POSITAL
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ABSOLUTE ROTARY ENCODER WITH J1939 INTERFACE

USER MANUAL

SAE J1939

Main Features

- Reliable and heavy-duty industrial design
- Optional compact 36mm∅ housing
- Blind hollow shaft: 6, 8, 10, 12, 15mm∅
- Max. 4096 steps per revolution (12 Bit)
- Max. 32768 revolutions (15 Bit)
- J1939 interface with velocity output

Programmable Parameters

- Direction of rotation (complement)
- Resolution per revolution
- Total resolution
- Preset value
- Node-ID
- Baudrate
- Terminal Resistor

Mechanical Structure

- Optional stainless steel housing option
- Stainless steel shaft

Electrical Features

- Programmable Termination Resistor
- Polarity inversion protection
- Over-voltage-peak protection
- Galvanic Isolation

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J1939

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General

Important Information
Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Please Note
Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by POSITAL for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained people.

About this Manual

Background

This user manual describes how to install and configure an UCD absolute rotary encoder with J1939 interface.

Relate Note

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User Annotation

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J1939

1. Introduction

This manual explains how to install and configure an IXARC absolute rotary encoder with J1939 interface.

Magnetic rotary encoders determine positions using Hall effect sensor technology. A permanent magnet fixed to the shaft generates a magnetic field that is sampled by the Hall effect sensor, which translates the measured value into a unique absolute position value.

To register revolutions even when no voltage is applied, energy from the turning of the shaft must suffice for proper operation. An innovative, patented technology makes this feasible even at low rotational speeds and through long standstill periods – a Wiegand wire ensures that the magnetic field can only follow the turning of the shaft in discrete steps. A coil wound on the Wiegand wire receives only brief, strong voltage spikes, which prompt the reliable recognition of each revolution.

Typical Applications:
- Packing Machines
- Mobile Machines
- Wind Mills
- Medical Equipment

1.1 General J1939 Information

Functions such as preset value, resolution, etc can be configured. The node number and speed in bauds are determined by their corresponding object dictionary entries.

Note: All datasheets and manuals can be downloaded for free from our website www.posital.com

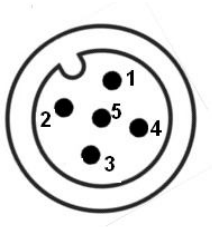
2. Installation

2.1 Electrical Connection

Please refer to the product specific datasheet, which can be downloaded from the website www.posital.com. The encoder is connected via a 5-pin round M12 connector or integrated cable exit.

Please note that different M12 cables may have different pin/color assignments. Extra care should be taken to ensure that the correct function/pin/color assignment is made.

Signal	5 pin round connector	Cable exit
CAN Ground	1	Green
V_S Supply Voltage	2	Red
0 V Supply Voltage	3	Yellow
CAN High	4	White
CAN Low	5	Brown



Connect the shield of the cable to the connector housing for proper EMC shielding measures. It is not recommended to connect the shield to CAN Ground.

2.2 Installation Precautions

Warning: Do not remove or mount while the encoder is under power!

Avert any modifications to the housing!

Avoid mechanical load!

Prior to installation, please check for all connections and mounting instructions to be complied with. Please also observe the general rules and regulations on operating low voltage technical devices, for safety and sustainability of IXARC encoders over a long period of time.

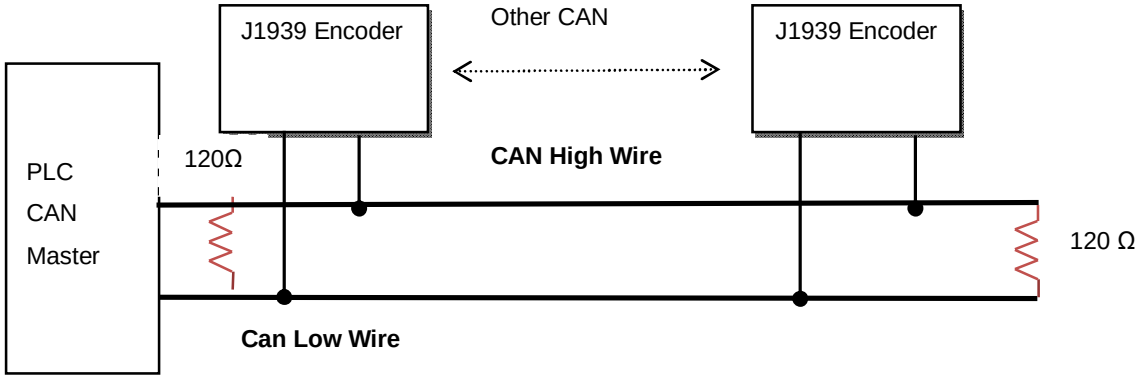
Please read the installation leaflet for detailed instructions and precautions during mounting and installation.

2.3 Bus Termination

If the encoder is connected at the end or beginning of the bus or is used at transmission ≥ 50 kBaud a termination resistor of 120 Ohm must be used in order to prevent reflection of information back into the CAN bus. IXARC J1939 sensors have built-in termination resistors that can be activated (1) or deactivated (0) if necessary.

The bus wires can be routed in parallel or twisted, with or without shielding in accordance with the electromagnetic compatibility requirements. A single line structure minimizes reflection.

The following diagram shows the components for the physical layer of a two-wire CAN bus:



2.4 LED Definition

Status LED (Duo colored) **Green / Red LED**	**Meaning**
Green off	No power supply
Green on	Normal operation mode, Encoder transmits data
Red off	Normal operating mode.
Red single flash	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
Red on	The can controller is in state bus off. No communication possible anymore. Too many error frames in the network or wrong baudrate.

3. Technical Data

In the following section you will find general technical data about IXARC absolute rotary encoders with J1939 interface.

Electrical Data

Interface	Transceiver according ISO 11898, galvanically isolated by opto-couplers
Transmission rate	Max. 1 MBaud (Default 250kbaud)
Supply voltage	9 – 30* V DC (absolute limits)
Current consumption	Max. 70 mA with 10 V DC, max. 50 mA with 24 V DC
Power consumption	Max. 1.2 Watts
EMC	Emitted interference: EN 61000-6-4
	Noise immunity: EN 61000-6-2

*Absolute rotary encoders should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Sensor data

Singleturn technology	Magnetic 2 axis Hall sensor
Singleturn resolution	Up to 65536 steps / revolution (16 Bit)
Singleturn accuracy	+/-0.1°
Internal cycle time	< 1 ms
Multiturn technology	Self supplied magnetic pulse counter

Environmental Conditions

Please refer to product specific datasheet

Mechanical Data

Please refer to product specific datasheet

4. Configuration

The purpose of this chapter is to describe the configuration parameters of the absolute rotary encoder with J1939 interface.

4.1 PGN Default Definitions

Repetition Rate	50 ms
Baudrate	250 k (Default)
Node ID	32
Positive Counting Direction	Clockwise (looking down at shaft)
Velocity Filter	On
Termination Resistor	Off

Position Data, PGN 61184

Data Page	0
PDU Format	255 (0xFF)
PDU Specific	170 (0xAA)
Data Length	8 bytes

Encoder Message

Byte	Description
Byte 1	Encoder Absolute Position – Byte 1 (LSB)
Byte 2	Encoder Absolute Position – Byte 2
Byte 3	Encoder Absolute Position – Byte 3
Byte 4	Encoder Absolute Position – Byte 4 (MSB)
Byte 5	Encoder Velocity – Byte 1 (LSB) - Steps/sec
Byte 6	Encoder Velocity – Byte 2- Steps/sec (MSB)
Byte 7	Byte Container 1 – constant
Byte 8	Byte Container 2 – constant

Encoder Cyclic Message

Identifier	CAN Data	Description
18FFAA20	4E B8 64 0A 0F 02 00 00	Bytes 1 − 4: Encoder absolute position 0x0A64B84E = 174372942 Bytes 5 − 6: Encoder speed 0x020F = 527 rpm Byte 7 – 8: constant 0x0000

4.2 Read Definitions

Identifier	CAN Data	Description
18EA20XX	01 EF 00 XX XX XX XX XX	Read request direction of rotation
18EF0020	*01* **00 00 00 00** 00 00 00	Encoder response Index 01 direction of rotation = 0x0000 =CW
18EA20XX	02 EF 00 XX XX XX XX XX	Read request steps per revolution
18EF0020	*02* ***00 10 00*** **00** 00 00 00	Encoder response Index 02 resolution = 0x00001000 = 4096 steps/revolution
18EA20XX	03 EF 00 XX XX XX XX XX	Read request total resolution
18EF0020	*03* **00 00 00 80** 00 00 00	Encoder response Index 03 total resolution = 0x80000000 = 2147483648 steps
18EA20XX	04 EF 00 XX XX XX XX XX	Read request Offset Value
18EF0020	*04* **00 00 00 00** 00 00 00	Encoder response Index 04 Preset = 0
18EA20XX	05 EF 00 XX XX XX XX XX	Read request cycle time
18EF0020	*05* **32 00 00 00** 00 00 00	Encoder response Index 05 PGN 65450 cycle time (position, speed, diagnosis) = 0x0032 = cyclic communication 50ms
18EA20XX	07 EF 00 XX XX XX XX XX	Read request baudrate
18EF0020	*07* **04 00 00 00** FF FF FF	Encoder response* Baudrate 0x04 = 250kBaud
18EA20XX	08 EF 00 XX XX XX XX XX	Read request encoder address
18EF0020	*08* **20 00 00 00** FF FF FF	Encoder response Address/Node ID 0x20 = $32_{decimal}$
18EA20XX	09 EF 00 XX XX XX XX XX	Read request termination resistor
18EF0020	*09* **00 00 00 00** FF FF FF	Encoder response Termination resistor off

4.3 Write Definitions

Identifier	CAN Data	Description
EF20XX	01 **00 00 00 00** XX XX XX	Index 01 direction of rotation = 0x0000 =CW
EF20XX	02 **00 10 00 00** XX XX XX	Index 02 resolution = 0x00001000 = 4096 steps/revolution
EF20XX	03 **00 00 00 20** XX XX XX	Index 03 total resolution = 0x20000000 = 536870912 steps
EF20XX	04 **00 00 00 00** XX XX XX	Index 04 Preset = 0
EF20XX	05 **00 00 00 00** XX XX XX	Index 05 PGN 65450 cycle time (position, speed, diagnosis) = 0x0000 = cyclic communication stopped
EF20XX	07 **03 00 00 00** XX XX XX	Baudrate 0x03 = 125kBaud*
EF20XX	08 **20 00 00 00** XX XX XX	Address/Node ID 0x20 = $32_{decimal}$
EF20XX	09 **00 00 00 00** XX XX XX	Termination resistor = off
EF20XX	FA **73 61 76 65** XX XX XX	Save parameter with Reset
EF20XX	FC **6C 6F 61 64** XX XX XX	Restore factory settings with save and reset

5. Parameter Index Definitions

Parameter Index 01 – Counting Direction

Data Type	Unsigned 16
Access	ReadWrite
Default	0 = CW
Function	Counting Direction
Values	Bit 0 direction of rotation 0 → CW, clockwise 1 → CCW, counter-clockwise

Parameter Index 02 – Resolution

Data Type	Unsigned 32
Access	ReadWrite
Default	0x00001000 = 4096 steps/revolution
Function	Steps per Turn
Values	≤4096 and must be equal to 2^n

Parameter Index 03 – Total Range

Data Type	Unsigned 32
Access	ReadWrite
Default	0x80000000 = 2147483648 steps
Function	Resolution/turn * # of turns
Values	Must be equal to 2^n

Parameter Index 04 – Preset

Data Type	Unsigned 32
Access	ReadWrite
Default	0
Function	Allows the zero point to be set at current position
Values	0

Parameter Index 05 – Cyclic Timer

Data Type	Unsigned 16
Access	ReadWrite
Default	50 (50ms)
Function	Cyclic Timer
Values	0 → Stop Cyclic Transmission n → Frequency of Cyclic Transmission (n*ms)

Parameter Index 07 – Baudrate

Data Type	Unsigned 16	
Access	ReadWrite	
Default	0x04 = 250kBaud	
Function	Set Baudrate	
Values	Baudrate in kBit/s	Byte
	20	00h
	50	01h
	100	02h
	125	03h
	250	04h
	500	05h
	800	06h
	1000	07h

Parameter Index 08 – NodeID

Data Type	Unsigned 8
Access	ReadWrite
Default	32
Function	Change NodeID
Values	1 - 126

Parameter Index 09 – Termination Resistor

Data Type	Unsigned 8
Access	ReadWrite

Default	0
Function	Activate or Deactivate Termination Resistor
Values	1 → On 0 → Off

Parameter Index FA – Save

Data Type	Unsigned 32
Access	Write
Default	FA 73 61 76 65 XX XX XX
Function	Save Current Settings and Reset Encoder
Values	FA 73 61 76 65 XX XX XX

Parameter Index FC – Restore

Data Type	Unsigned 32
Access	Write
Default	FC 6C 6F 61 64
Function	Restore to Factory Settings
Values	FC 6C 6F 61 64

6. Disclaimer