Vive Retrofit Solution for Existing DALI Control Systems

English

This application note demonstrates a retrofit solution for centralized existing DALI control systems to a Vive system. The aim is to provide a simple solution without the need for an infrastructure overhaul.

Digital Addressable Lighting Interface (DALI) control systems allow for individual luminaire addressability and are sold on maximum flexibility. DALI protocols allow for communication between digital equipment on a pair of polarity insensitive low-voltage wires. Digital lighting controls allow for integration with other devices including, but not limited to touchscreens, VOIP phones, and mobile applications. It is important, when putting together a retrofit solution, to understand how the customer controls and accesses their lighting. It is also important to understand the level of granularity the customer needs for control of their lighting. DALI might allow for individual luminaire control using “short addresses” or zone control using “group addresses”.

To ensure and identify a customer’s needs, an interview should be held with users of the system. Such an interview can take the form of a site walkthrough to identify which system components need to be maintained, replaced, or abandoned. An on-site interview or walkthrough might also identify new needs that can be provided as additional benefits of upgrading. To simplify retrofit system layout design, Lutron recommends installing a “broadcast” device to control each zone or individual luminaire depending on granularity of the control required.

Questions to ask of end users include:

1. Is software control required? If so,
   a. is historical data required in the software?
   b. is a graphical floorplan required in the software?
   c. does the software need to show individual fixtures on a floorplan?
   d. are system alerts required?
2. Is integration required?

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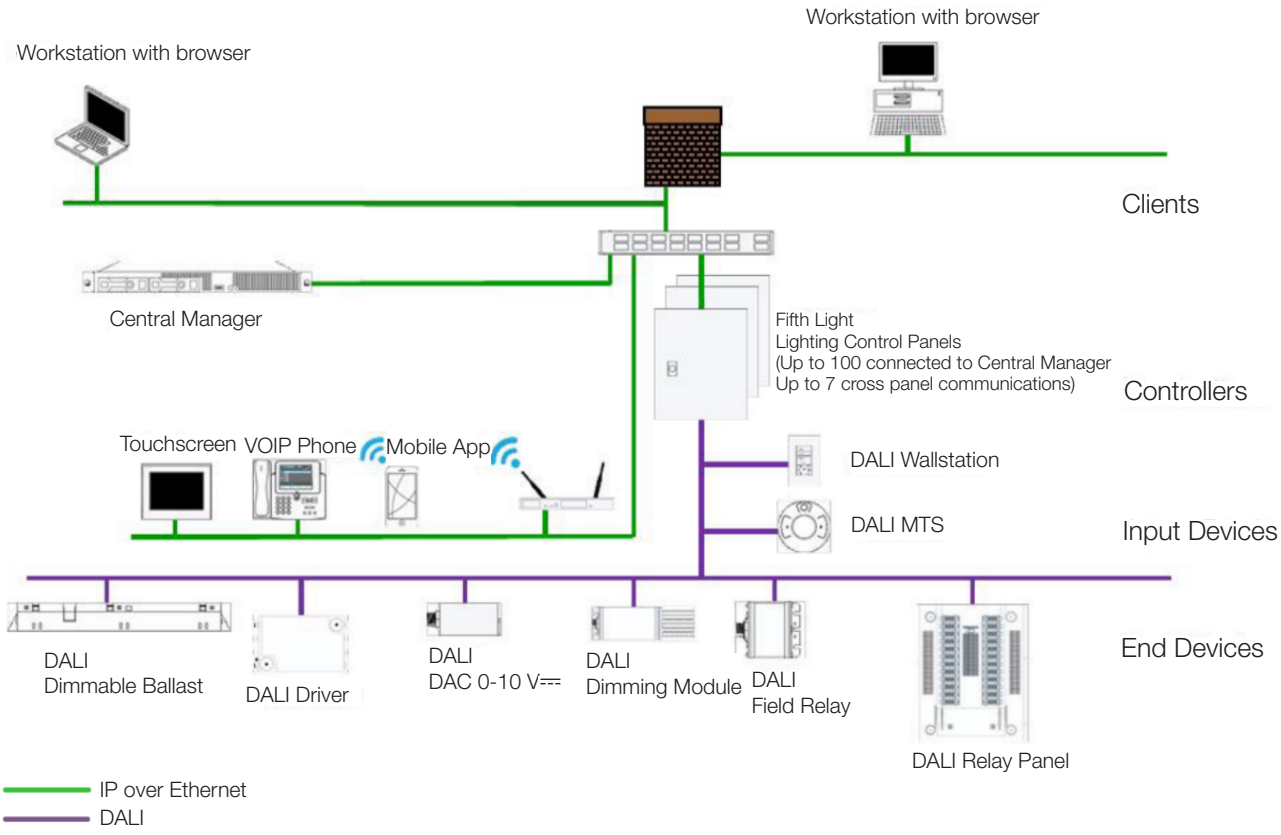
1.0 Existing DALI Control Systems

These control systems rely on a low-voltage wire pair for communication between components. These components communicate with each other through a DALI protocol. Components of these systems can typically be broken down into four different categories:

1. End Devices: Typically DALI ballasts/drivers and DALI converters, such as DALI field relays, DALI to 0-10 V⎓ converters, DALI to phase dim converters, and DALI relay panels.
2. Input Devices: Typically DALI sensors for occupancy and daylight harvesting, as well as DALI keypads to receive button presses from occupants.
3. Controllers: Managing all DALI communication to determine how End Devices should respond to Input Devices. Controllers also allow for user access software through a controller manager, often a personal computer or server.
4. Clients allowing users to access software.



2.0 Vive Retrofit Solution

Lutron's wireless Vive system offers building owners the opportunity to upgrade their older existing DALI control systems to be able to control their existing lighting with updated software and ongoing Lutron support. The control system upgrade involves replacing existing DALI controllers with distributed Vive DALI PowPak modules (one per control zone), existing DALI converters with appropriate Vive load controls, and existing Input Devices with Vive Input Devices.

2.1 Central Managers

Central managers or servers serve several purposes in traditional DALI systems. They host lighting management software, collect historical data, allow for individual fixture control, issue system alerts, and manage BACnet traffic for a Building Management System (BMS). It is important to understand which of these features an end user needs in order to most efficiently provide a replacement solution. There are three models of Vive hub (HJS-0, HJS-1, and HJS-2). All host basic dashboard software that allow users to:

- view current energy savings
- view current lighting levels
- view current occupancy status
- view and reprogram keypad buttons
- view and reprogram occupancy/vacancy levels
- view and reprogram schedules
- view, reprogram, and activate load shedding

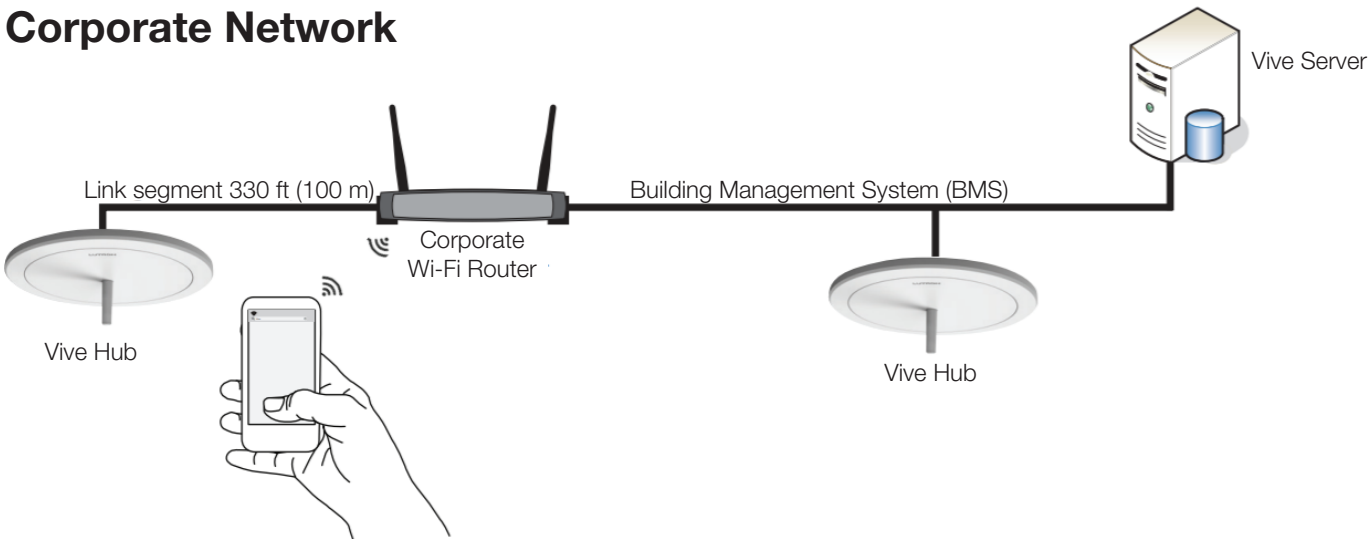
Vive Vue is the central management software for Vive that provides historical occupancy data, historical energy data, and a graphical floorplan. A Windows Server is required to host Vive Vue. If an end user needs their lighting control software to show individual fixtures on a floorplan, explain to them Quantum has this ability and much more.

The HJS-2 Vive hub hosts a BACnet server. This hub must be provided if BACnet is required. Any BMS communicating with the lighting control system over BACnet will need to be updated to reflect the BACnet objects available through Vive.

2.2 Workstations

Workstations were commonly deployed with traditional DALI systems to allow access to lighting management software at remote locations from the central server. These were configured as client computers and were deployed on the same Ethernet network as the central server. They often required a software client installation to be able to access the data served up by the central server.

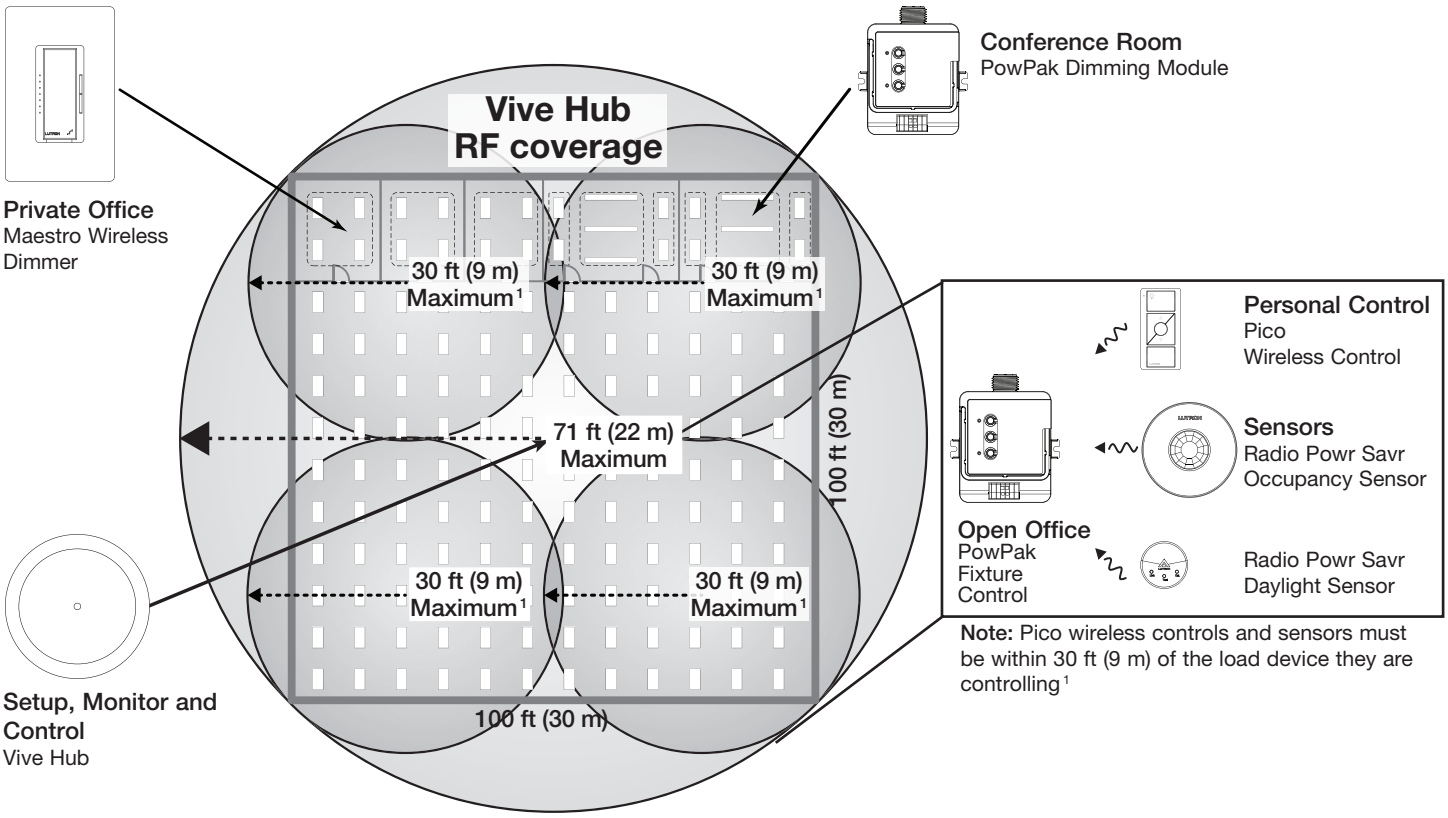
Both levels of Vive software, Vive dashboard and Vive Vue, are available on any device through a web browser. Both the Vive dashboard and Vive Vue are web-based, so they are accessible from any workstation with a web browser. Moreover, any smart device with a web browser becomes a defacto workstation when connected to Vive. No Internet connection is required for either Vive Vue or the Vive dashboard.



2.0 Vive Retrofit Solution *(continued)*

2.3 Lighting Control Panels

Lighting control panels in a centralized DALI system typically house a central controller and often one or more DALI buses. Each DALI bus can connect to up to 64 DALI devices. Hosting the central controller, the lighting control panel is responsible for managing communication across all DALI buses as well as the central server. While the distributed architecture of a Vive system eliminates the need to centrally locate all DALI buses, Vive hubs need to be physically networked to each other and to the optional Vive Vue server. The locations of existing lighting control panels typically have Ethernet drops for communication back to the central server. This makes them good locations for Vive hubs so long as the other Vive components are installed within 71 ft (22 m). If not, additional Vive hubs would need to be added, with their own Ethernet drops, connected back to the central server, in range of these components.



[1] Wireless sensors and controls must be located within 60 ft (18 m) line of sight, or 30 ft (9 m), through walls, of the associated device.

2.0 Vive Retrofit Solution *(continued)*

2.4 Touchscreens

Touchscreens are commonly used to adjust local and remote zones of lights as well as activating preset lighting scenes. This functionality can be replicated on physical Lutron Pico wallstations. Another option is giving occupants control from their smart phones via a web browser. The Vive system supports up to 10,000 unique login accounts. Each can be configured to control a different group of lights.

If the end user insists on needing touchscreen control of their lights, work with a touchscreen provider that has Vive system integration capabilities. Touchscreens can be integrated with the Vive system via the RESTful Web API hosted directly on the Vive hub. This requires a physical Ethernet connection between the Vive hubs and touchscreens, but allows for full lighting control from a third-party touchscreen as defined the Vive hub Integration API specification (http://www.lutron.com/TechnicalDocumentLibrary/3691147.pdf).

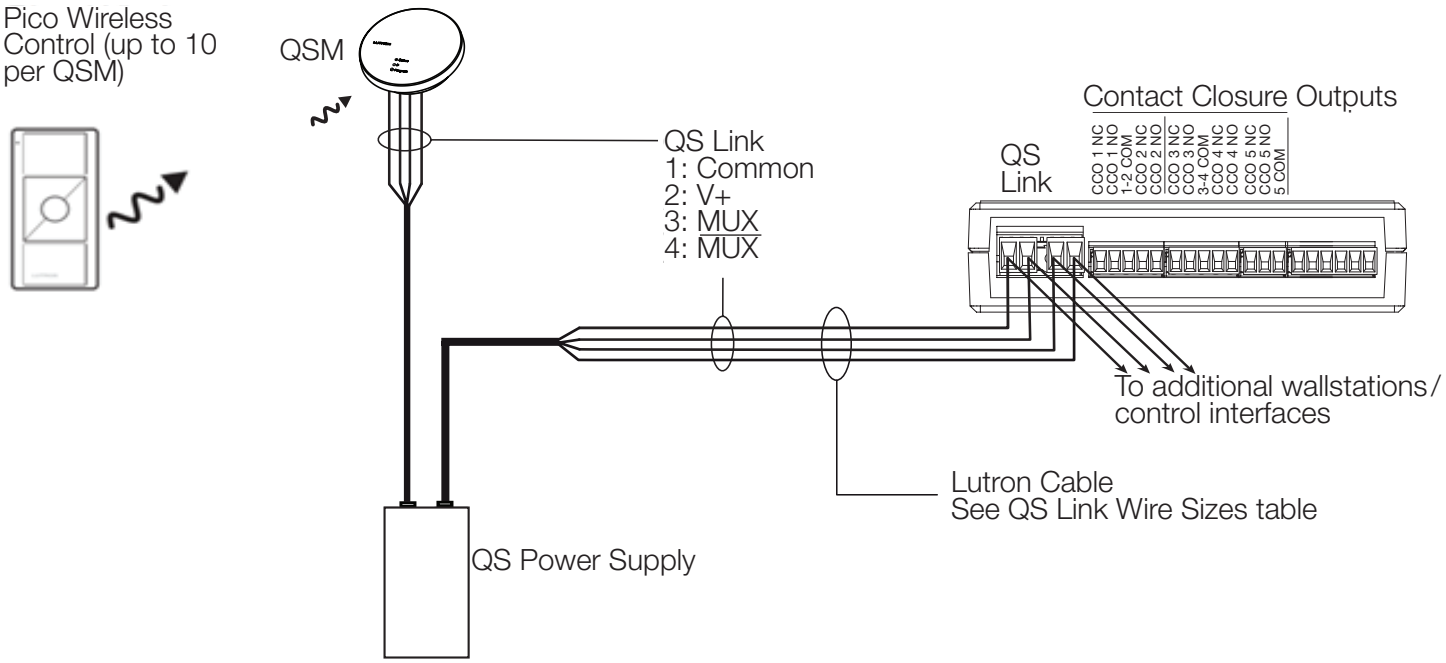
2.5 VOIP Phones

Voice Over Internet Protocol (VOIP) phones were a popular point of control for lighting systems in conference rooms, offices, and common areas. These were typically integrated with the lighting system through the central server connected on the same Ethernet network. With the rising popularity of smart phones, multi-platform collaboration software, and hidden in-room conference calling hardware, VOIP phones are less prevalent. As such, they are not as popular a lighting control point as they once were. If an end user still wants this control, steer them towards giving occupants control from their smart phones as explained above.

2.6 Third-Party Shades

Some DALI control systems include shade interfaces to control third-party shades (e.g., Mecho and Somfy) from DALI or other low-voltage wallstations. Lutron does manufacture a full line of low-voltage shade drives. If the customer is investing in upgrading their lighting control system, suggest they could upgrade their shading system to Lutron shade drives as well. Application Note #740 (P/N 048740) explains how to control QS shades with Vive (http://www.lutron.com/TechnicalDocumentLibrary/048740.pdf).

If a customer is not interested in upgrading their shading system, explain to them that third-party shades can be controlled by contact closures. This is achieved by wiring the third-party shades to a QSE-IO and connecting that to a QS power supply and QSM sensor module. The QSM sensor module can listen to up to 10 Pico wallstations, including those programmed through the Vive system, to control lighting.



2.0 Vive Retrofit Solution *(continued)*

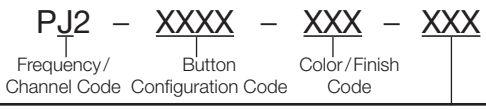
2.7 Mobile Apps

Mobile apps are a popular point of control for any lighting control systems. They offer users control from their own device from anywhere within WiFi range of the network hosting the lighting control system. Those that are supported on multiple platforms (e.g., iOS and Android) offer broader accessibility. Those that support multiple permission levels and segregate access to different lights for different accounts allow for different types of users (e.g., facilities managers, operations teams, occupants, etc.). Fortunately Vive Vue offers all of these features and requires only a web browser instead of a dedicated mobile installation. While Vive Vue requires a Windows Server, the Vive dashboard is a mobile programming tool for anyone the customers wants to have full access. The Vive dashboard is hosted directly on each Vive hub without requiring a Windows Server.

2.8 Wallstations

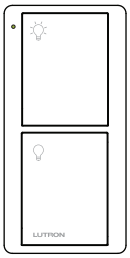
Wallstations come in many different configurations from single button to as many as ten or more. Typically, they are programmed as either zone toggle or scene select. Zone toggle allows for a user to turn on a zone of lights with the first press, then turn them off with the second. Scene select allows a user to activate preset lighting levels across many zones. The middle button on a 3 Button (3B) and 3 Button with Raise/Lower (3BRL) and the top three buttons on a 4 Button (4B) are all programmable.

Pico Wireless Control Model Number

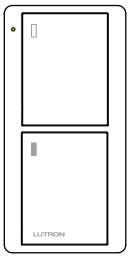


Button Marking Codes

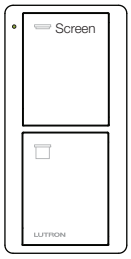
2 Button



L01: Lights (icons only)

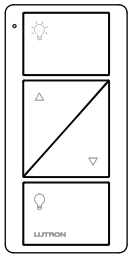


L02: Appliances (icons only)

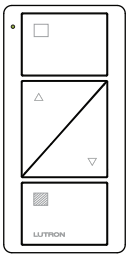


*__S08__: Screens (icons + text)

2 Button with Raise/Lower

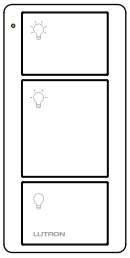


L01: Lights (icons only)

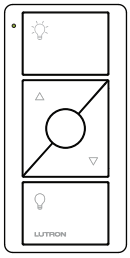


*__S01__: Shades (icons only)

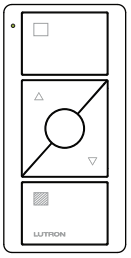
3 Button



L01: Lights (icons only)

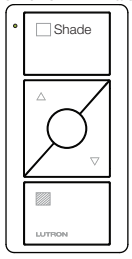


L01: Lights (icons only)

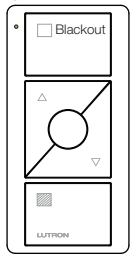


*__S01__: Shades (icons only)

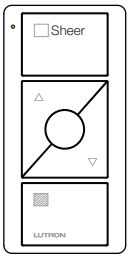
3 Button with Raise/Lower



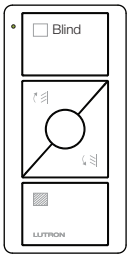
*__S02__: Shades (icons + text)



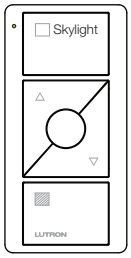
*__S03__: Blackouts (icons + text)



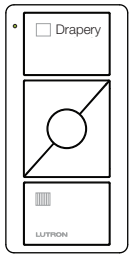
*__S04__: Sheers (icons + text)



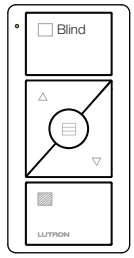
*__S05__: Blinds (icons + text)



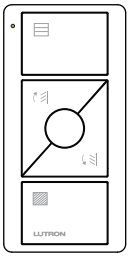
*__S06__: Skylights (icons + text)



*__S07__: Draperies (icons + text)



*__S09__: Horizontal Sheer Blinds (icons + text)



*__S10__: Tilt Blinds (icons only)

* Shade, drapery, blackout, sheer, skylight, horizontal, tilt blind, and screen Pico wireless controls are intended to control motorized window coverings not lighting fixtures. See Application Note #740 **Controlling Lutron QS Shading Solutions in Vive Wireless System** at www.lutron.com for details.

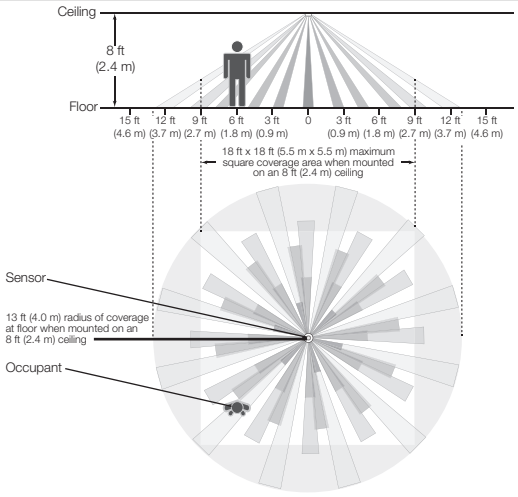
2.0 Vive Retrofit Solution *(continued)*

2.9 DALI Sensors

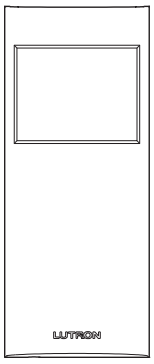
Sensors, both for occupancy detection and ambient light measurement, are typically wired into traditional DALI systems on the same DALI link as the DALI ballasts and drivers. Lutron takes a different approach by providing wireless sensors. Wireless sensors are more flexible because they install 70% faster and can be repositioned after installation for greater flexibility of coverage. Choose the sensor based on the coverage pattern that best meets the needs of the particular space being retrofitted. Occupancy and vacancy only sensors available are:

Ceiling Mount

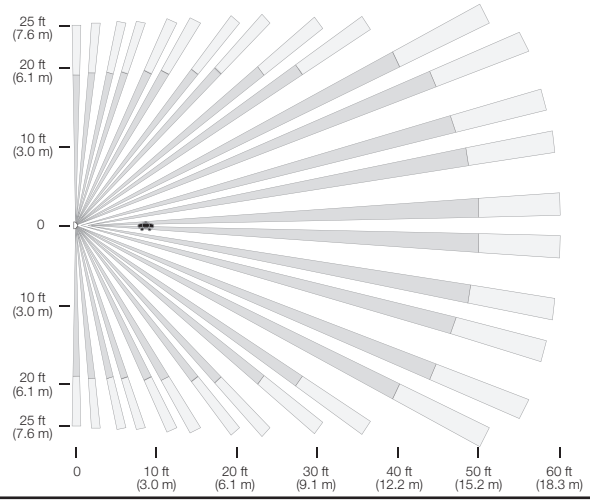
Occupancy: LRF2-OCR2B-P-WH
Vacancy: LRF2-VCR2B-P-WH



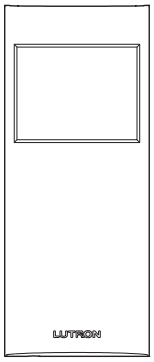
Wall Mount



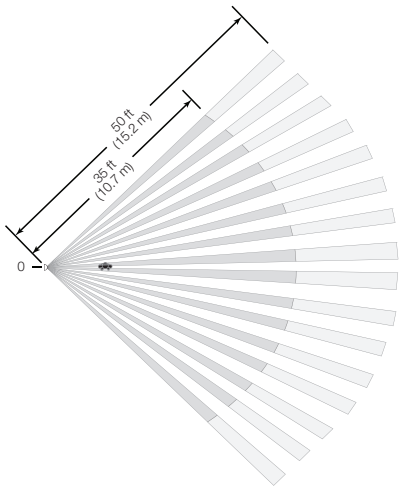
Occupancy: LRF2-OWLB-P-WH
Vacancy: LRF2-VWLB-P-WH



Corner Mount



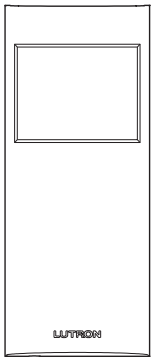
Occupancy: LRF2-OKLB-P-WH
Vacancy: LRF2-VKLB-P-WH



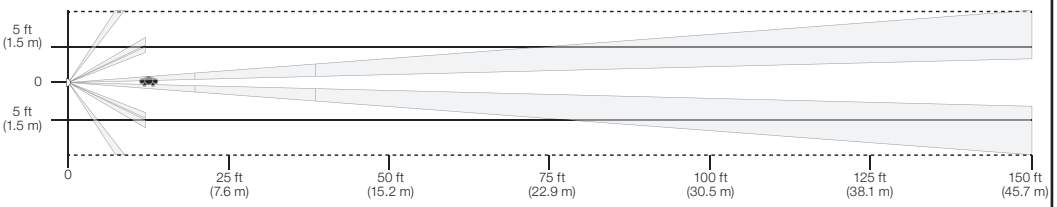
2.0 Vive Retrofit Solution *(continued)*

2.9 DALI Sensors *(continued)*

Hallway Mount

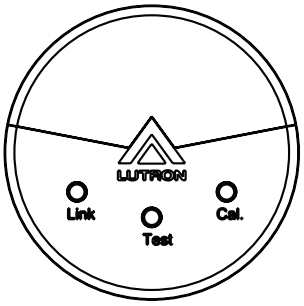


Occupancy: LRF2-OHLB-P-WH
Vacancy: LRF2-VHLB-P-WH

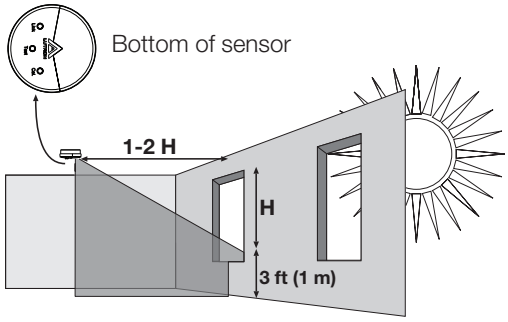


Lutron wireless photo sensors should be mounted between one and two window heights away from windows.

Ceiling Mount



LRF2-DCRB-WH



H = Effective Window Height

2.10 DALI Dimming Ballasts and Drivers

Existing DALI ballasts and drivers can be left in place. Existing DALI wiring should be disconnected or interrupted. Existing DALI wiring cannot be shorted (tied together) as part of this interrupt. A Lutron Vive DALI PowPak (RMJS-ECO32-SZ) needs to be connected. Each PowPak will control any DALI ballasts/drivers connected to it as a single zone. To separate control into multiple zones, simply add a PowPak for each zone. Each PowPak can control up to 32 ballasts/drivers.

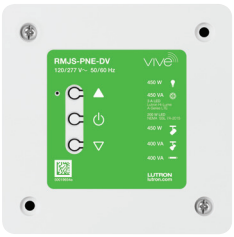
2.11 DALI 0-10 V⎓

Some DALI systems include 0-10 V⎓ interfaces controlled on the DALI link. They accept DALI commands from the system just like DALI ballasts and drivers do, but these interfaces control 0-10 V⎓ ballasts and drivers. Such 0-10 V⎓ interfaces can be controlled as a single zone by a RMJS-ECO32-SZ PowPak or the interface can be replaced with a Lutron Vive 0-10 V⎓ PowPak (RMJS-8TN-DV-B or RMJS-5T-347).

2.0 Vive Retrofit Solution *(continued)*

2.12 DALI Dimming Module

Phase dimming modules are also common in traditional DALI systems. These are similar to 0-10 V⎓ interfaces in that they accept DALI commands from the system just like DALI ballasts and drivers do, but these modules control phase dimmed loads. Such phase dimming modules can be controlled from an RMJS-ECO32-SZ PowPak or the dimming module can be replaced with a Lutron Vive PowPak Phase Select Dimming Module (model number below).

 RMJS-PNE-DV RMJS-PNE-DV-EM	450 VA reverse-phase LED 3 A (13 drivers max) Lutron LTEA Hi-lume 1% 2-wire LED driver 200 W 120 V LED NEMA SSL 7A-2015 450 W Incandescent/halogen or ELV 400 VA 2-wire fluorescent, MLV or neon/cold cathode

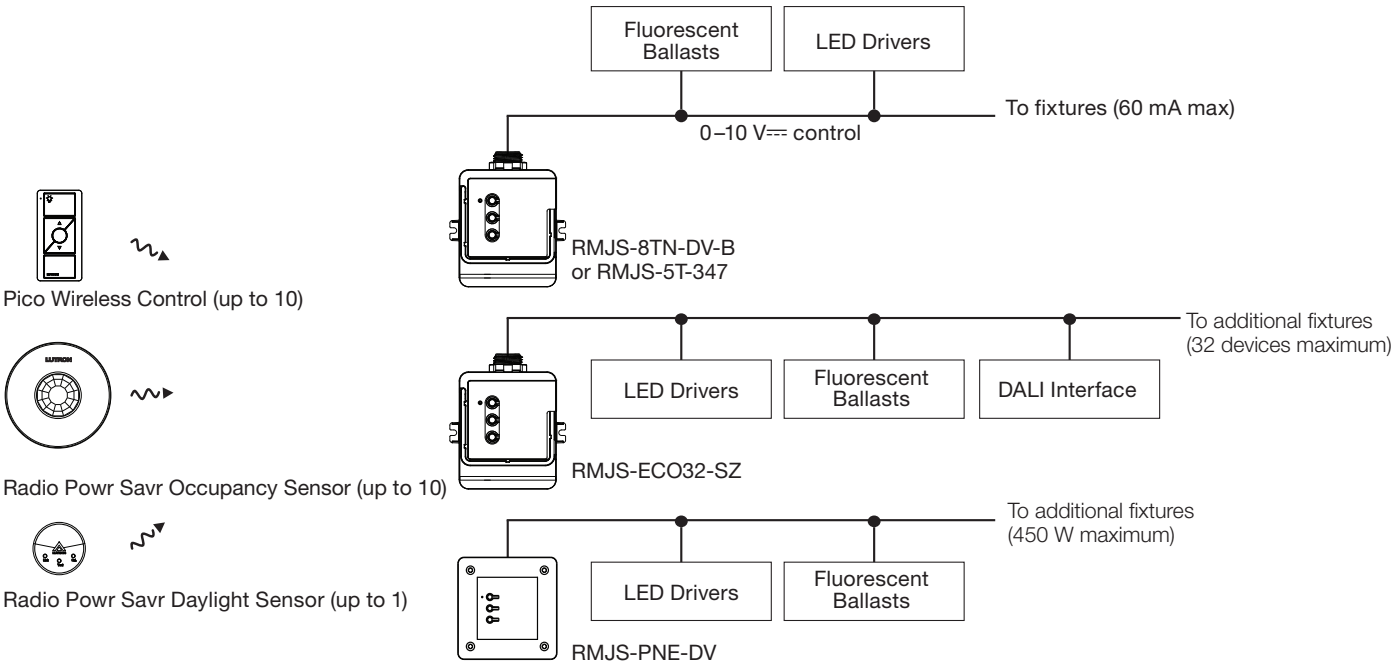
2.13 DALI Field Relay

Field relays are also common in traditional DALI systems. These are similar to phase dimming modules and 0-10 V⎓ interfaces in that they accept DALI commands from the system just like DALI ballasts and drivers do, but these modules provide a relay for switched loads. Such field relays can be controlled from an RMJS-ECO32-SZ PowPak or can be replaced with a Lutron Vive switching PowPak (RMJS-16R-DV-B or RMJS-5R-347).

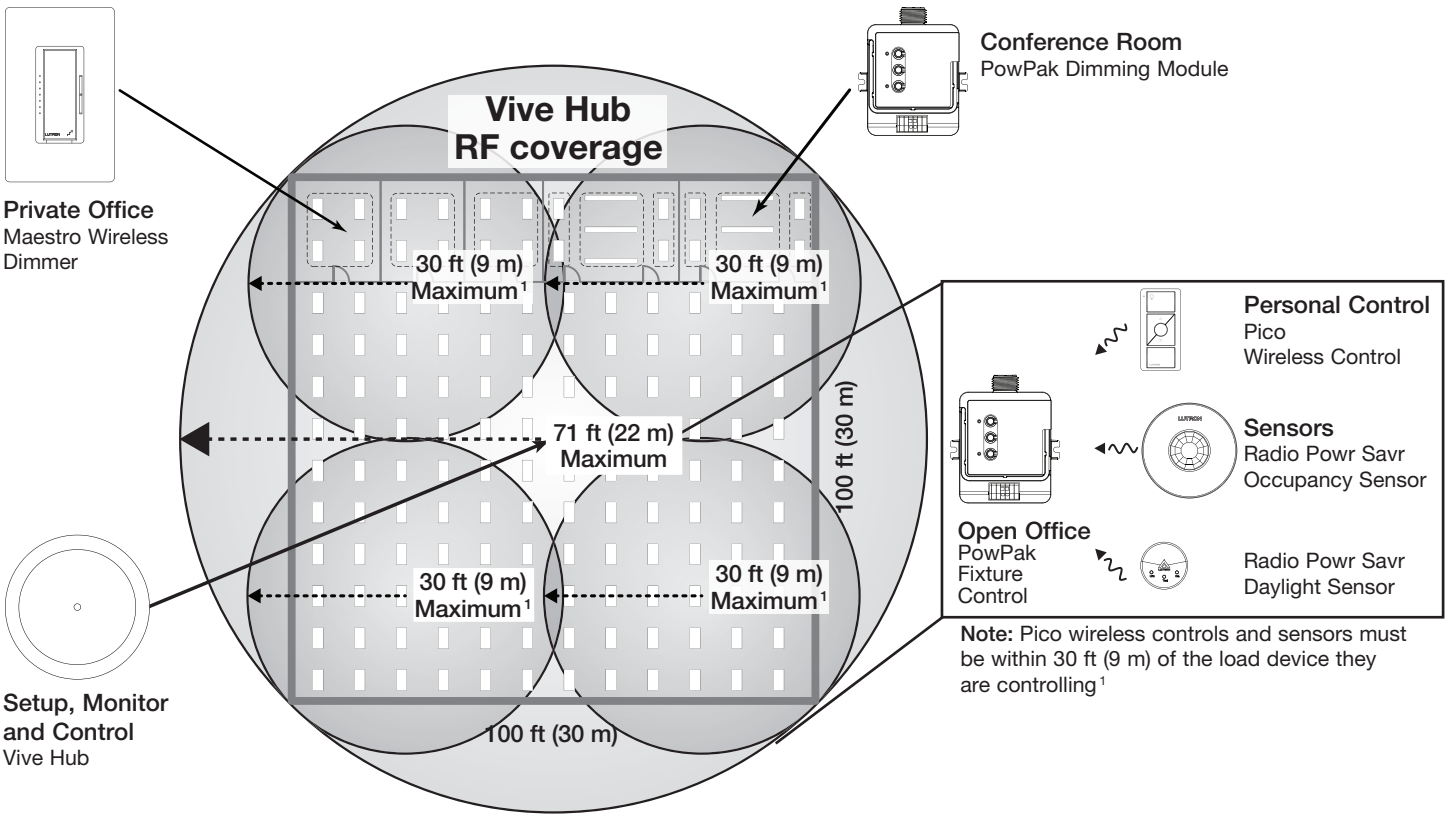
2.14 DALI Relay Panel

Some traditional DALI systems include DALI relay panels installed in central electrical rooms. Such relay panels can be controlled from an RMJS-ECO32-SZ PowPak or can be replaced with a Lutron Vive switching PowPak (RMJS-16R-DV-B or RMJS-5R-347) installed locally to their loads. These Lutron Vive load controllers need to be installed close to their controlling sensors to ensure proper wireless communication.

3.0 System Diagrams



If software control is required, all installed Vive components must be within 71 ft (22 m) of a Vive hub



[1] Wireless sensors and controls must be located within 60 ft (18 m) line of sight, or 30 ft (9 m), through walls, of the associated device.

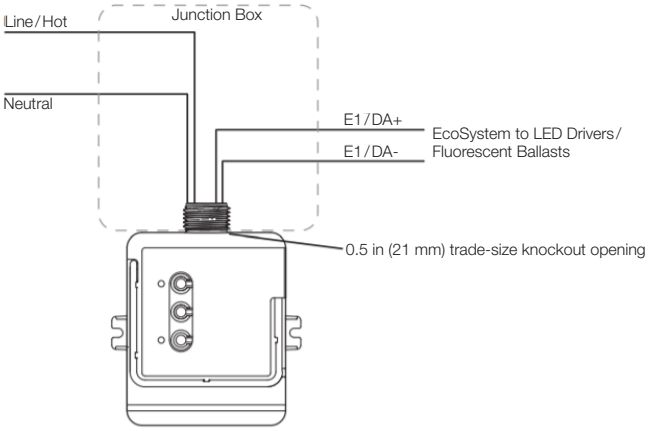
4.0 Existing DALI Control System Cross Reference Table

Existing Part	Vive Part Number
Central Manager/Server	HJS-0/1/2 (QS-A-CMP-SBO-0 if historical data required)
DALI Wallstation (1-button)	PJ2-2B-L01
DALI Wallstation (2-button)	PJ2-2B-L01
DALI Wallstation (3-button)	PJ2-3B-L01
DALI Wallstation (4-button)	2x PJ2-2B-L01
DALI Wallstation (5-button)	1x PJ2-2B-L01 and 1x PJ2-3B-L01
DALI Wallstation (6-button)	2x PJ2-3B-L01
DALI Wallstation (1-button with r/l)	PJ2-2BRL-L01
DALI Wallstation (2-button with r/l)	PJ2-2BRL-L01
DALI Wallstation (4-button with r/l)	2x PJ2-2BRL-L01
DALI Occupancy Sensor	LRF2-OCR2B-P-WH (ceiling mount)
DALI Occupancy Sensor	LRF2-OWR2B-P-WH (wall mount)
DALI Occupancy Sensor	LRF2-OKR2B-P-WH (corner mount)
DALI Daylight Sensor	LRF2-DCRB-WH
DALI Multi Sensor	LRF2-DCRB-WH and LRF2-OCR2B-P-WH (ceiling mount)
DALI Multi Sensor	LRF2-DCRB-WH and LRF2-OWR2B-P-WH (wall mount)
DALI Multi Sensor	LRF2-DCRB-WH and LRF2-OKR2B-P-WH (corner mount)
DALI to Phase Dim Interfaces	RMJS-PNE-DV
DALI Relays	RMJS-16R-DV-B/RMJS-5R-347
DALI to 0-10 V⎓ Interfaces	RMJS-8TN-DV-B/RMJS-5T-347
DALI Controllers	RMJS-ECO32-SZ

5.0 Wiring

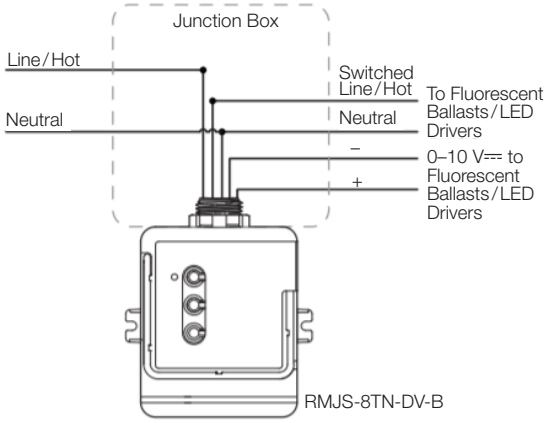
5.1 Wiring RMJS-ECO32-SZ

Wiring Schematic

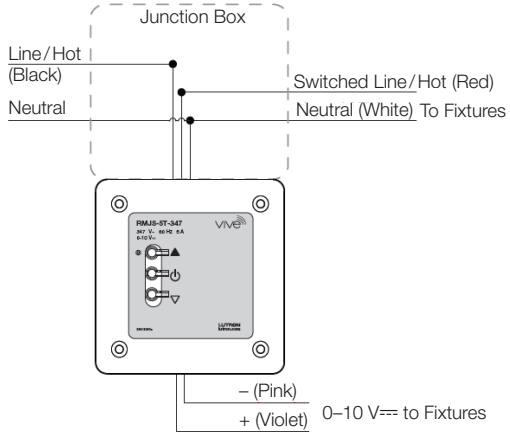


5.0 Wiring *(continued)*

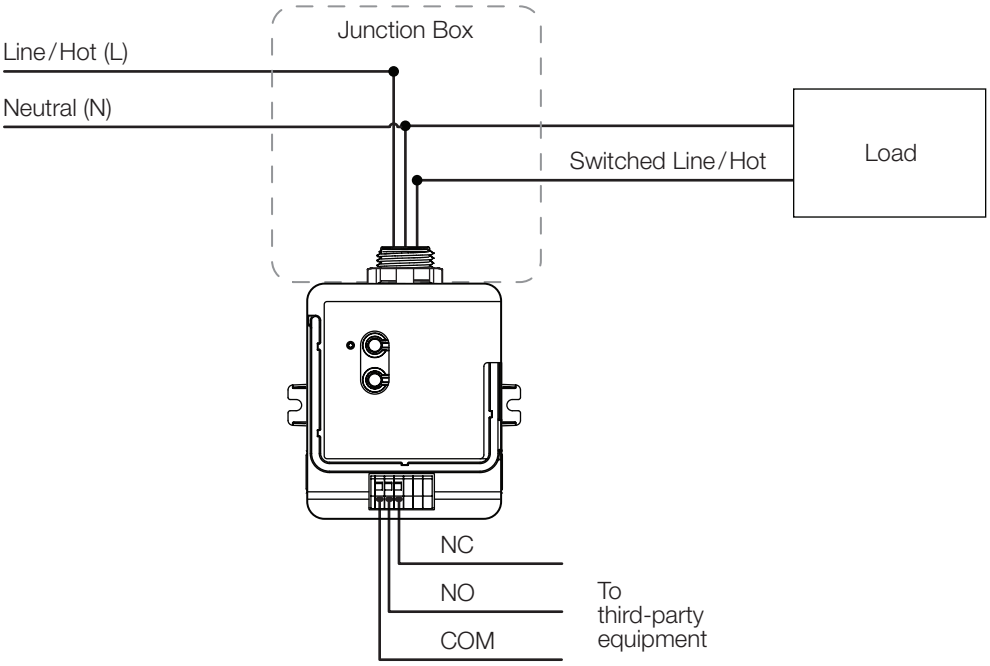
5.2 Wiring RMJS-8TN-DV-B



5.3 Wiring RMJS-5T-347

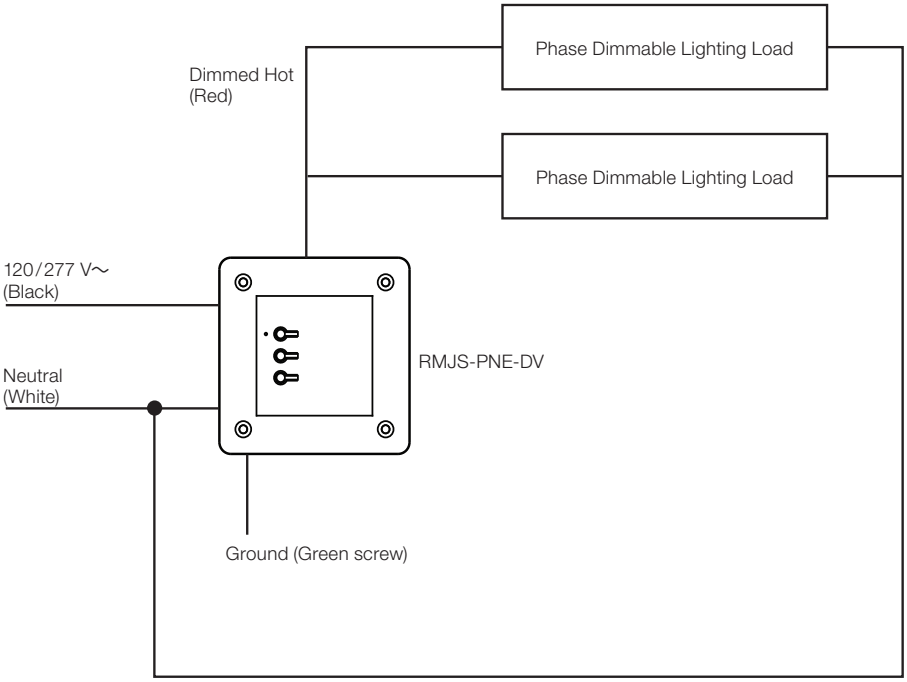


5.4 Wiring RMJS-16R-DV-B and RMJS-16RCCO1DV-B



5.0 Wiring *(continued)*

5.5 Wiring RMJS-PNE-DV



Note: Multiple drivers / ballasts connected to a PowPak control module will always work together as a single zone.

Note: The perceived light output of low-end trim may vary between fixture manufacturers and model numbers. For best results, do not mix different drivers or ballasts on the same DALI zone.

References

Typical DALI lighting control system (1)
http://www.cooperindustries.com/content/dam/public/lighting/products/documents/lighting_controls/instruction_sheets/MN503005EN-FLT-System-Planning-and-Installation-Guide.pdf

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