DNS-24L

Rev 2.0

Installation and Application Guide

Delta™ CONTROLS

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Introduction

This is the installation and application guide for the DNS-24L network sensor (hardware version 2.0). The guide will help you install, configure or program the network sensor on your LINKnet network.

The DNS-24L is a LINKnet intelligent room sensor with an LCD display and 4 push buttons for user control. Both the LCD display and push buttons are fully programmable in GCL+.

Other Relevant Documents

You may need to refer to these documents for additional information about networking, configuring or programming the DNS-24L. All these documents are found on the Delta Controls support web site support.deltacontrols.com.

- DNS-24L product page on the Delta Controls support web site
- Support product page of the Delta Controls controller connected to the network sensor
- *Delta Controls Wiring and Installation Guidelines*
- *ORCAview Technical Reference Manual* for your version of ORCAview

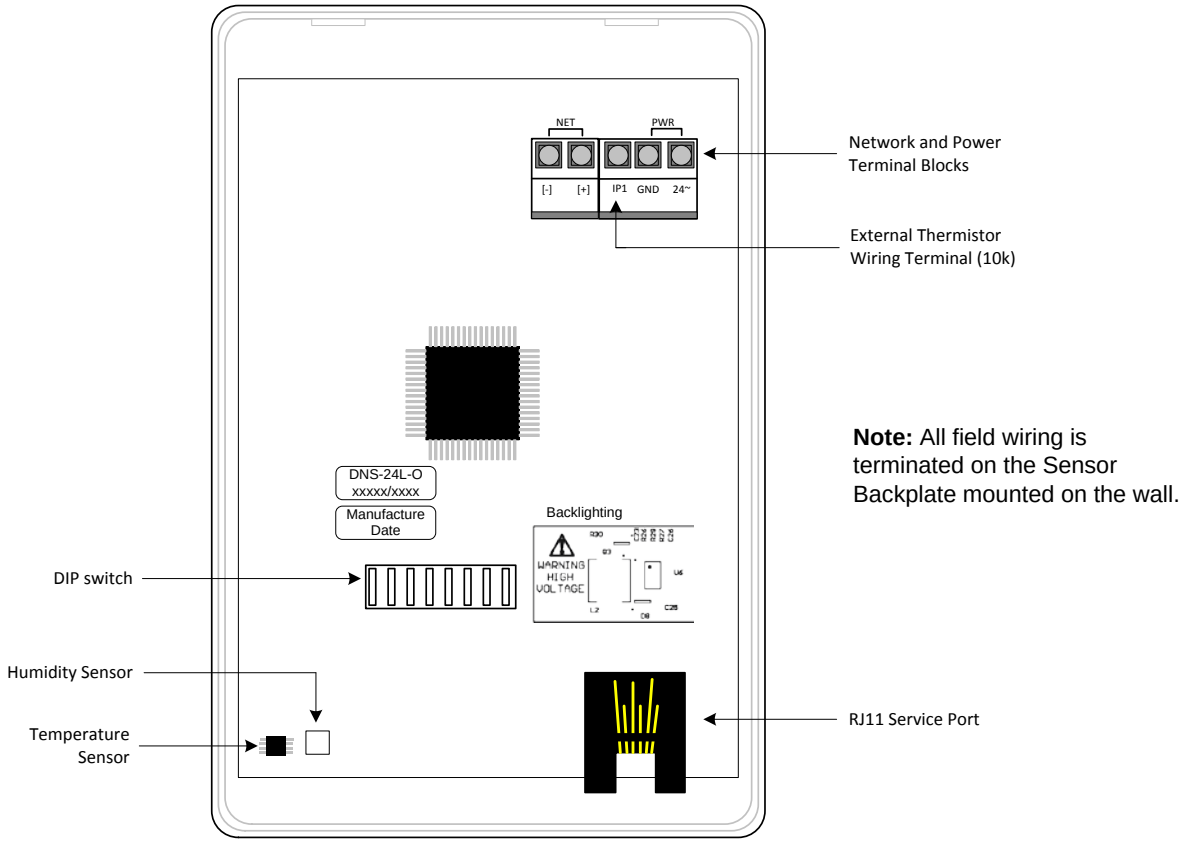
Cautions and Warnings

Warning! *The DNS-24L network sensor is an electro-statically sensitive device. However, since the electronics are contained within the housing, and if sufficient care is taken in handling, proper ESD protection (ground strap) should be unnecessary.*

If you are replacing older versions of this network sensor with revision 2.0 and higher DNS-24L models, you should replace the entire unit including the backplate. DNS-24L revision 2.0 and higher models' connectors are a slightly different size and installing the new models on an older backplate may cause unreliable connections.

Dimensions and Board Layout

The board layout shown here is for a network sensor model that contains all options.



Power and Wiring

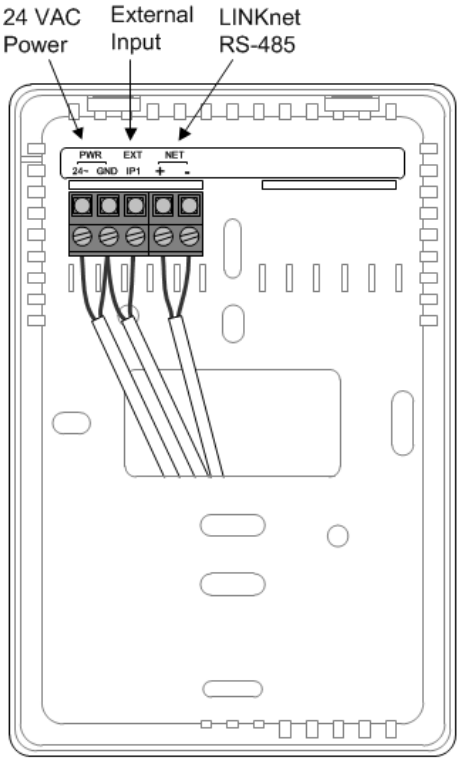
Power

The DNS-24L network sensor requires a 24 V AC (or DC) at 1.5 VA power supply, typically with an isolated Class II transformer. More than one device —not including full-wave powered products— may be connected to the same transformer provided the transformer is properly sized, line losses are compensated, and polarity is observed between controllers (in regards to 24~ and GND).

The transformer must **ONLY** be used to provide power to other MS/TP or LINKnet devices. Auxiliary field devices (i.e., 4-20 mA devices) that don't use half-wave rectification must be powered separately.

Refer to the Delta Controls Wiring and Installation Guidelines for more details about the powering wiring requirements of Delta Controls products.

Wiring



R2.0 DNS-x24Lx Backplate

Caution: *To reduce the risk of damaging the network sensor, the network shield and any other bare wires should be bent back and taped to ensure they do not come into contact with the board electronics and cause an electrical short circuit.*

Notes:

- Ensure you use the recommended balanced cable for the network and follow documented RS-485 installation guidelines for MS/TP or LINKnet networks.
- Do not use 4-wire multi-conductor cable for network and power as it does not meet the balanced cable requirements for the MS/TP or LINKnet networks. Use two separate cables: one for the network and the other for power.
- Do not terminate the network shield on the network sensor. Ensure shield conductivity is maintained along the network from end-to-end using wire-nuts® or Marrettes® where necessary.
- If the same power source is used for more than one device, ensure the transformer is properly sized for the rated VA and ensure that the same polarity is observed from device to device. The DNS-24L is rated at 1.5 VA.
- If you connect a 10kΩ temperature sensor to the external input, the device will automatically use this external sensor instead of the internal temperature sensor.

Network and Cabling Requirements

To ensure network stability and reliable communications, particularly at high speeds on the RS-485 LINKnet networks, it is imperative that you adhere to the following network and cabling requirements:

Item	Description
Cabling	For LINKnet networks it is recommended that you use network cabling that matches the following specifications: • Balanced 100 to 120Ω nominal impedance Twisted Shielded Pair (TSP) Cable • Nominal capacitance of 16 PF/FT or lower • Nominal velocity of propagation of 66% or higher
Topology	For LINKnet networks, ensure the cable is installed as a daisy-chain from one device to another.
Maximum nodes	The maximum number of devices per LINKnet network is 12, depending on the Application Controller used. Refer to the LINKnet appendix in the *ORCAview Technical Reference Manual*.
Termination boards	Termination boards need not be installed for only 1 or 2 nodes. However, install a termination board on each end of the network when there are more than 2 nodes.
Repeater	Repeaters are not necessary. As long as the overall network cable length is no more than 1000ft. (300m).

For more information about BACnet networking, see the KB article 1802 on the Delta Controls Support web site.

For more information about RS-485 network installation guidelines, see the Delta Controls Wiring and Installation Guidelines for more details.

There is a limit in the number of devices allowed on a LINKnet network, as well as the number of devices that can have outputs. These limitations vary depending on the type of controller that the LINKnet devices are connected to. For more information about these limitations, see the Appendix chapter about working with MS/TP and LINKnet in the ORCAview Technical Reference Manual for your version of ORCAview.

Set Up the Network Sensor

The network sensor address and Baud Rate are set up using the network sensor's DIP switches. The other device settings like display and value units are set up through software objects in the associated controller that the DNS-24L device is connected to via LINKnet.

This section describes how to set up the network sensor's address and baud rate, and briefly introduces GCL+ programming and how it is used to program the DNS-24L display.

Setting Up the Address and Baud Rate

The device address and baud rate are set up using the DIP switches on the network sensor. DIP switches 1 to 4 are used to set up the device address. The network sensor address is a number in the 1 to 12 range and must be unique in its LINKnet network segment. DIP switch 8 is used to set the baud rate. The default Baud Rate is set to 76 800 bps. In most cases, there is no need to change the rate.

To change the network sensor address:

Each individual DIP switch represents a unique value which forms the controller address when the values are added together. For example, if the controller is to be given an address of 5, set the switch 4 and switch 1 to the ON position.

To change the baud rate:

DIP switch 8 is used to set the baud rate. 76 800 is the default baud rate of all LINKnet devices. However, if you want to lower the baud rate to 38 400, move switch 8 to the ON position.

Software and Programming

Objects

On a LINKnet network, the DNS-24L is represented by objects in the associated controller that the DNS-24L is connected to, and are required to complete the device's set up process. The objects are listed in the table below (x is the network sensor address):

To find out more about each object and the different tabs and fields in each object, go to the Software Objects chapter in the ORCAview Technical Reference Manual for your version of ORCAview.

Object	Default Name	Description	Creation
LNKx01	LINKnet Device x	LINKnet Object (maps to DEV1 object in the network sensor. This is the only way to access the DEV1 object.) This object gives the device's online/offline status as well as its device type and firmware revision.	Automatically created in controller
LCDx01	LINKLCDx	LCD Object. It controls the device's LCD display and monitors all button presses.	Automatically created in controller
AIx01	User specified	Input 1 (Onboard temperature sensor **OR** connected external 10kΩ temperature sensor.)	User must create in controller
AIx03	User specified	Input 3 (Optional onboard humidity sensor)	User must create in controller
AIC (numbering is user specified)	User specified	Analog Input Configuration Object. They allow you to define input scale ranges for different types of sensors. On Delta Controls hardware, an input can read resistance, current, 0-5 VDC or 0-10 VDC type signals. However each input, regardless of the type, is converted internally to a 0-5 VDC signal. The AIC Object works with 0-5 VDC for all signal types.	User must create in controller

In order to access the AI value(s), you must create the AI objects in the associated controller following a predefined numbering scheme. The new object instance number is the LINKnet device address (1 to 12) multiplied by 100, plus the instance number of the object you want to access (1 or 3).
For example, you would create AI501 in the MS/TP DAC controller to represent the 10kΩ thermistor value on the network sensor addressed as 5. The automatically created LINKnet and LCD objects would be LNK501 and LCD501.

Input calibration for the network sensor inputs is done through the associated AI objects in the associated controller. These AI objects may also be configured for any valid units and scale ranges that are available in the associated controller.

GCL+ Programming

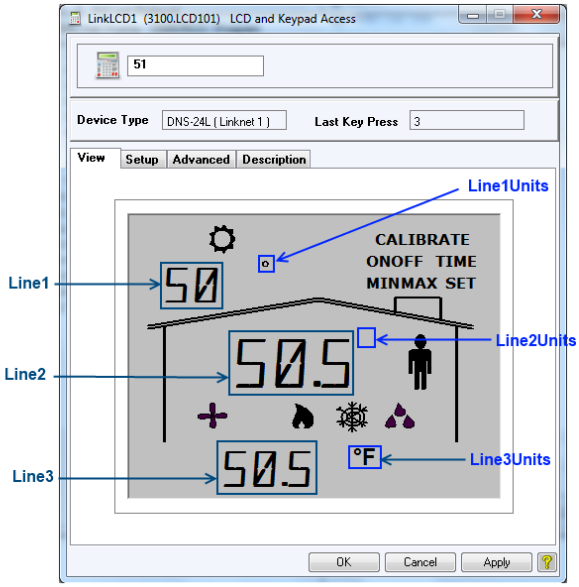
GCL+ programming is used to create programs that control outputs using objects, variables, inputs and other programs. With network sensors, GCL+ programming not only reads the sensor value(s), it is used to customize what is displayed on the sensor screens by reading and writing to the LCD object and its property values. A list of common LCD property values are listed in Appendix A. A more complete list is available in the GCL+ chapter in the *ORCAview Technical Reference Manual*. Specific programming notes related to network sensors are described in Appendix B.

To find out more about GCL+ programming and how to program an LCD object, go to the GCL+ chapter in the ORCAview Technical Reference Manual for your version of ORCAview.

Appendix A: LCD Object Property Values

This section lists the common LCD object properties and values used in GCL+ programming to customize the network sensor display in a LINKnet network with DAC/DSC controllers.

A more complete list is available in the GCL+ chapter in the *ORCAview Technical Reference Manual*.



LCD Property Name	Values and Description	Notes
Line 1	For sending a value to Line 1	
Line 2	For sending a value to Line 2	
Line 3	For sending a value to Line 3	
Line1Units	0 = ° icon is turned off 1 = ° icon is turned on	Only available in DAC/DSC firmware V3.30, V3.33 and V3.40.
Line2Units	0 = ° icon is turned off 1 = ° icon is turned on	Only available in DAC/DSC firmware V3.30, V3.33 and V3.40.

LCD Property Name	Values and Description	Notes
Line3Units	0 = No unit icons 1 = ° icon only 2 = °C 3 = °F 4 = % 5 = AM 6 = PM	Only available in DAC/DSC firmware V3.30, V3.33 and V3.40.
Blink	0 = Blinking is disabled 1 = Entire LCD display blinks	
Occupancy	0 = No House / Man (Disabled) 1 = House only (Unoccupied) 2 = House & Man (Occupancy)	
SunMoon	0 = No Sun or Moon (Disabled) 1 = Moon only 2 = Sun only	Only available in DAC/DSC firmware V3.30, V3.33 and V3.40.
Fan	0 = No Fan icons (All turned off) 1 = Fan icon only 2 = Fan with Air Flow Wave 1 3 = Fan with Wave 1 & Wave 2 4 = Fan with Wave 1, Wave 2, Wave 3	
Heating	0 = Heating icon is turned off 1 = Heating icon is turned on	
Cooling	0 = Cooling icon is turned off 1 = Cooling icon is turned off	
Humidity	0 = Humidity icon is turned off 1 = Humidity icon is turned on	
Calibrate	0 = CALIBRATE text is turned off 1 = CALIBRATE text is turned on	
On	0 = ON text is turned off 1 = ON text is turned on	
Off	0 = OFF text is turned off 1 = OFF text is turned on	
Time	0 = TIME text is turned off 1 = TIME text is turned on	
Minimum	0 = MIN text is turned off 1 = MIN text is turned on	
Maximum	0 = MAX text is turned off 1 = MAX text is turned on	

LCD Property Name	Values and Description	Notes
Set	0 = SET text is turned off 1 = SET text is turned on	

Examples

With a network sensor connected on a LINKnet network with an address of 1 (which is associated with LCD101 in the DAC controller), here is a simple example of GCL+ programming using the LCD properties.

```
DoEvery 30s
      IF SCH1 ON THEN
            LCD101.OCCUPANCY = 2
      ELSE
            LCD101.OCCUPANCY = 1
      ENDIF
EndDO
```

It is recommended and good practice to place this program strategy within an appropriate DOEVERY as shown above.

As a result, the network sensor will display the Man in the House during occupancy hours (according to SCH1 object), and the House without the Man during unoccupied hours. Note, however, that the command for either occupancy or unoccupied is sent every program scan (or the DOEVERY interval, as per recommendations). This means that a user would not be able to do any local override at the network sensor (which may be desirable for certain applications). If the user tries to do an override at the network sensor, the override will be over-written the next time the program in the DAC controller is executed (depending on the DOEVERY interval).

The following program is the same as above, except that the command for either occupancy or unoccupied is only sent when the SCH1 changes. This allows user-override at the network sensor between schedule changes, and the network sensor will revert back to matching the SCH1 object on the next change.

```
IFONCE SCH1 ON THEN
      LCD101.OCCUPANCY = 2
ENDIF
IFONCE SCH1 OFF THEN
      LCD101.OCCUPANCY = 1
ENDIF
```

Appendix B: Programming Notes

The following sections provide additional programming information:

Use DOEVERY or IFONCE statements

When controlling the LCD display by commanding properties of the LCD object using GCL+ programming, you may command these values and properties as often as required but it is good practice to use DOEVERY or IFONCE statements.

GCL+ programming with temperature units

It is possible in GCL+ programming to specify the temperature units when writing to lines 2 and 3 of the LCD display. Here is a table of example programming:

Description	GCL+ code
Temperature on line 2 with ° symbol	`LCD101.LINE2 = AI101` `LCD101.LINE2UNITS = 1`
Temperature on line 3 with °C symbol	`LCD101.LINE3 = AI101` `LCD101.LINE3UNITS = 2`
Temperature on line 3 with °F symbol	`LCD101.LINE3 = AI101` `LCD101.LINE3UNITS = 3`

GCL+ programming and KeyPress values

In GCL+ programming you can evaluate the LCD object's KeyPress field to determine which BACstat button has been pressed, or any 2-button combination. Where two buttons are pressed, the first button represents the hundreds digit and the second button represents the units digit of a 3-digit number. Here is the list of KeyPress values:

Button	Value	Button	Value	Button	Value	Button	Value	Button	Value
O	1	O + I	102	I + O	201	▼ + O	301	▲ + O	401
I	2	O + ▼	103	I + ▼	203	▼ + I	302	▲ + I	402
▼	3	O + ▲	104	I + ▲	204	▼ + ▲	304	▲ + ▼	403
▲	4								

For example, code to start or stop a night override based on KeyPress values might look something like this:

```
IFONCE LCD101.KeyPress = 1 THEN
      'Zone 1 Override' = Off
ENDIF
IFONCE LCD101.KeyPress = 2 THEN
      'Zone 1 Override' = On
ENDIF
```

Product Specifications

Power Requirements		24 V AC or DC Class 2
Power Consumption		1.5 VA
Ambient Ratings		32° to 131°F (0° to 55°C) 10 to 90% RH (non condensing)
Communication Port	LINKnet	Communications Speed @ 76,800 or 38,400 bps Maximum 12 devices (depending on the controller)
	Service Port (optional)	RJ11 Used with Delta Controls service tool devices (for example, CON-768BT)
Device Addressing		DIP switches
Input	Internal Temperature Sensor	Accuracy of +/- 0.36 °F (+/- 0.2 °C)
	Internal Humidity Sensor (optional)	Accuracy of +/- 3%RH from 20% to 80% RH (linearized accuracy of +/- 3% to +/- 5% from 0 to 20% and 80 to 100% RH) Display resolution of 0.1% Stability of < 0.5% RH per year
	External Temperature Terminal	Allows external 10kΩ temperature sensor to be used instead of internal temperature sensor
Technology		16-bit processor with internal A/D, Flash and RAM 3-value LCD with icons (96 total segments) and optional backlighting 4 stylized momentary push buttons with tactile feedback
Size		4 15/16 x 3 1/4 x 1 in. (12.5 x 8.3 x 2.6 cm)
Weight		0.3 lb. (120 g)
Listings		UL 916
Compliance		CE FCC

Document Revision History

Document Edition Number	Date Published	Author	Change Description
2.0	October 22, 2014	Norlinda Ghazali	Removed references to Sun and Moon object properties. New technical specs. Updated board layout. Removed all references to jumpers.
2.1	February 17, 2015	Norlinda Ghazali	Removed the reference to changing the address with ORCAview in the Set up the Network Sensor section.

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