EngA®

ENGINEERED AIR®

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

FOR

Q-TRAC

MODEL 1

Heat Pipe Control

INDOOR AND OUTDOOR MODELS

C LISTED ®

LISTED ®

UNIT MODEL NO. ______________________________

UNIT SERIAL NO. ______________________________

SERVICED BY: ______________________________

TEL. NO: ______________________________

CANADIAN HEAD OFFICE AND FACTORY
1401-HASTINGS CRES. S.E.
CALGARY, ALBERTA
T2G-4C8

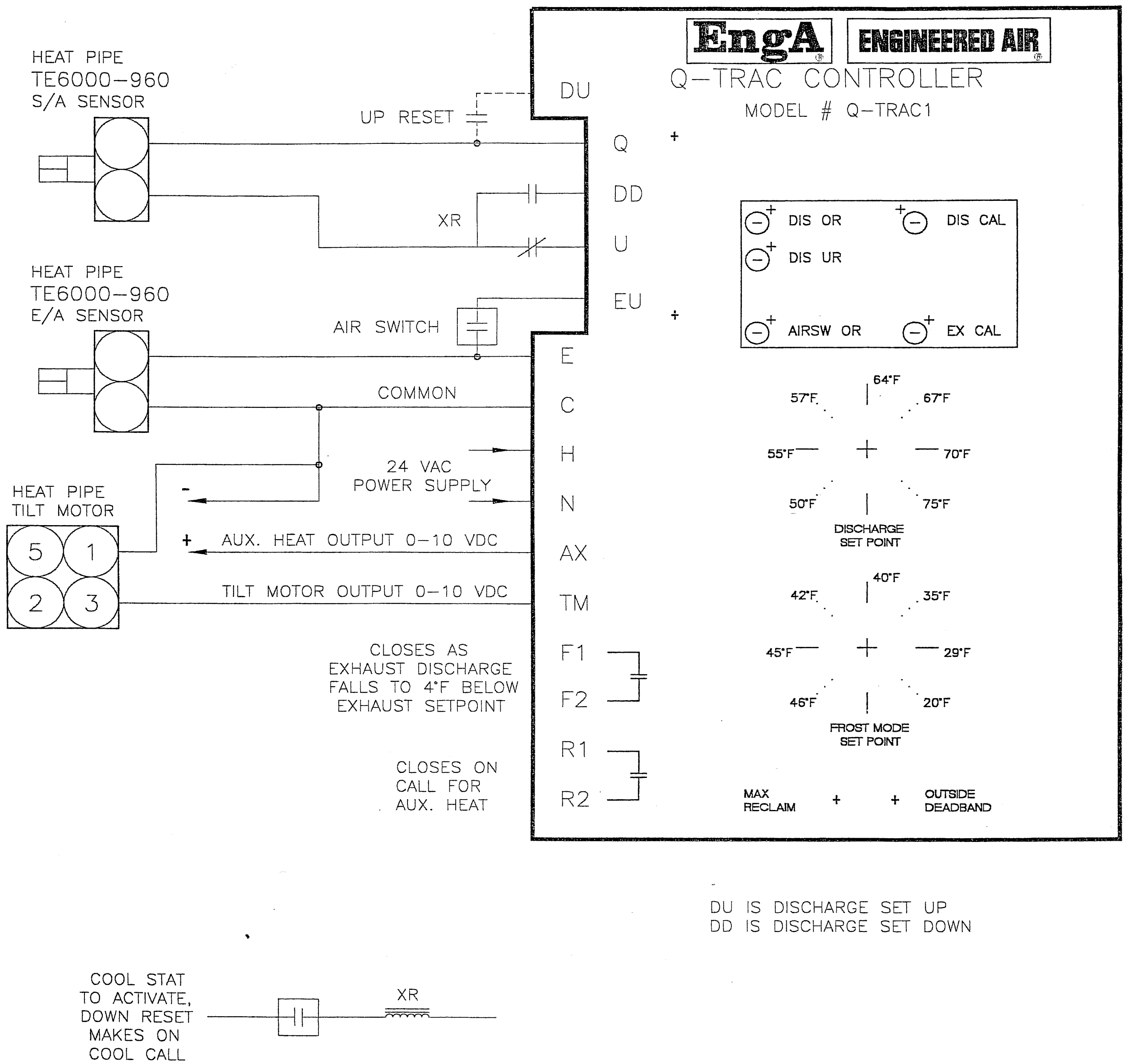
USA HEAD OFFICE AND FACTORY
32050 W. 83rd ST.
DESOTO, KANSAS
66018

CANADIAN EASTERN FACTORY
1175-TWINNEY DRIVE
NEWMARKET, ONTARIO
L3Y-5V7

SALES OFFICES ACROSS CANADA AND USA

RETAIN INSTRUCTIONS WITH UNIT AND MAINTAIN IN A LEGIBLE CONDITION
PLEASE GIVE MODEL NO. & SERIAL NO. WHEN CONTACTING
FACTORY FOR INFORMATION AND/OR PARTS

FORM #Q-TRAC March 1999



DU IS DISCHARGE SET UP
DD IS DISCHARGE SET DOWN

Q-TRAC

EngA ENGINEERED AIR	REVISIONS:	MAY 27/98		
	DATE:	DRN.BY:	CHKD.BY:	DRWG.NO.:
	DEC 11/96	ALW	WP	Q-TRAC-1

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QTRAC
HEAT PIPE CONTROLLER

If you note any errors or omissions in this document please contact Wade Pascoe at phone (403) 287-4775 or Fax (403) 287-4799 or (243-5059).

MOUNTING NOTE: All heat pipe applications must be mounted level, particularly those without the optional tilt package. The Q-TRAC is only applied to heat pipe units that have the optional tilt control package (which can be applied to heat and/or cool recovery. The Q-TRAC controls a standard 0-10 VDC motor that reacts in response to temperature. For dehumidification applications with dual pipes or wheel/pipe, the reheat pipe may be mounted with a fixed tilt. (If a heat pipe without a tilt package is mounted in a manner that has the cold air stream side of the coil tilted below the level of the warm air stream end, then the coil will not operate efficiently. Its efficiency depends on having liquid refrigerant in the end of the heat pipe that has the warm exhaust air flow over it.)

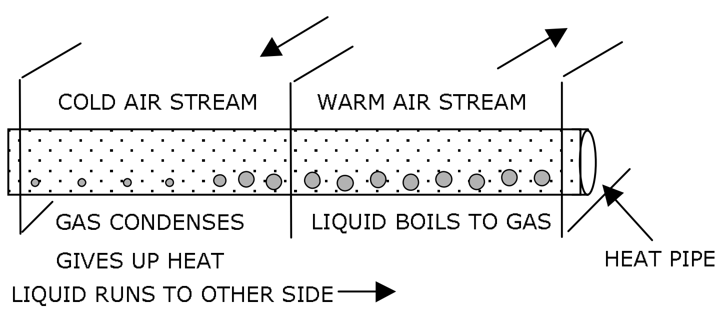
I. APPLICATION

In cold climates heat pipes are applied to recover heat from the building exhaust air. The exhaust air was heated through a costly energy consuming processes to maintain a comfortable space temperature. Much of this heat can be recovered from the exhaust air and transferred to the fresh air that is being brought in to ventilate the space.

The second common application of heat pipe is in hot weather where you exhaust cool air from a building that was cooled through an expensive mechanical means. As you exhaust this cool air from the building, warm outside air is brought in to replace it The heat pipe will pre-cool the incoming warm outside air which reduces the cost of mechanically cooling it.

A third situation that can result in an excellent source for heat recovery is when hot air is being exhausted from a manufacturing process.

II. WHAT IS A HEAT PIPE



The heat pipe is a device that transfers heat through a fluid media enclosed in a pipe without any mechanical work being performed (such as the use of a compressor or burning fuel). When one part of the heat pipe is located in a warmer air stream and the other part of the pipe is located in a cooler air stream, the heat pipe will transfer heat from the warm air stream to the cooler air stream.

The Engineered Air/QDT Heat Pipe is a sealed tube that is partially filled with a fluid and has excellent properties for heat transfer. The design temperature of the warm air stream will be the determining factor as to the choice of fluid that the tube is charged with. Engineered Air/QDT heat pipe also has certain internal mechanical enhancements which encourage improved heat transfer characteristics (*over that of other manufacturer's tubes).*

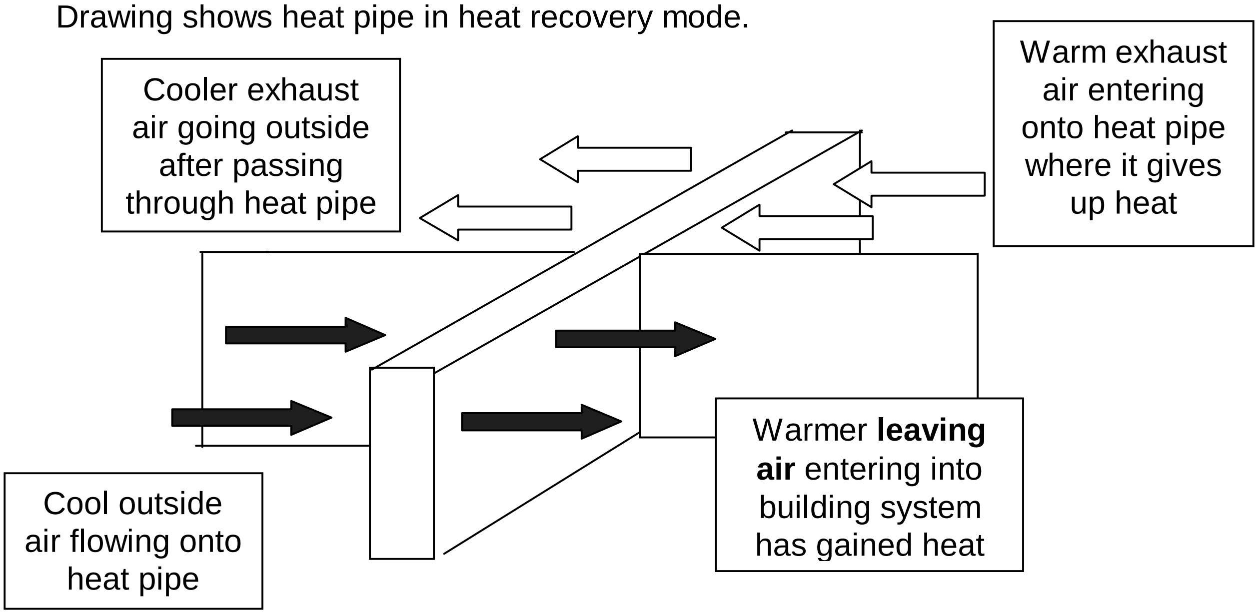
In a heat recovery mode, as the liquid in the portion of the tube located in the warm air stream absorbs heat from the air passing over the tube, the liquid evaporates. This warm gas now moves to the far end of the tube where it gives up its heat to the other (cooler) air stream. As the gas then cools and condenses to a liquid it moves to the warm end of the tube and the process repeats.

The heat pipe is actually a collection of a number of different individual tubes similar to the single tube shown in the diagram above. The tubes are mounted in a fin coil that looks similar to an air conditioning evaporator coil when viewed from the coil face. However, if you view the heat pipe coil from the end you will notice that none of the tubes are connected together as they are in a normal evaporator coil.

Tilting the coil down at the warm air stream end can also enhance heat pipe performance. This returns the liquid to the warm end quicker so it is less likely that there will be a lack of liquid for optimum performance.

III. GENERAL OPERATION OF THE TILT PACKAGE

Drawing shows heat pipe in heat recovery mode.



If the drawing was reducing the cooling load (such as in Texas in the summer), then cooler exhaust air would gain heat as it leaves, warmer outside air would lose heat.

1. One factor that affects the heat transfer of the heat pipe is the mounting angle or tilt from a level position. By controlling the tilt or mounting angle, the amount of heat transfer can be regulated. The QTRAC and its associated components are designed to regulate the leaving air (or discharge temperature) off the face of the coil and going into the building by controlling the heat pipes tilt angle. There is a **leaving air** temperature sensor located in the leaving air stream after the heat pipe. The leaving air temperature into the supply air plenum can be adjusted to a setting between 50 and 75ºF by a dial marked "**Discharge Set-Point**" located on the face of the QTRAC. An internal PI (Proportional plus Integral) control loop regulates the leaving air temperature to match the dial setting. The QTRAC is equipped with three LED lights. (Details in Section VI).

2. There is an optional provision to provide a discharge air temperature reset (up and/or down). To accomplish this, a single stage heat/cool room thermostat (on/off) must be installed in the space being served by the heat pipe and wired to the QTRAC. When the room thermostat calls for more or less heat, then the Q-TRAC terminals "DU (up) or DD (down) are powered. The leaving air "calculated set point" will be adjusted accordingly. The reset amount is selectable between 0 to 50ºF. Refer to section VIII for "DIS OR" and "DIS UR" potentiometer values.

3. In heat recovery applications, if the leaving **exhaust air** temperature becomes too cold, frost can form on the heat pipe fin. Frost will plug up the fins, reducing or stopping the exhaust air flow. To prevent this from happening, there is an exhaust air temperature sensor located after the heat pipe in the exhaust air stream. When this sensor senses exhaust air that is colder then the calculated frost mode setpoint, the QTRAC modifies its signal so the heat pipe tilt (mounting angle) is reduced. This reduces the heat transfer by reducing the coil tilt and moving much of the liquid in the warm exhaust end of the tubes to the cold fresh air entering end of the tube. There is now not enough liquid to encourage heat transfer. The result is less heat being removed from the exhaust air. This stops or reduces the formation of frost, but also results in less heat reclaim. The maximum amount of heat reclaim occurs just before frosting occurs on the exhaust side of the coil. Under cold conditions, the controller will regulate the position of the heat pipe to give the maximum amount of reclaim without allowing frosting. The exact exhaust air temperature setting where actual frost is formed is affected by the heat pipe configuration and exhaust air humidity. The exhaust air temperature setting for the unit to go into the modulated frost protection mode can be set between 20 to 45ºF with the "**Frost Mode Set Point**". The set point value is calculated by engineers and it is based on information supplied about the quantity of exhaust air humidity as well as other variables.

4. In order to use the lowest possible frost set point, (maximum reclaim), an **optional** air proving switch is often specified and installed to sense pressure drop across the heat pipe on the exhaust air stream side. An increase in pressure drop indicates frost formation, the air switch closes. This resets (adds to) the frost mode set-point calculated value. This higher set point defrosts by

reducing the tilt and reducing the efficiency. The amount of upwards reset is adjustable between 0 and 25ºF. See section VIII for the values to set the "AIRSW OR" pot. The optional air switch acts as a further backup safety control allowing the exhaust air temperature set-point to be set lower than normal and increasing the amount of reclaim allowed before entering the frost mode. The optional air switch acts as a further backup and safety control. This may allow the exhaust mode temperature set point to be set lower then normal in some instances thereby increasing the amount of reclaim allowed before the Q-TRAC reduces efficiency by reducing the tilt as it enters the frost mode.

5. When the frost mode is activated by the exhaust air temperature sensor, an auxiliary set of contacts (F1 and F2) closes. These contacts are intended to control an auxiliary defrost device such as bypass dampers, an extra heat source, a two speed motor, etc. This option is only used in special applications.

6. If the amount of reclaimed heat is not enough to satisfy the discharge air set-point, a set of contacts between terminals R1 and R2 close when the MAX RECLAIM light is on. These contacts can be used to enable/control an auxiliary heating device upstream (supply or exhaust side) of the heat pipe.

7. The QTRAC also has a modulating auxiliary 0-10 VDC output across terminals "AX and C". As the recovery of the heat pipe reaches its maximum limit, this 0-10 VDC auxiliary output voltage is gradually increased. This signal could be used to control a modulating heat source upstream of the heat pipe on either the supply or exhaust side. The frost protection mode still retains control over the heat pipe tilt angle. This ensures maximum reclaim without producing frost as well as maintaining the discharge air temperature on the supply side.

IV. HEAT PIPE EFFICIENCY

Heat recovery from a heat pipe will vary in each application depending on the temperature difference in the two air streams, the volume of air flow in each air stream, the fluid properties in the tube, the tubes mechanical properties to transfer heat, the tilt on the coil (if it has the tilt option), etc. A general rule would have the heat pipe recover about 60% of the BTUs from the exhaust air system.

NOTE: Heat recovery is measured in BTUs, not temperature in degrees.

NOTE: that if the optional tilt package is used, tilting the coil to place the liquid at the end where the cool air flow passes over the coil will turn off any heat recovery.

V. TECHNICAL INFORMATION

Power Supply

The QTRAC control requires a 24 VAC power supply (across QTRAC terminals H and N, 24 VAC, 5 va). The "N and C" terminals are internally tied to the controller's grounded metal case to reduce "noise" problems. This means the "common" or neutral DC voltage terminal "C" must not be connected to the DC common of the CTRAC, DJT, 109, DJM or GTRAC family of controllers.

General

The QTRAC controller has 3 PI control loops (discharge, frost, and auxiliary) that interact with each other in different methods under different circumstances to control both leaving supply air and leaving exhaust air temperature.

- Normal (non frost) operation, main control is the leaving supply air temperature loop, the other loops are in the background.
- Frost mode, the main control is by the leaving exhaust temperature loop with the other two loops in the background.
- When maximum reclaim has been reached , discharge control is by the auxiliary loop with the frost loop controlling the tilt angle.

Output to Tilt Operator

The output is capable of supplying a 0 to 10 VDC signal into a 350 ohm load (29 ma). The output is wired between terminals TM(+) and C.

Discharge Set Point (for Supply Air Leaving Temperature)

The Discharge Air Set-Point on the face of the QTRAC is adjustable from 50 to 75ºF. "Heating Deadband" is fixed at 6ºF (±3). Set-point calibration is done with the DIS CAL pot (counter clockwise (CCW) = +). The total calibration adjustment range is 25ºF (full turn). The Johnson Controls TE 6000-960 discharge sensor is a PTC silicon device, (note sensor resistance chart below). Wire the sensor to terminals Q and U.

Sensor Resistance Chart for TE 6000-960 Sensors

°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. (TE 6100-960 pot is 53C3, 500R, 7/8 by ¼ shaft.)

Discharge Air Set-Point Overrides

The Discharge Air Set-Point may be overridden either up or down. The reset occurs in a single step (not proportional). This reset will be activated by a single stage room thermostat or equivalent device. To activate the up reset, jumper terminal DU to Q. To activate the down reset, a relay switches the sensor wire normally connected to terminal U to terminal DD (This down reset option requires a relay). The amount of upward reset is set on trim pot "**DIS OR**". The amount of downward reset is set on trim pot "**DIS UR**". The trim pots have the following adjustment scale:

Full clockwise (CW) = 50ºF
Mid scale = 25ºF
Full CCW = 0ºF.

Frost Mode Set Point (for Exhaust Air Frost Prevention)

The centre LED "**EX COLD**" comes on when the exhaust discharge temperature falls below the Frost Mode Set-Point. When this light comes on, the authority of the exhaust sensor gradually increases. The calculated setting is done with an internal program. The Frost Mode Set-Point is selected using the face mounted pot marked **Frost Mode Set-Point** adjustable from 20 to 45ºF. The frost control deadband is fixed at 5ºF. The set-point calibration is done with trim pot "**EX CAL**" (CW = +). The total adjustment range on the calibration pot is 25ºF (full turn). The exhaust sensor is a Johnson Controls TE 6000-960. This sensor is a PTC silicon device, and has a resistance of 804 ohms at 20ºF and 881 ohms at 40ºF. The normal wiring method is to connect the sensor to terminals "E and C".

Frost Mode Air Switch

The Frost Mode Set-Point upwards reset is initiated by the air switch contacts closing. The amount is selectable by adjusting trim pot "AIRSW OR". Full CW = 25ºF, 25% turn back = 15ºF, 50% turn (center position) = 9ºF, 75 % turn back = 4ºF, full CCW = 0ºF. To activate the reset, connect the air switch between terminals "EU and E". Contact made = upwards reset mode. For proper defrost action, the recommended air switch setting will close the contacts as frost begins to form (usually when the leaving exhaust air temperatures (after the coil) are between 25º and 15º F. The temperature varies depending on the amount of humidity in the exhaust air.

Auxiliary Frost Control Contacts

A set of normally open contacts are connected between terminals F1 and F2. These contacts are rated at 5 amps and 120 VAC. At 4ºF below the Exhaust Air Set-Point the contact closes and will remain closed until the exhaust temperature is 1º above the exhaust set-point.

Auxiliary Heat Contacts

A set of normally open contacts are connected between terminals R1 and R2. These contacts are rated at 5 amps and 120 VAC. When the discharge air control loop demands 98% tilt angle, or the Frost Mode Control loop reaches 20% authority, the contacts will close. The contacts will remain closed until the discharge temperature demand has dropped to 80% or the frost mode authority has dropped to 10%. During morning start-up, if the exhaust or supply temperature is very cold, the contacts will close until the temperatures are close to the normal operating range. If this action is not required, an external morning start time delay relay must be added to disable the auxiliary heat.

Auxiliary Modulating Heat 0-10 VDC

This output is capable of supplying 0 to 10 VDC to a 350 ohm load (29 ma). The output is wired between terminals AX(+) and C. The auxiliary output PI loop uses an automatically varying set-point. Under normal operating conditions the auxiliary set-point is about 10 to 15 degrees lower than the dial setting. As the tilt position exceeds 60% or the frost mode starts to take control, the auxiliary set-point is gradually increased until it is 2 to 3ºF lower than the dial set-point. This setting occurs when the reclaim is no longer capable of satisfying the discharge set-point. The auxiliary heating deadband is 7ºF.

VI. LED INDICATOR LIGHTS

The QTRAC has 3 LED lights.

- The **Max Reclaim Light** on the left indicates that the unit is operating with the maximum allowable (frost mode or at maximum travel) tilt angle. Contacts “R1 and R2” are closed when this light is on.

- The **Outside Deadband Light** on the right indicates the discharge temperature is not within limits and the controller is working on correcting the temperature. The “Outside Deadband” light will be off if the QTRAC is satisfied. If it is not satisfied then the light will be on, indicating that the QTRAC is trying to adjust the coil tilt up or down to reach a satisfied condition.

- The **Ex Cold Light** (exhaust temperature too cold) located in the centre is on when the exhaust leaving air temperature is too cold and frost may begin to form. When this light comes on the frost mode will gradually take control of the tilt angle. The speed and magnitude of activation is based on how large the error is and how long the error has existed. (Also refer to Exhaust Air Frost Mode above.)

VII. POTS

There are a number of pots on the Q-TRAC.

- **Discharge Set Point** on the face of the Q-TRAC is used to set the supply air leaving temperature.
- **Frost Mode Set Point** on the face of the Q-trac is used to set the exhaust air leaving temperature. This must be set at a position to stop the coil building frost on

the exhaust air side. As the exhaust air cools passing through the coil its humidity increases. If that humidity settles in the coil it will restrict air flow, reduce capacity and may even damage the coil.

- **Dis Cal** is a trim pot to calibrate the supply air discharge temperature sensor.
- **Ex Cal** is a trim pot to calibrate the exhaust air discharge temperature sensor.
- **Dis OR** is a trim pot to set the value of over ride up when an optional room thermostat is used and it is calling for more heat.
- **Dis UR OR** is a trim pot to set the value of under ride down when an optional room thermostat is used and it is calling for less heat.
- **AIRSW OR** is a trim pot used to set the value of frost reduction when the optional air switch is used on the Q-TRAC. (If no value is given, start with a setting of about .75 inches water column for the air switch (if the unit is equipped with one)
- **P100** is the pot that is not marked on the faceplate. It is located between the DIS CAL and the EX CAL pots on the left row of pots. P100 has been factory set and should not be field adjusted. If you are not sure as to its correct position, set it to the center of its rotation.

NOTE: TILT MOTOR SPEED

The tilt coil has liquid in it and that liquid tends to move very quickly from one end of the tube to the other as the coil tips. For this reason the Q-TRAC has a PI control strategy. If you are trying to simulate some conditions you may only be able to obtain just over 6 vdc to the tilt motor. Additional voltage will build very slowly (up to an hour) if conditions are calling for it. This allows the tilt coil to regulate where the liquid is in the tube instead of rapid hunting of the tilt motor. Rapid coil movement would just slosh the liquid back and forth at level position.

NOTE: TILT MOTOR POSITION 0-10 VDC POWER OFF

With no voltage to the tilt motor there should be no reclaim being done in the heat reclaim mode. The exhaust side of the tilt coil should be high so the liquid has moved to the supply side of the tubes. As there is a call for reclaim, the tilt coil motor will be powered to tip the exhaust side of the coil down and force liquid to move to the exhaust end of the tubes.

FACTORY CALIBRATION

If the control was factory installed in the unit, it was calibrated there. Do not play with the pots in the field. Field calibration is not as accurate as factory calibration, especially when related to frost control. Pot P100 can only be factory set to any accuracy other then centered.

FIELD CALIBRATION (CAN NOT BE AS ACCURATE AS IN FACTORY)

If the control was factory installed in the unit, it was calibrated there. Do not play with the calibration pots in the field. If however you needed to purchase a Q-TRAC for a field replacement, some field calibration and setup will need to be done. Set the trim pots to about the center of their range. Note that depending on the Q-TRAC application, many of the trim pots may not be used. The “DIS CAL” and “EX CAL” pots will always be in use. The “DIS OR”, “DIS UR” and “AIRSV OR” should be set mid range if not in use. Pot P100 should be set to the center and left there.

DIS CAL

- Install a resistor of about 940 - 1000 ohm value across terminals “Q and U” in place of the discharge air sensor. Refer to the table in section V for values.
- Set the “DISCHARGE SET POINT” to a value that matches the above chosen resistor.
- Adjust the “DIS CAL” pot until the “Outside Deadband” light is off and the pot appears to be centered in dead band.

EX CAL

- Install a resistor of about 850 – 890 ohms across terminals “C and E” in place of the exhaust air sensor. Refer to the table in section V for values.
- Set the “FROST MODE SET POINT” to the value that matches the above chosen resistor.
- Adjust the “EX CAL” pot until the “Outside Deadband” light is off and the pot appears to be centered in the dead band

FROST AUTH Trim Pot

- This pot has been removed on all but the earliest Q-TRACS and replaced with a fixed resistor due to the need for the control to be slow to move the motor and consequently the very long time needed to set this up. If your control has this pot, contact the factory for instructions.

NEXT CALIBRATION STEP

- follow the steps in section VII, Factory Setup.

EXAMPLE OF OPERATION

To quickly simulate the Q-TRAC and prove it is operational, you need variable resistors to replace the temperature sensors so you can falsely simulate supply and exhaust temperatures. Following is a sample of what you may observe quickly without waiting for the integral loop of the PI control to do its thing. You will have to make up two simulators based on the resistance values found in the table in section V.

Turn the Q-TRAC power off.
Disable any resets (wires to terminals DU, DD, EU)
Set the Discharge Set Point set to 75
Set the Frost Mode Set Point set to 46
Wire Supply air sensor simulator across Q and U and set it low (such as 20-40 F.)
Wire the Exhaust air sensor simulator across E and C setting it to 45 F.
Turn the Q-TRAC power on.

- The tilt motor will quickly have about 6 + vdc onto it
- The Outside Deadband light will be on
- The Max Reclaim light will be on

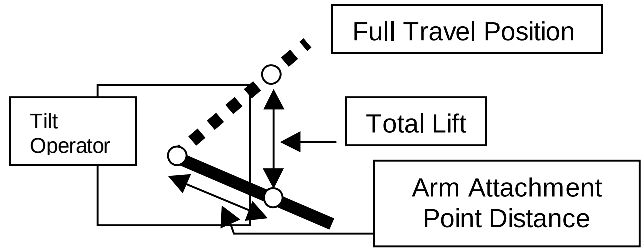
Adjust the supply air sensor simulator up to a temperature about 76 F

- The tilt motor voltage will fall
- The Max Reclaim light will go off
- If you are in the deadband range the Deadband light will stay off but it may come back on if you have passed over the deadband range.

Adjust the supply air sensor simulator down to a point that the tilt motor has about 4vdc to it. At this point if you turn the Exhaust air sensor simulator up to a higher temperature the tilt motor voltage may fall some and if you turn it to a lower temperature the tilt motor voltage may rise some depending on conditions.

VIII. QTRAC FACTORY SET UP

Sept 17/96



Tilt Motor

1. To calculate the required linkage set up for 90 degree stroke.
   Arm attachment point (inches) = Total lift inches x 0.7
   Example 5 inches: 5 x 0.7 = 3.5" Arm Attachment Point

Steps 2 and 3 for a 0-10 VDC Actuator (External Power)

2. With a signal generator, apply 4 VDC to the tilt motor. (10 volts = winter)
3. After the motor stops moving, connect the linkage such that the heat pipe is level.

Steps 2 and 3 for a 2-10 VDC Actuator (External Power)

2. With a signal generator, apply 5 VDC to the tilt motor. (10 volts = winter)
3. After the motor stops moving, connect the linkage such that the heat pipe is level.

Rest of steps for both motors

4. (POWER OFF) – On systems with an air switch across the exhaust side, set the trim pot AIRSW OR to the maximum setting (full CW or 25 degrees F.).
5. (POWER OFF) – Set the QTRAC frost set-point to 35. Set the discharge set-point to 65ºF.
6. (POWER OFF) – Remove the sensor wires (Q to U and E to C) and measure the sensor resistance. The sensor resistance at 70ºF = 1005 ohms. (Refer to the table in section V for other temperature values)
7. (POWER OFF) – Attach *sensor simulators* to the QTRAC. Set the *exhaust air temperature sensor simulator* (wired E to C) to 50ºF. Set the *discharge temperature sensor simulator* (wired to Q and U) to a low setting (ex 20 F).
8. Turn on the power, and the tilt motor should drive to the full tilt position (winter maximum heat recovery mode). This will be about 10 vdc if the proportional control will allow it. Depending on the time the power has been on to the Q-TRAC, you may only get a little over 6 vdc and the very slow integral may have control from there to the 10 v level (over hours). If the control has been off for awhile and is turned on with the above noted values, the motor will likely get near the 10 volts.
9. At this point, the Max Reclaim Light should be on, and the modulating auxiliary heat output (AX and C) should begin operating. It will raise quickly to 5 vdc and then rise slowly from 5 to 10 vdc (time dependant). If the auxiliary heating reset is being used, check that the auxiliary heat is in fact being reset.
10. Turn off the power and set the *simulators discharge temperature* to 65ºF. After 3 seconds while the motor is still moving on its spring return, turn the power back on, and the tilt motor should drive to the summer position (reverse tilt).
11. As the discharge setpoint and *the discharge temperature sensor simulator* are both at 65 F, the deadband light should be off. If the deadband light is not off, calibrate the discharge set-point using the "DIS CAL" pot on the Q-TRAC. (Light should be off between 62 and 68ºF).
12. Turn down the *discharge temperature sensor simulator* until the outside deadband light just comes on.
13. Slowly turn down the simulators *exhaust air temperature* (exhaust air frost sensor). When it reaches the Frost Mode Set Point, the centre light (EX COLD) should come on. If it does not then adjust the EX CAL pot to make the EX COLD light come on. Continue turning the *exhaust air temperature sensor simulator* (exhaust air frost sensor) down until the OUTSIDE DEADBAND light goes out.
14. Turn up the *exhaust air temperature sensor simulator* (exhaust air frost sensor) until the centre light (EX COLD) goes out and then set the *exhaust air simulator* 5 degrees F higher. If the optional air switch pressure is used, lower the setting until the air switch makes or place a jumper on it. At this

point, the centre light (EX COLD) should be on.

15. Set the air switch according to the set up sheet. Unless otherwise specified, set the "AIRSW OR" pot to 85% of full clockwise rotation.
16. If a volt meter is attached to the tilt motor terminals and the discharge temperature simulator has been adjusted to have about 4vdc on the tilt motor; and if the Q-TRAC has any optional overides wired to it then 1) if DU to Q is jumpered the voltage to the tilt motor increases (more reclaim). (The amount of reset adjusts on pot Dis OR.) 2) if the U terminal opens and DD closes the voltage to the tilt motor decreases (amount of reset adjusts on pot Dis UR) 3) if E to EU is jumpered the voltage to the tilt motor will decrease. The amount of reset adjusts on pot AIRSW OR.
17. Reconnect the sensors, and drive the heat pipe to near the level position. A quick way to get the QTRAC to position the actuator may be:

    - Place a jumper from terminal DU to Q. This is asking for more reclaim and should increase the voltage to the motor.
    - Briefly turn the power off then back on.
    - Adjust the discharge set-point until the voltage to the damper motor is as set in step 2. (TM to C)

    NOTE: This voltage will slowly climb and may have to be adjusted several times. Both the supply and exhaust air temperature sensors are affecting the amount of heat recovery by adjusting the voltage to the damper through the Q-TRAC logic.
18. Set the QTRAC set-points on the face of the Q-TRAC and any applicable trim pots (DIS OR, DIS UR and AIRSV OR) to the values indicated on the set up sheets.

Set Up is now complete.

IX. QTRAC 1.1 SET UP SHEET

JOB DESCRIPTION____

____

STANDARD INFORMATION

1. TOTAL TILT in inches (up + down) ______ Crank arm length _______
2. DISCHARGE AIR SET-POINT ______ºF *(Range = 50 to 80º)*
3. FROST MODE SET-POINT (base) ______ºF *(Range = 20 to 45º)*
4. ON FROST BUILD UP, RESET THE FROST SET-POINT UPWARDS BY _______ºF

AIR SW OR trim pot position	Pos 1 (CCW)	Pos 2	Pos 3	Pos 4	Pos 5 (CW)
Amount of upward reset ºF			9	15	25

Positions below Pos 3 not recommended, only use Pos 3 in mild climates.

5. AIR SWITCH PRESSURE SETTING _______"wc

OPTION INFORMATION

6. Discharge temperature single stage reset. (May select either, both, or none)
UP RESET (Number of ºF). ______
(Activated when terminals DU and Q jumpered.)

DIS OR trim pot position	Pos 1 (CCW)	Pos 2	Pos 3	Pos 4	Pos 5 (CW)
Amount of upward reset ºF	0	12	25	37	50

DOWN RESET (Number of ºF) _____
(Activated when discharge sensor connected across terminals Q and DD)

DIS UR trim pot position	Pos 1 (CCW)	Pos 2	Pos 3	Pos 4	Pos 5 (CW)
Amount of Downward reset ºF	0	12	25	37	50

7. Auxiliary heat set-point. _____ (RESET MODE) The QTRAC has a 0-10 VDC output from terminals AX (+) to C (-) which can be used to reset an auxiliary heating device. Ten (10) volts = more heat. In this case, the auxiliary heating control device must have its own sensor and set-point.

NOTE: The heat source must be upstream of the heat pipe (either side is okay).

8. Auxiliary heat control. (DIRECT CONTROL) The QTRAC can use the 0-10 VDC output from terminals AX (+) to C (-) to directly control a 0-10 volt operator. (Example hot water coil operator).

NOTE: The heat source is usually upstream of the supply air side heat pipe. If a QTRAC controlled heat source is on the exhaust side, use a 0-10VDC as the reset signal.

X. TROUBLESHOOTING

Supply Air Sensor Shorted or Open

Shorted Supply Air sensor, maximum volts to tilt motor
Open Supply Air sensor, minimum volts to tilt motor

Exhaust Air Sensor Shorted or Open

Shorted Exhaust Air sensor, minimum volts to tilt motor
Open Exhaust Air sensor, minimum volts to tilt motor

No Tilt Motor Attached, Voltage at TM

With no tilt motor attached and a call for full power to the tilt motor, the voltage can be in the general area of 13.6 VDC

Control Ceases to Function, Lights Dim

The QTRAC contains a self resetting fuse. When the above problem occurs, turn the power off to the QTRAC for a few minutes to allow the fuse to cool and reset. When the power is turned back on the control will again begin to function correctly when the fuse resets. If it does not reset, the control will need to be removed and repaired.

Supply Air Temperature too cold

- If the supply air sensor is open circuited or its resistance is too high the tilt motor will have little or no dc volts to it. The tilt coil will be in the “off” position or tilted so the supply air end is low.
- If the exhaust sensor is open circuited or its resistance is too high the tilt motor will have little or no dc volts to it. The tilt coil will be in the “off” position or tilted so the supply air end is low.
- If the exhaust sensor is short circuited or its resistance is too low the tilt motor will have little or no dc volts to it. The tilt coil will be in the “off” position or tilted so the supply air end is low.

Supply Air Temperature too hot

If the supply air sensor is shorted or the resistance is too low the tilt motor will have close to maximum dc voltage to it. The tilt motor will be tipped so the exhaust end is low and heat recovery will be at a maximum

No Exhaust Air Flow

As noted above, if the supply air sensor is shorted or its resistance is too low (or if it is not calibrated correctly) there will be an attempt for maximum heat recovery that may frost the exhaust air coil.

Heat Recovery Does Not Appear To Function

Before suspecting the controller, check the linkage to ensure that it is connected and functional. Next ensure the tilt motor responds to a signal. If necessary, disconnect the 0-10 volt signal and temporarily wire in a 9 volt battery to test the motor. Note the motor will still need its 24 volt power supply.