

Network Backbone is the Key to Proper DLM Network Functionality

Topic: DLM Segment Network Installation

Issue: # TB179.2

Date: October 10, 2013

The success of a DLM network installation and the functionality of the Segment Manager is dependent upon a properly routed and connected network wire backbone. WattStopper #LM-MSTP wire is required for Segment Network connections, and installers must ensure that the shield is not damaged when the wire is pulled.

Because DLM is a distributed control system, the Local Networks are powered by a variety of branch circuits that typically originate in many panel boards throughout the building. This has no effect on the independent operation of the DLM devices. However, when each Local Network is equipped with a Network Bridge, and then interconnected by a Segment Network, there is a possibility for communications problems if each Network Bridge's independent relationship to the building's electrical distribution system is not reconciled by a dedicated signal ground connection.

DLM's Segment Network communications use a differential type signal relative to this dedicated signal ground, or "common reference voltage," and so disparate reference levels can distort the ability of the Network Bridges to communicate effectively. To eliminate this as a potential source of problems, the DLM Segment Network design provides a common reference connection for all of the connected devices via the LM-MSTP wire and terminals on the network devices.



System Architecture

DLM room-based Local Networks are designed as electrically isolated circuits: the DLM devices installed using LMRJ Series cables are not connected to earth ground. This is often referred to as a 'floating' circuit design. Unlike LMRC-100 Series Room Controllers, which have no ground wire, LMRC-200 Series Room Controllers have a green wire for ground. However, this is a safety ground and is connected only to the metal housing of the Room Controller and not to the device's electronic circuitry. This isolation allows the individual DLM Local Networks to operate without interference from the building's electrical distribution system that might be conducted through an earth ground.

Reference Connection

LMBC-300 Network Bridge modules have Segment Network terminals labeled "R", "+", "-", and "S". The "R" or "reference" terminal is for the common reference connection. The green conductor in the LM-MSTP wire provides the connection between the "R" terminals on each Network Bridge. This green wire should not be confused with the shield conductor also present in the LM-MSTP cable. Do **not** connect the shield conductor to the "S" terminal. **The "S" terminal should be left empty during installation, but may be used at the discretion of WattStopper field personnel.**

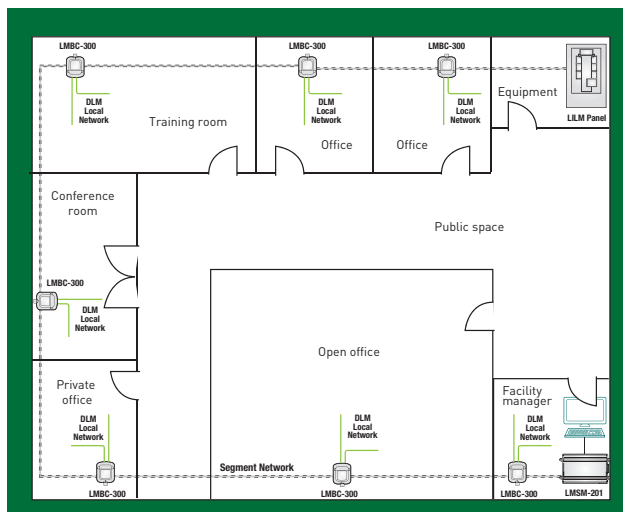
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Planning the Segment Network



The DLM Segment Network uses EIA-485 signaling standards and a protocol known in the building automation industry as BACnet MS/TP. Consequently, the installation must follow the rules established for this form of communication. This includes routing the network wire using linear topology, often referred to as a "daisy chain." No branches, stars, or T taps are permitted in the segment network wire. Each Segment Network must have only two ends, and the total wire length cannot exceed 4,000 feet without the use of repeater/isolators, with a maximum of two repeater/isolators per network.

Before installation, lay out the Segment Network routing on the plans, connecting each Network Bridge in a linear fashion. Estimate the length of the LM-MSTP wire run, taking into account that the installer may actually use more wire than estimated. If there is any chance that a Segment Network may exceed the maximum length of 4,000 feet, it should be broken down into multiple networks.

Additionally, make note of the number of Network Bridges

on each Segment Network. While DLM automatic MAC address configuration supports up to 96 bridges per segment with addresses in the range of 33 to 127, and bridges can be statically assigned any MAC address from 0 to 127, the number of Network Bridges on each segment **is limited to 40 as a best practice** (see technical bulletin #189). Projects with more than 40 Network Bridges should be configured with multiple Segment Networks.

The LMSM-3E Segment Manager provides provides three Segment Network connections. The LMSM-6E can be used with NB-ROUTERS to add more Segment Networks as needed to accommodate up to 300 Network Bridges.

NOTE TO INSTALLERS: it can be very helpful during the commissioning of the Segment Network if the actual wire routing and final location of the ends is noted on the plans and supplied to the technician.

Connecting the Network Bridge Terminals to the Segment Network

With the exception of devices at each end of the Segment Network, all DLM Segment Network connections to Network Bridges will have an inbound and outbound wire, each with its own set of terminals ("+", "-" and "R"). No more than one set of wires should land under any one terminal set to ensure that the LM-MSTP Segment Network wire run is a linear topology "daisy chain." Properly terminating and dressing these connections, as illustrated in this bulletin, will ensure a solid network installation.



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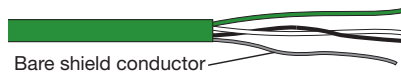
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CONNECTING NETWORK BRIDGE TERMINALS TO THE SEGMENT NETWORK

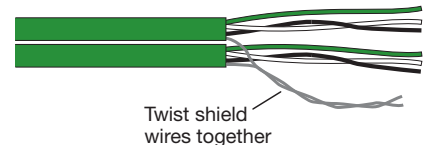
Step 1 >

Strip back the outer jacket of the LM-MSTP wire about 3" and clip off both the foil wrapper and the string. Do NOT clip off the bare shield drain conductor.



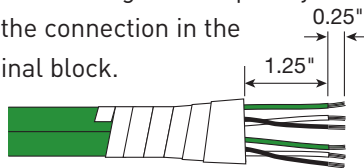
Step 2 >

Hold the two LM-MSTP wire ends together so that the jacket ends are even. Twist the bare shield drain conductors together and then wrap them around the two segment wires near the end of the jackets.



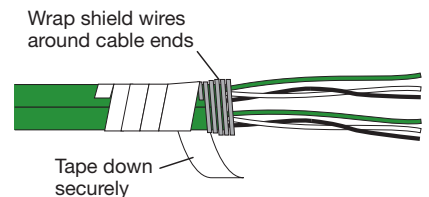
Step 4 >

Clip off the six insulated conductors to 1-1/2" long so that they are exactly the same length. Strip each conductor about 1/4", or just far enough to completely seat the connection in the terminal block.



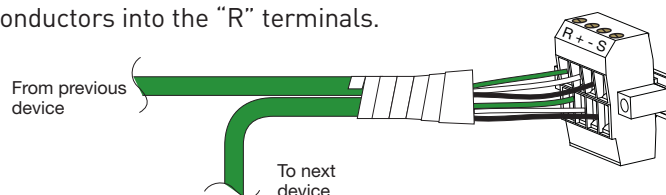
Step 3 >

Tape this connection down securing the two wires together in the process. Do NOT use wire nuts to secure the bare drain conductors.



Step 5 >

Install the black conductors into the "-" terminals. Install the white conductors into the "+" terminals. Install the green conductors into the "R" terminals.



Step 6 >

Tug on the connections to make sure they are solid and inspect the terminal block to ensure that there are no loose strands of wire.

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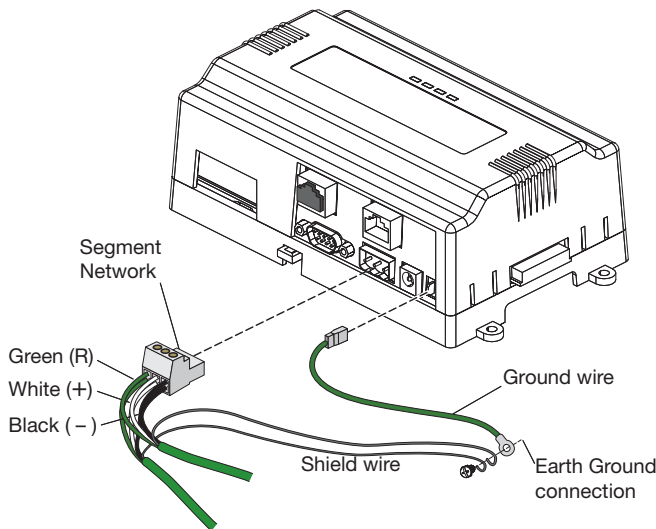
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Connecting the Segment Manager to the Segment Network

The LM-MSTP wire connects to the Segment Manager network connector using the same procedure as the Network Bridge connections. However, the terminal locations on the terminal block are different. Ensure that the white wire connects to "+", the black wire connects to "-" and the green wire connects to the "R" terminal (marked as "S" on some older hardware).

Additionally, twist the bare shield drain wires from all of the network segments together and bond them to earth ground (ground screw if using LMSM-ENC enclosure). Note that this connection should be the only connection to earth ground for the shield over the entire length of the network.

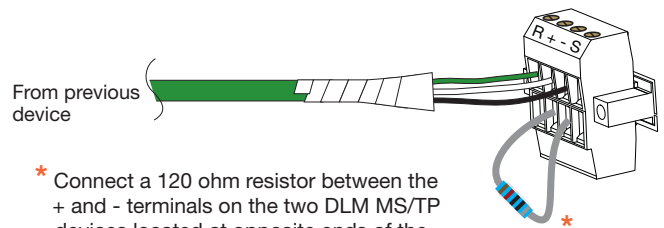


Bond the Shield conductor on the LM-MSTP segment network wires to Earth Ground, along with the ground wire from the Segment Manager.

Do not connect the Shield conductor to any other device in the Segment Network.

Terminating the Segment Network

Each end of each Segment Network wire must be properly terminated. This is accomplished by installing a 120 Ohm resistor between the "+" and "-" communication terminals along with the white and black LM-MSTP wire conductors. The resistors are provided with the Segment Manager.



* Connect a 120 ohm resistor between the + and - terminals on the two DLM MS/TP devices located at opposite ends of the network to terminate the Segment Network.

NOTE TO INSTALLERS: shorten the leads on the resistor as required so that there is no danger of them shorting together.

Segment Network Installation Check List

- ___ Use WattStopper #LM-MSTP wire
- ___ Run network wire as a daisy chain (linear topology)
- ___ Wrap and tape shield drain conductors (no wire nuts)
- ___ Mark the wire route and physical location of each Segment Network end point on plans
- ___ Mark the physical location of each Network Bridge connection on plans
- ___ Install termination resistors at the two ends of the network wire
- ___ Connect ground and shield conductors to earth ground at the Segment Manager only