





# CONTENTS

<b>Warning .....</b>	<b>3</b>
<b>Introduction .....</b>	<b>4</b>
<b>Keypad Functionality.....</b>	<b>4</b>
<b>Default Configuration .....</b>	<b>4</b>
<b>Programming Protocol .....</b>	<b>4</b>
Proprietary Single Frame Parameter Group.....	4 - 5
Group Function Definitions .....	6 - 9
<b>Revision Control .....</b>	<b>10</b>

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## INTRODUCTION

This document describes the PowerKey Pro (PKP) keypad's functionality, default configuration and programmable parameters.

## KEYPAD FUNCTIONALITY

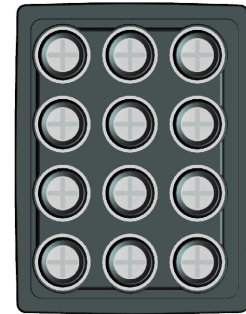


The PowerKey Pro is a microcontroller based momentary contact keypad with LED illumination that can be interfaced to CAN and RS485 networks. Keypad contact closures are monitored by the microcontroller and their occurrence is transmitted on the CAN and/or RS485 interface. LED illumination states are received over the CAN and/or RS485 interface by the microcontroller, which then illuminates the LEDs accordingly.

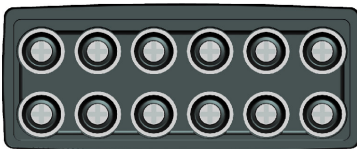
## DEFAULT CONFIGURATION

The PowerKey Pro keypad's default configuration is as follows:

- The keypad's amber LEDs flash instantaneously at power-up
- The contact type is set to momentary
- The Green and Red indicator LEDs are set to OFF
- Back lighting is set to off
- The CAN source address is set to 21
- The Keypad Identifier is set to 0x21
- Periodic Status Transmission is disabled
- Event Status Transmission is enabled
- LED Acknowledgement is disabled
- Address Claim Transmission is disabled



## PROGRAMMING PROTOCOL



Parameter group numbers (PGNs) and group functions are used to control/command the PowerKey Pro keypad. The following sections define the proprietary format used by Digital Switching Systems (DSS) for NMEA 2000 Addressable Proprietary Single Frame (SF) parameter group (PGN 61184), as well as the assigned group functions/commands.

### Proprietary Single Frame Parameter Group

PGN 61184 is defined by both J1939 and NMEA 2000. This parameter group number (PGN) is also known in J1939 as Proprietary A.

DSS has defined this parameter group as a group function type of parameter group. A Group function parameter group uses an enumerated Group Function field to identify the purpose of the parameter group. Typically, the remaining fields in the parameter group following the group function field are defined specifically for that group function.

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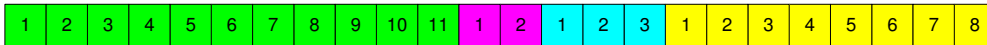


The general format of the parameter group definition is shown below.

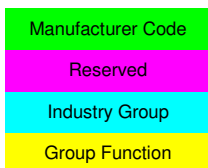
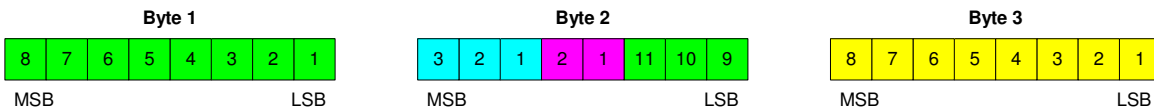
<b>DSS Proprietary SF Group Function (PGN 61184)</b> (Based on NMEA 2000 Proprietary SF A General Message Format)			
This proprietary message is defined as a group function with a maximum available payload of 5 bytes			
#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	See Assigned Group Function Codes
TBD	TBD	TBD	Allocated/defined in accordance with group function code (for a total of 5 bytes)
TBD	TBD	TBD	

The first three bytes of the parameter group are always encoded as shown in the following diagram. This diagram illustrates one aspect of CAN data transmissions that is frequently misunderstood. CAN data bytes are transmitted LSB first, and fields are defined according to the bit order defined by transmission. For fields that overlap byte boundaries, the higher order bits are mapped into the lower bits of the next byte before the next field is mapped/transmitted.

**As Transmitted**



**As Returned in Data Bytes**



On each receipt of the PGN 61184, the receiving keypad first tests to see if the Destination address in the CanId matches the keypad's own address, and to see if the Definer Tag in the first two data bytes matches the DSS manufacturer and industry code. The third byte of each frame is the group function byte used to determine the format and use of any remaining data bytes.

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## Group Function Definitions

This section contains data format definitions for assigned group functions defined for the DSS Proprietary SF Parameter Group (PGN 61184). Field numbers may not directly map to byte positions. Unused bits and bytes are set to all 1's (0xFF).

### Keypad Contact Status/LED Command (0x01)

This group function is used to send contact status from or receive LED commands by a keypad. The group function is defined differently depending on whether it is sent from or received by a keypad ECU. Contact Status: Broadcast with Destination Address = 255 from a Source Address assigned to a keypad.

LED Command: Addressed to a specific keypad Destination Address.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Keypad Contact Status/LED Command = 0x01
			Remaining field defined only when transmitted from a keypad ECU Source Address (keypad transmit)
5	Key Code/ID	1 byte	Contact identifier
6	Contact State	1 byte	0x00 = [Turn off, Disable, Reset] 0x01 = [Turn on, Enable, Set] 0x02 = Reserved 0xFF = [Unavailable, Unknown]
7	Keypad Identifier	1-byte	Valid range 0x21 to 0x2F
8	Contact Process Type	1-byte	0x01 = Momentary 0x03 = Latching

### Dim Level (0x02)

This group function transmits the desired LED illumination level when on. The illumination level is given as an integer value from 0 – no illumination, to 64 – full illumination. Transmitted level applies to all LEDs.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Dim Level = 0x02
5	LED Brightness	1 byte	Valid range 0 to 64

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### Back Light Level (0x03)

This group function transmits the desired LED back lighting level when on. The back lighting level is given as an integer value from 0 – no back lighting, to 64 – full back lighting. Transmitted level applies to all LEDs.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Back light Level = 0x03
5	LED Brightness	1 byte	Valid range 0 to 64

### Set ECU Source Address (0x70)

This group function is used to change the ECU CAN Source Address and/or keypad identifier. Either or both the Source Address or Keypad Identifier may be changed independently.

It is required that only the keypad with the address to be changed be connected when changing the keypad address.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Set ECU Source Address = 0xF0
5	CAN Source Address	1 byte	Valid range 0 to 252 Values 253 and 254 reserved Value 255 = No change.
6	Keypad Identifier	1 byte	Valid range 0x21 to 0x2F Value =0xFF = No change

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**Periodic Status Transmission (0x71)**

This group function enables or disables periodic ECU status transmissions at a rate of 10 messages per second. For example, a keypad may transmit the status of all contacts periodically; this enables or disables that feature.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Configuration – Periodic Status Transmission = 0x71
5	Periodic Status Transmission Flag	1 byte	0x00 = [Off, Disabled, Reset] 0x01 = [On, Enabled, Set] 0x02 = [Error, Alert, Blinking] 0xFF = No action

**Event Status Transmission (0x72)**

This group function enables or disables event driven ECU status transmissions. For example, a keypad may transmit the status of a contact at the time that the contact changes state (opens or closes); this enables or disables that feature.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Configuration – Event Status Transmission = 0x72
5	Event Status Transmission Flag	1 byte	0x00 = [Off, Disabled, Reset] 0x01 = [On, Enabled, Set] 0x02 = [Error, Alert, Blinking] 0xFF = No action

**LED Acknowledgement (0x73)**

This group function enables or disables the transmission of an LED Acknowledgement. For example, a keypad may transmit an acknowledgement each time an LED Command is received; this enables or disables that feature.

#	Field Name	Size	Description
1	Manufacturer Code	11 bits	Field 1-3 make up the Definer Tag that ensures the definition of the remaining fields. DSS = 211
2	Reserved	2 bits	(each bit set to logical "1")
3	Industry Group	3 bits	Marine = 4
4	Group Function	1 byte	Configuration – LED Acknowledgement = 0x73
5	LED Acknowledgement Flag	1 byte	0x00 = [Off, Disabled, Reset] 0x01 = [On, Enabled, Set] 0x02 = [Error, Alert, Blinking] 0xFF = No action

**Address Claim Transmission (xxxx)**

This group function enables or disables the transmission of Address Claim messages (PGN 060928). If enabled, the PKP keypad will transmit PGN 060928 on power up and after every Address change command. This allows recognition of the keypad and its current Address on an RS485 or CAN network.

*Call to receive command code to enable this feature.*



**Revision Record:**

<b>Date</b>	<b>Rev</b>	<b>Filename</b>	<b>Comment</b>
5-31-10	A	PowerKey Pro Programmers Manual	Initial Release
6-2-10	B	PowerKey Pro Programmers Manual	Modified Table, page 9
6-4-10	C	PowerKey Pro Programmers Manual_REVC	Updated Paragraph 2, page 3

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