

PROFINET GSDML File

PROFINET Device Design Guideline

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Introduction

This document describes the all aspects for developing a PROFINET field device. It is intended to be guideline through all steps of a PROFINET device development in order to avoid unpleasant surprises at the customer.

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1. GSD (General Station Description) for the TPS-1

1.1 What is a GSD?

The GSD is a formalized technical description of the PROFINET field device which contains all the information for the data transport and engineering.

These are:

- Communication parameters, communication capabilities
- Device structure (as far as relevant for the communication: modules, submodules)
- Catalogue information (device description,...)
- Structure of cyclic data and ramp-up parameters
- Definition of diagnosis information (only alarms)
- Engineering information (icons, pictures, texts, values)
- Order numbers (for selection and order processing)

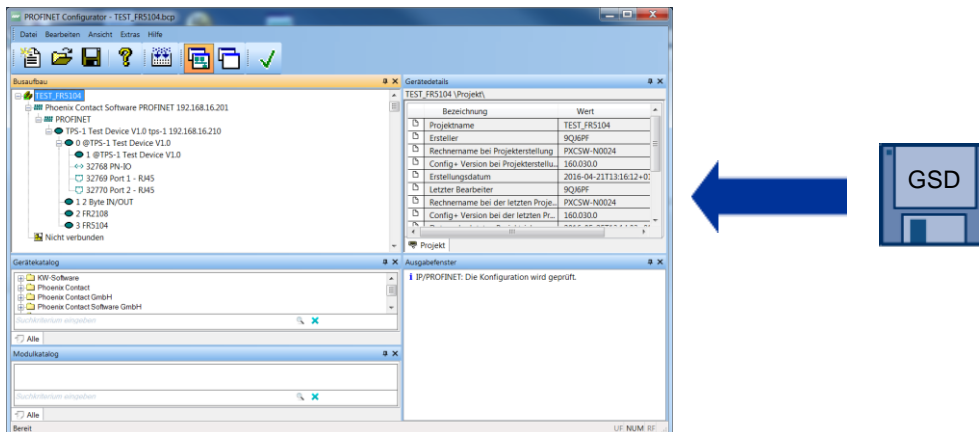
The GSD does not describe:

- Complex user interface (graphics, charts, wizards)
- Dependencies (e.g. of variables among each other)
- Complex slot rules
- Applicative diagnostics
- Device specific business logic
- Mechanical data, connection diagrams

The GSD is indispensable for a PROFINET field device because this is the only gateway to engineering. Every manufacturer of a PROFINET field device must create a corresponding GSD file whose verification is part of the certification test.

GSD data is the sole source for the engineering tool to gain knowledge about the device as shown in **Figure 1-1**. For this purpose, the GSD file is read once in the engineering tool (e.g. the programming device). After that, the field device can e.g. be configured from the product catalogue of the engineering tools

Engineering Tool

**Figure 1-1:** GSD and engineering tool

During the device development, the GSD, and its properties must be taken into consideration at an early stage so that the device functions can also be properly mapped to the GSD file. If it is done too late, it may lead to unnecessary modification efforts. You can find further general information about GSD in chapter 2 of „PROFINET System Description, Technology and Application“ (german version: „*PROFINET Systembeschreibung, Technologie und Anwendung*“), which can be downloaded free of charge under:

<http://www.profibus.com/download/technical-descriptions-books>

1.2 What is the GSDML (GSD Markup Language)?

The GSD file is an XML file, which can be created and processed with standard tools. GSDML is the descriptive language of GSD file, which defines the device properties over multiple layers and is thus well suited for hierarchical illustration of PROFINET field devices. The following figure shows e.g. the general part of the identification of field device of a simple GSD file.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- ***** Simple example GSD V2.31 File Set xsi:
- <ISO15745Profile xsi:schemaLocation="http://www.profibus.com/GSDML/2003/11/DeviceProfile ..\xsd\GSDML-DeviceProfile-V2.31.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.profibus.com/GSDML/2003/11/DeviceProfile">
  <!-- ProfileHeader Definition as defined in ISO15745-1. Please do not change the content. -->
  - <ProfileHeader>
    <ProfileIdentification>PROFINET Device Profile</ProfileIdentification>
    <ProfileRevision>1.00</ProfileRevision>
    <ProfileName>Device Profile for PROFINET Devices</ProfileName>
    <ProfileSource>PROFIBUS Nutzerorganisation e. V. (PNO)</ProfileSource>
    <ProfileClassID>Device</ProfileClassID>
  - <ISO15745Reference>
    <ISO15745Part>4</ISO15745Part>
    <ISO15745Edition>1</ISO15745Edition>
    <ProfileTechnology>GSDML</ProfileTechnology>
  </ISO15745Reference>
  </ProfileHeader>
  - <ProfileBody>
  - <DeviceIdentity DeviceID="0x0008" VendorID="0x002A">
    <InfoText TextID="TOK_DevIdent_InfoText"/>
    <VendorName Value="SIEMENS"/>
  </DeviceIdentity>
  - <DeviceFunction>
    <Family ProductFamily="DEVKIT" MainFamily="I/O"/>
  </DeviceFunction>
  - <ApplicationProcess>
    - <DeviceAccessPointList>
```

Figure 1-2: General part of a GSD file in XML illustration

1.3 Which Information can be Found in the GSD File?

The interaction between GSD file and engineering is illustrated in Figure 1-3. It shows e.g. how, based on the information from GSD file (see also XML illustrations in the previous figure) the engineering classifies the field device in its product catalogue.

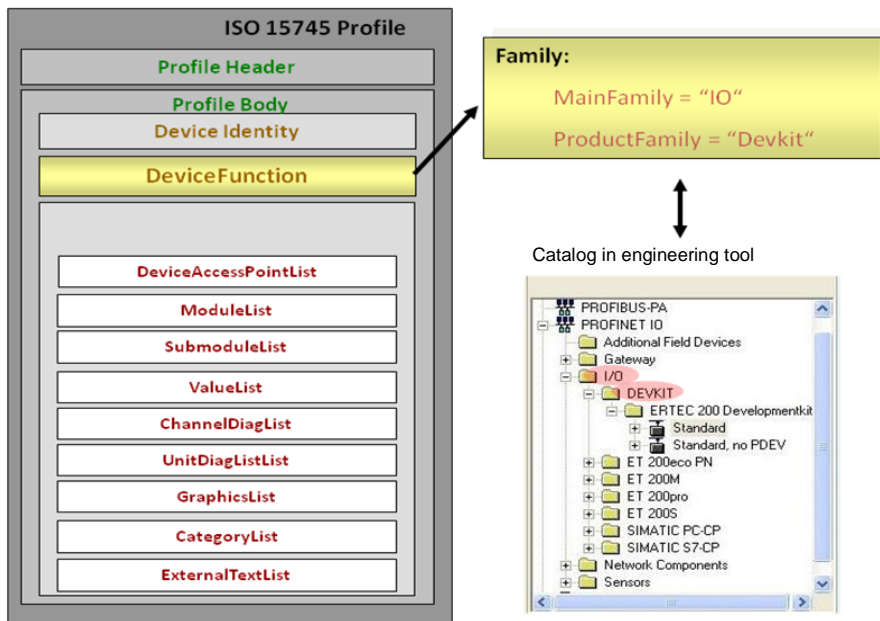


Figure 1-3: Interaction GSD and engineering

The basic structure of the GSD file can be seen from the block diagram in **Figure 1-3**.

1.3.1 Profile Header

General profile information like e.g. profile name, profile version, the publisher of the profile are stored in the profile header.

1.3.2 Profile Body

The actual field device data is located in the profile body. It contains the information for unambiguous identification, indicates to which product family the device belongs and describes all the communication properties of the field device. Depending upon the functions and structure of the device, this main part of the GSD file can be very extensive, because information

- about communication capabilities
- about configuration
- of parametrisation
- of illustration
- of diagnosis
- about references to graphics and texts

is necessary. What needs to be considered for the Vendor ID and Device ID in the GSD?

The PROFINET field device of a manufacturer must be unambiguously identifiable in the engineering tool and the subsequent real automation system. This is achieved by the combination of the company ID (Vendor ID) and a specific device identifier (DeviceID).

The DeviceID which must be unambiguous in the manufacturing company is specified by the manufacturer himself. To avoid multiple assignments, it is recommended to coordinate the assignment with the marketing or product management within the company. Block wise assignment to departments or maintaining a central list has proven to be a pragmatic approach.

Besides the VendorID and DeviceID approach, which is essential for the engineering and production data traffic, there is also the possibility to identify a field device in the engineering through its order number. This option is convenient for simplifying the ordering process.

Note: In real life, it may happen that device manufacturers, who realise their PROFINET connection with a communication module, leave the VendorID of the communication module or its manufacturer unchanged in the GSD file. This leads in subsequent system diagnostics to misinterpretation, because not the manufacturer of the device is displayed, but rather the module supplier. It is, therefore, important to ensure that the VendorID of the device supplier is used.

1.4 What are the Application Implications on the GSD?

The application requirements demand certain device functions which in turn are mirrored in the GSD file. The philosophy of the GSD is that every technical feature is described by a separate element or attribute. In case there are technical dependencies to other features, then it is described in the GSDML specifications and will also be verified by the GSD Checker (see chapter xyz).

Moreover, there are marketing rules that are non-technical in nature. Thus, if “x” and “y” are supported, then “z” must also be supported. This serves to reduce the number of variants. To this end, in particular, both the „Conformance Classes” as well as the „Application Classes” play a role.

1.4.1 Conformance Classes (CC)

The conformance classes provide a convenient summary of various minimum requirements. Through the certification of a field device to a conformance class it is ensured that the selected field devices support unambiguously defined minimum requirements on functionality and interoperability. The conformance classes are geared to the needs of specific fields, such as e.g. factory automation and motion control.

1.4.2 Application Classes (Optional)

Application Classes define device characteristics so that the application function can be provided and it is interoperable with the system properties. In an application class, the minimum scope for the relevant application in an automation system is defined.

The following application classes are defined:

- Isochronous Application
- Process automation
- High performance
- Controller to Controller
- Functional safety

If the manufacturer specifies an application class in the GSD file, the corresponding minimum scope is also tested in the certification test.

1.5 What are the Key Issues in „Life Cycle Management“ of GSD?

The life cycle management of the GSD can be influenced by newer versions of the GSDML or newer versions of the PROFINET field device, see also chapter 10.

1.5.1 What are the Implications of Changing the GSDML?

Further developments of the PROFINET technology may affect the GSDML. In the context of further development of the GSDML, it is ensured that the current GSD files are always compatible with a newer GSDML version. That means, an engineering tool with a newer GSDML version can also handle GSDs based on older GSDML versions (upwards compatibility).

A workaround in the other direction is also available. If a GSD based on a new GSDML Version is to be handled by an engineering tool which only supports an older GSDML version, then it can be specified as to which GSD objects should be over read by the (older) tool, without this leading to a fault behaviour. For this purpose, the attribute „RequiredSchemaVersion“(current version or later) for the objects DAP, module and submodule was introduced.

1.5.2 Do Further Developments of the Field Device Influence the GSD File?

In case the PROFINET field device is developed further and its functions are enhanced, then for the same PROFINET level or the same GSDML version, only a newer edition of the GSD file is required that includes the new functions.

If modules are added to a modular field device, renewed certification is not required, although the GSD file needs to be expanded indeed. Only if new functions are also added with new models, which were not testable before, then, a re-certification is required. Example: If a device did not support PROFIsafe earlier, and if now a PROFIsafe module is added, then the PROFIsafe part must be re-certified. This applies then to the DAP as well as to the actual PROFIsafe module.

If, from a newer PNIO level onwards new features are added and can thus only be described as a newer GSDML version, then the entire GSD must be upgraded to the newer GSDML version.

1.5.3 How do I Provide the GSD to my Customers?

For the use of PROFINET field devices, the GSD file must be available and therefore is usually delivered with the field device. Many manufacturers also offer the GSD file along with the device presentation for download via Internet. Thus, the manufacturer can always provide the latest version. Such examples can be found in the Internet product catalogue of the field device vendors.

1.6 PROFINET GSD Checker Tool

The PROFINET GSD Checker is a piece of software for checking the GSD file. For PI members, this tool is available free of charge on the PI website <http://www.profibus.com/nc/download/software-and-tools/downloads/profinet-xml-viewer-v22/display/> and it essentially offers two functions:

- Displaying the contents of GSD in a concise HTML representation (see Figure 1-4).
- Validation of a GSD against the schema files and reviewing the rules, which go beyond the schema and are documented in the GSDML specification (see Figure 1-5).

Above that, the checker also provides the schema documentation (a more user-friendly, better readable form of the schema) for GSD. A simple XML editor is already included in the PROFINET GSD Checker. However, the GSD Checker also allows the integration of another XML editor.

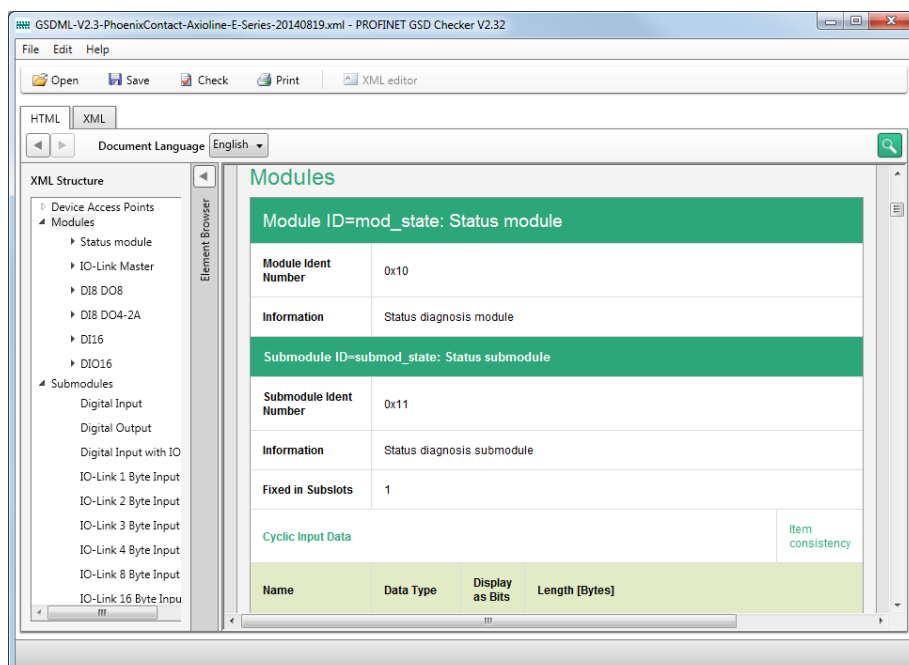


Figure 1-4: HTML representation in the GSD checker

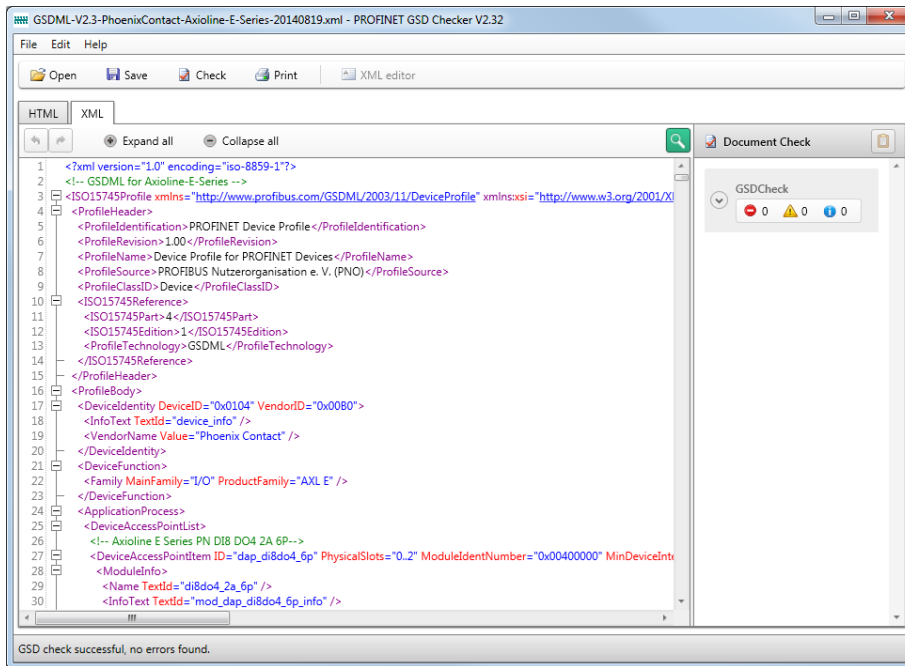


Figure 1-5: XML representation in the GSD checker

1.7 Good Practices

1.7.1 Creating the GSD

A pragmatic approach for creating GSD is via the XML checker and the supplied examples (in the TPS Development Toolkit). Using the examples, the correct structure can easily be identified, and it can serve as the basis for the new product.

If built on the technology components (e.g. ASIC, Development Kit) as a platform, you get a functioning device software with sample application and sample GSD files. Also here, it must be ensured that the sample GSD is adapted to the individual field device.

1.7.2 Testing the GSD

The structure of an XML document can be tested with the help of a schema file. In this context, one speaks of the “validation” of a document. In this process, among other things, it is checked whether the element structure and the attributes used in the XML document comply with the schema definition. The schema file e.g. defines whether an attribute must be present and which values are allowed for the attribute.

For using the GSD Checker to check the GSD, no know-how about the function and use of schema files is required because these are automatically installed and used for validation by the PROFINET GSD Checker.

Also, one or two frequently used integrated engineering tools are also very useful to ensure that the GSD is processed as desired, that the graphics are displayed accordingly, and finally, whether the result then also meets the expectations.

1.7.3 Adaptation to a new GSDML schema

The required schema files e.g. for the GSDML 2:31 are:

- GSDML-CommNetworkProfile-v2.31.xsd
- GSDML-DeviceProfile-v2.31.xsd
- GSDML-Primitives-v2.31.xsd

To use the new schema files , they must be copied in the following directory:

`\program files(x86)\PhoenixContactSoftware\PROFINET Configurator\Schemas\GSDML\.`

After new start, the new schema is available, and the GSDML can be imported.

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Revision History

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