CL-630 Jog Dial

J1939 Protocol Specification Manual

Revision	Description	Date
01	Initial Release	2/28/2020

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1 Overview

This document describes the functionality and communication of the JOG DIAL module.

1.1 Reference Documents

The following documents are referenced within this document.
- SAE-J1939
- SAE-J1939/11
- SAE-J1939/21
- SAE-J1939/71
- SAE-J1939/81

2 Functionality

The JOG DIAL module is shown as in Figure 1. Module have 5 buttons and one encoder. The encoder can be pushed left, right, up, down by the joystick.

There are 14 backlight LED illuminations. When the encoder or button status change, the JOG DIAL module will send out the CAN message right away. When there is not a status change, the JOG DIAL module will send the CAN message every 500ms.

Figure 1

2.1 Power Up Sequence

Upon first power up, the JOG DIAL module sends out an Address Claimed message. If there is a Name contention and the VDC module loses arbitration, it will either send another Address Claimed message with a new source address (source address range is from *128* to *226*). if the JOG DIAL module fails on each address claim, it will send out the Cannot Claim Address message. If JOG DIAL module sends out the Cannot Claim Address message it will not enter Run Mode (it will not transmit or act upon any messages), but it still can send the "Cannot Claim Address" message upon the request for Address Claimed.

2.2 Run Mode

2.2.1 Button or encoder Pressing Data - Transmit

The JOG DIAL switches status information are sent on a single message every 500ms or upon a change in status with a minimum period of 100ms. The JOG DIAL's PGN, priority and transmission period can be configurable at runtime.

2.2.2 Backlights - Received

The JOG DIAL module will monitor the backlight message sent by CAB illumination control Unit and adjusts the brightness accordingly. The function light can be activated by related control unit or can be activated by JOG DIAL itself; this can be configurable at run time.

2.3 Sleep Mode

In running mode, if JOG DIAL doesn't receive any message and the switch has not been pressed for 1 minute, it will enter sleep mode, and all LEDs will be turned off to conserve energy. In sleep mode, JOG DIAL will not send out the message of switch status every 500ms, but once it receives any CAN message, or the buttons or encoder is pressed, it will exit sleep mode and enter run-mode.

2.4 Configuration Mode

JOG DIAL only can be configurated in configuration mode, which need Mode Command message to switch the mode. In configuration mode JOG DIAL will not send out the switch status message every 500ms until it exits the mode by Mode Command message.

3 Communications

3.1 Standard Message

3.1.1 Transmission of JOG DIAL Button and encoder Status

Description	Transmission of JOG DIAL Logical channel Status		
PF	252		
PS	8		
PGN	64520(0xFC08)		
Default Priority	6		
DLC	8		
Update Rate	250ms or upon switch status change		
Direction	JOG DIAL→CA		
Start	**Length**	**Description**	**SPN**	**Value**
1.1	2 bits	Joystick 1 X-Axis Right		00-Not pushed right 01- Pushed right 10- Unused 11- Not available
1.3	2 bits	Joystick 1 X-Axis left		Same as above
1.5	2 bits	Joystick 1 Y-Axis Up		Same as above
1.7	2 bits	Joystick 1 Y-Axis Down		Same as above
2.1	2 bytes	Encoder data		Value between 0 and TOP. See the Encoder Configuration in Sec 4.6 for definition of TOP. 65535 - Not available
4.1	2 bits	Button 1 Status		00 - Button not pressed 01 - Button pressed 10 - Unused 11 - Not available
4.3	2 bits	Button 2 Status		Same as above
4.5	2 bits	Button 3 Status		Same as above
4.7	2 bits	Button 4 Status		Same as above
5.1	2 bits	Button 5 Status		Same as above

5.3	2 bits	Button 6 Status		Same as above
5.5	4 bits	Unused		All bits set
6.1	3 bytes	Unused		All bytes set to 255

The CA will parse status sent by JOG DIAL to get the buttons and encoder status. The buttons sequence number is shown as Figure 2.
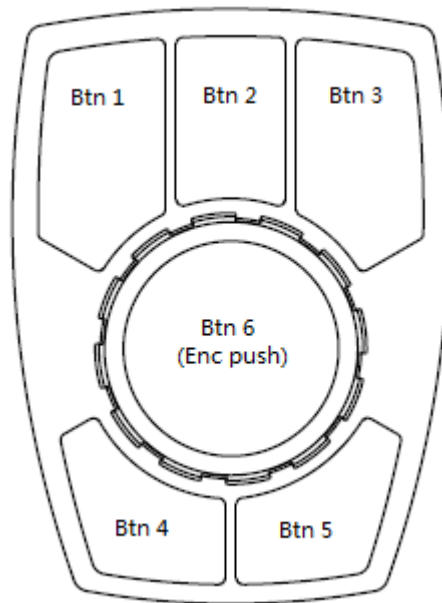
Figure 2

3.1.2 Reception of the backlight percentage command

Description	Reception of the backlight percentage command, J1939-71, *Cab Illumination Message*
PF	208
PS	DA, The source address of JOG DIAL.
PGN	53248(0xD000)
Default Priority	6
DLC	8

Update Rate	upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Backlight percentage value	1487	0-250, Percentage, 0.4%/bit, data range 0-100%. If this value >250, it will be regarded as 250.
2.1	7 bytes	unused		All bytes set to 255

The default brightness is 0.

3.1.3 Mode Change Command

Description	Reception of the command to change the mode of JOG DIAL			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Value of changing the mode.		0 – Boot Mode 1 – Run Mode 2 – Sleep Mode 3 – Diagnostic Test Mode 5 – Configuration Mode
2.1	7 bytes	unused		All bytes set to 255

When the mode is changed by CA, the JOG DIAL cannot recover the previous mode until to get the mode changed command from CA or re-power.

3.1.4 Transmission of JOG DIAL Status

	Description	Response to query of JOG DIAL Status		
	PF	252		
	PS	7		
	PGN	64519(0xFC07)		
	Default Priority	6		
	DLC	8		
	Update Rate	upon request		
	Direction	JOG DIAL→CA		
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Mode Type		0 – Boot Mode 1 – Run Mode 2 – Sleep Mode 3 – Diagnostic Test Mode
2.1	2 bits	Joystick 1 X-Axis Right Status		00- Not pushed right 01- Pushed right 10- Unused 11- Not available
2.3	2 bits	Joystick 1 X-Axis Left Status		Same as above
2.5	2 bits	Joystick 1 Y-Axis Up Status		Same as above
2.7	2 bits	Joystick 1 Y-Axis Down Status		Same as above
3.1	2 bytes	Encoder data		Value between 0 and TOP. 65525 - Not available.
5.1	2 bits	Button 1 Status		00 - Button not pressed 01 - Button pressed 10 - Unused 11 - Not available
5.3	2 bits	Button 2 Status		Same as above
5.5	2 bits	Button 3 Status		Same as above
5.7	2 bits	Button 4 Status		Same as above
6.1	2 bits	Button 5 Status		Same as above
6.3	2 bits	Button 6 Status		Same as above

6.5	4 bits	Unused		All bits set
7.1	1 byte	Backlight percentage value		0-250, Percentage, 0.4%/bit, data range 0-100%. Value >250 will be regarded as 250.
8.1	1 byte	Unused		FF

The CA use the PGN request message (PGN 59904) with the first three data byte the same as the PGN number 64519 to get the JOG DIAL status.

3.2 J1939 Message

3.2.1 Address Claimed

Description	Address Claimed, J1939-81			
PF	238			
PS	DA, global address, 255			
PGN	60928(0xEE00)			
Default Priority	6			
DLC	8			
Update Rate	Upon initialization or requested			
Direction	JOG DIAL→CA			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	21 bits	Identity Number		0 to $2^{21}-1$
3.6	11 bits	Manufacturer Code		2005(default)
5.1	3 bytes	ECU Instance		0(Default)
5.4	5 bits	Function Instance		0(Default)
6.1	8 bits	Function		37(Default)
7.1	1 bit	Reserved		0 (Defined by SAE)
7.2	7 bits	Vehicle System		0 (Default)
8.1	4 bits	Vehicle System Instance		0 (Default)
8.5	3 bits	Industry Group		0 - Global (Default) * 1 - On-Highway Equipment

				2 - Agricultural and Forestry Equipment
				3 - Construction Equipment
				4 - Marine
				5 - Industrial-Process Control-Stationary
				6 & 7 - Reserved
8.8	1 bit	Arbitrary Address Capable		0 - Not Capable
				1 - Capable (Default)

3.2.2 PGN request

Description	PGN request, J1939-81			
PF	234			
PS	DA, global address (255) or the source address of JOG DIAL			
PGN	59904(0xEA00)			
Default Priority	6			
DLC	3			
Update Rate	Upon initialization or requested			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 Byte	Byte 1 of PGN being requested (LSB)		0-255
2.1	1 Byte	Byte 2 of PGN being requested		0-255
3.1	1 Byte	Byte 3 of PGN being requested (MSB)		0-255

This is a standard request message, and the following are the supported PGNs that can be requested from the JOG DIAL module.
- JOG DIAL Status (PGN 64519)
- Address Claimed (PGN 60928)
- ECU Identification Information (PGN 64965)
- Software Identification Information (PGN 65242)

If the quested PGN is unsupported, or the DLC is not 3, the JOG DIAL module shall respond with a NACK.

Description	PGN request, J1939-81

PF	234			
PS	DA, global address(255) or the source address of JOG DIAL			
PGN	59904(0xEA00)			
Default Priority	6			
DLC	4			
Update Rate	Upon initialization or requested			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 Byte	Byte 1 of PGN being requested (LSB)		0-255
2.1	1 Byte	Byte 2 of PGN being requested		0-255
3.1	1 Byte	Byte 3 of PGN being requested (MSB)		0-255
4.1	1 Byte	Control Byte		

Note: This is not a standard request message, and it only be used in requesting for JOG DIAL configured information.

Byte 4 is control byte, and it indicates which message will be requested, and its value is the same as the Control Byte in configuration message in chapter 4.

3.2.3 Acknowledgement Message

Description	Acknowledgement Message, J1939-81			
PF	238			
PS	DA, global address, 255			
PGN	59392(0xE800)			
Default Priority	6			
DLC	8			
Update Rate	Upon reception of a PGN that requires this form of acknowledgment			
Direction	JOG DIAL→CA			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Control Byte		0 - Positive Acknowledgement 1 - Negative Acknowledgement 2 - Access Denied 3 - Cannot Respond

2.1	1 byte	Group Function		Refer to SAE-J1939-21. 0(Default)
3.1	1 byte	Reserved by SAE		255(Default)
4.1	1 byte	Reserved by SAE		255(Default)
5.1	1 byte	Reserved by SAE		255(Default)
6.1	1 byte	Byte 1 of PGN being requested (LSB)		
7.1	1 byte	Byte 2 of PGN being requested		
8.1	1 byte	Byte 3 of PGN being requested (MSB)		

3.2.4 ECU Identification Information

Description	ECU Identification Information, J1939-71
PF	253
PS	197
PGN	64965(0xFDC5)
Default Priority	6
DLC	variable
Update Rate	Upon request
Direction	JOG DIAL→CA

Start	Length	Description	SPN	Value
a	<=110 characters	ECU Part Number	2901	Ex. "17000-08312"
b	<=110 characters	ECU Serial Number	2902	Ex. "000001"
c	<=110 characters	ECU Location	2903	Ex. "CAB"
d	<=110 characters	ECU Type	2904	Ex. "JOG DIAL-24-00000002"

The length of the whole ECU ID should be not more than 110 bytes.

3.2.5 Software Identification Information

Description	Software Identification Information, J1939-71			
PF	254			
PS	218			
PGN	65242(0xFEDA)			
Default Priority	6			
DLC	variable			
Update Rate	Upon request			
Direction	JOG DIAL→CA			
Start	**Length**	**Description**	**SPN**	**Value**
1	1 byte	Number of Software Identification Fields	965	0-125
2-N	Variable	ECU Serial Number	234	ASCII characters. Each field delimited with an "*" and up to 200 characters.

The length of the whole software ID should be not more than 60 bytes.

3.2.6 Transport Protocol Connection Management BAM

Description	Transport Protocol-Connection Management BAM, J1939-21			
PF	236			
PS	DA, global address, 255			
PGN	60416(0xEC00)			
Default Priority	7			
DLC	8			
Update Rate	Upon requested			
Direction	JOG DIAL→CA			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Control Byte		32-Broadcast Announce Message
2.1	2 bytes	Message length		9-1785
4.1	1 byte	Total number of packets		2-255
5.1	1 byte	Reserved by SAE		255
6.1	3 bytes	Parameter Group Number of the packeted message		LSB at sixth byte, MSB at eighth byte.

3.2.7 Transport Protocol Data Transfer

Description	Transport Protocol Data Transfer, J1939-21
PF	235
PS	DA, global address, 255
PGN	60160(0xEB00)
Default Priority	7
DLC	8
Update Rate	Upon requested
Direction	JOG DIAL→CA

Start	Length	Description	SPN	Value
1.1	1 byte	Sequence Number:		1-255
2.1	7 bytes	Related PGN data		Packetized Data

2   Configuration

Changing the configuration can meet some of the variation of the application requirement without changing the source code. The first byte serves as the control byte. Where applicable, changes take effect immediately and are stored in non-volatile memory.
The configuration PGN is 61184 for all configuration options.

2.1   Enter Configuration

Use Mode Change Command to change current mode to configuration mode.

Description	Reception of the command to change the mode of JOG DIAL
PF	239
PS	DA, The source address of JOG DIAL.
PGN	61184(0xEF00)
Default Priority	6
DLC	8
Update Rate	upon commanded

Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Value of changing the mode.		0 – Boot Mode 1 – Run Mode 2 – Sleep Mode 3 – Diagnostic Test Mode 5 – Configuration Mode
2.1	7 bytes	unused		All bytes set to 255

2.2 Set New Source Address

Description	Set JOG DIAL New Source Address			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	Upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Control Byte		225-Set JOG DIAL source address
2.1	1 byte	New source address		128-247, otherwise the JOG DIAL will send NACK message.
3.1	6 bytes	Not used		0xFFFFFFFFFFFF

2.3 Set New Priority

Description	Set JOG DIAL New Priority
PF	239
PS	DA, The source address of JOG DIAL.
PGN	61184(0xEF00)
Default Priority	6
DLC	8
Update Rate	Upon commanded
Direction	CA→JOG DIAL

Start	Length	Description	SPN	Value
1.1	1 byte	Control Byte		226-Set JOG DIAL new priority
2.1	1 byte	New Priority		0-7, otherwise the JOG DIAL will send the NACK message.
3.1	6 byte	Not used		0xFFFFFFFFFFFF

2.4 Set New Transmit Rate

Description	Set JOG DIAL New Transmit Rate			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	Upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Control Byte		227-Set JOG DIAL New Transmit Rate
2.1	1 byte	New Transmit Rate		10-250(The value multiplied by 10ms, range from 100ms to 2.5s). If the value <10,it will be regarded as 10,and if the value >250,it will be regarded as 250.
3.1	6 byte	Not used		0xFFFFFFFFFFFF

2.5 Set New Name Field

Description	Set JOG DIAL New Name Field			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	Upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**

Start	Length	Description	SPN	Value
1.1	1 byte	Control Byte		228-Set JOG DIAL New Name Field
2.1	1 byte	Sub-Control Byte		0-ID 1-Manufacurer Code 2-ECU Instance 3-Function Instance 4- Function 5-Vehicle System 6-Vehicle System Instance 7-Industry Group 8-Arbitrary Address Capable
3.1	1 byte	Data0		0-255
4.1	1 byte	Data1		0-255
5.1	1 byte	Data2		0-255
6.1	3 byte	Not used		0xFFFFFF

2.6 Set New PGN

Description	Set New PGN			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	Upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Control Byte		204- Set New PGN
2.1	1 byte	Sub-control Byte		0- Set PGN of Transmission of JOG DIAL Status 1- Set PGN of Transmission of JOG DIAL Buttons and encoder Status
3.1	3 bytes	New PGN		Variable. It should not be the same as all other valid PGN, otherwise the JOG DIAL will send NACK message.

| 6.1 | 3 bytes | Not used | | 0xFFFFFF |

2.7 Set Encoder

Description	Set Encoder
PF	239
PS	DA, The source address of JOG DIAL.
PGN	61184(0xEF00)
Default Priority	6
DLC	8
Update Rate	Upon commanded
Direction	CA→JOG DIAL

Start	Length	Description	SPN	Value
1.1	1 byte	Control Byte		206 - Set Encoder
2.1	1 byte	PARAM		0 - Manually sets the encoder value to the value in DATA 1 - Set TOP, which is the maximum value the encoder will count up to. Values range from 4 to 65534 with the default=255. 2 - Set the initial value, which stored in non-volatile memory, and does not manually change the encoder's value.
3.1	1 byte	ROLL OVR		A non-zero value, with the exception of FFh, causes the value to roll over back to zero when incremented passed TOP or from zero to TOP when decremented below zero, otherwise the count remains at zero or TOP.
4.1	1 byte	Not used		0xFF
5.1	2 bytes	DATA		Input data used in setting of the parameters
7.1	2 bytes	Not used		0xFFFF

2.8 Set Buttons

Description	Set Buttons			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	Upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Control Byte		207- Set Buttons
2.1	2 bits	Joystick Right Set Status		00: Not used 01: Useful Others: Don't care
2.3	2 bits	Joystick Left Set Status		Same as above.
2.5	2 bits	Joystick Up Set Status		Same as above.
2.7	2 bits	Joystick Down Set Status		Same as above.
3.1	2 bits	Button1 Set status		
3.3	2 bits	Button2 Set status		
3.5	2 bits	Button3 Set status		
3.7	2 bits	Button4 Set status		
4.1	2 bits	Button5 Set status		
4.3	2 bits	Button6 Set status		
4.5	36 bits	Not used		0xFFFFFFFFF

2.9 Configuration exit

Description	Reception of the command to change the mode of JOG DIAL			
PF	239			
PS	DA, The source address of JOG DIAL.			
PGN	61184(0xEF00)			
Default Priority	6			
DLC	8			
Update Rate	upon commanded			
Direction	CA→JOG DIAL			
Start	**Length**	**Description**	**SPN**	**Value**
1.1	1 byte	Value of changing the mode.		0 – Boot Mode 1 – Run Mode 2 – Sleep Mode 3 – Diagnostic Test Mode 5 – Configuration Mode
2.1	7 bytes	unused		All bytes set to 255

Use Mode change Command to change current mode to run mode or sleep mode to exit the configuration.