READ AND SAVE THESE INSTRUCTIONS

VAPOR-LOGIC®

MICROPROCESSOR HUMIDIFIER CONTROL SYSTEM

INSTALLATION INSTRUCTIONS & MAINTENANCE OPERATIONS MANUAL

Engineering Humidification For 30th ANNIVERSARY 1965 to 1995 A Better Environment

DRI-STEEM® HUMIDIFIER COMPANY

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TO THE PURCHASER AND THE INSTALLER

Thank you for deciding to purchase the VAPOR-LOGIC® microprocessor humidifier control system. We have applied our best efforts in designing and developing this microprocessor to give you total satisfaction and many years of trouble-free service. Avoiding certain pitfalls during installation and observing proper operating practices thereafter will assure you of achieving that objective. We therefore respectfully urge you to familiarize yourself with the contents of this manual.

DRI-STEEM Humidifier Company

INTRODUCTION

This manual explains the operation of, and gives instructions for, the installation and use of the VAPOR-LOGIC® microprocessor.

VAPOR-LOGIC is a custom microprocessor humidifier control system developed to be compatible with DRI-STEEM electric humidifiers. The versatile microprocessor software is configured to meet the needs of a multitude of humidifier applications. The advanced technology of VAPOR-LOGIC is paired with simplified operating procedures that make the microprocessor easy to use.

VAPOR-LOGIC features include a self-diagnostics test during initialization, end of season auto-drain, and a full-function digital display key pad which allows you to monitor and adjust humidifier performance parameters as necessary. VAPOR-LOGIC also offers a variety of control modes:

- On-off operating mode controls single or multiple electric staged outputs and multiple zone valve humidification applications.
  Expected accuracies: ±5-7% RH

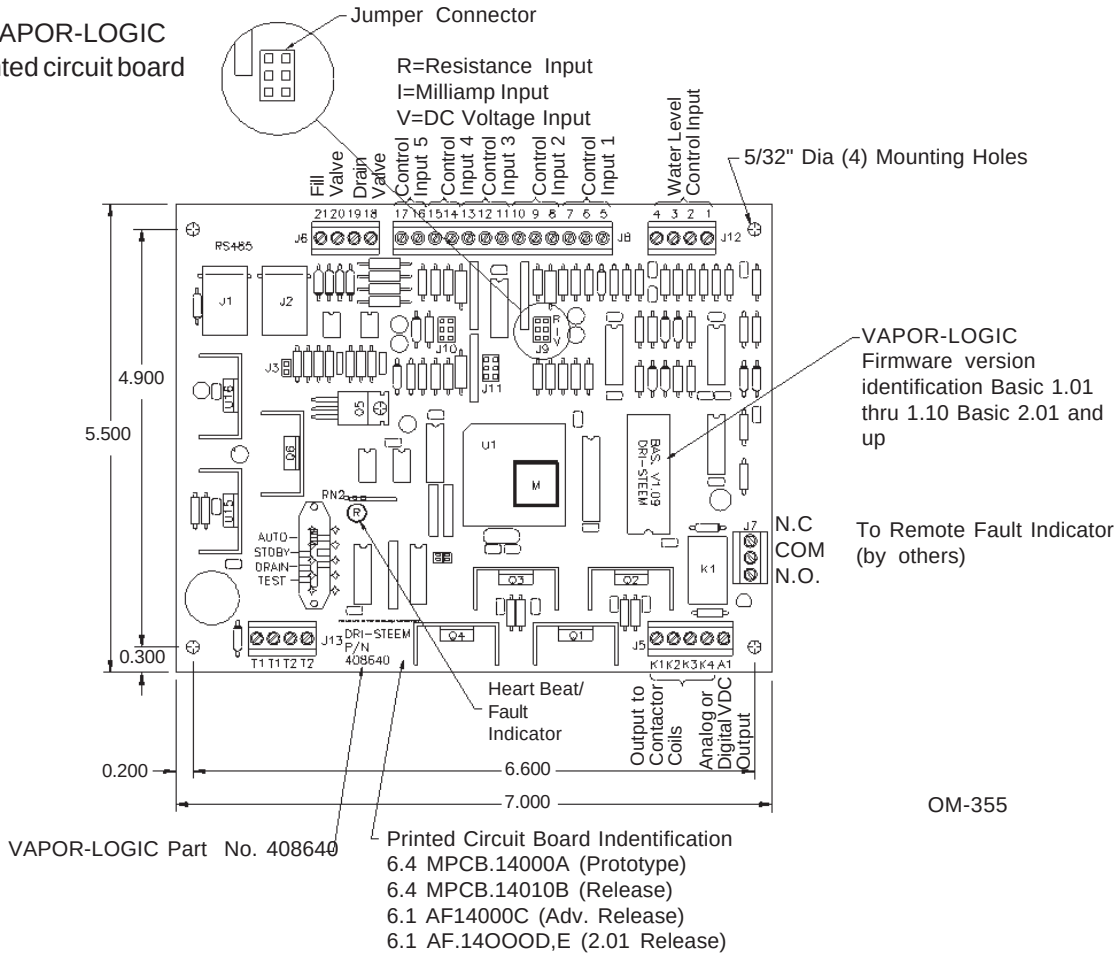
- Time proportioning modulation function controls humidifier outputs via cyclic actions on electrical contactors or a modulated pulsed signal to our solid state zero fired SCR power controllers.
  Expected accuracies:
  - ContactorAction: ±2-4%RH
  - SCRAction: ±1-3%RH

- Proportional Action controls modulating steam or hot water valves by providing a linear analog D.C. signal voltage to the valve motors. (For STS or LTS humidifiers.)
  Expected Accuracies: ±2-5% RH

- VAPOR-LOGIC controls with a P.I.D. (proportional, integral, derivative) function.
  Expected accuracies: ±1-3% RH

VAPOR-LOGIC controls humidifier systems with capacities up to 1140 pounds per hour.

Figure 3-1: VAPOR-LOGIC printed circuit board



VAPOR-LOGIC® CONTROL BOARD INSTALLATION

The VAPOR-LOGIC control board is shipped mounted with all internal wiring completed within a control cabinet. All software has been custom programmed into your VAPOR-LOGIC system according to the original order requirements. Refer to the VAPOR-LOGIC control board drawing for detail of the board and connection points. (See Figure 3-1 on page 3.)

The VAPOR-LOGIC control board should always be wired following local and national electric codes.
VAPOR-LOGIC is powered by a low voltage class #2 control transformer. The transformer provides a 24 VAC supply, protected by an integrally mounted manual reset circuit breaker.

All humidifier power wiring is represented on the humidifier wiring diagram.* Follow field wire torque requirements shown on the humidifier wiring diagram when connecting the power and control wiring inside the humidifier control cabinet. Additional precautions about VAPOR-LOGIC control board connections:

- Use 1/8" straight blade or number zero Phillips head screwdriver on VAPOR-LOGIC control board terminal blocks.
- DRI-STEEM recommends single #18 gauge pre-tinned wire end. Torque to 5 inch pounds.
- When terminating multiple wires to VAPOR-LOGIC control board terminal blocks, DRI-STEEM recommends securing the multiple wires and one additional wire with appropriately sized wire nut. Use the single additional wire's opposite end to connect to the VAPOR-LOGIC terminal block.
- Never run control system wires bundled with, or in the same conduit as, power wires.
- Pick a location that will allow for easy access to control cabinet and internal electrical components. Mount control cabinet using the mounting tabs.
- Install the control cabinet less than 30 feet from the humidifier.

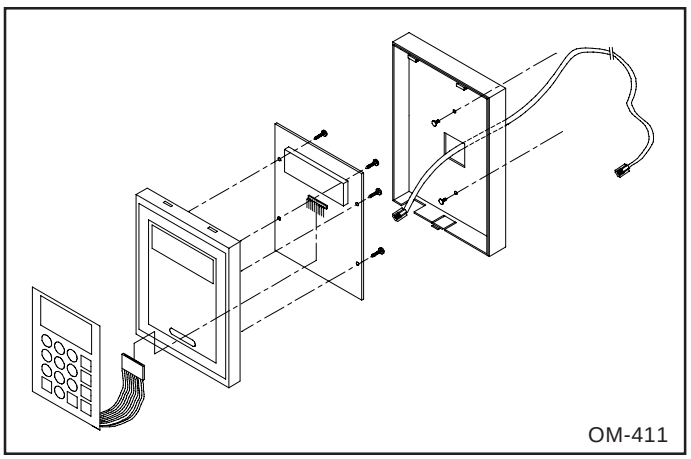
***A wiring diagram and information guide is attached to the inside of control cabinet door. All instructions should remain with the control cabinet after installation.**

VAPOR-LOGIC KEY PAD / DIGITAL DISPLAY INSTALLATION

When the local and/or remote digital display key pads are provided with the VAPOR-LOGIC system, mounting and wiring the modules have been simplified for you. **Do not locate the module inside the control cabinet.** The hardware is pre-mounted in a thermoplastic case with front access to digital display and key pad. DRI-STEEM also provides 26 gauge 4-wire pre-connected modular cables with male modular plugs attached. The modular plugs are 6-position 4-wire type RJ11 arrangement. Position case in a convenient location for easy access. **The ambient temperature range for modules is 32°-122°F. Exceeding these limits will result in a poor reading, or no reading at all.**

The digital display key pad case is fabricated in two sections; light pressure at the base of the back of the case will separate the two sections. The front half includes the electronic display module control board and key pad, which are secured by four screws. DRI-STEEM recommends the back section of enclosure be secured to a standard flush mounted single gang electrical switch box with modular cable routed out the rear of the case. (See Figure 4-1.) A second choice is a direct mount to any surface using field supplied screws. Route modular cable out the bottom of enclosure. Because of various mounting possibilities, first provide necessary clearance holes for the hardware you are using by opening the two pilot mounting holes on back of enclosure. Mount back of enclosure to flat surface and secure as necessary. **Caution: Overtightening will distort the back of the case.**

Figure 4-1: Exploded view of key pad/digital display



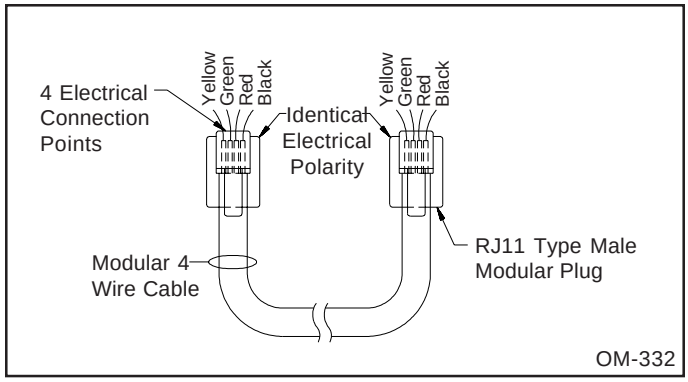
VAPOR-LOGIC® KEY PAD / DIGITAL DISPLAY INSTALLATION

Align the front section over the two top finger hooks on the back section, rotate down, and snap front section onto the back section. Route modular cable as needed to control cabinet and drill necessary hole for appropriate cable strain relief fitting. **Note: Do not wrap cable around the key pad.** When routing modular cable within control cabinet, route cable away from all power wiring and connect the male modular plug into either VAPOR-LOGIC printed circuit board-mounted female modular receptacles, J1 or J2. Push male plug in until you hear a "click." The 4-wire cable provides the D.C. power to digital module and completes the RS485 type digital communication between the local and/or remote modules and the VAPOR-LOGIC control board.

Caution: When fabricating longer modular cables, electrical polarity is very important in securing the type RJ11 male plugs to cable. Both ends of cable polarity connections must be identical. (See Figure 5-1.)

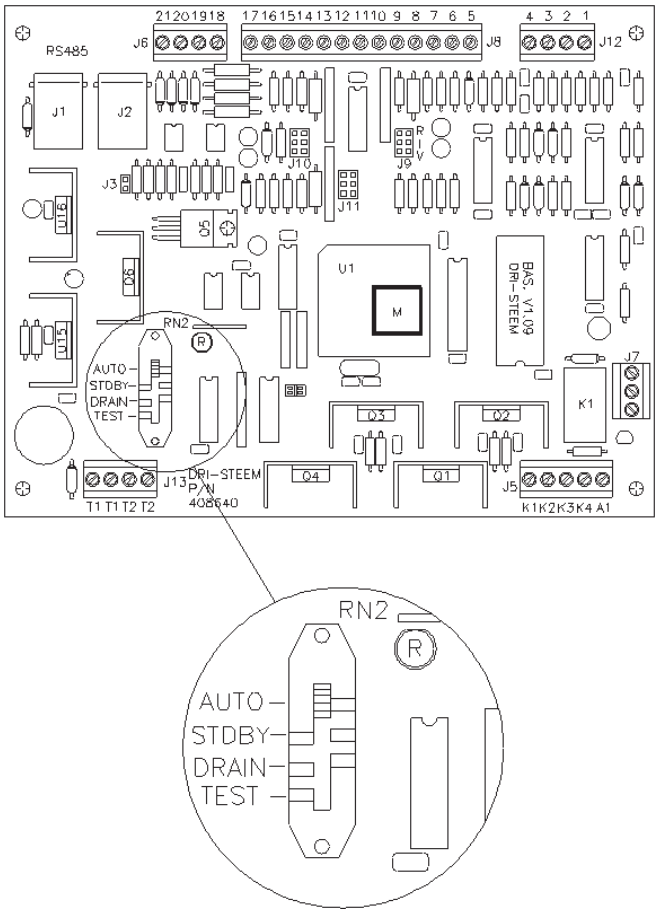
Important: To properly identify the second remote key pad to the master VAPOR-LOGIC microprocessor, a shunt connection is provided and installed by DRI-STEEM across connector pin J6. Refer to the digital module printed circuit board on page 8 to confirm location and

Figure 5-1: Cable polarity connections



VAPOR-LOGIC CONTROL BOARD OPERATION

Figure 5-2: Four position slide switch placement



AUTO When the slide switch is in "AUTO" position, the humidifier is in full operation, maintaining the water level and capable of generating steam upon a call for humidity.

STDBY When the slide switch moves to the "STDBY" (stand-by) position, it interrupts the control system and turns the humidifier off. "STDBY" is used for regular humidifier inspection.

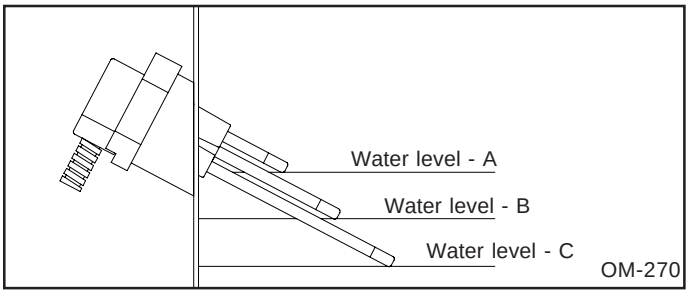
DRAIN When the slide switch moves to the "DRAIN" position, it deactivates the heating elements and the fill valve. The electric drain valve is then activated, and the water drains from the evaporating chamber. The drain valve also has a manual drain lever. If the humidifier needs to be drained during an electrical power outage, this function can be used. (A "DI" model humidifier will have a "DRAIN" mode only with special option End of Season Drain.)

TEST When the slide switch moves to the "TEST" position, it activates the test cycle. All electrical devices that are on when the test cycle is initiated are deactivated. During this cycle the fill valve and all electrical contactors will be cycled on-off individually. The drain valve will then be held open for 30 seconds. At the completion of the test cycle, VAPOR-LOGIC will revert to stand-by mode. (The "TEST" mode is not functional on Slave Boards.)

Auto Drain Sequence
VAPOR-LOGIC is pre-programmed to enter an automatic drain, flush, and refill cycle based upon the actual time the humidifier has produced steam. VAPOR-LOGIC is factory-set for a 50 hour (accumulated "ON" time) drain interval, with 8 minute drain and 8 minute flush durations. When VAPOR-LOGIC initiates the auto drain sequence, all energized heaters are turned off. The drain valve is then opened to allow the tank to drain. The drain valve remains open during the flush sequence for drainage while the fill valve is open. At the completion of the flush cycle, the drain valve closes, allowing the fill valve to refill the tank. The VAPOR-LOGIC timers are then reset and the humidifier returns to normal "AUTO" operation.

End of Season Drain
If there is not a call for humidity over a 72 hour period, VAPOR-LOGIC automatically drains the evaporating chamber. The drain valve is held open for one hour. The humidifier then switches into "STDBY" mode until there is a call for humidity, at which time VAPOR-LOGIC automatically resumes normal operation.

Figure 6-1: Conductivity probe system



Probe System
A conductivity probe system allows VAPOR-LOGIC to control water levels for optimum operating efficiency. The three-probe system is monitored by the VAPOR-LOGIC control, which performs all the necessary logic and timing functions to provide total water level control and safety shutdown.

VAPOR-LOGIC automatically maintains the water level between the upper two probes A and B. When the water level falls below probe B, the fill valve is opened until the water level reaches the upper probe A. A minimum two second delay is incorporated in the skim time software to ensure that turbulence does not cause an incomplete fill. An adjustable skim time allows for an extended skim period (2-60 seconds) to reduce surface mineral accumulation. The fill valve remains energized for the designated delay time. Access this adjustment through the key pad sub-menu. (See page 10.) Probe C provides low water protection for the heating elements. If the water level falls below probe C, the heaters are de-energized. (See Figure 6-1.)

In addition to controlling the water level, VAPOR-LOGIC determines when the heaters are turned on. If there is a call for humidification, even during the fill cycle, the heating elements will stay on to provide continuous output.

On-Board Fault Indicator Light
The indicator light has dual functions. One function is to present a continuous heartbeat (cycling on-off), indicating a normal operation control by the VAPOR-LOGIC microprocessor. The second function is the detection of a FAULT condition, indicated by the change from the normal heartbeat to an on-off cycle of long and short pulses. The different pulse patterns indicate the type of fault detected. The chart of fault code descriptions can be found in the Trouble-shooting Guide on pages 24-27.

To have an indication of a humidifier fault at a remote location, VAPOR-LOGIC has a pre-wired fault relay (SPDT contact arrangement) wired to control terminal block J7. This will allow for field connection of a low voltage (24 VAC, 1 amp max.) circuit for remote indication that a fault condition exists. The remote fault indication does not indicate which fault has occurred, only that VAPOR-LOGIC has detected a fault. You must return to the humidifier VAPOR-LOGIC control board to read the on-board fault indicator light code in order to determine what type of fault was detected.

Control Board Connections (See Figure 7-1.)

J1, J2 Two parallel wired type RJ11 (6 position, 4 wire) female modular jack connections for supply voltage and VAPOR-LOGIC communication to optional digital key pad. When multiple humidifier systems are combined using RS485 communication format, J1 and J2 also provide communication to additional VAPOR-LOGIC control slave boards.

J3 End of line communication terminator pins require a jumper connector across J3 pins when VAPOR-LOGIC supports a "Remote" digital key pad.

J5 Wire terminal connection supplies output signal to electric contactor coils and/or modulating SCR control.

- Terminal K1: 24 VAC signal to heater number 1 contactor
- Terminal K2: 24 VAC signal to heater number 2 contactor
- Terminal K3: 24 VAC signal to heater number 3 contactor
- Terminal K4: 24 VAC signal to heater number 4 contactor
- Terminal A1: A time proportioned positive polarity 0-SVDC signal to the input of a slave SCR power controller, 0-15 VDC to the input steam or hot water valve. The negative polarity from SCR is connected to terminal #4 of wire connector J12.

J6 Wire terminal connector supplies 24 VAC voltage to fill (20) and drain (18) valves with terminals 19 (drain) and 21 (fill) as neutral returns.

J7 Wire terminal connection allows for remote fault indication.

J8 Wire terminal connector receives the necessary input signal from external device:

a. Humidity Control uses Control Input 1.
- Terminal 5: Positive polarity 21 VDC supply max. 25 mA
- Terminal 6: Positive polarity of control signal
- Terminal 7: Negative polarity of control signal

Input selector pin J9 configures Input 1.

b. Optional high limit humidity control uses Control Input 2.
- Terminal 8: Positive polarity 21 VDC supply max. 25 mA
- Terminal 9: Positive polarity of control signal
- Terminal 10: Negative polarity of control signal

Input selector pin J10 configures Input 2.

c. Optional temperature compensation sensor uses Control Input 3.
- Terminal 11: Positive polarity 21 VDC supply max. 25 mA
- Terminal 12: Positive polarity of control signal
- Terminal 13: Negative polarity of control signal

Input selector pin J13 configures Input 3.

d. Air flow proving switch uses optically isolated Control Input 4. Terminal 14 supplies 24 VAC to proving switch circuit, SPST, normally closed. Terminal 15 is return connection from proving switch into VAPOR-LOGIC control.

e. Optional freeze protection aquastat uses optically isolated Control Input 5. Terminal 16 supplies 24 VAC to aquastat, SPST, normally closed. Adjustable temperature range 40°-180°F, but 40°F setting preferred. Terminal 17 is return connection from aquastat into VAPOR-LOGIC control.

J9 Selection pins control the configuration of the type of input control into Control Input 1 (Terminals 5 through 7) of wire terminal connector J4.

a. R = Resistance 0-135 ohms range
- used with on-off humidistats, staging switches, PE switches
- used with analog 0-135 ohm input device (pneumatic transducer or humidistat)

b. I = Milliamp 4-20 mA range
- used with any humidity sensor with output 4-20 mA
- used with any computer or energy management system with 4-20 mA output
- internal resistance 250 ohms, terminal #6 positive VDC input, terminal #7 negative VDC input

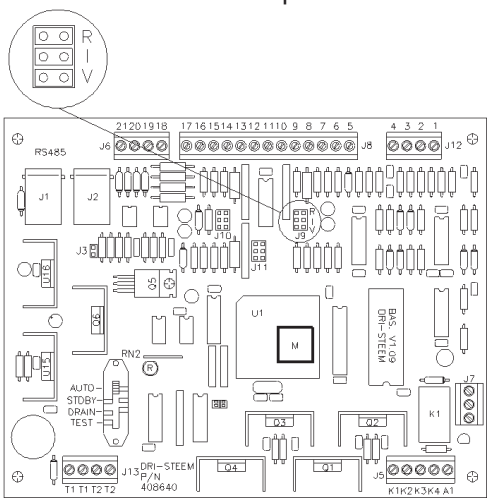
c. V = Volts D.C. 1-15 volt range (6-9 VDC control span)
- used with any control humidistat 0-15 VDC
- Terminal #5 provides positive 21 VDC supply, terminal #6 positive VDC input, terminal #7 negative VDC input

J10 Identical to J9 input selector pins except configures Control Input 2 (Terminals 8 through 10) of wire terminal connector J4. Typically used for high limit humidistat.

Important: All connection diagrams show connector shunts on J9 and J10. The connector shunts and appropriate computer software have been selected by DRI-STEEM based on original customer orders. **Field changing the input connector shunts will require computer software modification.**

J11 Identical to J9 input selector pins except configures Control Input 3 (Terminals 11 through 13) of wire terminal connector J4. Typically used for on-off staging or 4-20 mA input for optional temperature compensation.

Figure 7-1: VAPOR-LOGIC printed circuit board



VAPOR-LOGIC® CONTROL BOARD OPERATION

J12 Connector receives necessary continuity input signals from water detection devices.

a. Probe system water level detection
- Terminal 1 detects maximum water level from top probe rod and brown wire plug.
- Terminal 2 detects water level at refill point from middle probe rod and orange wire plug.
- Terminal 3 detects water level at its lowest point from lower probe rod and purple plug wire.
- Terminal 4 is the common return path for all water detection rods from the humidifier tank ground (yellow pigtail wire in humidifier junction box) back to VAPOR-LOGIC control.

b. DI system detection
- Terminals 1 & 2 are not used.
- Terminal 3 is connected to the humidifier tank low water float switch (normally open).
- Terminal 4 is the return signal from float switch to VAPOR-LOGIC control.

J13 Wire terminal connector supplies 24 VAC to power the VAPOR-LOGIC control board.
- Double terminal T1 - 24 VAC +, 7 VA maximum load.
- Double terminal T2 - 24 VAC-comm.

The key pad/digital display completes the advanced VAPOR-LOGIC system. The key pad with the digital LCD read-out provides descriptions of any faults detected by VAPOR-LOGIC, continuous scrolling of all functions and conditions, and access to VAPOR-LOGIC main and sub-menus in order to change operating parameters.

VAPOR-LOGIC KEY PAD / DIGITAL DISPLAY OPERATION

The standard key pad/digital display is identified as the "Local" module by the VAPOR-LOGIC microprocessor. **Important: When a second key pad is supplied, VAPOR-LOGIC must identify it as "Remote."** DRI-STEEM does this by attaching a connector shunt across pin J6 on the digital display printed circuit board. (See Figure 8-1 for location.)

CAUTION: Do not connect or disconnect modular cable on key pad/digital display from VAPOR-LOGIC control board while power is applied. A communication failure would most likely take place.

Digital Display Printed Circuit Board Connections
(See Figure 8-1.)

J1, J2 Same as VAPOR-LOGIC control board. (See page 6.)

J4 A plastic connector shunt placed over J4 pins will terminate the end of line communication.

J5 A plastic connector shunt or jumper placed over J5 pins will allow you to test each function of the key pad keys.

J6 A plastic connector shunt placed over J6 pins will identify the key pad/digital display as the second, or remote operating device, to the VAPOR-LOGIC microprocessor.

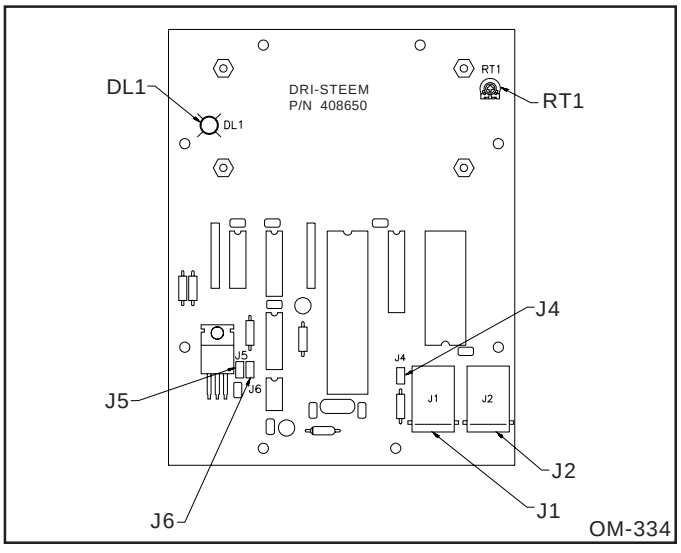
RT1 You may adjust the visual vertical angle at which the display reads using this control. Turning in a clockwise direction will direct the angle of view above center. (Later model incorporates fixed resistors on wide angle displays.)

DL1 The indicator light will blink on and off at a constant heartbeat rate to indicate that all system controls are operating properly.

Key Pad Key Descriptions
(See Figure 9-1.)

0-9 The number keys allow you to enter new data into a VAPOR-LOGIC sub-menu.

Figure 8-1: Digital display printed circuit board connections



CLR The "clear" function will clear any new data presented to VAPOR-LOGIC sub-menu. Pressing this key will also return you to the VAPOR-LOGIC main menu from the sub-menu. Pressing "CLR" a second time will place you into "AUTO" mode.

ENT The "enter" function will display the information held in VAPOR-LOGIC sub-menu memory and will also enter new data into the sub-menu memory.

TEST (Located in the same position as , the test key was used on VAPOR-LOGIC firmware V1.01 through V1.10.) The "test" function will initiate a self-test cycle on the humidifier. The test mode will perform an on-off cycle of fill and drain valves and all electrical contactors. (When multiple humidifiers are incorporated, each humidifier's fill and drain valves and contactors are cycled on-off, one humidifier at a time.) No other functions are accessible during a "test" cycle. If the humidifier is in operation at the time the "test" function is initiated, all humidifier electrical devices are turned off before the cycle begins.

Figure 9-1: Key pad

OM-335

ARROWS The "up" and "down" arrows will allow you to scroll through the VAPOR-LOGIC main menu one step at a time.

MODE The "mode" function transfers VAPOR-LOGIC from the automatic scrolling mode into the Main Menu format. You may then scroll through the main menu using the arrow keys to find the item of interest. After selecting the item, press the "ENT" key. VAPOR-LOGIC will take you into the sub-menu and display the present data held in memory for that item. To change the data in memory, enter the new information using the 0-9 keys. After new information is keyed in, press the "ENT" key to have VAPOR-LOGIC read the new information and store in the microprocessor memory. Press "mode" to return to the automatic scrolling mode.

✳ (On key pad/digital displays with firmware V2.01 and higher.) The "✳" function will transfer one of the automatic scrolling items on the lower line to the upper line for review. The item selected will be updated every few seconds if a change is detected by VAPOR-LOGIC and will remain isolated on the upper line while the remaining functions will continue scrolling on the lower line. Typical items that may be selected from Auto Scroll for review are: Actual RH, Actual High Limit RH, Glass Temperature, System Demand, and System Output.

Sensor Trim Calibration
VAPOR-LOGIC can compensate for differences in sensing device accuracies caused by sensor placement, environment, aging, etc. By accessing the VAPOR-LOGIC submenu (press "MODE" key) and scrolling to the appropriate sensor trim menu (using arrow keys), pressing the "ENT" key will allow you to input a two-digit trim factor to the sensor input. (Note:As long as the adjusted value does not exceed the range limits for each sensor, the trim value will allow you to compensate for small variances in the readings.)

Example: The desired room RH is 50%, the display shows 48% RH, and the actual value is 51%.

1. Access the trim % RH sub-menu as directed above.
2. Key in the RH value: 51
3. Press "ENT." VAPOR-LOGIC will then enter the value into memory.
4. Press "CLR" twice to complete the adjustment.

Note: To disable any trim value, enter "00" into the submenu. This will return you to the value being read.

VAPOR-LOGIC® KEY PAD/DIGITAL DISPLAY OPERATION

Key Pad/Digital Display Function Keys Test
To perform the operation test on the function keys:

1. Turn power off.

2. To access the printed circuit board, remove the front section of the key pad. (Apply pressure at the bottom of the key pad.)

3. Remove the connector shunt from the single pin of J5 and reposition it across the pair of J5 pins.

4. Restore power.

5. The display will read: "DISPLAY DIAG. TEST," while alternately flashing "ADJUST CONTRAST" and "SHORT J6 TO CONT."

6. Place the second connector shunt across J6 pins. This will initiate the self-test of key pad function keys.

7. The first prompt, "DISPLAY DIAG.TEST," and "PRESS <1>" will appear. Press key number "1." If key number "1" operates satisfactorily, the key pad will bring up the next prompt: "PRESS <2>." This process will continue, from left to right, top row to the bottom row, until all the keys have been tested.

8. At the completion of the test, remove connector shunt J5 and reposition to a single pin of J5. IMPORTANT: If the key pad was identified as a "Local" display, remove connector shunt from the pair of J6 pins and reposition to a single pin of J6.

9. Re-connect front section of the key pad to the back section.

10. Press the "RESET" button on the sub-panel inside the control cabinet and hold for a few seconds to restart VAPOR-LOGIC.

Accessing VAPOR-LOGIC Sub-Menu Information
To access any sub-menu from the main menu, press "MODE" and then use the up and down arrow keys to scroll through until the menu item you want is shown. Press "ENT." As an example, this is how you would access the first sub-menu item and change the parameters:

1. Press "MODE." "Set % RH" will be displayed.

2. To view present set point, press "ENT" and VAPOR-LOGIC will bring up the current information:

   1. Set % RH
   __: 35% RH

3. You may now either return to the Main Menu (press "CLR") or enter a different set point. To enter a new set point, press the numerical keys that correspond. For instance, if you want to enter a set point of 50%, press "5" followed by "0." The display will read:

   1. Set % RH
   50: 35% RH

4. Press "ENT" to instruct VAPOR-LOGIC to replace the old set point with the new information you just entered. The key pad should now display :

   1. Set % RH
   __: 50% RH

   Note: If you exceed the range limits of any sub-menu (see chart on pages 20-21), VAPOR-LOGIC will prompt: "Out of Range." Press "CLR" to return to Item 1 of the Main Menu and start over.

5. Scrolling up and down (using the arrow keys) will allow you to choose another sub-menu. Press "CLR" again to return VAPOR-LOGIC to "AUTO" mode. (Press "MODE" at any time while in the Main Menu or Sub-Menu items to return to "AUTO" mode.)

SENSING DEVICE PLACEMENT AND WIRING

Sensing Placement
The location of the humidity sensing devices is very important to achieve accurate humidity control. A drawing of a typical small air handling system is shown below (Figure 12-1). For the best control, place the humidity sensing device in the center of room, just inside of the return air duct (location "A"). This will provide the least amount of variation caused by air flow patterns and room temperature. Placement of the duct humidity sensing device within outlet of air handler (location "D") is ideal for duct high limit control, but the actual placement must be downstream from dispersion tubes a sufficient distance to ensure steam absorption has taken place. Accurate control of temperatures in room and ducts is also very important to improve control of relative humidity.

Control Precautions
Unsatisfactory results from humidifying control may involve more than just the controller's capability to control the system. Other factors that play an important role in overall system control are:

- Size of the humidification system.
- Overall system dynamics associated with moisture migration time lags.
- Accuracy of humidistats and humidity transmitters and their location.
- Dry bulb temperature accuracy in space or duct.
- Velocities and air flow patterns in ducts and space environments.
- Electrical noise or interference.

Wiring On-Off Humidistats
DRI-STEEM may provide three types of on-off controls: wall mounted, duct mounted, and pneumatic/electric relay. The wiring diagram (found on the inside of the humidifier control cabinet) will show proper wiring for these controls.

Wiring Modulating Humidistats
The standard modulating humidistat controllers DRI-STEEM may provide are either duct or room humidistats.

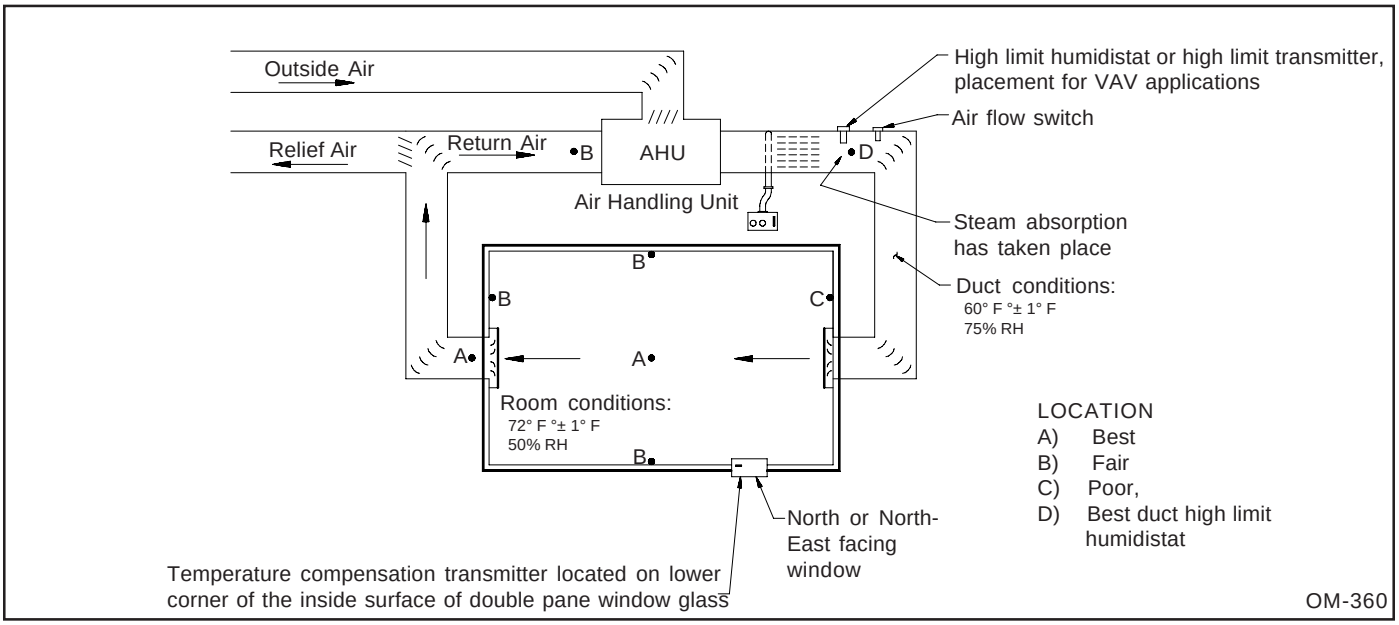
The humidistats are powered by 21 VDC supply provided by the VAPOR-LOGIC control board. A 6-9 VDC control signal is returned to provide the modulating function.

Using a pneumatic modulating signal, DRI-STEEM may provide a transducer to accept a 3-20 psi pneumatic input range.

A two-wire 0-135 ohm humidistat is also adaptable to the VAPOR-LOGIC control board.

Wiring Modulating Humidity or Temperature Transmitters
All transmitters provided by DRI-STEEM are two-wire devices. (See your wiring diagram for proper connections.) The humidity transmitters have a range of 0-100% RH with an output of 4-20 mA. The temperature transmitters (there are two models) have ranges of -20° to 120° F or -20° to 160° F. Both produce 4-20 mA output. %RH= (Milliamp reading minus 4.) Divide by .16.

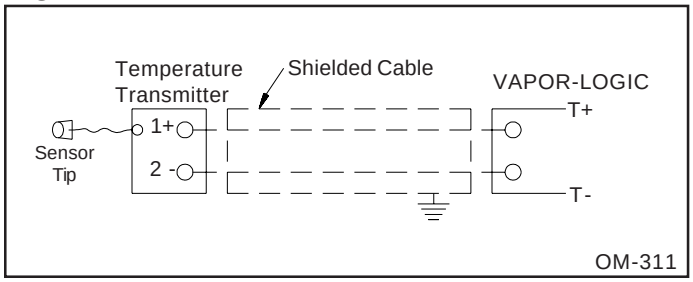
Figure 12-1: Humidistat control or humidity and temperature transmitters recommended placement



OPTION: Variable Air Volume (VAV) (30 feet from the humidifier.) When the VAV control option is requested, DRI-STEEM will provide, in addition to the room control transmitter, a duct mounted humidity transmitter (4-20 mA output over 0-100% RH range).

Note: DRI-STEEM recommends using a #18 gauge plenum rated shielded cable for transmitter wiring and grounding shield at a common point in control cabinet. (See Figure 13-1.)

Figure 13-1: Shielded cable



OPTION: **Cold Snap RH Offset**
When selected as an option, DRI-STEEM provides a cold snap temperature transmitter. The cold snap transmitter monitors interior window glass temperature to prevent condensation from forming on the interior glass surfaces by lowering the relative humidity set point below the dew point.

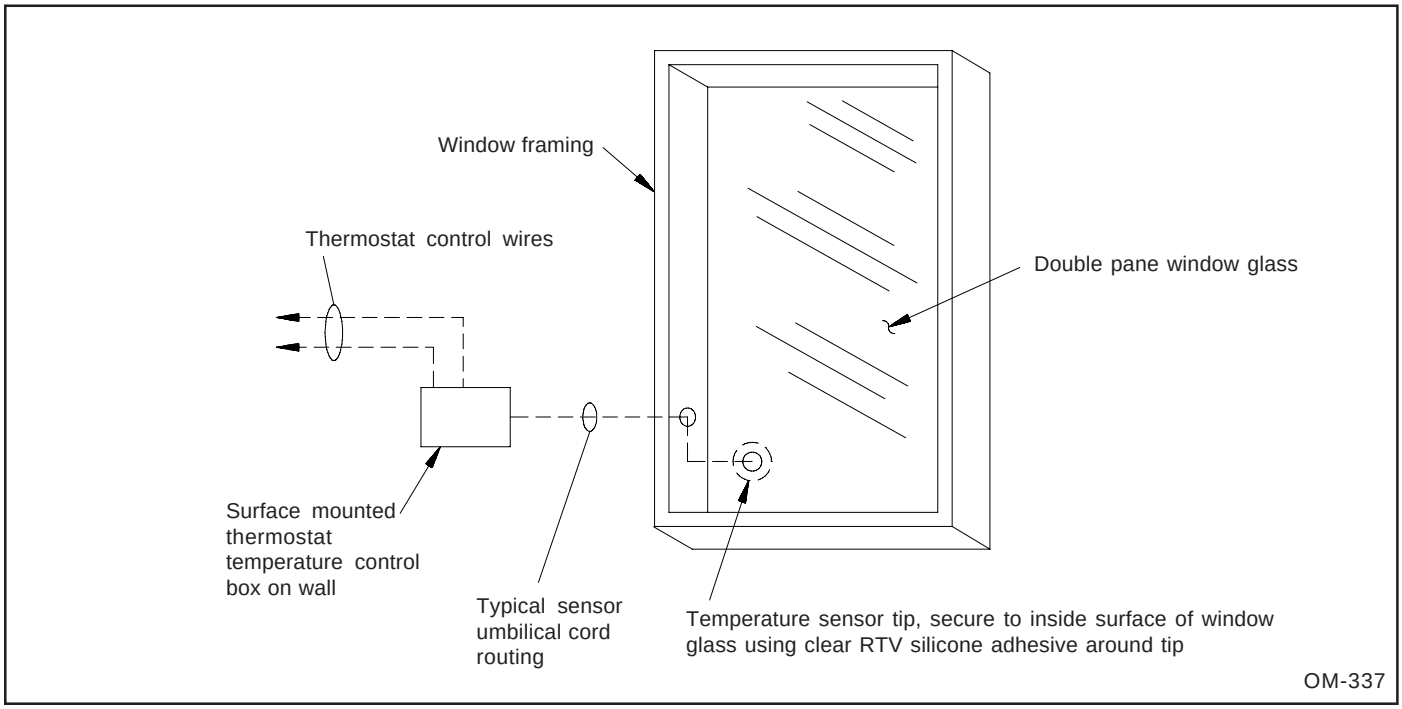
The transmitter provided with VAPOR-LOGIC firmware V1.01 through V1.10 (part #405882) is calibrated for -20° F to 120° F with output from 4-20 mA. A temperature reading of 50° F should produce a measurement of 12 mA.

The transmitter provided with VAPOR-LOGIC firmware V2.01 and higher (part #405889) is calibrated for -20° F to 160° F with output from 4-20 mA. A temperature reading of 70° F should produce a measurement of 12 mA.

Cold Snap Transmitter Placement (See Figure 13-2.)

1. Position the cold snap transmitter control box on a wall adjacent to lower window framing and route the temperature sensor umbilical cord behind the wall and out through window framework.
2. Place flat surface of temperature sensor tip on lower corner of glass surface.
3. Temporaily hold the sensor tip in place with strips of masking tape.
4. Apply small amount of clear RTV silicone adhesive over and around the sensor tip (making sure the sensor tip is in contact with the window glass).
5. After adhesive has cured, remove masking tape.

Figure 13-2: Cold snap transmitter placement



PROPER WIRING PROCEDURES

Electrical currents can produce undesirable effects in the electronic control circuits that eventually affect controllability. Electrical “noise” is generated by electrical equipment, such as switching resistive loads, electric motors, solenoid coils, welding machinery, fluorescent light circuits, etc. The electrical “noise” or interference generated from these sources (and the effects on controllers) is very difficult to define, but most common symptoms are erratic operation or intermittent problems.

However, most noise problems can be prevented by using wiring practices and techniques which do not allow for coupling or inducing of electrical interference into control circuits. Some simple wiring practices associated with DRI-STEEM humidifier equipment should minimize interaction of noise and controls:

- Humidifier and control cabinets must be connected to a code approved earth ground.
- When routing electrical wiring inside the control cabinet, separate line voltage wiring from low voltage control circuit wiring.
- Use separate electrical conduits for line and low voltage wiring from the humidifier to humidity sensors airflow switches etc.
- Do not mix chassis or safety grounds with current carrying commons. No safety grounds should ever be used as a conductor or neutral to return circuit current.
- The preferred method of external electrical connections to humidistats, room/duct humidity and temperature transmitters, water level control devices and control signal input connections from building control systems is by using minimum size #18 gauge plenum rated wire cable of twisted pair type, including cable shielding and ground wire.
- All grounding of shielded cable connections should be returned to the control cabinet and tied to the earth a single ground point. Do not ground shield at the device end.
- Do not locate the control cabinet more than 30 feet from the humidifier.

VAPOR-LOGIC® P.I.D. CONTROL LOOP: TERMINOLOGY

Optional Feature
Using the P.I.D. Control Loop in conjunction with VAPOR-LOGIC gives you the potential for unprecedented control accuracies. You are able to fine-tune the control system to meet your specific humidification needs. Understanding the terminology of P.I.D., and the purpose for each inclusion, will greatly assist you in using VAPOR-LOGIC P.I.D. to its full potential.

Proportional Band (P)
Adjustable range: 100, or 20% RH, to 1000, or 2% RH.

The Proportional Band is the % RH band below the set point where the control will time-proportion the output via a contactor or solid state SCR preset at 10% RH. Or, it is the % RH band below the set point where the control will provide a steady state analog VDC signal to a steam or hot water valve.

If the Proportional Band is too narrow, on-off control action hunting will be evident. There will be minimal proportional action.

If the Proportional Band is too wide, proportional action will be present, but there will be slow response to change. The greatest potential in this situation would be to control away from the desired set point. (See Figure 15-1.)

Integral Term (I)
Adjustable range: 50 to 500 factor, with default of 250.

The Integral, or reset, Term will reduce the actual set point droop from the desired set point when added to the Proportional Band control.

To do this, the Integral Term algorithm actually shifts the Proportional Band around the desired set point to increase or decrease the output as needed.

If the Integral Term is too little, droop will be evident.

If the Integral Term is too large, on-off cycling, or hunting, will be evident. (See Figure 15-2.)

Figure 15-1: Proportional band

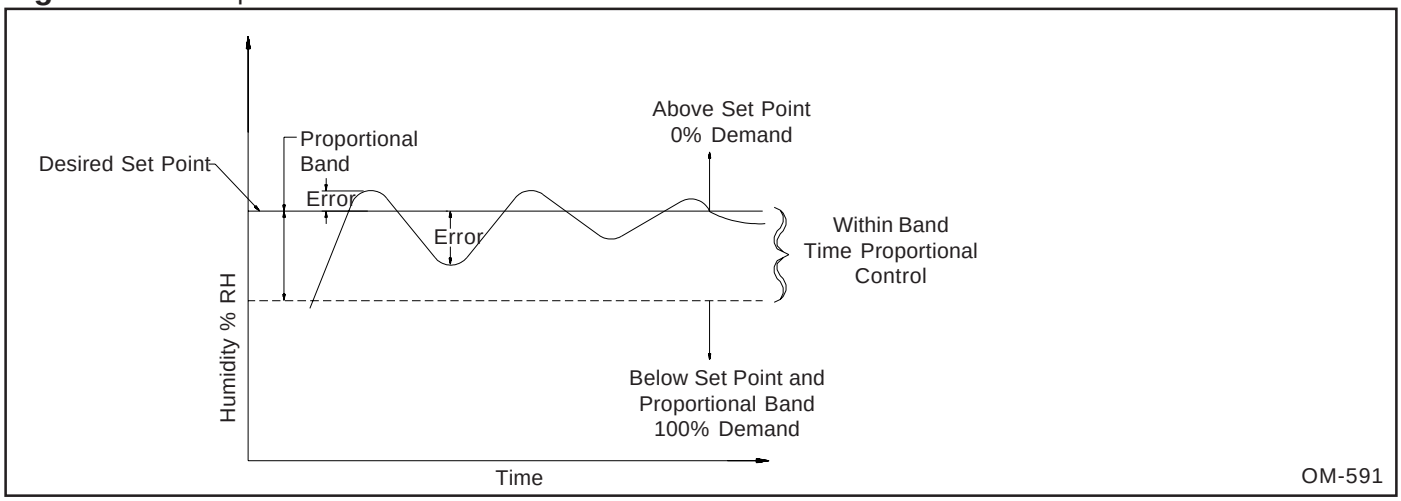
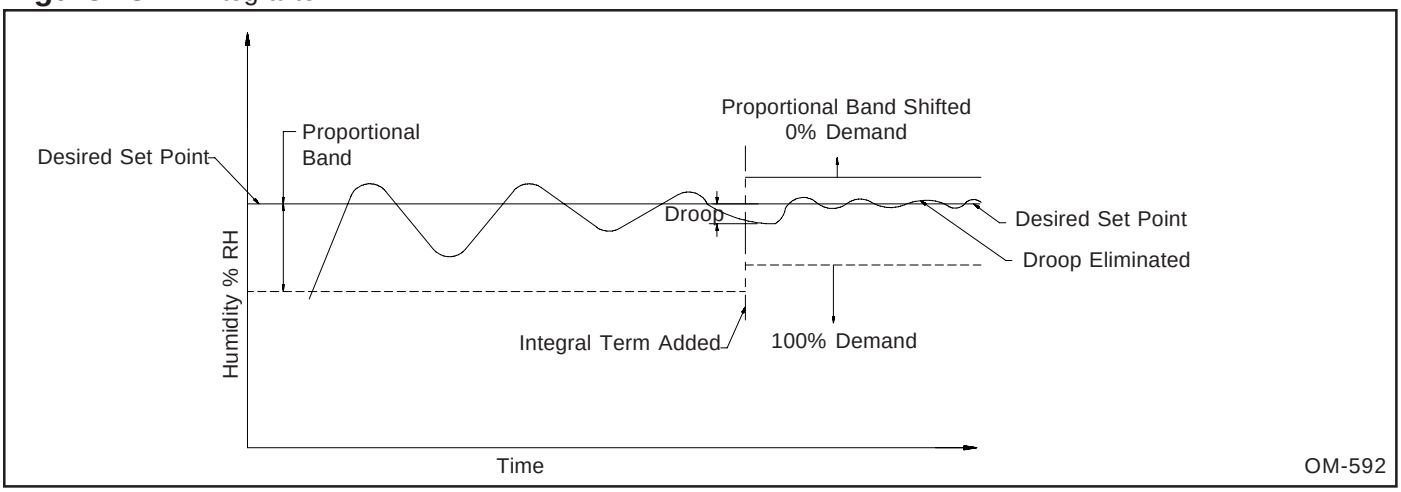


Figure 15-2: Integral term



Derivative Term (D)
Adjustable gain factor range: 0 to 500, with default of zero.

The Derivative, or rate (anticipatory), Term reduces the potential for overshoot and undershoot around the desired set point when added to the Proportional Band and Integral control functions. The Derivative algorithm measures the rate of % RH change-over time that is taking place and forces the control into the proportioning actions on an accelerated basis to slow the change.

As the rate of change diminishes, the Derivative Term becomes less effective on the Proportional Band. (See Figures 16-1 and 16-2.)

Important: In 80% of the humidification applications, the Derivative Term is not necessary, which explains why the default value is zero.

If there is too little Derivative Term, overshoot is evident.

If there is too much Derivative Term, there will be very poor control, frequent system disturbances, or too much time to reach the desired set point.

Sample Interval
Adjustment range: 5 to 1200 seconds, default value of 30 seconds.

The Sample Interval is the interval time (in seconds) during which VAPOR-LOGIC reviews all the controlling parameters (desired and actual RH set points, P.I.D. terms, and output percentage) and then makes the necessary adjustments to the control output to achieve the desired set point.

If the Sample Interval is too short, over control and system on-off hunting will be evident.

If the Sample Interval is too long, there will be poor response to changes and large errors from the desired set point.

Figure 16-1: Proportional action without derivative gain

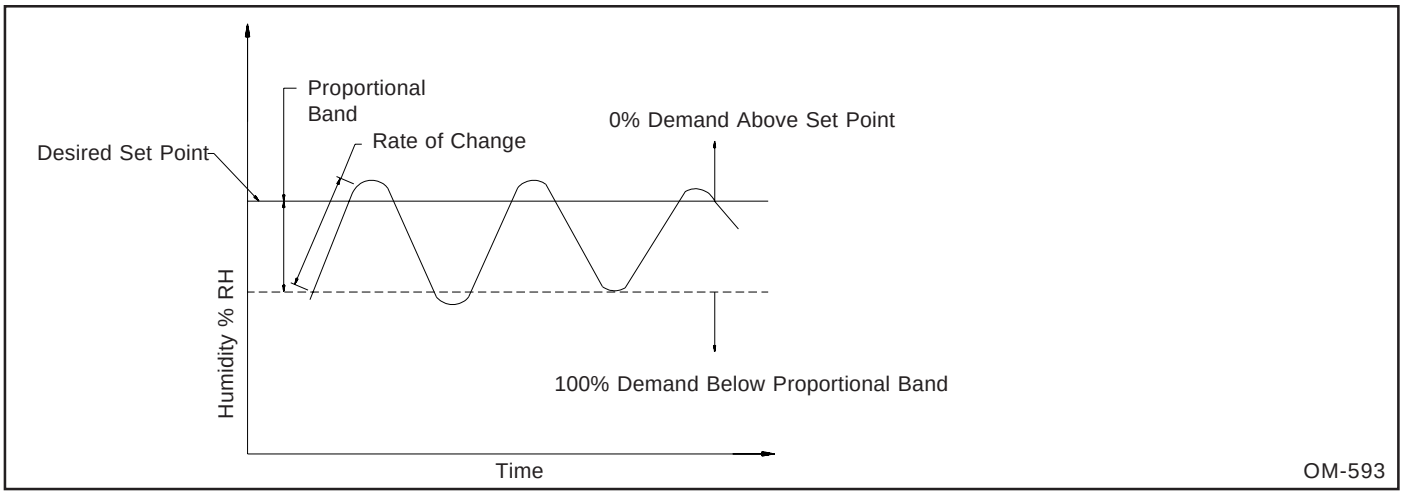
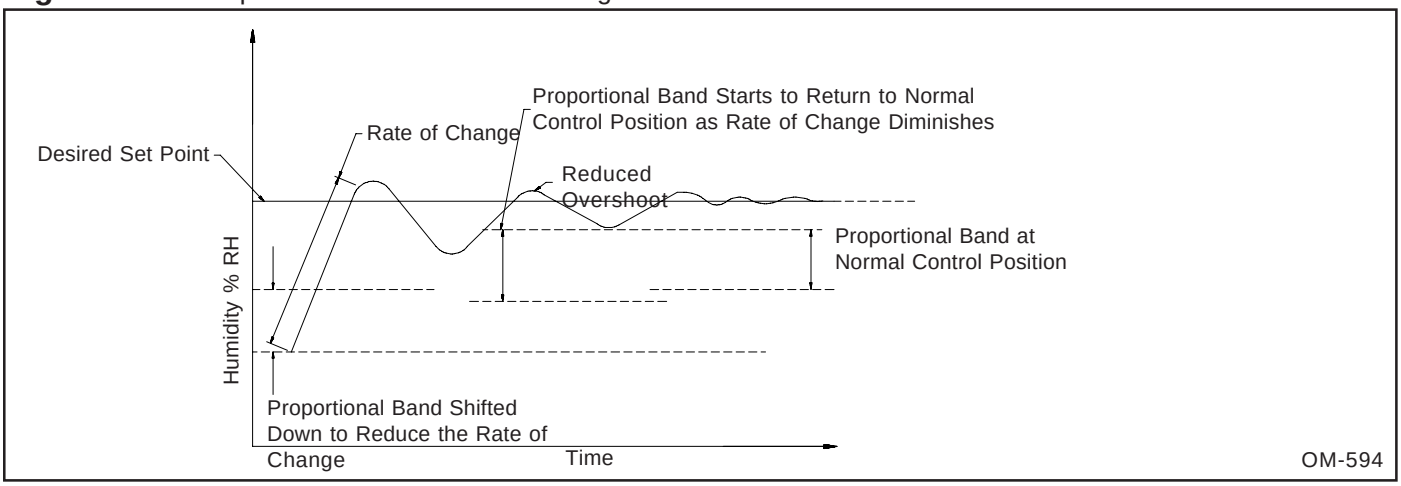


Figure 16-2: Proportional action with derivative gain



VAPOR-LOGIC® P.I.D. CONTROL LOOP: TUNING

In this section, we will focus on the VAPOR-LOGIC P.I.D. controller as the primary control in a closed loop system that needs to be tuned for optimum performance. The availability of these adjustments provide a means to work with different humidification applications.

The following steps are general and applicable to most humidification situations. Each setting is gone through in sequence: Proportional Band, Integral, Derivative, and Sample Interval Rate.

Precautions

- Take your time when tuning the VAPOR-LOGIC system.
- Evaluate the system dynamics: slow changes in large humidification areas or humidification for comfort, medium changes for most applications, and fast changes for system RH's that can change in seconds, controlling within a duct or controlling downstream from the humidifier.
- Do not change more than one control adjustment at a time, allowing the system to settle down and reach a state of equilibrium before making another change.
- Remember that the time you spend tuning the VAPOR-LOGIC system is in direct proportion to the accuracy of control you need.

Potential Accuracies

- TP modulation (contactor): ± 2-5% RH
- TP modulation (SCR): ± 2-4% RH
- 100% SCR modulation: ± 1-3% RH
- 100% SCR modulation (DI/RO water systems): ± 1-2% RH
- Modulated steam and hot water valves: ± 1-4% RH

The P.I.D. controls are listed in the sequence in which they should be adjusted.

Proportional Band Adjustment

The Proportional Band adjustment is the means of selecting the response speed (gain) or sensitivity of the VAPOR-LOGIC controller to achieve stability in the system. The Proportional Band is measured in the percent RH span that must be wider than the natural dynamics of the system and yet not wide enough to dampen the system response. (Time Proportioning Output.)

The internal cycle time is pre-set to switch faster than the natural dynamics of the system.

The tuning procedure is very simple if a humidity recorder is available to monitor the actual % RH variable. If a recorder is not available, observe the process response and record readings over a defined time period using a wet/dry bulb psychrometric sling.

If there are oscillations with the Proportional Band at its narrowest setting (not zero), the adjustment of the Proportional Band should be increased in small increments until the offset (droop) starts to increase. When the Proportional Band has been tuned properly, you will see system stability. Often, an offset (droop) from the set point will then occur. At this point in tuning the system, the % RH variable should be in a state of equilibrium, but not right at the desired set point. (Refer to Figures 17-1,17-2 and 17-3.)

Figure 17-1:

If the system response looks like this, decrease the Proportional Band by a factor of two.

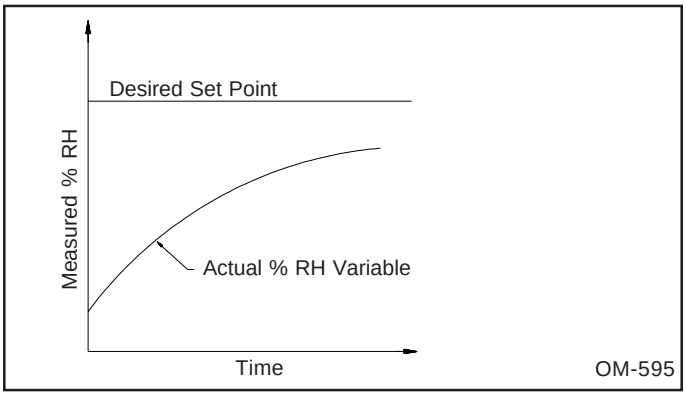


Figure 17-2:

If the system response looks like this, increase the Proportional Band by a factor of two.

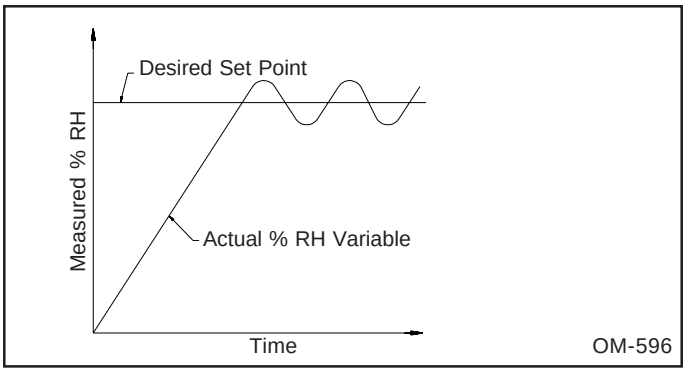
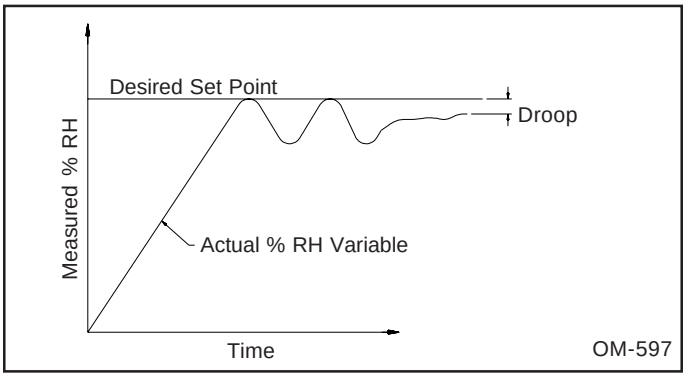


Figure 17-3:

If the system response looks like this, the Proportional Band is very close to the correct setting for this system. Increase the Proportional Band in small increments until the % RH stabilizes.



VAPOR-LOGIC® P.I.D. CONTROL LOOP: TUNING

Integral Adjustment
The VAPOR-LOGIC Integral Adjustment is tuned at this point in time to adjust for the droop that is caused by the proportional output. (VAPOR-LOGIC default is 250 derivative adjustment for Integral Term.) The operator will make small Integral Adjustments in the proper direction (increase or decrease) to bring about the alignment of the actual % RH and the desired % RH set point.

Please make small changes in the Integral Adjustment (range 0 to 1000) and allow the system to return to a state of equilibrium before making additional changes. This may take several system cycle times. Also, the integral will have to be changed if the % RH set point or other dynamic characteristics are changed substantially.

Derivative

The initial setting for the Derivative Adjustment should be at the smallest integer possible (least corrective action). Increase the integer in small increments and increase the % RH set point moderately after each adjustment. Observe the actual process of the approach of the % RH to the set point. If it overshoots, continue to increase the rate integer in small increments. Then increase the set point % RH moderately until the optimum approach to the desired set point is achieved. If at some point the system becomes very sluggish, or doesn't reach the new set point at all, too much Derivative action has been adjusted in the control system. The amount of Derivative value must be decreased to reduce the "dampening" effect.

Sample Interval Adjustment
The Sample Interval default setting is at 30 seconds, and this will perform satisfactorily in most applications. The range of Interval time is from 4 to 1200 seconds. Too short an Interval will cause over control, while too long an Interval will cause sluggish control.

Important: Any dramatic set point changes or system dynamic variations will require a re-tuning of the control parameters (P.I.D.).

VAPOR-LOGIC® PROGRAM CODE NOMENCLATURE

All the combinations represented are supported by appropriate software. Your particular system may not include all the features shown in this program code nomenclature. Always refer to your wiring diagram on the inside of control cabinet door to identify your particular Program Code Number, then decipher your system using VAPOR-LOGIC Program Code described below.

VAPOR-LOGIC PROGRAM CODE

A. VAPOR-LOGIC board classification:
- Single tank system = 1
- Double tank system = 2
- Triple tank system = 3
- Quad tank system = 4

B. Digital Display/Key Pad features:
- N = None L = Local
- B = Local & Remote

C. Type of outputs (0-4) _____
- 0 = Steam valve
- 1 = One heater 3 = Three heater
- 2 = Two heater 4 = Four heater

D. Output size _____
Steam valve = 00

2KW Heater = 02	9KW Heater = 09
3KW Heater = 03	10KW Heater = 10
4KW Heater = 04	12KW Heater = 12
5KW Heater = 05	14KW Heater = 14
6KW Heater = 06	16KW Heater = 16
7KW Heater = 07	18KW Heater = 18
8KW Heater = 08	20KW Heater = 20
	25KW Heater = 25

E Type of water level control:
- VSDI w/manual drain = D
- Probe w/manual drain = M
- Probe w/auto drain = A

F. Operating mode:

Single staged	= 1	Steam Valve (ANALOG)	= 6
Externally staged	= 2	TP/PID	= 7
Zone valve	= 3	SCR/PID	= 8
TP	= 4	SV/PID	= 9
SCR (DIGITAL)	= 5		

G. VAV options:
- V = Option
- O = Otherwise

H. Temp. comp. options:
- T = Option
- O = Otherwise

I. Aquastat options:
- A = Option
- O = Otherwise

J. Type of humidity sensing device:
- N = None, for off-on
- C = 0-135 ohms humidistat
- D = 6-9 VDC humidistat
- E = 4-20 MA humidistat
- X = 4-20 MA transmitter
- S = Special

Example: Code number: 1L-110-A7-000-X

1	L	1	10	A	7	0	0	0	X

A. Single tank system
B. Local
C. One heater
D. 10KW heater
E Probe w/auto drain
F. TP/PID
G. Otherwise
H Otherwise
I Otherwise
J 4-20 MA transmitter

Code number for typical VAPOR-LOGIC slave control board 1N-110-A7-000-N
Revised 2-18-94

MAIN MENU/AUTO SCROLL INFORMATION

The following pages contain information about the digital read-outs and fault conditions that VAPOR-LOGIC communicates. This includes a wide variety of present system conditions, faults, and programmable parameters that ultimately control the humidification system, as well as a trouble-shooting guide to help you with operational procedures. The charts are organized based upon when or why the information is communicated.

MAIN MENU READ-OUT	MAIN MENU DESCRIPTION	RANGE	DEFAULT	AUTO SCROLL	AUTO SCROLL READ-OUT
"SET % RH"	Room Set Point (1)	20-80% RH	35%	yes	"DESIRED RH:%" "ACTUAL RH: %"
"TRIM % RH"	Trim Range (1)	±10% from present set point reading	No trim.	no	
"SET RH T.R."	Throttling Range (1)	2-20% RH	11% RH	no	
"SET H.L. RH"	Duct Set Point (VAV Option) (2)	50-90% RH	70% RH	yes	"MAX. H.L. RH:%" "ACT. H.L. RH:%"
"TRIM H.L. %RH"	Trim High Limit Range (2)	±10% from present high limit set point reading	No trim.	no	
"TRIM TEMP"	Trim Temperature Range (3)	±20°F from present glass temperature reading	No trim.	no	
"SET ADS INTERVAL"	Auto Drain Sequence Interval (4)	1-99 hours	50 hours	no	
"SET ADS DURATION"	Auto Drain Sequence Duration (4)	1-30 minutes	8 minutes	no	
"SET AFS DURATION"	Auto Flush Sequence Duration (4)	1-30 minutes	8 minutes	no	
"SET SKIM DUR"	Skim Time Duration	2-60 seconds	2 seconds	no	
"TIME TO ADS"	Time Until Auto Drain Sequence (in hours, minutes, seconds) (4)	1-99 hours	50 hours	no	
"TIME TO SERVICE"	Time Until Recommended Service (in hours, minutes, seconds) (4)	Counts down from 2000 hours.	2000 hours	no	

MAIN MENU/AUTO SCROLL INFORMATION

MAIN MENU READ-OUT	MAIN MENU DESCRIPTION	RANGE	DEFAULT	AUTO SCROLL	AUTO SCROLL READ-OUT
	Cycle Time (1)				
"SET CYC TIME"	TP Type Control	15-99 seconds	20 seconds	no	
"SET CYC TIME"	SCR Type Control	4-99 seconds	4 seconds	no	
"SET DLY TIME"	Multiple Heater Delay Time (1)	4-99 seconds	20 seconds	no	
"SET KP"	Proportional Band (5)	100-1000	10% (200)	no	none
"SET KI"	Integral Gain Factor (5)	50-500	5% (250)	no	none
"SET KD"	Derivitive Gain Factor (5)	0-500	0 (000)	no	none
"SET SMPL INT"	Sample Interval (5)	5-1200 seconds	0030 (30 seconds)	no	none
AUTO SCROLL DESCRIPTION				**AUTO SCROLL**	**AUTO SCROLL READ-OUT**
Heater One Demand %				yes	"K1 DEMAND: %"
Heater Two Demand %				yes	"K2 DEMAND: %"
Heater Three Demand %				yes	"K3 DEMAND: %"
Heater Four Demand %				yes	"K4 DEMAND: %"
Total System Demand %				yes	"SYS DEMAND:%"
Steam Ouput (lbs/hr)				yes	"SYS OUT: #/HR"

(1) Modulation type control
(2) Modulation type control with VAV option
(3) Modulation type control with % RH offset option
(4) VPC Series with Auto-Drain feature
(5) Modulation type control with PID control option feature

DIGITAL DISPLAY READ-OUTS

READ-OUT DISPLAYED	DESCRIPTION
"SERVICE"	Humidifier has reached the point where the review of humidifier operations for possible servicing is recommended.
"END OF SEASON"	Humidifier has not had a call for humidity over a 3-day period. All water drains from the tank and VAPOR-LOGIC goes into end of season mode until the next call for humidity.
"DISABLED BY HL"	High limit humidistat has opened.
"DISABLED BY AFPS"	Air flow proving switch has opened.
"STANDBY"	VAPOR-LOGIC is in stand-by mode.
"AUTO DRAIN"	VAPOR-LOGIC is in drain mode.
"AUTO FLUSH"	VAPOR-LOGIC is in flush mode.
"LOW WATER"	VAPOR-LOGIC has detected low water condition in tank.
"FILLING"	VAPOR-LOGIC has instructed fill valve to open to fill tank with water.
"GLASS TEMP °C"	Metric notation of glass temperature.
"SYS OUT KG/H"	Metric notation for kilogram/hour steam output.
"AQUASTAT"	Aquastat control option has activated to heat water for freeze protection.
"VAV OUTPUT LIMIT"	The VAV control package detects high limit condition in duct and begins to limit humidifier output.

DIGITAL DISPLAY/KEY PAD TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
VAPOR-LOGIC RED INDICATOR LIGHT IS OFF	No control voltage present	Check for proper supply voltage.
	Heater fuses open	Check heater fuses for voltage present at transformer.
	Transformer secondary circuit breaker tripped	Check wiring for shorts; reset breaker.
	Disruption in microprocessor logic	Verify proper control cabinet wiring. Press "RESET" button to reset VAPOR-LOGIC control board.
VAPOR-LOGIC RED INDICATOR LIGHT ON CONTINUOUSLY	VAPOR-LOGIC microprocessor disrupted	Verify proper control cabinet wiring. Press "RESET" button to reset VAPOR-LOGIC control board.
VAPOR-LOGIC RED INDICATOR LIGHT BLINKING ON-OFF (heartbeat)	Normal operation	
INDICATOR LIGHT BLINKING ON-OFF (long/short pulses)	Indicates fault condition	See Fault Chart on pages 24-25 for more information. Identify the fault, turn power off, repair, restart.
NO REMOTE FAULT INDICATION	Field wiring not installed	Provide field wiring to a remote fault indicator from VAPOR-LOGIC terminal block J7.
	Field supplied remote fault indicator lamp burned out	Check if lamp is burned out and replace.
	Remote fault VAPOR-LOGIC relay not switching	Check relay continuity (VAPOR-LOGIC terminal J7) for contact closure.
NO READABLE INFORMATION DISPLAYED ON KEYPAD (Continued on next page.)	No power to VAPOR-LOGIC board	Check main supply power. Check control transformer secondary manual reset circuit breaker.
	Modular communication cable disconnected	Connect modular cable.

DIGITAL DISPLAY/KEY PAD TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
NO READABLE INFORMATION DISPLAYED ON KEY PAD (con't.)	Reverse polarity between modular cable and plugs	See page 5 for correct polarity of the modular cable connection to cable plugs.
	Digital key pad lock-up	Press "RESET" button on panel.
READ-OUT NOT AUTO SCROLLING	Digital display in main or sub-menu format	Press "MODE" key.
CANNOT ENTER NEW PARAMETERS INTO MICRO-PROCESSOR THROUGH KEY PAD	Digital display in "AUTO" or main menu format	Press "MODE" key to enter main menu. Press "ENT" key to access data in the main menu item selected.
	New parameters out of range	Press "CLR" key to start over, and enter new parameters within range.

FAULT INDICATOR CODES

FAULT	MASTER (CODE)	SLAVE 1 (CODE)	SLAVE 2 (CODE)	SLAVE 3 (CODE)	DIGITAL DISPLAY READ-OUT
COMMUNICA-TION FAILURE	SSSSS	LSSSS	SLSSS	LLSSS	"1) LOCAL COMM" (Master to local key pad communication failure) "21) REMOTE COMM" (Master to remote key pad communication failure) "2) SLAVE 1 COMM" (System B control board to Master control board failure) "3) SLAVE 2 COMM" (System C control board to Master control board failure) "4) SLAVE 3 COMM" (System D control board to Master control board failure)
LEVEL CONTROL (PROBE FAILURE)	SSLSS	LSLSS	SLLSS	LLLSS	"5) MASTER WATER" (Main humidifier probe and low water failure) "6) SLAVE 1 WATER" (System B humidifier probe and low water failure) "7) SLAVE 2 WATER" (System C humidifier probe and low water failure) "8) SLAVE 3 WATER" (System D humidifier probe and low water failure)
DRAIN VALVE FAILURE	SSSLS	LSSLS	SLSLS	LLSLS	"9) MASTER DRAIN" (Main humidifier water drain failure) "10) SLAVE 1 DRAIN" (System B humidifier water drain failure) "11) SLAVE 2 DRAIN" (System C humidifier water drain failure) "12) SLAVE 3 DRAIN" (System D humidifier water drain failure)
FILL VALVE FAILURE	SSLLS	LSLLS	SLLLS	LLLLS	"13) MASTER FILL" (Main humidifier water fill failure) "14) SLAVE 1 FILL" (System B humidifier water fill failure) "15) SLAVE 2 FILL" (System C humidifier water fill failure) "16) SLAVE 3 FILL" (System D humidifier water fill failure)

FAULT INDICATOR CODES

POSSIBLE CAUSE	RECOMMENDED ACTION
Modular cable to local and/or remote key pads or VAPOR-LOGIC boards not connected	Connect modular cables.
Reversed polarity of modular cable connection to cable plugs	See page 5 for correct polarity of the modular cable connection to cable plugs.
Remote key pad missing J6 cable jumper	Add jumper. (See page 8.)
Modular plug and/or cable connected or removed with power on	Reconnect with power "off" and reset VAPOR-LOGIC.
Improper water level changes inside tank	Verify proper wiring of probe system. Clean probe rod assembly.
When in auto drain sequence, end-of-season, or manual drain, VAPOR-LOGIC allows 20 minutes for the water level to drop from the top probe to below the lowest probe. If the tank does not drain to this level in the time allotted, a fault will be indicated.	Check drain valve wiring.
	Check for voltage present at the valve. If present, clean or replace valve.
	Check if the tank drain outlet is plugged. Clean outlet if needed.
	Reset VAPOR-LOGIC.
When in the fill sequence, VAPOR-LOGIC allows 40 minutes for the water to reach the maximum proper level. If the water does not reach the designated level, and the probe system is not satisfied, a fault will be indicated.	Check water supply shut-off valve. If it is closed, open the valve.
	Check if the in-line strainer or valves are plugged. Clean them as needed.
	Check if there is 24 VAC present at control board terminals 20 & 21. If yes, replace valve.
	Verify proper fill valve wiring.

FAULT INDICATOR CODES

FAULT	MASTER (CODE)	SLAVE 1 (CODE)	SLAVE 2 (CODE)	SLAVE 3 (CODE)	DIGITAL DISPLAY READ-OUT
EEPROM FAILURE	SSSSL	LSSSL	SLSSL	LLSSL	"17) MASTER EEPROM" (Master control board programming failure) "18) SLAVE 1 EEPROM" (System B control board programming failure) "19) SLAVE 2 EEPROM" (System C control board programming failure) "20) SLAVE 3 EEPROM" (System D control board programming failure)
TRANSMITTER FAULT (Control)	LSLSL	none	none	none	"22) RH XMTR" (Control % RH humidity transmitter failure)
TRANSMITTER FAULT (High limit)	SLLSL	none	none	none	"23) HL XMTR" (Control duct high limit % RH humidity transmitter failure)
TRANSMITTER FAULT (temperature)	LLLSL	none	none	none	"24) TMP XMTR" (Temperature compensation transmitter failure)
LOCAL DIGITAL DISPLAY FAULT	SSSSS	none	none	none	"LOCAL DISPLAY" (Communication failure to Local Digital Key Pad)
REMOTE DIGITAL DISPLAY FAULT	SSLSL	none	none	none	"REMOTE DISPLAY" (Communication failure to Remote Digital Key Pad)

FAULT INDICATOR CODES

POSSIBLE CAUSE	RECOMMENDED ACTION
Internal program changed (VAPOR-LOGIC detects a change from its previous program check)	Consult DRI-STEEM.
Incorrect placement of control boards, resulting in a switch of master and control boards (The system can only have a single "Master.")	Verify that the boards are placed correctly in the system.
Open, shorted, or incorrect wiring of transmitter	Check D.C. supply voltage terminals: 5+, 7- (21 VDC).
	If there is no output 4-20 mA, replace.
	Recalibrate if there is a calibration error: Normal Range 4-20 mA = 0-100% RH 12 mA = 50% RH (Refer to Trim Adjustment on page 10 for further information.)
	Measure for normal 1-5 VDC range on Control RH transmitter: 6+, 7-.
	Measure for normal 1-5 VDC range on Duct High Limit transmitter: 9+, 10-.
Improperly located	Transmitter must be on inside window glass only. (See page 11 for correct placement.)
Incorrect transmitter wiring	Check D.C. supply voltage terminals 11+, 13- (21 VDC).
	Temperature transmitter -20°-120°F should have 12 mA = 50°F (VAPOR-LOGIC firmware V1.01 through V1.10, part #405882).
	Temperature transmitter -20°-160°F should have 12 mA = 70°F (VAPOR-LOGIC firmware V2.01 and higher, part #405889).
	Refer to Trim Adjustment on page 20 for further information.
Modular cable disconnected	Connect modular cables.
Reversed polarity of modular cable connection to cable plugs	See page 5 for correct polarity of the modular cable connection to cable plugs.
Remote key pad missing J6 cable jumper	Add jumper. (See page 8.)

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
CONTROL DOES NOT ENERGIZE	Non-existent supply voltage to unit	Check main line fuse. Check main line safety switch. Check heater fuses.
	Non-existent control voltage	Check for proper supply. Verify proper transformer voltage characteristics. Verify proper wiring of transformer. Check for control circuit voltage, 24 VAC. If voltage is not present, check transformer circuit breaker. Reset if needed.
	Heater over-temperature thermostat open (optional)	Reset manual switch located above heater.
UNIT DOES NOT FILL WITH WATER	Malfunctioning fill valve	First, disconnect brown wire and then the orange wire from VAPOR-LOGIC board terminals 1 & 2 of terminal block J12. Fill valve should open. If fill valve does not open, verify proper 24 volt AC (terminals 20 & 21) to fill valve. If voltage is present and valve does not open, replace valve or valve coil. Verify that coil is 24 VAC. Verify that valve stem moves freely.
	No water supply to fill valve	Check if water supply line strainer is plugged. Verify that manual water line shut-off valve is open and that pressure exists.
	Improper slide switch setting on VAPOR-LOGIC control board	Set slide switch to "AUTO" mode.
	VAPOR-LOGIC control is in "end of season" drain mode	Check for humidity demand. (VAPOR-LOGIC control board terminals 5, 6 & 7 - Control Input 1 of terminal block J8.)
	Malfunctioning level control system	Verify that unit has new probe head design. If probe head does not have skirt extensions surrounding probe rods, it is an obsolete model and DRI-STEEM recommends replacement of probe assembly.

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
UNIT DOES NOT FILL WITH WATER (con't.)	Malfunctioning level control system (con't.)	Disconnect brown and orange wires connected to VAPOR-LOGIC board terminals 1 & 2 of terminal block J12. If fill valve does not open, check for proper 24 VAC (terminals 20 & 21) to fill valve coil. If proper voltage is not present, the control board is defective. Check terminals 1, 2, 3 & 4 on VAPOR-LOGIC control board terminal block J12 for correct voltage: 3 (purple) to 4 (yellow), no water present > 2 VAC. 3 (purple) to 4 (yellow), water present < 1/4 VAC. 2 (orange) to 4 (yellow), same readings as above. 1 (brown) to 4 (yellow), same readings as above.
FILL VALVE DOES NOT CLOSE	Open drain valve	If automatic drain valve is locked in manual open position, reset to automatic. Replace valve if there is a broken return spring on the drain valve. Clean or replace drain valve if an obstruction in the valve will not allow complete closure. Close manual drain valve, if it is open. If VAPOR-LOGIC shorted output to fill valve coil, replace board.
	Malfunctioning level control system	Check if probe head is fully plugged in. If needed, clean probe rod tips. Verify that VAPOR-LOGIC control board terminal 4 is grounded. If there is low water conductivity, add salt to tank water. (If this solves the problem, consult DRI-STEEM for further advice.) Replace board if VAPOR-LOGIC control board is defective. Verify that slide switch is set to "AUTO" mode. Verify that probe is wired correctly. Check terminals 1, 2, 3 & 4 on VAPOR-LOGIC control board terminal block J12 for correct voltage: 3 (purple) to 4 (yellow), no water present > 2 VAC. 3 (purple) to 4 (yellow), water present < 1/4 VAC. 2 (orange) to 4 (yellow), same readings as above. 1 (brown) to 4 (yellow), same readings as above.

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
FILL VALVE DOES NOT CLOSE (con't.)	Fill valve is stuck	Check if fill valve is installed backwards. If yes, re-pipe. If there is a faulty internal spring or diaphragm in the fill valve, replace valve. Check if there is an obstruction that will not allow valve to seat properly. Clean or replace valve as needed. Check for control voltage across fill valve coil. (Check wiring and controls.)
REDUCED OUTPUT OR NO OUTPUT (even though water level is proper)	Heater malfunctioning	Verify that proper voltage is being applied to heaters. Check heater amperage.
	Malfunctioning control system	If heater contactor is not functioning, replace. Check if heater fuses are blown and replace if required. Check if auxillary limit controls are not allowing system to operate (i.e.: duct humidistats, air flow proving switch, etc.). Reset, replace or calibrate as needed. (Air flow switch, terminals 14 & 15, measures 24 VAC if open. On-off high limit, terminals 9 & 10, measures 21 VDC if open.) Check if the (optional) heater overtemperature thermostat has been tripped. Reset if necessary. Replace zone valve, if end switch is not closing.
FILL VALVE CYCLES ON & OFF FREQUENTLY (several times per minute)	Malfunctioning level control system	Verify that unit has the new probe head design. If probe head does not have skirt extensions surrounding probe rods, it is an obsolete model and DRI-STEEM recommends replacement of probe assembly. If needed, clean probe tips. Check water conductivity. (Minimum conductivity for proper operation of level control system is 100 micromhos per centimeter or 2 grains per gallon.) Verify that probe wiring is correct.

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
FILL VALVE CYCLES ON & OFF FREQUENTLY (con't.)	Drain valve not fully closed	If an obstruction will not allow drain valve to fully close, clean valve. If there is a broken or weak return spring on drain valve, replace the valve. Check if 24 VAC is present at valve. If so, reset VAPOR-LOGIC control board terminals 18 & 19.
HEATER BURNOUT	Water level too low	Check probes and clean tips if necessary. Clean probe still-well area in tank. Verify that unit has new probe head design. If probe head does not have skirt extensions surrounding probe rods, it is an obsolete model and DRI-STEEM recommends replacement of probe assembly. Check drain valve and clean, repair, or replace as needed.
	Improper wiring	Verify proper voltage applied to heater. Verify proper electrical connections.
	Mineral build-up impeding heat transfer to water	Inspect tank for severe mineral build-up on or around heater. Increase skimming quantity, frequency of drain cycle, and/or frequency of cleaning. Use softened make-up water.
	Heater corrosion	Inspect heater for surface corrosion or pitting. If evident, consult DRI-STEEM.
NOISY OPERATION	"Thunder" type noise coming from tank during refill	Normal on larger units, caused by the cold fill water collapsing steam in the tank. Reduce psi (minimum of 25 psi) if inlet water pressure is too high.
	Contactor noise	Contactor normally makes a "clunk" as it pulls in. A continuous chattering noise is not normal and is symptomatic of a failing contactor or malfunctioning controls. Replace contactor or troubleshoot the control system.
	Fill valve noise	A clicking sound as fill valve opens or closes and a hissing sound during fill are normal. A slamming sound as fill valve closes is "water hammer" and can be minimized by installing a shock arrester. A loud buzzing sound indicates poor alignment of valve stem. Replace valve.

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
HUMIDITY BELOW DESIRED LEVEL	Unit operating but fails to meet required humidity output	Unit undersized; replace with a larger unit or add additional humidifier. Skimmer rate is too high. If drain valve will not close fully, determine the cause and clean, repair or replace as needed. If drain pipe water seal is allowing steam to go down the drain, repair as needed. If there is an improper water seal height, increase to recommended height. (See humidifier O&M manual) If there is excessive internal steam pressure, determine the cause of the high pressure (i.e.: high duct static pressure, undersized orifices in dispersion tubes, water, or crushed vapor hose, etc.) and repair as required. Replace leaking gasket or vapor hose. Recalibrate if controls are out of calibration. If fill valve is stuck open, repair or replace. If zone valve will not open, repair or replace.
	No call for humidity from humidistat or control and high limit humidity transmitters	Low or no signal strength from humidistat. Check for proper wiring. Check humidity transmitters. (4-20 mA output) Adjust set point if VAPOR-LOGIC set point is too low.
	Excessive outside air volume	Verify proper operation of fans, dampers, VAV systems, etc.
	Heating elements not operating	If heaters are burned out, refer to previous section on HEATER BURNOUT. Humidistat calling for humidity (out of calibration.) Check for control voltage if limit controls (air flow proving switch, zone valves, etc.) are not allowing unit to operate. Check fuses and replace if they are blown. Check if the (optional) heater overtemperature has been tripped. Reset if necessary.

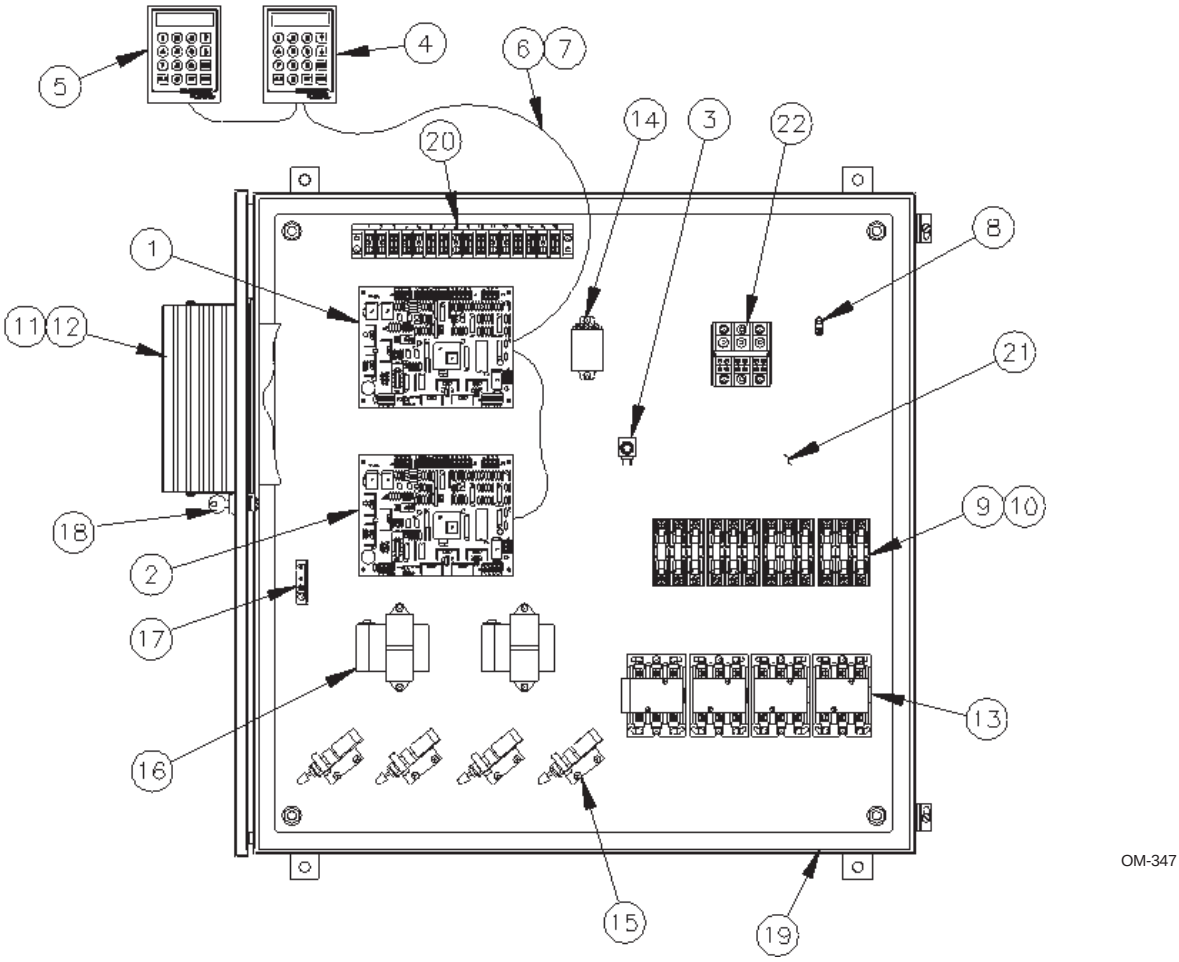
TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
HUMIDITY ABOVE DESIRED LEVEL (con't.)	Humidity control input type not the same as VAPOR-LOGIC software	Check VAPOR-LOGIC control board connections J9, J10 and J11. Consult DRI-STEEM.
HUMIDITY ABOVE SET POINT	High entering relative humidity	Dehumidify.
	Unit oversized	Consult DRI-STEEM.
	Reduced air flow	Check fans, dampers, VAV systems, etc.
	Improperly located humidistat or humidity transmitters	Relocate using guidelines established in this manual. (See page 11.)
	Malfunctioning controls	Check for incorrect supply voltage. Check for incorrect control signal. Check for improper wiring hook-up. If humidity controller or transmitter are out of calibration or malfunctioning, repair or recalibrate. If zone valve end switch is not opening, repair or replace. If aquastat is malfunctioning and heaters are locked in, check for 24 VAC return from aquastat. Check if SCR shorted. Repair or replace as needed.
HUNTING (humidity swings above and below desired set point)	Malfunctioning control system	If there is a faulty or inaccurate humidity controller or transmitter, repair or replace. Check for proper VAPOR-LOGIC control settings: RH set point, HL set point, throttling range, cycle rate, delay time settings, PID tuning, etc. Relocate poorly located control components. (See humidity control placement drawing on page 11 for recommendations.) If inappropriate control components are being used, change components. If inappropriate control components are being used, change components. On SCR units: Control wire and power wires must be physically separated from each other. If they are not, an induced control voltage may occur, causing erratic operation.

TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
HUNTING (con't.)	Malfunctioning control system (con't.)	Verify that 4 wire modular cable is isolated from power wiring.
	Air volume varying rapidly	Stabalize.
	Air temperature varying rapidly	Stabalize ±1°F.
UNIT DOES NOT PERFORM AUTO-DRAIN SEQUENCE	System may not have automatic drain system	Inspect unit to verify that automatic drain valve was furnished.
	Drain fault, plugged drain valve or plugged drain pipe	Clean drain valve piping.
	Malfunctioning auto drain sequence	Check VAPOR-LOGIC main menu settings and reset if necessary.
	No power to automatic drain valve	Check if 24 VAC is present at VAPOR-LOGIC control board terminals 18 & 19, and drain valve.
	Defective automatic drain valve	Valve should be replaced if voltage is present at valve and it still does not open.

REPLACEMENT PARTS



OM-347

No.	Description	Qty.	Part No.
1.	Master Control Board	1	408640
2.	Slave Control Board	1	408640
3.	Reset Pushbutton (SPDT)	1	405888
4.	Digital Display Module "Local"	1	408650
5.	Digital Display Module "Remote"	1	405887
6.	Cable 4 Wire 2 6 gauge		405885
7.	Modular Cable Plug RJ11	1	405886
8.	Ground Lug	1	409250-017
8.	Ground Lug	1	409250-018
8.	Ground Lug	1	409250-019
9.	Fuse Block	1	407500
10.	Fuse - 10 amp	1	406700-010
10.	Fuse - 15 amp	1	406700-015
10.	Fuse - 20 amp	1	406700-020
10.	Fuse - 30 amp	1	406700-030
10.	Fuse - 45 amp	1	406720-045
10.	Fuse - 60 amp	1	406720-060
11.	Slave SCR 50 amp, 480 V	1	408671-001
11.	Slave SCR 50 amp, 600 V	1	408671-002
11.	Slave SCR 70 amp, 480 V	1	408673-001
11.	Slave SCR 70 amp, 600 V	1	408673-002
12.	SCR Gasket - 50 amp	1	308411

No.	Description	Qty.	Part No.
12.	SCR Gasket - 70 amp	1	308412
13.	Contactors - 30 amp	1	407001-tab
13.	Contactors - 50 amp	1	407001-tab
14.	Relay DPDT	1	407900-001
15.	Pneumatic/Electric (PE) Switch	1	408100
16.	Control Transformer 75 VA	1	408970
17.	Interlock Door Switch	1	408470
18.	Keylock	1	407100-009
19.	NEMA Cabinet	1	
20.	Terminal Strip	1	408250
21.	Subpanel	1	
22.	Power Block (310A)	1	407920
22.	Power Block (175A)	1	407600
22.	Power Block (85A)	1	408300-002
	3% Room Transmitter		405883-001
	2% Room Transmitter		405883-002
	3% Duct Transmitter		405884-001
	2% Duct Transmitter		405884-002
	Temperature Transmitter #T184 -20 to 120° F		405882
	High Temp. Transmitter #T184H -20 to 160° F		405889

GLOSSARY

Algorithm: A series of computer software equations which instruct decisions to be made and calculation to be performed.

Alphanumeric: Pertaining to a character set that contains both letters and numbers and usually other characters.

Cable (Plenum Rated): A plenum or duct rated interconnecting electrical cable with twisted pairs of wires, including shielding and grounding wire. Cable used to reduce electrical interference into sensitive electronic components.

Cold Snap: See Temperature Transmitter.

Connector Shunt: A small plastic connector used to select type of control input on VAPOR-LOGIC P.C. board.

Control Span: An output signal range where proportional action takes place. 6-9 VDC range typical for DRI-STEEM. An input signal range by others where proportional action takes place.
(6-9 VDC range, 17-117 ohm range or 5-19 mA range typical for DRI-STEEM.)

Cycle Time: The time necessary (seconds) to complete a full on - through - off period in a time proportioning control system with contactors on solid state SCR power controller.

Delay Time: Time in seconds to energize or de-energize additional output stages.

Derivative: The control action to compensate for the rate or anticipatory change of the % RH.

Droop: A term used with proportioning controls. Refers to the difference between % RH (set point) and actual % RH values once the system stabilizes.

Digital Display: An alphanumeric Digital Display / Key Pad assembly allows user to review and change the control parameters.

EEPROM: Electronically Erasable Programmable Read Only Memory chip.

Error: The difference between the desired % RH (set point) and the actual % RH value reading.

Fault Relay: A SPDT relay mounted on VAPOR-LOGIC printed circuit board, energized when a fault condition is detected.

Firmware: Software programs and instructions that are stored in memory type IC chips.

Heartbeat/ Fault Indicator: An indicator lamp mounted on VAPOR-LOGIC printed circuit board to give visual information of system operating status.

High Limit Humidistat: A controlling humidistat that is mounted in a duct to prevent a high humidity level.

Humidistat: A controlling device that regulates and maintains a degree of humidity in % RH.

Humidity Transmitter: A monitoring device that senses the humidity level and provides an output signal based on humidity level and provides an output signal based on humidity level.

Integral: The control action that allows the proportional controller to adjust the % RH to the desired set point after the system has stabilized, eliminate droop.

Local Digital Display: Digital display / key pad identified as “LOCAL” module to VAPOR-LOGIC, no connector shunt on J6.

Main Menu: The main list of items to review or change the control parameters.

Microprocessor: The control and processing portion of VAPOR-LOGIC that handles arithmetic and logic.

P.I.D.: Proportional, Integral, Derivative. A control mode with three functions. Proportional action dampens system response, integral corrects for droop, derivative seeks to prevent overshoot and undershoot.

PE Switch: Pneumatic/Electric off-on switch, pneumatic input range 3-20 psi, preset pneumatic setting for electrical switch closure.

Prompt: An alphanumeric instruction displayed on the digital read-out directing you to perform an action to proceed with the VAPOR-LOGIC software.

GLOSSARY

Proportional Band: The range in which the VAPOR-LOGIC system controls the proportioning function, expressed in percent of RH span.

Rate: See Derivative.

Reset: See Integral.

Remote Digital Display: Digital display / key pad identified as “REMOTE” module to VAPOR-LOGIC board and digital display / key pad.

Sample Interval: The specified time in seconds that the input/output values are sampled to evaluate and adjust the control function of P.I.D. control terms.

SCR Power Controller: A power regulating device that controls voltages and current to the heaters and includes a command signal board.

Scrolling: When VAPOR-LOGIC is in “Auto” mode, the digital module continually moves information across the digital display screen.

Software: The entire set of programs, procedures and related documentation associated with VAPOR-LOGIC system.

Sub-Menu: The point in the main menu where the parameters are reviewed and changed.

Temperature Transmitter: A monitoring device that senses the window glass temperature and provides an output signal based on the temperature level.

Range: -20 to 120ºF part #405882 (model T184) used with firmware V1.01 thru V1.10.

Range: -2- to 160ºF part #405889 (model T184-H) used with firmware V2.01 and higher.

Throttling Range: The span in % RH symmetrically around set point using digital display module and humidity transmitter or the control signal span from a humidistat where VAPOR-LOGIC time proportioning control action takes place.

VAV: Variable Air Volume system notation.

MAINTENANCE SERVICE RECORD

DATE INSPECTED	PERSONNEL	OBSERVATION	ACTION PERFORMED

TWO YEAR LIMITED WARRANTY

DRI-STEEM Humidifier Company ("DRI-STEEM") warrants to the original user that its products will be free from defects in materials and workmanship for a period of two (2) years after installation or twenty-seven (27) months from the date DRI-STEEM ships such product, whichever date is the earlier.

If any DRI-STEEM product is found to be defective in material or workmanship during the applicable warranty period, DRI-STEEM's entire liability, and the purchaser's sole and exclusive remedy, shall be the repair or replacement of the defective product, or the refund of the purchase price, at DRI-STEEM's election. DRI-STEEM shall not be liable for any costs or expenses, whether direct or indirect, associated with the installation, removal or re-installation of any defective product.

DRI-STEEM's limited warranty shall not be effective or actionable unless there is compliance with all installation and operating instructions furnished by DRI-STEEM, or if the products have been modified or altered without the written consent of DRI-STEEM, or if such products have been subject to accident, misuse, mishandling, tampering, negligence or improper maintenance. Any warranty claim must be submitted to DRI-STEEM in writing within the stated warranty period.

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By purchasing DRI-STEEM's products, the purchaser agrees to the terms and conditions of this limited warranty.

Engineering Humidification For 30th ANNIVERSARY 1965 to 1995 A Better Environment

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