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DISK ENVIRONMENT MONITOR™

Part Number UDE-DEM

INSTRUCTION MANUAL

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GENERAL:

The DEMTM monitors the power being supplied on the -5,+5 and 24 volt supply lines and indicates the presence of these supply voltages via LED's on the circuit board.

In addition, the DEMTM monitors the temperature of the mounting location of the DEMTM board and provides a direct digital readout of this temperature in degrees Centigrade using a standard Digital Voltmeter. On board temperature calibration is provided by a multi-turn trimmer potentiometer.

The DEMTM so contains trip point circuitry and both audio & visual alarms to provide warning signals whenever the temperature exceeds a preset trip point. This trip point is continuously variable within the range of 20 degrees to 200 degrees Centigrade by means of a multiturn trimmer potentiometer mounted on the circuit board.

Power requirements to the circuit board are +5,-5 and +24 Volts DC. These are connected via a keyed five terminal Panduit header with industry standard .1 inch spaced pins.

When used with either the III UDE-004 or UDE-TTT disk enclosures, power is connected to the DEMTM by connecting a plug in cable between the UDE DC power board and the DEMTM. This cable is provided and is connectored for keyed attachment to the Panduit strip on the DEMTM board on one end and a separately keyed Panduit strip on the DC Power board at the other end. If the user wishes to install the DEMTM in other equipment, care should be taken to assure that the proper power is connected to the proper pins of the DEMTM. Please refer to the power attachment chart shown as figure one.

THEORY OF OPERATION

The power present indicators on the DEMTM consist of three LED's and associated current limiting resistors. These are:
-5 volt supply monitor-LED 61 and current limiting resistor R69
+5 volt supply monitor-LED 62 and current limiting resistor R70
+24 volt supply monitor-LED 63 and current limiting resistor R71

All three supply voltages are normally used for the operation of the DEMTM circuits. However, if a closely regulated +5 volt supply is available, the 24 volt supply need not be used. To accomplish this, U64 is removed and a jumper is installed (as shown in the attached circuit diagram) to connect the +5V supply to the V+ bus of the DEMTM circuit board. The DEMTM requires +/- five volts for the bipolar operation of the temperature measurement portion of the circuit. These voltages should be

well regulated since any shifting of the +/- references will cause a corresponding shift in the voltage displayed on the volt meter (ie. the indicated temperature reading). Since the -5 volt supply of the UDE series of disk enclosures is normally used only for biasing of the drive logic of the disk drives connected to the system and, as such, is used at very low current levels, this supply is assumed to remain essentially constant and is used "as is" for the -5 volt requirements of the DEMTM. However, the same cannot be said for the use of the +5 volt supply. The +5 volt supply may be called upon to supply up to six amps of DC power for the various drive configurations which may be housed in the UDE. Disk drives use the 5 volt supply for their digital logic circuits and are normally specified at 5 volts +/- 10%. A ten percent variation is fine for digital circuits but is woefully inadequate for analog circuits such as the temperature section of the DEMTM.

In order to assure that the + five volt supply of the DEMTM remains constant, the +24 volt supply is dropped to +5 volts by use of an on board voltage regulator--this is U64 on the DEMTM circuit diagram.

The basic temperature sensing and measurement circuit consists of IC U60 and its associated components: R60/R61/R62/R63 & VR60. This circuit contains a single temperature measurement IC with its own internal zener regulator and a built in voltage comparator with a voltage corresponding to the temperature applied to one input and a user settable reference voltage applied to the other. However, as used in the DEMTM, the Temperature sensing IC does not use this comparator in the conventional manner but ties the reference point to ground thereby forcing the entire temperature related voltages of IC60 to be referenced about a ground point which has been made dependant upon the temperature. This allows the use of a voltmeter to monitor the temperature directly using the 2 volt measurement range and mentally shifting the displayed decimal place two positions to the right for a direct temperature reading to .1 degree Centigrade. R62 and R63 establish the offset point for the measurement IC and are selected such that the range being measured by the IC equates to the Centigrade temperature scale rather than the Kelvin temperature scale which the IC actually uses. R60/R61 then establish the rough calibration point for a voltmeter display of the temperature in degrees Centigrade and VR60 allows trimming for precise calibration of the meter. The output will provide 10 mv per degree Centigrade with a properly calibrated DEMTM. NOTE: IN THE EVENT THAT THE -5 VOLT SUPPLY VOLTAGE IS CHANGED FOR ANY REASON, THE DEMTM MUST BE RECALIBRATED FOR PRECISION TEMPERATURE READINGS. THIS WILL NORMALLY ONLY OCCUR IF THE POWER SUPPLY IS CHANGED OR IF THE -5 VOLT REGULATOR ON THE SUPPLY IS REPLACED.

Since the temperature reference has been tied to a bipolar ground, the upper V+ input point of U60 will now shift up or down depending upon the temperature sensed by the IC with 10 mv of voltage shift for each +/- ° Kelvin (or Centigrade) of temperature change.

This signal is taken from pin 4 of U60 and is used to establish the trip point for the "OVERTEMP" alarm in the DEM™. This circuit consists of the Multiturn Potentiometer VR61, fixed base point resistor R64 and smoothing capacitor C61. The setting of VR61 determines the percentage of the voltage representing temperature that will be fed into the control element of the DEM™. This control element is a portion of the Analog Switch U61. This switch is connected in a reverse manner such that a rising voltage (temperature) turns the switch "off" and a falling voltage (temperature) turns it "on". The gate of this switch is controlled by the temperature related voltage provided by U60 and the amount of voltage required to hold the gate "on" is approximately 50% of V+. Therefore, trip points can vary from approximately 10° Centigrade to over 200° Centigrade.

U62 is a conventional IC timer connected to operate in the free running multivibrator mode with a cycle time of approximately 2 Hz. This frequency is established by resistor R66 and capacitor C62. The reset (pin 4) of this timer is the control element and is connected to the temperature "trip point" portions of the circuit covered in the preceding paragraph. In operation, this reset pin is active low and will allow U62 to free run at 2 Hz as long as it remains high. When it goes low, U62 is "reset."

The output signal from U62 is taken from pin 7 (this is normally used as the discharge element for conventional timer connection and consists of an open collector transistor on the IC). However, we have reversed the normal pin 3 output signal and the discharge signals in order to provide the proper polarity gating signal to the audio tone IC (to be covered next). Another benefit derives from this circuit in that only one timing resistor need be used to establish the cycle time rather than the two usually found in circuits of this type. We are also able to directly drive the "OVER TEMP" indicator, LED 60, with this circuit and allow it to remain "on" whenever the temperature is within limits and cause it to "blink" at a 2 Hz rate when the temperature exceeds the "trip point." The only other element in this portion of the circuit is the current limiting resistor R67 which limits the current through LED60 to a safe value and acts as the pullup resistor for the open-collector output of U62.

The output from the "BLINK RATE" U62, previously discussed, is used to gate U63. U63 is an identical timer connected in exactly the same manner as U62 except that its timing period (set by R68 and C63) has been made approximately 2 KHz. This 2 KHz signal is

buffered by a portion of analog switch U61 and by Q60 before driving Piezoelectric transducer XD1. Drive power for high volumn operation of XD1 is assured by use of transistor Q60 with its collector connected directly to the +5 volt power line originally fed into the DEMTM board and use of XD1 as an emitter load. The tone signal is provided by the output from buffer U61 limited by resistor R73.

OVERALL OPERATION OF THE DEMTM

Once the DEMTM is properly connected to the multiple DC power sources and has been calibrated for use with these sources, its operation is as follows:

U60 exhibits an output voltage change which is directly related to temperature with 10 mv of voltage change for each degree Kelvin of temperature change. This output is scaled and calibrated and may be monitored on a conventional digital voltmeter connected between pin jack terminals TP60 and TP61. The voltmeter is set to the 2 volt DC scale and the readout is directly in tenths of a degree Centigrade but with the decimal place mentally moved two places to the right. The DEMTM allows the user to select an alarm "OVERTEMP" point by setting of potentiometer VR61 within the range of approximately 10 degrees to 200 degrees Centigrade. Once the trip point is established, the "overtemp" LED will blink and the audio alarm will sound whenever the temperature established by the "trip point" setting is exceeded. The LED will glow continuously and the alarm is silent as long as the temperature remains below the "trip point" value. Units calibrated by the factory are set with a trip point of approximately 50 degrees Centigrade as this is below the safe operating temperatures for most diskettes and disk drive systems yet well above the highest temperatures the UDE series of drive enclosures should develop in normal operation.

The DEMTM has a temperature sensing pad constructed on the PC board and connected such that it will prevent the sensing IC from "seeing" brief excursions in temperature such as a short blast of hot or cold air. This sensing plate will effectively buffer the temperature changes and generally attains the same ambient temperature as the DEMTM mounting location. This location has been selected as the dead air space in the upper portion of the enclosure for the UDE series of disk drive cabinets. This location provides the "worst case" temperature for the sensitive elements housed in the enclosure. The user who wishes to utilize the DEMTM with other enclosures or for other applications should carefully consider the mounting location to assure that the worst case condition is monitored.

SETUP AND CALIBRATION

POWER CONNECTIONS

Power is supplied to the DEMTM by means of a five pin Panduit header located at the rear edge of the circuit board and labeled J60. One of the pins from this connector has been cut off and the mating connector on the supply cable has been plugged so that the cable will only connect one way. DO NOT DEFEAT THE KEYED CONNECTION FOR THE POWER CABLE SINCE REVERSE CONNECTIONS OF THESE VOLTAGES WILL BLOW THE DEMTM BOARD (AND PERHAPS YOUR POWER SUPPLY AS WELL). The other end of this cable also has a five pin Panduit connector which has been keyed in a different way to connect to the standard III UDE DC POWER board. If the DEMTM is not to be used with the standard III UDE DC POWER board, be very careful to attach the various power leads to the proper voltages as shown in Figure one , below. NOTE: CONNECTION OF THE DEMTM BOARD TO ANY VOLTAGES OTHER THAN THOSE SHOWN IN FIGURE ONE ON A PIN BY PIN BASIS WILL VOID THE WARRANTY AND NECESSITATE EXTENSIVE REPAIRS TO THE UNIT.

FRONT OF DEMTM CIRCUIT BOARD

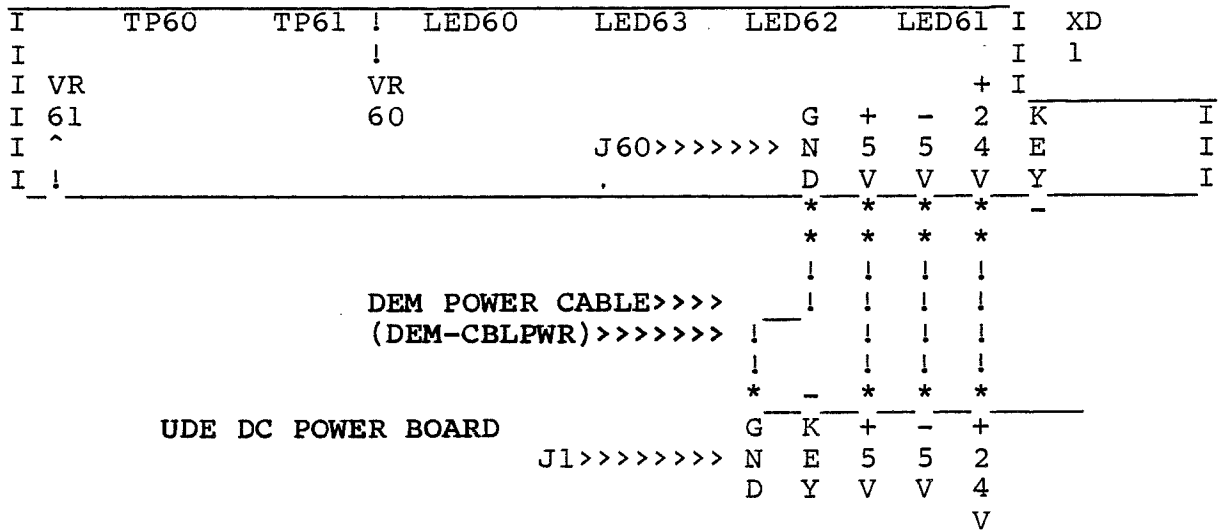


FIGURE ONE

CALIBRATION

The DEMTM is shipped from the factory fully calibrated for standard -5 volt supplies and with on board regulation of the 24 volt supply to provide a closely regulated +5 volts over wide variations in the 24 volt supply. However, the user should

consider recalibration of the DEMTM if his -5 volt supply varies more than a few millivolts from the expected value. In the case of DEMTM's shipped installed with one of the III drive enclosures, they have been factory calibrated for precisely the same supply found in the UDE itself and need be recalibrated only if the -5 volt regulator is changed for some reason.

RECALIBRATION

To recalibrate the DEMTM, proceed as follows:

- A. Connect power to the unit as specified above.
- B. Insert the voltage probes from a good Digital Multimeter into the pin jacks on the DEMTM board. The negative lead should be inserted into J60 (nearest the center of the board) and the positive lead into J61. Set the volt meter to the 2 volt DC scale.
- C. Place the pickup of a good temperature probe on the DEMTM circuit pad labeled "HEAT SENSE." This pad is just beside IC U60 on the circuit board. Note the temperature reading and then adjust potentiometer VR60 (adjusted from the rear of the DEMTM board) until the voltmeter reading agrees with the temperature meter reading. The voltmeter reading will be in degrees Centigrade with a resolution of .1 degree Centigrade and with the decimal two places to the right of that shown on the meter itself.

IF A TEMPERATURE PROBE IS NOT AVAILABLE, THE UNIT CAN BE SET TO AN APPROXIMATE VALUE BY SETTING IT FOR A READING OF .300 VOLTS (30.0 DEGREES CENTIGRADE) ON THE VOLTMETER. THIS IS AN APPROXIMATION OF THE READING WHICH SHOULD BE OBSERVED FOR THE DEMTM IN A NORMAL AIR CONDITIONED ROOM. THE REASON THAT THE DEMTM WILL BE SLIGHTLY HIGHER THAN NORMAL ROOM TEMPERATURE IS THAT THE IC ITSELF GENERATES HEAT AND RAISES THE TEMPERATURE TO A FEW DEGREES ABOVE AMBIENT IN NORMAL OPERATION.

SETTING THE TRIP POINT

The trip point has been factory calibrated for approximately 50 degrees Centigrade and need not be reset unless the user desires to have the alarm sound at some other temperature cross over point.

RECALIBRATION OF THE TRIP POINT

Should the user wish to set the temperature alarm to sound at some other temperature, perform the following:

- A. Calibrate the meter to read the temperature as outlined above.
- B. Obtain a very small bladed screwdriver to fit into the adjustment slot of potentiometer VR61.
- C. Attach a voltmeter as outlined above to observe the temperature reading for the DEMTM "HEAT SENSE" pad.
- D. Use a low wattage soldering iron to heat the "HEAT SENSE" pad on the DEMTM board.
- E. Turn the adjustment of VR61 counterclockwise until the alarm sounds and then continue to turn it clockwise keeping just above the "alarm sound" setting until the meter reads the desired temperature "trip point."
- F. Remove the soldering iron as soon as the trip point is reached. Normally, the user will not be able to make a precise setting while the "HEAT SENSE" pad is heating up since the amount of heat applied will not be well controlled. However, the setting just made will place the adjustment somewhere near the desired "trip point." Application of heat in this fashion will result in an overshoot and the temperature will stabilize at some value a few degrees above the trip point. Once it has reached this stabilization point, the temperature will begin to drop. It will drop in a much more linear manner and should allow adjustment VR61 so that the alarm just turns off as the temperature drops through the "trip point."
- G. To perform this adjustment, turn the adjustment of VR61 clockwise until the alarm just turns off when the temperature stabilizes and begins to fall. Then continue to rock the adjustment between sounding and silent as the temperature drops towards the desired trip point. As the temperature nears the trip point, adjust VR61 more frequently and within a smaller and smaller range. In this way, the alarm trip point can be easily adjusted to within a few tenths of a degree of the desired trip point.
- H. If the setting was not done precisely enough, simply repeat this procedure of heating up and cooling the "HEAT SENSE" pad while adjusting VR61 until the desired results are obtained.

PHYSICAL MOUNTING CONSIDERATIONS

The DEM™ consists of a single circuit board. This board has four pre-drilled mounting holes. This is shown in figure two, below. The UDE-004 and UDE-TTT series of disk enclosures are PEM nutted for mounting the DEM™. These are located in the center of the upper tray (the plastic front bezel attaches to this tray). These PEM nuts are located for exact mounting using the hole locations of the DEM™ and 4/40 type screws. ONLY PLASTIC OR NYLON SCREWS SHOULD BE USED. When mounting the DEM™, a plastic washer should be used underneath the circuit board between the DEM™ board and the PEM nuts to avoid shorting the circuit traces of the DEM™.

FRONT OF DEM™ CIRCUIT BOARD

I @1	TP60	TP61	!	LED60	LED63	LED62	@	LED61	I	XD
I			!				3		I	l
I VR			VR					+	I	
I 6l			60			G	+	-	2	K
I ^	@2			J60>>>>>>>	N	5	5	4	E	@4 I
I !					D	V	V	V	Y	I

Mounting Hole Locations indicated by @ followed by number 1-4

FIGURE TWO

MOUNTING LOCATIONS OTHER THAN III UDE DISK DRIVE SERIES CABINETS

The DEM™ may be used in applications other than the III Drive Enclosure Series of cabinets if the necessary power is supplied as previously discussed. The user should select a location which provides typical or worst case temperature conditions since the DEM™ mounting location is also the temperature pickup location. It is this location's temperature which will be monitored. Additionally, the indicator lights, PIN sockets and adjustments and commonly viewed or accessed controls have been mounted for access from the front of the board. For this reason, the board is usually mounted near the front edge of the host system. The actual mounting location of the board or its mounting orientation is non-critical except for the practical user considerations mentioned above.

