



Net/X Thermostat™ Network Installation and Troubleshooting Guide

Introduction

This document contains basic procedures that can be used when installing the Net/X Thermostat network. It is highly recommended that to review these procedures to gain an understanding where you may experience problems during installation.

In many cases, we see the attitude of "wire the network, apply power, check what doesn't work, and fix it." We understand that you're excited about getting your Net/XThermostat Network up and running quickly, and it seems so easy to accomplish. After all, it's just two wires, right?? Unfortunately, about 95% of the tech support telephone calls and e-mails that are fielded by NetworkThermostat regarding starting up a network are related to miss-wired networks.

The problem with this approach is that the electronics connected to the network can be damaged because of short-circuits that exist in your finished wiring. Of course, the electronics are protected, but our devices aren't protected against these short-circuits for an indefinite period. Eventually, something has to blow, just like a circuit breaker would in your house if it's wired wrong or if there is too much draw on a circuit

This document was written to apply to large networks, but is just as valid for smaller installations. In general, the tests described in this document consist of making a few simple measurements at the thermostat baseplate using an ordinary voltage-ohm meter commonly known as a multi-meter. These tests are useful because they remove any doubt about problems hidden when you only verify wiring color codes at each location. By measuring the resistance at each baseplate, you will be assured that there are no short-circuits due to frayed or nicked wires. By measuring the voltage at each thermostat baseplate, you will ensure that the proper signal is carried on the communications wire. Both measurements should be performed before any of the thermostat electronics are actually connected to the network. This results in a high level of confidence that the thermostat network will operate without any damage to the electronics.

We have attempted to keep everything as simple as possible for you during your first installation of the Net/X Thermostat network. If you will invest a little of your time on familiarizing yourself with these procedures and pay close attention to the key aspects described in this document, then you will find that implementation of the Net/X Thermostat network is simple.

Equipment Required

1. Notebook computer.
2. Digital Multi-Meter (DMM).
3. Appropriate wire strippers, screwdrivers, punch-down tools, etc.

Installing the Thermostat

1. If you're not an HVAC contractor, please coordinate the thermostat installation with the HVAC contractor on the job. Each thermostat includes instructions required to install the unit.
2. These electronic thermostats should be installed and tested by the HVAC contractor. We request this to make sure the contractor and any network/automation specialist understand that the NET/X thermostat will work stand-alone (with or without the network controllers). Communications cables between the thermostat location and other control systems can be connected by the network/automation specialist or the HVAC contractor.

Installing wiring to the Thermostat Network.

1. Verify that all wires from the NT-SSAx network controller are disconnected by removing the terminal block connectors on the network controller.
2. Go to each thermostat location and remove the display unit from the baseplate. Perform the following steps for each location.
3. Pull the network cable (CAT5) out from behind the thermostat baseplate using a pair of needle-nose pliers.
4. Connect the appropriate wires for X1 (**BLUE/WHITE**) and X2 (**BLUE**) terminals. The other end of these two wires should not be connected to the communications network controller or any other thermostat at this time.

To verify no cross-wiring has occurred, complete the following steps:

5. Using an ohmmeter, verify that the resistance is infinite, or open-circuit, across the X1 and X2 terminals on the thermostat baseplate.
6. Using an ohmmeter, verify that the resistance is infinite, or open-circuit, across the X1 and CLK1 terminals on the thermostat baseplate.
7. Using an ohmmeter, verify that the resistance is infinite, or open-circuit, across the X2 and CLK1 terminals on the thermostat baseplate.
8. Using a voltmeter, verify that the DC voltage is zero across the X1 and X2 terminals on the thermostat baseplate.
9. Using a voltmeter, verify that the DC voltage is zero across the X1 and CLK1 terminals on the thermostat baseplate.
10. Using a voltmeter, verify that the DC voltage is zero across the X1 and CLK2 terminals on the thermostat baseplate.
11. Using a voltmeter, verify that the AC voltage is zero across the X1 and CLK1 terminals on the thermostat baseplate.
12. Using a voltmeter, verify that the AC voltage is zero across the X1 and CLK2 terminals on the thermostat baseplate.

Continue only after the above measurements are completed and correct.

13. Reattach the thermostat display back to the baseplate.
14. Verify that thermostat is operational.
15. Using a voltmeter, verify that the DC voltage is approximately +3.8VDC to +4.1VDC the end of the X1 and X2 wires in the location at which they will connect to the NT-SSAx network controller or the next thermostat in the communications loop. The positive lead of the voltmeter should be connected to the X1

wire. The negative, or common lead, should be connected to the X2 wire. Any voltage below 0.5 VDC indicates that you do not have a complete path to the thermostat.

WARNING: The thermostat communications bus is polarity sensitive. You must correct any problems with your wiring if you measure a negative voltage. This situation usually occurs because the network communications wires are reversed.

16. Fix all wiring problems before you continue.
17. Repeat steps 1-17 for all thermostats in the building before proceeding. Continue this process, wiring in each verified thermostat to the communications bus as you continue to work your way through the network.
18. Once all thermostats are wired with the X1 and X2 terminals connected, perform one more test as described in step 15 above.

Standalone Network Controller Test

This test can be used for verifying operation of the NT-SSAx network controller without any thermostats connected to the device. This step is only required to establish a baseline DC voltage for the thermostat communications network.

1. Verify that 16 VAC transformer supplied is wired to the NT-SSAx network controller. Remove the power connector from the network controller so the unit is powered off.
2. Remove all other wires from the remaining terminal block connectors so that only thing being evaluated is the NT-SSAx network controller. This means removing the X1 and X2 terminal block wires from the network controller. Also remove the 5-wire connector block to the RS-485 network.
3. Connect the network controller to your computer using the cable supplied.
4. Configure the computer's terminal emulator (Hyperterminal or similar) for 9600 baud, 8 bits, N parity, 1 stop bit (9600B,8,N,1). *One easy way to get the configuration taken care of for terminal emulation is to load the Net/X Command Center software.*
5. Reattach the power connector to the network controller. When the network controller is powered up, verify that the red, yellow and green LEDs are illuminated. Verify that the green LED is blinking.
6. Verify text in the terminal emulator screen that indicates that the network controller transmitted characters to the computer. The string should include the characters NT-SSAx. This gives you an additional indication that the network controller is operational. The text will be something in the form NT-SSAx/CLK v2.09.
7. Using a voltmeter, measure the DC voltage on the network controller terminal block connector between the pins labeled X1 and X2 where X2 is common. Verify that you have a solid connection by tightening the screw terminals down or by placing the probes in the connector where the wires are normally attached. You should measure a voltage between +22.5 and +23.3 VDC. This is a no-load condition and is used to establish the baseline for DC voltage for subsequent measurements.

WARNING: You should not measure a DC voltage that is greater than about 25.0 VDC. This indicates that the network controller has been damaged.

8. DO NOT continue if the network controller is not operation in accordance with this procedure.

Thermostat Network Tests

This is an additional test to help you verify that the thermostat network is wired correctly to X1 and X2 and to establish communication with each thermostat on the network.

DO NOT attempt to perform these tests without first completing all steps above.

1. Connect the network controller pins labeled X1 and X2 to the thermostat network. Connect the thermostat network wires X1 and X2 to the network controller terminal block connector. Screw the wires firmly in place on the network controller.

To verify no cross-wiring has occurred, complete the following steps:

2. Using a voltmeter, verify that the DC voltage is at least +19.5 volts on network controller pins labeled X1 and X2. The positive lead of the voltmeter should be connected to the X1 wire. The negative, or common lead, should be connected to the X2 wire. Any voltage below +19.5 VDC indicates that you may have difficulty communicating with the thermostats. The following table should assist your troubleshooting if you do not measure voltage that is ≥ 19.5 VDC.

Voltage Measured	Status	Potential Problem
≥ 19.5 VDC to 23.5VDC	Correct	None
~ 2 VDC to ~ 19 VDC	Incorrect loading	1) Wrong cable installed or cables too long. 2) Thermostats must be within 1000 ft of the network controller.
0VDC to ~ 2 VDC	Short Circuit	1) At least one (1) thermostat pair has X1 and X2 reversed, or 2) At least one (1) direct short of X1 and X2 has occurred.

3. Correct any wiring problems that may exist in accordance the previous table.

Continue only after the above measurements are completed and correct.

4. Verify that the thermostat address has been configured properly. This can be done by holding the thermostat Mode and Fan buttons down at the same time for approximately eleven (11) seconds. The factory default for the thermostat address is 01. You change the address by pressing the Up \uparrow or Down \downarrow arrows once you have entered this mode. Press the Mode button to lock in the value once the desired address has been displayed. The thermostat should return to displaying the Indoor temperature if you have performed this step correctly.

NOTE: The thermostat address entered from the front of the thermostat will match the Net/X Command Center addressing. When performing set-up tests using a terminal emulation program, all addresses greater than nine (9) will need to be converted using the thermostat address cross-reference table, P/N 200025-001.

5. Return to the computer terminal and type the commands that follow.
6. Type the command REV and press the \downarrow Enter key. The network controller should respond with the same revision string you saw in the standalone test.
7. Type the command WTVD0 and press the \downarrow Enter key.
8. Type the command RVM and press the \downarrow Enter key. Record the network controller response in case you require technical support. The requirements for this mode are determined by the software written to manage your thermostat network.
9. Type the command ROL and press the \downarrow Enter key. Record the network controller response in case you require technical support. If the network controller has not been configured, then the list will contain all zeros separated by commas.
10. Type the command WOL0D0 and press the \downarrow Enter key. Another way of saying this is with the phrase DoubleYou Oh Ell Zero Dee Zero. This command will clear the on-line list in the event that it contains old thermostat addresses that are not found in your network. *Sorry about that! We don't mean to insult your intelligence. Just want to make sure that our instructions are clear at this point since we can't be sure that you could tell the difference between 0 and O with the fonts used in these instructions.*
11. Repeat step 7 of this test to verify that you have cleared the list.

12. Type the command **RASaddr** and press the ↵ Enter key. Substitute **addr** with the thermostat address you set in step 6. If you are actually communicating with the thermostat, you should see a list that contains the settings you've seen at the thermostat. The only other response to this command is usually **READ ERROR**.
13. We have seen problems with noise in the system when only one thermostat is connected and the rest of the network wire between X1 and X2 is still connected. If the response to step 13 is **READ ERROR**, then try disconnecting any wiring that might be acting as an antenna. (*Think about it this way, if you've got 16 thermostats connected in a daisy-chain that's 700 feet long and you only have one thermostat connected to a backplate, you've got an antenna that can be 650+ feet long!*) In other words, try to first isolate wiring problems by making sure that you only have one communicating thermostat and wire in the network until you are satisfied that you can communicate successfully with it.
14. If these steps work, then repeat for each thermostat address on the network. Be sure that you are using the address conversion table provided in the installation guide when entering the address manually.
15. If these steps don't work, then it's time to call tech support.

(Option) Installing the Outdoor Sensor

(Perform this step only after the baseline thermostat network is operational)

1. Go to the appropriate thermostat location and remove the display unit from the baseplate.
2. Verify that the network controller is not connected to the automation equipment by removing any connections to X1, X2, CLK1 and CLK2.
3. If necessary, pull the outdoor sensor cable out from behind the thermostat baseplate using a pair of needle-nose pliers.
4. Connect the outdoor sensor in accordance with the instructions included inside the box with the sensor.
5. Place the thermostat display unit back onto its baseplate.
6. Wait five to ten seconds for the remote outdoor sensor to establish communications with the thermostat.
7. Push the thermostat button labeled Outdoor.
8. Verify that an outdoor temperature is displayed.
9. If the outdoor sensor is not installed correctly, then this value will usually be two dashes. Fix your wiring problems and then repeat this procedure until you are able to read the outdoor temperature.

Outdoor Temperature Broadcasts

Outdoor temperature broadcasting gives you the ability to display outdoor temperature on all thermostats connected to each building's thermostat network. Once you have successfully tested communications with all RS-485 network devices, you must enable outdoor temperature broadcasting to allow outdoor temperature to be displayed on all thermostats in that building.

1. Enter the NT-SSA2/CLK command **>addrWOSaddr2Daddr2** where **addr2** is the thermostat address to which the physical outdoor sensor is installed.

NOTE: This command must be issued for each building on the RS-485 network to allow outdoor temperature to be displayed on all thermostats in that building.

2. To disable outdoor temperature broadcasting, then enter the command **>addrWOS0D0**.
3. Wait one minute for the outdoor temperature to be broadcast to all thermostats. Go to one of the thermostat locations that does not have an outdoor temperature sensor installed and verify that the outdoor temperature is displayed when you press the thermostat button labeled **Outdoor**.

4. Upon completion of this test, restore NT-SSA2/CLK switch labeled Master/Slave to the position labeled **Slave**.

WARNING: Only one Master device on the RS-485 network is permitted. You must restore all slave network controllers to the Slave mode upon completion of these tests. You can usually determine if another network controller on the network is configured as master. All you require is to wait for one minute and determine whether time and date strings are spontaneously received in the terminal emulator screen.

(Option) Installing wiring to a Security Panel

(Perform this step only after the baseline thermostat network is operational)

1. Verify that all wires from the NT-SSAx network controller are disconnected by removing the terminal block connectors on the network controller.
2. Go to each thermostat location and remove the display unit from the baseplate. Perform the following steps for each location.
3. Pull the automation cable out from behind the thermostat baseplate using a pair of needle-nose pliers.
4. Connect the appropriate wires for CLK1 (**ORANGE/WHITE**) and CLK2 (**ORANGE**) terminals. The other end of these two wires should not be connected to the security panel relay at this point.

To verify no cross-wiring has occurred, complete the following steps:

5. Using an ohmmeter, verify that the resistance is infinite, or open-circuit, across the CLK1 and CLK2 terminals on the thermostat baseplate.
6. Using a voltmeter, verify that the DC voltage is zero across the CLK1 and CLK2 terminals on the thermostat baseplate.
7. Using a voltmeter, verify that the AC voltage is zero across the CLK1 and CLK2 terminals on the thermostat baseplate.
8. Create a short-circuit by twisting together the ends of the CLK1 and CLK2 terminals where they will be connected to the security panel.
9. Using an ohmmeter, verify that the resistance is zero, or short-circuit, across the CLK1 and CLK2 terminals on the thermostat baseplate.