

HED J1939 Module and Keypad Communication Specification

Version: 24

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Version Control

REVISION CONTROL			
Version	Date	Author	Description
12	May 15, 2015	R. Farrell	Conversion from excel to word format Added PWM Freq Configuration Message Added Output Diagnostic Messages
13	June 14, 2017	T. Honegger	Added disabled option to input/output type configuration messages
14	March 22, 2018	T. Honegger	Added option to change the configuration messaging source address
15	August 02, 2018	T. Honegger	Added messaging to query LED output status
16	February 25, 2019	T. Honegger	Updated input and output type selected response messages
17	November 04, 2020	T. Honegger	Added Output Current Messages Added Tx Rate support for Encoder inputs Added Config Clone Function
18	September 27, 2021	T. Honegger	Added enable/disable option for analog input messaging
19	February 01, 2022	T. Honegger	Added Output Out of Tolerance state to the Output Diagnostic State enumeration for S32K architecture; Added note regarding states required for valid output diagnostic reporting; Added note regarding CANLink protocol support under the S32K architecture; Added CL-455 as a supported module
20	March 30, 2023	T. Honegger	Added autobaud option to the baud rate configuration message; Updated supported modules table
21	August 24, 2023	A. Boley	Updated Initialization Configuration Message (0xE8) to allow device response PGN configuration.
22	December 11, 2023	A. Boley	Added ECC Flyback Control, which allows control over Flyback A, B, and C. Function will auto configure the pin to Constant Current Output if the new message is received.
23	October 8, 2024	H. Fritchen	Added new keypad backlight default control in 0xE8 message. - Function will control default backlight behavior on power up, all on or off. Added new DPU functionality controlled in 0xF2 message. - Function will control DPU pins to be all on, off or toggle.
24	January 21, 2025	R. Farrell	Update Backlight and LED Intensity Control (Message Description: 0x80) to include Night Mode intensity settings Added Tri-Color LED Default Color Configuration (Message Description: 0xB0) Added Tri-Color LED Running Color Setting (Message Description: 0xB1) Added Night Mode CAN Configuration (Message Description: 0xB2)
24	Feb 11, 2025	R. Farrell	Added Device Serial Number Request (Message Description: 0xB3) Added Device Serial Number Response
24	April 10, 2025	R. Farrell	Update to Tri-Color LED Default Color Configuration (Message Description: 0xB0) Update to Tri-Color LED Running Color Setting (Message Description: 0xB1) Note messages not supported by Next Gen (CL-6xxx) keypads
24	April 20, 2025	R. Farrell	Updated appendices for CL-6000 series keypads
24	April 22, 2025	R. Farrell	Update 6000 series keypads to have same Backlight and LED numbering as 600 series for Digital Output Added UDS notes for addressing

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Abstract

This document details the HED J1939 compliant protocol for control of I/O modules and keypads.

Protocol Message Identifiers

This section details the HED J1939 compliant protocol CAN message identifiers in use for configuring the device and sent by the device.

Configuration Message Identifier Sent TO the HED Device

All messages sent to a given device for configuration have the same identifier format. The priority section can be any 5-bit value other than 0x01, the PGN is a Point-to-Point PGN of 0xEFXX where the XX is the Node ID of the device receiving the configuration message (default Node ID is 0x80). The final byte of the configuration message identifier is the configuration source address (default is 0xF9).

Configuration Message to CL-xxx Identifier Description																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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Priority: Any 5-bit value except 0x01 (Default is 0x00)

Point to Point: 0xEF

Node ID: Node ID of the keypad being configured (Default is 0x80)

Configuration: Configurable source address (Default is 0xF9)

Data Message Identifier Sent FROM the HED Device

CAN messages sent by the HED device are configurable; however, the source address is always the Node ID of the device.

CL-xxx Transmitted Message Identifier Description																			
Priority					PGN										Module ID				
2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
18					FF02										80				
Example default setting Button Message with Node ID = 0x80																			

Priority: Configuration defined; default is 0x18

PGN: Configuration defined; default is 0xFF02 (Keypad buttons) and 0xFF03 (Digital Inputs)

Module ID: Configuration defined Node ID of the keypad transmitting message; default is 0x80)

Software Updates

The 6000 series keypads utilize UDS for software updates. The process is kicked off by sending a Standard identifier message that is adjusted by the Keypads Node ID. As UDS only supports an address range of 0x00 to 0x7F and J1939 Node IDs are 0x00 to 0xFF, the UDS ID is a modified version of the J1939 Node ID.

$$UDS\ Node\ ID = J1939\ Node\ ID / 2$$

So, for the default Node ID of 0x80, the UDS ID would be 0x40. Which is the same UDS ID for a Node ID of 0x81.

When architecting your system with 6000 series keypads and 4000 series modules, take this into account when assigning addresses so that you do not have multiple devices at the same UDS address.

Configuration Messages

Configuration messages utilize PGN 0xEFXX where the XX is the Node ID of the device being configured. All configuration messages will utilize the same source address. The address default value is 0xF9, but may be configured by the user via the Device Node ID Change message. The first byte of the configuration message is the **Message Description** and defines the purpose of the message. Additionally, many configuration messages also require byte 7 to be 0x55 and byte 8 to be 0xAA.

Incorrect message descriptions or missing configuration values from the last 2 bytes will cause the message to be ignored by the device.

Unless otherwise noted, changes to the device's configuration are saved on receiving the configuration message that changes a setting. Power loss during this save can result in the device being restored to factory defaults. Furthermore, the number of configuration changes for a given setting is limited to 10,000 changes due to the nature of the nonvolatile memory. Finally, saving configuration changes can result in the device being nonresponsive for up to 250 ms (typically less), so changes to the configuration should only occur when the device is in a non-operational state (system start-up or shutdown, etc.).

Input/Output Numbers

Input and output numbers referred to in this document do not correlate to pin number in the module connectors. When configuring/commanding an input/output, be sure to refer to the input/output number and not its pin location.

i.e. The CL-449-100-31 datasheet lists Output #2 on pin #8 of the 12-pin connector. When configuring the output frequency, byte 2 of the message should contain 0x02, not 0x08.

Power-up Configuration Messages

This section details the configuration messages used to specify the initialization and power-up behavior of the device.

Initialization Configuration (Message Description: 0xE8)

This message is used to specify the LED flash pattern (keypads) on power-up as well as enabling the Version Information Message on power-up (all devices).

Updates to the device by this message are saved such that the new setting will remain in use after a power cycle.

Reply ID is used to alter the reply CAN identifiers. If changed from the default value, the reply CAN identifier will be 0xEFYYXX where YY is the Configuration Source Address (default 0xF9) and XX is the Reply ID value.

Initialization Configuration (Message Description: 0xE8)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE8	Backlight Default State / LED Enable	LED Timer		Version Report	Reply ID	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9). If Reply ID is changed from its default The XX in the identifier becomes the current Source Address (Default 0xF9). The YY in the identifier becomes the current Reply ID of the Target Device.									

Data Description		
Byte	Range	Description
1	0xE8	Initialization Configuration Message Description Value
2.1 – 2.4	Lower Nibble 0x00 – 0x01, 0x0F	Enables or disables the flashing of LEDs on Power-up (Keypads only) 0 for Disable 1 for Enable (default) All other values result in no change
2.5 – 2.8	Upper Nibble 0x00 – 0x01, 0x0F	Enables or disables button backlights on Power-up. 0 for Disable 1 for Enable (default) All other values result in no change
3 (LSB) – 4 (MSB)	0x0000-0xFFFF	LED Initialization Timer - Sets the amount of time the Keypad LEDs flash on power-up. Resolution is 10 ms per bit. Value of 0xFFFF is no change. Default is 0x64 (1 s)
5	0x00 – 0x01, 0xFF	Enables or Disables sending of the Device Version Information Message during power-up 0 for Disable 1 for Enable (default) All other values result in no change
6	0x00 - 0xFF	The Reply ID of the current device – if changed from the default, it will change the CAN-ID format. Default Value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

CAN Communication Configuration Messages

This section details the configuration messages related to CAN communication: setting the device Node ID; CAN message transmission settings; device heartbeat messages, etc.

Unless otherwise noted, updates to the device by these messages are saved such that the new setting will remain in use after a power cycle.

Device Node ID Change (Message Description: 0xE0)

This message is sent to the device to change the Node ID of that device.

NOTE: For the 6000 series keypads, the Node ID divided by 2 is the UDS ID for programming firmware. So, for the default Node ID of 0x80, the UDS programming ID will be 0x40. It is recommended that Node IDs for 6000 series Keypads are always different by 2 to allow programming in the system. See the [Software Updates](#) section.

Device Node ID Change (Message Description: 0xE0)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE0	New Node ID	0xFF	0xFF	New CSA	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE0	Node ID Change Message Description Value
2	0x00 – 0xFB	The new Node ID for the target device Default Value is 0x80
3 – 4	0xFF	Locations are currently unused, set to don't care value of 0xFF
5	0x00 – 0xFB	The new Configuration Source Address for the device Default Value is 0xF9
6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Button Transmission ID PGN Change (Message Description: 0xE1)

This message is sent to the keypad to change the PGN of the CAN message the device uses to report keypad button status.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx PGN Change (Message Description: 0xE1)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE1	New Button Tx PGN	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE1	Button Tx PGN Change Message Description Value
2 (LSB) – 3 (MSB)	0x00 – 0xFFFF	The new PGN for the keypad to transmit button press status. Default Value is 0xFF02
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Button Transmission ID Priority Change (Message Description: 0xE2)

This message is sent to the device to change the Priority of the CAN message the device uses to report keypad button status.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx Priority Change (Message Description: 0xE2)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE2	New Priority	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE2	Button Tx Priority Change Message Description Value
2	0x00 – 0x1F	The new Priority for the keypad to transmit button press status. Default Value is 0x18
3 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Button Tx Rate / Event Change (Message Description: 0xE3)

This message is sent to the keypad to configure the button press Transmission Rate and Event State.

A Tx Rate of 0 will prevent any time-based transmission of this message; however transmission will still occur based on the Event State setting.

Available Event States are “transmission rate only” or “transmission rate and on button state change”.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx Rate / Event Change (Message Description: 0xE3)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE3	Tx Rate	Button Event	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE3	Button Tx Rate / Event Change Message Description Value
2	0x00 – 0xFF	New Tx Rate for button press CAN message, used after the next message. Resolution is 10 ms per bit. Value of 0xFF is no change. Default Value is 0x0A (100 ms)
3	0x00 or 0x01	Sets the Event State for the button press message transmission. 0 - on Tx Rate only 1 - Transmits on change of button state and/or the Tx timer Note: The Tx timer is reset when the Button Status message is sent on a change of state. All other values result in no change. Default Value is 0x01
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Input Transmission ID PGN Change (Message Description: 0xE4)

This message is sent to the device to change the PGN of the CAN message the device uses to report input values.

Input Tx PGN Change (Message Description: 0xE1)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE4	New Input Tx PGN	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE4	Input Tx PGN Change Message Description Value
2 (LSB) – 3 (MSB)	0x00 – 0xFFFF	The new PGN for the device to transmit input values. Default Value is 0xFF03
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Input Transmission ID Priority Change (Message Description: 0xE5)

This message is sent to the device to change the Priority of the CAN message the device uses to report input values.

Input Tx Priority Change (Message Description: 0xE2)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE5	New Priority	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE5	Input Tx Priority Change Message Description Value
2	0x00 – 0x1F	The new Priority for the device to transmit input values. Default Value is 0x18
3 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Input Tx Rate / Event Change (Message Description: 0xE6)

This message is sent to the device to configure the input value Transmission Rate and Event State.

A Tx Rate of 0 will prevent any time-based transmission of this message; however transmission will still occur based on the Event State setting.

Available Event States are “transmission rate only” or “transmission rate and on digital input change”.

Input Tx Rate / Event Change (Message Description: 0xE6)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE6	Tx Rate	Input Event	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE6	Input Value Tx Rate / Event Change Message Description Value
2	0x00 – 0xFF	New Tx Rate for input value CAN message, used after the next message. Resolution is 10 ms per bit. Value of 0xFF is no change. Default Value is 0x0A (100 ms)
3	0x00 or 0x01	Sets the Event State for the input value message transmission. 0 - on Tx Rate only 1 - Transmits on change of digital input value and/or the Tx timer Note: The Tx timer is reset when the Input Value message is sent on a change of state All other values result in no change. Default Value is 0x01
4	0x00 or 0x01	Enables or disables transmission of analog input messages. 0 - Disabled 1 - Enabled Default Value is 0x01 (Enabled)
5 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Heartbeat Configuration Change (Message Description: 0xE9)

This is used to define a heartbeat message that the device will receive to determine that CAN communication is active - in the event of a time out, outputs will turn off (all devices) and the LED states will flash as defined by the initialization state (keypads).

The Heartbeat CAN Message ID is a 29-bit identifier constructed by: Heartbeat Priority (defined in this message); Heartbeat PGN (defined in this message); Device Node ID.

As an example, if Heartbeat Priority = 0x0C; Heartbeat PGN 0xEFFF; Node ID = 0x80; then the ID would be 0x0CEFFF80.

Heartbeat Configuration (Message Description: 0xE9)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE9	Priority	Heartbeat PGN		Timeout Length		0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE9	Heartbeat Configuration Message Description Value
2	0x00 – 0x1F	Priority used by the Device for the incoming Heartbeat Rx. 0xFF to disable Heartbeat feature Default Value is 0xFF
3 (LSB) – 4 (MSB)	0x0000 – 0xFFFF	PGN used by the Device for the incoming Heartbeat Rx.
5 (LSB) – 6 (MSB)	0x0000 – 0xFFFF	Maximum amount of time between receiving the heartbeat message before the device goes into communication failure. Resolution is 10 ms per bit. Default is 25 (250 ms)
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Device Version Information Request (Message Description: 0xEA)

This message is used to request the Device Version Information CAN message detailing the device's firmware version, J1939 Protocol software version, and supported J1939 protocol specification version.

As this is a query-response message, nothing is saved by the device on receiving this message.

Device Version Information Request (Message Description: 0xEA)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xEA	0xFF	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xEA	Device Version Information Request Message Description Value
2 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Device Serial Number Request (Message Description: 0xB3)

This message is used to request the Device Serial Number CAN message response.

As this is a query-response message, nothing is saved by the device on receiving this message.

Device Version Information Request (Message Description: 0xEA)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xB3	0xFF	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xB3	Device Serial Number Request Message Description Value
2 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

CAN Baud Rate Configuration (Message Description: 0xEB)

This message is used to change the device's CAN Baud Rate on the specified CAN line.

For systems where the baud rate of the CAN bus may vary, the Autobaud option may be selected. In Autobaud, the module will boot in a "listen only" mode until a CAN message is detected on the bus. The module will then lock in on the baud rate being used and begin normal operation. This is the default setting for devices at specification Revision 20 and later.

HED programming and diagnostic tools (Orchestra® and Conductor®) require CAN communication at 250Kbs to function.

CAN Baud Rate Configuration (Message Description: 0xEA)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xEB	CAN Line Select	New CAN Baud Rate	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xEB	CAN Baud Rate Configuration Message Description Value
2	0x00-0xFF	Device CAN Line Selection – refer to specific device datasheet for number of CAN lines. Unavailable CAN lines are handled as "No Change". 0x00 – No Change 0x01 – CAN Line 1 0x02 – CAN Line 2 0x03 – CAN Line 3... 0xFF – No Change
3	0x02-0x07, 0xF0, 0xFF	New CAN baud rate for the selected CAN line 0x00 to 0x01 - No Change

		0x02 - 20K 0x03 - 50K 0x04 - 100K 0x05 - 125K 0x06 - 250K 0x07 - 500K 0x08 to 0xEF - No Change 0xF0 – Autobaud (Default) 0xF1 to 0xFF - No Change Default Value is 0xF0 (Autobaud)
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Enable CANLink® Communication Protocol (Message Description: 0xFD)

This message is used to enable the HED CANLink® Protocol. Once enabled the device can be programmed over CAN or connected to Conductor® (the Orchestra® Diagnostic Tool).

This setting is **NOT** saved, the CANLink® Protocol is disabled on a power cycle.

NOTE: Due to the change in programming tools, this CAN message is not required for 6000 series keypads.

Enable CANLink® (Message Description: 0xFD)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xFD	CAN Line Select	CANLink® Status	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xFD	Enable CANLink® Message Description Value
2	0x00-0xFF	Device CAN Line Selection – refer to specific device datasheet for number of CAN lines. Unavailable CAN lines are handled as “No Change”. 0x00 – No Change 0x01 – CAN Line 1 0x02 – CAN Line 2 0x03 – CAN Line 3... 0xFE - Set ALL CAN Lines to CANLink® status in Byte 3 0xFF - Undefined, reserved for future use (no change)
3	0x00, 0x01, 0xFF	CANLink® Enable Status: 0x00 - Disables CANLink® 0x01 - Enables CANLink® 0x02 to 0xFF - Undefined, reserved for future use (no change) Default Value is 0x00
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Note: The CANLink® communications protocol is not supported under the S32K architecture.

Configuration Clone Trace (Message Description: 0xFE)

This message is used to trigger a series of messages that can be recorded and then played back to clone the current module configuration on subsequent modules. The Configuration Clone Trace may be triggered once per power cycle of the module. During the broadcast of the clone messages, the standard functionality of the module is disabled and will be restored upon completion of the trace. To facilitate easily locating the config messages within the normal module status messages, the configuration trace will be encapsulated by two messages with a payload of 0xFF for all eight bytes. **It is strongly recommended that this functionality only be used on the bench in a lab setting and not on an operational vehicle or system.**

The resulting configuration messages assume the module receiving the cloned configuration will start with the default Node ID (0x80) and Configuration Source Address (0xF9).

NOTE: This feature is currently not available on 6000 series keypads.

Configuration Clone Trace (Message Description: 0xFE)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xFE	0x00	0x00	0x00	0x00	0x00	0x00	0x00
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Input Configuration Messages

This section details the configuration messages related to device inputs such as selecting the input type.

Related Messages

The following messages are related to input data:

1. Button Transmission ID PGN Change (Message Description: 0xE1)
2. Button Transmission ID Priority Change (Message Description: 0xE2)
3. Button Tx Rate / Event Change (Message Description: 0xE3)
4. Input Transmission ID PGN Change (Message Description: 0xE4)
5. Input Transmission ID Priority Change (Message Description: 0xE5)
6. Input Tx Rate / Event Change (Message Description: 0xE6)
7. Keypad Button Press State
8. Input Data Message
9. Input Type Selected Response (Message Description: 0xE7)

Input Type Configuration (Message Description: 0xE7)

This message is used to configure the input type for a given input. Multiple inputs can be configured at once; although, they are arranged in sequential groups of 8 inputs.

Input Group values range from 0x00 to 0x12 (maximum supported number of inputs is 152).

Adding 0x80 to a given group number will trigger the device to send a response detailing the current configurations for that input group. The identifier of the response is 0x01EFxxF9 where xx is the device Node ID.

Reference the device datasheet to know what input types are available for a given input.

Software configurable pins that share input and output function will have their output function disabled if the input is configured as anything other than disabled.

NOTE: The only input on the 6000 series keypads is system voltage, as such this CAN message is not supported by those keypads.

Input Type Configuration (Message Description: 0xE7)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xE7	Input Group	Group Input 1 and 2	Group Input 3 and 4	Group Input 5 and 6	Group Input 7 and 8	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9). If Reply ID is set in Initialization Configuration (Message Description: 0xE8) The XX in the identifier becomes the current Source Address (Default 0xF9). The YY in the identifier becomes the current Reply ID of the Target Device.									
Data Description									
Byte	Range		Description						

1	0xE7	Input Type Configuration Message Description Value
2	0xFF	Selects the input group being configured OR the input group that current input type is being requested. 0x00 to 0x12 - Input Group being configured. 0x80 - 0x92 (Value - 0x80) for input group configuration request - module will respond with CAN message 0x01EFxxF9 where the values are the currently selected input types
3.1 – 3.4	0x0-0xF	Input (1 + Group*8) Input Type Selection 0 (0000) for Switch to Battery (STB) 1 (0001) for Switch to Ground (STG) 2 (0010) for Voltage to Digital (VTD) 3 (0011) for Resistance to Digital (RTD) 4 (0100) for Frequency (Hz) 5 (0101) for Pulse Width Modulation (PWM - duty cycle) 6 (0110) for Counter 7 (0111) for Encoder 8 (1000) for Current to Digital (CTD) 9 (1001) for 4-20mA 10 (1010) Reserved for Future Use (no change) 11 (1011) Reserved for Future Use (no change) 12 (1100) Reserved for Future Use (no change) 13 (1101) Reserved for Future Use (no change) 14 (1110) for Disabled 15 (1111) Reserved for Future Use (no change) Default Value is 0x0 (STB) or 0x1 (STG) or 0x2 (VTD) based on availability
3.5 – 3.8	0x0-0xF	Input (2 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
4.1 – 4.4	0x0-0xF	Input (3 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
4.5 – 4.8	0x0-0xF	Input (4 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
5.1 – 5.4	0x0-0xF	Input (5 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
5.5 – 5.8	0x0-0xF	Input (6 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
6.1 – 6.4	0x0-0xF	Input (7 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
6.5 – 6.8	0x0-0xF	Input (8 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Input Group example: If the selected input group is 0x02, then the inputs that can be configured by the message are inputs 17 through 24:

Byte 3.1-3.4: Input 17

Byte 5.1-5.4: Input 21

Byte 3.5-3.8: Input 18

Byte 5.5-5.8: Input 22

Byte 4.1-4.4: Input 19

Byte 6.1-6.4: Input 23

Byte 4.5-4.8: Input 20

Byte 6.5-6.8: Input 24

Output Configuration Messages

This section details the configuration messages related to device outputs such as selecting the output type.

Related Messages

The following messages are related to output data:

1. Indicator (LED) Control (Message Description: 0x01 – 0x20)
2. Backlight and LED Intensity Control (Message Description: 0x80)
3. Digital Output Command (Message Description: 0xED)
4. Analog Output Command (Message Description: 0xEE)
5. Output Flash Command (Message Description: 0xEF)

Output Type Configuration (Message Description: 0xEC)

This message is used to configure the output type for a given output. Multiple outputs can be configured at once; although, they are arranged in sequential groups of 8 outputs.

Output Group values range from 0x00 to 0x11 (maximum supported number of Outputs is 144).

Adding 0x80 to a given group number will trigger the device to send a response detailing the current configurations for that output group. The identifier of the response is 0x01EFxxF9 where xx is the device Node ID.

Reference the device datasheet to know what output types are available for a given output.

Software configurable pins that share input and output function will have their input function disabled if the output is configured as anything other than disabled.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Type Configuration (Message Description: 0xEC)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xEC	Output Group	Group Output 1 and 2	Group Output 3 and 4	Group Output 5 and 6	Group Output 7 and 8	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9). If Reply ID is set in Initialization Configuration (Message Description: 0xE8) The XX in the identifier becomes the current Source Address (Default 0xF9). The YY in the identifier becomes the current Reply ID of the Target Device.									

Data Description		
Byte	Range	Description
1	0xEC	Output Type Configuration Message Description Value
2	0xFF	Selects the output group being configured OR the output group that current output type is being requested. 0x00 to 0x11 - Output Group being configured. 0x80 - 0x91 (Value - 0x80) for output group configuration request - module will respond with CAN message 0x01EFxxF9 where the values are the currently selected output types
3.1 – 3.4	0x0-0xF	Output (1 + Group*8) Output Type Selection 0 (0000) for Digital 1 (0001) for Pulse Width Modulation (PWM) 2 (0010) for Constant Current (CC) 3 (0011) for Single Servo 4 (0100) for Double Servo 5 (0101) for Frequency 6 (0110) for Constant Current Single Servo 7 (0111) for Constant Current Double Servo 8 (1000) for PVG 9 (1001) for Reserved for Future Use (no change) 10 (1010) Reserved for Future Use (no change) 11 (1011) Reserved for Future Use (no change) 12 (1100) Reserved for Future Use (no change) 13 (1101) Reserved for Future Use (no change) 14 (1110) for Disabled 15 (1111) Reserved for Future Use (no change) Default Value is 0x1 (Digital)

3.5 – 3.8	0x0-0xF	Output (2 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
4.1 – 4.4	0x0-0xF	Output (3 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
4.5 – 4.8	0x0-0xF	Output (4 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
5.1 – 5.4	0x0-0xF	Output (5 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
5.5 – 5.8	0x0-0xF	Output (6 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
6.1 – 6.4	0x0-0xF	Output (7 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
6.5 – 6.8	0x0-0xF	Output (8 + Group*8) Input Type Selection (see Bytes 3.1-3.4 for value definitions)
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Group example: If the selected output group is 0x02, then the outputs that can be configured by the message are outputs 17 through 24.

Byte 3.1-3.4: Output 17

Byte 5.1-5.4: Output 21

Byte 3.5-3.8: Output 18

Byte 5.5-5.8: Output 22

Byte 4.1-4.4: Output 19

Byte 6.1-6.4: Output 23

Byte 4.5-4.8: Output 20

Byte 6.5-6.8: Output 24

Output Diagnostics Transmission ID PGN Change (Message Description: 0xF0)

This message is sent to the device to change the PGN of the CAN message the device uses to report output diagnostic values.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Diagnostic Tx PGN Change (Message Description: 0xF0)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF0	New Output Diagnostic Tx PGN		0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF0	Output Diagnostic Tx PGN Change Message Description Value
2 (LSB) – 3 (MSB)	0x0000 – 0xFFFF	The new PGN for the device to transmit output diagnostic values. Default Value is 0xFF04
4-6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Diagnostics Transmission ID Priority Change (Message Description: 0xF1)

This message is sent to the device to change the Priority of the CAN message the device uses to report output diagnostic values.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Diagnostic Tx Priority Change (Message Description: 0xF1)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF1	New Priority	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF1	Output Diagnostic Tx Priority Change Message Description Value
2	0x00 – 0x1F	The new Priority for the device to transmit output diagnostic values. Default Value is 0x18
3-6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Diagnostics Tx Rate / Event Change (Message Description: 0xF2)

This message is sent to the device to configure the output diagnostic value Transmission Rate and Event State.

A Tx Rate of 0 will prevent any time-based transmission of this message; however transmission will still occur based on the Event State setting.

Available Event States are “transmission rate only” or “transmission rate and on diagnostic status change”.

***DPU is the diagnostic pull up which allows the diagnostic reporting on the output pins by outputting a diagnostic voltage.

- Setting the DPU on enables diagnostic reporting and there will be a voltage on the pin even when the output is off.
- Setting the DPU off disables the diagnostic reporting and will also remove the diagnostic voltage from the output.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Diagnostic Tx Rate / Event Change (Message Description: 0xF2)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF2	Tx Rate	Diagnostic Event	DPU Mode	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF2	Output Diagnostic Tx Rate / Event Change Message Description Value
2	0x00 – 0xFF	New Tx Rate for output diagnostic value CAN message, used after the next message. Resolution is 10 ms per bit. Value of 0xFF is no change. Default Value is 0x32 (500 ms)
3	0x00 or 0x01	Sets the Event State for the output diagnostic value message transmission. 0 - on Tx Rate only 1 - Transmits on change of output diagnostic value and/or the Tx timer Note: The Tx timer is reset when the Output Diagnostic Status message is sent on a change of state All other values result in no change. Default Value is 0x1
4	0x01 – 0x03, 0xFF	Sets the default mode for the DPU*** 1 – All On 2 – All Off 3 – Toggle/Periodic All other values are ignored / result in no change. Default Value is 0x01
5-6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Diagnostics Enable Status Configuration (Message Description: 0xF3)

This message is used to enable and disable the sending of the output status for a given output.

By default, all outputs have this enabled.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Diagnostic Enable Status Configuration (Message Description: 0xF3)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF3	Output Group	Status for Outputs 1 to 4	Status for Outputs 5 to 8	Status for Outputs 9 to 12	Status for Outputs 13 to 16	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9). If Reply ID is set in Initialization Configuration (Message Description: 0xE8) The XX in the identifier becomes the current Source Address (Default 0xF9). The YY in the identifier becomes the current Reply ID of the Target Device.									

Data Description		
Byte	Range	Description
1	0xF3	Output Diagnostic Status Enable Configuration Message Description Value
2	0x00 – 0x08, 0x80 – 0x88, 0xFF	Selects the output group being configured OR the output group that current output diagnostic reporting is being requested. 0x00 to 0x08 - Output Group being configured. 0x80 - 0x88 (Value - 0x80) for output group configuration request - module will respond with CAN message 0x01EFxxF9 where the values are the current output diagnostic enable statuses
3.1-3.2	0x0-0x3	Output (1 + Group*16) Output Type Selection 0 for Disable 1 for Enable 2 Reserved for Future Use (no change) 3 No change Default Value is 0x1 (Enabled)
3.3-3.4	0x0-0x3	Output (2 + Group*16) Output Type Selection
3.5-3.6	0x0-0x3	Output (3 + Group*16) Output Type Selection
3.7-3.8	0x0-0x3	Output (4 + Group*16) Output Type Selection
4.1-4.2	0x0-0x3	Output (5 + Group*16) Output Type Selection
4.3-4.4	0x0-0x3	Output (6 + Group*16) Output Type Selection
4.5-4.6	0x0-0x3	Output (7 + Group*16) Output Type Selection
4.7-4.8	0x0-0x3	Output (8 + Group*16) Output Type Selection
5.1-5.2	0x0-0x3	Output (9 + Group*16) Output Type Selection
5.3-5.4	0x0-0x3	Output (10 + Group*16) Output Type Selection
5.5-5.6	0x0-0x3	Output (11 + Group*16) Output Type Selection
5.7-5.8	0x0-0x3	Output (12 + Group*16) Output Type Selection
6.1-6.2	0x0-0x3	Output (13 + Group*16) Output Type Selection
6.3-6.4	0x0-0x3	Output (14 + Group*16) Output Type Selection
6.5-6.6	0x0-0x3	Output (15 + Group*16) Output Type Selection
6.7-6.8	0x0-0x3	Output (16 + Group*16) Output Type Selection
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Group example: If the selected output group is 0x01, then the outputs that can be configured by the message are outputs 17 through 32.

Byte 3.1-3.2: Output 17

Byte 3.3-3.4: Output 18

Byte 3.5-3.6: Output 19

Byte 5.3-5.4: Output 26

Byte 3.7-3.8: Output 20

Byte 5.5-5.6: Output 19

Byte 4.1-4.2: Output 21

Byte 5.7-5.8: Output 27

Byte 4.3-4.4: Output 22

Byte 6.1-6.2: Output 28

Byte 4.5-4.6: Output 23

Byte 6.3-6.4: Output 29

Byte 4.7-4.8: Output 24

Byte 6.5-6.6: Output 30

Byte 5.1-5.2: Output 25

Byte 6.7-6.8: Output 31

Output Current ID PGN Change (Message Description: 0xFA)

This message is sent to the device to change the PGN of the CAN message the device uses to report output current.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Current ID PGN Change (Message Description: 0xFA)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xFA	New Output Current PGN	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xFA	Output Current ID PGN Change Message Description Value
2 (LSB) – 3 (MSB)	0x00 – 0xFFFF	The new PGN for the device to transmit Output Current Default Value is 0xFF06
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Current ID Priority Change (Message Description: 0xFB)

This message is sent to the device to change the Priority of the CAN message the device uses to report output current.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Current ID Priority Change (Message Description: 0xFB)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xFB	New Priority	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE2	Output Current ID Priority Change Message Description Value
2	0x00 – 0x1F	The new Priority for the device to transmit Output Current Default Value is 0x18
3 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Current Tx Rate (Message Description: 0xFC)

This message is sent to the device to configure the Output Current Transmission Rate.

A Tx Rate of 0 will prevent any time-based transmission of this message.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Current Tx Rate (Message Description: 0xFC)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xFC	Tx Rate	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xFC	Output Current Tx Rate Message Description Value
2	0x00 – 0xFF	New Tx Rate for Output Current CAN message, used after the next message. Resolution is 10 ms per bit. Value of 0xFF is no change. Default Value is 0x64 (1000 ms)
3 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output PWM Configuration (Message Description: 0xF4)

This message is used to configure the PWM and Frequency characteristics of the selected output. This message applies to the PWM, Frequency, and Current Control output types.

One output per message is configured.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output PWM Configuration (Message Description: 0xF4)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF4	Selected Output	Frequency or Duty Cycle	Slew On	Slew Off	0x55	0xAA	
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF4	Output PWM Configuration Message Description Value
2	0x01-0x90	Selects the output being configured, values greater than the maximum output number for the device results in the message being ignored
3 (LSB) – 4 (MSB)	0x0000-0x2710 (Hz) 0x0000-0x03E8 (%) 0xFFFF	For outputs of the type PWM or Current Control, this value sets the output frequency. Range is 0x0020-0x03E8 (32-1,000 Hz), 1 Hz per bit resolution. Default is 0x64 (100 Hz) For outputs of the type of frequency, this value sets the output duty cycle. Range is 0x0000-0x03E8, 0.1% per bit resolution. Default is 0x1F4 (50%) For all output types, the value of 0xFFFF is no change
5	0x00-0xFF	Slew Rate On setting for the selected output. Resolution is 10 ms per bit. Default is 0 (00 ms) Value of 0xFF is no change
6	0x00-0xFF	Slew Rate Off setting for the selected output. Resolution is 10 ms per bit. Default is 0 (00 ms) Value of 0xFF is no change
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Current Control Configuration (Message Description: 0xF5)

This message is used to configure the closed-loop PI control settings of a Current Control (CC) output.

One output per message is configured.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Current Control Configuration (Message Description: 0xF5)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF5	Selected Output	K0 (P) Gain	K1 (I) Gain	Start Offset	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF5	Output Current Control Configuration Message Description Value
2	0x01-0x90	Selects the output being configured, values greater than the maximum output number for the device results in the message being ignored
3	0x00-0xFF	K0 (Proportional) Gain Setting – determines the aggressiveness of the closed-loop control. Default is 0x64 (100) Value of 0xFF is no change
4	0x00-0xFF	K1 (Integral) Gain Setting – reduces the overshoot of the closed-loop control. Default is 0x0A (10) Value of 0xFF is no change
5	0x00-0xFF	Output Start Offset – this is the starting output duty cycle for the PI closed-loop control. Resolution is 0.1% per bit Default is 0x00 Value of 0xFF is no change
6	0xFF	Location is currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

LED Config Messages

This section details the messages used to configure device LEDs.

LED Status Query (Message Description: 0xF6)

This message is used to query the status of the keypad LED indicators.

This message only applies to HED J1939 compliant keypads.

LED Status Query									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF6	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the configuration source address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF6	LED Status Query Message Description Value
2	0x00 – 0x20	1 st Bank Requested, 0x00 for All
3	0x00 – 0x20, 0xFF	2 nd Bank Requested, 0x00 for All, 0xFF for None
4	0xFF	Locations are currently unused, set to don't care value of 0xFF
5	0x00 – 0x01	Response Type 0x00 – Simple (On/Off) Requests all banks 0x01 – Verbose (On/Off/Flash Rate)
6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

LED Status Query ID PGN Change (Message Description: 0xF7)

This message is sent to the keypad to change the PGN of the CAN message the device uses to report keypad LED status.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx PGN Change (Message Description: 0xE1)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF7	New Button Tx PGN	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF7	LED Status Tx PGN Change Message Description Value
2 (LSB) – 3 (MSB)	0x00 – 0xFFFF	The new PGN for the keypad to transmit LED status. Default Value is 0xFF05
4 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

LED Status Query ID Priority Change (Message Description: 0xF8)

This message is sent to the device to change the Priority of the CAN message the device uses to report keypad LED status.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx Priority Change (Message Description: 0xE2)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF8	New Priority	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF8	LED Status Tx Priority Change Message Description Value
2	0x00 – 0x1F	The new Priority for the keypad to transmit LED status. Default Value is 0x18
3 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

LED Status Query Tx Rate (Message Description: 0xF9)

This message is sent to the keypad to configure the LED Stats Transmission Rate.

A Tx Rate of 0 will prevent any time-based transmission of this message; however transmission will still occur on request.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx Rate / Event Change (Message Description: 0xE3)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xF9	Tx Rate	0xFF	0xFF	0xFF	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xF9	LED Status Tx Rate Message Description Value
2	0x00 – 0xFF	New Tx Rate for button press CAN message, used after the next message. Resolution is 10 ms per bit. Value of 0xFF is no change. Default Value is 0x64 (1000 ms)
3 – 6	0xFF	Locations are currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Tri-Color LED Default Color Configuration (Message Description: 0xB0)

This message is sent to the keypad to configure the default value of the LED color. This value is saved in non-volatile memory so that it is retained through power cycles. This applies to both LEDs over the buttons and the button backlights.

Desired colors are achieved by sending a specific RGB setting. This is done by sending the device percentage values for red, blue, and green. The default setting is white (all three values at 250).

LED numbers are listed in the appendices – they are referenced with the same values as when utilizing the Digital Output message.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx Rate / Event Change (Message Description: 0xE3)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xB0	LED Select	Red	Green	Blue	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xB0	Tri-Color LED Default Color configuration
2	0x01 – 0xFF	Selects the LED being configured, values greater than the maximum LED number for the device results in the message being ignored
3	0x00 – 0xFA, 0xFF	Percentage for the Red driver of the LED. Value is 0 – 250 for 0 – 100% Values greater than 250 are ignored Default value is 250
4	0x00 – 0xFA, 0xFF	Percentage for the Green driver of the LED. Value is 0 – 250 for 0 – 100% Values greater than 250 are ignored Default value is 250
5	0x00 – 0xFA, 0xFF	Percentage for the Blue driver of the LED. Value is 0 – 250 for 0 – 100% Values greater than 250 are ignored Default value is 250
6	0xFF	Location is currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Tri-Color LED Running Color Setting (Message Description: 0xB1)

This message is sent to the keypad to set the running, or current, color of the LED. This value is not saved and will be replaced by the default setting on a power cycle. This applies to both LEDs over the buttons and the button backlights.

Desired colors are achieved by sending a specific RGB setting. This is done by sending the device percentage values for red, blue, and green.

LED numbers are listed in the appendices – they are referenced with the same values as when utilizing the Digital Output message.

This configuration message only applies to HED J1939 compliant keypads.

Button Tx Rate / Event Change (Message Description: 0xE3)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xB1	LED Select	Red	Green	Blue	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xB1	Tri-Color LED Running Color setting
2	0x01 – 0xFF	Selects the LED being configured, values greater than the maximum LED number for the device results in the message being ignored
3	0x00 – 0xFA, 0xFF	Percentage for the Red driver of the LED. Value is 0 – 250 for 0 – 100% Values greater than 250 are ignored
4	0x00 – 0xFA, 0xFF	Percentage for the Green driver of the LED. Value is 0 – 250 for 0 – 100% Values greater than 250 are ignored
5	0x00 – 0xFA, 0xFF	Percentage for the Blue driver of the LED. Value is 0 – 250 for 0 – 100% Values greater than 250 are ignored
6	0xFF	Location is currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Night Mode CAN Configuration (Message Description: 0xB2)

This message is sent to the keypad to configure the CAN message it will receive to enter and exit Night Mode. The intent is to be able to define a single CAN message that will be received by all HED J1939 keypads to select the state of Night Mode.

These values are saved in non-volatile memory so that they are retained through power cycles. While this CAN message is used to configure the Night Mode CAN Message identifier, the Night Mode CAN Message data fields are defined after the Night Mode Configuration definition.

This configuration message only applies to HED J1939 compliant keypads.

Night Mode CAN Configuration (Message Description: 0xC2)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xB2	Priority	PGN (LSB)	PGN (MSB)	Source Address	0xFF	0x55	0xAA
The XX in the identifier is the current Node ID of the target keypad. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xB2	Night Mode CAN Configuration
2	0x00 – 0x1F	The new Priority for the Night Mode CAN message. Default Value is 0x18
3 (LSB) – 4 (MSB)	0x00 – 0xFFFF	The new PGN for the Night Mode CAN message. Default Value is 0xEFFF
5	0x00 – 0xFF	The new Source Address for the Night Mode CAN message. Default Value is 0xF9
6	0xFF	Location is currently unused, set to don't care value of 0xFF
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Night Mode CAN Message									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
User defined Default: 0x18EFFF9	8	Night Mode State	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF

Data Description: Night Mode CAN Message		
Byte	Range	Description
1	0x00 – 0x01, 0xFF	Night Mode Enabled 0 = Exit Night Mode 1 = Enter Night Mode All other values are ignored
2 - 8	0xFF	Locations are currently unused, set to don't care value of 0xFF

CC Flyback Config Messages

This section details the messages used to set Estimated Current Control flyback values, which help tune the approximation algorithm used, as well as how to calculate them.

Calculating Flybacks

Required Items

- Microsoft Excel (Or similar plotting software)
- J1939 Module(s) to be used by the system.
- PCAN View (Or Similar CAN Message Viewing Software)
- Grid Connect (Or Similar CAN Interface device)
- Meter Capable of reading current
- Coil (this is the coil that will be used by the Output on the system)

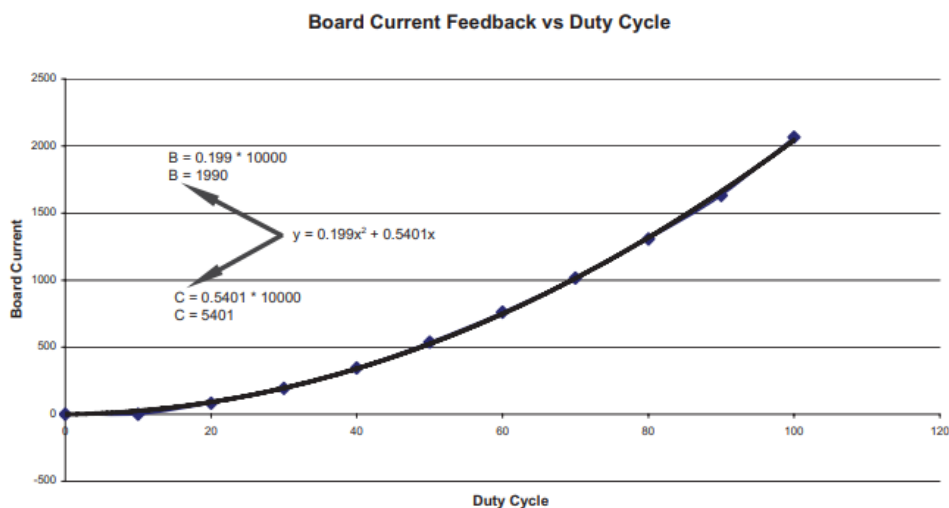
Steps

1. Select only one *Output* from the coil for this test (This *Output* must be capable of being a *PWM Output* with *Current Feedback*).
2. Connect the coil to an *Output* on the module that can do PWM.
3. Send the **Output Current Control Flyback A Configuration (0xC0)**, select the *Output* pin you are testing and enable Calibration Mode.
 - a. This will put the pin into PWM output to allow testing.
4. Send the **Analog Output Command (0xEE)** setting the commanded output to 100 (10% Duty)
 - a. Ensure that this is sent about every 100ms.
5. Using a meter, record the *Coil Current* (Ensure that you record as mA).
6. Record the value reported from the **Output Current Message** for your specified output pin, ensuring you grab both the LSB and the MSB when recording your value (Value reported in mA).
 - a. Outputs 1-3 = Group 0
 - b. Outputs 4-6 = Group 1 (etc. etc.)
7. Calculate and record the Flyback Current (*Coil Current* – *Board Current* = *Flyback Current*)
8. Turn the *Output* off and let the coil cool down.
9. Repeat Steps 4-8, each time adding 100 (10%) to the previous duty cycle. This should give you data points for 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100% duty as found in the *Example Data Points* table below.

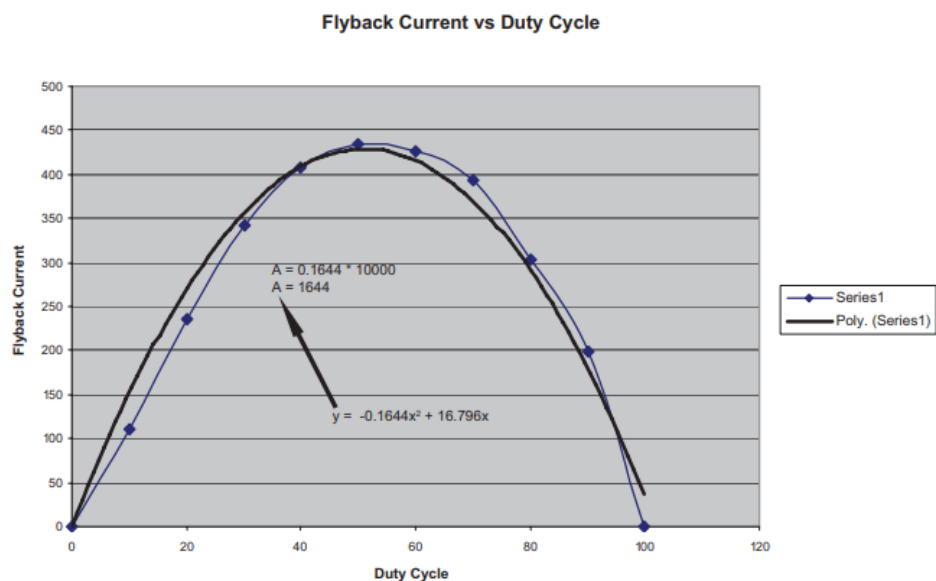
Example Data Points			
Duty Cycle (Commanded)	Coil Current (Measured)	Board Current Feedback (From Output Current Message)	Flyback Current (Calculated)
0	0	0	0
10	110	0	110
20	319	83	236
30	536	194	342
40	753	345	408
50	971	537	434
60	1189	762	427
70	1409	1015	394
80	1610	1307	303
90	1830	1631	199
100	2065	2065	0

a.

10. Once the data is recorded, plot two X-Y graphs to view as the examples below. *Board Current Feedback vs Duty Cycle* and *Flyback Current vs Duty Cycle*.



a.



b.

11. Create a polynomial (Order 2) trend line for each graph with an equation of it.
 - a. In the *Board Current Feedback vs Duty Cycle*
 - i. Trendline Equation: $y = 0.199x^2 + 0.5401x$
 - ii. Disregard the sign of the numbers and multiply each by 10,000.
 - iii. Factor B = $0.199 * 10000 = 1990$
 - iv. Factor C = $0.5401 * 10000 = 5401$
 - v. Factor B and C will be used later in the *Output Current Control Flyback B+C Configuration (0xC1)*
 - b. In the *Flyback Current vs Duty Cycle*
 - i. Trendline Equation: $y = -0.1644x^2 + 16.796x$
 - ii. Disregard the sign of the number and multiply it by 10,000.
 - iii. Factor A = $0.1644 * 10000 = 1644$
 - iv. Factor A will be used later in the ***Output Current Control Flyback A Configuration (0xC0)***
12. On the same pin that you enabled calibration mode, disable Calibration mode, and set your Flyback A value.
 - a. Disabling Calibration Mode will restore the pin to its previous configuration regardless of if it was input or output.
13. Send the ***Output Current Control Flyback B+C Configuration (0xC1)*** with the flybacks B and C set.
14. Send ***Output Current Control Configuration (0xF5)*** to set your K0, K1 and CC Offset.
15. Change your *Output* to ECC using ***Output Type Configuration (0xEC)***.
16. Verify your results: The current should remain constant when the voltage is turned up or down. If it does not, adjust Factor A.
 - a. When the voltage goes down and the current goes up, Factor A is set too high.
 - b. When the voltage goes down and the current goes down, Factor A is set too low.
 - c. Keep adjusting Factor A until current remains relatively stable as voltage is raised and lowered.
 - d. If you cannot get the current to stabilize, try adjusting K0 and K1

Output Current Control Flyback A Configuration (Message Description: 0xC0)

This message, the first of 2 messages, is used to configure Flyback A control settings of an Estimated Current Control (ECC) output.

Byte 3 will control if Calibration mode is enabled, which will convert the specified pin to PWM for testing, and once disabled, will restore the pin to what it previously was.

One Output per message is configured.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Current Control Flyback A Configuration (Message Description: 0xC0)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xC0	Selected Output	Calibration Mode	0xFF	Flyback A		0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xC0	Output Current Control Flyback A Configuration Message Description Value
2	0x01-0x90	Selects the output being configured, values greater than the maximum output number for the device results in the message being ignored
3	0x00-0x01	Calibration Mode Enable/Disable – 0x00 for Disable, 0x01 for enable. Default is 0x00 All other values ignored
4	0xFF	Location is currently unused, set to don't care value of 0xFF
5 (LSB) – 6 (MSB)	0x0000-0xFFFF	Flyback A value used to smooth ECC output Default is 0x00 Value of 0xFF is no change
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Output Current Control Flyback B+C Configuration (Message Description: 0xC1)

This message, the 2nd Message of the series, is used to configure Flyback B and C control settings of an Estimated Current Control (ECC) output.

One Output per message is configured.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Output Current Control Flyback A Configuration (Message Description: 0xC0)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xC0	Selected Output	Flyback B		Flyback AC		0x55	0xAA
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xC0	Output Current Control Flyback A Configuration Message Description Value
2	0x01-0x90	Selects the output being configured, values greater than the maximum output number for the device results in the message being ignored
3 (LSB) – 4 (MSB)	0x0000-0xFFFF	Flyback B value used to smooth ECC output Default is 0x00 Value of 0xFF is no change
5 (LSB) – 6 (MSB)	0x0000-0xFFFF	Flyback C value used to smooth ECC output Default is 0x00 Value of 0xFF is no change
7	0x55	Device Configuration Value
8	0xAA	Device Configuration Value

Command Output Messages

This section details the messages used to set output and indicator LED values.

Indicator (LED) Control (Message Description: 0x01 – 0x20)

This message is used to turn keypad indicator LEDs ON, OFF, or to a predefined FLASH rate.

LEDs are associated with a button and are defined as “LEFT”, “CENTER”, “RIGHT”, and “BETWEEN”. As an example, on the CL-610 2x4 keypad, to control LEDs 1, 2, 3, and 4 the button (bank) selection would be 1 (Button 1) and the LED assignments are:

LEFT LED = 1
CENTER LED = 2

RIGHT LED = 3
BETWEEN LED = 4

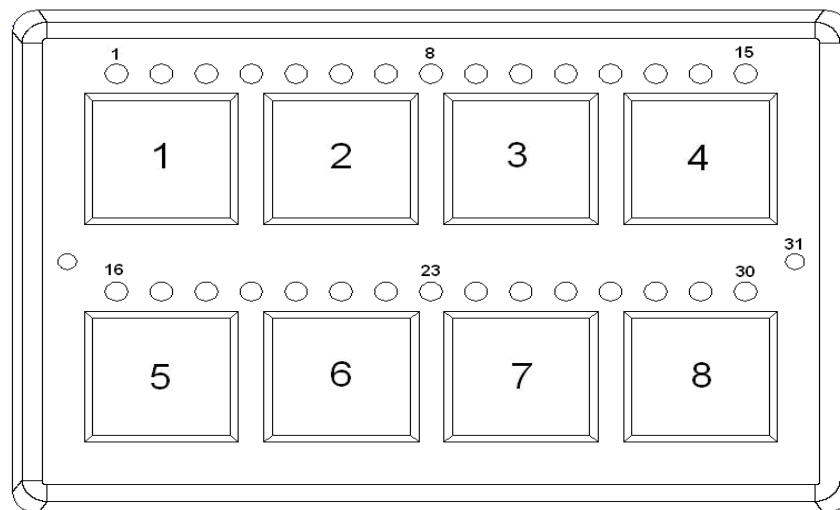


Figure 1: CL-610 LED and Button assignments

The Power LED is the Left LED on the "next" button (i.e. for a 2x4 keypad, button 9 controls the Power LED).

After the power-up sequence, LEDs default to OFF, Backlights to ON, and the Power LED is ON.

Appendix A: Keypad LED and I/O Assignments details the LED and Button assignments for all HED keypads.

This message only applies to HED J1939 compliant keypads.

Indicator (LED) Control (Message Description: 0x01 – 0x20)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	Button (LED Bank) Number 0x01 – 0x20	Byte 1 Selected Button LED Control		0xFF	Button (LED Bank) Number 0x01 – 0x20	Byte 5 Selected Button LED Control		0xFF
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0x01 – 0x20	Button Selection 1
2.1 – 2.4	0x0 – 0xF	Left LED Control for Button Selection 1 0000 - OFF 0001 - ON 0010 - Flash Slow (1/2 Hz) 0011 - Flash Med (1 Hz) 0100 - Flash Fast (2 Hz) 0101 - 1111 - No Change
2.5 – 2.8	0x0 – 0xF	Center LED Control for Button Selection 1
3.1 – 3.4	0x0 – 0xF	Right LED Control for Button Selection 1
3.5 – 3.8	0x0 – 0xF	Between LED Control for Button Selection 1
4	0xFF	Location is currently unused, set to don't care value of 0xFF
5	0x01 – 0x20	Button Selection 2
6.1 – 6.4	0x0 – 0xF	Left LED Control for Button Selection 2
6.5 – 6.8	0x0 – 0xF	Center LED Control for Button Selection 2
7.1 – 7.4	0x0 – 0xF	Right LED Control for Button Selection 2
7.5 – 7.8	0x0 – 0xF	Between LED Control for Button Selection 2
8	0xFF	Location is currently unused, set to don't care value of 0xFF

Backlight and LED Intensity Control (Message Description: 0x80)

This message is used to set the Button Backlight Level and LED Intensity.

All Button Backlights share the same intensity when on (individual backlights can be turned on and off with the Digital Output Command message).

All Indicator LEDs share the same intensity when on (individual LEDs can be turned on and off with the Digital Output Command message or the Indicator (LED) Control Message).

Backlight and LED Intensity Control (Message Description: 0x80)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0x80	Indicator LED Intensity	Backlight Intensity	Indicator LED Intensity – Night Mode	Backlight Intensity – Night Mode	0xFF	0xFF	0xFF
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0x80	Backlight and LED Intensity Control Message Description Value
2	0x00-0xFF	Indicator LED Intensity 0 - Dimmest 0xFE - Brightest 0xFF - No change Default is 0xFE
3	0x00-0xFF	Backlight Intensity 0 - Dimmest 0xFE - Brightest 0xFF - No change Default is 0xFE
4	0x00-0xFF	Indicator LED Intensity – Night Mode 0 - Dimmest 0xFE - Brightest 0xFF - No change Default is 0x7F
5	0x00-0xFF	Backlight Intensity – Night Mode 0 - Dimmest 0xFE - Brightest 0xFF - No change Default is 0x7F
6 – 8	0xFF	Location is currently unused, set to don't care value of 0xFF

Digital Output Command (Message Description: 0xED)

This message is used to control the value for digital outputs turning them either ON or OFF.

This message can also be used to independently control Button Backlights and Indicator LEDs on HED J1939 compliant keypads - see the [Appendix A: Keypad LED and I/O Assignments](#) for LED to output assignment.

Sending this message to update the value for a non-digital output will result in that output being set to 0 (OFF), maximum (ON), or no change (10, 11) . Maximum for a non-digital output is 100% (PWM) or max rated current (current control output) as defined by the device datasheet.

This message or the Analog Output Command message must be received at least once every 250 ms or the external outputs on the device are turned off. It is recommended that one of the two messages is sent every 50 ms. LEDs and Backlights do not have this timeout

By default, all outputs are OFF at power up.

Digital Output Command (Message Description: 0xED)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xED	Output Group	Command for Outputs 1 to 4	Command for Outputs 5 to 8	Command for Outputs 9 to 12	Command for Outputs 13 to 16	Command for Outputs 17 to 20	Command for Outputs 21 to 24
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xED	Digital Output Command Message Description Value
2	0x00 – 0x05, 0xFF	Selects the output group being commanded. 0x00 to 0x05 - Output Group being set. 0x06 to 0xFE - Reserved for future use (no change) 0xFF - No Change
3.1 – 3.2	0x0-0x3	Command for Output (1 + Group*24) 00 - OFF 01 - ON 10 - Reserved for future use (no change) 11 - No Change Default Value is 0x00 (OFF)
3.3 – 3.4	0x0-0x3	Command for Output (2 + Group*24)
3.5 – 3.6	0x0-0x3	Command for Output (3 + Group*24)
3.7 – 3.8	0x0-0x3	Command for Output (4 + Group*24)
4.1 – 4.2	0x0-0x3	Command for Output (5 + Group*24)
4.3 – 4.4	0x0-0x3	Command for Output (6 + Group*24)
4.5 – 4.6	0x0-0x3	Command for Output (7 + Group*24)
4.7 – 4.8	0x0-0x3	Command for Output (8 + Group*24)
5.1 – 5.2	0x0-0x3	Command for Output (9 + Group*24)
5.3 – 5.4	0x0-0x3	Command for Output (10 + Group*24)
5.5 – 5.6	0x0-0x3	Command for Output (11 + Group*24)
5.7 – 5.8	0x0-0x3	Command for Output (12 + Group*24)
6.1 – 6.2	0x0-0x3	Command for Output (13 + Group*24)
6.3 – 6.4	0x0-0x3	Command for Output (14 + Group*24)
6.5 – 6.6	0x0-0x3	Command for Output (15 + Group*24)
6.7 – 6.8	0x0-0x3	Command for Output (16 + Group*24)
7.1 – 7.2	0x0-0x3	Command for Output (17 + Group*24)

7.3 – 7.4	0x0-0x3	Command for Output (18 + Group*24)
7.5 – 7.6	0x0-0x3	Command for Output (19 + Group*24)
7.7 – 7.8	0x0-0x3	Command for Output (20 + Group*24)
8.1 – 8.2	0x0-0x3	Command for Output (21 + Group*24)
8.3 – 8.4	0x0-0x3	Command for Output (22 + Group*24)
8.5 – 8.6	0x0-0x3	Command for Output (23 + Group*24)
8.7 – 8.8	0x0-0x3	Command for Output (24 + Group*24)

Output Group example: If the selected output group is 0x01, then the outputs that can be commanded by this message are outputs 25 through 48.

Byte 3.1-3.2: Output 25

Byte 6.1-6.2: Output 37

Byte 3.3-3.4: Output 26

Byte 6.3-6.4: Output 38

Byte 3.5-3.6: Output 27

Byte 6.5-6.6: Output 39

Byte 3.7-3.8: Output 28

Byte 6.7-6.8: Output 40

Byte 4.1-4.2: Output 29

Byte 7.1-7.2: Output 41

Byte 4.3-4.4: Output 30

Byte 7.3-7.4: Output 42

Byte 4.5-4.6: Output 31

Byte 7.5-7.6: Output 43

Byte 4.7-4.8: Output 32

Byte 7.7-7.8: Output 44

Byte 5.1-5.2: Output 33

Byte 8.1-8.2: Output 45

Byte 5.3-5.4: Output 34

Byte 8.3-8.4: Output 46

Byte 5.5-5.6: Output 35

Byte 8.5-8.6: Output 47

Byte 5.7-5.8: Output 36

Byte 8.7-8.8: Output 48

Analog Output Command (Message Description: 0xEE)

This message is used to control the value for analog outputs by setting the command value. Units for the commanded value are based on the output type:

PWM/Servo/PVG: 0 to 1000 value (0.1% of output)

Frequency: 0 - xxx (Hz)

Constant Current: 0 - Rated Current (mA)

This message or the Digital Output Command message must be received at least once every 250 ms or the external outputs on the device are turned off. It is recommended that one of the two messages is sent every 50 ms.

By default, all outputs are OFF at power up.

NOTE: The 6000 series keypads do not have outputs, as such this CAN message is not supported by those keypads.

Analog Output Command (Message Description: 0xEE)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xEE	Output Group	Command for Output 1		Command for Output 2		Command for Output 3	
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xEE	Analog Output Command Message Description Value
2	0x00 – 0x2F, 0xFF	Selects the output group being commanded. 0x00 to 0x2F - Output Group being configured. 0x30 to 0xFE - Reserved for future use (no change) 0xFF - No Change
3 (LSB) - 4 (MSB)	0x0000-0xFFFF	Command for Output (1 + Group*3) PWM/Servo/PVG: 0 to 1000 value (0.1% of output) Frequency: 0 - xxx (Hz) Constant Current: 0 - Rated Current (mA) 0xFFFF to not update. Default Value is 0x0000 (OFF)
5 (LSB) - 6 (MSB)	0x0000-0xFFFF	Command for Output (2 + Group*3)
7 (LSB) - 8 (MSB)	0x0000-0xFFFF	Command for Output (3 + Group*3)

Output Group example: If the selected output group is 0x0A (10), then the outputs that can be commanded by this message are outputs 11, 12, and 13.

Byte 3-4: Output 11

Byte 7-8: Output

Byte 5-6: Output 12

Output Flash Command (Message Description: 0xEF)

This message is used to set the output to one of the 3 pre-defined flash rates.

The output needs to be ON for this message to have any visible effect.

For Keypads, this message can be used as a secondary LED Flash control message in place of Indicator (LED) Control - see the [Appendix A: Keypad LED and I/O Assignments](#) for LED to output assignment.

By default, Flash is set to OFF.

Output Flash Command (Message Description: 0xEF)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x00EFXXYY	8	0xEF	Output Group	Command for Outputs 1 to 2	Command for Outputs 3 to 4	Command for Outputs 5 to 6	Command for Outputs 7 to 8	Command for Outputs 9 to 10	Command for Outputs 11 to 12

The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).

Data Description		
Byte	Range	Description
1	0xEF	Output Flash Command Message Description Value
2	0x00 – 0x0B, 0xFF	Selects the output group being commanded. 0x00 to 0x0B - Output Group being configured. 0x0C to 0xFE - Reserved for future use (no change) 0xFF - No Change
3.1 – 3.4	0x0-0xF	Command for Output (1 + Group*12) 0000 - No Flash 0001 - Flash Slow (1/2 Hz) 0010 - Flash Med (1 Hz) 0100 - Flash Fast (2 Hz) 1000 - Reserved for future use (no change) 1111 - No Change Default Value is 0x0 (OFF)
3.5 – 3.8	0x0-0xF	Command for Output (2 + Group*12)
4.1 – 4.4	0x0-0xF	Command for Output (3 + Group*12)
4.5 – 4.8	0x0-0xF	Command for Output (4 + Group*12)
5.1 – 5.4	0x0-0xF	Command for Output (5 + Group*12)
5.5 – 5.8	0x0-0xF	Command for Output (6 + Group*12)
6.1 – 6.4	0x0-0xF	Command for Output (7 + Group*12)
6.5 – 6.8	0x0-0xF	Command for Output (8 + Group*12)
7.1 – 7.4	0x0-0xF	Command for Output (9 + Group*12)
7.5 – 7.8	0x0-0xF	Command for Output (10 + Group*12)
8.1 – 8.4	0x0-0xF	Command for Output (11 + Group*12)
8.5 – 8.8	0x0-0xF	Command for Output (12 + Group*12)

Output Group example: If the selected output group is 0x01, then the outputs that can be commanded by this message are outputs 13 through 24.

Byte 3.1-3.4: Output 13

Byte 4.1-4.4: Output 15

Byte 3.5-3.8: Output 14

Byte 4.5-4.8: Output 16

Byte 5.1-5.4: Output 17

Byte 7.1-7.4: Output 21

Byte 5.5-5.8: Output 18

Byte 7.5-7.8: Output 22

Byte 6.1-6.4: Output 19

Byte 8.1-8.4: Output 23

Byte 6.5-6.8: Output 20

Byte 8.5-8.8: Output 24

Device Transmitted Messages

This section details the configuration messages used to specify the initialization and power-up behavior of the device.

Keypad Button Press State

This is the message used by HED J1939 compliant keypads to transmit the status of the buttons. The identifier of the message is configurable (Button Transmission ID PGN Change and Button Transmission ID Priority Change) although the source address is always the Node ID of the keypad.

Keypad Button Press State (Identifier)		
	Default	Range
Identifier:	0x18FF0280 Priority = 0x18; PGN = 0xFF02; Node = 0x80	0x00000000 - 0x1FFFFFFF
Tx Rate:	100 ms	0-0xFE; 10ms per bit
Event:	0 (based on Tx Rate only)	0-1 (Tx Rate, or Button change then Tx Rate)
Message Identifier, transmission rate, and if the message is sent on Button state change are all user configurable based on the configuration messages.		

Keypad Button Press State									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
*Configurable	8	Press Status for Buttons 1 to 4	Press Status for Buttons 5 to 8	Press Status for Buttons 9 to 12	Press Status for Buttons 13 to 16	Press Status for Buttons 17 to 20	0xFF	0xFF	0xFF

Data Description		
Byte	Range	Description
1.1 – 1.2	0x0 – 0x3	Press Status of Button 1 00 = OFF 01 = ON 10 = ERROR 11 = Don't Care or Not Available
1.3 – 1.4	0x0 – 0x3	Press Status of Button 2
1.5 – 1.6	0x0 – 0x3	Press Status of Button 3
1.7 – 1.8	0x0 – 0x3	Press Status of Button 4
2.1 – 2.2	0x0 – 0x3	Press Status of Button 5
2.3 – 2.4	0x0 – 0x3	Press Status of Button 6
2.5 – 2.6	0x0 – 0x3	Press Status of Button 7
2.7 – 2.8	0x0 – 0x3	Press Status of Button 8
3.1 – 3.2	0x0 – 0x3	Press Status of Button 9
3.3 – 3.4	0x0 – 0x3	Press Status of Button 10
3.5 – 3.6	0x0 – 0x3	Press Status of Button 11
3.7 – 3.8	0x0 – 0x3	Press Status of Button 12
4.1 – 4.2	0x0 – 0x3	Press Status of Button 13
4.3 – 4.4	0x0 – 0x3	Press Status of Button 14
4.5 – 4.6	0x0 – 0x3	Press Status of Button 15
4.7 – 4.8	0x0 – 0x3	Press Status of Button 16
5.1 – 5.2	0x0 – 0x3	Press Status of Button 17
5.3 – 5.4	0x0 – 0x3	Press Status of Button 18
5.5 – 5.6	0x0 – 0x3	Press Status of Button 19
5.7 – 5.8	0x0 – 0x3	Press Status of Button 20
6 – 8	0xFF	Location is currently unused, set to don't care value of 0xFF

Device Input Status

This is the message used by HED J1939 compliant device to transmit the status of the inputs. The identifier of the message is configurable (Input Transmission ID PGN Change and Input Transmission ID Priority Change) although the source address is always the Node ID of the device.

The data bytes are dependent on the Input Group Selected and change based on if the inputs are digital or analog.

NOTE: The only input on the 6000 series keypads is system voltage, as such they will only transmit the 1st analog input message (Group 0x10).

Device Input Status (Identifier)		
	Default	Range
Identifier:	0x18FF0380; Priority = 0x18; PGN = 0xFF03; Node = 0x80	0x00000000 - 0x1FFFFFFF
Tx Rate:	100 ms	0-0xFE; 10ms per bit
Event:	1	0-1 (Tx Rate, or Button change then Tx Rate)
Message Identifier, transmission rate, and if the message is sent on Button state change are all user configurable based on the configuration messages.		

Device Input Status									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
*Configurable	8	Digital Input Group: 0x00 – 0x05	Input Status for Group Inputs 1 to 4	Input Status for Group Inputs 5 to 8	Input Status for Group Inputs 9 to 12	Input Status for Group Inputs 13 to 16	Input Status for Group Inputs 17 to 20	Input Status for Group Inputs 21 to 24	Input Status for Group Inputs 25 to 28
*Configurable	8	Analog Input Group: 0x10 – 0xFE	Analog Input Value for Group Input 1		Analog Input Value for Group Input 2		Analog Input Value for Group Input 3		0xFF

Data Description (Digital Inputs)		
Byte	Range	Description
1	0x00 – 0x05	Digital Input Group Selection 0x00 - 0x05
2.1 – 2.2	0x0 – 0x3	Input 1 + (Group*28) State 00 = OFF 01 = ON 10 = ERROR 11 = Disabled, Don't Care or Not Available
2.3 – 2.4	0x0 – 0x3	Input 2 + (Group*28) State
2.5 – 2.6	0x0 – 0x3	Input 3 + (Group*28) State
2.7 – 2.8	0x0 – 0x3	Input 4 + (Group*28) State
3.1 – 3.2	0x0 – 0x3	Input 5 + (Group*28) State
3.3 – 3.4	0x0 – 0x3	Input 6 + (Group*28) State
3.5 – 3.6	0x0 – 0x3	Input 7 + (Group*28) State
3.7 – 3.8	0x0 – 0x3	Input 8 + (Group*28) State
4.1 – 4.2	0x0 – 0x3	Input 9 + (Group*28) State
4.3 – 4.4	0x0 – 0x3	Input 10 + (Group*28) State
4.5 – 4.6	0x0 – 0x3	Input 11 + (Group*28) State
4.7 – 4.8	0x0 – 0x3	Input 12 + (Group*28) State
5.1 – 5.2	0x0 – 0x3	Input 13 + (Group*28) State
5.3 – 5.4	0x0 – 0x3	Input 14 + (Group*28) State

5.5 – 5.6	0x0 – 0x3	Input 15 + (Group*28) State
5.7 – 5.8	0x0 – 0x3	Input 16 + (Group*28) State
6.1 – 6.2	0x0 – 0x3	Input 17 + (Group*28) State
6.3 – 6.4	0x0 – 0x3	Input 18 + (Group*28) State
6.5 – 6.6	0x0 – 0x3	Input 19 + (Group*28) State
6.7 – 6.8	0x0 – 0x3	Input 20 + (Group*28) State
7.1 – 7.2	0x0 – 0x3	Input 21 + (Group*28) State
7.3 – 7.4	0x0 – 0x3	Input 22 + (Group*28) State
7.5 – 7.6	0x0 – 0x3	Input 23 + (Group*28) State
7.7 – 7.8	0x0 – 0x3	Input 24 + (Group*28) State
8.1 – 8.2	0x0 – 0x3	Input 25 + (Group*28) State
8.3 – 8.4	0x0 – 0x3	Input 26 + (Group*28) State
8.5 – 8.6	0x0 – 0x3	Input 27 + (Group*28) State
8.7 – 8.8	0x0 – 0x3	Input 28 + (Group*28) State

Data Description (Analog Inputs)		
Byte	Range	Description
1	0x10 – 0xFE	Analog Input Group Selection 0x10 - 0xFE
2 (LSB) - 3 (MSB)	0x0000-0xFFFF	Analog value (when available) for input 0 + ((Group-16)*3) Units are based on the type of Analog input. VTD - mV RTD - Ohms Freq - Hz PWM - Duty Cycle % (0-1000; 0.1% per bit) Counter - running counts. Encoder – Counts +/- to show direction and Hz. CTD – mA 4-20mA - mA
4 (LSB) - 5 (MSB)	0x0000-0xFFFF	Analog value (when available) for input 1 + ((Group-16)*3)
6 (LSB) - 7 (MSB)	0x0000-0xFFFF	Analog value (when available) for input 2 + ((Group-16)*3)
8	0xFF	Location is currently unused, set to don't care value of 0xFF

Note: System Voltage (when available) is Analog Input 0, when not available it will report 0xFFFF for Analog Input 0

Encoder Input Status Reporting

Each encoder input occupies a pair of input pins designated as Encoder A and Encoder B on the module data sheet.

Encoder A inputs will report the average frequency of encoder pulses since the last Input Status Message was sent. The accuracy of the values reported for Encoder A can be increased by increasing the Tx Rate of the Input Status Message.

Encoder B inputs will report the accumulated counts since the last Input Status Message was sent. The counts will be encoded in the Input Status Message as a signed integer. Clockwise rotation will be indicated by a positive count value, while counterclockwise rotation will be indicated by a negative count value. If the indicated direction does not match the physical rotation direction, reversing the wiring to the encoder A/B input pins should correct the indicated direction.

Input Type Selected Response

This message is used to report the current input type configurations.

Reference the device datasheet to know what input types are available for a given input.

NOTE: The only input on the 6000 series keypads is system voltage, as such this CAN message is not supported by those keypads.

Input Type Current Configuration (Message Description: 0xE7)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x01EFXXYY	8	0xE7	Input Group	Group Input 1 and 2 Configuration	Group Input 3 and 4 Configuration	Group Input 5 and 6 Configuration	Group Input 7 and 8 Configuration	0xFF	0xFF
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xE7	Input Type Configuration Message Description Value
2	0x00-0x12	Specifies the input group configuration being reported. 0x00 to 0x12
3.1 – 3.4	0x0-0xF	Reports the current configuration for Input (1 + Group*8) 0 (0000) for Switch to Battery (STB) 1 (0001) for Switch to Ground (STG) 2 (0010) for Voltage to Digital (VTD) 3 (0011) for Resistance to Digital (RTD) 4 (0100) for Frequency (Hz) 5 (0101) for Pulse Width Modulation (PWM - duty cycle) 6 (0110) for Counter 7 (0111) for Encoder 8 (1000) for Current to Digital (CTD) 9 (1001) for 4-20mA 10 (1010) Reserved for Future Use (no change) 11 (1011) Reserved for Future Use (no change) 12 (1100) Reserved for Future Use (no change) 13 (1101) Reserved for Future Use (no change) 14 (1110) for Disabled 15 (1111) Reserved for Future Use (no change)
3.5 – 3.8	0x0-0xF	Reports the current configuration for Input (2 + Group*8)
4.1 – 4.4	0x0-0xF	Reports the current configuration for Input (3 + Group*8)
4.5 – 4.8	0x0-0xF	Reports the current configuration for Input (4 + Group*8)
5.1 – 5.4	0x0-0xF	Reports the current configuration for Input (5 + Group*8)
5.5 – 5.8	0x0-0xF	Reports the current configuration for Input (6 + Group*8)
6.1 – 6.4	0x0-0xF	Reports the current configuration for Input (7 + Group*8)
6.5 – 6.8	0x0-0xF	Reports the current configuration for Input (8 + Group*8)
7 – 8	0xFF	Locations are currently unused, set to don't care value of 0xFF

Output Type Selected Response

This message is used to report the current output type configurations.

Reference the device datasheet to know what output types are available for a given output.

NOTE: The only input on the 6000 series keypads is system voltage, as such this CAN message is not supported by those keypads.

Output Type Current Configuration (Message Description: 0xEC)									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x01EFXXYY	8	0xEC	Output Group	Group Output 1 and 2 Configuration	Group Output 3 and 4 Configuration	Group Output 5 and 6 Configuration	Group Output 7 and 8 Configuration	0xFF	0xFF

The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).

Data Description		
Byte	Range	Description
1	0xEC	Output Type Configuration Message Description Value
2	0x00-0x0B	Specifies the output group configuration being reported. 0x00 to 0x0B
3.1 – 3.4	0x0-0xF	Reports the current configuration for Output (1 + Group*8) 0 (0000) for Digital 1 (0001) for Pulse Width Modulation (PWM) 2 (0010) for Constant Current (CC) 3 (0011) for Single Servo 4 (0100) for Double Servo 5 (0101) for Frequency 6 (0110) for Constant Current Single Servo 7 (0111) for Constant Current Double Servo 8 (1000) for PVG 9 (1001) for Reserved for Future Use (no change) 10 (1010) Reserved for Future Use (no change) 11 (1011) Reserved for Future Use (no change) 12 (1100) Reserved for Future Use (no change) 13 (1101) Reserved for Future Use (no change) 14 (1110) for Disabled 15 (1111) Reserved for Future Use (no change)
3.5 – 3.8	0x0-0xF	Reports the current configuration for Output (2 + Group*8)
4.1 – 4.4	0x0-0xF	Reports the current configuration for Output (3 + Group*8)
4.5 – 4.8	0x0-0xF	Reports the current configuration for Output (4 + Group*8)
5.1 – 5.4	0x0-0xF	Reports the current configuration for Output (5 + Group*8)
5.5 – 5.8	0x0-0xF	Reports the current configuration for Output (6 + Group*8)
6.1 – 6.4	0x0-0xF	Reports the current configuration for Output (7 + Group*8)
6.5 – 6.8	0x0-0xF	Reports the current configuration for Output (8 + Group*8)
7 – 8	0xFF	Locations are currently unused, set to don't care value of 0xFF

Device Version Information Response

This message is in response to the [Device Version Information](#) CAN message and reports the device's firmware version, J1939 Protocol software version, and supported J1939 protocol specification version.

The device can also be configured to send this message once on power-up. By default, the message is sent.

Device Version Information Response									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x01EFXXYY	8	0xEA	Firmware	Firmware	J1939	J1939	J1939	0xFF	0xFF
			Major	Minor	Application	Application	Specification		
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xEA	Device Version Information Response
2	0x00 – 0xFF	Major portion of the Firmware Version (the XX in XX.YY)
3	0x00 – 0xFF	Minor portion of the Firmware Version (the YY in XX.YY)
4	0x00 – 0xFF	Major portion of the J1939 Application Software Version (the XX in XX.YY)
5	0x00 – 0xFF	Minor portion of the J1939 Application Software Version (the YY in XX.YY)
6	0x00 – 0xFF	J1939 Specification Version (This document) Supported by the J1939 Application Software
7 – 8	0xFF	Locations are currently unused, set to don't care value of 0xFF

Device Serial Number Response

This message is in response to the [Device Serial Number Request](#) CAN message and reports the device's serial number.

Device Version Information Response									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0x01EFXXYY	8	0xB3	Device Serial Number					0xFF	0xFF
The XX in the identifier is the current Node ID of the target device. The YY in the identifier is the current Configuration Source Address (Default is 0xF9).									

Data Description		
Byte	Range	Description
1	0xB3	Device Version Information Response
2 (LSB) – 6 (MSB)	0x00 – 0x174876E7FF, 0xFFFFFFFF	Device Serial Number Value of 0xFFFFFFFF denotes not available on the device
7 – 8	0xFF	Locations are currently unused, set to don't care value of 0xFF

Output Diagnostic Data Message

This is the message used by HED J1939 compliant device to transmit the diagnostic status of the outputs. The identifier of the message is configurable (Output Diagnostics Transmission ID PGN Change and Output Diagnostics Transmission ID Priority Change) although the source address is always the Node ID of the device.

NOTE: The only input on the 6000 series keypads is system voltage, as such this CAN message is not supported by those keypads.

Output Diagnostic Data (Identifier)		
	Default	Range
Identifier:	0x18FF0480; Priority = 0x18; PGN = 0xFF04; Node = 0x80	0x00000000 - 0x1FFFFFFF
Tx Rate:	500 ms	0-0xFE; 10ms per bit
Event:	1	0-1 (Tx Rate, or Button change then Tx Rate)
Message Identifier, transmission rate, and if the message is sent on status state change are all user configurable based on the configuration messages.		

Device Input Status									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
*Configurable	8	Output Group: 0x00 – 0x0B	Output Diagnostic Status for Group Outputs 1 and 2	Output Diagnostic Status for Group Outputs 3 and 4	Output Diagnostic Status for Group Outputs 5 and 6	Output Diagnostic Status for Group Outputs 7 and 8	Output Diagnostic Status for Group Outputs 9 and 10	Output Diagnostic Status for Group Outputs 11 and 12	Output Diagnostic Status for Group Outputs 13 and 14

Data Description (Digital Inputs)		
Byte	Range	Description
1	0x00 – 0x0A	Output Group Selection 0x00 - 0x0A
2.1 – 2.4	0x0 – 0xF	Output 1 + (Group*14) Diagnostic State 0 (0000) for Normal 1 (0001) for Open Circuit 2 (0010) for Short to Ground 3 (0011) for Short to Battery 4 (0100) for Over Current 5 (0101) for Grounded 6 (0110) for Short to Battery OR Open 7 (0111) for Over/Under Voltage 8 (1000) for Over Temperature 9 (1001) for Grounded OR Open 10 (1010) for Output Out of Tolerance (S32K Only) 11 (1011) Reserved for Future Use 12 (1100) Reserved for Future Use 13 (1101) Reserved for Future Use 14 (1110) Reserved for Future Use 15 (1111) Output Disabled
2.5 – 2.8	0x0 – 0xF	Output 2 + (Group*14) Diagnostic State
3.1 – 3.4	0x0 – 0xF	Output 3 + (Group*14) Diagnostic State
3.5 – 3.8	0x0 – 0xF	Output 4 + (Group*14) Diagnostic State
4.1 – 4.4	0x0 – 0xF	Output 5 + (Group*14) Diagnostic State
4.5 – 4.8	0x0 – 0xF	Output 6 + (Group*14) Diagnostic State
5.1 – 5.4	0x0 – 0xF	Output 7 + (Group*14) Diagnostic State
5.5 – 5.8	0x0 – 0xF	Output 8 + (Group*14) Diagnostic State
6.1 – 6.4	0x0 – 0xF	Output 9 + (Group*14) Diagnostic State
6.5 – 6.8	0x0 – 0xF	Output 10 + (Group*14) Diagnostic State
7.1 – 7.4	0x0 – 0xF	Output 11 + (Group*14) Diagnostic State
7.5 – 7.8	0x0 – 0xF	Output 12 + (Group*14) Diagnostic State

8.1 – 8.4	0x0 – 0xF	Output 13 + (Group*14) Diagnostic State
8.5 – 8.8	0x0 – 0xF	Output 14 + (Group*14) Diagnostic State

Note: The “Open Circuit” diagnostic status is only supported by outputs operating at 100% duty cycle.

Output Current Message

This is the message used by HED J1939 compliant device to transmit the current draw of the outputs. The identifier of the message is configurable (Output Current ID PGN Change and Output Current ID Priority Change) although the source address is always the Node ID of the device.

NOTE: The only input on the 6000 series keypads is system voltage, as such this CAN message is not supported by those keypads.

Output Current (Identifier)	
Default	Range
Identifier: 0x18FF0680; Priority = 0x18; PGN = 0xFF06; Node = 0x80	0x00000000 - 0x1FFFFFFF
Tx Rate: 500 ms	0-0xFE; 10ms per bit
Message Identifier, transmission rate, and message rate are all user configurable based on the configuration messages.	

Device Input Status									
CAN-ID (29-bit)	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
*Configurable	8	Output Group: 0x00 – 0xFE	Output Current for Group Output 1 (LSB)	Output Current for Group Output 1 (MSB)	Output Current for Group Output 2 (LSB)	Output Current for Group Output 2 (MSB)	Output Current for Group Output 3 (LSB)	Output Current for Group Output 3 (MSB)	Unused

Data Description (Digital Inputs)		
Byte	Range	Description
1	0x00 – 0x0A	Output Group Selection 0x00 - 0x0A
2 - 3	0x0 – 0xFFFF	Output 1 + (Group*3) Current (mA) 0xFFFF - Unavailable
4 - 5	0x0 – 0xFFFF	Output 2 + (Group*3) Current (mA) 0xFFFF - Unavailable
6 - 7	0x0 – 0xFFFF	Output 3 + (Group*3) Current (mA)
8	0xFF	Location not currently used

Note: CL-305-102-30 output is reported in 10mA increments. Multiply the reported value by 10 to get an approximate “actual” value.

LED Status Query Response

This message is in response to the LED Status Query. When sent at Tx rate, response type will always be simple. Verbose responses are only available upon request.

This message only applies to HED J1939 compliant keypads.

NOTE: For Keypads this only reports the LED status, it does not report the Backlight Status.

Output Diagnostic Data (Identifier)		
	Default	Range
Identifier:	0x18FF0580; Priority = 0x18; PGN = 0xFF05; Node = 0x80	0x00000000 - 0x1FFFFFFF
Tx Rate:	1000 ms	0-0xFE; 10ms per bit
Message Identifier, transmission rate, and if the message is sent on status state change are all user configurable based on the configuration messages.		

Data Description (Verbose)		
Byte	Range	Description
1	0x00 – 0x01	Response Type 0x00 – Simple (On/Off) 0x01 – Verbose (On/Off/Flash Rate)
2	0x01 – 0x20	LED bank being reported
3.1 – 3.4	0x00 – 0x0F	Left LED status. 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1Hz) 0100 – Flash Fast (2Hz) 0101 – 1111 – Not Currently Used
3.5 – 3.8	0x00 – 0x0F	Center LED Status 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1Hz) 0100 – Flash Fast (2Hz) 0101 – 1111 – Not Currently Used
4.1 – 4.4	0x00 – 0x0F	Right LED Status 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1Hz) 0100 – Flash Fast (2Hz) 0101 – 1111 – Not Currently Used
4.5 – 4.8	0x00 – 0x0F	Between LED Status 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1 Hz) 0100 – Flash Fast (2 Hz) 0101 – 1111 – Not Currently Used
5	0xFF	Not Currently Used
6	0x01 – 0x10	LED bank being reported
7.1 – 7.4	0x00 – 0x0F	Left LED status. 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1Hz) 0100 – Flash Fast (2Hz) 0101 – 1111 – Not Currently Used
7.5 – 7.8	0x00 – 0x0F	Center LED Status

		0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1Hz) 0100 – Flash Fast (2Hz) 0101 – 1111 – Not Currently Used
8.1 – 8.4	0x00 – 0x0F	Right LED Status 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1Hz) 0100 – Flash Fast (2Hz) 0101 – 1111 – Not Currently Used
8.5 – 8.8	0x00 – 0x0F	Between LED Status 0000 – Off 0001 – On 0010 – Flash Slow (1/2Hz) 0011 – Flash Med (1 Hz) 0100 – Flash Fast (2 Hz) 0101 – 1111 – Not Currently Used

Data Description (Simple)		
Byte	Range	Description
1.1 – 1.4	0x00 – 0x01	Response Type 0x00 – Simple (On/Off) 0x01 – Verbose (On/Off/Flash Rate)
1.5 – 1.8	0x00 – 0x0F	LED Group
2.1	0x00 – 0x01	Power LED Status 00 – Off or Not Supported 01 - On
2.2	0x00 – 0x01	LED 01 + (Group * 55) Status
2.3	0x00 – 0x01	LED 02 + (Group * 55) Status
2.4	0x00 – 0x01	LED 03 + (Group * 55) Status
2.5	0x00 – 0x01	LED 04 + (Group * 55) Status
2.6	0x00 – 0x01	LED 05 + (Group * 55) Status
2.7	0x00 – 0x01	LED 06 + (Group * 55) Status
2.8	0x00 – 0x01	LED 07 + (Group * 55) Status
3.1	0x00 – 0x01	LED 08 + (Group * 55) Status
3.2	0x00 – 0x01	LED 09 + (Group * 55) Status
3.3	0x00 – 0x01	LED 10 + (Group * 55) Status
3.4	0x00 – 0x01	LED 11 + (Group * 55) Status
3.5	0x00 – 0x01	LED 12 + (Group * 55) Status
3.6	0x00 – 0x01	LED 13 + (Group * 55) Status
3.7	0x00 – 0x01	LED 14 + (Group * 55) Status
3.8	0x00 – 0x01	LED 15 + (Group * 55) Status
4.1	0x00 – 0x01	LED 16 + (Group * 55) Status
4.2	0x00 – 0x01	LED 17 + (Group * 55) Status
4.3	0x00 – 0x01	LED 18 + (Group * 55) Status
4.4	0x00 – 0x01	LED 19 + (Group * 55) Status
4.5	0x00 – 0x01	LED 20 + (Group * 55) Status
4.6	0x00 – 0x01	LED 21 + (Group * 55) Status
4.7	0x00 – 0x01	LED 22 + (Group * 55) Status
4.8	0x00 – 0x01	LED 23 + (Group * 55) Status
5.1	0x00 – 0x01	LED 24 + (Group * 55) Status
5.2	0x00 – 0x01	LED 25 + (Group * 55) Status
5.3	0x00 – 0x01	LED 26 + (Group * 55) Status
5.4	0x00 – 0x01	LED 27 + (Group * 55) Status
5.5	0x00 – 0x01	LED 28 + (Group * 55) Status
5.6	0x00 – 0x01	LED 29 + (Group * 55) Status
5.7	0x00 – 0x01	LED 30 + (Group * 55) Status
5.8	0x00 – 0x01	LED 31 + (Group * 55) Status

6.1	0x00 – 0x01	LED 32 + (Group * 55) Status
6.2	0x00 – 0x01	LED 33 + (Group * 55) Status
6.3	0x00 – 0x01	LED 34 + (Group * 55) Status
6.4	0x00 – 0x01	LED 35 + (Group * 55) Status
6.5	0x00 – 0x01	LED 36 + (Group * 55) Status
6.6	0x00 – 0x01	LED 37 + (Group * 55) Status
6.7	0x00 – 0x01	LED 38 + (Group * 55) Status
6.8	0x00 – 0x01	LED 39 + (Group * 55) Status
7.1	0x00 – 0x01	LED 40 + (Group * 55) Status
7.2	0x00 – 0x01	LED 41 + (Group * 55) Status
7.3	0x00 – 0x01	LED 42 + (Group * 55) Status
7.4	0x00 – 0x01	LED 43 + (Group * 55) Status
7.5	0x00 – 0x01	LED 44 + (Group * 55) Status
7.6	0x00 – 0x01	LED 45 + (Group * 55) Status
7.7	0x00 – 0x01	LED 46 + (Group * 55) Status
7.8	0x00 – 0x01	LED 47 + (Group * 55) Status
8.1	0x00 – 0x01	LED 48 + (Group * 55) Status
8.2	0x00 – 0x01	LED 49 + (Group * 55) Status
8.3	0x00 – 0x01	LED 50 + (Group * 55) Status
8.4	0x00 – 0x01	LED 51 + (Group * 55) Status
8.5	0x00 – 0x01	LED 52 + (Group * 55) Status
8.6	0x00 – 0x01	LED 53 + (Group * 55) Status
8.7	0x00 – 0x01	LED 54 + (Group * 55) Status
8.8	0x00 – 0x01	LED 55 + (Group * 55) Status

Appendix A: Keypad LED and I/O Assignments

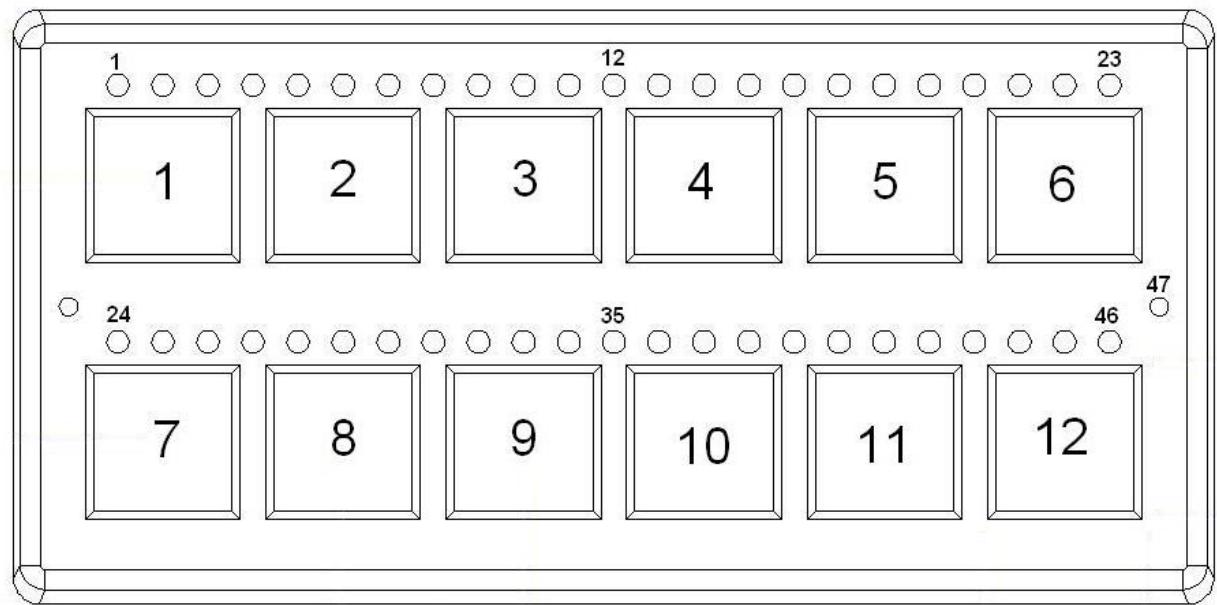
For keypad secondary connector I/O assignments, refer to the specific keypad datasheet.

For the CL-607, CL-608, CL-609, and CL-610 keypad families, the second connector I/O assignment is:

CL-6XX-1XX-3X I/O Assignment				
Keypad Type	Pin B1	Pin B2	Pin B3	Pin B4
CL-6XX- 102 -3X	Input #1	Input #2	Output #1	Output #2
CL-6XX- 103 -3X	Output #1	Output #2	Output #3	Output #4
CL-6XX- 104 -3X	Input #1	Input #2	Input #3	Input #4

For the CL-613 and CL-614 keypad families, Pin 4 is Output 1, and Pin 5 is Digital Input 1.

CL-607-XXX-3X 2x6 Keypad



CL-607-XXX-3X 2x6 Keypad LED to Button Assignment

CL-607 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	8
3	9	10	11	12
4	13	14	15	16
5	17	18	19	20
6	21	22	23	N/A
7	24	25	26	27
8	28	29	30	31
9	32	33	34	35
10	36	37	38	39
11	40	41	42	43
12	44	45	46	N/A
13	Power LED (47)	N/A	N/A	N/A

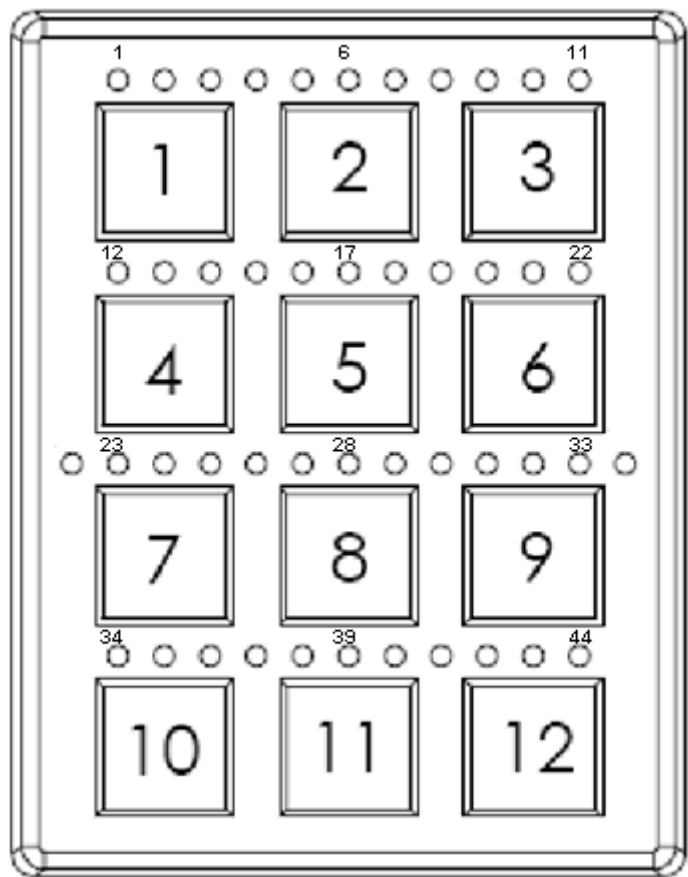
CL-607-XXX-3X 2x6 Backlight to Digital Output Assignment

CL-607 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	7	11
2	6	8	12
3	7	9	13
4	8	10	14
5	9	11	15
6	10	12	16

CL-607-XXX-3X 2x6 LED to Digital Output

CL-607 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	25	49
2	26	26	50
3	27	27	51
4	28	28	52
5	29	29	53
6	30	30	54
7	31	31	55
8	32	32	56
9	33	33	57
10	34	34	58
11	35	35	59
12	36	36	60
13	37	37	61
14	38	38	62
15	39	39	63
16	40	40	64
17	41	41	65
18	42	42	66
19	43	43	67
20	44	44	68
21	45	45	69
22	46	46	70
23	47	Power LED (47)	71
24	48		

CL-608-XXX-3X 4x3 Keypad



CL-608-XXX-3X 4x3 Keypad LED to Button Assignment

CL-608 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	8
3	9	10	11	N/A
4	12	13	14	15
5	16	17	18	19
6	20	21	22	N/A
7	23	24	25	26
8	27	28	29	30
9	31	32	33	N/A
10	34	35	36	37
11	38	39	40	41
12	42	43	44	N/A
13	Power LED (45)	N/A	N/A	N/A

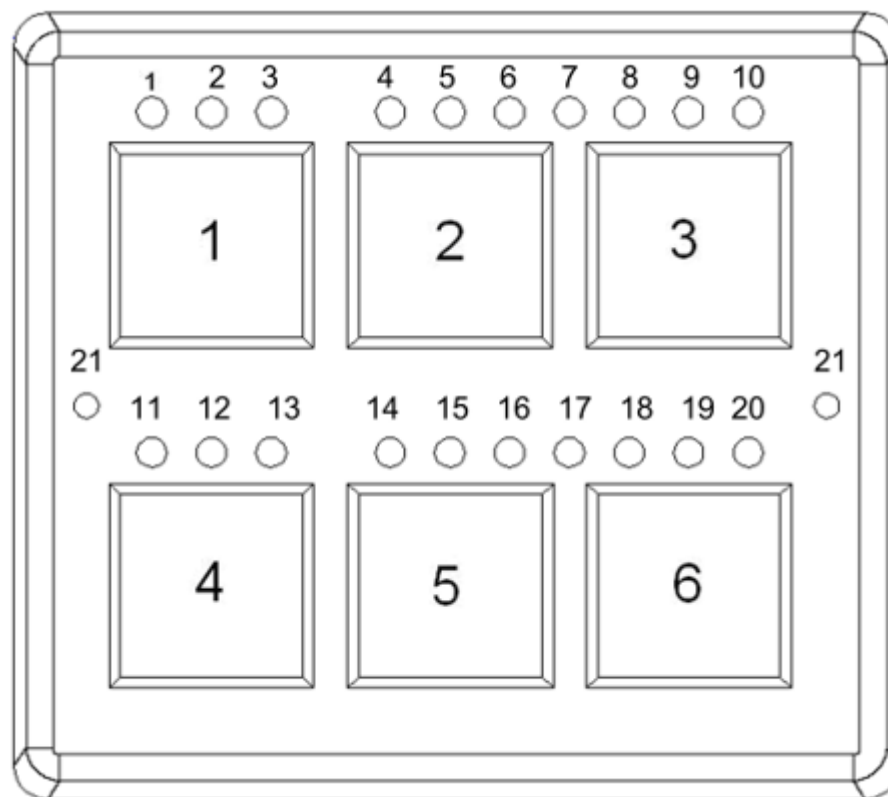
CL-608-XXX-3X 4x3 Backlight to Digital Output Assignment

CL-608 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	7	11
2	6	8	12
3	7	9	13
4	8	10	14
5	9	11	15
6	10	12	16

CL-608-XXX-3X 4x3 LED to Digital Output

CL-608 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	23	47
2	26	24	48
3	27	25	49
4	28	26	50
5	29	27	51
6	30	28	52
7	31	29	53
8	32	30	54
9	33	31	55
10	34	32	56
11	35	33	57
12	36	34	58
13	37	35	59
14	38	36	60
15	39	37	61
16	40	38	62
17	41	39	63
18	42	40	64
19	43	41	65
20	44	42	66
21	45	43	67
22	46	44	68
Power LED (45)			69

CL-609-XXX-3X 2x3 Keypad



CL-609-XXX-3X 2x3 Keypad LED to Button Assignment

CL-609 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	N/A
2	4	5	6	7
3	8	9	10	N/A
4	11	12	13	N/A
5	14	15	16	17
6	18	19	20	N/A
7	Power LED (21)	N/A	N/A	N/A

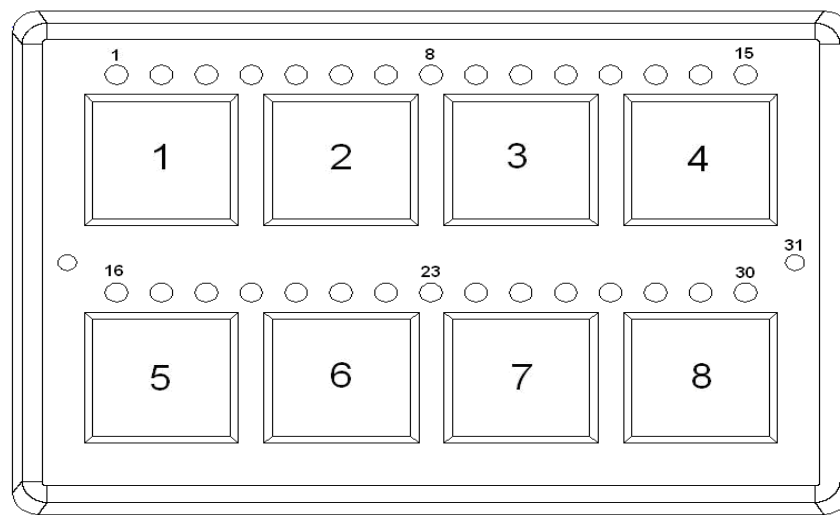
CL-609-XXX-3X 2x3 Backlight to Digital Output Assignment

CL-609 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	4	8
2	6	5	9
3	7	6	10

CL-609-XXX-3X 2x3 LED to Digital Output

CL-609 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	12	36
2	26	13	37
3	27	14	38
4	28	15	39
5	29	16	40
6	30	17	41
7	31	18	42
8	32	19	43
9	33	20	44
10	34	Power LED (21)	45
11	35		

CL-610-XXX-3X 2x4 Keypad



CL-610-XXX-3X 2x4 Keypad LED to Button Assignment

CL-610 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	8
3	9	10	11	12
4	13	14	15	N/A
5	16	17	18	19
6	20	21	22	23
7	24	25	26	27
8	28	29	30	N/A
9	Power LED (31)	N/A	N/A	N/A

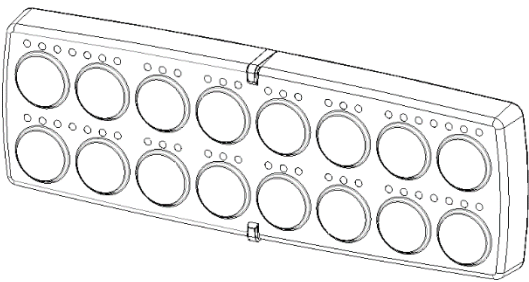
CL-610-XXX-3X 2x4 Backlight to Digital Output Assignment

CL-610 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	5	9
2	6	6	10
3	7	7	11
4	8	8	12

CL-610-XXX-3X 2x4 LED to Digital Output

CL-610 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	17	41
2	26	18	42
3	27	19	43
4	28	20	44
5	29	21	45
6	30	22	46
7	31	23	47
8	32	24	48
9	33	25	49
10	34	26	50
11	35	27	51
12	36	28	52
13	37	29	53
14	38	30	54
15	39	Power LED (31)	55
16	40		

CL-613-XXX-3X 2x8 Keypad



CL-613-XXX-3X 2x8 Keypad LED to Button Assignment

CL-613 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	N/A
4	11	12	13	N/A
5	14	15	16	N/A
6	17	18	19	N/A
7	20	21	22	23
8	24	25	26	N/A
9	27	28	29	30
10	31	32	33	N/A
11	34	35	36	N/A
12	37	38	39	N/A
13	40	41	42	N/A
14	43	44	45	N/A
15	46	47	48	49
16	50	51	52	N/A

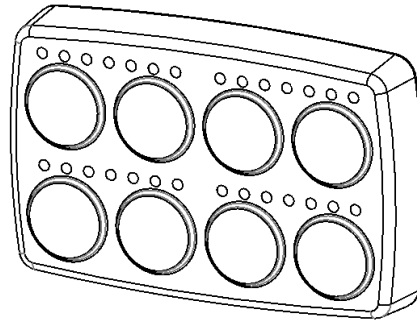
CL-613-XXX-3X 2x8 Backlight to Digital Output Assignment

CL-613 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16
5	9	13	17
6	10	14	18
7	11	15	19
8	12	16	20

CL-613-XXX-3X 2x8 LED to Digital Output

CL-613 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	27	51
2	26	28	52
3	27	29	53
4	28	30	54
5	29	31	55
6	30	32	56
7	31	33	57
8	32	34	58
9	33	35	59
10	34	36	60
11	35	37	61
12	36	38	62
13	37	39	63
14	38	40	64
15	39	41	65
16	40	42	66
17	41	43	67
18	42	44	68
19	43	45	69
20	44	46	70
21	45	47	71
22	46	48	72
23	47	49	73
24	48	50	74
25	49	51	75
26	50	52	76

CL-614-XXX-3X 2x4 Keypad



CL-614-XXX-3X 2x4 Keypad LED to Button Assignment

CL-614 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	11
4	12	13	14	N/A
5	15	16	17	18
6	19	20	21	N/A
7	22	23	24	25
8	26	27	28	N/A

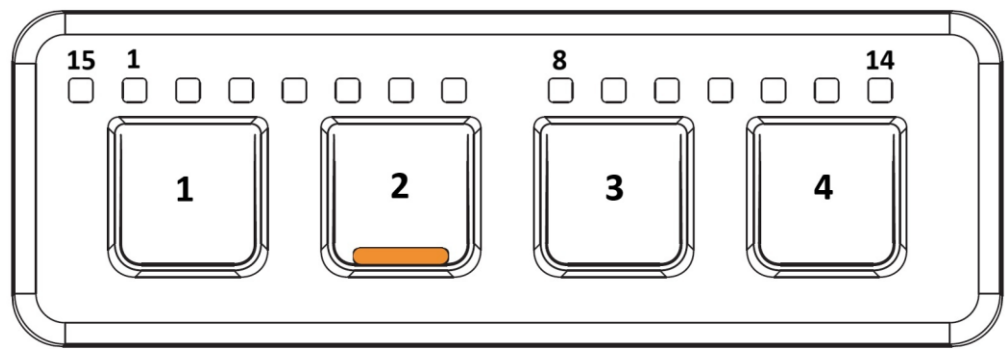
CL-614-XXX-3X 2x4 Backlight to Digital Output Assignment

CL-614 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	5	9
2	6	6	10
3	7	7	11
4	8	8	12

CL-614-XXX-3X 2x4 LED to Digital Output

CL-614 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	15	39
2	26	16	40
3	27	17	41
4	28	18	42
5	29	19	43
6	30	20	44
7	31	21	45
8	32	22	46
9	33	23	47
10	34	24	48
11	35	25	49
12	36	26	50
13	37	27	51
14	38	28	52

CL-6014-100-30 1x4 Keypad



CL-6014-100-30 1x4 Keypad LED to Button Assignment

CL-6014 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	11
4	12	13	14	N/A
5	Power LED (15)	N/A	N/A	N/A

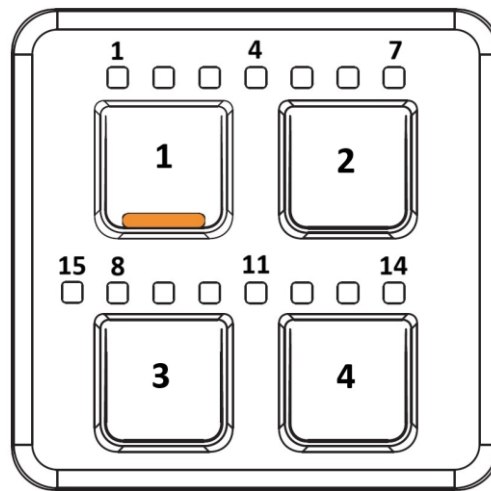
CL-6014-100-30 1x4 Backlight to Digital Output Assignment

CL-6014 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	3	7
2	6	4	8

CL-6014-100-30 1x4 LED to Digital Output Assignment

CL-6014 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	9	33
2	26	10	34
3	27	11	35
4	28	12	36
5	29	13	37
6	30	14	38
7	31	Power LED (15)	39
8	32		

CL-6022-100-30 2x2 Keypad



CL-6022-100-30 2x2 Keypad LED to Button Assignment

CL-6022 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	11
4	12	13	14	N/A
5	Power LED (15)	N/A	N/A	N/A

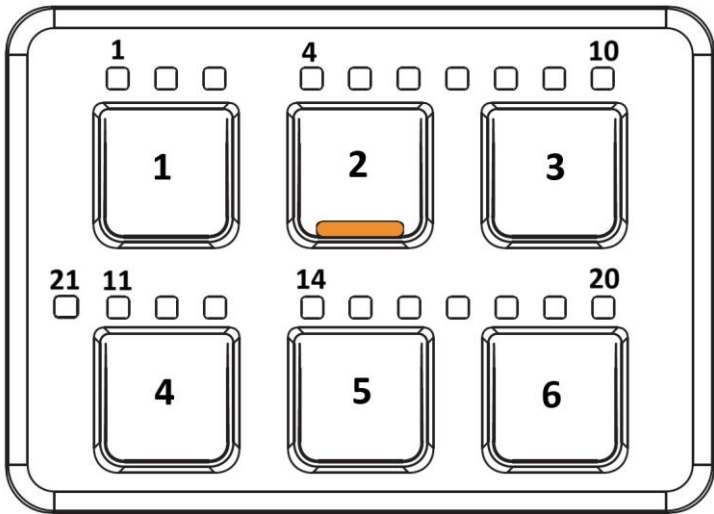
CL-6022-100-30 2x2 Backlight to Digital Output Assignment

CL-6022 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	3	7
2	6	4	8

CL-6022-100-30 2x2 LED to Digital Output Assignment

CL-6022 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	9	33
2	26	10	34
3	27	11	35
4	28	12	36
5	29	13	37
6	30	14	38
7	31	Power LED (15)	39
8	32		

CL-6023-100-30 2x3 Keypad



CL-6023-100-30 2x3 Keypad LED to Button Assignment

CL-6023 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	N/A
2	4	5	6	7
3	8	9	10	N/A
4	11	12	13	N/A
5	14	15	16	17
6	18	19	20	N/A
7	Power LED (21)	N/A	N/A	N/A

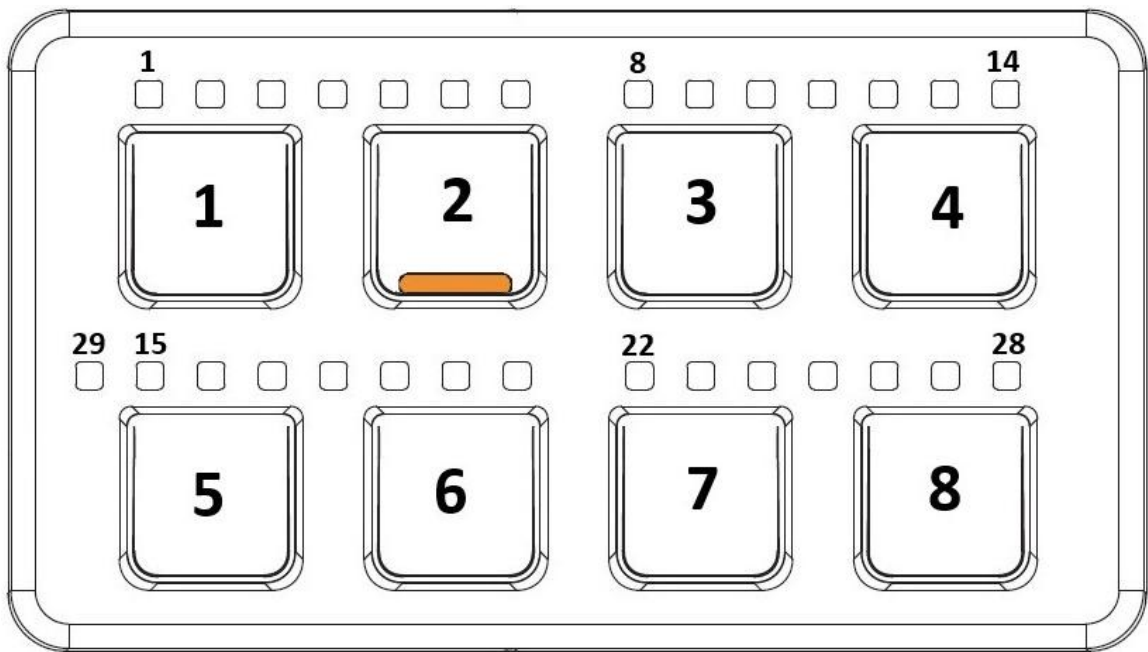
CL-6023-100-30 2x3 Backlight to Digital Output Assignment

CL-6023 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	4	8
2	6	5	9
3	7	6	10

CL-6023-100-30 2x3 LED to Digital Output Assignment

CL-6023 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	12	36
2	26	13	37
3	27	14	38
4	28	15	39
5	29	16	40
6	30	17	41
7	31	18	42
8	32	19	43
9	33	20	44
10	34	Power LED (21)	45
11	35		

CL-6024-100-30 2x4 Keypad



CL-6024-100-30 2x4 Keypad LED to Button Assignment

CL-6024 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	11
4	12	13	14	N/A
5	15	16	17	18
6	19	20	21	N/A
7	22	23	24	25
8	26	27	28	N/A
9	Power LED (29)	N/A	N/A	N/A

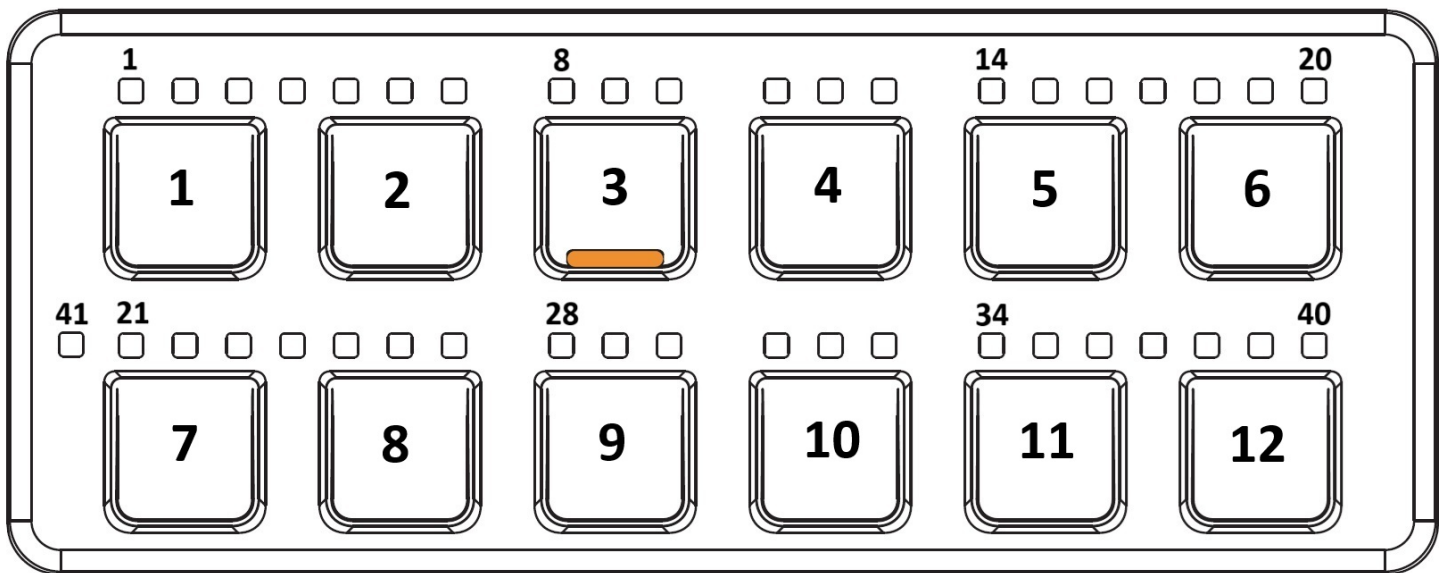
CL-6024-100-30 2x4 Backlight to Digital Output Assignment

CL-6024 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	5	9
2	6	6	10
3	7	7	11
4	8	8	12

CL-6024-100-30 2x4 LED to Digital Output Assignment

CL-6024 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	17	42
2	26	18	43
3	27	19	44
4	28	20	45
5	29	21	46
6	30	22	48
7	31	23	49
8	33	24	50
9	34	25	51
10	35	26	52
11	36	27	53
12	37	28	54
13	38	Power LED (29)	55
14	39		
15	40		
16	41		

CL-6026-100-30 2x6 Keypad



CL-6026-100-30 2x6 Keypad LED to Button Assignment

CL-6026 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	N/A
4	11	12	13	N/A
5	14	15	16	17
6	18	19	20	N/A
7	21	22	23	24
8	25	26	27	N/A
9	28	29	30	N/A
10	31	32	33	N/A
11	34	35	36	37
12	38	39	40	N/A
13	Power LED (41)	N/A	N/A	N/A

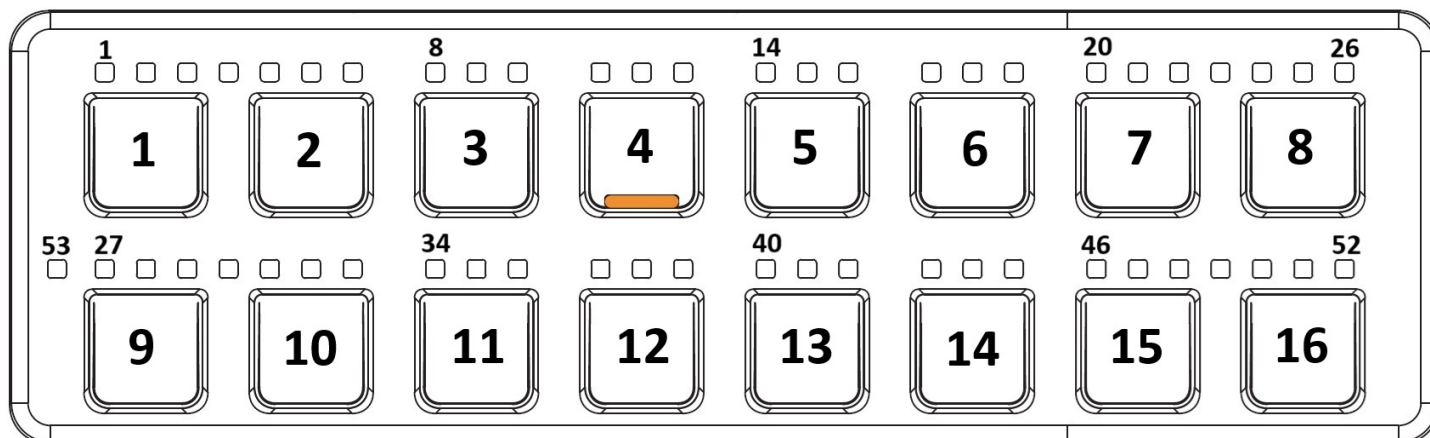
CL-6026-100-30 2x6 Backlight to Digital Output Assignment

CL-6026 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	7	11
2	6	8	12
3	7	9	13
4	8	10	14
5	9	11	15
6	10	12	16

CL-6026-100-30 2x6 LED to Digital Output Assignment

CL-6026 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	22	49
2	26	23	50
3	27	24	51
4	28	25	52
5	29	26	53
6	30	27	54
7	31	28	56
8	33	29	57
9	34	30	58
10	35	31	60
11	37	32	61
12	38	33	62
13	39	34	64
14	41	35	65
15	42	36	66
16	43	37	67
17	44	38	68
18	45	39	69
19	46	40	70
20	47	Power LED (41)	71
21	48		

CL-6028-100-30 2x8 Keypad



CL-6028-100-30 2x8 Keypad LED to Button Assignment

CL-6028 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	4
2	5	6	7	N/A
3	8	9	10	N/A
4	11	12	13	N/A
5	14	15	16	N/A
6	17	18	19	N/A
7	20	21	22	23
8	24	25	26	N/A
9	27	28	29	30
10	31	32	33	N/A
11	34	35	36	N/A
12	37	38	39	N/A
13	40	41	42	N/A
14	43	44	45	N/A
15	46	47	48	49
16	50	51	52	N/A
17	Power LED (53)	N/A	N/A	N/A

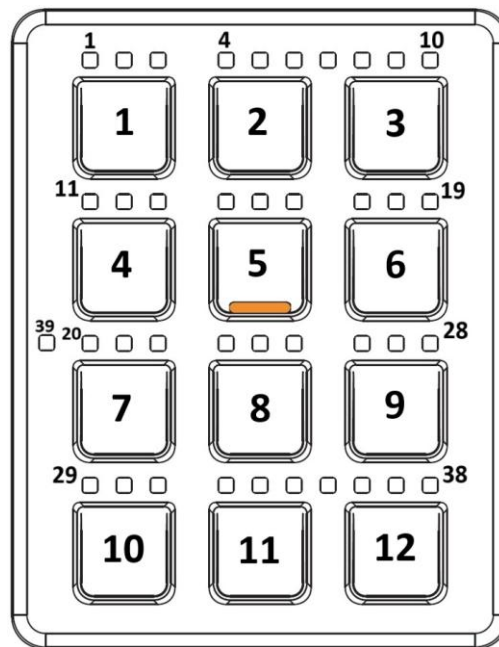
CL-6028-100-30 2x8 Backlight to Digital Output Assignment

CL-6028 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16
5	9	13	17
6	10	14	18
7	11	15	19
8	12	16	20

CL-6028-100-30 2x8 LED to Digital Output Assignment

CL-6028 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	28	52
2	26	29	53
3	27	30	54
4	28	31	55
5	29	32	56
6	30	33	57
7	31	34	58
8	32	35	59
9	33	36	60
10	34	37	61
11	35	38	62
12	36	39	63
13	37	40	64
14	38	41	65
15	39	42	66
16	40	43	67
17	41	44	68
18	42	45	69
19	43	46	70
20	44	47	71
21	45	48	72
22	46	49	73
23	47	50	74
24	48	51	75
25	49	52	76
26	50	Power LED (53)	77
27	51		

CL-6043-100-30 4x3 Keypad



CL-6043-100-30 4x3 Keypad LED to Button Assignment

CL-6043 LED to Button Assignment				
Button	Left LED#	Center LED#	Right LED#	Between LED#
1	1	2	3	N/A
2	4	5	6	7
3	8	9	10	N/A
4	11	12	13	N/A
5	14	15	16	N/A
6	17	18	19	N/A
7	20	21	22	N/A
8	23	24	25	N/A
9	26	27	28	N/A
10	29	30	31	N/A
11	32	33	34	35
12	36	37	38	N/A
13	Power LED (39)	N/A	N/A	N/A

CL-6043-100-30 4x3 Backlight to Digital Output Assignment

CL-6043 Backlight to Digital Output Assignment			
Button Backlight	Output #	Button Backlight	Output #
1	5	7	11
2	6	8	12
3	7	9	13
4	8	10	14
5	9	11	15
6	10	12	16

CL-6043-100-30 4x3 LED to Digital Output Assignment

CL-6043 LED to Digital Output Assignment			
LED	Output #	LED	Output #
1	25	21	48
2	26	22	49
3	27	23	51
4	29	24	52
5	30	25	53
6	31	26	55
7	32	27	56
8	33	28	57
9	34	29	58
10	35	30	59
11	36	31	60
12	37	32	62
13	38	33	63
14	40	34	64
15	41	35	65
16	42	36	66
17	44	37	67
18	45	38	68
19	46	Power LED (39)	69
20	47		

Appendix B: HED J1939 Protocol Modules

Released HED J1939 Protocol Modules			
Module	Description	Specification Version	J1939 Application Software Version
CL-305-102-30	Power Module	17	08.06
CL-442-127-30	14 In / 4 Out Module	12	07.00
CL-442-140-30	18 In / 4 Out	16	08.03
CL-449-100-31	4 In / 4 Out Module	17	08.06
CL-449-101-31	2 In / 4 Out Module w/5v	17	08.06
CL-449-102-31	4 In / 4 Out Module	17	08.06
CL-449-103-31	4 In / 4 Out Module	17	08.06
CL-451-100-30	18 In / 16 Out Module	17	08.06
CL-455-100-30	18 In / 16 Out Module	19*	08.08
CL-607-100-30	No I/O 2x6 Keypad	17	08.06
CL-607-101-30	No I/O 2x6 Keypad	17	08.06
CL-607-102-30	2 In / 2 Out 2x6 Keypad	17	08.06
CL-607-103-30	4 Out 2x6 Keypad	17	08.06
CL-608-100-30	No I/O 4x3 Keypad	17	08.06
CL-608-101-30	No I/O 4x3 Keypad	17	08.06
CL-608-102-30	2 In / 2 Out 4x3 Keypad	18	08.07
CL-608-103-30	4 Out 4x3 Keypad	17	08.06
CL-608-104-30	4 In 4x3 Keypad	17	08.06
CL-609-100-30	No I/O 2x3 Keypad	17	08.06
CL-609-101-30	No I/O 2x3 Keypad	17	08.06
CL-609-102-30	2 In / 2 Out 2x3 Keypad	17	08.06
CL-609-103-30	4 Out 2x3 Keypad	17	08.06
CL-610-100-30	No I/O 2x4 Keypad	20	08.08
CL-610-101-30	No I/O 2x4 Keypad	20	08.08
CL-610-102-30	2 In / 2 Out 2x4 Keypad	17	08.06
CL-610-103-30	4 Out 2x4 Keypad	17	08.06
CL-610-104-30	4 In 2x4 Keypad	17	08.06
CL-613-100-30	2x8 Keypad	17*	08.05
CL-614-100-30	2x4 Keypad	17*	08.05
CL-6014-100-30	1x4 Keypad	24	09.01
CL-6022-100-30	2x2 Keypad	24	09.01
CL-6023-100-30	2x3 Keypad	24	09.01
CL-6024-100-30	2x4 Keypad	24	09.01
CL-6026-100-30	2x6 Keypad	24	09.01
CL-6028-100-30	2x8 Keypad	24	09.01
CL-6043-100-30	4x3 Keypad	24	09.01

* Partial support only - Contact HED Technical Support for details