



**Communicating Thermostat
System Installation Manual**

COMMUNICATING THERMOSTAT SYSTEM INSTALLATION MANUAL

This manual will guide the installer through the installation, wiring and checkout of an Aprilaire Model 8870 Communicating Thermostat System. Instructions for the Aprilaire 8840 Series communicating thermostat system are found in a separate document (Part No. 10004345). A portion of the command set is found in Appendix 2 in this manual. For a complete command set with programming suggestions, see the programming manual (Part No. 10005756). Contact Research Products Corporation for these documents at 888-782-8638.

THERE ARE 14 STEPS INVOLVED IN THE INSTALLATION OF A COMPLETE SYSTEM.

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WARNING

1. 120 volts may cause serious injury from electrical shock. Disconnect electrical power to the HVAC system before starting installation. This system is a low-voltage system.
2. Improper installation may cause serious injury from electrical shock. This system must be installed by a qualified contractor in accordance with NEC Standards and applicable local and state codes.

Step 1

GET ALL THE COMPONENTS YOU WILL NEED

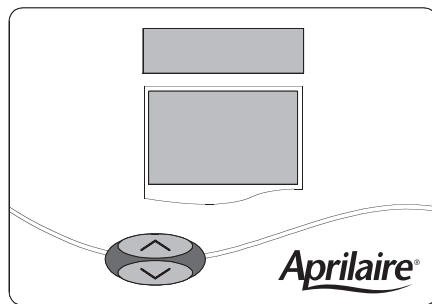
COMPONENTS YOU WILL NEED... (see ILLUSTRATION 1)

- One Aprilaire® Model 8870 Communicating Thermostat for each zone or single zone HVAC system
- One Aprilaire Model 8818 Distribution Panel per eight (8) thermostats in the system
- One Aprilaire Model 8811 Protocol Adapter per 32 thermostats
- 4 to 8 conductor thermostat cable depending on equipment stages (18 – 20 gauge)
- Category 5 communication wire (4-pair twisted cable)
- One 24V AC transformer, ungrounded per 8818 Distribution Panel (part number 8027 or California approved 8029)
- RS-232 or RS-485 based automation system such as the Aprilaire Model 8825 System Controller
- OPTIONAL: Aprilaire Model 8061 Temperature Support Module or Model 8062 Temperature/Humidity Support Module

TOOLS YOU WILL NEED...

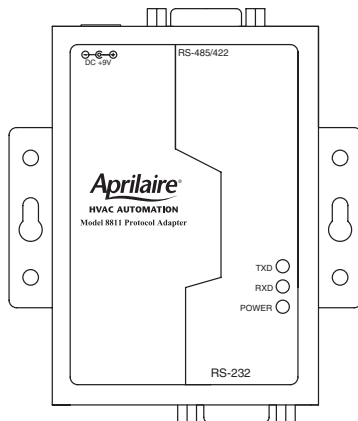
- Small flat head screwdriver for terminal screws (1/8" wide tip)
- Medium size flat/phillips head screwdriver for component mounting screws
- Volt/ohm meter
- Computer with available com port (RS-232) and terminal emulator such as HyperTerminal (for system checkout)
- Wire strippers
- Small level (use to mount components level, required for appearance only)

ILLUSTRATION 1 – System Components



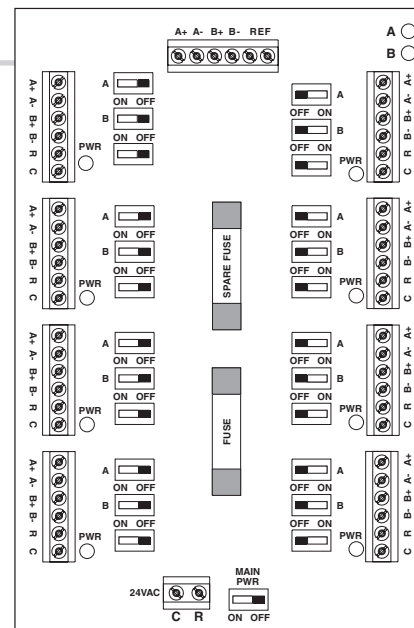
Model 8870 Thermostat

RS-422 Communicating Thermostat controls single or multi-stage heat/cool or heat pump HVAC systems.



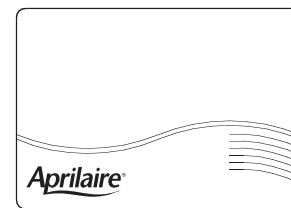
Model 8811 Protocol Adapter

Use to convert RS-485 communication signal from Aprilaire Communication System to RS-232 communication signal readable by host computer. Supports up to 32 thermostats.



Model 8818 Distribution Panel

Switches in the Distribution Panel allow power or communications to be turned off at each individual thermostat to make installation and troubleshooting easy.



Model 8061 and 8062 Support Modules

Up to four can be connected to a single thermostat to sense temperature or relative humidity at a location remote from the thermostat.

MODEL 8870 THERMOSTAT

The Model 8870 Thermostat is field configurable to operate single and multi-stage separate heating and cooling equipment (such as furnace and air conditioner or roof top units), or single and multi-stage heat pump systems. A menu driven set up, using the message center display of the thermostat, can be used to configure many other features. Network communication is non-isolated, full duplex RS-485 (RS-422). The 'A' terminals are the receive pair while the 'B' terminals are the transmit pair. This nomenclature uses the computer or host as the reference, so transmit refers to the lines on which the host transmits data to the thermostat while receive refers to the lines on which the host receives data from the thermostat. The baud rate is selectable between 9600 and 19200. Up to 64 uniquely addressed thermostats may reside on the same thermostat network.

MODEL 8818 DISTRIBUTION PANEL

The Distribution Panel is a switch controlled communication bus that can be wired to eight (8) Aprilaire Model 8870 thermostats. This allows thermostat communication (transmit, receive or both) to be turned on and off at one convenient location which simplifies installation and trouble shooting. Each thermostat station on the distribution panel has an on/off switch for power. This allows isolation of any one thermostat to simplify troubleshooting. Order one Distribution Panel per eight thermostats.

Step 2

DISCONNECT POWER TO ALL HVAC EQUIPMENT AND/OR ZONE CONTROL PANELS

- If the thermostats are wired to a zone control panel, there is generally one set of input terminals supplying power to the thermostats and dampers. This must be disconnected.
- If the thermostats are wired directly to HVAC equipment, the power must be shut off at the equipment. This can generally be accomplished by turning off the disconnect switch located near the equipment. If an obvious disconnect switch is unavailable, you will need to turn the circuit off using the fuse or circuit breaker. Remove the fuse or shut down the circuit breaker serving the equipment.

CAUTION

Failure to disconnect power could result in damage to the HVAC equipment or thermostats. Leave power disconnected until all other electrical connections have been made and checked for accuracy.

MODEL 8061 AND MODEL 8062 SUPPORT MODULES

Support modules are used to either monitor or control temperature or humidity at a location other than the thermostat. They communicate with the thermostat using a RS-485 protocol. Up to four support modules may be wired to a thermostat, with each module able to support two sensors. The Model 8061 has one onboard temperature sensor and room for one offboard temperature sensor (sensor #1 & sensor #2) while the Model 8062 has one onboard temperature sensor (sensor #1) and one onboard humidity sensor (sensor #2). All sensors can be configured as either a control sensor (replaces thermostat temperature sensor as control variable) or a monitor sensor (read only). An offboard sensor such as a Model 8051 Flush Mount Sensor can replace sensor #1 on the Model 8062 or both on the Model 8061. Each support module is addressed and each sensor value can be accessed through thermostat commands. See sensor literature for additional information.

FOR EASE OF INSTALLATION AND TROUBLE SHOOTING DO THE FOLLOWING:

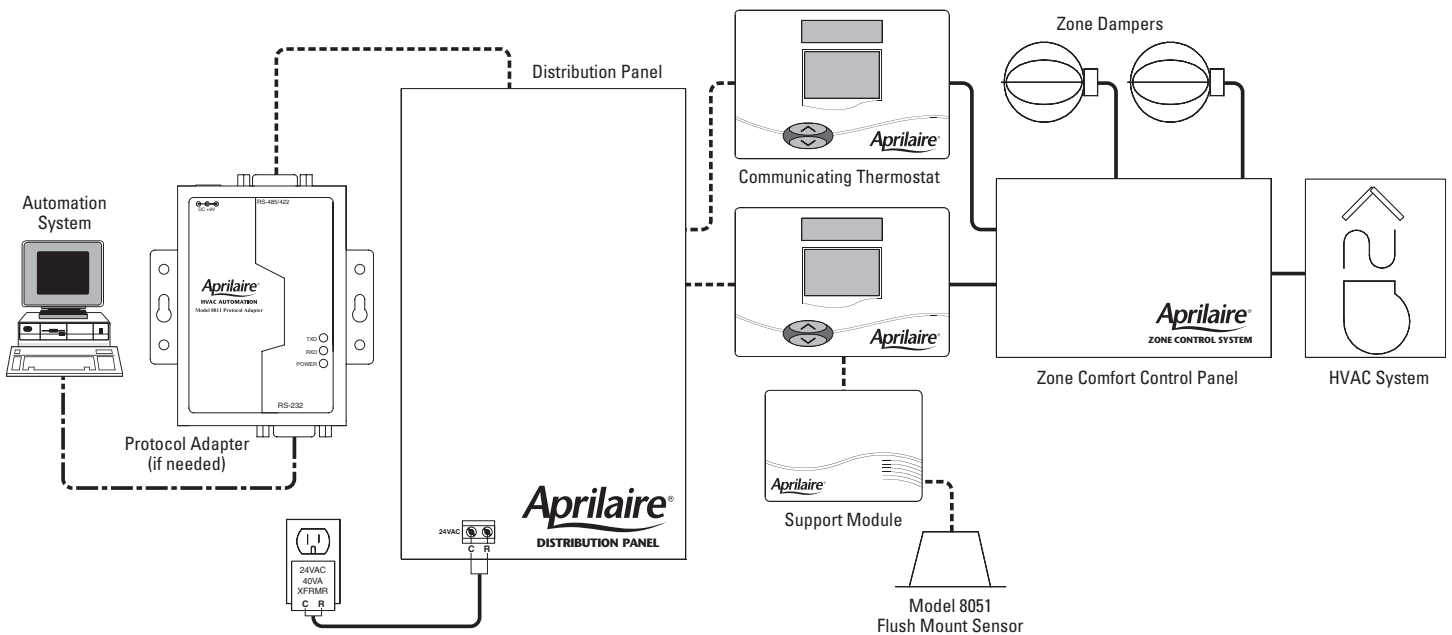
- ✓ Use Category-5 cable for all communication wiring.
- ✓ Check and recheck to ensure connection to the proper terminals before powering up the thermostats. Use wire color as a guide and be consistent.
- ✓ Use a Distribution Panel on all systems with more than one zone. The trouble shooting benefits will outweigh the cost of the Distribution Panel.

Step 3

RUN THE REQUIRED WIRES (SEE ILLUSTRATION 2)

- Run thermostat cable from each thermostat to the appropriate HVAC system or zone control panel. Use 4 through 8-conductor thermostat cable depending on the type of equipment and number of equipment stages. Run one more wire than would be required if connecting to a mechanical thermostat.
 - ❖ If you are using remote temperature or humidity support modules as part of your installation, now is the time to run the additional wires for these items. A separate Category 5 cable must be run from thermostat to support module.
- At the HVAC/zone control system, use a piece of tape to label the location of the thermostat on the cable as you go.
- Run Category-5, 4-pair twisted cable (8-conductor) from each thermostat to the Distribution Panel.
- At the Distribution Panel, use a piece of tape to label the location of the thermostat on the cable as you go.
- Run Category-5 wire from the Distribution Panel to the Protocol Adapter. If more than one Distribution Panel is used, run Category-5 wire between each panel.
- Run two-conductor thermostat cable from the Model 8027 or 8029 Transformer to the Distribution Panel. You can use Category-5 wire, but you must use one pair of wires per terminal.

ILLUSTRATION 2 – Run Wire For System



Maximum Wiring Distances		
From	To	Maximum Distance
Automation or Computer System	Protocol Adapter	3 ft. Cable Provided with Protocol Adapter
Protocol Adapter	Thermostat (this includes going through the Distribution Panel)	4000 ft.
Thermostat	Support Module	1000 ft.
Support Module	Temperature Sensor Option	300 ft.


- Straight through serial cable provided with Protocol Adapter
- Category 5 (4 pair twisted) communication wire
- Thermostat cable

Step 4

LOCATE AND MOUNT THE AUTOMATION SYSTEM COMPONENTS

1. **Thermostats and sensors** are to be located according to the installation instructions provided with the units. **The thermostat has four configuration dip switches on the circuit board that must be set according to the equipment the thermostat will be controlling. Sensors have six configuration dip switches that must be properly set.**

The installation manuals provided with the products detail how the switches are to be set.

Review the Network Interconnection Worksheet (**ILLUSTRATION 3**) which shows how all the communication components are connected together and  write down the location of, or a name for, each thermostat in the system. This will assist in the software set-up. Additional copies are available in the back of this manual.



IMPORTANT!

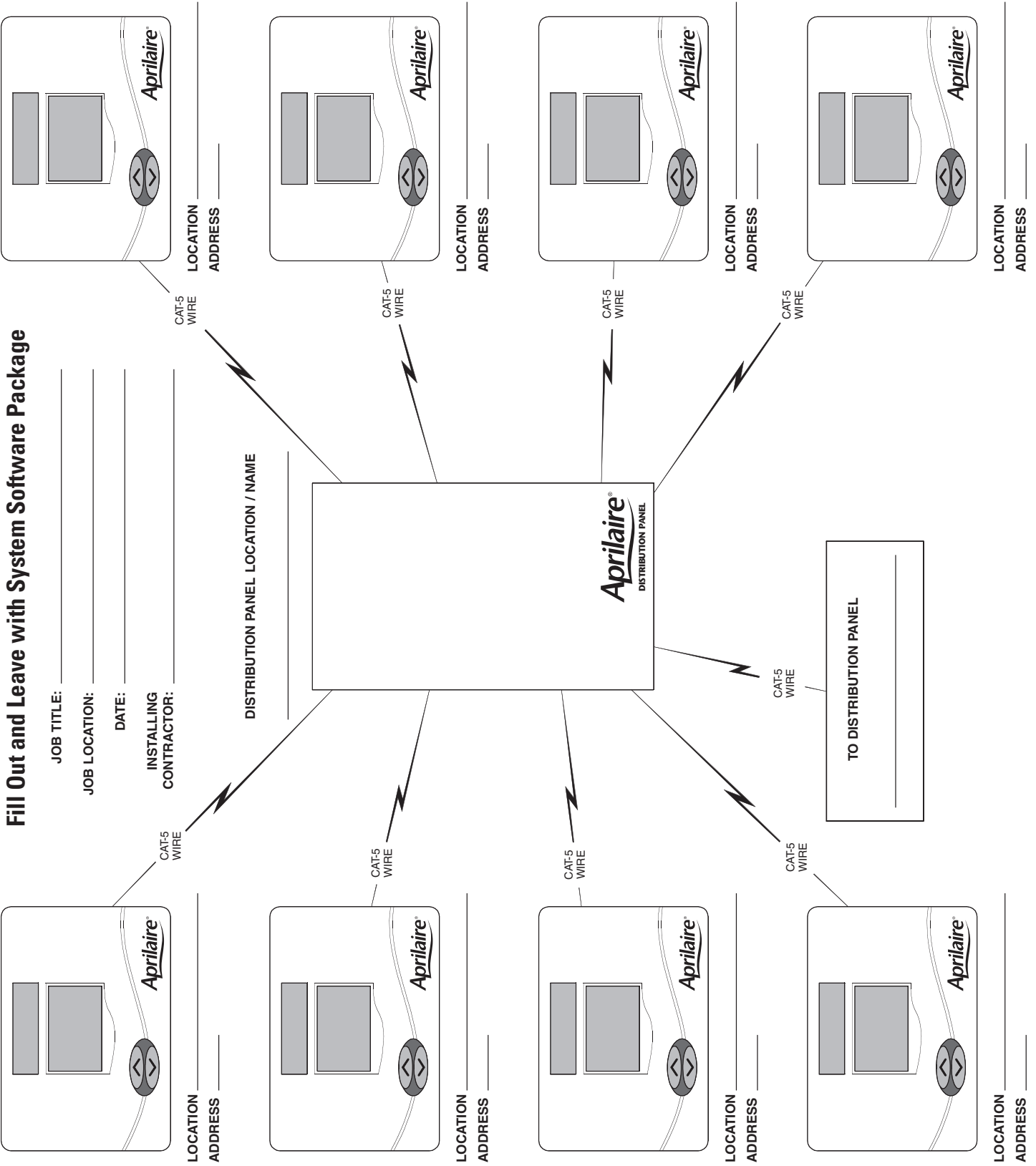
THE FEW MINUTES SPENT WRITING DOWN THE INFORMATION SUGGESTED IN THESE STEPS WILL SAVE A TREMENDOUS AMOUNT OF TIME DURING THE REST OF THE INSTALLATION.

2. Mount the zone control panel(s) if the HVAC system(s) is zoned. Refer to the zone control panel installation instructions.
3. The Aprilaire **Distribution Panel** must be mounted indoors in an accessible location such as a closet or utility room. All thermostats will be wired to the Distribution Panel, so adequate workspace will be important. There are wire access holes on the top, bottom, sides and back of the Distribution Panel.
4. The Model 8811 Aprilaire **Protocol Adapter** must be placed within three feet of the host computer or RS-232 port of the automation system. All the cables and connectors needed to attach the Protocol Adapter to the computer or automation system are included with the adapter.
5. The Model 8027 or 8029 (California approved) Plug-in **Transformer** is used to power the communication system. The transformer is wired to the Distribution Panel. Locate this transformer in the same space as the Distribution Panel if possible. When using multiple distribution panels and multiple transformers, make sure the polarity of the individual transformer connections are consistent from panel to panel. **R** from the transformer to **R** on the distribution panel(s), etc. See **DIAGRAM 5** for an example. Even though the power source is AC, maintaining proper polarity at each panel is very important for establishing stable communications.

ILLUSTRATION 3 – Network Interconnection Worksheet

Fill Out and Leave with System Software Package

JOB TITLE: _____
 JOB LOCATION: _____
 DATE: _____
 INSTALLING CONTRACTOR: _____



Step 5

CONNECT THE CONTROL WIRES TO THE HVAC/ZONE SYSTEM AND THERMOSTATS

A qualified HVAC technician should perform this step to ensure proper termination.

1. Make sure the HVAC system power is off.
2. The Thermostat Installation Instructions show wiring diagrams for several different HVAC equipment types. Use **DIAGRAMS 1 & 2** as a reference only. Use color coding where possible.

DO NOT TURN ON THE HVAC SYSTEM POWER YET!

DIAGRAM 1 – Typical Heating / Cool Wiring Schematic

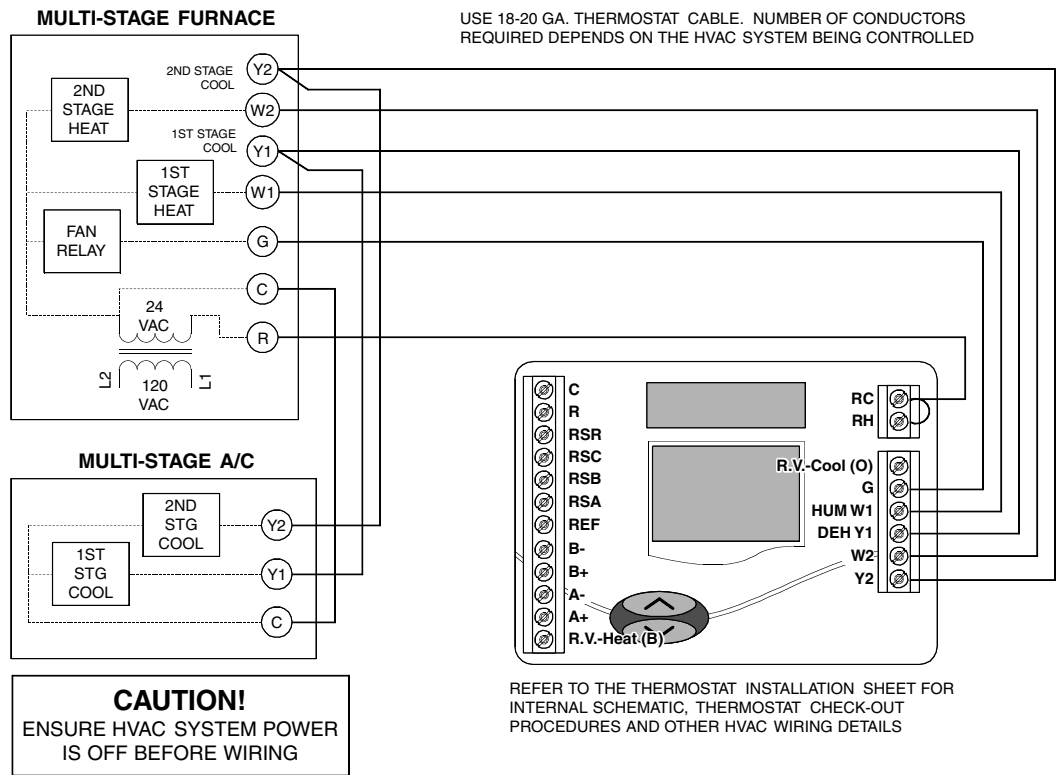
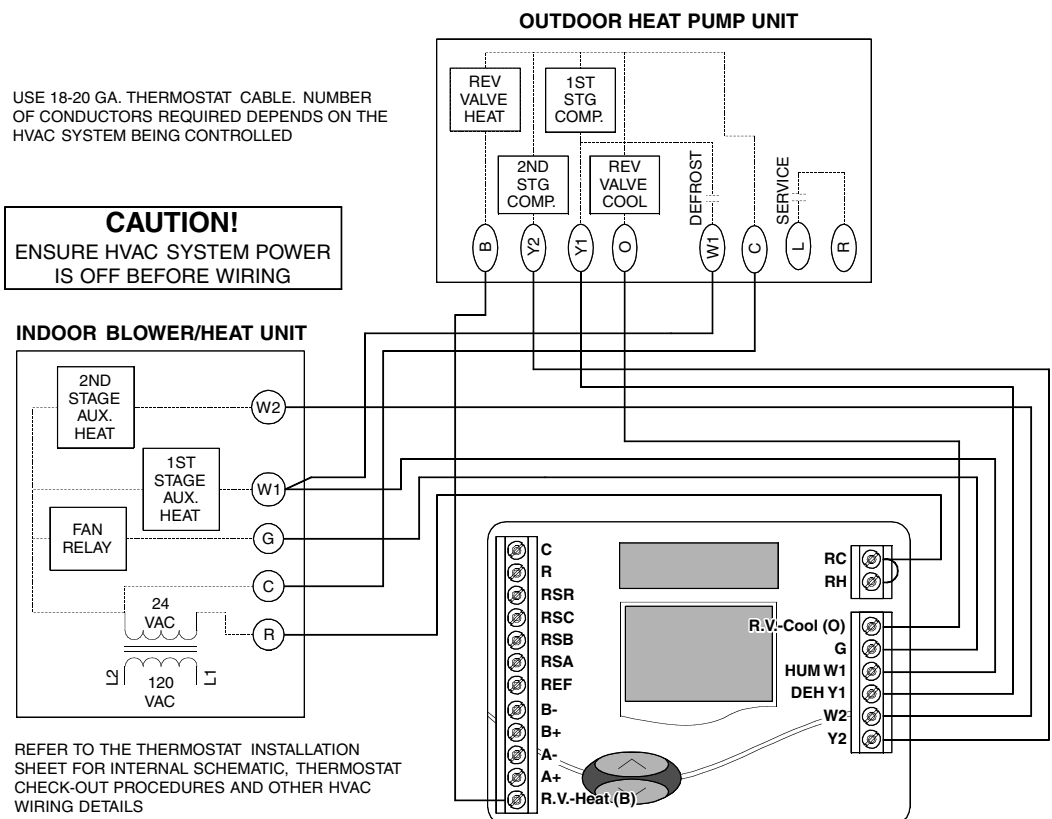


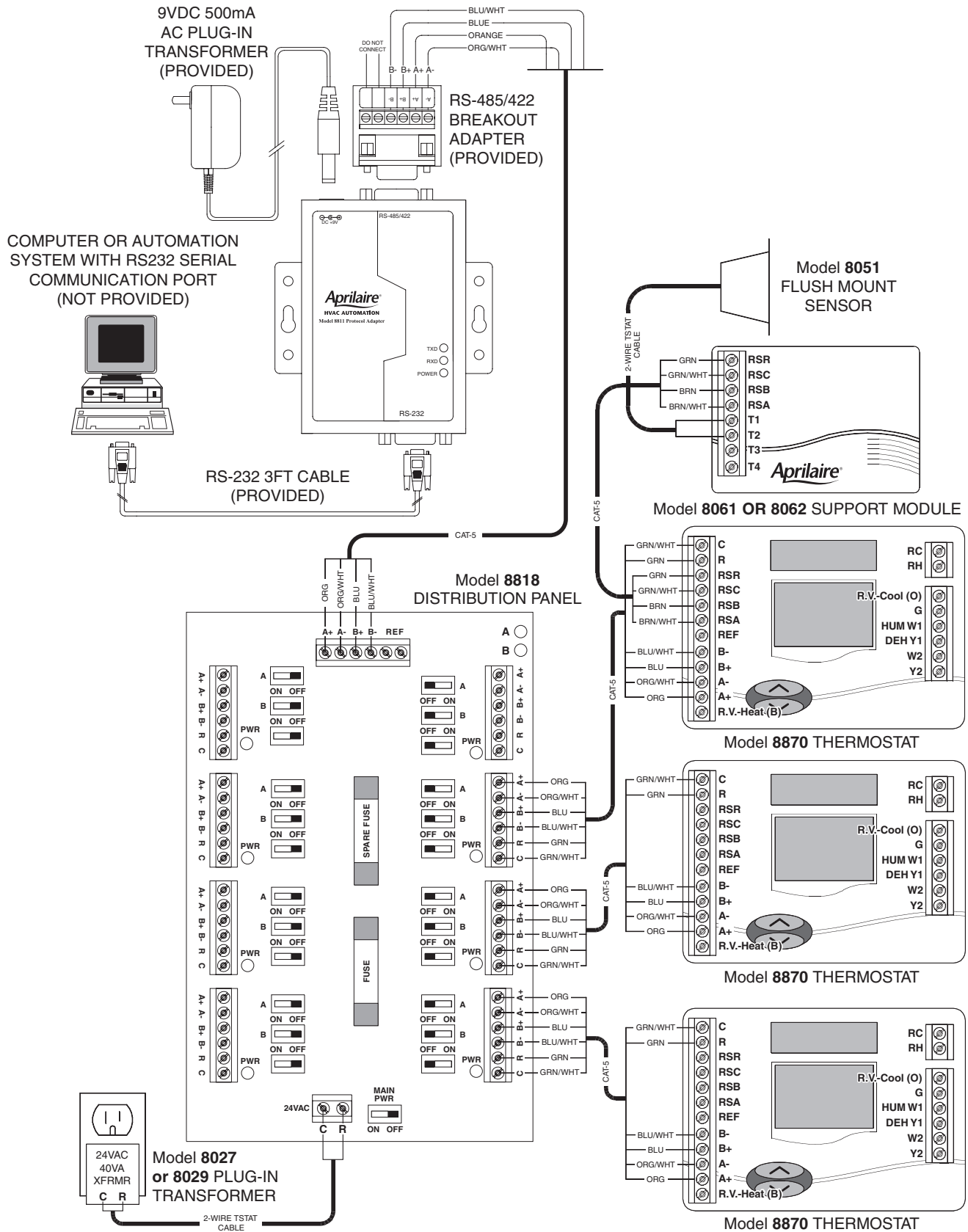
DIAGRAM 2 – Typical Heat Pump Wiring Schematic



COMMUNICATION SYSTEM WIRING

DIAGRAM 3 shows all communication system wiring with terminations. Steps 6 through 8 provide additional detail for each wiring step.

DIAGRAM 3 – System Communication Wiring

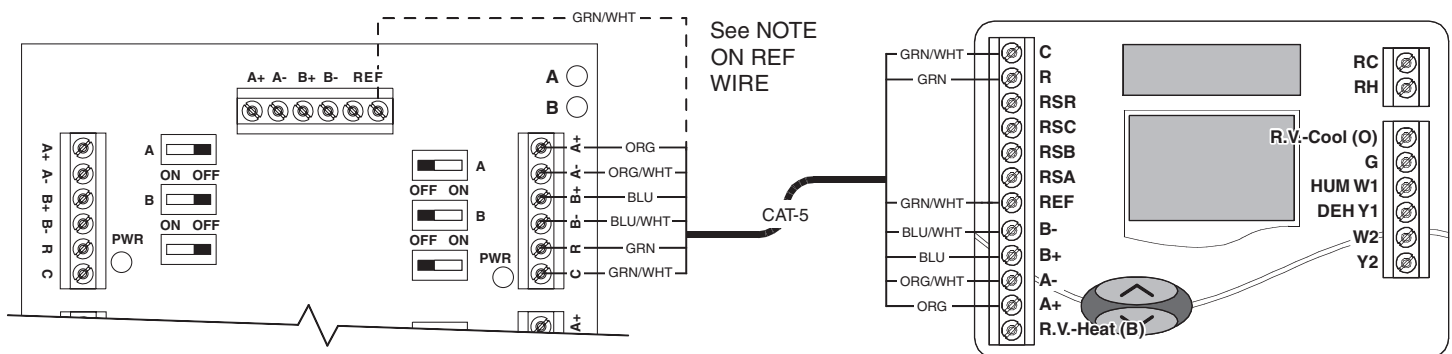


Step 6

CONNECT THE COMMUNICATION AND POWER WIRES TO THE DISTRIBUTION PANEL AND THERMOSTAT

1. **MAKE SURE THAT ALL SWITCHES IN THE DISTRIBUTION PANEL ARE OFF!**
2. Connect the communication wires. **DIAGRAM 4** shows how each thermostat is to be wired to the distribution panel.
 - Use the wire colors shown in **DIAGRAM 4** to help ensure proper, consistent connections.
3. Connect the REF terminal of each thermostat to the Distribution Panel REF terminals if:
 - More than one transformer is used to power the thermostats in the network
 - Installation is in an environment that has excessive electromagnetic interference from fluorescent lights, motors, or other EMI generating devices, such as in an industrial or office setting

DIAGRAM 4 – Thermostat Communication Wiring



COMMUNICATION TERMINAL DEFINITIONS

- B+/B- TRANSMIT (from automation system)
- A+/A- RECEIVE (from the thermostats)
- REF GROUND REFERENCE (see Note)
- R THERMOSTAT VOLTAGE (hot)
- C THERMOSTAT VOLTAGE (common)

NOTE ON REFERENCE WIRE

Usually connection of the REF terminal is not necessary.

Connect the REF terminals if:

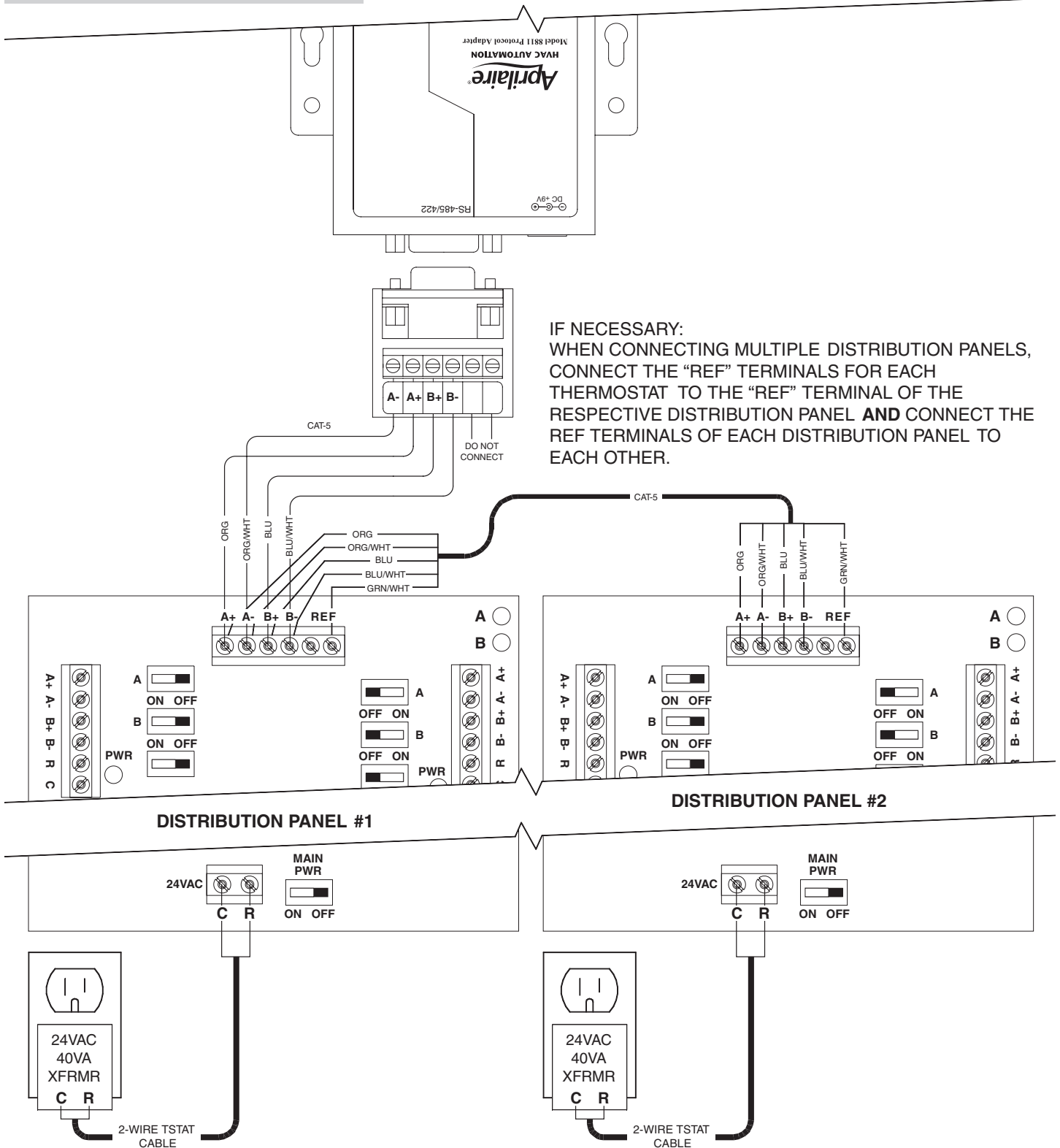
- Your installation is in an environment that has excessive electromagnetic interference (experiencing interference from fluorescent lights, motors, or other EMI generating devices, found in an industrial or office setting).

Step 7

CONNECT MULTIPLE DISTRIBUTION PANELS

1. **MAKE SURE THAT ALL SWITCHES IN THE DISTRIBUTION PANEL ARE OFF!**
2. If more than one Distribution Panel is used in the thermostat network, the communication lines must be daisy-chained together.
 - Use the wire colors shown in **DIAGRAM 5** to help ensure proper, consistent connections.

DIAGRAM 5 – Multiple Distribution Panels

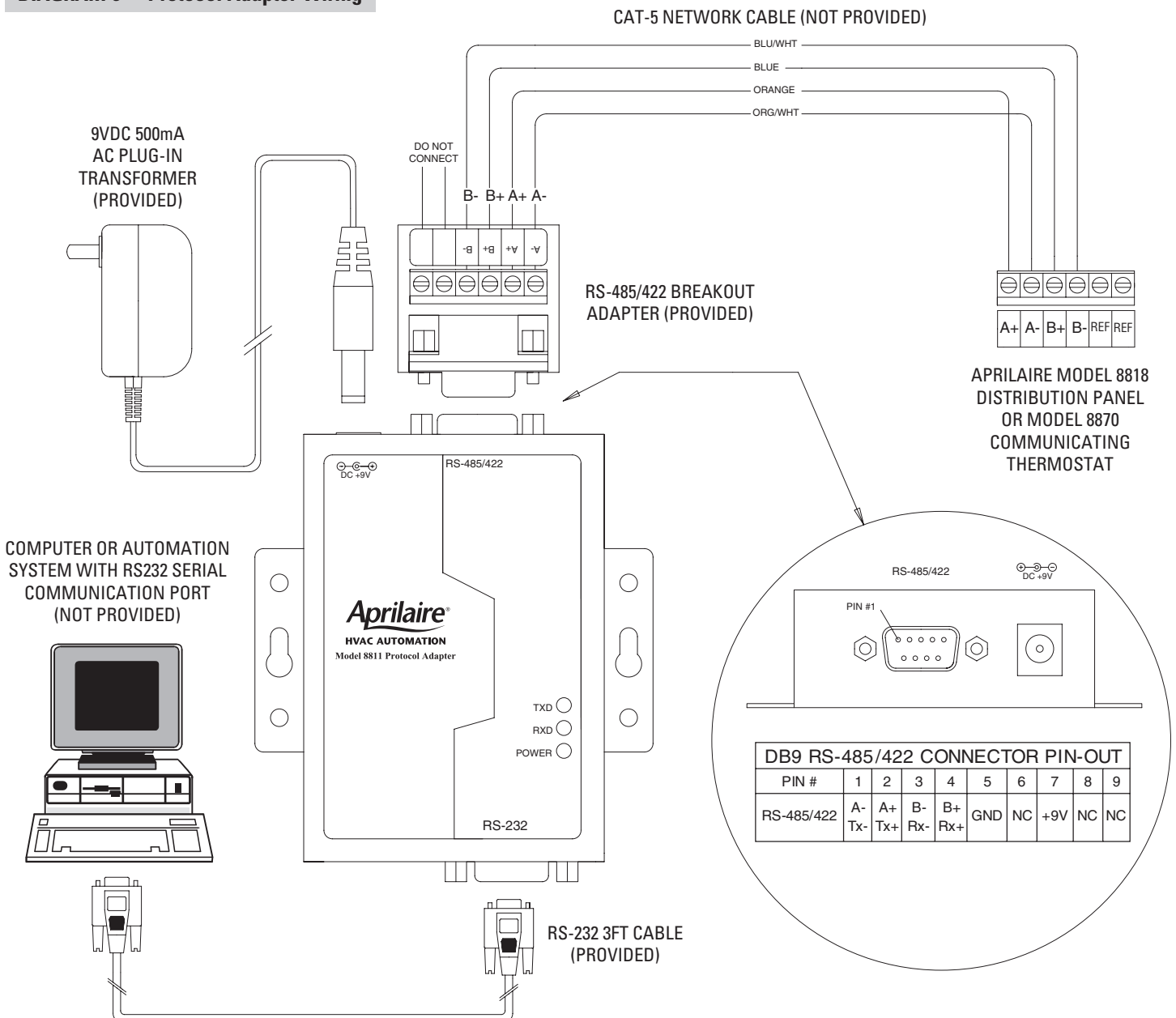


Step 8

CONNECT PROTOCOL ADAPTER TO THE DISTRIBUTION PANEL AND HOST COMPUTER OR AUTOMATION SYSTEM

1. **MAKE SURE THAT ALL SWITCHES IN THE DISTRIBUTION PANEL ARE OFF!**
2. Use Category-5 wire to connect the main communication terminals on the Distribution Panel to the "Breakout Adapter" of the protocol adapter (see **DIAGRAM 6**).
3. Connect the RS-232 cable from the protocol adapter to the computer or automation system. A 3 ft. RS-232 cable is provided. Some computers use 25-pin connectors on serial ports, which requires a DB25 connector. A DB9 connector fits a 9-pin port. DB9 to DB25 transitions are available at most computer retail stores.
4. Power up the Protocol Adapter with the plug-in transformer provided. The "Power" LED on the Protocol Adapter should light up when power is applied.

DIAGRAM 6 – Protocol Adapter Wiring



Step 9

PROVIDE POWER TO THE DISTRIBUTION PANEL

1. **MAKE SURE THAT ALL SWITCHES IN THE DISTRIBUTION PANEL ARE OFF!**
2. Use a 2-wire thermostat cable to connect the load terminals of the Model 8027 or 8029 Plug-in Transformer to the 24V AC terminals of the Distribution Panel (see **DIAGRAM 3** and **DIAGRAM 5**). Make sure **R** of the Transformer goes to **R** of the Distribution Panel, and **C** of the Transformer goes to **C** of the Distribution Panel.
3. Plug-in the transformer.
4. NO LEDs ON THE DISTRIBUTION PANEL SHOULD BE ON.

Step 10

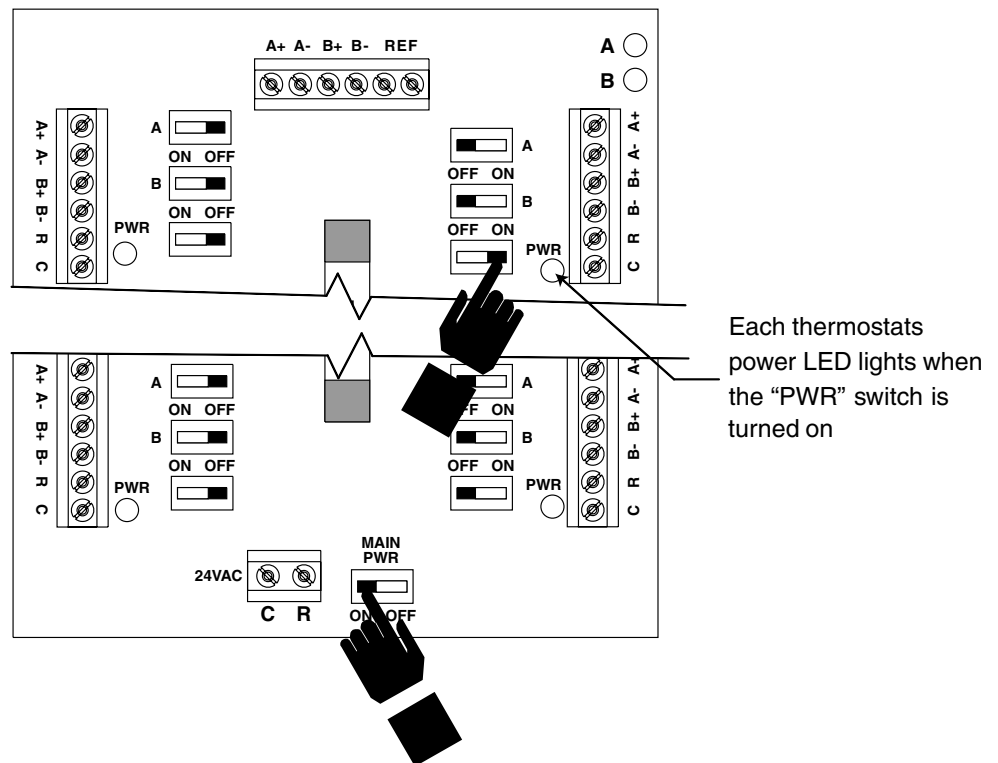
TURN ON POWER TO ALL HVAC EQUIPMENT AND TO THE THERMOSTATS

1. Turn on power to the HVAC and/or zone control systems.
2. Go to the Distribution Panel and verify that no LEDs on the Distribution Panel are on. If none are on, proceed to # 3. If any LED is on, immediately unplug the transformer that powers the Distribution Panel.
3. Turn on the main power switch then turn on the power switch to one of the thermostats (see **ILLUSTRATION 4**). The green LED next to the power switch should go on, and the corresponding thermostat display should power up. **DO NOT TURN ON ANY OTHER SWITCHES.**
4. One by one, turn on only the power switches (not the communication switches) for each thermostat. Verify that the green LED comes on and that the thermostat display powers up.

- If any LED is on, it is likely that the HVAC system transformer is powering the thermostat. Go to the thermostats, remove thermostat from the base and check the wiring. There must be no jumper between the RH or RC and R terminal. The Category 5 cable used to wire communications and power should supply the only wires connected to the thermostat R and C terminals.

3. Turn on the main power switch then turn on the power switch to one of the thermostats (see **ILLUSTRATION 4**). The green LED next to the power switch should go on, and the corresponding thermostat display should power up. **DO NOT TURN ON ANY OTHER SWITCHES.**

ILLUSTRATION 4 – Power Switches



Step 11

CHECK-OUT HVAC SYSTEM OPERATION

Use the thermostat buttons to verify that the thermostat is controlling the equipment operation. A checkout procedure is supplied in the installation instructions with the thermostat. This procedure will verify only that the thermostat operates the equipment. Communication system checkout will be performed next.

Step 12

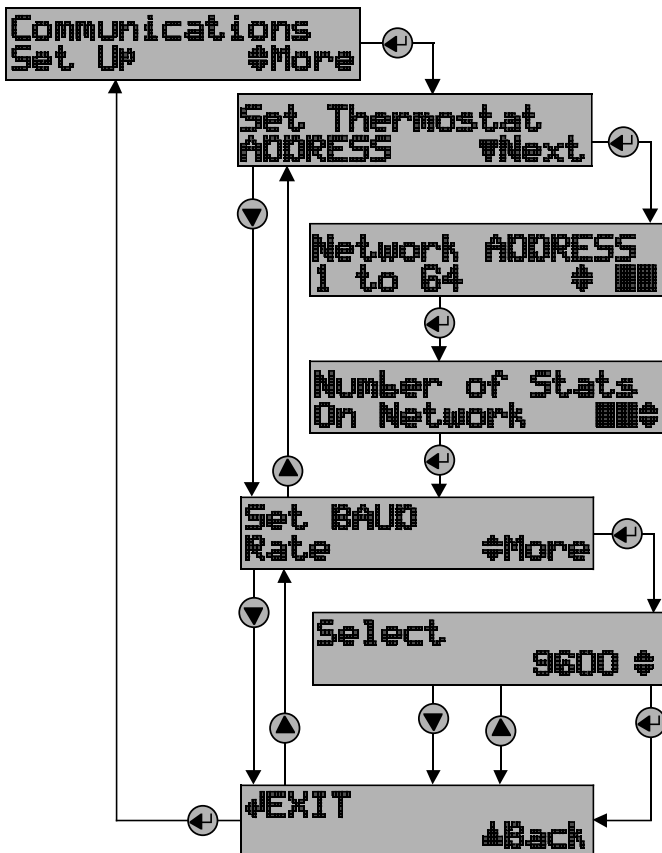
ADDRESS THE THERMOSTATS AND SET HIGHEST ADDRESS

IMPORTANT!

THESE STEPS MUST BE DONE AT EACH THERMOSTAT FOR COMMUNICATION TO WORK PROPERLY.

1. Press the **Mode** and **Enter** buttons simultaneously through the thermostat. It may take a couple of tries to get them pressed together. This will enter the Thermostat Set Up Menu. The first menu item that will appear on the message center display is an informational item that indicates that only the **Scroll Up**, **Scroll Down** (two buttons located immediately to the right of the message center display) and the **Enter** (↵) buttons are used in thermostat set up. This will remain on the display for approximately 5 seconds or until any of the three aforementioned buttons is pressed. Thermostat Set Up is a series of sub-menus available to customize the thermostat in various ways. The thermostat Owners Manual and Installation Manual outline the thermostat set up features. The following steps will guide you only through the Communications Set Up sub-menu (see **ILLUSTRATION 5**).

ILLUSTRATION 5 – Setting the Thermostat Address



2. Press the **Scroll Down** button until the “Communications Set Up” menu shows on the display.
3. Press the **Enter** button to select this sub-menu.
4. The first sub-menu item is “Set Thermostat ADDRESS”. Press the **Enter** button to select this item.
5. Set the address between 1 and 64 using the **Scroll Up** and **Scroll Down** buttons. (If using Model 8840 thermostats, see Appendix 1.)
 - Each thermostat must have a unique address (i.e. no two thermostats can have the same address)
 - Start with address 1 and increment by 1 for each new address – do not skip an address. This will help to speed communications.

Write down the address for each thermostat on the Network Interconnection Worksheet (see ILLUSTRATION 3).
6. After the address has been selected, press the **Enter** button to store the address.
7. Use the **Scroll Up** and **Scroll Down** buttons to set the “Number of Stats On Network” to the highest address that will be on the thermostat network. This will be equal to the total number of thermostats on the network, unless one or more addresses are skipped.

IMPORTANT!

THIS NUMBER MUST BE SET THE SAME AT EACH THERMOSTAT

8. After setting the number of thermostats on the network press **Enter**. The next item will be to “Set BAUD Rate”. The thermostat defaults to 9600 baud (bits per second).
 - If you want to change to 19200 baud operation, continue with #9.
 - If you want to operate at 9600 baud, press the **Scroll Down** button to get to the “EXIT” screen for the Communications Set Up sub-menu and go to #10.
9. Press **Enter** to set the baud rate. Use the **Scroll Up** or **Scroll Down** button to toggle between 9600 baud and 19200 baud. Press **Enter** when the baud rate desired is showing.
10. Press **Enter** to “EXIT” the Communications Set Up sub-menu. This will return you to the main menu.
11. Press the **Scroll Down** button until “EXIT” is displayed. Press the **Enter** button. The thermostat will then reset and return to normal operation.

Step 13

SETUP COMPUTER FOR COMMUNICATION SYSTEM CHECKOUT

1. Connect the Protocol Adapter RS-232 output to a computer with Windows '95, '98, Windows 2000, Windows NT, or XP. This may already have been done in **Step 7**.
2. Turn on the computer.
3. From the **Start** menu, select **PROGRAMS**⇒**ACCESSORIES**⇒**COMMUNICATION**⇒**HYPERTERMINAL** (see **ILLUSTRATION 6**). HyperTerminal is a terminal emulator program provided with Windows that will be used to test the communication system.

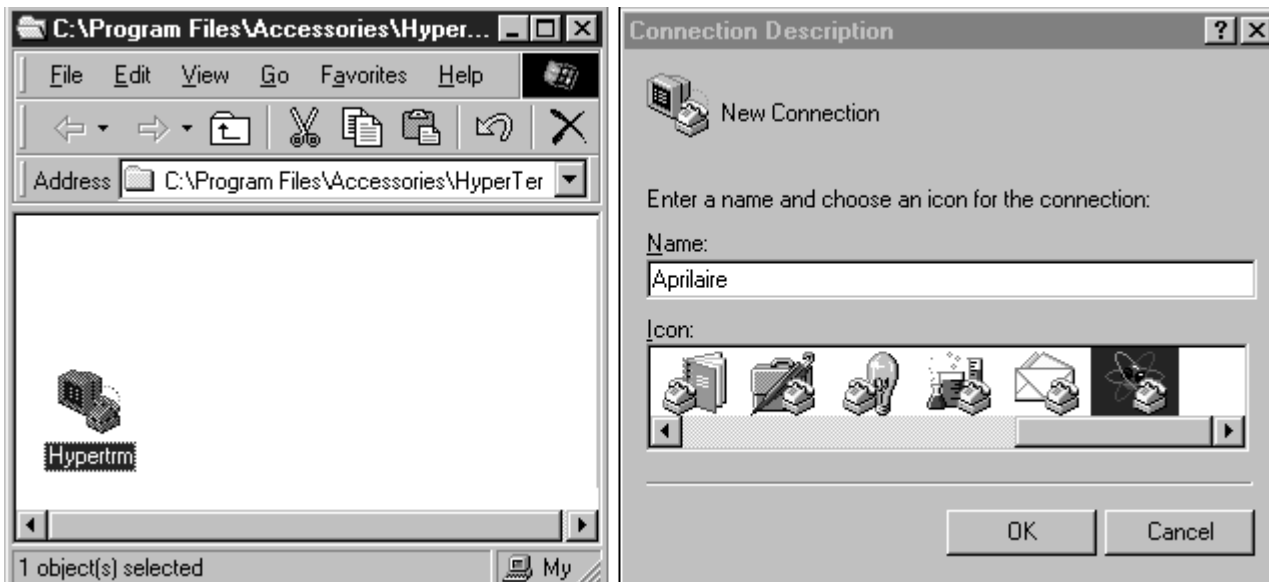
ILLUSTRATION 6 – Access HyperTerminal



❖ If you now have the **HYPERTERMINAL** folder available, skip the next step and go to #6.

4. If the **COMMUNICATIONS** or **HYPERTERMINAL** folder is not present, you will need to add this program to your Windows setup. From the **Start** menu, select **SETTINGS**⇒**CONTROL PANEL**, then select (double click) the **Add/Remove Programs** icon. Select the Windows Setup tab, and place a ✓ in the Communications component box. This will add HyperTerminal to your Windows setup. Go back to #3 and get into the HyperTerminal folder as described.
5. Double click the **Hypertrm** icon. You will then be asked to name the new connection and select an icon. Type in any name you want (the shorter the better) and select the “atom-like” symbol at the end of the Icon list (see **ILLUSTRATION 7**). Then click **OK**.

ILLUSTRATION 7 – New Connection



6. This will bring up a **Connect to** dialog box. From the pull down next to “Connect using:”, select the Com port to which the Protocol Adapter is connected (see **ILLUSTRATION 8**). Start with Com port 1 (or the next lowest available number) if you are unsure which one to use. Click **OK**.

ILLUSTRATION 8 – Select Com Port



7. A **COM1 Properties** dialog box should appear. Use the pull-down menus or type in the following for each selection (see **ILLUSTRATION 9**):

Bits per second: 9600 (or 19200 if thermostats are configured for this baud rate)

Data bits: 8

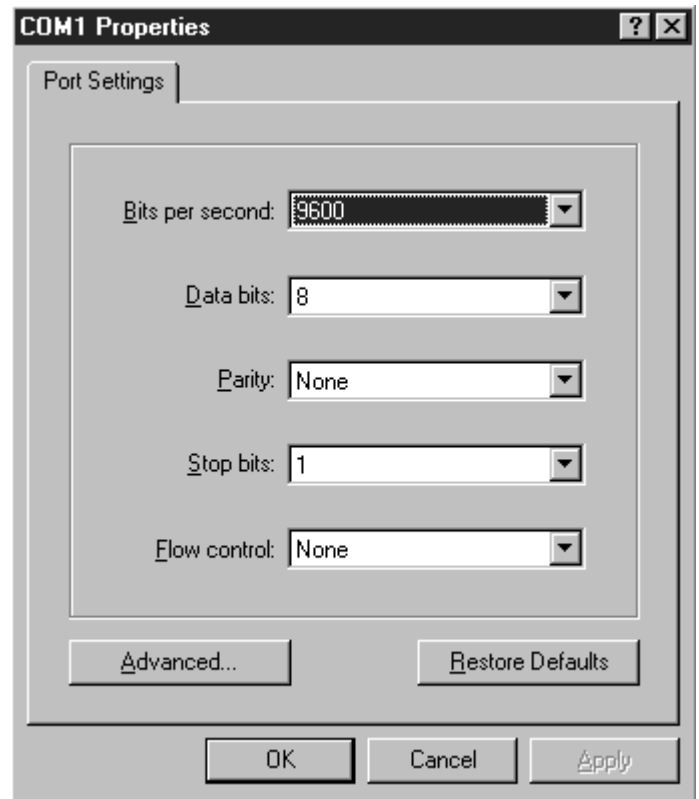
Parity: None

Stop bits: 1

Flow control: none

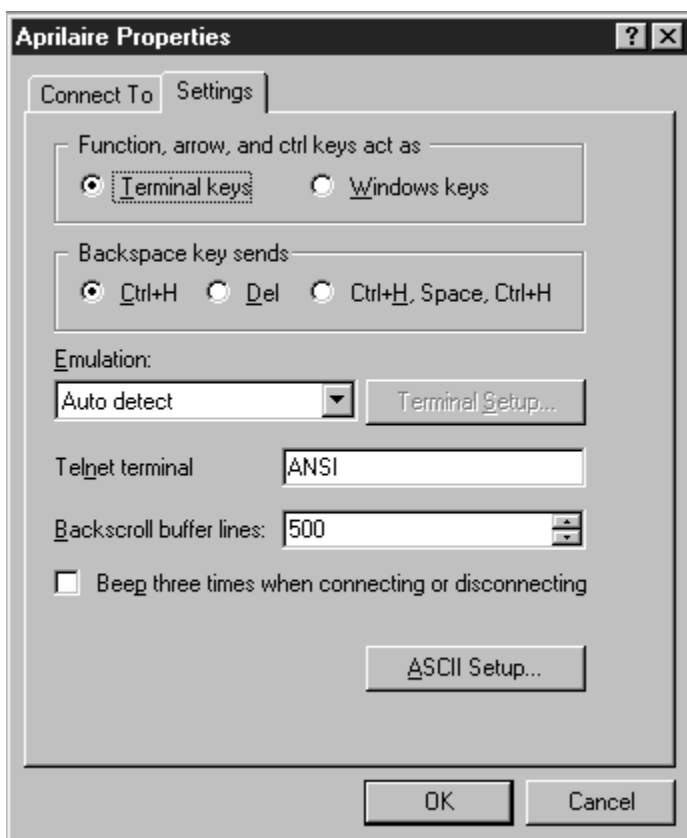
Click **OK**.

ILLUSTRATION 9 – Connection Properties



8. From the **File** pull-down menu, select **Properties**. This will bring up a **Properties** dialog box.
9. Select the **Settings** tab. Make the following selections (see **ILLUSTRATION 10**):
 - Terminal keys
 - Ctrl+H
 - Emulation: Auto Detect
 - Telnet terminal: ANSI
 - Backscroll buffer lines: 500

ILLUSTRATION 10 – Terminal Settings



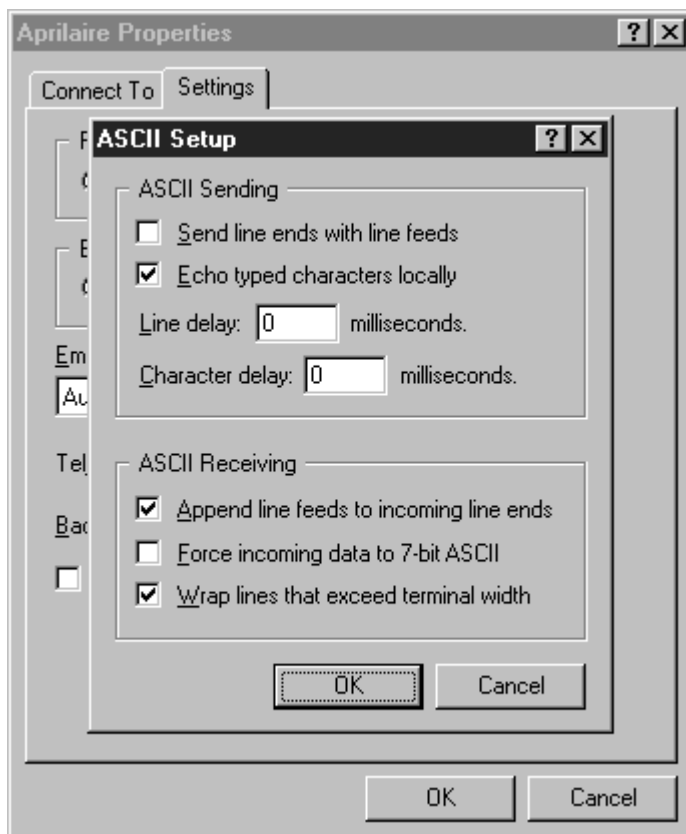
10. Then select the **ASCII Setup** button. This will bring up an ASCII Setup dialog box. Make the following selections (see **ILLUSTRATION 11**):

- ✓ Echo typed characters locally
- ✓ Append line feeds to incoming line ends
- ✓ Wrap lines that exceed terminal width

NOTE:

1. IF USING AN EXISTING HYPERTERMINAL CONNECTION YOU MAY NEED TO UNCHECK THE "SEND LINE FEEDS..." BOX.
2. THE MODEL 8870 HAS AN EXPANDED COMMAND SET. REFER TO DP 10004345 FOR THE MODEL 8840 SERIES COMMAND SET.

ILLUSTRATION 11 – ASCII Setup



11. Click **OK** to put away both dialog boxes.
12. Verify that you have a connection between the computer and the Protocol Adapter. Have the Protocol Adapter within eyesight of the computer keyboard. Type any character and confirm that the "RXD" LEDs on the Protocol Adapter flash as you type (see **DIAGRAM 6** on page 10). The LEDs flash very quickly.
13. Press Enter to clear the command line.

Note: On Windows '98 computers, HyperTerminal does not echo typed characters (doesn't show them on the screen as you type) locally. Do not be concerned. This can be a little confusing, but does not affect the checkout of the thermostat communication system.

- **If you were unable to verify a connection**, specify a different com port. Go to the **File** pull down menu, and select **Properties**. Change the "**Connect using:**" setting to a different port by using the pull down menu options. Start typing and look for the Protocol Adapter "RXD" or "TXD" LEDs to flash. Repeat until you have successfully verified connection between the computer and communication system, or until you run out of com ports to choose from in the "**Connect using:**" pull down. If there is still no communication you are going to have to consult a computer professional.

Step 14

CHECK-OUT COMMUNICATIONS TO THE THERMOSTAT NETWORK

1. At the computer type SN? (it does not matter if it is small or capital letters) then press **Enter**.

You should get no response because none of the communication switches to the thermostats have been turned on yet.

2. Go to the Distribution Panel and turn on the communication switches for the thermostat with address #1 (see **ILLUSTRATION 12**).

3. Type SN? and press **Enter**.

The computer should respond SN1. **This indicates that the thermostat with address #1 is communicating.**

- If no response, type in SN? and press **Enter** again. If it still does not appear, go to the Distribution Panel make sure the communication switches for the thermostat with address #1 are on.
- If the "SN" response contained a number other than one, the communication switches you turned on were for an address other than number one. Now is the time to verify that the thermostat names/locations match the addresses shown on the Network Interconnection Worksheet (**ILLUSTRATION 3**). There is room on the Distribution Panel label (on the inside cover of the Distribution Panel enclosure) to write the address and thermostat name with the corresponding terminal connections.

4. Type SN ID? and press **Enter**.

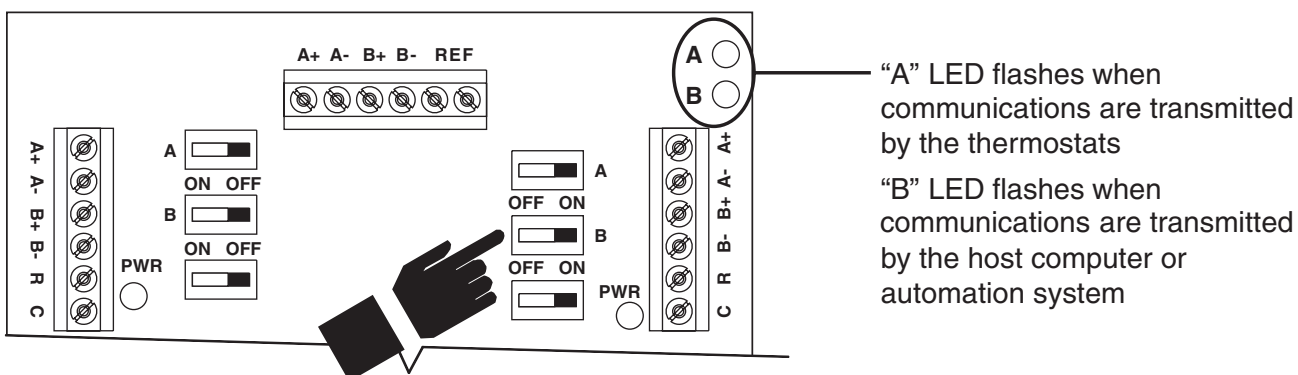
The computer should respond SN1 MODEL# 8870 VER: **x.xxx** - RPC 2006; where **x.xxx** represent the current firmware version number. This is done to determine if the communication is robust. The large amount of data being transmitted by the thermostat may be corrupted if there is interference on the communication lines.

- **If the response is not exactly as shown**, there is a communication signal problem. The most likely sources

are a loose terminal connection, incorrect wire type, damaged wire, electrical interference or incorrect power supply. Look at all the terminal connections and look at the wire where the insulation was stripped. If the wire appears kinked, trim the wire and carefully strip the insulation. Also, make sure the wires connected to the thermostat "R" and "C" terminals is connected to the corresponding Distribution Panel "R" and "C" terminals for that particular thermostat. If this doesn't help, connect the "REF" terminal of all the thermostats to the two "REF" terminals on the Distribution Panel.

5. Go to the Distribution Panel and turn off the communication switches for address #1 and turn on the communication switches for address #2.
6. Repeat this process to verify communications to all thermostats one address at a time. Each time you turn on the communication switches to a new thermostat, a new "SN" number should respond. If this is not the case, go to the thermostats and address them as indicated in **Step 12**.
7. Finally, go to the Distribution Panel and turn on all the communication switches.
8. Type SN ID? then press **Enter**.
All thermostats should respond as shown in #4. Make sure the number of responses equals the number of thermostats in your system, and that the responses are complete and accurate.
9. Once you have successfully completed this procedure you have verified that proper communication exists between the computer and all of the thermostats. To test out all of the functions of the thermostat, use the software or automation package being installed with this system. You can check out other thermostat functions using HyperTerminal: go to the "Aprilaire Command Set" section on page 19.

ILLUSTRATION 12 – Com Switches



Appendix 1

SPECIAL CONSIDERATIONS FOR INSTALLING THE MODEL 8870 WITH THE 8840 SERIES COMMUNICATING THERMOSTAT

If adding a Model 8870 thermostat to a system using 8840 series thermostats (8844, 8846, 8847 or 8848), you must change the power supply installation and modify the addressing method.

1. A separate power supply is required for Model 8870 thermostats and 8840 series thermostats. This requires different wiring.
 - If using a Model 8800-8808 Communication Panel, see **DIAGRAM 7** for wiring schematic.
 - If using a Model 8818 Distribution Panel you must use the 8840 series thermostat with an 8809 Sub-base to allow RS-485 communications to be connected directly to the Distribution Panel. See **DIAGRAM 8** for wiring schematic.

NOTE:

1. IF USING AN EXISTING HYPERTERMINAL CONNECTION YOU MAY NEED TO UNCHECK THE "SEND LINE FEEDS..." BOX.
2. THE MODEL 8870 HAS AN EXPANDED COMMAND SET. REFER TO DP 10004345 FOR THE MODEL 8840 SERIES COMMAND SET.

DIAGRAM 7 – Adding an 8870 Thermostat

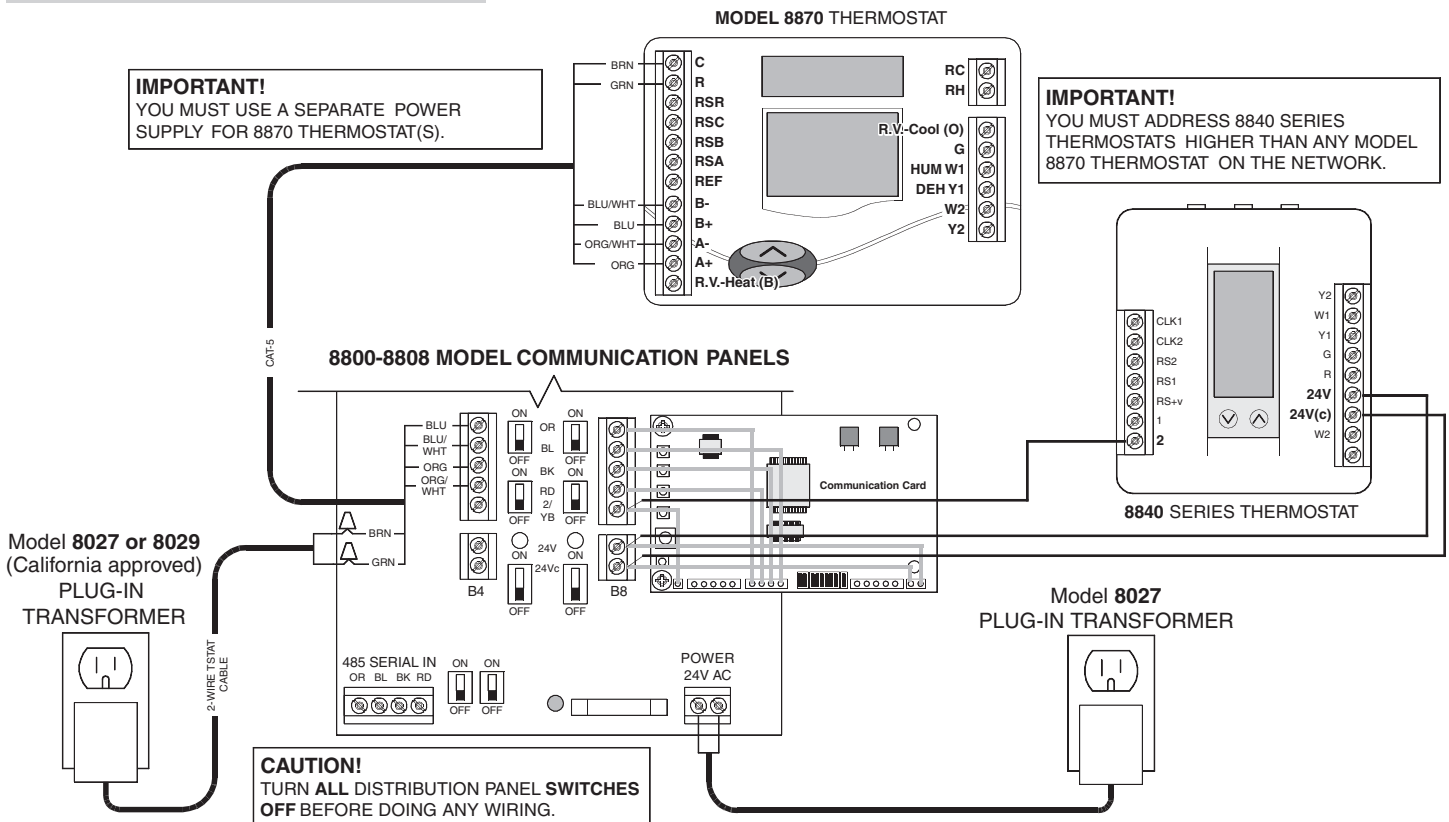
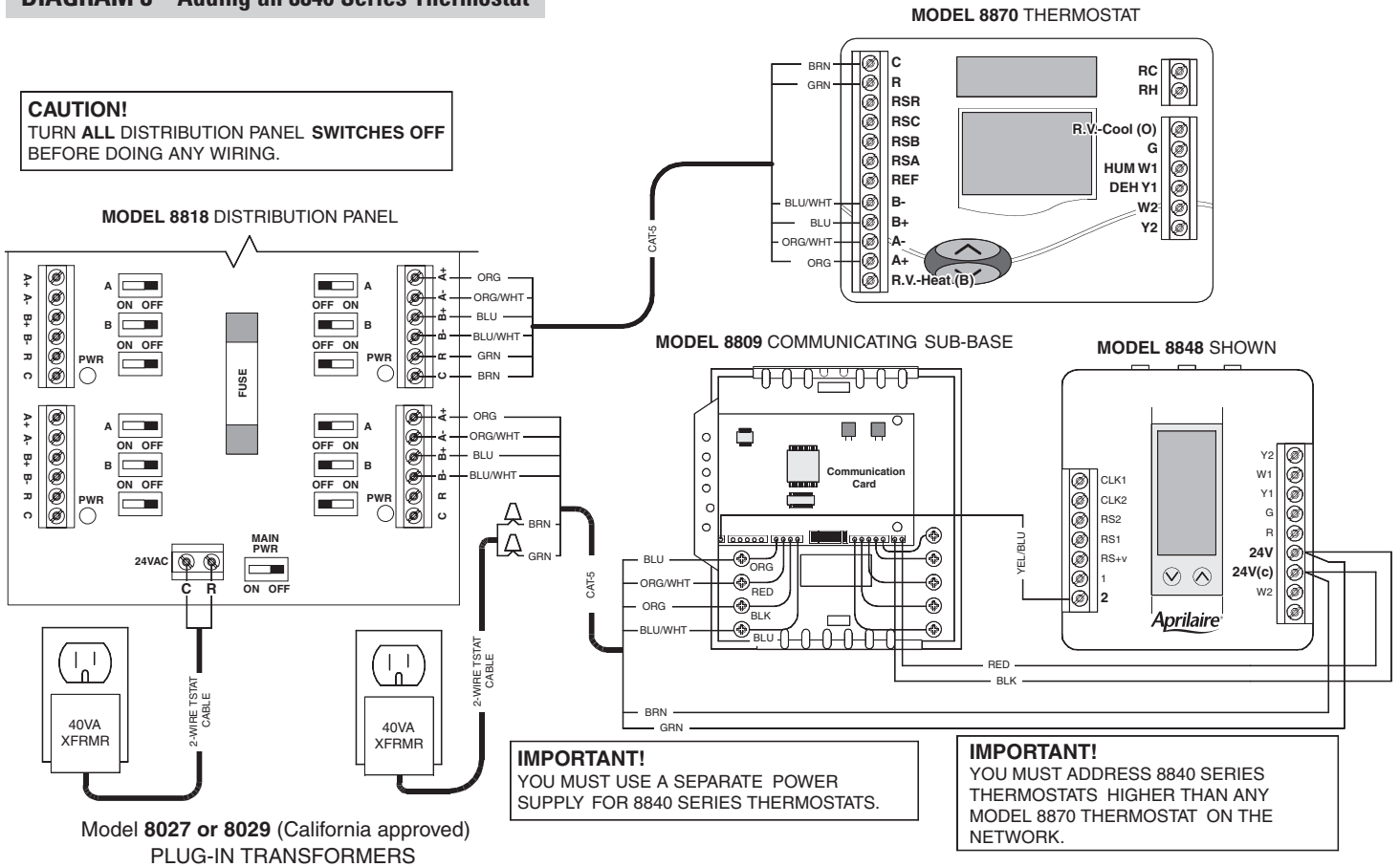


DIAGRAM 8 – Adding an 8840 Series Thermostat



2. **IMPORTANT!** When addressing the thermostats, the Model 8870 thermostat(s) must either be the first addresses on the network, or there must be one address skipped between 8840 series thermostats. For example, if one Model 8870 thermostat were to be added to an existing four 8840 series thermostat network then the 8870 thermostat must be addressed #1 or #6. Change the existing address #1 to be #5 and add the 8870 as address #1, or simply add the new thermostat as address #6.

IMPORTANT: Set "Number of Stats On Network" to 32 and Set BAUD Rate to 9600.

Appendix 2


APRILAIRE COMMAND SET

SN# [Command] [? or =] [Value (*use with = only*)] 

A full command set and detailed explanation of the command set is available for those who want to write their own software. Contact Research Products Corporation at 888-782-8638 to request a copy of DP 10005756.

Upper or lower case letters may be used for all commands. Invalid characters will immediately invalidate a command, so the use of backspace or delete is not allowed (applies mainly when interacting with the thermostat using HyperTerminal).

All commands will begin with the characters **SN**. Immediately following the SN, without any intervening spaces (blanks), will be the address (**#**) from 1 to 64 of the Model 8870 Thermostat with which you are communicating.

Single digit addresses may be sent as a two digit address with a leading zero. Omitting the address, or using a 0 (zero) in place of a space makes the command global, and all connected thermostats will respond. Following this initial command sequence, spaces may be inserted at this point only, for clarity between commands. The next portion is the command or variable **[Command]**. The table on page 20 describes the basic commands. The next portion **[? or =]** is the action to be performed: "?" corresponds to "state your value" while "=" corresponds to "set your value". Spaces are allowed between the command and the action. The final portion, **[Value]**, is used only if a command or variable is to be set. The value must follow the action with no intervening spaces. A carriage-return  is used as the terminator for the command string. **Line feeds (LF) should not be sent with commands as this is a recognized ASCII character and invalidates any command received between the line feed and the next carriage return.**

EXCEPTION: The command SN? or SN0? will respond with all connected thermostats returning their address.

COMMAND RESPONSE SYNTAX

The Model 8870 will respond by supplying the information requested or by confirming the completion of an action command. The response syntax is generally the same as that used for commands, but no spaces separate command, action or value. Responses are sent in upper case ASCII format. Should a command not be recognized, no response will be forthcoming – there is no ERROR message.

Unless otherwise noted as "Read Only" or "Write Only", all commands are "Read and Write".

Inquiries can be made with all commands (with the exception of BLTON) to determine the existing value of a variable. Inquiry is done using the following syntax:

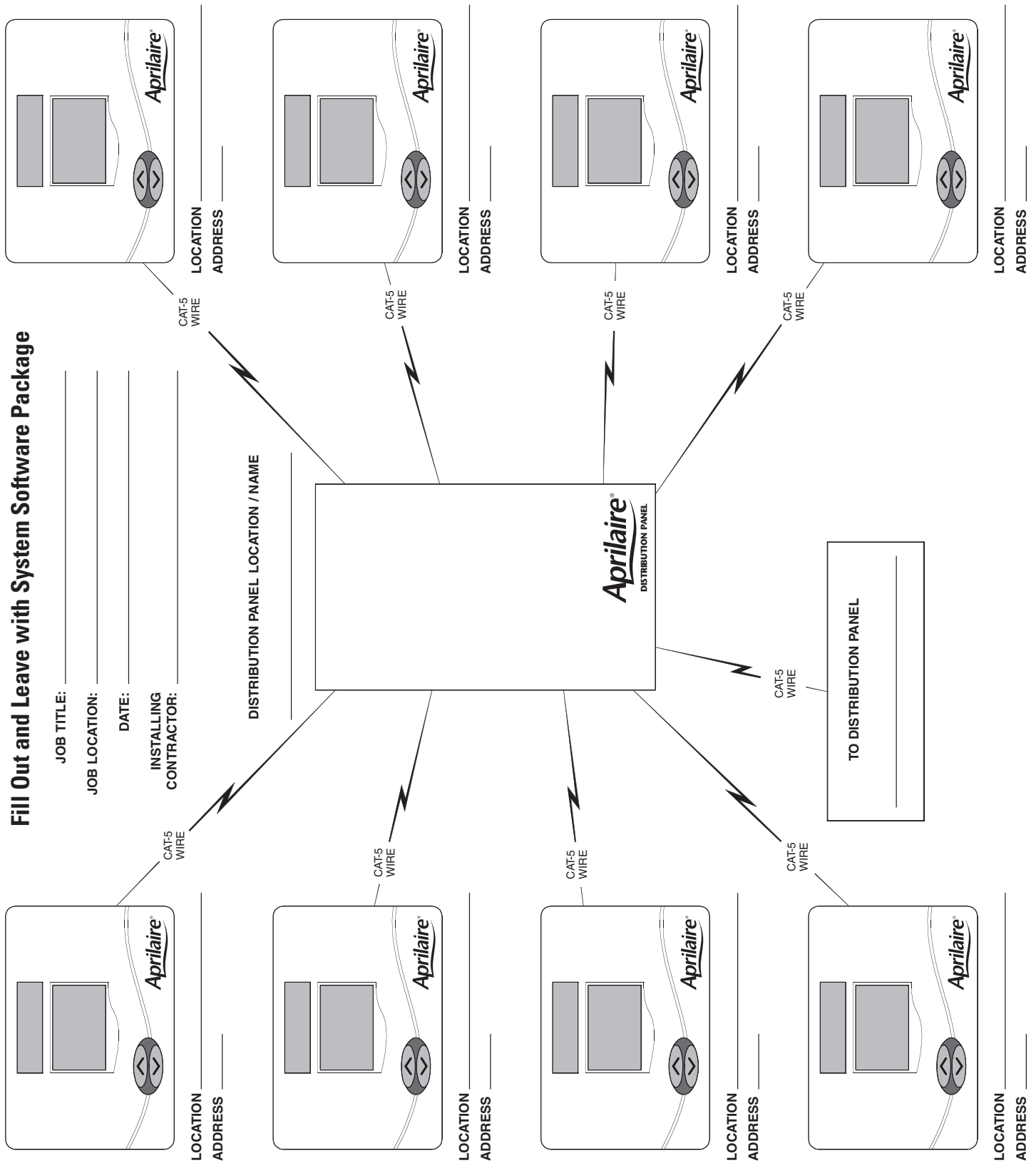
SN [address number, or <blank> or 0 (zero) for global] **"COMMAND"?**; where command is the variable whose value is desired.

MODEL 8870 BASIC COMMAND SET

COMMAND	DESCRIPTION	VALUE
Communication Control Commands		
CR	Command Response Control	Silent / Quiet / Normal
C1	Change of State (COS) – HVAC relays	ON/OFF
C2	COS – Temperature	ON/OFF
C3	COS – Remote Temperature	ON/OFF
C5	COS – Set Points	ON/OFF
C6	COS – Network Override	ON/OFF
C7	COS – Mode	ON/OFF
C8	COS – Fan	ON/OFF
HOLD	User Hold Status	ON / OFF
NAME	Location Name	<String>
ID	Report Model No. and software rev.	Read Only
Thermostat Sensing Commands		
SCALE	Command Temperature Scale	F / C (Fahrenheit/Celsius)
TEMP, T	Report Thermostat Room Temperature	Read Only
HUM	Report Thermostat Room Humidity (requires humidity control sensor)	Read Only
RSM	Identify all external sensors connected to a thermostat's local communication network	Read Only
RxSy (x = 1-4; y = 1,2)	Report value of any sensor on thermostat's local communication network	Read Only
OT	Report Thermostat Remote "Outdoor" Temperature	Read Only
R	Report Thermostat Remote "Outdoor" Temperature	Read Only
OH	Report Thermostat Remote Humidity	Read Only
Thermostat HVAC Operational Commands		
SH	Heat Mode Set Point	Two or three digit integer: 40 – 88 for °F; 4 – 31 for °C
SH++	Increment heat set point	Integer value which when added to the current heat set point does not fall outside the SH limits
SH--	Decrement heat set point	Integer value which when deducted from the current heat set point does not fall outside the SH limits
SC	Cool Mode Set Point	Two or three digit integer: 42 – 90 for °F; 6 – 33 for °C
SC++	Increment cool setpoint	Integer value which when added to the current cool set point does not fall outside the SC limits
SC--	Decrement cool setpoint	Integer value which when deducted from the current cool set point does not fall outside the SC limits
S	Current Mode Set Point	Two or three digit integer (see next two commands)
SP++	Increment current mode set point	Integer value which when added to the current mode set point does not fall outside the SH and SC limits
SP--	Decrement active setpoint	Integer value which when deducted from the current mode set point does not fall outside the SH and SC limits
MODE, M	Thermostat Mode of Operation	A/C/H/E/OFF (Auto/Cool/Heat/EMHT/Off)Humid/Dehum when operating as a humidity controller
FAN, F	Fan Switch Setting	A/ON (Auto/On)
HVAC, H	Report HVAC Relay States	Read Only
Auxiliary Information Commands		
EQUIPCONFIG	Reports the setting of the thermostat configuration dip switches	Read Only
BLTON	Turns on backlighting for 10 seconds.	No Value Required for this Command

Fill Out and Leave with System Software Package

JOB TITLE: _____
 JOB LOCATION: _____
 DATE: _____
 INSTALLING CONTRACTOR: _____



LOCATION _____
 ADDRESS _____

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DISTRIBUTION PANEL LOCATION / NAME _____

TO DISTRIBUTION PANEL _____

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1015 E. WASHINGTON AVE. • MADISON, WI 53703 • PHONE: 888/782-8638 • FAX: 608/257-4357 • www.aprilairepartners.com