

PKP-2400-LI  
J1939 USER MANUAL



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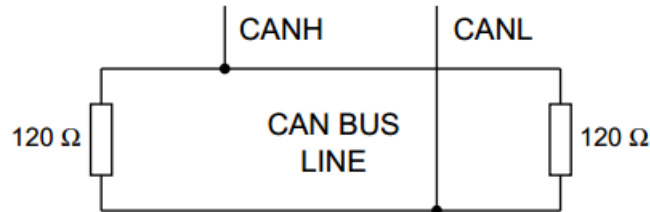
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## 1. How to connect CAN bus:



PIN	COLOUR	FUNCTION
1	Blue	CAN L
2	White	CAN H
3	Black	Negative battery
4	Red	Vbatt. (12-24V)



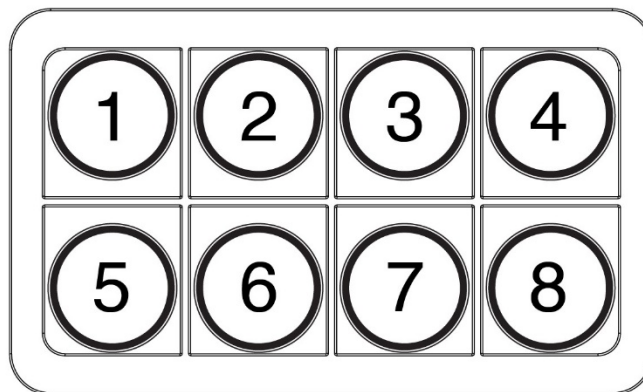
Each end of the CAN bus is terminated with 120Ω resistors in compliance with the standard to minimize signal reflections on the bus. You may need to place a 120Ω resistor between CAN-L and CAN-H.



Warning: to avoid breakage do not tighten the backshell nuts with a torque exceeding 0.8 Nm!

## 2. Reference

### PKP-2400-LI



### 3. Message header description

The 29-bit CAN identifier used in J1939 is structured in the following way.

Priority	Reserved	Data Page	PDU Format	PDU Specific	Source Address
3 bits	1 bit	1 bit	8 bits	8 bits	8 bits

The proprietary format used by PKP keypads is defined as follows:

Priority = 6.

Reserved = 0.

Data page = 0.

PDU Format = EFh (the message is addressable).

PDU Specific = Destination Address.

Parameter Group Number (PGN) = 61184 (EFO0h).

An example of CAN identifier of messages sent to the keypad is 18EF2100h where:  
21h is the destination address (keypad)  
00h is the source address.

An example of CAN identifier of messages sent by the keypad is 18EFFF21h where:  
FFh refers to broadcast messages (no specific destination address)  
21h is the source address (keypad).

### 4. General Data Format

The proprietary protocol has defined a general format for the data fields in the PGN 61184. The format consists of:

1 header field (2 bytes)

1 command byte

5 bytes (the remaining field) are defined specifically for each command.

The data length is 8 bytes, unused bits and bytes are set to all 1's (0xFF).

Byte 0	04h
Byte 1	1Bh
Byte 2	Command
Byte 3-7	Data required for each specific command

## 5. Default Settings

Setting	Default state or level	How to change
CAN bus Baud Rate	250 kbit/s	<a href="#">Command 6Fh</a>
Source Address	21h	<a href="#">Command 70h</a>
Keypad Identifier	21h	<a href="#">Command 70h</a>
Heartbeat Message	Disable	<a href="#">Command 75h</a>
Periodic state transmission	Disable	<a href="#">Command 71h</a>
Periodic transmission period	100ms	<a href="#">Command 77h</a>
Event state transmission	Enable	<a href="#">Command 72h</a>
Address claim	Disable	<a href="#">Command 74h</a>
LED brightness level	3Fh	<a href="#">Command 7Ch</a>
Startup backlight	OFF	<a href="#">Command 7Bh</a>
Startup LED show	Complete LED Sequence	<a href="#">Command 34h</a>
Backlight color	Amber	<a href="#">Command 7Dh</a>
LED acknowledgment	Disable	<a href="#">Command 73h</a>

## 6. Key Contact state (01h)

This message is sent by the keypad to indicate the state of the contacts. The destination address is set to FFh: broadcast message. See chapter 2 for Key number reference.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	01h	Contact state message
<b>Byte 3</b>	XXh	XX: Key number
<b>Byte 4</b>	YYh	Contact State 00: Switch OFF (Key released) 01: Switch ON (Key pressed)
<b>Byte 5</b>	ZZh	Keypad Identifier (default 21h)
<b>Byte 6,7</b>	FFh	Not used

Examples:

Direction	Identifier	Form	Message	Data
From Keypad	18EFFF21h	Ext	04 1B 01 01 01 21 FF FF	Key 1 ON
From Keypad	18EFFF21h	Ext	04 1B 01 01 00 21 FF FF	Key 1 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 02 01 21 FF FF	Key 2 ON
From Keypad	18EFFF21h	Ext	04 1B 01 02 00 21 FF FF	Key 2 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 03 01 21 FF FF	Key 3 ON
From Keypad	18EFFF21h	Ext	04 1B 01 03 00 21 FF FF	Key 3 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 04 01 21 FF FF	Key 4 ON
From Keypad	18EFFF21h	Ext	04 1B 01 04 00 21 FF FF	Key 4 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 05 01 21 FF FF	Key 5 ON
From Keypad	18EFFF21h	Ext	04 1B 01 05 00 21 FF FF	Key 5 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 06 01 21 FF FF	Key 6 ON
From Keypad	18EFFF21h	Ext	04 1B 01 06 00 21 FF FF	Key 6 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 07 01 21 FF FF	Key 7 ON
From Keypad	18EFFF21h	Ext	04 1B 01 07 00 21 FF FF	Key 7 OFF
From Keypad	18EFFF21h	Ext	04 1B 01 08 01 21 FF FF	Key 8 ON
From Keypad	18EFFF21h	Ext	04 1B 01 08 00 21 FF FF	Key 8 OFF

If the Event state transmission is enabled, the Key Contact state message is sent when a key is switched. If the Periodic state transmission is enabled, every Periodic

transmission period a Key Contact state message is sent for each button of the keypad.

## 7. LED command (01h)

This message is sent to the keypad to set the state of the LED indicators. See chapter 2 for Key and LED number reference

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	01h	LED command message
<b>Byte 3</b>	XXh	XX: Key number
<b>Byte 4</b>	YYh	LED State 00h: off 01h: red on 02h: red blink 03h: red alternate blink 04h: green on 05h: green blink 06h: green alternate blink 07h: amber on 08h: amber blink 09h: amber alternate blink 0Ah: blue on 0Bh: blue blink 0Ch: blue alternate blink 0Dh: cyan on 0Eh: cyan blink 0Fh: cyan alternate blink 10h: magenta on 11h: magenta blink 12h: magenta alternate blink 13h: white on 14h: white blink 15h: white alternate blink 16h: red and green alternate blink 17h: red and blue alternate blink 18h: red and amber alternate blink 19h: green and blue alternate blink 1Ah: green and amber alternate blink 1Bh: blue and amber alternate blink
<b>Byte 5,7</b>	FFh	Not used

Examples:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 01 01 01 FF FF FF	LED Key1 red on
To Keypad	18EF2100h	Ext	04 1B 01 01 00 FF FF FF	LED Key1 off
To Keypad	18EF2100h	Ext	04 1B 01 02 04 FF FF FF	LED Key2 green on
To Keypad	18EF2100h	Ext	04 1B 01 02 00 FF FF FF	LED Key2 off
To Keypad	18EF2100h	Ext	04 1B 01 07 0A FF FF FF	LED Key7 blue on
To Keypad	18EF2100h	Ext	04 1B 01 07 00 FF FF FF	LED Key7 off

<b>To Keypad</b>	18EF2100h	Ext	04 1B 01 08 05 FF FF FF	LED Key8 green blinks
<b>To Keypad</b>	18EF2100h	Ext	04 1B 01 05 09 FF FF FF	LED Key5 amber alternate blinks
<b>To Keypad</b>	18EF2100h	Ext	04 1B 01 07 15 FF FF FF	LED Key7 white alternate blinks
<b>To Keypad</b>	18EF2100h	Ext	04 1B 01 04 16 FF FF FF	LED Key4 blinks red and green in alternate mode

## 8. Set LED brightness level (02h)

This message sets the value of the indicator LED brightness. The value can be set from 0 to 3Fh from a minimum value to 100% of the LED dimming range.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	02h	LED brightness level message
<b>Byte 3</b>	XXh	XX: Dim Value (default 3Fh) From 00h (min) to 3Fh (100%)
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
<b>To Keypad</b>	18EF2100h	Ext	04 1B 02 10 FF FF FF FF	Brightness set to 25%

## 9. Set backlight level (03h)

This message sets the value of the backlight LED brightness. The value can be set from 0 to 3Fh from 0 to 100% of the brightness range.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	03h	Backlight brightness level message
<b>Byte 3</b>	XXh	XX: Value (default 00h) From 00h (0%) to 3Fh (100%)
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
<b>To Keypad</b>	18EF2100h	Ext	04 1B 03 0C FF FF FF FF	Backlight set to 18,75%

## 10. Set startup keys message(28h)

This command enables the transmission during power up of the state of the keys.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	28h	Startup keys message
<b>Byte 3</b>	XXh	XX: 00h Disabled (default) 01h Enabled
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 28 01 FF FF FF FF	Enable startup keys message

## 11. Get software revision (2Ah)

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	2Ah	Get software revision
<b>Byte 3,7</b>	FFh	Not used

Answer:

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	2Ah	Get software revision
<b>Byte 3,6</b>	XXh XXh XXh XXh	SW revision ASCII
<b>Byte 7</b>	00h	Not used

Example

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 2A FF FF FF FF FF	Get software revision
From Keypad	18EFFF21h	Ext	04 1B 2A 56 32 2E 36 00	V2.6

## 12. Set startup LED show (34h)

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	34h	Startup LED show
<b>Byte 3</b>	XXh	XX: 00h OFF 01h Complete led show (default) 02h Fast flash
<b>Byte 4,7</b>	FFh	Not used

Example

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 34 00 FF FF FF FF	Set Startup LED show OFF



### 13. Baud rate setting (6Fh)

This message is used to change the baud rate of the CAN bus. Connecting only one keypad to the bus when changing the baud rate is recommended. If an invalid value is chosen, then no change is done to the stored value.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	6Fh	Set baud rate message
<b>Byte 3</b>	02h	
	03h	250kbit/s
<b>Byte 4,7</b>	FFh	Not used

#### Example

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 6F 02 FF FF FF FF	Set Baud rate at 500kbit/s

### 14. Set Source Address (70h)

This message is used to change the keypad CAN Source Address and/or the Keypad Identifier. Either or both the Source Address or Keypad Identifier may be changed independently. Connecting only one keypad to the bus when changing the keypad address is recommended. If an invalid value is chosen, then no change is done to the stored value.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	70h	Set Address message
<b>Byte 3</b>	XXh	
		From 01h to FEh FFh No change
<b>Byte 4</b>	YYh	YY: Keypad Identifier
		From 00h to FEh FFh No change
<b>Byte 5,7</b>	FFh	Not used

#### Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 70 18 22 FF FF FF	Set Source Address = 18h, Set Keypad identifier = 22h.

## 15. Periodic state transmission (71h)

This message enables or disables the periodic transmission of the Key state. When enabled, one contact state message is periodically sent for each button of the keypad. For some keypad models there could be additional messages. The period is set to 100ms as default value but can be changed by command 77h.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	71h	Periodic state transmission message
<b>Byte 3</b>	XXh	XX: 00h Disabled (default) 01h Enabled
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 71 01 FF FF FF FF	Enable periodic state transmission.

## 16. Event state transmission (72h)

This message enables or disables event driven key state transmissions. When this feature is enabled, the keypad transmits the state of a contact at the time that the contact changes state (pressed or released).

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	72h	Event state transmission
<b>Byte 3</b>	XXh	XX: 00h Disabled 01h Enabled (default)
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 72 00 FF FF FF FF	Disable event state transmission

## 17. LED Acknowledgment (73h)

This message enables or disables the transmission of the LED Acknowledgement message. When this feature is enabled the keypad transmits an acknowledgement message each time a LED Command is received.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	73h	LED Acknowledgement XX: 00h Disabled (default) 01h Enabled
<b>Byte 3</b>	XXh	
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 73 01 FF FF FF FF	Enable LED acknowledgment
To Keypad	18EF2100h	Ext	04 1B 01 01 04 FF FF FF	LED Command
From Keypad	18EFFF21h	Ext	00 FF 01 04 FF FF FF FF	LED Ack message

LED Acknowledgment message:

<b>Byte 0</b>	00h	
<b>Byte 2</b>	XXh	XX: LED number
<b>Byte 3</b>	YYh	YY: LED state
<b>Byte 1,4,5,6,7</b>	FFh	Not used

## 18. Address Claim at boot (74h)

This message enables or disables the address claim procedure.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	74h	Address claim at boot XX: 00h Disabled (default) 01h Enabled
<b>Byte 3</b>	XXh	
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 74 01 FF FF FF FF	Enable Address Claim

## Address claiming procedure:

Under normal operation, the keypad application sends an Address Claim parameter group at start up and waits up to 250ms for the other devices connected to the same network to send a message containing the device's address and name. The keypad checks every response and compares the names to see who has the highest priority. If a device is already using the address and has a higher priority, then a new address is selected and the process starts over. If the keypad has a higher priority than the device in use then it waits for other systems to reply, while the responding device will have to change its address and send an address claim itself. If no message is received after the time (250ms) is up, then the device has claimed the address.

## Address claim parameter group:

Priority = 6.

Destination Address should always be the Global Address FFh

Parameter Group Number (PGN) = 60928(EE00h).

Data Length = 8

Data = NAME field

Example:

Direction	Identifier	Format	Message	Data
From Keypad	18EEFF21h	Ext	3F 42 6F 1A 00 82 3C CO	

## 19. Heartbeat (75h)

This message enables or disables the transmission of Heartbeat message. This message is designed to indicate to other devices on the bus that this unit continues to function.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	75h	Heartbeat
<b>Byte 3</b>	XXh	
		XX: 00h Disabled (default) 01h Enabled
<b>Byte 4</b>	YYh	YY: Period in milliseconds ÷ 10 From 05h (50ms) to FEh (2.54 sec)
<b>Byte 5,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
<b>To Keypad</b>	18EF2100h	Ext	04 1B 75 01 32 FF FF FF	Set heartbeat enabled with 500ms period.

Heartbeat generated message:

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	F9h	Heartbeat message
<b>Byte 3</b>	XXh	
		XX: Message counter, incremented each message sent
<b>Byte 4</b>	K8 K7 K6 K5 K4 K3 K2 K1	Button state indicators Each bit represents a button state
<b>Byte 5</b>	00 00 00 00 00 00 00 00	
		0: OFF 1: ON
<b>Byte 6,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
<b>From Keypad</b>	18EFFF21h	Ext	04 1B F9 03 02 00 FF 21	Heartbeat message with button 2 pressed.
<b>From Keypad</b>	18EFFF21h	Ext	04 1B F9 03 80 00 FF 21	Heartbeat message with button 8 pressed

## 20. Periodic Key message period (77h)

This message sets the period time for the Key state messages (71h). This does not enable or disable the messages.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	77h	Periodic key message period
<b>Byte 3</b>	XXh	XX: Period in milliseconds ÷ 10 From 05h (50ms) to FEh (2.54 sec)
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 77 0A FF FF FF FF	Period set to 100ms

## 21. Start Demo mode(7Ah)

This message enables the Demo mode function. Demo mode is a special feature that consists in different LED states for each button pressing. Refer to the appendix "Demo mode instructions" to try these special features. Disconnect and reconnect the keypad after the enable message to enter this mode. To exit the Demo mode, send the Disable Demo mode command or another command message.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	7Ah	Demo mode
<b>Byte 3</b>	XXh	XX: 00h Disabled (Default) 01h Enabled
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 7A 01 FF FF FF FF	Demo mode enabled

## 22. Set backlight level at startup (7Bh)

This message sets the value of the backlight at keypad power up. The value can be set from 0 to 3Fh for 0 to 100% of the brightness range.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	7Bh	Set backlight at startup
<b>Byte 3</b>	XXh	XX: Value From 00h (0%) to 3Fh (100%)
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 7B 06 FF FF FF FF	Backlight at startup 12,5%

## 23. LED dim at startup (7Ch)

This message sets the value of the indicator LED brightness at keypad power up. The value can be set from 0 to 3Fh from a minimum value to 100% of the LED dimming range.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	7Ch	LED dim at startup
<b>Byte 3</b>	XXh	XX: Value From 00h (min) to 3Fh (100%)
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 7C 2D FF FF FF FF	LED dim set to 75%

## 24. Set backlight color (7Dh)

This message sets the color of the backlight.

<b>Byte 0</b>	04h	Header bytes
<b>Byte 1</b>	1Bh	
<b>Byte 2</b>	7Dh	Set backlight color
<b>Byte 3</b>	XXh	XX: color 01: red 02: green 03: blue 04: yellow 05: cyan 06: magenta 07h: white/light blue 08h: amber/orange 09h: yellow/green
<b>Byte 4,7</b>	FFh	Not used

Example:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 7D 07 FF FF FF FF	Set backlight color to white/light blue

## 25. Set CAN protocol

This set of messages are used to change to the desired CANbus protocol.

- Change from J1939 to CANopen:

Direction	Identifier	Format	Message	Data
To Keypad	18EF2100h	Ext	04 1B 80 00 FF FF FF FF	Change to CANopen

- Change from CANopen to J1939:

Direction	Identifier	Format	Message	Data
To Keypad	615h	Std	2B FF 20 01 01	Change to J1939

## APPENDIX: DEMO Mode instructions

In DEMO Mode you can try the following functions by pressing buttons on the PKP2400LI.

Entering this mode, you turn on backlight red; for the key 1 each time you press the button you can change the color of backlight with this sequence:

1. Red;
2. Green;
3. Blue;
4. Yellow;
5. Cyan;
6. Magenta;
7. White/light blue;
8. Amber;
9. Yellow/green;
10. OFF.

Pressing key 2, you can increase LED and backlight brightness.

Pressing key 3, you can decrease LED and backlight brightness.

For the key 4, each time that you press the button, there are different steps in this sequence:

1. Complete LED show of all colors;
2. Backlight active with keys on in sequence (it is possible to change the color of LED keys by pressing button 1);
3. Alternate blinking of LED keys number 1 red color; 2 with amber color; 3 with yellow; 4 with green color; 5 with magenta color; 7 with blue color and 6-8 with white/light blue color.

In the case you press the other keys there are no events.

## 26. Revision history

Date	Manual Revision	Comment	Related SW version
10/01/2019	1.0	First release PKP2400LI J1939 manual	SWx.x