Overview
The Vantage LVOS-0-10-PWM-1 (LVOS) has four PWM and four analog Low Voltage Outputs along with four high voltage relays. All twelve connections are independent from each other. The station is powered from a universal input of 120-277 VAC 50/60Hz source. The high voltage relays are isolated from the station’s high voltage power supply. All outputs can be manually controlled and monitored from the front of the station. An Override switch may be connected allowing all the low voltage loads and high voltage relays to be ON or OFF for fail-safe applications. The station comes housed in a custom metal enclosure or may be ordered separately for installation into Vantage’s IAUX enclosure. Communication to the Vantage System is via Ethernet or Station Bus.

Two Ways to Order

- LVOS-0-10-PWM-1 Station with Single Enclosure
  - Low Voltage Output Station (PWM and 0-10) 120v-277v - comes in a custom Vantage supplied, UL rated enclosure.
- LVOS-0-10-PWM-P-1 LVOS-0-10-PWM station only – for installing in UL rated IAUX-2, IAUX-4, or LCAP44A-6 enclosures.*

*WARNING: This is not a DIN station and is not designed for DIN rail. Vantage’s auxiliary enclosures, IAUX-2 / IAUX-4 and LCAP44A-6 enclosures are ordered separately!

Highlight Features
- 4 PWM, LV outputs
- 4 Analog, 0-10V outputs
- 4 High Voltage Relays – tied to LV outputs in Design Center
- Twelve membrane style actuators and LED status indicators
- High Resolution Performance when Dimming
- Communicates via Vantage Ethernet Bus or Station Bus
- Housed in a custom, UL rated enclosure
- 12 memonic style actuators and LED status indicators
- Override Switch connections for ON and OFF states of all loads collectively

Station Specifications

- **Wall Box**
  - Dimensions, HWD: 9.0" x 10.5" x 2.75"
  - Weight with box: 8.43 cm x 26.26 cm x 8.77 cm
- **Cover**
  - Dimensions, HWD: 9.75" x 11.25" x 0.18" (1/16" Thick)
  - Weight with cover: 8.58 lbs or 3.9kg
- **Station Only**
  - Dimensions, HWD: 22.86 cm x 26.67 cm x 15.0 cm
  - Weight with station only: 9.75" x 10.5" x 2.75"
  - Temperature: 32-104°F / 0-40°C
- **Relative Humidity**
  - Maximum 90%, non-condensing
- **Protection**
  - High voltage input, over voltage protection
  - Low voltage 0-10V output over current protection
  - Low voltage PWM output over current protection
  - Overcurrent Protection: PTC Fuse (self reset)

**AC Input – Power Supply**

- **Input voltage / frequency**
  - 120 - 277 VAC 50-60Hz
- **Input power**
  - <18W
- **Connection type**
  - 0.20" pitch removable plug
- **Connection rating**
  - 300V 10A

**Input / Output Connections (Low Voltage)**

- **Vantage Ethernet Bus Port (VEB)**
  - RJ45 - Auto Crossover Detection – 10 / 100
- **Station Bus connection**
  - 2C, 16AWG / 1/32mm² twisted, non-shielded, <30pF per foot. Separate a minimum of 12" / 30.5cm from other parallel communication and/or high voltage runs.
- **Station Bus Wire Specification**
  - 2C, 16AWG / 1/32mm² twisted, non-shielded, <30pF per foot. Separate a minimum of 12" / 30.5cm from other parallel communication and/or high voltage runs.
- **Station Wiring configuration**
  - Daisy-chain/Star/Branch
- **Station Equivalent InFusion**
  - 0.35W on IC-24 / 0.55W on IC-36
- **Auxiliary Inputs**
  - 4 Dry Contacts, (3 and 4 may be for an IR Receiver and Light Sensor respectively)
- **Override inputs**
  - Yes – All ON or All OFF contacts

**Low Voltage Output Station, 0-10V & PWM – MODEL: LVOS-0-10-PWM-1**

**Low Voltage Output: PWM Low**

- **Specification**
  - IEC 60929 Annex E
- **Number of outputs**
  - 4
- **Output voltage**
  - 12V (source only)
- **Output current**
  - 100mA per channel, 400mA total
- **Loads Per Output**
  - 50Ω 2.0mA per load (typical)
- **Resolution**
  - > 1024 steps
- **Duty cycle**
  - Variable 0% to 99.9%
- **Frequency**
  - 760Hz
- **Connection type**
  - 0.20" pitch removable plug
- **Connection rating**
  - 300V 10A
- **Connection Torque**
  - 4.4 inches pounds

**Low Voltage Output: 0-10V**

- **Specification**
  - IEC 60929 Annex E
- **Number of outputs**
  - 4
- **Output**
  - 0-10V @ 100mA sink or source
- **External source voltage**
  - Typical 10V / Maximum 20V
- **Loads Per Output**
  - 50Ω 2.0mA per load (typical)
- **Resolution**
  - >1024 steps
- **Connection type**
  - 0.20" pitch removable plug
- **Connection rating**
  - 300V 10A
- **Connection Torque**
  - 4.4 inches pounds

**High Voltage Outputs and Relays**

- **Number of relays**
  - 4
- **Voltage rating**
  - 120V-277V VAC
- **Type**
  - Normally open
- **Load rating, general purpose**
  - 10A
- **Load rating, incandescent**
  - 5A
- **Electronic Ballast**
  - 5A
- **Relay input connected to line feed**
  - No
- **Connection type**
  - 0.20" pitch removable plug
- **Connection rating**
  - 300V 10A
- **Connection Torque**
  - 4.4 inches pounds

**Certifications**

- **UL Listed**
  - 508
- **CE, FCC Part 15, Sub-Part B**
  - ENS5022 Radiated / Conducted emissions
  - ENS5024 61000-4-2 ESD immunity
  - ENS5024 61000-4-3 Radiated immunity
  - ENS5024 61000-4-4 Fast transient immunity
  - ENS5024 61000-4-5 Surge immunity
  - ENS5024 61000-4-6 Conducted immunity
  - ENS5024 61000-4-8 Magnetic field immunity
  - ENS5024 61000-4-11 Voltage dips/interuption immunity
  - 61000-3-2 Harmonics current emissions
  - 61000-3-3 Flicker emissions

**PWM Outputs, 12V (Source)**

Low voltage outputs 1-4 may be configured as PWM (Pulse Width Modulation). PWM Duty Cycles are programmed using Power Profiles (Power Profile Minimum On and Maximum On). The output can be reversed in Design Center through the Power Profile. For example, a 0% duty cycle can either be load ON or load OFF.

**Low Voltage Outputs, 0-10V (analog)**

Low Voltage Controls 5-8 and Ground are used to control devices that work with an analog 0-10V signal. Ground provides the negative reference for the output voltages. All Grounds are connected internally to each other. Each output, 5-8, can sink or source 0-100mA at any voltage from 0-10VDC. The load sets the percentage between the minimum and maximum voltage that is selected for that load.

**NOTE:** Loads 1 - 8, Low Voltage outputs, should be limited to 250 feet / 76.2 meters for each wire run, using a minimum of 18AWG / 0.823mm² gauge wire. All LV connections use 4.4 inch pound torque. Stranded wire recommended.

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Line Voltage Relay Operation
There are four (4) AC line voltage relays on this LVOS station. They are single-pole, single-throw relays (SPST) and are initially independent from the low voltage outputs. However, in Design Center, each relay may be programmed to automatically switch in conjunction with a selected low voltage output, so up to four of these conjunctions are possible. When this conjunction is made in Design Center if the low voltage output is >0, the corresponding relay is ON and if the low voltage load is 0 then the relay is OFF. Not all low voltage lighting installations require a switched, high voltage relay, it depends on the fixture. Any relay not used in conjunction with a low voltage output is free and may be programmed to operate as an independent relay load.

Software/Firmware
Design Center Software version 3.x or higher and accompanying Firmware, are compatible. For new projects it is recommended that software and firmware be kept to the most current release.

Power Profiles / Power Outages
The station stores Power Profile configuration data locally so that it will continue to operate correctly if communication with the system is lost. This information includes: load profile-duty cycle settings, and last load level.

If a power outage occurs, when power is restored the station will return the loads to the last load level with all profiles at their last known settings. This occurs whether or not the station is connected to the Controller.

Actuator Buttons
The actuator buttons on the front of the station are for local control only and are not programmable through Design Center software. These buttons will not register in Monitor Button press.

Button Operation

<table>
<thead>
<tr>
<th>LV Buttons</th>
<th>LV Load Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press/Release</td>
<td>1. The load ramps to 100% or fades to 0% over three seconds, alternating with every other press and release. 2. If the button is pressed again before the three seconds time, the load stops ramping/fading.</td>
</tr>
<tr>
<td>Press and Hold/Learn</td>
<td>Press and Hold and learned level features are not supported from the front panel buttons.</td>
</tr>
<tr>
<td>HV Buttons</td>
<td>Relay Load Operation</td>
</tr>
<tr>
<td>Press/Release</td>
<td>ON – (instant) / OFF – (three second delay)</td>
</tr>
</tbody>
</table>

Installation of Vantage products should be performed or supervised by a Certified Vantage Installer. Each LVOS must be mounted in the custom electrical box provided. In areas that have a drop ceiling it may be installed in the ceiling close to the loads it is controlling. Low voltage connections are located through the top side of the LVOS. Line voltage connections are through the bottom side. Connect wiring to the electrical enclosure so low voltage and high voltage wires stay on their respective sides. The electrical box and the LVOS must be grounded to the systems electrical ground. See Wiring Terminations table on page 3 or 4.

Station Connection
The LVOS communicates with the InFusion Controller via an RJ45 Ethernet connection to the local network. Communication to the LVOS may also be through Station Bus. Screw terminals for station bus and the Ethernet jack are located in the low voltage section of the electrical box (through the top). When using station bus, the wire should comply with Vantage's, Station Bus specification.

Remote Infrared Receiver or Dry-Contact
A remote infrared receiver (part # REMOTEIR) may be connected to dry-contact 3. This terminal is not compatible with remote infrared receivers from other manufacturers. The receiver connects to +12V, IR IN (dry contact 3) and Gnd. If not used with an IR receiver this input may be used as a standard dry contact input, connecting the contact between IR IN (dry contact 3) and Gnd.

Sensor Input or Dry-Contact
A sensor may be connected to dry-contact 4. The sensor connects to +12V, SENSOR IN (dry contact 4) and Gnd. If not used with a sensor this input may be used as a standard dry contact input, connecting the contact between SENSOR IN (dry contact 4) and Gnd.

Override
The station supports two Override modes, ON and OFF. When either switch is closed all loads are ON or OFF depending on which override loop is closed. However, the ON override takes precedence over the OFF override if both switches are closed. Station does not communicate to controller when in override.

Power Connection
A 120 - 277 VAC 50-60Hz line feed from breaker connects to the Line, Neutral, and Ground connections. This provides power for the LVOS and is required for the station to operate. The four high voltage relays are not internally connected to this power source.

Configuration
Simultaneous connection to station bus and Ethernet is not supported. When the LVOS is first powered the STATUS LED will blink three times. See table below for additional blink patterns. In Design Center, click the Configure Stations button on the toolbar. The Status LED will have a 5 blink pattern and the load LEDs will blink. With the LVOS highlighted in Design Center, press one of the load buttons on the front of the station three times to configure. The station may also be configured by typing the serial number in the project file, configuring when the system is programmed.

NOTE: Switching from Ethernet bus to Station bus, or Station bus to Ethernet bus requires these steps:
1. Unconfigure the LVOS in Design Center
2. Update the system from Design Center
3. Re-configure on the new bus.
4. Update the system again from Design Center.

STATUS LED Blink Patterns Description
Working normally, the Status LED blinks once per second. Other patterns are 2, 3, 4 or 5 blinks followed by a short pause.

Status LED Blink patterns:

<table>
<thead>
<tr>
<th>Blink Cycle</th>
<th>Station Bus</th>
<th>Ethernet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Configured/Programmed</td>
<td>Configured/Programmed</td>
</tr>
<tr>
<td>2</td>
<td>Communicating/not configured</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>No Station Bus Connection</td>
<td>Not configured</td>
</tr>
<tr>
<td>4</td>
<td>Station Problem</td>
<td>Station Problem</td>
</tr>
<tr>
<td>5</td>
<td>Configuration Mode</td>
<td>Configuration Mode</td>
</tr>
</tbody>
</table>

NOTE 1: Station is not communicating with the Main Controller. Verify station bus wiring is correct.

Firmware Upgradable From Design Center
1. The station must always be configured and programmed to the system in order to perform a firmware update.
2. Click on System | Update Firmware | Update LVOS PWM Firmware.
3. Select the checkbox for each LVOS PWM station needing a firmware upgrade.
4. Complete the upgrade – wait for the process to finish.

Placing Station in Boot Code
If the application code is corrupted it may not be possible for Design Center to connect to the LVOS PWM station to update. If this condition is suspected, place the LVOS PWM station into boot code and then update following the steps above.
1. Remove HV power to the station.
2. Press and hold PWM buttons 2 and 3 while HV power is restored.
3. All of the station's load and status LED lights will flash in unison.
4. While in this mode attempt the regular firmware update steps 2-4 again. (Above - Firmware Upgradable From Design Center)
5. When the firmware update is finished the update dialog box will display a green checkmark and the station will reboot automatically.

LVOS WITH COVER
This example shows the wiring for one load. Please note that the HV-Relay, to the ballast, does not get its power from the stations HV power supply, however it may be possible to share the breaker as long as the breaker limit is not exceeded. Repeat for additional loads.

Station Bus - (from InFusion Controller)

Low Voltage Control Wire to Ballast Limit to 250ft / 76.2m, max. length, using 18AWG / 0.823mm2 wire

Wiring Terminations:

- CONNECTOR: SCREW TERMINALS
- TORQUE: 4.4 INCH POUNDS
- WIRE RANGE: 12-30 AWG *

Wire Description:
- Type: Copper, CU Wire only
- Temperature Rating: 60C

* MUST MATCH BREAKER/LOAD WIRE GAUGE

WARNING: This is NOT A DIN station and is not designed for DIN rail. Only mount this station in Vantage’s UL rated box supplied with part number LVOS-0-10-PWM or Vantage’s auxiliary enclosures, I AUX-2/IAUX-4 when ordered separately!
AUX ENCLOSURE WITH LVOS STATIONS EXAMPLE
LVOS Load Wiring Examples using Vantage auxiliary enclosures; order LVOS-0-10-PWM-P-1 for station only and IAUX-2(4) as needed. Notice all high voltage is through the LEFT or RIGHT sides of the enclosure and all low voltage is through the CENTER of the enclosure. These connections can be through the TOP and/or BOTTOM of the enclosure from the respective sides. The example below is identical to the wiring example on the previous page with the exception of the enclosure. Using Vantage’s IAUX enclosures allows the system to be expanded to a large number of loads.

POSSIBLE LVOS LOADS IN IAUX-2:
• Low Voltage Output: PWM ............................................. 24 LOADS
• Low Voltage Output: 0-10VDC ...................................... 24 LOADS
• High Voltage 120-277 VAC Output Relays ............... 24 LOADS

POSSIBLE LVOS LOADS IN IAUX-4:
• Low Voltage Output: PWM ............................................. 40 LOADS
• Low Voltage Output: 0-10VDC ..................................... 40 LOADS
• High Voltage 120-277 VAC Output Relays ............... 40 LOADS

(See Wiring Terminations table below)

Example 1 (left side of IAUX Enclosure)
• Romex wire for station and load fed into the enclosure.
• Neutrals are connected inside the enclosure and Hot runs through one of the relay loads.

Example 2 (right side of IAUX Enclosure)
• Romex wire run for station power.
• Load wire run is from single wires (run in conduit) HOT feed is fed into the enclosure, through one of the relay loads and back out to the fixture.
• Neutrals / GND are straight to the lighting fixture.

Wiring Terminations:

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>TORQUE</th>
<th>WIRE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCREW TERMINALS</td>
<td>4.4 INCH POUNDS</td>
<td>12-30 AWG*</td>
</tr>
</tbody>
</table>

Wire Description
- Copper, CU Wire only
- Temperature Rating: 60C
• MUST MATCH BREAKER/LOAD WIRE GAUGE

Examples of Loaded IAUX and LCAP Enclosures

POSSIBLE LVOS LOADS IN IAUX-2:
• Low Voltage Output: PWM ............................................. 24 LOADS
• Low Voltage Output: 0-10VDC ...................................... 24 LOADS
• High Voltage 120-277 VAC Output Relays ............... 24 LOADS

POSSIBLE LVOS LOADS IN IAUX-4:
• Low Voltage Output: PWM ............................................. 40 LOADS
• Low Voltage Output: 0-10VDC ..................................... 40 LOADS
• High Voltage 120-277 VAC Output Relays ............... 40 LOADS

VANTAGE
LVOS-0-10-PWM-1

<table>
<thead>
<tr>
<th>Wire Gauge Max.</th>
<th>12 AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw Torque Max.</td>
<td>4.4 in/lb.</td>
</tr>
<tr>
<td>Enclosure Type</td>
<td>LP20</td>
</tr>
<tr>
<td>AC Input Power Maximum</td>
<td>16 W</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>120-277 VAC</td>
</tr>
<tr>
<td>Input Frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Relay Input Current Max.</td>
<td>5 A</td>
</tr>
<tr>
<td>Relay Load General Purpose Max.</td>
<td>30 A</td>
</tr>
<tr>
<td>Relay Load Electronic Ballast Max.</td>
<td>5 A</td>
</tr>
</tbody>
</table>

Strip back stranded wire 6.5mm / 0.25”

Recommended Wire Type
- Loads: Stranded: 0.75-3.31mm² / 18-12 AWG, copper wire; must match breaker wire gauge
- Station Bus: Vantage Station Bus (see specifications table)

Examples of Loaded IAUX and LCAP Enclosures

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