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The LON controller is an interoperable, LONMark® compliant controller. The LON controller has factory loaded application specific software which allows optimal control of our water source heat pumps in buildings which require DDC control.

The ASW01, ASW02, and ASW03 sensors are digital wall mounted temperature sensors to be used with the LON controller. The LON controller and ASW digital wall sensors communicate via Sensor Link (S-Link) communications protocol. S-Link is a simple two wire communication protocol which provides power to the ASW wall sensor as well as transmits information between the ASW wall sensor and the LON controller. The S-Link protocol is NOT polarity sensitive and does NOT require shielded cable.

The ASW wall sensors have an optional wiring connection which allows access to the LON network via a LON jack on the left side of each ASW wall sensor.

The LON controller can function in either stand-alone mode, or as part of a LONWorks® FTT-10 Free Topology communications network. When connected to a network, the operator can monitor LON controller performance and edit operational values.

### LON Controller Overview & Features

**LON Controller**
- Uses LONMark® HVAC profiles for interoperability.
- Capability to function in stand-alone mode or as part of a LONWorks® FTT-10 Free Topology communications network.
- Proportional Plus Integral (PI) control for heating and cooling.
- Protective hinged covers provide easy access to field wiring terminals.
- Onboard LED indication without cover removal.
- Occupied/Unoccupied modes of operation.
- Intermittent or continuous fan operation.
- Non-polarized wiring between LON controller and wall sensors.
- Programability provides for custom applications.

**ASW Digital Wall Sensors**
- Contemporary, low-profile design.
- Digital zone temperature indication (selectable for 0.1 or 1 degree display resolution of °F or °C).
- Accepts virtually any wiring type including unshielded pairs without termination resistors.
- Separate wiring subbase and electronics.
- Occupancy override push-button on ASW02 and ASW03 wall sensors allows occupants to switch to timed Occupied Mode for after hours operation.

---

**Figure 1: Typical Heat Pump System Diagram**

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Hardware Specifications

LON Controller
- Dimensions
  4.3” high x 4.31” wide x 2” deep.
  [109mm x 111mm x 51mm]
- Enclosure
  Conforms to NEMA-1 requirements.
- Power Supply Input
  20 to 30Vac, 50/60Hz.
- Maximum Power Consumption
  15VA@ 24Vac, 50/60Hz, excluding relay output power.
- Surge Immunity Compliance
- Agency Listings
  FCC, Class B
  UL Listed
  UL-916 (File #E71385 Category PAZX)
  UL Listed to Canadian Safety Standards
  (CAN/CSA C22.2).
- European Community - EMC Directive
  Emissions EN50081-1.
  Immunity EN50082-1.
- Ambient Operating Temperature Limits
  -40 to 140 °F [-40 to 60°C].
- Shipping and Storage Temperature Limits
  -40 to 160 °F [-40 to 71°C].
- Humidity
  5 to 95% RH, non-condensing.
- Wiring Terminals
  All terminals rated for AWG #16 to #24 [1.5 mm² maximum] wire.
- Digital Inputs
  Requires dry contact. Detection of closed switch requires less than 300 Ohms. Detection of open switch requires more than 1.5k Ohms.
- Digital Outputs
  Each DO is an isolated Form A (SPST) relay.
  Current ratings of 24VA at 24Vac, pilot duty.
- Universal Inputs
  Leaving Air Temperature and Leaving Water
  Temperature sensors are 10K Ohm thermistors with an 11k Ohm shunt resistor. Monitors range of -40 to 250°F [-40 to 121°C].

ASW Digital Wall Sensor
- Dimensions
  4.81” high x 3.25” wide x 0.93” deep. [122mm x 83mm x 24mm]
- Enclosure
  Conforms to NEMA-1 requirements.
- Surge Immunity Compliance
- Agency Listings
  FCC, Class B
  UL Listed
  UL-916 (File #E71385 Category PAZX)
  UL Listed to Canadian Safety Standards
  (CAN/CSA C22.2).
- European Community - EMC Directive
  Emissions EN50081-1.
  Immunity EN50082-1.
- Ambient Operating Temperature Limits
  32 to 122 °F [0 to 50°C].
- Shipping and Storage Temperature Limits
  -40 to 160 °F [-40 to 71°C].
- Humidity
  5 to 95% RH, non-condensing.
- Wiring Terminals
  Four screw terminals rated for AWG #18 to #24 (1.0 mm² maximum) wire.
- Display (ASW03 only)
  Temperature setpoint, room temperature, Lockout code (if heat pump has locked out).

Table 1: Relay Output Load Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum relay contact switched output voltage</td>
<td>24VAC</td>
</tr>
<tr>
<td>Maximum output load @ 24VAC, pilot duty</td>
<td>24VAC</td>
</tr>
<tr>
<td>Minimum permissible load</td>
<td>10.0 mA at 5VDC</td>
</tr>
<tr>
<td>Minimum cycles at rated load @ 0.4 power factor</td>
<td>300,000 cycles</td>
</tr>
</tbody>
</table>
Communications wiring includes a connection between the LON controller and an ASW digital wall sensor via the S-Link and a connection between the LON controller and the LON network. An optional LON connection between the LON controller and the ASW digital wall sensor is also possible. See CXM Single Stage Heat Pump Wiring Schematic.

- Communication wire pairs must be dedicated to S-Link and LON network communications. They cannot be part of an active, bundled telephone trunk.
- Shielded cable is not required for S-Link or LON wiring.
- If the cable is installed in areas of high RFI/EMI, the cable must be in conduit.
- If shielded wire is used, the shield must be connected to earth ground at one end only by a 470K Ohm 1/4 Watt resistor. Shield must be continuous from one end of the trunk to the other.

**Sensor Link (S-Link) Wiring**

S-Link wiring powers and enables the ASW Sensor. The S-Link needs at least 24 gage [0.51mm], twisted pair, voice grade telephone wire. The capacitance between conductors cannot be more than 32 pF per foot [0.3m].

If shielded cable is used, the capacitance between any one conductor and the others, connected to the shield, cannot be more than 60 pF per foot [0.3m]. Maximum wire length is 200 ft. [61m].

**Notes:**

- LON Controller supports only one ASW digital wall sensor.
- S-Link wiring is not polarity sensitive.
- If conduit is used between an ASW Sensor and a LON controller, the LONWorks® network and S-Link wiring can be in the same conduit.

**LON Network Wiring**

A Category 4, twisted-pair (two conductors) cable may be used for both S-Link and optional LON connection between the LON controller and ASW Sensor. LON wiring is not polarity sensitive.

LON controllers use LONWorks® Free Topology Transceiver (FTT-10) and support polarity insensitive bus wiring topologies. A maximum of 62 nodes can be connected per segment. See Invensys Building Systems I/A Series MicroNet System Engineering Guide, F-26507 to design a LONWorks® FTT-10 network, including recommended topologies and approved cable types (see Table 6).

**Neuron ID** - Identical pairs of factory barcode labels are attached to each LON controller. The labels can be used to select LON controllers for application downloading purposes. Each pair of labels contains a unique Neuron ID. One of the labels remains on the LON controller permanently; the other label can be placed on a job site node list plan. The Neuron ID can then be entered into a job network database through a third party network management tool. The service pin button on the LON controller is also used to select LON controllers. When this button is pressed, the LON controller sends a broadcast message containing its Neuron ID to the third party network management tool.
Typical LON Controller Wiring Schematic - CXM Single Stage Heat Pump

Note:

1. CXM control board should be set for Stage 1 operation. (Dip 2 in ON Position). This is needed for the signal to the LON controller.

2. "AL2 Dry" jumper must be clipped.

3. For Optional Alarm Input, contact should be closed during Unoccupied Mode.

4. For Optional Time Clock Input, contact should be closed during Unoccupied Mode.
Typical LON Controller Wiring Schematic - CXM Dual Stage Heat Pump

LONWorks* Communications Network

Note:
1. Both CXM control boards should be set for Stage 2 operation. (Dip 2 in OFF Position). This is needed for the signal to the LON controller.
2. Both "AL2 Dry" jumpers must be clipped.
3. For Optional Alarm Input, contact should be closed during Unoccupied Mode.
4. For Optional Time Clock Input, contact should be closed during Unoccupied Mode.
Typical LON Controller Wiring Schematic - DXM Single Stage Heat Pump

Note:

1. DXM control board should be set for Stage 1 operation. (Dip 1.2 in ON Position). This is needed for the signal to the LON controller.

2. "AL2 Dry" jumper must be clipped.

3. For Optional Alarm Input, contact should be closed during Unoccupied Mode.

4. For Optional Time Clock Input, contact should be closed during Unoccupied Mode.
Typical LON Controller Wiring Schematic - DXM Dual Stage Heat Pump

Note:

1. DXM 1 should be set for Stage 1 operation. (Dip 1.2 in ON Position). DXM 2 should be set for stage 2 operation. This is needed for the signal to the LON controller.

2. Both "AL2 Dry" jumpers must be clipped.

3. For Optional Alarm Input, contact should be closed during Unoccupied Mode.

4. For Optional Time Clock Input, contact should be closed during Unoccupied Mode.
Operations Description

Fan Operation
Digital output point N04 is the fan output and is connected to the “G” terminal on the CXM or DXM control. If Fan Mode (software point within the LON controller) is set to On Mode, then the fan is energized continuously during occupied times and intermittently during unoccupied times. If Fan Mode is set to “Auto” Mode, then the fan is energized only during a call for heating or cooling. “Auto” Mode is the default mode of operation.

Heating/Cooling Changeover
Digital output point N03 is the RV output and is connected to the “O” terminal on the CXM or the “O/W2” terminal on the DXM. N03 is energized during a call for cooling. The LON controller employs “smart RV” control. This ensures that the RV will only switch positions if the LON controller has called for a heating/cooling mode change.

Cooling Operation
Digital output points N01 and N02 are the outputs for compressor stage 1 and compressor stage 2, respectively. N01 is connected to the “Y” terminal on the CXM or the “Y1” terminal on the DXM. If the heat pump is a dual stage heat pump, then N02 is used to control the Stage 2 compressor. N02 (if used) is connected to the “Y” terminal on the stage 2 CXM or the “Y2” terminal on the stage 1 DXM.

N01 and N02 are Off when the zone temperature is between the occupied heating and cooling setpoints. (See figure 3). As the zone temperature rises above the cooling setpoint, N01 is turned On for a proportional amount of time as required to maintain the cooling setpoint. N03 (RV output) would be turned On, if not already On. The N01 On and Off times vary depending upon the difference between the zone temperature and the cooling setpoint, and is controlled over the first half of the cooling throttling range. N01 will be On 100% of the time when the zone temperature exceeds the cooling setpoint by one half of the cooling throttling range.

If the zone temperature continues to rise above the cooling setpoint by more than one half of the cooling throttling range, then N02 is turned On for a proportional amount of time as required to maintain the cooling setpoint. The N02 On and Off times vary depending upon the difference between the zone temperature and the cooling setpoint, and is controlled over the second half of the cooling throttling range.

Figure 3: N01 and N02% On Time

![Image of N01 and N02% On Time](image-url)
The LON controller’s cooling throttling range and cooling setpoint provide the percent of time over which the N01 and N02 outputs will cycle. For example, at 25% throttling range above the cooling setpoint, the N01 output will be On one half the cycle time and Off one half the cycle time; with N02 output being Off. At 75% throttling range above the cooling setpoint, the N01 output is On 100% of the time with the N02 output On one half the cycle time and Off one half the cycle time.

Application defaults may be adjusted to satisfy the requirements of a particular heat pump.

Heating Operation
Digital output points N01 and N02 are the outputs for compressor stage 1 and compressor stage 2, respectively. N01 is connected to the “Y” terminal on the CXM or the “Y1” terminal on the DXM. If the heat pump is a dual stage heat pump, then N02 is used to control the Stage 2 compressor. N02 (if used) is connected to the “Y” terminal on the stage 2 CXM or the “Y2” terminal on the stage 1 DXM.

N01 and N02 are Off when the zone temperature is between the occupied heating and cooling setpoints. (See figure 3). As the zone temperature drops below the heating setpoint, N01 is turned On for a proportional amount of time as required to maintain the heating setpoint. N03 (RV output) would be turned Off, if not already Off. The N01 On and Off times vary depending upon the difference between the zone temperature and the heating setpoint, and is controlled over the first half of the heating throttling range. N01 will be On 100% of the time when the zone temperature drops below the heating setpoint by one half of the heating throttling range.

If the zone temperature continues to drop below the heating setpoint by more than one half of the heating throttling range, then N02 is turned On for a proportional amount of time as required to maintain the heating setpoint. The N02 On and Off times vary depending upon the difference between the zone temperature and the heating setpoint, and is controlled over the second half of the heating throttling range.

The LON Controller’s heating throttling range and heating setpoint provide the percent of time over which the N01 and N02 outputs will cycle. For example, at 25% throttling range below the heating setpoint, the N01 output will be On one half the cycle time and Off one half the cycle time; with N02 output being Off. At 75% throttling range below the heating setpoint, the N01 output is On 100% of the time with the N02 output On one half the cycle time and Off one half the cycle time.

Application defaults may be adjusted to satisfy the requirements of a particular heat pump.

Occupied/Unoccupied Changeover
When the LON controller is in the Stand-Alone Mode of operation, and no time clock input is available, the LON controller defaults to the Occupied Mode.

When an optional external time clock is connected to the UI2 input, occupancy changeover can be provided. Alternatively, the occupancy changeover may be provided through another LON device on the network through either the nviOccCmd, nviOccupSw.State, or nviOccSchedule.currentstate network variables.
Communications Hardware Checkout

1. Verify controlled equipment is in a manually controlled, safe state.
2. Place LON controller power breaker in the ON position. See job wiring diagrams.
3. Observe green Data Transmission LED on top of LON controller (see figure 4.) and do the following:
   a) If green Data Transmission LED is steady on or blinking, go to step 4.
   b) If green Data Transmission LED is off, check power.
4. Observe red Service LED and yellow date reception LED and do the following:
   a) If red service LED is blinking (1/sec), use third party network management tool to download application into the LON controller.
   b) If red service LED is steady on, turn power off to controller, wait 5 seconds, then turn power back on. If red service LED is still steady on, turn power off and contact service personnel.

Mechanical Hardware Checkout

1. Verify wiring between ASW Wall Sensor and LON controller is installed according to job wiring diagram and with national and local wiring codes.

Note: Wiring of the S-Link and LON network between the sensor and the LON controller is not polarity sensitive.

2. If LON controller is part of a LON network, verify the FTT-10 LONWorks® network wiring between LON controller and other devices is installed according to job wiring diagram and national and local electrical codes.

Service

Components within the LON controller can not be field repaired. If there is a problem with a LON controller, follow the steps below before contacting your local service office.

1. Make sure LON controllers are connected and communicating to desired devices.
2. Check all sensors and controlled devices are properly connected and responding correctly.
3. If LON controller is operating, make sure the correct profile and application is loaded by checking the LONMark® Program ID and the nciSECMdlNum using third party network management tool.

Record precise hardware setup indicating the following:
- Version numbers of application software.
- Controller firmware version number.
- A complete description of difficulties encountered.
Table 2: LED Indication

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Context</th>
<th>Status</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Reception LED - Yellow</td>
<td>Anytime</td>
<td>Blinks when the LON controller receives data from the LON</td>
<td>None required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON indicates the LONWorks network wire may be disconnected</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF indicates that data reception is not taking place</td>
<td></td>
</tr>
<tr>
<td>Data Transmission LED - Green</td>
<td>Anytime</td>
<td>Blinks when the LON controller transmits data to the LON</td>
<td>None required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON indicates that the LON controller is not transmitting data, ON also indicates that power is being applied to the LON controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF indicates no power to LON controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power-up</td>
<td>If a valid application is loaded, the LED blinks once to indicate successful power-up</td>
<td>None required</td>
</tr>
<tr>
<td></td>
<td>Wink mode</td>
<td>Blinks ON and OFF five times to indicate physical location of the LON controller</td>
<td>Replace the LON controller</td>
</tr>
<tr>
<td></td>
<td>Power-up</td>
<td>ON indicates that the neuron application is not running, neuron applications are not field replaceable</td>
<td></td>
</tr>
<tr>
<td>Service LED - Red</td>
<td>Power-up</td>
<td>Blinks (1/second) to indicate that the neuron application is loaded, but the neuron’s communication parameters are not loaded, are being reloaded, or have been corrupted. Communications parameters cannot be configured by field personnel</td>
<td>Use their party network management tool to download the appropriate application. If the red service LED continues to blink, download the application two to three more times. If the red LED is still blinking, replace the LON controller.</td>
</tr>
<tr>
<td></td>
<td>Power-up</td>
<td>OFF indicates that the neuron application is loaded but the device is off line. In this state, a pre-loaded HVAC application will not run, and you will be unable to download an application to the LON controller.</td>
<td>If you are unable to download and/or run an HVAC application, use third party network management tool to put LON controller online. It will be possible to download and/or run an HVAC application.</td>
</tr>
<tr>
<td></td>
<td>Power-up</td>
<td>OFF may also indicate a normal state, in this state, the LON controller operates normally, and you can download and/or run HVAC applications.</td>
<td>If the LON controller is able to accept and/or run downloaded HVAC application, no action is required.</td>
</tr>
</tbody>
</table>
ASW Wall Sensors

Table 3: Model Chart

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Keypad</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASW01</td>
<td>Sensor Only</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>ASW02</td>
<td>Sensor with Override</td>
<td>One-Key</td>
<td>LED Override Status Indication</td>
</tr>
<tr>
<td>ASW03</td>
<td>Sensor with Setpoint Adjustment and Override</td>
<td>Three-Key</td>
<td>LED Override Status Indication and Digital LCD</td>
</tr>
</tbody>
</table>

Table 4: Setup of ASW03 Sensor

<table>
<thead>
<tr>
<th>Item</th>
<th>Resource Tag Name</th>
<th>Default</th>
<th>Display Format</th>
<th>Icons Enabled</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Units</td>
<td>*</td>
<td>°F</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>PB Override Time</td>
<td>PBOccMode</td>
<td>120 Minutes</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Fan Mode</td>
<td>Fan Mode</td>
<td>AUTO</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>HVAC Mode</td>
<td>HVAC Mode</td>
<td>AUTO</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Setpoint Value</td>
<td>Occ Heat SP</td>
<td>80</td>
<td>XX</td>
<td>*</td>
<td>56</td>
<td>84</td>
</tr>
<tr>
<td>Current Status Display</td>
<td>Room Temperature</td>
<td>Room Temperature</td>
<td>XX</td>
<td>°F</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

Table 4 shows the setup options associated with ASW03 Digital Wall Sensor that have been implemented in the LON controller. This programming resides in the LON controller and is in effect any time an ASW03 is connected to the LON controller.
### Table 5: Profile Network

<table>
<thead>
<tr>
<th>SNVT Name</th>
<th>LON</th>
<th>Water-Air</th>
<th>Water-Water</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Point Type</strong></td>
<td><strong>NVT Index</strong></td>
<td><strong>Default</strong></td>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>
Wall Sensor Application

ASW Sensors are wall-mounted digital temperature sensors for use with LON Controllers. These sensors feature Sensor Link (S-LINK) communication protocol which provides a simple two wire interface for power and exchange of sensor and LON Controller information. Available in three models, these ASW Sensors provide integral analog to digital conversion for elimination of electrical interference between sensor and LON controller. An optional wiring connection allows access to the LON network via a LON jack on the left side of each controller.

ASW Sensors are suitable for direct-wall, 2” x 4” electrical box, 1/4 DIN electrical box, or surface box mounting.

Installation
The ASW Sensor is packaged disassembled in one container and consists of three major parts:
• A pre-wireable base plate for wiring to the LON controller and to the LON network.
• An electronic assembly containing the sensor and associated circuitry.
• A removable cover.

Inspection
Inspect carton for damage. If damaged, notify carrier immediately. Inspect sensors for damage. Return damaged products.

Table 6: Model Chart

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Keypad</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASW01</td>
<td>Sensor Only</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>ASW02</td>
<td>Sensor with Override</td>
<td>One-Key</td>
<td>LED Override Status Indication</td>
</tr>
<tr>
<td>ASW03</td>
<td>Sensor with Setpoint Adjustment and Override</td>
<td>Three-Key</td>
<td>LED Override Status Indication and Digital LCD</td>
</tr>
</tbody>
</table>
Obtain the following prior to installation:
• Job wiring diagrams.
• Tools:
  - Drill and bits for mounting screws
  - Level
  - Static protection wrist strap
• Two mounting screws.
• Drywall anchors for direct-wall mount
• Accessories (if required) from Invensys.
  - AT-1104 Cast aluminum guard with steel base plate.
  - AT-1155 Clear plastic guard with solid and ring base, tumbler type key lock.
  - AT-1163 Wire guard with steel base plate.
  - MNA-STAT-1 Replacement covers (qty. 12).
  - MNA-STAT-2 Designer inserts for ASW01 model (qty. 25).

Precautions
• Installer must be a qualified technician.
• Follow static precautions when installing this equipment.
• Use copper conductors that are suitable for 167°F (75°C).
• Make all connections according to electrical wiring diagram, national and local electrical codes.

Static Precautions - Static charges damage electronic components. The microprocessor and associated circuitry are extremely sensitive to static discharge. Use the following precautions when installing, servicing, or operating the system.
• Work in a static-free area.
• Discharge static electricity by touching a known, securely grounded object.
• Use a wrist strap connected to earth ground when handling the controller’s printed circuit board.

Federal Communications Commission (FCC) - This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy and may cause harmful interference if not installed and used in accordance with the instructions. Even when instructions are followed, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
• Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications (DOC) - This class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

**WARNING!**
Electrical shock hazard! Disconnect power before installing or removing the cover.

**CAUTION!**
• Avoid locations where excessive moisture, corrosive fumes, vibration, or explosive vapors are present.
• Avoid electrical noise interference. Do not install near large contractors, electrical machinery, or welding equipment.
• Locate where ambient temperatures do not exceed 122°F [50°C] or fall below 32°F [0°C] and relative humidity does not exceed 95% or fall below 5%, non-condensing.

**Location** - ASW Sensors are suitable for indoor use only. Locate the ASW Sensor on an inside wall where the sensor is exposed to at least 30 feet (9 meters) per minute of unrestricted air circulation. The location should represent the average temperature in the room or space. Make certain sensor is located out of direct sunlight, away from sources of heat or cold, and away from concealed ducts or pipes.

**Mounting** - ASW Sensors can be direct-wall, 2” x 4” electrical box, 1/4 DIN electrical box, or surface box mounted. See Figure 7 and Figure 8 for appropriate mounting dimensions.
Installation

Figure 7: Dimensions for Direct-wall, 2x4 Electrical Box, and Surface Box Mounting

Direct-wall Mount
1. Use mounting dimensions shown in Figure 7.
2. Feed S-LINK wires through base plate.
3. If required, feed LON wires through base plate.
4. Using two appropriate screws (use drywall anchors as necessary), mount base plate to wall. (Figure 9)

Figure 8: Dimensions for 1/4 DIN Electrical Box Mounting

Figure 9: Direct Wall Mounting
2” x 4” Electrical Box Mount
1. Use mounting dimensions shown in Figure 8.
2. Feed S-LINK wires from electrical box through base plate.
3. If required, feed LON wires through base plate.
4. Using two 6-32 x 5/8 in. flat head screws (not provided), mount base plate to electrical box. (Figure 10).

1/4” DIN Electrical Box Mount
1. Use mounting dimensions shown in Figure 8.
2. Feed S-LINK wires from electrical box through base plate.
3. If required, feed LON wires through base plate.
4. Using two appropriate screws (not provided), mount base plate to electrical box using vertical mounting holes indicated. (Figure 11)

CAUTION! Failure to use horizontal mounting holes as shown in Figure 8 may cause a short of the LON.

Surface Box Mount
1. Use mounting dimensions shown in Figure 7.
2. Feed S-LINK wires from electrical box through base plate.
3. If required, feed LON wires through base plate.
4. Using two 6-32 x 5/8 in. flat head screws (not provided), mount base plate to surface box. (Figure 12)
Communications Wiring

The following electrical connections can be made to the ASW Sensors:
• Sensor Link (S-LINK) Wiring.
• LON network Wiring.

Communications Wiring - Communications wiring includes a connection between the LON controller and an ASW Sensor via the S-LINK and an optional connection between the sensor and the LONWorks® network. Figure 13 shows S-LINK and LON wiring terminations.

<table>
<thead>
<tr>
<th>CAUTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication wire pairs must be dedicated to the S-LINK LON controller and to the LON network. They cannot be part of an active, bundled telephone trunk.</td>
</tr>
<tr>
<td>Shielded cable is not required for S-LINK or LON wiring.</td>
</tr>
<tr>
<td>If the cable is installed in areas of high RFI/EMI, the cable must be in conduit.</td>
</tr>
<tr>
<td>Do not mix S-LINK or LON with UI, DI, AO, DO, or power types of wiring. If conduit is used between an ASW Sensor and a controller, LON wiring and S-LINK wiring can be in the same conduit.</td>
</tr>
<tr>
<td>If shielded wire is used, the shield must be connected to earth ground at one end only by a 470K Ohm 1/4 Watt resistor. Shield must be continuous from one end of the trunk to the other.</td>
</tr>
</tbody>
</table>

Sensor Link (S-LINK) Wiring - S-LINK wiring powers and enables the ASW Sensor. The S-LINK needs at least 24 gage (0.51mm), twisted pair, voice grade telephone wire. The capacitance between conductors cannot be more than 32 pF per foot (0.3m). If shielded cable is used, the capacitance between any one conductor and the others, connected to the shield, cannot be more than 60 pF per foot (0.3m). Maximum wire length is 200 ft. (61m).

Note:
• S-LINK wiring is not polarity sensitive.
• If conduit is used between an ASW Sensor and a controller, the LONWorks® network and S-LINK wiring can be in the same conduit.
• S-LINK wiring and LON wiring can not be in the same conduit with UI, AO, and DI Wiring.

Connect the S-LINK to ASW Sensor
1. Strip 1/4 in. (6mm) of insulation from S-LINK wires.
2. Connect wires to screw terminals 1 and 2 (Figure 13) The S-LINK terminals are polarity insensitive.
3. Push excess wire back through the base plate to minimize air flow restriction.

LON Network Wiring - An approved two-pair cable may be used for both S-LINK and optional LON connection between the controller and ASW Sensor. LON wiring is polarity insensitive.
ASW Sensors use LONWorks® Free Topology Transceiver (FTT-10) and support polarity insensitive bus wiring topologies. Four wires (a daisy chain connection) must be used to connect an ASW Sensor to a doubly terminated bus. Use two wires to connect sensors to LON network. Free topology rules apply.

See I/A Series® MicroNet System Engineering Guide, F-26507 to design a LONWorks® FTT-10 network, including recommended topologies and approved cable types (See Table 10).

Connecting the LON network to an ASW Sensor provides local access to the LON network via the sensor’s LON jack. This connection is optional.

**Connect LON to ASW Sensor**
1. Strip 1/4 in. (6mm) of insulation from LON wires.
2. Connect wires to screw terminals 3 and 4. (Figure 13)  
   The LON terminals are polarity insensitive.
3. Push excess wire back through the baseplate to minimize air flow restriction.

**Wiring Checkout** - Verify wiring between ASW Sensor base plate and the LON Controller is installed according to job wiring diagram, national and local wiring codes.

**Electronic Assembly and Cover Installation**
1. Set electronic assembly onto bottom hooks of baseplate.
2. Secure electronic assembly to base plate by tightening two screws at top of assembly. (Figure 14)
3. Insert bottom tabs of cover and then snap top into place.

**Note:** To remove sensor cover, place thumb in middle of sensor, grasp top edge of cover with fingers and pull firmly.

**LON Network Jack** - A LON jack is located on the left side of each sensor model. The mating plug for the LON jack is a 1.3mm DC power plug. (Figure 15) shows location of the LON jack.
Push-button Override - During the Unoccupied Mode of operation, if the “Override” button on the ASW02 or ASW03 sensor is pressed for 1 to 3 seconds, the LON controller switches to the Occupied Mode of operation. Control is based on occupied attribute values. The override is in effect for the time specified by the sensor’s Override Time set up option. The default value is 120 minutes.

If the “Override” button is pressed for less than 4 seconds during the override operation, the override timer resets to its starting value. The override can be canceled by pressing the “Override” button for more than 4 seconds. The override feature can be enabled or disabled by changing the Object Control Logic within the LON controller.

The override LED indicator flashes when timed override has less than 5 minutes remaining. If the override time is left to expire, the controller returns to the Unoccupied Mode.

- **To override the Unoccupied Mode:**
  Press (for less than 4 seconds) and release the Override key (LED Indicator turns on). The controller goes into the Occupied Mode for override time specified by controller.

- **To reset override time:**
  If override time has not expired, press (for less than 4 seconds) and release Override key. Override time resets to time specified by controller.

- **To cancel override:**
  Press and hold Override key for 4 seconds (LED Indicator turns off). Override is cancelled and controller returns to Unoccupied Mode.

Reading Lockout Code at ASW Wall Sensor

If a given heat pump experiences a lockout condition, for example, a heat pump locks out due to High Pressure refrigeration failure; then a corresponding code will be displayed at the wall sensor if an ASW03 is being used.

Codes at the ASW03 wall sensor:

- High Pressure Lockout Code = “2”
- Low Pressure Lockout Code = “3”
- Water Coil Low Temperature Limit Lockout Code = “4”
- Air Coil Low Temperature Limit Lockout Code = “5”
- Condensate Overflow Lockout Code = “6”
- Over/Under Voltage Shutdown Code = “7”
- UPS Warning Code = “8”
- CXM Dual Stage Heat Pump Lockout Code = “9”

See CXM or DXM Application Manuals for detailed description of lockout type.

The Lockout code will be displayed along with the current zone temperature. For example, if a high pressure lockout has occurred, then the ASW03 will display:

“75….2….75….2….75….2….75….2….2…..”
Note: If LON controller is connected to a dual compressor heat pump with 2 CXM controls, the wall sensor will display code 9 when there is a lockout. If the LON controller is connected to a dual compressor heat pump with 2 DXM controls, the wall sensor will always display the lockout code for the compressor stage 1, even if the stage 2 compressor locks out. If the dual stage DXM heat pump locks out via either compressor, a warning code, of some type, will always be displayed at the wall sensor.

Resetting Lockout at ASW Wall Sensor
To reset a heat pump lockout via the ASW02, ASW03 or ASW04 wall sensors, the user can accomplish this by using the override button:

A) If the ASW02 or ASW03 is NOT in “Override” mode (red LED is not on), then push the “Override” button for 1 to 3 seconds and the red LED will turn on momentarily. The LON Controller turns off the N01 and N02 outputs, which in turn resets the CXM or DXM control.

B) If the ASW02 or ASW03 is in “Override” mode (red LED is on), then push the “Override” button for more than 4 seconds and the red LED will turn off. Re-enter Override mode by pressing the Override button for 1 to 3 seconds and the red LED will turn on. Once ASW Sensor enters “Override” mode, the LON controller turns off the N01 and N02 outputs which in turn resets the CXM or DXM control.

Fail Safe Mode
When communications between the LON controller and its ASW wall temperature sensor is interrupted, the LON controller’s digital outputs default to the Off state. When communication is restored, the LON controller resumes normal control.

Display Screen Functions
The ASW03 model has one display screen slot. The connected LON controller’s application defines what is visible in each slot. The first display screen slot always shows the sensor’s default display.
Sensor time-out - The ASW Sensor times out and returns to the default display if left idle for 15 seconds. If sensor is in diagnostics mode, then time out is 30 seconds.

To enter a selection: Press any key besides the Up/Down Key after making your selection. The selection will be automatically entered after a 5 second timeout.

To fast scroll toggle for increasing or decreasing values: Press and hold either end of the Up/Down Key and tap and release Override Key. To terminate fast scroll, release Up/Down Key.

Service Pin - To command controller to send controller service pin to the LON: Press and hold Override key for eight seconds. The service pin of connected controller is sent out on the LON.

Setpoint Functions - The ASW03 model has one setpoint slot. The setpoint assigned to each slot depends on LON controller application and sensor's configuration.

Service - Components within ASW Sensors can not be field repaired. If there is a problem with a sensor, follow the steps below before contacting your local Service office.

1. Make sure sensors are connected and communicating to desired devices.
2. Record precise hardware setup indicating the following:
   - Version numbers of applications software.
   - Controller firmware version number.
   - A complete description of difficulties encountered.

### Table 8: Troubleshooting

<table>
<thead>
<tr>
<th>Sensor Condition</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD remains blank</td>
<td>Check sensor and LON Controller wiring and correct, if necessary. If wiring is okay, check to see if power is being applied to the sensor by pressing the Override Key for less than four seconds. If the Override LED lights up, the sensor is powered. If the Override LED does not light up, the sensor may not be receiving power. Check LON Controller power to verify presence. If the above measures do not address the problem, download a new application to the LON Controller.</td>
</tr>
<tr>
<td>Sensor displays “Abn” Indefinitely.</td>
<td>Check the documentation to make sure the sensor model is compatible with the LON Controller application and then choose one of the following options. If the sensor and application are compatible, download a new application to the LON Controller. If the sensor and application are incompatible, download an application that is compatible with the sensor. Or, install a sensor that is compatible with the LON Controller application.</td>
</tr>
<tr>
<td>All LCD icons light up and remain lit.</td>
<td>Check to see if the LON Controller is constantly resetting and correct, if necessary. Check sensor and LON Controller wiring and correct, if necessary. If reset and wiring are okay, download a new application to the LON Controller. If the above measures do not address the problem, the LON Controller may need to be configured. For configuration instructions, consult documentation associated with the network management tool.</td>
</tr>
</tbody>
</table>
ASW03 Digital Wall Sensor

Figure 16: ASW03 Digital Wall Sensor

- Display
- Up/Down Key
- Override Key
We work continually to improve our products. As a result, the design and specifications of each product at the time of order may be changed without notice and may not be as described herein. Please contact our Customer Service Department at 1-405-745-6000 for specific information on the current design and specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties, but are merely our opinion or commendation of its products.