit is controlled by a zero to ten VDC signal such as from a C-TRAC or METASYS it is important to set the BMSS and BMSZ pots correctly also. Refer to "DJM2 controlled by a C-TRAC", Page 12.*

Burner Stays on Low Fire

If a DJM2.4 is staying on low fire for an extended period of time and overheating the space it may be the CONT pot is giving too much integral authority. If so reduce the integral.

Combustion Fan Motor Surging in Speed

If a combustion fan motor is surging in its speed after the motor has been in operation for an extended period of time, it is likely that the "triac" is overloaded and is running hotter then design. When this occurs, the surging is caused by the triac shutting down due to heat. The surging occurs at lower modulated speeds of the combustion fan and pulses about twice a minute. Be careful to not incorrectly assume this is a problem as it may also be possible the fan is changing speed in relation to the demand from the DJM2.4 control system. The surging described above will not occur until the triac has operated for a few minutes at low speed and built up considerable heat.

Modulating Valve Will Not Respond to Signal to Open

Items that may contribute to this are:

- Ice in valve *(in bottom or above diaphragm)*.
- Burnt out coil.
- Sticky substance or debris in valve.

Modulating Valve Sticks When Returning to Low Fire

If the modulating valve sticks partly open as the combustion fan slows down, the combustion process will be very poor. The products of combustion may smell badly or in rare instances even form carbon. The usual symptom of a sticking valve is when voltage is low to it and the manifold pressure is higher then it should be, a solid rap on the valve corrects the problem. Replace valve.

Sooting Burner/Heat Exchanger

Soot is created during improper combustion. Do not try to correct combustion set up with a badly sooted burner or heat exchanger, clean it first. One cause of sooting is on units with horizontal flues. The wind blows into the outlet harder then the combustion fan blows. Correct this by installing a vertical chimney *(double walled in colder climates)*. The second item to check on high turndown units is loose lock ring on series 20 valves. Described in Section XIV, sub section Low Fire Set-up – refer to the type of valve in your unit. The third item is combustion set up is correct but the modulating gas valve sticks partially open when returning to low fire. This can usually be determined by monitoring gas pressure and analyzing combustion while at low fire, then rapping the modulating valve if above was not correct. If the valve was stuck then it releases and low fire returns to the desired settings. *(Refer to **Combustion Set Up** on page 16.)*

On heat/cool units the combustion air is normally drawn by the combustion fan from the intake screen located on the compressor floor area. As this floor area is cantilevered it can plug up with blowing snow, especially if the unit is mounted on a low level roof curb. This can cause combustion air to starve and result into sooting or the heat exchanger.

Smell From Flue (Products of Combustion)

Smells are usually created by improper combustion set up. This can be due to a sticking valve *(note above)*, low inlet gas pressure, or just a bad combustion set up. Note the following comments about combustion set up.

Water and Ice From Combustion

These heat exchangers are very efficient. Water is one of the major products of combustion and as such must be controlled. The units are equipped with a drain. It is however best to allow water to leave the unit in the flue gases in vapour form. Combustion that is set at maximum efficiency will produce excess moisture. Often it is desirable to have 1% to 2% higher excess oxygen readings then those normally listed to assist in keeping the flue gases drier. Also note that extended chimneys can contribute to condensation problems *(especially if they are not insulated or at least double walled)*. Water in the heat exchanger can lead to premature failure due to thermal stress or freezing. Another source of excess condensation is when a unit designed with capacity to heat 100% outside air is operating with very little outside air, therefore operating at a low fire or cycling. This allows the cool flue gases from low fire to cool and condense in the chimney.

Burner Pulsing, Backfiring

An improper air/fuel mixture usually causes this condition. Do not attempt to do any combustion analysis until the inlet fuel pressure has been checked. If inlet fuel pressure falls too low then the air velocity on the burner *(which is likely set for proper fuel pressure)* would be too high for the quantity of fuel being supplied to the burner. If the inlet fuel pressure is correct, then the combustion air is possibly set too high for the burner and combustion analysis should be done.

If an explosion occurs after the burners flame has definitely extinguished, and the burner is being re-lit on a heat call, the explosion is likely due to a fuel build-up from a slow leaking gas valve. It is recommended that both pilot and main manifold valves be changed if you cannot prove the source of a leak.

Also note that a possible cause of burner rumble on standard *(round)* burners is having the turndown rate set too low. If the combustion blower is at low speed and the manifold pressure is set below the 40% turndown, then there is too much air for the quantity of fuel, correct by increasing low fire manifold pressure. Refer to notes in "***Rumble During Light Off***", page 30.

Power Vented Flues

Engineered Air offers Tjurland vent devices for side venting some units. If technical information is required on the operation of the control system for these devices, contact a Tjurland representative or Engineered Air. In many cases there are power ventors that operate only when the combustion blower is in operation. This has a relay wired to the combustion blower terminals on the DJM. If you need an operation description for this relay and some problems that have been observed, contact an Engineered Air Technical Services Representative and request a copy of section 38-56-L through P from their manual. Note that the afore mentioned documents description notes some terminals that may have been re-labelled on later DJM models. Refer to information later in this document for a table cross referencing the label changes.

Fire Without Combustion Fan

If there is a fire in the burner section without the combustion fan in operation, check to see if there is power on the DJM2.4 terminal VFB24 or VFB120 and VN. Record the result. Next check to see if there is power on the DJM2.4 terminal FR. Record the result. Next check if there is power to the DJM2.4 "H and N" terminals. Record the result. If there is no power to any of the above terminals and if the unit has not had any wire changed, there should not be any power to the pilot or main gas solenoid valve. Very gently turn off the manual valve on the pilot line. Check to see if the fire has gone out. If it has then the pilot solenoid is leaking and should be changed. If there was no difference, gently turn off the firing valve for the main manifold. If this stops the fire, this would prove the main solenoid-blocking valve was leaking.

Replacement of Combustion Fan Motors

Motors being used for combustion fan application are applied to a device *(DJM2 or DJM3)* that reduces the motor speed. Speed reduction of a motor results in additional heat being generated within the motor as well as reduced cooling capability from the motors internal cooling fan. If a motor that is not designed for this duty is installed on the DJM, it may result in failure of the new motor and/or the DJM. For this reason we recommend combustion fan motors only be replaced with motors that meet all the specification requirements of the original motor. Also note "Improper Burning" above.

Replacement / Location of Combustion Fan Wheels

If a combustion fan wheel is located in a different spot on the shaft then it was on the original combustion setup it can both affect pilot ignition and the results of combustion analysis. Note the following diagram on suggested combustion fan wheel location in reference to the pilot air tube.

XVI. SET UP WHEN INSTALLING A DJM2.4 IN FIELD

1. The two pots on the back of the board are factory adjusted and should not be field adjusted. They are for the tachometer calibration. Only on the odd exception should the low fire light off pot be adjusted, that being if the burner rumbles on during every light off *(even when warm)*.

2. There are two possible burners that the DJM2.4 can be applied to. Check the burner in your unit and if necessary cut the jumper next to terminal "PV1" on the back of the control before mounting the control.

- STANDARD BURNER *(Round Burner)* - do not cut jumper.
- HIGH TURNDOWN BURNER *(Rectangular)* - you must cut jumper.

NOTE:	*Be aware that the position of the "CONT" pot should be considered during parts of the set up procedure as it may make the control react slowly if set too far CW.*

3.	***NOTE:***	*If the DJM2 is controlled by a Maxitrol series 14, Johnson TE 6000-960 discharge sensor or DC volts applied to terminals "R and W".*

- Jumper "SV to SR" to put the control into service mode, adjust combustion as per instructions found under "***Burner Set Up***". Remove jumper.
- Set the discharge set point to desired setting.
- Adjust pot 1 DCAL to match set point and D/A temperature if needed.
- Adjust pot 3 CONT as described in the manual to give an acceptable temperature control band.

4.	***NOTE:***	*If the DJM2 is controlled by a C-TRAC2.1 or Metasys then resistor R19 should be cut before installation. If the DJM2.4 is being controlled by a BMS signal that cannot put out enough VA to drive the DJM2.4, resistor R19 should be cut.*

If the DJM2 is controlled by a C-TRAC, Megatrac, METASYS or other BMS device that is wired to terminals "+ and -" then:

- Set combustion as in point 3A above.
- Return control to the C-TRAC *(or whatever control is attached)* by removing the jumper "SV to SR".
- Make a call for full heat; adjust pot 6 BMSS to obtain full fire. You are at full fire when output to the Maxitrol valve exceeds 13 VDC.
- Make a call for low fire and adjust pot 2 BMSZ to just keep low fire on. When incoming voltage on terminals "+ and -" falls below about 2.5 VDC *(5.5 ma)* the burner should cycle off.

XVIII. MISCELLANEOUS NOTES

Combustion Blower Speeds

DJM2 configured for the ***REGULAR ROUND BURNER***.

- **Low fire combustion blower speed** is about 1830 RPM ±10 RPM *(30.5 Hz.) [1800 to 2000 RPM]*
- **High fire combustion blower speed** is about 3400 RPM
- **Light off speed** is about 2700 RPM

DJM2 configured for the ***HIGH TURNDOWN BURNER***.

- **Low fire combustion blower speed**
  - 10:1 turndown is about 1250 RPM ±10 RPM *(20.8 Hz)*
  - 15:1 turndown is about 1195 RPM ±5 RPM *(19.91Hz) [1150 to 1400 RPM]*
- **High fire combustion blower speed** is about 3400 RPM
- **Light off speed** is about 2300 RPM

Maxitrol Modulating Gas Valve Voltages

The different **Maxitrol valves** reach high fire at about the following **voltages**:

- M650 or M651 2 - 13 VDC
- M550 or M520 2 - 12 VDC
- M450 or M420 2 - 11 VDC
- MR212 2 - 11 VDC

Low fire is at about 2 VDC on each of the above valves.

DJM2 Slaving From C-TRAC

Occasionally reports are received where a C-TRAC, acting as the main temperature control (*with the DJM2 its slave*) cycles from heat mode to free cool mode (*neither heat nor cool light on*) then back to heat mode. This results in excessive temperature swings due to the time delays as the C-TRAC changes modes. To reduce this occurrence:

Firstly, ensure the CONT, BMSS and BMSZ pots are correct as described in the DJM2 manual section X.

Secondly, if the above does not resolve the problem, adjust the C-TRAC COOLING DEADBAND Pot #3 to number value eleven. Also access the C-TRAC Pot eleven on the back of the C-TRAC and set it to number 2.

Thirdly, if the above steps do not resolve the issue, use an open sensor (*contact the factory for details*).

Fourth, if after doing the above and reasonable control cannot be attained, contact the factory about “Splitting” the C-TRAC and DJM2 apart.

DJM2.x Applied to a “SH” (Steam Humidifier)

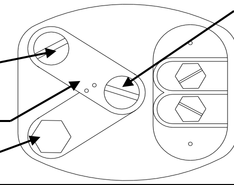
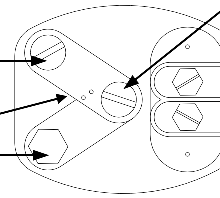
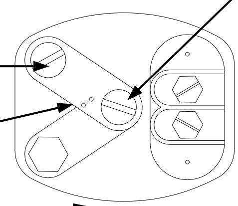
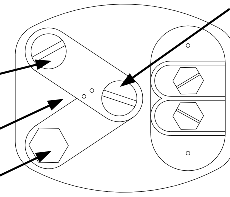
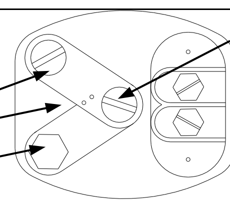
The DJM2.x has been applied to the SH product line to control the burner that is providing heat for the formation of steam. Operation is very similar to that of heating air except that water is being maintained to a temperature adequate to provide enough steam to meet the demands of the steam distribution system.

Items to be aware of on SH units are:

- SH units are shipped from the factory with a condensate line that is open to atmosphere. If it is to be used it must either be gravity fed from the bottom of the steam grid or if the steam grid is below the level of the condensate return then a condensate pump must be used. The condensate return line connection on the humidifier must be sealed off if not in use.

- The SH unit must be drained daily to reduce scaling from the minerals etc that are left behind when the water is boiled off into steam. If this is not done the unit will fail prematurely.
- The SH unit must be de-scaled at least annually (will vary depending on water usage and water quality).
- There are water level controls sensing minimum and maximum water levels in the water heater. A buildup of moisture and / or dirt on some portions of the sensor ceramics may allow the heat to operate without proper water levels. This could result in damage to the heat exchanger / SH tank. When servicing, these water level sensors should be confirmed as operating correctly at least annually. If the unit location is remote from suppliers and humidity control is important, stocking a spare water level sensor control system is recommended. (As well other parts may be stocked if desired).

XIX. MAXITROL GAS VALVE DRAWINGS

BEING REPLACED BY M_____20 ETC NO SPRING ON TOP OF PLUNGER DIRECT ACTING, POWERS OPEN	M450, M550 AND M650 N.C. VALVE DJ 20, 40, 60 100, 140 - SET HIGH GIRE MAIN RV REGULATOR - SET LOW FIRE AT LOW FIRE ADJUSTMENT GAS FLOW LOW FIRE ADJUSTMENT NO COVER VENT HOLE (MUST BE PLUGGED IF VALVE IS TOP LOADED) 12A06 VENT ORIFICE WHITE PLASTIC DISK COVERING PLUNGER BLACK SIDE UP 
BEING REPLACED BY M_____20 ETC NO SPRING ON TOP OF PLUNGER DIRECT ACTING, POWERS OPEN	ES350 N.V. VALVE DJ-60, DJ-100, DJ-140 HIGHT TURNDOWN UNITS ONLY - SET HIGH FIRE MAIN RV REGULATOR - SET LOW FIRE AT LOW FIRE ADJUSTMENT GAS FLOW LOW FIRE ADJUSTMENT NO COVER VENT HOLE (MUST BE PLUGGED IF VALVE IS TOP LOADED) 12A06 VENT ORIFICE WHITE PLASTIC DISK COVERING PLUNGER BLACK SIDE UP 
NO SPRING ON TOP OF PLUNGER DIRECT ACTING, POWERS OPEN LOW FIRE LOCK RING MUST BE TIGHT	M420, M520 AND M620 N.C. VALVE DJ-20, DH-40, DJ-60 AND DJ-100 STANDARD AND HIGH TURN DOWN UNITS - SET HIGH FIRE MAIN RV REGULATOR - SET LOW FIRE AT TOP ADJ ZERO V - THEN ADJUST LOW FIRE AT 2.25 VDC AT BOTTOM/SIDE LOW FIRE ADJUSTMENT USING HT BURNER SETUP DETAIL GAS FLOW TOP ADJ. SILVER OR BRASS LOW FIRE ADJ NO COVER W/ LOCK RING VENT HOLE (MUST BE PLUGGED IF VALVE IS TOP LOADED) LOCATION BOTTOM/SIDE FOR SECOND LOW FIRE ADJUSTMENT BYPASS WHITE PLASTIC DISK COVERING PLUNGER BLACK SIDE UP 
SPRING ON TOP OF PLUNGER POWER DRAWS PLUNGER UP REVERSE ACTING, POWERS CLOSED	MR410, MR510 AND MR610 N.O. VALVE DJ-20, DJ-40 WITH A1010 AMPLIFIER DJ-60 WITH DJT MODULE "PACKS" XE AND RT WITH MAXITROL A1010 AMPLIFIER - SET HIGH FIRE MAIN RV REGULATOR (REFER TO DJT-2 MANUAL) - SET LOW FIRE AT LOW ADJUSTMENT GAS FLOW BRASS LOW FIRE ADJUSTMENT NO COVER VENT HOLE (MUST BE PLUGGED IF VALVE IS TOP LOADED) 12A06 VENT ORIFICE BRASS DISK COVERING PLUNGER BLACK SIDE UP 
SPRING ON TOP OF PLUNGER REVERSE ACTING, POWERS CLOSED	SR500 N.O. VLVE (24 VAC) DJ-20, DJ-40 TWO STAGE ROOM CONTROL 0 VOLTS – HIGH FIRE 24 VOLTS – LOW FIRE - SET HIGH FIRE ON LARGE BRASS SCREW ADJUSTMENT - SET LOW FIRE ON SMALL BRASS SCREW ADJUSTMENT GAS FLOW BRASS LOW FIRE ADJUSTMENT NO COVER VENT HOLE 12A06 BRASS DISK COVERING SPRING, UNDER SPRING IS PLUNGER, SILVER SIDE UP 
NO SPRING ON TOP OF PLUNGER REVERSE ACTING, POWERS OPEN	ES345D-L DJ-140 HIGH TURNDOWN ONLY 1050 – 1400 MBH 12A06 TO BE REMOVED AND TOP LOADED FROM BURNER BOX RUN ¼" ϕ ALUMINUM TUBING THROUGH 7/8" ϕ KNOCKOUT HIGH FIRE REGULATOR GAS FLOW SET LOW FIRE AT LOW FIRE BYPASS, AND THEN ADJUST LOW FIRE AT 2.25 VOC AS PER SETUP PROCEDURE* WHITE PLASTIC DISK COVERING PLUNGER BLACKSIDE UP * LOW FIRE BYPASS ADJUSTMENT