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Section 1: Getting Started

What is Halio?
Halio smart-tinting glass is the world’s most advanced natural light management system. Ideal for exterior and interior walls, partitions, and doors, Halio is designed to respond to user commands or environmental changes with unparalleled speed and uniformity.

Halio comes as an **insulated glass unit (IGU)** or as a **laminated glass unit (LGU)** and can be ordered in sizes ranging from 2’ x 2’ (0.6m x 0.6m) to 5’ x 10’ (1.5m x 3m). Each unit can be tinted via a keypad, web portal, or an app and can also adjust tint by receiving local sky conditions using a roof sensor.

Halio IGUs provide comfort from heat and glare, deliver privacy or openness, and are the ideal solution for commercial and residential buildings seeking to create a healthy, modern, and thriving environment for their occupants.

What is the Purpose of this Manual?
This guide is designed to facilitate the installation of Halio glass units and other ecosystem components and is a resource for generating project bids. It includes what to expect when receiving Halio glass panels and how to safely install panels and components.

Each part of the installation process is addressed in the glazing and high- and low-voltage electrical sections.

Who is this Manual for?
The Halio installation process is very straightforward and can be completed without complications following these instructions.

This guide is designed for the electricians and glaziers installing the Halio system components. With this document, professional contractors have everything they need to equip a commercial building or residential home with Halio smart-tinting glass windows, from start to finish.

You will find three symbols throughout this manual; their meanings are as follows:

- **A HELPFUL TIP**
- **PROCEED WITH CAUTION, NOT RECOMMENDED**
- **PROHIBITED**
Section 2: Halio Ecosystem Core Component Overview

This section provides an overview of a complete Halio system, including smart-tinting glass panels, Drivers, System Gateway, Energy Manager, interfaces, software, and sensors. A schematic of a complete system is shown in Figure 1 below.

The following subsections list and describe each component of the Halio ecosystem. Keep in mind that some components are optional and may not be used in every installation.

Halio Glass

In a standard configuration, Halio is incorporated into a double-pane insulated glass unit (IGU). The Halio device is laminated between two panes of glass, followed by a spacer, and another glass pane. This configuration is mostly used for exterior applications on facades.

For interior applications or applications where thermal insulation is not a requirement, Halio is incorporated into a laminated glass unit (LGU), where the Halio device is laminated between two panes of glass.
Exterior/Interior Facades

HALIO IGU/LGU
Each Halio unit includes a waterproof cable, the pigtail, that runs from the IGU and connects to the Halio Driver Cable. Halio units are compatible with the most popular building automation systems, as well as digital assistants and other cloud-connected devices.

HALIO BLACK IGU/LGU
Each Halio Black unit includes two pigtails that run from the IGU and each connect to a Halio Driver Cable. Halio Black has the same configuration and form factor options of standard Halio smart-tinting glass units. Key differences include its higher visible light blocking range (up to 99.9%) and improved sound reduction (38 dB.)

Halio and Halio Black can work with most framing systems, if there is enough space in the glazing pocket and framing channels for the system wiring. When installed, Halio will block up to 98% of visible light, provides a standard sound reduction range of 36 dB (-1; -3), and can be configured with single-, double-, or triple-paned glass.

An example of the glass orientation with Halio device on surface 2 and a low-E coating on surface 3 of an IGU can be seen in Figures 2 and 3. Refer to project-specific shop drawings for glass orientation.

FIG. 2. HALIO IGU CROSS-SECTION
Electronics

Each Halio IGU or LGU is controlled by a Driver that can be located up to 300 feet (91 meters) away. Halio Cabinets are available in four sizes and can hold anywhere up to 35 Drivers. The Driver Cabinet can be located up to 250 feet (106 meters) from the Power Supply Cabinet, depending on the section of the cables (12 AWG or 14 AWG.)

TINT DRIVER

The Tint Driver powers and controls the IGU or LGU, ensuring that desired tint levels are achieved quickly, efficiently, and reliably. Halio IGU/LGU requires one Driver, while Halio Black IGU/LGU requires two Drivers. Drivers get their instructions on what level to tint the windows over a secure, wireless mesh network.

GATEWAY

Each system typically has one Gateway per every 80 Drivers or, at a minimum, one per floor. There is one Gateway per mesh and it carries messages between the Drivers and the cloud. The system can be configured via an iOS app or portal by communicating through the Halio cloud service to the Gateway. The system can be configured via an iOS app or portal. In some scenarios additional Gateways may need to be added to provide additional wireless coverage. Note: The Gateway is mounted at the bottom of the Cabinet, just above the Energy Manager.
POWER DISTRIBUTION

48 Volt Power Supply
The Power Supply provides DC power to the Energy Manager, Wireless Range Extenders, Gateway, Tint Drivers (100-240 VAC input), and automatic daylight management system and is coupled with an AC Disconnect Switch.

Energy Manager
The Energy Manager is the power conditioner and battery backup system for the Gateway and Tint Drivers. It ensures consistent voltage over varying loads.
Interfaces
Occupants can interact and control Halio windows through a number of different interfaces. From an installation perspective, only the hardware (outside of the Tint Driver) is included in this section.

WALL-MOUNTED TINT SELECTOR
Halio’s wall-mounted Tint Selector is an easy-to-use, wireless communication device enabling local control of one or more windows. Working similarly to a dimmer light switch, the Tint Selector can be programmed to tint a single Halio window or a group of windows to one of nine different tint levels. The Tint Selector is battery-powered and typically needs to be within 50 feet of a Wireless Range Extender, Gateway, or Driver. If there are multiple walls between the Tint Selector and other Halio devices, the range may be further reduced.

Other Components

WIRELESS RANGE EXTENDER
The Wireless Range Extender makes it easy to expand coverage of the Halio wireless mesh network and ensure reliable communication between devices. It is easily mounted to ceilings or wherever additional coverage is needed and, once installed, it intelligently listens to messages from up to 80 Halio devices and repeats and routes them to their destination. The wireless range extender supports flexible range of low-voltage DC input power.

ROOF PYRANOMETER
The Halio Rooftop Sensor enables the industry’s most advanced tinting automation. It mounts on the rooftop and continuously measures precise solar irradiance levels. The sensor and sensor hub mount on standard rooftop mast system and the sensor kit includes SPN1 Sensor, sensor hub, mounting hardware, and cables.
Section 3: Sample Installation Workflow

This workflow is explained from the perspective of the project manager who will oversee and guide contractors through each phase of a Halio system installation. Each phase will be expanded and explained in detail in later sections.

System Design

- Obtain detailed drawings of the property, including window schedule
- Understand the design goals of the project and how Halio reaches those goals
- Finalize system design and goals

Glazier

- Work with glazier to determine window frame and impact on the installation
- Glazier modifies the frame to allow for pre-wiring
- Glazier installs frame and window and routes the pigtail in the framing to a predetermined location

High-Voltage Electrical

- Review system design with the electrical contractor
- Mount Power Supply Cabinets, install AC Disconnect Switch, and connect electrical service

Low-Voltage Electrical

- Route, terminate, and connect all cables to windows and Tint Drivers
- Electrician connects Tint Driver cables to window pigtails, documents cable/window ID, or uses Halio installation app to scan windows and scan/verify cables
- Mount Driver Cabinets and install Halio equipment
- Run low-voltage cable to Wireless Range Extender location(s)
- Connect power cable from Driver Cabinet to Power Supply Cabinet
- Connect power from Energy Manager as instructed from terminal blocks to Tint Drivers

Provision the Driver Cabinet, Energy Manager, and Range Extender

- Commission the Gateway using the Halio installation application
- Install Tint Selectors and commission using Halio installation application
- Test system functionality

Final Optimization

- Configure system
- Configure glare control settings
- Connect to home automation or building automation system, if applicable, then test
Section 4: Glazier Installation Overview

This section covers everything glazing contractors need to know to safely and securely install Halio IGUs or LGUs. It includes the specifics of components, recommended methods, and step-by-step instructions for the installation.

Components

This section provides details for the hardware and software components involved in the Halio glass installation.

Cables

There is only one cable connection that glaziers need for installation, the one connecting the Driver to the window. Cabling is provided by Halio, and consists of:

- Eight (8) conductors
- Four (4) wires that are 16 AWG stranded cable for power
- Two (2) twisted pairs (four wires) for data transfer
- Plenum-rated, if installing in a plenum space

All wires terminate into an 8-pin Phoenix connector at the head end (field installed.) A Molex-type M12 connector (factory installed) is used to connect the cable to the window frame (see the next section for images and details.)

Wiring & Connections

The cable coming from the Driver terminates with a female barrel connector, like the one seen below in Figures 4 and 5, and includes a dust cap to protect the M12 connector against moisture.
The cable from the window terminates in a male barrel connector matching the female Driver connector (Figures 6 and 7.)

Where both ends come together (Figure 8), there are four (4) inches of non-flexible cable.

The size and rigidity of the barrel connectors should be accounted for when considering wire routing and framing type. The cable has a barrel diameter of 0.559” (14.2mm.)

On the other end, the Driver cable is field terminated using a Phoenix connector (Figure 9.)
Frames & Cable Routing
Numerous framing and cable routing factors must be considered before installing Halio windows. This section lists everything a glazier needs to verify and consider when preparing for installation.

Glazing/Framing Considerations
- Obtain a sample of the framing system. Get detailed drawings of the framing system and installation details. Determine if changes to the framing system need to be made to accommodate Halio wiring.
- For pre-wiring, verify whether the frame will have static non-tinting glass installed prior to installation. You must ensure the pocket is deep enough to install the window with the cable.

Cable Routing Considerations
If drilling guide holes or notching aluminum framing, care should always be taken to effectively deburr, or a rubber grommet should be applied, to protect Halio wiring from snags and cuts.

EXTERIOR CURTAIN WALL FRAMING EXAMPLE
1. The hole is drilled into the vertical parallel surface of the frame
2. Rubber grommet inserted into the hole
3. The terminated cable fed through the grommet and out the end of the dry channel

FIG. 10. EXTERIOR CURTAIN FRAMING EXAMPLE
Cable Installation Overview

MINIMUM BEND RADIUS - PLENUM-RATED CABLE

Plenum-rated cables have a minimum bend radius of 1.5” (3.8cm) that ensures and protects connectivity. See Figure 11 below.

![Diagram of minimum bend radius for plenum-rated cable]

FIG. 11. MINIMUM BEND RADIUS DIAGRAM FOR A PLENUM-RATED CABLE; DO NOT EXCEED A MINIMUM BEND RADIUS OF 1.5” (3.8CM) WHEREVER THE PLENUM RATED CABLE IS MAKING A 90° TURN

Documenting the Cable ID & Connecting Windows in Frames

DOCUMENT CABLE & WINDOW IDs

The Halio system uses Quick Response (QR) codes to identify components specific to an IGU or LGU. Each IGU/LGU, cable, Driver, Gateway, and Cabinet contains a unique QR code. These QR codes must be scanned and recorded during the installation process, so it’s important to know their exact location when prepping for an install.

![QR codes on Halio tint drivers]

FIG. 12. QR CODE ON HALIO TINT DRIVERS

After scanning the cable and window stickers, they should be removed from the cable and window and placed on the frame markup.
CONNECT CABLES FROM WINDOW TO DRIVER

While the window is being installed, the cables will need to be connected and tucked back into the frame (as shown in Figure 13.)

![Figure 13. Cables being installed and tucked into frame](image)

WINDOWS WITHIN OPERATING DOOR FRAMES

A power loop must be purchased to properly install the cable to a Halio window that is being installed in a door or double-hinged frame. Considerations should be made for Halio Black, as it requires two cables.

![Figure 14. Model shown is CEPT NW from ASSA ABLOY](image)

Halio Glazier Installation Process

The following is a step-by-step guide through the glazier phase of a typical Halio window installation. A Halio representative will be on-site during this process to handle any questions or challenges outside the scope of this guide.
Step 1

After the architect has determined the frame and design, the glazier will work with the Halio Project Manager (PM) using frame samples to look for any cable routing issues.

The Halio team will work with the appropriate representatives dictated by the glazier, to find solutions for cable routing in various framing systems.
Step 2

Prepare the frame as you normally would. Follow adjusted shop drawings to make cable routing holes/cutouts. This can be done in the field with proper tools, but the best results are done in the shop while the frame is disassembled.
Step 3
As the frame is being assembled on-site, the low-voltage contractor may be present working side by side with the glazier to run cables through the prepared cutouts in the frame.

![Fig. 19. Low-voltage contractors working with glaziers](image)

If cables are pre-ran before the window installation, the glazier may connect the wires.

Step 4
Windows will be installed according to glazier mark numbers. Halio will provide glass tags for each window in an elevation.

![Fig. 20. Example of a Halio panel layout](image)

The Halio representative will be available to answer any installation questions. The low voltage contractor may be on hand to assist plugging the cables in as the windows are being installed.
Step 5
As windows are plugged in and installed, the low voltage contractor will work to finish connections to each window and test the windows for functionality. All windows will need to be tested prior to any beauty caps, vinyl, or sealant is installed.

![FIG. 21. FINAL STEPS OF HALIO WINDOW INSTALLATION FOR GLAZIERS](image)

Once all the windows are tested, the beauty caps, sealant, and any vinyl can be installed.

It is important to note that although these windows are heat strengthened and very strong, using hammers and shims can affect the electronics within the windows. So, take caution when these items are needed for wrapping up the installation after testing. If an opening has been made on the “wet side” of the frame, be sure to seal the opening and make weather-proof.
Section 5: Glazier Best Practices

Window Storage Before Commissioning

We recommend that the panels be stored in a tinted state if the panels will be sitting for a long period of time before commissioning; but if long-term storage is necessary, make sure there is no obstruction, nearby structure, overhang, decal/sticker, or anything that will cause a permanent shadow on the window. White opaque plastic film is the best protection around the glazing.

Every new panel should arrive with a 60% tint. Partially tinted panels are much less susceptible to photosensitivity issues than panels that are completely clear.

Connector Pins

Before connecting the Driver and window cables, verify that all the pins are present and straight and align the arrows on the male and female connectors. If the connection feels loose or unstable, unscrew the connectors and check the pins again in case they bent when fastening. If the connection did not feel like it sealed or if it does not feel screwed down tightly, check to see that the pins are not bent.

FIG. 22. ALWAYS CHECK THAT THE CABLE ARROWS OR LINES ARE ALIGNED BEFORE JOINING THE CABLE ENDS TOGETHER. THIS HELPS ENSURE THE PINS ARE STRAIGHT AND THE CONNECTION WILL BE TIGHT
Section 6: High-Voltage Installation

This section covers everything qualified electricians need to know to safely and securely complete the high-voltage (>50V) phase of Halio system installations. It includes detailed breakdowns of components, recommended methods, and step-by-step instructions for the installation.

Components
Since the high-voltage phase of a Halio installation is relatively brief compared to other phases, the component list is short. Below is each item with a description.

48 Volt Power Supply
The Power Supply has a 100-240VAC input and a 600W 10.5A output and provides DC power to the Energy Manager, Gateway, and Drivers.
The power supply is housed in a separate Cabinet away from the other components (Figure 24.).

**FIG. 24. POWER SUPPLY CABINET**

**AC Power Disconnect Switch**

A Halio Power Disconnect (cutoff) Switch is required—one (1) per every three (3) Halio System Power Supply (PS120)—as shown in Figure 25.

**FIG. 25. HALIO POWER DISCONNECT SWITCH**
Halio High-Voltage Installation Process

All the high-voltage electrical connections that are required to install a Halio system are listed in this section.

Step 1

The electrician wires 20A/110VAC to line side of the Disconnect Switch. In the upper left of the cutoff switch, the neutral and ground wires are terminated to bus bars on the left side. The line voltage conductors terminate at the switch itself (shown with the arrow in Figure 26.)

Step 2

The electrician wires 20A/110VAC from load side switch to terminal blocks located at the bottom of the Power Supply Cabinet.
In the lower left of the cutoff switch, the neutral and ground wires are terminated to bus bars on the left side. The load conductors terminate at the switch itself.

The conductors from the load side of the Disconnect (cutoff) Switch connect to terminal blocks at the bottom of the Power Supply Cabinet. Terminations are made at the left side of these terminal blocks. Ensure proper connections of ground, neutral, and line conductors to the proper terminal blocks.

The Power Cabinet is prewired for both AC and DC power supplies to terminal blocks.

**Step 3**

The electrician wires 4-conductor power cable from terminal blocks located at the top of the Power Supply Cabinet to the Energy Manager DC Molex termination.

From the right side of the DC terminal blocks, you will have 16/4 AWG wire going to one Energy Manager.

The Power Cabinet is prewired for power supplies and DC-to-terminal blocks.
Using the 16/4 AWG wire (Figure 30), you will have two (2) positive and two (2) negative pinouts (see Figure 31.)

**FIG. 30. DC MOLEX WIRE TERMINATING AT ENERGY MANAGER**

**FIG. 31. ENERGY MANAGER MOLEX PINOUT DIAGRAM**
Section 7: Low-Voltage Installation

This section covers everything contractors need to know to safely and securely complete the low-voltage phase of Halio system installations. It includes detailed breakdowns of components, recommended methods, and step-by-step instructions for the installation of each system element.

Components

Below is a brief description of each component used in the low-voltage phase of a Halio system installation.

Tint Driver

The Driver supplies the DC power necessary to tint or clear the glass. One Driver per window is required (two Drivers per Halio Black window.) Drivers get their instructions on what level to tint the windows over a wireless (thread mesh) network.

Gateway

Each system typically has one Gateway per every 80 Drivers or, at a minimum, one per floor. There is one Gateway per mesh and it carries messages between the Drivers and the cloud. The system can be configured via an iOS app or portal by communicating through the Halio cloud service to the Gateway.
48 Volt Power Supply
The Power Supply provides DC power to the Energy Manager, Gateway, and Drivers. It has a 100-240 VAC input, a 600W 10.5A output, and is installed in a separate Power Cabinet away from the other components.

Energy Manager
The Energy Manager is the power conditioner and battery system for Halio components. A Halio-provided power calculator determines how many power chargers and Energy Managers are required for your project.

DIN Rail Cabinet
The electronic components of a Halio system are housed on a DIN rail inside one or more Cabinets. DIN rail mounting is a common and easy way to house Halio parts. This picture illustrates what a typical Cabinet with Halio components may look like (note a manifold cover will also be placed over the distribution wire harness.)
Halio Components – Specifics

Tint Driver
The Tint Driver provides elegant, efficient control of Halio windows. It continuously monitors the health of each connected window while providing visual feedback via color-coded LEDs on the device.

**FIG. 34. HALIO TINT DRIVERS**

**FIG. 35. TINT DRIVER SIDE PORTS AND BUTTONS**

**TINT DRIVER FEATURES**
- Communication to Halio system via wireless thread communication
- DIN rail compatible mounting system
- Flexible installation options, up to 300 ft (91m) from window
- Powered by low voltage: 48VDC
- Allows manual operation of the window
- Window Clear and Tint status indicators
- Status, on-line and fault indicators
• Self-diagnostic modes
• Configurable fallback operation: Clear, Privacy, pre-set level
• Uniquely addressable
• IEEE 802.15.4, thread wireless communications using IPv6 TCP/IP interface
• OFDM modulation with BPSK encoding provides robust performance in noisy environments for improved wireless communication
• Power consumption monitoring, output drive fault detection
• Remote "over the air" upgradability
• Network identify button for wireless network join as well as factory reset
• Uniquely addressable using IEEE MAC OUI
• ESD protection to over 20kV
• Temperature sensor
• Low power modes
• Operational temperature: -10°C to 45°C
• Storage temperature: -20°C to 60°C
• Power requirements: Low voltage (48V)
• Power consumption: 7.5A max current - varies depending on window size
• Recommended RH level: 30% to 70%

**Halio Gateway**

The Gateway handles communication between Halio Drivers and the cloud. Operating on the Linux operating system, it provides a level of network security and flexibility ideal for its role within the Halio ecosystem.

**FIG. 36. GATEWAY PORTS AND BUTTONS**
GATEWAY FEATURES

- Powered by 48V DC
- IEEE 802.15.4, thread wireless communications using IPv6 TCP/IP interface for communication to Halio electronics such as Drivers and Tint Selectors
- External thread network antenna connection (no WiFi)
- Linux Operating System (OS)
- Intelligent message broker; gets out of the way when not needed
- Rules engine when Internet (cloud) is not available; flexible, upgradeable
- Interface to local 3rd party products; scalable, expandable
- Secure, remote connectivity using TLS/SSL security and OAuth2 authentication
- Operational temperature: 0°C to 40°C
- Storage temperature: -40°C to 70°C
- Ethernet 10/100Mbps, DHCP compatible; requires Ethernet connection to the Internet

Tint Selector

Press top end to clear window or decrease tint level

LEDs blink to display status; three quick blinks confirm new tint level

Color gradient indicates CLEAR is up and TINT is down

Press bottom end to increase tint level

**FIG. 37. WIRELESS TINT SELECTOR DETAIL VIEW**

TINT SELECTOR FEATURES

- Easy-to-use, surface-mounted wireless communication device enabling local control of one or more windows (no backbox or wiring required)
- Works like a dimmer light switch to set a Halio window or group of windows to one of nine different tint levels
- Powered by two (2) coin cell CR2032 batteries
- LED provides visual confirmation of the selected tint level
**Energy Manager**

The Energy Manager is installed in the Driver Cabinet and it conditions the electricity from the battery supply for all the components in the Cabinet and all Halio glass products.

**ENERGY MANAGER FEATURES**

- Battery backup
- Requires one 600W Power Supply per Energy Manager
- Each unit takes up six Cabinet mounting spaces

**Wireless Range Extender**

**FIG. 38. ENERGY MANAGER PORTS, BUTTONS, AND LEDS**

**FIG. 39. HALIO WIRELESS RANGE EXTENDER**
WIRELESS RANGE EXTENDER FEATURES

- Extends the Halio mesh network between Driver Cabinets or Tint Selectors by repeating wireless messages
- Ensures reliable wireless network communication and eliminates dead zones
- Powered by 12-56V DC

Driver Cabinets

Driver Cabinets house most of the hardware components for the Halio ecosystem, including the Drivers, Gateway, Energy Manager, and wiring.

DRIVER CABINET FEATURES

- Cabinets are surface mount or recessed
- Cabinets come with DIN rail, power wire harness, door, and manifold
- Cabinets are available in four sizes and the number of Drivers in each will vary by configuration:
  - 60-inch
    - Holds max 45 Drivers
    - Holds max three Energy Manager units
  - 42-inch
    - Holds max 31 Drivers
    - Holds max two Energy Manager units
  - 28-inch
    - Holds max 20 Drivers
    - Holds max two Energy Manager units
  - 14-inch
    - Holds max 9 Drivers
    - Holds max one Energy Manager unit
Power Cabinets
The Power Cabinet currently comes in one size and is strictly for housing the Power Supply and its supplemental components.

FIG. 40. RENDERING OF A POWER CABINET

POWER CABINET FEATURES

- Includes two (2) 600W power chargers, DIN rail, removable screw cover, and terminal blocks

Note: a Halio Power Disconnect Switch is also required—one (1) per every three (3) Halio System Power Supply (PS120)—as shown in Figure 41

FIG. 41. HALIO POWER DISCONNECT SWITCH
Wiring & Cables

Cables

You’ll be using several types of cable in a typical Halio installation. Some key guidelines to follow are:

- Halo-approved or recommended cables are required for warranty purposes
- Driver-to-window should be plenum-rated if running through plenum space
- Driver cables have eight (8) conductors, four 24 AWG wires, and four 16 AWG wires
- 16/4 AWG power runs from Power Supply to Driver Cabinet Energy Manager
- Driver Cabinet Energy Manager to terminal block is 16/4 AWG

Best practices for installing all cables can be found later in this section.

Wiring - Terminations

There is only one low-voltage field termination used in the basic assembly of a Halio system (Figure 42):

![FIG. 42. PHOENIX CONNECTOR WITH TERMINATION SEQUENCE](image)
Wiring - Connections

The cable coming from the Driver terminates with a female Phoenix-type barrel connector like the one seen in Figure 43.

The cable from the window terminates in a male barrel connector matching the female Driver connector (Figure 45.)

Where both ends come together (Figure 47), there are four (4) inches of non-flexible cable.

The size and rigidity of the barrel connectors should be accounted for when considering wire routing. The cable has a barrel diameter of 0.559" (14.2mm.)
Wire Routing

Whether it is an internal or external installation with a waterproof screw connection, wire routing will be the same:

- Cables come pre-terminated on one end (this is the end that will connect to the window)
- Cables will have to be labeled and routed from window frame to Cabinet leaving pre-terminated end exposed in window pocket

Cable routing will be evaluated based on individual framing systems. Following are a few examples.

A step bit used to drill out an elongated hole from the internal back of the frame into the window pocket will provide a hole large enough to fit the cable through but still be able to be sealed if required. Chamfering or deburring holes to remove rough edges is required. (see Figure 49 below.)
Run wires from the frame into the Cabinet through conduit or another channel.

It is important to note how significant it is to have both ends of the wire labeled with provided Halio cable labels for proper identification when terminating.

Cable Management

While the Halio Cabinet comes with the wire harness and power wires pre-terminated, the wires coming from the window frames will need to be cut to length and terminated into Phoenix connectors. The recommended length of insulation to be stripped from the cables is 4-5 inches. Ferrules, if carefully placed, are recommended but not required.

FIG. 50. LABELED CABLES READY FOR TERMINATION

FIG. 51. WIRE FROM WINDOW FRAME TERMINATED WITH PHOENIX CONNECTOR (LEFT) AND DRIVER CABINET (RIGHT)
Halio Low-Voltage Installation Process

The low-voltage installation process can be completed easily and quickly following these instructions. Always keep in mind that while these instructions will guide installers through the typical low-voltage installation phase, a Halio representative will be available to answer questions and provide additional guidance should it be necessary.

Step 1

Using the Halio shop drawings provided by the Halio Project Manager (PM), hang the Driver Cabinet on either a surface mount or in-wall as requested by the customer.

FIG. 52. DRIVER CABINET INSTALLED IN-WALL (LEFT) AND SURFACE-MOUNTED (RIGHT)
Step 2

Run conduit, as required, to all locations from the Driver Cabinet. This will include the conduit running from the Power Cabinet located in the area shown in the shop drawings and installed by the electrician. If supported properly, cables can run in free air if no conduit is required.

⚠️ Do not make more than two 90 degree turns if pulling cable through conduit.

![Conduit being run to windows (top) and installed (bottom)](image)

FIG. 53. CONDUIT BEING RUN TO WINDOWS (TOP) AND INSTALLED (BOTTOM)
Step 3

Mount Gateway above the Energy Manager in the Cabinet and plug in the ethernet wire. Mount all the Drivers in the Driver Cabinet, and label them with Halio-provided naming schema. Apply power to all the devices in the Cabinet.

Step 4

Prepare the cables to run. The Halio PM will provide you with the shop drawings indicating the window naming convention.

If you use your own labeling schema for the cables, red-line the Halio shop drawings with new numbering schema.

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**FIG. 54. HALIO CABINET WITH TRIM KIT ATTACHED AFTER ALL DEVICES ARE CONNECTED AND COMMISSIONED**

**FIG. 55. EXAMPLE OF A PANEL LAYOUT**
While preparing your cables, look at the pins in the terminated end. If using extension cables look for bent or broken pins in every connection.

![Image of a connector with pins]

**FIG. 56. CHECK ALL CONNECTORS FOR PIN INTEGRITY**

### Step 5

New window frames should be prepared with cutouts or holes for cable routing. Work with glaziers to pull cables through as frames are being assembled.

![Image of glaziers working on a window frame]

**FIG. 57. LOW-VOLTAGE CONTRACTORS WORKING WITH GLAZIERS DURING INSTALLATION**
Step 6

*If non-tinting glass is being installed temporarily, please skip to Step 7 and refer back to this step when replacing with Halio glass.*

After all the cables have been run and the glazier starts to install Halio windows, check pins in pigtail of the window prior to it being plugged in.

![Fig. 58. Checking pigtail pins](image)

Certain framing systems require that, as glaziers mount the window, you will need to plug the Driver cable into the pigtail while they hold it in place.

![Fig. 59. Glaziers holding window in place for plug-in](image)
Step 7
Terminating the Driver cables at the head end may be done while the frames are being prepared for glass installation as long as you have room to store any excess cable in service loops along the cable path.

With the provided spring-type 8-position connectors, use the following termination order for your cables (from left to right):


![FIG. 60. PHOENIX CONNECTOR WITH TERMINATION SEQUENCE](image)

Remember to relabel the cable as you cut off the excess. Leave yourself a 4-inch (10cm) service loop on each cable.

Step 8
Once each panel is installed, or before the glazier seals up the frame, test each panel-to-Driver connection (Halio Black panels will require a test of two Drivers.)

Once the window is connected to the Tint Driver, press the Clear button and wait for the white LED to start to blink. When the window is completely clear, the white LED will extinguish.

Select the Tint button on the Driver. It should start to blink Red momentarily, and then begin blinking blue. If it continues to blink blue, you should be able to physically see the window tinting.

If the LED on the Driver flashes red momentarily and all left-side LEDs are extinguished, there is a problem with the wiring. You will need to check your terminations for wire frays or incorrect termination order.

Note: multiple selections in sequence will pause the driver and the left-side LEDs will extinguish. If all LEDs are extinguished, make a single selection to activate the device.
Press the Clear button to clear the window and try the next Driver/Device combination.

**Step 9**

Clean and dress all cable runs.

Make sure the Cabinet and any wire runs have zip ties in place, and exposed cables look organized.

The default configuration for the driver is generally for a smaller size window than you will be installing. This will result in the windows not being able to be fully tinted until the Halio PM applies the proper configuration file to the driver after you have finished your work.
FIG. 63. FINISHED HALIO CABINET WITH MANIFOLD

FIG. 64. COMPLETED HALIO COMPONENT INSTALLATION SHOWING DRIVER CABINETS, POWER SUPPLY CABINET, AND DISCONNECT/CUTOFF SWITCH
Section 8: Support

For questions or concerns not addressed in this manual, please contact your Halio project manager.

Additional support contacts:

- Email: support@kinestral.com
- Phone: 866-983-0448
Appendix