

## GENERAL DISCRIPTION

The Digital Instruments DI-5200 series of temperature monitors have been designed to meet the alarm and monitor requirements established in the Standards for Blood Bank and Transfusion Services. Each monitor in the DI-5200 series includes a digital status display, audio / visual alarm indicators, a power monitor with battery backup, and precision temperature sensors.



DI-5200 monitors are microprocessor controlled, designed around a state of the art 16 bit HC12 microprocessor. A real time clock with dedicated battery backup, and non-volatile data storage provide enhanced on board data logging features. An optional USB flash drive based data logging interface is also available.

The DI-5200 series temperature measurement circuitry uses a high accuracy 24bit Delta Sigma Analog to Digital converter, and proprietary self diagnostic probe(s). Through the use of hardware and software algorithms, probe cable losses and connection resistance is detected, and probe temperature accuracy is maintained. These algorithms provides the ability to change probe lengths without effecting accuracy. In addition, 50/60 Hz electrical noise, a common cause of interference, is electrically detected and filtered out of the temperature sensor circuits.

Monitors in the 5200 series include the ability to run a user initiated, automated test of the temperature monitoring system. This test is able to detect probe, measurement circuit, and alarm problems. To accomplish this, the ambient probe temperature is raised slightly above the environmental temperature, and then allowed to cool to its initial temperature. A software algorithm determines system status by analyzing temperature rise, rate of temperature change, and the monitor's alarm reaction time.

To optimize power utilization and battery backup time, a high efficiency switch mode power supply and a low loss FET power switch are used. These significantly reduce the power losses during battery backup operation, providing extended battery backup capabilities. In addition, the power supply circuitry provides user initiated timed power source switching, and battery condition monitoring. This feature is included to meet the regulatory battery monitoring and test requirements.

The basic unit operates off low voltage AC or DC power, with the option of adding an internal 120/240 Vac power supply. The backup battery is either a standard 9V alkaline (400 mAh) or optional 9V long life lithium battery (1200 mAh). The lithium battery provides 3 to 4 times the backup time, and has a 5 year operational life. Typical backup time with a fresh battery will be approximately 4 hours for the alkaline, and 12 hours for the lithium battery. Contact Digital Instruments for the availability of a higher ampacity battery, or rechargeable cell with internal charger.

DI-5200 Series Monitors are designed to provide a wide range of interface options. An electrically isolated NO/NC relay contact closure and a low voltage current loop status signal provide basic go/no go status. Legacy DTPM style remote monitors are supported by way of an industry standard Pulse Width Monitor (PWM) port. An optional Serial Data Interface is also available. This port may be configured as a TTL SPI interface, or as a NRZ serial interface. Currently, RS-232, RS-485, and 20ma current loop protocols are supported. Network, USB, and Wireless interface options will be available in the future.

All monitors in the DI-5200 Series are available in either wall mount or panel mount version. The wall mount version (pictured above) is identical in size to Digital Instrument's first generation of DTPM monitors. Panel mount configurations are available with dimensions and mounting fasteners that are identical to Digital Instrument's HP-101 monitors. In addition, custom panel size and mounting configurations are available on special request.

## MONITOR FEATURES

### TEMPERATURE RANGE:

-55°C to 50°C with temperature display increments of 0.1°C. An accuracy of 0.1°C for -10°C to 20°C and 0.3°C over the full measurement range is standard.

### ALARM TEMPERATURE SELECTION:

Two configuration methods are available to set the temperature alarm settings. A jumper on the PCB selects either the Configuration Menu or Dip Switch options.

- Menu Option – High and low temperature alarms are set using the configuration menu. The alarms are set in 0.1 degree increments, between the minimum and maximum alarm temperature settings, using the user configuration menu. A disable setting also permits disabling high, low, or both alarms.
- DIP Switch Option – One eight position DIP switch is provided for each probe channel. Four switches are used for the high alarm, and four switches are for the low alarm settings. This provides the ability to predefine 15 individual preset temperatures, and a disable setting, for the high and low alarms. The list of high and low temperature settings may each be different for the high and low lists, and each channel may have different settings. The only limitation is that the list of temperatures must be predefined at the time of manufacture, and cannot be field modified.

### TEMPERATURE OFFSET ADJUSTMENT:

Each probe channel may have a temperature offset applied to the measured temperature. If an offset is set, the temperature shown on the LCD display, and the temperature used to determine if an alarm condition exists, will contain that offset. When a probe channel has an offset applied, the temperature affected by the offset will be displayed on the LCD display in parentheses. For example, a measured temperature of +4.0°C with a -0.2°C offset will be displayed as (+3.8°C).

### DISPLAY:

2 Line by 20 character display using high contrast FSTN technology. Characters are white on a black background, and 3.2mm by 5.95MM in size. Overall viewing area is 85mm by 18.6mm.

### VISUAL INDICATORS:

- Power Status – Red/Green bi-color LED.
- Probe Status – Red/Green bi-color LED.
- Alarm Status – Red LED.

### AUDIO INDICATOR:

Solid state audio transducer, 85db @ 3100Hz. Continuous and multiple tone sequences.

## **USER KEYS:**

The standard tactile switch keyboard contains eight predefined buttons.

- Battery Test
- Probe Test
- Alarm Mute
- System Test
- Menu
- Enter
- Up Menu
- Down Menu

## **SENSORS:**

### TEMPERATURE PROBES

- Thermistor based sensor system with 4.5" x 0.186" stainless steel well. Encapsulated sensor and potted well provide liquid resistant seal.
- Built in probe cable length compensation and single mode diagnostic test circuit.
- 10' cable, shielded UL type 2464 with mini DIN molded connector.
- Precision thermistor, 0.44% / +/- 0.1°C curve track over operating range.

### DOOR AJAR SENSORS

- Two 12VDC, 20MA current loop sensors, operating in fail safe mode.
- Each sensor operates independently, and generates it's own fault indication.
- Multiple contacts may be series wired to expand the number of monitor points.
- Requires low wetting current remote switch.

## **ALARM AND STATUS INTERFACES:**

- Relay Contact – Electrically isolated normally open and normally closed contacts. Each contact is rated at 24VDC at 1 AMP. These contacts are in a forced on state during the NO/NC conditions, providing a fail safe indicator in the event of controller failure of power loss. Failure mode signaling occurs when over or under temperature conditions exist, on a low or discharged battery condition, during a power failure, or as a result of a probe or monitor failure.
- Low Voltage Current Loop – A 12V, 20-50ma status signal is available to interface with either current loop monitoring or voltage level monitoring remote devices.
- PWM Signaling – This pulse width modulated signal uses the legacy DTPM communications protocol, and compatible with existing legacy DTPMR and TMR monitoring products. The signal timing is:
  - High Temperature – 3.92ms/380us
  - Normal Operation – 2.74ms/380us
  - Low Temperature – 1.58ms/380us
  - Power Failure – 800us/400us

- Serial Data Interface – TTL standard. Optional RS232, RS423, 20ma current loop, network or RF TX data interfaces optional. Packetized data messages provide temperature, status, and fault information to remote unit or terminal. Proprietary packetized data content and formats available as an option.

**REAL TIME CLOCK AND CALENDER:**

An onboard real time clock provides an accurate time source for event and data logging. The clock is backed up using a dedicated backup battery, which has a 5 year life span. The battery is socket mounted for easy replacement. Time and date are set using the set time function in the configuration menu.

**DATA LOGGING:**

- Onboard NVRAM may be configured to save status or status and operational data. Saved data is downloaded from the unit using the serial data interface. NVRAM memory between 512 and 64,000 bytes are supported.
- Additional data logging capabilities are available using an optional USB flash of travel drive. This data logging option adds a USB connector to the side edge of the wall mount unit, or a front mount connector on the panel mount unit. USB 1.0 or 2.0 drives between 250MB and 8GB are supported.

The flash drives are formatted using FAT16 or FAT 32, and are compatible with PC or MAC USB ports. Data is saved to the drive in an ASCII format, using comma delimited fields and CR delimited messages. The message data may be imported directly into EXCEL using its data import feature.

Standard data formats include:

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Record Time</li> <li>• Record Date</li> <li>• Channel #1 Temperature <ul style="list-style-type: none"> <li>Over Alarm Temperature</li> <li>Under Alarm Temperature</li> <li>Probe Unplugged</li> <li>Probe Defective</li> </ul> </li> <li>• Channel #2 Temperature <ul style="list-style-type: none"> <li>Over Alarm Temperature</li> <li>Under Alarm Temperature</li> <li>Probe Unplugged</li> <li>Probe Defective</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Monitor Status <ul style="list-style-type: none"> <li>Low Battery</li> <li>Disconnected Battery</li> <li>Door #1 Ajar</li> <li>Door #2 Ajar</li> <li>Alarm Active</li> </ul> </li> <li>• Power Source Voltage</li> <li>• Backup Battery Voltage</li> <li>• Power-up and Restart Events</li> <li>• Unit Serial Number</li> </ul> |
|--|--|

## MONITOR MODE

Monitor mode is the default mode, and automatically entered after the unit powers up. This mode monitors probe temperature, probe condition, battery and power status, and the door ajar contacts. It also controls the generation of temperature, probe, power, and door ajar alarms.

### TEMPERATURE MONITOR

The probe temperatures are continuously monitored while the unit is in monitor mode. The temperature measured by each probe is displayed on the top line of the LCD display, with the probe #1 temperature on the left, and probe #2 on the right. The displayed temperature will be shown as a one or two digit whole number, with a single decimal digit and sign, in the form of `+TT.T°C` `+TT.T°C`. The lower line will normally display the time and date.

### TEMPERATURE ALARM MONITOR

The probe temperatures are continuously monitored, and compared to the temperature alarm settings. If the measured temperature exceeds the high temperature setting, is below the low temperature setting, or falls outside of a high/low window setting, a temperature alarm will occur. The alarm will be initiated when the fault condition occurs, and will be terminated when the temperature fault condition is resolved. If an error condition exists, the displayed message will alternate between the error message and time and date message. If multiple error conditions exist, the time and date message, and each error message will be sequentially displayed.

### PROBE MONITOR

The temperature probes and measurement circuits are continuously monitored to detect potential fault conditions. The monitoring algorithms are designed to detect disconnected or shorted probe sensors, electrical leakage current to the sensor well, and sensor characteristics that are outside of the sensor's operating parameters. These errors will generate a `PROBE #X UNPLUGED`, or `PROBE #X ERROR` message on the LCD display. In addition, probe cable resistance is dynamically monitored, and compensated for. Changes outside of the normal operating range are detected, and will generate a `SENSOR/ALARM FAILURE` on the LCD display. These messages will alternately be displayed with the time/date message, and any other error messages.

### POWER MONITOR

The main power source and back-up battery are continuously monitored. A fault condition will be generated if the main power source voltage falls below a low threshold level, if the back-up battery terminal voltage indicates a discharged condition, or if the back-up battery is disconnected. If any of these conditions occur, the power LED will illuminate red, and an `AC POWER FAILURE`, `LOW BATTERY VOLTAGE` or `DISCONNECTED BATTERY` message will be displayed on the lower line of the LCD

display. These messages will alternately be displayed with the time/date message, and any other error messages. An alarm condition will be generated, activating the alarm contact closure and audio alarm. The alarm generated by this test is automatically cleared when the fault condition is corrected.

## **DOOR AJAR MONITOR**

The two door ajar contact monitoring circuits are continuously monitored. If either or both contacts are open for a time greater than the time period set by the door ajar time setting, a door ajar alarm will be generated. An activated alarm will result in a `DOOR #1 AJAR` and/or `DOOR #2 AJAR` message(s) being displayed on the lower line of the LCD display. These messages will alternately be displayed with the time/date message, and any other error messages.

The door ajar alarms may be enabled or disabled by the door ajar settings in the configuration menu. A setting of 00 minutes enables an instant alarm whenever a door contact is activated. Settings of 01 through 20 minutes activate the alarm after a door is open for the number of minutes set. The disabled setting, located one increment above the 20 minute time setting, disables the door ajar alarms.

## **DATA AND ERROR LOGGING**

The unit maintains a real time internal record of its monitored and operational parameters. These may be saved to an external USB flash drive. Two recording functions are available.

1. **DATA LOGGING** – Data records may be saved to the flash drive on a scheduled interval. This interval is set using the Configuration Menu. Recording interval times of 1 to 20 minutes are selectable using the menu inputs. In addition, data logging may be disabled by setting the data logging interval to the disabled value. Disabling the data logging feature does not disable error logging to the flash drive. Data is saved to a file called `datalog.txt`.
2. **ERROR LOGGING** – If a flash drive is connected, a data record is saved to the drive every time a fault condition occurs, and then again when that condition is cleared. Data is saved in a file called `errlog.txt`.
3. **BOOT LOGGING** – If a flash drive is connected, the unit records each power-up and reset event. Data is saved in a file called `bootlog.txt`.

Data and error logging messages are saved on the USB flash drive in 52 character comma delimited ASCII records. Each record contains a snapshot view of the operational and monitored parameters at the time of recording. Boot Logging messages contain event time and date, the unit serial number, power supply and battery voltage and the number of times the unit has been restarted, using a 40 character format.

Data and Error records use identical formatting. The format is:

10/27/10,05:10A,+5.2C ,00000,+2.0C ,00000,00,000,00 (CR)

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| A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|
|---|---|---|---|---|---|---|---|---|

- A – Date in MM/DD/YY format.
- B – Time in HH:MM(AM/PM) format.
- C – Probe #1 Temperature in °C
- D – Probe #1 Status
  - Probe #1 offset status (0-none, 1-offset)
  - Probe #1 over alarm temperature (0-none, 1-error)
  - Probe #1 under alarm temperature (0-none, 1-error)
  - Probe #1 resistance error (0-none, 1-error)
  - Probe #1 disconnected error (0-none, 1-error)
- E – Probe #2 Temperature in °C
- F – Probe #2 Status
  - Probe #2 offset status (0-none, 1-offset)
  - Probe #2 over alarm temperature (0-none, 1-error)
  - Probe #2 under alarm temperature (0-none, 1-error)
  - Probe #2 resistance error (0-none, 1-error)
  - Probe #2 disconnected error (0-none, 1-error)
- G – Probe #2 Temperature in °C
  - Alarm status (0-off, 1-alarm)
  - Mute status (0-off, 1-muted)
- H – Probe #2 Status
  - Low battery error (0-none, 1-error)
  - Disconnected battery error (0-none, 1-error)
  - Low DC supply voltage error (0-none, 1-error)
- I – Probe #2 Status
  - Door 1 ajar (0-closed, 1-ajar)
  - Door 2 ajar (0-closed, 1-ajar)

Boot records contain the following data:

10/27/10,05:10A,000199,18.7V,8.99V,00045(CR)

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| A | B | C | D | E | F |
|---|---|---|---|---|---|
|---|---|---|---|---|---|

- A – Date in MM/DD/YY format.
- B – Time in HH:MM(AM/PM) format.
- C – Unit serial number
- D – Main power supply source voltage
- E – Backup battery voltage
- F – Power-up and restart counter



The drive is formatted using a FAT 16 format, and is compatible with PC and MAC operating systems. Data records may be imported directly into any spreadsheet software for analysis.

The USB Flash drive is interchangeable, and can be plugged in at any time. Drives should not be removed when a pending write is about to occur. It is advisable to monitor the drive status light for activity. The drive may be removed immediately after a write occurs, but before the interval time expires.

**MONITOR ERROR SIGNALING:**

The audio alarm, relay signaling, and serial status messages may be factory configured to be activated by any combination of error conditions. The default configuration is:

| ERROR CONDITION            | AUDIO ALARM | RELAY ALARM | SERIAL STATUS MESSAGE |
|----------------------------|-------------|-------------|-----------------------|
| LOW BATTERY                | Active      | Active      | LOW BATTERY VOLTAGE   |
| BATTERY DISCONNECTED       | Active      | Active      | DISCONNECTED BATTERY  |
| LOW SUPPLY VOLTAGE         | Active      | Active      | AC POWER FAILURE      |
| PROBE #1 OUT OF RANGE      | Active      | Active      | PROBE #1 OUT OF RANGE |
| PROBE #1 DISCONNECTED      | Active      | Active      | PROBE #1 DISCONNECTED |
| PROBE #2 OUT OF RANGE      | Active      | Active      | PROBE #2 OUT OF RANGE |
| PROBE #2 DISCONNECTED      | Active      | Active      | PROBE #2 DISCONNECTED |
| PROBE #1 OVER TEMPERATURE  | Active      | Active      | PROBE #1 – HIGH ALARM |
| PROBE #1 UNDER TEMPERATURE | Active      | Active      | PROBE #1 – LOW ALARM  |
| PROBE #1 OVER TEMPERATURE  | Active      | Active      | PROBE #2 – HIGH ALARM |
| PROBE #1 UNDER TEMPERATURE | Active      | Active      | PROBE #2 – LOW ALARM  |
| DOOR #1 AJAR               | Active      | Active      | DOOR #1 AJAR          |
| DOOR #2 AJAR               | Active      | Active      | DOOR #2 AJAR          |

## UNIT TEST MODE

### BATTERY TEST:

To enter battery test mode, depress and hold the BATTERY TEST button until a confirmation tone is sounded. After the button is released, the power test sequence will begin. The sequence of test events are:

- (1) The power LED will show an orange illumination, and a BATTERY BACK-UP TEST message will be displayed on the top line of the LCD display. The DC power supply voltage will be measured, and that measured voltage will be displayed on the lower LCD display line. If the voltage is above or below a nominal value, a LOW SUPPLY VOLTAGE or HIGH SUPPLY VOLTAGE warning message will be displayed. The power LED will illuminate red, a warning tone will be sounded, and the battery test will be aborted. The power LED will remain red until the fault is corrected.
- (2) The no load back-up battery voltage is measured, and it's no load condition is evaluated. A fully discharged battery will generate an ERROR - LOW BATTERY message, and a disconnected battery results in an ERROR - NO BATTERY message. Both conditions will illuminate the red power LED, sound a warning tone, and abort the power test. The power LED will remain red until the fault is corrected.
- (3) A loaded battery test is run upon the successful completion of the no load battery test. This test simulates the loss of AC power to the unit, and runs the unit on back-up battery power. During the test, the measured battery voltage is displayed on the LCD display. The battery voltage is also evaluated to determine the battery state of charge. If during a specific period of test time, the battery voltage drops below a discharged battery level, an ERROR - LOW BATTERY message is displayed. The power LED will illuminate red, a warning tone will be sounded, and the battery test will be aborted. The power LED will remain red until the fault is corrected.
- (4) If all of the battery tests were successful, the power LED will be illuminated green, and a SUCCESSFUL message will be displayed on the LCD display. After several seconds, the unit will return to monitor mode.
- (5) If the test is initiated while the unit has a pending AC power failure condition, only the DC supply voltage monitor will be operational. This may be used to trouble shoot main power source problem.

### PROBE TEST:

To enter probe test mode, depress and hold the PROBE TEST button until a confirmation tone is sounded. After the button is released, the probe test sequence will begin. The sequence of test events are:

- (1) The unit tests the power status to verify that the main power source is operational. If so, the test will proceed, and the probe test LED will be illuminated orange. If the unit is running off the back-up battery, a MAIN POWER FAULT / TEST DISABLED message will be displayed, and the test will be terminated.

- (2) The probe test mode begins by running a probe status test on probe #1. This test analyzes the measured probe resistance, to determine if the probe is connected and within its expected operational parameters. A PROBE #1 UNPLUGGED / TEST DISABLED message is displayed for a disconnected probe, or a PROBE #1 ERROR / TEST DISABLED message for an out of range probe. In addition, the probe LED will illuminate red, and a warning tone will sound.
- (3) If the initial probe test was successful, Probe #1 will be cycled through the active probe test. On entry to this test PROBE TEST #1 is displayed on the top line of the LCD display. The lower line has the current probe temperature, heating time in seconds, and cooling time in seconds, in the format of TTT.T°C H:000 C:000.
- (4) The probe will then be heated several degrees using a controlled heating cycle. Once the heating threshold temperature is reached, the heating process will terminate and the total heating time will be displayed on the LCD display. The probe will be allowed to cool to several tenths of a degree from its initial temperature, and that time will be displayed on the LCD display. A test algorithm evaluates the heating and cooling rates of change, and determines if the probe sensor, probe cables, and electronic temperature sensing circuitry are within specified limits.
- (5) If the probe test finds no problems, the tests proceeds to the test for probe #2. If a fault condition is detected, a SENSOR/ALARM FAILURE message will be displayed on the LCD display, a warning tone will be sounded, and the probe LED will be illuminated red for several seconds.
- (6) After completion of the probe #1 test, probe #2 will be tested. This begins by running a probe status test on probe #2. This test analyzes the measured probe resistance, to determine if the probe is connected and within its expected operational parameters. A PROBE #2 UNPLUGGED / TEST DISABLED message is displayed for a disconnected probe, or a PROBE #2 ERROR / TEST DISABLED message for an out of range probe. In addition, the probe LED will illuminate red, and a warning tone will sound.
- (7) If the initial probe test was successful, Probe #2 will be cycled through the active probe test. On entry to this test PROBE TEST #2 is displayed on the top line of the LCD display. The lower line has the current probe temperature, heating time in seconds, and cooling time in seconds, in the format of TTT.T°C H:000 C:000.
- (8) The probe will then be heated several degrees using a controlled heating cycle. Once the heating threshold temperature is reached, the heating process will terminate and the total heating time will be displayed on the LCD display. The probe will be allowed to cool to several tenths of a degree from its initial temperature, and that time will be displayed on the LCD display. A test algorithm evaluates the heating and cooling rates of change, and determines if the probe sensor, probe cables, and electronic temperature sensing circuitry are within specified limits.
- (9) If the probe #2 test finds no problems, the probe LED is illuminated green. After a few seconds, the unit goes back to standard monitor mode. If a fault condition is detected, a SENSOR/ALARM FAILURE message will be displayed on the LCD display, a warning tone will be sounded, and the probe LED will be illuminated red for several seconds. After a few seconds the probe LED is illuminated green the unit goes back to standard monitor mode.

**NOTE: Ambient temperature changes will affect the accuracy of the probe test diagnostic algorithm. Allow the probe temperatures, shown on the monitor mode display, to stabilize at ambient temperature before running the probe test.**

#### **SYSTEM TEST:**

To enter system test mode, depress and hold the SYSTEM TEST button until a confirmation tone is sounded. After the button is released, the probe test sequence will begin. The sequence of test events are:

- (1) LED TEST - The SYSTEM DIAGNOSTICS message will be displayed on the top line of the LCD display, and LED INDICATOR TEST on the lower line. The LED indicators will all be off, and then illuminate in the sequence of Power Red, Power Green, Probe Red, Probe Green, and then Alarm.
- (2) LCD TEST - The LCD DISPLAY message will be displayed on the lower line of the LCD display. After a few seconds, the bottom line of the LCD will clear, and then display a cyclic bar pattern.
- (3) AUDIO INDICATOR TEST - The AUDIO INDICATOR TEST message will be displayed on the lower line of the LCD display. After a few seconds, three short beeps will be sounded.
- (4) RTC TEST – The REAL TIME CLOCK TEST message will be displayed on the lower line of the LCD display. After a few seconds, tests will be run on the RTC NVRAM validity bytes. If no errors are found, test #5 will immediately be run. If an error is detected, an RTC ERROR / RECONFIGURING RTC message will be displayed on the LCD display. The unit will then attempt to correct the RTC byte errors. If the correction was successful, the RTC ERROR / RECONFIGURING RTC message is displayed for several seconds, and then the user will be prompted to reenter the time and date. If the correction was unsuccessful, RTC FAILURE / REPLACE RTC BATTERY will be displayed, and an audio warning tone will be sounded. The unit will remain in this state until the problem is corrected.
- (5) NVRAM MEMORY TEST – The NVRAM MEMORY TEST message will be displayed on the lower line of the LCD display. After a few seconds, tests will be run on the NVRAM validity bytes. If no errors are found, the unit will immediately return to temperature monitoring mode. If a any of the validity tests result in a fault condition, the unit will display NVRAM MEMORY TEST / NVRAM TEST FAILURE. An audio warning tone will be sounded. The unit will remain in this state until the unit is serviced.

## UNIT CONFIGURATION MODE

The Configuration Menu provides the ability to make the following settings:

(1) REAL TIME CLOCK TIME AND DATE - Sets the clock time and calendar date on the unit's real time clock.

(2) ALARM MUTE TIME - Alarm mute time sets the time period that the audio alarm is muted after the alarm mute button is depressed. The alarm mute time may be set to 0 minutes to disable alarm muting, or to between 1 minute and 30 minutes of alarm mute time.

(3) TEMPERATURE MONITOR #1 TEMPERATURE ALARM SETTINGS - Sets the high and low temperature alarm for temperature monitor channel #1.

(4) TEMPERATURE MONITOR #2 TEMPERATURE ALARM SETTINGS - Sets the high and low temperature alarm for temperature monitor channel #2.

(5) TEMPERATURE MONITOR #1 DISPLAY TEMPERATURE OFFSET – Sets the offset value applied to the displayed and monitored temperature for monitor channel #1. Offset values between +9.0°C and -9.0°C, in 0.1°C increments are provided. A temperature of +0000°C indicates no offset, and offset mode disabled for monitor channel #1.

(6) TEMPERATURE MONITOR #2 DISPLAY TEMPERATURE OFFSET - Sets the offset value applied to the displayed and monitored temperature for monitor channel #2. Offset values between +9.0°C and -9.0°C, in 0.1°C increments are provided. A temperature of +0000°C indicates no offset, and offset mode disabled for monitor channel #2.

(7) DOOR AJAR ALARM TIME THRESHOLD – Sets the time interval between a door ajar condition and the activation of a door ajar alarm. The time period may be set to 0 minutes to generate an immediate door ajar alarm, 1 to 20 minutes to provide a door ajar time delay, or DISABLED, to disable the door ajar alarm.

(8) DATA LOG RECORDING INTERVAL TIME - Sets the time interval for saving data records to the USB flash drive. The time period may be set to between 1 minute and 20 minutes, or disabled. A disabled setting prevents the unit from writing timed data records to the datalog.txt file on the USB flash drive. Error messages will continue to be saved to the errlog.txt file.

## **CONFIGURATION MENU USE:**

All configuration settings are done from the Configuration Menu. This menu may be accessed by depressing, and holding the MENU key, until a confirmation tone is sounded. After the key is released, the SET TIME/DATE setting prompt is displayed. This is the first option in the configuration menu, which may be noted by the presence of only a down arrow at the right side of the display. The time and date setting mode may be entered by depressing the ENTER button, or the configuration menu may be exited by depressing the MENU button.

Other setting modes may be accessed by depressing the UP or DOWN buttons. The presence of an up arrow on the right side of the display indicates that the UP button can be used to scroll up the configuration menu. A DOWN arrow on the right side of the display indicates that additional modes may be accessed by depressing the DOWN button.

The configuration menu may be exited at any time, except during the entry of time or date information in the set time/date mode. Exiting any other menu will abort the current setting process, and the data for that mode will not be changed.

## **CONFIGURATION MENU SETTINGS:**

### **(1) SET REAL TIME CLOCK TIME AND CALANDER DATE**

When the SET TIME / DATE message is displayed on the LCD display, enter the time setting mode by depressing the ENTER button. A confirmation tone will sound, and a SET HOURS prompt will be displayed. The hour value may be increased by depressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the hour value will automatically be incremented until the button is released. After the correct hour value is shown on the LCD display, depress the ENTER button to save that hour setting. A confirmation tone will be sounded, and the SET MINUTES prompt will be displayed.

Enter the minutes value by depressing the UP or DOWN button. After the correct minutes value is shown on the LCD display, depress the ENTER button to save that minutes setting. A confirmation tone will be sounded, and the SET AM/PM prompt will be displayed.

Select AM or PM, by depressing the UP or DOWN button. After the correct AM/PM setting is shown on the LCD display, depress the ENTER button to save that AM/PM setting. A double confirmation tone will be sounded, the unit time will be set, and the SET MONTH prompt will be displayed.

Enter the month by depressing the UP or DOWN button. After the correct month is shown on the LCD display, depress the ENTER button to save the month setting. A confirmation tone will be sounded, and the SET DATE prompt will be displayed.

Enter the date by depressing the UP or DOWN button. After the correct date is shown on the LCD display, depress the ENTER button to save the month setting. A confirmation tone will be sounded, and the SET YEAR prompt will be displayed.

Enter the year by depressing the UP or DOWN button. After the correct year is shown on the LCD display, depress the ENTER button to save the month setting. A double confirmation tone will be sounded, and the unit date will be set, and the UNIT will return to SET TIME/DATE in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

## (2) SET ALARM MUTE TIME

When the SET ALARM MUTE TIME is displayed on the LCD display, enter the set alarm muting time by depressing the ENTER button. A confirmation tone will sound, and a SET ALARM MUTE TIME prompt will be displayed. The alarm mute time in minutes may be increased by pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the mute time value will automatically be incremented until the button is released.

After the correct minutes value is shown on the LCD display, depress the ENTER button to save that setting. A dual confirmation tone will be sounded, and the newly set alarm mute time will be displayed on the LCD display. After several seconds, the unit will return to SET ALARM MUTE TIME in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

The alarm time may be set to values between 00 and 30 minutes. If the alarm mute time is set to 00 minutes, the alarm mute will be disabled.

## (3) SET CH#1 ALARM TEMPERATURE

The procedure used to set the CH#1 alarm temperatures are dependant on the setting of JP6. If JP6 is not installed, the temperature settings are made and verified using the menu and UP and Down buttons. If JP6 is installed, the temperature setting is made using the DIP switches on the PCB, and their setting can only be verified using the menu.

NOTE: After changing from menu to dip switch, or dip switch to menu alarm setting mode (changing the JP6 setting), the unit must be powered down and then restarted. This is necessary to reinitialize the alarm temperature configuration.

### (a) MENU TEMPERATURE SETTING (JP6 OUT)

When the SET CH#1 ALARM TEMP is displayed on the LCD display, enter the set CH#1 alarm temperature by depressing the ENTER button. A confirmation tone will sound, and a SET CH#1 HIGH ALARM prompt will be displayed. The high alarm temperature in °C may be increased by

pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the temperature setting value will automatically be incremented until the button is released. After the correct minutes value is shown on the LCD display, depress the ENTER button to save that setting. A confirmation tone will be sounded, and the SET CH#1 LO ALARM prompt will be displayed.

Enter the low alarm temperature in °C, and depress the ENTER button to save that setting. A dual confirmation tone will be sounded. A channel #1 confirmation message showing the newly set high and low alarm limits will be displayed. After several seconds, the unit will return to SET CH#1 ALARM TEMP in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

The high or low alarm settings may be disabled by incrementing the high alarm temperature to their maximum settings. These settings will show an OFF on the LCD display, in place of the temperature digits.

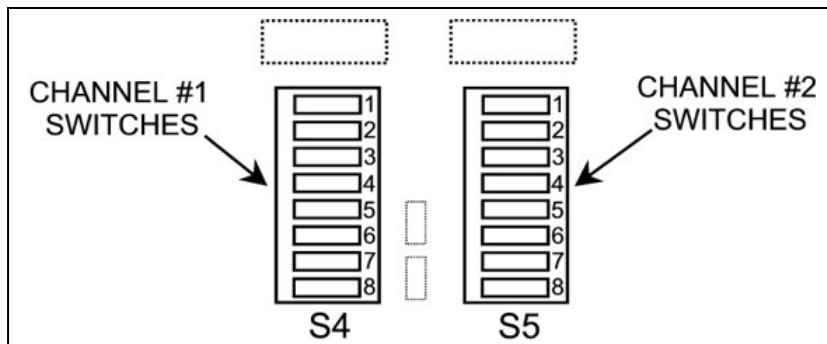
(b) SWITCH TEMPERATURE SETTING (JP6 IN)

When the SET CH#1 ALARM TEMP is displayed on the LCD display, enter the set CH#1 alarm temperature by depressing the ENTER button. A confirmation tone will sound, and a CH#1 ALARMS SET TO prompt will be displayed on the top line. The lower line will show the high and low alarm temperature settings in the format of H:TT.T°C L:TT.T°C. This displays shows continuous updates of the current temperature switch settings. Any changes to the switch settings will be immediately displayed.

The high, low or both alarm settings may be disabled by setting the respective DIP switch to DISABLE. The disabled setting will show an OFF on the LCD display, in place of the temperature digits.

To exit the switch temperature setting mode, depress the ENTER or MENU button. A confirmation tone will be sounded, and the unit will return to the main menu. A SET CH#1 ALARM TEMP message will prompt the user for the next action.

CONFIGURATION SWITCH LOCATIONS ON PCB





## TEMPERATURE ALARM SWITCH SETTINGS

| CH #1 HIGH ALARM TEMPERATURE |       |       |       |         |
|------------------------------|-------|-------|-------|---------|
| SW4-1                        | SW4-2 | SW4-3 | SW4-4 | °C      |
| OFF                          | OFF   | OFF   | OFF   | DISABLE |
| OFF                          | OFF   | OFF   | ON    | 10.0    |
| OFF                          | OFF   | ON    | OFF   | 8.0     |
| OFF                          | OFF   | ON    | ON    | 7.5     |
| OFF                          | ON    | OFF   | OFF   | 6.0     |
| OFF                          | ON    | OFF   | ON    | 5.5     |
| OFF                          | ON    | ON    | OFF   | 2.0     |
| OFF                          | ON    | ON    | ON    | 1.5     |
| ON                           | OFF   | OFF   | OFF   | 1.0     |
| ON                           | OFF   | OFF   | ON    | 0.5     |
| ON                           | OFF   | ON    | OFF   | -0.5    |
| ON                           | OFF   | ON    | ON    | -2.0    |
| ON                           | ON    | OFF   | OFF   | -5.0    |
| ON                           | ON    | OFF   | ON    | -10.0   |
| ON                           | ON    | ON    | OFF   | -15.0   |
| ON                           | ON    | ON    | ON    | -20.0   |

| CH #1 LOW ALARM TEMPERATURE |       |       |       |         |
|-----------------------------|-------|-------|-------|---------|
| SW4-5                       | SW4-6 | SW4-7 | SW4-8 | °C      |
| OFF                         | OFF   | OFF   | OFF   | DISABLE |
| OFF                         | OFF   | OFF   | ON    | 10.0    |
| OFF                         | OFF   | ON    | OFF   | 8.0     |
| OFF                         | OFF   | ON    | ON    | 7.5     |
| OFF                         | ON    | OFF   | OFF   | 6.0     |
| OFF                         | ON    | OFF   | ON    | 5.5     |
| OFF                         | ON    | ON    | OFF   | 2.0     |
| OFF                         | ON    | ON    | ON    | 1.5     |
| ON                          | OFF   | OFF   | OFF   | 1.0     |
| ON                          | OFF   | OFF   | ON    | 0.5     |
| ON                          | OFF   | ON    | OFF   | -0.5    |
| ON                          | OFF   | ON    | ON    | -2.0    |
| ON                          | ON    | OFF   | OFF   | -5.0    |
| ON                          | ON    | OFF   | ON    | -10.0   |
| ON                          | ON    | ON    | OFF   | -15.0   |
| ON                          | ON    | ON    | ON    | -20.0   |

NOTE #1: When JP6 is in (switch setting enabled), the alarm temperature settings may be changed by setting the DIP switches while in any mode. The set CH#1 alarm temperature mode is only a monitor of the switch settings, used to verify the actual temperature that each switch setting represents.

NOTE #2: Customer specified DIP switch temperature settings may be ordered as a factory installed option.

### (4) SET CH#2 ALARM TEMPERATURE

The procedure used to set the CH#2 alarm temperatures are dependant on the setting of JP6. If JP6 is not installed, the temperature settings are made and verified using the menu and UP and Down buttons. If JP6 is installed, the temperature setting is made using the DIP switches on the PCB, and their setting can only be verified using the menu.

NOTE: After changing from menu to dip switch, or dip switch to menu alarm setting mode (changing the JP6 setting), the unit must be powered down and then restarted. This is necessary to reinitialize the alarm temperature configuration.

(a) MENU TEMPERATURE SETTING (JP6 OUT)

When the SET CH#2 ALARM TEMP is displayed on the LCD display, enter the set CH#2 alarm temperature by depressing the ENTER button. A confirmation tone will sound, and a SET CH#2 HIGH ALARM prompt will be displayed. The high alarm temperature in °C may be increased by pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the temperature setting value will automatically be incremented until the button is released. After the correct minutes value is shown on the LCD display, depress the ENTER button to save that setting. A confirmation tone will be sounded, and the SET CH#2 LO ALARM prompt will be displayed.

Enter the low alarm temperature in °C, and depress the ENTER button to save that setting. A dual confirmation tone will be sounded. A channel #2 confirmation message showing the newly set high and low alarm limits will be displayed. After several seconds, the unit will return to SET CH#2 ALARM TEMP in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

The high or low alarm settings may be disabled by incrementing the high alarm temperature to their maximum settings. These settings will show an OFF on the LCD display, in place of the temperature digits.

(b) SWITCH TEMPERATURE SETTING (JP6 IN)

When the SET CH#2 ALARM TEMP is displayed on the LCD display, enter the set CH#1 alarm temperature by depressing the ENTER button. A confirmation tone will sound, and a CH#2 ALARMS SET TO prompt will be displayed on the top line. The lower line will show the high and low alarm temperature settings in the format of H:TT.T°C L:TT.T°C. This display shows continuous updates of the current temperature switch settings. Any changes to the switch settings will be immediately displayed.

To exit the switch temperature setting mode, depress the ENTER or MENU button. A confirmation tone will be sounded, and the unit will return to the main menu. A SET CH#1 ALARM TEMP message will prompt the user for the next action.

The high, low or both alarm settings may be disabled by setting respective DIP switch to DISABLE. The disabled setting will show an OFF on the LCD display, in place of the temperature digits.

## TEMPERATURE ALARM SWITCH SETTINGS

| CH #2 HIGH ALARM TEMPERATURE |       |       |       |         |
|------------------------------|-------|-------|-------|---------|
| SW5-1                        | SW5-2 | SW5-3 | SW5-4 | °C      |
| OFF                          | OFF   | OFF   | OFF   | DISABLE |
| OFF                          | OFF   | OFF   | ON    | 10.0    |
| OFF                          | OFF   | ON    | OFF   | 8.0     |
| OFF                          | OFF   | ON    | ON    | 7.5     |
| OFF                          | ON    | OFF   | OFF   | 6.0     |
| OFF                          | ON    | OFF   | ON    | 5.5     |
| OFF                          | ON    | ON    | OFF   | 2.0     |
| OFF                          | ON    | ON    | ON    | 1.5     |
| ON                           | OFF   | OFF   | OFF   | 1.0     |
| ON                           | OFF   | OFF   | ON    | 0.5     |
| ON                           | OFF   | ON    | OFF   | -0.5    |
| ON                           | OFF   | ON    | ON    | -2.0    |
| ON                           | ON    | OFF   | OFF   | -5.0    |
| ON                           | ON    | OFF   | ON    | -10.0   |
| ON                           | ON    | ON    | OFF   | -15.0   |
| ON                           | ON    | ON    | ON    | -20.0   |

| CH #2 LOW ALARM TEMPERATURE |       |       |       |         |
|-----------------------------|-------|-------|-------|---------|
| SW5-5                       | SW5-6 | SW5-7 | SW5-8 | °C      |
| OFF                         | OFF   | OFF   | OFF   | DISABLE |
| OFF                         | OFF   | OFF   | ON    | 10.0    |
| OFF                         | OFF   | ON    | OFF   | 8.0     |
| OFF                         | OFF   | ON    | ON    | 7.5     |
| OFF                         | ON    | OFF   | OFF   | 6.0     |
| OFF                         | ON    | OFF   | ON    | 5.5     |
| OFF                         | ON    | ON    | OFF   | 2.0     |
| OFF                         | ON    | ON    | ON    | 1.5     |
| ON                          | OFF   | OFF   | OFF   | 1.0     |
| ON                          | OFF   | OFF   | ON    | 0.5     |
| ON                          | OFF   | ON    | OFF   | -0.5    |
| ON                          | OFF   | ON    | ON    | -2.0    |
| ON                          | ON    | OFF   | OFF   | -5.0    |
| ON                          | ON    | OFF   | ON    | -10.0   |
| ON                          | ON    | ON    | OFF   | -15.0   |
| ON                          | ON    | ON    | ON    | -20.0   |

NOTE #1: When JP6 is in (switch setting enabled), the alarm temperature settings may be changed by setting the DIP switches while in any mode. The set CH#1 alarm temperature mode is only a monitor of the switch settings, used to verify the actual temperature that each switch setting represents.

NOTE #2: Customer specified DIP switch temperature settings may be ordered as a factory installed option.

### (5) SET CH#1 OFFSET TEMPERATURE

When the SET CH#1 OFFSET TEMP is displayed on the LCD display, enter the set CH#1 offset temperature by depressing the ENTER button. A confirmation tone will sound, and a SET CH#1 OFFSET TEMP prompt will be displayed. The CH#1 offset temperature in °C may be increased by pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the correct offset temperature setting value will automatically be incremented until the button is released. After the correct temperature value is shown on the LCD display, depress the ENTER button to save that setting. A dual confirmation tone will be sounded, and the newly set CH#1 offset temperature will be displayed on the LCD display. After several seconds, the UNIT will return to SET

CH#1 OFFSET TEMP in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

#### (6) SET CH#2 OFFSET TEMPERATURE

When the SET CH#2 OFFSET TEMP is displayed on the LCD display, enter the set CH#2 offset temperature by depressing the ENTER button. A confirmation tone will sound, and a SET CH#2 OFFSET TEMP prompt will be displayed. The CH#2 offset temperature in °C may be increased by pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the correct offset temperature setting value will automatically be incremented until the button is released. After the correct temperature value is shown on the LCD display, depress the ENTER button to save that setting. A dual confirmation tone will be sounded, and the newly set CH#2 offset temperature will be displayed on the LCD display. After several seconds, the UNIT will return to SET CH#1 OFFSET TEMP in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

#### (7) SET DOOR AJAR MODE

When the SET DOOR AJAR MODE is displayed on the LCD display, enter the set door ajar time by depressing the ENTER button. A confirmation tone will sound, and a SET DOOR AJAR TIME prompt will be displayed. The door ajar alarm time, in minutes, may be increased by pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the door ajar time value will automatically be incremented until the button is released.

After the correct minutes value is shown on the LCD display, depress the ENTER button to save that setting. A dual confirmation tone will be sounded, and the newly set alarm mute time will be displayed on the LCD display. After several seconds, the unit will return to SET DOOR AJAR TIME in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

The door ajar alarm may be disabled by incrementing the door ajar setting to it's highest setting. When set, the LCD display will display an OFF in place of the two digit numeric value. A 00 minutes setting may be used to cause an immediate alarm when the door ajar contact is opened.

#### (8) SET DATA LOGGING INTERVAL MODE

When the SET DATA LOG INTERVAL is displayed on the LCD display, enter the data logging interval time by depressing the ENTER button. A confirmation tone will sound, and an INTERVAL MINUTES prompt will be displayed on the top line of the display. The currently set interval time, in minutes, will be displayed on the lower line. This time may be increased by pressing the UP button, or decreased by depressing the DOWN button. If the UP or DOWN button is kept depressed, the interval time value will automatically be incremented until the button is released.

After the correct minutes value is shown on the LCD display, depress the ENTER button to save that setting. A dual confirmation tone will be sounded, and the newly set alarm mute time will be displayed on the LCD display. After several seconds, the unit will return to SET DATA LOG INTERVAL in the configuration menu. Use the UP or DOWN buttons to access other setting functions, or depress the MENU button to exit the configuration menu.

The data logging function may be disabled by decrementing the interval time setting to it's lowest setting. When set, the LCD display will display a DISABLED prompt in place of the two digit numeric value.

### CONFIGURATION RESET

The unit's configuration may be restored to the factory default settings by disconnecting the battery and turning off power to the unit. After several seconds, depress and hold the SYSTEM TEST button while applying power. Release the SYSTEM TEST button after a confirmation tone is heard. If the initialization was successful, an INITIALIZED NVRAM / TO DEFAULT VALUES prompt will be displayed. After a few seconds, the unit will return to monitor mode. Reconnect the battery to silence the DISCONNECTED BATTERY alarm.

NOTE: Alternate default configuration settings may be ordered as a customer specific option.

#### DEFAULT CONFIGURATION SETTINGS:

Alarm mute time: ..... 0 minutes  
Channel #1 high alarm: ..... 0.0°C  
Channel #1 low alarm: ..... 0.0°C  
Channel #2 high alarm: ..... 0.0°C  
Channel #1 high alarm: ..... 0.0°C  
Channel #1 temperature offset: ..... 0.0°C  
Channel #2 temperature offset: ..... 0.0°C  
Door ajar delay: ..... 0 minutes  
Data logging interval: ..... 5 minutes

NOTE: The unit continuously monitors the data integrity of the configuration data stored in NVRAM. If the configuration table becomes corrupted, the unit will display an illuminated block character in place of each corrupted numeric character. This may occur if the unit is powered down while configuration data is being saved to NVRAM. If this occurs, run the Configuration reset to re-initialize the configuration data table stored in NVRAM.

## ELECTRO/MECHANICAL SPECIFICATIONS

### MECHANICAL SPECIFICATIONS:

Wall Mount: 8.00"W x 4.67"H x 2.55"D

Panel Mount: 10.00"W x 6.31"H x 1.30"D

### TEMPERATURE MEASUREMENT SPECIFICATIONS:

-55°C to 50°C with temperature display increments of 0.1°C.

Temperature accuracy of 0.1°C for -10°C to 20°C and 0.3°C over the full measurement range.

### ENVIRONMENTAL REQUIREMENTS:

Operating Temperature: -10°C to 50°C (14°F to 122°F)

Storage Temperature: -10°C to 60°C (14°F to 140°F)

Humidity: 0 to 95%, Non condensing.

### POWER REQUIREMENTS:

The basic unit requires an external 12VAC source, or an unregulated 12VDC supply. Input voltage may be 10 - 15 Vrms AC, or 9 - 15 VDC. An optional internal AC supply is available. The AC supply operates at 85 – 264 VAC/47 – 440 Hz or 120 – 370VDC. The supply is certified under the following agency approvals:

- Safety Standards: UL60601-1, TUV EN60601-1, IEC60601-1 approved
- EMI: Compliance to EN55011(CISPR11), EN55022 (CISPR22) Class B
- EMS: Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN55024, EN60601-1-2, EN61204-3, medical level, criteria A.
- Harmonic Content: Compliance to EN61000-3-2,-3
- MTBF: 7 38.7Khrs min. MIL-HDBK-217F (25C)

### BATTERY REQUIREMENTS:

RTC Clock – CR2032, user replaceable, 5 year life cycle.

Main Backup – 9 Volt alkaline, user replaceable, approximate 4 hour backup, 1 year life cycle.

9 Volt Lithium, user replaceable, approximate 12 hour backup, 5 year life cycle.

### INTERFACE CONNECTIONS:

- Temperature Probes – Shielded six pin mini DIN circular connectors.
- Low Voltage Power – Two pin, 5.08mm Phoenix MSTBA header with removable screw type straight MSTB or right angle MVSTBR connector.
- Door Ajar Monitor – Four pin, 5.08mm Phoenix MSTBA header with removable screw type straight MSTB or right angle MVSTBR connector.
- Alarm and Status interface - Six pin, 5.08mm Phoenix MSTBA header with removable screw type straight MSTB or right angle MVSTBR connector.

INTERFACE CONNECTORS:

