IO-Link Diagnostics

IO -Link / V1.0

https://support.industry.siemens.com/cs/ww/en/view/109772813

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1 IO-Link Diagnostics with PROFINET in the Siemens Environment

1.1 Introduction

IO-Link basically provides a powerful diagnostics system that can transport detailed diagnostics information and, in this way, give optimum support to users when troubleshooting.

This document describes the structure of the IO-Link diagnostics. This document also answers the following questions:

- How is the IO-Link diagnostics information displayed in the higher level PROFINET on an S7-CPU?
- What are the options for accessing the diagnostics data?

1.2 IO-Link Diagnostics

The IO-Link master provides diagnostics results of the IO-Link device or of the IO-Link port. The diagnostics events are identified by an EventQualifier and an IO-Link EventCode.

The EventQualifier includes the following information about the diagnostics event:

- Source of the event: IO-Link or IO-Link port
- Diagnostics type: Fault or warning
- Incoming or outgoing event

The EventCode references with a number the actual diagnostics event that is defined in Appendix D of the IO-Link specification; for example, EventType 0x7711 - Ground fault - Check installation.

In addition to the standardized diagnostics there are also manufacturer-specific diagnostics; for example, EventType 0x8CA0 - Vendor specific diagnosis.

Detailed information is available in the system manual entitled "IO-Link System".

https://support.industry.siemens.com/cs/ww/en/view/65949252

The concrete meaning of the manufacturer-specific diagnostics is available in the IODD or in the operating instructions of the IO-Link device.

The IO-Link specification is available at the following link in the "Downloads" area.

https://io-link.com

1.3 IO-Link Diagnostics in the System Environment

The IO-Link master makes the IO-Link diagnostics available in complete detail in the automation system via PROFINET in order to enable targeted troubleshooting by the operating personnel.

The following diagnostics mechanisms are provided to access the IO-Link diagnostics information:

- **System diagnostics:**
  Using PROFINET diagnostics interrupts all the IO-Link diagnostics events are imported into the Siemens system diagnostics and are automatically visible in the diagnostics buffer of the S7-1200 / S7-1500 CPU or in the diagnostics tree of the controller. All diagnostics clients (online diagnostics with TIA Portal, HMI, etc.) have access to this diagnostics tree. This happens automatically without further effort by the user (system-integrated diagnostics).
- **Diagnostics status:**
  Based on the Port Qualifier Information (PQI) you can identify the validity of the measured values or the presence of a diagnosis and reacting to it in the program, group error, for example. Each port has a PQI with the following properties:
  - The PQI provides information about the status of the port and of the IO-Link device (value status).
  - The PQI is transferred cyclically with the process data.
- **Active reading of the diagnostics (on demand) of the IO-Link device:**
  Using the integrated system functions of the library blocks "IO_LINK_DEVICE" and "IoIIdentAndDiag" you can have direct access to the active IO-Link diagnostics data of the IO-Link device.

Note

The "IoIIdentAndDiag" function is only supported by the IO-Link device if the common profile or another IO-Link profile is integrated in the IO-Link device.

Information about the IO-Link profiles is available in the IO-Link specification at the following link in the "Download" area.

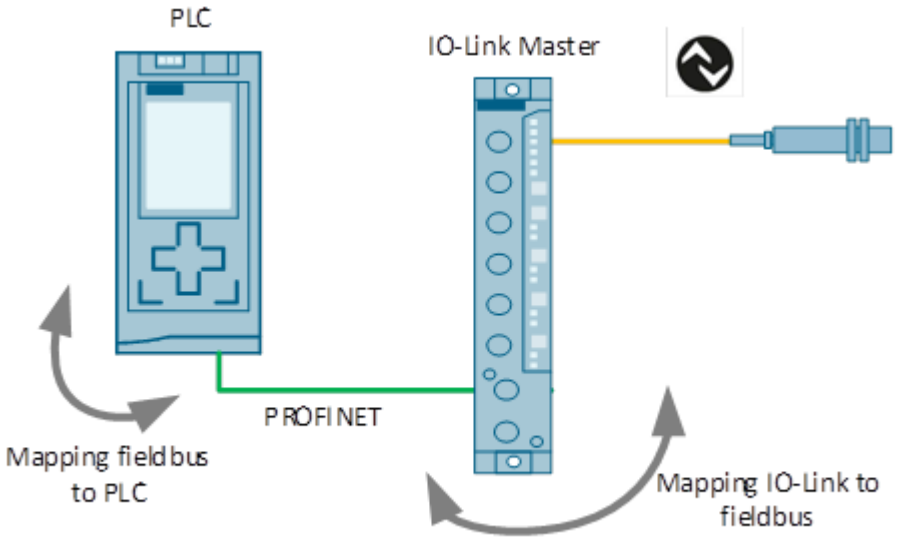
https://io-link.com/

An application example for using the IO-Link profiles is available at the following link:

https://support.industry.siemens.com/cs/ww/en/view/109766016

The following figure shows the IO-Link diagnostics mapping.

Figure 1-1



1.4 Examples

The diagnostics mechanisms described in section 1.4.2 are shown based on an IO-Link device that is set into a fault state.

The following faults are triggered on the IO-Link device:

- EventType 0x7711 - Ground fault - Check installation

In the following we show how the fault has an effect on the diagnostics mechanisms described in section 1.3.

1.4.1 System Diagnostics

The fault shown is reported automatically to the system diagnostics. This results in the following behaviors.

In the following we show the diagnostics from 2 different IO-Link masters (Version A and Version B):

Version A: Diagnostics Mapping IO-Link EventType 0x7711

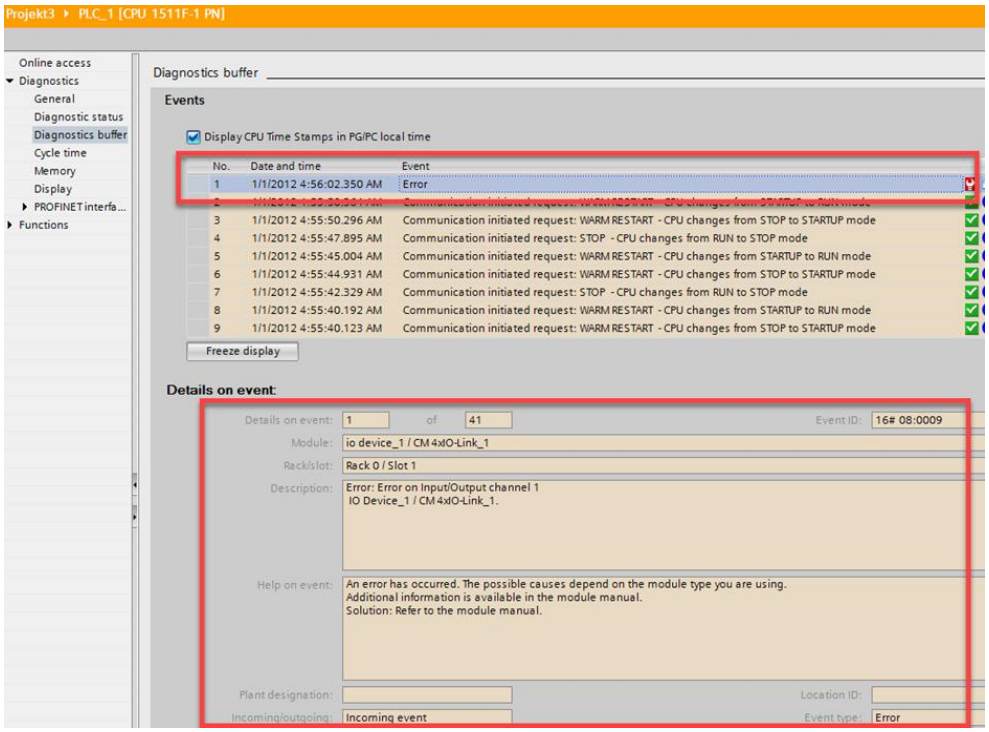
Version A is valid for the following IO-Link masters:

Table 1-1

IO-Link master	Article number
ET 200SP CM 4xIO-Link	6ES7137-6BD00-0BA0
ET 200AL CM 4xIO-Link	6ES7147-5JD00-0BA0
ET 200pro EM 4 IO-Link HF	6ES7147-4JD00-0AB0
S7-1200 SM 1278 4 IO-Link	6ES7278-4BD32-0XB0
ET 200MP CM 8xIO-Link	6ES7547-1JF00-0AB0

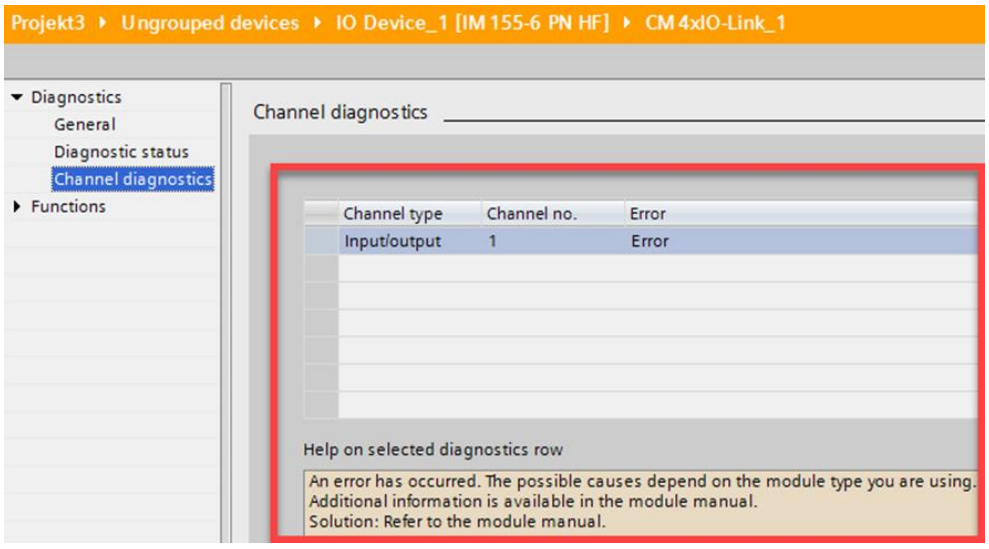
The following figure shows how the fault on the ET 200SP IO-Link master is displayed in the diagnostics buffer of a S7-1500 CPU.

Figure 1-2



The following figure shows the channel diagnostics in the TIA Portal in the "Online&Diagnostics" view of the ET 200SP IO-Link master.

Figure 1-3



Version B: Diagnostics Mapping IO-Link EventType 0x7711

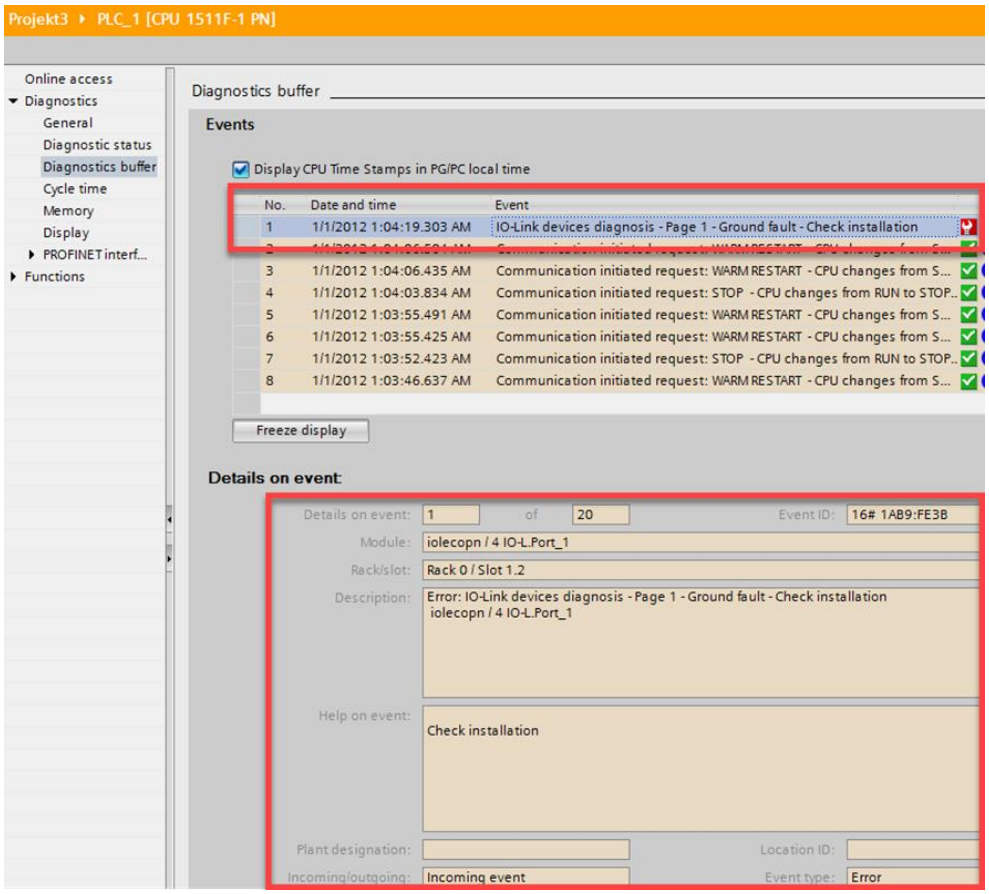
Version B is valid for the following IO-Link masters:

Table 1-2

IO-Link master	Article number
ET 200ecoPN IO-Link master	6ES7148-6JD00-0AB0

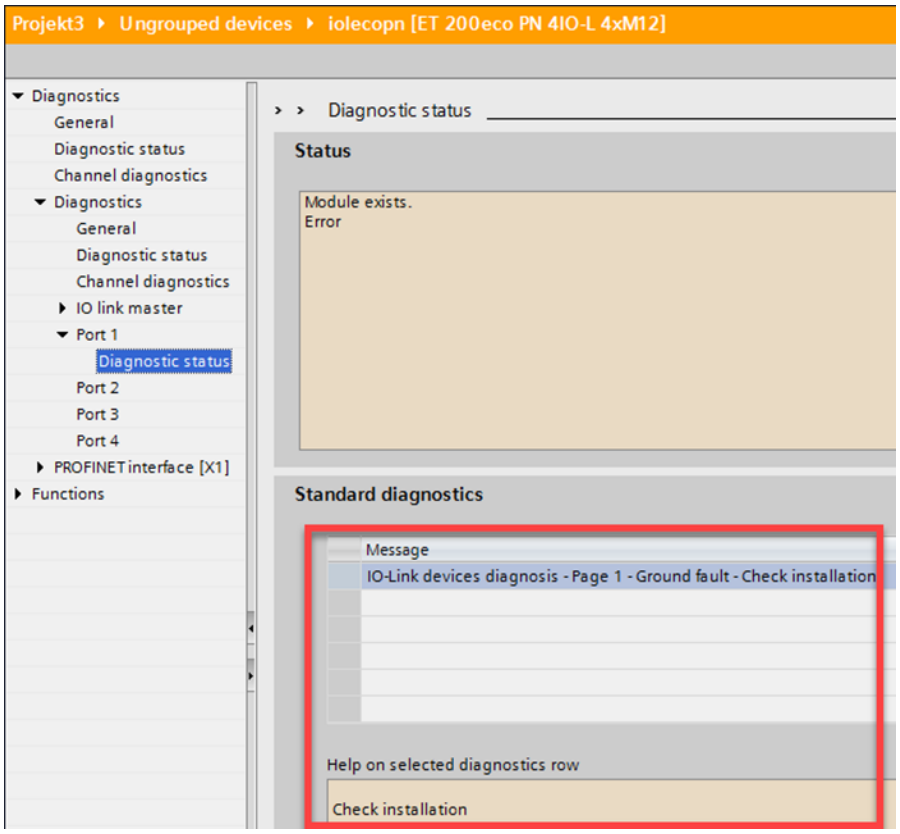
The following figure shows how the fault on the ET 200ecoPN IO-Link master is displayed in the diagnostics buffer of a S7-1500 CPU.

Figure 1-4



The following figure shows the channel diagnostics in the TIA Portal in the "Online&Diagnostics" view of the ET 200ecoPN IO-Link master.

Figure 1-5



1.4.2 Diagnostics Status

Each port has a Port Qualifier Information (PQI). This PQI provides information about the port and IO-Link device status and about the validity of the process data (value status). You have to enable the sending of the PQI when you parameterize the IO-Link device and the PQI is transferred cyclically with the process data of the IO-Link device.

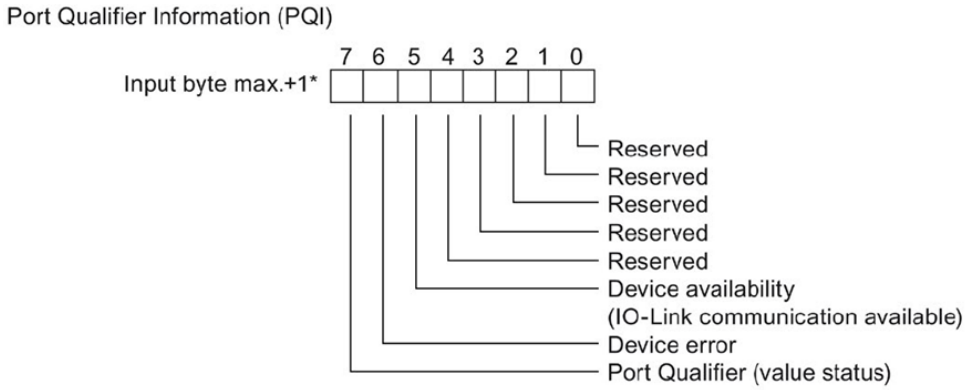
Example

The PQI of the EventType 0x7711 (Ground fault – Check installation) delivers the following information:

- Device availability (Bit 5) =1, this means active communication with the IO-Link device.
- Device fault (Bit 6) = 1, this means an active fault is present on the IO-Link device - "Ground fault".
- PortQualifier (PQ) (Bit 7) = 0, this means the measured values of the IO-Link device are not valid.

The figure below shows the structure of the PQI.

Figure 1-6



1.4.3 Active Reading of the Diagnostics (on demand) of the IO-Link Device

Using the blocks "IO_LINK_DEVICE" and "IoIIdentAndDiag" you can read out the available diagnostics information directly from the IO-Link device.

Detailed information about using the blocks is available in the following application examples.

- "IO_LINK_DEVICE": Acyclic reading and writing with the IO-Link library https://support.industry.siemens.com/cs/ww/en/view/82981502
- "IoIIdentAndDiag": Common and Smart Sensor Profiles for IO-Link: https://support.industry.siemens.com/cs/ww/en/view/109766016

Note IO-Link devices with integrated IO-Link profiles return the current diagnostics status. Diagnostics feedback from the IO-Link device without IO-Link profile depends on the device.