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SIMATIC

ET 200pro
IM 154-8 CPU Interface Module

Operating Instructions

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Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.



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Warning

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Caution

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Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

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Prescribed Usage

Note the following:



Warning

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Preface

Purpose of the operating instructions

These operating instructions are intended to supplement the *ET 200pro Distributed I/O Device* operating instructions. It contains a description of all the functions performed by the IM 154-8 CPU interface module. The operating instructions do not include functions that relate generally to ET 200pro. These can be found in the *ET 200pro Distributed I/O Device* operating instructions.

The information contained in these operating instructions and the *ET 200pro Distributed I/O Device* operating instructions allows you to commission ET 200pro with the IM 154-8 CPU interface module and to run it as a DP master or DP slave on the PROFIBUS DP or as an IO controller on the PROFINET.

Basic knowledge required

To understand these operating instructions you should have general experience in the field of automation engineering.

Range of validity of these operating instructions

These operating instructions apply to the IM 154-8 CPU interface module with order number 6ES7154-8AB00-0AB0 and the CM IM PN DP M12, 7/8" terminal module with order number 6ES7194-4AN00-0AA0 and for the components of the ET 200pro distributed I/O device specified in the *ET 200pro Distributed I/O Device* operating instructions.

These operating instructions contain a description of the components that was valid at the time of publication. We reserve the right to issue a Product Information which contains up-to-date information about new components and new versions of components.

Changes since the previous version

These operating instructions are the first version published.

Guide

The operating instructions contain the following guides which provide quick access to the specific information you need:

- You will find a comprehensive table of contents and a list of all the tables in the document at the beginning of the operating instructions.
- Important terms are explained in the glossary.
- Navigate to the most important topics in our documents using the index.

Special notes

If you are using the IM 154-8 CPU as a DP slave on the PROFIBUS DP you will also need the manual for the DP master used in addition to these operating instructions.

Recycling and disposal

The IM 154-8 CPU is recyclable due to its non-toxic materials. For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste.

Further support

If you have any questions relating to the products described in these operating instructions, and do not find the answers in this document, please contact your Siemens partner at our local offices.

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The portal to our technical documentation for the various SIMATIC products and systems is available at:

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Training center

Siemens offers various courses to get you started with the ET 200pro distributed I/O and the SIMATIC S7 automation system. Please contact your regional training center or the central training center in D -90327, Nuremberg, Germany.
Phone: +49 (911) 895-3200.

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- The right documentation for you using our Service & Support search engine.
- The bulletin board, a worldwide knowledge exchange for users and experts.
- Your local contact for Automation & Drives in our contact database.
- Information about on-site services, repairs, spare parts. Lots more can be found on our "Services" pages.

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Description

1

1.1 What is the IM 154-8 CPU interface module?

Function

The IM 154-8 CPU interface module is a component of the ET 200pro distributed I/O device with degree of protection IP65, IP66 or IP67. The IM 154-8 CPU is an "intelligent preprocessor". It enables you to decentralize control tasks.

An ET 200pro with an IM 154-8 CPU can therefore exercise full and, if necessary, independent control over a process-related functional unit and can be used as a stand-alone CPU. A IM 154-8 CPU can be

- Operated with an MPI interface.
- Either a DP slave or DP master on the PROFIBUS DP.
- Either an IO controller or a PROFINET CBA device (with or without proxy functionality for PROFIBUS DP) on the PROFINET

The use of the IM 154-8 CPU leads to further modularization and standardization of process-related functional units and simple, clear machine concepts.

Properties of the IM 154-8 CPU

The IM 154-8 CPU interface module has the following special features:

- The interface module has PLC functionality (integrated CPU component with 256 KB RAM).
- The interface module can only be used with the load memory inserted (SIMATIC micro memory card).
- The PROFIBUS DP address and the IP address for PROFINET are stored on the SIMATIC micro memory card.
- The IM 154-8 CPU is connected to the supply voltages, PROFIBUS DP and PROFINET via a terminal module.
- The interface module can be enhanced with up to 16 I/O modules from the ET 200pro range.
- The IM 154-8 CPU has an integrated power module for the load voltage supply 2L+ for the connected ET 200pro modules. This means that an external power module is not essential if you want to add an ET 200pro.
- The interface module has a mode selector with positions for RUN, STOP and MRES.

- There are 11 LEDs on the front of the interface module to indicate the following:
  - ET 200S faults (SF)
  - Bus faults (BF-DP, BF-PN)
  - Available maintenance information (MAINT)
  - Supply voltage for electronic components (ON)
  - Load voltage supply (DC 24V)
  - Force requests (FRCE)
  - Operating mode of the IM 154-8 CPU (RUN and STOP)
  - Connection status at ports 1 and 2 of the PROFINET interface (P1, P2)
- There are 2 separate status LEDs (LINK, RX/TX) integrated at port 3 of the PROFINET interface.
- Connection to PROFIBUS DP or MPI via a combined MPI / DP interface (RS 485) with 2 M12 circular socket connectors for connecting and routing the connecting leads.
- Connection to PROFINET via PROFINET interface with integrated switch and 3 ports:
  - Ports 1 and 2: M12 circular socket
  - Port 3: RJ45 (primarily for connecting a programming device)

Integrating the IM 154-8 CPU into ET 200pro

The IM 154-8 CPU interface module is integrated into the ET 200S in the same way as any other module. In other words, its configuration concept, installation and expansion capability are the same.
Information on this topic can be found in the *ET 200pro Distributed I/O Device* Operating Instructions.

How do I configure and program the ET 200pro with IM 154-8 CPU?

To configure ET 200pro with IM 154-8 CPU (configuration and parameter assignment) and to program the IM 154-8 CPU you will need the *STEP 7* project design software, V5.4 + ServicePack 1 + HSP or later.
The procedure for configuring the ET 200pro with IM 154-8 CPU is described in the *Commissioning* section of these operating instructions. The *Instruction list* contains the *STEP 7* instruction set for programming the IM 154-8 CPU.

Constraints on using ET 200pro modules

Note

To configure an ET 200pro with IM 154-8 CPU you will need the relevant HSPs for *STEP 7* V5.4 + SP 1. The specified versions or later must be used. A detailed list is given in the following table.

Notice

Install all of the HSPs listed in the following table to ensure that the ET 200pro works smoothly with the IM 154-8 CPU.

ET 200pro modules that were configured with older HSP versions must not be copied to the rack with the IM 154-8 CPU.

The individual modules (without the specified interface modules) can only be used centrally in an ET 200pro with IM 154-8 CPU if the product version / firmware version with the specified HSP is as stated or later.

Table 1-1 Constraints on using ET 200pro modules

Module	Order number	As of product version / firmware version	HSP required
IM 154-1 DP	6ES7154-1AA00-0AB0	E01	HSP0063 V1.3
IM 154-2 DP High Feature	6ES7154-2AA00-0AB0	E01	HSP0063 V1.3
IM 154-4 PN High Feature	6ES7154-4AB00-0AB0	E01	HSP0092 V1.3
PM-E	6ES7148-4CA00-0AA0	E01	HSP0068 V1.4
8 DI DC 24V	6ES7141-4BF00-0AA0	E01	HSP0064 V1.5
8 DI DC 24V High Feature	6ES7141-4BF00-0AB0	E01	HSP0064 V1.5
4 DO DC 24V/2.0A	6ES7142-4BD00-0AA0	E01	HSP0065 V2.3
4 DO DC 24V/2.0A High Feature	6ES7142-4BD00-0AB0	E03	HSP0065 V2.3
8 DO DC 24V/0.5A	6ES7142-4BF00-0AA0	E03	HSP0065 V2.3
4 AI U High Feature	6ES7144-4FF00-0AB0	E01	HSP0066 V2.3
4 AI I High Feature	6ES7144-4GF00-0AB0	E01	HSP0066 V2.3
4 AI RTD High Feature	6ES7144-4JF00-0AB0	E01	HSP0066 V2.3
4 AO U High Feature	6ES7145-4FF00-0AB0	E02	HSP0067 V1.4
4 AO I High Feature	6ES7145-4GF00-0AB0	E02	HSP0067 V1.4
16 DO DC 24V CPV10	6ES7148-4EA00-0AA0	E02	HSP2015 V1.1
16 DO DC 24V CPV14	6ES7148-4EB00-0AA0	E02	HSP2015 V1.1
RF170C	6GT2002-0HD00	V2.0	Contained in the OM [1]
Motor starter	3RK1304-5xS40-xAAx	E03	HSP0082 V2.0

[1] OM is included as an optional package on the *RFID Systems Software & Documentation* CD, 11/2006 edition (6GT2080-2AA10).

Note

If the 8 DO DC 24V/0.5A, 8 DI DC 24V, 16 DO DC 24V CPV10 and 16 DO DC 24V CPV14 modules are used centrally on an IM 154-8 CPU, then SFB 53 cannot be used to write data records to these modules.

Constraints on using ET 200S IO devices on an IM 154-8 CPU

Note

To configure an ET 200S IO devices with IM 154-8 CPU you will need the relevant HSPs for *STEP 7* V5.4 + SP 1. The specified versions or later must be used. A detailed list is given in the following table.

Table 1-2 HSPs for ET 200S PROFINET IO devices on an IM 154-8 CPU

PROFINET IO device	Order number	As of Firmware Version	HSP required
ET 200S with interface module			
• IM 151-3 PN	6ES7151-3AA10-0AB0	V2.0.0	HSP0089 V1.3
• IM 151-3 PN	6ES7151-3AA20-0AB0	V3.0.1	HSP0098 V1.3
• IM 151-3 PN High Feature	6ES7151-3AA20-0AB0	V3.0.1	HSP0099 V1.3

Sample configuration of an ET 200pro with the IM 154-8 CPU

The figure below shows a sample configuration of an ET 200S with an IM 154-8 CPU.

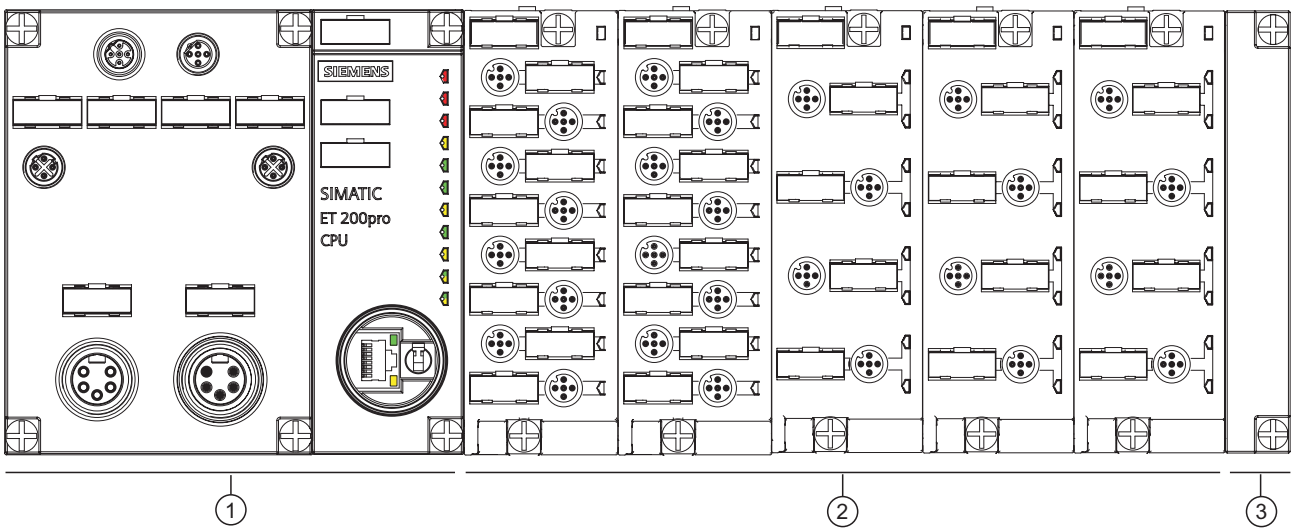


Figure 1-1 View of the ET 200pro distributed I/O device with the IM 154-8 CPU

Code	Meaning
①	IM 154-8 CPU interface module
②	Electronic modules
③	Terminating module

See also

Procedure: Commissioning the software (Page 107)

Operating and display elements

2

2.1 Operating and display elements on the IM 154-8 CPU

Operating and display elements

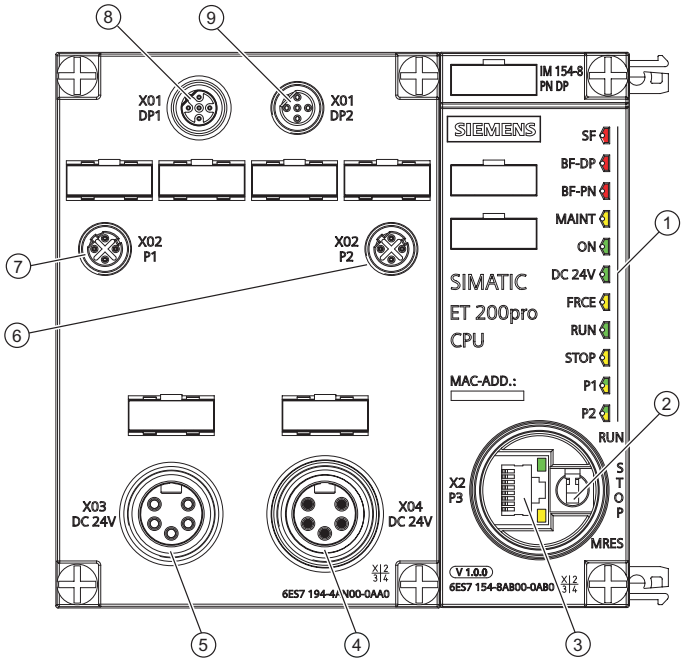


Figure 2-1 IM 154-8 CPU with CM IM PN DP M12 7/8" terminal module inserted

The figures show	the following elements of the IM 154-8 CPU
①	Status and error displays
②	Mode selector switch
③	RJ45 socket; e.g. for connecting a programming device for servicing purposes (port 3 of the PROFINET interface)
④	7/8" circular socket (with female contact insert), for looping the electronic / encoder supply 1L+ and load voltage supply 2L+
⑤	7/8" circular socket (with male contact insert) for connecting the electronic / encoder supply 1L+ and load voltage supply 2L+
⑥	M12 circular socket (with female socket insert) for connecting to PROFINET (port 2 of the PROFINET interface)
⑦	M12 circular socket (with female socket insert) for connecting to PROFINET (port 1 of the PROFINET interface)
⑧	M12 circular socket (with male contact insert) for connecting PROFIBUS DP
⑨	M12 circular socket (with female contact insert) for looping PROFIBUS DP

Slot for the SIMATIC Micro Memory Card

Memory module is a SIMATIC Micro Memory Card. You can use MMCs as load memory and as portable storage media. The slot for the SIMATIC micro memory card can be accessed by removing the terminal module on the front of the interface module. The *Inserting/Replacing a Micro Memory Card* section contains detailed information on inserting the SIMATIC micro memory card.

Note

The IM 154-8 CPU does not have an integrated load memory, so you will need to add a SIMATIC micro memory card in order to use it.

Mode selector switch

You can use the mode selector switch to set the current operating mode of the IM 154-8 CPU.

Table 2-1 Mode selector switch settings

Position	Meaning	Description
RUN	RUN mode	The IM 154-8 CPU runs the user program.
STOP	STOP mode	The IM 154-8 CPU does not run the user program.
MRES	Memory reset	Mode selector switch setting for • A general reset of the IM 154-8 CPU • Backing up the firmware to the SIMATIC micro memory card • Resetting to the as-supplied state A memory reset using the mode selector requires a number of steps to be carried out in a set order.

Reference

- IM 154-8 CPU operating modes: *STEP 7 Online Help.*
- Information about an IM 154-8 Memory reset: See the *Resetting the IM 154-8 CPU using the mode selector* section.
- Evaluation of the LEDs for errors or diagnostics: See the *Diagnostics using status and error LEDs* section.

See also

Inserting/Replacing a SIMATIC Micro Memory Card (Page 110)

2.2 Status and error displays on the IM 154-8 CPU

General status and error displays

Table 2-2 General status and error displays on the IM 154-8 CPU

LED designation	Color	Meaning
SF	Red	Group fault for hardware or software error
MAINT	Yellow	Maintenance information
ON	Green	Electronic module / encoder supply 1L+ for IM 154-8 CPU
DC 24V	Green	Load voltage supply 2L+ for IM 154-8 CPU
FRCE	Yellow	LED is lit: Active force job LED flashes at 2 Hz: Node flash test function.
RUN	Green	IM 154-8 CPU set to RUN The LED flashes during STARTUP at a rate of 2 Hz, and in HOLD state at 0.5 Hz.
STOP	Yellow	IM 154-8 CPU set to STOP or HOLD, or STARTUP The LED flashes at 0.5 Hz when the CPU requests a memory reset, and during the reset at 2 Hz.

Status and error displays for the bus interfaces

Table 2-3 Status and error displays for the bus interfaces on the IM 154-8 CPU

LED designation	Color	Meaning
BF-DP	Red	Bus fault on the PROFIBUS DP
BF-PN	Red	Bus fault on the PROFINET
P1	Green/ Yellow	Connection at port 1 is active Receiving / Transmitting data at port 1
P2	Green/ Yellow	Connection at port 2 is active Receiving / Transmitting data at port 2
LEDs at port 3 of the PROFINET interface [1]	Green	Connection at port 3 is active
	Yellow	Receiving / transmitting data at port 3
[1] On the IM 154-8 CPU, these are located directly on the RJ45 socket (LEDs are not labeled!)		

Reference

- IM 154-8 CPU operating modes: *STEP 7 Online Help.*
- Information about an IM 154-8 Memory reset: See the *Resetting the IM 154-8 CPU using the mode selector* section.
- Evaluation of the LEDs for errors or diagnostics: See the *Diagnostics using status and error LEDs* section.

Communication 3

3.1 Interfaces

3.1.1 Multi-Point Interface (MPI)

Availability

The IM 154-8 CPU interface module has a combined MPI / DP interface with 2 M12 circular sockets for connecting and routing the connecting leads. This interface is configured as an MPI interface in the as-supplied state.

Properties

The MPI (Multi-Point Interface) is the interface between the IM 154-8 CPU and a programming device/OP, or for communication on an MPI subnet.

The typical (default) baud rate is 187.5 kbps. You can also set 19.2 kbps for communication with an S7-200. Baud rates up to 12 Mbps are possible.

The IM 154-8 CPU automatically broadcasts its set bus parameters (such as the baud rate) to the MPI interface. A programming device, for example, can thus receive the correct parameters and automatically connect to a MPI subnet.

Note

You may only connect programming devices to an MPI subnet which is in RUN mode. Other stations (for example, OP, TP, ...) should not be connected to the MPI subnet while the system is in RUN. Otherwise, transferred data might be corrupted as a result of interference, or global data packages may be lost.

Time synchronization

Time synchronization is possible if the MPI / DP interface is programmed as an MPI interface on the IM 154-8 CPU. The IM 154-8 CPU may act as the time master (with suitably programmed synchronization interval) or time slave. This is set in HW Config. The default setting is no time synchronization.

As the time master, the IM 154-8 CPU sends synchronization message frames to the MPI interface at the set synchronization interval in order to synchronize other stations on the connected MPI subnet. If you set the time on the IM 154-8 CPU using a programming device or SFC, then the time synchronization is started immediately.

As the time slave, the IM 154-8 CPU receives synchronization message frames from another time master and accepts this time as its own internal time.

In addition to time synchronization at the MPI / DP interface, there is also time synchronization at the PROFINET interface. The IM 154-8 CPU may only be the time slave at one of these interfaces. At the PN interface, it can only acts as a time client (functionality is the same as that of a time slave at the MPI / DP interface).
Example: The IM 154-8 CPU is time synchronized by a time server over NTP via the PN interface. The IM 154-8 CPU can then only be used as a time master at the MPI interface.

Devices capable of MPI communication

- Programming device / PC
- OP/TP
- S7-300 / S7-400 with MPI interface
- S7-200 (19.2 kbps only)

3.1.2 PROFIBUS DP

Availability

The IM 154-8 CPU interface module has a combined MPI / DP interface with 2 M12 circular sockets for connecting and routing the connecting leads.
The MPI / DP interface is always configured as an MPI interface when supplied. You will have to convert it to DP mode in *STEP 7* if you want to use the DP interface.

Properties

The PROFIBUS DP interface is mainly used to connect distributed I/Os. PROFIBUS DP allows you to create large subnets, for example.

You can configure the PROFIBUS DP interface as master or slave. It allows a transmission rate of up to 12 Mbps.

The IM 154-8 CPU broadcasts its bus parameters (such as the baud rate) to the PROFIBUS DP interface when it is used as the master. A programming device, for example, can thus receive the correct parameters and automatically connect to a PROFIBUS subnet. In your configuration you can specify to disable bus parameter broadcasting.

Note

(For DP interface in slave mode only)

If you have unchecked the Test, commissioning, routing check box in the DP interface properties dialog in *STEP 7*, the baud rate you set will be ignored, and the baud rate of the master will be automatically set instead. This disables the routing function at this interface.

Time synchronization using PROFIBUS

Time synchronization is possible if the MPI / DP interface is programmed as a DP interface on the IM 154-8 CPU. The IM 154-8 CPU may act as the time master (with suitably programmed synchronization interval) or time slave. This is set in HW Config. The default setting is no time synchronization.

As the time master, the IM 154-8 CPU sends synchronization message frames to the DP interface at the set synchronization interval in order to synchronize other stations on the connected PROFIBUS DP subnet. If you set the time on the IM 154-8 CPU using a programming device or SFC, then the time synchronization is started immediately.

As the time slave, the IM 154-8 CPU receives synchronization message frames from another time master and accepts this time as its own internal time.

In addition to time synchronization at the MPI / DP interface, there is also time synchronization at the PROFINET interface. The IM 154-8 CPU may only be the time slave at one of these interfaces. At the PN interface, it can only acts as a time client (functionality is the same as that of a time slave at the MPI / DP interface).

Example: The IM 154-8 CPU is time synchronized by a time server over NTP via the PN interface. The IM 154-8 CPU can then only be used as a time master at the DP interface.

Devices capable of PROFIBUS DP communication

- Programming device / PC
- OP/TP
- DP slaves
- DP master
- Actuators/Sensors
- S7-300/S7-400 with PROFIBUS DP interface

Reference

Additional information on PROFIBUS: http://www.profibus.com

3.1.3 PROFINET (PN)

Availability

The IM 154-8 CPU interface module has a PROFINET interface with integral switch and 3 ports:

- Ports 1 and 2 are IP65-rated (M12 circular socket). At these ports, the network can be configured with a line structure with no additional external switch.
- Port 3 (RJ45 socket) is provided so that you can connect a programming device during commissioning.

Connecting to Industrial Ethernet

You can use the integrated PROFINET interface of the IM 154-8 CPU to establish a connection to Industrial Ethernet.

The integrated PROFINET interface of the IM 154-8 CPU can be configured via the MPI / DP interface or via the PROFINET interface.

Time Synchronization using PROFINET

The IM 154-8 CPU can be used as a time client at the PROFINET interface using the NTP method. This is set in HW Config. The default setting is no time synchronization.

As the time client, the IM 154-8 CPU receives synchronization message frames from a time NTP server (e.g. SICLOCK TS) and accepts this time as its own internal time.

In addition to time synchronization at the PROFINET interface, there is also time synchronization at the MPI / DP interface. The IM 154-8 CPU may only be the time slave at one of these interfaces. At the PN interface, it can only acts as a time client (functionality is the same as that of a time slave at the MPI / DP interface).

Example: The IM 154-8 CPU is time synchronized by a time server over NTP via the PN interface. The IM 154-8 CPU can then only be used as a time master at the MPI / DP interface.

Devices capable of PROFINET (PN) communication

- PROFINET IO devices (for example, interface module IM 151-3 PN in an ET 200S)
- S7-300 / S7-400 with PROFINET interface (for example, CPU 317-2 PN/DP or CP 343-1)
- Active network components (a switch, for example)
- IE/PB link
- Programming device / PC with network card

Properties of the PROFINET interface

Properties	
IEEE standard	802.3
Connector design	
• Ports 1 and 2:	M12 circular socket, D-coded
• Port 3	RJ45
Transmission speed	Up to 100 Mbps
Media	Twisted pair Cat5 (100 BASE-TX)

Note

Networking PROFINET components

The use of switches, rather than hubs, for networking PROFINET components brings about a substantial improvement in decoupling bus traffic, and improves runtime performance under higher bus load. PROFINET CBA with cyclic PROFINET interconnections requires the use of switches in order to maintain compliance with performance specifications. Full duplex mode at 100 Mbps is mandatory for cyclic PROFINET interconnections.

PROFINET IO also requires the use of switches and 100 Mbps full duplex mode.

Addressing the ports

To diagnose the individual ports of a PROFINET interface, these ports must each have a separate diagnostic address. The addressing is done in HW Config.
For further information, refer to the *PROFINET System Description*.

The diagnostic message (fault and maintenance information) can be enabled using OB 82 (enable in HW Config) and then analyzed using SFB 54, for example, in order to diagnose any problems identified in the user program. There are also various data records (read using SFB 52) and system status lists (read using SFC 51) provided for more detailed diagnostics.

Diagnostics is also possible in *STEP 7* (e.g. communication diagnostics, network connection, Ethernet statistics, IP parameters, etc).

Send clock and send cycle

Acting as an IO controller, the IM 154-8 CPU can work with a send clock of 250 µs, 500 µs or 1 ms.

Controllers and devices can be used with a standardized send clock in a PROFINET IO subnet. For devices that do not support a faster controller send clock, the send clock is adapted to the capabilities of the device. This may mean, for example, that there are devices working with both 250 µs and 1 ms send clocks on an IM 154-8 CPU (IO controller) which works with a 250 µs send clock.

The device send cycle can be set within a relatively large range. This, in turn, depends on the send clock. The following send cycles can be programmed with the IM 154-8 CPU:

Send clock		Update Time
250 µs	⇒	250 µs to 128 ms
500 µs	⇒	500 µs to 256 ms
1 ms	⇒	1 ms to 512 ms

The minimum send cycle depends on the number of devices in use, the amount of configured user data and the communication portion for PROFINET IO. *STEP 7* automatically considers these dependencies during configuration.

Reference

- Details of how to configure the integral PROFINET interface of the IM 154-8 CPU are given in the *Connecting a programming device/PC to the integrated PROFINET interface of the IM 154-8 CPU* and *Commissioning PROFINET IO* sections.
- For additional information on PROFINET, refer to *PROFINET System Description*
- Extensive information on the subject of Ethernet networks, network configuration and network components can be found in the *SIMATIC NET, Twisted Pair and Fiber Optic Networks* manual.
  This can be found on the Internet at
  http://www.siemens.com/automation/service&support, entry ID 8763736.
- *Component Based Automation, Commissioning Systems - Tutorial,*
  entry ID 18403908
- Additional information about PROFINET at http://www.profinet.com

See also

Connecting a programming device/PC to the integrated PROFINET interface of the IM 154-8 CPU (Page 120)

Configuring and commissioning the PROFINET IO system (Page 143)

3.2 Communication services

3.2.1 Overview of communication services

Selecting the communication service

You need to decide on a communication service, based on functionality requirements. Your choice of communication service will have no effect on:

- The functionality available
- Whether an S7 connection is required or not
- The time of connecting

The user interface can vary considerably (SFC, SFB, ...), and is also determined by the hardware used (IM 154-8 CPU, PC, ...).

Overview of communication services

The table below provides an overview of the communication services provided by the IM 154-8 CPU.

Table 3-1 Communication services of the IM 154-8 CPU

Communication service	Functionality	Time at which the S7 connection is established ...	via MPI	via DP	via PN
Programming device communication	Commissioning, test, diagnostics	From the programming device, starting when the service is used	X	X	X
OP communication	Control and monitoring	From the OP at Power ON	X	X	X
S7 basic communication	Data exchange	Is programmed at the blocks (SFC parameters)	X	–	–
S7 communication	Data exchange in server and client mode: Configuration of communication required.	From the active partner at POWER ON.	Only in server mode	Only in server mode	X
Global data communication	Cyclic data exchange (for example, bit memory)	Does not require an S7 connection	X	–	–
Routing programming device functions	for example testing, diagnostics on other networks also	From the programming device, starting when the service is used	X	X	X
PROFIBUS DP	Data exchange between master and slave	Does not require an S7 connection	–	X	–
PROFINET CBA	Data exchange by means of component based communication	Does not require an S7 connection	–	–	X
PROFINET IO	Data exchange between IO controllers and the IO devices	Does not require an S7 connection	–	–	X
Web Server	Diagnostics	Does not require an S7 connection	–	–	X

Communication service	Functionality	Time at which the S7 connection is established ...	via MPI	via DP	via PN
SNMP (Simple Network Management Protocol)	Standard protocol for network diagnostics and configuration	Does not require an S7 connection	–	–	X
Open communication by means of TCP/IP	Data exchange via Industrial Ethernet with TCP/IP protocol (by means of loadable FBs)	Does not require an S7 connection, is handled in the user program by means of loadable FBs	–	–	X
Open communication by means of ISO on TCP	Data exchange via Industrial Ethernet with ISO-on-TCP protocol (by means of loadable FBs)	Does not require an S7 connection, is handled in the user program by means of loadable FBs	–	–	X
Open communication by means of UDP	Data exchange via Industrial Ethernet with UDP protocol (by means of loadable FBs)	Does not require an S7 connection, is handled in the user program by means of loadable FBs	–	–	X

See also

Distribution and availability of S7 connection resources (Page 68)

Connection resources for routing (Page 69)

3.2.2 PG communication

Properties

Programming device communication is used to exchange data between engineering stations (programming device, PC, for example) and SIMATIC modules which are capable of communication. This service is available for MPI, PROFIBUS and Industrial Ethernet subnets. Transition between subnets is also supported.

Programming device communication provides the functions needed to download / upload programs and configuration data, to run tests and to evaluate diagnostic information. These functions are integrated into the IM 154-8 CPU operating system.

An IM 154-8 CPU can maintain several simultaneous online connections to one or multiple programming devices.

3.2.3 OP communication

Properties

OP communication is used to exchange data between operator stations (OP, TP, for example) and SIMATIC modules which are capable of communication. This service is available for MPI, PROFIBUS and Industrial Ethernet subnets.

OP communication provides functions you require for monitoring and modifying. These functions are integrated into the IM 154-8 CPU operating system.

An IM 154-8 CPU can maintain several simultaneous connections to one or multiple OPs.

3.2.4 S7 basic communication (via MPI only)

Properties

S7 basic communication is used to exchange data between various IM 154-8 CPUs (acknowledged data exchange). The data is exchanged across non-configured S7 connections. The service is possible via the MPI subnet.

S7 basic communication provides the functions you need to exchange data. These functions are integrated into the IM 154-8 CPU operating system. The user can utilize this service by means of "System function" (SFC) user interface.

Reference

Additional information

- On SFCs, refer to the *Instruction list*.
  A detailed description is given in the *STEP 7 Online Help* or *System and Standard Functions for S7-300/400* reference manual.
- On communication are found in the *Communication with SIMATIC* Manual.

3.2.5 S7 communication

Properties

The IM 154-8 CPU can act as either a server or a client in S7 communication: We distinguish between

- Communication with unilateral configuration (for PUT/GET only)
- Communication with bilateral configuration (for USEND, URCV, BSEND, BRCV, PUT, GET)

The available functionality is described in the following table.

Table 3-2 Client and server in S7 communication, using connections with unilateral / bilateral configuration

CPU	Use in server mode for connections with unilateral configuration	Use in server mode for connections with bilateral configuration	Use as client
IM 154-8 CPU	Always possible at the MPI/DP/PN interface, without programming the user interface	Possible at the PN interface with loadable FBs	Possible at the PN interface with loadable FBs

The user interface is implemented using standard function blocks (FBs) under communication blocks in the standard *STEP 7* library.

Reference

For additional information on communication, refer to the *Communication with SIMATIC* manual.

3.2.6 Global data communication (via MPI only)

Properties

Global data communication is used for cyclic exchange of global data via MPI subnets (for example, I, Q, M) between SIMATIC S7 CPUs (data exchange without acknowledgement). One CPU broadcasts its data to all other CPUs on the MPI subnet. This function is integrated into the IM 154-8 CPU operating system.

Reduction ratio

The reduction ratio specifies the cyclic intervals for GD communication. You can set the reduction ratio when you configure global data communication in *STEP 7* . For example, if you set a reduction ratio of 7, global data are transferred only with every 7th cycle. This reduces load on the IM 154-8 CPU.

Send and receive conditions

Conditions which should be satisfied for GD communication:

- The transmitter of a GD packet must meet the following requirement:
  Reduction ratio$_{transmitter}$ x cycle time$_{transmitter}$ ≥ 60 ms
- The receiver of a GD packet must meet the following requirement:
  Reduction ratio$_{receiver}$ x cycle time$_{receiver}$
  < reduction factor$_{transmitter}$ x cycle time$_{transmitter}$

Information about the cycle time can be found in the *Cycle and response times* appendix.

A GD packet may be lost if these requirements are not met. The reasons being:

- The performance of the "smallest" CPU in the GD circuit
- Asynchronous transmitting / receiving of global data at the stations

When setting in *STEP 7*: “Transmit after each CPU cycle“, and the IM 154-8 CPU has a short CPU cycle (< 60 ms). In this case, the operating system may overwrite a GD packet from the IM 154-8 CPU before it is transmitted. The loss of global data is indicated in the status box of a GD circuit, if you set this function in your *STEP 7* configuration.

GD resources of the IM 154-8 CPU

Table 3-3 GD resources of the IM 154-8 CPU

Parameters	IM 154-8 CPU
Number of GD circuits per CPU	Max. 8
Number of GD packets transmitted per GD circuit	Max. 1
Number of GD packets transmitted by all GD circuits	Max. 8
Number of GD packets received per GD circuit	Max. 1
Number of GD packets received by all GD circuits	Max. 8
Data length per GD packet	Max. 22 bytes
Consistency	Max. 22 bytes
Min. reduction ratio (default)	1 (8)

See also

Calculating the cycle time (Page 223)

3.2.7 Routing

Properties

STEP 7 V5.4 + SP 1 + HSP or later allows you to access your IM 154-8 CPU across all subnets with your programming device /PC, for example, to

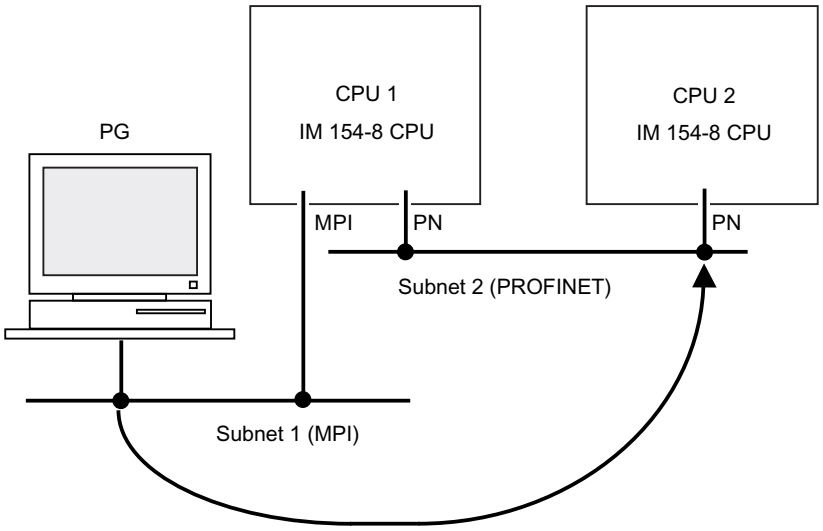
- Download user programs
- Download a hardware configuration, or
- Perform debugging and diagnostic functions.

Note

If you are using your IM 154-8 CPU as an intelligent slave, the routing function is only available when the DP interface is set to active. In *STEP 7*, check the Test, Commissioning, Routing check box in the Properties dialog for the DP interface. For detailed information, refer to the *Programming with STEP 7* manual, or directly to the *STEP 7 Online Help*

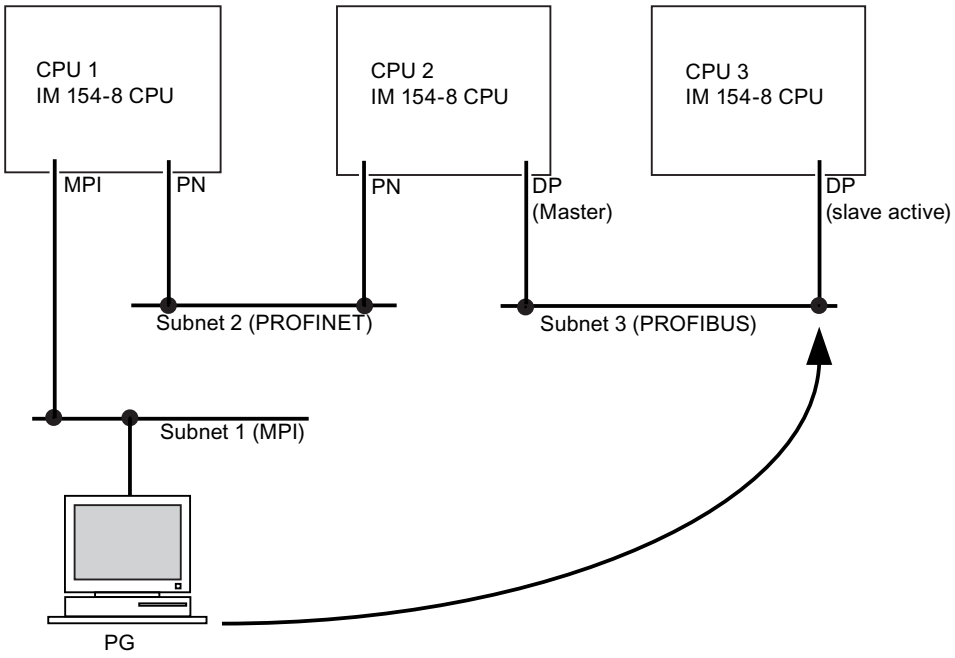
Routing network nodes: MPI - PROFINET

Gateways between subnets are routed in a SIMATIC station that is equipped with interfaces to the respective subnets. The figure below shows CPU 1 (IM 154-8 CPU) acting as router between subnets 1 and 2.



Routing network nodes: MPI - PROFINET - PROFIBUS

The figure below shows the MPI access to PROFIBUS via PROFINET. CPU 1 (IM 154-8 CPU) is the router between subnets 1 and 2. CPU 2 is the router between subnets 2 and 3.



Number of connections for routing

The IM 154-8 CPU provides a different number of connections for the routing function:

Table 3-4 Number of routing connections for IM 154-8 CPU

CPU	Number of connections for routing
IM 154-8 CPU	Interface X01 DP1 / DP2 configured as: • MPI: Max. 10 • DP master: Max. 24 • DP slave (active): Max. 14 Interface X02 P1 / P2 / P3 configured as: • PROFINET: Max. 24

Requirements

- The station modules are "capable of routing" (CPUs or CPs).
- The network configuration does not exceed project limits.
- The modules have loaded the configuration data containing the latest "knowledge" of the entire network configuration of the project.

  Reason: All modules participating in the network transition must receive the routing information defining the paths to other subnets.
- In your network configuration, the programming device/PC you want to use to establish a connection via network node must be assigned to the network it is physically connected to.
- If the MPI / DP interface of the IM 154-8 CPU is configured as a DP slave, then the Test, Commissioning, Routing checkbox must be checked in the Properties dialog for the DP interface in *STEP 7*.

Reference

Additional information

- About configuring with *STEP 7* can be found in the *Configuring Hardware and Connections in STEP 7* manual
- On communication are found in the *Communication with SIMATIC* Manual.
- On SFCs, refer to the *Instruction list*.
  A detailed description is given in the *STEP 7 Online Help* or *System and Standard Functions for S7-300/400* reference manual.

3.2.8 Data consistency

Properties

A data area is consistent if it can be read or written to from the operating system as a consistent block. Data exchanged collectively between the stations should belong together and originate from a single processing cycle, that is, be consistent. If the user program contains a programmed communication function, for example, access to shared data with X-SEND/ XRCV, access to that data area can be coordinated by means of the "BUSY" parameter itself.

With PUT/GET functions

For S7 communication functions, such as PUT/GET or write / read via OP communication, which do not require a block in the user program on the IM 154-8 CPU (acting as a server), allowances must be made in the program for the extent of the data consistency. The PUT/GET functions for S7 communication, or for reading/writing variables via OP communication, are executed at the IM 154-8 CPU's cycle control point. In order to ensure a defined process interrupt reaction time, communication variables are copied consistently in blocks of up to 64 bytes to/from the user memory at the operating system's cycle control point. Data consistency is not guaranteed for larger data areas.

Note

If defined data consistency is required, the length of the communication variables in the IM 154-8 CPU operating system's user program must not exceed 64 bytes.

3.2.9 Communication by means of PROFINET

What is PROFINET?

Within the framework of Totally Integrated Automation (TIA), PROFINET represents a consequent enhancement of:

- PROFIBUS DP, the established field bus, and
- Industrial Ethernet, the communication bus for the cell level

Experience gained from both systems was and is being integrated into PROFINET.

PROFINET is an Ethernet-based automation standard of PROFIBUS International (previously PROFIBUS Users Organization e.V.), and defines a multi-vendor communication, automation, and engineering model. PROFINET has been part of the standard IEC 61158 since 2003.

Objectives in PROFINET

The objectives in PROFINET are:

- Open Ethernet Standard for automation based on Industrial Ethernet.
  Although Industrial Ethernet and Standard Ethernet components can be used together, the Industrial Ethernet devices are more sturdy and therefore better suited for industrial environments (temperature, immunity to interference, etc.)
- Use of TCP/IP and IT standards
- Automation with real-time Ethernet
- Total integration of field bus systems

Implementation of PROFINET in SIMATIC

We have integrated PROFINET as follows:

- We have implemented communication between field devices in SIMATIC with **PROFINET IO**.
- In SIMATIC, communication between controllers as components in distributed systems is implemented with **PROFINET CBA** (Component based Automation).
- Installation engineering and network components are available in SIMATIC NET.
- Established IT standards from the Office environment (e.g., SNMP=Simple Network Management Protocol for network parameter assignment and diagnosis) are used for remote maintenance and network diagnostics.

Documentation from PROFIBUS International on the Internet

At the website of PROFIBUS International (previously PROFIBUS User Organization, PNO), you will find numerous documents on the topic of PROFINET. http://www.profinet.com

Additional information can be found at http://www.siemens.com\profinet.

What is PROFINET IO?

Within the framework of PROFINET, PROFINET IO is a communication concept for the implementation of modular, distributed applications.

PROFINET IO allows you to create automation solutions, which are familiar to you from PROFIBUS.

This means that you have the same application view in *STEP 7*, regardless of whether you are configuring PROFINET or PROFIBUS devices.

What is PROFINET CBA (Component Based Automation)?

Within the framework of PROFINET, PROFINET CBA is an automation concept for the implementation of applications with distributed intelligence.

PROFINET CBA lets you create distributed automation solutions, based on default components and partial solutions.

Component Based Automation allows you to use complete technological modules as standardized components in large systems.

The components are also created in an engineering tool which may differ from vendor to vendor. Components of SIMATIC devices are created, for example, with *STEP 7*.

Extent of PROFINET CBA and PROFINET IO

PROFINET IO and CBA represent two different views of automation devices on Industrial Ethernet.

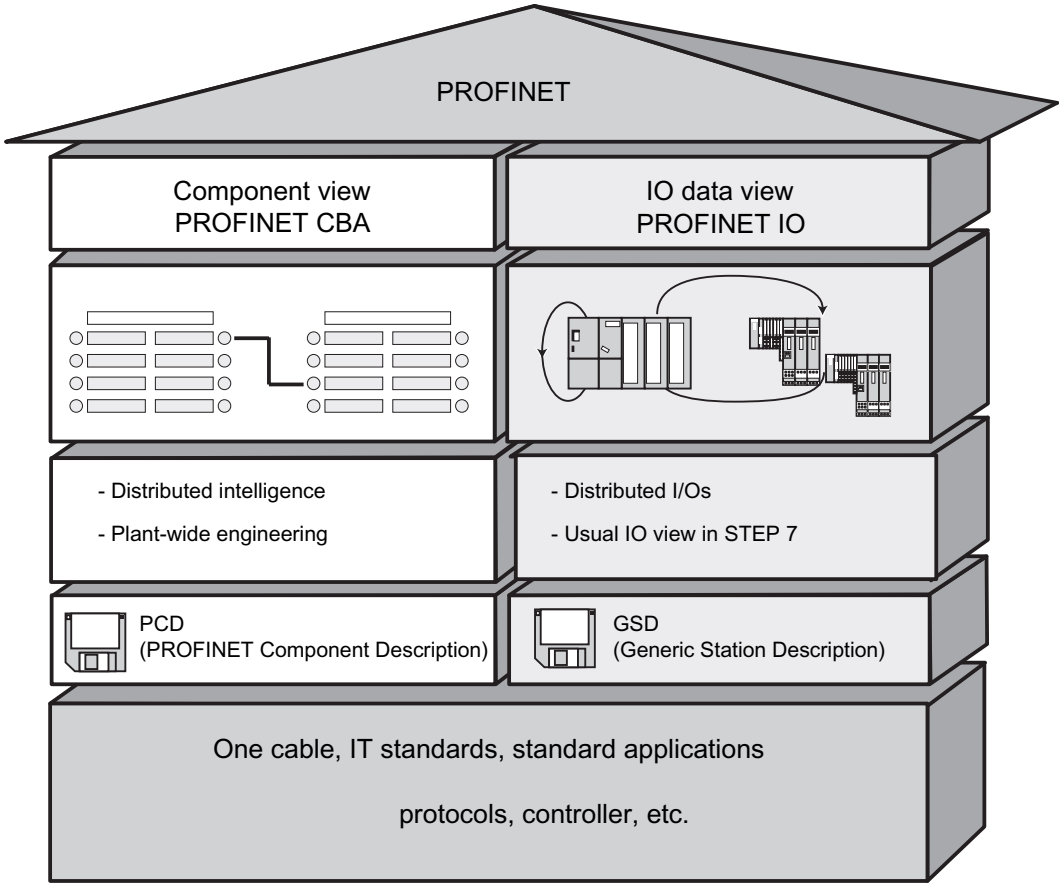


Figure 3-1 Extent of PROFINET IO and Component-Based Automation

Component Based Automation divides the entire system into various functions. These functions are configured and programmed.

PROFINET IO provides you with a view of the system that is very similar to the view obtained in PROFIBUS. You continue to configure and program the individual automation devices.

Reference

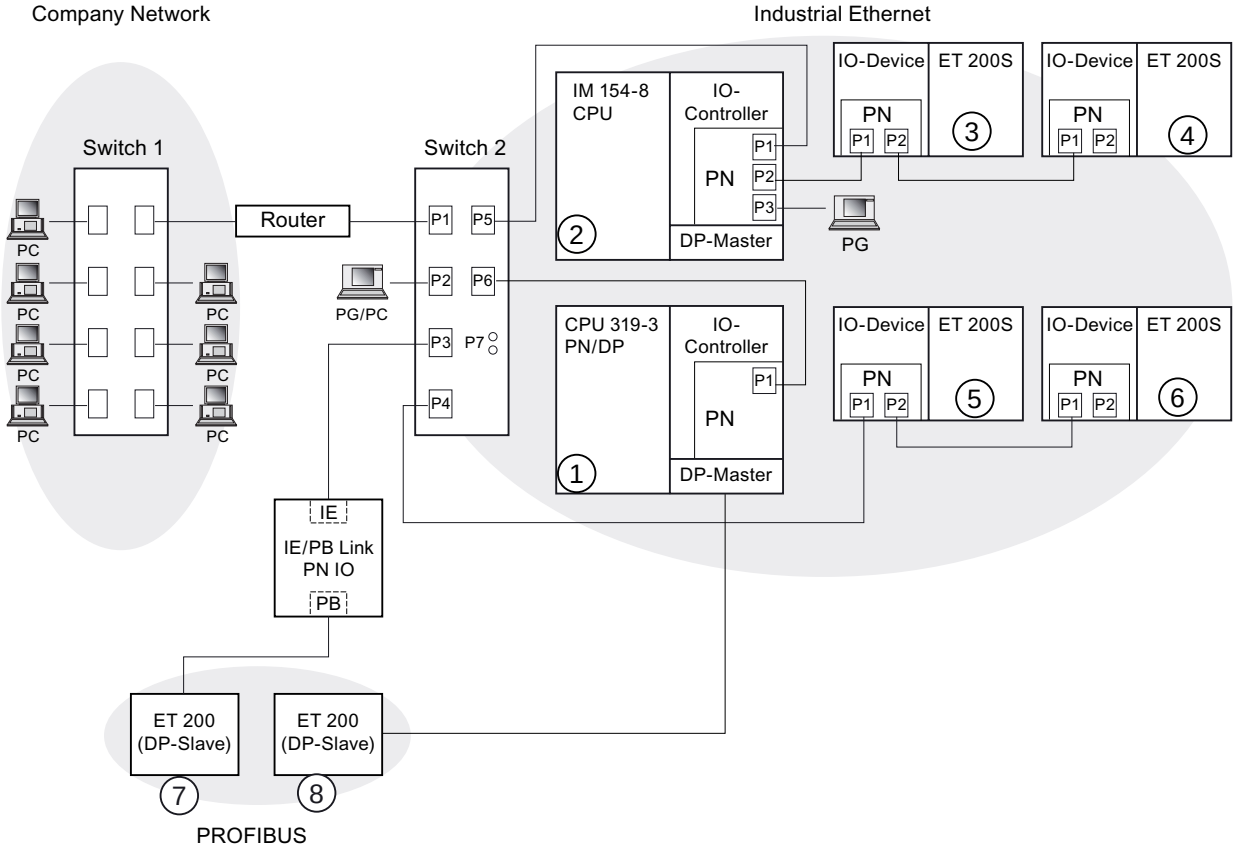
Additional information

- On PROFINET IO and PROFINET CBA is available in the *PROFINET system specification.*
  For differences and similarities between PROFIBUS DP and PROFINET IO, refer to the manual *From PROFIBUS DP to PROFINET IO* programming manual.
- For additional information about PROFINET CBA, refer to the documentation on SIMATIC iMAP and Component Based Automation.

3.2.9.1 PROFINET IO System

Functions of PROFINET IO

The following graphic shows the new functions in PROFINET IO.



The graphic shows	Examples of connection paths
The connection of company network and field level	From PCs in your company network, you can access devices at the field level. Example: • PC - Switch 1 - Router - Switch 2 - CPU 319-3 PN/DP ①
Connections between the automation system and field level	You can, of course, also access other areas on the Industrial Ethernet from a programming device at the field level. Example: • Programming device - Integrated switch IM 154-8 CPU ② - Switch 2 - Integrated switch IO device ET 200S ⑤ - on IO device ET 200S ⑥
The IO controller of the IM 154-8 CPU ② **directly** controls devices on the Industrial Ethernet and PROFIBUS.	At this point, you can see IO features between the IO controller and IO device(s) on the Industrial Ethernet: • The IM 154-8 CPU ② is the IO controller for the two IO devices ET 200S ③ and ET 200S ④ • The IM 154-8 CPU ② is also the IO controller for the ET 200 (DP slave) ⑦ via the IE/PB Link.
The CPU 319-3 PN/DP ① can be both the IO controller and the DP master	Here you can see that a CPU can be both the IO controller for an IO device and the DP master for a DP slave: • The 319-3 PN/DP CPU ① is the IO controller for the two IO devices - ET 200S ⑤ and ET 200S ⑥ • The 319-3 PN/DP CPU ① is the DP master for a DP slave ⑧. The DP slave ⑧ is assigned locally to the CPU ① and is not visible on the Industrial Ethernet.

Reference

Additional information

- About PROFINET can be found in the *From PROFIBUS DP to PROFINET IO* programming manual. This manual also provides a clear overview of the new PROFINET blocks and system status lists.

See also

PROFINET (PN) (Page 26)

3.2.9.2 Blocks for PROFINET IO

Content of this Section

This section explains the following:

- Which blocks are intended for PROFINET
- Which blocks are intended for PROFIBUS DP
- Which blocks are intended for both PROFINET IO and PROFIBUS DP

Compatibility of the New Blocks

For PROFINET IO, it was necessary to create some new blocks, among other things, because larger configurations are now possible with PROFINET. You can also use the new blocks with PROFIBUS.

Comparison of the System and Standard Functions of PROFINET IO and PROFIBUS DP

For IM 154-8 CPUs with an integrated PROFINET interface, the table below provides an overview of:

- System and standard functions for SIMATIC that you may need to replace when converting from PROFIBUS DP to PROFINET IO.
- New system and standard functions

Table 3-5 New System and Standard Functions/System and Standard Functions to be Replaced

Blocks	PROFINET IO	PROFIBUS DP
SFC 12 (deactivation and activation of DP slaves/IO devices)	Yes	Yes
SFC 13 (read diagnostic data of a DP slave)	No Substitute: • Event-related: SFB 54 • State-related: SFB 52	Yes
SFC 58/59 (write/read data record in I/O)	No Substitute: SFB 53/52	Yes You should use SFB 52 / 53 under DPV1.
SFB 52/53 (read/write data record)	Yes	Yes
SFB 54 (evaluate interrupt)	Yes	Yes
SFC 102 (read predefined parameters)	No Substitute: SFB 81	Yes
SFB 81 (read predefined parameters)	Yes	Yes
SFC 5 (determine logical start address of a module)	No (replacement: SFC70)	Yes
SFC 70 (determine start address of a module)	Yes	Yes
SFC 49 (determine the slot belonging to a logical address)	No Substitute: SFC 71	Yes
SFC 71 (determine the slot belonging to a logical address)	Yes	Yes

The following table provides you with an overview of the system and standard functions for SIMATIC, whose functionality must be implemented by other functions when converting from PROFIBUS DP to PROFINET IO.

Table 3-6 System and Standard Functions in PROFIBUS DP that must be Implemented with Different Functions in PROFINET IO

Blocks	PROFINET IO	PROFIBUS DP
SFC 55 (write dynamic parameters)	No Replicate via SFB 53	Yes
SFC 56 (write predefined parameters)	No Replicate via SFB 81 and SFB 53	Yes
SFC 57 (assign module parameters)	No Replicate via SFB 81 and SFB 53	Yes

You cannot use the following SIMATIC system and standard functions with PROFINET IO:

- SFC 7 (trigger hardware interrupt on DP master)
- SFC 11 (synchronize groups of DP slaves)
- SFC 72 (read data from a communication partner within local S7 station)
- SFC 73 (write data to a communication partner within local S7 station)
- SFC 74 (cancel an existing connection to a communication partner within local S7 station)
- SFC 103 (determine the bus topology in a DP master system)

Comparison of the Organization Blocks of PROFINET IO and PROFIBUS DP

Here, there are changes in OB 83 and OB 86, as shown in the following table.

Table 3-7 OBs in PROFINET IO and PROFIBUS DP

Blocks	PROFINET IO	PROFIBUS DP
OB 83 (removal and insertion of modules during operation)	New error information	The removal and insertion of modules during operation is signaled by slaves added using a GSD file by means of a diagnostic interrupt, in other words OB 82. In the case of S7 slaves, a swapping interrupt causes a CPU stop to be reported and OB 86 to be called.
OB 86 (CPU stop)	New error information	Unchanged

Detailed Information

For detailed descriptions of the individual blocks, refer to the *System and Standard Functions for S7-300/400* manual.

3.2.9.3 Open communication via Industrial Ethernet

Requirement

- *STEP 7* V5.4 or later + Service Pack 1 + HSP

Functionality

The IM 154-8 CPU with integrated PROFINET interface supports open communication functionality via Industrial Ethernet (abbreviated to *open IE communication*)

The following services are available for open IE communication:

- Connection oriented protocols
  - TCP to RFC 793, connection type B#16#01
  - TCP to RFC 793, connection type B#16#11
  - ISO on TCP to RFC 1006
- Connectionless protocols
  - UDP according to RFC 768

Features of the communication protocols

The following distinctions are made between protocol types in data communication:

- Connection oriented protocols:

  Prior to data transmission these establish a (logical) connection to the communication partner and close this again, if necessary, after transmission is completed. Connection oriented protocols are used when security in especially important in data transmission. A physical cable can generally accommodate several logical connections.

  For the FBs to open communication by means of Industrial Ethernet, the following connection oriented protocols are supported:

  - TCP according to RFC 793 (connection types B#16#01 and B#16#11)
  - ISO on TCP according to RFC 1006 (connection type B#16#12)
- Connectionless protocols:

  These operate without a connection. There is also no establishing or terminating a connection to remote partner. Wireless protocols transmit data to the remote partner without any acknowledgement; data transfer is, therefore, not secure.
  The FBs for open communication over Industrial Ethernet support the following wireless protocol:

  - UDP according to RFC 768 (connection type B#16#13)

How to use open IE communication

To allow data to be exchanged with other communication partners, *STEP 7* provides the following FBs and UDTs under "Communication Blocks" in the "Standard Library":

- Connection oriented protocols: TCP/ISO-on-TCP
  - FB 63 "TSEND" for sending data
  - FB 64 "TRCV" for receiving data
  - FB 65 "TCON", for connecting
  - FB 66 "TDISCON", for disconnecting
  - UDT 65 "TCON_PAR" with the data structure for the configuration of the connection
- Connectionless protocol: UDP
  - FB 67 "TUSEND" for sending data
  - FB 68 "TURCV" for receiving data
  - FB 65 "TCON" for establishing the local communication access point
  - FB 66 "TDISCON" for resolving the local communication access point
  - UDT 65 "TCON_PAR" with the data structure for configuring the local communication access point
  - UDT 66 "TCON_ADR" with the data structure of the address parameters of the remote partner

Data blocks for the configuration of the connection

- Data blocks for assigning parameters for TCP and ISO-on-TCP connections

  To assign parameters for your connection at TCP and ISO-on-TCP, you need to create a DB that contains the data structure of UDT 65 "TCON_PAR." This data structure contains all parameters you need to establish the connection. You need to create such a data structure for each connection, and you can also organize it in a global DB.

  Connection parameter CONNECT of FB 65 "TCON" reports the address of the corresponding connection description to the user program (for example, P#DB100.DBX0.0 byte 64).

- Data blocks for the configuration the local UDP communication access point

  To assign parameters for the local communication access point, create a DB containing the data structure from the UDT 65 "TCON_PAR" This data structure contains the required parameters you need to establish the connection between the user program and the communication level of the operating system

  The CONNECT parameter of the FB 65 "TCON" contains a reference to the address of the corresponding connection description (e.g. P#DB100.DBX0.0 Byte 64).

Note

Setting up the connection description (UDT 65)

You must enter the interface to be used for communication in the "local_device_id" parameter in UDT 65 "TCON_PAR" (e.g. B#16#02: Communication via the integrated PN interface of the IM 154-8 CPU).

Establishing a connection for communication

- Use with TCP and ISO-on-TCP

  Both communication partners call FB 65 "TCON" to establish the connection. In your connection configuration, you define which communication partner activates the connection, and which communication partner responds to the request with a passive connection. To determine the number of possible connections, refer to your IM 154-8 CPU's technical specifications.

  The IM 154-8 CPU automatically monitors and maintains the active connection.

  If the connection is broken, for example by line interruption or by the remote communication partner, the active partner tries to reestablish the connection. You do not have to call FB 65 "TCON" again.

  FB 66 "TDISCON" disconnects the IM 154-8 CPU from a communication partner, as does STOP mode. To reestablish the connection to have to call FB65 "TCON" again.

- Use with UDP

  Both communication partners call FB 65 "TCON" to set up their local communication access point. This establishes a connection between the user program and operating system's communication level No connection is established to the remote partner.

  The local access point is used to send and receive UDP message frames.

Disconnecting

- Use with TCP and ISO-on-TCP

  FB 66 "TDISCON" disconnects the communication connection between the IM 154-8 CPU and a communication partner.

- Use with UDP

  FB 66 "TDISCON" disconnects the local communication access point, i.e., the connection between the user program and the communication layer of the operating system is interrupted.

Options for interrupting the communication connection

Events causing interruptions of communication:

- You program the cancellation of connections at FB 66 "TDISCON."
- The IM 154-8 CPU changes from RUN to STOP.
- At POWER OFF / POWER ON

Reference

For detailed information on the blocks described earlier, refer to the *STEP 7 Online Help.*

3.2.9.4 SNMP communication service

Availability

The SNMP communication service is available for the IM 154-8 CPU with integrated PROFINET interface.

Properties

SNMP (Simple Network Management Protocol) is a standard protocol for TCP/IP networks.

Reference

For additional information on the SNMP communication service and diagnostics with SNMP, refer to the *PROFINET System Description.*

3.3 Web Server

Introduction

The web server allows you to monitor your IM 154-8 CPU over the Internet or your company's intranet. This allows analyses and diagnostics to be carried out remotely.

Messages and status information are displayed on HTML pages.

Web browser

You will need a web browser to access the HTML pages for the IM 154-8 CPU.

The following web browsers are suitable for communication with the IM 154-8 CPU:

- Internet Explorer (version 6.0 or later)
- Mozilla Firefox (version 1.5 or later)
- Opera (version 9.0 or later)
- Netscape Navigator (version 8.1 or later)

Reading information via the web server

The web server can be used to read the following information from the IM 154-8 CPU:

- Start page with general CPU information
- Identification data
- Contents of the diagnostics buffer
- Messages (without acknowledgment option)
- Information about the PROFINET
- Variable status
- Variable tables

The following pages describe the HTML pages and contain detailed explanatory notes.

Display languages

You can select two of the following five languages for displaying messages and diagnostic information. See also the *Language settings* section.

- German
- English
- French
- Spanish
- Italian

Web access to the IM 154-8 CPU via programming device / PC

Proceed as follows to access the web server:

1. Connect the client (programming device or PC) to the IM 154-8 CPU via the PROFINET interface.
2. Open the web browser (e.g. Internet Explorer).

   Enter the IP address of the IM 154-8 CPU in the "Address" field of the web browser in the format http://a.b.c.d. (for example: http://192.168.3.141).
   The start page of the IM 154-8 CPU opens. From the start page you can navigate to additional information.

Web access to the IM 154-8 CPU via HMI devices and PDAs

The web server also supports the Windows terminal service which means that thin client solutions with mobile devices (e.g. PDA or MOBIC T8) and robust local stations (e.g. SIMATIC MP370 with the ThinClient/MP option) can be implemented under Windows CE, in addition to the use of programming devices and PCs.

Proceed as follows to access the web server:

1. Connect the client (HMI device or PDA) to the IM 154-8 CPU via the PROFINET interface.
2. Open the web browser (e.g. Internet Explorer).

   Enter the IP address of the IM 154-8 CPU in the "Address" field of the web browser in the format http://a.b.c.d/basic (for example: http://192.168.3.141/basic).
   The start page of the IM 154-8 CPU opens. From the start page you can navigate to additional information.

The IM 154-8 CPU information is processed in a specially-designed browser for HMI devices running under Windows CE V 5.x or earlier. The information appears in a simplified format in this browser. This simplified format is not discussed further in the following illustrations.

Activating the Web Server

The web server is deactivated in HW Config by default. Activate the web server in HW Config with the command "CPU -> Object Properties -> Web". See also the *Language settings* section.

Note

You can also use the web server without the SIMATIC micro memory card inserted provided that you have assigned an IP address to the IM 154-8 CPU. The content of the message buffer is displayed in hexadecimal code; the start page, identification and PROFINET information and the variable status are all displayed in plain text.

Security

The web server by itself does not provide any security. Protect your web-compliant IM 154-8 CPU against unauthorized access by means of a firewall.

Screen content refresh status and printing

The web server screen display contains static information. As is normally the case on web pages, you have to refresh the screen contents yourself.

On the other hand, any print-outs will always show the current information for the IM 154-8 CPU. It is therefore possible for the information on a print-out to be more current than the display on your screen.

Filter settings have no effect on the print-out, which always contains the entire content of the message buffer.

See also

Language settings (Page 51)

3.3.1 Language settings

Introduction

The web server provide information in the following languages:

- German (Germany)
- English (United States)
- French (France)
- Italian (Italy)
- Spanish (traditional sorting)

What you need to display texts in different languages

You must make two language settings in *STEP 7* so that the web server displays the various languages correctly.

- Set the language for display devices in SIMATIC Manager
- Set the language for the Web in the IM 154-8 CPU Properties dialog

Set the language for display devices in SIMATIC Manager

Select the language for display devices in SIMATIC Manager:
Options > Language for display devices



Figure 3-2 Example for selecting the display device language

Set the language for Web

Select up to two languages for the Web from the languages installed for display devices.

Open the Properties dialog for the IM 154-8 CPU:

- Check the "Activate web server on this module" check box
- Select up to two languages for the Web.

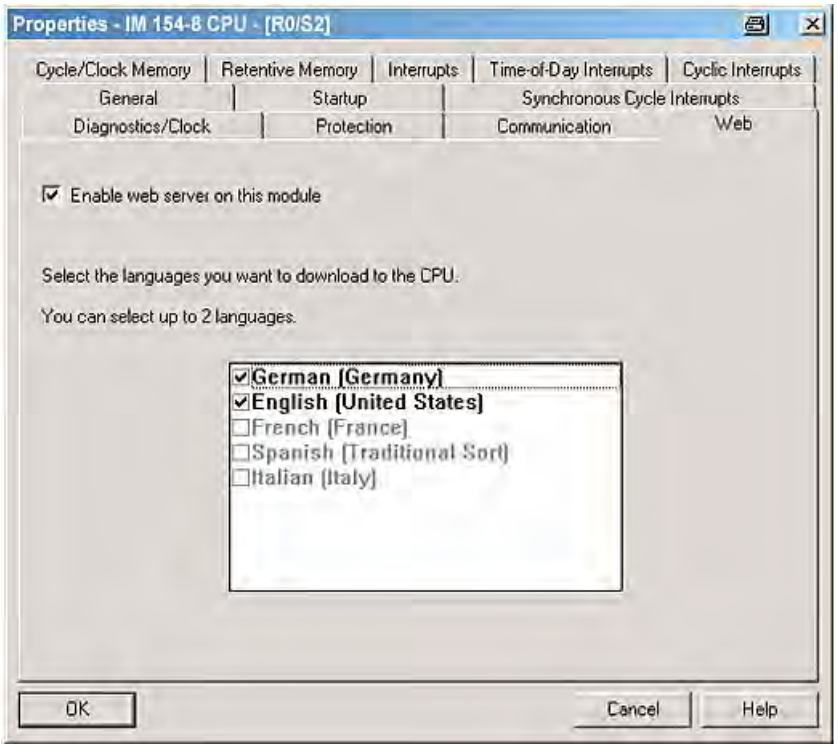


Figure 3-3 Example for selecting the web server

Note

If you activate the web server and do not select a language, messages and diagnostic information will be displayed in hexadecimal code.

3.3.2 Web pages

3.3.2.1 Start page with general CPU information

Establishing a connection to the web server

Connect to the web server by entering the IP address of the configured IM 154-8 CPU on the web browser's address bar (e.g. http: //192.168.1.158). The connection is established and the "Intro" page opens.

Intro

The first page (Intro) called up by the web server is shown below.



Figure 3-4 Intro

Click on the ENTER link to access the web server pages.

Note

Skip website intro

Check the "Skip Intro" check box to skip the intro. You will then access the web server's start page directly in future. You can reverse the "Skip intro" setting by clicking on the "Intro" link on the start page.

Start page

The start page contains information as shown below.

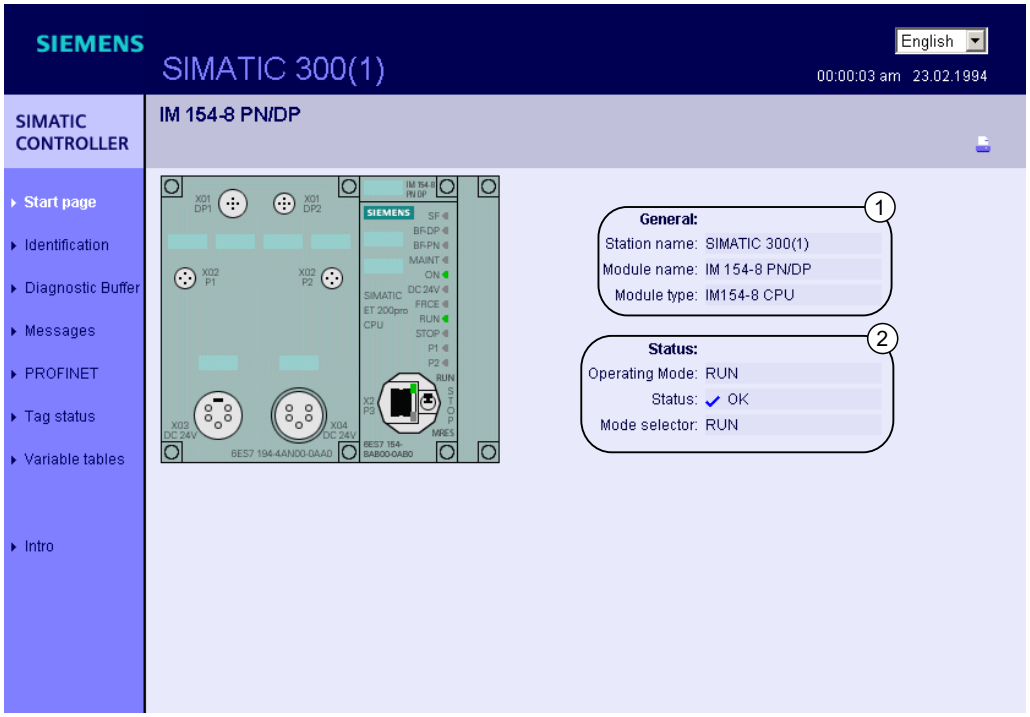


Figure 3-5 General Information

The image of the IM 154-8 CPU with LEDs reflects your current status at the time of checking the data.

① "General"

Information about the IM 154-8 CPUs with whose web servers you are currently connected is combined in this group.

② "Status"

Status information about the IM 154-8 CPU at the time of the query is displayed in the "Status" info box.

3.3.2.2 Identification

Characteristics

The Identification web page contains the characteristic data for the IM 154-8 CPU.



Figure 3-6 Identification

① "Identification"

The "Identification" info box contains the system and location designations and the serial number.

② "Order number"

The "Order number" info box contains order numbers for the hardware and software.

③ "Version"

The hardware, firmware and boot loader versions are displayed in the "Version" info box.

3.3.2.3 Diagnostic buffer

Diagnostic buffer

The browser displays the content of the diagnostic buffer on the Diagnostic Buffer web page.

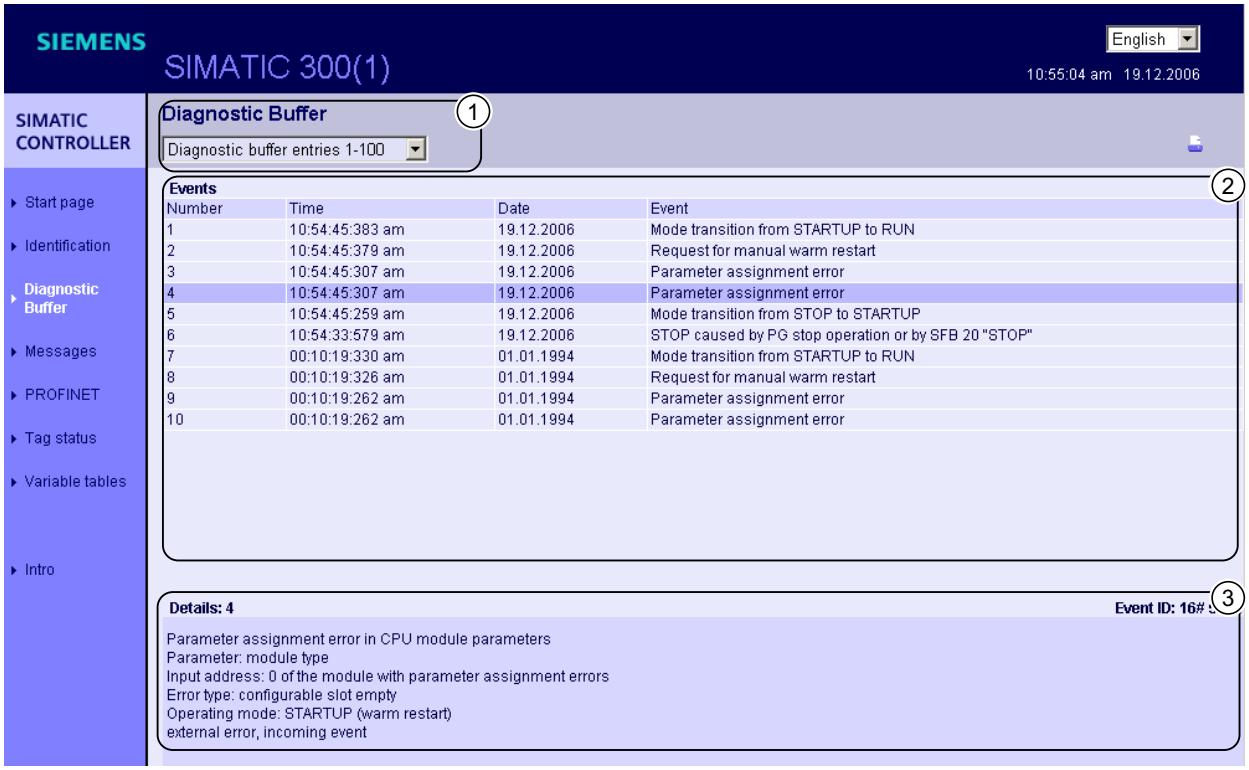


Figure 3-7 Diagnostic buffer

Requirement

You must have activated the web server, made the language setting and compiled and loaded the project in *STEP 7*.

① "Diagnostic buffer entries 1-100"

The diagnostic buffer may contain up to 500 messages. Select an interval for the buffer entries from the list box. Each interval contains 100 entries.

Note that, for performance reasons, it is always the last 10 buffer entries that are displayed in RUN mode.

② "Events"

The "Events" info box contains the diagnostic events with the date and time.

③ "Details"

This box contains detailed information about the selected event.

Select the event from the ② "Events" info box.

Configuration

Configuration involves the following steps:

1. Select the "Object Properties" dialog box from the context menu of the relevant IM 154-8 CPU.
2. Select the "Web" tab and check the "Activate web server on this module" check box.
3. Select up to two languages to be used to display plaintext messages.
4. Save and compile the project and download it to the IM 154-8 CPU.

Point to note when changing between languages

You can change the language, e.g. from German to English, in the top right-hand corner. If you select a language that you have not configured, then the information will appear as hexadecimal code, rather than in plaintext.

3.3.2.4 Messages

Messages

The browser displays the content of the message buffer on the Messages web page. You cannot acknowledge the messages via the web server.

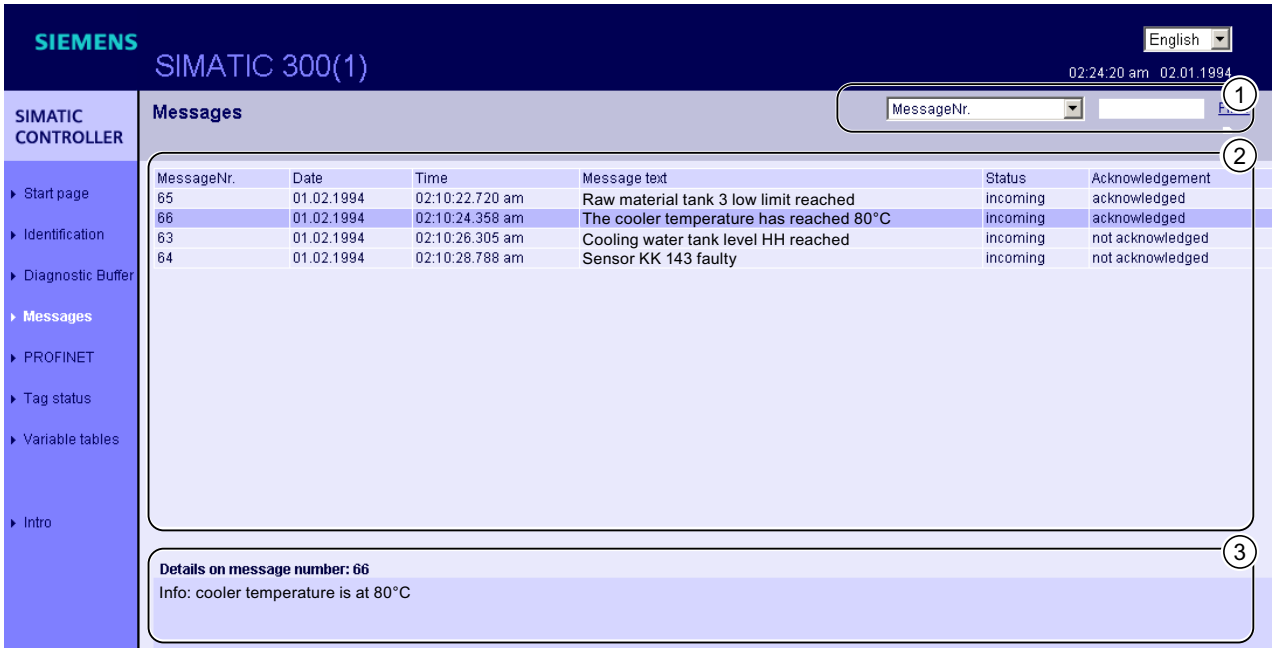


Figure 3-8 Messages

Requirement

The message texts must have been configured in the correct languages. You will find information about configuring messages texts in *STEP 7* and on the Internet at: http://support.automation.siemens.com/WW/view/en/23872245

① "Filter"

Allows you to access certain specific information on this page.

The list box ① allows you to display only entries for the selected parameter. Enter the value of the selected parameter in the input box and click on "Filter".

If you wish to display all messages with the status "arrived", for example, then:

1. Select the "Status" parameter from the list box.
2. Enter "arrived" in the input box.
3. Click on "Filter".

The filter conditions remain active even after a page refresh.

② "Messages"

IM 154-8 CPU messages are displayed in chronological order in the info box ②, together with the **date** and **time**.

The **Message text** parameter relates to the entering of message texts configured for the particular error definitions.

Sort

You also have the option of displaying the individual parameters in ascending or descending order. To do this, click on one of the parameters in the column header:

- Message number
- Date
- Time-of-day
- Message text
- State
- Acknowledgement

If you click "Date", the messages will be displayed in chronological order.

Incoming and outgoing events are output in the **Status** parameter.

③ "Details for message number"

This info box is used to display detailed information about a message. Select the message for which you are interested in the details from the info box ②.

Point to note when changing between languages

You can change the language, e.g. from German to English, in the top right-hand corner. If you select a language that you have not configured or for which no message text was configured, then the information will appear as hexadecimal code, rather than in plaintext.

3.3.2.5 PROFINET

PROFINET

On this web page, tab ① "Parameters" contains information about the integrated PROFINET interface of the IM 154-8 CPU.

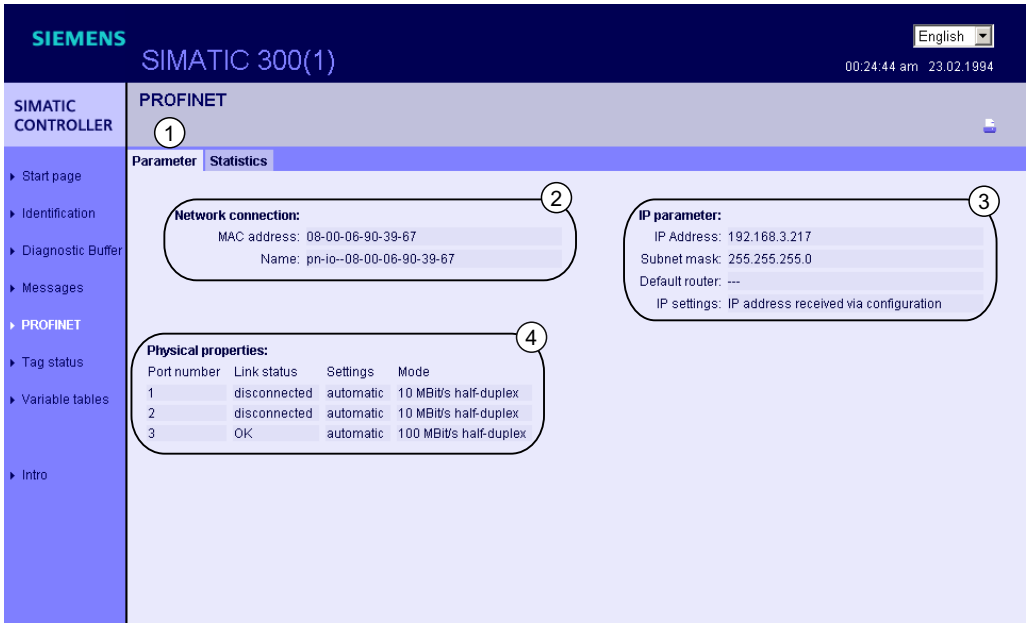


Figure 3-9 Parameters of the integrated PROFINET Interface

② "Network connection"

Here you will find information that will help you to identify the integrated PROFINET interface of the IM 154-8 CPU.

③ "IP parameters"

Information about the configured IP address and number of the subnet containing the IM 154-8 CPU.

④ "Physical properties"

The following information is available in the "Physical properties" info box:

- Port number
- Link status
- Settings
- Mode

Note

Update data

The data that you see in the HTML browser is not automatically updated. You can display the current data by regularly refreshing the display in the HTML browser (Update button).

The "Statistics" tab ① contains information about the quality of the data transmission.

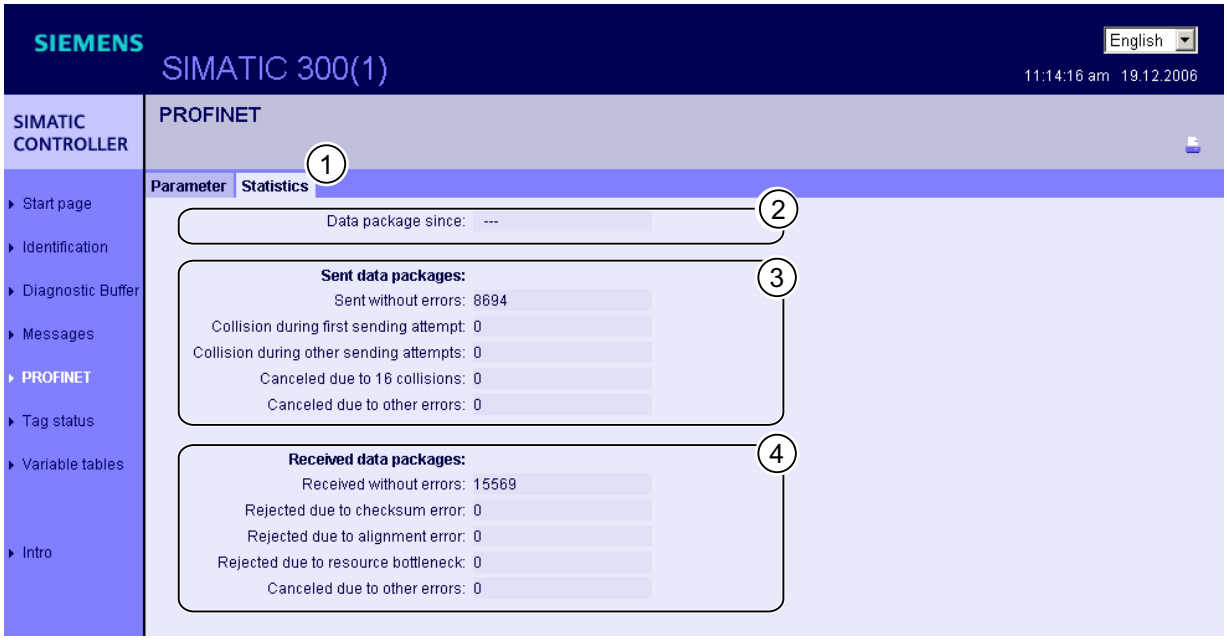


Figure 3-10 Key data transmission figures

② "Data packets since"

This shows the time at which the first data packet was sent or received.

③ "Sent data packets"

The quality of the data transmission on the transmission line can be determined from the key figures in this info box.

④ "Received data packets"

The quality of the data transmission on the reception line can be determined from the key figures in this info box.

3.3.2.6 Variable status

Variable status

The variable status is displayed by the browser via the web page of the same name. You can monitor the status of of up to 50 variables.

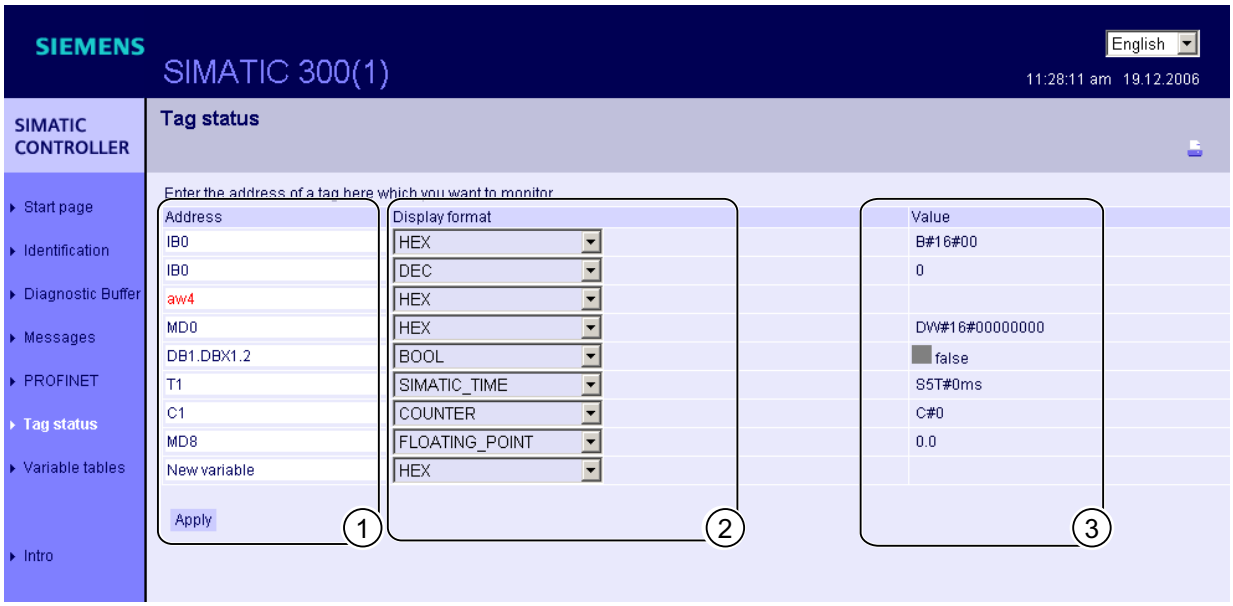


Figure 3-11 Variable status

① "Address"

In the "Address" text box, enter the address of the operand whose behavior you wish to monitor. If you enter an invalid address, it is displayed in red.

② "Display format"

Select the required display format for the variable from this drop-down list box. If the variable cannot be displayed in the required display format, it will be displayed in hexadecimal code.

③ "Value"

This displays the value of the operand in the selected format.

Point to note when changing between languages

You can change the language, e.g. from German to English, in the top right-hand corner. Please note that the mnemonic for German differs from that for the other languages. This means that the operand that you entered may have the wrong syntax when you change between languages. For example: ABxy rather than QBxy. Incorrect syntax is displayed in red in the browser.

3.3.2.7 Variable tables

Variable tables

The browser displays the content of the variable tables on the web page of the same name. You can monitor up to 200 variables with each variable table.

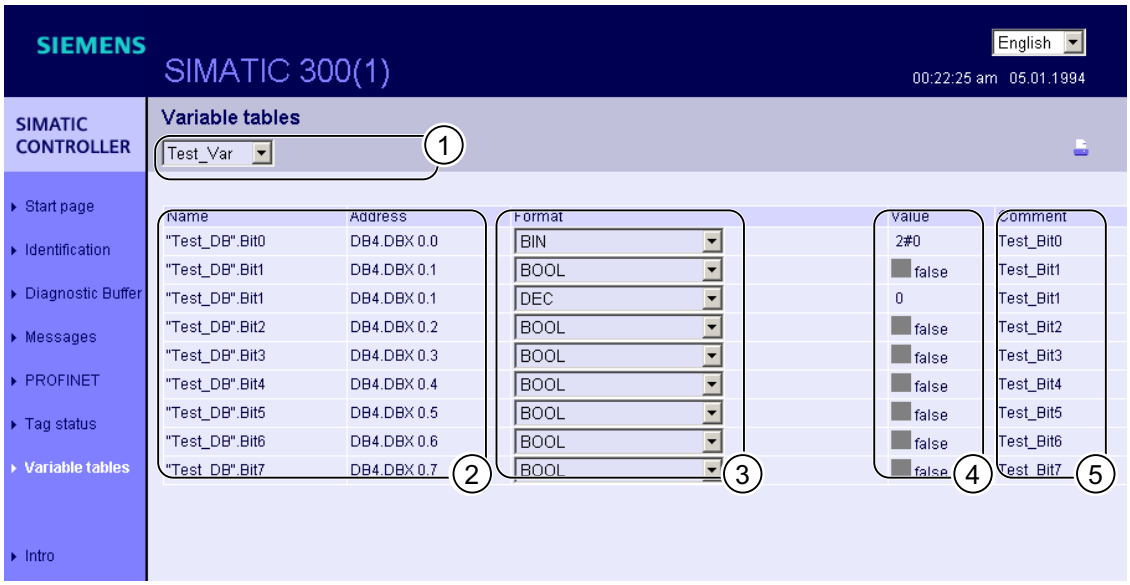


Figure 3-12 Variable tables

① Selection

Select one of the configured variable tables from the drop-down box.

② "Name" and "Address"

This info box displays the name of an operand and its address.

③ "Format"

Select the display format for the operand from this drop-down list box. The drop-down list box contains all the permitted display formats.

④ "Value"

This column shows the values in the display format.

⑤ "Comment"

The comment that you enter is displayed to make it easy to recognize the importance of an operand.

Configuring variable tables for web servers

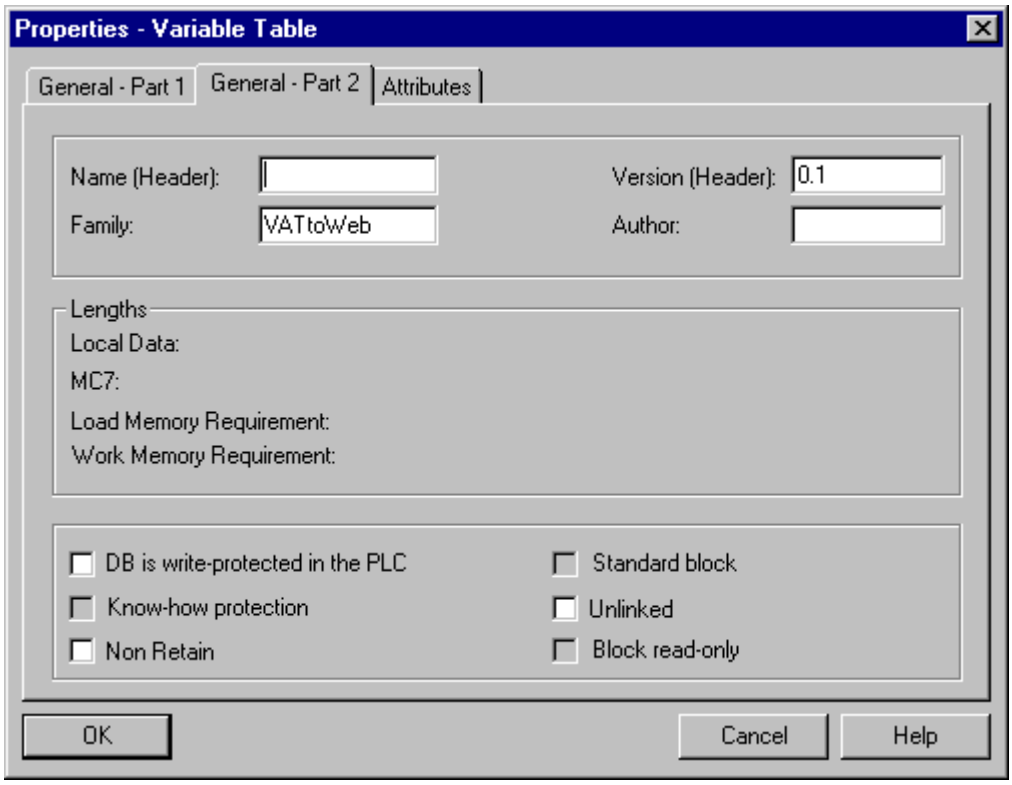
The web server allows you to monitor up to 50 variable tables with up to 200 variables. The available memory of the IM 154-8 CPU is used by both messages and variables, so it is possible that the number of variable tables that can actually be used may be smaller. Example: The available memory is sufficient for around 400 messages and 50 variable tables with 100 variables (with symbol names, but without symbol comments).

If the permitted memory is exceeded by configured messages and variables, the variable tables displayed in the web browser will be incomplete. In this case, you will have to replace the memory needed by your messages and symbol comments. If at all possible, you should only use one language for the display.

You should also configure your variable tables with as few variables as possible since these variable tables are more likely to be displayed in full by the web server and will also be updated faster than tables with lots of variables.

Creating a variable table for web servers

1. Create a variable table with *STEP 7*.
2. Open the Properties dialog for the variable table and enter "VATtoWEB" in the "Family" box.



3. Save and compile the project and download it to the IM 154-8 CPU.

3.4 S7 connections

3.4.1 S7 connection as communication path

An S7 connection is established when S7 modules communicate with one another. This S7 connection is the communication path.

Note

No S7 connections are required for global data communication or communication via PROFIBUS DP, PROFINET CBA, PROFINET IO, web server, TCP/IP, ISO on TCP, UDP and SNMP

Every communication link requires S7 connection resources on the IM 154-8 CPU for the entire duration of this connection.

Thus, every IM 154-8 CPU provides a specific number of S7 connection resources. These are used by various communication services (Programming device/OP communication, S7 communication or S7 basic communication).

Connection points

An S7 connection between modules with communication capability is established between connection points. The S7 connection always has two connection points: The active and passive connection points:

- The active connection point is assigned to the module that establishes the S7 connection.
- The passive connection point is assigned to the module that accepts the S7 connection.

Any module that is capable of communication can thus act as an S7 connection point. At the connection point, the established communication link always uses one S7 connection of the module concerned.

Transition point

If you use the routing functionality, the S7 connection between two modules capable of communication is established across a number of subnets. These subnets are interconnected via a network transition. The module that implements this network transition is known as a router. The router is thus the point through which an S7 connection passes.

Any IM 154-8 CPU can be the router for an S7 connection. You can establish a certain maximum number of routing connections. This does not limit the data volume of the S7 connections.

See also

Connection resources for routing (Page 69)

3.4.2 Assignment of S7 connections

There are several ways to allocate S7 connections on a communication-capable module:

- Reservation during configuration
- Assigning connections in the program
- Allocating connections during commissioning, testing and diagnostics routines
- Allocating connection resources to HMI services

Reservation during configuration

One connection resource each is automatically reserved on the IM 154-8 CPU for Programming device and OP communication. Whenever you need more connection resources (for example, when connecting several OPs), configure this increase in the IM 154-8 CPU properties dialog box in *STEP 7*.

Connections must also be configured (using *NetPro*) for the use of S7 communication. For this purpose, connection resources have to be available, which are not allocated to programming device/OP or other connections. The required S7 connections are then permanently allocated for S7 communication when the configuration is uploaded to the IM 154-8 CPU.

Assigning connections in the program

In S7 basic communication, and in open Industrial Ethernet communication with TCP/IP, the user program establishes the connection. The IM 154-8 CPU operating system initiates the connection. S7 basic communication uses the corresponding S7 connections. The open IE communication does not use any S7 connections. The maximum number of eight connections also applies to this type of communication.

Using connections for commissioning, testing and diagnostics

An active online function on the engineering station (programming device /PC with *STEP 7*) assigns S7 connections for programming device communication:

- An S7 connection resource for programming device communication which was reserved in your IM 154-8 CPU hardware configuration is assigned to the engineering station, that is, it only needs to be allocated.
- If all reserved S7 connection resources for programming device communication are allocated, the operating system automatically assigns a free S7 connection resource which has not yet been reserved. If no more connection resources are available, the engineering station cannot communicate online with the IM 154-8 CPU.

Allocating connection resources to HMI services

An online function on the HMI station (OP/TP/... with *WinCC*) is used for assigning S7 connection resources for the OP communication:

- An S7 connection resource for OP communication which was reserved in your IM 154-8 CPU hardware configuration is assigned to the HMI station, i.e. it only needs to be allocated.
- If all reserved S7 connection resources for OP communication are allocated, the operating system automatically assigns a free S7 connection resource which has not yet been reserved. If no more connection resources are available, the HMI station cannot communicate online with the IM 154-8 CPU.

Chronological order in which S7 connection resources are assigned

When you program your project in *STEP 7*, the system generates parameter assignment blocks which are read by the modules in the startup phase. This allows the module's operating system to reserve or assign the relevant S7 connection resources. This means, for example, that OPs cannot access an S7 connection resource that has been reserved for programming device communication. If the IM 154-8 CPU has S7 connection resources that have not been reserved, these can be used freely. These S7 connection resources are allocated in the order they are requested.

Example

If there is only one free S7 connection left on the IM 154-8 CPU, you can still connect a programming device to the bus. The programming device can then communicate with the IM 154-8 CPU. The S7 connection is only used, however, when the programming device is communicating with the IM 154-8 CPU. If you connect an OP to the bus while the programming device is not communicating, the OP can establish a connection to the IM 154-8 CPU. Since an OP maintains its communication link at all times, in contrast to the programming device, you cannot subsequently establish another connection via the programming device.

See also

Open communication via Industrial Ethernet (Page 44)

3.4.3 Distribution and availability of S7 connection resources

Distribution of connection resources

Table 3-8 Distribution of connections

Communication service	Distribution
Programming device communication OP communication S7 basic communication	In order to avoid allocation of connection resources being dependent only on the chronological sequence in which various communication services are requested, connection resources can be reserved for these services. For PG and OP communication, at least one connection resource is reserved by default. The following table and the technical specifications for the IM 154-8 CPU contain the configurable S7 connections and the default setting. You "redistribute“ the connection resources by setting the relevant IM 154-8 CPU parameters in *STEP 7*.
S7 communication	Available connection resources that are not specially reserved for a service (Programming device / OP communication , S7 basic communication) are used for this.
Routing PG functions	The IM 154-8 CPU provides a number of connection resources for routing. These connections are available in addition to the connection resources. The subsection below shows the number of connection resources.
Global data communication	This communication service requires no S7 connection resources.
PROFIBUS DP	This communication service requires no S7 connection resources.
PROFINET CBA	This communication service requires no S7 connection resources.
PROFINET IO	This communication service requires no S7 connection resources.
Web Server	This communication service requires no S7 connection resources.
Open communication by means of TCP/IP	This communication service requires no S7 connection resources.
Open communication by means of ISO on TCP	Independently of the S7 connections, a total of 8 own resources are available for connections or local access points (UDP) for TCP/IP, ISO on TCP, UDP.
Open communication by means of UDP	
SNMP	This communication service requires no S7 connection resources.

Availability of connection resources

Table 3-9 Availability of connection resources

CPU	Total number connection resources	Reserved for			Free S7 connections
		Programming device communication	OP communication	S7 basic communication	
IM 154-8 CPU	16	1 to 15 default 1	1 to 15 default 1	0 to 14 default 0	Displays all non-reserved S7 connections as free connections.

Note

If you are using the IM 154-8 CPU, you can configure up to 14 connection resources for S7 communication in *NetPro*. These connections are then reserved.

3.4.4 Connection resources for routing

Number of connection resources for routing

The IM 154-8 CPU provides a different number of connection resources for the routing function:

Table 3-10 Number of connection resources for routing

CPU	Number of connections for routing
IM 154-8 CPU	Interface X01 DP1 / DP2 configured as: • MPI: Max. 10 • DP master: Max. 24 • DP slave (active): Max. 14 Interface X02 P1 / P2 / P3 configured as: • PROFINET: Max. 24

Example for the IM 154-8 CPU

The IM 154-8 CPU provides 16 connection resources:

- Reserve two connection resources for programming device communication.
- Reserve three connection resources for OP communication.
- Reserve one connection resource for S7 basic communication.
- In *NetPro* you configure 6 S7 connection resources for S7 communication via the integrated PROFINET interface.

This leaves 4 S7 connections available for any communication services, e.g. S7 communication, OP communication, etc.

However, no more than 14 connection resources for S7 communication at the integrated PN interface can be configured in *NetPro*.

There are also 24 routing connections available for the IM 154-8 CPU that do not affect the S7 connection resources mentioned above.

You should take the interface-specific maximum numbers into account, however (see table above).

3.5 DPV1

New automation and process engineering tasks require the range of functions performed by the existing DP protocol to be extended. In addition to cyclical communication functions, acyclical access to non-S7 field devices is another important requirement of our customers, and was implemented in the EN 50170 standard. In the past, acyclic access was only possible with S7 slaves. The standard concerning distributed I/Os (EN 50170) has been further developed. All the changes concerning new DPV1 functions are included in IEC 61158/ EN 50170, volume 2, PROFIBUS.

Definition DPV1

The term DPV1 is defined as a functional extension of the acyclic services (to include new interrupts, for example) provided by the DP protocol.

Availability

As the DP master, the IM 154-8 CPU has this extended DPV1 functionality.

Note

If you want to use the IM 154-8 CPU as an intelligent slave, remember that it does not have DPV1 functionality.

Requirement for using the DPV1 functionality with DP slaves

For DPV1 slaves from other vendors, you will need a GSD file conforming to EN 50170, revision 3 or later.

Extended functions of DPV1

- Use of any DPV1 slaves from external vendors (in addition to the existing DPV0 and S7 slaves, of course).
- Selective handling of DPV1-specific interrupt events by new interrupt blocks.
- Reading/writing SFBs that conform to standards to the data record (although this can only be used for centralized I/O modules).
- User-friendly SFB for reading diagnostics.

Interrupt blocks with DPV1 functionality

Table 3-11 Interrupt blocks with DPV1 functionality

OB	Functionality
OB 40	Process interrupt
OB 55	Status interrupt
OB 56	Update interrupt
OB 57	Vendor-specific interrupt
OB 82	Diagnostic interrupt

Note

You can now also use organization blocks OB40 and OB82 for DPV1 interrupts.

System blocks with DPV1 functionality

Table 3-12 System function blocks with DPV1 functionality

SFB	Functionality
SFB 52	Read data record from DP slave / IO device or centralized I/O module
SFB 53	Write data record to DP slave / IO device or centralized I/O module
SFB 54	Read additional alarm information from a DP slave / IO device or a centralized I/O module in the relevant OB
SFB 75	Set any interrupts for intelligent slaves

Note

You can also use SFB 52 to SFB 54 for centralized I/O modules. SFBs 52 to 54 can also be used for PROFINET IO.

If the 8 DO DC 24V/0.5A, 8 DI DC 24V, 16 DO DC 24V CPV10 and 16 DO DC 24V CPV14 modules are used centrally on an IM 154-8 CPU, then SFB 53 cannot be used to write data records to these modules.

Reference

For additional information on the above blocks can be found in the *System and Standard Functions for S7-300/400* reference manual, or in the *STEP 7 Online Help*.

See also

PROFIBUS DP (Page 25)

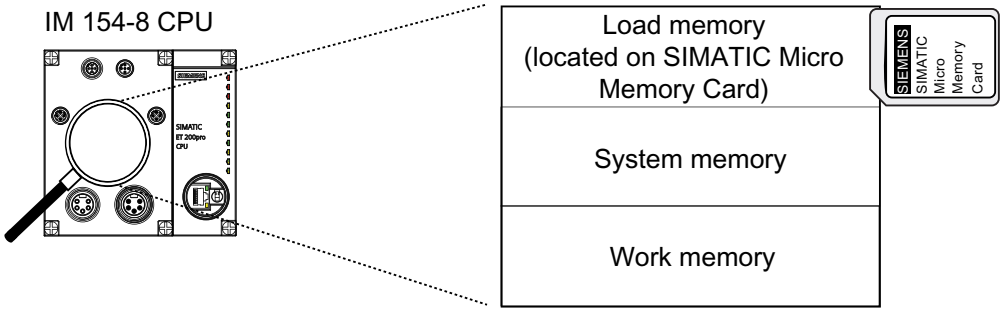
Memory concept

4

4.1 Memory areas and retentive address areas

4.1.1 Memory areas of the IM 154-8 CPU

The three memory areas of your IM 154-8 CPU:



Load memory

The load memory is located on the SIMATIC Micro Memory Card. The size of the load memory corresponds exactly to the size of the SIMATIC Micro Memory Card. It is used to store code blocks, data blocks and system data (configuration, connections, module parameters, etc.). Blocks that are identified as non runtime-related are stored exclusively in load memory. You can also store all the configuration data for your project on the SIMATIC Micro Memory Card.

Note

User programs can only be downloaded and thus the IM 154-8 CPU can only be used if the SIMATIC Micro Memory Card is inserted in the interface module.

System memory

The system memory is integrated in the IM 154-8 CPU and cannot be expanded.

It contains

- The address areas for address area memory bits, timers and counters
- The process image of the I/Os
- Local data

Work memory

The RAM is integrated in the IM 154-8 CPU and cannot be expanded. It is used to run the code and process user program data. Programs only run in work memory and system memory.

4.1.2 Retentivity of load memory, system memory and RAM

Your IM 154-8 CPU is equipped with a maintenance-free retentive memory, i.e. its operation does not require a back-up battery. Data is kept in retentive memory across POWER OFF and restart (warm start).

Retentive data in load memory

Your program in load memory is always retentive: It is stored on the SIMATIC Micro Memory Card, where it is protected against power failure or CPU memory restart

Retentive data in system memory

In your configuration (IM 154-8 CPU Properties, Retentivity tab), specify which parts of the bit memory, timers and counters should be kept retentive and which should be reinitialized to "0" on restart (warm restart).

The diagnostic buffer, MPI address (and transmission rate) and operating hour counter data are generally written to the retentive memory area on the IM 154-8 CPU. Retentivity of the MPI address and baud rate ensures that your IM 154-8 CPU can continue to communicate, even after a power failure, memory reset or loss of communication parameters (e.g. due to removal of the SIMATIC micro memory card or deletion of communication parameters).

Retentive data in RAM

Therefore, the contents of retentive DBs are always retentive at restart and POWER ON/OFF. Retentive data blocks can be uploaded to the work memory in accordance with the maximum limit allowed by the work memory.

The IM 154-8 CPU also does not support retentive DBs. Non-retentive DBs are initialized from the load memory with their initial values whenever a restart is performed or when the power is switched off and then on again. Non-retentive data blocks and code blocks can be loaded in accordance with the maximum work memory limit.

128 KB of RAM can be used for retentive data blocks in the IM 154-8 CPU.

See also

Properties of the SIMATIC Micro Memory Card (Page 80)

4.1.3 Retentivity of memory objects

Retentive behavior of the memory objects

The table below shows the retentive behavior of memory objects during specific operating state transitions.

Table 4-1 Retentive behavior of the memory objects

Memory object	Operating state transition		
	POWER OFF / POWER ON	STOP → RUN	Memory reset
User program / data (load memory)	X	X	X
• Retentivity of the DBs for the IM 154-8 CPU	This can be set in the DB Properties in *STEP 7* V5.4 + SP 1 + HSP or later.		–
Bit memory, timers and counters configured as retentive data	X	X	–
Diagnostics buffers, operating hour counters	X[1]	X	X
MPI address, transmission rate (or DP address and transmission rate of the MPI / DP interface of the IM 154-8 CPU, if it is set up as a DP node).	X	X	X
X = retentive; – = not retentive [1] Only the last 100 entries in the diagnostic buffer are retained in the event of a POWER OFF / POWER ON.			

Retentivity of a DBs in the IM 154-8 CPU

For the IM 154-8 CPU, you can specify in *STEP 7* or via SFC 82 "CREA_DBL" (parameter ATTRIB -> NON_RETAIN bit), whether, in response to a POWER ON / OFF or RUN-STOP, a DB

- Keeps the actual values (retentive DB), or
- Accepts the initial values from load memory (non-retentive DB)

Table 4-2 Retentivity of the DBs in the IM 154-8 CPU

After a POWER OFF / ON or restart of the IM 154-8 CPU, the DB should	
Receive the initial values (non-retentive DB)	**Retain the last actual values (retentive DB)**
Reason: After a POWER OFF / ON and restart (STOP-RUN) of the IM 154-8 CPU, the actual values of the DB are non-retentive. The DB receives the start values from load memory.	Reason: After a POWER OFF / ON and restart (STOP-RUN) of the IM 154-8 CPU, the actual values of the DB are retained.
Requirement in *STEP 7*: • The "Non-retain" check box must be activated in the block properties of the DB, or • A non-retentive DB was generated with SFC 82 "CREA_DBL" and the corresponding block attribute (ATTRIB -> NON_RETAIN bit.)	Requirement in *STEP 7*: • The "Non-retain" check box must be deactivated in the block properties of the DB, or • A retentive DB was generated with SFC 82.

4.1.4 Address areas of system memory

The system memory of the IM 154-8 CPU is broken down into address areas (refer to the table below). In a corresponding operation of your user program, you address data directly in the relevant address area.

Address areas of system memory

Table 4-3 Address areas of system memory

Address areas	Description
Process image of inputs	At every start of an OB 1 cycle, the IM 154-8 CPU reads inputs the input modules and saves the values to the process input image.
Process image of outputs	During its cycle, the program calculates the values for the outputs and writes these to the process image of outputs. At the end of the OB 1 cycle, the IM 154-8 CPU writes the calculated output values to the output modules.
Bit memory	This area provides memory for saving the intermediate results of a program calculation.
Timers	Timers are available in this area.
Counters	Counters are available in this area.
Local data	Temporary data in a code block (OB, FB, FC) is saved to this memory area while the block is being edited.
Data blocks	See *Recipes and measurement value logs*

Reference

The address areas of your IM 154-8 CPU are listed in the *S7-300 instruction list*.

I/O process image

When the user program addresses the input (I) and output (Q) address areas, it does not query the signal states of digital electronic modules. Instead, it accesses a memory area in the IM 154-8 CPU system memory. This particular memory area is the process image.

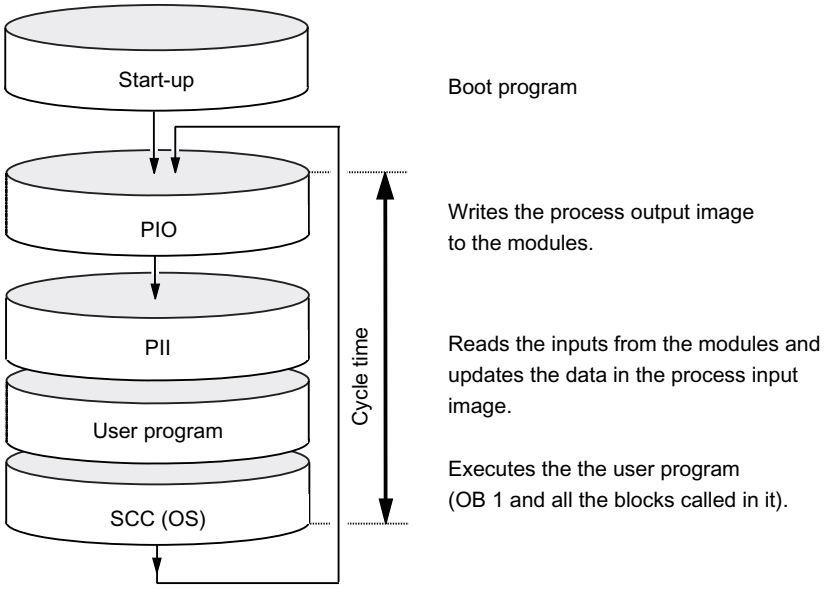
The process image is organized in two sections: The process image of inputs, and the process image of outputs.

Advantages of the process image

In contrast to direct access of the input / output modules, accessing the process image has the advantage that a consistent image of the process signals is made available to the IM 154-8 CPU during cyclic program execution. When the signal status at an input module changes during program execution, the signal status in the process image is maintained until the image is updated in the next cycle. Moreover, since the process image is stored in the IM 154-8 CPU system memory, access is significantly faster than direct access to the electronic modules.

Process image update

The operating system updates the process image periodically. The figure below shows the sequence of this operation within a cycle.



Variable process image

In *STEP 7*, you can set the size of the I/O process image to any value from 0 to 2048 bytes for the IM 154-8 CPU.

Note the information below:

Note

Currently, the dynamic setting of the process image only affects its update at the scan cycle control point. That is, the process input image is only updated up to the set PII size with the corresponding values of the peripheral input modules existing within this address area, or the values of the process output image up to the set POI size are written to the peripheral output modules existing within this address area.

This set size of the process image is ignored with respect to the *STEP 7* commands used to access the process image (for example U I100.0, L IW200, = Q20.0, T AD150, or the corresponding indirect addressing commands). However, up to the maximum size of the process image (that is, up to I/O byte 2047), these commands do not return any synchronous access errors, but rather access the permanently available internal memory area of the process image.
The same applies to the use of actual parameters of block calls from the I/O area (area of the process image).

Particularly if these process image limits were changed, you should check to which extent your user program accesses the process image in the area between the set and the maximum process image size. If such access is to continue to take place, this means that inputs on the I/O module that change may not be detected or that outputs may not really be written to the output module without an error message being generated.

Local data

Local data store:

- The temporary variables of code blocks
- The start information of the OBs
- Transfer parameters
- Intermediate results

Temporary Variables

When you create blocks, you can declare temporary variables (TEMP) which are only available during block execution and then overwritten again. These local data have fixed length in each OB. Local data must be initialized prior to the first read access. Each OB also requires 20 bytes of local data for its start information. Local data access is faster compared to access to data in DBs.

The IM 154-8 CPU has memory for storing temporary variables (local data) of recently executed blocks. This memory is divided among the priority classes into partitions of equal size. Each priority class has its own local data area.



Caution

All temporary variables (TEMP) of an OB and its nested blocks are stored in local data. When using complex nesting levels for block processing, you may cause an overflow in the local data area.
The IM 154-8 CPU will change to STOP mode if the permissible length of the local data for a priority class is exceeded.
Make allowances for local data space required for synchronous error OBs. This is assigned to the respective triggering priority class.

See also

Retentivity of load memory, system memory and RAM (Page 74)

4.1.5 Properties of the SIMATIC Micro Memory Card

The SIMATIC Micro Memory Card as a memory module for the IM 154-8 CPU

The memory module used in your IM 154-8 CPU is a SIMATIC Micro Memory Card. It can be used as load memory or as a portable storage medium.

Note

The IM 154-8 CPU requires the SIMATIC Micro Memory Card for operation.

The following data are stored on the SIMATIC Micro Memory Card.

- User programs (all blocks)
- Archives and recipes
- Configuration data (*STEP 7* projects)
- Data for operating system update and backup

Note

You can either store user and configuration data or the operating system on the SIMATIC Micro Memory Card.

Properties of a SIMATIC Micro Memory Card

The SIMATIC Micro Memory Card ensures maintenance-free and retentive operation of the IM 154-8 CPU.

SIMATIC Micro Memory Card copy protection

Your SIMATIC Micro Memory Card has an internal serial number that implements an MMC copy protection. You can read this serial number from the SSL partial list $011C_H$ index 8 using SFC 51 "RDSYSST." If the reference and actual serial number of your SIMATIC Micro Memory Card are not the same, program a STOP command in a know-how-protected module, for example.

Reference

Additional information

- On the *SSL partial list* refer to the *Instruction list* or the *System and standard functions for S7-300/400* reference manual.
- On resetting the IM 154-8 CPU memory can be found in the section entitled *Resetting the IM 154-8 CPU using the mode selector*.

Useful life of a SIMATIC Micro Memory Card

The life of an SIMATIC Micro Memory Card depends mainly on the following factors:

1. The number of delete or programming cycles
2. External influences such as ambient temperature

At ambient temperatures up to 60 °C, up to 100,000 delete/write operations can be performed on a SIMATIC Micro Memory Card.



Caution

To prevent data losses, do not exceed this maximum of delete/write operations.

See also

Retentivity of load memory, system memory and RAM (Page 74)

Operating and display elements on the IM 154-8 CPU (Page 19)

4.2 Memory functions

4.2.1 General: Memory functions

Memory functions

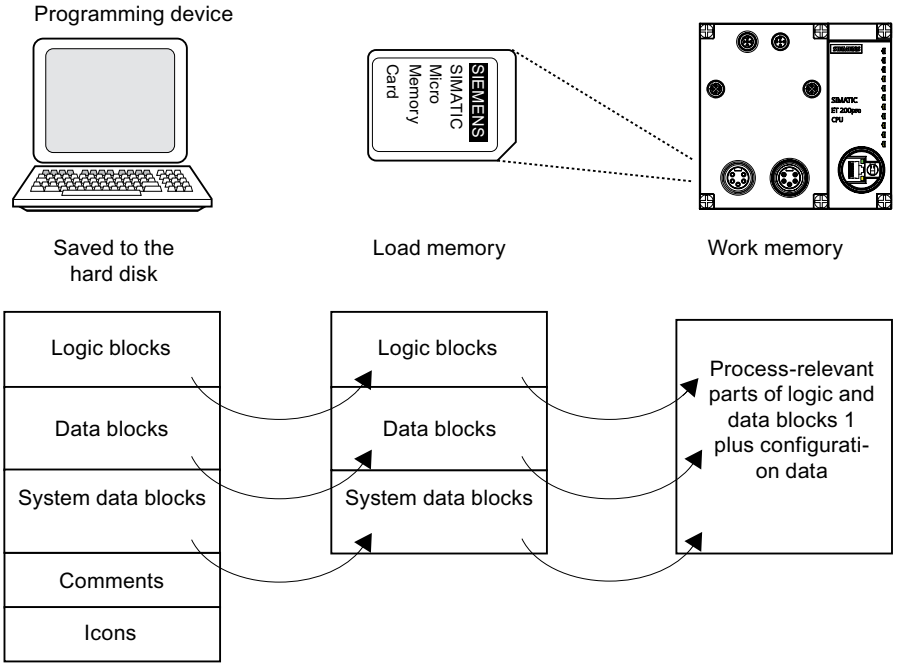
Memory functions are used to generate, modify or delete entire user programs or specific blocks. You can also ensure that your project data are retained by archiving these. If you created a new user program, use a programming device/PC to download the complete program to the SIMATIC Micro Memory Card.

4.2.2 Loading the user program to the IM 154-8 CPU via the SIMATIC Micro Memory Card

User program download

The entire user program is downloaded from your Programming device / PC to the IM 154-8 CPU via the SIMATIC Micro Memory Card. The previous content of the SIMATIC Micro Memory Card is deleted in the process. Blocks use the load memory area as specified under "Load memory requirements" in "General block properties".

The figure shows the load and work memory of the IM 154-8 CPU.



[1]: If not all of the work memory area is retentive, the retentive part is indicated in the *STEP 7* module status as retentive memory. You cannot run the program until all the blocks are downloaded.

Note

This function is only permitted when the IM 154-8 CPU is in STOP mode. Load memory is cleared if the load operation could not be completed due to power loss or illegal block data.

4.2.3 Handling blocks

4.2.3.1 Download of new blocks or delta downloads

There are two ways to download additional user blocks or download deltas:

- Download of blocks: You have already created a user program and downloaded it to the IM 154-8 CPU via the SIMATIC Micro Memory Card. You then want to add new blocks to the user program. In this case you do not need to reload the entire user program to the MCC. Instead you only need to download the new blocks to the SIMATIC Micro Memory Card (this reduces the download times for highly complex programs.)
- Delta download: In this case, you only download the deltas in the blocks of your user program. In the next step, perform a delta download of the user program, or only of the changed blocks to the SIMATIC Micro Memory Card, using the programming device/PC.



Warning

The delta down of block / user programs overwrites all data stored under the same name on the SIMATIC Micro Memory Card.

The data of dynamic blocks are transferred to RAM and activated after the block is downloaded.

4.2.3.2 Uploading blocks

In contrast to downloading, uploading involves the transfer of individual blocks or a complete user program from the IM 154-8 CPU to the programming device / PC. The block content is identical to the content of the last download to the IM 154-8 CPU. Dynamic DBs form the exception, because their actual values are transferred. Uploading blocks or the user program from the IM 154-8 CPU in *STEP 7* does not affect the memory assignment of the IM 154-8 CPU.

4.2.3.3 Deleting blocks

When you delete a block, it is deleted from load memory. In *STEP 7*, you can also delete blocks with the user program (DBs also with SFC 23 "DEL_DB"). RAM used by this block is released.

4.2.3.4 Compressing blocks

When data are compressed, gaps which have developed between memory objects in load memory/RAM as a result of load/delete operations will be eliminated. This releases free memory in a continuous block. Data compression is possible when the IM 154-8 CPU is in RUN or STOP mode.

4.2.3.5 Promming (RAM to ROM)

When writing the RAM content to ROM, the actual values of the DBs are transferred from RAM to load memory to form the start values for the DBs.

Note

This function is only permitted when the IM 154-8 CPU is in STOP mode. Load memory is cleared if the function could not be completed due to power loss.

4.2.4 CPU memory reset and restart

Memory reset

After inserting or removing a Micro Memory Card, a complete memory reset restores the IM 154-8 CPU to defined conditions in order to make a restart (warm start) possible. This memory reset rebuilds the IM 154-8 CPU's memory management. Blocks in load memory are retained. All dynamic runtime blocks are transferred once again from load memory to RAM, in particular to initialize the data blocks in RAM (restore initial values).

Restart (warm start)

- All retentive DBs retain their current values. Non-retentive DBs are reset to their initial values.
- The values of all retentive M, C, T are retained.
- All non-retentive user data are initialized:
  - M, C, T, I, O with "0"
- All run levels are initialized.
- The process images are deleted.

Reference

The *Resetting the IM 154-8 CPU using the mode selector* section contains more information.

See also

Resetting the IM 154-8 CPU memory using the mode selector (Page 113)

4.2.5 Recipes

Introduction

A recipe represents a collection of user data. You can implement a simple recipe concept using static DBs. In this case, the recipes should have the same structure (length). One DB should exist per recipe.

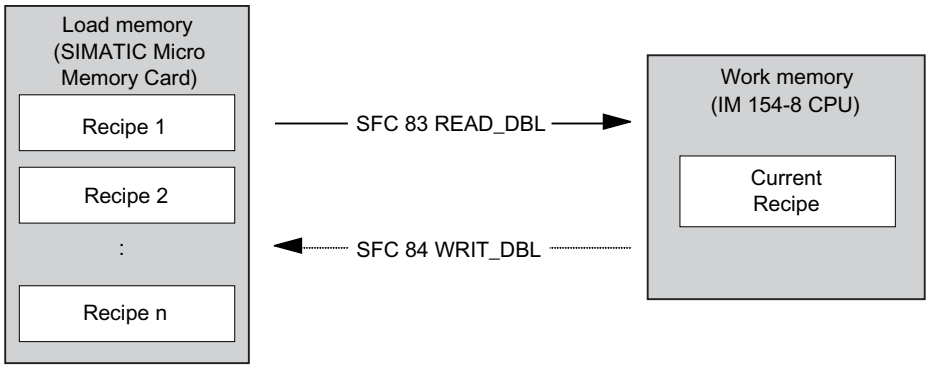
Processing sequence

Recipe is written to load memory:

- The various data records of the recipes are created as static DBs in *STEP 7* and then downloaded to the IM 154-8 CPU. Therefore, recipes only use load memory, rather than RAM.

Working with recipe data:

- SFC83 "READ_DBL" is called in the user program to copy the data record of a current recipe from the DB in load memory to a static DB that is located in work memory. As a result, the RAM only has to accommodate the data of one record. The user program can now access data of the current recipe. The figure below shows how to handle recipe data:



Saving a modified recipe:

- The data of new or modified recipe data records generated during program execution can be written to load memory. To do this, call SFC 84 "WRIT_DBL" in the user program. The data written to load memory are portable and retentive on Memory reset. You can backup modified records (recipes) by uploading and saving these in a single block to the programming device/PC.

Note

Active system functions SFC82 to 84 (active access to the SIMATIC Micro Memory Card) have a distinct influence on programming device functions (for example, block status, variable status, download block, upload, open.) This typically reduces performance (compared to passive system functions) by a factor of 10.

Note

To prevent data losses, do not exceed this maximum of delete/write operations.

4.2.6 Measured value log files

Introduction

Measured values are generated when the IM 154-8 CPU executes the user program. These values are to be logged and analyzed.

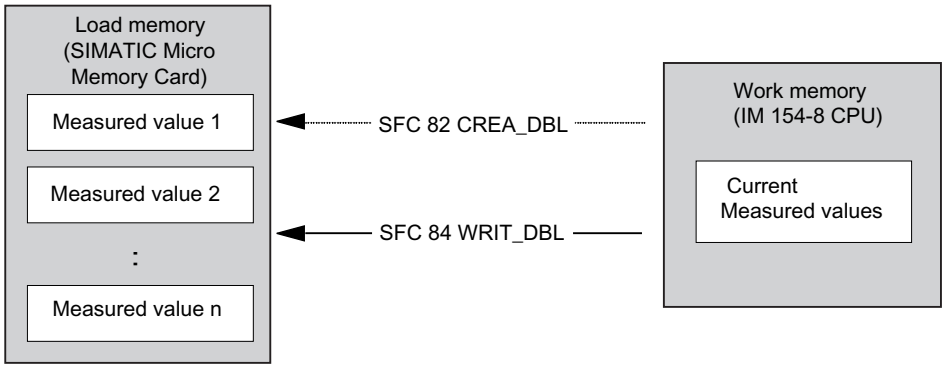
Processing sequence

Acquisition of measured values:

- The IM 154-8 CPU writes all measured values to a DB (for alternating backup mode in several DBs) which is located in the work memory.

Measured value logging:

- Before the data volume can exceed work memory capacity, you should call SFC 84 "WRIT_DBL" in the user program to swap measured values from the DB to load memory. The figure below shows how to handle measured value log files:



- You can call SFC 82 "CREA_DBL" in the user program to generate new (additional) static DBs in load memory which do not require RAM space.

Reference

For additional information on the block SFC 82 can be found in the *System and Standard Functions for S7-300/400* reference manual, or in the *STEP 7 Online Help*.

Note

SFC 82 is terminated and an error message is generated if a DB already exists under the same number in load memory and/or work memory.

The data written to load memory are portable and retentive on Memory reset.

Evaluation of measured values:

- Measured value DBs saved to load memory can be uploaded and evaluated by other communication partners (programming device, PC, for example).

Note

Active system functions SFC82 to 84 (active access to the SIMATIC Micro Memory Card) have a distinct influence on PG functions (for example, block status, variable status, download block, upload, open.) This typically reduces performance (compared to passive system functions) by a factor of 10.

Note

With the IM 154-8 CPU, you can also generate non-retentive DBs using SFC 82 (parameter ATTRIB -> NON_RETAIN bit.)

Note

To prevent data losses, do not exceed this maximum of delete/write operations.

4.2.7 Backup of project data to SIMATIC Micro Memory Card

Function principle

Using the **Save project to Memory Card** and **Fetch project from Memory Card** functions, you can save all project data to a SIMATIC Micro Memory Card, and retrieve these at a later time. For this operation, the SIMATIC Micro Memory Card can be located in the IM 154-8 CPU or in the programming adapter of a programming device or PC.

Project data is compressed before it is saved to a SIMATIC Micro Memory Card, and uncompressed on retrieval.

Note

In addition to project data, you may also have to store your user data on the MMC. You should therefore first select a SIMATIC Micro Memory Card with sufficient free memory.

A message warns you if the memory capacity on your SIMATIC Micro Memory Card is insufficient

The volume of project data to be saved corresponds with the size of the project's archive file.

Note

For technical reasons, you can only transfer the entire contents (user program and project data) using the **Save project to memory card** action.

Installing and connecting

5

Where can I find what information?

You will find comprehensive information about fitting and connecting an ET 200pro in the relevant sections of the *ET 200pro Distributed I/O Device* operating instructions.

The following sections will show you the differences and special features associated with using an ET 200pro with the IM 154-8 CPU interface module.

5.1 Installing the IM 154-8 CPU interface module and terminal module

Introduction

The IM 154-8 CPU interface module connects the ET 200pro with the PROFIBUS DP / PROFINET and supplies power to the electronic modules.

Requirements

- The terminating module has been removed from the IM 154-8 CPU interface module.
- The rack has been fitted (see the *ET 200pro Distributed I/O Device* operating instructions).

Required tools

Cross-tip screwdriver, size 2

Procedure

1. Snap-fit the IM 154-8 CPU interface module onto the rack, then slide it into the correct position, if necessary.
2. Screw the IM 154-8 CPU interface module onto the rack.

   2 recessed head screws on the front: top and bottom, tightening torque 1.5 N/m
3. Insert a blank SIMATIC Micro Memory Card or one with the correct user program into the slot.

   See the *Inserting / changing the SIMATIC Micro Memory Card* section for additional information.
4. Plug the CM IM PN DP M12, 7/8" terminal module into the IM 154-8 CPU.
5. Screw the terminal module onto the rack.

   4 recessed head screws on the front, 1.5 Nm torque.
6. Install the I/O modules (electronic modules and any power modules and motor starters). See the *ET 200pro Distributed I/O Device* operating instructions and the *ET 200pro Motor Starter* manual for information.
7. Install the terminating module (see the *ET 200pro Distributed I/O Device* operating instructions).

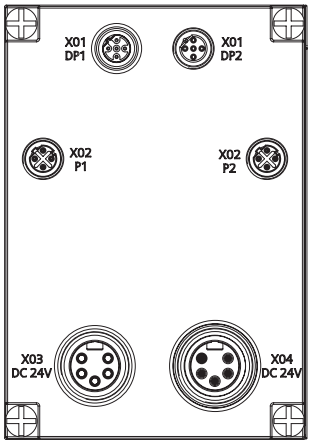
See also

Inserting/Replacing a SIMATIC Micro Memory Card (Page 110)

5.2 Connect the IM 154-8 CPU interface module to the CM IM PN DP M12, 7/8" terminal module

Introduction

Connect the power supplies, PROFIBUS DP and PROFINET to the CM IM DP M12, 7/8" terminal module. The IM 154-8 CPU interface module is equipped with an internal PROFINET Switch. This allows the PROFINET to be looped through directly, or an additional IO device (e.g. ET 200pro with IM 154-4 PN) to be connected directly.



X01 DP1	M12 circular socket (with male contact insert) for connecting PROFIBUS DP
X01 DP2	M12 circular socket (with socket insert) for looping PROFIBUS DP through
X02 P1	M12 circular socket (with socket insert) for connecting PROFINET
X02 P2	M12 circular socket (with socket insert) for connecting PROFINET
X03 DC 24V	7/8" circular socket (with male contact insert) for connecting the electronic / encoder supply 1L+ and load voltage supply 2L+
X04 DC 24V	7/8" circular socket (with socket insert) for looping through the electronic / encoder supply 1L+ and load voltage supply 2L+

Caution

PROFINET

Modules with PROFINET interfaces may only be operated in LANs (Local Area Network) where all nodes are equipped with SELV / PELV power supplies or protection systems of equal quality.

A data transfer terminal (modem, for example) is required to access the WAN (Wide Area Network) in order to ensure compliance with this safety standard.

Requirements

The IM 154-8 CPU interface module (including the bus module) and the CM IM PN DP M12, 7/8" terminal module have been installed on the rack.

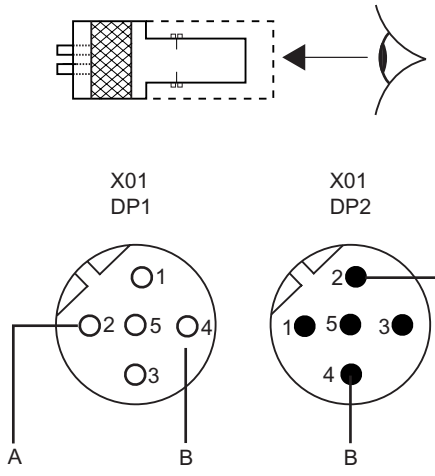
Required tools

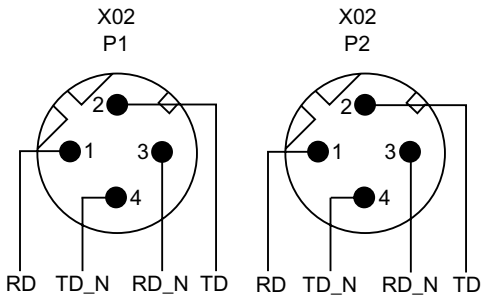
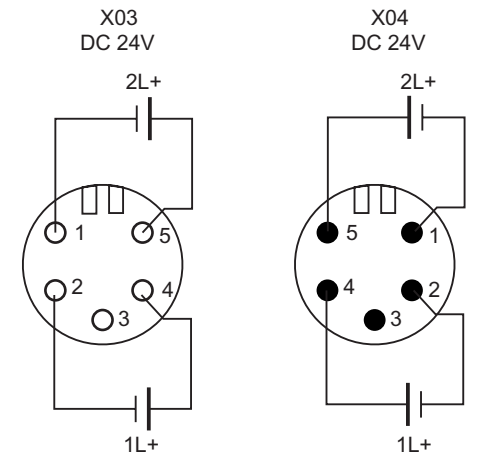
- Screwdriver
- Stripping tool for wiring the M12 und 7/8" connectors, if you are making up your own cables.

Accessories required

- Pre-fabricated cable with M12 and 7/8" connectors The patch cables are available in different lengths.
- To produce your own cable:
  - M12: 2-wire, shielded bus cable, and b-coded M12 connectors (PROFIBUS DP)
  - M12: 4-wire, shielded bus cable, and d-coded M12 connector (PROFINET)
  - 7/8": 5-wire patch cable with 7/8" connectors

Pin assignment of the M12 and 7/8" connectors

View of the M12 and 7/8" connectors	Terminal	Assignment
M12 connector, b-coded (PROFIBUS DP)		
	**X01 DP1 for incoming supply** **X01 DP2 for looping through**	
	1	Supply-Plus (P5V2)*
	2	Data line A
	3	Data reference potential (M5V2)*
	4	Data line B
	5	Functional ground
	Thread	Functional ground
* The voltage must only be used to supply the external terminating resistor. The voltage must not be looped through to the next plug connector using a cable.		

View of the M12 and 7/8" connectors	Terminal	Assignment
M12 connector, d-coded (PROFINET)		
	**X02 P1 for connecting PROFINET** **X02 P2 for connecting PROFINET**	
	1	RD (Receive Data +)
	2	TD (Transmit Data +)
	3	RD_N (Receive Data –)
	4	TD_N (Transmit Data –)
	Thread	Functional ground
7/8" connectors (1L+ and 2L+ supply voltages)		
	**X03 DC 24V for incoming supply** **X04 DC 24V for looping through**	
	1	Load voltage ground 2M
	2	Electronic / encoder supply ground 1M
	3	Functional ground
	4	Electronic / encoder supply 1L+
	5	Load voltage supply 2L+

Connecting M12 and 7/8" connectors

1. Plug the M12 and 7/8" connectors into the corresponding circular sockets of the CM IM PN DP M12, 7/8" terminal module. Ensure that the connector and socket are properly engaged.
2. Tighten the knurled screws of the connectors (torque = 1.5 N/m).

Caution

It is not allowed to remove the 7/8" connector while ET 200pro is in operation! Always switch off the electronic / encoder supply 1L+ and the load voltage supply 2L+ before you remove the 7/8" connector.

Note

Removal of the 7/8" connector interrupts the supply to downstream modules.

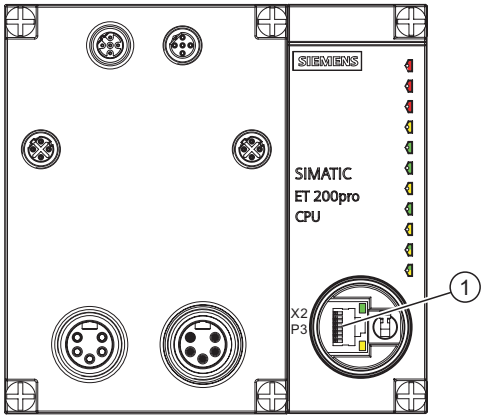
Closing unused sockets

Always close all unused sockets using M12 and 7/8" caps in order to achieve degree of protection IP65, IP66 or IP67.

5.3 Connect the IM 154-8 CPU interface module to the RJ45 socket

Introduction

You can connect a programming device, for example, at the RJ45 socket of the IM 154-8 CPU interface module. The PROFINET interface is equipped with an internal switch that allows PROFINET nodes to be connected directly.



① X02 P3 RJ45 socket for connecting to PROFINET

Requirements

- The IM 154-8 CPU interface module (including the bus module) and the CM IM PN DP M12, 7/8" terminal module have been installed on the rack.
- The supply voltages are connected to the terminal module.

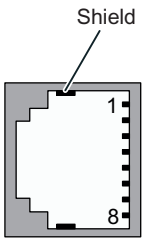
Required tools

- Screwdriver
- Stripping tool for wiring the RJ45 connector, if you are making up your own cables.
- 32 mm open-ended wrench

Accessories required

- Patch cable with RJ45 connector The cable is available in different lengths.
- To make up your own cable:
  - 4-wire, shielded bus cable, and RJ45 connector

Pin assignment of the RJ45 connector

View of the RJ-45 socket	Terminal	Assignment
	1	RD (Receive Data +)
	2	RD_N (Receive Data –)
	3	TD (Transmit Data +)
	4	Ground
	5	Ground
	6	TD_N (Transmit Data –)
	7	Ground
	8	Ground

Connect the RJ45 connector

1. Remove the screw cap from the IM 154-8 CPU interface module.
2. Plug the RJ45 connector into the socket of the interface module.

Note

Ensuring degree of protection IP65, IP66 and IP67 after removing the RJ45 connector

Replace the screw cap in the interface module to ensure degree of protection IP65, IP66 and IP67 (torque 1 to 1.5 Nm).

5.4 Terminating the PROFIBUS DP network with terminating resistor

Introduction

An ET 200pro with an IM 154-8 CPU at the start, middle or end of the subnet can be used on the PROFIBUS DP. This gives you much flexibility in adding the ET 200pro to your automation environment.
If you add the IM 154-8 CPU at the start or end of a PROFIBUS DP subnet, you will have to terminate it with a bus termination connector (terminating resistor).

Note

Different bus termination connectors for the start and end of the PROFIBUS DP subnet

For the start of a PROFIBUS DP subnet you will need a bus termination connector with socket insert, while you will need a bus termination connector with male insert for the end. Note this difference when you order the bus termination connector.
The order numbers can be found in the *Accessory order numbers* appendix.

Adding an IM 154-8 CPU at the start of the PROFIBUS DP subnet

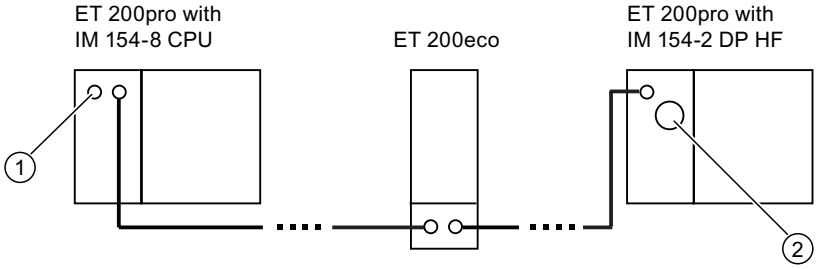


Figure 5-1 Example of a configuration: IM 154-8 CPU at the start of the PROFIBUS DP subnet

Steps for the sample configuration:

1. At the start of the PROFIBUS DP subnet, plug an M12 bus termination connector with socket insert (order number 6GK1905-0ED00) into the M12 circular socket X01 DP1 ①.
2. At the end of the PROFIBUS DP subnet, connect the terminating resistor ② integrated into the terminal module.

Adding an IM 154-8 CPU in the middle of the PROFIBUS DP subnet

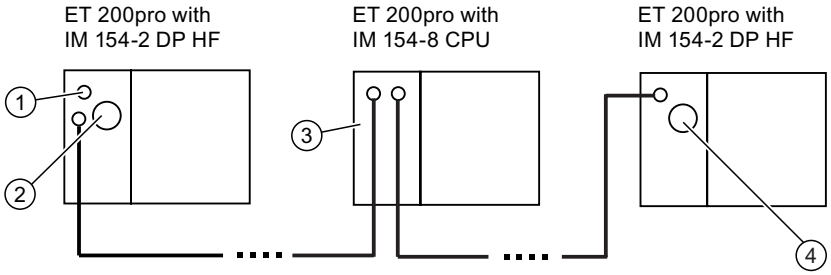


Figure 5-2 Example of a configuration: IM 154-8 CPU in the middle of the PROFIBUS DP subnet

Steps for the sample configuration:

1. At the start of the PROFIBUS DP subnet, plug an M12 bus termination connector with socket insert (order number 6GK1905-0ED00) into the M12 circular socket DP1 X03 ①.

   The terminating resistor ② integrated into the terminal module must not be switched on (OFF position).
2. **No** bus terminator is required on the IM 154-8 CPU ③.
3. At the end of the PROFIBUS DP subnet, connect the terminating resistor ④ integrated into the terminal module.

Adding an IM 154-8 CPU at the end of the PROFIBUS DP subnet

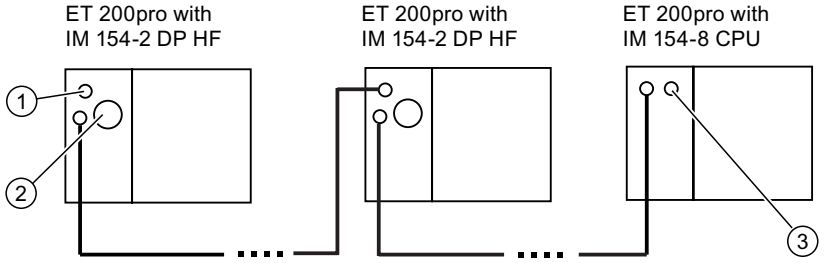


Figure 5-3 Example of a configuration: IM 154-8 CPU at the end of the PROFIBUS DP subnet

Steps for the sample configuration:

1. At the start of the PROFIBUS DP subnet, plug an M12 bus termination connector with socket insert (order number 6GK1905-0ED00) into the M12 circular socket DP1 X03 ①.

   The terminating resistor ② integrated into the terminal module must not be switched on (OFF position).

2. At the end of the PROFIBUS DP subnet, plug an M12 bus termination connector with socket insert (order number 6GK1905-0EC00) into the M12 circular socket X01 DP2 ③.

See also

Order numbers of accessories (Page 216)

Addressing

6

6.1 Addressing the I/O modules

6.1.1 Slot-oriented addressing of the centralized I/O modules

Slot-oriented addressing

Slot-oriented addressing only applies to the centralized I/Os of the IM 154-8 CPU. If the IM 154-8 CPU is started up without a configuration loaded, then the I/O modules are addressed by slot by default.

This is the digital or analog address set by default according to the type of I/O module (see table below).

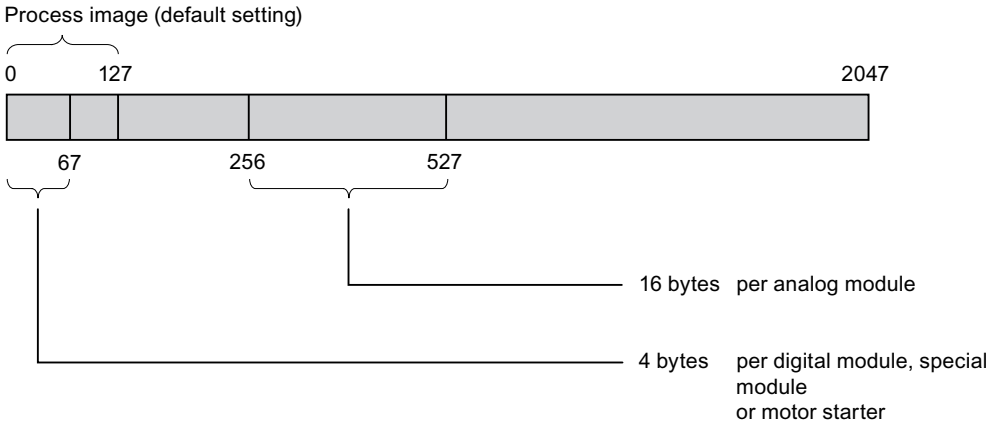


Figure 6-1 Structure of the default address area

Slot assignment

The figure below shows an ET 200pro configuration with digital and analog electronic modules and the slot assignment.

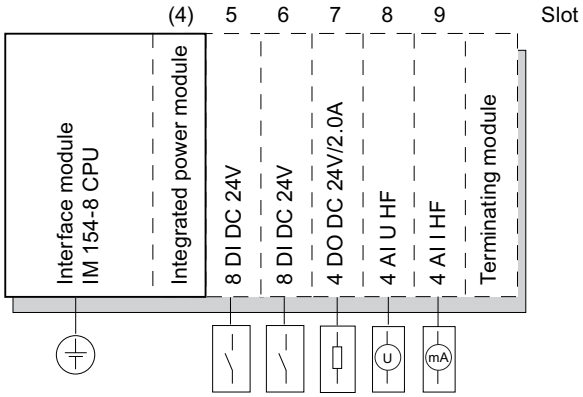


Figure 6-2 Slots on the ET 200pro

Address assignment

Depending on the slot, 4 bytes are reserved for digital I/Os, special modules and motor starters, and 16 bytes are reserved for analog I/Os in the address areas of the IM 154-8 CPU for each I/O module (up to 16).

The table below indicates the default address assignment for analog and digital modules per slot for slot-oriented addressing.

Table 6-1 Default address assignment for centralized I/O modules in an ET 200pro with IM 154-8 CPU

Reserved Address Area	Slot number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**…**	**20**
Digital modules, special modules, motor starters	IM 154-8 CPU [1]				4	8	12	16	…	64
Analog modules					272 to 287	288 to 303	304 to 319	320 to 335	…	512 to 527
Power modules [2]				256 [3]	272	288	304	320	…	512

[1] with X01 DP1 / DP2 as the MPI / DP interface and X02 P1 / P2 / P3 as the PROFINET interface

[2] Diagnostic addresses (no user data)

[3] For the power module integrated into the IM 154-8 CPU

Example of Slot-Oriented Address Assignment for I/O Modules

The figure below illustrates a sample ET 200pro configuration, showing an example of the address allocation for I/O modules. The addresses for the I/O modules are predefined in default addressing.

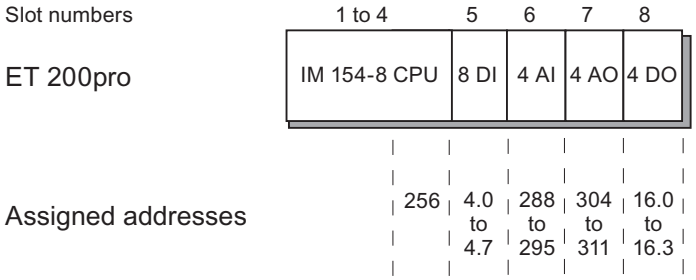


Figure 6-3 Example of address assignment for I/O modules

6.1.2 User-oriented addressing of the I/O Modules

User-oriented addressing

User-oriented module addressing is possible with both centralized and distributed I/Os.

User-oriented addressing means you can freely select

- Input addresses for modules and
- Output addresses for modules

within the range 0 to 2047 with byte-level granularity independently of one another. Assign the addresses in *STEP 7*. Specify the module start address that forms the basis for all other addresses of the module.

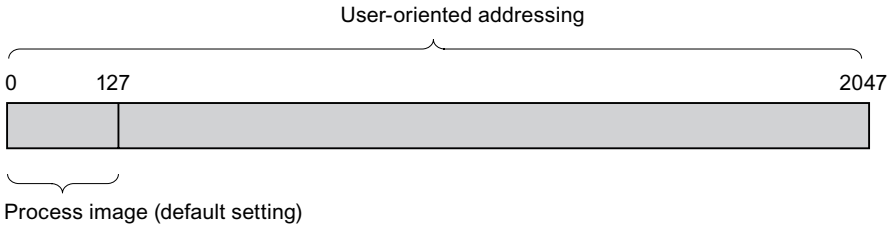


Figure 6-4 Structure of the address area for user-oriented addressing

Note

If you are using PROFIBUS DP or PROFINET IO field devices, then you must always configure the hardware in *STEP 7* HW Config. User-oriented addressing of modules is used automatically, and there is no fixed slot addressing.

Advantage

Advantages of user-oriented addressing:

- You can make the best possible use of the available address spaces because there are no "address gaps" between the modules.
- When creating standard software, you can specify addresses that are independent of the configuration of the ET 200pro station.

6.2 Addressing on PROFIBUS DP

Overview

The relevant DP slaves must first be brought into service on the PROFIBUS DP before the distributed I/Os can be addressed from the user program.

During this commissioning process:

- PROFIBUS addresses are assigned to the slaves
- Address ranges are assigned to the input / output modules or slots so that they can be addressed from the user program. Slots without user data are given a diagnostic address.

This applies equally if the IM 154-8 CPU is itself being operated as a DP slave.

Additional information on commissioning the IM 154-8 CPU as a DP master or DP slave can be found in the *Commissioning PROFIBUS DP* section.

User-oriented addressing of the distributed PROFIBUS I/Os

You must use user-oriented addressing for the distributed PROFIBUS DP I/Os.

Information can be found in the *User-oriented addressing of the I/O modules* section.

Addressing consistent user data areas

The table below illustrates the points to consider with respect to communication in a PROFIBUS DP master system if you want to transfer I/O areas with "Total length" consistency.

For 1 to 32 byte data consistency on the PROFIBUS DP:
The address area of consistent data in the process image is automatically updated.
To read and write consistent data, you can also use SFC 14 "DPRD_DAT" and SFC 15 "DPWR_DAT". If the address area of consistent data is not in the process image, you must use SFC 14 and SFC 15 to read and write consistent data.
The length in the SFC must tally with the length of the programmed area when accessing areas with "Total length" consistency.
Direct access to consistent areas is also possible (e.g. L PEW or T PAW).
In a PROFIBUS DP system you can transfer up to 32 bytes of consistent data.

See also

Commissioning the IM 154-8 CPU as the DP master (Page 131)
Commissioning the IM 154-8 CPU as a DP slave (Page 135)
User-oriented addressing of the I/O Modules (Page 101)

6.3 Addressing on PROFINET IO

Overview

The relevant IO devices must first be brought into service on the PROFINET IO before the distributed I/Os can be addressed from the user program.

During this commissioning process:

- The device number and device name are defined for the IO devices.
- The device names are assigned to the IO devices so that the IM 154-8 CPU, as the IO controller, can assign an address to and thus address the IO devices.
- Address ranges are assigned to the input / output modules or slots / subslots so that they can be addressed from the user program. Slots without user data are given a diagnostic address.

Additional information on commissioning the IM 154-8 CPU as an IO controller can be found in the *Commissioning PROFINET IO* section.

User-oriented addressing of the distributed PROFINET I/Os

You must use user-oriented addressing for the distributed PROFINET IO I/Os.

Information can be found in the *User-oriented addressing of the I/O modules* section.

Addressing consistent user data areas

The table below illustrates the points to consider with respect to communication in a PROFINET IO system if you want to transfer I/O areas with "Total length" consistency.

For 1 to 254 byte data consistency on the PROFINET IO:
The address area of consistent data in the process image is automatically updated.
To read and write consistent data, you can also use SFC 14 "DPRD_DAT" and SFC 15 "DPWR_DAT". If the address area of consistent data is not in the process image, you must use SFC 14 and SFC 15 to read and write consistent data.
The length in the SFC must tally with the length of the programmed area when accessing areas with "Total length" consistency.
Direct access to consistent areas is also possible (e.g. L PEW or T PAW).
In a PROFINET IO system you can transfer up to 254 bytes of consistent data.

See also

Configuring and commissioning the PROFINET IO system (Page 143)

User-oriented addressing of the I/O Modules (Page 101)

Commissioning 7

7.1 Overview

This section contains important notes on commissioning which you should strictly observe in order to avoid injury or damage to machines.

Note

Your commissioning phase is determined primarily by your application, so we can only offer you general information, without claiming completeness of this topic.

Reference

Note the information about commissioning provided in the descriptions of your system components and devices.

7.2 Commissioning procedure

7.2.1 Procedure: Commissioning the hardware

Hardware requirements

- ET 200pro has been installed
- ET 200pro has been wired up

With a networked ET 200pro, the following applies to the interfaces:

- MPI / PROFIBUS
  - the MPI / PROFIBUS addresses have been configured
  - The terminating resistors on the segments are enabled
- PROFINET
  - The integrated PROFINET interface of IM 154-8 CPU has been configured in *STEP 7* (IP address and device name set in HW Config)
  - The IM 154-8 CPU has been connected to the subnet.

Recommended procedure: Hardware

With its modular structure and many different expansion options, an ET 200pro can be very large and complex. It is therefore not a good idea to switch it on for the first time with all the modules installed. Rather, we recommend a step-by-step commissioning procedure.

We recommend the following initial commissioning procedure for an ET 200pro:

Table 7-1 Recommended commissioning procedure: Hardware

Activity	Remarks	Information on this can be found in section
An installation and wiring check according to checklist	-	*Commissioning check list*
Disconnecting drive aggregates and control elements	This prevents negative effects on your system as a result of program errors. Tip: By redirecting data from your outputs to a data block, you can always check the status at the outputs	-
Prepare the IM 154-8 CPU	Connect a programming device	*Connecting the programming device (PG)*
Start up the power supply and ET 200pro with the IM 154-8 CPU and check the LEDs	Start up the power supply and the ET 200pro with the IM 154-8 CPU plugged in.	*Initial power on*
	Check the LED displays on both the IM 154-8 CPU.	*Debugging functions, diagnostics and troubleshooting*
Reset the IM 154-8 CPU memory and check the LEDs	-	*Resetting the IM 154-8 CPU using the mode selector*
Commission the rest of the modules	Gradually install the other modules in the ET 200pro and start them up in succession.	*ET 200pro* operating instructions



Danger

Proceed step-by-step. Do not go to the next step unless you have completed the previous one without error / error message.

Reference

Important notes can also be found in the *Debugging Functions, Diagnostics and Troubleshooting* section.

See also

Procedure: Commissioning the software (Page 107)

7.2.2 Procedure: Commissioning the software

Requirements

Your ET 200pro with the IM 154-8 CPU is

- mounted and
- wired.

Software requirements to be satisfied in order to utilize the full functionality of your IM 154-8 CPU:

For …	you require the following versions of *STEP 7*
IM 154-8 CPU	V5.4 + Service Pack 1 + HSP0116 or later

At the ports for

- MPI / PROFIBUS
  - the MPI / PROFIBUS addresses have been configured
  - The terminating resistors on the segments are enabled
- PROFINET
  - The integrated PROFINET interface of IM 154-8 CPU has been configured in *STEP 7* (IP address and device name set in HW Config)
  - the IM 154-8 CPU has been connected to the subnet.

Note

Please observe the procedure for commissioning the hardware.

Hardware support packages (HSP) required

To configure an ET 200pro with IM 154-8 CPU you will need *STEP 7* V5.4 + SP 1 + HSP0116 and the HSPs listed in the *Constraints on using ET 200pro modules* table in the *Description* section.

Notice

Install all the HSPs listed in the specified table to ensure that the ET 200pro works smoothly with the IM 154-8 CPU.

ET 200pro modules that were configured with older HSP versions must not be copied to the rack with the IM 154-8 CPU.

To configure an ET 200pro with IM 154-8 CPU as PROFINET IO devices you will need *STEP 7* V5.4 + SP 1 + HSP0116 and the HSPs listed in the *HSPs for ET 200S PROFINET IO devices on an IM 154-8 CPU* table in the *Description* section.

Recommended procedure: Software

Table 7-2 Recommended commissioning procedure: Software

Activity	Remarks	Information can be found ...
• Switch on the programming device and run SIMATIC Manager • Download the configuration and the program to the IM 154-8 CPU	-	in the *STEP 7* Programming Manual
Debugging the I/Os	Helpful functions are here: • Monitoring and modifying variables • Testing with program status • Forcing • Controlling the outputs in STOP mode (PO enable) **Tip:** Test the signals at the inputs and outputs	• in the *STEP 7* Programming Manual • in the *Alarm, error and system messages* section
Commissioning PROFIBUS DP	-	in the *Commissioning PROFIBUS DP* section
Commissioning PROFINET IO		• in the *Commissioning PROFINET IO* section • in the *System Description PROFINET*
Connect the outputs	Commissioning the outputs successively.	-



Danger

Proceed step-by-step. Do not go to the next step unless you have completed the previous one without error / error message.

Reaction to errors

React to errors as follows:

- Check the system with the help of the check list in the chapter below.
- Check the LED displays on all modules. The meaning is described in the *ET 200pro Distributed I/O Device* operating instructions.
- If required, remove individual components to trace the error.

Reference

Important notes can also be found in the *Debugging Functions, Diagnostics and Troubleshooting* section.

See also

Procedure: Commissioning the hardware (Page 105)

What is the IM 154-8 CPU interface module? (Page 13)

7.3 Commissioning check list

Introduction

Once you have installed and wired up your ET 200pro, we advise you to check all the previous steps once again.

The checklist tables below will guide you through the process of checking your ET 200pro. They also provide cross-references to sections containing additional information on the relevant topic.

Rack

The points to be checked are listed in the ET 200pro operating instructions	*ET 200pro* operating instructions under
Are the racks firmly fixed to the wall, in the frame or in the cabinet?	*Installing*
Have you maintained the free space required?	*Installing*

Concept of grounding and chassis ground

The points to be checked are listed in the ET 200pro operating instructions	*ET 200pro* operating instructions under
Have you established a low-impedance connection (large surface, large contact area) to ground potential?	*Installing*
Are all racks properly connected to reference potential and ground potential (direct electrical connection or ungrounded operation)?	*Connecting*
Are all grounding points of electrically connected measuring instruments and of the load power supply units connected to reference potentials?	*Appendix*

Module installation and wiring

The points to be checked are listed in the ET 200pro operating instructions	*ET 200pro* operating instructions under
Are all the modules, including the terminating module, installed correctly?	*Installing*
Are all the modules wired up correctly (e.g. connectors plugged into the terminal modules and screwed down, terminal modules plugged in and screwed to the rack)?	*Connecting*

7.4 Commissioning the modules

7.4.1 Inserting/Replacing a SIMATIC Micro Memory Card

SIMATIC Micro Memory Card (MMC) as memory module

The memory module used in your IM 154-8 CPU is a SIMATIC Micro Memory Card. You can use the SIMATIC Micro Memory Card as a load memory or a portable data medium.

Note

There must be a SIMATIC Micro Memory Card inserted in order to use the IM 154-8 CPU. The SIMATIC Micro Memory Card is not supplied as standard with the IM 154-8 CPU.



Warning

Make sure that the SIMATIC Micro Memory Card to be inserted contains the proper user program for the IM 154-8 CPU (system). The wrong user program may have fatal processing effects.

Inserting / replacing the SIMATIC Micro Memory Card

1. First switch the IM 154-8 CPU to STOP.
2. Loosen the 4 screws on the CM IM PN DP M12, 7/8" terminal module and remove it from the interface module.

   Caution

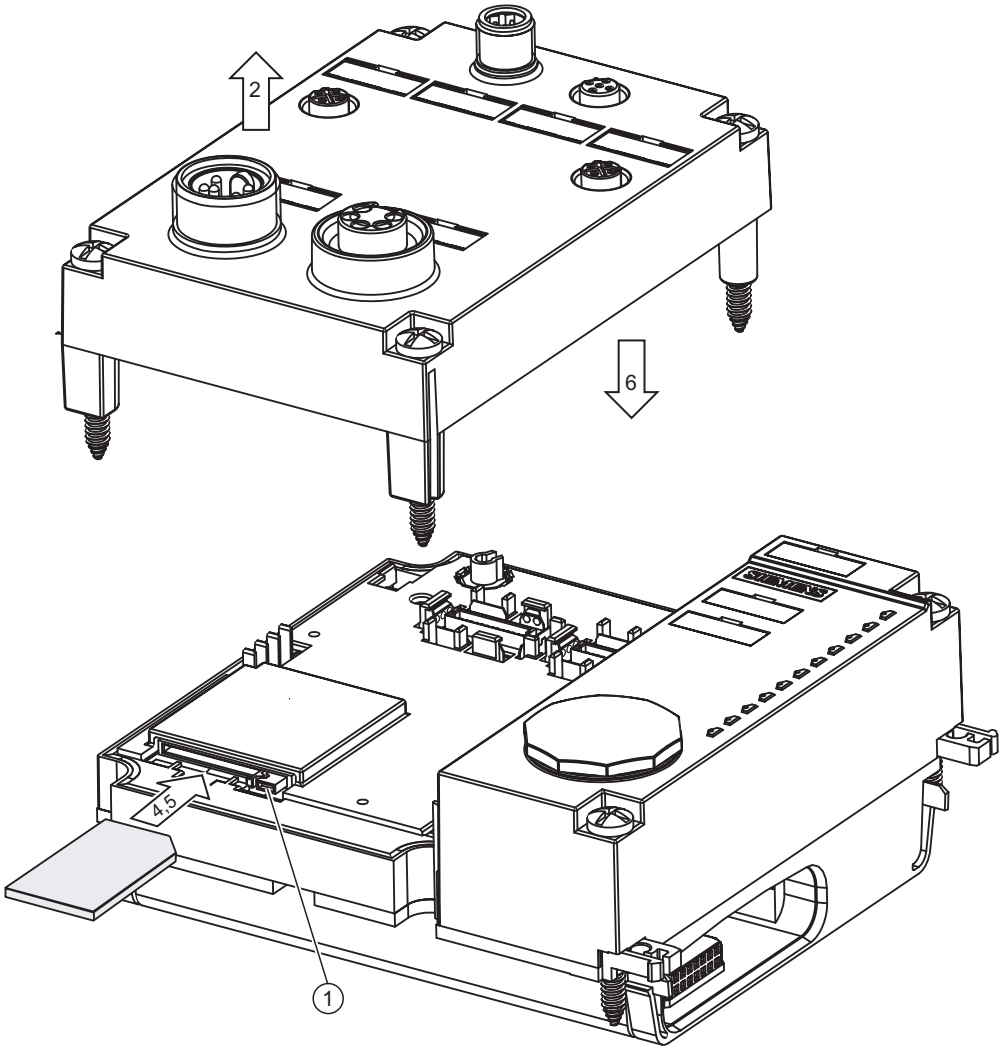
   In order to prevent damage to your ET 200pro, always shut down the outputs (off power) before you remove any connection modules.

3. Is there a SIMATIC Micro Memory Card inserted?

   If there is, press the ejector and remove the SIMATIC Micro Memory Card.

   An ejector ① is located on the frame of the module receptacle to enable you to remove the SIMATIC Micro Memory Card.
   Use a small screwdriver or ball-point pen to eject.
4. Insert the ("new") SIMATIC Micro Memory Card into the receptacle so that its beveled edge points towards the ejector.

5. Gently press the SIMATIC Micro Memory Card into the IM 154-8 CPU until it clicks into place.
6. Plug the terminal module into the interface module once more and secure it with the screws.
7. Reset the memory see the *(Resetting the IM 154-8 CPU using the mode selector)* section.



Removing and inserting a SIMATIC Micro Memory Card

When you change the SIMATIC Micro Memory Card, the IM 154-8 CPU detects

- A physically identical SIMATIC Micro Memory Card with a different content
- A new SIMATIC Micro Memory Card with the same content as the old SIMATIC Micro Memory Card

It automatically performs a Memory reset after POWER ON.

Reference

Additional information about the SIMATIC Micro Memory Card can be found in the *Technical Data* section of the *S7-300, CPU 31xC and CPU 31x* manual.

See also

Resetting the IM 154-8 CPU memory using the mode selector (Page 113)

7.4.2 Initial power on

Requirements

- You must have installed and wired up the ET 200pro.
- The SIMATIC Micro Memory Card is inserted in the IM 154-8 CPU.
- Your IM 154-8 CPU's mode selector switch must be set to STOP.

Switching on an ET 200pro with IM 154-8 CPU for the first time

Switch on the 1L+ and 2L+ power supplies for the ET 200pro.

Result:

On the IM 154-8 CPU

- The ON LED lights up
- The DC 24V LED lights up.
- The STOP LED flashes at 2 Hz when the IM 154-8 CPU carries out an automatic memory reset.
- The STOP LED lights up after the memory reset.

7.4.3 Resetting the IM 154-8 CPU memory using the mode selector

When should I reset the IM 154-8 CPU memory?

You should reset the IM 154-8 CPU memory

- When all retentive memory bits, timers and counters have been cleared and the initial values of retentive data blocks in the load memory are to be used as actual values in the work memory.
- If the retentive memory bits, timers and counters could cause unwanted responses after "Load user program onto memory card" with the user program just downloaded to the IM 154-8 CPU.

  Reason: "Load user program onto memory card" does not delete the retentive areas.
- If the IM 154-8 CPU requests a memory reset with its STOP LED flashing at 0.5 Hz intervals. Possible reasons for this request are listed in the table below.

Table 7-3 Possible reasons for a request from the IM 154-8 CPU to reset the memory

Reasons for a request from the IM 154-8 CPU to reset the memory	Special features
The SIMATIC Micro Memory Card has been replaced.	–
RAM error in IM 154-8 CPU	–
Work memory is too small, i.e. not all the blocks of the user program on a SIMATIC Micro Memory Card can be loaded.	IM 154-8 CPU with SIMATIC Micro Memory Card inserted: This causes continuous requests for a memory reset. This may be prevented by formatting the SIMATIC Micro Memory Card (see *Formatting the SIMATIC Micro Memory Card*).). For additional information on the way the SIMATIC Micro Memory Card responds to a memory reset, see *Memory reset and restart*.
Attempts to load faulty blocks; if a wrong instruction was programmed, for example.	

How to reset memory

There are two ways to reset the IM 154-8 CPU memory:

Memory reset using the mode selector switch	Memory reset using the programming device
... is described in this section.	... is only possible when IM 154-8 CPU is in STOP mode (see *STEP 7 Online Help*).

Resetting the IM 154-8 CPU memory with the mode selector

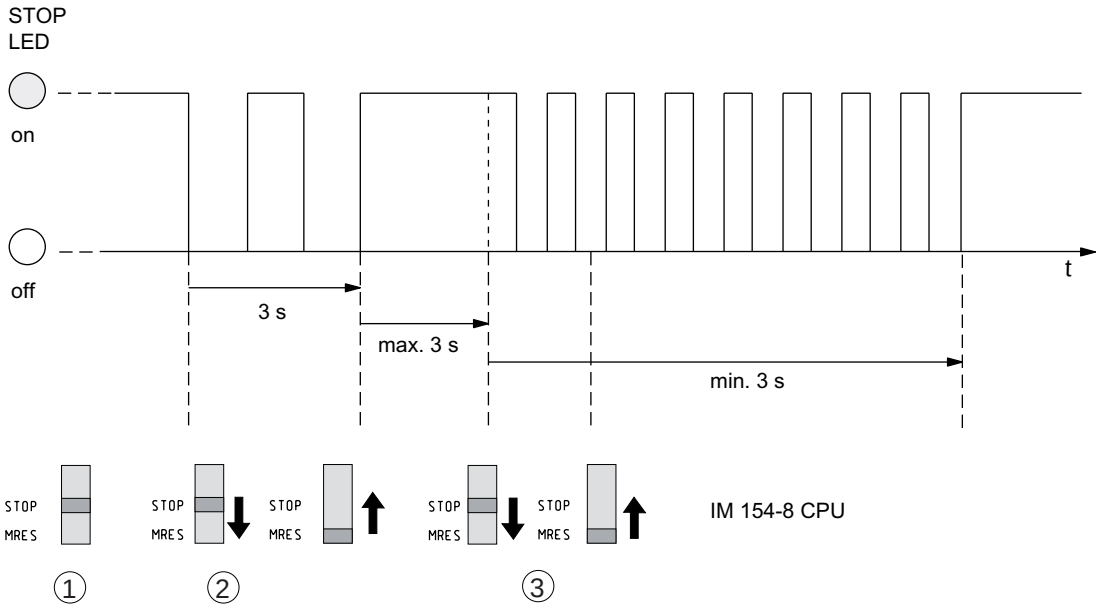
The table below shows the steps involved in resetting the IM 154-8 CPU memory.

Table 7-4 Steps for resetting the IM 154-8 CPU memory

Step	Resetting the IM 154-8 CPU memory
1.	Turn the key to STOP position
2.	Turn the key to MRES position Hold the key in this position until the STOP LED lights up for the second time and remains on (this takes 3 seconds). Now release the key.
3.	You must turn the key to MRES position again within 3 seconds and hold it there until the STOP LED flashes (at 2 Hz). You can now release the switch. When the IM 154-8 CPU has completed the memory reset, the STOP LED stops flashing and lights up. The IM 154-8 CPU has reset the memory.

The procedure described in the table above is only required if you wish to reset the IM 154-8 CPU memory without this being requested by the IM 154-8 CPU (STOP LED flashing slowly). If the IM 154-8 CPU prompts you for a memory reset, you only have to turn the mode selector briefly to the MRES position to initiate the memory reset operation.

The figure below shows how to use the mode selector switch to reset the IM 154-8 CPU memory:



If the IM 154-8 CPU prompts you for another memory reset following a successful memory reset operation, the SIMATIC Micro Memory Card may need to be reformatted (*see Formatting the Micro Memory Card*).

STOP LED does not flash during the memory reset

What should I do if the STOP LED does not flash during the memory reset or if other LEDs are lit?

1. You must repeat steps 2 and 3.
2. If the IM 154-8 CPU still does not reset the memory, you must analyze the diagnostic buffer of the IM 154-8 CPU.

What happens in the IM 154-8 CPU during the memory reset?

Table 7-5 Internal processes in the IM 154-8 CPU during the memory reset

Event	Action in the IM 154-8 CPU	
Sequence in the IM 154-8 CPU	1.	The IM 154-8 CPU deletes the entire user program in the main memory.
	2.	The IM 154-8 CPU deletes the retentive data.
	3.	The IM 154-8 CPU tests its hardware.
	4.	The IM 154-8 CPU copies the sequence-related content of the SIMATIC Micro Memory Card (load memory) to the work memory. **Tip:** If the IM 154-8 CPU is unable to copy the content of the SIMATIC Micro Memory Card and requests a memory reset: • Remove the SIMATIC Micro Memory Card • Resetting the IM 154-8 CPU memory • Read the diagnostic buffer.
Memory contents after reset	The user program is transferred back from the SIMATIC Micro Memory Card to the work memory and the memory utilization is indicated accordingly.	
What's left?	Data in the diagnostic buffer.[1] You can read the diagnostic buffer with the programming device (see *STEP 7 Online Help*).	
	• MPI parameters (MPI address and highest MPI address, baud rate). • The same applies if the X01 interface of the IM 154-8 CPU was set up as a DP interface (PROFIBUS address, highest PROFIBUS address, baud rate, setting as active or passive interface).	
	Content of elapsed time counter	
[1] After POWER OFF / POWER ON (see above, action 4 in the IM 154-8 CPU under *Tip*), only the last 100 entries in the diagnostic buffer are retentive.		

Special feature: Interface parameters (MPI/DP interface)

The following parameters hold a special position when CPU memory is reset.

- Parameters of the interface (MPI/DP interface)

The table below describes which interface parameters remain valid after a Memory reset.

Memory reset ...	MPI/DP parameters
with SIMATIC Micro Memory Card inserted	... stored on the SIMATIC Micro Memory Card are valid If this location does not contain any parameter data (SDB), the previously set parameters stay valid.
without SIMATIC Micro Memory Card inserted	... are retained and valid.

See also

CPU memory reset and restart (Page 84)

Formatting the SIMATIC Micro Memory Card (Page 116)

7.4.4 Formatting the SIMATIC Micro Memory Card

You must format the SIMATIC Micro Memory Card in the following cases

- The SIMATIC Micro Memory Card module type is not a user module.
- The SIMATIC Micro Memory Card has not been formatted.
- The SIMATIC Micro Memory Card is defective.
- The content of the SIMATIC Micro Memory Card is invalid.

  The content of the SIMATIC Micro Memory Card has been identified as invalid.
- The "Load user program" operation was interrupted as a result of Power Off.
- The "Write RAM to ROM" operation was interrupted as a result of Power Off.
- Error when evaluating the module content during Memory reset.
- Formatting error, or formatting failed.

If one of these errors has occurred, the IM 154-8 CPU prompts for yet another memory reset, even after the memory has already been reset. The card's content is retained until the SIMATIC Micro Memory Card is formatted, unless the "Load user program" or "Write RAM to ROM" operation was interrupted as a result of Power Off.

The SIMATIC Micro Memory Card is only formatted if there is a reason to do so (see above) and not, for example, when you are prompted for a memory reset after a module is changed. In this case, a switch to MRES triggers a normal memory reset for which the module content remains valid.

Use the following steps to format your SIMATIC Micro Memory Card

If the IM 154-8 CPU is requesting a memory reset (STOP LED flashing slowly), you can format the SIMATIC Micro Memory Card by setting the selector switch as follows:

1. Toggle the switch to the MRES position and hold it there until the STOP LED lights up and remains on (after approx. 9 seconds).
2. Within the next three seconds, release the switch and toggle it once again to MRES position. The STOP LED flashes to indicate that formatting is in progress.

Note

Always perform this sequence of operation within the specified time. Otherwise, the SIMATIC Micro Memory Card will not be not formatted, but rather returns to memory reset status.

See also

Resetting the IM 154-8 CPU memory using the mode selector (Page 113)

7.4.5 Resetting to the as-delivered state

As delivered state of the IM 154-8 CPU

In the as delivered state, the IM 154-8 CPU properties are set to the following values:

Table 7-6 Properties of the IM 154-8 CPU in the as delivered state

Properties	Value
MPI address	2
MPI baud rate	187.5 Kbps
Retentive memory bits, timers, counters	All retentive memory bits, timers and counters are cleared
Set retentive area for memory bits, timers and counters	Default setting (16 memory bytes, no timers, 8 counters)
Contents of the diagnostics buffer	cleared
Operating hours counter	0
Time-of-day	1.1.1994 00:00:00
IP address	None

Required tools

- Cross-tip screwdriver, size 2
- Screwdriver with 3 mm blade

Procedure

Proceed as follows to reset a IM 154-8 CPU to the as delivered state using the mode selector:

1. Switch off the supply voltage.
2. Loosen the 4 screws on the front panel of the CM IM PN DP M12, 7/8" terminal module using the cross-head screwdriver.
3. Remove the terminal module from the IM 154-8 CPU interface module.
4. Remove the SIMATIC Micro Memory Card from the receptacle (see *Inserting/replacing a Micro Memory Card*)
5. Plug the terminal module into the interface module once more and secure it with the screws.
6. Hold the mode selector switch in the MRES setting and switch the supply voltage on again.
7. Wait until LED lamp image 1 from the subsequent overview is displayed.
8. Release the mode selector switch, set it back to MRES within 3 seconds and hold it in this position.
9. The LED lamp image 2 from the subsequent overview is displayed.
   This lamp image lights up while the reset operation is running (approximately 5 seconds). During this period you can cancel the resetting procedure by releasing the mode selector.
10. Wait until LED lamp image 3 from the following overview is displayed and release the mode selector again.

The IM 154-8 CPU is now reset to the as delivered state. It runs unbuffered (all the LEDs light up, apart from P1 and P2) and changes to STOP mode.

Lamp images while the IM 154-8 CPU is being reset

While you are resetting the IM 154-8 CPU to the as delivered state, the LEDs light up in succession in the following lamp images:

Table 7-7 Lamp images

LED	Color	Lamp image 1	Lamp image 2	Lamp image 3
SF	Red	□	○	Δ
BF-DP	Red	□	□	□
BF-PN	Red	□	□	□
MAINT	Yellow	□	□	□
ON	Green	Δ	Δ	Δ
DC 24V	Green	◇ [1]	◇	◇
FRCE	Yellow	○	□	□
RUN	Green	○	□	□
STOP	Yellow	○	□	□
P1	Green	□	□	□
P2	Green	□	□	□

Key:
Δ = LED lights up;
□ = LED out;
○ = LED flashing at 0.5 Hz;
◇ = LED lights up if load voltage supply 2L+ switches on

[1] The DC 24V LED retains the state that it had before the reset process started (i.e. no change if the load voltage supply 2L+ fails during the reset).

See also

Inserting/Replacing a SIMATIC Micro Memory Card (Page 110)

7.4.6 Connecting the programming device (PG)

7.4.6.1 Connecting a programming device/PC to the integrated PROFINET interface of the IM 154-8 CPU

Introduction

The IM 154-8 CPU has an RJ45 socket for connecting a programming device for commissioning and maintenance.

Requirement

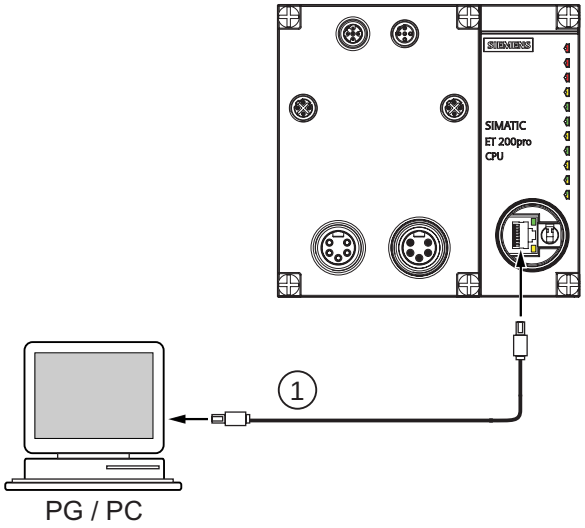
- IM 154-8 CPU with integrated PROFINET interface
- Programming device / PC with network card

Required tools

32 mm open-ended wrench

Connecting a programming device/PC to the integrated PROFINET interface of the IM 154-8 CPU

1. Remove the screw cap from the IM 154-8 CPU interface module.
2. Connect the programming device/PC to the X02 P3 interface of the IM 154-8 CPU using a pre-assembled, uncrossed twisted pair cable ①.



Of course, a programming device can also be connected and used at the other two ports of the PROFINET interface:

– Using a cable with M12 connector (IP65)

– Using an external switch

Result

You connected the programming device/PC to the integrated PROFINET interface of the IM 154-8 CPU.

Reference

- For information on PROFINET, refer to the *PROFINET System Description*.
- For information on passive network components such as switches, refer to the *SIMATIC NET manual: Twisted Pair and Fiber-Optic Networks.*

See also

Configuring and commissioning the PROFINET IO system (Page 143)

7.4.6.2 Connecting the programming device to a node

Requirement

The programming device must be equipped with an integrated MPI interface or an MPI card in order to connect it via MPI.

Connecting a programming device / PC to the integrated MPI interface of the IM 154-8 CPU

1. Connect the programming device to the MPI interface of your IM 154-8 CPU using a preassembled cable ①.

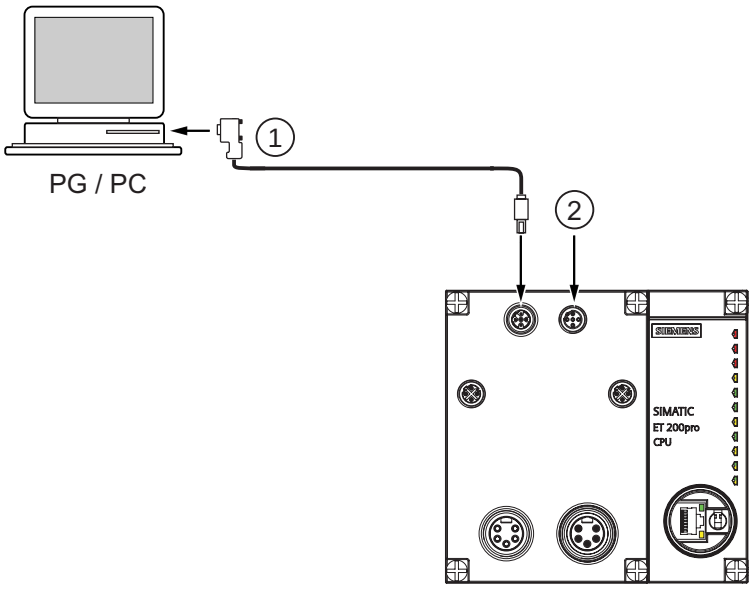
   The following components can be used for the cable:

   – Bus connector 6ES7972-0BA50-0XA0

   – PROFIBUS FC trailing cable 6XV1830-3EH10

   – PROFIBUS DP M12 plug connector, socket insert 6GK1905-0EB00

   The figure below illustrates the connection between the programming device and the IM 154-8 CPU.



The figure illustrates the following	
①	PROFIBUS bus cable Switch on the terminating resistor in the bus connector on the programming device side.
②	Terminating resistor, male insert 6GK1905-0EC00

Procedure for PROFIBUS DP

The procedure is essentially the same if the IM 154-8 CPU interface is set to PROFIBUS DP mode

7.4.6.3 Connecting the programming device to several nodes

Requirement

The programming device must have an integrated MPI interface or an MPI card in order to connect it to an MPI.

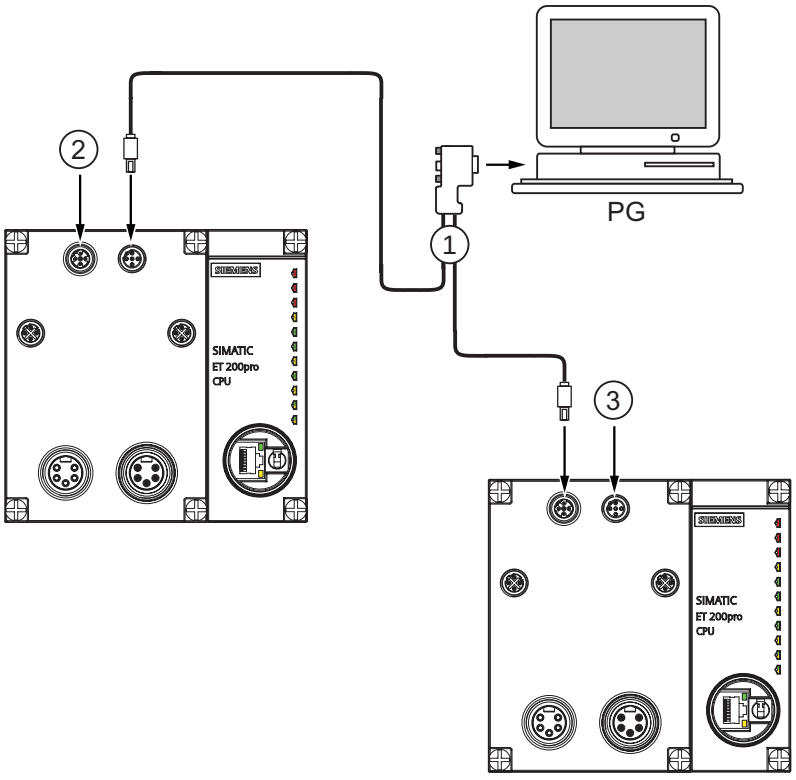
Connecting the programming device to several nodes

1. Use bus connectors to connect a programming device which is permanently installed on the MPI subnet to the other nodes of the MPI subnet.

   The following components can be used for the cable:

   – Bus connector 6ES7972-0BB50-0XA0
   – PROFIBUS FC trailing cable 6XV1830-3EH10
   – 1x PROFIBUS DP M12 plug connector, socket insert 6GK1905-0EB00
   – 1x PROFIBUS DP M12 plug connector, male insert 6GK1905-0EA00

The following picture shows two networked ET 200pro units with IM 154-8 CPU. The two ET 200pro units are connected to one another via the PROFIBUS bus cable. At one end, the bus cable has a PROFIBUS DP M12 plug connector with socket insert and at the other it has a male insert.



The figure illustrates the following	
①	PROFIBUS bus cable
②	Terminating resistor, socket insert 6GK1905-0ED00
③	Terminating resistor, male insert 6GK1905-0EC00

7.4.6.4 Connecting a programming device to ungrounded MPI nodes

Requirement

The programming device must have an integrated MPI interface or an MPI card in order to connect it to an MPI.

Connecting a programming device to ungrounded nodes of an MPI subnet

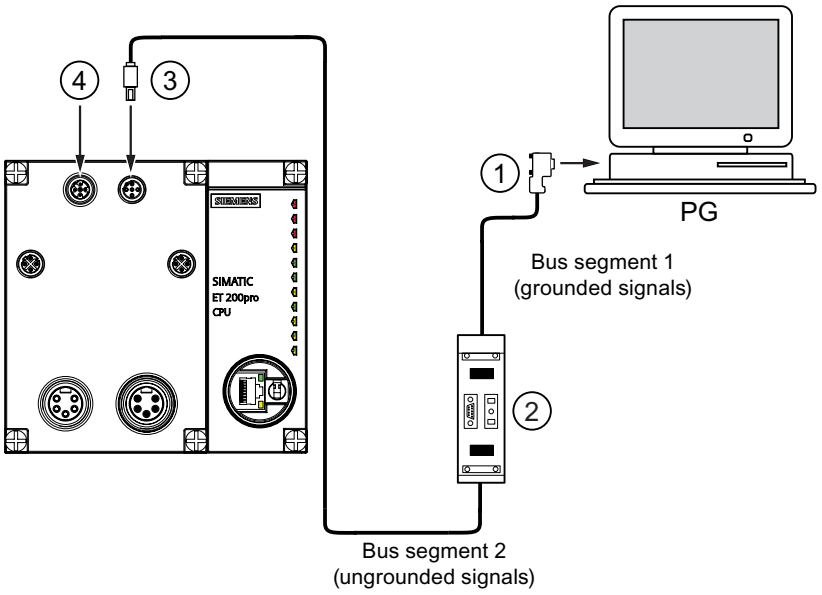
Connecting a programming device to ungrounded nodes

Always use an ungrounded PG to connect to ungrounded subnet nodes or to an ungrounded ET 200pro with IM 154-8 CPU.

Connecting a grounded PG to the MPI

You want to operate with ungrounded nodes. If the MPI at the programming device is grounded, you must interconnect the nodes and the programming device with an RS485 repeater. You must connect the ungrounded nodes to bus segment 2 if the programming device is connected to bus segment 1 (terminals A1 B1) or to the programming device/OP interface (refer to section 9 of the *S7-300 Automation System, Module Data* manual).

The figure below shows an RS485 repeater as the interface between a grounded and an ungrounded node of an MPI subnet.



The figure illustrates the following	
①	Bus connector, e.g. 6ES7972-0BA50-0XA0 Switch on the terminating resistor in the bus connector.
②	Switch on the terminating resistor in the repeater for both bus segments.
③	PROFIBUS DP M12 plug connector, male insert 6GK1905-0EA00
④	Terminating resistor, socket insert 6GK1905-0ED00

7.4.7 Starting SIMATIC Manager

Introduction

SIMATIC Manager is a GUI for online/offline editing of S7 objects (projects, user programs, blocks, hardware stations and tools).

The SIMATIC Manager lets you

- Manage projects and libraries,
- Call *STEP 7* tools,
- Access the PLC (AS) online,
- Edit Memory Cards.

Starting SIMATIC Manager

After installation, the **SIMATIC Manager** icon appears on the Windows desktop, and the Start menu contains entry **SIMATIC Manager** under **SIMATIC**.

1. Run SIMATIC Manager by double-clicking the icon, or from the Start menu (same as with all other Windows applications).

User interface

A corresponding editing tool is started up when you open the relevant objects. You start the program editor by double-clicking the program block you want to edit (object-oriented start).

Online Help

The online help for the active window is always called by pressing F1.

7.4.8 Monitoring and modifying I/Os

The "Monitor and modify tags" tool

The *STEP 7* "Monitor and modify tags" tool lets you:

- Monitor program tags in any format
- Edit (modify) the tag status or data in the IM 154-8 CPU.

Creating a variable table

You have two options of creating a tag table (VAT):

- In the LAD / FBD / STL editor by selecting the **PLC > Monitor/Modify Variables** command

  This table is also available directly online.

- In the SIMATIC Manager with the **Blocks** container open via menu item **Insert New Object > Variable table**

  This table created offline can be saved for future retrieval. You can also test it after switching to online mode.

VAT structure:

In the VAT, every address to be monitored or modified (e.g. inputs, outputs) occupies one row.

The meaning of the VAT columns is as follows:

Column text	This field ...
Address	contains the absolute address of the tag
Icon	contains the symbolic descriptor of the tag This is identical to the specification in the Symbol Table.
Symbol comment	shows the symbol comment of the Symbol Table
Status format	contains the default format setting, e.g. HEX. You can change the format as follows: • right-click in the format field. The Format List opens. or • left-click in the format field until the relevant format appears
Status value	shows the content of the tag at the time of update
Modify value	is used to enter the new tag value (modify value)

Monitor tag

You have two options for monitoring tags:

- Updating the status values once via menu item **Tag > Update Status Values**

  or

- Continuous update of status values via menu item **Tag > Monitor**

Modifying tags

To modify tags , proceed as follows:

1. Left-click the field **Modify value** of the relevant tag.
2. Enter the modify value according to the data type.
3. To update modify values once, select the menu item **Tag > Activate Modify Value**.

   or

   Enable modify values permanently via menu item **Tag > Modify**.
4. In the **Monitor** test function, verify the modify value entry in the tag.

Is the modify value valid?

You can disable the modify value entered in the table. An invalid value is displayed same as a comment. You can re-enable the modify value.

Only valid modify values can be enabled.

Setting the trigger points

Trigger points:

- The "Trigger point for monitoring" determines the time of update for values of tags to be monitored.
- The "Trigger point for modifying" determines the time for assigning the modify values to the tags to be modified.

Trigger condition:

- The "Trigger condition for monitoring" determines whether to update values once when the trigger point is reached or continuously every time the trigger point is reached.
- The "Trigger condition for modifying" determines whether to assign modify values once or permanently to the variable to be modified.

You can customize the trigger points using the tool "Monitoring and Modifying Variables" in the menu item **Variable > Set Trigger...** .

Special features

- If "Trigger condition for monitoring" is set to **once** , the menu items **Variable > Update Status Values** or **Variable > Monitor** have the same effect, namely a single update.
- If "Trigger condition for modifying" is set to **once** , the menu items **Variable > Update Status Values** or **Variable > Modify** have the same effect, namely a single assignment.
- If trigger conditions are set to **permanent** , the said menu items have different effects as described above.
- If monitoring and modifying is set to the same trigger point, monitoring is executed first.
- If **Process mode** is set under **Debug > Mode**, values are not cyclically updated when **permanent modifying** is set.
  To correct or avoid error: Use the **Force** test function.

Saving/opening the variable table

Saving the VAT

1. After aborting or completing a test phase, you can save the variable table to memory. The name of a variable table starts with the letters VAT, followed by a number from 0 to 65535; e.g. VAT5.

Opening VAT

1. Select the menu item **Table > Open**.
2. Select the project name in the **Open** dialog.
3. In the project window below, select the relevant program and mark the **Blocks** container.
4. In the block window, select the desired table.
5. Confirm with **OK**.

Establishing a connection with the IM 154-8 CPU

The variables of a VAT represent dynamic quantities of a user program. To monitor or modify variables, you will need to establish a connection with the relevant IM 154-8 CPU. Every variable table can be linked to another IM 154-8 CPU.

Use the **PLC > Connect to ...** menu item to establish a connection to one of the following CPUs:

- Configured CPU
- Directly connected CPU
- Available CPU ...

The table below lists the display of variables.

CPUs	The IM 154-8 CPU variables are displayed, ...
Configured CPU	in their S7 program (hardware station) in which the variable table is stored.
Directly connected CPU	that is connected directly to the programming device.
Available CPU	that is selected in the dialog window. Use the **PLC > Connect to ... > Available CPU ...** menu item to connect to an available IM 154-8 CPU. This can be used to connect to any IM 154-8 CPU available on the network.

Modifying outputs when the IM 154-8 CPU is in STOP mode

The function **Enable PO** resets the output disable signal for the peripheral outputs (PO), thus allowing the PO to be modified when the IM 154-8 CPU is in STOP mode.

In order to enable the POs, proceed as follows:

1. Select **Table > Open the variable table (VAT)** to open the variable table containing the POs you want to modify, or activate the window containing the corresponding VAT.
2. To modify the POs of the active VAT, select the required IM 154-8 CPU connection using the **PLC > Connect to ...** menu item.
3. Use the **PLC > Operating Mode** menu item to open the **Operating Mode** dialog and switch the IM 154-8 CPU to STOP mode.
4. Enter your values in the "Modify value" column for the PO you want to modify.

   Examples:
   PO: POB 7 modify value: 2#0100 0011
   POW 2 W#16#0027
   POD 4 DW#16#0001
5. Select **Variable > Enable PO** to set "Enable PO" mode.
6. Modify the PO by selecting **Variable > Activate Modify Values**. "Enable PO" mode remains active until reset by selecting **Variable > Enable PO** once mode.

   "Enable PO" is also terminated when the connection to the programming device is dropped.
7. Return to step 4 if you want to set new values.

Note

For example, a message pops up to indicate a IM 154-8 CPU mode transition from STOP to RUN or STARTUP.
A message also pops up when the "Enable PO" function is set while the IM 154-8 CPU is in RUN mode.

7.5 Commissioning PROFIBUS DP

7.5.1 Commissioning the PROFIBUS DP network

Requirements

Requirements for commissioning a PROFIBUS DP network:

- A PROFIBUS DP network is installed.
- You have configured the PROFIBUS DP network using *STEP 7* and have assigned a PROFIBUS DP address and the address space to all the nodes.
- Note that you must also set address switches for some of the DP slaves (see the description of the relevant DP slave).
- The software listed in the following table is required for the IM 154-8 CPU:

Table 7-8 Software requirements for the IM 154-8 CPU

CPU	Order number	Software required
IM 154-8 CPU	6ES7154-8AB00-0AB0	*STEP 7* V5.4 or later + Service Pack 1 + HSP

DP address area of the IM 154-8 CPU

Table 7-9 DP address area of the IM 154-8 CPU

Address area	IM 154-8 CPU
DP address area for I/Os	2048 bytes
Number of those in process image for I/Os	Bytes 0 to 127 [1]
[1] For the IM 154-8 CPU, you can set a maximum number of 2047 bytes for the process image. The default setting is bytes 0 to 127.	

DP diagnostic addresses occupy 1 byte for the DP master and for each DP slave in the input address area. For example, at these addresses DP standard diagnostics can be called for the relevant node (LADDR parameter of SFC 13). The DP diagnostic addresses are specified in your configuration. If you do not specify any DP diagnostic addresses, *STEP 7* assigns these DP diagnostic addresses in descending order, starting at the highest byte address.

If there is an IM 154-8 CPU as the master, assign two different diagnostic addresses for S7 slaves:

- Diagnostic address of the slave (address for slot 0)
  At this address all slave events are reported in the DP master (node proxy), e.g. node failure.
- Diagnostic address of the module (address for slot 2)
  All module (IM 154-8 CPU as an intelligent DP slave, for example) events are reported in the master (OB 82) at this address. With a IM 154-8 CPU as DP Slave, for example, diagnostic interrupts for operating mode transitions are reported at this address.

See also

Connecting the programming device to a node (Page 122)

Connecting the programming device to several nodes (Page 123)

7.5.2 Commissioning the IM 154-8 CPU as the DP master

Requirements for commissioning

- The PROFIBUS subnet has been configured.
- The DP slaves are ready for operation (see relevant DP slave manuals).
- If the MPI/DP interface is to act as a DP interface, you must configure the interface as the DP interface.
- You must configure the IM 154-8 CPU as the DP master prior to commissioning. That means that, in *STEP 7* you must
  - Configure the IM 154-8 CPU as the DP master,
  - Assign a PROFIBUS address to the IM 154-8 CPU,
  - Assign a master diagnostic address to the IM 154-8 CPU,
  - Integrate the DP slaves into the DP master system

    Is the DP CPU a DP slave?

    If so, this DP slave will appear in the PROFIBUS DP catalog as an **already configured station**. In the DP master, assign a slave diagnostic address to this DP slave CPU. You must interconnect the DP master with the DP slave CPU and specify the address areas for data exchange with the DP slave CPU.

Commissioning

Commission the IM 154-8 CPU as the DP master in the PROFIBUS subnet as follows:

1. Download the PROFIBUS subnet configuration created with *STEP 7* (preset configuration) from the programming device to the IM 154-8 CPU.
2. Switch on all the DP slaves.
3. Switch the IM 154-8 CPU from STOP to RUN.

Starting up IM 154-8 CPU as the DP master

During startup, the IM 154-8 CPU checks the configured preset configuration of its DP master system against the actual configuration.

If the preset configuration = the actual configuration, the IM 154-8 CPU switches to RUN mode.

If the preset configuration ≠ the actual configuration, the configuration of parameter **Startup if preset configuration ≠ actual configuration** determines the startup behavior of the IM 154-8 CPU.

Startup when the preset configuration ≠ actual configuration = Yes (default setting)	**Startup when the preset configuration ≠ actual configuration = no**
IM 154-8 CPU switches to RUN. (BUSF LED flashes if any of the DP slaves cannot be addressed).	The IM 154-8 CPU remains in STOP mode, and the BUSF LED flashes after the set **Monitoring time for transfer of parameters to modules**. The flashing BUSF LED indicates that at least one DP slave cannot be addressed. In this case, check that all the DP slaves are switched on and correspond with your configuration, or read out the diagnostic buffer with *STEP 7*.

Recognizing the operating state of DP slaves (Event recognition)

The table below shows how the IM 154-8 CPU acting as a DP master recognizes operating mode transitions of a CPU acting as a DP slave or any interruption of the data exchange.

Table 7-10 Event recognition for the IM 154-8 CPU as the DP master

Event	**What happens in the DP master?**
Bus interruption (short circuit, connector removed)	• Call of OB86 with the message **Station failure** (incoming event; diagnostic address of the DP slave assigned to the DP master) • With I/O access: Call of OB 122 (I/O access error)
DP slave: RUN → STOP	• Call of OB 82 with the message **Module error** (incoming event; diagnostic address of the DP slave assigned to the DP master; Variable OB82_MDL_STOP=1)
DP slave: STOP → RUN	• Call of OB82 with the message **Module OK** (outgoing event; diagnostic address of the DP slave assigned to the DP master; variable OB82_MDL_STOP=0)

Tip:

When commissioning the IM 154-8 CPU as the DP master, always program OB 82 and OB 86. This helps you to recognize and evaluate data exchange errors or interruptions.

Programming, status/control via PROFIBUS

As an alternative to the MPI interface, you can program the IM 154-8 CPU or execute the programming device's status and control functions via the PROFIBUS DP interface.

Note

The use of Status and Control function via the PROFIBUS DP interface extends the DP cycle.

Constant Bus Cycle Time

This is a property of PROFIBUS DP that ensures bus cycles of exactly the same length. The "Constant bus cycle time" function ensures that the DP master always starts the DP bus cycle after a constant interval. From the perspective of the slaves, this means that they receive their data from the master at constant time intervals.

In *STEP 7* V5x or later, you can configure constant bus cycle times for PROFIBUS subnets. A detailed description of the constant bus cycle time can be found in the *STEP 7 Online Help*.

Isochronous updating of process image partitions

SFC 126 "SYNC_PI" is used to isochronously update the process input image partition. A user program which is linked to a DP cycle (via OB 61) can use this SFC to update the input data in the process input image partition consistently and synchronously with these intervals. SFC 126 accepts interrupt control and can only be called in OB 61.

SFC 127 "SYNC_PO" is used to isochronously update the process output image partition. An application program which is linked to a DP cycle can use the SFC to transfer the computed output data from the process output image partition to the I/O consistently and synchronously with these intervals. SFC 127 accepts interrupt control and can only be called in OB 61.

SFC 126 and 127 are described in the *STEP 7 online help* and in the *System and Standard Functions for S7-300/400* reference manual. For additional information, refer to the *Isochronous Mode* function manual.

Time synchronization

Information about time synchronization via PROFIBUS DP can be found under *Interfaces > PROFIBUS DP*.

SYNC/FREEZE

The **SYNC** control command is used to set the DP slaves of a group to sync mode. In other words, the DP master transfers the current output data and instructs the relevant DP slaves to freeze their outputs. The DP slaves writes the output data of the next output frames to an internal buffer; the state of the outputs remains unchanged.

After each SYNC control command, the DP slaves of the selected groups transfer the output data stored in their internal buffer to the process outputs.

The outputs are only updated cyclically again after you transfer the UNSYNC control command using SFC11 "DPSYC_FR".

The **FREEZE** control command is used to set the relevant DP slaves to Freeze mode. In other words, the DP master instructs the DP slaves to freeze the current state of the inputs. It then transfers the frozen data to the input area of the IM 154-8 CPU.

Following each FREEZE control command, the DP slaves freeze the state of their inputs again.

The DP master does not receive the current state of the inputs cyclically once more until you have sent the UNFREEZE control command with SFC11 "DPSYC_FR".

SFC 11 is described in the *STEP 7 online help* and in the *System and Standard Functions for S7-300/400* reference manual.

Powering up the DP master system

IM 154-8 CPU is the DP master
Set the power-up monitoring time for DP slaves using the **Monitoring time for parameter transfer to modules** parameter.
This means that the DP slaves must power up within the set time and must be set by the IM 154-8 CPU (as DP master).

PROFIBUS address of the DP master

For the IM 154-8 CPU (DP CPU), you **must not set "126"** as a PROFIBUS address.

See also

PROFIBUS DP (Page 25)

7.5.3 Commissioning the IM 154-8 CPU as a DP slave

Requirements for commissioning

- The DP master is configured and programmed.
- If the MPI / DP interface of your IM 154-8 CPU is to act as a DP interface, you must configure the interface as the DP interface.
- You must configure the IM 154-8 CPU as a DP slave prior to commissioning. That means that, in *STEP 7* you must
  - "Switch on" the IM 154-8 CPU as a DP slave,
  - Assign a PROFIBUS address to the IM 154-8 CPU,
  - Assign a slave diagnostic address to the IM 154-8 CPU,
  - Specify whether the DP master is an S7 DP master or another DP master,
  - Specify the address areas for data exchange with the DP master.
- All other DP slaves are programmed and configured.

GSD file

If you are working on an IM 308-C or third-party system, you will need a GSD file in order to be able to configure the IM 154-8 CPU as a DP slave in a DP master system.

You can download the GSD file from the Internet at http://www.siemens.com/automation/service&support. Search for the entry with the number 21221197.

Note

If you wish to use the IM 154-8 CPU as a standard slave using the GSD file, you must not check the Test, Commissioning, Routing check box in the DP Interface Properties dialog when you configure this slave CPU in *STEP 7*.

Configuration and parameter assignment message frame

STEP 7 will guide you through the process of configuring / assigning parameters to the IM 154-8 CPU. If you need a description of the configuration and parameter assignment frame in order to use a bus monitor, for example, you will find it on the Internet at http://www.siemens.com/automation/service&support under article ID 1452338.

Commissioning

Commission the IM 154-8 CPU as a DP slave in the PROFIBUS subnet as follows:

1. Switch on the power supply, but keep the IM 154-8 CPU in STOP mode.
2. Then switch on all the other DP masters/slaves.
3. Now switch the IM 154-8 CPU to RUN mode.

Starting up IM 154-8 CPU as a DP slave

When the IM 154-8 CPU is switched to RUN mode, two mutually independent operating mode transitions take place:

- The **IM 154-8 CPU** switches from STOP to RUN mode.
- The IM 154-8 CPU starts exchanging data with the DP master via the **PROFIBUS DP interface**.

Recognizing the operating states of the DP master (event recognition)

The table below shows how the IM 154-8 CPU acting as a DP slave recognizes operating state transitions or any interruption of the data exchange.

Table 7-11 Event recognition for the IM 154-8 CPU as the DP slave

Event	What happens in the DP slave?
Bus interruption (short circuit, connector removed)	• Call of OB86 with the message **Station failure** (incoming event; diagnostic address of the DP slave assigned to the DP slave) • With I/O access: Call of OB 122 (I/O access error)
DP master RUN → STOP	• Call of OB 82 with the message **Module error** (incoming event; diagnostic address of the DP slave assigned to the DP slave; Variable OB82_MDL_STOP=1)
DP master: STOP → RUN	• Call of OB82 with the message **Module OK** (outgoing event; diagnostic address of the DP slave assigned to the DP slave; Variable OB82_MDL_STOP=0)

Tip:

When you commission the IM 154-8 CPU as the DP slave, always program OB82 and OB86. This helps you to recognize and evaluate data exchange errors or interruptions.

Programming, status/control via PROFIBUS

As an alternative to the MPI interface, you can program the IM 154-8 CPU or execute the programming device's status and control functions via the PROFIBUSDP interface.

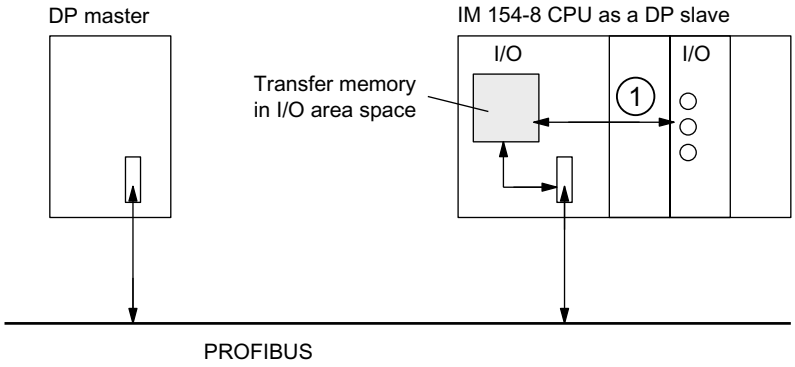
Note

The use of Status and Control function via the PROFIBUS-DP interface extends the DP cycle.

Transferring user data via a transfer memory

The IM 154-8 CPU, as an intelligent DP slave, provides a transfer memory for PROFIBUS DP. All exchanges of user data between the IM 154-8 CPU as the DP slave and the DP master take place via this transfer memory. You can configure up to 32 address areas for this function.

This means that the DP master writes its data to these transfer memory address areas, while the IM 154-8 CPU reads these data in the user program, and vice versa.



(1) The exchange of data between the transfer memory and centralized I/Os of the slave CPU must be implemented in the user program. It is not possible for the DP master to access these I/Os directly.

Figure 7-1 Transfer memory in a IM 154-8 CPU acting as a DP slave

Data consistency

The data consistency is defined as the byte, word or overall consistency per address area. The consistency must not exceed 32 bytes / 16 words per address area.

Address areas of transfer memory

Configure the input and output address areas in *STEP 7*:

- You can configure up to 32 I/O address areas.
- Maximum length per address area is 32 bytes.
- You can configure a maximum of 244 input bytes and 244 outputs bytes.

The table below shows the principle of address areas. You can also find this figure in the *STEP 7* configuration. In *STEP 7*, you must set "MS" mode for master-slave or "DX" for direct data exchange.

Table 7-12 Configuration example for the address areas of transfer memory

	Mode	DP master		DP slave		Parameters		
		I/O	Address	I/O	Address	Length	Unit	Consistency
1	MS	I	222	Q	310	2	Byte	Unit
2	MS	Q	0	I	13	10	Word	Total length
:								
32								
		Address areas in the DP master CPU		Address areas in the IM 154-8 CPU		These parameters of the address areas must be the same for DP master and DP slave.		

Sample program

Below you will see a small sample program for data exchange between DP master and DP slave. The addresses used in the example are found in the table above.

In the IM 154-8 CPU (DP slave)

```
L     2            //Data preparation in the
                   //DP slave
T     MB   6
L     IB   0
T     MB   7
L     MW   6       //Forward data to DP master
T     PQW  310
```

```
CALL  SFC  14      //Receive data from
                   //DP master
  LADDR:=W#16#D    //In the slave, the
                   //peripheral bytes PEB13
                   //to PEB32 (data
                   //transferred from master)
                   //are read consistently and
                   //stored in MB30 to MB49
  RET_VAL:=MW 20
  RECORD:=P#M30.0 byte 20
L       MB     30    //Received data
                     //continue processing
L       MB     7
+       I
T       MW     100
```

In the DP master CPU

```
L      PIB    222  //continued processing of
                   //received data in DP master
T      MB     50
L      PIB    223
L      B#16#3
+      I
T      MB     51
L      10           //Data preparation in the
                    //DP master
+      3
T      MB     60
CALL   SFC    15   //Send data to DP slave
  LADDR:= W#16#0
  RECORD:=P#M60.0 Byte 20
                    //In the user program for the
                    //master, a block of 20 bytes from
                    //MB60 is consistently written to
                    //the output area PAB0 to PAB19
                    //(transfer area from the master
                    //to the slave)
  RET_VAL:=MW 22
```

Working with transfer memory

Note the following rules when working with the transfer memory:

- Assignment of address areas:
  - Input data of DP slaves is **always** output data of the DP master
  - Output data from the DP slave is **always** input data of the DP master
- The user can define these addresses. In the user program, access data with load/transfer instructions or with SFC 14 and SFC 15. You can also define addresses of the process image of inputs or outputs.
- The lowest address of specific address areas is their respective area start address.
- The length, unit and consistency of the address areas for DP master and DP slave must be identical.
- The addresses for the master and slave may be different, even though the transfer memory is logically the same (mutually independent logical peripheral address areas in the master and slave CPUs).

Of course, only the logical addresses within the slave CPU are assigned when the IM 154-8 CPU is configured in *STEP 7* for use in SIMATIC S5 or third-party systems. It is assigned in the master system using the configuration tool specific to that master system.

Note

Assign addresses from the peripheral address area of the IM 154-8 CPU to the transfer memory.

You must not reassign addresses already assigned to the transfer memory to other I/O modules.

S5 DP master

If you use an IM 308-C as the DP master and the IM 154-8 CPU as a DP slave, the following applies to the exchange of consistent data.

You must program FB192 in the S5 controller with IM 308-C to allow data to be exchanged consistently between the DP master and DP slave. With FB 192, the data from the IM 154-8 CPU is only output or read out in a consistent block.

Transfer of user in STOP mode

The user data in the transfer memory is handled differently according to whether it is the DP master or the DP slave (IM 154-8 CPU) that is in STOP mode.

- The IM 154-8 CPU switches to STOP:

  The data in the IM 154-8 CPU's transfer memories (outputs only from the slave's viewpoint) is overwritten with "0", i.e. the DP master or a recipient in the direct data exchange reads "0".

- The DP master switches to STOP:

  The current data in the IM 154-8 CPU's transfer memory (inputs in the slave, outputs in the master) is retained and can be read in the user program on the IM 154-8 CPU.

PROFIBUS address

For the IM 154-8 CPU (DP CPU), you **must not set "126"** as a PROFIBUS address.

See also

User-oriented addressing of the I/O Modules (Page 101)

7.5.4 Direct data exchange

Requirement

In *STEP 7* V5.x or later you can configure "direct data exchange" for the PROFIBUS nodes. The IM 154-8 CPUs can take part in the direct data exchange as senders and recipients.

Definition

"Direct data exchange" is a special communication relationship between PROFIBUS DP nodes.

Direct data exchange is characterized by the fact that the PROFIBUS DP nodes "listen" on the bus for data that a DP slave returns to its DP master. This mechanism allows the "listening node" (recipient) direct access to deltas of input data of remote DP slaves.

Address Areas

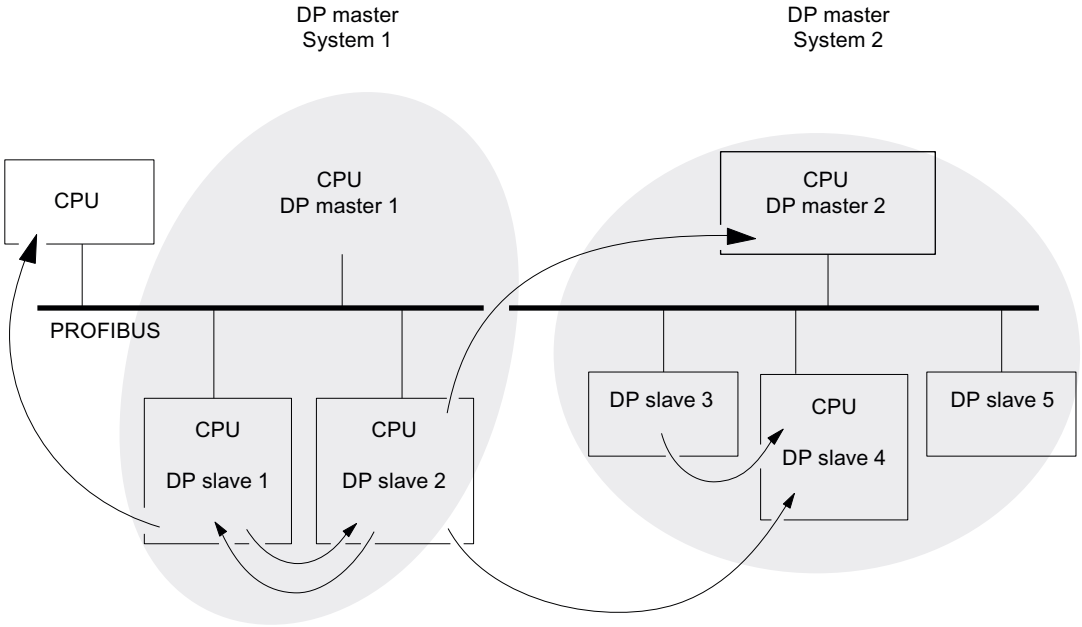
During configuration in *STEP 7*, use the I/O input addresses to specify the address area of the recipient at which the sender's data should be read.

An IM 154-8 CPU may be:

- DP slave sending station
- Receiving station, as DP slave or DP master, or as CPU not integrated in a master system.

Example: Direct data exchange via DP CPUs

The example in the figure below shows the relationships you can configure for direct data exchange. In the picture, the DP masters and DP slaves are all DP CPUs (e.g. including an IM 154-8 CPU). Note that other DP slaves (ET 200M, ET 200X, ET 200S) can only operate as sending node.



7.6 Commissioning PROFINET IO

7.6.1 Requirements for commissioning PROFINET

Requirements

Requirements to be satisfied before you can start to commission your PROFINET IO system:

ET 200pro with	Software required	PROFINET IO system installed
IM 154-8 CPU	*STEP 7* V5.4 or later + Service Pack 1 + HSP	X

PROFINET IO address areas of the IM 154-8 CPU

Table 7-13 PROFINET IO address areas of the IM 154-8 CPU

Address area	IM 154-8 CPU
PROFINET address area, for inputs and outputs	2048 bytes
Number of those in process image for I/Os	Bytes 0 to 2047 (can be set)
	Byte 0 to 127 (preset)

In the input address area, **diagnostic addresses** each take up 1 byte for

- The IO controller
- The PROFINET interface and its ports and each IO device (header module at slot 0)
- Each module / submodule without user data within the device (e.g. ET 200pro power module or ports of the PROFINET interface).

You can use these addresses, for example, to read module-specific diagnostics data records by calling SFB 52. The diagnostic addresses are specified in your configuration. If you do not specify any diagnostic addresses, *STEP 7* assigns these addresses in descending order, starting from the highest byte address.

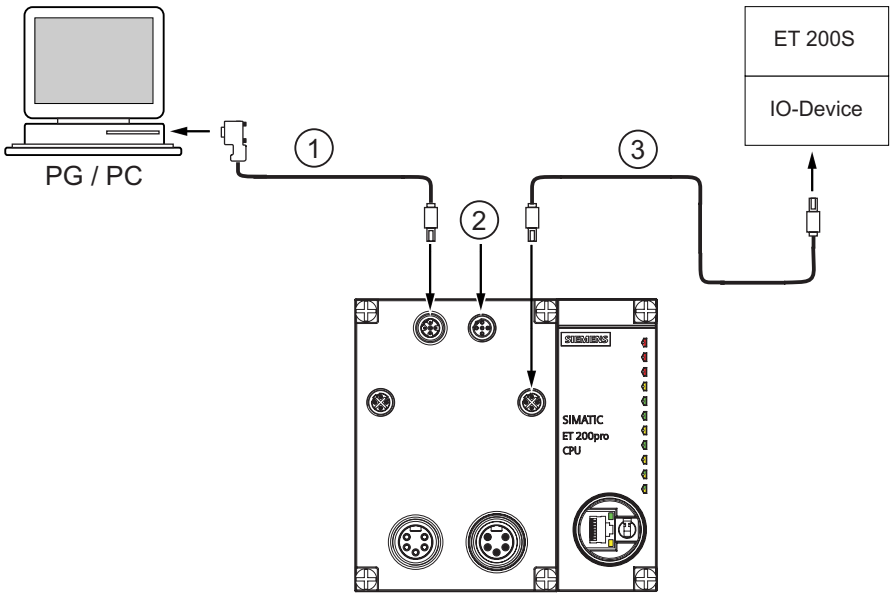
7.6.2 Configuring and commissioning the PROFINET IO system

Overview

There are several ways to start commissioning the PROFINET IO interface of the IM 154-8 CPU, and then the PROFINET IO system:

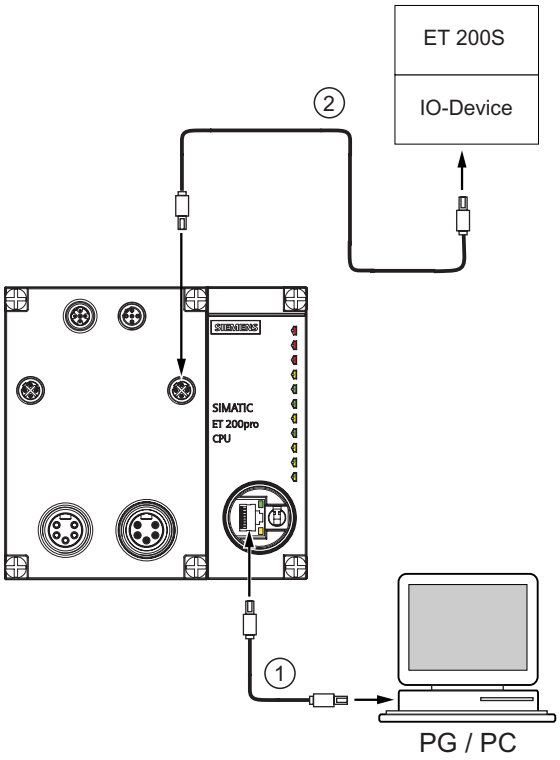
- Online via the MPI / DP interface
- Online via the PN interface
- Offline, by saving the data to a SIMATIC Micro Memory Card in SIMATIC Manager on your programming device, and then inserting the SIMATIC Micro Memory Card into the IM 154-8 CPU

Commissioning a PROFINET IO system via MPI/DP



Code	Meaning
①	Connect the programming device to the integrated MPI / DP interface of your IM 154-8 CPU using a preassembled cable. The following components can be used for the cable: • Bus connector 6ES7972-0BA50-0XA0 • PROFIBUS FC trailing cable 6XV1830-3EH10 • PROFIBUS DP M12 plug connector, socket insert 6GK1905-0EB00 Switch on the terminating resistor in the bus connector on the programming device side.
②	Terminating resistor, male insert 6GK1905-0EC00
③	Connect the integrated PROFINET IO interface of the IM 154-8 CPU to the PROFINET using a preassembled twisted pair cable (e.g. to an ET 200S IO device). The following components can be used for the cable: • PROFINET RJ45 connector 6GK1901-1BB10-2AA0 • PROFINET FC TP standard cable 6XV1840-2AH10 • PROFINET M12 connector, d-coded, 6GK1901-0DB10-6AA0 **Please note:** If the IO device to be connected is an ET 200pro, you can use a pre-assembled PROFINET M12 connecting cable for this connection, e.g. 6XV1870-8AH20.

Commissioning a PROFINET IO system directly via PN interface



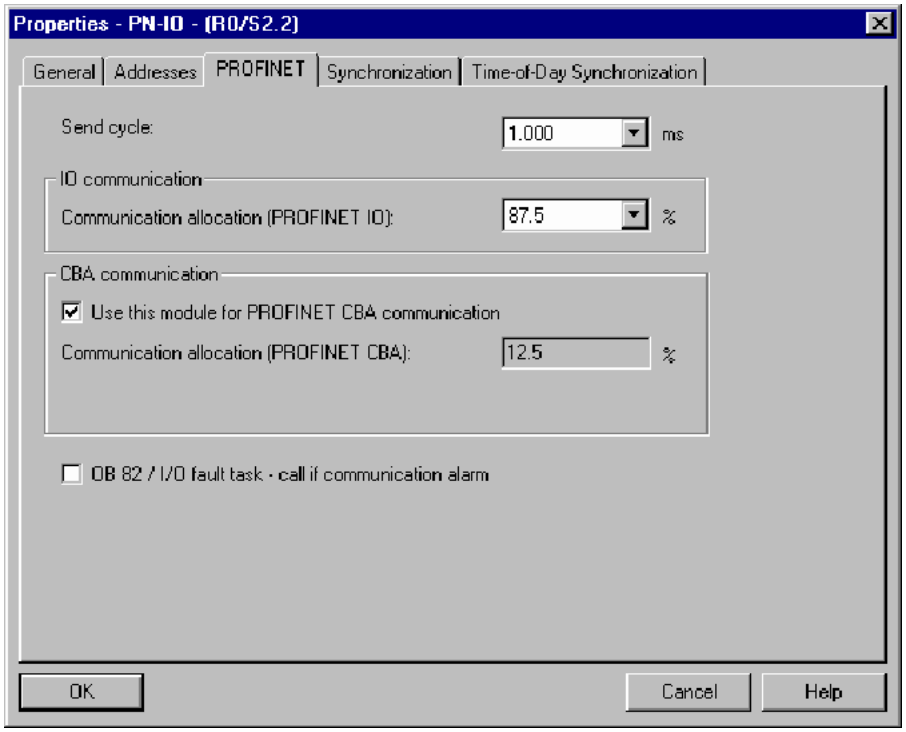
Code	Meaning
①	Connect the programming device/PC to the X02 P3 PROFINET interface of the IM 154-8 CPU using a pre-assembled, uncrossed twisted pair cable.
②	Use a made-up twisted pair cable to connect the IO device (e.g. ET 200S) to the integrated PROFINET interface X02P2 of your IM 154-8 CPU. [1] The following components can be used for the cable: • PROFINET RJ45 connector 6GK1901-1BB10-2AA0 • PROFINET FC TP standard cable 6XV1840-2AH10 • PROFINET M12 connector, d-coded, 6GK1901-0DB10-6AA0 [1] The IO device can also be connected to X02 P1. It is also possible to interpose a switch. **Please note:** If the IO device to be connected is an ET 200pro, you can use a pre-assembled PROFINET M12 connecting cable for this connection, e.g. 6XV1870-8AH20.

Commissioning requirements:

- The IM 154-8 CPU is in STOP mode.
- The IO devices are switched on.
- The PROFINET subnet is installed, and the communication partners (programming device, IO controller, IO devices, for example) are connected to the PROFINET subnet.

Configuring the PROFINET IO system

Step	Activity
Configuring hardware in STEP 7 SIMATIC Manager	
1	Select **File > New...** Enter a name for your project and click on OK to confirm.
2	Select **Insert > Station > SIMATIC 300 Station** to add an S7-300 station.
3	Double-click "Hardware." **Result**: HW Config opens.
4	Insert your IM 154-8 CPU using drag-and-drop. **Result**: The "Properties – Ethernet Interface PN-IO" dialog box opens. The properties of the PROFINET X02 interface are shown on the Parameters tab.
Assigning the IP address	
5	Click "New" on the "Properties – Ethernet Interface PN-IO" dialog box to create a new subnet. **Result**: The "Properties – New Industrial Ethernet Subnet" dialog box opens.
6	Assign a name and confirm with "OK." **Result**: You are back to the "Properties – Ethernet Interface PN-IO" dialog box.
7	Enter the IP address and the subnet mask in the dialog box. This information is available from your network administrator. Note: The worldwide unique MAC address is preset by the manufacturer and cannot be changed.
8	If you setup a connection via router, you must also enter the address of the router. This information is also available from your network administrator.
9	Click "OK" to close the properties dialog box.

Step	Activity
Configuring the PROFINET IO system	
10	Insert the IO devices at the PROFINET IO system, for example, an IM 151-3 PN (ET 200S under PROFINET IO), then configure the slots and set their parameters using drag-and-drop with reference to the physical layout.
11	Select **Edit > Object properties** to assign device names and numbers to the IO devices.
12	If you are running PROFINET IO and PROFINET CBA in parallel, open the Properties dialog for the PROFINET IO system, • Check the "Use this module for PROFINET CBA communication" check box and • Modify the "Communication portion (PROFINET IO)" parameter (e.g. change the communication portion of PROFINET IO to 87.5 %). 
13	Save your configuration with **Station > Save and compile**.

Step	Activity
Configuration Download	
14	Download the configuration to the IM 154-8 CPU. You have three options: • Online via the MPI / DP interface (the programming device and IM 154-8 CPU must be located on the same subnet). When you download the configuration in a system containing several node addresses, select the appropriate MPI or PROFIBUS address for the IM 154-8 CPU (target CPU). • Online via the PN interface. When you download the configuration in a system containing several nodes, select the appropriate IP address for the IM 154-8 CPU. Select the MAC address of the target CPU if the IM 154-8 CPU does not yet have an IP address. In the next dialog box, you can assign the configured IP address to the IM 154-8 CPU. The programming device must be connected to the subnet. The programming device interface must be set to TCP/IP (Auto) mode. Setting in the **IE-PG Access** tab of the interface properties dialog box: **Assign Project-Specific IP Address**. • Offline, by saving the data to a SIMATIC Micro Memory Card in SIMATIC Manager on your programming device, and then inserting the SIMATIC Micro Memory Card into the IM 154-8 CPU
Assigning IO Device Names	
15	**Requirement:** The programming device must be connected to the subnet. The programming device interface must be set to TCP/IP (Auto) mode. Setting in the **IE-PG Access** tab of the interface properties dialog box: **Assign Project-Specific IP Address.** **Procedure:** In online mode, select the various IO devices in HW Config, then select **PLC > Ethernet > Assign Device Name** to assign the corresponding device names. **Note**: The IM 154-8 CPU can only assign the IP address automatically, and thus communicate correctly with the IO device, if you have assigned a device name to the IO device. If the configuration of the IO devices you downloaded to the IM 154-8 CPU actually corresponds to their physical configuration on the subnet, then the IO devices will be addressed by the IM 154-8 CPU, and the BF LED will stop flashing on both the IM 154-8 CPU and the IO device. You can then switch the IM 154-8 CPU to RUN, provided there are no other conditions preventing startup, and the IM 154-8 CPU and IO devices will exchange data (read inputs, write outputs, for example).

Result

You have used *STEP 7* to configure the PROFINET interface of your IM 154-8 CPU and the PROFINET IO system. The IM 154-8 CPU can now be reached by other nodes on your Industrial Ethernet subnet.

Reference

Detailed Information

- About assigning addresses to the PROFINET IO interface and
- Setting the properties of the PROFINET IO interface and the individual ports

can be found in the *STEP 7 online help* and the *PROFINET System Description*.

Starting up the IM 154-8 CPU as an IO controller

During startup, the IM 154-8 CPU checks the preset configuration against the actual configuration

- Of the local I/O,
- Of the distributed I/O on the PROFIBUS DP system, and
- The PROFINET IO system.

The IM 154-8 CPU startup depends on the COY configuration settings made on the **Startup** tab:

Table 7-14 Starting up the IM 1548 CPU as an IO controller

Preset = Actual configuration	**Preset ≠ Actual configuration**	
	Startup permitted if Preset configuration is not the same as the Actual configuration	**Startup not permitted if Preset configuration is not the same as the Actual configuration**
IM 154-8 CPU switches to RUN.	IM 154-8 CPU switches to RUN. After POWER ON, and after the parameter monitoring time has elapsed, the IM 154-8 CPU switches to RUN. The flashing BF-PN LED indicates that at least one IO device cannot be addressed. In this case, check that all IO devices are switched on and correspond to the set configuration. For additional information, read the diagnostics buffer in *STEP 7*.	IM 154-8 CPU does not start up.

Detecting interruptions in the data transfer to the IO device

The following table shows how the IM 154-8 CPU recognizes interruptions in the transfer of data:

Table 7-15 Event recognition by the IM 154-8 CPU as an IO controller

Event	**What happens in the IO controller?**	
	IM 154-8 CPU set to RUN	**IM 154-8 CPU in STOP mode**
Bus interruption (short circuit, connector removed)	• Call to OB 86 with the message **Station failure** (incoming event; diagnostic address of the IO device) • With I/O access: Call to OB 122 (I/O access error)	• The event is written to the diagnostics buffer

Tip:

Always program OB 86 when you commission the IM 154-8 CPU. This allows you to detect and analyze interruptions in the data transfer.

Status/control, programming via PROFINET

As an alternative to the MPI/DP interface, you can program the IM 154-8 CPU or execute the programming device's status and control functions via the PROFINET interface.

If you have not commissioned the PROFINET interface of the IM 154-8 CPU yet, you can connect to the IM 154-8 CPU using its MAC address (see also *Configuring the PROFINET IO System* in the table above).

To do so, use HW Config to download your configuration to the IM 154-8 CPU. Address the IM 154-8 CPU using its MAC address. After you have downloaded the configuration, the IM 154-8 CPU is also assigned the set IP address. With that you can then use all programming device functions, such as download program, status/control etc., on the interface.

Maintenance and service

8

8.1 Overview

For the ET 200pro with IM 154-8 CPU, service and maintenance means

- Backing up the firmware to the SIMATIC Micro Memory Card
- Updating the firmware via the SIMATIC Micro Memory Card
- Updating of the firmware online
- Backing up of project data on a SIMATIC Micro Memory Card
- Replacing the fuse in the IM 154-8 CPU interface module
- Replacing an IM 154-8 CPU

8.2 Backing up firmware on a SIMATIC Micro Memory Card

In which situations should I back up the firmware?

In some cases, we recommend that you back up the firmware on your IM 154-8 CPU:

For example, you might want to replace the IM 154-8 CPU in your system with a IM 154-8 CPU from your inventory. In this case, you should make sure that the IM 154-8 CPU from your inventory has the same firmware that is used in the system.

We also recommend that you create a back-up copy of the firmware for emergency situations.

On which IM 154-8 CPU can you backup the firmware?

You can back up the firmware as of the following IM 154-8 CPU versions:

CPU	Order number	SIMATIC Micro Memory Card required ≥ in MB
IM 154-8 CPU	6ES7154-8AB00-0AB0 or later	4

Backing up the firmware on your IM 154-8 CPU to the SIMATIC Micro Memory Card

Table 8-1 Backing up the firmware to the SIMATIC micro memory card

Step	Action required:	This is what happens on the IM 154-8 CPU:
1.	Switch the IM 154-8 CPU off at the power supply, detach and remove the terminal module. Insert the new SIMATIC Micro Memory Card.	-
2.	Plug in the terminal module and screw in place.	-
3.	Turn the mode selector switch to MRES position and hold it there.	-
4.	Switch supply voltage 1L+ on again and hold the mode selector in the MRES position until ...	... the STOP, RUN and FRCE LEDs start flashing.
5.	Mode selector switch to STOP.	-
6.	Mode selector switch briefly to MRES position, then let it return to STOP.	• The IM 154-8 CPU starts to back up the firmware on the SIMATIC Micro Memory Card. • All LEDs are lit during the backup operation. • The STOP LED flashes when the backup is complete to indicate that the IM 154-8 CPU requires a memory reset.
7.	Switch the IM 154-8 CPU off at the power supply, detach and remove the terminal module. Remove the SIMATIC Micro Memory Card with the backed up firmware.	-

8.3 Updating the firmware

8.3.1 When should you update the IM 154-8 CPU?

After (compatible) functional expansions, or after an enhancement of operating system performance, the firmware of the IM 154-8 CPU interface module should be upgraded (updated) to the latest version.

Where do I get the latest version of the firmware?

You can order the latest firmware (as *.UPD files) from your Siemens partner, or download it from the Siemens Internet homepage:

http://www.siemens.com/automation/service&support

8.3.2 Firmware update using a SIMATIC Micro Memory Card

Table 8-2 Firmware update using a SIMATIC Micro Memory Card

Step	Action required:	This is what happens on the IM 154-8 CPU:
1.	**Recommendation** Before you update the firmware on your IM 154-8 CPU, you should create a backup copy of the "old" firmware on an empty SIMATIC Micro Memory Card. If problems occur during the update, you can simply reload your old firmware from the SIMATIC Micro Memory Card.	
2.	Transfer the update files to a blank SIMATIC Micro Memory Card using *STEP 7* and your programming device.	-
3.	Switch the IM 154-8 CPU off at the power supply, detach and remove the terminal module. Insert the SIMATIC Micro Memory Card containing the firmware update.	-
4.	Plug in the terminal module and screw in place. Switch on power 1L+.	• The IM 154-8 CPU automatically detects the SIMATIC Micro Memory Card with the firmware update and runs the update. • All LEDs are lit during firmware update. • The STOP LED flashes when the firmware update is complete to indicate that the IM 154-8 CPU requires a memory reset.
5.	Switch the IM 154-8 CPU off at the power supply, detach and remove the terminal module. Remove the SIMATIC Micro Memory Card containing the firmware update.	-

8.3.3 Updating the firmware online (via networks)

To update the IM 154-8 CPU firmware, you require the *.UPD files containing the latest FW version.

Requirements

- The firmware can be updated online in *STEP 7* V5.4 or later + SP 1 + HSP.
- The interface module of the station pending a firmware update must be accessible online.
- The files containing the current firmware versions must be available in the file system of your programming device or PC. A folder may contain only the files of one firmware version.

Performing a firmware update

1. Run *STEP 7* and change to HW Config.
2. Open the station containing the IM 154-8 CPU you want to update.
3. Highlight the IM 154-8 CPU.
4. Select **PLC > Update Firmware**.
5. In the **Update Firmware** dialog, select the path to the firmware update files (*.UPD) using the **Browse** button.
6. After you selected a file, the information in the lower fields of the **Update Firmware** dialog box shows you the firmware file and version for the corresponding modules.
7. Click on the **Run** button. *STEP 7* verifies that the selected file can be interpreted by the IM 154-8 CPU and then downloads the file to the interface module. If this requires changing the operating state of the IM 154-8 CPU, you will be asked to perform these tasks in the relevant dialog boxes. The IM 154-8 CPU then automatically updates the firmware.
8. In *STEP 7* (reading the CPU diagnostics buffer), verify that the IM 154-8 CPU can start with the new firmware.

Result

You have updated your IM 154-8 CPU online with a new firmware version.

8.4 Backing up project data on a SIMATIC Micro Memory Card

Function principle

Using the **Save project to Memory Card** and **Fetch project from Memory Card** functions, you can save all project data to a SIMATIC Micro Memory Card, and retrieve these at a later time. For this operation, the SIMATIC Micro Memory Card can be located in a IM 154-8 CPU or in the SIMATIC Micro Memory Card adapter of a programming device or PC.

Project data is compressed before it is saved to a SIMATIC Micro Memory Card, and uncompressed on retrieval.

Note

In addition to project data, you may also have to store your user data on the SIMATIC Micro Memory Card. You should therefore first select a SIMATIC Micro Memory Card with sufficient free memory.

A message warns you if the memory capacity on your SIMATIC Micro Memory Card is insufficient

The volume of project data to be saved corresponds with the size of the project's archive file.

Note

For technical reasons, you can only transfer the entire contents (user program and project data) using the **Save project to memory card** action.

Handling the functions

How you use the **Save project to memory card** / **Retrieve project from memory card** functions depends on the location of the SIMATIC micro memory card:

- If the Micro Memory Card is inserted in the MMC slot, select a project level that is uniquely assigned to the IM 154-8 CPU from the SIMATIC Manager project window (e.g. CPU, program, source or blocks). Select the **Target system > Save project to memory card** or **Target system > Retrieve project from memory card** menu command. All the complete project data is then written to / retrieved from the SIMATIC Micro Memory Card.
- If project data are not available on the currently used programming device (PG/PC), you can select the source CPU via "Available nodes" window. Select **PLC > Show available nodes** to open the "Available nodes" window. Select the connection / IM 154-8 CPU that contains your project data on SIMATIC Micro Memory Card. Now select menu command **Fetch project from Memory Card**.
- If the Micro Memory Card is located in the SIMATIC MMC adapter of a programming device or PC, open the "S7 memory card window" using the **File > S7 Memory Card > Open** menu command. Select the **Target system > Save project to memory card** or **Target system > Retrieve project from memory card** menu command. to open a dialog in which you can select the source or target project.

Note

Project data can generate high data traffic. Especially in RUN mode with read/write access to the IM 154-8 CPU, this can lead to waiting periods of several minutes.

Sample application

When you assign more than one member of your service and maintenance department to perform maintenance tasks on a SIMATIC PLC, it may prove difficult to provide quick access to current configuration data to each staff member.

However, IM 154-8 CPU configuration data available locally on any IM 154-8 CPU that is to be serviced can be accessed by any member of the service department. They can edit this data and then release the updated version to all other personnel.

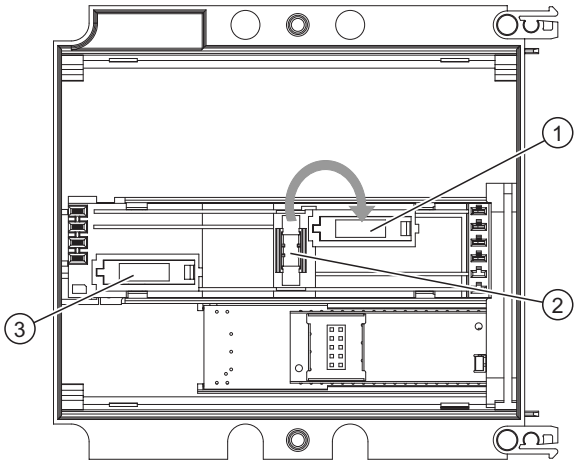
8.5 Replacing the fuse in the IM 154-8 CPU interface module

Introduction

The IM 154-8 CPU has replaceable fuses to protect the ET 200pro:

The bus module of the IM 154-8 CPU interface module contains fuses for the electronic / encoder supply 1L+ and load voltage supply 2L+ (glass tube fuse; 5x20; type 194; 12.5 A; fast-blow), and a replacement fuse.

The figure below shows the fuses in the bus module of the interface module.



① Fuses (with cap) for the load voltage supply 2L+
② Replacement fuse
③ Fuses (with cap) for the electronic / encoder supply 1L+

Requirements

- To replace a fuse, shut down the 1L+ and 2L+ supply voltages, or remove the terminal module from the interface module.
  Result: Failure of the ET 200pro station and all components connected to it (DP slaves, IO devices)
- Always replace fuses with the same type (see the *Accessory order numbers* appendix).

Required tools

- Cross-tip screwdriver, size 2
- Screwdriver with 3 mm blade

Replacing a fuse in the IM 154-8 CPU interface module

1. Loosen the 4 screws on the front panel of the CM IM PN DP M12, 7/8" terminal module using the cross-head screwdriver.
2. Remove the terminal module from the IM 154-8 CPU interface module.
3. Loosen the 2 screws on the front panel of the interface module (top and bottom right) using the cross-head screwdriver.
4. Remove the interface module from the bus module.
5. Remove the fuse cap in the bus module and lever the defective fuse out using the screwdriver.
6. Take the replacement fuse from its holder and install it.
7. Close the fuse cover.
8. Install the interface module and the connection modul.
9. Switch on the power supplies.

See also

Order numbers of accessories (Page 216)

8.6 Replacing the IM 154-8 CPU interface module

Introduction

If the IM 154-8 CPU interface module is defective, you can replace it.

Requirements

- Before you can replace the IM 154-8 CPU interface module, you must first switch off the supply voltages 1L+ and 2L+ on the defective IM 154-8 CPU.
  Consequence: Failure of the ET 200pro station and all components connected to it (DP slaves, IO devices)

Notice

PROFIBUS DP: Removing the terminal module for the interface module (CM IM, etc)

The bus terminator function may fail if you shut down 1L+ at the first and last ET 200pro of a bus segment or remove the terminal module.

Caution

PROFINET IO: Removing the IM 154-8 CPU interface module

If you switch off the 1L+ voltage at an ET 200pro, the integrated switch will also fail. This will interrupt communication with all connected peers (e.g. IO devices or other PROFINET devices) that communicate with one another via this switch.

Required tools

- Cross-tip screwdriver, size 2
- Screwdriver with 3 mm blade

Replacing the IM 154-8 CPU interface module

1. Loosen the 4 screws on the front panel of the CM IM PN DP M12, 7/8" terminal module using the cross-head screwdriver.
2. Remove the terminal module from the IM 154-8 CPU interface module.
3. Remove the SIMATIC Micro Memory Card from the receptacle (see *Inserting/replacing a Micro Memory Card*)
4. Remove the two screws from the front (top and bottom right) of the IM 154-8 CPU using the cross-head screwdriver.
5. Remove the interface module from the bus module.

Note

If the bus module is defective, you must replace it as well. See the *Replacing a bus module* section of the *ET 200pro* operating instructions for information.

6. Remove the two screws from the front (top and bottom right) of the new IM 154-8 CPU using the cross-head screwdriver and remove the interface module from the bus module.
7. Install the new interface module on the bus module.
8. Insert the SIMATIC Micro Memory Card removed from the defective IM 154-8 CPU into the receptacle on the new IM 154-8 CPU.
9. Plug the terminal module into the interface module once more and secure it with the screws.
10. Switch on the power supplies.

IM 154-8 CPU response after replacement

After replacement, the IM 154-8 CPU always automatically resets the memory and remains in STOP mode, regardless of the position of the mode selector. The IM 154-8 CPU can then be switched to RUN once more using the mode selector.

If the IM 154-8 CPU stays in STOP, you can view the cause of error in *STEP 7* (see the *STEP 7* user manual).

See also

Inserting/Replacing a SIMATIC Micro Memory Card (Page 110)

Debugging functions, diagnostics and troubleshooting

9

9.1 Overview

This chapter helps you to get acquainted with tools you can use to carry out the following tasks:

- Hardware/software error diagnostics.
- Elimination of hardware/software errors.
- Testing the hardware/software – for example, during commissioning.

Note

It would go beyond the scope of this manual to provide detailed descriptions of all the tools you can use for diagnostics, testing and troubleshooting functions. Further notes are found in the relevant hardware/software manuals.

9.2 Identification and maintenance data of the IM 154-8 CPU

Definition and properties

Identification and maintenance data (I&M) are data that are stored in a module for assisting you in:

- Checking the system configuration
- Locating hardware changes in a system
- Correcting errors in a system

Identification data (I data) is information regarding the module, like for example, order number and serial number, which are partly also printed on the housing of the module. I data is manufacturer´s information about the module. It is fixed and can only be read.

Maintenance data (M data) is system-specific information, such as the installation location. M data is created during the configuration and written to the module.

I&M data enable modules to be uniquely identified online.

Reading and writing I&M data for the IM 154-8 CPU in *STEP 7*

Read:

- In *STEP 7* the I&M data is displayed under "Module state – IM 154-8 CPU" ("General" and "Identification" tabs) and via "Available nodes" (see *STEP 7* online help).
- In the user program, the I&M data can be read via SFC 51. Specify the required SSL sublist number and the index in the input parameters of the SFC 51 (see table below).
- You can read the I&M data on the "Start" and "Identification" pages using the web server.

Write:

You will always need *STEP 7* HW Config to write the M data for modules.

For example, you can enter the following data during configuration:

- Name of the automation system (device name)

  The device name is assigned when you create the station in SIMATIC Manager. In this case a "SIMATIC 300(1) station is created by default. This name can be changed at any time.

- You can enter the following data in *STEP 7* HW Config on the "General" tab under "CPU Properties":
  - Name of the module

    In this case, HW Config assigns a default name, e.g.IM 154-8 CPU (this can be changed).
  - Higher level designation of the module

    No default setting
  - Location designation of a module

    No default setting

Reading the I&M data from the IM 154-8 CPU with the user program

If you want to read the I&M data from the IM 154-8 CPU in the user program, you must read the associated system state list, specifying the relevant SSL ID and the index using SFC 51. The SSL IDs and the associated indexes are listed in the following table.

SSL sublists with I&M data

The I&M data can be found in the following SSL sublists under the specified indexes.

Table 9-1 SSL sublists with I&M data

SSL ID W#16#…	Index W#16#…	Meaning
Module identification		
0111		an identification data record
	0001	Identification of the module This contains the module's order number and the product version.
	0006	Identification of the basic software Provides information on the software version of the module. (The IM 154-8 CPU has no basic software so, in this case, the identification data is the same as index 0001).
	0007	Identification of the basic firmware Provides information on the firmware version of the module.
Identification of a component		
011C		Identification of a component
	0001	Name of the automation system The name of the automation system (device name) is saved to this parameter.
	0002	Name of the module The name of the module is saved to this parameter.
	0003	Higher level designation of the module This is a system-wide unique identifier for the module.
	000B	Location designation of a module This is the module's installation location.

For detailed information on the structure and content of the system state lists, see the *System and Standard Functions for S7-300/400* reference manual.

Additional information reading the SSL with SFC 51 can be found in the *System and Standard Functions for S7-300/400* reference manual, or in the *STEP 7 Online Help*.

I&M data for the connected I/O devices

Information about the I&M data for the I/O devices connected to the IM 154-8 CPU can be found in the relevant I/O module manuals.

9.3 Debugging functions

9.3.1 Overview: Debugging functions

Determining addressed nodes with "Node flashing test"

To identify the addressed node, select **PLC > Diagnostics/Setting > Node/Flashing Test** in *STEP 7*.

A dialog appears in which you can set the flashing time and start the flashing test. The directly connected node can be identified by a flashing FRCE LED. The flashing test cannot be performed if the FORCE function is active.

Debugging functions of the software: Monitoring and modifying variables, stepping mode

STEP 7 offers you the following testing functions that you can also use for diagnostics:

- Monitoring and modifying variables

  Can be used to monitor the current values of individual variables of a user program or an IM 154-8 CPU on the programming device / PC. You can also assign constant values to the variables.

- Testing with program status

  You can test your program by viewing the program status of each function (result of logical links, status bit) or the data of specific registers in real-time mode.

  If you have selected the LAD programming language to be represented in *STEP 7*, the color of the symbol will indicate a closed switch or an active circuit, for example.

Note

The *STEP 7* testing function with program status extends the IM 154-8 CPU's cycle time. *STEP 7* allows you to set a maximum permitted increase in the cycle time. To do this you have to set process mode in the CPU parameters in *STEP 7*.

- Stepping mode

  When testing in single-step mode, you can process your program instructions in sequence (= single-step) and set break points. This is only possible in testing mode and not in process mode.

Debugging functions of the software: Forcing variables

The Force function can be used to assign the variables of a user program or IM 154-8 CPU (also: inputs and outputs) constant values which can not be overwritten by the user program.

For example, you can use it to jumper sensors or switch outputs permanently, irrespective of the user program.

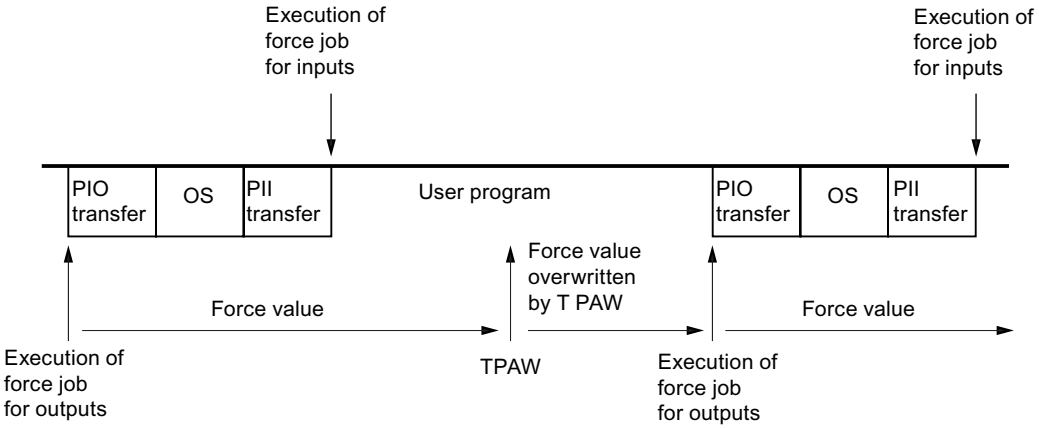
Danger

This could result in severe injury or even death, and damage to property.
Incorrect use of the Force function could result in death or severe injury, and damage to machinery or even the entire plant. Always follow the safety instructions in the *STEP 7 manuals*.

Danger

Forcing with the IM 154-8 CPU
The force values in the process **input** image can be overwritten by write commands (such as T IB x, = I x.y, Copy with SFC, etc.) and by read I/O commands (such as L PIW x) in the user program, or by write programming device / OP functions! **Outputs** initialized with forced values only return the forced value if not accessed by the user program via I/O write instructions (TPQB x, for example) or by programming device / OP write functions!
Always ensure that forced values in the I/O process image cannot be overwritten by the user program or programming device / OP functions!

On the IM 154-8 CPU, forcing corresponds to "cyclical control"



OS: Operating system processing

Figure 9-1 How forcing works with the IM 154-8 CPU

The differences between forcing and modifying variables

Table 9-2 The differences between forcing and modifying variables

Characteristics/function	Forcing	Modifying Variables
Memory bit (M)	-	Yes
Timers and counters (T, C)	-	Yes
Data blocks (DB)	-	Yes
Inputs and outputs (I, O)	Yes	Yes
Peripheral inputs (PI)	-	-
Peripheral outputs (PO)	-	Yes
User program can overwrite modify/force values	Yes	Yes
Maximum number of force values	10	-

Reference

A detailed description of the software testing functions can be found in the *STEP 7 Online Help* and *STEP 7 Programming Manual*.

9.3.2 Overview: Diagnostics

Introduction

System errors can occur especially in the commissioning phase. Tracking these errors might be a time-consuming effort, since they can occur both on the hardware and software side. The many different testing functions ensure that commissioning runs smoothly.

Note

Errors during **operation** are almost always a result of faults or damage to the hardware.

Type of error

Errors that the IM 154-8 CPU can recognize and to which you can respond with organization blocks (OBs) can be split into the following categories:

- Synchronous error: Errors you can relate to a specific point in the user program (error when accessing an I/O module, for example).
- Asynchronous error: Errors you can **not** relate to a specific point in the user program (cycle time exceeded, module error, for example).

Troubleshooting

Programming with foresight and, above all, knowledge and proper handling of diagnostic tools puts you into an advantageous position in error situations:

- You can reduce the effects of errors.
- It makes it easier for you to locate errors (by programming error OBs, for example).
- You can limit downtimes.

Diagnostics with LED display

The SIMATIC hardware of the distributed I/Os offers diagnostics with LEDs.

These LEDs are implemented in three colors:

LED color	State of the IM 154-8 CPU
Green	Regular operation. Example: Power is on.
Yellow	Non-regular operating status. Example: Forcing is active.
Red	Fault. Example: Bus error
LED flashing	Special event Example: Memory reset

The LEDs for the PROFINET interface ports are of the following colors:

LED color [1]	State	Meaning
Green	Off	No other device is connected to the corresponding port of the integrated PROFINET interface of the IM 154-8 CPU.
	On	Another PROFINET device (such as a switch) is connected at the corresponding port of the integrated PROFINET interface of the IM 154-8 CPU and the physical connection has been established.
Yellow	Off	No activity: No data is transferred via the corresponding port of the integrated PROFINET interface of the IM 154-8 CPU.
	On	Activity: Data is transferred via the corresponding port of the integrated PROFINET interface of the IM 154-8 CPU. Note: The LED flickers when small data volumes are transferred.
[1] There is only one LED for ports 1 and 2. This lights up in the appropriate color.		

Reference

Notes on diagnosing suitable I/O modules can be found in the *ET 200pro* operating instructions.

Diagnostic buffer

If an error occurs, the IM 154-8 CPU writes the cause of error to the diagnostic buffer. In *STEP 7* you use the programming device to read the diagnostic buffer. This location holds error information in plain text.

Modules with diagnostics capability that do not have their own diagnostic buffer write their error information to the IM 154-8 CPU's diagnostic buffer.

When an error or an interrupt event occurs, (e.g. time-of-day interrupt), the IM 154-8 CPU switches to STOP mode, or you can respond in the user program via error/interrupt OBs. This would be OB82 in the above example.

Diagnostics of field devices on PROFINET

For additional information, refer to the *PROFINET System Description* and to the *From PROFIBUS DP to PROFINET IO* Programming Manual.

Diagnostics with system functions

On the IM 154-8 CPU, we recommend that you use the more user-friendly **SFB 54** RALRM (called in diagnostic OB 82) to evaluate the diagnostics from I/O modules or DP slaves:

Further options for diagnostics with system functions are listed below:

- Using **SFC 51** "RDSYSST" to read an SSL sublist or an extract thereof.
- Reading the diagnostic data (slave diagnostics) of a DP slave, using **SFC 13** "DPNRM_DG"

  Every DP slave provides slave diagnostic data according to EN 50170 Volume 2, PROFIBUS. You can use SFC 13 "DPNRM_DG" to read this diagnostic data. Error information is stored in hex code. Refer to the relevant module manual for information on the meaning of the read code.

  For example, the entry of the value 50H (= dual 0101 0000) in byte 7 of the slave diagnostics for the distributed I/O module ET 200B indicates a faulty fuse or missing load voltage in channel group 2 and 3.
- Reading a data record with **SFB 52** "RDREC"

  You can use SFB 52 "RDREC" (read record) to read a specific data record from the addressed module. Data records 0 and 1 are especially suitable for reading diagnostic information from a diagnosable module.

  Data record 0 contains 4 bytes of diagnostic data that indicates the current state of a module. Data record 1 contains the 4 bytes of diagnostic data also stored in data record 0, plus module-specific diagnostic data.
- Reading the start information of the current OB using **SFC 6** "RD_SINFO"

Information about the error can also be found in the start information of the relevant error OB.

You can use SFC 6 "RD_SINFO" (read start information) to read the start information of the OB that was last called and not yet processed completely, and of the startup OB that was last called.

- Triggering detection of the bus topology in a DP master system with **SFC 103** "DP_TOPOL"

  The diagnostic repeater makes it easier to identify faulty modules or an interruption on the DP cable when a fault occurs during operation. The repeater acts as a slave and is able to determine the topology of a DP segment and log faults on the basis of this topology.

  You can use SFC103 "DP_TOPOL" to trigger the identification of the bus topology of a DP master system by the diagnostic repeater. SFC 103 is described in the *STEP 7 online help* and in the *System and Standard Functions for S7-300/400* reference manual. The diagnostic repeater is described in the *Diagnostic Repeater for PROFIBUS DP* manual, order number 6ES7972-0AB00-8BA0.

9.3.3 Diagnostic functions available in STEP 7

Diagnosing with the "Diagnosing hardware" function"

Locate the cause of a module error by viewing the online information on the module. You can locate the cause of an error in the user program cycle with the help of the diagnostic buffer and of the stack content. You can also check whether a user program will run on a specific IM 154-8 CPU.

Hardware diagnostics give you an overview of the PLC status. In an overview representation, a symbol can display the error status of every module. A double-click on the faulty module opens detailed error information. The scope of this information depends on the specific module. You can view the following information:

- General information about the module (e.g. order number, version, designation) and state of the module (e.g. faulty).
- Module errors (channel errors, for example) in centralized I/O modules and PROFIBUS DP slaves or PROFINET IO devices.
- Display of messages from the diagnostic buffer.
- Diagnostic data about the PROFINET interface and its ports is also available (e.g. network connection, communication diagnostics and statistics).

For the IM 154-8 CPU, you can also view the following information about the module states:

- Cause of an error in the user program cycle.
- Indication of the cycle time (longest, shortest and last cycle).
- Options and utilization of MPI communication.
- Performance data (number of possible inputs and outputs, memory bits, counters, timers and blocks).

For complete and current details of diagnostic functions in *STEP 7* and specific procedures, refer to the *Programming with STEP 7* manual and the *STEP 7 Online Help*.

9.3.4 Network infrastructure diagnostics (SNMP)

Availability

As an open standard, you can use any systems or software solutions for diagnostics based on SNMP in PROFINET.

Network Diagnostics

SNMP (Simple Network Management Protocol) makes use of the wireless UDP transport protocol. It consists of two network components, similar to the client/server model. The SNMP manager monitors the network nodes and the SNMP agents collect the various network-specific information in the individual network nodes and stores it in a structured form in the **MIB** (Management Information Base). This information allows a network management system to run detailed network diagnostics.

Detecting the network topology

LLDP (Link Layer Discovery Protocol) is a protocol that is used to detect the closest neighbors. It enables a device to send information about itself and to save information received from neighboring devices in the LLDP MIB. This information can be looked up via the SNMP. This information allows a network management system to determine the network topology.

Integration in *STEP 7*

Configuration of the OPC server is integrated into *STEP 7* HW Config. Stations that have already been configured in the *STEP 7* project can be transferred directly. As an alternative to *STEP 7*, the configuration can also be run with the NCM PC (included on the SIMATIC NET CD) or can be determined automatically and transferred to the project configuration.

No *STEP 7* connection is needed for network management with the SNMP protocol.

Use of SNMP in the SIMATIC NET environment

SNMP-compliant devices from the SIMATIC NET family can be monitored and operated via a conventional standard Internet browser. The management system known as web-based management offers a range of device-specific information (network statistics, status of redundant supply, for example).

Diagnostics with the SIMATIC NET SNMP OPC server

The SNMP OPC server software provides diagnostics and parameter assignments for all SNMP devices. The OPC server uses the SNMP protocol to exchange data with these devices.

All information can be integrated into OPC-compatible systems, into the WinCC HMI system for example. This enables process and network diagnostics to be combined in the HMI system.

Uses of SNMP

SNMP can be used as follows:

- By users to integrate network diagnostics into a central HMI/SCADA system using the SNMP OPC server.
- By the IT administrators of machine and system operators to monitor their Industrial Ethernet network using standard network management systems.
- By the IT administrators to primarily monitor the office network, but often also the automation network using standard network management systems (for example, HP Openview).

Additional information

Information relating to SNMP in the network management standardization group can be found at http://www.profibus.com.

Additional details about SNMP can be found at http://www.snmp.org.

Additional information about the SNMP OPC server can be found at http://www.siemens.com/snmp-opc-server.

The *PROFINET system description* contains additional information about the SNMP communication service and diagnostics with SNMP.

9.4 Diagnostics using status and error LEDs

9.4.1 Introduction

Diagnostics with LEDs is an initial tool for error localization. Usually, you evaluate the diagnostic buffer for further error localization.

The buffer contains plain text information on the error that has occurred. For example, you will find the number of the appropriate error OB here. If you generate this error OB, you can prevent the IM 154-8 CPU switching to STOP mode.

9.4.2 Status and error displays on the IM 154-8 CPU

Table 9-3 Status and error displays on the IM 154-8 CPU

LED					Meaning
SF	**ON**	**FRCE**	**RUN**	**STOP**	
Off	Off	Off	Off	Off	The IM 154-8 CPU has no power supply. To correct or avoid error: Check whether the power supply module is connected to mains and switched on.
Off	On	X	Off	On	The IM 154-8 CPU is in STOP mode. To correct or avoid error: Start the IM 154-8 CPU.
On	On	X	Off	On	The IM 154-8 CPU is in STOP mode as a result of error. To correct or avoid error: refer to the tables below, evaluation of the SF LED
X	On	X	Off	Flashes (0.5 Hz)	The IM 154-8 CPU requests a memory reset.
X	On	X	Off	Flashes (2 Hz)	The IM 154-8 CPU carries out the memory reset.
X	On	X	Flashes (2 Hz)	On	The IM 154-8 CPU is starting up.
X	On	X	Flashes (0.5 Hz)	On	The IM 154-8 CPU was paused by a programmed break point. For details, refer to the Programming Manual *Programming with STEP 7* .
On	On	X	X	X	Hardware or software error To correct or avoid error: refer to the tables below, evaluation of the SF LED
X	X	On	X	X	You enabled the Force function For details, refer to the Programming Manual *Programming with STEP 7*.
X	X	Flashes (2 Hz)	X	X	Node flashing test was activated.
Flashes	Flashes	Flashes	Flashes	Flashes	Your IM 154-8 CPU has an internal system error. The procedure is as follows: 1. Set the mode selector switch to STOP. 2. Switch the supply voltage 1L+ off and on again. 3. Read the diagnostics buffer with *STEP 7*. 4. Contact your local SIEMENS partner.
X = This state is irrelevant for the current IM 154-8 CPU function.					

DC 24V status indicator

The DC 24V LED lights up green to indicate the presence of the 2L+ load voltage supply. If the LED is not lit, check the state of power supply or of the fuse.

Maintenance information MAINT

The MAINT LED lights up yellow when there is maintenance information from PROFINET available. Maintenance information may indicate maintenance required or maintenance requested. An alarm message is generated in addition to the LED display.

Reference

A detailed description of the OBs and on SFCs required for their evaluation can be found in the *STEP 7 Online Help* and in the *S7-300/400 System and Standard Functions* reference manual.

9.4.3 Evaluating the SF LED in case of software errors

Table 9-4 Evaluation of the SF LED (software error)

Possible error	Response by the IM 154-8 CPU	Possible Remedies
TOD interrupt is enabled and triggered. However, a matching block is not loaded. (Software/configuration error)	Call OB 85. The IM 154-8 CPU STOPs if OB 85 is not loaded.	Load OB 10 (OB number can be seen from the diagnostic buffer).
Start time of the enabled TOD interrupt was jumped, e.g. by advancing the internal clock.	Call OB 80. The IM 154-8 CPU STOPs if OB 80 is not loaded.	Disable the TOD interrupt before you set the time-of-day with SFC 29.
Delay interrupt triggered by SFC 32. However, a matching block is not loaded. (Software/configuration error)	Call OB85. The IM 154-8 CPU STOPs if OB85 is not loaded.	Load OB 20 (OB number can be seen from the diagnostic buffer).
Process interrupt is enabled and triggered. However, a matching block is not loaded. (Software/configuration error)	Call OB85. The IM 154-8 CPU STOPs if OB85 is not loaded.	Load OB 40 (OB number can be seen from the diagnostic buffer).
Status alarm is generated, but the appropriate OB55 is not loaded.	Call OB85. The IM 154-8 CPU STOPs if OB85 is not loaded.	Load OB55
Update alarm is generated, but the appropriate OB 56 is not loaded.	Call OB85. The IM 154-8 CPU STOPs if OB85 is not loaded.	Load OB56
Vendor-specific alarm is generated, but the appropriate OB57 is not loaded.	Call OB85. The IM 154-8 CPU STOPs if OB85 is not loaded.	Load OB57
Access to missing or defective I/O module when the process image is updated (software or hardware error)	Call OB 85 (depending on the parameter settings in HW Config). The IM 154-8 CPU STOPs if OB 85 is not loaded.	Load OB 85. The start information of the OB contains the address of the relevant I/O module. Replace the affected I/O module or eliminate the program error.

Possible error	Response by the IM 154-8 CPU	Possible Remedies
The cycle time was exceeded. Probably too many interrupt OBs called simultaneously.	Call OB 80. The IM 154-8 CPU STOPs if OB 80 is not loaded. The IM 154-8 CPU switches to STOP even though OB 80 is loaded if twice the cycle time was exceeded without the cycle time being triggered again.	Extending the cycle time (*STEP 7* – Hardware configuration), changing the program structure. To correct or avoid error: If necessary, retrigger cycle time monitoring by calling SFC 43
Programming error • Block not loaded • Wrong block number • Wrong timer/counter number • Read/write access to wrong area • etc.	Call OB 121. The IM 154-8 CPU STOPs if OB 121 is not loaded.	Eliminate the programming error. The *STEP 7* testing function helps you to locate the error.
I/O access errors An error has occurred when I/O module data was accessed	Call OB122. The IM 154-8 CPU STOPs if OB 122 is not loaded.	Check the I/O module addressing in HW Config and identify whether a I/O module / DP slave has failed.
Global data communication error, e.g. insufficient length of the DB for global data communication.	Call OB 87. The IM 154-8 CPU STOPs if OB 87 is not loaded.	Check global data communication in *STEP 7*. If required, correct the DB size.

Tip:

- You can use SFC 39 to disable all interrupts and asynchronous error events.
- You can set the times in the cyclic interrupt OB32 and OB35, starting from 1 ms.

Note

The shorter the selected cyclic interrupt period, the more likely it is that cyclic interrupt errors will occur. You must take into account the operating system times of the IM 154-8 CPU, the user program runtime and extension of the cycle time by active programming device functions, for example.

Reference

A detailed description of the OBs and on SFCs required for their evaluation can be found in the *STEP 7 Online Help* and in the *S7-300/400 System and Standard Functions* reference manual.

9.4.4 Evaluating the SF LED in case of hardware errors

Table 9-5 Evaluating the SF LED (hardware error)

Possible error	Response by the IM 154-8 CPU	Possible Remedies
A centralized I/O module was removed or inserted while the system was in RUN mode.	Call OB 83. The IM 154-8 CPU STOPs if OB 83 is not loaded. If more than one module is removed, the IM 154-8 CPU always STOPs.	Load OB 83.
A distributed module was removed from or inserted on the PROFIBUS DP while the system was in RUN mode.	Call OB 86. The IM 154-8 CPU STOPs if OB 86 is not loaded. If the module was integrated using a GSD file: Call OB82. The IM 154-8 CPU STOPs if OB 82 is not loaded.	Load OB86 or OB82.
A distributed module was removed or inserted on PROFINET IO while the system was in RUN.	Call OB 83. The IM 154-8 CPU STOPs if OB 83 is not loaded. OB 86 is also called when one or more modules of an ET 200S (IO device) are removed or inserted while the system is in RUN. The IM 154-8 CPU STOPs if OB 86 is not loaded.	Load OB 83 and OB 86.
An I/O module with diagnostic capability reports a diagnostic interrupt.	Call OB 82. The IM 154-8 CPU STOPs if OB 82 is not loaded.	Response to the diagnostic event, which depends on the parameter assignments for the I/O module.
Attempt to access a missing or faulty I/O module. Loose connector (software or hardware error).	Call of OB85, if access was attempted during update of the process image (OB 85 call must be enabled accordingly in the parameters). Call OB 122 for direct I/O access. The IM 154-8 CPU STOPs if the OB is not loaded.	Load OB 85 or OB 122. The start information of the OB contains the address of the relevant I/O module. Replace the relevant I/O module, fix the connector or eliminate the program error.
SIMATIC Micro Memory Card is faulty.	The IM 154-8 CPU STOPs and requests a memory reset.	Replace the SIMATIC Micro Memory Card, reset the IM 154-8 CPU memory, transfer the program again, then set the IM 154-8 CPU to RUN mode.

Reference

A detailed description of the OBs and on SFCs required for their evaluation can be found in the *STEP 7 Online Help* and in the *S7-300/400 System and Standard Functions* reference manual.

9.4.5 Status and error displays for the DP interface

Explanation of the BF-DP LED

Table 9-6 BF-DP LED

Meaning			
SF	**ON**	**BF-DP**	
On	On	On/flashes	PROFIBUS DP interface error. To correct or avoid error: See the tables below

Table 9-7 BF-DP LED lights up

Possible error	Response by the IM 154-8 CPU	Possible remedies
• Bus fault (hardware fault). • DP interface error. • Different transmission rates in multiple DP master mode. • If the DP slave / master interface is active: short-circuit on the bus. • With passive DP slave interface: transmission rate search, i.e. there are no other active nodes on the bus (a master, for example)	Call OB 86 (if the IM 154-8 CPU is in RUN mode). The IM 154-8 CPU STOPs if OB86 is not loaded.	• Check the bus cable for short-circuit or breaks. • Analyze the diagnostic data. Edit the configuration.

Table 9-8 BF-DP LED flashes

Possible error	Response by the IM 154-8 CPU	Possible remedies
The IM 154-8 CPU is the DP master: • Failure of a connected station • At least one of the configured slaves cannot be accessed. • Bad engineering configuration	Call OB 86 (if the IM 154-8 CPU is in RUN mode). The IM 154-8 CPU STOPs if OB86 is not loaded.	Check that the bus cable is connected to the IM 154-8 CPU and that the bus is not interrupted. Wait until the IM 154-8 CPU has powered up. If the LED does not stop flashing, check the DP slaves or evaluate the diagnostic data for the DP slaves.
The IM 154-8 CPU is the active DP slave: Possible causes: • The response monitoring time has expired. • Bus communication via PROFIBUS DP has been interrupted. • Wrong PROFIBUS address. • Bad engineering configuration	Call OB 86 (if the IM 154-8 CPU is in RUN mode). The IM 154-8 CPU STOPs if OB86 is not loaded.	• Check the IM 154-8 CPU. • Verify that the bus connector is properly seated. • Check if the bus cable to the DP master is interrupted. • Check the configuration and parameter settings.

Reference

A detailed description of the OBs and on SFCs required for their evaluation can be found in the *STEP 7 Online Help* and in the *S7-300/400 System and Standard Functions* reference manual.

9.4.6 Status and error displays for the PN interface

Status and Error Indicators: PROFINET devices

Note

For ports 1 and 2, the LINK and RX/TX indicators are combined in the P1 and P2 LEDs. If the LED lights up green, this signals that there is a connection with a communication peer on the Ethernet. If there is also active data traffic via this port, then the LED color changes to yellow. If there is little data traffic, the LED can also flicker green and yellow.

Port 3 has a green and a yellow LED at the RJ45 socket.

LED		LED status	Description of the status
P1, P2	Green = LINK	Lit	There is an Ethernet connection between the allocated port of the PROFINET interface of your PROFINET device and a communication peer on the Ethernet (a switch, for example).
		Flashes	The user has activated flashing from *STEP 7*.
		Does not light up	There is no Ethernet connection between the allocated port of the PROFINET interface of your PROFINET device and a communication peer on the Ethernet.
	Yellow = RX/TX	Flickers	There is currently data being received from a communication peer on the Ethernet via the allocated port of the PROFINET interface of the PROFINET device.
		Does not light up	No data is currently being received / sent via the allocated port of the PROFINET interface.
BF-PN		lit[1]	Error at the PROFINET interface, communication is no longer possible To correct or avoid error: See the table below
		Flashes	Error at the PROFINET interface (for example, due to CPU stop in one or more IO devices) To correct or avoid error: See the table below
		Does not light up	No error at the PROFINET interface
[1] The BF-PN LED only lights up if a PROFINET IO system is configured. If the BF-PN LEDs do not light up because the PROFINET interface is not used, for example, then the PROFINET IO system must be separated or deleted from the configuration in HW Config.			

Remedy for errors at the PROFINET interface - BF-PN LED lights up

Table 9-9 BF-PN LED lights up

Possible error	Response with reference to an IM 154-8 CPU	Possible remedies
• Bus fault (no cable connection to a subnet/switch) • Wrong transmission speed • Full duplex mode not set	Call OB 86 (if the IM 154-8 CPU is in RUN mode). The IM 154-8 CPU STOPs if OB86 is not loaded.	• Check the bus cable for a short-circuit or break. • Check whether the IM 154-8 CPU is connected to a switch and not to a hub. • Check that data are being transmitted at 100 Mbps and in full duplex mode. • Analyze the diagnostic data. Edit the configuration.

Remedy for errors at the PROFINET interface of an IO controller - BF-PN LED flashes

Table 9-10 BF-PN LED flashes with a PROFINET IO controller

Possible error	Response with reference to an IM 154-8 CPU	Possible remedies
• Failure of a connected IO device • At least one of the assigned IO devices cannot be addressed • Bad engineering configuration	Call OB 86 (if the IM 154-8 CPU is in RUN mode). The IM 154-8 CPU STOPs if OB86 is not loaded.	• Check whether the Ethernet cable is connected to the IM 154-8 CPU and that the bus is not interrupted. • Wait until the IM 154-8 CPU has powered up. If the LED does not stop flashing, check the IO devices or evaluate their diagnostic information. • Check whether the configured device name matches its actually assigned name. • Check whether the connected IO devices have different device names and IP addresses.

Remedy for errors at the PROFINET interface of an IO controller - BF LED flashes

Table 9-11 BF LED flashes with a PROFINET IO device

Possible error	Possible remedies
• Wrong IP address • Bad engineering configuration • Wrong parameter assignment • IO controller not found / switched off, but there is an Ethernet connection. • Bad or no device name • The response monitoring time has expired.	• Check that the Ethernet cable is correctly connected. • Check whether the Ethernet cable to the controller is interrupted. • Check the configuration and parameter settings. • On the IO device: Switch on the IO controller. • Check whether the expected configuration matches the actual configuration. • Check the physical communication connection for interruption

Tip: Identification of the PROFINET device in the control cabinet

PROFINET IO devices must be assigned a device name when they are started for the first time. In *STEP 7* HW Config, you can make the LINK LED of the PROFINET IO device to be assigned a name flash using **PLC > Ethernet > Assign device name**. This allows you, for example, to clearly identify the PROFINET IO device among several identical devices in a cubicle.

9.5 Diagnostics for the integrated power module

The IM 154-8 CPU interface module has an integrated power module for the load voltage supply 2L+ for the centrally connected ET 200pro modules. This means that an external power module is not essential if you want to add an ET 200pro.

Parameterization of the diagnostics

You can use the "Diagnostics: No load voltage" parameter in HW Config to enable or disable diagnostics for the integrated power module of the IM 154-8 CPU. Diagnostics is disabled by default.

If the IM 154-8 CPU is in RUN mode and load voltage diagnostics has been enabled, then a suitable diagnostic buffer entry is generated and diagnostic interrupt OB 82 is called when the load voltage supply 2L+ fails or returns. If OB 82 is not loaded, the IM 154-8 CPU STOPs.

In addition to this diagnostic information, you can also read diagnostic data record 1 in the user program using SFB 52 "RDREC" (specifying the diagnostic address of the integrated power module).

The structure of this diagnostic data record is described below.

Structure of the diagnostic data record 1

Note

The first 4 bytes correspond to diagnostic data record 0 which is also saved in the start info of OB 82, for example.

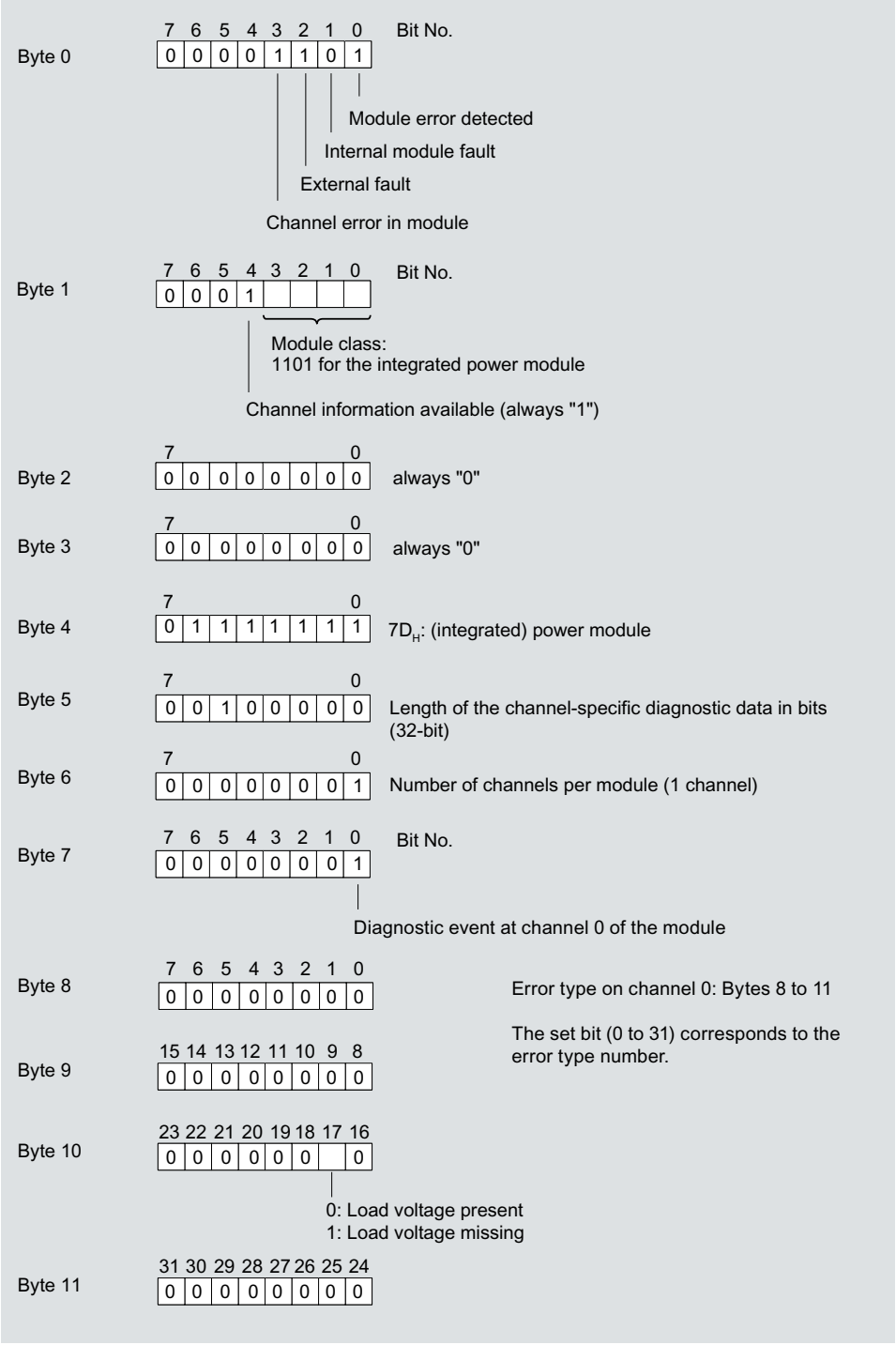


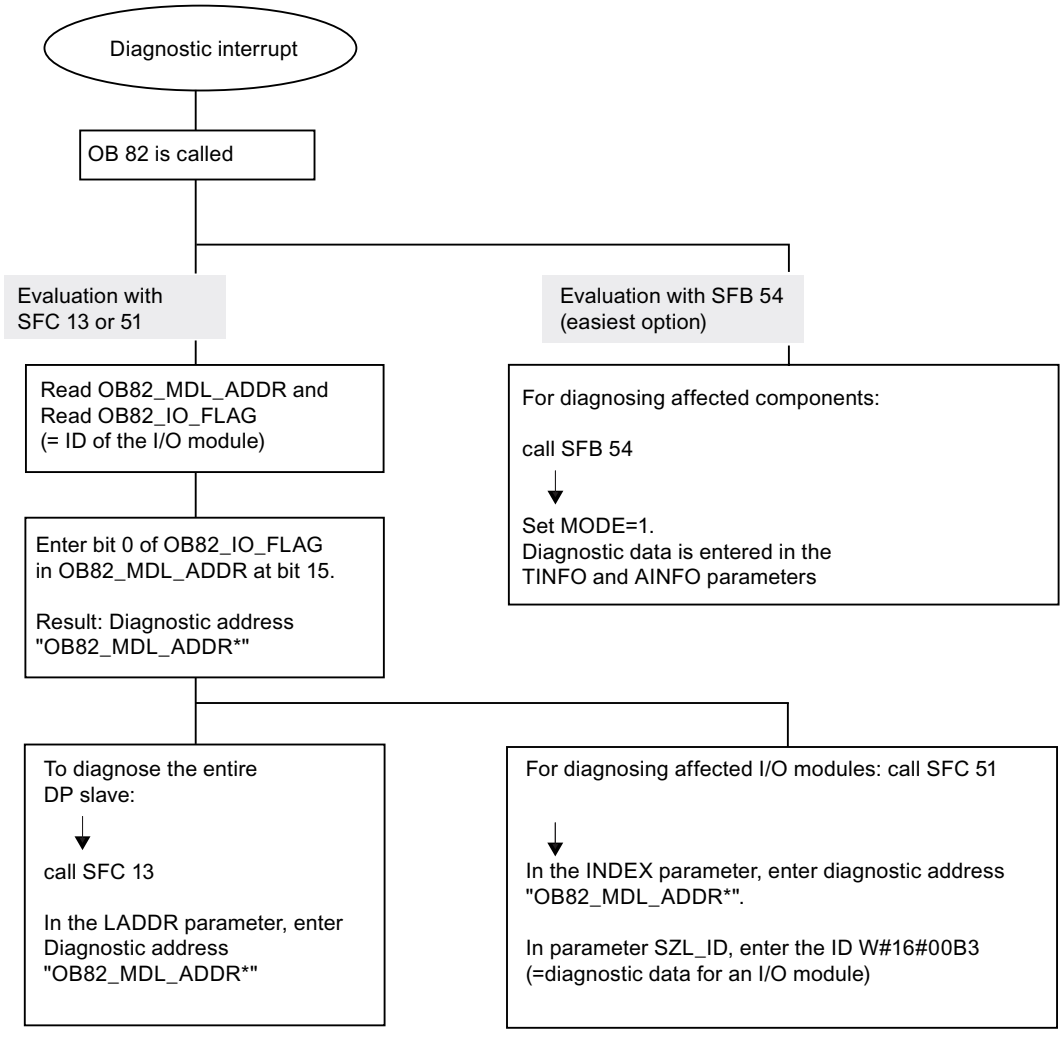
Figure 9-2 Diagnostic data record 1 of the integrated power module (bytes 0 to 11)

9.6 Diagnostics on the PROFIBUS DP

9.6.1 Diagnosing the IM 154-8 CPU as the DP master

Evaluate diagnostics in the user program

The figure below illustrates the procedure for evaluating diagnostics data in the user program.

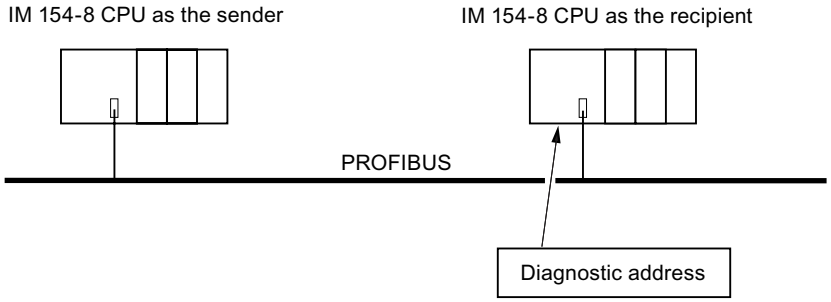


Note:
SFC 13 is asynchronous, which means that it may be called multiple times until its state has changed to BUSY=0.

Initial call in OB 82,
execution completed in the cycle

Diagnostic addresses for DP masters and DP slaves

For the IM 154-8 CPU, assign diagnostic addresses for the PROFIBUS DP. Verify in your configuration that the DP diagnostic addresses are assigned once to the DP master and once to the DP slave.



Explanation of the DP master configuration	Explanation of the DP slave configuration
When you configure the DP master, assign two different diagnostic addresses for an intelligent DP slave, that is, one diagnostic address for slot 0, and one for slot 2. These two addresses perform the following functions: • The diagnostic address for slot 0 reports in the master all events relating to the entire slave (station representative), for example, node failure. • The diagnostic address for slot 2 is used to report events concerning this slot. For example, if the IM 154-8 CPU is acting as an intelligent slave, it returns the diagnostic interrupts for operating state transitions. These diagnostic addresses are referred to as *assigned to the DP master* below. These diagnostic addresses are used by the DP master to obtain information about the state of the DP slave, or about bus interruptions.	When you configure the DP slave, you also assign it a diagnostic address (in the associated DP slave project). This diagnostic address is referred to as *assigned to the DP slave* below. This diagnostic addresses is used by the DP slave to obtain information about the state of the DP master, or bus interruptions.

Event recognition

The table below shows how the IM 154-8 CPU acting as a DP master recognizes operating mode transitions of a CPU acting as a DP slave or any interruption of the data exchange.

Table 9-12 Event recognition for the IM 154-8 CPU as the DP master

Event	What happens in the DP master?
Bus interruption (short circuit, connector removed)	• Call of OB 86 with the message **Station failure** (incoming event; diagnostic address of Slot 0 of the DP slave that is assigned to the DP master) • With I/O access: call of OB 122 (I/O access error)
DP slave: RUN → STOP	• Call of OB 82 with the message **Module error** (incoming event; diagnostic address of Slot 2 of the DP slave that is assigned to the DP master; Variable OB82_MDL_STOP=1)
DP slave: STOP → RUN	• Call of OB 82 with the message **Module OK.** (outgoing event; diagnostic address of Slot 2 of the DP slave that is assigned to the DP master; Variable OB82_MDL_STOP=0)

Evaluation in the user program

The table below shows how you can, for example, evaluate RUN to STOP transitions of the DP slave in the DP master.

Table 9-13 Evaluating RUN to STOP transitions of the DP slave in the DP master

In the DP master	In the DP slave (e.g. CPU 31x-2 DP)
Diagnostic addresses: (Example) Master diagnostic address =**1023** Slave diagnostic address =**1022** (Slot 0 of slave) (Diagnostic) address for "Slot 2"=**1021** (Slot 2 of slave)	Diagnostic addresses: (Example) Slave diagnostic address =**422** Master diagnostic address = irrelevant
The IM 154-8 CPU calls OB 82 with the following information: • OB82_MDL_ADDR:=**1021** • OB82_EV_CLASS:=B#16#39 (incoming event) • OB82_MDL_DEFECT:=module fault Tip: The IM 154-8 CPU diagnostic buffer also contains this information. In the user program you should also include SFC 13 "DPNRM_DG" for reading DP slave diagnostic data.	CPU: RUN -> STOP The CPU generates a DP slave diagnostic message frame

9.6.2 Diagnosing the IM 154-8 CPU as the DP slave

The slave diagnostic data is compliant with EN 50170, Volume 2, PROFIBUS. Depending on the DP master, diagnostic information can be read out for all DP slaves that comply with the standard using *STEP 7*.

Diagnostic addresses for the receiving station with direct data exchange

For direct data exchange, you assign a diagnostic address in the receiving station:

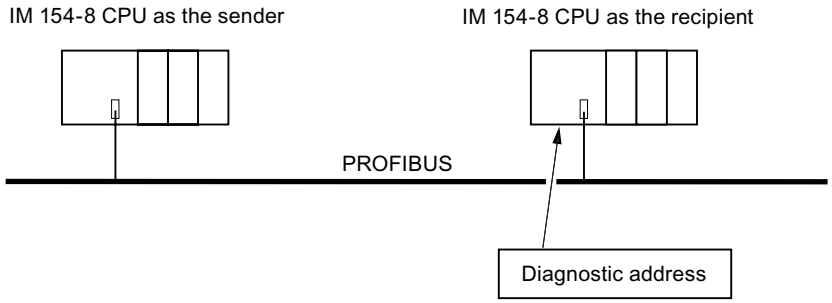


Figure 9-3 PROFIBUS DP diagnostics address

In this figure, you see that assign a diagnostic address to the receiving station in your configuration. The receiving station receives information about the status of the transmitting station or about a bus interruption by means of this diagnostic address.

Reading out the diagnostic data

The table below shows you how the various DP master systems can read diagnostic information from a slave.

Table 9-14 Reading out diagnostic data in the master system, using STEP 5 and STEP 7

Automation system with DP master	Block or tab in *STEP 7*	Application	Additional information
SIMATIC S7 / M7	"DP slave diagnostics" tab	Display slave diagnostics in plain text on the *STEP 7* user interface	Found under the keyword *Hardware diagnostics* in the *STEP 7 Online Help* and the *Programming STEP 7* manual.
	SFB 54 "RALRM"	Read additional interrupt information from a DP slave or an I/O module from the relevant OB.	*System and Standard Functions for S7-300/400* reference manual
	SFC 13 "DPNRM_DG"	Reading out slave diagnostics (store in data area of the user program)	*System and Standard Functions for S7-300/400* reference manual
	SFC 51 "RDSYSST"	Reading SSL sublists. In the diagnostic interrupt, call SFC 51 with the SSL ID W#16#00B4, and then read the SSL for the slave CPU.	*System and Standard Functions for S7-300/400* reference manual
	SFB 52 “RDREC” and SFC 59 “RDREC”	Reading data records for the S7 diagnosis (stored in the data area of the user program)	*System and Standard Functions for S7-300/400* reference manual
	FB 125 / FC 125	Evaluating slave diagnostic data	On the Internet at http://www.siemens.com/automation/service&support, article number 387257
SIMATIC S5 with IM 308-C as DP-master	FB 192 "IM308C"	Reading slave diagnostic data (stored in the data area of the user program)	*Distributed I/O System ET 200* Manual

Example for reading the slave diagnostics with FB 192 "IM308C"

Here you will find an example of how to use the FB 192 to read the slave diagnosis for a DP slave in the *STEP 5* user program.

Assumptions regarding the *STEP 5* user program

For this *STEP 5* user program it is assumed that:

- The IM 308-C acting as a DP master uses the page frames 0 to 15 (number 0 of IM 308-C).
- The DP slave has PROFIBUS address 3.
- The slave diagnostics should be stored in DB 20. You may also use any other DB.
- Slave diagnostics data consist of 26 bytes.

STEP 5 user program

```
STL                                    Explanation
          :A        DB 30
          :SPA      FB 192
Name      :IM308C
DPAD      :         KH F800            //Default address area of IM 308-C
IMST      :         KY 0, 3            //IM no. = 0, PROFIBUS address of the DP slave = 3
FCT       :         KC SD              //function: Read slave diagnostics
GCGR      :         KM 0               //not evaluated
TYPE      :         KY 0, 20           //S5 data area: DB 20
STAD      :         KF +1              //Diagnostic data starting at data word 1
LENG      :         KF 26              //Length of diagnostic data = 26 bytes
ERR       :         DW 0               //Error code storage in DW 0 of DB 30
```

Example of reading S7 diagnostic data with SFC 59 "RD REC"

Here you will find an example of how to use SFC 59 in the *STEP 7* user program to read S7 diagnostic data records for a DP slave. The process of reading the slave diagnostics is similar to SFC 13.

Assumptions regarding the *STEP 7* user program

For this *STEP 7* user program it is assumed that:

- Diagnostic data for the input module at address 200_H is to be read.
- Data record 1 is to be read out.
- Data record 1 is to be stored in DB 10.

STEP 7 user program

```
STL                                     Explanation
CALL SFC 59

REQ         :=TRUE                      //Request to read
IOID        :=B#16#54                   //Identifier of the address area, here the I/O input
LADDR       :=W#16#200                  //Logical address of the IM 154-8 CPU
RECNUM      :=B#16#1                    //Data record 1 is to be read
RET_VAL     :=MW2                       //An error code is output if an error occurs
BUSY        :=MO.0                      //Read operation not finished
RECORD      :=P# DB10.DBX 0.0 BYTE 240  //DB 10 is target area for the read data record 1
```

Note:

Data is only returned to the target area if BUSY is reset to 0 and if no negative RET_VAL has occurred.

Diagnostic addresses

For the IM 154-8 CPU, assign diagnostic addresses for the PROFIBUS DP. Verify in your configuration that the DP diagnostic addresses are assigned once to the DP master and once to the DP slave.

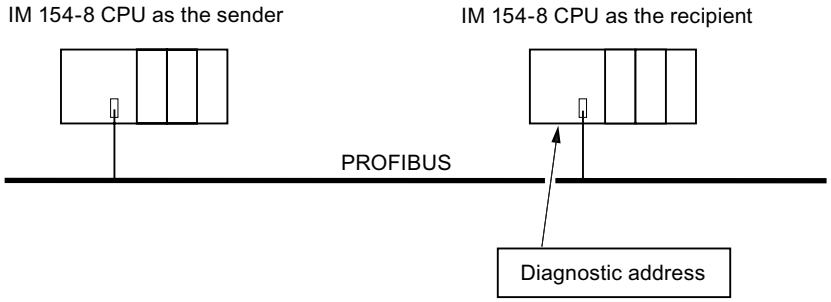


Figure 9-4 PROFIBUS DP diagnostics address

Explanation of the DP master configuration	Explanation of the DP slave configuration
When you configure the DP master, assign two different diagnostic addresses for an intelligent DP slave, that is, one diagnostic address for slot 0, and one for slot 2. These two addresses perform the following functions: • The diagnostic address for slot 0 reports in the master all events relating to the entire slave (station representative), for example, node failure. • The diagnostic address for slot 2 is used to report events concerning this slot. For example, if the IM 154-8 CPU is acting as an intelligent slave, it returns the diagnostic interrupts for operating state transitions. These diagnostic addresses are referred to as *assigned to the DP master* below. These diagnostic addresses are used by the DP master to obtain information about the state of the DP slave, or about bus interruptions.	When you configure the DP slave, you also assign it a diagnostic address (in the associated DP slave project). This diagnostic address is referred to as *assigned to the DP slave* below. This diagnostic addresses is used by the DP slave to obtain information about the state of the DP master, or bus interruptions.

Event recognition

The table below shows how the IM 154-8 CPU acting as a DP slave recognizes operating state transitions or any interruption of the data exchange.

Table 9-15 Event recognition for the IM 154-8 CPU as the DP slave

Event	What happens in the DP slave?
Bus interruption (short circuit, connector removed)	• Calls OB86 with the message **Station failure** (incoming event; diagnostic address of the DP slave, assigned to the DP slave) • With I/O access: Calls OB 122 (I/O access error)
DP master: RUN → STOP	• Calls OB82 with the message **Module error** (incoming event; diagnostic address of the DP slave assigned to the DP slave; Variable OB82_MDL_STOP=1)
DP master: STOP → RUN	• Call of OB 82 with the message **Module OK.** (outgoing event; diagnostic address of the DP slave assigned to the DP slave; Variable OB82_MDL_STOP=0)

Evaluation in the user program

The table below shows an example of how to evaluate RUN-STOP transitions of the DP master in the DP slave (see also the previous table).

Table 9-16 Evaluating RUNSTOP transitions in the DP master/DP slave

In the DP master	In the DP slave
Diagnostic addresses: (Example) Master diagnostic address =**1023** Slave diagnostic address in the master system=**1022** (Slot 0 of slave) (Diagnostic) address for "Slot 2"=**1021** (Slot 2 of slave)	Diagnostic addresses: (Example) Slave diagnostic address =**422** Master diagnostic address = irrelevant
CPU: RUN → STOP	→ The IM 154-8 CPU calls OB82 with the following information: • OB82_MDL_ADDR:=422 • OB82_EV_CLASS:=B#16#39 (incoming event) • OB82_MDL_DEFECT:=module fault Tip: The IM 154-8 CPU diagnostic buffer also contains this information.

9.6.3 Interrupts on the DP Master

Interrupts with S7 DP master

Process interrupts from an intelligent DP slave with SFC 7

In the IM 154-8 CPU acting as a DP slave, you can trigger a user-defined process interrupt from the DP master from the user program.

You can trigger an OB40 in the user program of the DP master by calling SFC7 "DP_PRAL". The SFC 7 allows you to forward interrupt information to the DP master in a double word. This information can then be evaluated in the OB40_POINT_ADDR variable in the OB40. The interrupt information can be programmed user-specific. You will find a detailed description of SFC7 "DP_PRAL" in the *System and Standard Functions for S7-300/400* reference manual.

Setting user-defined interrupts for intelligent slaves using SFB 75

In the IM 154-8 CPU acting as a DP slave, you can trigger any interrupts from the DP master from the user program. SFB 75 "SALRM" is used to send a process or diagnostic interrupt from a slot in the transfer area (virtual slot) to the associated DP master from the user program on an intelligent slave. This starts the associated OB on the DP master.

Additional interrupt-specific information may be included. You can read this additional information in the DP master using SFB 54 "RALRM."

Interrupts with a different DP master

If you are using the IM 154-8 CPU with another DP master, an image of these interrupts is created in its device-specific diagnostic data. You must continue to process the relevant diagnostic events in the user program of the DP master.

Note

To evaluate diagnostic and process interrupts via the device-specific diagnostics with a different DP master, please note that:

the DP master should be able to save the diagnostic messages, i.e. the diagnostic messages should be stored in the DP master in a ring buffer. If the DP master cannot save the diagnostic messages, e.g. then only the last incoming diagnostic message is ever saved.

You must scan the relevant bits in the device-related diagnostic data in your user program at regular intervals. Make allowances for the PROFIBUS DP bus cycle time, for example, to be able to poll these bits at least once and in synchronism to the bus cycle time.

With an IM 308-C acting as a DP master, you cannot use process interrupts in device-specific diagnostics because only incoming events are reported, rather than outgoing events.

9.6.4 Structure of the slave diagnostic data when the IM 154-8 CPU is used as an intelligent slave

Syntax of the diagnostics datagram for slave diagnostics

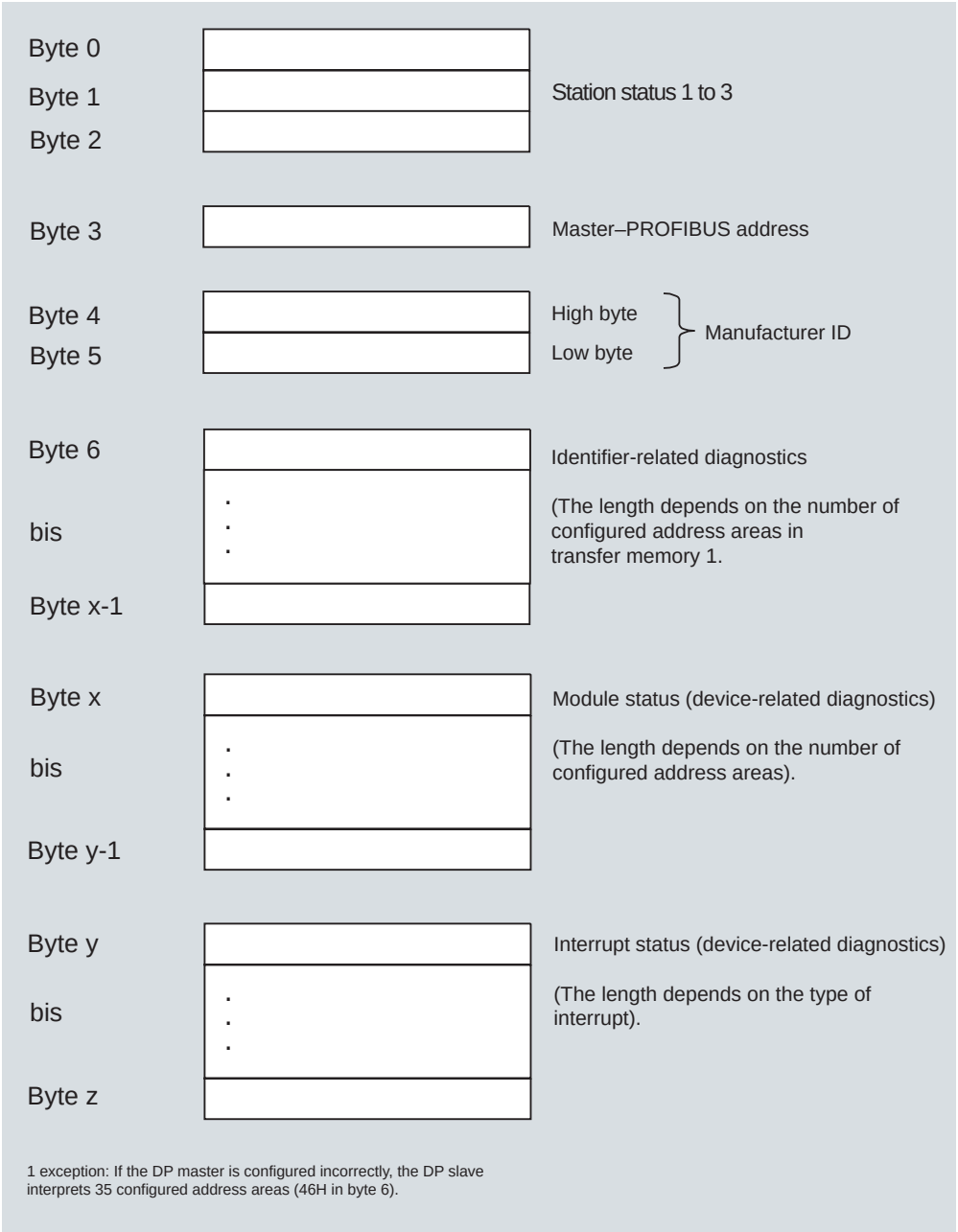


Figure 9-5 Structure of the slave diagnostic data

Station status 1

Table 9-17 Structure of station status 1 (byte 0)

Bit	Meaning		Remedy
0	1:	The DP slave cannot be addressed by the DP master.	• Is the correct DP address set on the DP slave? • Is the bus connector in place? • Voltage at DP slave? • Correct configuration of the RS485 Repeater? • Perform a reset on the DP slave.
1	1:	The DP slave is not yet ready to exchange data.	• Wait for the slave to complete power up.
2	1:	The configuration data sent to the DP slave from the DP master does not match the configuration of the DP slave.	• Was the software set for the correct station type or DP slave configuration?
3	1:	Diagnostic interrupt, generated by a RUN to STOP transition on the IM 154-8 CPU or by SFB 75	• You can read the diagnostic data.
	0:	Diagnostic interrupt, generated by a STOP to RUN transition on the IM 154-8 CPU or by SFB 75	
4	1:	Function is not supported, e.g. changing the DP address via software	• Check configuration data.
5	0:	The bit is always "0".	• -
6	1:	DP slave type does not correspond to the software configuration.	• Was the software set for the right station type? (parameter assignment error)
7	1:	DP slave was configured by a different DP master (not by the DP master that currently has access to the DP slave).	• The bit is always 1, for example, if you access the DP slave with the programming device or another DP master. The DP address of the parameter assignment master is in the "master PROFIBUS address" diagnostic byte.

Station status 2

Table 9-18 Structure of station status 2 (Byte 1)

Bit	Meaning	
0	1:	The DP slave must be assigned new parameters and reconfigured.
1	1:	A diagnostic message is pending. The DP slave cannot resume operation until the error has been cleared (static diagnostic message).
2	1:	The bit is always set to "1" if the DP slave with this DP address is present.
3	1:	Response monitoring has been enabled for this DP slave.
4	1:	DP slave has received control command "FREEZE".
5	1:	DP slave has received control command "SYNC".
6	0:	The bit is always set to "0".
7	1:	DP slave is disabled, i.e. it has been excluded from cyclic processing.

Station status 3

Table 9-19 Structure of station status 3 (Byte 2)

Bit	Meaning	
0 to 6	0:	Bits are always set to "0".
7	1:	There are more diagnostic messages than the DP slave is able to store. The DP master cannot enter all the diagnostic messages sent by the DP slave in its diagnostic buffer.

Master PROFIBUS address

The "Master PROFIBUS address" diagnostic byte stores the DP address of the DP master:

- Which the DP slave has configured and
- Has read and write access to the DP slave.

Table 9-20 Structure of the Master PROFIBUS address (byte 3)

Bit	Meaning
0 to 7	DP address of the DP master that has configured the DP slave and has read/write access to that DP slave.
	FF_H: DP slave was not configured by a DP master

Manufacturer ID

The manufacturer's ID contains a code that describes the type of the DP slave.

Table 9-21 Structure of the manufacturer ID (byte 4 and 5)

Byte 4	Byte 5	Manufacturer's ID for
81_H	54_H	IM 154-8 CPU

Structure of the identifier-related diagnostic data for the IM 154-8 CPU

Module diagnostics indicate the configured address area of Transfer memory that has received an entry.

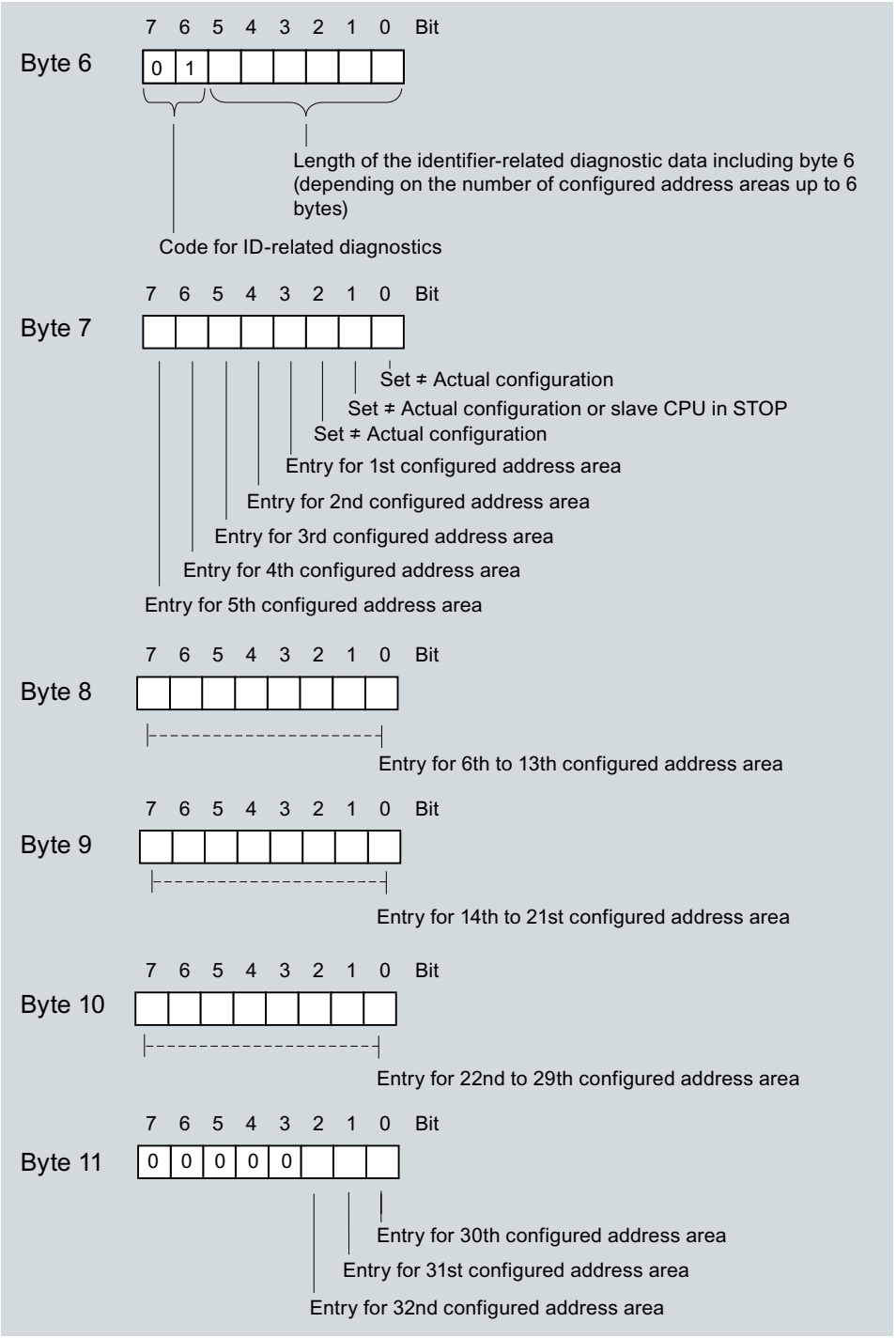


Figure 9-6 Identifier-related diagnostics

Structure of the module status

The module status reflects the status of the configured address areas, and provides detailed ID-specific diagnostics with respect to the configuration. Module status starts with module diagnostics and consists of a maximum of 13 bytes.

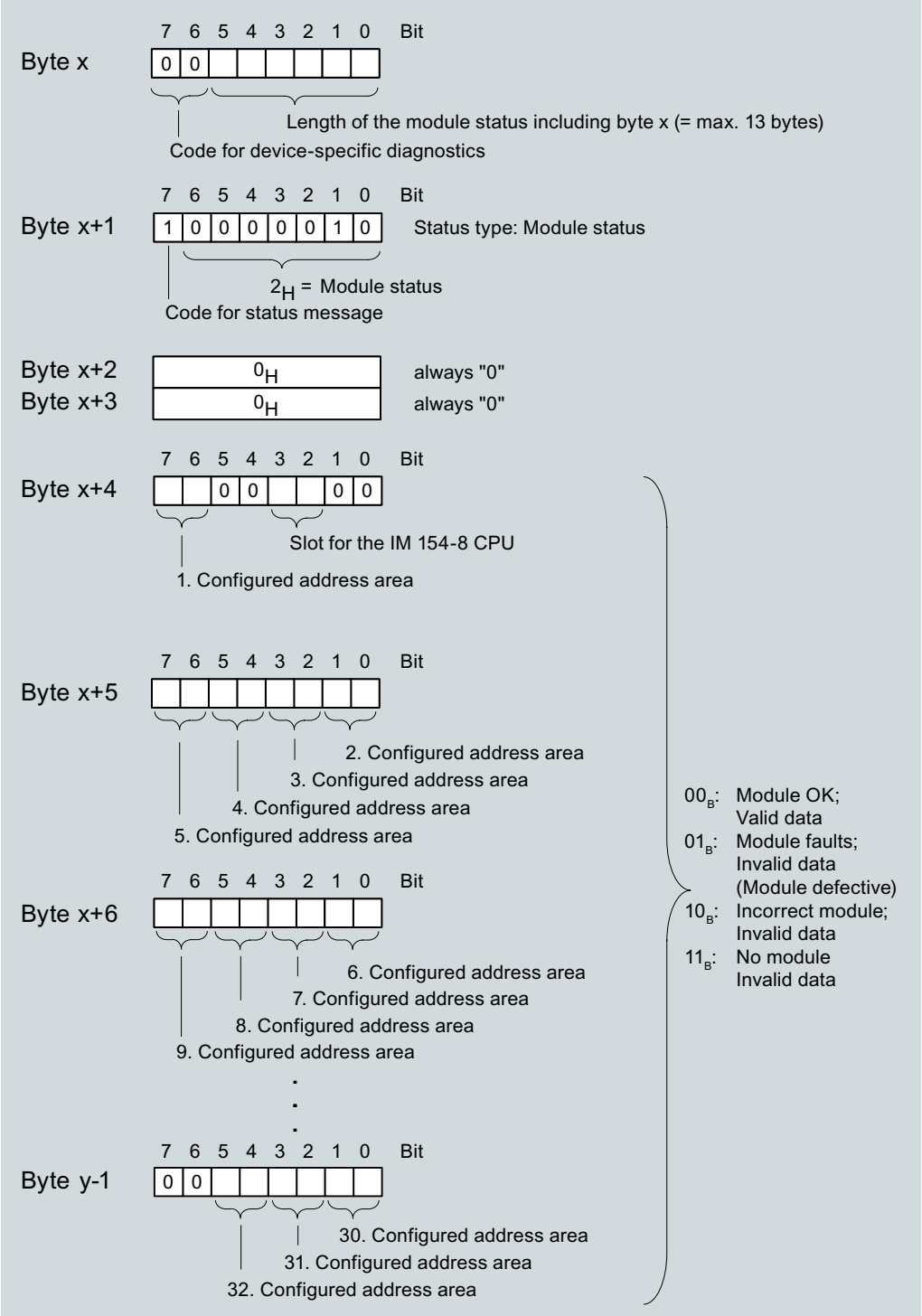


Figure 9-7 Structure of the module status for the IM 154-8 CPU

Structure of the interrupt status:

The interrupt status of module diagnostics provides detailed information about a DP slave. Device-specific diagnostics starts at byte y and has a maximum length of 20 bytes.

The following figure describes the structure and content of the bytes for a configured address area of transfer memory.

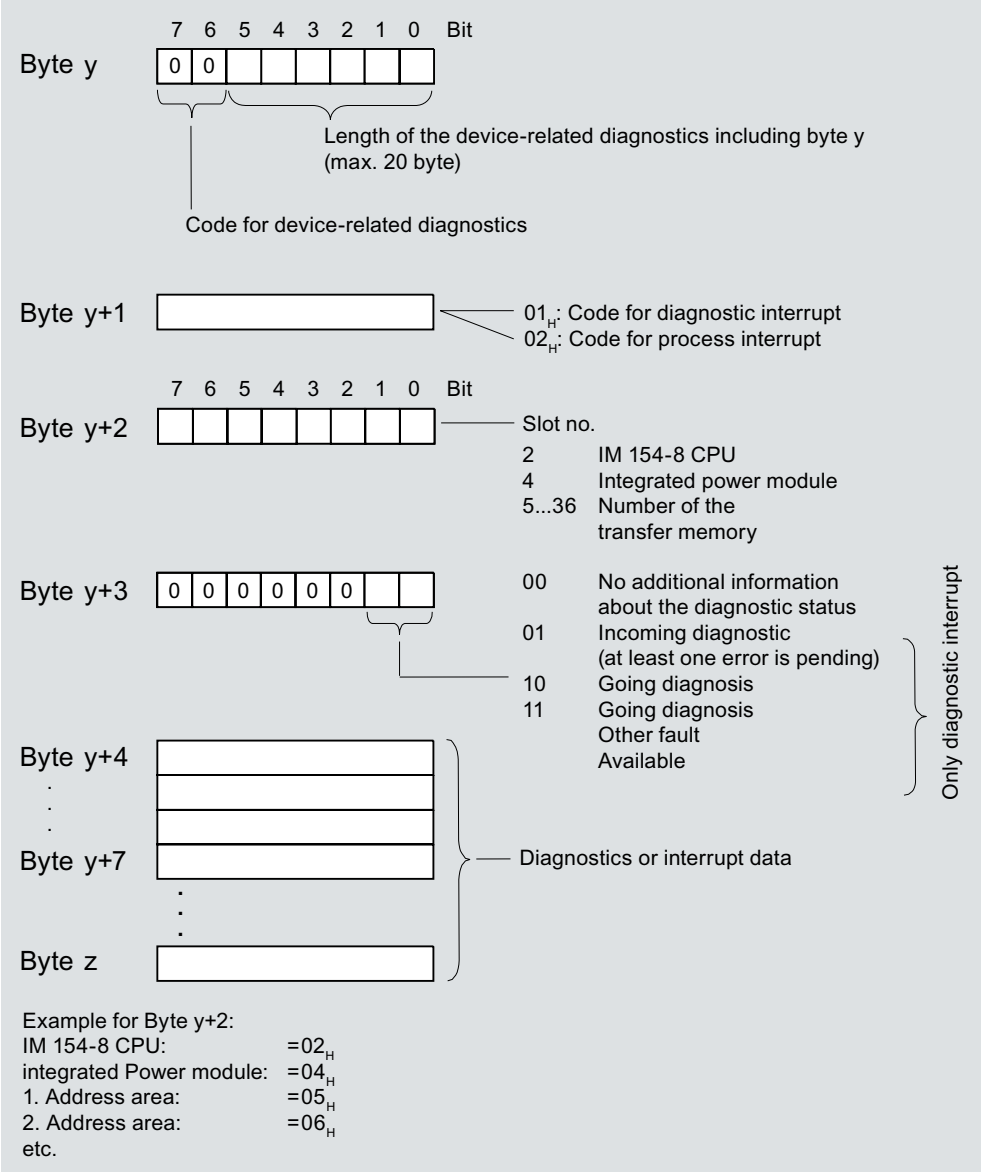


Figure 9-8 Device-specific diagnostics

Structure of the interrupt data for a process interrupt (from byte y+4)

When a process interrupt occurs (code 02_H for process interrupt in byte y+1), 4 bytes of interrupt information after byte y+4 are transferred. These 4 bytes are transferred to the intelligent DP slave using SFC 7 "DP_PRAL" or SFC 75 "SALRM" when the process interrupt for the master was generated.

Structure of the interrupt data when a diagnostic interrupt is generated in response to an operating state transition by the intelligent DP slave (from byte y+4)

Byte y+1 contains the code for a diagnostic interrupt (01_H). The diagnostic data contains the 16 bytes of status information from the IM 154-8 CPU. The figure below shows the allocation of the first four bytes of diagnostic data. The next 12 bytes are always 0.

The data in these bytes corresponds to the contents of data record 0 of the diagnostic data in *STEP 7* (in this case, not all bits are used).

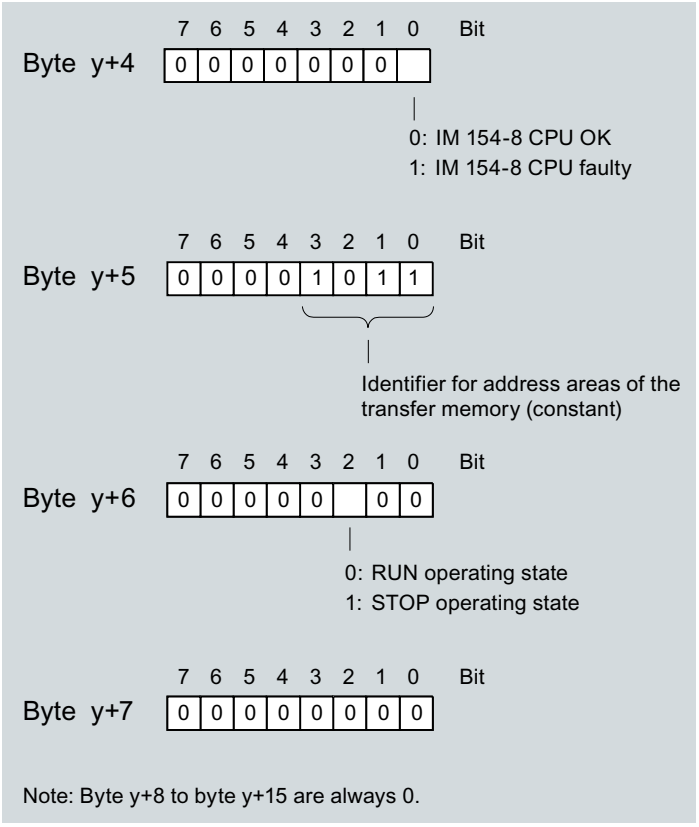


Figure 9-9 Bytes y+4 to y+15 for a diagnostic interrupt (operating state transition by the intelligent DP slave)

Structure of the interrupt data when a diagnostic interrupt is generated by SFB 75 on the intelligent DP slave (from byte y+4)

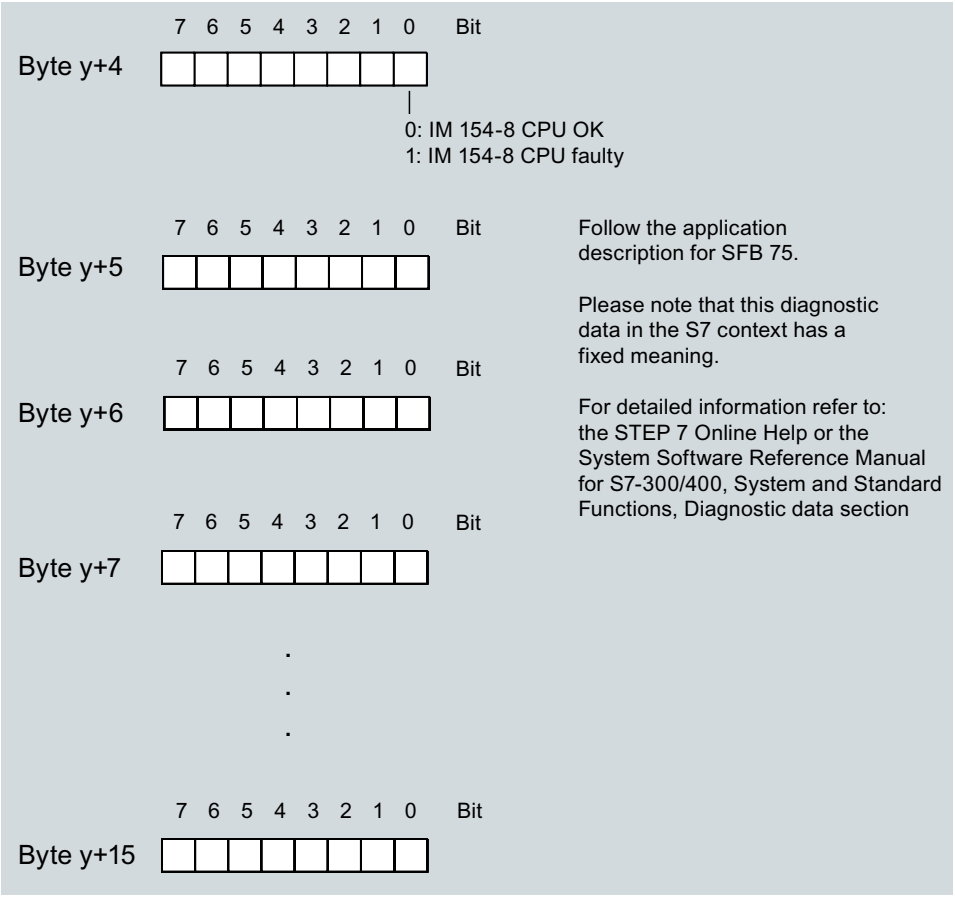


Figure 9-10 Bytes y+4 to y+15 for the diagnostic interrupt (SFB 75)

9.7 Basics of diagnostics in PROFINET IO

Totally Integrated Diagnostics Concept

PROFINET IO supports you with an integrated diagnostics concept. The diagnostics concept with PROFINET IO is similar to that of PROFIBUS DP.

Below, we will explain the basics of the concept.

Basic concept

Each individual or several errors occurring simultaneously are transferred from the IO device to the IO controller.

If you require the full status of the IO device including any pending errors, you can also read the status directly from the IO device.

Extended maintenance concept

PROFINET devices support the comprehensive diagnostics and maintenance concept described in the IEC 61158-6-10 standard.

The aim of the maintenance concept is the early detection and elimination of potential faults - before they cause a production failure.

The PROFINET devices / modules / submodules can therefore also display information for preventive maintenance, in addition to the status information "OK" and "Faulty".

Maintenance information

Maintenance information describes the urgency with which maintenance is needed. The concept distinguishes between two levels of maintenance information:

- Maintenance requested (identified by a yellow wrench in *STEP 7*):
  - Maintenance is recommended
- Maintenance demanded (identified by an orange wrench in *STEP 7*):
  - Maintenance alarm

The times at which maintenance information is generated are defined individually for each wear parameter (e.g. attenuation on a fiber optic cable).

Information on Diagnostics in PROFINET IO

For additional information, refer to the *STEP 7 Online Help*, the *From PROFIBUS DP to PROFINET IO* programming manual and the *PROFINET System Description.*

The system status lists and data records for PROFINET diagnostics are described in the programming manual.

10 Technical specifications

10.1 General technical data

Reference

The IM 154-8 CPU interface module conforms to the standards and test values that apply to the ET 200pro distributed I/O device. Detailed information on the general technical data can be found in the *ET 200pro Distributed I/O Device* operating instructions.

Differences

The IM 154-8 CPU interface module (6ES7154-8AB00-0AB0) can be used at -25 °C to 55 °C (indoor use only).

10.2 IM 154-8 CPU Interface Module

10.2.1 Block diagram

The figure below shows the block diagram for the IM 154-8 CPU interface module with the CM IM PN DP M12, 7/8" terminal module.

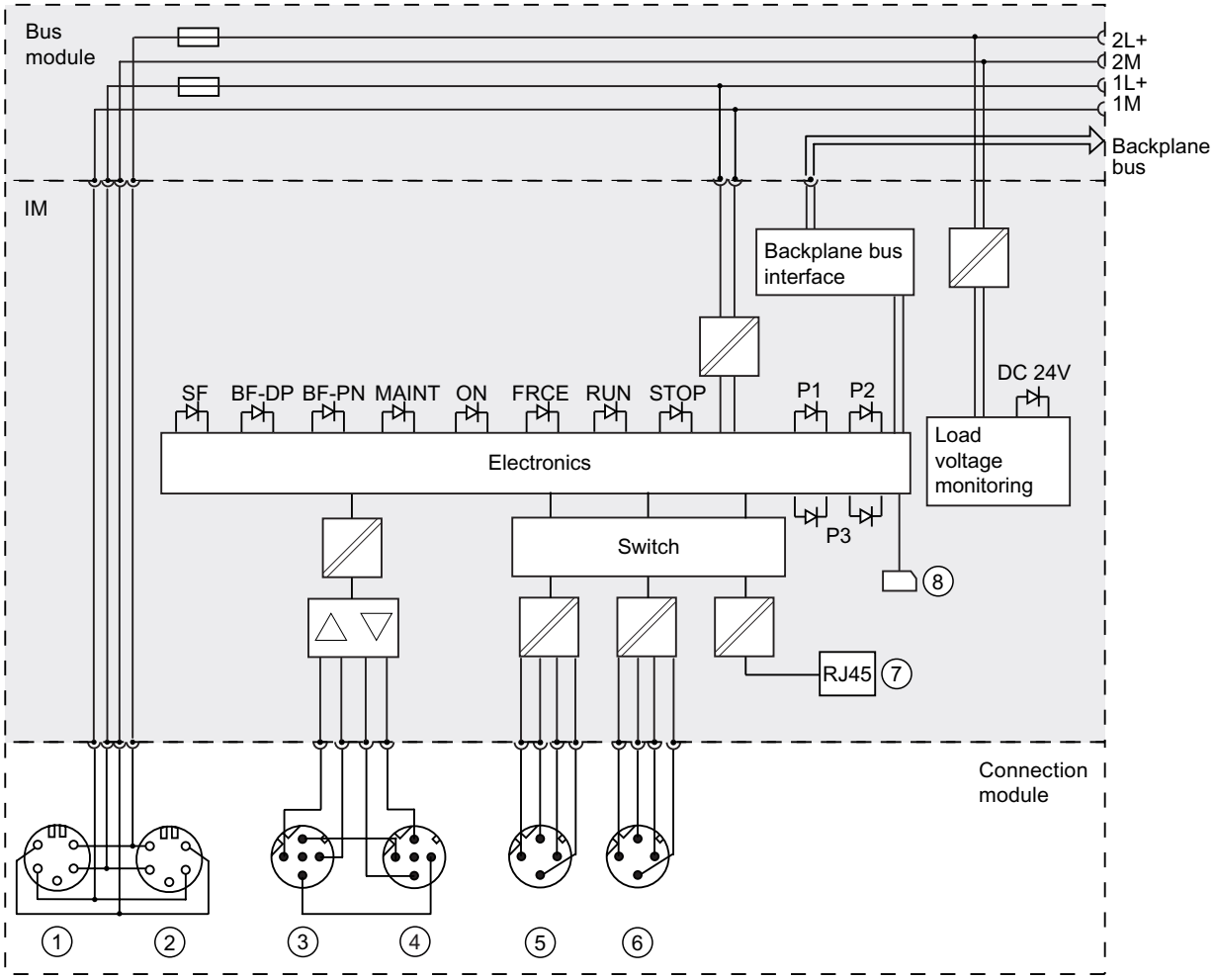


Figure 10-1 Block diagram for the IM 154-8 CPU

① Terminal for the electronic / encoder / load voltage supplies (incoming supplies)
② Terminal for the electronic / encoder / load voltage supplies (loop-through)
③ Terminal for PROFIBUS DP (incoming supply)
④ Terminal for PROFIBUS DP (loop-through)
⑤ Terminal for PROFINET (port 1)
⑥ Terminal for PROFINET (port 2)
⑦ Terminal for PROFINET (port 3)
⑧ SIMATIC Micro Memory Card

10.2.2 Technical specifications

Table 10-1 Technical specifications for the IM 154-8 CPU

Technical data	
IM 154-8 CPU and product version	
Order number [MLFB]	6ES7154-8AB00-0AB0
• Hardware version	01
• Firmware version	V 2.5.0
• Associated programming package	*STEP 7* V5.4 or later + Service Pack 1 + HSP
Memory	
Work memory	
• Work memory	256 KB
• Expandable	No
• Capacity of the retentive memory for retentive data blocks	128 KB
Load memory	Pluggable via SIMATIC Micro Memory Card (max. 8 MB)
Buffering	Guaranteed by SIMATIC MMC (maintenance-free)
Data retention on the SIMATIC Micro Memory Card (after final programming)	At least 10 years
Execution times	
Processing times of	
• Bit operations	0.1 µs
• Word instructions	0.2 µs
• Fixed-point arithmetic	2 µs
• Floating-point arithmetic	3 µs
Timers / counters and their retentivity	
S7 counters	256
• Retentive memory	Configurable
• Default	From C0 to C7
• Counting range	0 to 999
IEC Counters	Yes
• Type	SFB
• Number	Unlimited (limited only by work memory)
S7 timers	256
• Retentive memory	Configurable
• Default	Not retentive
• Timer range	10 ms to 9990 s
IEC timers	Yes
• Type	SFB
• Number	Unlimited (limited only by work memory)

Technical data	
Data areas and their retentive address areas	
Bit memory	2048 bytes
• Retentive memory	Configurable
• Preset retentive address areas	From MB0 to MB15
Clock memory	8 (1 memory byte)
Data blocks	
• Number	1023 (in the 1 to 1023 range of numbers)
• Size	16 KB
• Non-retain support (configurable retentive address areas)	Yes
Local data per priority class	Max. 1024 bytes per task/510 per block
Blocks	
Total	1024 (DBs, FCs, FBs) The maximum number of blocks that can be loaded may be reduced if you are using another SIMATIC Micro Memory Card.
OBs	See the Instruction List
• Size, max.	16 KB
• Number of free cycle OBs	1 (OB 1)
• Number of time-of-day-interrupt OBs	1 (OB 10)
• Number of delay interrupt OBs	1 (OB 20)
• Number of cyclic interrupt OBs	1 (OB 35)
• Number of hardware interrupt OBs	1 (OB 40)
• Number of DPV1 interrupt OBs	3 (OB 55, 56, 57)
• Number of synchronous cycle interrupt OBs	1 (OB 61)
• Number of asynchronous error interrupts	6 (OB 80, 82, 83, 85, 86, 87) (OB 83 only for centralized I/O and PN IO)
• Number of startup OBs	1 (OB 100)
• Number of synchronous error interrupt OBs	2 (OB 121, 122)
Nesting depth	
• Per priority class	8
• Additional within an error OB	4
FBs	See the Instruction List
• Number, max.	1024 (in the 0 to 2047 range of numbers)
• Size	16 KB
FCs	See the Instruction List
• Number, max.	1024 (in the 0 to 2047 range of numbers)
• Size	16 KB

Technical data	
Address areas (I/O)	
Total I/O address area	
• Inputs, freely adressable	2048 bytes
• Outputs, freely adressable	2048 bytes
• Of which distributed – Inputs, freely adressable – Outputs, freely adressable	 2048 bytes 2048 bytes
Process I/O image	
• Inputs, adjustable	2048
• Outputs, adjustable	2048
• Inputs, preset	128
• Outputs, preset	128
Number of process image partitions	1
Digital channels	
• Inputs	16384
• Outputs	16384
• Inputs, central	128
• Outputs, central	128
Analog channels	
• Inputs	1024
• Outputs	1024
• Inputs, central	64
• Outputs, central	64
Removal	
Rack	1
I/O modules per ET 200pro	Max. 16
Station width	≤ 1 m
Current carrying capacity	
• for electronic / encoder supply 1L+	Max. 5 A
• for load voltage supply 2L+	Max. 8 A
Time-of-day	
Clock	Yes (hardware clock)
• Factory setting	DT#1994-01-01-00:00:00
• Buffered	Yes
• Buffered period	Typically 6 weeks (at an ambient temperature of 40 °C)
• Behavior of the clock on expiration of the buffered period	The clock keeps running, continuing at the time-of-day it had when power was switched off.
• Behavior of the realtime clock after POWER ON	The clock continues running after POWER OFF.
• Accuracy	Deviation per day: < 10 s

Technical data	
Operating hours counter	1
• Number	0
• Value range	2^{31} hours (if SFC 101 is used)
• Granularity	1 hour
• Retentive	Yes; must be manually restarted after every restart
Time synchronization	Yes
• On MPI	Time-of-day master/time-of-day slave
• on PROFIBUS DP	• If the IM 154-8 CPU is used as a DP master: Time-of-day master/time-of-day slave • If the IM 154-8 CPU is used as a DP slave: Time-of-day slave
• on PROFINET	Via NTP (only as time-of-day client)
S7 message functions	
Number of stations that can be logged on for signaling functions	16 (depends on the number of connections configured for programming device / OP and S7 basic communication)
Process diagnostics messages	Yes
• Simultaneously enabled interrupt S blocks	40
Test and startup functions	
Monitor/modify tag	Yes
• Variables	Inputs, outputs, memory bits, DBs, timers, counters
• Number of variables – Of those as status variable – Of those as control variable	30 Max. 30 Max. 14
Force	
• Variables	Inputs/Outputs
• Number of variables	Max. 10
Block status	Yes
Single-step	Yes
Breakpoints	2
Diagnostic buffer	Yes
• Number of entries (not configurable)	Max. 500
• Retentivity of the entries after POWER OFF / POWER ON	Only the last 100 entries are retained.
Communication functions	
Open IE communication	
Number of connections / access points, total	8
TCP/IP	Yes (via integrated PROFINET interface and loadable FBs)
• Maximum number of connections	8
• Data length for connection type 01_H, max.	1460 bytes
• Data length for connection type 11_H, max.	8192 bytes

Technical data	
ISO on TCP	Yes (via integrated PROFINET interface and loadable FBs)
• Maximum number of connections	8
• Data length, max.	8192 bytes
UDP	Yes (via integrated PROFINET interface and loadable FBs)
• Maximum number of connections	8
• Data length, max.	1472 bytes
Programming device / OP communication	Yes
Global data communication	Yes
• Number of GD circuits	8
• Number of GD packets – Sending stations – Receiving stations	Max. 8 Max. 8 Max. 8
• Length of GD packets – Consistent data	Max. 22 bytes 22 bytes
S7 basic communication	Yes
• User data per job – Consistent data	Max. 76 bytes 76 bytes
S7 communication	Yes
• As server	Yes
• As client	Yes (via integrated PN interface and loadable FBs, or even via CP and loadable FBs)
• User data per job – Consistent data	See the *STEP 7 Online Help, Common parameters of SFBs/FBs and SFCs/FCs for S7 communication)*
Number of connections	16
can be used for	
• Programming device communication – Reserved (default) – Configurable	Max. 15 1 1 to 15
• OP communication – Reserved (default) – Configurable	Max. 15 1 1 to 15
• S7 basic communication – Reserved (default) – Configurable	Max. 14 0 0 to 14
Routing • Interface X01 configured as: – MPI – DP master – DP slave (active) • Interface X02 configured as PROFINET	Yes Max. 10 Max. 24 Max. 14 Max. 24

Technical data	
CBA	
Reference setting for CPU communication	50%
Number of remote interconnecting partners	32
Number of master/slave functions	30
Total of all master/slave connections	1000
Data length of all incoming master/slave connections, max.	4000 bytes
Data length of all outgoing master/slave connections, max.	4000 bytes
Number of device-internal and PROFIBUS interconnections	500
Data length of the device-internal and PROFIBUS interconnections, max.	4000 bytes
Data length per connection, max.	1400 bytes
Remote interconnections with acyclical transmission	
• Scan rate: Scan interval, min.	500 ms
• Number of incoming interconnections	100
• Number of outgoing interconnections	100
• Data length of all incoming interconnections, max.	2000 bytes
• Data length of all outgoing interconnections, max.	2000 bytes
• Data length per connection, (acyclic interconnections), max.	1400 bytes
Remote interconnections with cyclical transmission	
• Transmission frequency: Minimum transmission interval	1 ms
• Number of incoming interconnections	200
• Number of outgoing interconnections	200
• Data length of all incoming interconnections, max.	2000 bytes
• Data length of all outgoing interconnections, max.	2000 bytes
• Data length per connection, (acyclic interconnections), max.	250 bytes
HMI variables via PROFINET (acyclic)	
• Update HMI variables	500 ms
• Number of stations that can be logged on for HMI variables (PN OPC/iMAP)	2xPN OPC/1x iMAP
• Number of HMI variables	200
• Data length of all HMI variables, max.	2000 bytes
PROFIBUS proxy functionality	
• supported	Yes
• Number of coupled PROFIBUS devices	16
• Data length per connection, max.	240 bytes (slave dependent)

Technical data	
Interfaces	
1st interface (X01)	
Type of interface	Integrated RS485 interface
Physics	RS 485
Isolated	Yes
Interface power supply (5 VDC)	May only be used for external terminating resistor
Connection	2 x M12 b-coded
Functionality	
• MPI	Yes
• PROFIBUS DP	Yes
• Point-to-point communication	No
• PROFINET	No
MPI	
Services	
• PG/OP communication	Yes
• Routing	Yes
• Global data communication	Yes
• S7 basic communication	Yes
• S7 communication – As server – As client	Yes Yes No
• Transmission rates	Max. 12 Mbps
DP master	
Services	
• PG/OP communication	Yes
• Routing	Yes
• Global data communication	No
• S7 basic communication	Yes (I blocks only)
• S7 communication	Yes (server only, configured one-way connection)
• Support for constant bus cycle time	Yes
• Isochronous mode	Yes (OB 61)
• Enable/disable DP slaves	Yes
• SYNC/FREEZE	Yes
• DPV1	Yes
Transmission speed	Up to 12 Mbaud
Number of DP slaves, max.	124
Address area	
• Inputs, max.	2048 bytes
• Outputs, max.	2048 bytes
User data per DP slave	
• Inputs, max.	244 bytes

Technical data	
• Outputs, max.	244 bytes
DP slave	
Services	
• Routing	Yes (only if interface is active)
• Global data communication	No
• S7 basic communication	No
• S7 communication	Yes (server only, configured one-way connection)
• Direct data exchange	Yes
• Transmission rates	Up to 12 Mbaud
• Automatic baud rate search	Yes (only if interface is passive)
• Transfer memory	244 bytes I / 244 bytes O
• Address areas	Max. 32 with max. 32 bytes each
• DPV1	No
2nd interface (X02)	
Type of interface	PROFINET
Physics	Ethernet
Isolated	Yes (on CM IM PN DP M12, 7/8")
Transmission rate	100 Mbps full duplex
Transmission mode	100BASE-TX
Autosensing (10/100 Mbaud)	Yes
Interface	
• Connection	2 x M12 d-coded; 1 x RJ45
• Switch function	Yes, internal
• Auto-cross-over	Yes; for segment expansion with additional IO devices or for the connection of a programming device
Functionality	
• PROFINET	Yes
• MPI	No
• PROFIBUS DP	No
• Point-to-point communication	No
Services	
• Programming device communication	Yes
• OP communication	Yes
• S7 communication – Max. configurable interconnections – Maximum number of instances	Yes (with loadable FBs) 14 32
• Routing	Yes
• Web Server	Yes
• PROFINET IO	Yes
• PROFINET CBA	Yes
• Open IE communication – via TCP/IP – ISO on TCP – UDP	 Yes Yes Yes

Technical data	
PROFINET IO	
Number of integrated PROFINET IO controllers	1
Number of connectable PROFINET IO devices	128
Activate / deactivate PROFINET IO devices	Yes
Max. user data consistency with PROFINET IO	254 bytes
Send clock	Configurable: 250 µs, 500 µs and 1 ms
Update Time	The minimum value is determined by the set communication portion for PROFINET IO, the number of IO devices and the amount of configured user data.
• for send clock of 250 µs	250 µs to 128 ms
• for send clock of 250 µs	500 µs to 256 ms
• for send clock of 1 ms	1 ms to 512 ms
Routing	Yes
S7 protocol functions	
• PG functions	Yes
• OP functions	Yes
GSD file	The latest GSD file is available at: http://www.siemens.com/automation/service&support in the Product Support area
Programming	
Programming language	*STEP 7* (LAD, FBD, STL)
Instruction set	See the Instruction List
Nesting levels	8
System functions (SFC)	See the Instruction List
System function blocks (SFB)	See the Instruction List
User program protection	Yes
Dimensions	
Mounting dimensions W x H x D (mm)	135 x 130 x 60* * 60: without screw cap for RJ45 socket 65: with screw cap for RJ45 socket
Weight	approx. 555 g
Voltages, currents, electrical potentials	
Rated supply voltage for the electronic components 1L+	24 VDC
• Permissible range	20.4 V to 28.8 V
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes; with replaceable fuse
• Power failure buffering	5 ms
Rated load voltage 2L+	24 VDC (integrated power module)
• Reverse polarity protection	Yes; against destruction
• Short-circuit protection	Yes; with replaceable fuse

Technical data	
Current consumption from rated supply voltage 1L+	Typically 350 mA
Inrush current	Typically 2.0 A
I^2t	Typically 0.04 A^2s
External fusing of power supply lines (recommended)	
• Electronic / encoder supply 1L+	24 VDC / 16 A circuit-breaker with type B or C tripping characteristic **Note:** A 24 VDC/16A circuit-breaker with type B tripping characteristic trips before the equipment fuse is tripped. A 24 VDC/16A circuit-breaker with type C tripping characteristic trips after the equipment fuse is tripped.
• Load voltage supply 2L+	
Power loss	Typically 8.5 W
Insulation tested with	500 VDC
Galvanic isolation	
• between the backplane bus and power supplies 1L+, 2L+:	Yes
• between PROFIBUS / PROFINET and power supplies (1L+, 2L+)	Yes
• between the electronic circuits and power supplies 1L+, 2L+:	Yes
Maximum potential difference	75 VDC, 60 VAC
Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostics function	Yes
Group errors	Red "SF" LED
PROFIBUS DP bus monitoring	Red "BF-DP" LED
Bus monitoring PROFINET	Red "BF-PN" LED
Maintenance information	Yellow "MAINT" LED
Monitoring of the supply voltage for the electronic components 1L+	Green LED "ON"
Monitoring of the rated load voltage 2L+	Green "DC 24V" LED
Existing connection to PROFINET	Green LED "P1" and "P2"; Green LED at port 3 (RJ45 socket)
Send / receive via PROFINET	Yellow LED "P1" and "P2"; Yellow LED at port 3 (RJ45 socket)

10.3 Terminal module CM IM PN DP M12, 7/8"

Technical specifications

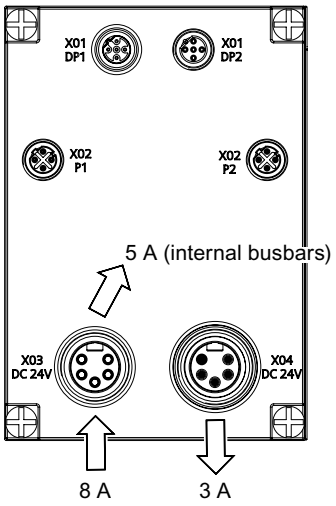
Technical specifications	
Dimensions and weights	
Dimensions W x H x D (mm)	90 x 130 x 51
Weight	approx. 565 g
Currents	
Feed current	
• Electronic / encoder supply 1L+	max. 8 A
• Load voltage supply 2L+	max. 8 A

Note

Maximum permissible load on the internal power busbars of the ET 200pro:
- for 1L+ 5 A
- for 2L+ 10 A

Example of splitting the incoming power

- 8 A is fed in at the terminal module on the IM 154-8 CPU for the electronic / encoder supply 1L+.
- 5 A passes via the internal busbar for the electronic / encoder supply 1L+.
- This leaves 3 A for looping through to the electronic / encoder supply 1L+.



Appendix

A

A.1 Order numbers

A.1.1 Module order numbers

IM 154-8 CPU interface module

Table A-1 IM 154-8 CPU order numbers

Designation	Order number
IM 154-8 CPU interface module with terminating module, 1x *	6ES7154-8AB00-0AB0
* The SIMATIC Micro Memory Card is not supplied as standard.	

Connection module

Table A-2 Terminal module order numbers

Designation	Order number
CM IM PN DP M12, 7/8", 1x	6ES7194-4AN00-0AA0

A.1.2 Order numbers of accessories

IM 154-8 CPU interface module accessories

Table A-3 IM 154-8 CPU accessory order numbers

Designation	Order number
SIMATIC Micro Memory Card 64k	6ES7953-8LF11-0AA0
SIMATIC Micro Memory Card 128k	6ES7953-8LG11-0AA0
SIMATIC Micro Memory Card 512k	6ES7953-8LJ11-0AA0
SIMATIC Micro Memory Card 2M	6ES7953-8LL11-0AA0
SIMATIC Micro Memory Card 4M	6ES7953-8LM11-0AA0
SIMATIC Micro Memory Card 8M	6ES7953-8LP11-0AA0
Labels 20 x 7 mm, pale turquoise 340 items per pack, 1 pack	3RT1900-1SB20
12.5 A fast-blow replacement fuse, 10 items per package, 1 unit	6ES7194-4HB00-0AA0

Accessories for terminal module CM IM PN DP M12, 7/8"

Table A-4 Accessories for terminal module CM IM PN DP M12, 7/8", order numbers

Designation		Order number
PROFIBUS M12 connecting cable, suitable for cable carriers, 2-wire • connecting cable with PROFIBUS M12 connectors 180 at both ends, fixed lengths, 1 unit:	1.5 m	6XV1830-3DH15
	2.0 m	6XV1830-3DH20
	3.0 m	6XV1830-3DH30
	5.0 m	6XV1830-3DH50
	10.0 m	6XV1830-3DN10
	15.0 m	6XV1830-3DN15
PROFIBUS M12 connecting cable, suitable for cable carriers, 2-wire • connecting cable with PROFIBUS M12 angled connectors at both ends, fixed lengths, 1 unit:	1.5 m	(on request)
	2.0 m	(on request)
	3.0 m	(on request)
	5.0 m	(on request)
	10.0 m	(on request)
	15.0 m	(on request)
PROFINET M12 connecting cable, suitable for cable carriers, 2x2-wire • Pre-fabricated cable with M12 connectors 180 at both ends, fixed lengths, 1 unit:	0.3 m	6XV1870-8AE30
	0.5 m	6XV1870-8AE50
	1.0 m	6XV1870-8AH10
	1.5 m	6XV1870-8AH15
	2.0 m	6XV1870-8AH20
	3.0 m	6XV1870-8AH30
	5.0 m	6XV1870-8AH50
	10.0 m	6XV1870-8AN10
	15.0 m	6XV1870-8AN15

Designation		Order number
7/8" power connecting cable, suitable for cable carriers, 5 x 1.5 mm^2, • connecting cable with 7/8" connectors 180 at both ends, fixed lengths, 1 unit:	1.5 m	6XV1822-5BH15
	2.0 m	6XV1822-5BH20
	3.0 m	6XV1822-5BH30
	5.0 m	6XV1822-5BH50
	10.0 m	6XV1822-5BN10
	15.0 m	6XV1822-5BN15
7/8" power connecting cable, suitable for power cable carriers, 5 x 1.5 mm^2, • connecting cable with 7/8" angled connectors at both ends, fixed lengths, 1 unit:	1.5 m	(on request)
	2.0 m	(on request)
	3.0 m	(on request)
	5.0 m	(on request)
	10.0 m	(on request)
	15.0 m	(on request)
PROFIBUS M12 bus terminating connector, male insert 5 per pack, 1 pack		6GK1905-0EC00
PROFIBUS M12 bus terminating connector, female insert 5 per pack, 1 pack		6GK1905-0ED00
M12 cover caps (for circular sockets with socket insert) 100 per pack, 1 pack		3RX9802-0AA00
M12 cover caps (for circular sockets with male insert) 5 per pack, 1 pack		6ES7194-4JD60-0AA0
7/8" cover caps 10 per pack, 1 pack		6ES7194-3JA00-0AA0
Labels 20 x 7 mm, pale turquoise 340 items per pack, 1 pack		3RT1900-1SB20
Non-assembled cables and connectors:		
PROFIBUS DP M12 connector, male insert 5 per pack		6GK1905-0EA00
PROFIBUS DP M12 connector, female insert 5 item per pack		6GK1905-0EB00
PROFIBUS DP M12 connector, angled, male insert 5 per pack		(on request)
PROFIBUS DP M12 connector, angled, female insert 5 per pack		(on request)
PROFINET M12 connector, d-coded, with FastConnect connection system, 180° cable outlet		
• 1 per pack, 1 pack		6GK1901-0DB10-6AA0
• 8 per pack, 1 pack		6GK1901-0DB10-6AA8
PROFINET RJ45 connector with FastConnect connection system, 180° cable outlet		
• 1 per pack, 1 pack		6GK1901-1BB10-2AA0
• 10 per pack, 1 pack		6GK1901-1BB10-2AB0
PROFINET RJ45 connector with FastConnect connection system, 90° cable outlet		
• 1 per pack, 1 pack		6GK1901-1BB20-2AA0
• 10 per pack, 1 pack		6GK1901-1BB20-2AB0

Designation	Order number
7/8" connector (screw technique), male insert 5 items/package	6GK1905-0FA00
7/8" connector (screw technique), female insert 5 items/package	6GK1905-0FB00
7/8" connector (screw technique), angled, male insert 5 items/package	(on request)
7/8" connector (screw technique), angled, female insert 5 items/package	(on request)
PROFIBUS FC cable Sold by meter, min. ordering quantity 20 m Delivery unit max. 1000 m, 1 m	
• FC Standard Cable	6XV1830-0EH10
• FC Trailing Cable (for cable carriers)	6XV1830-3EH10
• FC Food Cable (PE sheath)	6XV1830-0GH10
• FC Food Cable (PUR sheath)	6XV1830-0JH10
PROFIBUS FastConnect stripping tool	6GK1905-6AA00
PROFINET FC cable Sold by meter, min. quantity 20 m Delivery unit max. 1000 m, 1 m	
• FC TP standard cable	6XV1840-2AH10
• FC TP trailing cable (for cable carriers)	6XV1840-3AH10
• FC TP marine cable	6XV1840-4AH10
PROFINET FastConnect stripping tool	6GK1901-1GA00
Energy Cable power cable suitable for cable carriers, 5 x 1.5 mm^2 Sold by meter, min. ordering quantity 20 m, Delivery unit max. 1000 m, 1 m	6XV1830-8AH10

A.2 Dimension drawings

A.2.1 IM 154-8 CPU interface module with terminal module

IM 154-8 CPU interface module with CM IM PN DP M12, 7/8" terminal module

Top: With narrow type rack. Bottom: With compact type rack.

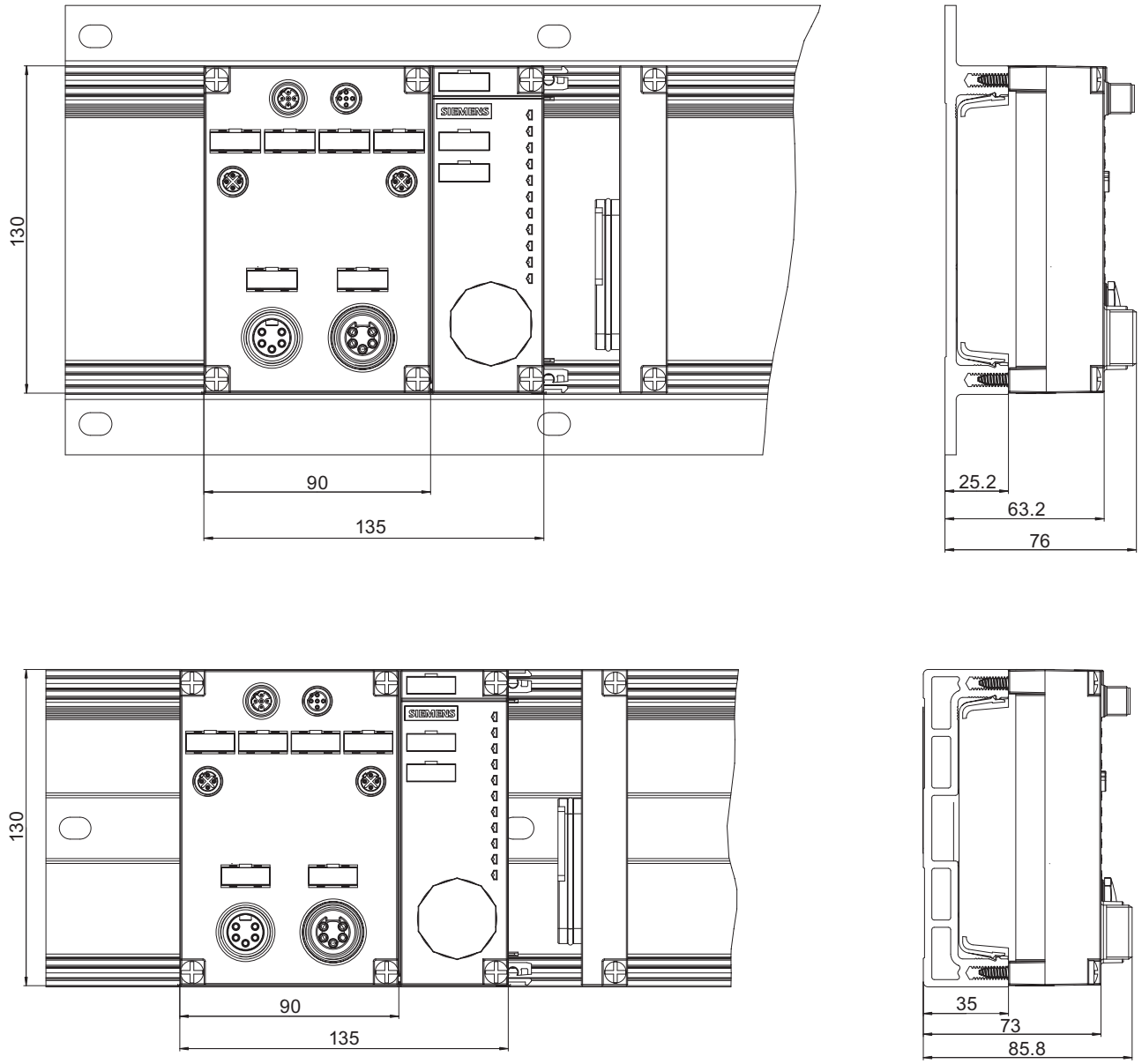


Figure A-1 Dimension drawing for IM 154-8 CPU interface module with CM IM PN DP M12, 7/8" terminal module

A.3 Cycle and response times

A.3.1 Overview

Overview

This section contains detailed information about the following topics:

- Cycle time
- Response time
- Interrupt response time

Reference: Cycle time

You can view the cycle time of your user program on the programming device. For additional information, refer to the *STEP 7 Online Help* or to the *Configuring Hardware and Connections in STEP 7* manual.

Reference: Execution time

Processing times can be found in the *S7-300 Instruction List for CPUs 31xC and 31x*. The instruction list contains the execution times in table form for all

- *STEP 7* instructions that can be processed by the IM 154-8 CPU,
- The SFCs / SFBs integrated into the IM 154-8 CPU,
- The IEC functions that can be called in *STEP 7*.

A.3.2 Cycle time

A.3.2.1 Overview: Cycle time

Introduction

This section explains what we mean by the term "cycle time", what it consists of, and how you can calculate it.

Meaning of the term cycle time

The cycle time represents the time that an operating system needs for one program pass, i.e. one OB 1 cycle, including all program sections and system activities interrupting this cycle. This time is monitored.

Time slice model

Cyclic program processing, and therefore user program execution, is based on time shares. To clarify these processes, let us assume that every time share has a length of precisely 1 ms.

Process image

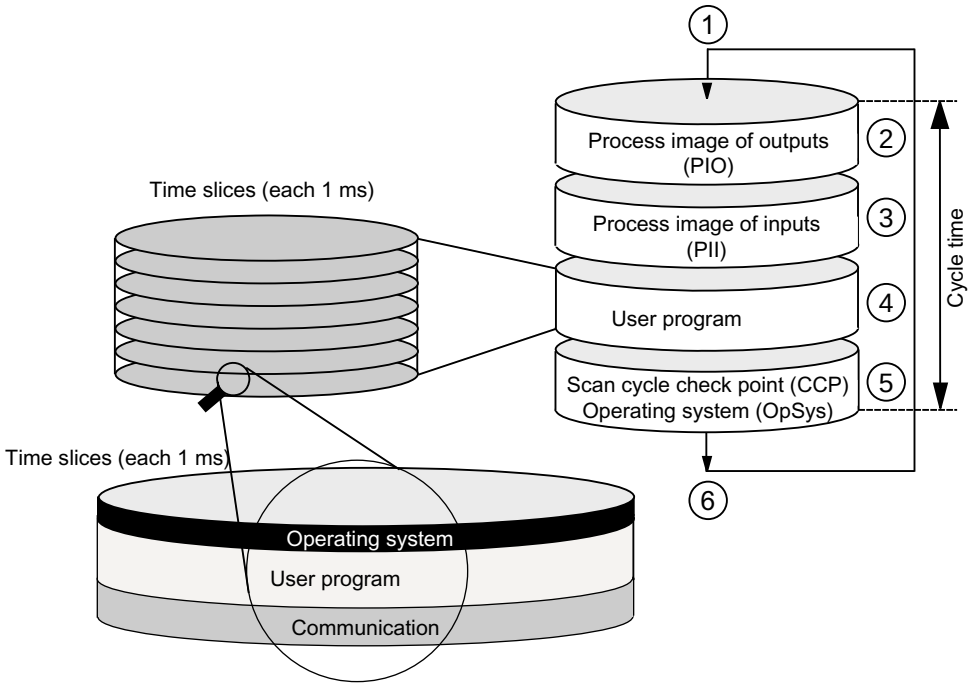
During cyclic program processing, the IM 154-8 CPU requires a consistent image of the process signals. To ensure this, the process signals are read/written prior to program execution. The IM 154-8 CPU then does not address input (I) and output (Q) address areas directly at the signal modules, but rather accesses the system memory area containing the I/O process image.

Sequence of cyclic program processing

The table and figure below show the phases in cyclic program processing.

Table A-5 Cyclic program processing

Step	Sequence
1	The operating system initiates cycle time monitoring.
2	The IM 154-8 CPU writes the values from the process output image to the output modules.
3	The IM 154-8 CPU reads the status at the inputs of the input modules and then updates the process input image.
4	The IM 154-8 CPU processes the user program in time slices and executes the operations specified in the program.
5	At the end of a cycle, the operating system executes queued tasks, for example, loading and deleting blocks.
6	The IM 154-8 CPU then returns to the start of the cycle, and restarts cycle time monitoring.



PIO: Process Image of Outputs
PII: Process Image of Inputs
SCC: Scan cycle check point
OpSys: Operating system

In contrast to S7-400 CPUs, the IM 154-8 CPU only accesses data with an OP / TP (monitor and modify functions) at the cycle control point (for data consistency, see *Technical specifications*). Processing of the user program is not interrupted by the monitor and modify functions.

Extending the cycle time

Always make allowances for the extension of the cycle time of a user program due to:

- Time-based interrupt processing
- Process interrupt processing
- Diagnostics and error processing
- Communication with programming devices (PGs), operator panels (OPs) and via connected CPs (e.g. Ethernet or PROFIBUS DP)
- Testing and commissioning such as, e.g. status/controlling of variables or block status functions.
- Transfer and deletion of blocks, compressing user program memory
- Write/read access to the SIMATIC Micro Memory Card using SFC 82 to 84 in the user program
- S7 communication via the integrated PROFINET interface.
- PROFINET CBA communication via the PROFINET interface (system load, SFC call, updating at the cycle control point)
- PROFINET IO communication via PROFINET interface (system load)

A.3.2.2 Calculating the cycle time

Introduction

The cycle time is derived from the sum of the following influencing factors.

Process image update

The table below shows the times that an IM 154-8 CPU needs to update the process image (process image transfer time). The specified times may be extended as a result of interrupts or IM 154-8 CPU communication. The process image transfer time is calculated as follows:

Table A-6 Formula for calculating the process image (PI) transfer time

The transfer time of the process image is calculated as follows:	
Base load K	+ Number of bytes in the PI for ET 200pro I/Os (A) + Number of words in the PI via PROFIBUS DP (D) + Number of words in the PI via PROFINET (P) **= Transfer time for the process image**

Table A-7 Data for calculating the process image (PI) transfer time

Const.	Components	IM 154-8 CPU
C	Base load	100 µs
A	Per byte in the PO for centralized ET 200pro I/Os	78 µs
D (PROFIBUS DP only)	Per word in the DP area for the integrated DP interface	5 µs
P (PROFINET only)	per WORD in the PROFINET area for the integrated PROFINET interface	7 µs

Extending the user program processing time

In addition to actually working through the user program, your IM 154-8 CPU's operating system also runs a number of processes in parallel, such as timer management for the core operating system. These processes extend the processing time of the user program. The table below lists the multiplication factors required to calculate your user program processing time.

Table A-8 Extending the user program processing time

CPU	Factor
IM 154-8 CPU	1,10

Operating system processing time at the scan cycle check point

The table below shows the operating system processing time at the cycle control point of the IM 154-8 CPU. This time applies without:

- Testing and commissioning routines, e.g. status/controlling of variables or block status functions
- Transfer and deletion of blocks, compressing user program memory
- Communication
- Writing, reading of the SIMATIC Micro Memory Card with SFC 82 to 84

Table A-9 Operating system processing time at the scan cycle check point

CPU	Cycle control at the scan cycle check point (CCP)
IM 154-8 CPU	500 µs

Extension of the cycle time as a result of nested interrupts

Enabled interrupts also extend cycle time. Details are found in the table below.

Table A-10 Extended cycle time due to nested interrupts

Interrupt type	Process interrupt	Diagnostic Interrupt	Time-of-day interrupt	Delay interrupt	Cyclic interrupt
IM 154-8 CPU	500 µs	600 µs	400 µs	300 µs	150 µs

The program runtime at interrupt level must be added to this time extension.

Extension of the cycle time due to error

Table A-11 Cycle time extension as a result of errors

Type of error	Programming errors	I/O access errors
IM 154-8 CPU	400 µs	400 µs

The interrupt OB processing time must be added to this extended time. The times required for multiple nested interrupt/error OBs are added accordingly.

A.3.3 Response time

A.3.3.1 Overview: Response time

Definition of response time

The response time is the time between the detection of an input signal and the change of a linked output signal.

Fluctuation width

The physical response time lies between the shortest and the longest response time. You must always reckon with the longest response time when configuring your system.

The shortest and longest response times are shown below, to give you an idea of the fluctuation width of the response time.

Factors

The response time depends on the cycle time and following factors:

- Delay in the I/O module inputs and outputs
- Additional send cycles for PROFINET IO
- Additional DP cycle times on PROFIBUS DP
- Execution in the user program

Reference

- The delay times are described in the technical data for the I/O modules *ET 200pro Distributed I/O Device* operating instructions.

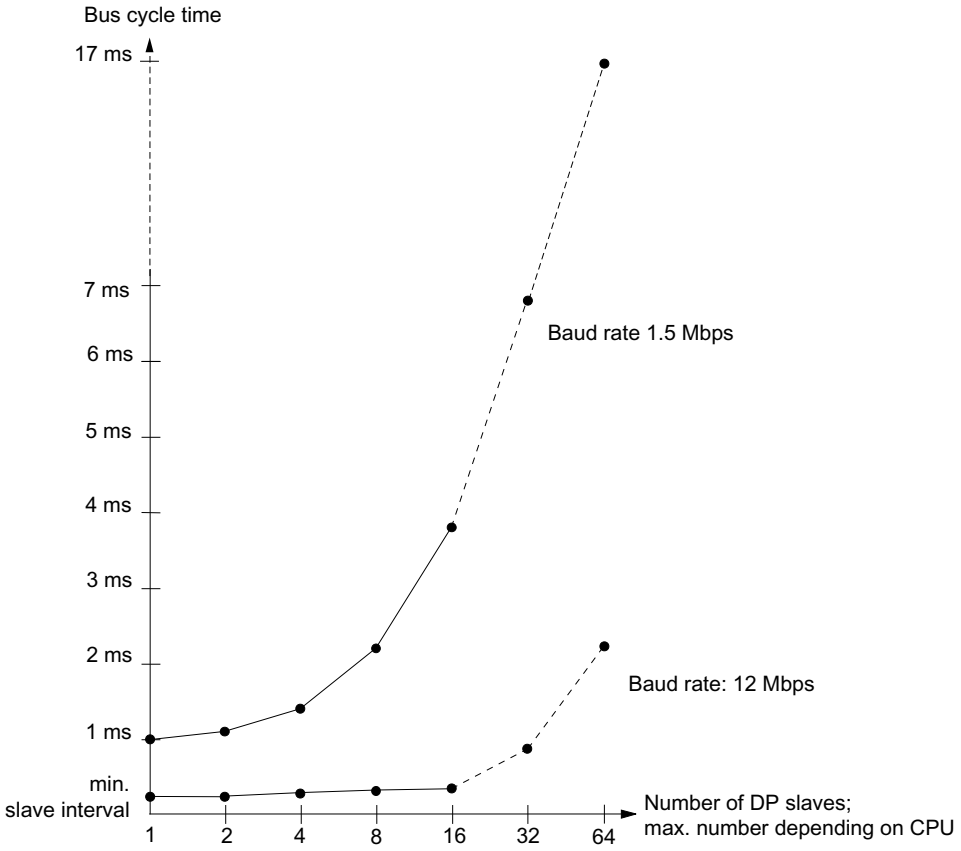
Update Time for PROFINET IO

If you configured your PROFINET IO system in *STEP 7*, *STEP 7* calculates the send cycle for PROFINET IO. You can then view the PROFINET IO send cycles on your PG.

DP cycle times in the PROFIBUS DP network

If you configured your PROFIBUS DP master system with *STEP 7*, then *STEP 7* will calculate the typical DP cycle time that must be expected. You can then view the DP cycle time of your configuration on the programming device.

The figure below gives you an overview of the DP cycle time. In this example, let us assume that the data of each DP slave has an average length of 4 bytes.

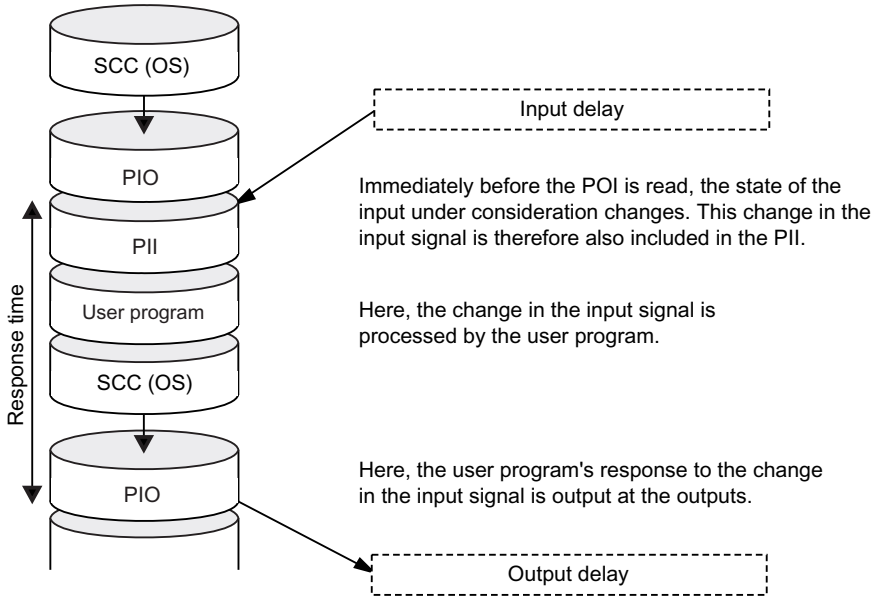


With multi-master operation on a PROFIBUS-DP network, you must make allowances for the DP cycle time at each master. That is, you will have to calculate the times for each master separately and then add up the results.

A.3.3.2 Shortest response time

Conditions for the shortest response time

The figure below shows the conditions under which the shortest response time is reached.



Calculation

The (shortest) response time is the sum of:

Table A-12 Formula: Shortest response time

	1 x process image transfer time for the inputs
+	1 x process image transfer time for the outputs
+	1 x program processing time
+	1 × operating system processing time at the SCC
+	Delay in the inputs and outputs
=	**Shortest response time**

The result is equivalent to the sum of the cycle time plus the I/O delay times.

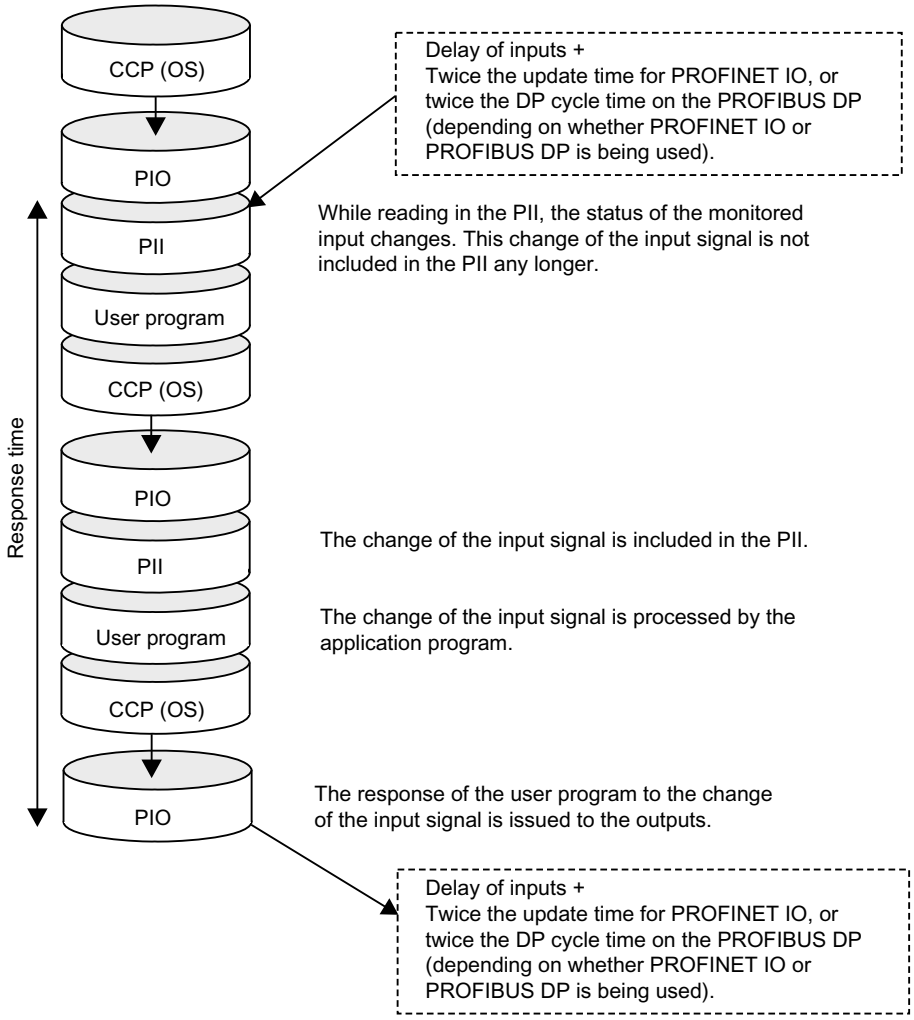
See also

Overview: Response time (Page 225)

A.3.3.3 Longest response time

Conditions for the longest response time

The figure below shows the conditions under which the longest response time is reached.



Calculation

The (longest) response time is the sum of:

Table A-13 Formula: Longest response time

	2 x process image transfer time for the inputs
+	2 x process image transfer time for the outputs
+	2 x program processing time
+	2 × operating system processing time
+	4 x PROFINET IO send cycle (only if PROFINET IO is used.)
+	4 x DP cycle time on PROFIBUS DP (only if PROFIBUS DP is used.)
+	Delay in the inputs and outputs
=	**Longest response time**

Equivalent to the sum of 2 x the cycle time + I/O delay time + 4 x the PROFINET IO scan cycle or 4 x the DP cycle time on PROFIBUS DP.

See also

Overview: Response time (Page 225)

A.3.4 Interrupt response time

A.3.4.1 Overview: Interrupt response time

Definition of interrupt response time

The interrupt response time is the time that elapses between the first occurrence of an interrupt signal and the call of the first interrupt OB instruction. Generally valid: Higher-priority interrupts take priority. This means that the interrupt response time is increased by the program processing time of the higher-priority interrupt OBs and the interrupt OBs of equal priority which have not yet been executed (queued).

Process/diagnostic interrupt response times of the IM 154-8 CPU

Table A-14 Process/diagnostic interrupt response times of the IM 154-8 CPU

Interrupt response times (without communication) for ...	Duration
Process alarm / diagnostic alarm	less than 10 ms

Process interrupt processing

Process interrupt processing begins after process interrupt OB 40 is called. Higher-priority interrupts stop process interrupt processing. Direct I/O access is executed during runtime of the instruction. After process interrupt processing has terminated, cyclic program execution continues or further interrupt OBs of equal or lower priority are called and processed.

See also

Overview (Page 220)

A.4 Porting a user program

Introduction

By porting we mean making available on a distributed basis a program that was previously used centrally on a master. Certain adjustments may be necessary to relocate an existing program partially or completely from a master to an intelligent slave. The resources required for porting sections of a user program to an intelligent slave depend on how the address assignment of outputs is stored in the FBs in the source program.

The outputs can be used in the FCs in the source program in different ways. In a distributed ET 200pro, addresses can be compressed. If ET 200pro I/O modules are used downstream of the IM 154-8 CPU (used centrally), this is not possible, however.

Porting with unpacked addresses

If you use FBs with uncompressed output addresses, the required program sections can be transferred easily to the IM 154-8 CPU without the need for porting.

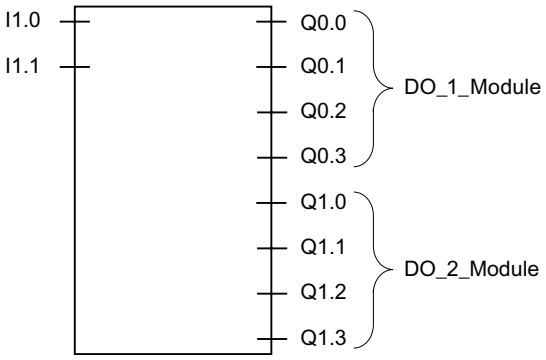


Figure A-2 Example: FB with unpacked addresses

Porting with packed addresses

If FBs with compressed output addresses are copied to the IM 154-8 CPU, the compressed addresses there can no longer be assigned to the outputs of the I/O modules locally because the CPU of the IM 154-8 CPU cannot work with compressed addresses. This requires rewiring of the corresponding FBs. Rewiring corresponds to "unpacking" the addresses.

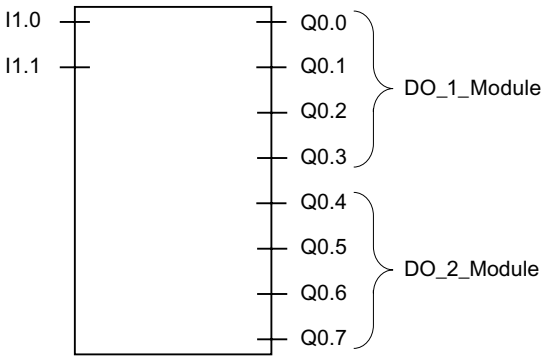


Figure A-3 Example: FB with packed addresses

Rewiring

The following blocks and addresses can be rewired:

- Inputs, outputs
- Bit memories, timers, counters
- Functions and function blocks

To rewire the signals, please do the following:

1. In SIMATIC Manager, select the "Blocks" folder containing the blocks with compressed addresses that you want to port to the IM 154-8 CPU.
2. Select **File > Rewire**.
3. In the "Rewire" dialog box that appears, enter the required substitutions (old address / new address) in the table.
4. Press the "OK" button.

This will start the rewiring. After rewiring, a dialog box opens so you can decide whether to view the info file about the rewiring. The info file contains the "Old address" and "New address" lists. These list the individual blocks and the number of wiring operations carried out in each block.

If you assign symbols to the outputs in *STEP 7* using the symbol table, if the symbol table is modified you will also have to modify the program segment for use in the IM 154-8 CPU.

Example: Substitution under Options > Rewire

Table A-15 Example: Substitutions under Options > Rewire

	Old address	New address
1	Q0.4	Q1.0
2	Q0.5	Q1.1
3	Q0.6	Q1.2
4	Q0.7	Q1.3

Example: Rewiring the signals

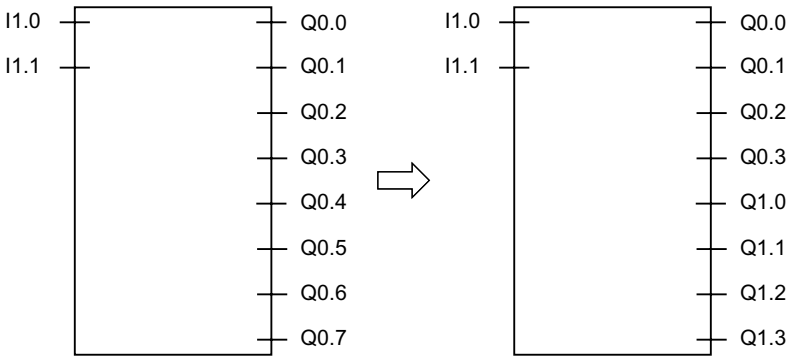


Figure A-4 Example: Rewiring the signals

Porting FBs with outputs to an I/O word

If you map the addresses of the outputs via an I/O word onto a function block you have programmed, porting is significantly more time-consuming.

There are two ways to do this:

- Program a shell around the FB that makes an adjustment so that the FB can be used with the IM 154-8 CPU.
- Reprogram the FB.

We recommend you reprogram the FB because this is easier than programming a shell.

Additional information

See also the *STEP 7 Online Help*.

Glossary

Accumulator

Accumulators represent CPU register and are used as buffer memory for download, transfer, comparison, calculation and conversion operations.

Address

An address is the identifier of a specific address or address area.
Examples: Input I 12.1; Memory Word MW 25; Data Block DB 3.

Analog modules

Analog modules convert analog process values (for example, temperature) into digital values that can be processed by the CPU, or convert digital values into analog manipulated variables.

Application

An application is a program that runs directly on the MS-DOS / Windows operating system. Applications on the programming device include, for example, the *STEP 7* basic package, S7-GRAPH and others.

→ *User program*

ASIC

ASIC is the acronym for Application Specific Integrated Circuits.

PROFINET ASICs are components with a wide range of functions for the development of your own devices. They implement the requirements of the PROFINET standard in a circuit and allow extremely high packing densities and performance.

Because PROFINET is an open standard, SIMATIC NET offers PROFINET ASICs for the development of your old devices under the name ERTEC .

Automation system

An automation system is a programmable logic controller in the context of SIMATIC S7.

Autonegotiation

Configuration protocol in the Fast Ethernet. Before the actual data transfer the devices on the network agree a transfer mode that each participating device can master (100 Mbps or 10 Mbps, full-duplex or half-duplex)

Backplane bus

Serial data bus used by the interface module to communicate with electronic modules and to supply power to these. The various modules are interconnected via bus modules.

Backup memory

Backup memory ensures buffering of the memory areas of a CPU without backup battery. It backs up a configurable number of timers, counters, bit memory, data bytes and retentive timers, counters, bit memory and data bytes).

Baud rate

Data transfer rate (in bps)

Bit memory

Bit memory are part of the CPU's system memory. They store intermediate results of calculations. They can be accessed in bit, word or dword operations.

Bus

A bus is a communication medium connecting several nodes. Data can be transferred via serial or parallel circuits, that is, via electrical or fiber optic conductors .

Bus connector

Physical connection between the bus node and the bus cable.

Bus node

This is a device that can send, receive or amplify data via the bus. It can be a DP master, DP slave, RS 485 repeater, active star coupler etc.

Bus segment

A bus segment is a self-contained section of a serial bus system. Bus segments are linked to one another using repeaters in PROFIBUS DP, for example.

Chassis ground

Chassis ground includes all the interconnected inactive parts of equipment that must not carry a hazardous voltage even in the event of a fault.

Clock memory

Memory bit which can be used to generate clock pulses in the user program (1 memory byte).

Note

Make sure that the clock memory byte is not overwritten in the user program.

CM

Connection Module: Connection module

CM IM

Connection module for an interface module Those modules are mounted onto the interface modules. They are used to connect PROFIBUS DP, PROFINET, the electronics / encoder 1L+ supply and the load voltage supply 2L+.

Code block

A SIMATIC S7 logic block contains elements of the *STEP 7* user program. (in contrast to a DB: this contains only data.)

Component-based automation

→ *PROFINET CBA*

Compression

The programming device online function "Compress" is used to rearrange all valid blocks in CPU RAM in one continuous area of user memory, starting at the lowest address. This eliminates fragmentation which occurs when blocks are deleted or edited.

Configuration

Assignment of modules to slots and (for example with electronic modules) addresses.

Consistent data

Data which are related in their contents and not to be separated are referred to as consistent data.

For example, the values of analog modules must always be handled as a whole, that is, the value of an analog module must not be corrupted as a result of read access at two different points of time.

Counters

Counters are part of CPU system memory. The content of "Counter cells" can be modified by *STEP 7* instructions (for example, up/down count.)

CPU

Central processing unit = CPU of the S7 automation system with a control and arithmetic unit, memory, operating system, and interface for programming device.

Cycle time

The cycle time represents the time a CPU requires for one execution of the user program.

Cyclic interrupt

→ *Interrupt, cyclic interrupt*

Data block

Data blocks (DB) are data areas in the user program which contain user data. There are shared data blocks which can be accessed by all code blocks, and instance data blocks which are assigned to a specific FB call.

Data exchange broadcast

→ *Direct data exchange*

Data exchange traffic

→ *Direct data exchange*

Data, static

Static data can only be used within a function block. These data are saved in an instance data block that belongs to a function block. Data stored in an instance data block are retained until the next function block call.

Data, temporary

Temporary data is the local data of a block. It is stored in the L-stack when the block is executed. After the block has been processed, this data is no longer available.

Default router

The default router is the router that is used when data must be forwarded to a partner located within the same subnet.

In *STEP 7*, the default router is called **Router**. *STEP 7* assigns a local IP address to the default router by default.

Determinism

→ *Real Time*

Device

Within the context of PROFINET, "device" is the generic term for:

- Automation systems
- Field devices (PLC, PC, for example)
- Active network components (for example, distributed I/O, valve terminals, drives)
- Hydraulic devices
- Pneumatic devices

The main characteristic of a device is its integration in PROFINET communication over Ethernet or PROFIBUS.

The following device types are distinguished based on their attachment to the bus:

- PROFINET devices
- PROFIBUS devices

→ *PROFIBUS device*

→ *PROFINET device*

Device name

Because a fixed IP address is assigned to the device name, an IO device must have a device name in order to be addressed by an IO controller. With PROFINET, this procedure is used because names are easier to handle than complex IP addresses.

The assignment of a device name for a specific IO device can be compared with the setting of the PROFIBUS address for a DP slave.

In the state of delivery a IO device has no device name. The IO device can only be addressed by a IO controller after the device has been assigned a device name, for the transfer of configuration data (IP address and other data) in the startup phase or for the exchange of user data in cyclic operation, for example.

Alternatively the device name can be written directly to the SIMATIC micro memory card (for the ET 200pro IO device) in the programming device.

Diagnostic buffer

The diagnostics buffer represents a buffered memory area in the CPU. It stores diagnostic events in the order of their occurrence.

Diagnostic interrupt

Modules capable of diagnostics operations report detected system errors to the CPU by means of diagnostic interrupts.

Diagnostics

→ *System diagnostics*

Direct data exchange

Direct data exchange is a special communication relationship between PROFIBUS DP nodes. The direct data exchange is characterized by PROFIBUS DP nodes which "listen" on the bus and know which data a DP slave returns to its DP master.

Distributed I/O systems

I/O systems that are not integrated into the central controller, but rather at distributed locations a long distance from the CPU, such as:

- ET 200M, ET 200X, ET 200L, ET 200S, ET 200pro
- DP/AS-I Link
- S5-95U with PROFIBUS DP slave interface
- Further DP slaves supplied by Siemens or other vendors.

The distributed I/O systems are connected to the DP master via PROFIBUS DP.

DP master

A master that complies with the IEC 61784-1:2002 Ed1 CP 3/1 standard is known as a DP master.

→ *Master*

DP slave

A slave running on the PROFIBUS using the PROFIBUS DP protocol in compliance with IEC 61784-1:2002 Ed1 CP 3/1 is known as a DP slave.

→ *Slave*

DP Standard

Bus protocol of the ET 200 distributed I/O system to IEC 61784-1:2002 Ed1 CP 3/1.

DPV1

The designation DPV1 means extension of the functionality of the acyclical services (to include new interrupts, for example) provided by the DP protocol. The DPV1 functionality is an integral part of the IEC 61784-1:2002 Ed1 CP 3/1 standard.

Electrically isolated

Electrically isolated I/O modules are isolated from the reference potentials of the control and load circuits by means of an optocoupler, relay contact or transformer circuit, for example. I/O circuits may be connected to the same potential.

Electronic modules

Electronic modules form the interface between the process and the automation system. There are digital input and output modules and analog input and output modules.

Equipotential bonding

Electrical connection (equipotential bonding conductor) that keeps electrical equipment and extraneous conductive objects to the same or almost the same potential in order to prevent disturbing or dangerous voltages between those objects.

Error display

One of the possible reactions of the operating system to a runtime error is to output an error message. Further reactions: Error reaction in the user program, CPU in STOP.

Error handling via OB

After the operating system has detected a specific error (e.g. an access error with *STEP 7*), it calls a dedicated organization block (error OB) in which the subsequent behavior of the CPU can be defined.

Error response

Reaction to a runtime error. Reactions of the operating system: It sets the automation system to STOP, indicates the error, or calls an OB in which the user can program a reaction.

ERTEC

→ *ASIC*

ET 200

The ET 200 distributed I/O system with PROFIBUS DP protocol allows the connection of distributed I/Os to a CPU or suitable DP master. ET 200 is characterized by high-speed reaction times, because of a minimum data transfer volume (bytes.)

The ET 200 is based on IEC 61784-1:2002 Ed1 CP 3/1.d standard.

ET 200 operates according to the master-slave principle. Possible DP masters include the IM 308-C master interface module or the IM 154-8 CPU.

The ET 200M, ET 200X, ET 200L, ET 200S distributed I/Os or DP slaves from Siemens or other vendors may be used as DP slaves.

External lightning protection

External plant components at which galvanic coupling of lightning surges is excluded. Corresponds with lightning protection zone 0_A and 0_B.

Fast Ethernet

Fast Ethernet describes the standard for transferring data with 100 Mbits. Fast Ethernet uses the 100 Base-T standard.

FB

→ *Function block*

FC

→ *Function*

Flash EPROM

FEPROMs can retain data in the event of power loss, same as electrically erasable EEPROMs. However, they can be erased within a considerably shorter time (FEPROM = Flash Erasable Programmable Read Only Memory). They are used on SIMATIC Micro memory cards.

FORCE

The Force function can be used to assign the variables of a user program or CPU (also: inputs and outputs) constant values.

In this context, also note the restrictions in the *Overview: Test functions* section in the *Test functions, diagnostics and troubleshooting* chapter.

FREEZE

Control command a DP master may broadcast to a group of DP slaves.

When it receives a FREEZE command, the slave freezes its current input status and outputs its data cyclically to the DP master.

The DP slave freezes its input status again after each new FREEZE command.

The DP slave does not resume the transfer input data to the DP master until the DP master has sent the UNFREEZE control command.

Function

According to IEC 1131-3, a function (FC) is a code block without static data. A function allows transfer of parameters in user program. Functions are therefore suitable for programming frequently occurring complex functions, e.g. calculations.

Function block

According to IEC 1131-3, a function block (FB) is a code block with static data. An FB allows the user program to pass parameters. Function blocks are therefore suitable for programming complex functions, e.g., closed-loop controls, mode selections, which are repeated frequently.

Functional ground

Grounding which has the sole purpose of safeguarding the intended function of electrical equipment. With functional grounding you short-circuit interference voltage which would otherwise have an unacceptable impact on equipment.

GD circuit

A GD circuit comprises a number of CPUs sharing data by means of global data communication, and is used as follows:

- A CPU broadcasts a GD packet to the other CPUs.
- A CPU sends and receives a GD packet from another CPU.

A GD circuit is identified by a GD circuit number.

GD element

A GD element is generated by assigning shared global data. It is identified by a unique global data ID in the global data table.

GD packet

A GD packet can consist of one or several GD elements transmitted in a single message frame.

Global data

Global data can be addressed from any code block (FC, FB, OB). In particular, this refers to bit memory M, inputs I, outputs Q, timers, counters and data blocks DB. Global data can be accessed via absolute or symbolic addressing.

Global data communication

Global data communication is a method of transferring global data between CPUs (without CFBs).

Ground

The conductive earth whose electrical potential can be set equal to zero at any point.

Ground potential may be different from zero in the area of grounding electrodes. The term reference ground is frequently used to describe this situation.

Ground-free

Having no direct electrical connection to ground

Grounding

Grounding means, to connect an electrically conductive component via an equipotential grounding system to a grounding electrode (one or more conductive components with highly conductive contact to earth).

GSD file

The properties of a PROFINET device are described in a GSD file (General Station Description) that contains all the information required for configuration.

As with PROFIBUS, you can link a PROFINET device in *STEP 7* by means of a GSD file.

In the case of the PROFINET IO the GSD file is in XML format. The structure of the GSD file is compliant with ISO 15734, which is the world-wide standard for device descriptions.

For PROFIBUS, the GSD file is in ASCII format (according to IEC 61784-1:2002 Ed1 CP 3/1).

Hot-swapping

The removal and insertion of modules while ET 200pro is in run.

IM

Interface module: The interface module connects the ET 200pro to the DP master or IO controller and prepares the data for the electronic modules.
In an ET 200pro with IM 154-8 CPU, this is the actual IM 154-8 CPU.

- DP master or intelligent DP slave or
- IO controller.

Industrial Ethernet

Industrial Ethernet (formerly SINEC H1) is a technology that allows data to be transmitted free of interference in an industrial environment.

Standard Ethernet components can be used since the PROFINET is an open system. However, we recommend setting up PROFINET as Industrial Ethernet.

→ *Fast Ethernet*

Industrial Wireless LAN

In addition to data communication, Industrial Wireless LAN from SIMATIC NET with the standard IEEE 802.11, offers a multitude of extensions (I-Features) that are of great benefit to industrial users. IWLAN is particularly suited for complex industrial applications with requirement for reliable radio communication, owing to:

- Automatic roaming if connection to Industrial Ethernet is interrupted (Rapid Roaming)
- Cost savings generated by using a single wireless network for secure operation of a process with both process-critical data (alarm message, for example) and non-critical communication (service and diagnostics, for example)
- Cost-effective connection to devices in remote, difficult-to-access environments

Instance data block

The *STEP 7* user program assigns an automatically-generated DB to every call of a function block. The instance data block stores the values of input, output and in/out parameters, as well as local block data.

Intelligent DP slave

One feature of an intelligent DP slave is that input / output data is not made available to the DP master directly from an actual input / output of the DP slave. Rather it is provided by a CPU that preprocesses the data, in this case the IM 154-8 CPU interface module.

Interface, MPI-capable

→ *MPI*

Internal lightning protection

Shielding of buildings, rooms or devices Corresponds with lightning protection zone 1, 2 or 3.

Interrupt

The operating system of an S7 CPU can distinguish between different priority classes that control how the user program is executed. These priority classes include interrupts, e.g. process interrupts. When an interrupt is triggered, the operating system automatically calls an assigned OB. In this OB the user can program the desired response (e.g. in an FB).

Interrupt, cyclic interrupt

A cyclic interrupt is generated periodically by the CPU in a configurable time pattern. A corresponding OB will be processed.

Interrupt, delay

The delay interrupt belongs to one of the priority classes in SIMATIC S7 program processing. It is generated on expiration of a time started in the user program. A corresponding OB will be processed.

Interrupt, diagnostic

→ *Diagnostic interrupt*

Interrupt, process

→ *Process interrupt*

Interrupt, status

A status interrupt can be generated by a DPV1 slave and causes OB55 to be called on the DPV1 master. For detailed information on OB55, see the Reference Manual *System and Standard Functions for for S7-300/400*.

Interrupt, time-of-day

The time-of-day interrupt is one of the priority classes in SIMATIC S7 program processing. It is generated at a specific date (or daily) and time-of-day (e.g. 9:50 or hourly, or every minute). A corresponding OB will be processed.

Interrupt, update

An update interrupt can be generated by a DPV1 slave and causes OB56 to be called on the DPV1 master. For detailed information on OB56, see the Reference Manual *System and Standard Functions for for S7-300/400*.

Interrupt, vendor-specific

A vendor-specific interrupt can be generated by a DPV1 slave and causes OB57 to be called on the DPV1 master. For detailed information on OB57, see the Reference Manual *System and Standard Functions for for S7-300/400*.

IO controller

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

IO device

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

IO supervisor

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

IO system

→ *PROFINET IO System*

IP address

To allow a PROFINET device to be addressed as a node on Industrial Ethernet, this device also requires an IP address that is unique within the network. The IP address is made up of 4 decimal numbers with a range of values from 0 through 255. The decimal numbers are separated by periods.

The IP address is made up of:

- The address of the (subnet) network
- The address of the node (generally called the host or network node)

LAN

Local area network. Interconnects computers within an enterprise. The LAN therefore has a limited geographical span and is solely available to a company or institution.

Load memory

The load memory contains objects generated by the programming device. For the IM 154-8 CPU, it takes the form of a plug-in SIMATIC micro memory card with various memory sizes. There must be a SIMATIC micro memory card plugged in before you can use the IM 154-8 CPU.

Load power supply

Power supply for the load voltage supply 2L+

Local data

→ *Data, temporary*

MAC Address

Every PROFINET device is assigned a worldwide unique device identification before it leaves the factory. This 6-Byte long device identification is the MAC address.

The MAC address is divided into:

- 3-Byte manufacturer identification
- 3-Byte device identification (consecutive number)

The MAC address is normally printed on the front of the device.
Example: 08-00-06-6B-80-C0

Master

When a master is in possession of the token, it can send data to other nodes and request data from other nodes (= active node). DP masters include the 315-2 DP or the IM 154-8 CPU.

→ *Slave*

Micro Memory Card

→ *SIMATIC Micro Memory Card*

Module parameters

Module parameters are values which can be used to configure module behavior. There are two different types of parameter: static and dynamic.

MPI

The multipoint interface (MPI) represents the programming device interface of SIMATIC S7. It enables multiple-node operation (PGs, text-based displays, OPs) on one or several PLCs. Each node is identified by a unique address (MPI address).

MPI address

→ *MPI*

NCM PC

→ *SIMATIC NCM PC*

Nesting depth

A block can be called from another by means of a block call. Nesting depth is referred to as the number of simultaneously called code blocks.

Network

A network consists of one or more interconnected subnets with any number of nodes. Several networks can exist alongside each other.

A network is a larger communication system that allows data exchange between a large number of nodes.

All the subnets together form a network.

Non-isolated

The reference potentials of the control and load circuit of non-isolated I/O modules are electrically interconnected.

NTP

The Network Time Protocol (NTP) is a standard for synchronizing clocks in automation systems via Industrial Ethernet. NTP uses the UDP wireless network protocol.

OB

→ *Organization blocks*

OB priority

The CPU operating system distinguishes between different priority classes, for example, cyclic program execution or process interrupt-controlled program processing. Each priority class is assigned organization blocks (OBs) in which the S7 user can program a response. The OBs are assigned different default priority classes. These determine the order in which OBs are executed or interrupt each other when they appear simultaneously.

Operating state

SIMATIC S7 automation systems know the following operating states: STOP, STARTUP, RUN.

Operating system

The CPU OS organizes all functions and processes of the CPU which are not associated to a specific control task.

→ *CPU*

Organization blocks

Organization blocks (OBs) form the interface between CPU operating system and the user program. The order in which the user program is executed is defined in the organization blocks.

Parameter

- Variable of a *STEP 7* code block
- Variable used to set the behavior of a module (one or more per module). All modules have a suitable basic factory setting which can be customized in *STEP 7*.
  There are static and dynamic parameters.

Parameter assignment

This means the passing of parameters from the DP master to the DP slave or from the IO controller to the IO device.

Parameters, dynamic

In contrast to static parameters, you can change dynamic module parameters in runtime by calling an SFC in the user program, e.g. limit values for an analog input module.

Parameters, static

In contrast to dynamic parameters, static parameters of modules cannot be changed by the user program. You can only modify these parameters by editing your configuration in *STEP 7*, for example, by modifying the input delay parameters of a digital input module.

PC station

→ *SIMATIC PC station*

PELV

Protective Extra Low Voltage = extra low voltage with safe isolation

PG

→ *Programming device*

PLC

Programmable controllers (PLCs) are electronic controllers whose function is saved as a program in the control unit. Therefore, the configuration and wiring of the unit does not dependend on the PLC function. A programmable logic controller has the same structure as a computer; it consists of a CPU with memory, input/output modules and an internal bus system. The I/O and the programming language are oriented to control engineering needs.

→ *CPU*

PNO

→ *PROFIBUS International*

Priority class

The S7 CPU operating system provides up to 26 priority classes (or "Program execution levels"). Specific OBs are assigned to these classes. The priority classes determine which OBs interrupt other OBs. Multiple OBs of the same priority class do not interrupt each other. In this case, they are executed sequentially.

Process image

The process image is part of CPU system memory. At the start of cyclic program execution, the signal states at the input modules are written to the process image of the inputs. At the end of cyclic program execution, the signal status of the process image of the outputs is transferred to the output modules.

Process interrupt

A process interrupt is triggered by interrupt-triggering modules as a result of a specific event in the process. The process interrupt is reported to the CPU. The assigned organization block will be processed according to interrupt priority.

Process-Related Function

→ *PROFINET components*

Product version

The product version identifies differences between products which have the same order number. The product version is incremented when forward-compatible functions are enhanced, after production-related modifications (use of new parts/components) and for bug fixes.

PROFIBUS

PROcess FIeld BUS, German process field bus standard specified in IEC 61784-1:2002 Ed1 CP 3/1. It provides functional, electrical and mechanical properties for a bit-serial fieldbus system.
From the viewpoint of the user program, the distributed I/Os are addressed in exactly the same way as the centralized I/Os.

PROFIBUS is available with the protocols DP (= Distributed Peripherals), FMS (= Fieldbus Message Specification), PA (= Process Automation), or TF (= Technological Functions.)

→ *PROFIBUS International*

PROFIBUS address

A node must be assigned a unique PROFIBUS address in order to allow its identification on PROFIBUS.

The PC/Programming device is assigned PROFIBUS address "0."

The ET 200pro distributed I/O system supports the PROFIBUS addresses 1 to 125.

PROFIBUS device

A PROFIBUS device has at least one or more PROFIBUS ports.

A PROFIBUS device cannot take part directly in PROFINET communication but must be included over a PROFIBUS master with a PROFINET port or an Industrial Ethernet/PROFIBUS link (IE/PB Link) with proxy functionality.

→ *Device*

PROFIBUS DP

→ *PROFIBUS International*

→ *PROFIBUS*

PROFIBUS International

Technical committee dedicated to the definition and development of the PROFIBUS and PROFINET standard.

Also known as the PROFIBUS User Organization membership corporation (PNO.)

Homepage: http://www.profibus.com

PROFINET

Within the framework of Totally Integrated Automation (TIA), PROFINET represents a consequent enhancement of:

- PROFIBUS DP, the established field bus, and
- Industrial Ethernet, the communication bus for the cell level

Experience gained from both systems was and is being integrated into PROFINET.

PROFINET is an Ethernet-based automation standard of PROFIBUS International (previously PROFIBUS Users Organization e.V.), and defines a multi-vendor communication, automation, and engineering model. PROFINET has been part of the standard IEC 61158 since 2003.

→ *PROFIBUS International*

PROFINET ASIC

→ *ASIC*

PROFINET CBA

In the context of PROFINET, PROFINET CBA (Component-based Automation) is an automation concept for:

- Implementation of modular applications with distributed intelligence
- Machine-to-machine communication

PROFINET CBA lets you create distributed automation solutions, based on default components and partial solutions. This concept satisfies demands for a higher degree of modularity in the field of mechanical and systems engineering by extensive distribution of intelligent processes.

Component-based Automation allows you to use complete technological modules as standardized components in large systems.

PROFINET CBA is implemented by:

- The PROFINET standard for programmable controllers
- The SIMATIC iMAP engineering tool

The components are created in an engineering tool that can differ from vendor to vendor. Components of SIMATIC devices are created, for example, with *STEP 7*.

PROFINET components

A PROFINET component encompasses the entire data of the hardware configuration, the parameters of the modules, and the corresponding user program. The PROFINET component is comprised of:

- Technological function

  The (optional) technological (software) function includes the interface to other PROFINET components in the form of configurable inputs and outputs.

- Device

  The device is the representation of the physical automation device or field device including the IO devices, sensors, actuators, mechanics, and device firmware.

PROFINET device

A PROFINET device always has at least one Industrial Ethernet port. A PROFINET device can also have a PROFIBUS port as a master with proxy functionality.

→ *Device*

PROFINET IO

Within the framework of PROFINET, PROFINET IO is a communication concept for the implementation of modular, distributed applications.

PROFINET IO allows you to create automation solutions, which are familiar to you from PROFIBUS.

PROFINET IO is based both on the PROFINET standard for programmable controllers and on the *STEP 7* engineering tool. This means that you have the same application view in *STEP 7*, regardless of whether you are configuring PROFINET or PROFIBUS devices. Programming your user program is essentially the same for PROFINET IO and PROFIBUS DP if you use the extended blocks and system status lists for PROFINET IO.

PROFINET IO Controller

Device via which the connected IO devices are addressed. That means: the IO controller exchanges input and output signals with assigned field devices. The IO controller is often the controller on which the automation program runs.

→ *PROFINET IO Device*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

PROFINET IO Device

Distributed field device assigned to one of the IO controllers
(e.g. remote IO, valve terminals, frequency converters, switches).

→ *PROFINET IO Controller*

→ *PROFINET IO Supervisor*

→ *PROFINET IO System*

PROFINET IO Supervisor

PG/PC or HMI device for commissioning and diagnostics.

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

→ *PROFINET IO System*

PROFINET IO System

PROFINET IO controller with assigned PROFINET IO devices.

→ *PROFINET IO Controller*

→ *PROFINET IO Device*

Programming device

Basically speaking, PGs are compact and portable PCs which are suitable for industrial applications. They are identified by a special hardware and software for programmable logic controllers.

Proxy

The PROFINET device with proxy functionality is the substitute for a PROFIBUS device on Ethernet. The proxy functionality allows a PROFIBUS device to communicate not only with its master but also with all nodes on PROFINET.

You can integrate existing PROFIBUS systems into PROFINET communication, for example with the help of an IE/PB link or an IM 154-8 CPU. The IE/PB link / then IM 154-8 CPU handles communication over PROFINET as a substitute for the PROFIBUS components.

→ *PROFINET device*

Publisher

The publisher is a sender in the direct data exchange.

→ *Direct data exchange*

RAM

RAM (Random Access Memory) is a semiconductor read/write memory.

Real Time

Real time means that a system processes external events within a defined time.

Determinism means that a system reacts in a predictable (deterministic) manner.

In industrial networks, both these requirements are important. PROFINET meets these requirements. PROFINET is implemented as a deterministic real-time network as follows:

- The transfer of time-critical data between different stations over a network within a defined interval is guaranteed.

  To achieve this, PROFINET provides an optimized communication channel for real-time communication : Real Time (RT).
- An exact prediction of the time at which the data transfer takes place is possible.
- This ensures that unimpeded communication can take place via other standard protocols in the same network, e.g. industrial communication for the programming device/PC.

→ *Real Time*

Reduction ratio

The reduction rate determines the send/receive frequency for GD packets on the basis of the CPU cycle.

Reference ground

→ *Ground*

Reference potential

Reference potential for the evaluation / measuring of the voltages of participating circuits.

Restart

On CPU startup (e.g. after is switched from STOP to RUN mode via selector switch or with POWER ON), OB100 (restart) is initially executed, prior to cyclic program execution (OB1). On restart, the input process image is read in and the *STEP 7* user program is executed, starting at the first instruction in OB1.

Retentive memory

A memory area is considered retentive if its contents are retained even after a power loss and transitions from STOP to RUN. The non-retentive area of bit memory, timers and counters is reset following a power failure and a transition from the STOP mode to the RUN mode.

Retentive can be the:

- Bit memory
- S7 timers
- S7 counters
- Data areas

Router

A router connects two subnetworks with each other. A router works in a way similar to a switch. With a router, however, it is also possible to specify which communications nodes can communicate via the router and which cannot. Communication nodes on different sides of a router can only communicate with each other if you have explicitly enabled communication between the two nodes via the router. Real time data cannot be replaced beyond subnetwork limits.

→ *Default router*

→ *Switch*

RT

→ *Real Time*

Runtime error

Errors occurred in the PLC (that is, not in the process itself) during user program execution.

Scan cycle check point

The cycle control point is the section of the CPU program processing in which the process image is updated.

Segment

→ *Bus segment*

SELV

Safety Extra Low Voltage

SFB

→ *System function block*

SFC

→ *System function*

SIMATIC

The term denotes Siemens products and systems for industrial automation.

SIMATIC Micro Memory Card

SIMATIC Micro Memory Cards are storage media for the IM 154-8 CPU.

SIMATIC NCM PC

SIMATIC NCM PC is a version of *STEP 7* designed specifically for configuring PCs. It provides the complete *STEP 7* functionality for PC stations.

SIMATIC NCM PC is the central tool with which you configure the communication services for your PC station. The configuration data generated with this tool must be downloaded to the PC station or exported. This makes the PC station ready for communication.

SIMATIC NET

Siemens business area for industrial communication, networks, and network components.

SIMATIC PC station

A "PC station" is a PC with communication modules and software components within a SIMATIC automation solution.

Slave

A slave can only exchange data after being requested to by the master.

→ *Master*

SNMP

SNMP (Simple Network Management Protocol) makes use of the wireless UDP transport protocol. It consists of two network components, similar to the client/server model. The SNMP manager monitors the network nodes and the SNMP agents collect the various network-specific information in the individual network nodes and stores it in a structured form in the **MIB** (Management Information Base). This information allows a network management system to run detailed network diagnostics.

STARTUP

A STARTUP routine is executed at the transition from STOP to RUN mode. Can be triggered by means of the mode selector switch, or after power on, or by an operator action on the programming device. The IM 154-8 CPU is restarted.

STEP 7

Engineering system. Contains programming software for the creation of user programs for SIMATIC S7 controllers.

Subnet mask

The bits set in the subnet mask determine which part of the IP address contains the address of the subnet/network.

In general:

- The network address is obtained by an AND operation on the IP address and subnet mask.
- The node address is obtained by an AND NOT operation on the IP address and subnet mask.

Subnetwork

All the devices connected by switches are located in the same network, called a subnet. All the devices in a subnet can communicate directly with each other.

All devices in the same subnet have the same subnet mask.

A subnet is physically restricted by a router.

Subscriber

The subscriber is a recipient in the direct data exchange.

→ *Direct data exchange*

Substitute

→ *Proxy*

Substitute value

Substitute values are configurable values which output modules transfer to the process when the CPU switches to STOP mode.

In the event of an I/O access error, a substitute value can be written to the accumulator instead of the input value which could not be read (SFC 44).

Switch

PROFIBUS is based on a line topology. Communication nodes are interconnected by means of a passive cable known as the bus.

By contrast, Industrial Ethernet is made up of point-to-point connections: Each communication node is interconnected directly with one other communication node.

A node is interconnected with several other communication nodes via the port of an active network component (switch). Other communications nodes (including switches) can then be connected to the other ports of the switch. The connection between a communication node and the switch remains a point-to-point connection.

The task of a switch is thus to regenerate and distribute received signals. The switch "learns" the Ethernet address(es) of a connected PROFINET device or of other switches, and passes only the signals intended for the connected PROFINET device or switch.

A switch has a certain number of ports. Connect only one PROFINET device or a further switch to any one of the ports.

SYNC

Control command a DP master may broadcast to a group of DP slaves.

With the SYNC control command the DP master causes the DP slave to freeze the statuses of the outputs at the current value. The DP slave stores the output data contained in the next frame, but does not change the state of its outputs.

After each new SYNC control command, the DP slave sets the outputs it has saved as output data. The outputs are not updated cyclically again until the DP master has sent a UNSYNC control command.

System diagnostics

System diagnostics refers to the detection, evaluation, and signaling of errors that occur within the PLC, for example programming errors or module failures. System errors can be indicated by LEDs or in *STEP 7*.

System function

A system function (SFC) is a function integrated in the operating system of the CPU that can be called when necessary in the *STEP 7* user program.

System function block

A system function block (SFB) is a function block integrated in the operating system of the CPU that can be called when necessary in the *STEP 7* user program.

System memory

System memory is an integrated RAM memory in the CPU. System memory contains the address areas (e.g. timers, counters, bit memory) and data areas that are required internally by the operating system (for example, communication buffers).

System status list

The system status list contains data that describes the current status of an ET 200pro with IM 154-8 CPU. You can always use this list to obtain an overview of:

- The configuration of the ET 200pro
- The current CPU parameter assignments and configurable electronic modules
- The current statuses and processes in the CPU and the configurable electronic modules

Terminating module

The ET 200pro distributed I/O system is always terminated with a terminating module An ET 200pro is not ready for operation without a terminating module.

Terminating resistor

The terminating resistor is used to avoid reflections on data links.

Time-of-day interrupt

→ *Interrupt, time-of-day*

Timer

→ *Timers*

Timers

Timers are part of CPU system memory. The content of timer cells is automatically updated by the operating system, asynchronously to the user program. *STEP 7* instructions are used to define the precise function of the timer cell (for example, switch-on delay) and to initiate their execution (for example, start).

Token

Allows access to the PROFIBUS DP for a limited time.

Topology

Structure of a network. Common structures include:

- Bus topology
- Ring topology
- Star topology
- Tree topology

Twisted Pair

Fast Ethernet via twisted-pair cables is based on the IEEE 802.3u standard (100 Base-TX). Transmission medium is a shielded 2x2 twisted-pair cable with an impedance of 100 Ohm (AWG 22). The transmission characteristics of this cable must meet the requirements of category 5.

The maximum length of the connection between end device and network component must not exceed 100 m. The ports are implemented according to the 100 Base-TX standard with the RJ-45 connector system.

Update Time

During the send cycle, all IO devices in the PROFINET IO system are supplied with new data from the IO controller (outputs), and all IO devices have their latest data sent to the IO controller (inputs).

Note

Send Cycles for Cyclical Data Exchange

STEP 7 determines the send cycle on the basis of the existing hardware configuration and the resulting cyclical data traffic. During this time, a PROFINET IO device has exchanged its user data with the associated IO controller.

The send cycle can be set for an entire bus segment of a controller or for an individual IO device.

You can increase the send cycle manually in *STEP 7*.

If other cyclic PROFINET services (for example, cyclic services for PROFINET CBA) need to be taken into account in addition to PROFINET IO: In the Send Cycle dialog in STEP 7 / HW Config, set a send cycle for the relevant devices to be reserved for PROFINET IO.

For more information, refer to the *STEP 7 online help*.

User program

In SIMATIC, a distinction is made between the operating system of the CPU and user programs. The user program contains all instructions, declarations and data for signal processing required to control a plant or a process. It is assigned to a programmable module (for example CPU) and can be structured in smaller units (blocks).

→ *Operating system*

→ *STEP 7*

Voltage group

A group of electronic modules supplied by one power module.

WAN

Wide Area Network; extends beyond LAN limits and allows worldwide communication. Legal rights do not belong to the user, but to the provider of the WAN networks.

Work memory

The work memory is integrated in the CPU and cannot be extended. It is used to run the code and process user program data. Programs only run in work memory and system memory.

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