

ABSOLUTE ROTARY ENCODER WITH J1939 INTERFACE USER MANUAL



SAE J1939

Main Features

- Reliable and heavy-duty industrial design
- Optional compact 36mmØ housing
- Blind hollow shaft: 6, 8, 10, 12, 15mmØ
- 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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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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Author: JOR, KMA

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FRABA B.V.

Jan Campertstraat 11,

NL-6416 SG Heerlen

T +49 221-96213-0

info@fraba.com, www.fraba.com

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User Annotation

FRABA B.V. welcomes all readers to send us feedback and comments about this document. For America info@posital.com, for Asia info@fraba.sg, and for Europe info@posital.eu.

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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

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

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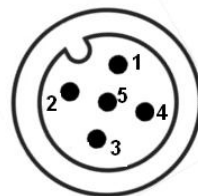
2. Installation

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.

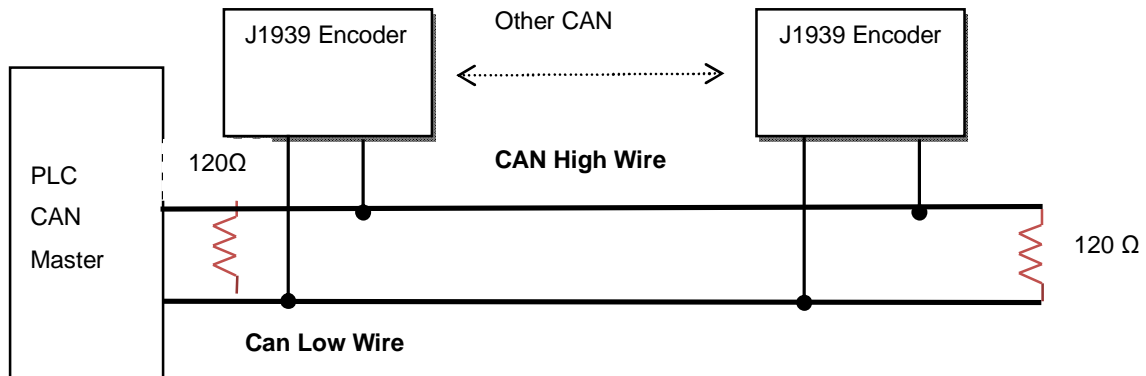
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2.3 Bus Termination

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:



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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. |
| | |

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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

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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 |

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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 |

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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 |

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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 |

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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 |

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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) |

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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 |

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| | |
|----------|---|
| 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

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