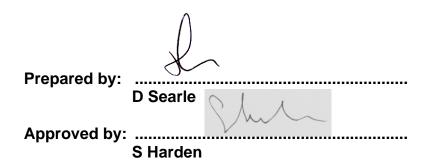# NRH27C CAN Rotary Hall-Effect Sensor

PGS-NRH27C J1939 Issue 3

Sae J1939 technical information

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Change History

Issue	Date	Change	Author
1	02/11/15	Created	D Searle
2	11/07/17	Rolling counter added to position message PGN_PG 654000. Documentation errors amended.	D Searle
3	20/02/19	Motorola byte order configuration option added. 10ms framerate configuration option added. SPN 1 & 2 Degrees per bit calculation added. SPN_PG 8 Configuration commands updated.	D Searle

1. **CONTENTS** 2

PGNs

2.1. PGN_PG 65400   *NRH27C Rotary Position*   *PGNRH27CRP*

This parameter group is used to transmit dual channel rotary positional information about the NRH27C sensor.

Transmission Repetition Rate:	10ms / 25ms / 50ms / 100ms
Data Length:	8
Extended Data Page:	0
Data Page:	0
PDU Format:	255
PDU Specific:	120 PGN Supporting Information:
Default Priority:	3
Parameter Group Number:	65400 (0x00FF78)

Start Position	Length	Parameter Name	SPN
1-2	2 bytes	Rotary Position Channel 1	1
3-4	2 bytes	Rotary Position Channel 2	2
5.1	2 bits	Channel 1 Status	3
5.3	2 bits	Channel 2 Status	4
5.5	4 bits	System Status	5
6	1 byte	Channel 1 Error Flags	6
7	1 byte	Channel 2 Error Flags	7
8	1 byte	Sequential Counter	10

2.2. PGN_PG 65401   *NRH27C Acknowledge*   *PGNRH27A*

This parameter group is used to transmit an acknowledgement message on successful receipt of a configuration command (PGN_PG 65402).

Transmission Repetition Rate:	As required
Data Length:	8
Extended Data Page:	0
Data Page:	0
PDU Format:	255
PDU Specific:	121 PGN Supporting Information:
Default Priority:	6
Parameter Group Number:	65401 (0x00FF79)

Start Position	Length	Parameter Name	SPN
1	1 byte	Command ID	8
2-8	7 bytes	0x00 (for factory use)	

2.3. PGN_PG 65402   NRH27C Configuration Command PGNRH27CC

This parameter group is used to configure the NRH27C device. See SPN_PG 9 (Command ID) and SPN_PG 10 (Command Data) for available commands. When a configuration command has been successfully received and processed the NRH27C will reply with an acknowledgement (PGN_PG 65401).

Transmission Repetition Rate: As required
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 255
PDU Specific: 122   PGN Supporting Information:
Default Priority: 6
Parameter Group Number: 65402 (0x00FF7A)

Start Position	Length	Parameter Name	SPN
1	1 byte	Command ID	8
2-8	7 bytes	Command Data	9

3. SPNs

3.1. SPN_PG 1 Rotary Position Channel 1

NRH27C Angle of rotation for channel 1 output.

Data Length: 2 bytes**
Resolution: 0.022* degrees/bit, 0 offset
Data Range: 0 to 1440 degrees   Operational Range: 0 to 360 degrees
Type: Measured
Supporting Information:
PGN reference: 65400

Note:
* 360 degrees using least significant 14 bits – Calculated as 360° / 2^14 per bit.
** Position data is transmitted in MOTOROLA format by default (i.e. most significant byte first).   Can be configured to INTEL format (i.e. least significant byte first).

3.2. SPN_PG 2 Rotary Position Channel 2

NRH27C Angle of rotation for channel 2 output.

Data Length: 2 bytes**
Resolution: 0.022* degrees/bit, 0 offset
Data Range: 0 to 1440 degrees   Operational Range: 0 to 360 degrees
Type: Measured
Supporting Information:
PGN reference: 65400

Note:
* 360 degrees using least significant 14 bits – Calculated as 360° / 2^14 per bit.
** Position data is transmitted in MOTOROLA format by default (i.e. most significant byte first).   Can be configured to INTEL format (i.e. least significant byte first).

3.3. SPN_PG 3 Channel 1 Status

NRH27C Status signal which indicates the status of channel 1.

00 – Disabled
01 – Enabled / Normal Operation
10 – Error
11 – Not Available

Note: Bit order is LSB 1

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3   Operational Range: same as data range
Type: Measured
Supporting Information:
PGN reference: 65400

3.4. SPN_PG 4 Channel 2 Status

NRH27C Status signal which indicates the status of channel 2.

00 – Disabled
01 – Enabled / Normal Operation
10 – Error
11 – Not Available

Note: Bit order is LSB 1

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3   Operational Range: same as data range
Type: Measured
Supporting Information:
PGN reference: 65400

3.5. SPN_PG 5 System Status

NRH27C status signal which indicates the status of the system. Any value other than 0 represents an internal system error. Outputs should be ignored if there is a system error.

0000 – System OK
xxx1 – Configuration Data Checksum Error
xx1x – Linearity Table Checksum Error
x1xx – Internal SPI Bus Error
1xxx – Internal Loop Time Overrun Error

Data Length: 4 bits
Resolution: 2 states/4 bit, 0 offset
Data Range: 0 to 16   Operational Range: same as data range
Type: Measured
Supporting Information:
PGN reference: 65400

3.6. SPN_PG 6 Channel 1 Error Flags

Channel 1 Error Flags indicates error states of various diagnostic available for channel 1.

Bit Position	Error Description
LSB 1	ADC Failure
2	ADC Saturation (Electrical failure or field too strong)
3	Analogue Gain Below Trimmed Threshold (Likely reason: field too weak)
4	Magnetic Field Too Weak
5	Magnetic Field Too Strong
6	Analogue Gain Above Trimmed Threshold (Likely reason: field too strong)
7	Analogue Chain Rough Offset Compensation: Clipping
MSB 8	Device Supply Vdd Greater than 7V

Note: Bit order is LSB 1

For each bit:
0 – No error
1 – Error

Data Length: 1 byte
Resolution: 256, 0 offset
Data Range: 0 to 255   Operational Range: same as data range
Type: Measured
Supporting Information:
PGN reference: 65400

3.7.   SPN_PG 7 Channel 2 Error Flags

Channel 2 Error Flags indicates error states of various diagnostic available for channel 2.

Bit Position	Error Description
LSB 1	ADC Failure
2	ADC Saturation (Electrical failure or field too strong)
3	Analogue Gain Below Trimmed Threshold (Likely reason: field too weak)
4	Magnetic Field Too Weak
5	Magnetic Field Too Strong
6	Analogue Gain Above Trimmed Threshold (Likely reason: field too strong)
7	Analogue Chain Rough Offset Compensation: Clipping
MSB 8	Device Supply Vdd Greater than 7V

Note: Bit order is LSB 1

For each bit:
0 – No error
1 – Error

Data Length: 1 byte
Resolution: 256, 0 offset
Data Range: 0 to 255   Operational Range: same as data range
Type: Measured
Supporting Information:
PGN reference: 65400

3.8.   SPN_PG 8 Command ID

This SPN is used to identify which command to process on receipt of a configuration command (PGN_PG 65402). Additional data needed to process the command if needed is set in SPN_PG 9 (Command Data).

When used in the Acknowledge message (PGN_PG 65401) this SPN will reflect the command that has been processed.

Data Length: 1 byte
Resolution: 256, 0 offset
Data Range: 0 to 255   Operational Range: 1 to 13
Type: Measured
Supporting Information:
PGN reference: 65401 / 65402

Value	Command	Command Actioned
0x01	Unlock	Instantly
0x02	Node ID	After a power cycle
0x03	Frame Rate	Instantly
0x04	Baud Rate	After a power cycle
0x05	Output Direction	Instantly
0x06	Zero	Instantly
0x07	Save	Instantly
0x08 to 0x0C	Reserved	n/a
0x0D	Byte Order	Instantly

3.9. SPN_PG 9 Command Data

This SPN is used for any additional data needed to process the command (SPN_PG 8) if needed. It is always 7 bytes long with unused bytes set to 0x00.

Data Length: 7 bytes
Resolution: n/a
Data Range: n/a   Operational Range: n/a
Type: Measured
Supporting Information:
PGN reference: 65402

Command (SPN_PG 8)	Data Bytes (SPN_PG 9)	Description
(0x01) Unlock	Byte 1 – 0x2A ('*') Byte 2 – 0x55 ('U') Byte 3 – 0x4E ('N') Byte 4 – 0x4C ('L') Byte 5 – 0x4F ('O') Byte 6 – 0x43 ('C') Byte 7 – 0x4B ('K')	This command unlocks the device for configuration. No other commands will be processed until the NRH27C first receives this Unlock command.
(0x02) Node ID	Byte 1 – New Node ID In the range of 0x00 – 0xF7	This command sets the Node ID for the device.
(0x03) Frame Rate	Byte 1 – New Frame Rate Chosen from: 1 – 25mS 2 – 50mS 3 – 100mS	This command sets the Frame Rate for the device.
(0x04) Baud Rate	Byte 1 – New Baud Rate Chosen from: 1 – 50 Kbps 2 – 125 Kbps 3 – 250 Kbps 4 – 500 Kbps 5 – 1 Mbps	This command sets the Baud Rate for the device. It is updated at next power up.
(0x05) Output Direction	Byte 1 – Channel Where: 0x00 – Channel 1 0x01 – Channel 2 Byte 2 – Direction Where: 0x00 – Counter Clockwise 0x01 – Clockwise	This command sets the output direction for a channel.
(0x06) Zero	Byte 1 – Channel Where: 0x00 – Channel 1 0x01 – Channel 2	This command sets the current position to 0° for a channel.
(0x07) Save	Unused, set all to 0x00	This command saves any previous configuration settings permanently to EEPROM.

(0x0D) Byte Order	Byte 1 – New Byte Order Chosen From: 0x00 – MOTOROLA 0x01 - INTEL	This command sets SPN 1 & 2 (Rotary Position data) byte order. The default is MOTOROLA.

3.10. SPN_PG 10 Sequential Counter

A sequential counter starting from zero, incrementing on every position message (PGN_PG 65400) transmission. On reaching 255, the next position message transmitted will start from zero.

Data Length: 1 byte
Resolution: 256, 0 offset
Data Range: 0 to 255   Operational Range: same as data range
Type: Measured
Supporting Information:
PGN reference: 65400

4. Configuring Parameters

To make changes to the configurable parameters listed in SPN_PG 8 Command ID the device must first be unlocked. This is achieved by sending a configuration command (PGN_PG 65402) with the command ID (SPN_PG 8) set to 1 and the command data (SPN_PG 9) set to 0x 2A 55 4E 4C 4F 43 4B. An acknowledgement (PGN_PG 65401) will be transmitted from the device.

Subsequent command id's and command data selected from SPN_PG 8 and SPN_PG 9 respectively, can be transmitted to the device to configure the devices parameters. Each will be acknowledged by PGN_PG 65401 if successful.

Some of the parameters will be effective immediately and some will need a power cycle (see SPN_PG 8).

To permanently store the new parameters into EEPROM the save command must be transmitted to the device (Command ID (SPN_PG 8) set to 7 and the command data (SPN_PG 9) set to 0x 00 00 00 00 00 00 00).

On power cycling the device, the device will be locked. There is no command to lock the device.

5. J1939 Address Claiming

The NRH27C is classified as a Service Configurable Address CA. The Node ID can only be configured by using the configuration command (PGN_PG 65402).

The following J1939 Address Claiming features are implemented in the NRH27C:

Capability	Required / Desirable / Permissible / Not recommended or Required	Implemented in NRH27C?
Issue a Valid Address Claim Message before using a Source Address	Required	YES
Upon receipt of a request for Address Claimed message, a CA should transmit an Address Claimed or a Cannot Claim SA Message	Required	YES
Name retained across power up cycle	Required	YES
Address retained across power up cycle	Required	YES
Name field programmability	Desirable	NO
Address table retained across power-up	Permissible	NO
Support Commanded Address Message Containing Own NAME	Permissible	NO
Support transmission of Commanded Address Message	Permissible	NO
Send Request for Address Claim before attempting to claim	Permissible	NO
Address configuration capability	Permissible	NO
Monitor and correct situations where CAs cannot claim addresses	Not recommended or required	NO

The devices unique serial number is contained in the NAME field (Byte 1 bits 8-1, byte 2 bits 8-1 and byte 3 bits 8-6) of the Address Claim message (PGN 60928).