

MANUAL

ENI58PL-S*, ENI58PL-R*****
Programming via IO-Link



CE

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



Note!

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols



Note!

This symbol brings important information to your attention.



Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

1.4 Intended Use

Incremental rotary encoders in the ENI58PL product family deliver a set number of pulses for each shaft revolution. Downstream electronics can be used to determine the rotational speed, the angle of rotation, or the direction of rotation by evaluating the impulse. The rotary encoders from the ENI58PL product family allow the pulse count, the direction of rotation, and the output type to be programmed via the standardized IO-Link interface. The programming is carried out by integrating the device-specific IODD (IO Device Description) into an FDT frame program or by using the Pepperl+Fuchs SmartBridge® and a mobile device in conjunction with the SmartBridge® app via Bluetooth. We recommend using the "PACTware" software as an FDT frame application.



1.5 General Safety Instructions

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Installation and commissioning of all devices may only be performed by trained and qualified personnel.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.



Note!

Disposal

Electronic waste is hazardous waste. When disposing of the equipment, observe the current statutory requirements in the respective country of use, as well as local regulations.

1.6 Declaration of Conformity

This product was developed and manufactured under observance of the applicable European standards and guidelines.



Note!

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, D-68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.



2 Product Description

2.1 Use and Application

Incremental rotary encoders in the ENI58PL product family deliver a set number of pulses for each shaft revolution. Downstream electronics can be used to determine the rotational speed, the angle of rotation, or the direction of rotation by evaluating the impulse.

Typical applications include positioning tasks and measuring length or velocity in drive motors, wind power plants, material handling, elevators, and automation systems.

The rotary encoders in the ENI58PL product family can be programmed offline via the standardized IO-Link interface V1.1.

The following parameters can be programmed offline:

- Clockwise/counterclockwise direction of rotation
- Resolution as a pulse count from 1 to 16384
- Output configuration as a TTL or HTL signal level

What is IO-Link?

IO-Link is a new dimension in the communication of and with devices (sensors, rotary encoders, etc.). The possibility of making the intelligence that is already integrated in each and every device fully available to users opens up new possibilities for automation. Use of IO-Link produces positive effects for all factory automation applications. The technology offers particular benefits with regard to servicing (troubleshooting, maintenance, and device replacement), during the commissioning process (cloning, identification, configuration, and localization) and during operation (job changeover, continuous parameter monitoring, and online diagnostics). Reducing the variety of interfaces offers users considerable potential for savings. This variety of interfaces often results from having analog sensor inputs and the complex installation associated with them.

With the rotary encoders from the ENI58PL product family, the IO-Link interface is only used for programming. The rotary encoders are not intended for IO-Link operation.

Device description file (IODD)

The device parameters are different for each device. A standardized description of these parameters can be found in the IO Device Description file (IODD). IODDs can be integrated in a control environment to allow IO-Link devices to be used for IO-Link operation. Thus, both programming and exchanging process data can be done with a PLC. In addition, the IODD can be imported into various engineering tools from different system providers for programming and diagnostics if necessary, providing that these tools support IODD.

Offline parameterization

You can carry out offline parameterization using either an IO-Link master USB and an FDT frame application or using the Pepperl+Fuchs SmartBridge® and a mobile device in conjunction with the SmartBridge® app via Bluetooth.

We recommend using the "PACTware" software as an FDT frame application and user interface. So that it can be used in PACTware, the IODD must first be translated via the "IODD interpreter DTM" software.

The device description file for your ENI58PL rotary encoder can be found online at www.pepperl-fuchs.com on the relevant product page. It contains the IODD (IO Device Description) and also a GDD (Graphical Device Description) for visualizing the programming. The PACTware software and "IODD Interpreter DTM" can also be found here.

The SmartBridge® app is available for Android devices in the Google Play Store and for iOS devices in the Apple App Store.

2.2 Accessories

Various accessories are available.

2.2.1 Programming Aids for Use with the IO-Link Master USB



Note!

The simplest way to obtain the software products listed below is to download them from the **www.pepperl-fuchs.com** website on the product page for the relevant ENI58PL rotary encoder.

The following programming aids are available:

Designation	Description
PACTware	FDT frame application for operating IODDs and DTMs
Pepperl-Fuchs-ENI58PL-1024CGR-IODD1.0.0	IODD IO Device Description—device description for programming the rotary encoder See the product page for the relevant ENI58PL at www.pepperl-fuchs.com .
IODD Interpreter DTM	Software for integrating IODDs into an FDT frame application (e.g., PACTware).
IO-Link-Master02-USB	USB to IO-Link adapter box for controlling an IO-Link sensor directly via a PC.
IO-Link-Master02-USB DTM	Device type manager—software for operating the IO-Link-Master02 USB via FDT.
PACTware IO-Link Connection Wizard	Add-in for PACTware that enables automatic detection of the connected IO-Link master USB and IO-Link sensor, also offering automatic setup of PACTware projects and connection to the IO-Link sensor.

Table 2.1

2.2.2 Programming Aids for Use with the SmartBridge®

Designation	Description
Pepperl-Fuchs-ENI58PL-1024CGR-IODD1.0.0	IODD IO Device Description—device description for programming the rotary encoder See the product page for the relevant ENI58PL at www.pepperl-fuchs.com .
SmartBridge® WRM-F301-IO-B15-2V15	IO-Link/Bluetooth interface using SmartBridge technology for programming IO-Link devices using a mobile end device and the SmartBridge® app.
24 V power supply	24 VDC power supply for SmartBridge and rotary encoders (power of at least 24 W, with 1 A output current). To be provided by the customer.

Table 2.2

2.2.3 Connection Cable for Programming

Depending on the connection type on the rotary encoder, the following adapter cables are available for connecting the rotary encoder to the IO-Link master:

Connection type on the rotary encoder	Adapter cable	Connection type of the adapter cable
M12, 5-pin	V15S-G-0.5M-CGR-BD	Rotary encoder side: M12 single-ended female cordset, 5-pin IO-Link master side: M12 plug, 5-pin
M12, 8-pin	V15S-G-0.5M-CGR-BE	Rotary encoder side: M12 single-ended female cordset, 8-pin IO-Link master side: M12 plug, 5-pin
M23, 12-pin, right-rotating	V15S-G-0.5M-CGR-AA	Rotary encoder side: M23 single-ended female cordset, 12-pin, right-rotating IO-Link master side: M12 plug, 5-pin
M23, 12-pin, left-rotating	V15S-G-0.5M-CGR-AB	Rotary encoder side: M23 single-ended female cordset, 12-pin, left-rotating IO-Link master side: M12 plug, 5-pin
Cable	V15S-G-0.6M-CGR-TC	Rotary encoder side: Terminal block IO-Link master side: M12 plug, 5-pin

Table 2.3

2.2.4 Connection Cable for Normal Operation

To use the rotary encoder for normal operation in the plant, you can select one of the following connection cables. Additional connection cables are available as accessories.

Connection type on the rotary encoder	Connection cable	Connection type of the adapter cable
M12, 8-pin	V19-G-2M-PVC-TP	Rotary encoder side: M12 single-ended female cordset, 8-pin Other side: 2 m cable with free cable end
M12, 8-pin	V19-G-5M-PVC-TP	Rotary encoder side: M12 single-ended female cordset, 8-pin Other side: 5 m cable with free cable end
M12, 8-pin	V19-G-10M-PVC-TP	Rotary encoder side: M12 single-ended female cordset, 8-pin Other side: 10 m cable with free cable end

Table 2.4



3 Installation

3.1 Instructions for Mechanical and Electrical Installation

**Note!**

More installation-relevant information on technical data, mechanical data, and available connection cables for the relevant incremental rotary encoder types "ENI58PL-S***" and "ENI58PL-R***" can be found in the corresponding datasheet.

Please observe the following instructions to ensure safe operation of the incremental rotary encoder:

**Warning!**

Work must only be performed by trained and qualified personnel!

Commissioning and operation of this electrical equipment must only be performed by trained and qualified personnel. This means individuals who are qualified to commission (in accordance with safety technology), connect to ground, and label devices, systems, and circuits.

**Warning!**

Only perform work when the system is in a de-energized state!

De-energize your device before performing work on the electrical connections. Short circuits, voltage peaks, and similar events can lead to faults and undefined statuses. This presents a significant risk of personal injury and property damage.

**Warning!**

Check electrical connections before switching on the system!

Check all electrical connections before switching on the system. Incorrect connections present a significant risk of personal injury and property damage. Incorrect connections can lead to malfunctions.

**Caution!**

Do not remove the rotary encoder housing!

Do not remove the rotary encoder housing under any circumstances, as damage and contamination can occur as a result of taking improper action. It is, however, permitted to remove connector covers.

**Caution!**

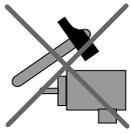
Do not perform any electrical modifications!

It is not permitted to perform electrical modifications on the rotary encoders. If you open or modify the device yourself, not only are you endangering yourself and others, but you will also void any warranty and absolve the manufacturer of any liability.

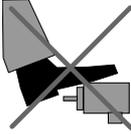
**Caution!**

Ensure that the data cable and power supply cable are physically separate!

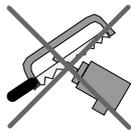
Route the cordset of the rotary encoder so that it is a suitable distance away from power supply cables to avoid faults. Shielded cables must be used to ensure reliable data transfer. A perfect ground connection must also be ensured.



Do not allow the rotary encoder to fall or expose it to strong vibrations. The rotary encoder is a precision instrument.



Rotary encoders from Pepperl+Fuchs are robust; however, they should nevertheless be protected against damage in ambient conditions by taking appropriate protective measures. In particular, the devices must not be installed in a location where they could be misused as a handle or climbing aid.



Do not make any alterations to the drive shaft or the housing of the rotary encoder.



Note!

For rotary encoders with solid shaft, the shaft must be connected to the drive shaft on the part to be measured via a suitable coupling. The coupling is required to protect the drive shaft on the rotary encoder against excessive levels of force, to compensate for shaft offset, and to reduce the impact of vibrations. Suitable couplings are available as accessories from Pepperl+Fuchs.

3.2 Connection for IO-Link Programming

Connection for IO-Link programming via IO-Link master USB

Connect the rotary encoder to the IO-Link master via a suitable 5-wire connection cable, depending on the connection type of the rotary encoder (according to the following table).

Connection for IO-Link programming via IO-Link master USB

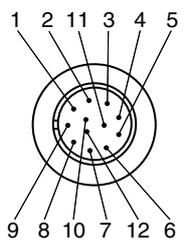
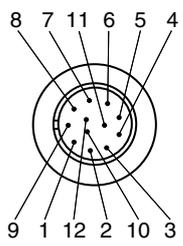
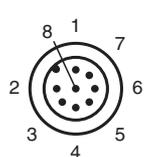
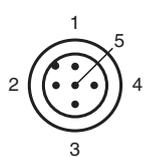
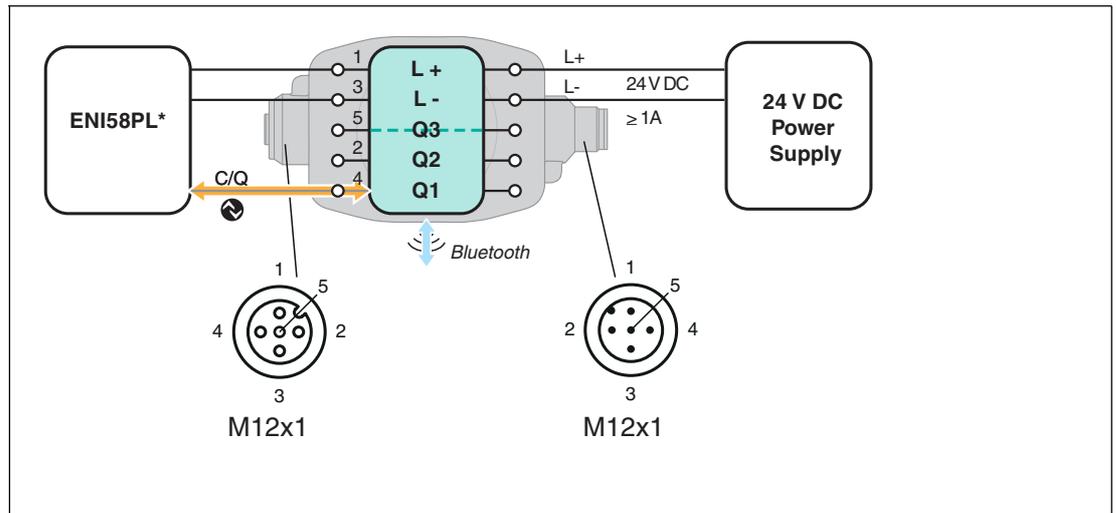
Signal	Cable	M23 connector plug, 12-pin, right-rotating	M23 connector plug, 12-pin, left-rotating	M12 x 1 connector plug, 8-pin	M12 x 1 connector plug, 5-pin
L-	White	10	10	1	3
L+	Brown	12	12	2	1
NC	Green	5	5	3	2
NC	Gray	8	8	5	4
NC	Yellow	6	6	4	-
NC	Pink	1	1	6	-
IO-Link	Blue	3	3	7	5
NC	Red	4	4	8	-
NC	-	2	2	-	-
NC	-	7	7	-	-
NC	-	11	11	-	-
					

Table 3.1

Connection for IO-Link programming via SmartBridge®



1. Connect the SmartBridge® to the rotary encoder using a suitable connection cable, depending on the connection type of the rotary encoder.
2. Connect the SmartBridge® to a 24 VDC voltage source.

3.3 Connection for Normal Operation



To use the rotary encoder in normal operation after programming, proceed as follows:

Connect the rotary encoder to the higher-level control panel via a suitable connection cable, depending on the connection type of the rotary encoder (according to the following table).

Signal	Cable	M23 connector plug, 12-pin, right-rotating	M23 connector plug, 12-pin, left-rotating	M12 x 1 connector plug, 8-pin	M12 x 1 connector plug, 5-pin
GND	White	10	10	1	3
U _b	Brown	12	12	2	1
A	Green	5	5	3	2
B	Gray	8	8	5	4
A/	Yellow	6	6	4	-
B/	Pink	1	1	6	-
Z	Blue	3	3	7	5
Z/	Red	4	4	8	-
NC	-	2	2	-	-
NC	-	7	7	-	-
NC	-	11	11	-	-
Shield	Housing	Housing	Housing	Housing	Housing

Table 3.2

4 Commissioning

4.1 Commissioning with IO-Link in an FDT Environment



Note!

A 5-pin M12 cordset is necessary to connect the rotary encoder to the Pepperl+Fuchs IO-Link master. You can find suitable connection cables by visiting www.pepperl-fuchs.com and clicking on the product page for the relevant sensor.

An IODD (IO-Link Device Description) file is available to download for programming the sensor via IO-Link. See the product page for the relevant sensor at www.pepperl-fuchs.com.

This manual describes how to perform programming using the "PACTware" FDT frame application into which the relevant IODD is loaded. In principle you can use other appropriate FDT frame applications.

To integrate the IODD into PACTware, the IODD must first be converted into a Quasi-DTM using the "IODD Interpreter DTM" software. The IODD must be recorded in the PACTware device catalog. The "IODD Interpreter DTM" can be downloaded from www.pepperl-fuchs.com.

The "Pepperl+Fuchs PACTware Connection Wizard" is available to help you launch and connect the rotary encoder easily. The wizard takes you through all the necessary steps for opening a PACTware project. All of the required software components must first be installed on the PC. Alternatively you can launch PACTware directly and add or start devices such as the IO-Link master and the rotary encoder, the IODD, and the connection setup step by step.



Prerequisites for Commissioning

To activate the rotary encoder via IO-Link in an FDT environment, proceed as follows:

1. Download the necessary software components, such as the IODD Interpreter DTM, PACTware, IO-Link-Master02-USB DTM, and the associated IODD for the rotary encoder from the relevant product page.
2. Install the software.
3. Load the IODD in the IODD interpreter DTM to translate it for PACTware.
4. Check the connection between the rotary encoder and the IO-Link master.



Setting Up Sensor Communication Using PACTware via the "Pepperl+Fuchs PACTware Connection Wizard"

In addition to the aforementioned software components, the "Pepperl+Fuchs PACTware Connection Wizard" must be installed on the PC. The rotary encoder and IO-Link master must also be connected to the PC.

Double-click the "Pepperl+Fuchs PACTware Connection Wizard" icon.

↳ PACTware and the associated DTM/IODD are loaded and the connection to the rotary encoder is automatically established.

Setting Up Sensor Communication Using PACTware (Step by Step)

1. Launch PACTware by double-clicking the PACTware icon.

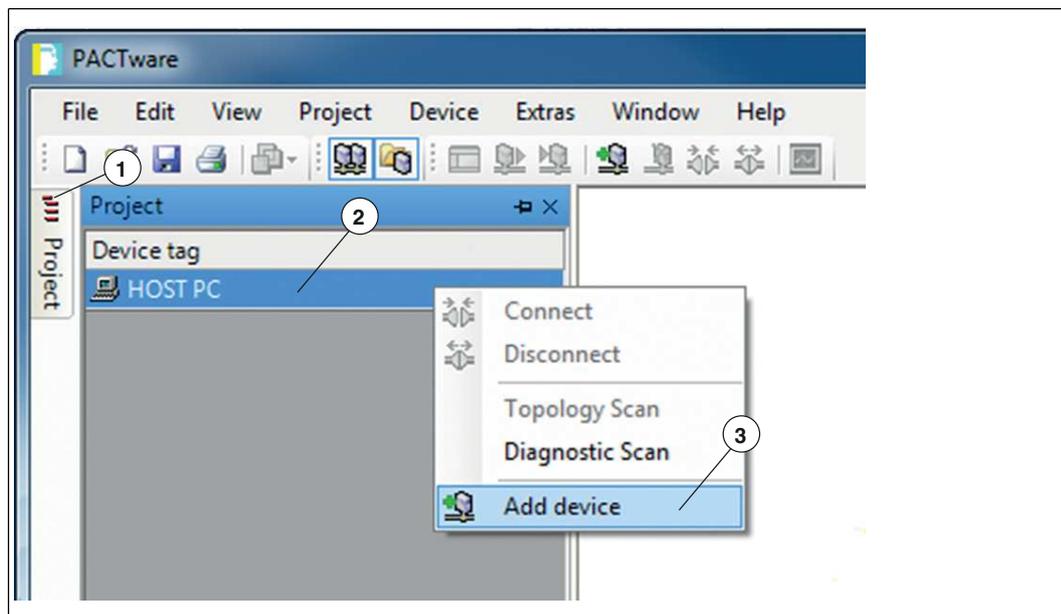


Figure 4.1

2. Click **Project** (1) at the top left.
3. Click **Host PC** (2), then click the right mouse button and select **Add device** (3).
↳ A window for selecting the device is displayed.
4. Check "IO-Link USB master..." in the window and click **OK** to confirm.
↳ The IO-Link USB master is installed in the project as a device.
5. Under Project, click **IO-Link USB master...** (4), then click the right mouse button and select **Add device** from the menu that opens.

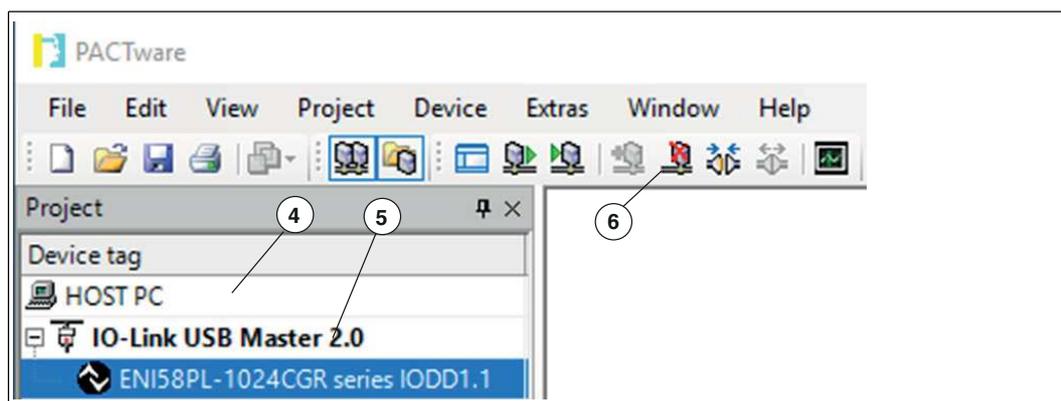


Figure 4.2

- ↳ The window for selecting devices is displayed again with all available DTMs and IODDs.
6. Select the required DTM and use OK to confirm.
↳ The DTM is installed in the project (5) here as example "ENI58PL-1024CGR series IODD1.1."
7. Click the icon for setting up the connection (6).

↳ The data connection to the sensor is established. Status information "connected" will be displayed in the bottom left of the menu if connection is successful.

4.2 Commissioning using IO-Link and the SmartBridge

Pepperl+Fuchs SmartBridge® simplifies setup and can be used to establish a connection to the rotary encoder. The combination of a mobile device, the SmartBridge® app, and the IODD make programming easy.

System requirements

The SmartBridge® app is available in the respective app store (Apple App Store; Google Play). You can install it on mobile devices such as smartphones and tablets that support "Bluetooth LE" (low energy) or "Bluetooth 4.0" and use the iOS (from version 10) or Android (from version 6.0) operating systems.

The IODD file (IO-Link Device Description) is available to download from the **www.pepperl-fuchs.com** website on the product page for the relevant sensor. The download is a zip file containing both the IODD and GDD files.



Note!

For communication between the SmartBridge® app and the SmartBridge® to be possible, the mobile device must meet the following requirements:

- Bluetooth must be enabled,
- The app must have permission to access location data.



Installing and configuring the SmartBridge® app and the IODD/GDD

1. Open the relevant app store on your mobile device and make sure that Bluetooth is enabled.
2. Search for the "SmartBridge Pepperl + Fuchs GmbH" app.



Figure 4.3

3. Follow the instructions for downloading and installing the SmartBridge® app on your mobile device.
4. Download the IODD and GDD from the product page at www.pepperl-fuchs.com and save the ZIP file locally on your mobile device. Unzip the ZIP file immediately.

↳ This will extract an HTML file (GDD) and another ZIP file (IODD).

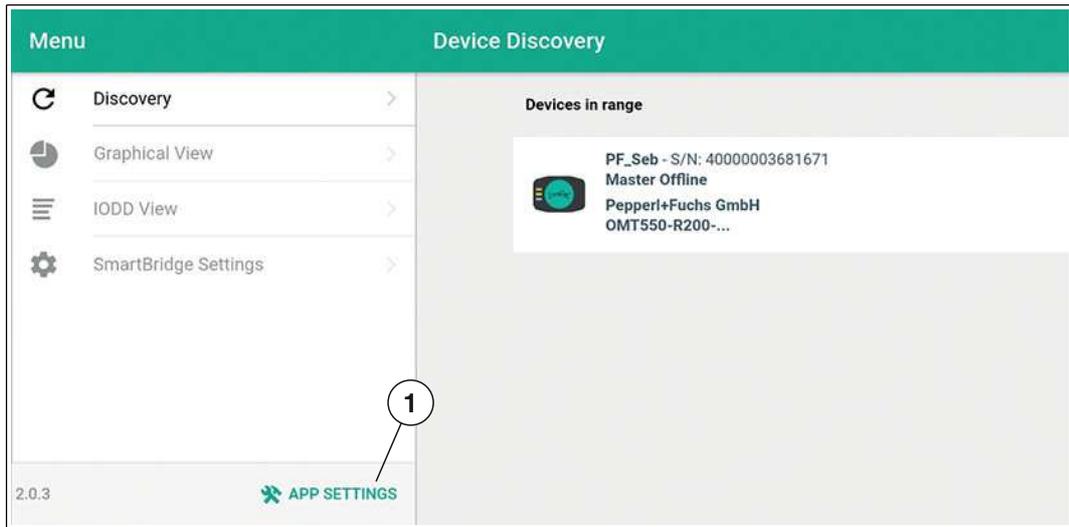


Figure 4.4

5. Open the SmartBridge® app and select the **App Settings** menu (1) using the corresponding menu option.

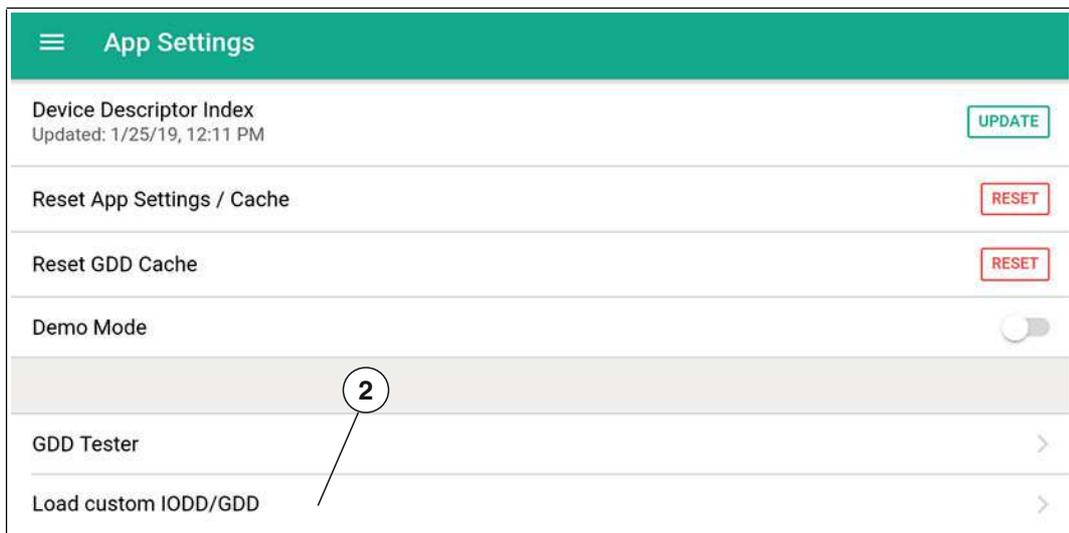


Figure 4.5

6. Select **Load custom IODD/GDD** (2) to load first the IODD and then the GDD into the app in 2 separate steps.

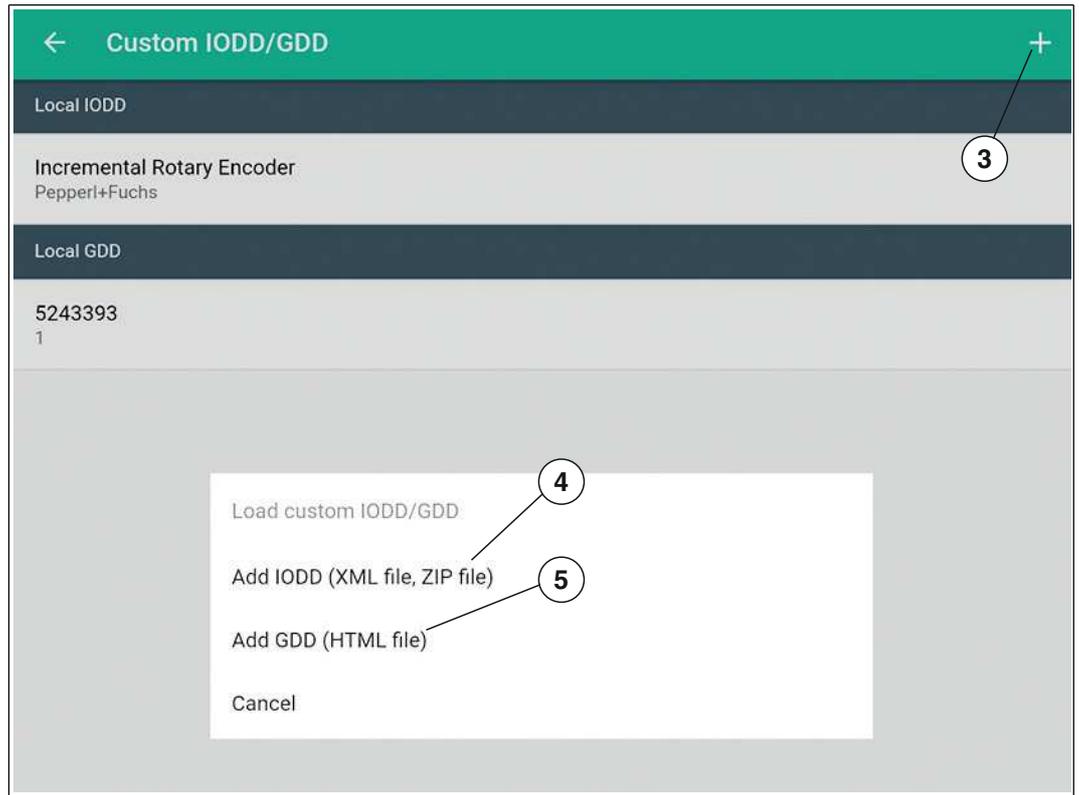


Figure 4.6

7. Tap + (3) to add the IODD and the GDD. First, select **Add IODD...** (4), and then select **Add GDD...** (5).

↳ If the files were implemented successfully, they will be displayed in the menu under **Local IODD** and **Local GDD**.

8. Close and reopen the SmartBridge® app.



Note!

To carry out the subsequent steps, the SmartBridge must be supplied with power and the rotary encoder must be connected to the SmartBridge via a cordset.



SmartBridge® Authentication

When the mobile device is initially connected with the SmartBridge interface, an authentication process first takes place between the communication partners. For this, each SmartBridge interface has a unique device key. The device key is located on the back of the SmartBridge interface in the form of a QR code and as text with the name "Key." After the initial connection, the SmartBridge app remembers the device key. The user does not need to enter it again, but must simply confirm it to establish the connection.

1. From the menu, select the SmartBridge interface you would like to use and follow any further instructions.
On delivery, the interface name is "SB_PF." The user can change this. To do so at a later point, go to "SmartBridge Settings" and "Local name."
2. Share the device key to the mobile device:
Either by typing in the **key**
or
by reading in the **QR code** using the mobile device's camera. Tap the **Scan Code** button when using the camera.

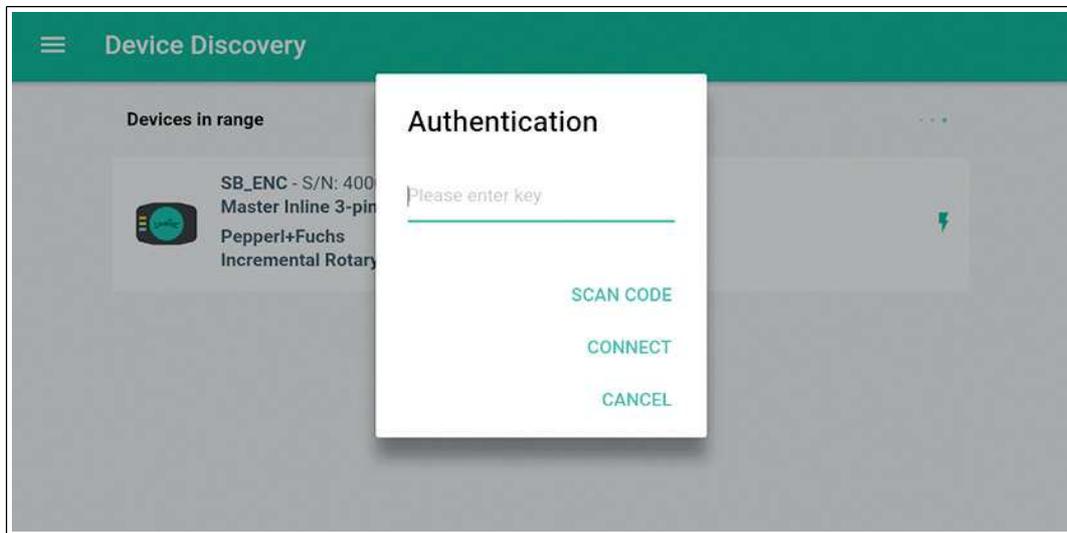


Figure 4.7

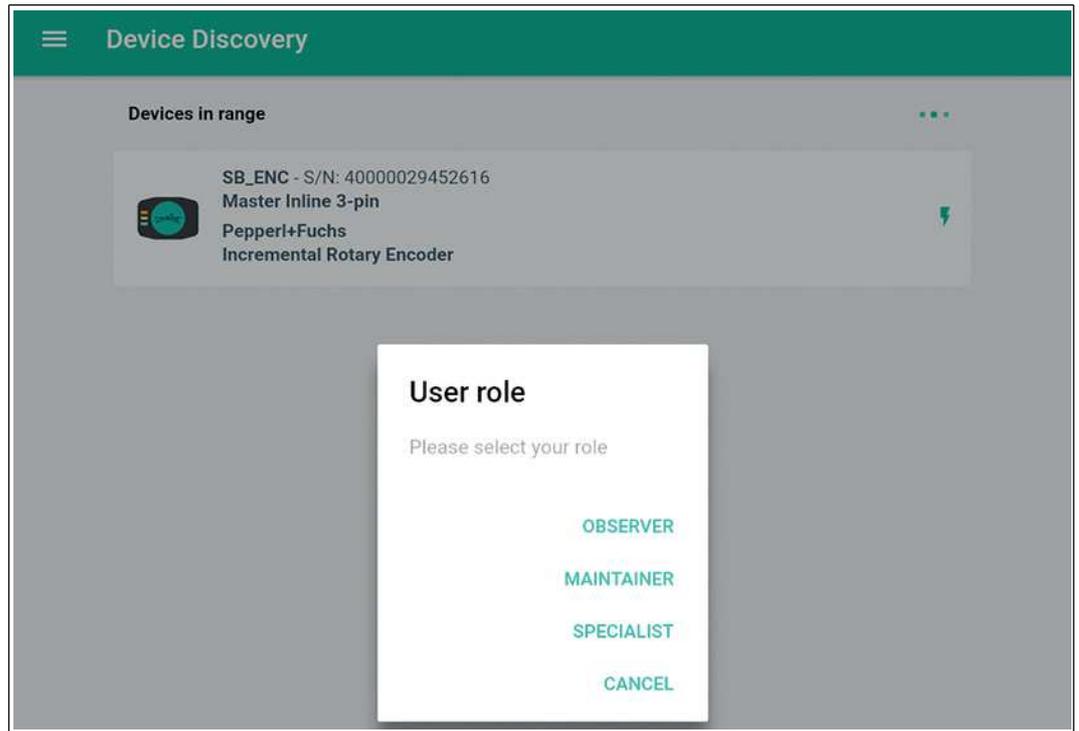


Figure 4.8

3. Select "SPECIALIST" as the user role to be able to use the entire range of programming features.

↳ If the authentication was successful and the rotary encoder has been detected, the app will switch to "Graphical View" and display the various programming options.

5 IO-Link Programming

5.1 IO-Link Programming in the PACTware FDT Environment

Overview

The rotary encoder parameters are different for each device. A standardized description of these parameters can be found in the IO Device Description (IODD). The IODD can be imported into various engineering tools from different system providers, providing they support IODD. The rotary encoder can then be programmed using the relevant tool (e.g., PACTware) and a user interface generated from the IODD.



Note!

The buttons under individual menu items in PACTware can be used to read/write data from the rotary encoder or to enable a cyclic update of dynamic variables. These features allow corresponding values to be read from the rotary encoder cyclically and written to the rotary encoder in the event of parameter changes. These buttons are shown in the image below. Hover over the buttons with the mouse to view the description of the buttons.

The "Parameter" menu item can be used for programming the rotary encoder. More information on this menu item can be found below. The other menu items are either self-explanatory or are not important for the ENI58PL product family and are therefore not described in great detail in this manual.



Figure 5.1



Note!

The following screenshot shows how the IODD is displayed in the PACTware framework program for all ENI58PL* product variants; the example is based on the ENI58PL-1024CGR rotary encoder.

"Parameter" Menu Item

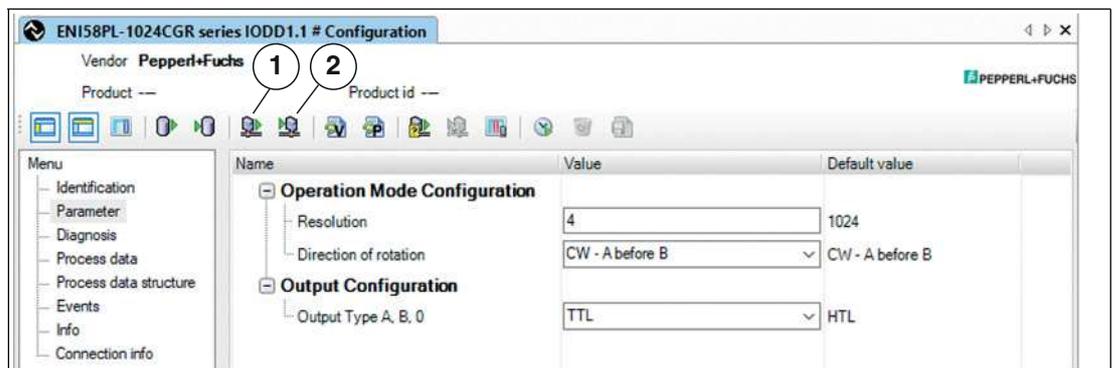


Figure 5.2

The **Parameter** menu item can be used to program the rotary encoder for your application.

The following parameters can be configured:

- Clockwise/counterclockwise direction of rotation
- Resolution as a pulse count from 1 to 16384
- Output configuration as a TTL or HTL signal level



After parameterization, you must save the new configuration of the parameters in the non-volatile memory of the rotary encoder.



Programming the rotary encoder

1. Set the required parameters for the Operation Mode Configuration and the Output Configuration.
2. Save the settings to the rotary encoder by clicking on "Store to device" (1).
 - ↳ The data is saved to the rotary encoder. As confirmation, you can read out the stored data from the rotary encoder by clicking on "Read from device" (2).



Note!

When the programming has been completed, you can disconnect the rotary encoder from the IO-Link master. To use the rotary encoder in normal operation with a higher-level control panel, you must use a suitable connection cable (see chapter 3.3 for the connection assignment).

5.2 IO-Link Programming using the SmartBridge®

Graphical View in the SmartBridge® app

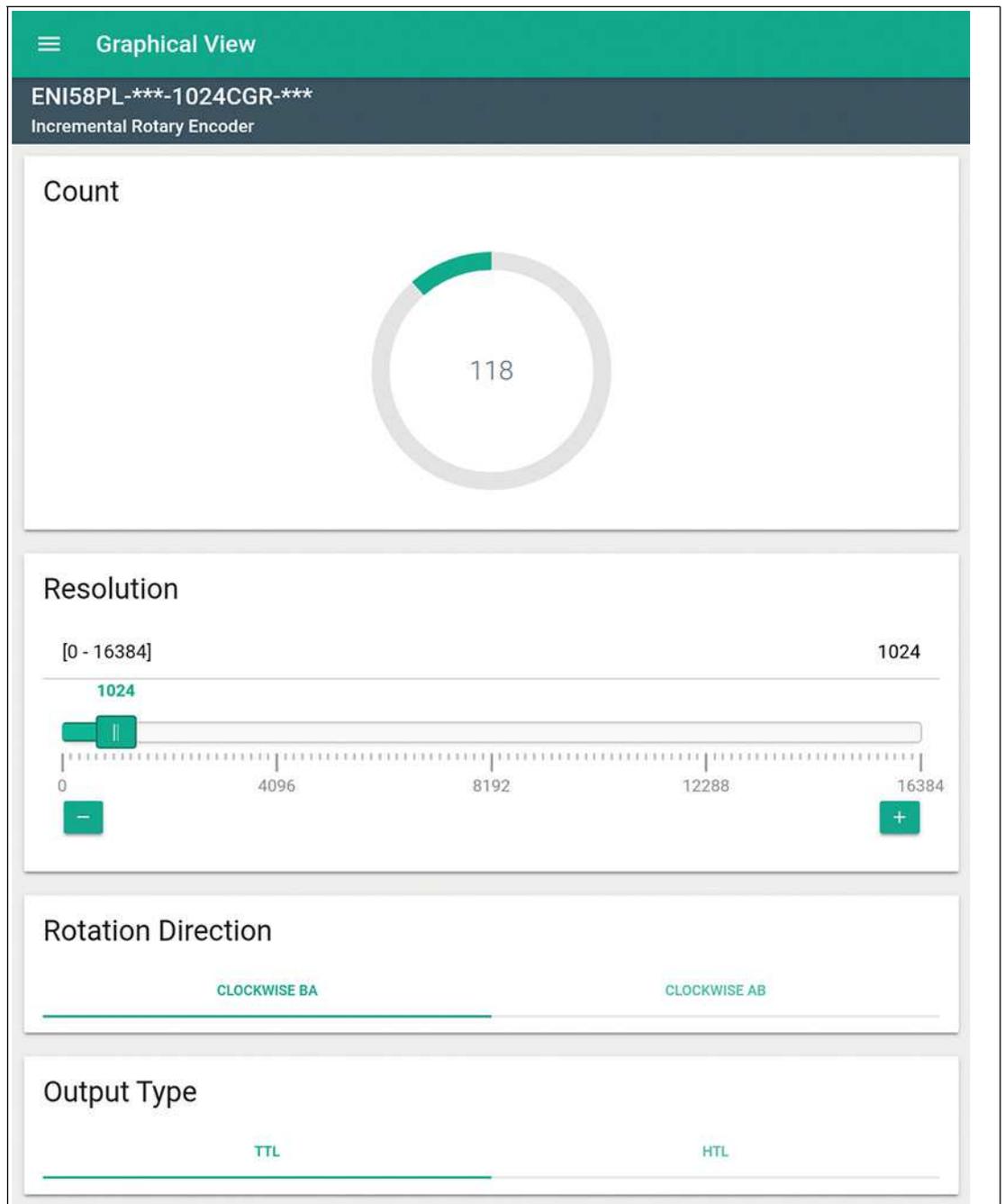


Figure 5.3

The menu can be used to program the rotary encoder for your application.

The following parameters are adjustable:

- Resolution as a pulse count from 1 to 16384
- Clockwise/counterclockwise direction of rotation
- Output configuration as a TTL or HTL signal level



As your settings are transferred to the device during live operation, you do not need to save your programming separately.



Programming the rotary encoder

Edit the relevant parameters.

↳ As your settings are transferred directly to the device during live operation, you do not need to save your programming separately.



Note!

When the programming has been completed, you can disconnect the rotary encoder from the SmartBridge®. To use the rotary encoder in normal operation with a higher-level control panel, you must use a suitable connection cable (see chapter 3.3 for the connection assignment).

6 Troubleshooting

6.1 What to Do in Case of a Fault

In case of a fault, use the following checklist to determine whether the fault with the IO-Link connection to the rotary encoder can be remedied.

If none of the information provided in the checklist solves the problem, you can contact Pepperl+Fuchs via your sales office with any queries. Have details of the model number and firmware version of the sensor ready if possible.

Checklist

Fault	Cause	Remedy
No IO-Link connection to rotary encoder	The C/Q communication port on the sensor is not connected to the IO-Link master. The data connection between the PC (PACTware), IO-Link master, and the rotary encoder is not working.	Make sure the C/Q communication port is connected to the IO-Link master. Re-start the PACTware if necessary.
No IO-Link connection to rotary encoder	No power supply	Check whether there is a reason for the absence of the power supply. Switch on the power supply.

FACTORY AUTOMATION – SENSING YOUR NEEDS



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