Intelligent Vehicle Controls

CL-6000 Series

User Manual

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CL-6000 Series

OVERVIEW
The CL-6000 series keypads come in 7 sizes from 1x4 up to 4x3. All are sealed and designed for mobile machine use.

CORE FEATURES

- J1939 and CANopen CAN communication
- Tri-Color LED Indicators and Button Backlight
- Dimmable Indicators and Backlight
- Individually controlled Button and Backlight LEDs
- Customizable button icons

USER NOTICES

Typical Use
The specifications contained herein represent all possible configurations for this product family. The actual configurations available on each module may be a subset of this specification. Please refer to the module-specific datasheet for the connector pinout and configurations that are available.

User Liability
HED, along with any affiliated distributor or reseller, shall not be liable for any direct, indirect, incidental, special, or consequential damages arising from the use or inability to use this product, even if advised of the possibility of such damages. Users assume all risks associated with the product's use. Always follow provided instructions and generally accepted safety guidelines.

The OEM of a machine or vehicle in which HED® electronic controls are installed is fully responsible for all consequences that might occur. HED®, and any authorized distributor, has no responsibility for any consequences, direct or indirect, caused by failures or malfunctions. Failure or improper selection or improper use of HED® products can cause death, personal injury and property damage.

The OEM must analyze all aspects of their application and review the information concerning product or system in the current product documentation. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by HED® at any time without notice.

PART NUMBERING

Part Number Configuration Details

Keypad	Size	Button Configuration		Base (100)	CAN Protocol Options (XX)		Custom Suffix for Custom Graphics	
Model		Number of Rows	Buttons per Row		J1939	CANopen	Customer	Number
6014	1x4	1	4	CL–6014–100–XX–CCCNNN	30	50	CCC	NNN
6022	2x2	2	2	CL–6022–100–XX–CCCNNN	30	50	CCC	NNN
6023	2x3	2	3	CL–6023–100–XX–CCCNNN	30	50	CCC	NNN
6024	2x4	2	4	CL–6024–100–XX–CCCNNN	30	50	CCC	NNN
6026	2x6	2	6	CL–6026–100–XX–CCCNNN	30	50	CCC	NNN
6028	2x8	2	8	CL–6028–100–XX–CCCNNN	30	50	CCC	NNN
6043	4x3	4	3	CL–6043–100–XX–CCCNNN	30	50	CCC	NNN

Standard Part Numbers Available

Size / Button Configuration	J1939 Part Numbers	CANopen Part Numbers
1x4	CL-6014-100-30-HED002	CL-6014-100-50-HED002
2x2	CL-6022-100-30-HED002	CL-6022-100-50-HED002
2x3	CL-6023-100-30-HED002	CL-6023-100-50-HED002
2x4	CL-6024-100-30-HED002	CL-6024-100-50-HED002
2x6	CL-6026-100-30-HED002	CL-6026-100-50-HED002
2x8	CL-6028-100-30-HED002	CL-6028-100-50-HED002
4x3	CL-6043-100-30-HED002	CL-6043-100-50-HED002

Example Part Number:
CL-6022-100-50-HED002

This part number designates a 2x2 CANopen keypad with HED generic rubber overlay of numbers in the boxes.

RELATED DOCUMENTS for CL-6000 Series

Related documents for the CL-6000 Series can be found at the following locations.

- Data Sheet: https://hedcontrols.com/product-resources/hed-cl-6000-series
- J1939 Protocol: https://hedcontrols.com/wp-content/uploads/2026/02/HED-J1939-Module-Keypad-Specifications.pdf
- CANopen EDS file: https://hedcontrols.com/wp-content/uploads/2026/03/cl-60XX-eds.zip
- STEP files:
    - CL-6014: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6014_1X4_05MAR2025.zip
    - CL-6022: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6022_2X2_05MAR2025.zip
    - CL-6023: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6023_2X3_05MAR2025.zip
    - CL-6024: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6024_2X4_05MAR2025.zip
    - CL-6026: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6026_2X6_05MAR2025.zip
    - CL-6028: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6028_2X8_05MAR2025.zip
    - CL-6043: https://hedcontrols.com/wp-content/uploads/2026/02/CL-6043_4X3_05MAR2025.zip

COMPUTING CORE

DESCRIPTION	VALUE	NOTES
Overview	Arm™ Cortex-M7 Microcontroller running at 120 MHz	
CPU	S32K310	
Flash	512 KB	
RAM	112 KB	
Bootup Time	150msec (approximate)	

INTERFACES / PROTOCOLS

INTERFACE/PROTOCOL	DETAILS
CAN	1x CAN-FD

CIRCUITS

BATTERY (+) CPU - with VTD2 (PIN 1)

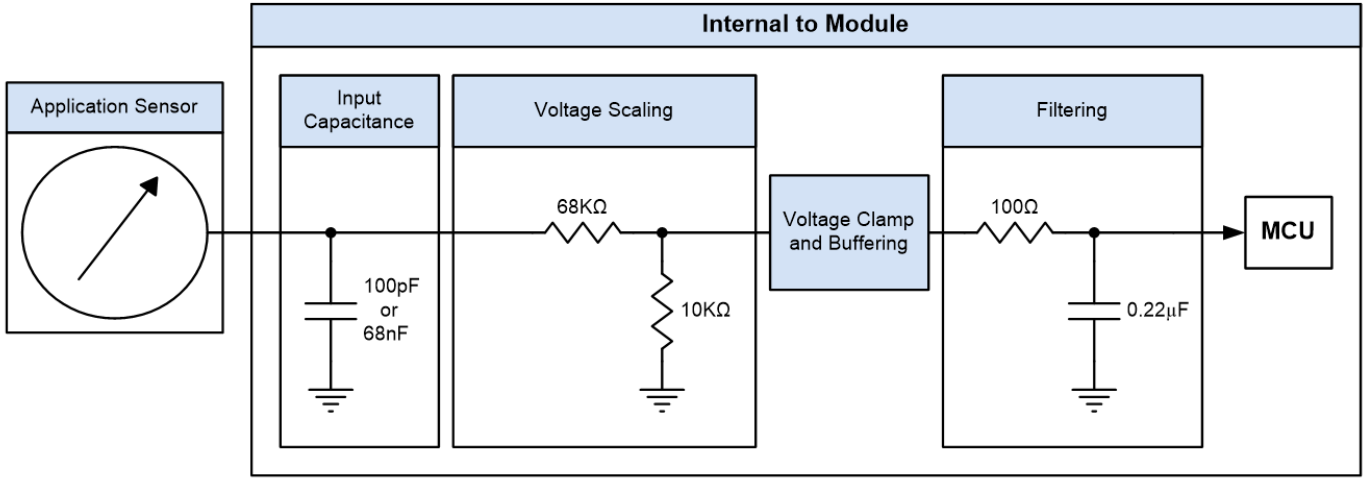
Voltage-to-Digital (VTD2) Mode (0 – 39.0VDC)

Input Voltage Range
- 0V to 39V
- Note: Do not exceed range outlined in Battery (+/-) section

Input Resistance
- 78KΩ (typical)

Resolution
- 12 Bits
- 9.52mV / count (typical)

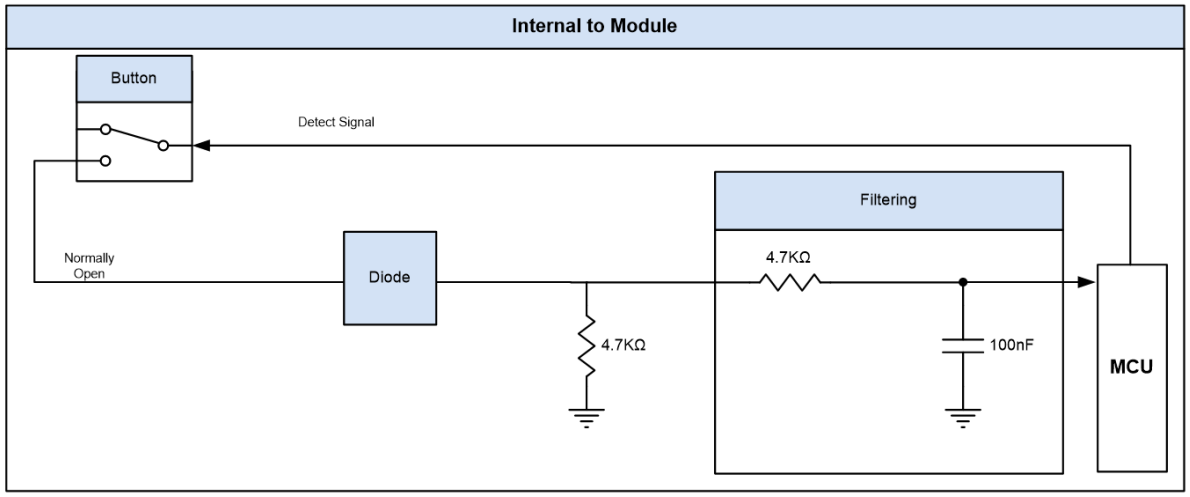
Accuracy
- ±1.0% and ±70mV (TA = 25°C)
- ±3.0% and ±100mV (TA = full range)



BUTTON(S) ID 1-16(MAX)

Response Timing

	Hardware Response	Default Debounce
On Press	.33ms	50ms
On Release	.65ms	50ms



CAN COMMUNICATIONS (PINS 3/4)

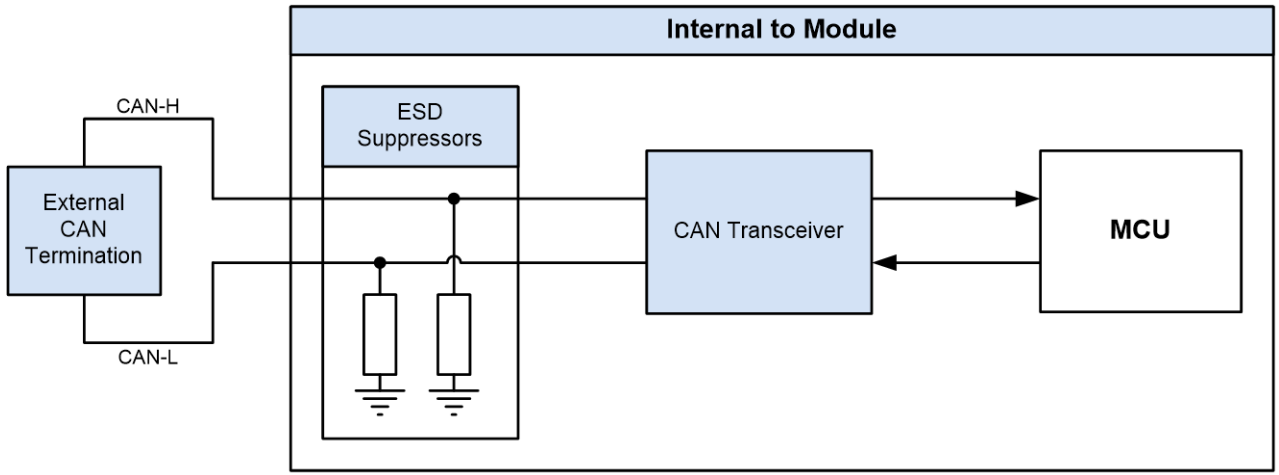
Baud Rate
- CAN Up to 1Mbps
- CAN FD up to 5Mbps

Maximum Allowable Voltage
- -70V to +70V

Input Capacitance (max)
- 30pF

No Internal Termination

Maximum allowable voltage defines the voltage extremes that the transceiver can tolerate. Exposure to these voltages for extended periods may affect device reliability.



BATTERY (+/-) MODULE (PIN 1/2)

Battery (+) (Pins 1,8)

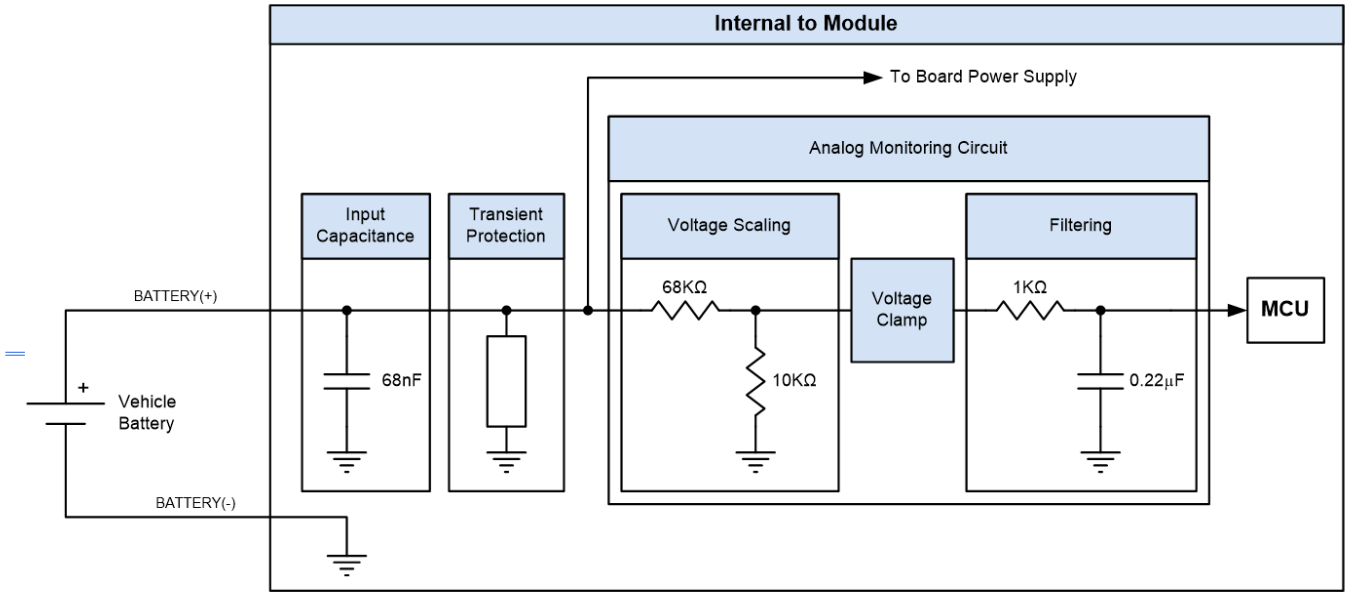
Operating Voltage Range
- 6VDC – 32VDC

Maximum Continuous Voltage
- 32 VDC

Module Current Draw
- See Appendix for full range of typical operating currents

Analog Monitoring Circuit

See Section Input – VTD Mode (0-39V Range)



PRODUCT RATINGS

GENERAL

DESCRIPTION	DETAILS	NOTES
Voltage	8-32 VDC	
Temperature Range	Operating: -40C to +70C Storage: -40C to +85C	

Minimum Current Draw	CL-6014	CL-6022	CL-6023	CL-6024	CL-6026	CL-6043	CL-6028
Input Voltage [V]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]
5	90	90	95	97	82	101	115
12	56	58	58	54	57	53	57
24	47	43	49	42	44	30	33
28	45	42	46	39	42	28	30

Typical Current Draw	CL-6014	CL-6022	CL-6023	CL-6024	CL-6026	CL-6043	CL-6028
Input Voltage [V]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]	Current Draw [mA]
5	180	155	216	243	323	318	424
12	81	85	100	122	168	175	181
24	52	65	79	81	92	84	105
28	51	62	63	67	92	83	87

COMPLIANCE MATRIXES

The CL-6000 series keypads are compliant to all standards listed in the matrixes below, unless otherwise stated, to the noted class as applicable.

MECHANICAL COMPLIANCE

Requirement Area	ISO 20653: Aug 2023	ISO 16750-3: Dec 2023 (E)	ISO 16750-4: 2023	ISO 16750-5: 2023	IEC 60068: Date Below	ISO 4892-2: 2013	Comments / Notes
IPx9K Waterjet	Sec 8.3						
Random Vibration		Sec 4.1.2.7					
Sine Vibration		Sec 4.1.2.6					
Mechanical Shock (Body/Frame and Doors/Flaps)		Sec 4.2.2			Part 2-27: (2008-02)		
Altitude					Part 2-13: (1983)		
Thermal Shock					Part 2-14: (2023-07)		
IP6K Dust	Sec 8.3						
Salt Mist, Cyclic					Part 2-52: (2017)		
Solar Weathering						See ISO	
Combined Environment Thermal Stability					2-1 (2007-03) 2-2 (2007-03) 2-30 (2005-08) 2-38 (2017-11))		
Vertical Impact (Drop Test)					Part 2-31: (2008)		
IPX7 Immersion	Sec 8.4						
Dewing			Sec 5.4.2				
Ice Water Shock			Sec 5.4.3				
Chemical Resistance				Sec 4.8			See Note 1

Note 1: The application of Zep-A-Lume was added as a non-required test. Application of the polish resulted in the clearcoat dissolving and white paint degrading. To protect the keypad's clear coat and ensure its functionality, avoid contact with Zep-A-Lume or similar products.

ELECTRICAL COMPLIANCE

Requirement Area	ISO 16750-2:2012 and 2023	Class	Comments / Notes
Short Circuit Protection	Sec 4.10.2	Class C	
Open Circuit Protection	Sec 4.9.1	Class C	
Reverse Voltage Protection	Sec 4.7, Case 2	Class C	
Momentary Drop in Supply Voltage Protection	Sec 4.6.1	Class C	
Reset Behavior from Voltage Drop	Sec. 4.6.2	Class C	
Starting Profile	Sec 4.6.3	Class A	
Jump Start Protection	Sec 4.3.1.2	Class B	
Load Dump (Clamped)	Sec 4.6.4	Class B	Device can withstand Load Dump of 32V at Class B

EMC COMPLIANCE

Requirement Area	EN ISO 13766-1:2018 (Construction)	EN ISO 14982:2009 (Ag/Forestry)	EN ISO 13766-2:2018 (HED Preferred)	ISO 10605	UNECE Reg 10.06 (Vehicle/Tractor)	IEC 61000-4-2	EN 13309: 2010	EN 50498: 10	CISPR 25 (HED Additional)	ISO 7637-2	Comments / Notes
Emissions Radiated from ESA	Sec 4.5 and 4.6	Sec 6.4 and 6.5	➞ Refers to 13766-1:2018 Sec 4.5 and 4.6		Sec 6.5 and 6.6		Sec 4.5 and 4.6	Sec 7.1 and 7.2			
Conducted Transients	Sec 4.9.4	Sec 6.8	➞ Refers to 13766-1:2018 Sec 4.9		Sec 6.9		Sec 4.9.4	Sec 7.4		Sec 5.6	*See Note 1 for 7637-2 details*
Immunity of ESA to Electromagnetic Radiation (Absorber Chamber)	Sec 4.7	Sec 6.6			Sec 6.8		Sec 4.7				
Immunity of ESA to Electromagnetic Radiation (BCI)	Sec 4.7	Sec 6.6	Sec 5.3.1		Sec 6.8		Sec. 4.7				
Electrostatic Discharge (ESD)	Sec 4.8	Sec 6.7	Sec 5.3	Sec 9	Sec 4.8	Sec 8.3	Sec. 4.7				
Conducted Transients Emissions on Supply Lines	Sec 4.9.3				Sec 6.7		Sec 4.9.3	Sec 7.3			
Conducted Emissions from Components – Voltage Method									Sec. 6.3		*See Note 2*
Radiated Emissions from Components – ALSE Method									Sec. 6.5		*See Note 2*

Note 1: Meets Status C for pulse 1; Meets Status A for pulse 2a; Meets Status C for pulse 2b; Meets Status A for pulse 3a; Meets Status A for pulse 3b.
Note 2: The following Variants passed to Class 4: CL-6026, CL-6028. The following Variants passed to Class 5: CL-6014, CL-6022, CL-6023, CL-6024, CL-6043.

INSTALLATION

MECHANICAL

DESCRIPTION	DETAILS	NOTES
Dimensions	CL-6014: 118.1 x 39.9 x 14.63 (mm) CL-6022: 67.3 x 66.4 x 14.63 (mm) CL-6023: 92.7 x 66.4 x 14.63 (mm) CL-6024: 118.1 x 66.4 x 14.63 (mm) CL-6026: 168.9 x 66.4 x 14.63 (mm) CL-6028: 219.7 x 66.4 x 14.63 (mm) CL-6043: 92.7 x 119.4 x 14.63 (mm)	
Housing material	Nylon 6/6 15% glass filled	
Installation	Panel mount (see dimensional drawings)	
Mating Connector	Deutsch DT06-4S (with W4S wedge)	
Connector Sockets	Deutsch 0462-201-16141 16AWG Sockets	Accepts 16 - 20 AWG wire
Weight	CL-6014: 0.20 lbs CL-6022: 0.22 lbs CL-6023: 0.25 lbs CL-6024: 0.30 lbs CL-6026: 0.35 lbs CL-6028: 0.45 lbs CL-6043: 0.35 lbs	
Mounting fasteners & Torque	Fastener for #10-32 threaded stud Mounting Torque: Typical: 10-18 in-lbs Max: 22 in-lbs Note: Lock washer should be utilized	

BEST PRACTICES

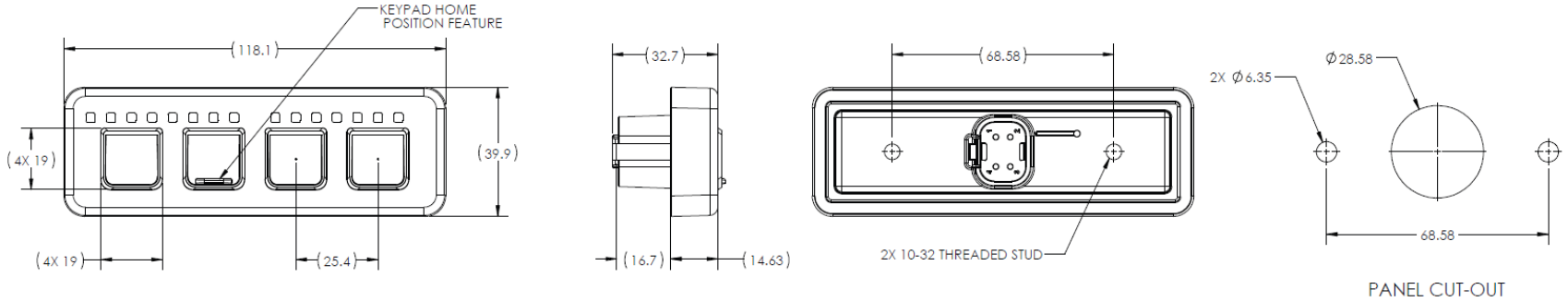
DESCRIPTION	DETAILS	NOTES
Grounding	An electronic control system should have all devices in the system connected to a common ground for proper operation. A dedicated ground wire, appropriately sized, run directly to the machine battery is recommended.	
Interface	**CAN Terminating Resistor:** To ensure reliable communication on the CAN network, install a 120-ohm terminating resistor at each end of the CAN bus backbone (two resistors total). This helps minimize signal reflections and maintain signal integrity. Avoid placing terminating resistors at intermediate nodes or devices along the bus, as this can disrupt network performance. Confirm proper placement with the vehicle's wiring diagram.	
Shielding	**CAN Shielding Best Practices** To ensure reliable CAN communication and minimize susceptibility to electromagnetic interference (EMI), follow these shielding guidelines: • Connect the CAN cable shield to vehicle chassis ground at a single point only, ideally near the battery negative terminal or a designated ground stud. • Do not connect the shield to signal grounds of any devices on the network. • At the keypad end, the CAN shield should remain unconnected (floating). • If your system uses a connector with a CAN Shield pin, only use this pin to connect to vehicle chassis ground. Do not connect it to the Keypad ground pin. • Avoid grounding the shield at multiple locations to prevent ground loops, which can cause communication errors or system instability.	
Wiring guidelines	**Live Battery Connect / Disconnect:** Machine power should be off when connecting or disconnecting that mating connector. **Machine Welding Guidelines:** Disconnect all connectors from the HED device before performing any welding on a machine. The following steps are recommended when welding: • Turn engine off • Remove electronic devices from machine before any arc welding • Disconnect the negative battery cable from the battery • Clamp the ground cable for welder to the item that will be welded as close as possible to the weld. Do not use any electrical device to ground the welder. **General Wiring Best Practices:** • Protect wires from potential mechanical damage. Run wires in durable sheathing, or flexible metal or plastic conduits. • Use wire size appropriate for device connectors • Run wires for high current loads such as solenoids, lights, motors, pumps separate from sensors and other noise/interference sensitive signal wires.	

	• Run wires close to metal surfaces of machine when possible to aid in shielding to help minimize potential effects of EMI/RFI interference. • Do not run wires near sharp corners or through holes unless utilizing a grommet for protection. • Do not run wires near hot components that could cause damage. • Use appropriate temperature rated wires for application. • Use wires with abrasion resistant insulation. • Provide strain relief for all wires. • Do not run wires near moving or vibrating components. • Avoid running wires over long and unsupported spans.	
Fusing	The Battery pin should be protected with a fuse according to the maximum current calculated in Current section of User Manual.	

PINOUT

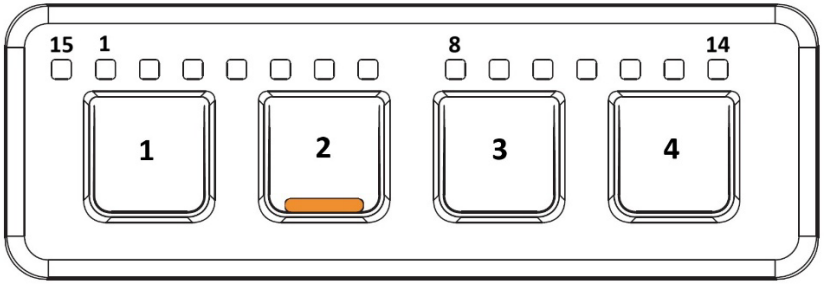
PIN	DESCRIPTION	VTD 2 RANGE
Pin 1	BAT(+) MODULE / INPUT VTD2	0-35V
Pin 2	BAT(-) MODULE	N/A
Pin 3	CAN-H	N/A
Pin 4	CAN-L	N/A

CL-6014 (1x4) Dimensional Drawings:

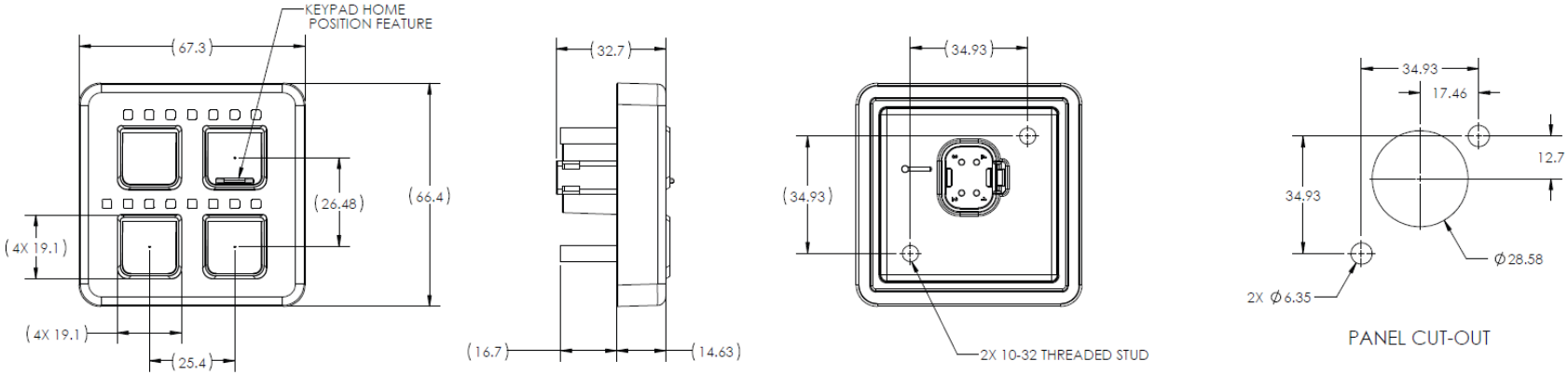


CL-6014 (1x4) Button and LED Indicator Numbering Drawing:

Note: LED number 15 is the Power LED and is Green only (not tri-color).

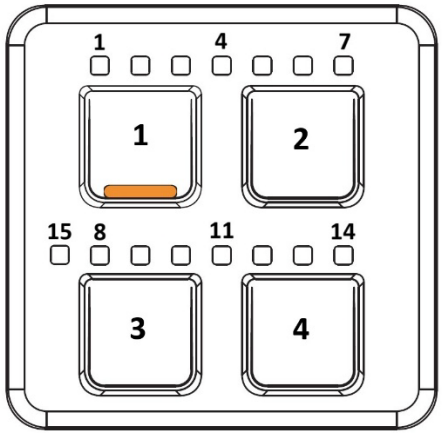


CL-6022 (2x2) Dimensional Drawings:

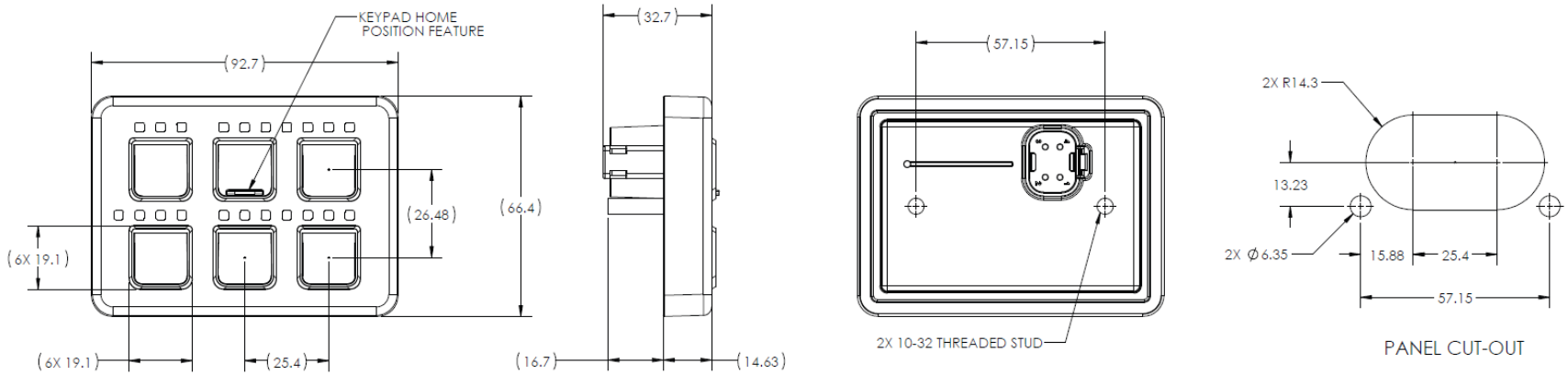


CL-6022 (2x2) Button and LED Indicator Numbering Drawing:

Note: LED number 15 is the Power LED and is Green only (not tri-color)..

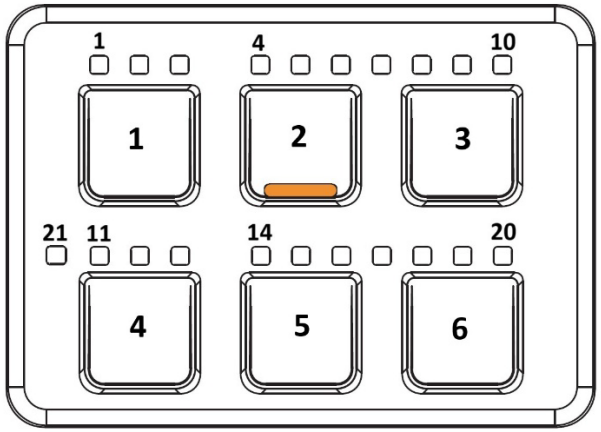


CL-6023 (2x3) Dimensional Drawings:

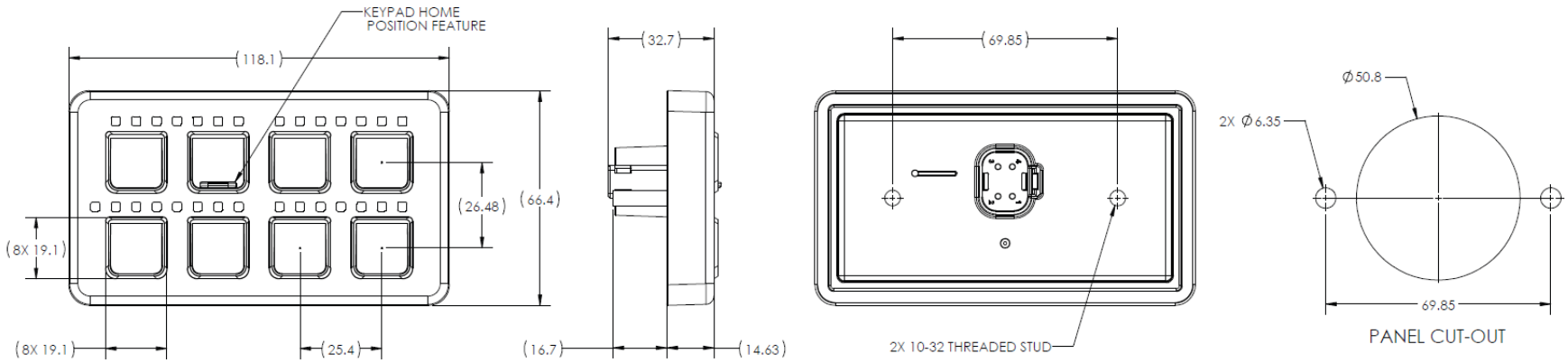


CL-6023 (2x3) Button and LED Indicator Numbering Drawing:

Note: LED number 21 is the Power LED and is Green only (not tri-color).

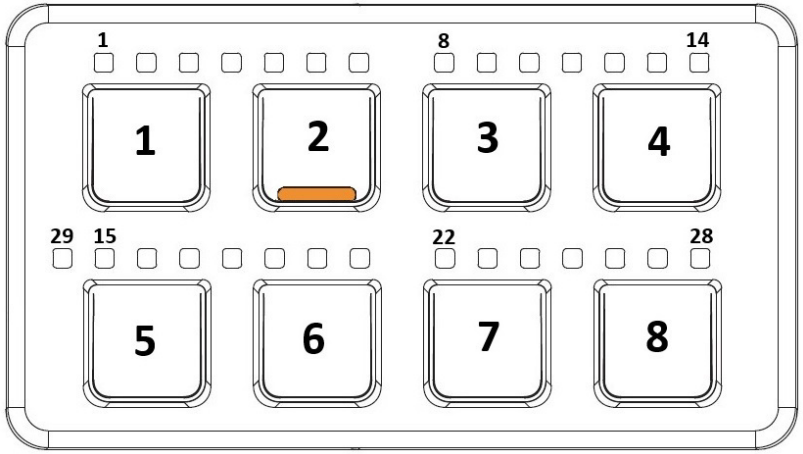


CL-6024 (2x4) Dimensional Drawings:

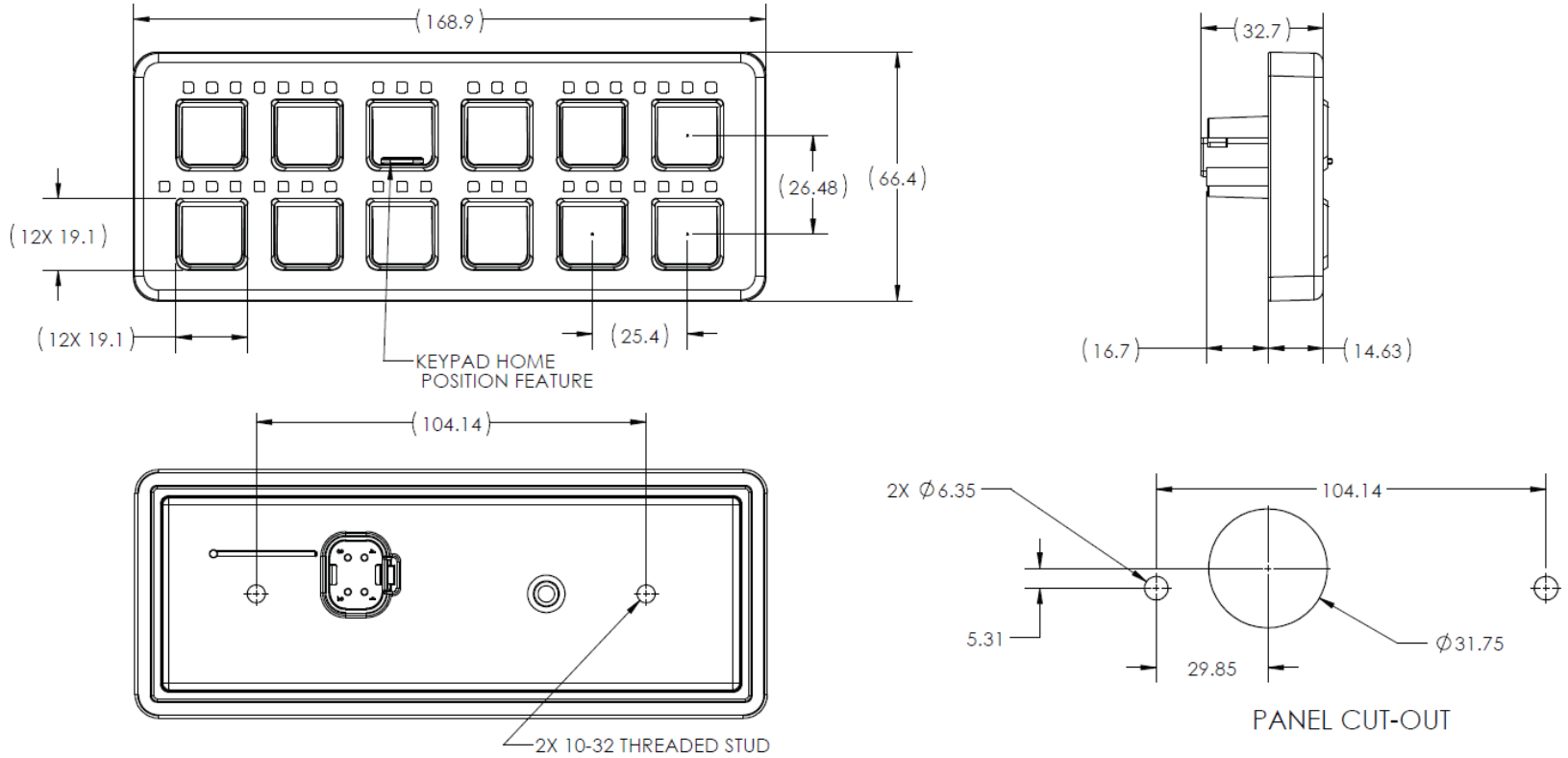


CL-6024 (2x4) Button and LED Indicator Numbering Drawing:

Note: LED number 29 is the Power LED and is Green only (not tri-color).

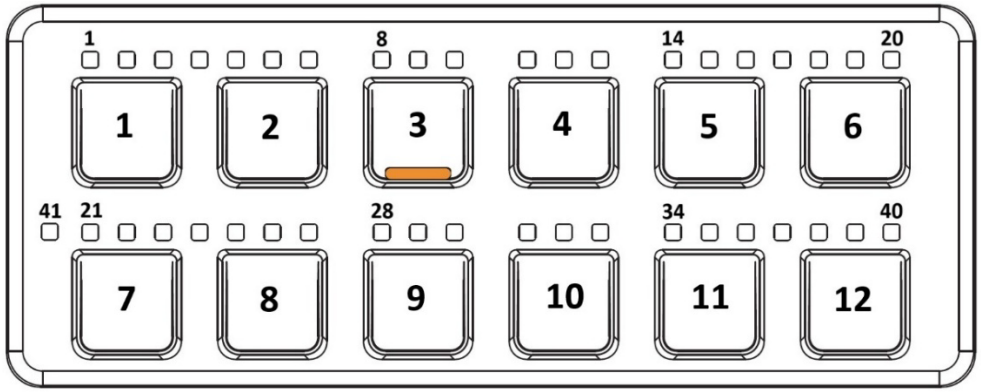


CL-6026 (2x6) Dimensional Drawings:

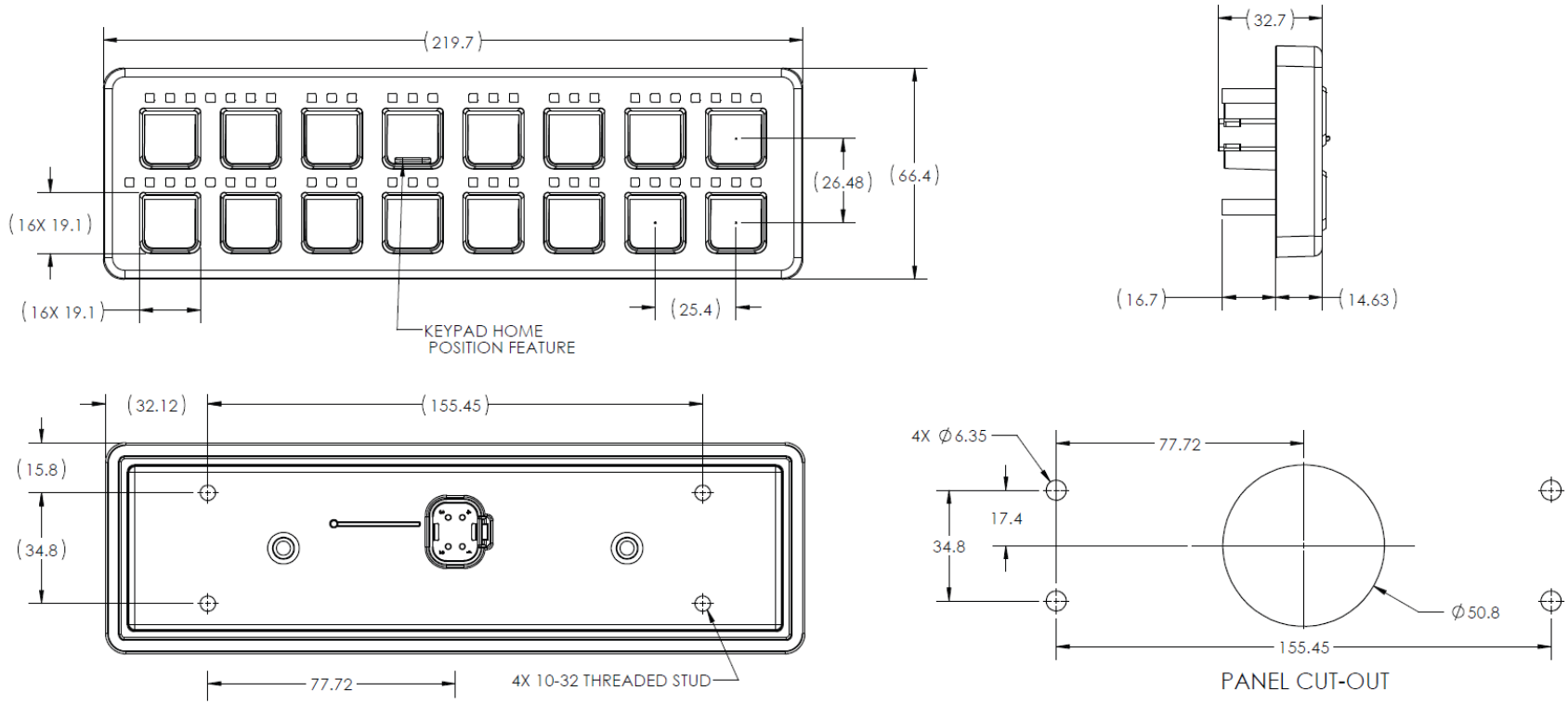


CL-6026 (2x6) Button and LED Indicator Numbering Drawing:

Note: LED number 41 is the Power LED and is Green only (not tri-color).

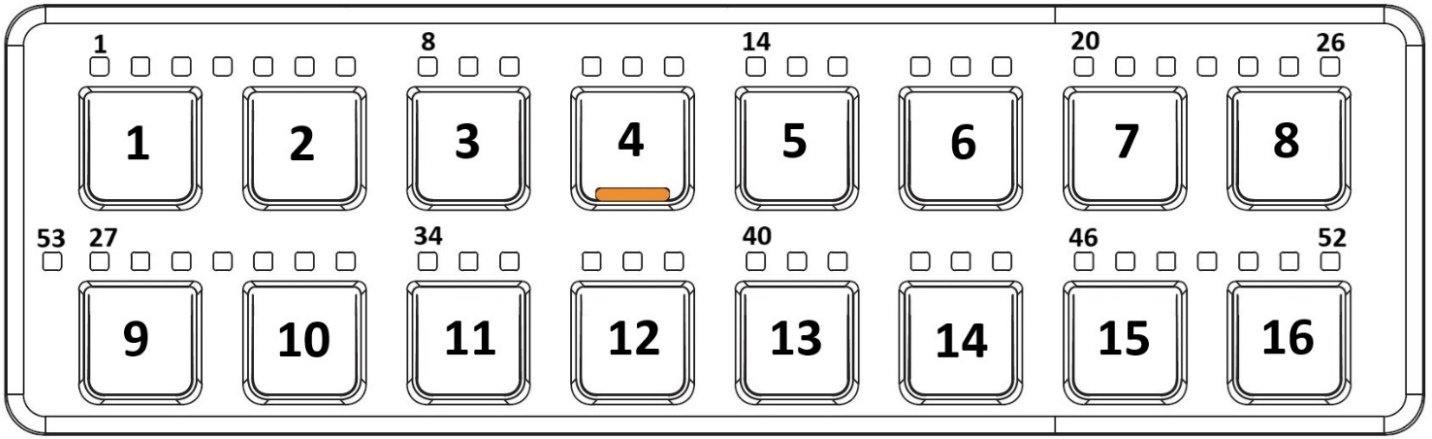


CL-6028 (2x8) Dimensional Drawings:

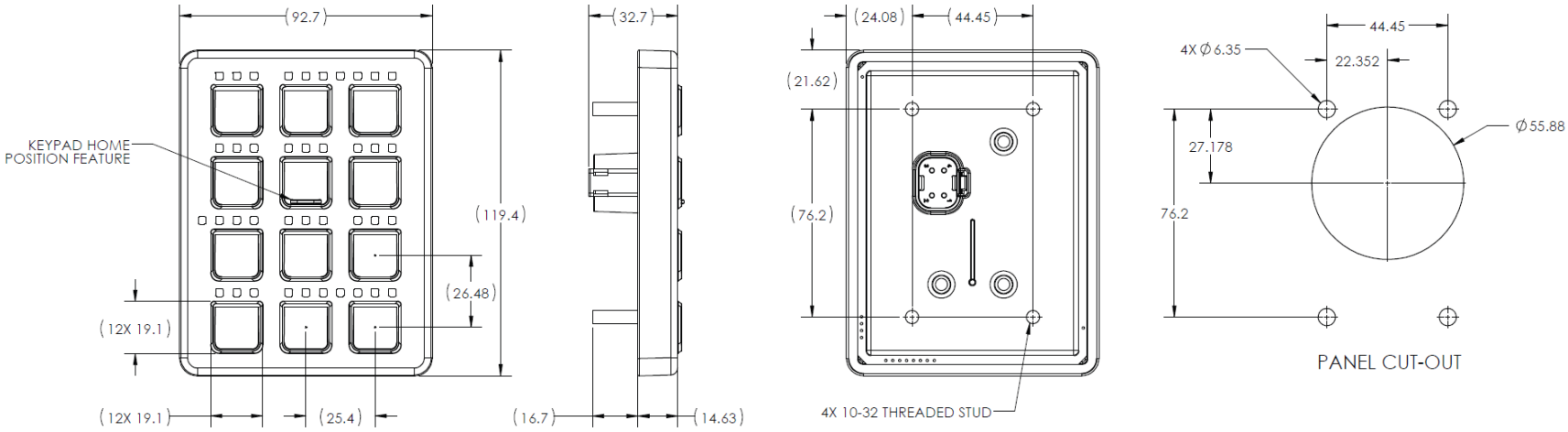


CL-6028 (2x8) Button and LED Indicator Numbering Drawing:

Note: LED number 53 is the Power LED and is Green only (not tri-color).

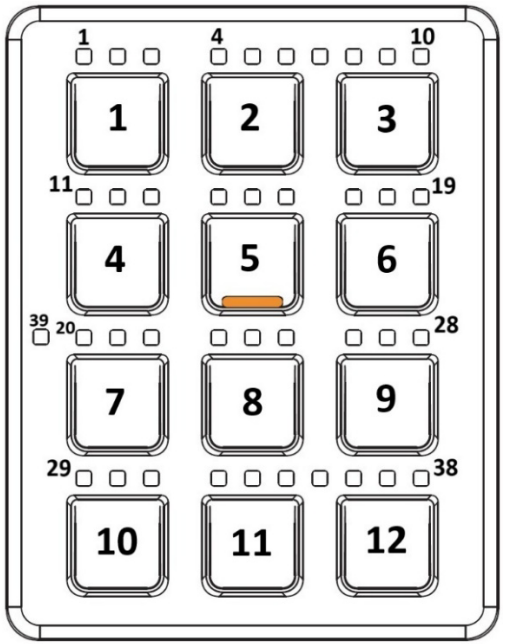


CL-6043 (4x3) Dimensional Drawings:



CL-6043 (4x3) Button and LED Indicator Numbering Drawing:

Note: LED number 39 is the Power LED and is Green only (not tri-color).



GENERAL GUIDELINES AND COMPLIANCE

FCC COMPLIANCE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This device contains the following FCC compliant module(s):

Device	Specification	ID
CL-6000	FCC 15B 15.109	NA
	ANSI C63.4:2014	

ISED COMPLIANCE (Formally IC Compliance)

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This device contains the following IC compliant module(s):

Device	Specification	ID
CL-6000	ISED ICES-003, Section 3.2.2	NA
	ANSI C63.4:2014	

EU / CE COMPLIANCE

Directives	Harmonized Standards
2014/30/EU (Electromagnetic Compatibility)	• EN 14982:2009 Agriculture and forestry machines – Electromagnetic compatibility – Test methods and acceptance criteria • EN 13309:2010 Construction machinery Electromagnetic compatibility of machines with internal electrical power supply • EN 50498:2010 Electromagnetic compatibility (EMC) — Product family standard for aftermarket electronic equipment in vehicles • ISO 13766:2006 Earth-moving machinery – Electromagnetic compatibility.
2011/65/EU (RoHS)	EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substance.

OTHER INFORMATION

Standard Warranty

Please see HED, Inc.'s standard warranty on our website at: https://hedcontrols.com/standard-warranty/