

MODEL 2000T

Initial Draft

TEMPERATURE DISPLAY AND COMMAND MODULE



- On-board temperature sensor.
- Mounts on any standard single-gang wiring conduit box.
- Compact, thin and stylish design. Only 2.8" W x 4.55" H x 0.79" D
- Sensing element is isolated from electronics for more accurate air temperature measurement.
- Implements LonMark 8090 Profile.
- Open communication standard using LONWORKS® Protocol
- All outputs available using Standard Network Variables (SNVT)
- HVAC Mode Control and display
- Temperature averaging using up to 4 network attached sensors.
- Setpoint display and modification
- Supports user lockout via network
- Display of outdoor temperature
- Occupancy status display and control
- Auxiliary network switch output control to control network attached devices such as lights or exhaust fans.

DESCRIPTION

The Model 2000T is an indoor temperature sensor, display and user interface. It allows occupants of a temperature-controlled environment to interact with the HVAC equipment via the LonWorks communication protocol. Occupants can view room temperature, current temperature setting, outside air temperature, equipment operating status, and equipment alarms.

Using the Model 2000T, the occupant can change the HVAC operating mode, the occupancy mode, as well as the temperature setpoint. For maximum compatibility the Model 2000T is implemented using the LonMark 8090 profile for Space Comfort Control Command Module.

The Model 2000T has unique features to allow more accurate reporting of room temperature to the HVAC equipment. One, the on-board temperature sensor is located away from the electronics in a separate compartment. This allows a more accurate measurement of air temperature. Two, a temperature averaging function allows up to four temperature sensors to be averaged before the room temperature is reported. This is important for large rooms, office buildings, or homes where the location of a single thermostat does not provide a good representation of the average temperature.

A feature of the Model 2000T allows the occupancy button to be used as an on/off switch to control other network attached devices.

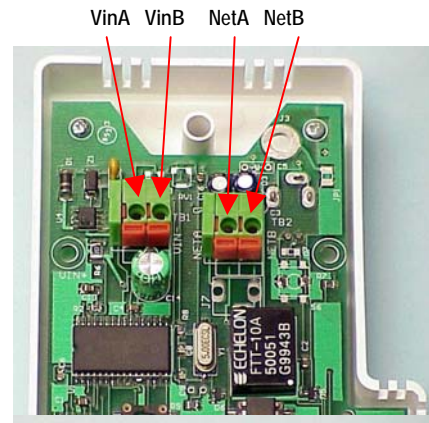
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WIRING AND INSTALLATION

The Model 2000T is supplied with two two-position terminal blocks. The first terminal block is used to connect power. The second is used to connect the network communication channel. For convenience, the Model 2000T accepts either low voltage AC or DC power. The input power and network wiring pairs are not polarity sensitive and the wiring can be reversed.

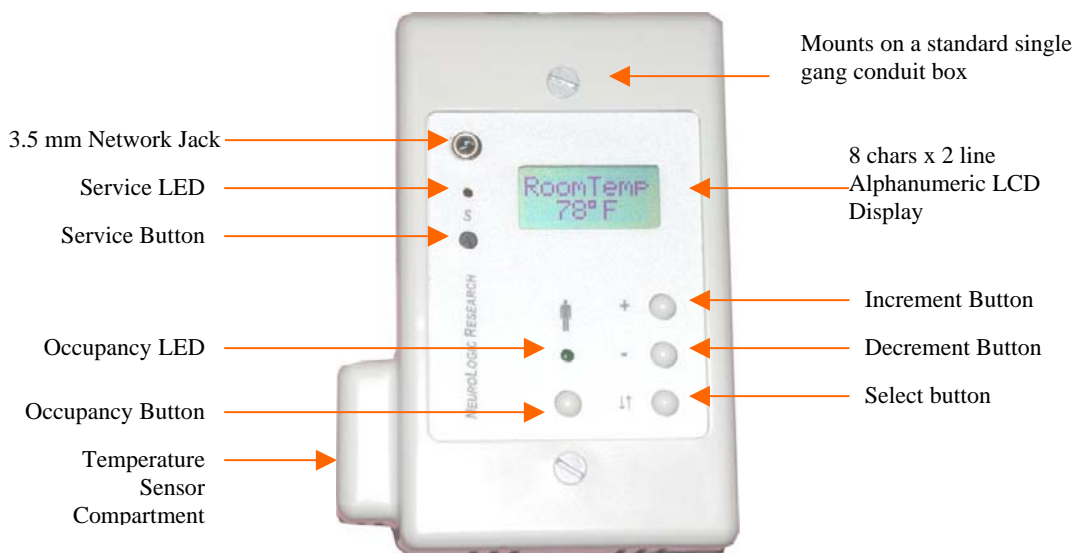
The on-board Service switch and LED allows installation on to the LONWORKS network. A 3.5 mm jack allows installers to connect to the network for configuration or local monitoring without disturbing the main wiring.



Please note, due to memory limitation the Model 2000T does not contain self-documentation of the network variables. Therefore, the 2000Txxx.XIF file must be used to perform the network installation. The XIF file contains all the needed documentation to commission the device.

The entire unit mounts directly to any standard single-gang wiring conduit box. Please see the diagram below for an overview of the user interface. By default, the Model 2000T will display room temperature in degrees Fahrenheit. However, this can be changed along with many other parameters to tailor the operation of the Model 2000T to the installation. Most customization parameters must be done via the network interface and are not available to the user. Please see the following sections for more detail.

Normally, the display will cycle between any active parameters such as room temperature, outside temperature, temperature setting, and date/time. Many of these values are only displayed if network updates are received. To view configuration parameters, press the Select Button. To modify a configuration, use the Increment and Decrement Buttons to change the value. If no buttons are pressed for 5 seconds, the edit mode will be aborted and any modified parameters will be sent to the HVAC equipment. Note, using the Select Button only displays the configuration parameters but does not change them.



ROOM TEMPERATURE DISPLAY, MEASUREMENT AND AVERAGING



Under normal operation, the Model 2000T displays the room temperature as shown. It measures and reports the current room temperature to other devices via the nvoSpaceTemp output network variable. On power-up, and by default, the on-board temperature sensor is used. If needed, the local temperature sensor can be calibrated using nciTempOffset configuration network variable. Under all modes, the local temperature sensor measurement is reported to the network via the nvoLocalTemp output network variable.

If a valid temperature is written into the nviSpaceTemp input network variable, it will override the local temperature sensor. The Model 2000T has three additional input network variables, nviSpaceTempAvg[3]. If received and are valid, will be used in addition to either nviSpaceTemp or the local temperature sensor. This is done automatically by the Model 2000T firmware. To average the local temperature sensor with other remote sensors, do not write to nviSpaceTemp. Instead, write to one of the nviSpaceTempAvg inputs.

The Model 2000T firmware does not require that nviSpaceTemp or nviSpaceTempAvg[] inputs be bound. However, if nciRcvHrtBt is non-zero it will be used to time-out any updates. When a temperature input times out, it will be reset to 327.7 degree C and will be ignored.

By default, all temperatures are displayed in degrees Fahrenheit. If degrees C are desired, set the nciDispInDegC configuration network variable to ST_ON.

DISPLAY OF EFFECTIVE TEMPERATURE SETPOINT



If valid, the effective temperature setpoint will be displayed as shown. The effective temperature setpoint is derived by the HVAC equipment and is received by the Model 2000T via the nviEffectSetpt network variable. This setpoint is influenced by pre-defined occupancy schedules, cooling setpoints, heating setpoints, operating mode as well as input from occupants.

It is not required for the Model 2000T to receive the effective temperature setpoint. On power-up and by default this value is set to 327.7 degrees C and is considered invalid. The Model 2000T firmware does not require that nviEffectSetpt be bound. However, if nciRcvHrtBt is non-zero it will be used to time-out any updates. When it times out, nviEffectSetpt will be reset to 327.7 degrees C and will not be displayed.

DISPLAY OF OUTDOOR TEMPERATURE



If valid, the outdoor temperature will be displayed as shown. The outdoor temperature is received by the Model 2000T via the nviOutdoorTemp network variable.

It is not required for the Model 2000T to receive the outdoor temperature. On power-up and by default this value is set to 327.7 degrees C and is considered invalid. The Model 2000T firmware does not require that nviOutdoorTemp be bound. However, if nciRcvHrtBt is non-zero it will be used to time-out any updates. When it times out, nviOutdoorTemp will be reset to 327.7 degrees C and will not be displayed.

DISPLAY OF DATE AND TIME



If valid, the date and time be displayed as shown. The date and time is received by the Model 2000T via the nviTime network variable. It is not required for the Model 2000T to receive nviTime. On power-up and by default this value is zeroed and considered invalid. The Model 2000T firmware does not require that nviTime

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be bound. However, nviTime must be updated at least once every 2.5 minutes or it will be zeroed out and ignored. The 2.5 minute period is not configurable and insures that time will always be valid.

Time display defaults to 12-hour am/pm format. To display in 24-hour format, set the nciDisp24HrTime configuration network variable to ST_ON.

Date display defaults to month first followed by day. To display day followed by month, set nciDispDayFirst configuration network variable to ST_ON.

DISPLAY OF HVAC SYSTEM STATUS



If available, the HVAC equipment status will be displayed in the lower right hand corner of the display. The equipment status is received via the nviUnitStatus input network variable. It is derived by the HVAC equipment to indicate whether it is heating, cooling, off and so on. If nviUnitStatus is not available or invalid, it will be displayed as shown above with a blank character. Note, HVAC_AUTO, HVAC_OFF, or any other condition that is not defined below, will also be displayed as a blank.



A flame symbol, as shown, will be displayed to indicate heating operation. It is displayed for system modes of HVAC_HEAT and HVAC_MERG_HEAT.



A snowflake symbol, as shown, will be displayed to indicate a cooling operation. It is displayed for system modes of HVAC_COOL and HVAC_PRE_COOL.



A fan symbol, as shown, will be displayed to indicate the system is operating in fan only mode. It is displayed if the system mode is HVAC_FAN_ONLY.



If the equipment indicates an alarm condition, 'A' will be displayed as shown. The 'A' and one of the system mode symbols described above will alternate.

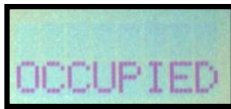
It is not required for the Model 2000T to receive nviUnitStatus. On power-up and by default the system mode is set to HVAC_NUL and ignored. The Model 2000T firmware does not require that nviUnitStatus be bound. However, if nciRcvHrtBt is non-zero it will be used to time-out any updates. When it times out, the mode will be reset to HVAC_NUL will not be displayed.

OCCUPANCY BUTTON OPERATION AND CONTROL OF AUXILIARY DEVICES

Occupants can use the Occupancy Button to send manual occupancy commands to the HVAC equipment. While working late, occupants can change the normally scheduled occupancy mode. Manual occupancy requests are sent via the nvoOccManCmd output network variable. The nvoOccManCmd is only sent when changed and is set to OC_NUL on power-up.



If the Occupancy Button is pressed for less than two seconds, OC_BYPASS will be sent and the display will be as shown.



If the Occupancy Button is pressed for more than two seconds but less than 5 seconds, OC_OCCUPIED will be sent and the display will be as shown.

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If the Occupancy Button is pressed for more than two seconds but less than 5 seconds, OC_UNOCCUPIED will be sent and the display will be as shown.

Setting the nciNoOccControl configuration network variable to ST_ON disables occupancy control.

The Occupancy Button also drives the nvoSwitch and nvoDiscSwitch network variables. This can be handy to alternately use the occupancy button to control exhaust fans or light without having to add an additional switch. If the Occupancy Button is pressed for less than five seconds and then released, nvoDiscSwitch and nvoSwitch will be set on. They are both provided since different network devices required different network variable types. If pressed for more than 5 seconds they are turned off.

Note, that the on state corresponds to a Bypass or Occupied mode, which usually correlates to occupants being in the room. The off state corresponds to unoccupied and usually implies occupants are not in the room.

DISPLAY OF EFFECTIVE OCCUPANCY MODE OR AUXILIARY SWITCH STATE

The effective occupancy mode of the HVAC equipment is displayed via the Occupancy LED. The effective occupancy mode is received via the nviEffectOccup input network variable. If nviEffectOccup is not available or invalid, the Occupancy LED will be off.

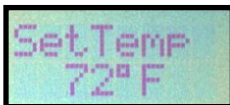
It is not required for the Model 2000T to receive nviEffectOccup. On power-up and by default the effective occupancy is set to OC_NUL and ignored. The Model 2000T firmware does not require that nviEffectOccup be bound. However, if nciRcvHrtBt is non-zero it will be used to time-out any updates. When it times out, the effective occupancy will be reset to OC_NUL will not be displayed.

The following is a table describing the LED display stated under different effective occupancy conditions.

Occupancy LED	Effective Occupancy
Off	OC_NUL, or any other value not shown below
On	Occupied mode.
One flash per second	Bypass mode.
Two flashes per second	Standby or unoccupied.

Alternatively, the Occupancy LED can reflect the state of nvoDiscSwitch and nvoSwitch states. Setting the nciLedIsSwState configuration network variable to ST_ON enables this function.

CHANGING THE TEMPERATURE SETPOINT



Press the Select Button and the display will be as shown. Press the Increment/Decrement button to select the desired temperature. When the display returns to the normal display mode, the new setpoint will be sent to the HVAC equipment via the nvoSetpoint output network variable.

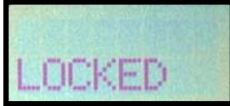
The minimum allowed setpoint is controlled by the nciMinSetpt configuration network variable, which defaults to 10 degrees C or 50 degrees F. The maximum is controlled by the nciMaxSetpt configuration network variable, which defaults to 35 degrees C or 95 degrees F.

CHANGING THE SYSTEM MODE



Press the Select Button until the display is as shown. Press the Increment/Decrement Buttons to select the desired mode. The following modes can be selected: Auto, Heat, Cool, Fan and Off. When the display returns to the normal display mode, the new mode will be sent to the HVAC equipment via the nvoHeatCool output network variable. This value is saved in non-volatile memory. You can disable the ability of occupants to change the system mode by setting the nciNoModeControl to ST_ON.

LOCKING OUT USERS



The HVAC equipment can lockout occupants from making changing by setting the nviUserLockout input network variable to on. While on, attempts to modify the system mode or temperature setpoints will display the message show. However, nviUserLockout does not disable operation of the Occupancy Button.

NETWORK INTERFACE

CONFIGURATION NETWORK VARIABLES

Network Variable	Format	Description
nciRcvHrtBt	SNVT_time_sec	Receive heart beat time. Default is 0.
nciSndHrtBt	SNVT_time_sec	Send heartbeat. Maximum time between output network updates even if no changes occur. Default is 0 or disabled
nciMinOutTm	SNVT_time_sec	Minimum allowed send time or throttle between temperature output updates.
nciTempMinDelta	SNVT_temp_p	Minimum temperature send delta. Default is 0.
nciTempOffset	SNVT_temp_p	Local temperature sensor calibration offset. Default is 0.
nciDispInDegC	SNVT_lev_disc	If ST_ON, display is in degrees C. Default is ST_OFF
nciDispDayFirst	SNVT_lev_disc	If ST_ON, date display is day followed by month. Default is ST_OFF for month followed by day.
nciDisp24HrTime	SNVT_lev_disc	If ST_ON, displays time in 24 hour format. Default is ST_OFF
nciNoOccControl	SNVT_lev_disc	If ST_ON, disables use of Occupancy Button to control nvoOccManCmd. However, does not affect control of nvoDiscSwitch and nvoSwitch. Default is ST_OFF
nciNoModeControl	SNVT_lev_disc	If ST_ON, does not allow occupant to change system mode. Default is ST_OFF
nciLedIsSwState	SNVT_lev_disc	If ST_ON, the Occupancy LED reflects the state of nvoDiscSwitch and nvoSwitch. Default is ST_OFF for display of nviEffectOccup.
nciMinSetpt	SNVT_temp_p	Minimum allowed temperature setpoint. Default is 10 C.
nciMaxSetpt	SNVT_temp_p	Maximum allowed temperature setpoint. Default is 35 C.

INPUT NETWORK VARIABLES

Network Variable	Format	Description
nviSpaceTemp	SNVT_temp_p	Room temperature over-ride to local temperature sensor.
nviUserLockout	SNVT_switch	If on, locks out occupant from making setpoint and system mode changes. Occupancy button is not affected.
nviTime	SNVT_time_stamp	Date/time to be displayed. Use nciDisp24HrTime, nciDispDayFirst to control the display format.
nviEffectSetpt	SNVT_temp_p	Effective setpoint input from HVAC equipment and used for display.
nviEffectOccup	SNVT_occupancy	Effective occupancy input from HVAC equipment and used for display.
nviUnitStatus	SNVT_hvac_status	Unit operating status from HVAC equipment.
nviOutdoorTemp	SNVT_temp_p	Input from an outside air temperature sensor.
nviSpaceTempAvg[3]	SNVT_temp_p	Temperature inputs from other room sensors for averaging.

OUTPUT NETWORK VARIABLES

Network Variable	Format	Description
nvoSetpoint	SNVT_temp_p	Absolute temperature setpoint output.
nvoSpaceTemp	SNVT_temp_p	Measured room temperature.
nvoHeatCool	SNVT_hvac_mode	Occupant commanded system-operating mode.
nvoOccManCmd	SNVT_occupancy	Occupant commanded occupancy mode.
nvoLocalTemp	SNVT_temp_p	Output of local temperature sensor.
nvoDiscSwitch	SNVT_lev_disc	Auxiliary switch output controlled by Occupancy Button.
nvoSwitch	SNVT_switch	Auxiliary switch output controlled by Occupancy Button.

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GENERAL SPECIFICATIONS

Temperature

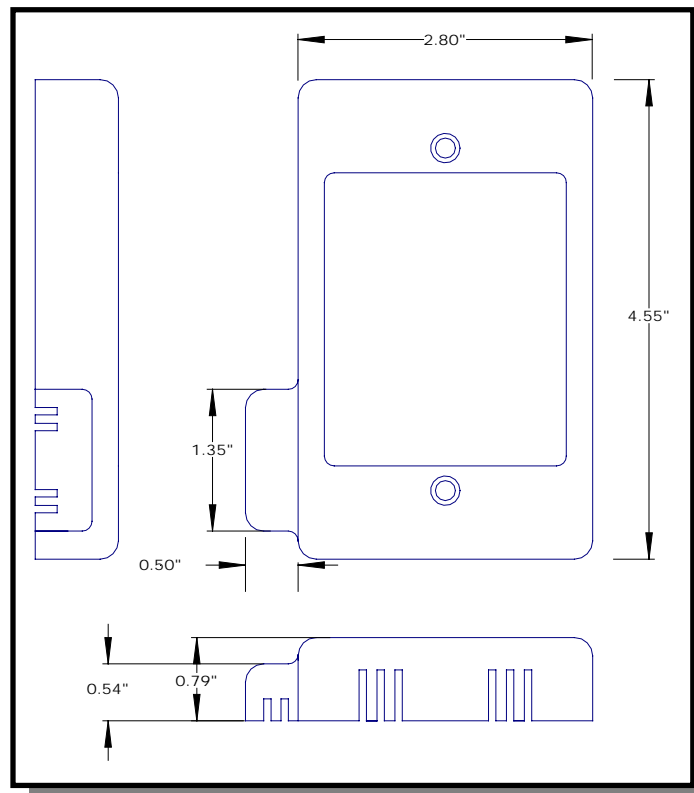
Sensing Element	Solid State
Accuracy	+/- 0.5 C typical 15 C to 55 C : +/- 1.0 C typical entire operating range
Temperature Range	0 to 70 C
Resolution	0.1 C

Electronics

Operating Environment	0 to 70C, 0-95% RH non-condensing
CPU	3120 Neuron
Input Power	10 to 26 VDC or 10 to 24 VAC
Input Power Protection	Input power is fused and transient voltage protected. (Fuses do not need to be replaced)
Current Consumption	30-32 mA
Network Transceiver Type	Echelon FTT-10A transceiver at 78 kbps. DC blocking capacitors for LPT10 network.
Input Power and Network Wiring	Wire clamp screw-less terminal blocks. Accepts up to 16 GA wire. Input power is polarity insensitive. Network wiring is polarity insensitive.

Dimension and Materials

Electronics Compartment	2.8" W x 4.55" L x 0.79" H
Sensor Compartment	0.5" W x 1.35" L x 0.54" H
Housing Material	ABS Plastic



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ORDERING INFORMATION

2000T	Model 2000T Temperature Display and Command Module			
Code -0	Network Transceiver Option TP/FTT-10A			
Code -0	Configuration Options Basic Unit			
Code -0	Housing Color White ABS Plastic Housing			
2000T	-0	-0	-0	Model 2000T with FTT-10A transceiver, white ABS housing

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