Communication and Software

9

HART protocol

Overview

HART is a widely used communication standard for field devices. Specification of HART devices takes place through the HCF (HART Communication Foundation).

The HART standard expands the analog 4 to 20 mA signal for modulated, industry-proven, digital signal transmission.

Benefits

- Service-proven analog measured value transmission
- Simultaneous digital communication with bidirectional data transmission
- Possibility of transmitting several measured variables from one field device (e.g. diagnosis, maintenance and process data)
- Connection to higher-level systems such as PROFIBUS DP
- Easy installation and startup

Use in conjunction with SIMATIC PDM

- Cross-vendor operation of all HART devices by means of standardized parameter records
- HART field devices that are described by HART DDL are integrated in SIMATIC PDM through the HCF catalog. HART DD (Device Description) is standardized in SIMATIC PDM, multivendor and very widely used. Other HART field devices are integrated in SIMATIC PDM through EDD (Electronic Device Description).
- Easy operation and startup of field devices, also in hard-to-reach locations
- Expanded diagnosis, evaluation and logging functions

Application

These devices can be connected in different ways:

- Using the distributed I/O system
  - SIMATIC ET 200M
  - SIMATIC ET 200iSP
  - SIMATIC ET 200iS with the HART modules

  or with analog modules 4 to 20 mA and a HART handheld communicator
- Using a HART modem, with which a point-to-point connection is established between the PC or engineering station and the HART device
- Using HART multiplexers, which are contained in the HART server of the HCF

Integration

Siemens field devices for process automation which are listed in this catalog and can be controlled using HART:

Measuring instruments for pressure
SITRANS P DS III
SITRANS P MS
Measuring instruments for temperature
SITRANS TF
SITRANS TK-H
SITRANS TW
Flowmeters
SITRANS F MAGFLO 5000
SITRANS F MAGFLO 6000 / I / I Ex d
SITRANS F MASSFLO 6000 19“ / IP67 / Ex d
Measuring instruments for level
Pointek CLS 500
SITRANS Probe LR
SITRANS Probe LU
SITRANS LR 200
SITRANS LR 300
SITRANS LR 400
SITRANS LC 500
SITRANS PD 500
Electropneumatic positioners
SIPART PS2
Power supply units and isolation amplifiers
SITRANS I

Overview

Today, distributed automation solutions based on open field buses are state-of-the-art in large areas of the manufacturing industry and process engineering. It is only with field buses that the functional benefits of digital communication can be put to full use, e.g. better resolution of measured values, diagnosis options and remote parameterization.

PROFIBUS is today's most successful open field bus with a large installed base for a wide range of application. Standardization to IEC 61158 / EN 50170 provides you with future protection for your investment.

Benefits

- A uniform modular system from the sensor into the control level enables new plant concepts
- Problem-free exchangeability of field devices, including from different manufacturers, that comply with the standard profile
- Networking of transmitters, valves, actuators, etc.
- Implementation of intrinsically safe applications through use of the field bus in hazardous areas
- Easy installation of 2-wire lines for joint energy supply and data transmission
- Reduced cabling costs through savings of material and installation time
- Reduced configuration costs through central, simple engineering of the field devices (PROFIBUS PA and HART with SIMATIC PDM, also cross-vendor)
- Fast and error-free installation
- Lower service costs thanks to simpler wiring and plant structure plus extensive diagnosis options
- Greatly reduced commissioning costs through simplified loop check
- Scaling/digitizing of the measured values in the field device already, hence no rescaling necessary in SIMATIC PCS 7

Application

PROFIBUS is suitable for fast communication with distributed I/Os (PROFIBUS DP) in production automation as well as for communication tasks in process automation (PROFIBUS PA). It is the first field bus system that meets the demands of both areas with identical communication services.

The transmission technique of the PROFIBUS PA is tailored to the needs of the process industry. Interoperability between field devices from different manufacturers and remote parameterization of the field devices during operation are guaranteed by the standardized communication services.

Using SIMATIC PDM (Process Device Manager), a uniform and cross-vendor tool for configuring, parameterizing, commissioning and diagnosis of intelligent process devices on the PROFIBUS, it is possible to configure a wide variety of process devices from different manufacturers using one uniform graphical user interface.

PROFIBUS PA can just as readily used in standard environments as well as hazardous areas. For use in hazardous areas, PROFIBUS PA and all connected devices have to be designed with type of explosion protection Ex [i].

The uniform protocol of PROFIBUS DP and PROFIBUS PA enables the two networks to be interlinked, thus combining time-based performance with intrinsically safe transmission.

Function

PROFIBUS PA expands PROFIBUS DP with near-process components for the direct connection of actuators and sensors.

For PROFIBUS PA the RS 485 transmission technique was replaced by a different technique optimized for intrinsically safe application. Both techniques are internationally standardized in IEC 61158.

PROFIBUS PA uses the same communication protocol as PROFIBUS DP; the communication services and telegrams are identical.

For PROFIBUS PA the data and energy supply for the field devices can be directed through a 2-wire line.

Integration

Siemens field devices for process automation which are listed in this catalog and can be controlled using PROFIBUS:

PROFIBUS PA

Measuring instruments for pressure
SITRANS P DS III PA
Measuring instruments for temperature
SITRANS T3K PA
Flowmeters
SITRANS F MAGFLO 6000 / I / I Ex d
SITRANS F MAGFLO TRANSMAG 2
SITRANS F MASSFLO 6000 / 19" / I
Measuring instruments for level
Pointek CLS 200
Pointek CLS 300
SITRANS Probe LR
SITRANS Probe LU
SITRANS LR 200
SITRANS LR 300
SITRANS LR 400
SITRANS LC 300
SITRANS LC 500
Electropneumatic positioners
SIPART PS2

PROFIBUS DP

Flowmeters
SITRANS F MAGFLO 6000
Measuring instruments for level
SITRANS LUC500
HydroRanger 200
MultiRanger 100/200
SITRANS Probe LU

SIMATIC PDM

Overview

SIMATIC PDM (Process Device Manager) is a uniform, cross-vendor tool for configuring, parameterizing, commissioning and diagnosis of intelligent field devices and components.
SIMATIC PDM allows a wide variety of process devices to be configured using *one* software system and one uniform graphical user interface. This results in reliability, and significantly saves costs for investment and staff training, as well as follow-up costs.

Application

SIMATIC PDM can be used in two manners:

- Independently of system suppliers on a personal computer or programming device with the Windows 95/98, NT, 2000, ME and XP operating system
- With an option as an integral tool in STEP 7, the SIMATIC S7 configuring and programming tool.
  In this manner, SIMATIC PDM is also integrated into the SIMATIC PCS 7 process control system.
- With the routing function, SIMATIC PDM permits access from a central engineering station to all field devices with communications capability in the plant. This is possible for field devices with PROFIBUS PA or HART communication as well as for PROFIBUS DP devices such as SIPART controllers or SIMOCODE motor protection and control devices.

Design

Graphical user interface

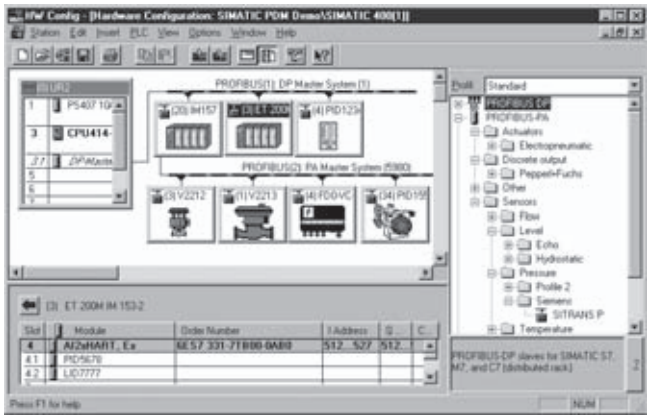
The SIMATIC PDM graphical user interface is designed according to the standard guidelines of Microsoft Windows and complies with the requirements of the VDI/VDE GMA 2187 guidelines. Menu structures and toolbars are used as is an Explorer view, thus simplifying navigation between parameter groups. Even complex devices with several hundred parameters can thus be processed clearly and rapidly.

The design of the graphical user interface is based on DIN V 19 259 or IEC.

The devices with different communication interfaces are displayed homogeneously and user-friendly within the graphical user interface. The main attention is paid to efficiency.

The user interface supports several views:

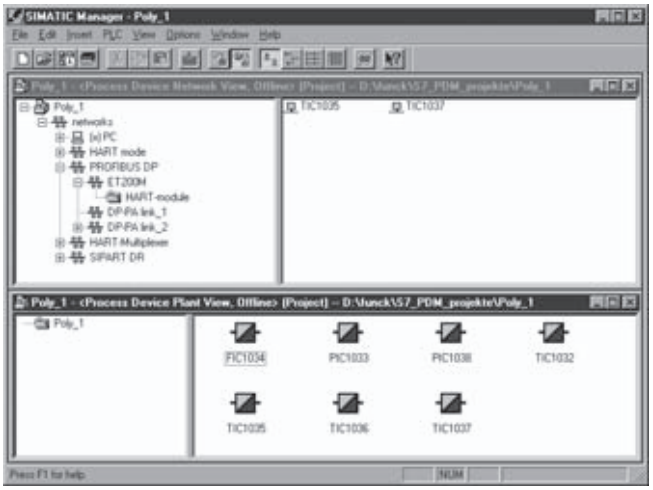
STEP 7 view



STEP 7 view using HW-Config

Process devices are configured using HW-Config within STEP 7 and displayed graphically or as a table.

Process device network view and plant view

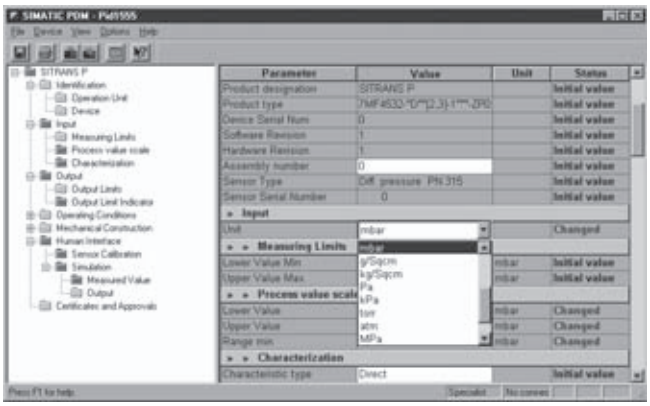


Process device network view (top) and plant view (bottom)

The hierarchical structure of networks, communication components, down to the process devices is configured in the process device network view (in the figure above). Configuring data can be imported from there when integrating in STEP 7; multiple inputs are thus prevented.

Devices configured in HW-Config or in the process device network view are also automatically created in the process device plant view (in the figure below) with their measuring point tag. This view permits direct access to a process device using the tag, without having to consider the connection paths or the communication design.

Parameter view



Parameter view

The parameters of a selected process device can be displayed, modified and saved in the parameter view. Communication to the device is also established here. This parameter display is started by double clicking a process device in one of the other views.

Lifelist – a user-friendly view for service and commissioning

SIMATIC PDM Lifelist

The Lifelist is a network view for the identification, diagnosis and online parameterization of devices. It is created online. Its special orientation makes the Lifelist the ideal work environment for service and commissioning.
It enables the scanning of of PROFIBUS DP and PROFIBUS PA lines, including their underlying structures, and presents them in a clearcut form. It is also possible to include HART devices that are connected through a HART modem. Hence it is no longer absolutely necessary to have a knowledge of the plant structure during a service engagement.

The parameterization interface of the devices can be called directly from the Lifelist, without having to open or create a project. All the offline and online functions of the devices are thus immediately available.

Function

The display of device parameters and functions is uniform for all supported process devices and independent of their communication link, e.g. through PROFIBUS DP, PROFIBUS PA or the HART protocol. The main functions of SIMATIC PDM are:

Adjustment and modification of device parameters

- Comparison of reference and actual parameters
- Plausibility testing of inputs
- Display of diagnosis information
- Management of parameterization data
- Commissioning functions for process devices, e.g. measuring circuit tests with simulation of measured values

SIMATIC PDM additionally permits process monitoring with display of selected values, alarms and status signals of the device on the screen, e.g. trend curves and echo curves.

Device Description Language

SIMATIC PDM supports all devices described by EDD (Electronic Device Description). EDD is standardized to EN 50391 and IEC 61804. Internationally it is the most widely used standardized technology for device integration. At the same time it is the directive of the established organizations for PROFIBUS (PNO: PROFIBUS-Nutzerorganisation) and HART (HCF: HART Communication Foundation).

The devices are directly integrated in SIMATIC PDM through their EDD or the current HCF catalog. The device is described in the EDD in functional and structural terms. Using this description, SIMATIC PDM automatically creates its user interface with the specific device data.

The current device catalog of SIMATIC PDM covers more than 1000 devices from over 100 manufacturers world-wide. In addition, devices from all manufacturers can be integrated in SIMATIC PDM by simply importing their EDDs. The device spectrum can thus be constantly maintained.

Access privileges

SIMATIC PDM supports two different groups of users: specialists and maintenance engineers. The maintenance engineer can modify the operating data, the specialist can access all parameters and functions.

A password can be assigned as required as access protection for specialists.

SIMATIC PDM

Diagnosis and Asset Management

Diagnosis and Asset Management covers all actions and measures for maintaining or enhancing a plant's value. This includes not only system management, process management and process optimization but also and above all value-maintaining and value-enhancing maintenance and servicing, i.e. near-plant asset management.

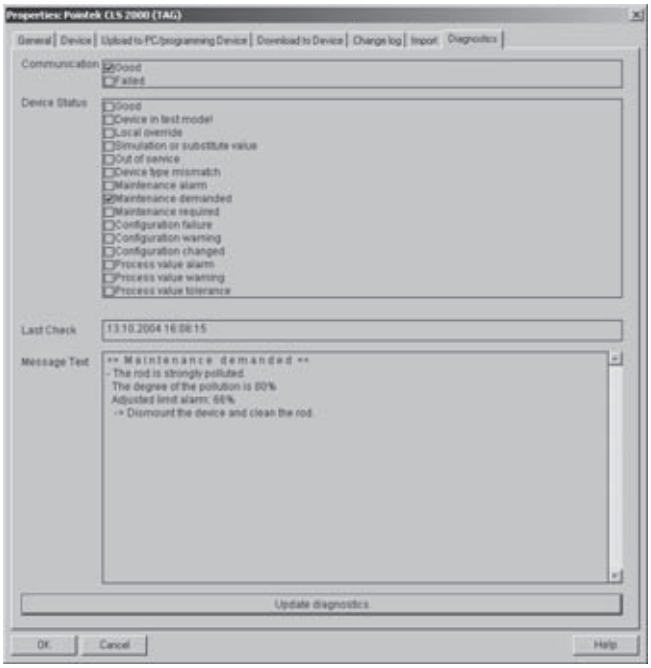
SIMATIC PDM is particularly predestined for near-plant asset management on account of its extensive functionality for the configuring, parameterization, commissioning, diagnosis and maintenance of intelligent field devices and components.

Asset management systems require a great deal of basic data in order to be able to provide informative and reliable results. In real plants these data are highly heterogeneous and unstructured, which makes them very difficult to access.

SIMATIC PDM is able to determine the device data of relevance for near-plant asset management and to transfer them in XML format through a uniform interface to a higher-level system. The basis for this is provided by device descriptions (EDD – Electronic Device Description) which are independent of the operating system. Collecting the data and interpreting the results are independent of the device type, i.e. it makes no difference whether the device is an actuator or sensor, or a PROFIBUS or HART device.

However, SIMATIC PDM is far more than just a collector of data for higher-level asset management systems. It also provides a series of its own asset management functions:

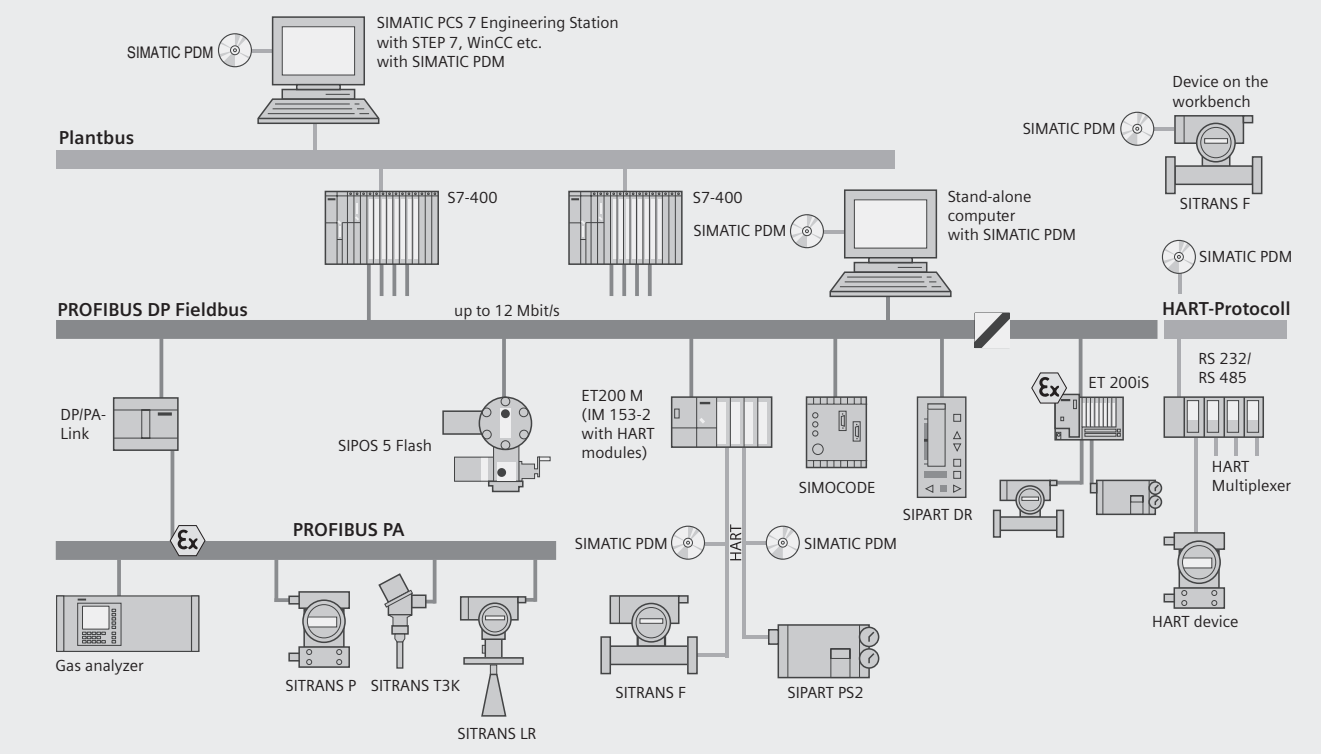
- Determination of differences between the offline data and the current parameters in the device
- Multilingual presentation of diagnosis data read from the devices (device-specific data and profile data)
- Uniform presentation and identification of diagnosis and status data of all devices with uniform symbols
- Data transfer to an asset management system activated by its request
- Extensive protocol functions
- Export interface for all data



Diagnosis

Integration

Central device operation



Communication in an automation solution with SIMATIC PDM

An overview of the possible connection points of SIMATIC PDM in a plant is shown in the figure. The SIMATIC PDM icon shows wherever SIMATIC PDM can be connected.

With SIMATIC PDM you can use the Routing function. Routing permits uniform communication from a central engineering station up to the process devices. Reconnection of the PC's DP interface to the respective DP segment is superfluous, and thus a possible source of error is eliminated.

Data collection times are eliminated, the device data are available directly online. In particular, the diagnostics data of the devices are available immediately. This decisively increases the plant safety, and the costs for data collection are significantly reduced. Customer experience shows that approx. 100 measuring circuit tests can then be carried out per day by one person.

The PCs/PGs on which SIMATIC PDM is to be installed are connected to the plant bus. This is either an ES engineering station or an engineering console with SIMATIC PDM. Common operations on a project database using different PCs/PGs are possible using a LAN.

Devices can be connected in different manners at the field level: PROFIBUS PA devices to DP/PA coupler and DP/PA link or HART devices to the HART analog input/output modules of the ET 200M/iS/iSP. HART devices can also be connected to conventional analog input/output modules.

A HART multiplexer through which all connected HART devices can be reached is shown on the right in the figure.

The SIPART DR controllers and the SIMOCODE are shown as representatives for PROFIBUS DP devices.

The PROFIBUS DP is connected here to a SIMATIC S7-400 automation system. Several DP segments can be connected to the S7-400. More SIMATIC S7-400 systems can be connected to the plant bus.

Communication

SIMATIC PDM supports several communication protocols and components for communication with the following devices:

Devices with PROFIBUS DP interface

These are connected directly to PROFIBUS DP. An example is the SIPART DR21 compact controller.

Devices with PROFIBUS PA interface

For example, the SITRANS PDS III pressure transmitter

Remote I/O stations such as e.g. the ET 200M/IiS/iSP

The PROFIBUS PA devices supported by SIMATIC PDM are connected to the PROFIBUS DP segment through DP/PA Link or a DP/PA coupler.

The fully integrated PROFIBUS PA devices can be parameterized, as well as all PROFIBUS PA devices complying with the profile.

- Pressure and temperature
- Level and flow
- Actuators
- Discrete I/Os
- Analyzers (only PA profile version 3.0)

Devices with HART interface

These devices can be connected in different manners:

- Through the SIMATIC ET 200M/IIS/iSP distributed I/O system with the HART modules
- Through a HART modem with which a point-to-point connection is established between the PC or engineering station and the HART device
- Through multiplexers which forward the telegrams transparently to the HART devices

SIMATIC PDM

In addition to the fully integrated HART-capable devices, almost all HART devices registered with HCF can also be parameterized.

Controllers with serial SIPART DR communication through RS 232 / RS 485.

The controllers SIPART DR19, DR21 and DR22 can be parameterized through the co-called SIPART DR network which uses the serial SIPART DR communication.

An overview of the possible connection points of SIMATIC PDM in a plant is shown in the above figure.

Selection and Ordering Data

		Order No.
SIMATIC PDM **Basic software V5.2** [2] Basis software for operation and parametrization of process devices and components incl. - communication via HART modem, - communication via RS 232, - communication via PROFIBUS DP/PA - 4 TAGs [1] - PDM Documentation	▶ F)	**6ES7 658-3AX05-0YC0**
PDM Starter Package V5.2 for SIMATIC PCS 7 Preferred variant for SIMATIC PCS 7 with: - SIMATIC PDM basic software - Integration in STEP 7 / PCS 7 - Routing via S7-400 - 128 TAGs [1]	▶ F)	**6ES7 658-3PX05-0YC0**
SIMATIC PDM **Update V5.1 to V5.2** [2] The Update becomes effective for the PDM basic software, together with all combinations of PDM optional packages and the Starter Package.	▶ F)	**6ES7 658-3AX05-0YC3**
Option(s) for SIMATIC PDM V5.2 to extend the SIMATIC PDM V5.2 basic software		
• Integration in STEP 7 / SIMATIC PCS 7 (required if the integration of SIMATIC PDM in HW Config is to be used)	▶	**6ES7 658-3BX00-2XD0**
• Routing via S7-400 (required if devices connected to the PROFIBUS are to be accessed from a central Engineering working station via the system bus.)	▶	**6ES7 658-3CX00-2XD0**
• Communication via standard HART multiplexer (required if HART devices are to be accessed via a HART multiplexer)	▶	**6ES7 658-3EX00-2XD0**
TAG-Option(s) for SIMATIC PDM V5.2		
• up to 128 TAGs [1]	▶	**6ES7 658-3XA00-2XD0**
• up to 512 TAGs [1]	▶ F)	**6ES7 658-3XB00-2XD0**
• up to 1.024 TAGs [1]	▶	**6ES7 658-3XC00-2XD0**
• up to 2.048 TAGs [1]	▶	**6ES7 658-3XD00-2XD0**
• PowerPack to change from		
- 128 TAGs to 512 TAGs	▶	**6ES7 658-3XB05-2XD5**
- 512 TAGs to 1024 TAGs	▶	**6ES7 658-3XC05-2XD5**
- 1024 TAGs to 2048 TAGs	▶	**6ES7 658-3XD05-2XD5**
- 2048 TAGs to TAGs unlimited	▶	**6ES7 658-3XH05-2XD5**
SIMATIC PDM V5.2 for demonstration purposes **SIMATIC PDM Demo Version V5.2** (without any communication function.)	▶ F)	**6ES7 658-3GX05-0YC8**

▶ Available ex stock.

1) A TAG is normally a terminal device such as a measuring transducer, e.g. SITRANS P.

2) Starting with version 5.2 the SIMATIC PDM basic software will only support 4 TAGs. In the case of projects with more than four TAGs, one of the available TAG options should be ordered.

F) Subject to export regulations AL: N, ECCN: EAR99S.