IntelliFrost™

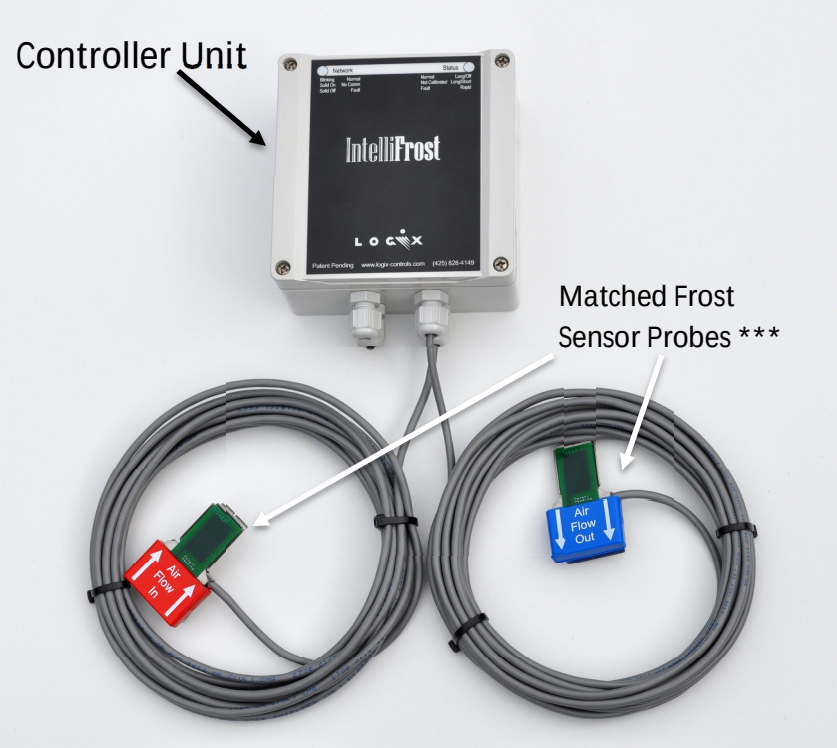
Installation & Calibration

General Overview

The IntelliFrost™ is an intelligent demand defrost system designed for use on a *properly functioning evaporator. The IntelliFrost does not directly control the air unit valves, rather it provides a defrost request and termination signal to a **3rd party evaporator defrost control system/controller.

The IntelliFrost Demand Defrost Control System is comprised of two ***matched* component sets– the Controller and two independent Frost Sensor Probes. The Probes directly measure both frost thickness and fin temperature and digitally relay the data to the Controller. The Controller processes the frost thickness data from the probe and determines when to initiate a defrost sequence. Once the Controller initiates a defrost sequence, it monitors the fin temperature rise to determine when to terminate the defrost sequence. When the defrost sequence is terminated, the Controller monitors fin temperature to determine when the fins are below freezing.

IntelliFrost Components



* See IntelliFrost Application Requirements Document for further details.

** A 3rd party evaporator defrost control system/controller can be a stand-alone device such as the Parker or Hansen Defrost Controller, a programmable Refrigeration Control System, or any device capable of receiving a Defrost Command. Refer to IntelliFrost Functional Overview for requirements.

*** The Frost Sensors can't be used with any Controller except the one with which the Frost Sensors were connected to when shipped. Frost Sensors used on any other controller will fail to work properly and may require costly effort to repair.

Failure to completely read and understand the manual BEFORE beginning the installation greatly increases the probability that the installation will fail and have to be redone.

Controller Description

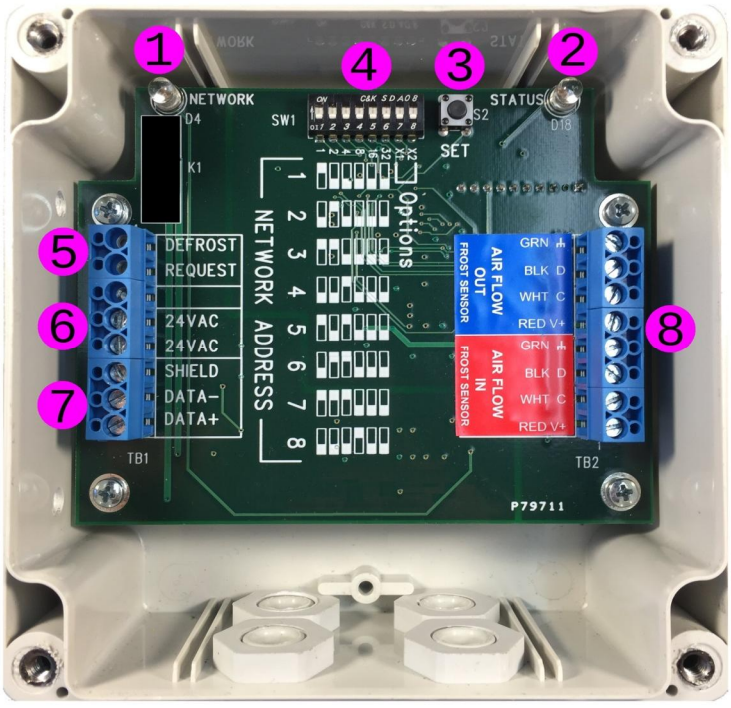
<table>
<tr><td>1. Network LED</td><td>Indicates network communication activity between the detector and Modbus Master. Master can be PC running IntelliFrostView™ Software or PLC programmed to communicate with a IntelliFrost Network. LED blinks rapidly when communicating normally.</td></tr>
<tr><td>2. Status LED</td><td>Indicates the operational status of the device (Ready, No Calibration, and Error). The following list contains the name and description for the various Status LED indications of the current operating status.

<table>
<tr><td>Operating Status</td><td>Status Light – Behavior</td></tr>
<tr><td>Normal</td><td>Steady blink - ON one second, OFF one second</td></tr>
<tr><td>Not Calibrated</td><td>Repeating long blink followed by a short blink</td></tr>
<tr><td>ERROR</td><td>Rapid blink - ON and OFF 5 times per second</td></tr>
</table>
</td></tr>
<tr><td>3. Set Button</td><td>The SET button controls the various detector operations such as calibration, setting network address and restoring default settings. Each time the button is pressed the STATUS light will be flash. When the button is held down, the STATUS light will indicate operation.

The SET button permits two types of operations:

Press Is to briefly press and release the SET button. This operation sets the network address as determined by the DIP switch.

Press and Hold Is to press and hold the SET button for a period of time, as described in this manual, and then release it when selecting or executing a particular operation. These time periods are accompanied by unique STATUS LED patterns as described in this manual.</td></tr>
<tr><td>4. Dip Switch</td><td>Dip switch SW1 is used to set the unit Communications Network ID. 1-based binary is used to configure the address.</td></tr>
<tr><td>5. Defrost Request Terminals</td><td>Field connections used to send Defrost Request output to evaporator defrost control system/controller. Defrost Relay Contact rating: 3 Amp, 24V AC/DC. Contacts are normally open and close to indicate a Defrost Request.</td></tr>
<tr><td>6. 24V Terminals</td><td>Field connections for power supply. Supply Voltage: 15V – 28V AC / 15V – 32V DC</td></tr>
<tr><td>7. Data Terminals</td><td>Field connections for RS-485 Serial Communications. Units may be daisy chained with one home run to PC or PLC.</td></tr>
<tr><td>8. Sensor Terminals</td><td>Factory wired. Note: sensors are not interchangeable with each other or with sensors on other IntelliFrost Units and must not be modified or extended.</td></tr>
</table>



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Preliminary Tasks

These tasks will take the most time but may be done with the Air Unit cooling.

1. Selecting the Unit ID Number

For each IntelliFrostView™ network, every attached IntelliFrost Detector must be configured with a unique network ID. The ID does not have to match the Zone name (e.g., FZ-04), but it is recommended that Unit ID's follow a logical order for the sake of consistency and potential network troubleshooting. The detector's unit number is set using dip switch (SW1) internal to the device. The switch permits 64 unique number selections, however only numbers 1 through 63 are recognized.

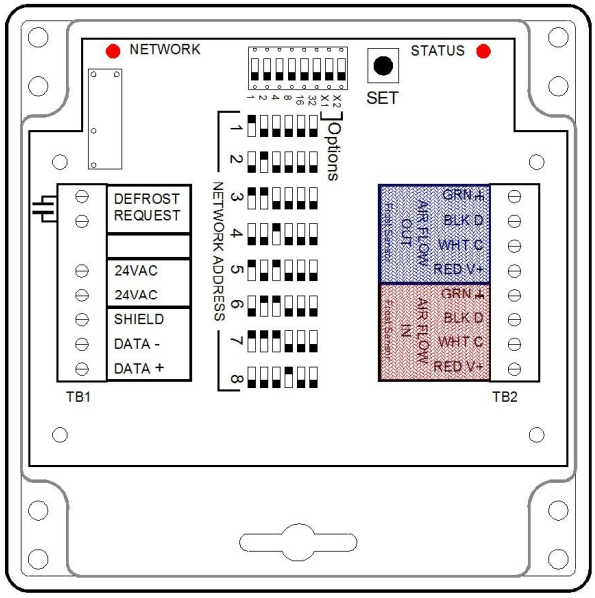


Figure 2. Address Switch and Connectors

Note that the address switch block contains 2 extra switches labeled X1 and X2 respectively. These switches are reserved for future functionality and should be left in the OFF position.

Select the desired number by placing the switches according to the table shown on the IntelliFrost printed circuit board. For example, an ID of 4 would require the 3rd dip switch in from the left be in the up "ON" position and all other dip switches in the down "OFF" position. Dip switch configuration can be done with power on or off. If selected with the power off, the unit will recognize and use the number the next time the unit is powered on. If the number is selected or changed with power on, then simply press and release the SET button. The unit will then automatically switch to the new number.

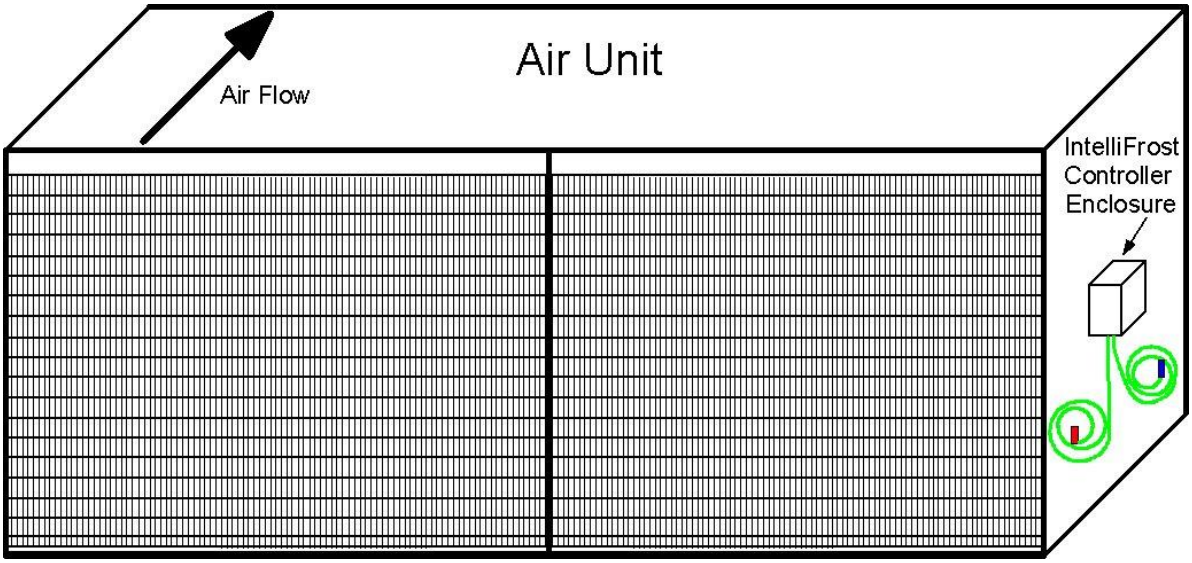
Refer to the unit number table found in the addendum if more than 8 units will be on the network

2. Mounting the Controller Enclosure

Select a mounting location allowing convenient and unencumbered access to the controller. The controller should be mounted in a location within 15 feet of both frost sensor mounting locations and in a location without direct exposure to sunlight or extremely harsh environmental conditions (i.e. direct water spray). Typically, the side of the air unit is a suitable mounting location.

Loosen the four (4) large plastic cover screws and carefully remove the cover. Be careful not to damage the sealing edge of the enclosure walls. Mount the controller to a flat vertical surface using four (4) suitable #8 stainless-steel screws (*not supplied*). Use the four existing enclosure mounting holes, which are external to the enclosure cavity and within each corner located under the cover's mounting screws. It is recommended that the frost sensors not be disconnected during this step as they are not interchangeable with each other or with frost sensors on other IntelliFrost controllers.

The IntelliFrost Frost sensors should remain unmounted up to this point.



Typical Mounting Location

3. Connect Power and Defrost Request signal

Each unit will require 24V AC/DC power and external connection from the IntelliFrost Defrost Request Terminals to the evaporator defrost system/controller. External connections for the controller are made on connector TB1. Refer to the IntelliFrost Wiring Diagram for power segment length limitations and further details.

Additionally, each IntelliFrost will be connected to a PC running the IntelliFrostView program via network cabling. This provides advanced monitoring and tuning capabilities. Refer to the wiring diagram for details.

Note: To maintain the enclosure's watertight integrity, the low-voltage network cable(s) must either be placed inside a separate low-voltage-only 4X liquid-tight rated ½" conduit or be secured with a PG7 type 4X liquid-tight rated strain relief (one for each cable).

Note: Under no circumstances can low voltage (power/network/sensor) wiring and line voltage control wiring be combined inside the same conduit.

4. Install IntelliFrostView™ Software and USB to Serial Converter

IntelliFrostView is the Windows PC based software that acts as the HMI between the operator and the IntelliFrost controller.
This software allows the user to quickly verify communications wiring, dip switch addressing, and calibration. It also provides the user with real-time frost level readings, fin temperature, and controller state.

Begin the IntelliFrostView setup by running the Install File provided by your vendor. Run through the install wizard and select "Finish" when done.

Next, setup the USB to Serial converter. Be sure to install the device driver before connecting the device. Follow the instructions provided with the device.

Now you can launch the IntelliFrostView™ software and begin the initial configuration. When first launching IntelliFrostView, you will be prompted to select a communications method. Select the Com Port number which was

assigned to your USB to Serial device. Next, select the total number of IntelliFrost units from Tools>Configure Options>Set Number of IntelliFrost Units.

Then, configure each IntelliFrost to match the Unit ID Number configured in Step 1 of this document. To access the configuration screen, Right-Click on the desired unit, then select Configure IntelliFrost. Here, you may add a unique Air Unit Description and ID to match your current facility nomenclature. However, the Network Address field must match the Unit ID set by the dip switches on the corresponding IntelliFrost controller. Perform this configuration on all units with their unique ID's.

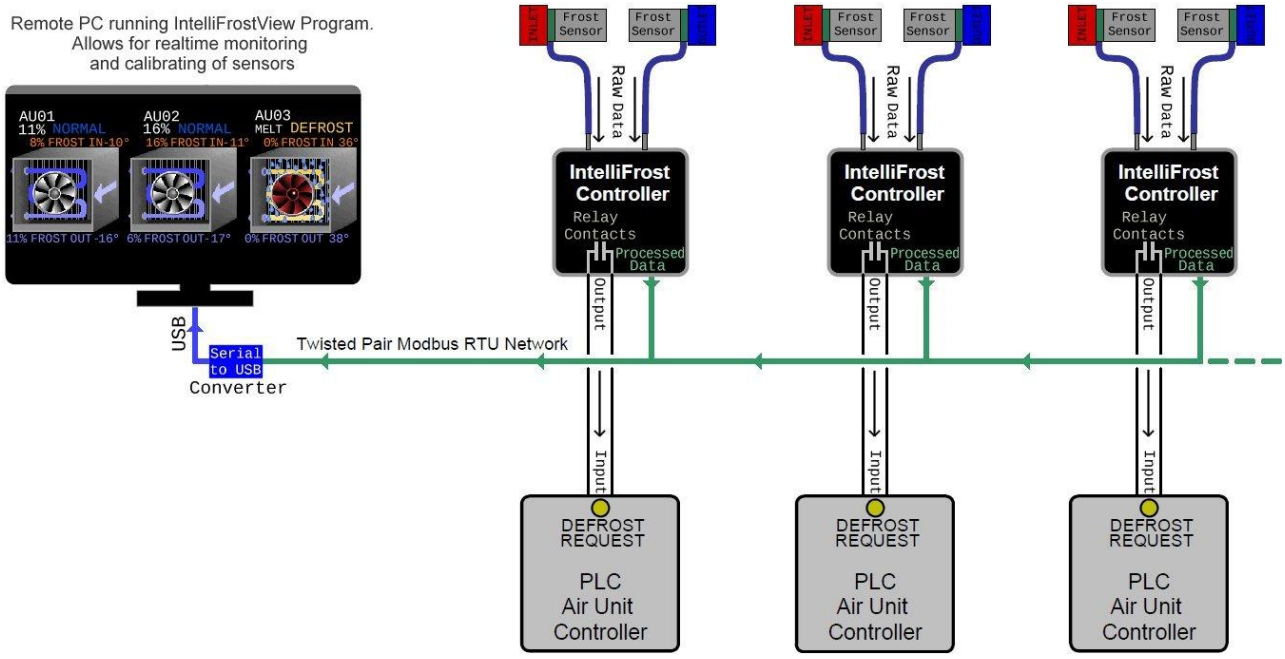
If configured properly, the IntelliFrostView Software will be ready to interface with the IntelliFrost controllers on the network. For more detail on IntelliFrostView operation, please refer to the help system built-in to the IntelliFrostView software.

5. Verify Power to the Controller

After verifying proper wiring, apply power to the network of IntelliFrost controllers. On all IntelliFrost controllers, the red Status LEDs should begin blinking and long/short pattern indicating the need for a bare (frost-free) calibration. The Network LEDs should begin blinking rapidly indicating proper network addresses and wiring. If installing multiple controllers at once, you may apply power to all controllers simultaneously and afterwards perform the Final Tasks one air unit at a time.

Third party evaporator defrost control system/controller integration

The IntelliFrost does not directly control the evaporator valves, rather it provides a defrost request and defrost termination signal to a 3rd party evaporator defrost control system/controller (PLC, Electro-Mechanical Controller). It is recommended that any modifications required for the evaporator defrost system/controller to accept a defrost request signal be completed and tested at this time. Refer to Functional Overview Document for further details.



Overview showing flow of data from IntelliFrost Sensors to PLC/Electro-mechanical via discrete I/O.

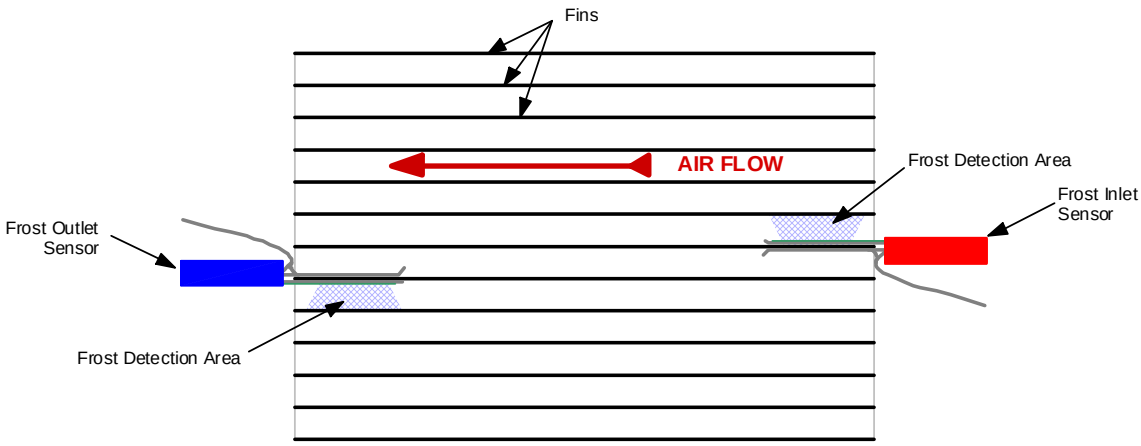
Probe Mounting Tasks

1. Fully Defrost evaporator

An extended defrost is typically necessary to ensure there is no moisture present at the time of calibration. It is essential that the evaporator coil be fully defrosted, and fins are completely dry, prior to performing any of the following tasks. IntelliFrost Sensors are highly sensitive to any moisture; as a result, calibration will be negatively affected if performed on anything other than a completely dry fin and completely dry sensor board. Once a full defrost is complete, stop the evaporator so that it is in a standby mode (no hot gas, no liquid) to reduce the chance of moisture/vapor affecting the calibration.

Sensor Function

The frost sensor clips have two sides: A hinging side that allows the clip to open and a fixed side that serves as a carriage for the actual sensor board. The sensor's clip is designed to slip over the edge of a cooling fin and has enough tension to hold the sensor assembly in place. The sensor board points away from the fin on which it is clipped on and senses frost accumulation on the opposing fin's surface.



Air Unit (Top View)

Identifying the sensors

The Controller has two color-coded Frost Sensors connected to terminal block TB2. Each cable consists of 4 conductors and must not be modified or extended. The Red Frost Sensor is mounted on the inlet (warm) side of the air unit. The Blue Frost Sensor is mounted on the outlet (cold) side of the air unit.

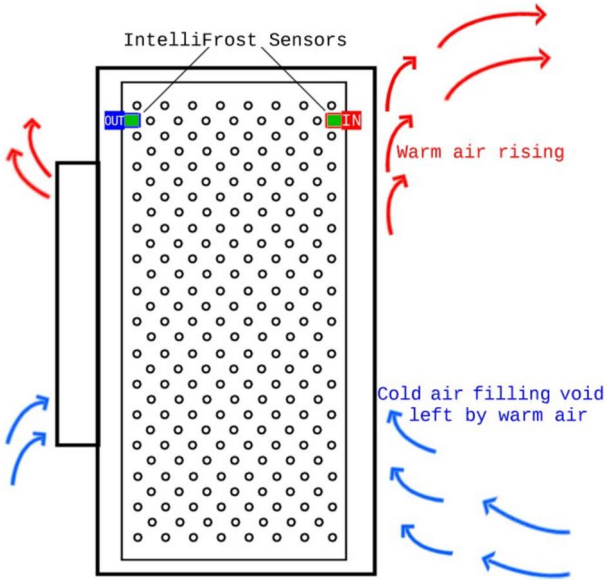
WARNING:

THE FROST SENSORS ARE FACTORY CALIBRATED TO EACH CONTROLLER AND ARE THEREFORE NOT INTERCHANGEABLE.

FROST SENSORS CAN ONLY BE USED ON THE CONTROLLER WITH WHICH THEY WERE SHIPPED.

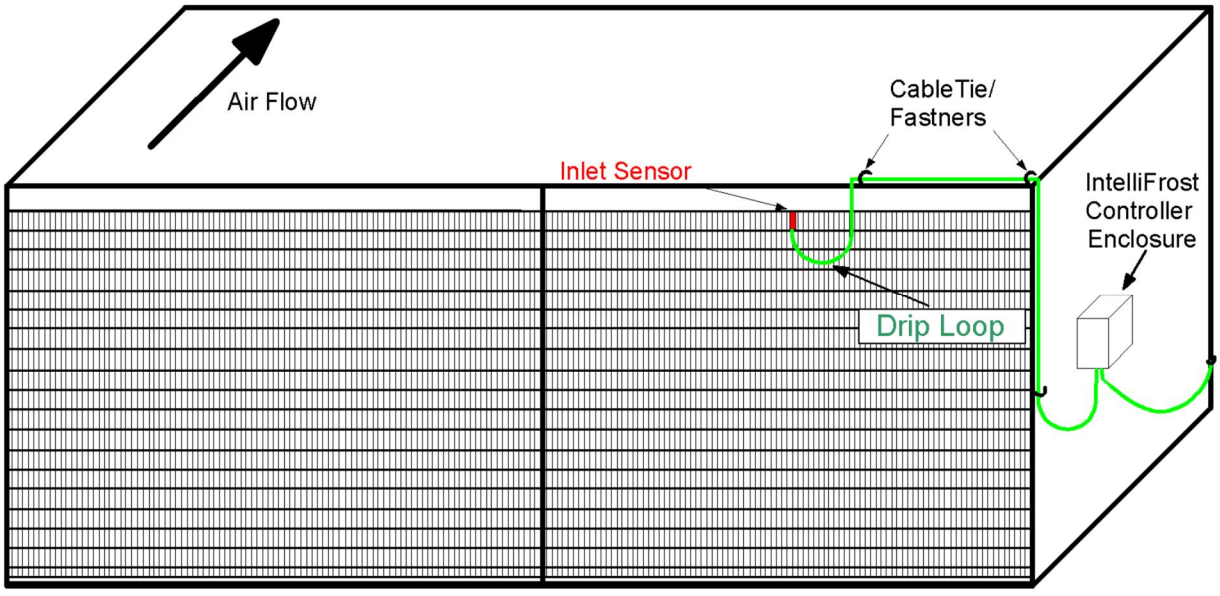
Sensor Location

It is critical that sensors be mounted near the top of the coil to ensure the sensor's temperature readings are not influenced by the natural cold air convection current that occurs during a hot-gas defrost. The IntelliFrost Controller uses fin temperature to terminate a defrost sequence, therefore, unnecessarily long defrosts may occur if the sensor is mounted too low. The ideal location for the sensors is between the top two refrigerant tubes of the coil and centered in the air unit's air flow.



Evaporator Cutaway Side View

2. Install Inlet sensor
   Install the Red Inlet Sensor between the top two refrigerant tubes. The sensor cable must exit toward the ground (not from the top) and loop upwards to prevent ice accumulation on sensor.
3. Ensure no moisture is present
   Once the clip has been mounted, use a small rag or paper towel to dry off any hidden moisture that may be present in the frost detection area (i.e. Fin and Sensor Board Surface).
4. Secure excess sensor cable
   Use cable ties or fasteners to secure the secure excess cable to the body of the air unit. Select a location on the air unit that will minimize potential weight on sensor clip and include a drip loop to prevent ice accumulation on sensor.



5. Access Outlet side of coil
   On some air units, removal of the fan guard and fan blades may be necessary in order to properly install the outlet sensor. As always, use proper Lock-Out/Tag-Out procedures when working around the fan motors.
6. Install Outlet Sensor
   Install the Blue Inlet Sensor between the top two refrigerant tubes. The sensor cable must exit toward the ground (not from the top) and loop upwards to prevent ice accumulation on sensor.
7. Ensure no moisture is present
   Once the clip has been mounted, use a small rag or paper towel to dry off any hidden moisture that may be present in the frost detection area (i.e. Fin and Sensor Board Surface).
8. Secure excess cable
   Use cable ties or fasteners to secure the secure excess cable to the body of the air unit. Select a location on the air unit that will minimize potential weight on sensor clip and include a drip loop to prevent ice accumulation on sensor.
9. Re-install fan blades/guards and re-apply power.
   All physical installation should be complete at this point and air unit should be back to its normal mechanical and electrical state.

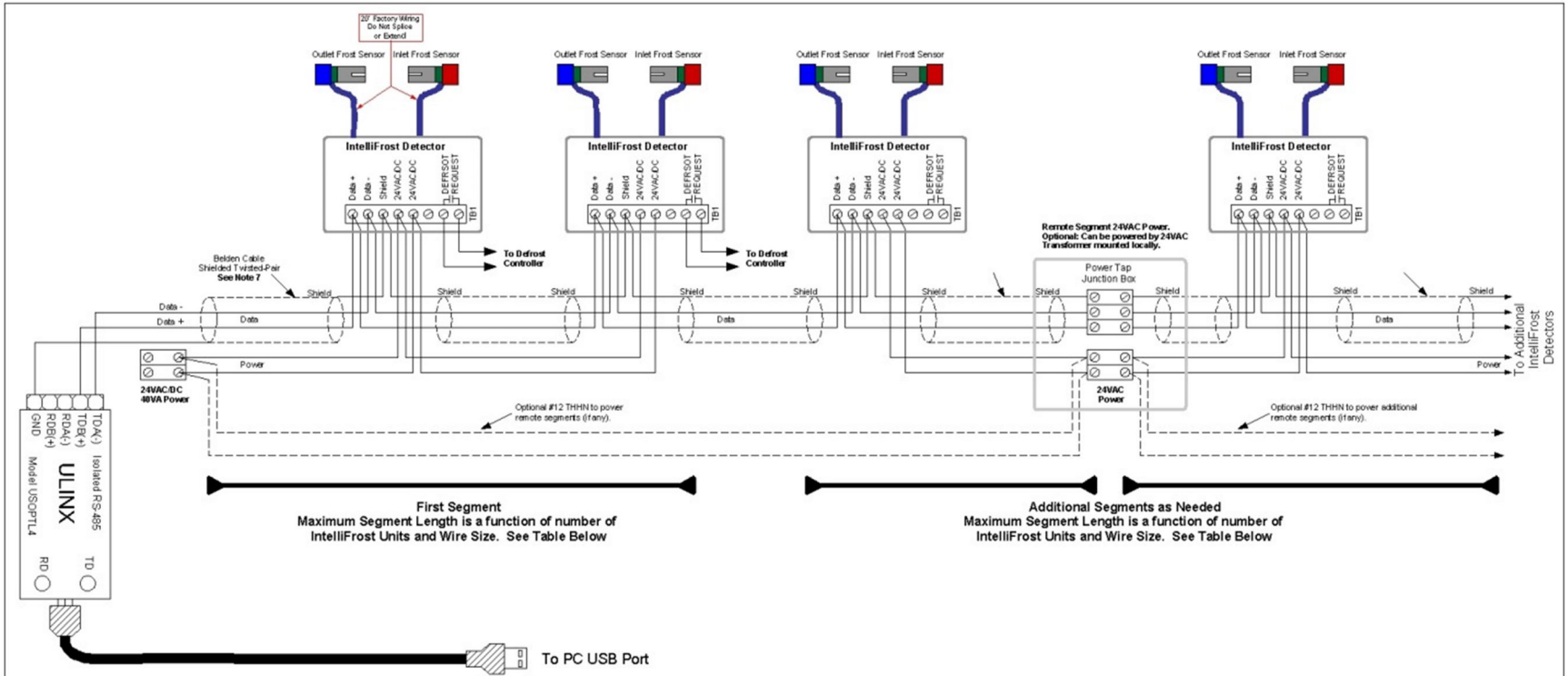
Initial Sensor Calibration on Frost-Free fins

WARNING: If the Frost sensors are moved or disturbed in any way, the calibration must be performed again. It is highly recommended that all the physical installation is completed (ex. cables secured) before calibrating the IntelliFrost System.

The IntelliFrost controller's STATUS LED light should be flashing a long blink then a short blink, indicating a need for an initial "frost free" calibration. This calibration must always be performed on a completely defrosted and dry evaporator coil so the IntelliFrost can "learn" its environment.

To perform the calibration, access the IntelliFrost Controller board inside the Controller housing and locate the SET button. Press and hold the SET button for 3 seconds until the STATUS light turns on solid (not blinking) and then release the SET button. The detector responds by attempting to perform the calibration. Once the calibration is complete, the IntelliFrost System is ready for Normal Operation and the Status LED will blink a steady one second on, one second off pattern.

Note that the initial calibration only provides a frost-free baseline (0% frost level). The IntelliFrost will initiate a defrost when frost accumulation reaches a calculated defrost initiate amount (100% frost level). This defrost initiate amount may be adjusted using the IntelliFrostView software.



24VAC Power Segment Length Table			
Max #IntelliFrost Units per Segment			
Segment Length	#22AWG Power	#18AWG Power	#14AWG Power
0'-250'	10 Units	15 Units	25 Units
250'-500'	6 Units	8 Units	15 Units
500'-1000'	2 Units	4 Units	8 Units

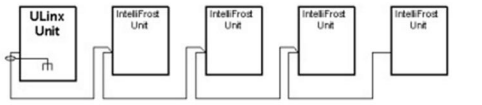
NOTES:

1. Maximum total cable length (all segments) is 2000 feet.
2. Only "Daisy Chain" wiring topology is allowed. Each screw termination can have a MAXIMUM of two wires. See example diagrams. The order of IntelliFrost units in the "Daisy Chain" is not important.
3. To prevent short-circuit, the foil shield foil must not be exposed. Cover with heatshrink tubing or "milk" the outer cable jacket back before cutting the foil.
4. The bare shield drain wire must be insulated with heatshrink tubing.
5. 24VAC/DC connections at the Intellifrost are not polarity sensitive.
6. To maintain enclosure integrity, use a PG7 liquid-tight 4X rated strain relief for each cable or combine the cables inside a liquid-tight conduit.
7. Do NOT combine low voltage and line voltage wiring inside the same conduit.
8. Only the Following Belden Cable can be used:

   For temperatures down to -22F/-30C, use Belden 9501 cable.

   For temperatures down to -90F/-70C, use Belden 88641.

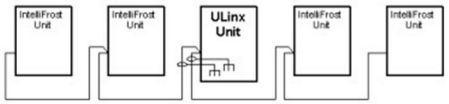
Inline data path example



Total network cable length for all IntelliFrost Units must be less than 2,000'

OR

Split data path example



Total network cable length for all IntelliFrost Units must be less than 2,000'

Note:
Sensors are Matched to each IntelliFrost Detector Unit and **ARE NOT INTERCHANGABLE**.

DIP Switch Address must be set for proper operation.

Title: IntelliFrost™ Wiring Diagram
Power and Network Wiring

Date	Rev	Drawn by
2015/03/19	1	MAG

Drawing Filename: IntelliFrostView_Network

DIP Switch									DIP Switch								
Unit #	1	2	4	8	16	32	X1	X2	Unit #	1	2	3	4	5	6	X1	X2
N/A	OFF	OFF	OFF	OFF	OFF	OFF	X	X	32	OFF	OFF	OFF	OFF	OFF	ON	X	X
1	ON	OFF	OFF	OFF	OFF	OFF	X	X	33	ON	OFF	OFF	OFF	OFF	ON	X	X
2	OFF	ON	OFF	OFF	OFF	OFF	X	X	34	OFF	ON	OFF	OFF	OFF	ON	X	X
3	ON	ON	OFF	OFF	OFF	OFF	X	X	35	ON	ON	OFF	OFF	OFF	ON	X	X
4	OFF	OFF	ON	OFF	OFF	OFF	X	X	36	OFF	OFF	ON	OFF	OFF	ON	X	X
5	ON	OFF	ON	OFF	OFF	OFF	X	X	37	ON	OFF	ON	OFF	OFF	ON	X	X
6	OFF	ON	ON	OFF	OFF	OFF	X	X	38	OFF	ON	ON	OFF	OFF	ON	X	X
7	ON	ON	ON	OFF	OFF	OFF	X	X	39	ON	ON	ON	OFF	OFF	ON	X	X
8	OFF	OFF	OFF	ON	OFF	OFF	X	X	40	OFF	OFF	OFF	ON	OFF	ON	X	X
9	ON	OFF	OFF	ON	OFF	OFF	X	X	41	ON	OFF	OFF	ON	OFF	ON	X	X
10	OFF	ON	OFF	ON	OFF	OFF	X	X	42	OFF	ON	OFF	ON	OFF	ON	X	X
11	ON	ON	OFF	ON	OFF	OFF	X	X	43	ON	ON	OFF	ON	OFF	ON	X	X
12	OFF	OFF	ON	ON	OFF	OFF	X	X	44	OFF	OFF	ON	ON	OFF	ON	X	X
13	ON	OFF	ON	ON	OFF	OFF	X	X	45	ON	OFF	ON	ON	OFF	ON	X	X
14	OFF	ON	ON	ON	OFF	OFF	X	X	46	OFF	ON	ON	ON	OFF	ON	X	X
15	ON	ON	ON	ON	OFF	OFF	X	X	47	ON	ON	ON	ON	OFF	ON	X	X
16	OFF	OFF	OFF	OFF	ON	OFF	X	X	48	OFF	OFF	OFF	OFF	ON	ON	X	X
17	ON	OFF	OFF	OFF	ON	OFF	X	X	49	ON	OFF	OFF	OFF	ON	ON	X	X
18	OFF	ON	OFF	OFF	ON	OFF	X	X	50	OFF	ON	OFF	OFF	ON	ON	X	X
19	ON	ON	OFF	OFF	ON	OFF	X	X	51	ON	ON	OFF	OFF	ON	ON	X	X
20	OFF	OFF	ON	OFF	ON	OFF	X	X	52	OFF	OFF	ON	OFF	ON	ON	X	X
21	ON	OFF	ON	OFF	ON	OFF	X	X	53	ON	OFF	ON	OFF	ON	ON	X	X
22	OFF	ON	ON	OFF	ON	OFF	X	X	54	OFF	ON	ON	OFF	ON	ON	X	X
23	ON	ON	ON	OFF	ON	OFF	X	X	55	ON	ON	ON	OFF	ON	ON	X	X
24	OFF	OFF	OFF	ON	ON	OFF	X	X	56	OFF	OFF	OFF	ON	ON	ON	X	X
25	ON	OFF	OFF	ON	ON	OFF	X	X	57	ON	OFF	OFF	ON	ON	ON	X	X
26	OFF	ON	OFF	ON	ON	OFF	X	X	58	OFF	ON	OFF	ON	ON	ON	X	X
27	ON	ON	OFF	ON	ON	OFF	X	X	59	ON	ON	OFF	ON	ON	ON	X	X
28	OFF	OFF	ON	ON	ON	OFF	X	X	60	OFF	OFF	ON	ON	ON	ON	X	X
29	ON	OFF	ON	ON	ON	OFF	X	X	61	ON	OFF	ON	ON	ON	ON	X	X
30	OFF	ON	ON	ON	ON	OFF	X	X	62	OFF	ON	ON	ON	ON	ON	X	X
31	ON	ON	ON	ON	ON	OFF	X	X	63	ON	ON	ON	ON	ON	ON	X	X

Unit Number Table