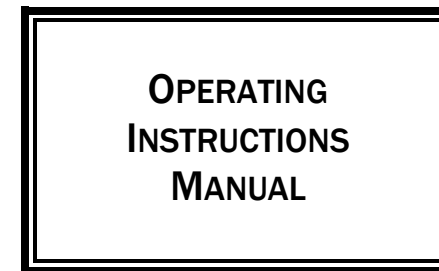


T° SENTRY MODEL 140

Digital Alarm Module



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Hampshire Controls Corporation warrants each manufactured item against defects in material and workmanship, when used as recommended, for a period of one year from original purchase. Products believed to have such defects must be returned to the factory by prepaid transportation.

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Hampshire Controls Corporation makes no other warranty, whether expressed or implied, in connection with the sale or use of its products.

Quick List of Button Functions

While in Run mode:

Press:	To:
HI/INCR	Display high temperature alarm point
LO/DECR	Display low temperature alarm point
MUTE & LO/DECR	Display software version number
HI/INCR & LO/DECR	For units with "Switch" option, display whether switch is open ("OP") or closed ("CL").
MUTE/PROGRAM	Mute alarm beeper for a short time.
MUTE/PROGRAM for 2 seconds	Bring unit into Programming mode for all parameters except Ch and SCh.
MUTE/PROGRAM & HI/INCR for 2 seconds	Bring unit into Programming mode for Ch and SCh parameters only.

While in Programming mode:

Press:	To:
HI/INCR	Increase parameter value
LO/DECR	Decrease parameter value
MUTE	Display next parameter

End of Model 140 Operator's Manual

Ch (Channel/unit ID)

This parameter allows the user to identify each 140 unit.

- “-1” means there is no temperature display on the unit; it is used only to receive an input from a switch. It operates in conjunction with the Switch Channel feature.
- “0” means that the 140 unit displays and alarms locally, but does not send any data to the CMS computer.
- “1” to “16” can be assigned as the numerical ID of each 140 unit, for use by the CMS computer.

SCh (Switch Channel)

This parameter allows the user to receive input from an additional channel that may run to a switch on the refrigeration unit or to some other source. The Switch Channel parameter ranges from 0 to 16, where

- “0” means there is no switch option on this 140 unit; it is a temperature-display only unit
- “1” through “16” refers to the switch ID that the user has assigned to the unit. This switch ID may be different from the channel/unit ID listed above.

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INTRODUCTION

The Model 140 Digital Alarm is a temperature monitoring and alarm device with user-programmable high/low alarm set points and initial alarm delay time. Parameters are stored in non-volatile memory, and are maintained even when power is removed.

The temperature readout for the Model 140 can factory-set to °C or °F. Its small size makes it easily interchangeable with the Hampshire Controls Model 125 Digital Alarm Module. It can also be readily mounted into optional custom panels, for integration with existing equipment.

The Model 140 is very simple to operate: plug in the unit, place the probe in the location to be monitored, and the display will show the temperature of that location. Pushing three buttons allows the user to program both high and low alarm set points for the temperature range.

Optional features allow the unit to send temperature data to a recorder or (through an appropriate translator), a computerized monitoring system. Please contact Hampshire Controls for details of the many possibilities!

Description of Parameters for D-Option Units:

The parameter list for the D-option 140 units is as follows:

H_i	High temperature limit (on all units)
L_o	Low temperature limit (on all units)
A_d	Alarm delay time (on all units)
SIL	Alarm silence/mute (on all units)
SA	Switch Alarm (option)
Ch	Channel (unit) identification number (option)
SCh	Switch channel (optional)

NOTE: The first four parameters are identical to the stand-alone version of the 140 (see above). The SA, Ch, and SCh parameters are only available for those units with the “D” option. To access the Ch and SCh features, start in RUN mode and press both the MUTE and HI/INCR buttons simultaneously for two seconds.

SA (Switch Alarm)

The Switch Alarm parameter allows the 140 unit to alarm when an outside switch is opened or closed. This feature displays only when the SCh parameter is set to a number other than 0. The Switch Alarm parameter can be set to:

- “-1” makes the unit alarm when the switch is closed.
- “+1” makes the unit alarm when the switch is open.
- “0” means there is no switch alarm.

rd (Relay Delay)

This parameter is used in conjunction with the relay option. If there is an alarm condition, the relay contacts will switch. The relay delay parameter allows the user to set the amount of time delay from when the alarm condition begins to when the relay contact actually switches. This keeps the relay from switching during short “nuisance alarms”. The operator may set the relay delay time for 0 to 30 seconds.

SIL (Alarm Silence, or Alarm Mute, Time)

This parameter sets the number of minutes the beeper will “chirp” when the mute button is pressed during an alarm condition. After the Silence Time elapses, if the alarm condition still exists, the beeper will begin to sound at full volume again. This parameter can be set from 5 to 120 minutes.

Unit Check

Check the serial number label on the rear of the unit to be certain that it is the proper unit for your application. The label will show model number, temperature range, probe type, and any options in the following format: 140-T-P-O.

Temperature ranges:

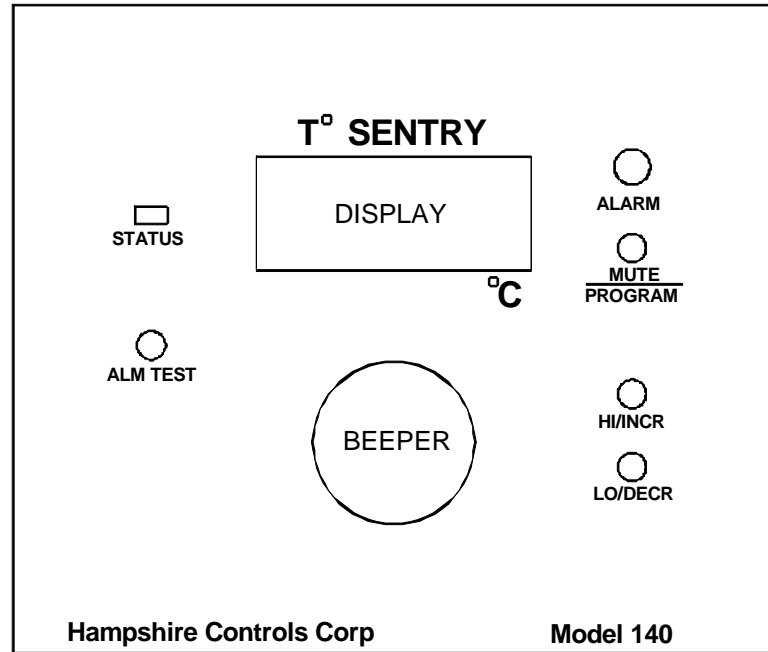
T Code	Range, °C	Range °F
100	-100 to +100 °C	-148 to 212 °F
200	-200 to +50 °C	-328 to 106 °F
400	0 to +400 °C	32 to 752 °F

Probe Types:

P Code	Probe
P100	100Ω RTD
P1000	1000Ω RTD (standard probe)
U	Micro-amp current source
K	K-type thermocouple
T	T-type thermocouple

Options:

O Code	Option
H	High resolution display (0.1 °C) (not available for every range or sensor)
R	Relay output
V	Voltage output for recorder
I	4-20 ma current output
B	NiMH battery back-up with built-in trickle charger
F	Fahrenheit calibration option
CMS	Analog computer monitoring system (used with CMS station)
D	Digital output system for computer monitoring (used with digital translator unit)
X	Custom option



PANEL

The LCD Display shows the temperature in °C or °F, depending on the option.

- If the unit has the battery-backup option, the display shows a BAT message to indicate that there has been a power loss and it is running on the battery. If the battery is low, the BAT message will blink.

The STATUS tricolor LED shows the status of the unit.

Green = normal run mode

Amber = program mode

Red = temperature is out of range

The light blinks off briefly each second to show the unit is active.

Description of Parameters for Stand-Alone Units:

The parameter list for the stand-alone 140 units is as follows:

Hi	High temperature limit (on all units)
Lo	Low temperature limit (on all units)
Ad	Alarm delay time (on all units)
rd	Relay delay (option)
Sil	Alarm silence/mute (on all units)

Hi (High Limit)

This is the high temperature limit. When in Normal Run mode, the alarm will trigger if the probe reads a temperature equal to or above the high temperature limit. The high temperature limit cannot be set above the operating temperature range of the unit.

Lo (Low Limit)

This is the low temperature limit. When in Normal Run mode, the alarm will trigger if the probe reads a temperature equal to or below the low temperature limit. The low temperature limit cannot be set below the operating temperature range of the unit.

Ad (Alarm Delay)

The Model 140 will not declare an alarm until the out-of-range state has continued for a specified time (the “alarm delay”). This alarm delay time will prevent transient nuisance alarms. The alarm delay time can be set for 0 to 30 minutes.

PROGRAMMING

To program the Model 140:

1. Hold the Mute button for two seconds to bring the unit into Programming mode.
2. The display will show the first parameter that can be programmed (high temperature limit). The name of the parameter will flash, then the current value of that parameter.
3. To change the value of a parameter, press the INCR or DECR buttons. Pressing either button will change the parameter value by one count.
4. Holding either button for half a second will change the parameter value by 10 counts. It will continue to step by ten on further button pushes, as long as the pushes occur within a short period.
5. Releasing the INCR or DECR buttons for a half second will cause the step to revert back to one.
6. Once the unit is in Programming mode, each time the Mute button is pressed, the unit steps to the next parameter. As the unit steps to the next parameter, the value of the previous parameter is saved. Once the final parameter is reached, pressing the Mute button returns the unit to Normal Run mode, saving the final parameter.

NOTE: 140 units that are part of a digital computer monitoring system ("D" option) have a different parameter list than stand-alone units.

The ALM TEST push-button interrupts line power, to allow testing of the battery and the alarm relay.

The bright red ALARM LED shows alarm conditions.

- In alarm mode, it flashes every half-second.
- In alarm mute mode, it gives a short blink every second.
- In battery mode, it gives a short blink every two seconds.

The BEEPER shows alarm conditions and user activity.

- In alarm mode, it gives a long beep.
- In alarm mute mode, it gives a short chirp.
- It gives an audible tick to indicate a button has been pressed.

The MUTE/PROGRAM button has three functions.

- In Normal Run mode, if the unit is beeping, pressing the button will mute the beeper for a preset time. Each time the button is pressed the mute time resets.
- Holding the button down for two seconds takes the unit out of Normal Run mode and into Programming mode. At the same time, it mutes the beeper.
- When in Programming mode, pressing the button steps the unit through the various programming parameters.

The HI/INCR button has a different function for each operating mode.

- In Normal Run mode, pressing the button causes the high temperature set point to be displayed.
- In Programming mode, pressing the button increases the displayed parameter value.

The LO/DECR button has a different function for each operating mode.

- In Normal Run mode, pressing the button causes the low temperature set point to be displayed.
- In Programming mode, pressing the button decreases the displayed parameter value.

UNPACKING INFORMATION

The 140 unit normally ships with the probe connected.

If the unit has the battery back-up option, the battery is disabled before shipping.

NOTE: Remove the tagged screw in the side of the 140 box to enable the battery. Assume the battery is discharged, and allow it to charge for at least 24 hours to ensure full capacity.

OPERATIONAL CHECK

1. Plug the Model 140 into a 110-120 volt power outlet. If the air temperature is within the unit's operating range, the display should show the current probe (air) temperature.
 - If the display is blank, check to make sure that power is going to the unit. If the STATUS LED is lit (any color), the Model 140 has power. If not, verify that the power supply is plugged into the unit and into line power.
2. Hold the sensing part of the probe tightly in your hand. If your body temperature is within the unit's operating range, the displayed temperature should begin to go up. It will take several seconds to level off.

If the Model 140 does not respond as it should, call Hampshire Controls for assistance.

Testing the battery:

The battery recharges when the unit is plugged into line power. To test the battery, push the ALM TEST button on the front panel. The following should happen:

- The tricolor LED will flash red.
- The beeper alarm will begin to chirp.
- On units with the relay option, the relay will switch.

Analog Computer Monitoring System Option (CMS)

This computer monitoring option is generally used for the older Model 125 temperature alarm; however the Model 140 may be added onto an existing Model 125 CMS system.

With the CMS option, one central computer monitors a number of external analog-to-digital data converters (A/D stations), communicating by way of a single twisted pair line. Modem interfaces allow monitoring of remote locations. Hampshire Controls provides a microcomputer-based system for monitoring up to 225 points, or can also provide a microprocessor-based system that is capable of monitoring up to 32 points.

Digital Computer Monitoring System (D)

This computer monitoring option is the preferred system for Model 140 Temperature Alarm units.

With the D option, one central computer monitors a number of external units via digital translators. Modem interfaces allow monitoring of remote locations. Hampshire Controls provides a microcomputer-based system for monitoring up to 225 points, or can also provide a microprocessor-based system that is capable of monitoring up to 32 points.

Voltage Output Option (V)

The V option sends out a millivolt signal that is proportional to the temperature being monitored. The standard output is 10 mv per degree C, with 0 mv at 0 °C. For example, if the monitored temperature is +37 °C, the voltage output is +370 mv (0.370 v). If the monitored temperature is -20 °C, the voltage present at the V option connector is -200 mv (-0.200v).

NOTE: This voltage output signal is intended for recorders and data loggers only. Do not try to use this voltage to operate other devices directly.

The input impedance of the apparatus using the voltage signal should not be less than 100K ohms.

Current Output Option (I)

The I option sends out a milliamp signal that is proportional to the temperature being monitored. The I option is calibrated so that the units sends out 4 ma at the low limit of the unit's temperature range, and 20 ma at the high limit of the unit's temperature range.

Battery Back-Up (B)

Model 140 units that have the battery back-up option ship with the battery in place and connected, but disabled. Remove the screw located on the outside of the left side of the module to activate the battery option.

When line power is present, all of the normal features of the Model 140 are operating. When line power is lost, the battery provides power to maintain two important functions:

- Operate the audio and visual alarms. They flash/beep less frequently than usual, in order to avoid draining the battery.
- Continue to display the temperature of the area being monitored. The display will flash, to save power.

BASIC OPERATION

The Model 140 has two modes: operating and programming. This section describes the unit in Operating Mode.

In operating mode, the display shows the temperature that the probe is reading. The display does not "round off" the temperature. If it shows a value of 10.0°, the actual temperature can range from 10.0° to 10.9°. Therefore, a very small system change of 0.1° or less (or a minor electronic disturbance) may cause the displayed temperature to change one digit. It is only when the displayed change holds steady for more than 20 seconds that it can be related to real thermal changes in the probe.

Press the push button labeled "HI/INCR" to cause the display to show the high temperature set point.

Press the push-button labeled "LO/DECR" to cause the display to show the low temperature set point.

Press the MUTE and LO/DECR buttons at the same time to cause the display to show the software version number. It will be different from the temperature display in that it will show two decimal places, such as "1.01".

If the unit has the "Switch" option, press the HI/INCR and LO/DECR buttons together to cause the display to show if the switch is open ("OP") or closed ("CL"). When the buttons are released, the display will go back to showing the temperature.

The Model 140 compares the probe's temperature reading to the set points for out-of-range states. An out-of-range state is a temperature that is "equal to or beyond the set point". For instance, if the low set point is 0.0, then the temperature reading is out-of-range for 0.0° and below. The STATUS LED glows green when the probe reads an in-range temperature and red when the temperature is out of range.

The Model 140 will not declare an alarm until the out-of-range state has continued for a specified time (the “alarm delay”). This alarm delay time will prevent transient nuisance alarms.

When an alarm condition occurs, the beeper and LED will both begin. Press the MUTE/PROGRAM button to stop the beeper for a specified time, changing the sound to short ‘chirps’. When the temperature goes back within range and there are no out-of-range readings for thirty seconds, the chirping stops and the MUTE/PROGRAM button resets. If another out-of-range condition then occurs, the beeper will again start at full volume.

After the user-programmable “SILENCE” parameter times out, if the Model 140 is still in a constant alarm condition, the beeper will go back to full volume.

SENSOR PROBE

The probe supplied with the Model 140 is a highly accurate temperature sensor. The sensor may be put in water or other mild aqueous solutions from 0 °C to 100 °C.

NOTE: Avoid submerging the probe in solvents or harsh chemicals. Use protective thermo wells when monitoring such materials.

NOTE: The warranty does NOT cover damage to probes or electronics that is caused by exceeding temperature limitations, or damage to probes caused by using them in solvents or other unsuitable environments.

NOTE: If the display shows a continuous reading of a very low number (for example, -450), the probe has failed. Replace the probe and recalibrate the unit.

OPTIONAL FEATURES

High Resolution Display (H)

The high-resolution option allows temperature monitoring and alarm setting to 0.1°C. All of the Model 140 standard features remain the same.

Fahrenheit Option (F)

The standard 140 displays temperature in degrees Celsius. The “F” option indicates that the unit is calibrated and displays degrees Fahrenheit.

Relay Option (R)

The relay option consists of a single-pole double-throw (SPDT) relay that changes state (switches) with the loss of line power or with the presence of an alarm condition.

NOTE: The relay is rated for pilot duty operation only. Do NOT use it for control switching. The relay contacts and connections are rated at 30v/1A.

In normal applications, the relay signals remote or central monitoring systems that an alarm condition has occurred at the equipment being monitored.

If the 140 unit has the relay option, the relay will “pull-in” when line power is present. If an alarm condition lasts for a designated time (the “relay delay”), the relay will “drop out”, causing the relay contacts to switch. If the alarm condition does not last long enough for the relay delay to time out, the relay will not go into its alarm position. The relay will also “drop out” if power to the alarm is lost, acting as a power loss detector. When the main power to the alarm is lost, the bicolor LED on the upper left of the panel will go dark.

NOTE: Mute button, beeper or LED activities do not affect relay status.

NOTE: If this higher temperature is changing rapidly, it will be difficult to make an accurate adjustment. One technique to slow the rate of change is to use an insulated container (Dewar flask or Thermos bottle), and keep the probe/thermometer near the bottom while stirring gently.

- 1.1. The SPAN and ZERO adjustments are interactive, therefore recheck the ZERO setting. Readjust if needed and then recheck the SPAN adjustment.

NOTE: No potentiometers other than the ZERO and SPAN should be adjusted in the field. Factory recalibration of units that have been incorrectly adjusted is not covered by warranty.

Probe Installation

The probe may be used in air or in simulated product, as long as the product does not contain solvents or reagents that attack polyvinyl or epoxy (see above).

If installing the sensor in a refrigerator, try to place the probe in a water and glycol chlorine solution to keep bacteria from forming.

If installing the sensor in a cabinet or enclosure (particularly freezers), make sure to use good techniques to prevent room moisture from getting into the cabinet. Whenever possible, install the probe through an existing access port provided by the cabinet manufacturer, then reseal the port.

Alternatively, the probe can be run under, over, or through the door-sealing gasket. Often a door gasket will have a joint at one or more corners. Open that joint slightly by carefully making a slit with a razor blade. Insert the flat probe wire and then reseal the joint with flexible silicone sealing compound. Inside the cabinet, run the probe wire so that it will not become snagged during loading, unloading or cleaning procedures.

Probe Location

Install the sensor probe in a location where it will respond to the average temperature of the space being monitored and not to local conditions caused by door openings, etc.

The object of the probe location is to provide a certain amount of safety for the area being monitored without generating "false" or nuisance alarms. For example, locating the sensor probe on the bottom of a chest freezer will result in the alarm being sounded later than if it was located near the top. However, locating the sensor too close to the top of the chest freezer could result in the alarm being sounded due to routine lid opening. Choose a probe location that offers the safety desired for the enclosure contents.

Probe Calibration

The temperature sensor used in the Model 140 has excellent long-term stability and should not need recalibration in normal usage. However, if the probe is subjected to temperature extremes outside of the normal operating range for the unit, or if the probe is damaged and must be replaced, it must be recalibrated.

To recalibrate the Model 140, follow these directions:

Equipment Needed:

- Small flat screwdriver or potentiometer adjuster
- Water bath, in an insulated container and at a KNOWN temperature different from 0 °C. Use a thermometer you can trust.
- Ice water bath, with plenty of clean solid ice in it. The following bath will provide a temperature of 0°C to within $\pm.04^\circ$:
- Use an insulated Thermos container to contain the bath.
- Get an ordinary aquarium bubbler. It should have a “stone” in it to make little bubbles rather than big ones. Put the end of the bubbler hose in the bottom of the Thermos container.
- Place cold water in the container, with plenty of ice. The water and ice should be distilled water, since water with impurities in it freezes at a temperature below 0°C.
- Start running the bubbler.
- Use this water bath rather than just putting the sensor on plain ice because the plain ice will probably be colder than 0°C (freezers generally operate at -20°C). The air from the bubbler keeps the water moving over the ice. The ice chills the water, but since the water is kept moving by the bubbler it doesn't freeze. The cold of the ice keeps it right at the freezing point, which for distilled water is 0°C.

1. Set up the unit for calibration:

- 1.2. Disconnect the unit from its power source.
- 1.3. Unscrew the four corner screws on the front panel. Carefully remove front panel from box. Turn it over and lay it down to the right of the case. The circuit board of unit is exposed to view.
- 1.4. Plug the unit into a 110-120 volt power supply.

2. Adjust the Zero Point:

- 2.1. Stir the ice water bath and place the temperature probe in it. Let the probe sit in the bath for about 5 minutes to allow it to stabilize at temperature.
- 2.2. Locate the adjustment potentiometers (pot) on the left edge of the board. One of the adjustment potentiometers will be marked with a “0”. This is the ZERO adjust. Another will be marked with an “S”. This is the SPAN adjust.
- 2.3. Turn the “0” adjustment pot with a small screwdriver until the display reads 0 (or 0.0 for H option models). Try to “center” 0 by turning a little past until a 1 or –1 appears, estimating the distance moved, and then returning the pot to a point where 0 just appears on the display.

3. Adjust the Span:

- 3.1. Using a rubber band or masking tape, join the sensor probe and the thermometer so that their sensing tips are as close together as possible.
- 3.2. Stir the probe/thermometer in the water bath. Allow time for the probe and the reference thermometer to stabilize.

Turn the “S” adjustment pot until the reference thermometer and the display agree. Use the same “centering” technique outlined under the zero adjust instructions.