INSTALLATION GUIDE

DSC/DAC/DNT-T305, DSM-T0 Application (*Room)* Controller Rev 8.5

Document Edition 1

Product Description

The Delta Application (*Room*) Controller (Dxx-T305 series) provides a versatile stand-alone or networking DDC controller adaptable to several applications. It is specifically designed for unitary room control applications, such as Fan Coil, VAV or Heat Pump control, as well as for small packaged equipment applications such as Rooftop Units.

The Dxx-T305 series Application Controller provides:

- LCD (Liquid Crystal Display).
- 4, 8 or 16 Button Keypad depending on the model.
- 1 jumper selectable Internally or Externally wired 10 KΩ Thermistor Room Temperature Sensor.
- NET1 Port for peer-to-peer MS/TP network communications to other BACnet controllers.

Other options depending on the model:

- 3 universal inputs / 5 binary outputs.
- RTC (Real Time Clock) and battery backed SRAM (DSC-T305).
- RS-485 Sub-net port for a secondary MS/TP controller network (DSC-T305, DAC-T305).
- RS-232 Communication Port (DSC-T305).
- Back lighting to illuminate LCD and keypad in low light conditions (optional for all models except the DNT-T305).
- Internal Audio Beeper.

The terminal connections are easily done with AMP connectors and the appropriate AMP Connector Tool. See the section Using the AMP Tool and Connectors at the end of this document.

Model Numbers and Features

Features	DNT-T305	DAC-T305	DSC-T305	DSM-T0B
	Delta **N**etwork **T**hermostat	**D**elta **A**pplication **C**ontroller	**D**elta **S**ystem **C**ontroller	**D**elta **S**ystem **M**anager
Internal Thermistor Input	●	●	●	●
Additional I/O (3 IP & 5 OP)	●	●	●	
Internal Audio Beeper		●	●	●
RTC and Battery backed SRAM			●	●
RS-485 Main Port	●	●	●	●
RS-485 Subnet Port		●	●	●
RS-232 Port			●	●
Backlighting		Option B	●	●
Keypad and Security Door	G1A, G2A, H2A	Any Listed Below	Any Listed Below	Any Listed Below

An appended keypad door code must be included to specify the desired model as follows:

Code	Description	Extra Programmable Buttons	Exposed Through Door
G1A	General - 4 Buttons	None	Top 4 Buttons
G1B	General - 16 Buttons	Yes	Top 4 Buttons
G2A	General c/w Fan - 8 Buttons	None	Top 8 Buttons
G2B	General c/w Fan - 16 Buttons	Yes	Top 8 Buttons
G3A	General c/w Time and Date - 8 Buttons	None	Top 4 Buttons
H2A	Hotel c/w Fan Speed- 8 Buttons	None	Top 8 Buttons
K1A	Keypad Applications – 16 Button	All	All 16 Buttons
VM1	Temp, Occupancy, Time Clock, and Numeric Keys – 16 Button	All	All 16 Buttons

Specifications

Power Requirements

- 24 VAC at 5VA or 10 to 35 VDC at 5VA not including output loading. When using internally sourced 24 V to power output devices, the output load must be added to the power requirement specifications.
- Class II.

Ambient Ratings

- 32° to 120°F (0° to 50°C).
- 10% to 90% RH (non-condensing).

Network Connections

- Network Port NET1 – Native BACnet MS/TP RS-485 @76,800 bps.
- Network Port NET2 – (except DNT-T305) DSC model can be either Linknet Port@76,800 bps or BACnet MS/TP @76,800, software configurable. DAC model is Linknet port only.
- RS-232 COM Port (DSM-T0 and DSC-T305 only) for modem or direct connection to OWS Workstation. (Up to 38,400 Bits/s).

Inputs

- 1 Internal/External jumper configurable Temperature Input (10 KΩ Thermistor).
- 3 External Universal Inputs, jumper configurable for the following input types:
  - 10 KΩ Thermistor.
  - 0 – 5 VDC.
  - 0 – 10 VDC.
  - Dry Contact (using 10 KΩ Thermistor jumper settings).

Outputs

- 5 FET (Field Effect Transistor) outputs.
- 24 VAC/ 10 – 35 VDC, 0.5 A maximum for each output. The total output load switched at one time should not exceed 1.5 Amps (see Special Considerations section).
- Outputs can switch external or internal power supply (jumper configurable).
- Can be used as PWM (Pulse Width Modulation) output by configuring output as analog in software (provides 0.59 – 2.93 sec PWM).

Package Contents

- Delta Application (*Room*) Controller Dxx-T305 Rev 8.5.
- Delta Application (*Room*) Controller Dxx-T305 Rev 8.5 Installation Guide.
- Up to 13 (Qty) depending on the model, 2 Pin Connectors (AMP 643817-2) 18 gauge (orange color).
- 1(Qty), 5 Pin Connector (AMP 643819-5) 22 gauge (red color) for DSC model only.
- 1(Qty), 2 Pin Connector (AMP 643820-2) 24 gauge (white color) for RS-485 connection. (2 (Qty) for DSC and DAC models, that have the NET2 subnet port.)
- 2(Qty), #6 x 1” screws.

Required Tools

- AMP Tool Handle Assembly and AMP Tool crimp die cartridge for handle assembly. (both of these devices are required for installation and can be obtained from Delta Controls (Part number DTT970).
- Wire cutter.
- Phillips screw driver.

Other Relevant Documents

- OWS321 or OWS322 ORCAview Technical Reference Manual.

Special Considerations

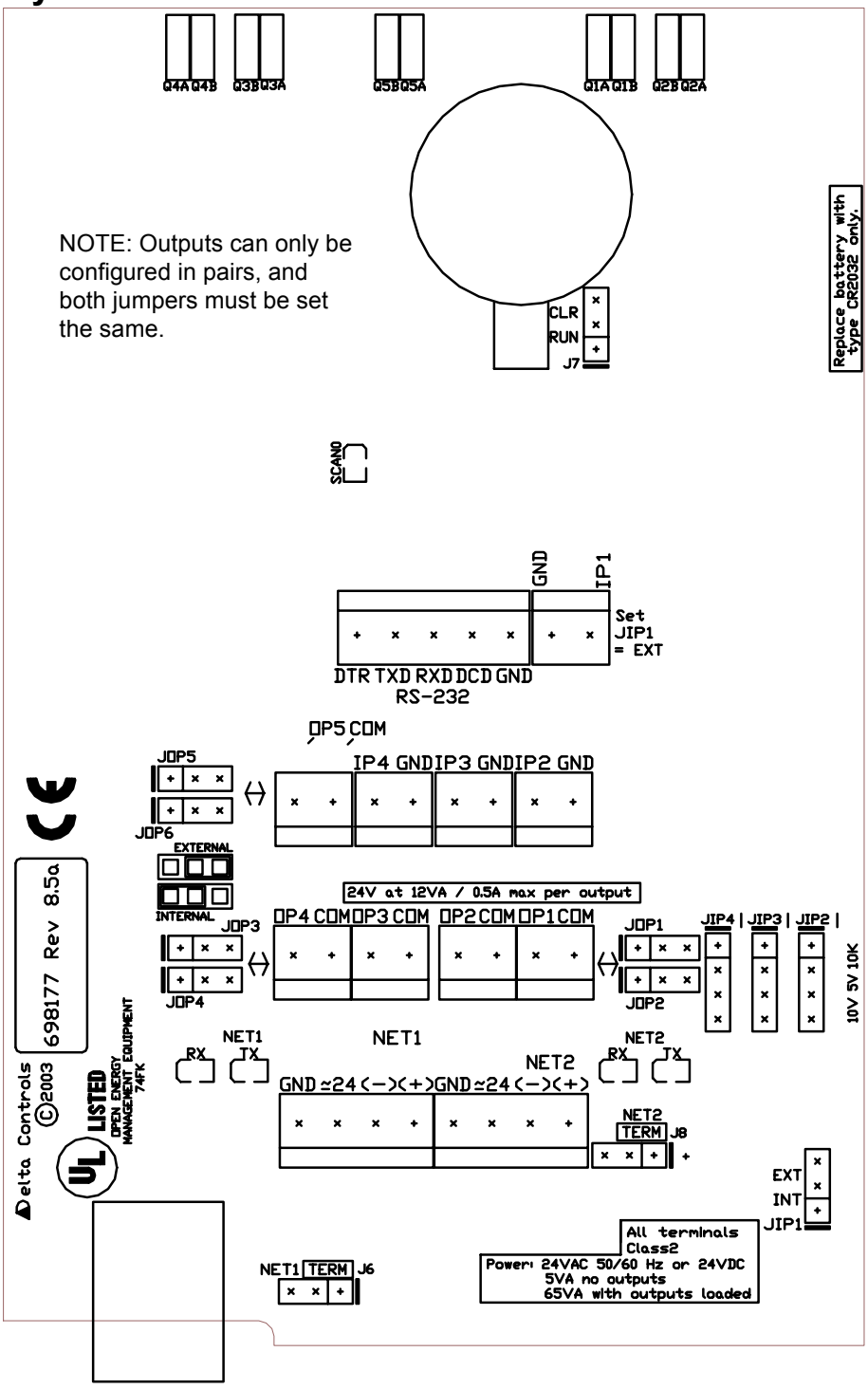
The following items are recommended installation practices.

- **Total output switching at one time should not exceed *1.5 Amps* maximum.** This should be adequate for most applications.
  - **Example 1:** RTU with fan, 1 stage heat (gas valve), 2 stage cool, and PWM damper actuator.
    - Blower relay = 100mA
    - Gas Valve = 300mA
    - Compressor Contactor (cooling) = 280mA each
    - Belimo NM24-PWM damper motor = 125mA

    At any one time the total load is less than 1.5Amps. For example, if heating mode, the Fan, Gas valve and damper motor would total 505mA or 0.505 Amps. In cooling mode the total load equals 785mA or .785 Amps.
  - **Example 2**: VAV control with 3 pt. Floating terminal reheat and radiation actuators.
    - Terminal reheat valve – MZ series electronic 3 pos. valve actuator = 250mA
    - Radiation Valve – MZ series electronic 3 pos. valve actuator = 250mA
    - Belimo NM24-PWM damper motor = 125mA

    At any one time the total load is less than 1.5Amps. For example if all devices are running the total load equals 625mA or 0.625 Amps
- When the Room Controller is being mounted on an electrical box, it is recommended that a 4X4 deep box with a mud ring be used. It has been found that smaller electrical boxes are more difficult to use due to the number of conductors terminated at the controller.
- To mount the Room Controller directly onto a wall without using an electrical box;
  - Cut a hole the same size as the wiring access hole on the backplate.
  - Use a Low Voltage Single Gang Screw on Bracket to attach the Room Controller (MPLS Caddy Fastener).
- Stranded wire should be used. Stranded wire allows for better flexibility when coiling wire into the electrical box.
- Shielded, balanced, 24 AWG, twisted pair cable is highly recommended for RS-485 wiring. (100-120Ω nominal impedance, 17pF/ft or lower capacitance – refer to DOC818-11 RS-485 Installation Guidelines for more information).
- Wire terminations should be properly tagged, either using the kit provided or conventional labeling methods.

Board Layout



Note: This drawing is based on the labeling sheet that covers the PCB board, and is indicative of the terminations for the full featured DSC model. Some connections are not available on the DAC and DNT models. Refer to the **Model Numbers and Features** table on page 2. Grey area indicates location of Input terminals, and clearly distinguishes the RS-485 connections from the power connections.

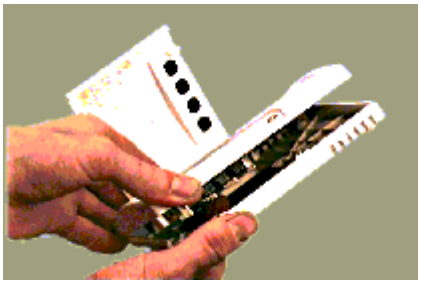
Mounting

The product dimensions are 4 3/16” (10.7cm) wide, 5 11/16” (14.4cm) high and 1 1/8” (3.0cm) deep. It is designed to be mounted on a standard North American 1110 electrical box as well as some standard international electrical boxes. In an application that requires a Dxx-T305 to be fully utilized, it is recommended that a 4X4 deep box with a mud ring be used due to the number of wires required.

Figure 1:

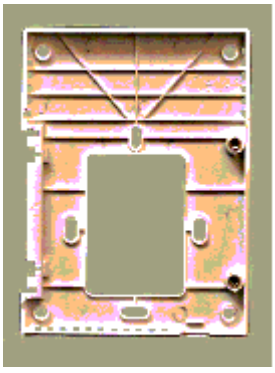
To remove the base from the Room Controller, back off the two backplate screws as shown in figure 1. These should only be backed off enough to separate the base from the Room Controller, they should not be removed.

Figure 2:



The base can then be separated from the Room Controller. Open the Room Controller slightly as shown in figure 2, until you feel the hinges on the left side of the Room Controller release.

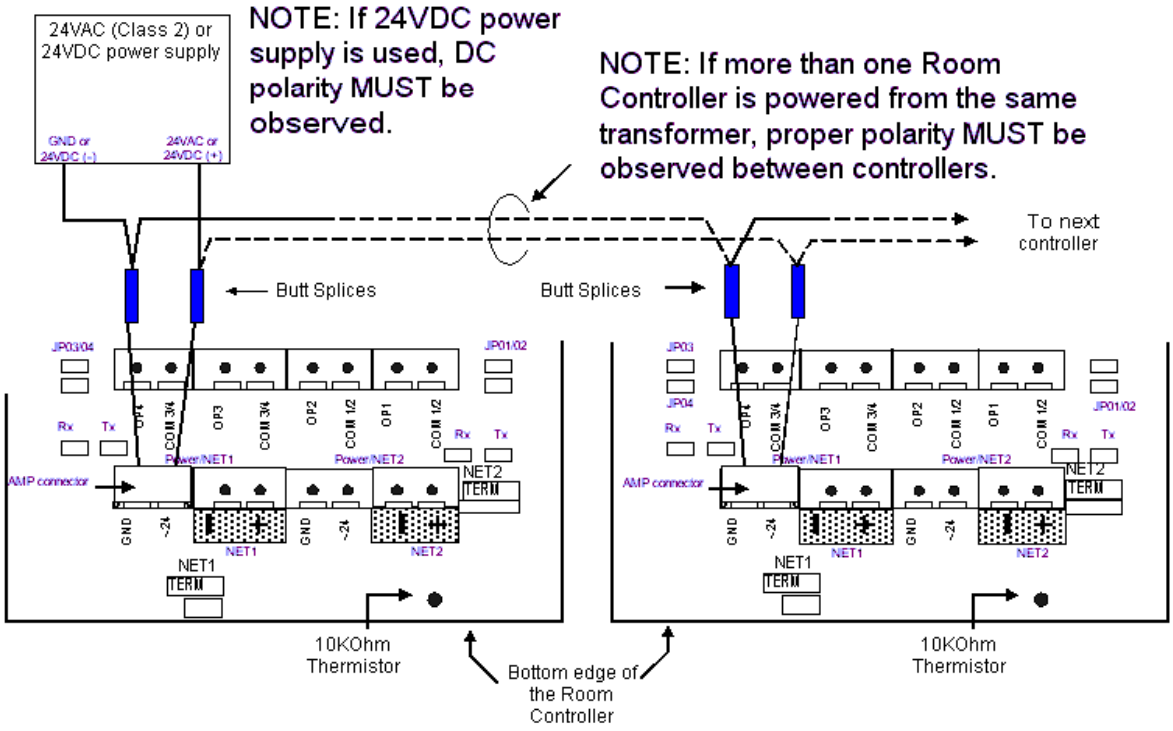
Figure 3:



The backplate can then be mounted to an appropriate electrical box, cabinet or wall. Figure 3 displays the base with the wiring opening and mounting holes above, below and on either side of the opening There are also mounting holes on each corner of the backplate. The mounting holes above and below the wiring opening align with a standard electrical box. The four mounting holes at each edge of the backplate or the 2 holes on each side of the opening can be used for mounting directly onto a wall if an electrical box is not used (it is recommended that plastic screw anchors – size 10-12 1" - be used. Larger steel wall anchors may be visible under the backplate mounting pads).

To reattach the Base, insert the hinged side first and then fold the two sections together. The screws to fasten the Base to the Room Controller can then be tightened. DO NOT over-tighten the screws, they should only be firm.

Power Connection



Note: Each Room Controller requires 24VAC 5VA or 10 to 35VDC 5VA power supply. This does not include output loading. If output devices are to be switched using internal 24Vcontroller power, the output load must be added to the transformer sizing.

When power is applied to the unit, all of the LCD segments will appear on the display for a few seconds. If the controller has an empty database the LCD will then go blank.

It is recommended that an ungrounded dedicated transformer be used to provide power to the Dxx-T305. If multiple Dxx-T305's are to be powered from the same transformer, polarity **MUST** be observed between controllers. Failure to observe polarity will result in the loss of communications to the affected controller. The transformer must **ONLY** be used to provide power to Dxx-T305's for controller power and output switching.

Inputs

Table 1:Input Jumper Configuration:

Input	Jumper	10K Thermistor	0-5VDC	0-10VDC
IP2	JP2			
IP3	JP3			
IP4	JP4			

IP1 is a 10KΩ Thermistor connected to the product internally, but may also be configured as an external 10KΩ Thermistor if JIP1 is set to EXT.

Room Controller models DNT-T305, DAC-T305 and DSC-T305 have 4 inputs. Input 1 is jumper configurable as an internally mounted 10K Ohm thermistor used to measure ambient air temperature at the Room Controller location or an externally mounted 10K Ohm Thermistor for measuring temperatures in a remote locations. The Room Controller has 3 other inputs available. These Inputs can accept a 10K Ohm thermistor, 0-5VDC, 0-10VDC, or 4-20mA input device. The Input jumpers must be set to the proper settings depending on the input device being connected to the corresponding input. (4-20mA devices use the 0-5VDC jumper settings, with an external 250Ω resistor added across the input. Refer to Figure 5 for proper termination).

Table 1 indicates the jumper positions for the various types of inputs.

Input Wiring

The following 2 pages contain wiring diagrams for wiring Internally powered and Externally powered input types, and indicates the proper jumper settings for each input type.

Figure 4 describes the wiring connections for inputs that do **not** require an external power supply, but are either powered from the controller (such as a 10K Ohm thermistor) or induce their own power (such as a current sensor).

Figure 5 describes the wiring connections for inputs that require an external power supply. These would be devices such as 4-20mA humidity and pressure sensors.

Figure 4: Inputs Not Requiring an External Power Source:

The following diagram shows how to connect input devices to the Room Controller that do not require an external power source.

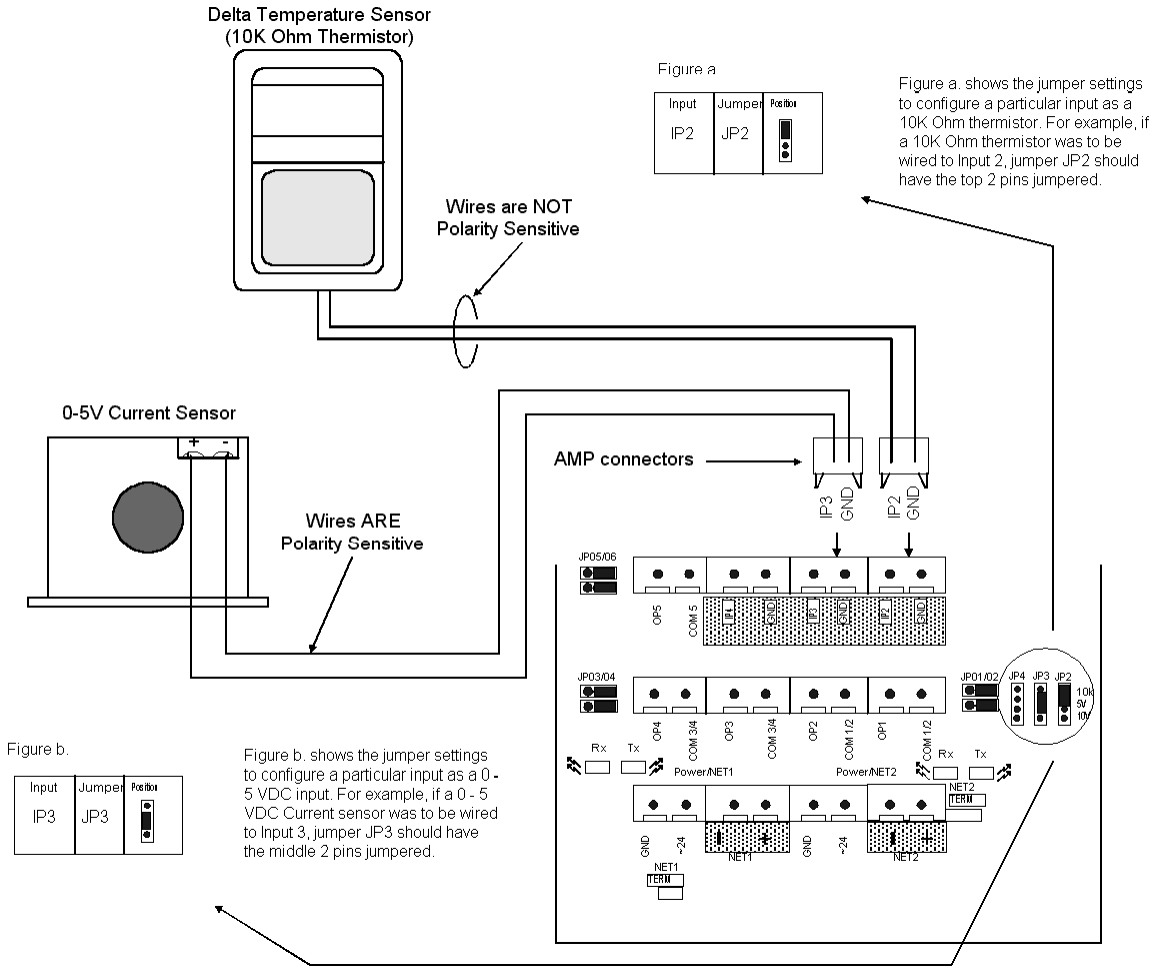
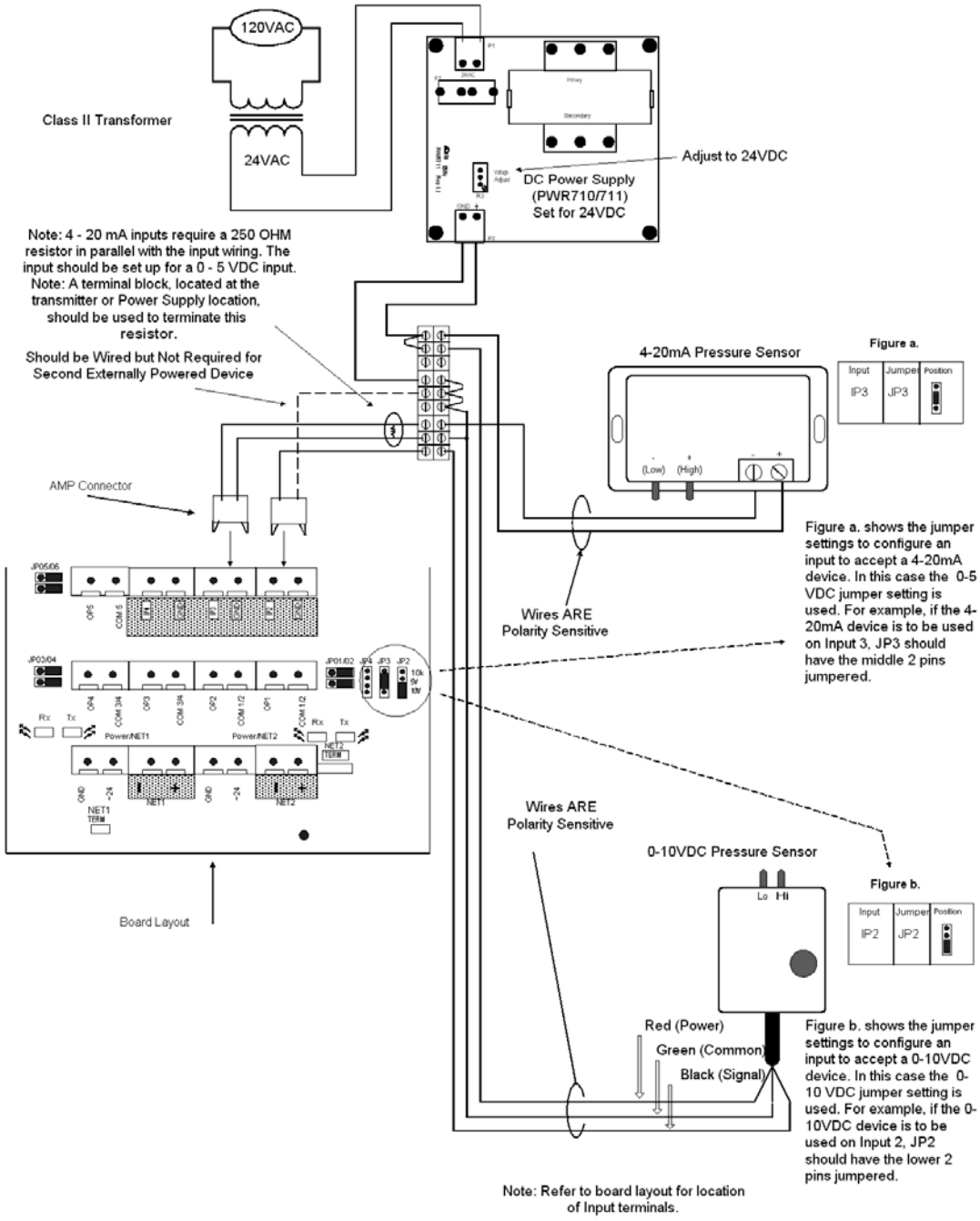


Figure 5: Inputs Requiring an External Power Source:

The following diagram shows how to connect input devices to the Room Controller that require an external power source.

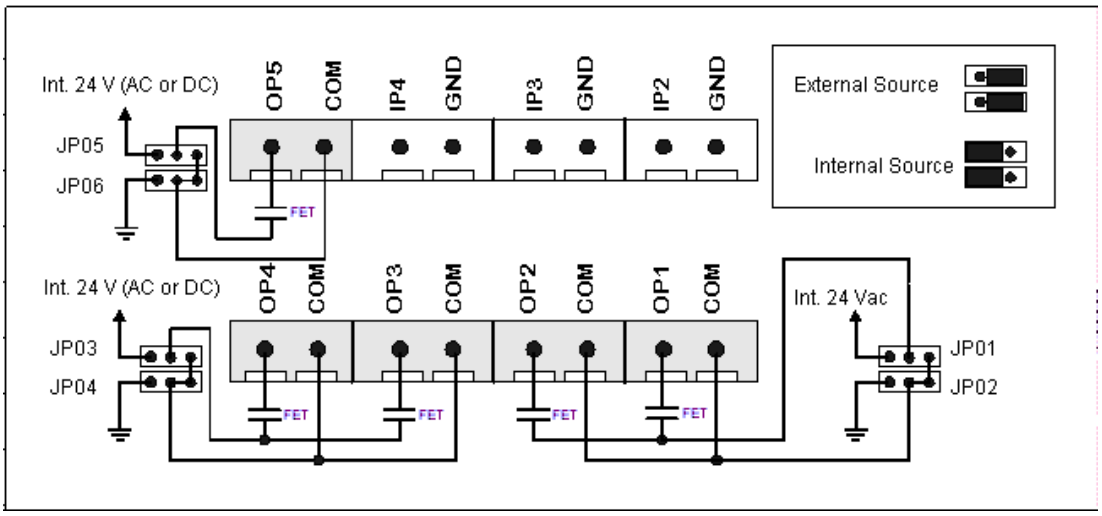


Outputs

The Dxx-T305 Application Controller uses FET (Field Effect Transistor) outputs. They are capable of switching 24VAC or 24VDC loads, up to 0.5 Amps per output.

Figure 6 :Internal Output Wiring Schematic:

Figure 6 shows the internal circuitry of the Room Controller outputs. The outputs share COMMONS in pairs (except for OP5 which has its own COMMON), meaning OP1 and OP2 share a common, and OP3 and OP4 share a common. This means that each output in a pair of outputs must switch the same power source, either Internal or external 24V. The outputs are configured by setting the JUMPERS to the proper settings. There are 2 jumpers for each pair of outputs and they must both be set to the SAME position. OP5 also has 2 jumpers and they must also be set to the same position.

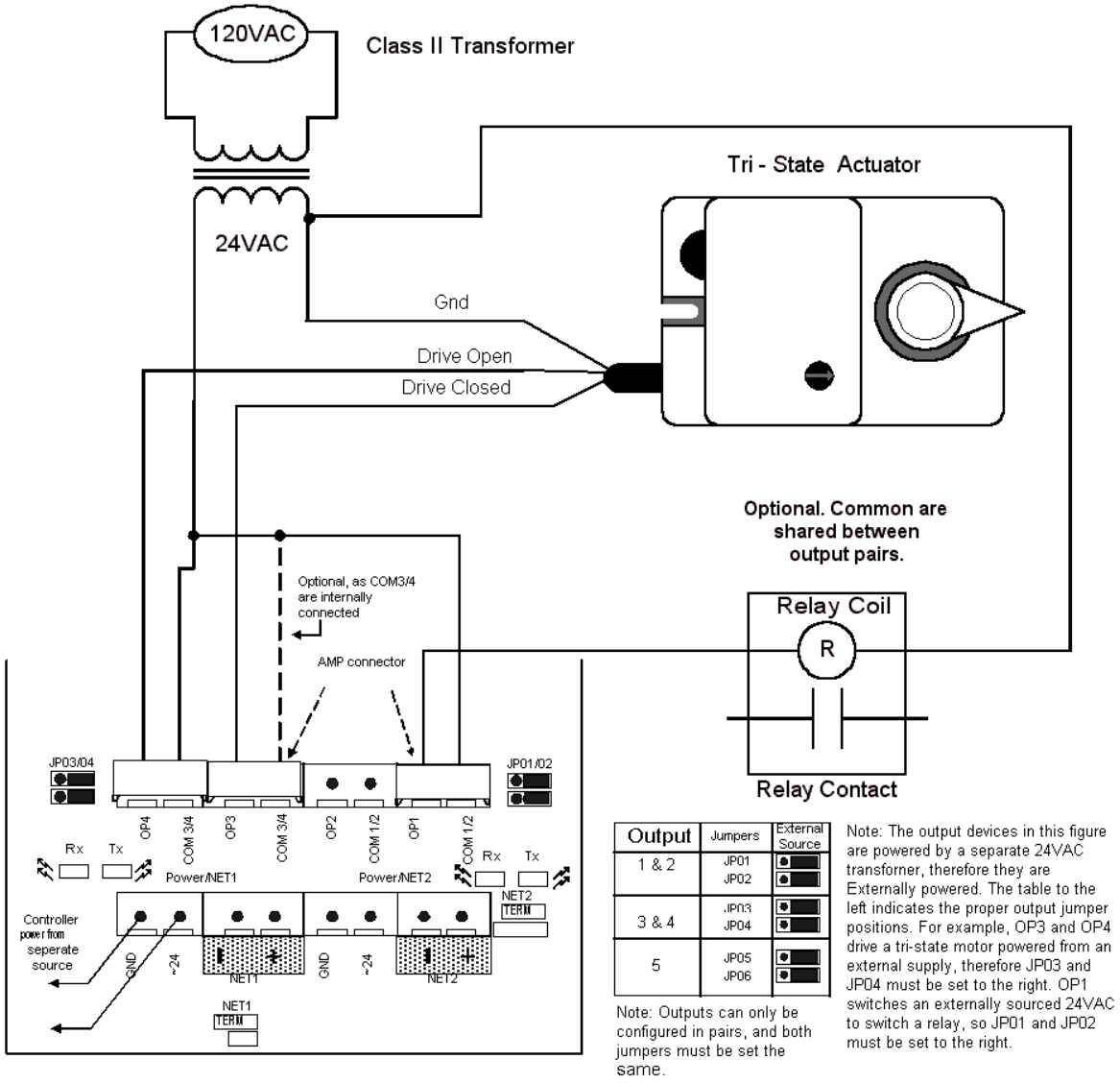


As indicated in Figure 6, Output Wiring Schematic, OP1 and OP2 share the common, OP3 and OP4 share the common, and OP5 has its own common. **Do not use two different power supplies to power the two outputs of a pair (1&2, 3&4)**, as damage to both the Room Controller and the power supplies could occur.

The outputs are factory set to switch Externally sourced output power. **Setting the outputs to switch Internal controller power when connected to output devices that have an externally mounted power supply will cause damage to the Room Controller and the output device**.

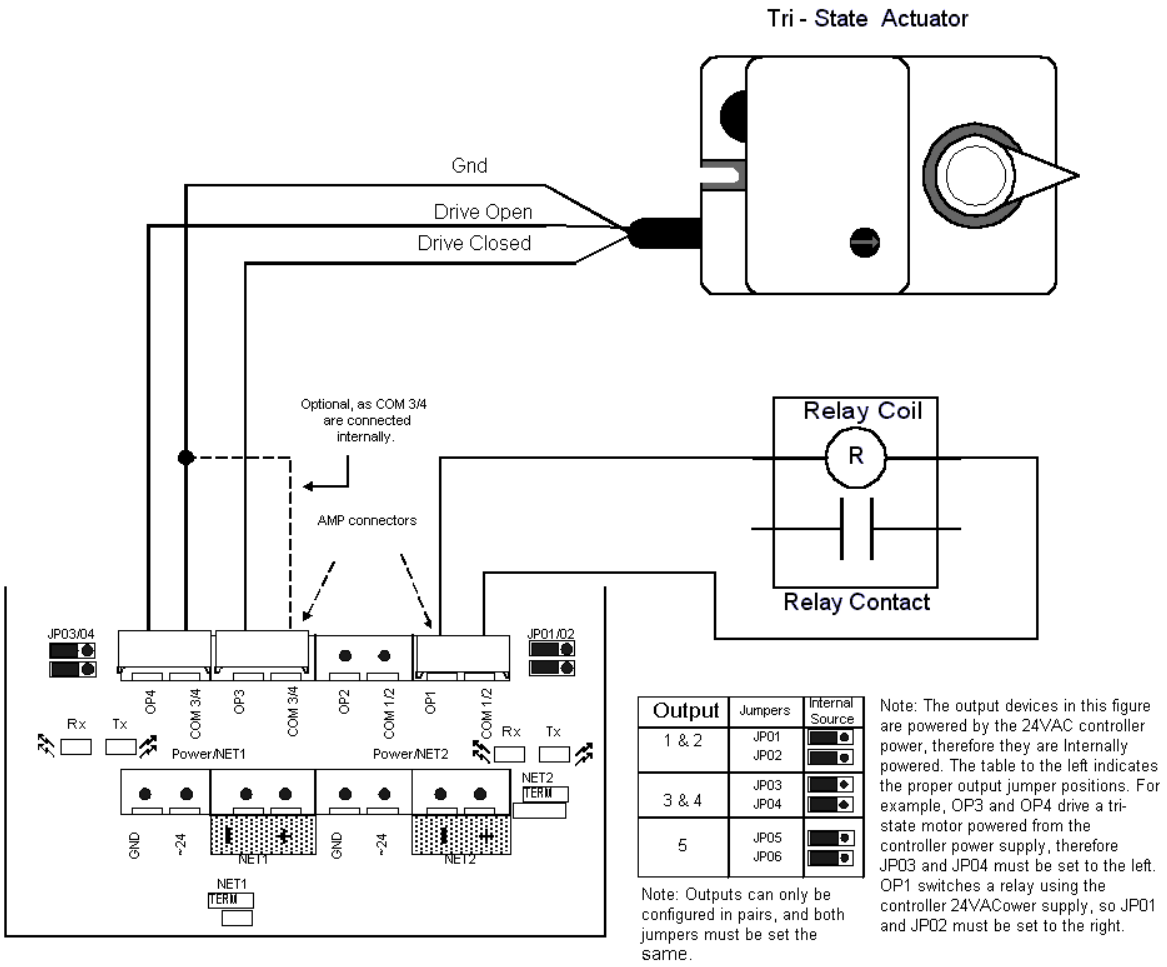
Heat generated by switching larger loads may effect the accuracy of the fixed internal temperature sensor. Testing has shown that all FETS closed at full load (0.5A) per output for extended periods can result in Room Temperature sensor offsets of +0.5°C. It is recommended that low current interface relays be used to switch larger loads.

Figure 7: Outputs Powered from an External 24VAC Power Source:



Note: It is highly recommended to review and understand the CAUTIONS on page 11 before terminating output devices.

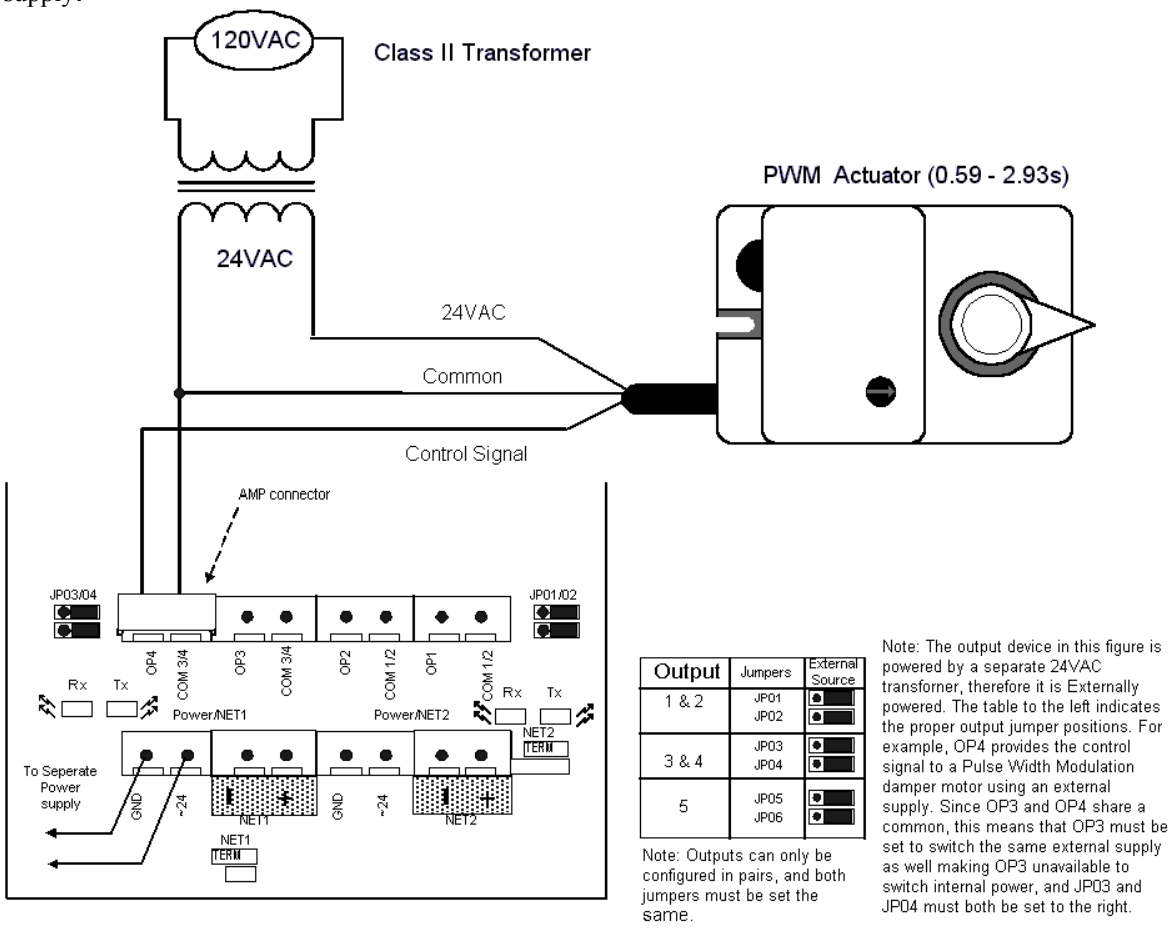
Figure 8: Outputs Powered from the Internal 24VAC Room Controller Power Supply:



Note: It is highly recommended to review and understand the CAUTIONS on page 11 before terminating output devices.

Figure 9: Wiring of a PWM damper motor using External Power.

This figure shows the wiring of a Belimo NM24-PWMus damper motor using an external 24VAC power supply.



Output	Jumpers	External Source
1 & 2	JP01 JP02	
3 & 4	JP03 JP04	
5	JP05 JP06	

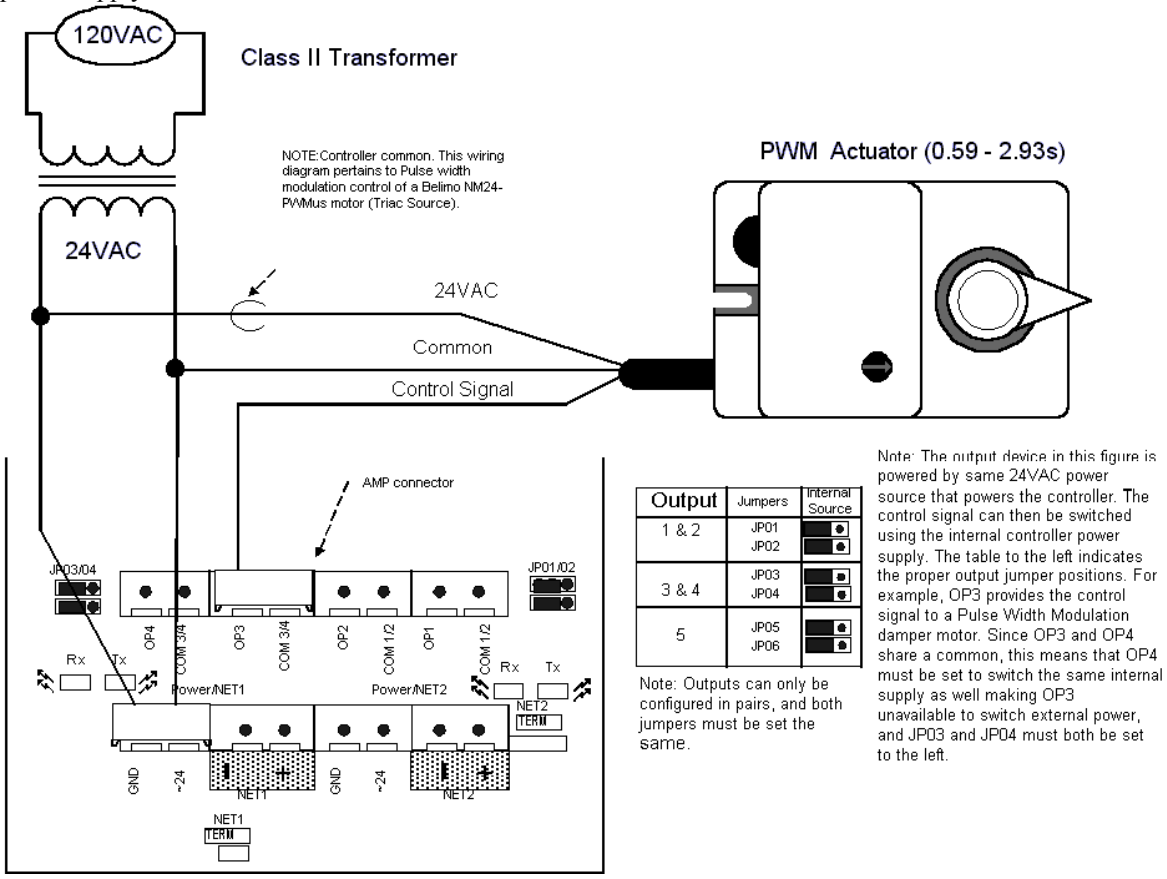
Note: Outputs can only be configured in pairs, and both jumpers must be set the same.

Note: The output device in this figure is powered by a separate 24VAC transformer, therefore it is Externally powered. The table to the left indicates the proper output jumper positions. For example, OP4 provides the control signal to a Pulse Width Modulation damper motor using an external supply. Since OP3 and OP4 share a common, this means that OP3 must be set to switch the same external supply as well making OP3 unavailable to switch internal power, and JP03 and JP04 must both be set to the right.

Note: It is highly recommended to review and understand the CAUTIONS on page 11 before terminating output devices.

Figure 10: Wiring of a PWM damper motor using Internal Controller Power.

This figure shows the wiring of a Belimo NM24-PWMus damper motor using internal 24VAC controller power supply.



Note: It is highly recommended to review and understand the CAUTIONS on page 11 before terminating output devices.

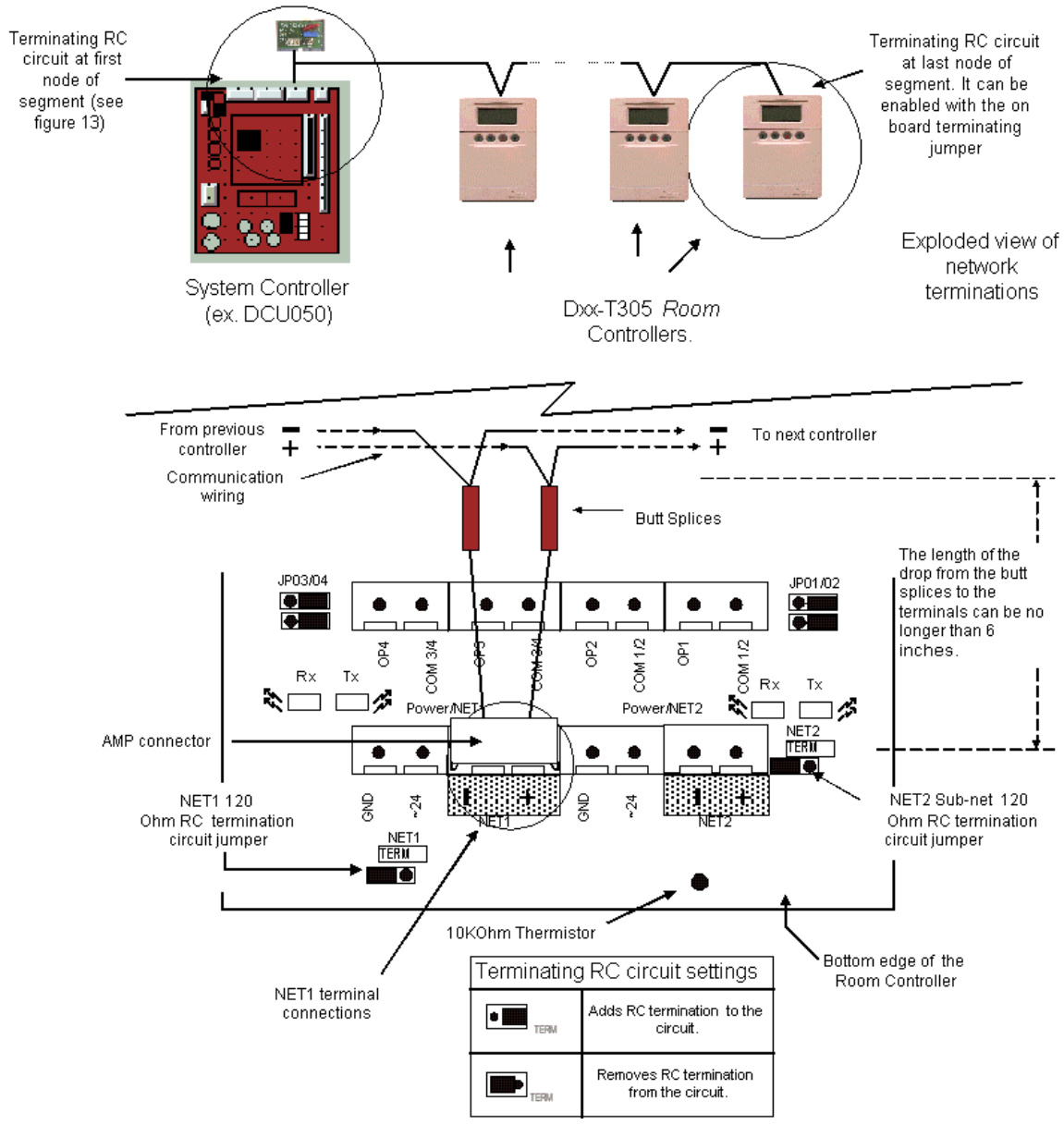
RS-485 Network Connections

All Room Controller models feature a primary RS-485 port (NET1) for connection to an ORCA network or system controller, such as a DCU050. All models (except the DNT-T305) also feature a secondary RS-485 sub network connection (NET2).
Figure 11 indicates the NET1 wiring and terminal locations, and Figure 12 indicates the NET2 wiring and terminal locations.
Note: Both the main RS-485 LAN and the RS-485 sub-net must be run in a "daisy chain" topology. There can not be any "star" or "T" configurations. The length of the "drop" from the butt splice to a controller must be no more than 6".
Each network connection has a jumper selectable *Resistor-Capacitor* (RC) terminating circuit. An RC termination is highly recommended on all RS-485 network configurations, at the ***first*** and ***last*** node of a segment. The RC termination circuit is easily enabled on a Room Controller by setting the termination jumper to the TERM position. If a DCU050 or any other controller that does not have a termination jumper is at either end of a segment a TRM-678 Terminator board should be installed in parallel to the RS-485 terminal connections.

Note: The Resistor in the RC circuit provides an end of line impedance matching the wire impedance, to prevent the signal from reflecting back onto the network. Reflections would create data collisions and therefore intermittent communication errors.
The Capacitor provides some high frequency filtering, which will help remove some electrical 'noise' that may be induced on the network wiring.

Figure 11: Primary MS/TP RS-485 Network Connection (NET1)

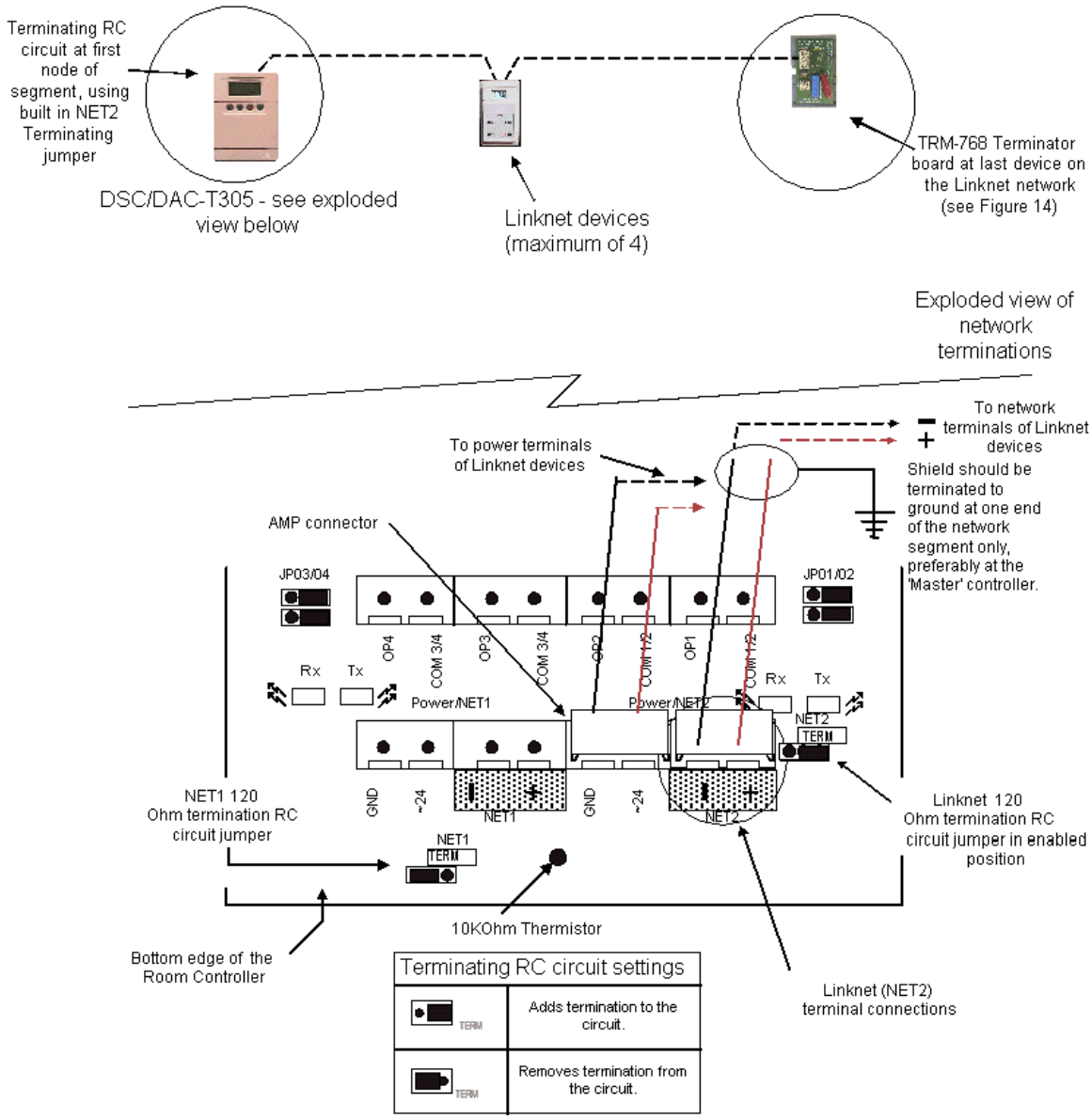
The following figure shows the RS-485 connection for a Dxx-T305 controller that resides on a BACnet MS/TP RS-485 network of a System Controller, such as a DCU050.



NOTE: All controllers must be the same firmware version, ie V3.21 or V3.22.
NOTE: The positive (+) terminals of all controllers on the network are connected together, and the negative (-) terminals of all controllers on the network are connected together.
NOTE: The ground wire of the network twisted shielded pair should be connected to earth ground at one end of the network only, preferably at the master panel.

Figure 12a: NET2 as a LINKnet Connection

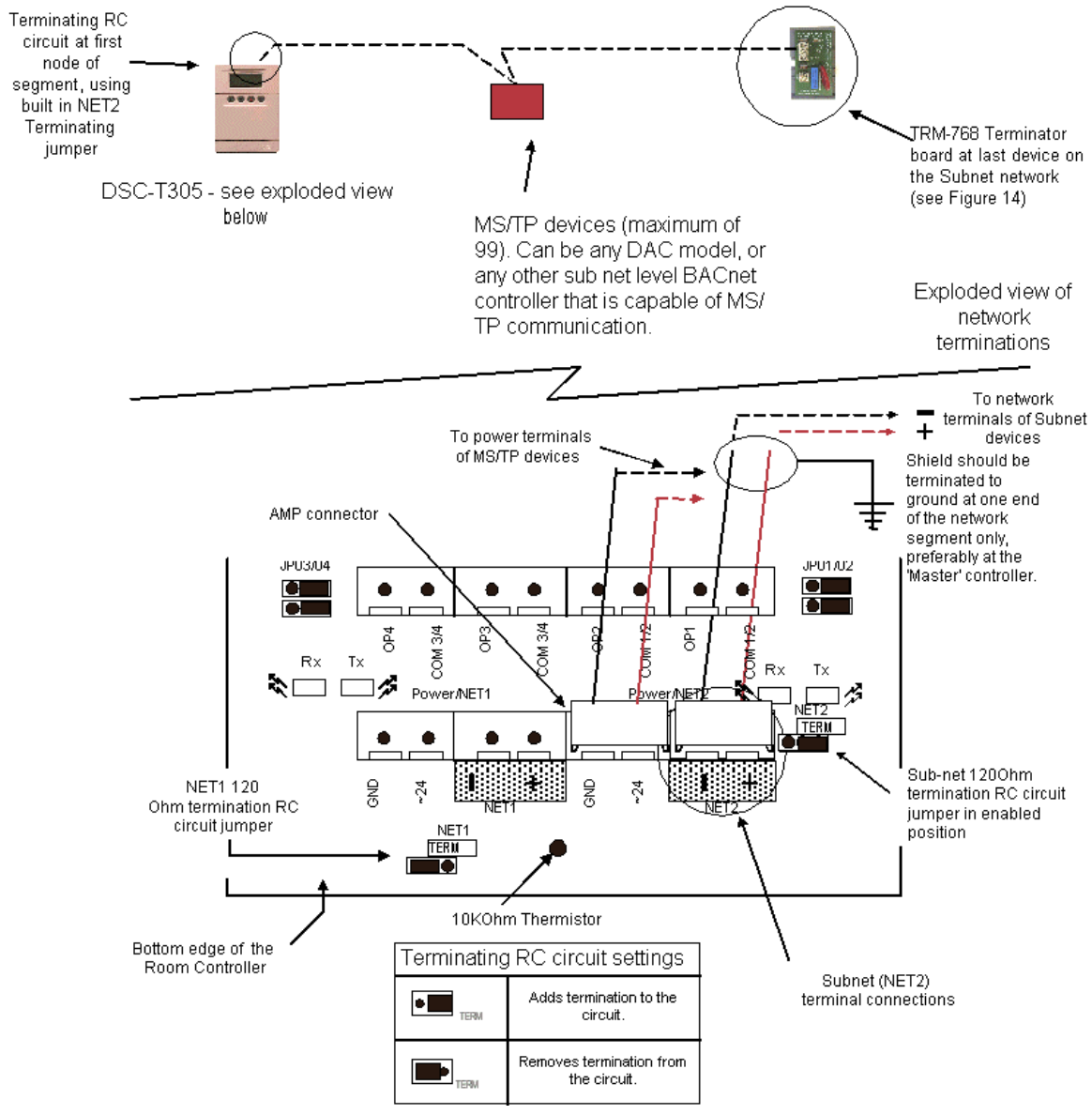
The following figure shows the RS-485 connection for a controller that becomes the Master panel of a sub network of Linknet devices (the DAC-T305 and DSC-T305 models only).



NOTE: Sub net devices can be either DFM (Delta Field Modules, maximum of 2), DNS-14 (BACstatI) or DNS-24 (BACstatII), with a total of 4 devices max.
NOTE: The positive (+) terminals of all controllers on the network are connected together, and the negative (-) terminals of all controllers on the network are connected together.
NOTE: The ground wire of the network twisted shielded pair should be connected to earth ground at one end of the network only, preferably at the master panel.

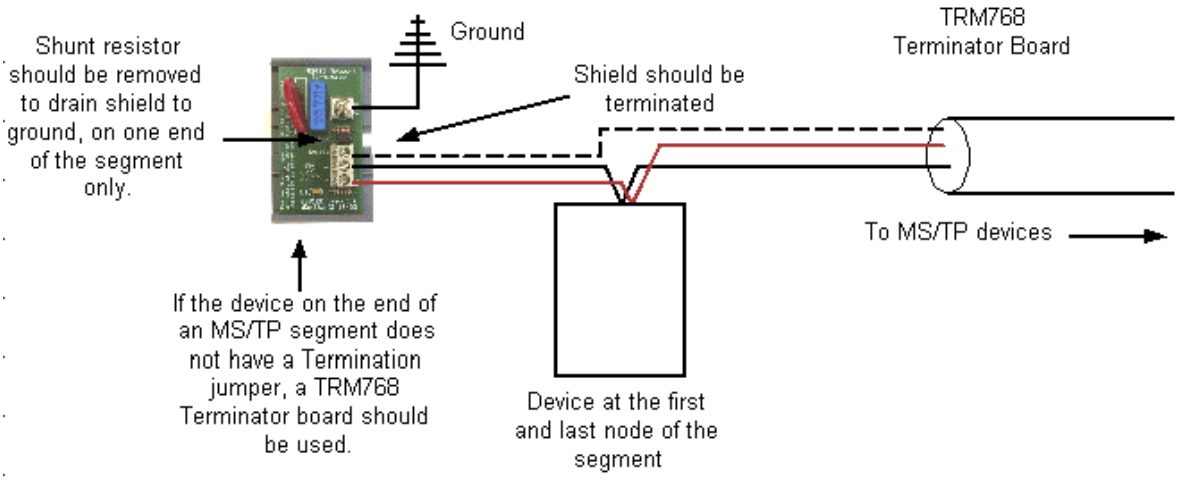
Figure 12b: NET2 as a BACnet MS/TP Sub Network Connection

The following figure shows the RS-485 connection for a controller that becomes the Master panel of a sub network of Linknet devices (the DAC-T305 and DSC-T305 models only).



NOTE: MS/TP Sub net devices can be any Delta DAC model controller (ex. DACV304, DAC606, etc), DFM (Delta Field Modules), DNS-14 (BACstatI) or DNS-24 (BACstatII) or any other sub net level controller capable of communicating via BACnet over MS/TP, with a total of 99 devices max.
NOTE: The positive (+) terminals of all controllers on the network are connected together, and the negative (-) terminals of all controllers on the network are connected together.
NOTE: The ground wire of the network twisted shielded pair should be connected to earth ground at one end of the network only, preferably at the master panel.

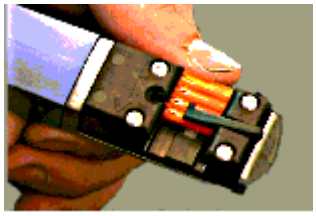
Figure 13: Connecting the TRM-786 Terminator Board at the end of the segment



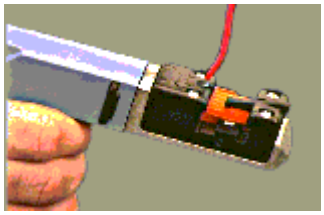
Note: The figure above describes how to use the TRM-768 for network termination. If the device at the first or last node of an MS/TP or Linknet segment does not have a built in terminator circuit this board should be installed. (This circuit is factory installed on a Room Controller and is enabled by moving the NET1 (for the Primary network) or NET2 (for the Secondary network) jumper to TERM).

Using the AMP Tool and Connectors

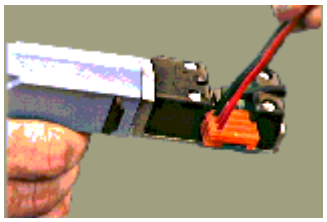
1. Insert the AMP connector into the cartridge of the AMP tool as shown above. The AMP connector and tool cartridge are keyed so that it can only be inserted one way, with the wire connections pointing toward the handle of the tool.



2. Line up the first wire terminal on the connector with the round notch on the AMP Tool.



3. Insert the wire into the slot so that it seats against the bottom edge of the cartridge. Squeeze and release the trigger of the AMP tool. The AMP connector will automatically advance to the next wire slot. Repeat the procedure until all the wires have been terminated into the AMP connector.



4. When all the wires have been inserted and crimped to the connector, the connector can be removed easily by sliding the connector out of the AMP Tool cartridge.

LED Indicators

LED	Function	Rate and Sequence
Tx (NET1)	Indicates that the Dxx-T305 has transmitted the token back onto the MS/TP RS-485 LAN.	This LED will blink when the controller passes the token to the next controller on the MS/TP RS-485 LAN.
Rx (NET1)	Indicates that the Dxx-T305 has received the token from the main MS/TP RS-485 LAN.	This LED will blink when it receives the token from the main RS-485 LAN.
Tx (NET2)	Indicates that the Dxx-T305 is transmitting the token onto the sub-network.	This LED will blink when transmitting the token onto the RS-485 sub-network.
Rx (NET2)	Indicates that the Dxx-T305 has received the token from a controller on the RS-485 sub-network.	This LED will blink only when it receives the token from the RS-485 sub-network.
CPU	Shows operation of main CPU.	Pulses at one pulse per scan. (Due to the high scan rate, this LED will appear to be on steady).

Calibration and Servicing:

To calibrate the on-board temperature sensor:

1: Apply power to the controller.
2: Allow 30 – 60 minutes for Controller's electronic components to reach nominal operating temperature.
3: Using an accurate thermometer, compare the actual temperature at the controller to the Temperature input (IP1) reading, and enter the appropriate offset in to the calibration field of the IP1 object.

NOTE: If backlighting is used and will be ON constantly, switch backlighting on and allow 60 minutes before calibration. If backlighting is to be on intermittently for a few seconds at a time (ex. ON only when a keypad button is pushed) it is recommended to calibrate the temperature sensor with the backlighting off.

K If problems occur with the LCD or Keypad do not attempt to troubleshoot by removing the controller PCB board from it's housing, as this will void the warranty and may damage the components. The LCD and keypad are factory installed and it may be difficult to align these components and re-assemble the controller to a functioning unit.

Battery

For those models that require a battery (DSC-T305) the controller is shipped with the battery installed in the battery holder. This battery is a non-rechargeable lithium battery.

The battery has a shelf life of approximately 10 years. The battery should be tested and changed after 5 to 10 years of normal use.

If a fully charged battery is installed and power is lost to the controller;

- At 20.0 °C the battery will last for about 15,000 hours with no power applied to the product. This is equivalent to about 1.5 years.
- At 55.0 °C the battery will last for about 8,000 hours with no power applied to the product. This is equivalent to just under 1 year.

It is recommended that the battery be removed from the holder if the controller is to be stored or powered down for extended periods of time.

CE - DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	Delta Controls
Manufacturer's Address:	17850 56th Avenue Surrey, British Columbia Canada V3S 1C7

declares that the product (s):

Product Name:	Room Controller
Model Numbers:	DAC250, DAC251, DAC252
Product Options:	All

conforms to the following Product Specifications:

EMC:

EN 55022:1994	Radiated and Conducted Emissions	Class B
EN 50082-1:1997	Generic Immunity Standard	
EN 61000-4-2:1995 + A1:1999	ESD Immunity	Level B
EN 61000-4-3:1996	RF Electromagnetic Field Immunity	Level A
ENV 50205:1995	RF Electromagnetic Field Immunity (Keyed)	Level A
EN 61000-4-4:1995	EFT/Burst Immunity	Level B
EN 61000-4-5:1995	Surge Immunity	Level B
EN 61000-4-6:1996	Conducted RF Disturbances Immunity	Level A
EN 61000-4-11:1994	Voltage Dips / Interruptions	Level B/C

Supplementary Information

The product(s) herewith comply with the requirements of the EMC Directive 89/336/EEC. The product(s) were tested in a typical configuration.

Lee Dickson
Quality Assurance Manager

FCC Compliance Information

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 a residential installation**.** This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause 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 into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada Compliance Statement

ICES-003 This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe B Respecte toutes les exigences du Règlement sur le matérial brouiller du Canada.