SIEMENS

SIMATIC

**Distributed I/O device
ET 200M**

Operating Instructions

The following supplement is part of this documentation:

No.	Product Information	Drawing number	Edition
1	Interface modules IM 153-4 PN and IM 153-2 HF	A5E02714952-AE	04/2015

Legal information

Warning notice system

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.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

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

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

(A   )   .

Preface

Purpose of the operating instructions

The information contained in these operating instructions enables you to operate an IM 153 interface module together with the modules of the S7-300 spectrum in the distributed I/O ET 200M as a DP slave.

Basic knowledge required

To understand the operating instructions you require general experience in the field of automation engineering.

Range of validity of these operating instructions

Module	Order number	As of product version
IM 153-1	6ES7153-1AA03-0XB0	02
	6ES7153-1AA83-0XB0	01
IM 153-2	6ES7153-2AA02-0XB0	07
	6ES7153-2BA00-0XB0	01
	6ES7153-2BA01-0XB0	01
	6ES7153-2BA02-0XB0	01
	6ES7153-2BA81-0XB0	01
	6ES7153-2BA82-0XB0	01
IM 153-2 FO	6ES7153-2AB01-0XB0	06
	6ES7153-2BB00-0XB0	01
IM 153-4 PN	6ES7153-4AA00-0XB0	01
	6ES7153-4AA01-0XB0	01

Declaration: In the following the term IM 153-x is used in the operating instructions, apart from when a description refers directly to a special variant of the IM 153-x.

A variant of the IM 153-1 as well as of the IM 153-2 is also available as a module for use in expanded environmental conditions ("outdoor"). To find out under which climatic and mechanical environmental conditions you can use the IM 153-1 /-2, refer to the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" Reference Manual.

With the IM 153-x in the latest version we reserve the right to enclose a product information bulletin containing up-to-date information regarding the respective IM 153-x interface module or the operating instructions.

The production information can also be found on the Internet (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo2&aktprim=99&lang=en). There, search for "IM 153-2", for example.

Changes since the previous version

The following changes have been made since the previous version of these operating instructions "ET 200M distributed IO device" with the drawing number EWA-4NEB780600601-07, version 02/2006:

The IM 153-4AA01 interface module offers the following new functions:

- Isochronous real-time communication Class2
- Prioritized startup
- Operation without removable data storage medium (SIMATIC Micro Memory Card)
- Device replacement without removable media / programming device
- Changing IO devices during operation (changing partner ports)

In addition to this, the production information from 01/2007 - 08/2007 attached to the operating instructions has been integrated in these operating instructions.

Approvals

See chapter "Standards and Approvals (Page 225)."

CE Label

See chapter "Standards and Approvals (Page 225)."

Identification for Australia (C-Tick mark)

See chapter "Standards and Approvals (Page 225)."

Standards

See chapter "Standards and Approvals (Page 225)."

Position in the Information Landscape

The following table provides an overview of the manuals for the ET 200M

Manual	Contents
"ET 200M distributed I/O device (http://support.automation.siemens.com/WW/view/en/1142798) "	• Configuring the mechanical and electrical configuration • Installing and wiring • Commissioning and Diagnostics • Interface module IM 153 • Order Numbers for the ET 200M
"S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629) "	• General technical specifications • Power supply modules • Digital modules • Analog modules • Order numbers for S7-300
"ET 200M signal modules for process automation (http://support.automation.siemens.com/WW/view/en/7215812) "	• Overview of the use in process automation • Parameter assignment with *SIMATIC PDM* • Digital input group • Digital output module

In addition to these operating instructions you will require the manual for the DP master that is being used and the "ET 200 distributed I/O system" manual.

Manual	Contents
ET 200 distributed I/O system	• System overview of the ET 200 and PROFIBUS • Planning and commissioning • Description of the RS 485 repeater • Description of the S5-95U
Manual for the DP master	• Configuring and commissioning a DP master system • Description of the DP master

In the appendix "Order Numbers for the ET 200M (Page 247)" you will find a listing of additional sources of information on the SIMATIC S7 and the ET 200 distributed I/O system.

The description of the parameter assignment and configuration message frame is not a constituent part of these operating instructions. You will find a description of this on the Internet (http://support.automation.siemens.com/WW/view/en/1455647).

Guide

To easily obtain quick access to the specific information, the operating instructions contain the following access aids:

- You will find a comprehensive table of contents and a list of all the tables in the document at the beginning of the manual.

- A heading indicating the contents of each section is provided in the left-hand column on each page of each chapter.

- After the appendices you will find a glossary in which important technical terms used in the manual are defined.

- At the end of the manual you will find a comprehensive index enabling rapid access to the information you are looking for.

Recycling and disposal

On account of its low level of contaminants, the ET 200M is suitable for recycling. Contact a certified electronic-waste disposal company to recycle and dispose of your old equipment in an environment-friendly manner.

Contacts

See product information "Technical Support, Contacts and Training (http://support.automation.siemens.com/WW/view/en/19293011)."

Training

See product information "Technical Support, Contacts and Training (http://support.automation.siemens.com/WW/view/en/19293011)."

SIMATIC Technical Support

See product information "Technical Support, Contacts and Training (http://support.automation.siemens.com/WW/view/en/19293011)."

Service & Support on the Internet

See product information "Technical Support, Contacts and Training (http://support.automation.siemens.com/WW/view/en/19293011)."

See also

IM 153-x: Variants and properties (Page 17)

Table of contents

Product overview 1

1.1 What Are Distributed I/O Devices

Area of application

When a system is set up, it is common for the inputs to and outputs from the process to be incorporated centrally in the automation system.

If there are inputs and outputs at considerable distances from the programmable controller, there may be long runs of cabling which are not easy to follow, and electromagnetic interference may impair reliability.

Distributed I/O devices are the ideal solution for such systems:

- the control CPU is located at a central location
- The I/O devices (inputs and outputs) operate locally on a distributed basis.
- the powerful PROFIBUS DP with high data transmission speed ensures that the control CPU and the I/O devices communicate smoothly.
- PROFINET IO

1.2 What is PROFIBUS DP?

What is PROFIBUS DP?

PROFIBUS DP is an open bus system in accordance with the standard IEC 61784-1:2002 Ed1 CP 3/1 with the transmission protocol "DP" (DP is the abbreviation of the German term "dezentrale Peripherie" (distributed I/O).

Physically, the PROFIBUS DP is either an electric network based on a shielded two-wire line (RS 485) or an optical network based on a fiber-optic cable (FOC).

The transmission protocol "DP enables a fast, cyclic data exchange between the control CPU and the distributed I/Os.

What are the DP master and DP slaves?

The DP master is the connecting link between the control CPU and the distributed I/Os. The DP master exchanges the data via the PROFIBUS DP with the distributed I/Os and monitors the PROFIBUS DP.

The distributed I/Os (= DP slaves) prepare the data of the encoder and the actuators on site in such a way that they can be transmitted via the PROFIBUS DP to the control CPU.

Which devices can be connected to PROFIBUS DP?

The most varied devices can be connected as DP masters or DP slaves to the PROFIBUS DP, the only proviso is that they behave in accordance with the standard IEC 61784-1:2002 Ed1 CP 3/1. Among others, devices of the following product families can be used:

- SIMATIC S7 / M7 / C7
- SIMATIC S5
- SIMATIC PD / PC
- SIMATIC HMI (operator panel (OP), operator station (OS), and text display (TD) operator control and monitoring devices)
- Devices from other manufacturers

Structure of a PROFIBUS DP network

The figure below illustrates a typical PROFIBUS DP network structure. The DP masters are integrated in the respective device, e.g. if the S7-400 has a PROFIBUS DP interface, the master connection IM 308-C is connected with an S5-115U. The DP slaves are the distributed I/O devices that are linked with the DP masters via the PROFIBUS DP.
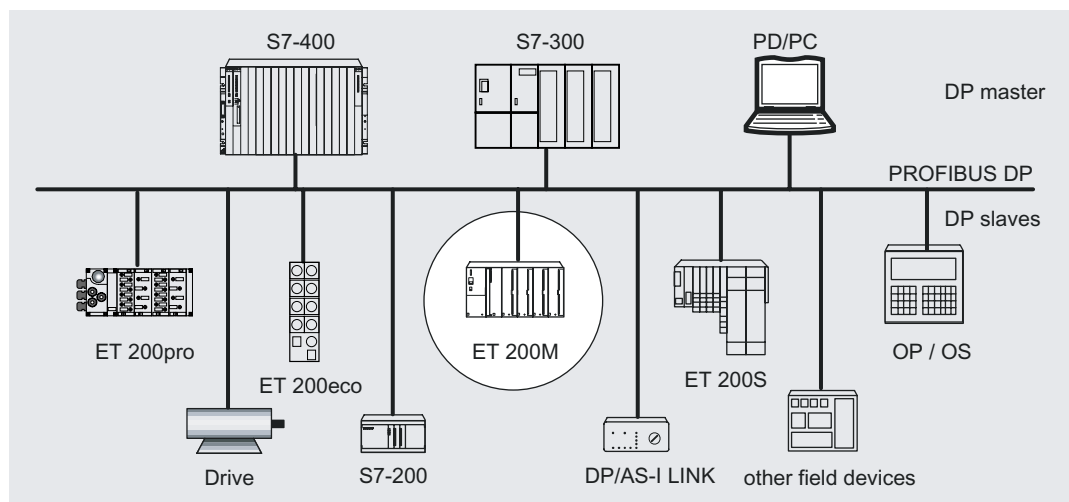
Figure 1-1   Typical structure of a PROFIBUS DP network

1.3 What is PROFINET IO?

Definition

PROFINET IO is an open transmission system with real-time functionality defined in accordance with the PROFINET standard. This standard defines a manufacturer-independent communication, automation and engineering model.

Accessories for wiring the PROFINET components are available in industrial quality.

● PROFINET discards the hierarchical PROFIBUS master/slave concept and deploys a provider/consumer principle instead. The modules of an I/O device that will be subscribed to by an IO controller are defined within the engineering phase.

● The quantity framework is extended in accordance with the options offered on PROFINET IO. Parameter limits are not exceeded during configuration.

● The transmission rate is 100 Mbps.

● The configuration interface for users is generally the same as that on PROFIBUS DP (the system is configured in STEP 7 > HW CONFIG).

Topology of a PROFINET IO network

The figure below shows a typical PROFINET IO network topology. Existing PROFIBUS slaves can be integrated using an IE/PB link.
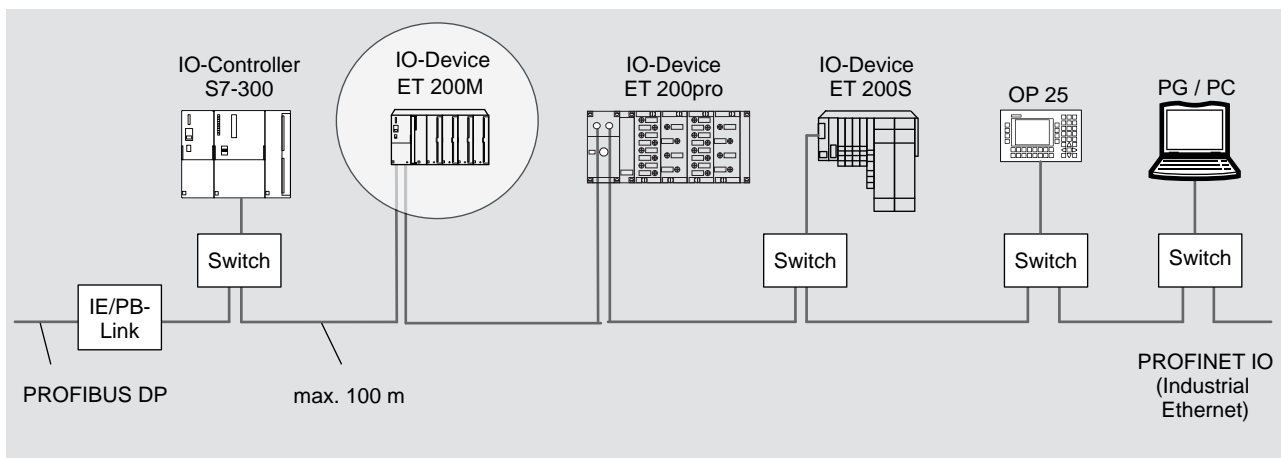
Figure 1-2   Typical structure of a PROFINET IO network

1.4   ET 200M distributed I/O device

Definition

The distributed IO device, ET 200M, is a modular DP slave with an IP 20 degree of protection.

The ET 200M has the configuration technology of the S7-300 automation system and consists of an IM 153-x and I/O modules of the S7-300.

ET 200M supports communication with:

● all DP masters compliant with IEC 61784-1:2002 Ed1 CP 3/1

● all IO controllers compliant with IEC 61158

Configuration of the ET 200M (example)

①   Power supply module PS 307
②   Interface module IM 153-x
③   up to 12 I/O modules (SM / FM / CP)
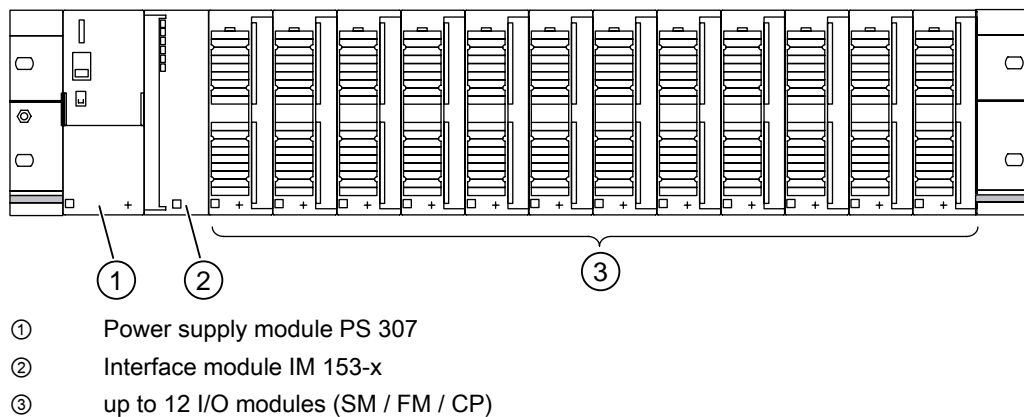
Figure 1-3   Configuration of the ET 200M distributed IO device (example)

In the *STEP 7* module catalog or in the GSD file you will find a list of the modules that you can use in the ET 200M.

For the current GSD file, go to Internet (http://support.automation.siemens.com/WW/view/en/113498).

"SIMATIC S7-DP-Slave"

The ET 200M distributed I/O system is a constituent part of the SIMATIC S7 automation system.

In other words, *STEP 7* provides support when configuring, assigning parameters to and programming the ET 200M in the DP master system as well as for the commissioning and diagnostics. Special services and functions of the IM 153-2 (e.g. configurable FM) can be used to their full extent only in the SIMATIC S7 / PCS 7.

If you use the ET 200M on a DP standard master (e.g. S5-95U), the configuration tool will also provide support with the GSD file, but, for example, you must pay attention to the technical data (project data) of the DP master (possible parameter assignment and diagnostics message frame lengths etc.).
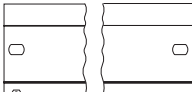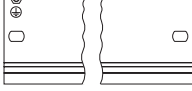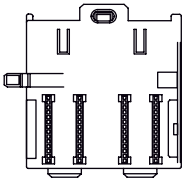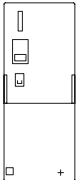
The PROFIBUS standard IEC 61784-1:2002 Ed1 CP 3/1 also includes the DPV1-mode. You can use this mode only if you integrated the GSD-file Revision ≥ 3.
The GSD-file Revision 2 remains available and hence the compatibility with earlier versions of the IM 153-x is assured.
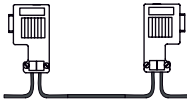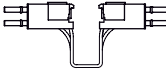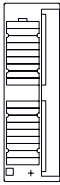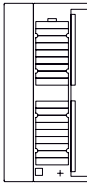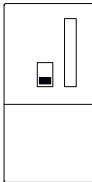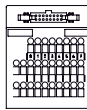
Components

A series of components are provided for the configuration and commissioning of the ET 200M. The most important components and their functions are listed in the following table:

Table 1- 1   ET 200M components

Components	Function	Diagram
Mounting rail Accessories: • Shield connecting element	... is the rack for the ET 200M.	
Mounting Rail for Active Bus Module Accessories: • Shield connecting element • active bus modules	... is the special rack for the ET 200M for the functions "Module change during operation", "Redundancy" and IM 153-4 PN.	
Active bus modules (BM) • BM IM/IM for redundancy with 2 IM 153-2 [1] • BM IM/IM for redundancy with 2 IM 153-2Bx00 [1] • BM PS/IM for PS 307; 2 A and IM 153-x • BM 2 40 for two 40 mm wide S7-300 modules • BM 1 80 for one 80 mm wide S7-300 module Accessories • Explosion-proof partition • Backplane bus and bus module cover	… provide the S7-300 backplane bus. In other words, if a module is missing, all the other modules can still be reached via the backplane bus.	
Power supply (PS) module Accessories: • Jumper	… converts the mains voltage (AC 120 / 230 V) to DC 24 V operating voltage for the supply of the ET 200M. ... can be used as load power supply for the DC 24 V load circuit.	

Components	Function	Diagram
IM 153-x Accessories: • Slot number plate (for the assignment of slot numbers)	... is the interface module; links the S7-300 modules to the PROFIBUS DP / PROFINET IO; supplies the backplane bus with operating voltage.	
PROFIBUS cable with bus connector	... combines nodes of a PROFIBUS DP configuration with each other.	
FOC duplex cable with simplex connector (in the plug adapter for the IM 153-2 FO)	... combines nodes of a PROFIBUS DP configuration with each other.	
PROFINET connector as per the specifications in the PROFINET Installation Guide and Industrial Ethernet FC installation lines	... connects nodes of a PROFINET IO configuration with one another.	
Signal modules (SM) Accessories: • Front connectors • Bus connectors	... adapt differing process signal levels.	
Function modules (FM) Accessories: • Front connectors • Bus connectors	... for time-sensitive and memory-intensive process signal processing tasks, e.g. positioning or controlling.	
Communication processor (CP) Accessories: • Connecting cable	... relieves the CPU from communication tasks.	
SIMATIC TOP connect Accessories: • Front connector with flat ribbon connection	... for wiring the digital modules or for 1-, 2- or 3-wire connection.	
[1] The assignment of the IM 153-2 interface module to the two active bus modules BM IM/IM can be found in chapter "Configuring the electrical structure (Page 47)".		

See also

1.5 IM 153-x: Variants and properties

Brief overview of the different IM 153-x

The IM 153-x contains interface modules for the signal modules (SM), function modules (FM) and communication processors (CP).

You have an RS 485 interface (IM 153-2 alternatively also with FOC interface) and offer a graded functional scope. The respective variants of the interface module IM 153-2 with RS 485 or FOC interface have the same functionalities.

From the IM 153-1 and IM 153-2 there is also a variant for use in other operating conditions (outdoors).

Properties and functions

The following table provides a detailed overview of the properties and functions of the different IM 153-x and their current versions.

You will find the comparison with the respective predecessor versions that are not listed in this table in the appendix "Compatibilities between the IM 153-x (Page 241)".

Table 1- 2   Properties and functions of the IM 153-x variants

Properties / functions	6ES7153-1AA..	6ES7153-2Ax..	6ES7153-2Bx00	6ES7153-2Bxx1
Module change during operation	x [2]	x	x	x
Direct data exchange	x	x	x	x
Enhanced diagnostics	x	x	x	x
SYNC, FREEZE	x	–	x	x
Passing on parameter assignment data from the PD / PC	–	x	x	x
Configurable FM in an ET 200M	–	x	x	x
Time synchronization on the PROFIBUS DP, time stamping of input signals	–	x	x	x
Time stamp with 1 ms precision	–	–	–	x
Time stamp outside of S7-400	–	–	–	x
Time-of-day synchronization on the I/O bus	–	–	–	x
Redundancy [1]	–	x	x	x
Flying redundancy	–	–	–	x
System modification in RUN mode				
• In the redundant system	–	x	x	x
• In the non-redundant system	–	–	x	x

Properties / functions	6ES7153-1AA..	6ES7153-2Ax..	6ES7153-2Bx00	6ES7153-2Bxx1
Clock synchronism [1]	–	–	x	x
identification and maintenance data (I&M data)	–	–	x (only I&A data)	x
Update	–	–	x	x
Direct data exchange with F-modules	–	–	–	x
IQ-sense	–	–	x (as of firmware V3.0.1)	x
[1] SYNC, FREEZE should not be used for these functions.				
[2] not with IM 153-1AA8x				

Front view of the interface modules IM 153-1 and IM 153-2AA02 / -2AB01

closed front door

opened front door

... with RS 485 interface

... with FOC interface (only IM 153-2 FO)

SIEMENS

SF
BF
ACT
ON

Door

SIMATIC ET 200M

IM 153-2

Slot

Product version

Order number

153-2AA02-0XB0

Status and error displays

Interface PROFIBUS DP: 9-pin jack or FOC connection

Cable duct

Settings for the PROFIBUS Address

Bridge (disconnectable)

Connection for Power supply and functional ground

24 VDC
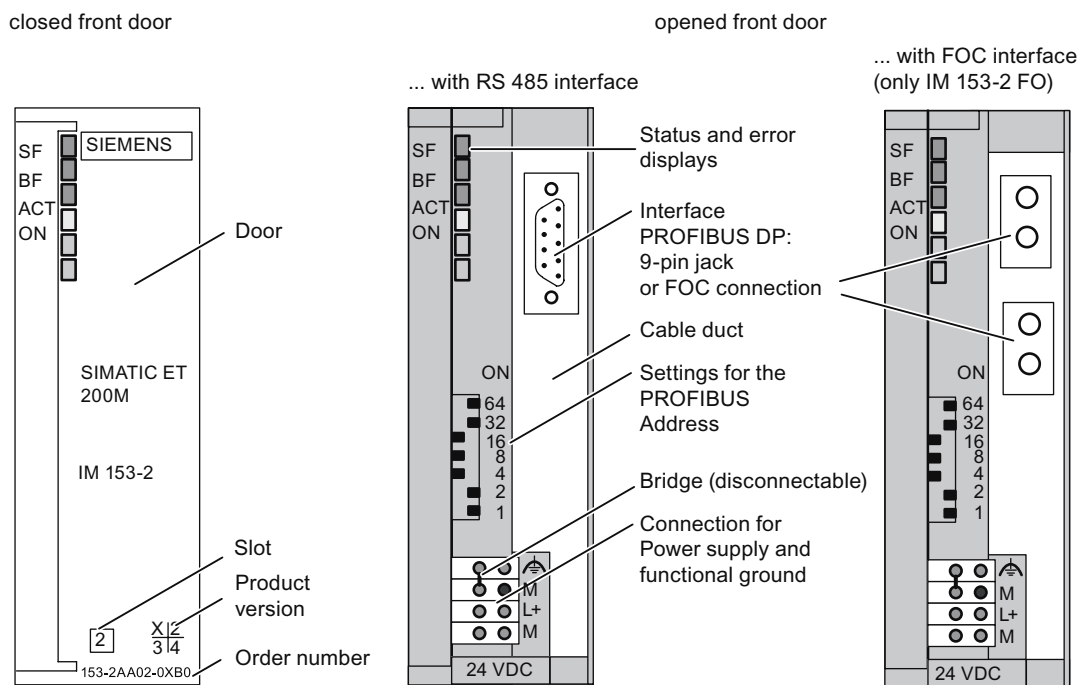
LED ACT only with IM 153-2

Figure 1-4   Front view of the interface modules IM 153-1 and IM 153-2AA02 / -2AB01

Front view of the IM 153-2Bx00

closed front door   opened front door

... with FOC interface
(only IM 153-2 FO)

... with RS 485 interface

Status and error
displays

PROFIBUS DP
interface:
9-pin jack or FOC
connection

Firmware status

Cable duct

Slot for SIMATIC
Micro Memory Card

Setting the
PROFIBUS
address

Bridge (disconnectable)

Connection for
Power supply and
functional ground

Door

Slot

Product
version

Order number
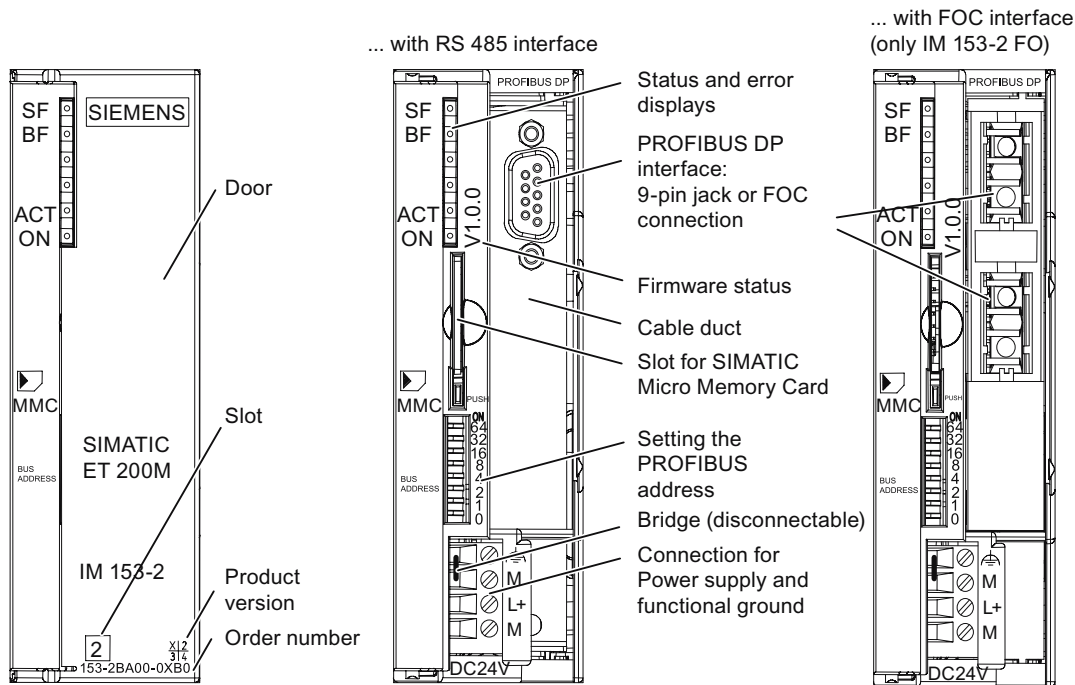
Figure 1-5 Front view of the IM 153-2Bx00

Front view of the IM 153-2Bxx1

closed front door   opened front door

with RS 485 interface
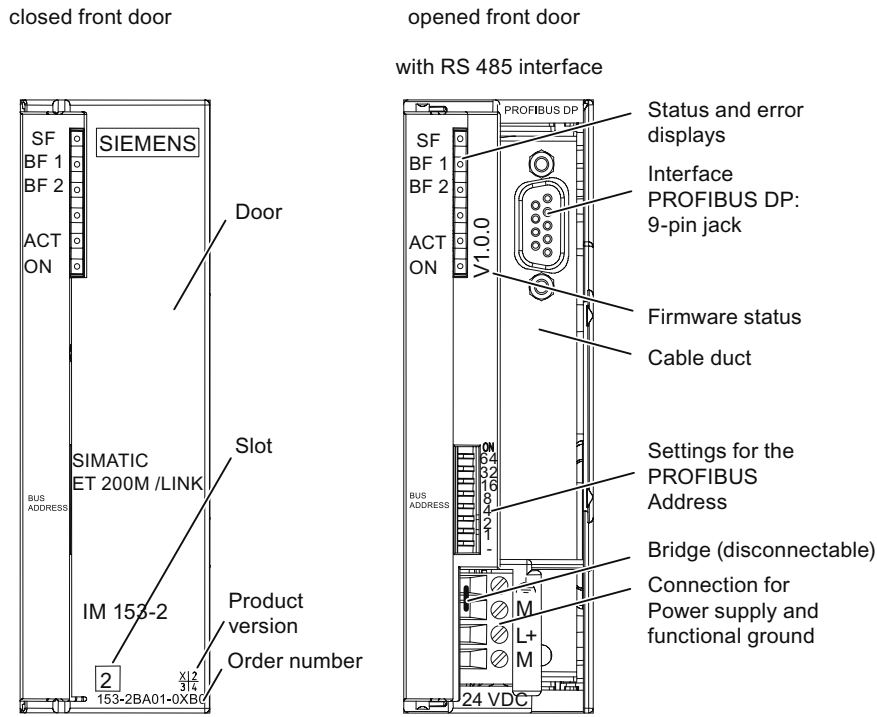
Figure 1-6   Front view of the IM 153-2Bxx1

Brief instructions on commissioning

<div style="text-align: right">

2

</div>

2.1   Commissioning on PROFIBUS DP

2.1.1   Introduction

Introduction

The following simple example shows you how to commission the ET 200M step by step.

- Installing and wiring the ET 200M
- Configuring with *STEP 7*
- Linking to the User Program
- Switching on the ET 200M
- Evaluating the diagnostics:
    - Encoder supply short circuit after M on the digital input module
    - Short circuit after L+ on the digital output module

Requirements

- You have configured an S7 station, consisting of a power supply module and a DP master (e.g. CPU 315-2 DP). For this example a CPU 315-2 DP is used as the DP master. You can of course use any other DP master (standard IEC 61784-1:2002 Ed1 CP 3/1).

- The current *STEP 7* version is fully installed on your programming device (PD). There may be restrictions if using older versions of *STEP 7*. You have experience with *STEP 7*.

- The PD is connected to the DP master.

Necessary components

The following figure shows you which ET 200M components you require for the commissioning example.
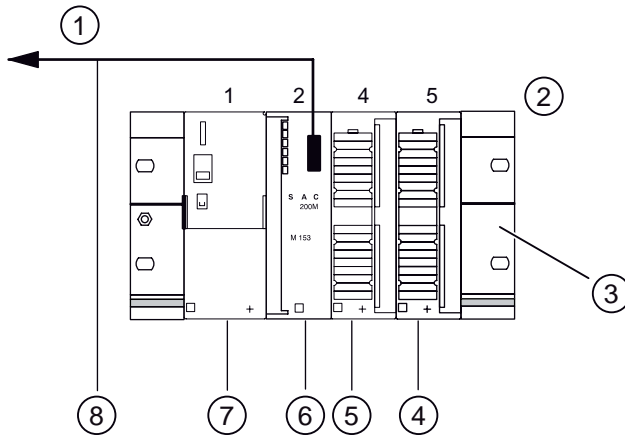
Figure 2-1   ET 200M components for the example configuration

①	to the DP master	⑤	SM 321
②	Slot	⑥	IM 153-2
③	Mounting rail	⑦	Power supply PS 307
④	SM 322	⑧	PROFIBUS cable with bus connector

Order numbers for the example configuration

Number	Item	Order number (Siemens)
1	Mounting rail	e.g. 6ES7390-1AE80-0AA0
1	PS 307 power supply with jumper	e.g. 6ES7307-1BA00-0AA0
1	Interface module IM 153-2	6ES7153-2BA01-0XB0
1	DI module SM 321	e.g. 6ES7321-7BH01-0AB0
1	DO module SM 322	e.g. 6ES7322-8BF00-0AB0
2	20-pin front connector with screw contacts	6ES7392-1AJ00-0AA0
x m	PROFIBUS DP cable with bus connectors	depending on design
x m	Cable for grounding the rail with 10 mm² cross section and cable lug suitable for M6, length depending on local factors	commonly available
Various	M6-screws and nuts (length dependent on location) with suitable screw driver	commonly available
1	Screwdriver with tip width 3,5 mm	commonly available
1	Screwdriver with tip width 4,5 mm	commonly available

Number	Item	Order number (Siemens)
1	Side cutters and wire stripping tools	commonly available
1	Tool for crimping wire-end ferrules	commonly available
Approx. 2 m	Stranded wire with 1 mm^2 cross section with appropriate wire end ferrules, type A, length 6 mm	commonly available
2	one-pin on button	commonly available
1	24 V indicator lamp	commonly available

2.1.2 Mounting the ET 200M

Procedure

1. Mount the rail on a firm base so that there is at least 40 mm clearance above and below the rail.

2. Starting from the left side, mount the individual modules on the rail (plug in the bus connectors (not for PS 307 and the last module) – engage – swing in – screw down). Observe the following sequence:

   – Power supply PS 307

   – Interface module IM 153-2

   – DI module SM 321

   – DO module SM 322

3. Set PROFIBUS address 3 on the interface module IM 153-2.
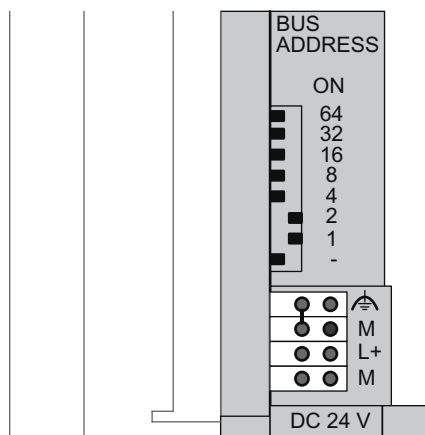
Figure 2-2   Setting PROFIBUS address 3

2.1.3   Wiring the ET 200M

Mounting rail

1. Connect the rail to the protective conductor. An M6 screw is provided on the rail for this purpose.

   Minimum cross-section from the conductor to the protective conductor: 10 mm^2

⚠ WARNING
You could touch live wires if the power supply module PS 307 is switched on or the supply cable of the power supply is connected to the mains supply.
Make sure the ET 200M is de-energized before doing any wiring.

Power supply and IM 153-2

1. Open the front doors of the PS and IM.

2. Undo the strain-relief assembly on the PS 307. Strip the power supply cable.

3. If necessary, attach wire end ferrules (in the case of multi-conductor cables). Then connect to the PS 307 (see the following figure).

4. Screw the strain-relief assembly tight.

5. Insert the jumper in the PS 307 and the IM 153-2 and tighten it (refer to following figure).

6. Check that the switch for selecting the mains voltage is set correctly to your mains voltage on the PS 307.

   The power supply module is factory-set to a mains voltage of 230 V AC. You can change the setting in the following way: Remove the protective cover using a screwdriver, set the switch to the available mains voltage and reattach the protective cover.

7. Insert the PROFIBUS DP cable between the DP master (2nd DP interface) and the IM 153-2. The terminating resistors in both connectors must be switched on.

Front Connectors of the DI and DO

1. Open the front doors of the DI and DO.
2. Move the front connector to the wiring position:
   To do so, push a front connector into each DI and DO until it engages. The front connector still protrudes from the module in this position. In the wiring position a wired front connector has no contact with the module.
3. Strip 6 mm of insulation off the ends of the wires you want to insert into the front connector and then attach appropriate wire end ferrules to the wire ends.
4. Wire the front connector of the DI in the following way:
   Terminal 1: L+ of PS;
   Terminal 20: M of PS;
   Terminal 3: Button 1;
   Terminal 4: Button 2;
   Terminal 10: Free cable ends of button (see the following figure)
5. Wire the front connector of the DO in the following way:
   Terminal 1: L+ of PS;
   Terminal 20: M of PS;
   Terminals 3 and 20: Indicator lamp (see the figure below)
6. Guide the wires down and out of the front connectors.
7. Press the release button of the front connector on the top of the module and simultaneously push the front connector into the module until the release button returns to its original position.
8. Close the front doors of PS, DI and DO.
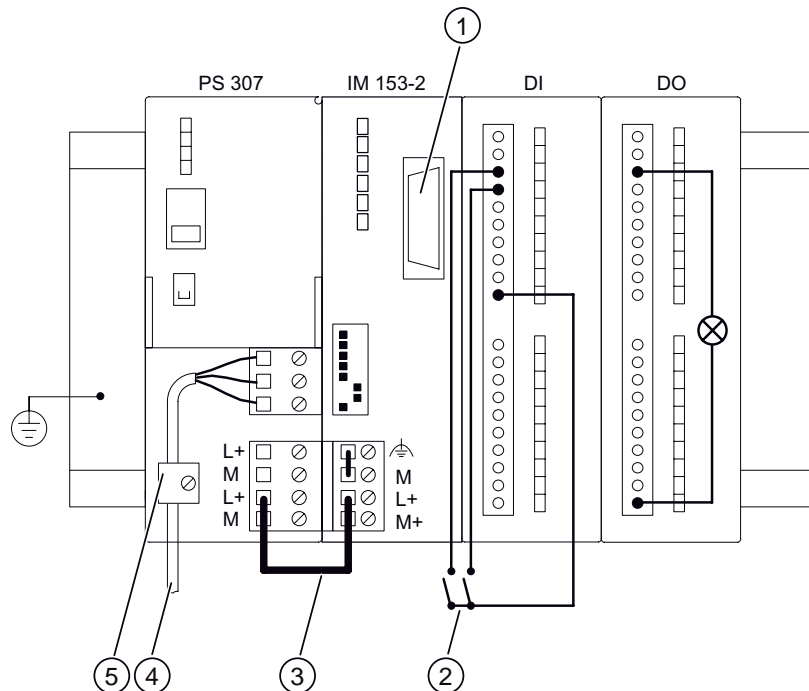
Figure 2-3   Wiring of the ET 200M

①   Connector for PROFIBUS cable
②   Button
③   Jumper
④   Power cable
⑤   Strain-relief assembly

2.1.4   Putting Hardware into Service

Procedure

1. Use the PD cable to connect the PD to the DP master (MPI interface). Make sure that the terminating resistors in the connectors are switched on. Set the mode switch to STOP.

2. Connect the supply cable to the power supply and then switch on the power supply module for the DP master.

   The 24 V DC LED lights up on the PS.

   With the CPU, all the LEDs light up briefly; the SF LED, the BAT LED and the DC5V LED remain switched on. The STOP LED flashes for 3 seconds and then remains on.

3. Insert the backup battery:

   – Plug the backup battery connector into the appropriate socket in the battery compartment of the CPU. The notch on the connector must point to the left.

   – Insert the backup battery into the battery compartment of the CPU.

   – Close the front door of the CPU.

   The BATF-LED goes out and then shortly afterwards the SF LED follows.

4. Boot the programming device.

5. Reset the CPU 315-2 DP:

   – Turn the mode switch to MRES. Hold the mode selector at this position until the STOP LED lights up for the second time and then remains lit (approx. 3 seconds)

   – You must turn the mode switch back to MRES within 3 s.

   The STOP LED begins to flash rapidly and the CPU performs a reset. The CPU has completed the memory reset when the STOP LED remains permanently lit again.

2.1.5 Configuring the ET 200M in the SIMATIC manager

Procedure

1. Start the SIMATIC Manager and then set up a new project with a DP master (e.g. CPU 315-2 DP). In addition to OB 1 also create OB 82 for the project.

2. From the hardware catalog, insert the IM 153-2 on the PROFIBUS DP.

3. Set the PROFIBUS address 3 on the IM 153-2.

4. Drag the individual modules out of the hardware catalog and drop them onto the configuration table.
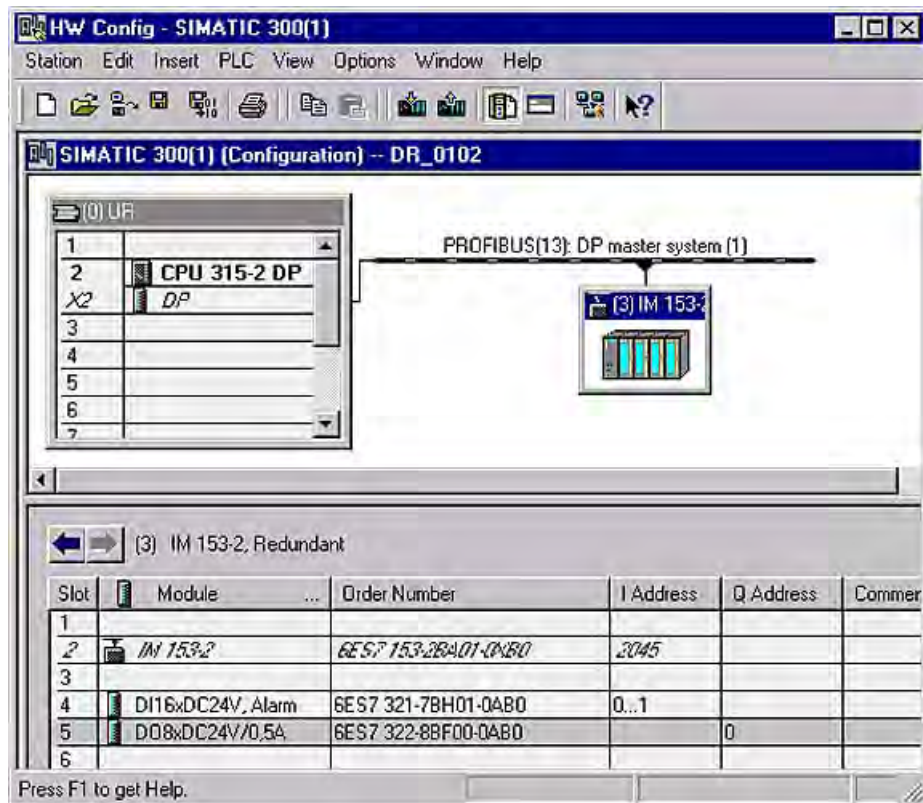
Figure 2-4   Configuration table for ET 200M

5. Set the following parameters:

   – in the dialog box DP slave properties for ET 200M
     adopt the default settings

   – in the dialog box DP slave properties for SM 321, slot 4 in the configuration table
     diagnosis: No load voltage yes
     Diagnostic alarm: Yes

   – in the dialog box DP slave properties for SM 322, slot 5 in the configuration table (see following figure)
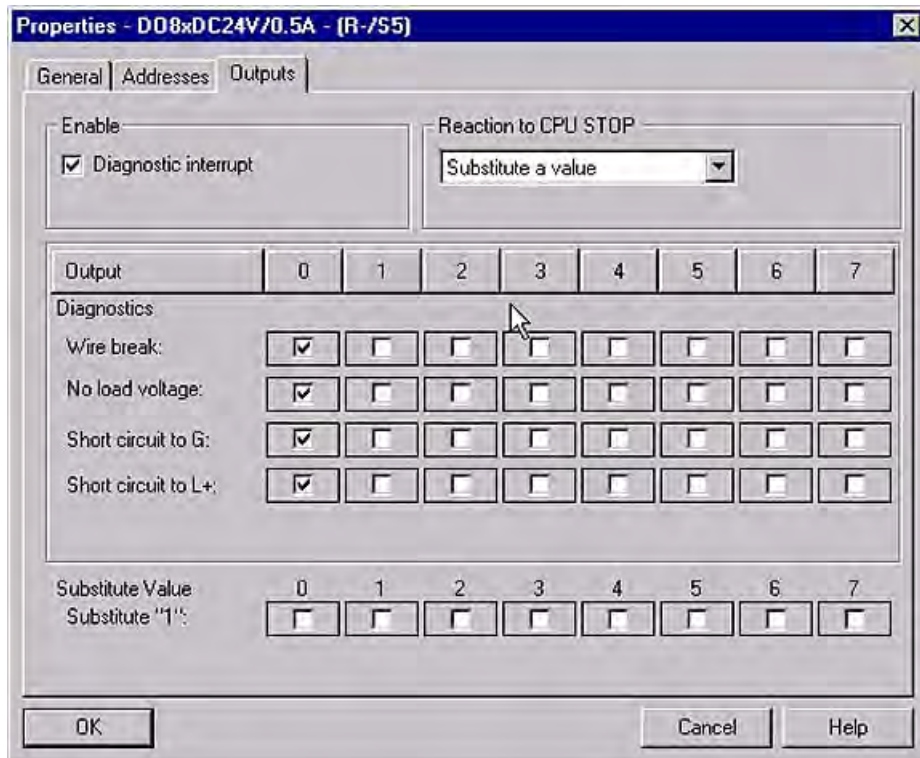
Figure 2-5   dialog box Properties - DP Slave for SM 322

6. Save and compile the configuration.

7. Download the configuration to the CPU 315-2.

2.1.6   Creating a user program

Procedure

1. Generate the user program in the LAD / STL / FAD Editor in the OB 1.
    Example: Reading in the inputs and activating an output

STL	Description
U I 0.1	If input E 0.1 is set and
U I 0.2	input E 0.2 is set, then
= Q 4.0	assign the VKE to output A 4.0

2. Save the project in the SIMATIC manager.

3. Download the configuration to the DP master.

2.1.7   Switching on ET 200M

Procedure

1. Switch on the power supply at the ET 200M.

2. Observe the status LEDs on the DP master and the ET 200M

    –   CPU 315-2 DP:
        DC5V: ON
        SF DP: OFF
        BUSF: off

    –   ET 200M:
        SF: OFF
        BF: OFF
        ON: ON

Carrying out a dry run

1. Press the two buttons on the ET 200M alternately (refer to the figure in chapter "Wiring the ET 200M (Page 24)").

    The LEDs of inputs E0.1 and E0.2 light up alternately.

    The channel status display 0 (LED of output A4.0) and the indicator lamp do not light up.

2. Press the two buttons simultaneously.

    The LEDs of inputs E0.1 and E0.2 light up alternately.

    The channel status display 0 (LED of output A4.0) and the indicator lamp light up.

2.1.8   Evaluating diagnostic messages:

Introduction

In this example, you generate diagnostic messages by provoking errors in the ET 200M. In the event of an error, OB82 is started. Evaluate the start information in the OB 82.
Tip: Call SFC 13 within OB 82 and evaluate the diagnostic frame.

SM 321: Short-circuit to M at encoder supply

1. Open the front panel of the DI-module and use a wire to short circuit the encoder supply Vs (terminal 10) after M (terminal 20).

2. Note the status LEDs.

   IM 153-2:

   – SF: ON

   SM 321; DI 16 x 24 V DC:

   – SF: lights up → a diagnostic message is pending

   – Vs: does not light up (terminal 10)

3. Evaluate the diagnostic message.

   Result:

   – Station status 1 Byte x.3 is set → external diagnostics

   – Identifier-related diagnostics: Byte (x+7).3 is set → Slot 4

   – Channel-related diagnostics:
     Byte (x+16).0 to (x+16).5: 000011_B → Slot 4
     Byte (x+17).0 to (x+17).5: not relevant
     Byte (x+18).0 to (x+18).4: 00001_B → Short circuit

4. Remove the wire between terminal 10 and terminal 20.
   Evaluate the diagnosis LEDs once again.

   IM 153-2:

   – SF: off

   SM 321; DI 16 x 24 V DC:

   – SF: off

   – Vs: lights up (terminal 10)

   The diagnostic message is deleted.

SM 322: Short-circuit to L+

1. Open the front panel of the DO-module and use a wire to short circuit the digital output 0 (terminal 3) after L+ (terminal 1).

2. Note the status LEDs.

   IM 153-2:

   – SF: ON

   SM 322; DO 8 x DC 24 V/0,5 A:

   – SF: lights up → a diagnostic message is pending

   – F0: light up → channel error

   – 0: OFF → Output is not active

3. Evaluate the diagnostic message.

   Result:

   – Station status 1 Byte x.3 is set → external diagnostics

   – Identifier-related diagnostics: Byte (x+7).4 is set → Slot 5

   – Channel-related diagnostics:
   Byte (x+16).0 to (x+16).5: 000100_B → Slot 5
   Byte (x+17).0 to (x+17).5: 000000_B → Channel 0
   Byte (x+18).0 to (x+18).4: 00001_B → Short circuit

4. Remove the wire between terminal 3 and terminal 1.
   Evaluate the diagnosis LEDs once again.

   IM 153-2:

   – SF: off

   SM 322; DO 8 x DC 24 V/0,5 A:

   – SF: off

   – F0: off

   – 0: On

   The diagnostic message is deleted.

See also

Diagnosis with STEP 7 or STEP 5 (Page 188)

2.2 Commissioning on PROFINET IO

You will find further information on the PROFIBUS IO in the following manuals:

- System Manual "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)"

- "From PROFIBUS DP to PROFINET IO (http://support.automation.siemens.com/WW/view/en/19289930)" Programming Manual

Assignment planning 3

3.1 Structure variants for PROFIBUS DP

With the IM 153-2Bxx1 you can set up an ET 200M with any input / output module.

The IM 153-2Bxx1 is also a spare part for the IM 153-2 (6ES7153-2xxxx-0XB0).

In addition, the IM 153-2Bxx1 can be used as an interface module for the DP/PA-link or the Y-link. You will find additional information in the "DP/PA Link and Y Link bus links (http://support.automation.siemens.com/WW/view/en/1142696)" operating instructions.

Structure variants in the non-outdoor area

Using the existing hardware you can realize the combinations listed in the following table in the non-outdoor area.

Table 3- 1   ET 200M structure variants in the non-outdoor area

non-redundant configuration	redundant configuration
• IM 153-2 + bus connector + I- / O-modules • BM PS/IM + PS + IM 153-2 + BM 2 x 40 / BM 1 x 80 + I- / O-modules • BM IM/IM (7HD10 / 7HD80) + IM 153-2 + BM 2 x 40 / BM 1 x 80 + I- / O-modules	• BM IM/IM (7HD10 / 7HD80) + 2x IM 153-2 + BM 2 x 40 / BM 1 x 80 + I- / O-modules
In the table, IM 153-2 stands for: • IM 153-2 (6ES7153-2BA01-0XB0) • IM 153-2 (6ES7153-2BA02-0XB0) • IM 153-2 (6ES7153-2BA81-0XB0) • IM 153-2 (6ES7153-2BA82-0XB0)	

Structure variants in the outdoor area

Using the existing hardware you can realize the combinations listed in the following table in the outdoor area.

Table 3- 2   ET 200M structure variants in the outdoor area

non-redundant configuration	redundant configuration

• IM 153-2 + bus connector
   + I- / O-modules*
• BM IM/IM (7HD80) + IM 153-2
   + BM 2 x 40 / BM 1 x 80 (painted) *
   + I- / O-modules*
	• BM IM/IM (7HD80) + 2x IM 153-2
	   + BM 2 x 40 / BM 1 x 80 (painted) *
	   + I- / O-modules*

* SIPLUS modules for use in expanded environmental conditions In the table, IM 153-2 stands for IM 153-2 (6ES7153-2BA81-0XB0 or 6ES7153-2BA82-0XB0)	

SIPLUS modules

For the outdoor area under the product names SIPLUS special S7-300 modules are available. You can use these under expanded environmental conditions. Expanded environmental conditions mean:

• can be used from –25 °C to +60 °C

• occasional, brief condensation is permitted

• increased mechanical load permitted

In the functional scope and in the technical data, the SIPLUS modules correspond to the "standard" modules.

The SIPLUS S7-300 modules have their own order numbers. These are based on those of the "standard" S7-300 modules, starting however with "6AG1…" instead of "6ES7…".

For more information on these modules, refer to the reference manual "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)".

You´ll find more information on SIPLUS and contact partners for this area in the Internet (http://www.automation.siemens.com/siplus/index_76.htm).

Reference

• You´ll find detailed information regarding the functions and properties of the IM 153-2 in chapter "Functions (Page 129)" and in the appendix "Functions (Page 129)".

• You´ll find detailed information on mechanical and climatic environmental conditions for operating the ET 200M in chapter "General technical specifications of the reference manual "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)".

• The IM 153-2Bxx1 is not just an interface module for the ET 200M, but also for the bus connections DP/PA-link and Y-link. For the configuration variant options please refer to the "DP/PA Link and Y Link bus links (http://support.automation.siemens.com/WW/view/en/1142696)" operating instructions.

See also

Compatibilities between the IM 153-x (Page 241)

3.2 Detecting the configuration variant by means of the IM 153-2

During start-up, the IM 153-2 automatically detects which structure variant (ET 200M or DP/PA-link or Y-link) it is being used in. The IM 153 2 determines its functionality in accordance with this.

NOTICE
The following structure variants ("mixed structures") are **not** permissible: • Input / output modules and coupler modules in one structure   • Bus modules BM 2 x 40 / BM 1 x 80 and BM DP/PA / BM Y coupler in one structure

3.3 Configuration possibilities for PROFIBUS DP

3.3.1 Distributed I/O with IM 153-1

The IM 153-1 is the interface module of the ET 200M for standard applications.

Sample Configuration

The following figure shows an example of an ET 200M with IM 153-1 and 4 I/O modules of the S7-300 as a distributed I/O to a CPU 315-2 DP as a S7 DP master.

①   CPU 315-2 DP as a DP Master
②   IM 153-1
③   PROFIBUS DP
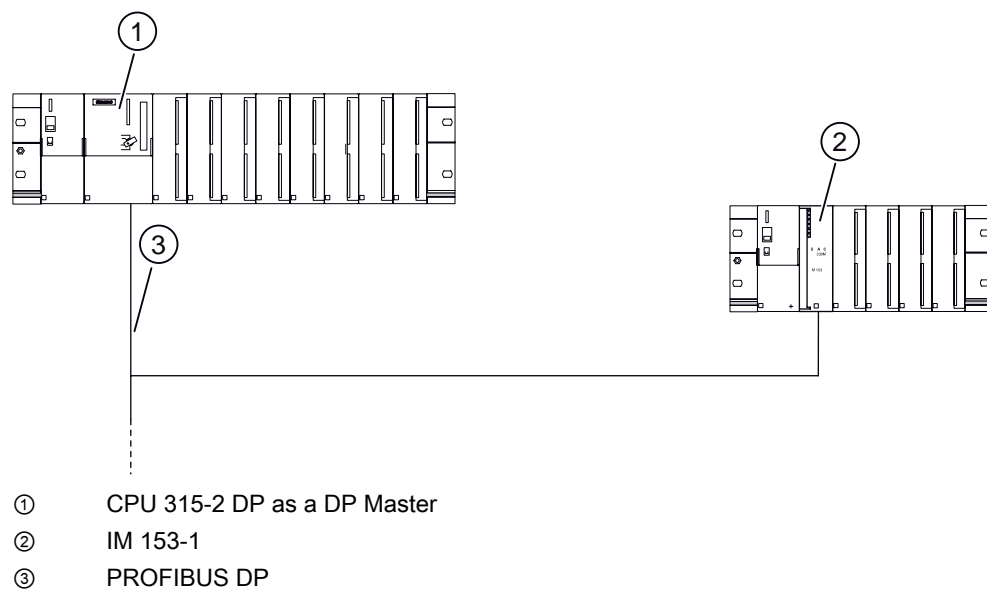
Figure 3-1   Distributed I/O with IM 153-1

3.3.2 Passing on parameter assignment data from the PD / PC with IM 153-2

Example configuration with IM 153-2 and a HART module

You can use HART modules in the ET 200M In this application, the ET 200M HART is a master for HART slaves (intelligent field devices) in the Ex area. The IM 153-2 passes on parameter assignment data from the PD / PC via the HART analog input module to the intelligent field devices and back again (the thick line indicates the communication path). For a detailed description, please refer to "S7-300 Automation Systems, ET 200M Ex I/O Modules (http://support.automation.siemens.com/WW/view/en/1096709)" in the device manual.
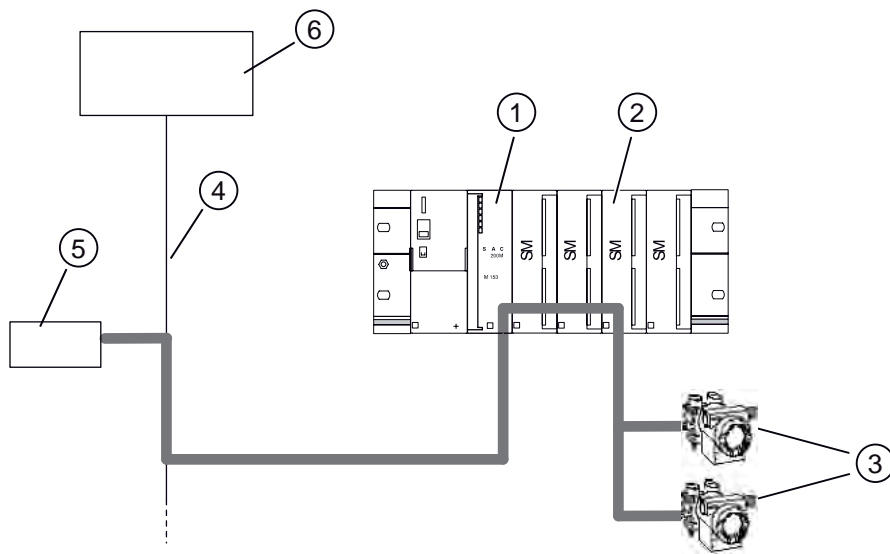
①   IM 153-2

②   For example: SM 331; AI 2 x 0/4 … 20 mA HART

③   Intelligent field devices

④   PROFIBUS DP

⑤   PD/PC

⑥   DP master

Figure 3-2   Passing on parameter assignment data with an IM 153-2 and HART modules

Parameter assignment / operation of HART field devices

The following is required for the parameter assignment / operation of HART field devices:

- EDD (for ET 200M) Version V1.1.8 or higher

  EDD (**E**lectronic **D**evice **D**escription) is required to set up HART field devices. It is included on the *PDM Device Library* CD (as of Edition 2, dated 2007) supplied with PDM.

- PDM V6.0 SP3

Note

If an older PDM version is used together with the EDD indicated above, an error message is not issued.

However, then HART field devices on HART input/output modules that plug into slots 12 to 15 cannot be operated.

3.3.3   Configurable FM in a configuration with IM 153-2

Example configuration with IM 153-2 and FM

The following figure shows an example of an ET 200M with IM 153-2 and in each case two SM and two FM of the S7-300 I/O modules. Via the IM 153-2 the S7 DP master or the PD / OP can communicate directly with the configured FM (the thick line represents the communication path). Configurable FM are, for example, the FM 353 / 354 / 355.

The following S7 functions are supported by the IM 153-2:

● Assigning FM parameters via the DP mater CPU

● Commissioning and diagnosing the FM via a PD / PC

● Operating and monitoring the FM via an OP

Refer to the appendix "Compatibilities between the versions of IM 153-2 / -2 FO (Page 243)" to see if the DP master you are using and the FM also comply with this functionality for distributed FM.

Figure 3-3   Configurable FM in an ET 200M with IM 153-2

① CPU 315-2 DP as a DP Master
② IM 153-2
③ PROFIBUS DP
④ PG
⑤ OP

3.3.4 FOC network with IM 153-2 FO

This chapter shows a configuration of an FOC network independently of the used function of the IM 153-2 FO.

Example configuration

The following figures gives an example of how an FOC network is configured as an interface module with ET 200M and IM 153-2 FO.

With FOC networks with partners with integrated FOC interfaces note:

- The FOC network can be configured as a line or star.

- If you remove the FOC from an integrated FOC interface, then the following partners are no longer available!
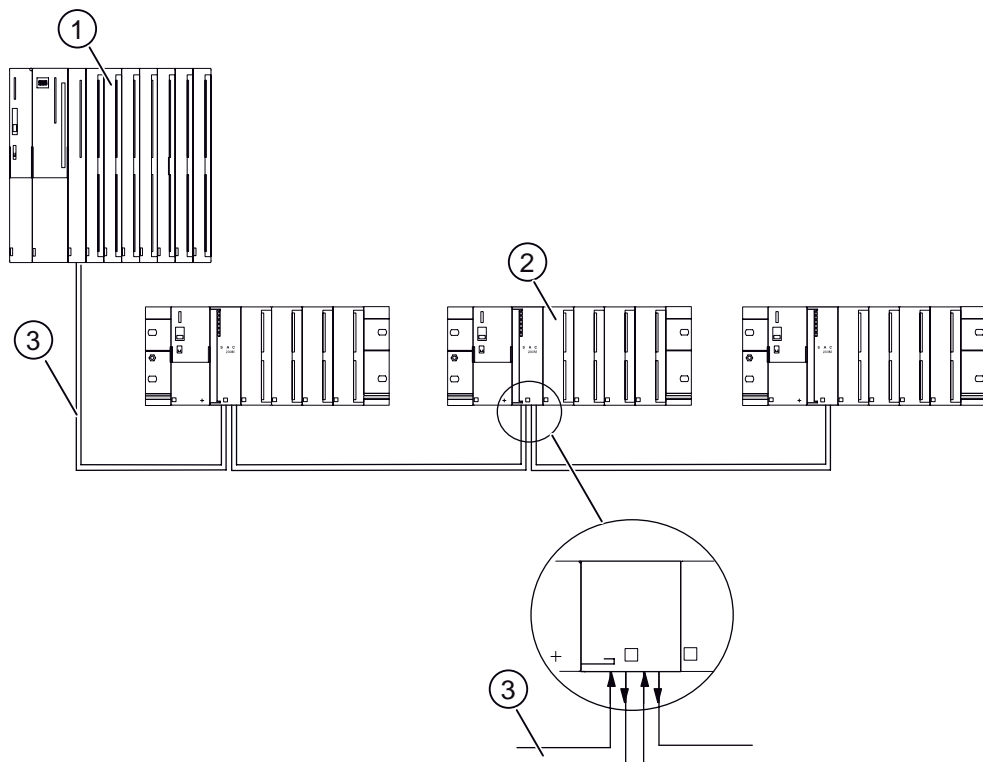
Figure 3-4   FOC network with IM 153-2 FO

①   S7-400 automation system with IM 467 FO as DP master

②   ET 200M distributed I/O with IM 153-2 FO

③   FOC duplex cable

For more information on network configuration and network components refer to the "SIMATIC NET PROFIBUS networks (http://support.automation.siemens.com/WW/view/en/1971286)" manual.

Redundant operation of the ET 200M on an S7-400H

Note the general rules for the structure of an H system.

You will find the general rules for the structure of an H system in the "S7-400H, – fault-tolerant systems (http://support.automation.siemens.com/WW/view/en/1186523)" system manual.

3.4 Structure variants and configuration possibilities for PROFINET IO

Structure variants and configuration possibilities for PROFINET IO can be found in the "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)" system manual.

3.5 Configuring the mechanical structure

3.5.1 Horizontal or vertical configuration

Installation Options

You can install the ET 200M horizontally or vertically.

Always arrange the power supply and IM 153-x to the left or below.
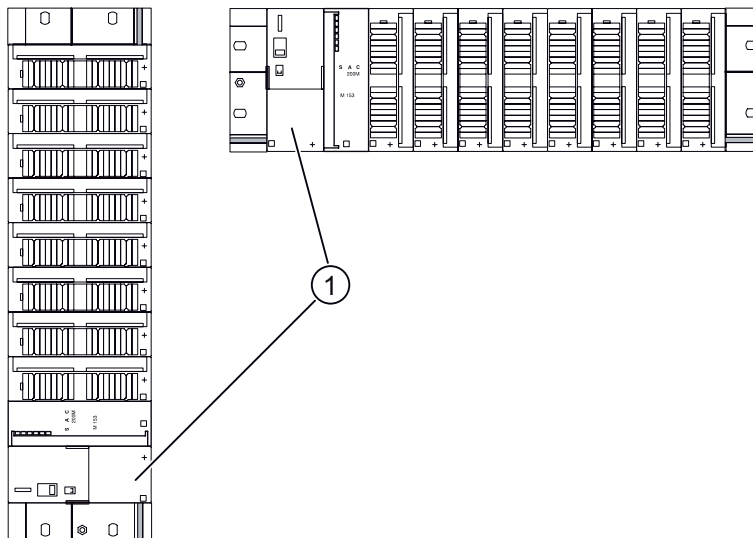
① Power supply, then IM 153-x

Figure 3-5   Horizontal and vertical installation of an ET 200M

Permissible Ambient Temperature

The following ambient temperature ranges are available:

● In horizontal mounting position: From 0°C to 60 °C

● In vertical mounting position: From 0°C to 40 °C

When configuring the ET 200M with IM 153-1AA8x or IM 153-2BA8x (outdoor) and SIPLUS S7-300 modules the specified temperature range extends up to -25 °C.

3.5.2 Clearance Measurements

Controlling

If you adhere to the minimum clearance measurements:

● you will guarantee heat dissipation of the S7-300 modules.

● you will have sufficient space to insert and remove the S7-300 modules.

● You have sufficient space for running cables.

Using a shielding contact element you can connect shielded lines directly with the rail. This increases the S7-300 rack´s installation height to 185 mm! You must nevertheless adhere to the distance of 40 mm.

Clearance Measurements

The following figure shows you the clearance measurements to nearby cable ducts, apparatus, cabinet walls etc. for an ET 200M installation.

If you use a shield contact element, the dimension specifications apply from the lower edge of the shield contact element.
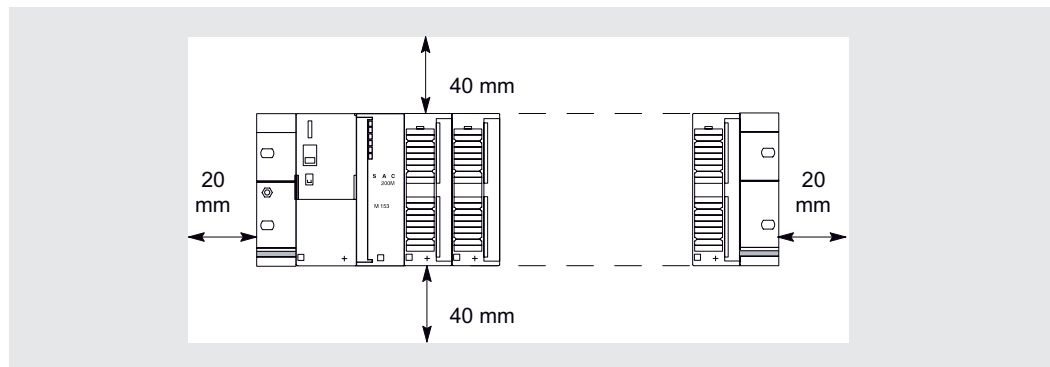
Figure 3-6   Clearance measurements for an ET 200M installation on a mounting rack

Installation Dimensions of the Modules

You will find the installation dimensions of the modules for the S7-300 spectrum in the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" reference manual.

The installation dimensions of the IM 153-x interface module are specified in the "Technical specifications of the IM 153-x (Page 231)" chapter.

Length of the Rails

Depending on the ET 200M installation you have, you can use the following rails:

Rail for ...		Usable length for modules	Remark
Standard configuration	Module change during operation		
160 mm	–	120 mm	Comes with fixing holes.
482.6 mm	482.6 mm	450 mm	
530 mm	530 mm	480 mm	
–	620 mm	580 mm	
830 mm	–	780 mm	
2000 mm	2000 mm	Cut to length required	Fixing holes have to be drilled.

See also

Connecting shielded cables via a shield connecting element (Page 85)

Installing the DIN rail (Page 60)

3.5.3 Arrangement of the modules of an ET 200M standard installation

Arrangement rules

The following rules apply to the location of the modules in an ET 200M:

● An ET 200M can only be installed on one mounting rack (rail), because coupling to other mounting racks via interface modules is not permissible.

A maximum of 8 (with IM153-2 or IM153-4 PN IO max. 12) signal modules, function modules or communication processors may be inserted to the right alongside the IM 153-x.

The following figure shows the arrangement of the modules in an ET 200M configuration equipped with eight S7-300 modules.

①   Power supply

②   IM 153-x

③   S7-300 modules
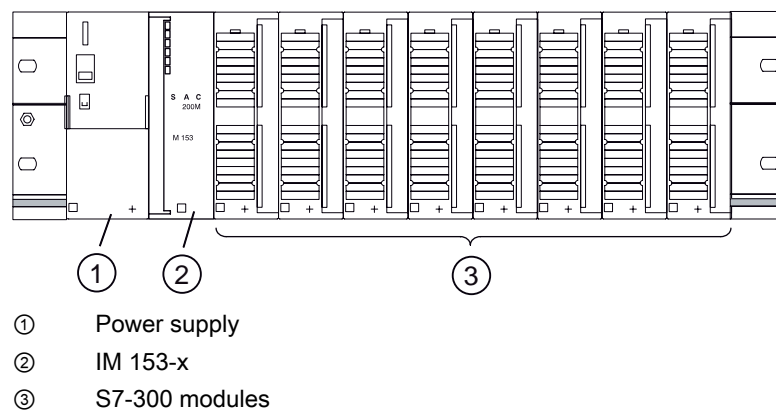
Figure 3-7   Arrangement of the modules of an ET 200M

Greater number of modules with the IM 153-2BAx2 and IM 153-4AA0x

A maximum of 12 modules can be operated with the IM 153-2BAx2 and IM 153-4AA0x interface module, compared to 8 modules previously.

Restrictions

Use of the high-accuracy time stamp (1 ms accuracy) is only possible with 8 modules. In this case, a maximum of 8 input modules can be inserted after the IM 153-2BAx2 interface module in the ET 200M.

Installation in an Intrinsically Safe Area

If you use the ET 200M in intrinsically safe areas, you must insert the dummy module DM 370 between the IM 153-x and the modules in the intrinsically safe area. Only in this way can you adhere to the necessary thread measure (refer also to the reference manual "S7-300 Automation Systems, ET 200M Ex I/O Modules (http://support.automation.siemens.com/WW/view/en/1096709)").

3.5.4 Arrangement of the modules for the function "Change During Operation" and / or "Redundancy"

Arrangement rules

The following rules apply to the location of the modules in an ET 200M:

● An ET 200M can only be installed on one mounting rack (rail), because coupling to other mounting racks via interface modules is not permissible.

● A maximum of 8 signal modules, function modules or communication processors may be inserted to the right alongside the IM 153-x.

● The IM 153-x and all the SM / FM / CP must be connected to active bus modules.

With the respective configuration, you can compatibly operate the combinations of interface modules IM 153-2 specified in the following table on active bus modules BM IM/IM.

Table 3- 3   Compatible versions of the IM 153-2 interface module

If the redundant IM 153-2 are configured as ...	... and the interface modules are connected to the active bus module 6ES7195-…,	then the following IM 153-2 can be operated compatibly:
IM 153-2AA02	7HD00-0XA0	IM 153-2AA02 IM 153-2BA00 IM 153-2BAx1
	7HD10-0XA0	IM 153-2BA00 IM 153-2BAx1
IM 153-2BA00	7HD10-0XA0	IM 153-2BA00 IM 153-2BAx1
IM 153-2BA01	7HD10-0XA0	IM 153-2BAx1
	7HD80-0XA0	IM 153-2BAx1
IM 153-2BA81	7HD80-0XA0	IM 153-2BA81
IM 153-2AB01	7HD00-0XA0	IM 153-2AB01 IM 153-2BB00
	7HD10-0XA0	IM 153-2BB00
IM 153-2BB00	7HD10-0XA0	IM 153-2BB00

Note

The active bus modules 6ES7195-7HD10-0XA0 and 6ES7195-7HD80-0XA0 are given two yellow markings for easier identification. These marks indicate that only IM 153-2Bx00 or IM 153-2Bxx1 can be connected to these bus modules.

- Use the rails for "module change during operation" (only these can take the active bus modules).

- Close unused slots with the backplane bus cover. Close the last bus module with the bus module cover. The bus module cover is included with the bus module BM PS/IM or BM IM/IM. The backplane bus cover has to be ordered.
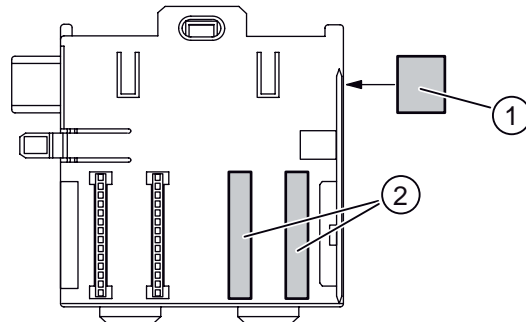
①   Bus module cover

②   Backplane bus cover

Figure 3-8   Example: Bus module 2 x 40 (…-7HB00-)

- To use the ET 200M in the intrinsically safe area, use the explosion-proof partition - preferably between the modules in the intrinsically safe area and the modules in the non-intrinsically safe area.

Greater number of modules with the IM 153-2BAx2 and IM 153-4AA0x

A maximum of 12 modules can be operated with the IM 153-2BAx2 and IM 153-4AA0x interface module, compared to 8 modules previously.

Restrictions

Use of the high-accuracy time stamp (1 ms accuracy) is only possible with 8 modules. In this case, a maximum of 8 input modules can be inserted after the IM 153-2BAx2 interface module in the ET 200M.

Installation Options

Dependent on the length of the rails you can fit up to 9 active bus modules:

Redundance with
2 x IM 153-2

IM 153-x for "Modules-
change in operation"

BM IM/IM

BM PS/IM

BM

BM

BM

BM

BM

maximum 8 BM 2 x 40 or BM 1 x 80

for 80 mm wide I/O
Modules (SM / FM / CP)

for 2 x 40 mm wide I/O modules
(SM / FM); here you require maximum 4 bus
Modules for an ET 200M
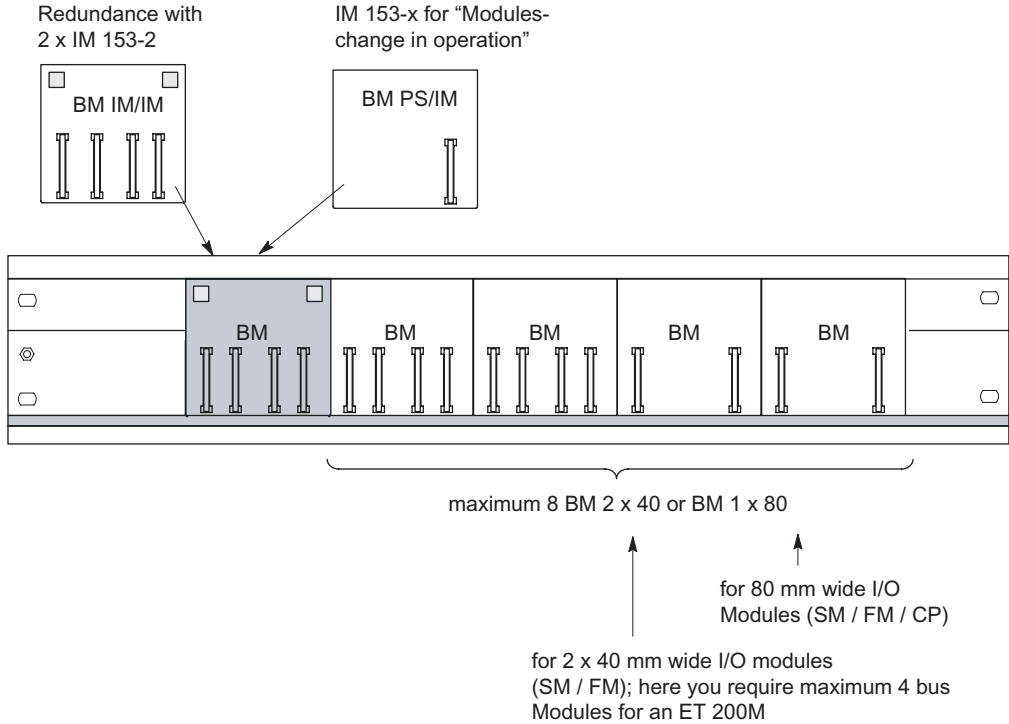
Figure 3-9   Configuration with active bus modules

Placement of the PS 307 power supply modules

Redundancy with 2 x IM 153-2	If you use the 530 mm rail, place the BM IM/IM in the right-hand of the two latched positions on the rail Then you can install either 2 x PS 307; 2A or 1 x PS 307; 5A to the rail to the left of the BM IM/IM.
	Otherwise you must fit the power supply modules to a separate S7 standard rail.
	Recommendation: Each IM 153-2 has its own PS.
IM 153-1 /-2 for "Module change in operation"	Alongside the IM 153-x, the PS 307; 2A is also compatible with the BM PS/IM. The PS 307; 5A or 10A are not compatible with the BM PS/IM. You must fit these to a separate S7 standard rail.

See also

3.6   Configuring the electrical structure

3.6.1   General rules and regulations for operating the ET 200M

Introduction

Depending on the particular area of application, the ET 200M programmable controller, as part of a plant or system, requires that you observe a number of specific rules and guidelines.

Note the safety and accident prevention directives applicable to specific application cases, e.g. the machine guidelines.

This section outlines the most important rules you must observe to integrate your ET 200M safely into an existing plant or system.

EMERGENCY-OFF devices

In all operating modes of the plant or system, EMERGENCY-OFF devices that conform to IEC 60204 "Safety of machinery – electrical equipment of machines" must remain effective.

Startup of the system after certain events

The following table identifies situations you must pay attention to when the system starts up after the occurrence of certain events.

If there is ...	then ...
• Start-up after voltage drop or failure • Startup of the ET 200M after an interruption of bus communication	should not cause any dangerous operating states. If necessary, the emergency stop must be forced!
• Start-up after releasing the emergency stop device • ET 200M start-up without the DP master triggering the ET 200M	There must not be an uncontrolled or undefined startup.

Note on Radio Interference

When several electronic components are used within a switch cabinet, the radio interference can overlap. As a result, the permissible level of radio interference intensity in the overall configuration may be exceeded.

Tip: Keep such modules as far away from each other as possible, if necessary use shielded cables or filters in the supply lines or HFswitching cabinets.

Supply voltage

The following table identifies requirements to be observed for the line voltage.

With ...	the ...
Stationary plants or systems without all-pole line voltage disconnect switch	There must be a supply isolating switch or a fuse in the building installation system
Load power supplies, power supply modules	The system voltage range set must correspond to the local system voltage
All ET 200M circuits	fluctuation / deviation of the input / load voltage from the rated value must lie within the permissible tolerances (refer to Technical Specifications of the S7-300 modules)

24 V DC supply

The following table identifies requirements to be observed for the 24 V supply.

With ...	you must ensure ...	
Buildings	Outdoor lightning protection	to provide lightening protection measures (e.g. lightening protection ductors)
24 V DC supply lines, signal lines	Indoor lightning protection	
24 V DC supply	Safe electrical isolation of safety extra-low voltage	

Protection against outside electrical influences

The following table identifies requirements you must observe to provide protection against electrical influences or faults.

With ...	you must ensure ...
All plants or systems in which the ET 200M is integrated	that the unit or the system is connected to the grounding wire in order to discharge electromagnetic interference.
Connection, signal and bus lines	The wiring routing and installation are correct.
Signal and bus lines	Any break of a line or conductor does not result in undefined states of the plant or system.

Rules on the Power Consumption and Power Loss of an ET 200M

For their operation, the S7-300 modules use the necessary power from the backplane bus as well as, if necessary, from an external load power supply.

● The current consumption of all signal modules from the backplane bus must **not** exceed the electrical output that the IM 153-x can supply to the backplane bus.

● The PS 307 power supply is dependent on the current consumption from the 24 V load power supply; this is the result of the total of the current consumption of the signal modules and all other connected loads.

● The power loss of **all** the components in a cabinet must not exceed the maximum thermal rating of the cabinet.

   Tip: When establishing the required dimensions of the cabinet, ensure that the temperature inside the cabinet does not exceed the permissible 60°C even where external temperatures are high

You will find the values for the power consumption and power loss of a module under the technical specifications of the relevant modules.

3.6.2   Operating the ET 200M with process I/O on a grounded supply

The following gives information on the overall configuration of an ET 200M to a grounded supply (TN-S-network). The topics covered here are:

● Switch-off organs, short-circuit and overload protection in accordance with DIN VDE 0100 and DIN VDE 0113

● Load power supplies and load circuits

Grounded supply

With grounded supplies the neutral line of the network is grounded. A simple contact to earth between a live cable and ground or a grounded part of the unit triggers the safety organs.

Components and safety measures

Different components and safety measures are prescribed for setting up a complete plant. The nature of the components and the degree of credibility of the safety measures depends on which DIN VDE directive applies to your unit configuration. The following table refers to the two following figures.

Table 3- 4   DIN VDE-directives for the configuration of a controller

Comparisons ...	Reference to figure	DIN VDE 0100	DIN VDE 0113
Switch-off organ for controllers, signal sensors and final control elements	(1)	… part 460: Main switch	… part 1: Separator
Short-circuit and overload protection: in groups for signal sensors and final control elements	(2)	… part 725: Single-pole protection of the circuit	… part 1: ● with grounded secondary power circuit: **single-pole** protection ● otherwise: **all-pole** protection
Load power supply for AC load circuits with more than five electromagnetic apparatus	(3)	metallic isolation with transformers **recommended**	metallic isolation with transformers **required**

Properties of load power supplies

The load power supply supplies input and output circuits (load circuits) as well as sensors and actuators. The following lists the properties of load power supplies that are required in special application cases.

Properties of load power supply	required for ...	Remarks
Safer (electrical) isolation	Modules that must be supplied with voltages ≤ DC 60 V or ≤ AC 25 V	The power supplies PS 307 as well as the Siemens load power supplies of the 6EP1 series have this property.
	24 V DC load power supply	
Tolerances of the output voltage:		In the case of considerable unevenness of the output voltage, we recommend using a supporting capacitor. Measurement: 200 µF per 1 A load current (with bridge rectification).
20.4 V to 28.8 V	24 V DC load power supply	
40.8 V to 57.6 V	48 V DC load power supply	
51 V to 72 V	60 V DC load power supply	

Rule: ground the load circuits

The load circuits should be grounded.

A perfect functioning security is given on account of the mutual reference potential (ground). On the load power supply (terminals L or M) or on the isolation transformer provide a disconnectable connection to the grounding wire (position ④ in the following figure). In the event of faults in the energy distribution, this measure makes it easier for you to localize contacts to earth.

ET 200M in the overall configuration

The following figure shows the position of the ET 200M in the overall configuration (load power supply and grounding concept) with a supply from a TN-S-network.

Note: The arrangement shown of the supply connections does not correspond to the actual arrangement; it has been chosen for reasons of clarity.
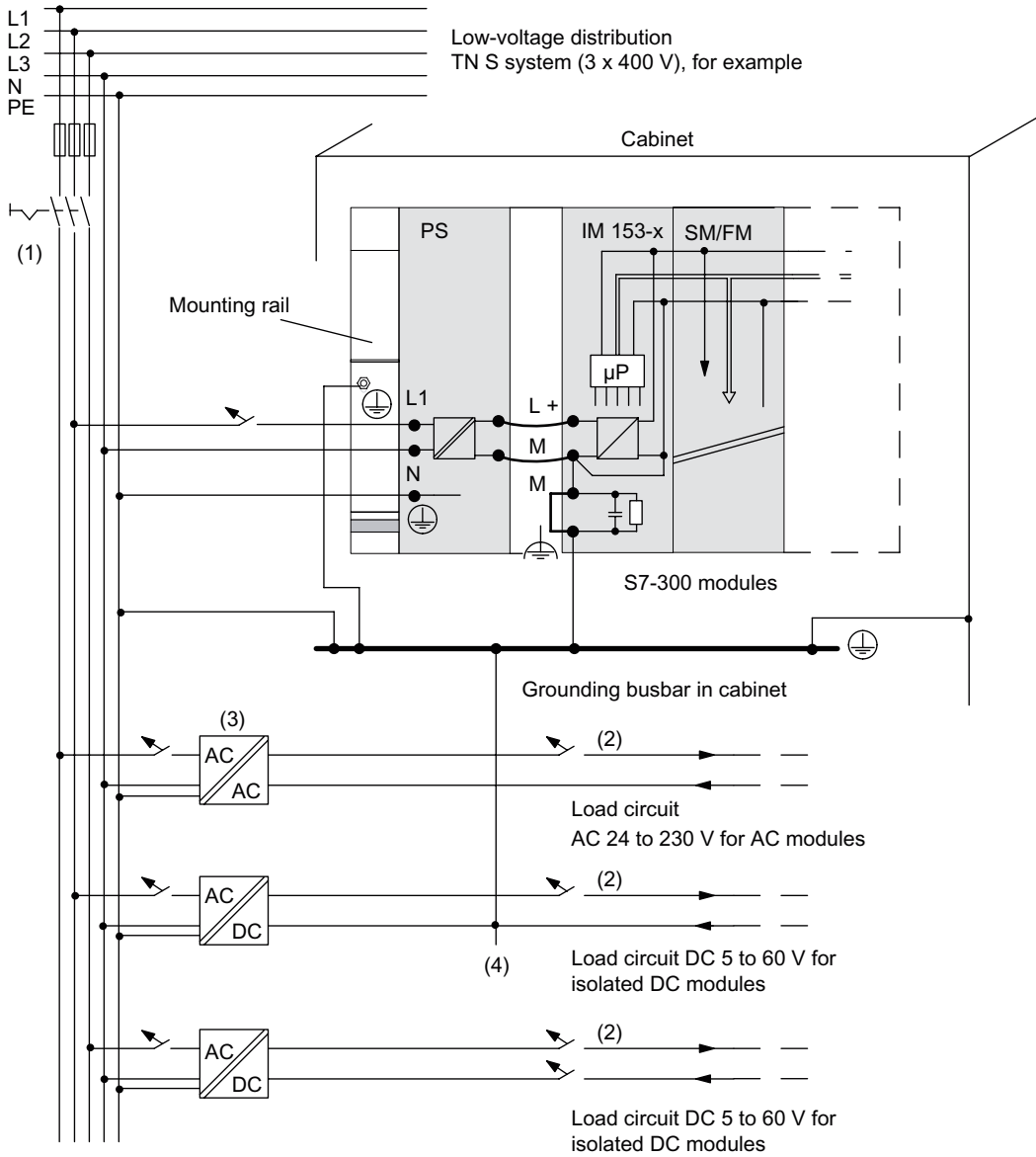
Figure 3-10   Operating S7-300 modules from grounded supply

ET 200M with load power supply from the PS 307

The following figure shows the position of the ET 200M in the overall configuration (load power supply and grounding concept) with a supply from a TN-S-network.

Alongside the IM 153-x, the PS 307 also supplies the load circuit for the 24 V DC modules.

Note: The arrangement shown of the supply connections does not correspond to the actual arrangement; it has been chosen for reasons of clarity.
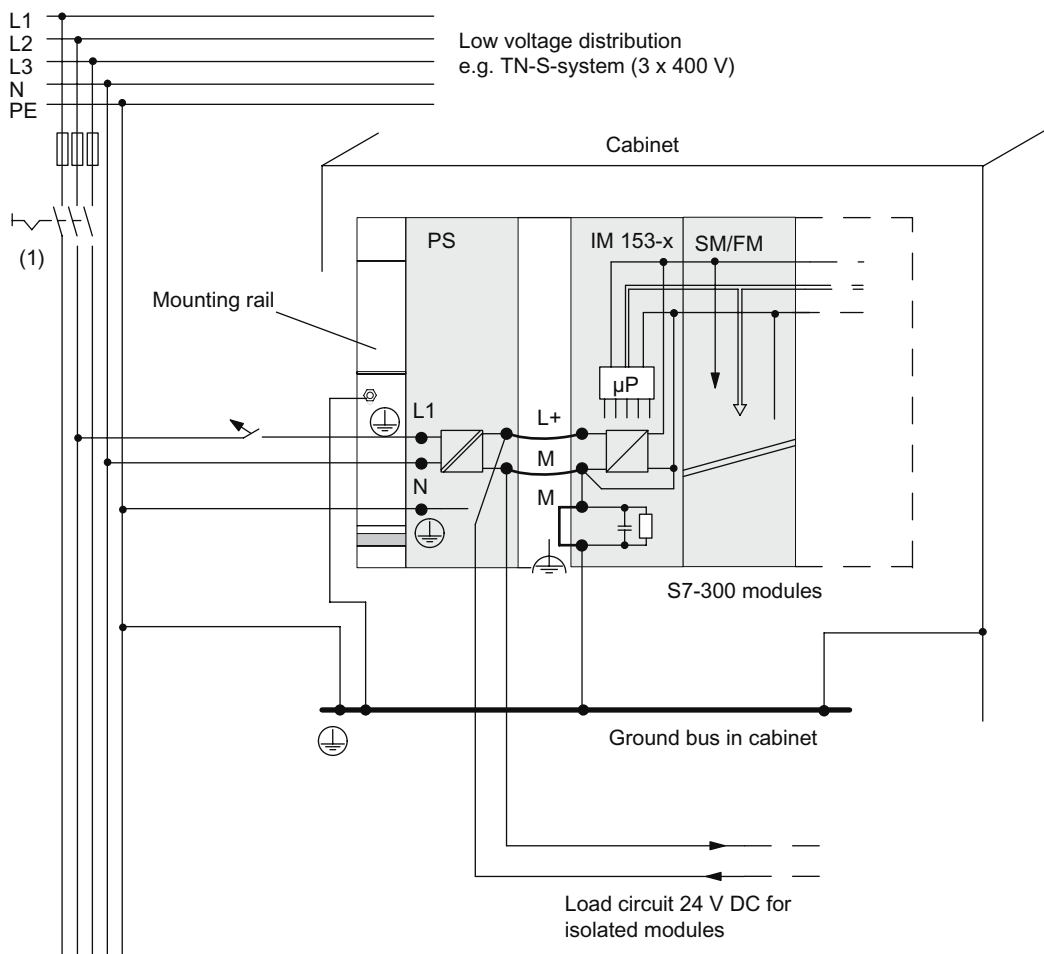
Figure 3-11   Operating S7-300 modules from the PS 307

3.6.3 Configuration of an ET 200M with ungrounded reference potential

In the configuration of the ET 200M with ungrounded reference potential, the occurring interference currents are deflected to the grounding wire via an RC network that is integrated in the IM 153-x (see following figure).

For information on older IM 153-x versions, refer to Appendix "RC network with 1 MΩ for a configuration with ungrounded reference potential (Page 246)".

Application

In extensive units it may be necessary, e.g. for the purposes of earth leakage monitoring, to configure the ET 200M with ungrounded reference potential. This is the case, for example, in the chemical industry or in power stations.

Connection diagram

The following figure shows the configuration of an ET 200M with IM 153-x and ungrounded reference potential. If you don´t want to ground the reference potential, then you must **remove the bridge on the IM 153-x between the terminals M and the functional earth**. If the bridge isn´t connected then the reference potential of the ET 200M is connected internally to the grounding wire via an RC combination and via the rail. This way, high-frequency interference currents are deflected and static charge avoided.
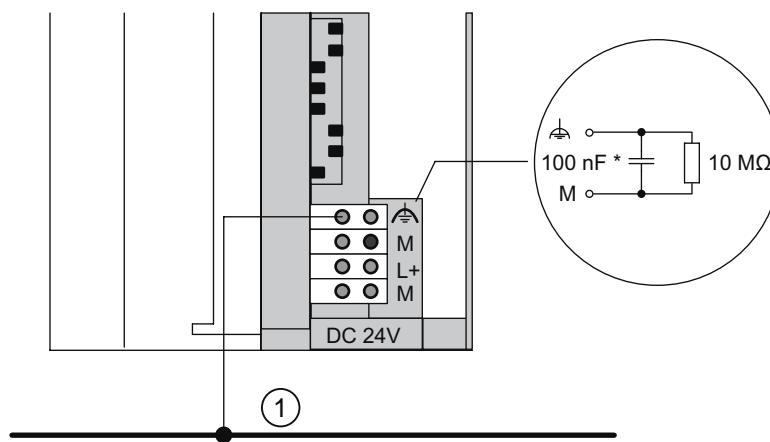
①   Ground bus

*   22 nF in IM 153-1AAx3, IM 153-2AA02, IM 153-2BA00, IM 153-2AB01, IM 153-2BB00

Figure 3-12   Configuration of an ET 200M with ungrounded reference potential

Network devices

When using network devices, note that the secondary winding must not be connected with the grounding wire. We recommend you use the power supply module PS 307.

Filtering the 24 V DC supply

If, with a configuration with ungrounded reference potential, you supply the IM 153-x from a battery, you must suppress the 24 V DC power supply. To do this, use a Siemens mains filter, e.g. B84102-K40.

Insulation monitoring

If, on account of double faults, dangerous situations could occur, then you must provide insulation monitoring.

3.6.4   Configuration of the ET 200M with isolated modules

Definition

With a configuration using isolated modules, the reference potentials are electrically isolated from the control circuit ($M_{internal}$) and load circuit ($M_{external}$) (refer also to the following figure).

Application area

You use electrically isolated modules for:

- all AC load circuits
- DC load circuits with separate reference potential, e.g.
    - DC load circuits, the encoders for which have different reference potentials (e.g. if grounded encoders are used far away from the controller and an equipotential bonding isn´t possible)
    - DC power circuits, the positive poles (L +) of which are grounded (battery circuit).

Isolated modules and grounding concept

You can use isolated modules irrespective of whether the reference potential of the ET 200M is grounded or not.

Configuration with isolated modules

The following figure shows the potential relation of an ET 200M configuration with isolated input and output modules.
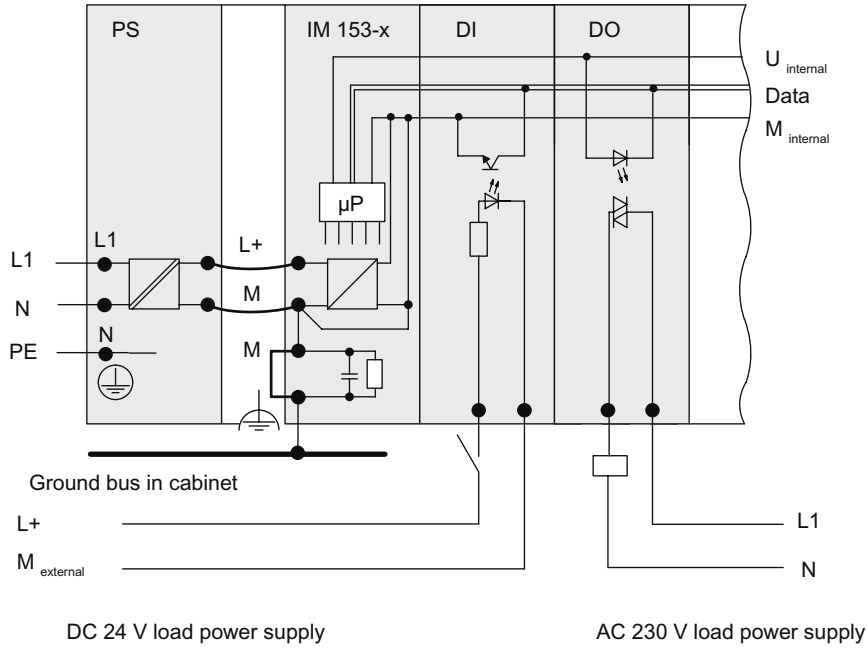
Figure 3-13   Simplified representation for the configuration with isolated modules

3.6.5 Configuration of the ET 200M with non-isolated modules

Potential relations in the configuration with isolated modules

The following figure shows the potential relations of an ET 200M configuration with grounded reference potential with the isolated analog input / output module SM 334; AI 4/AO 2 x 8/8 bit.

24 V DC load supply
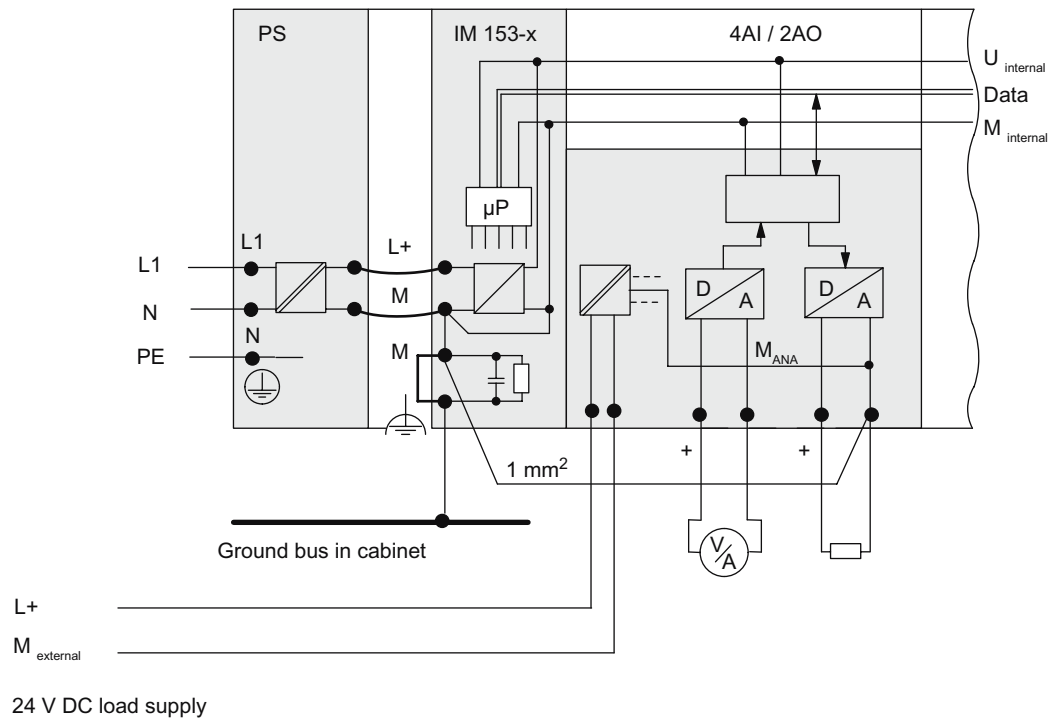
Figure 3-14   Potential relations in the configuration with the isolated analog input / output module SM 334; AI 4/AO 2 x 8/8bit

Installation

4

4.1 Overview

Introduction

In this chapter we will show you how to prepare and install the ET 200M components.

There are two configuration types for the ET 200M:

- Standard configuration with rail and bus connectors between the modules
- Configuration with active bus modules for the function "Change During Operation" and / or "Redundancy"

To set up an ET 200M, you must take into account the mechanical and electrical configuration. For more information, refer to the chapter "Assignment planning (Page 33)".

Open components

The modules of an ET 200M are open equipment. That means you can only install the ET 200M in housings, cabinets or electrical operating areas. These housings, cabinets and electrical operating areas should only be accessible by means of a key or a special tool. Only trained or authorized personnel should have access to the housings, cabinets or electrical operating areas.

4.2 Installation

4.2.1 Mounting Sequence

Mounting steps

Depending on the desired structure you have to carry out the following steps consecutively during mounting:

1. Installing the mounting rail
2. Mounting a Module
   - At standard configuration: Mount the modules on the rail
   - At configuration with active bus modules: Mount the active bus modules and modules
3. Carry out the concluding work: After mounting

Detailed information about the individual mounting steps can be found below in the sections of the same name.

4.2.2   Installing the DIN rail

Uniform Installation

All the information in this section applies to both the DIN rail and the rail for active bus modules.

Mounting Rail for Active Bus Module

To configure an ET 200M with the function "Module change during operation", "Redundancy", use the associated rails with the order number 6ES7195-1Gxx0-0XA0. Only these rails can take the active bus modules.

For the dimensions of the mounting rails for active bus module, refer to the chapter "Installing Active Bus Modules and Modules (Configuration with Active Bus Modules) (Page 66)".

Do you want to install a 2-meter rail?

If not, you can skip this section and read on from "Dimensioned Drawing for Fixing Holes".

If you do you need to prepare the 2-meter rail for installation. Proceed as follows:

1. Shorten the 2-meter rail to the required length.
2. Mark out:
    –   four holes for fixing screws (dimension: refer to the following figure and following table)
    –   One hole to take the fixing screw for the protective conductor.
3. Is the rail longer than 830 mm?
    –   If not: No further steps have to be taken.
    –   If so: Then, in order to stabilize the rail you must provide additional holes for extra fixing screws. Score out these extra holes across the groove in the central area of the rail (refer to following figure). These additional holes should be at approx. 500 mm intervals.
4. Drill the marked holes with a diameter of 6.5 $^{+0.2}$ mm for M6 screws.
5. Screw in an M6 screw to fix the grounding wire.
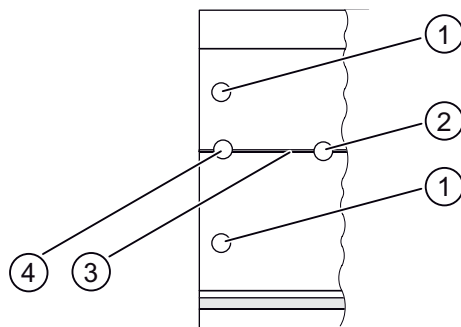
①   Hole for fixing screw

②   Drilled hole for extra fixing screw

③   Groove for drilling extra fixing holes

④   Hole for connecting a protective conductor

Figure 4-1   Fixing holes of the 2-meter rail

Dimensioned Drawing for Fixing Holes

The fixing-hole dimensions for the rail are shown in the following table.

Table 4- 1   Fixing holes for rails

DIN Rail Mounting rail for the "Insertion and Removal" function				
Length of rail	DIN Rail	Mounting rail for the "Insertion and Removal" function	Dimension a	Dimension b
160 mm	X	—	10 mm	140 mm
482.6 mm	X	X	8.3 mm	466 mm
530 mm	X	X	15 mm	500 mm
620 mm	—	X	15 mm	590 mm
830 mm	X	—	15 mm	800 mm

2-meter rail
2-meter rail for the "Insertion and Removal" function

Fixing Screws

You have a choice of the following screw types for fixing the rail.

For …	you can use ...	Description
Outer fixing screws	Fillister head screw M6 in accordance with ISO 1207 / ISO 1580 (DIN 84 / DIN 85)	Choose a suitable screw length for your configuration. You also require washers 6.4 in accordance with ISO 7092 (DIN 433).
	Hexagon head screw M6 in accordance with ISO 4017 (DIN 4017)	
additional fixing screw (only 2-meter rail)	Fillister head screw M6 in accordance with ISO 1207 / ISO 1580 (DIN 84 / DIN 85)	

Installing the mounting rail

To install the rail, proceed as follows:

1. Choose a position for the rail that leaves enough room to install it properly and enough space to cope with the temperature rise of the modules. Observe the minimum clearance distances of 40 mm above and below the rail.

2. Connect the rail to the base (screw size: M6).

   Is this base a grounded metallic plate or a grounded device supporting plate?

   If not: No particular steps are required.

   If so: Ensure there is a low-impedance connection between the rail and the base. In the case of painted or anodized metals, for instance, use a suitable contacting agent or contact washers.

3. Connect the rail to the protective conductor. An M6 screw is provided for this purpose on the rail.

   Minimum cross-section of the cable to the grounding wire: 10 mm^2.

   ### Note

   Ensure that your connection to the protective conductor is low-impedance (see the following figure). If the ET 200M is mounted on a hinged rail, for example, you must use a flexible cable to establish the connection to the protective conductor.

Connection of protective conductor

The following figure shows you how to connect the protective conductor to the rail.
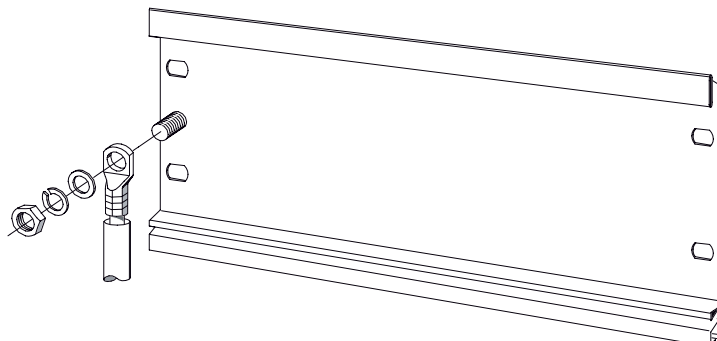
Figure 4-2   Connecting the protective conductor to the rail

See also

Clearance Measurements (Page 41)

4.2.3   Installing modules on the mounting rail (standard installation)

Accessories

The accessories you need for installation are included with the modules. The appendix "Order Numbers for ET 200M (Page 247)" contains a list of accessories and spare parts with the corresponding order numbers.

Table 4- 2   Module accessories

Module	Included accessories	Description
IM 153-x	1 x slot number label	For assigning slot numbers
Signal module (SM)	Bus connectors	For establishing the electrical connections between the modules
	Labeling strip	For labeling the input and output points on the module

Sequence when hanging the modules

Hang the modules onto the rail as follows:

1. Power supply module

2. IM 153-x

3. Signal module(s)
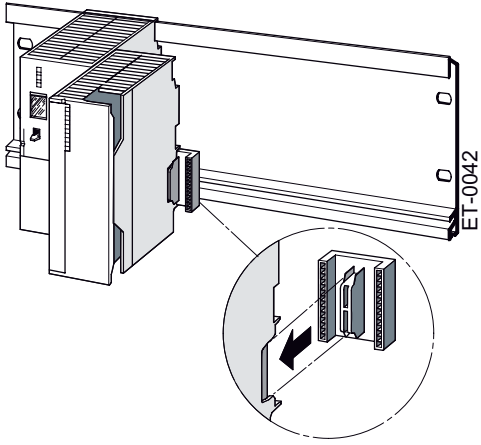
Note

If you are installing SM 331 analog input modules, please check **before** installation whether you have to move the measuring range submodules on the side of the module. (Refer to chapter "Analog modules" in the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" reference manual.)
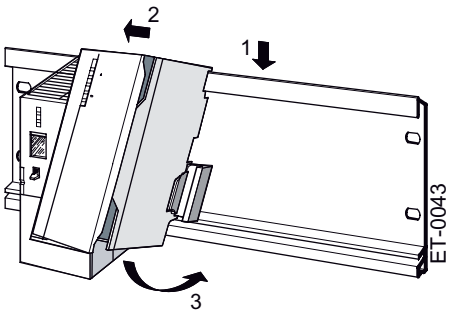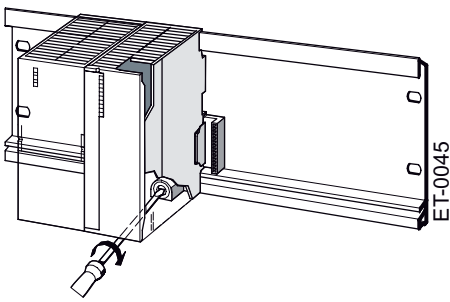
Sequence for Installation

Proceed as follows to install the modules:

Table 4- 3   Installing modules on mounting rails

Step	Activity	Figure
1.	Hook the power supply unit PS 307 onto the rail and screw it tight.	
2.	Clip on the bus connector. A bus connector is included with each signal module, but not however with the IM 153-x. When installing the bus connector always start with the IM 153-x: • Take the bus connector from the "last" module and insert it in the IM 153-x. • Do not plug a bus connector into the "last" module. Do not insert any bus connectors between the PS 307 and IM 153-x!	

Step	Activity	Figure
3.	Hook the modules onto the rail (1), slide them along as far as the module on the left (2), and swing them down into place (3).	
4.	Bolt the modules tight, applying a torque of between 0.8 and 1.1 Nm.	

4.2.4   Installing Active Bus Modules and Modules (Configuration with Active Bus Modules)

Installing Bus Modules and Modules

To install the active bus modules and modules, proceed as follows:

Only install the active bus modules in a de-energized state.

1. Suspend the bus module BM PS/IM or BM IM/IM with the lower edge in the rail, press it into the rail (a) and slide it to the left until the latched position (b).
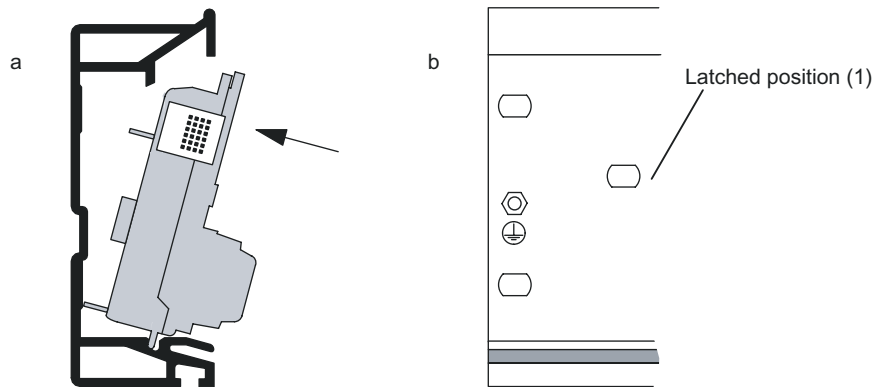
Do you use the 530 mm rail and the BM IM/IM?
If you position the BM IM/IM in the right of the two latched positions (1), to the left alongside the BM IM/IM you can still install either 2 x PS 307; 2A or 1 x PS 307; 5A.

2. Hook the next bus module (bus module BM 2 40 or BM 1 80) onto the rail and push it onto the rail. Push it towards the left bus module, so that the module connector has contact.

3. Are you installing the ET 200M in intrinsically safe areas?

   If yes, then you require the explosion-proof partition between the modules in the intrinsically safe and the non-intrinsically safe areas. To do this, simply insert the explosion-proof partition on the right lateral guide of the bus module.

4. Hook the modules onto the rail and swing them down into place. Use the side guides of the bus modules to do so. When you screw in the modules, fix the bus module to the rail at the same time

5. Plug the bus module cover onto the last bus module. If there is a slot with no module, plug in the backplane bus cover on the unoccupied slot.

Rail for active bus module

The figure below shows the dimensioned drawing of the rail with active bus module, S7-300 module and explosion-proof partition. The rail is 482.6 mm or 530 mm long.
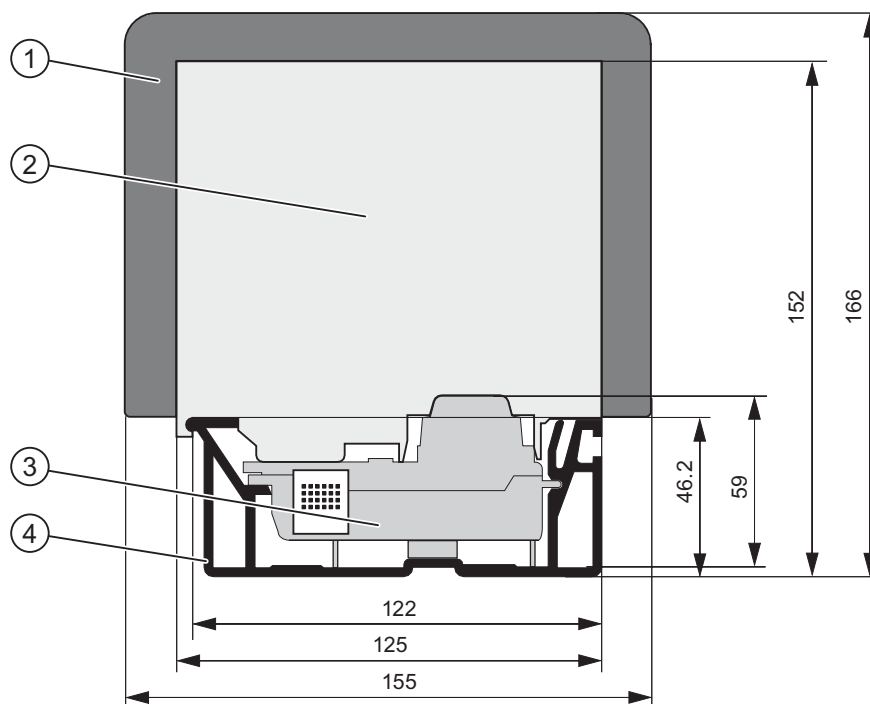
①	Explosion-proof partition
②	S7-300 module
③	active bus module
④	Mounting rail for the "Insertion and Removal" function

Plugging in Output Modules During Operation of an ET 200M Installation

⚠ **WARNING**

When you insert output modules, uncontrolled system states may occur.

This also applies if you insert input / output modules tilted on the bus module.

When you insert an output module, the outputs set by the user program immediately become active.

We recommend that you set the outputs in the user program to "0" when you remove an output module.

If modules are removed and inserted incorrectly, neighboring modules may be affected via the backplane bus.

4.2.5   After installation

Assign slot numbers

After installation you can assign a slot number to each module, and this makes it easier to assign the modules to the configuration table in *STEP 7* or in *COM PROFIBUS*. The following table illustrates the assignment of the slots.

Table 4- 4   Slot numbers for S7 modules

Slot number	Module	Remark
1	Power supply (PS) [1]	–
2	IM 153-x	–
3	–	inapplicable
4	1. S7-300 module	right alongside the IM 153-x
5	2. S7-300 module	–
…	…	–
11	8. S7-300 module	–
[1] The use of the power supply is optional.		

Unoccupied slots

If, in a configuration of an ET 200M with active bus modules, slots are unoccupied (e.g. reserved for later use), then you must leave these slots free in the configuration in *STEP 7* or *COM PROFIBUS*!

Attaching slot numbers

The following figure shows how you must attach the slot numbers. The slot number plates are provided with the IM 153-x.
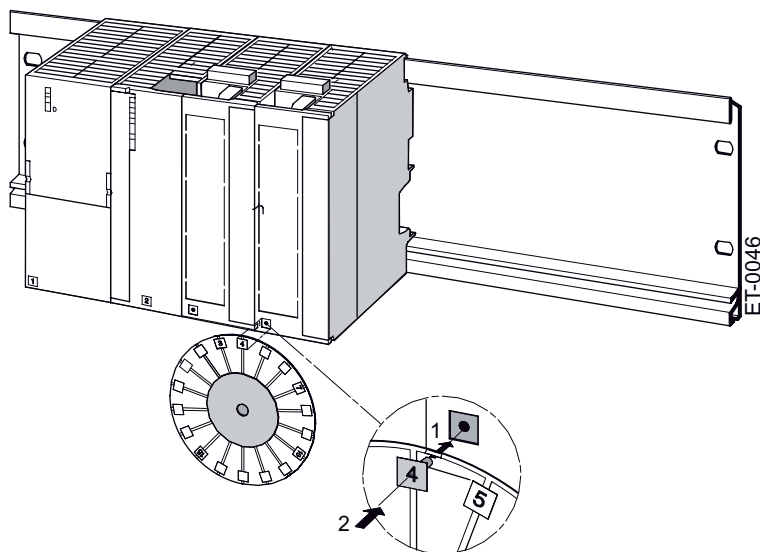
Figure 4-3   Attach the slot numbers to the modules.

4.3   Setting the PROFIBUS address

Definition

Each bus node must receive a PROFIBUS address to identify it uniquely on the PROFIBUS DP.

Controlling

The following rules apply for the PROFIBUS address of the IM 153-x:

- Permissible PROFIBUS addresses are: 1 to 125.
- Each PROFIBUS address can be allocated only once on the bus.

Setting the PROFIBUS Address

1. Set the PROFIBUS address using a screwdriver and with the door open.

   The PROFIBUS address is the addition of the switch that is located on the right ("ON" position).

   Note

   In the IM 153-2Bx00 and the IM 153-2Bxx1 the PROFIBUS address has an 8-pin DIL switch instead of the 7-pin switch that has been used up until now.

   The lowest switch has no function and is labeled with "0" or "-" in order to maintain the addition principle.

Example: Setting the PROFIBUS Address

IM 153-1, IM 153-2Ax0x	IM 153-2Bx00	IM 153-2Bxx1
PROFIBUS address: 64 + 32 + 2 + 1 = 99	PROFIBUS address: 64 + 32 + 2 + 1 = 99 Switch 0 has no function.	PROFIBUS address: 64 + 32 + 2 + 1 = 99 The switch "-" has no function.

Changing the PROFIBUS Address

You can change the set PROFIBUS address at any time. However, the IM 153-x adopts the new PROFIBUS address only after a switch off / switch on of the 24 V DC supply.

Connecting 5

5.1 Overview

Introduction

This chapter shows you how to wire an ET 200M.

To set up an ET 200M, you must take into account the mechanical and electrical configuration. Information can be found in the "Assignment Planning (Page 33)" chapter.

Basic Rules

In view of the many and varied applications of an ET 200M, this chapter can only describe a few basic rules on its electrical configuration. You must observe at least these basic rules if you want your ET 200M to operate faultlessly and satisfactorily.

5.2 Connecting PROFIBUS DP

5.2.1 Connecting the Bus Connector

Applicable bus connectors

To connect with the PROFIBUS DP it is preferable to use the following FastConnect bus connectors:

- up to 12 MBaud, with vertical cable departure
  - without PD jack (6ES7972-0BA50-0XA0)
  - with PD jack (6ES7972-0BB50-0XA0)
- up to 12 MBaud, with diagonal cable departure
  - without PD jack (6ES7972-0BA60-0XA0)
  - with PD jack (6ES7972-0BB60-0XA0)

These guarantee a fast and secure wiring with FC bus lines.

Of course you can also continue to use the conventional bus connector with screw clamp connection:

- up to 12 MBaud, with vertical cable departure
  - without PD jack (6ES7972-0BA12-0XA0)
  - with PD jack (6ES7972-0BB12-0XA0)
- up to 12 MBaud, with diagonal cable departure
  - without PD jack (6ES7972-0BA41-0XA0)
  - with PD jack (6ES7972-0BB41-0XA0)

Connecting the Bus Connector

Proceed as follows to connect the bus connector:

1. Plug the bus connector into the IM 153-x.

2. Tightly screw the bus connector into the IM 153-x.

3. If the bus connector is located at the start or end of a segment, you must connect the terminating resistor (switch setting "ON").

   Alternative: You use the PROFIBUS terminator as an active bus connector.

4. Lay the bus cable(s) in the area intended for the IM 153-x to the right alongside the DC 24 V connection terminal.

Ensure that the nodes to which the terminating resistor is connected are always supplied with voltage during power-up and operation.

5.2.2   Connecting the Fiber-Optic Cable to the IM 153-2 FO

Required accessories

- Packaging with Simplex connectors and polishing sets (6GK1901-0FB00-0AA0)
- Packaging with plug adapters (6ES7195-1BE00-0XA0)
- Tool for removing the cable sheath (6GK1905-6PA10)

Installing Connectors

1. Remove the sheath of the FOC duplex cable to around 30 cm in length.

2. Install the FOC duplex cable with the associated Simplex connectors.

   For detailed assembly instructions for simplex connectors, refer to the"SIMATIC NET PROFIBUS networks (http://support.automation.siemens.com/WW/view/en/1971286)" manual.

   IMPORTANT: The cut and polished surface of the plastic fiber must be absolutely smooth and even. Likewise, the plastic jacket must not protrude or be cut unevenly. Every irregularity causes strong attenuation of the light signal over the fiber-optic cable!

3. Place the Simplex connector in the plug adapter for the IM 153-2 FO and the FOC in the intended cable routing. Snap the plug adapter closed until you can hear clearly that the side panels have engaged.

   Ensure correct positioning when inserting the connector in the plug adapter: Make sure the transmitter is always on top and the receiver always on the bottom!
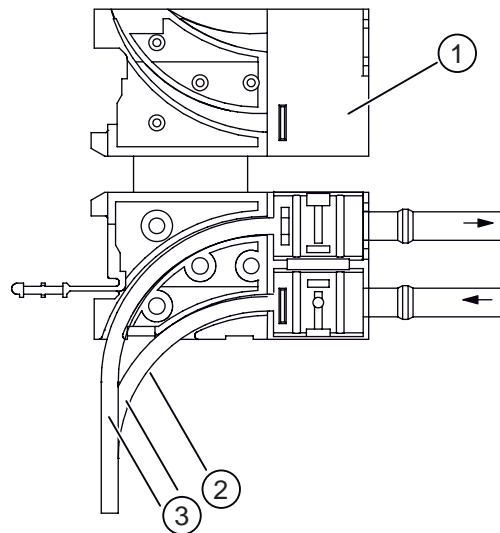
①	Plug adapter for the IM 153-2 FO
②	Maximum 30 mm bending radius
③	FOC duplex cable

Tip: Cut the bottom cable about 10 mm shorter than the top one. That way you´ll achieve a better cable routing in the cable channel of the IM 153-2 FO.

Reusing used fiber-optic cables

Note

If you once again insert the used FOC in the plug adapter, then you must shorten the two FOC wires around the bent lengths and then reinstall the Simplex connector.

This way you avoid any possible attenuation loss on account of re-bending and highly stressed parts of the FOC duplex wires.

Connect the FOC to the IM 153-2 FO

1. Insert the FOC with the already installed plug adapters into the IM 153-2 FO.

   Ensure that the positioning is correct: The transmitter FOC is inserted in the receiver jack of the FOC interface of the IM 153-2 FO and the receiver FOC in the transmitter jack.

2. Fold the protruding plug grip upward.

3. If the IM 153-2 FO is the last node of the FOC network, then you must close the unoccupied FOC interface with dummy plugs (plugging in factory state in the IM 153-2 FO).

> ⚠ **CAUTION**
>
> Do not look directly into the opening of the optical transmit diodes.
>
> The emitted light beam could damage your eyes.
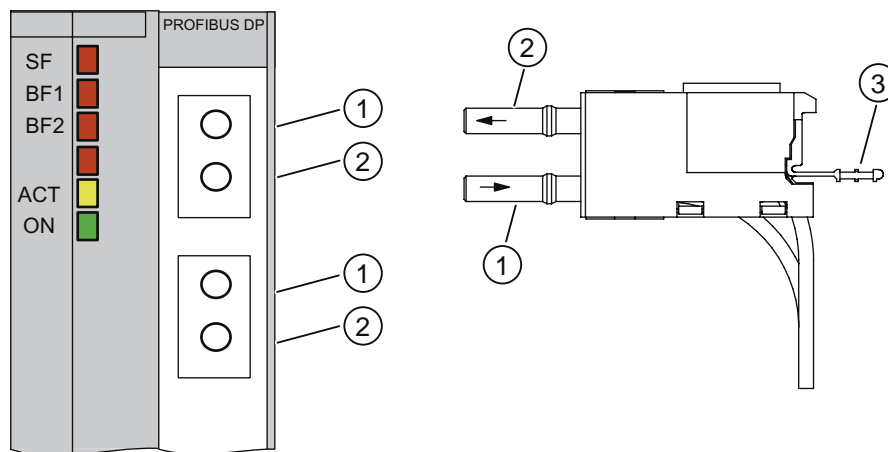
Figure 5-1   Connect the FOC to the IM 153-2 FO

① Receiver
② Transmitter
③ Grip

Bending radius for the fiber-optic cable

When inserting the FOC duplex wire in the plug adapter and when laying, ensure that the associated bending radius of 30 mm is not fallen short of. See also the installation guidelines on fiber-optic cables in the "ET 200 Distributed I/O System (http://support.automation.siemens.com/WW/view/en/1142470)" or "ET 200 Distributed I/O System (http://support.automation.siemens.com/WW/view/en/1142470)" manuals.

5.3 Connecting PROFINET IO

5.3.1 Connecting IM 153-4 PN

Introduction

You connect the supply voltage and PROFINET IO to the IM 153-4 PN interface module.

①   Front door
②   Connection for PROFINET IO (with 2 ports)
③   Connection for supply voltage
④   Cable holder

Requirements

Wire the interface module with the supply voltage switched off.

Required tools

- Screwdriver with 3 mm blade
- Cross-tip screwdriver, size 1
- Industrial Ethernet Fast Connect stripping tool (6GK1901-1GA00)
  (stripping tool for Industrial Ethernet Fast Connect installation cables)

Required accessories

- Cable with maximum 2.5 mm^2 conductor cross section for the supply voltage

- PROFINET connector according to the specifications in the "PROFINET installation guideline (http://www.profibus.com/pall/meta/downloads/article/00328/)".

  The following are suitable:

PROFINET RJ45 connector with Fast Connect connection system, 180° cable outlet	6GK1901-1BB10-2AA0

- Industrial Ethernet Fast Connect installation cables

  The following are suitable:
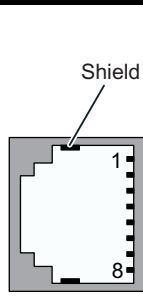
Fast Connect standard cable	6XV1840-2AH10
Fast Connect trailing cable	6XV1840-3AH10
Fast Connect marine cable	6XV1840-4AH10

Installing the PROFINET cable connector

Install the PROFINET connector according to the specifications in the "PROFINET installation guideline (http://www.profibus.com/pall/meta/downloads/article/00328/)".

For more information, refer to the "PROFINET Cabling and Interconnection Technology (http://www.profibus.com/pall/meta/downloads/article/00327/)" manual.

Pin assignment of the RJ45 connector

View of the RJ45 socket	Terminal	Assignment
Shield 1 8	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

Installing the cable holder

Install the supplied cable holder (see figure above).

1. Open the front door of the IM 153-4 PN interface module.

2. Insert the cable holder into the prepared cutout on the interface module.

3. Screw the cable holder firmly into place.

Connecting PROFINET IO and supply voltage

1. Connecting PROFINET IO

   – Insert the PROFINET cable connector onto the PROFINET terminal X1 P1.

   – Clamp the PROFINET cable securely in the cableholder.

   The integrated switch enables looping through of PROFINET IO.
   If necessary, you can connect the PROFINET terminal X1 P2 to another IO device.

   ### Note

   We recommend that you use a strain relief for the PROFINET connecting cable when using an ET 200M system under environmental conditions where it is subject to mechanical vibration or shock.

   To do this you require a cable tie with a standard width of 2.5 mm or 3.6 mm.

   Use it to attach the PROFINET connecting cable from right where it exits the PROFINET connector to the cable bracket provided on the Interface module (on the front side directly below the PROFINET IO interface).

2. Connecting the supply voltages

   – Strip the insulation from the supply voltage cables.

   – Insert the individual cables into the spring-loaded terminal of the supplied cable connector.

   – Insert the wired connector onto the PS terminal on the interface module.

3. Close the front door.
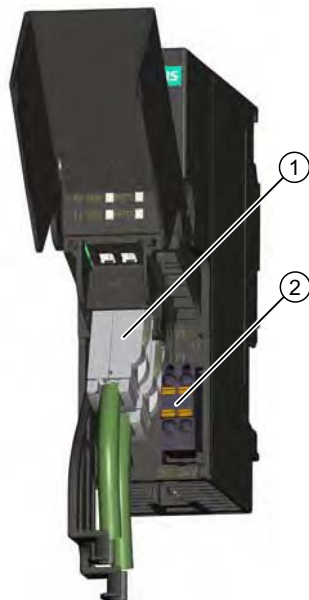
①   PROFINET IO

②   Supply voltage

5.4 Wiring the power supply and modules

5.4.1 Wiring rules

Note

For a configuration for "Module change during operation", provide longer cables to the front connectors (refer to chapter "Wiring front connectors of the signal modules (Page 81)").

Table 5- 1   Wiring rules for the power supply and the IM 153-x

Wiring rules for ...		Power supply and IM 153-x
connectable wire cross-sections for solid cables		No
connectable wire cross-sections for flexible cables	without wire end ferrules	0.25 to 2.5 mm^2
	with wire end ferrules	0.25 to 1.5 mm^2
Number of wires per connection		1 or combination of 2 wires up to 1.5 mm^2 (total) in a mutual wire end ferrule
Maximum external diameter of the wire insulation		Ø 3.8 mm
Stripping length of the wires	without insulation collar	11 mm
	with insulation collar	11 mm
Wire end ferrules in accordance with DIN 46228	without insulation collar	Form A, 10 to 12 mm long
	with insulation collar	Form E, up to 12 mm long

Table 5- 2   Wiring rules for front connectors of modules

Wiring rules for ...		Front connectors of modules (screw and spring terminals)	
		20-pin	40-pin
connectable wire cross-sections for solid wires		No	No
connectable wire cross-sections for flexible wires	without end sleeve	0.25 to 1.5 mm^2	0.14 to 0.75 mm^2
	with wire end ferrules	0.25 to 1.5 mm^2	0.14 to 0.75 mm^2
Number of wires per connection		1 or a combination of 2 wires up to 1.5 mm^2 (total) in a common wire end sleeve	1 or combination of 2 wires up to 0.75 mm^2 (total) in a mutual wire end ferrule
Maximum external diameter of the wire insulation		Ø 3.1 mm max. 20 cables	Ø 2.0 mm max. 40 cables
Stripping length of the wires	without insulation collar	6 mm	6 mm
	with insulation collar	6 mm	6 mm
End sleeves in accordance with DIN 46228	without insulation collar	Form A, 5 to 7 mm long	Form A, 5 to 7 mm long
	with insulation collar	Form E, up to 6 mm long	Form E, up to 6 mm long

5.4.2 Wiring the Power Supply and IM 153-x

Power Cables

Use flexible cables to wire the power supply.

If you use only one cable per connection, you don't need an end ferrule.

Jumper

Use the jumper to wire the power supply module PS 307 with the IM 153-x. The jumper comes with the power supply module.

Further 24 V connections

On the power supply PS 307 via the jumper an additional 24 V-connections are still free for connecting the supply of the S7-300 modules.

Wiring the 24 V connections with redundant configuration with 2 x IM 153-2

Note

If, in a configuration for redundancy, you connect the supply voltage L+ when wiring to the IM 153-2, this brings about a short circuit via the ground terminal.
Reason: The two IM 153-2 have a mutual ground cable via the BM IM /IM bus module.

with IM 153-2AA02 / -2AB01:
We recommend, with a redundant configuration, that you protect the L+-supply from the IM 153-2 with 2.5 A.

with IM 153-2Bx00 / -2Bxx1:
- In configurations with ungrounded reference potential (jumper between M and functional ground removed, see the figure in the "Configuration of an ET 200M with ungrounded reference potential (Page 54)" chapter), in the case of a polarity reversal an internal electronic fuse is triggered and this regenerates after approx. 30 seconds.
- With a configuration with grounded reference potential (bridge inserted between M and functional earth) when connection this brings about a short circuit current via this bridge and the functional earths.
  In doing so, the IM 153-2 is not damaged if a protection is built in before the module which is designed in accordance with the cross-section of the connection line.

Wiring a power supply and IM 153-x with jumper

In order to wire power supply modules and IM 153-x, proceed as follows (refer to the following figure):

⚠ WARNING
Ensure the ET 200M is de-energized before doing any wiring!

1. Open the front panels of the PS 307 and the IM 153-x.

2. Undo the strain relief assembly on the PS 307.

3. Insulate the power cable (230 V / 120 V) and connect this to the PS 307.

4. Screw the strain relief assembly tight again.

5. Insert the jumper and screw it tight.

6. Close the front doors.
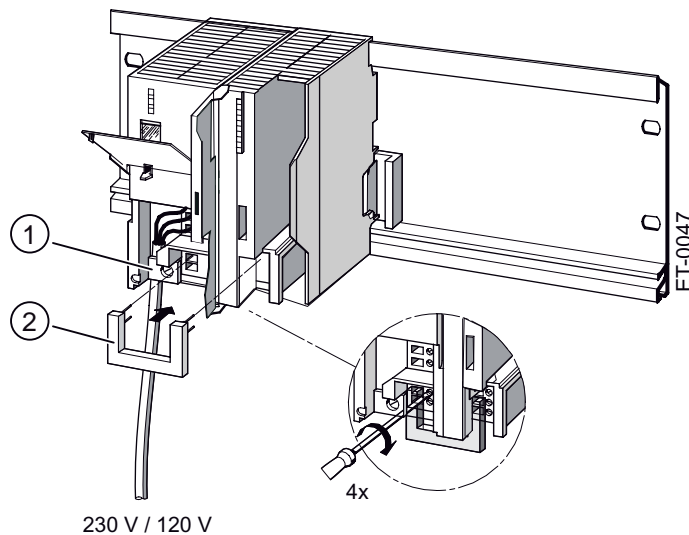
Figure 5-2   Wiring a power supply module PS 307 and IM 153-x with jumper

①   Strain relief
②   Jumper

Setting the Switch for the Mains Voltage

Check that the switch for selecting the mains voltage is set correctly to your mains voltage. This switch is always factory-set to 230 V on the PS 307. To select another mains voltage, do the following:

1. Prize the cover off with a screwdriver.

2. Set the selector to your mains voltage.

3. Place the cover back onto the switch opening.

See also

Wiring rules (Page 78)

5.4.3   Wiring front connectors of the signal modules

S7-Ex-modules

For information on how to wire the S7-Ex-modules and what you should observe when wiring modules in the intrinsically safe area, refer to the "S7-300 Automation Systems, ET 200M Ex I/O Modules (http://support.automation.siemens.com/WW/view/en/1096709)" reference manual.

Cables

You can use the flexible cables with cross-sections as specified in the "Wiring rules (Page 78)" chapter.

You do not need wire end ferrules.
If you use wire end sleeves, only use such as are specified in the "Wiring rules (Page 78)" chapter.

Types of Front Connector

The 20-pin and 40-pin front connectors are available in 2 designs: Cage-clamp terminals and screw-type terminals. For order numbers, refer to the appendix "Order Numbers for the ET 200M (Page 247)".

Cageclamp Technology

The front connectors in the cage-clamp technology can be wired very easily: Insert the screwdrivers vertically in the opening with the red opening mechanism, insert the cable in the associated terminal and then pull out the screwdriver.

Tip: There is a separate opening for test probes up to 2 mm in diameter to the left of the opening for the screwdriver.

Wiring for Module Change During Operation

If you wire modules for an ET 200M with the "module change during operation" function, you will require longer cables to the front connectors in order to easily insert and remove the modules during ET 200M operation. We recommend you make the wiring to the front connector approx. 20 cm longer.

Preparing the Connector for Wiring

To prepare for wiring, proceed as follows:

> ⚠️ **WARNING**
>
> You can come into contact with live cables if the power supply module and possibly in addition the load power supplies are switched on.
>
> Ensure the ET 200M is de-energized before doing any wiring!

1. Open the front door.
2. Put the front connector in the wiring position.

   To do so, push the front connector into the signal module until it snaps into place. The front connector still protrudes from the module in this position.

   Advantage of the wiring position: Comfortable wiring; in the wiring position a wired front connector has no contact with the module.

   The following figure shows you how to get the front connector into wiring position.
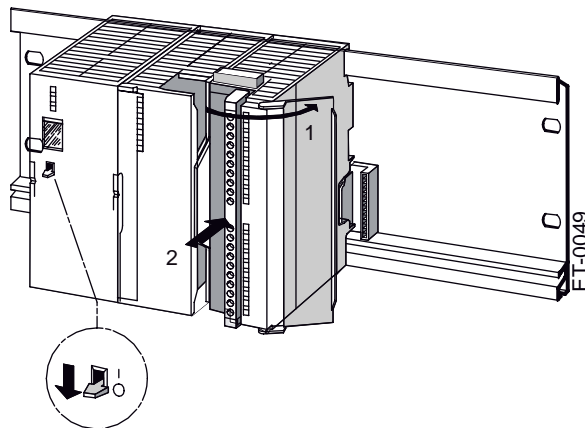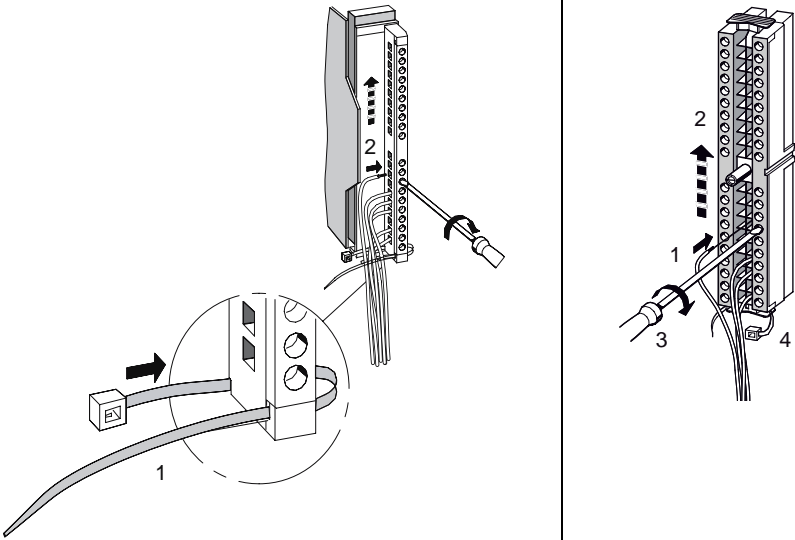
Figure 5-3   Bringing the front connector into the wiring position

3. Strip the insulation from the wires in accordance with the wiring rules.
4. When using wire end ferrules: Press the end ferrules and the cables together.
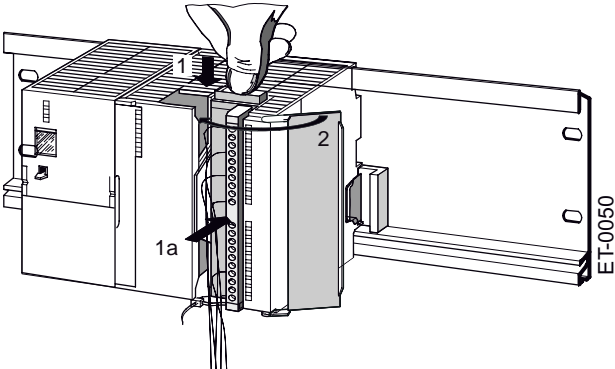
Wiring front connectors

Table 5- 3   Wiring front connectors

Step	20-pin front connector	40-pin front connector
1.	Thread the cable strain relief assembly into the front connector.	–
2.	Do you want to bring the cables out at the bottom of the module?	
	If so:	
	Start with terminal 20 and wire the terminals in the sequence terminal 20, 19, ... until you get to 1.	Start with terminal 40 or 20 and continue to wire the terminals reciprocally, i.e. the terminals 39, 19, 38, 18, etc. until terminals 21 and 1.
	If not:	
	Start with terminal 1 and wire the terminals in the sequence terminal 1, 2, ... until you get to 20.	Start with terminal 1 or 21 and continue to wire the terminals reciprocally, i.e. the terminals 2, 22, 3, 23, etc. until terminals 20 and 40.
3.	Also tighten the screws of any terminals that are not wired.	
4.	–	Thread the cable strain relief assembly into the front connector.
5.	Pull the cable strain relief assembly tight. Push the retainer on the strain relief assembly in to the left; this will improve utilization of the available space.	
—		

Preparing the signal module for operation

Table 5- 4   Preparing the signal module for operation

Step	20-pin front connector	40-pin front connector
1.	Press down the unlocking button on the top of the module and, at the same time, push the front connector into its operating position on the module. When the front connector reaches its operating position, the unlocking button will snap back into the locking position.	Tighten screws to bring front connector to its operating position.
2.	Close the front door.	
3.	Enter the addresses for identifying the individual channels on the labeling strip.	
4.	Slide the labeling strip into the guides on the front door.	
—		

Note

When the front connector is put in its operating position, a front connector encoding device engages. The front connector then only fits this type of module.

5.4.4   Connecting shielded cables via a shield connecting element

Introduction

This section tells you how to connect the shield of shielded signal lines to ground via a shield contact element. The connection to ground is achieved by direct contact between the shield contact element and the rail.

Application

You can do the following easily with the shield contact element:

● connecting all shielded lines from the S7-300 modules to ground

● Connect the interconnecting cable to ground.

Design of the Shield Contact Element

The shield contact element consists of the following parts:

● a clamp with 2 screwed bolts for fixing to the rail
  (order no.: 6ES7390-5AA00-0AA0) as well as

● The shield terminals

Depending on the cable cross-sections used, you must use the following shield terminal:

Table 5- 5   Assignment of cable cross-sections and terminal elements

Cable and shield diameter	Shield connection terminal order no.:
2 lines with in each case 2 to 6 mm shield diameter	6ES7390-5AB00-0AA0
1 line with 3 to 8 mm shield diameter	6ES7390-5BA00-0AA0
1 line with 4 to 13 mm shield diameter Bus cable	6ES7390-5CA00-0AA0

The shield contact element is 80 mm wide with space for two rows each with 4 shield terminals.

Installing the Shield Contact Element

Install the shield contact element as follows:

1. Push the two bolts of the fixing bracket into the guide on the underside of the rail. Position the fixing bracket under the modules to be wired.

2. Bolt the fixing bracket tight to the rail.

3. A slotted web is arranged at the bottom side of the terminal element. Place the shield terminal at this position onto the edge of the fixing bracket (see the figure).
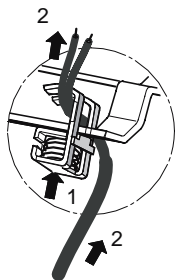
4. Press the shield terminals down and swing them into the desired position.

   You can attach up to four terminal elements on each of the two rows of the shield contact element.
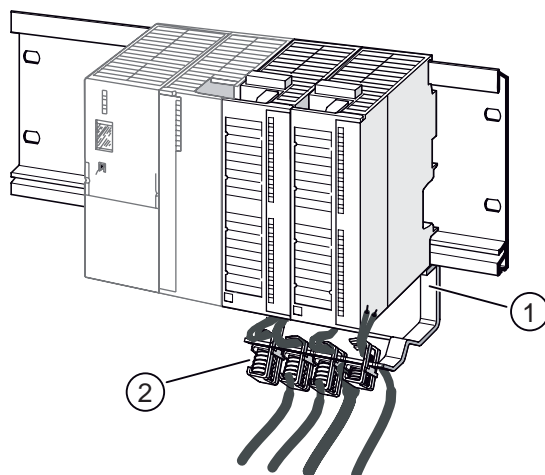
Figure 5-4   Placing shielded 2-wire lines on the shield contact element

①   Fixing bracket

②   Shield terminals

Attaching Cables

You can only attach one or two shielded cables per shield terminal (see figure and table above). The cable is connected by its bare cable shield. There must be at least 20 mm of bare cable shield. If you need more than 4 shield terminals, start wiring at the rear row of the shield contact element.

Note

Use a sufficiently long cable between the shield terminal and the front connector. This enables you to remove the front connector without removing the shield terminal.

Commissioning

6

6.1 PROFIBUS DP

6.1.1 Commissioning the DP slave

Software requirements

Table 6- 1   Software prerequisites for commissioning

Configuration software used	Version	Explanations
STEP 7	–	Configure the IM 153-x from the *STEP 7* hardware catalog, then the unrestricted S7 functionality is available (e.g removal / insertion interrupts to the DP master with "Module change during operation" or forwarding the configuration data to the FM or HART modules) If your IM 153-x version is not in the hardware catalog, then integrate the GSD file in *STEP 7*.
COM PROFIBUS	≥ Version 3.0	You have integrated the IM 153-x with the GSD-file in the *COM PROFIBUS*. *COM PROFIBUS* supports the GSD-file up to revision 2. You can use the GSD-file revision ≥ 3 for the configuration, however then the new functions of the IM 153-2Bx00 and the IM 153-2Bxx1 are not supported. [1]
Configuration software to the used DP master	–	You integrate the GSD file of the DP slave.
[1] Refer to chapter "PROFIBUS DPV1 operation (Page 95)" to find out which functions can be operated with the individual GSD revisions.		

For the current GSD file, go to Internet (http://support.automation.siemens.com/WW/view/en/113498).

Requirements for commissioning

The following conditions must be fulfilled in order to commission the ET 200M:

- DP slave installed
- PROFIBUS address set on the DP slave
- Bus connector or FOC is connected
- Only for DP interface RS 485:

  If the DP slave is located on the end of the segment, then the terminating resistor is switched on the DP slave.

- Only for DP interface FOC:

  If the DP slave is located at the end of an FOC line, then the unused FOC interface must be closed with a dummy plug.

- DP slave configured (refer to the online help / manual on configuration software)

NOTICE
when configuring with GSD file
When using an IM 153-2BA81 (outdoor) you must convert the user parameter "MLFB" to 6ES7153-2BA**8**1-0XB0.
If you configure the ET 200M (IM 153-2BAx2) with a GSD file, the length of the parameter assignment message frame (maximum 244 bytes) can lead to limitations in the number of assignable modules.

- Supply voltage for DP master switched on (refer to the DP master manual)
- Configuration loaded into the DP master (refer to the online help / manual on configuration software)
- DP master switched to RUN (refer to the DP master manual)

Commissioning the DP slave

Commission the DP slave as follows:

1. Switch on the supply voltage for the DP slave.
2. If necessary, switch on the supply voltage for the load.

6.1.2 IM 153-1 start-up

Switch on supply voltage for the DP slave

↓

LEDs "ON" and "BF" light up

↓

DP slave sets outputs to "0" and adopts the set PROFIBUS address

↓

DP slave receives configuration data from the DP master

↓

Does the configuration data tally with the real configuration? — No → "Preset ≠ actual configuration" → Starting behavior with "Change during operation"

↓ Yes

The "BF" LED goes out; inputs and outputs are enabled; data exchange is possible

Figure 6-1   Start-up of the IM 153 1

"Preset ≠ actual configuration"? (Continuation of the start up of the IM 153-1) →

Is the DP slave set up for "Module replacement during operation"? — No → Switch off the power supply → Compare the configuration data with the structure or vice-versa

↓ yes

Data exchange takes place only with the modules that correspond to the configuration (other or missing modules are reported by the IM 153-1 in the identifier-related diagnosis)

Figure 6-2   Startup behavior in the case of module change during operation

6.1.3   IM 153-2 / 153-2 FO start-up

Declaration

>The term IM 153-2 applies in this chapter to: IM 153-2 **and** IM 153-2 FO

Declaration in the case of redundancy:

>In the case of redundancy the 2 plugged IM 153-2 start up independently from each other. The following flow chart takes into consideration the start-up of the IM 153-2 (a). When you consider the IM 153-2 (b), then the following flow chart applies accordingly with the reverse terms.

ET 200M

IM 153-2	IM 153-2	SM	SM	SM	SM	SM
(a)	(b)					
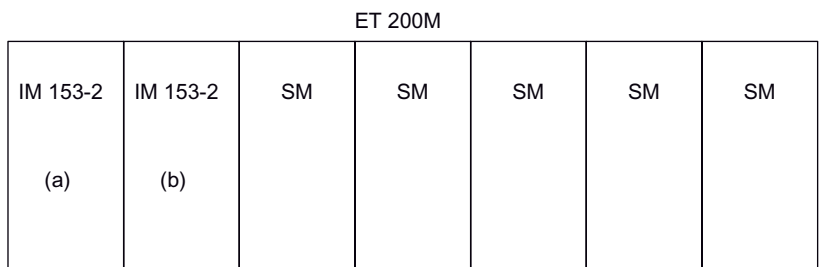
⚠ CAUTION
If, the IM 153-2AA02 / -2AB01 has inadvertently be plugged to the bus module BM IM/IM 6ES7195-7HD10-0XA0 or 6ES7195-7HD80-0XA0, then this IM cannot access the I/O modules. Hence it is not possible to operate the IM in this redundant system (results in station failure).

Start-up of the IM 153-2
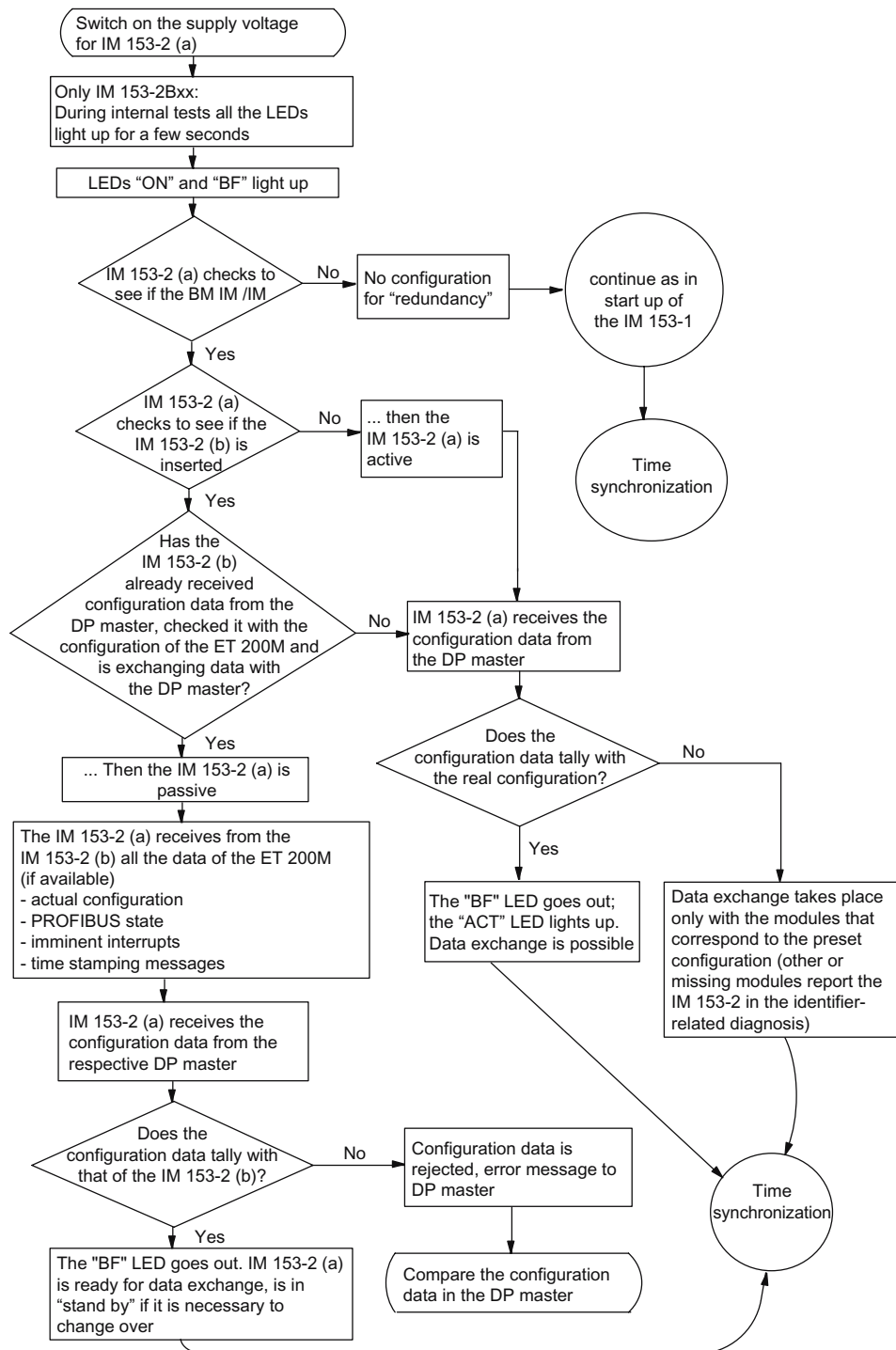
Figure 6-3   Start-up of the IM 153-2

Start-up for time synchronization / time stamp of the signal changes
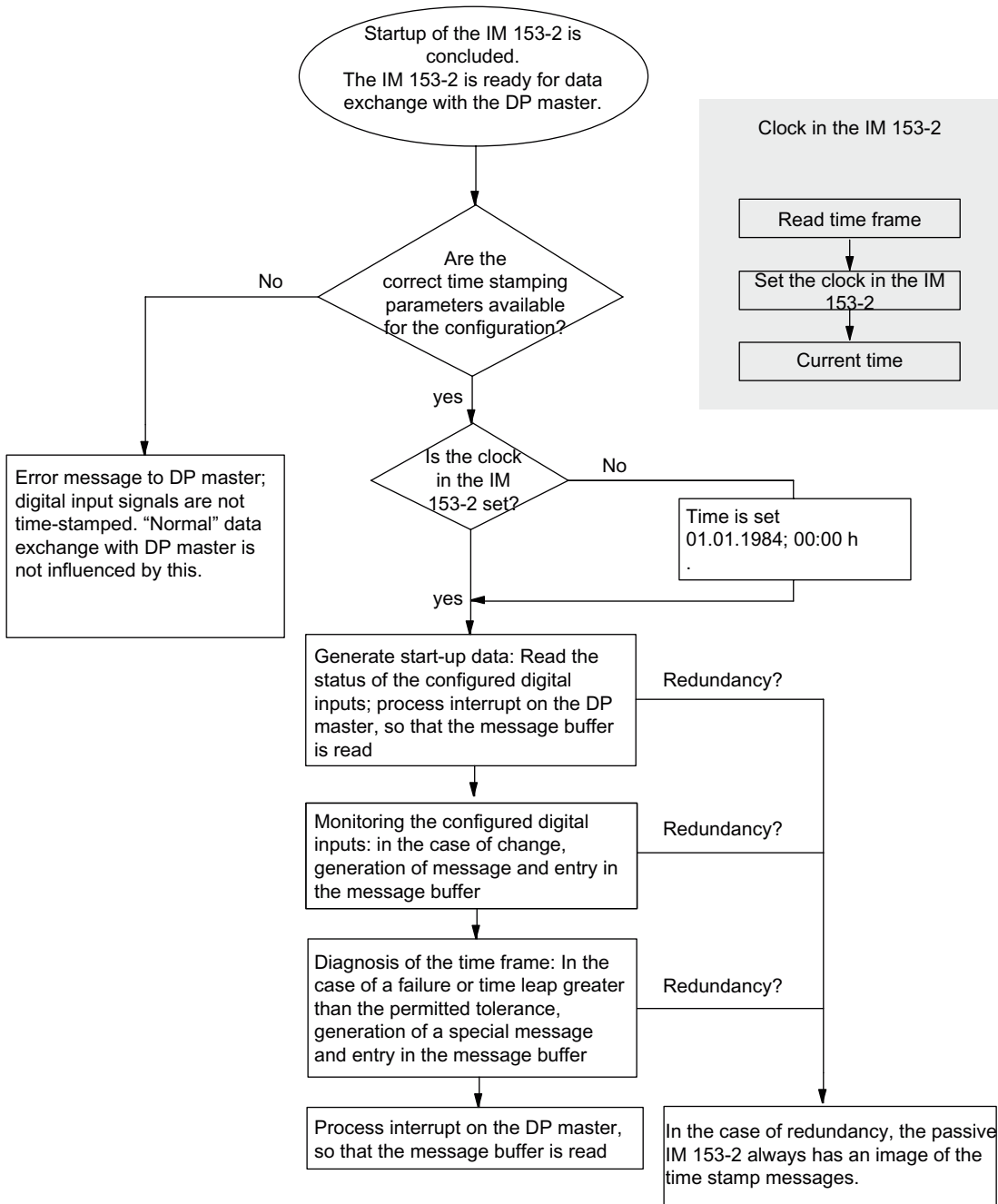
Figure 6-4   Start-up for time synchronization / time stamping

6.1.4 PROFIBUS DPV1 operation

The ET 200M fulfils the requirements in accordance with DPV1. If you wish to use the DPV1 functions, then the DP master must of course fulfill the requirements in accordance with DPV1 (refer to the DP master documentation).

Functions of the PROFIBUS DPV1 slave

The following table shows you the new functions of the PROFIBUS DPV1 slave compared with a PROFIBUS DPV0 slave:

Table 6- 2   Compare the DPV1 and DPV0 slave

Function [1]		DPV0 slave	DPV1 slave
Parameter assignment and configuration with GSD file [2]		x [5]	x [7]
Cyclic data exchange		x	x
Acyclic data traffic (read / write data record): • free access to parameters in the field device • Reparameterization of application process	Class 1 services (parameter assignment master, e.g. PLC)	–	x
	Class 2 services (e.g. PD / OP)	x	x
Diagnosis[3]			
• Identifier-related diagnostics		x	x
• Module status		x [6]	x [8]
• Channel-specific diagnostics		x [6]	x [8]
Interrupts			
• Diagnostic interrupt		-	x [9]
• Process interrupt		–	x [9]
• removing / insertion interrupt		–	x
Other functions			
• Time synchronization		–	x [10]
• Time stamping[4]		–	x [11]
• Isochronous		–	x [10]

[1] The assignment of the functions to the versions of the interface module can be found in the "Compatibilities between the IM 153-x (Page 241)" appendix.

[2] If configuring with HW-Config, with some functions S7-specific features are set.

[3] One interrupt can be used per diagnostic frame. With DPV1 (and S7 DP) there is an interrupt that comprise a slave diagnosis that is accompanied by an acknowledgement mechanism that does not exist with DPV0.

[4] Up to IM 153-2Bx00 the time stamping is available only in the S7 system environment.

[5] without GSD-file or with GSD rev. 2

[6] with GSD rev. 2

[7] as of GSD rev. 3

[8] only if the GSD-file is imported and if, in HW-Config the DPV1-mode is selected

[9] With S7 DP the interrupts are not reported if the CPU is in STOP.

[10] as of GSD rev. 4

[11] as of GSD rev. 5

Actions after the diagnostics message in the S7 or DPV1 mode

Actions initiated by diagnostic messages:

- With S7 or DPV1 operation the diagnoses are reported as diagnostic interrupts.

- In DPV1 mode, diagnoses are also reported when the master CPU is in STOP. In the diagnostic frame in addition the module status and the channel-related diagnoses are available.

- After a diagnostic message is signaled, the message is:

  – entered in the diagnostic frame as a diagnostic interrupt block (only one interrupt at any one time)

  – stored in the diagnostics buffer of the master CPU

- The SF LED lights up on the IM 153-x.

- The OB 82 is called in the master CPU. If the OB 82 is not available, then the master CPU goes to STOP.

- Acknowledging the diagnostic interrupt by the master CPU (a new diagnostic interrupt is possible after this)

Actions after the diagnostics message in DPV0 mode

The error is entered in the channel-specific diagnostics in the diagnostic frame:

- The SF LED lights up on the IM 153-x.

- Several simultaneous diagnostic messages are possible.

Faults and corrective measures

The causes of faults for diagnostics messages and possible troubleshooting are described in chapter "Channel-specific diagnostics (Page 200)".

6.2 PROFINET IO

6.2.1 Configuring in STEP 7

Introduction

The ET 200M is listed in the hardware catalog of HW Config after you start *STEP 7*.

Requirements

- *STEP 7* Version 5.4 Service Pack 2 or higher

- Device name assigned to the I/O device. See chapter "Assigning device names to the I/O device (Page 98)."

Procedure

1. Start SIMATIC Manager.

2. Create a new project.

3. Configure the ET 200M with HW Config.

4. Move the modules from the hardware catalog to the configuration table using a drag-and-drop operation.

5. Double-click the first module of the ET 200M in the configuration table, and set its parameters.

6. Assign parameters for the other modules of the ET 200M.

7. Save the configuration, or download it to the I/O controller.

Reference

For additional information, refer to the *STEP 7 Online Help*.

6.2.2 Configuring by means of GSD file

Introduction

The GSD file allows you to configure the ET 200M using *STEP 7* V5.4, Service Pack 2 or higher. To do so you must install the GSD in the configuration software beforehand.

Requirements

You will need a GSD file, available for download from the Internet (http://support.automation.siemens.com/WW/view/en/25057900).

Interface Module IM 153-4 PN:
GSDML-V1.0-Siemens-ET200M-"date in yyyymmdd format".xml

Configuring the ET 200M on PROFINET IO with *STEP 7*

1. Start *STEP 7* and then select the **Tools > Install New GSD file** menu command in HW Config.

2. Select the GSDML file to install from the next dialog box, then confirm with OK. Result: The ET 200M appears in the PROFINET IO folder of the hardware catalog.

3. For additional information, refer to the *STEP 7 Online Help*.

6.2.3   Assigning device names to the I/O device

Introduction

Each PROFINET IO device is assigned a unique device ID at the factory (MAC address).

For configuration and in the user program, each ET 200M IO device is addressed with its device name.

For detailed information on addressing in PROFINET IO, refer to the "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)" system manual.

Requirements

- Interface Module IM 153-4 PN
- up to IM 153-4AA00-0XB0: SIMATIC Micro Memory Card 64k and higher
- The programming device must be online on PROFINET to the IO device to let you assign a device name to the interface module.
- The IO device is configured in HW Config and assigned an IP address.

Assigning device names

1. For IM 153-4AA00-0XB0:

   Insert an empty SIMATIC Micro Memory Card into the module slot on the front of the IM 153-4 PN interface module.

2. Switch on the voltage supply for the IM 153-4 PN.

3. In HW Config, open the "Properties - IM 153-4 PN" window, enter the device name for the IO device, and then confirm your entry with "OK".

   Do not use the device name "noname".

Transferring the device name to the interface module.

1. In HW Config, select "PLC > Ethernet > Assign Device Name".
2. Click "Assign Name" in the "Assign Device Name" window.

Result

The device name is saved on the SIMATIC Micro Memory Card in the IM 153-4AA00-0XB0 interface module.

As of IM 153-4AA01-0XB0, the device name is saved in the interface module.

Forwarding the device name on replacement of the interface module

The device name of the IO device is saved on the SIMATIC Micro Memory Card for IM 153-4AA00-0XB0.

As of IM153-4AA01-0XB0, you can save the device name as previously on a SIMATIC Micro Memory Card or optionally in the interface module. In the latter case, no SIMATIC Micro Memory Card is required. If you use a SIMATIC Micro Memory Card, the device name is also saved to an IM153-4AA01-0XB0 on the SIMATIC Micro Memory Card.

To pass the device name when an interface module is replaced, move the SIMATIC Micro Memory Card from the "old" interface module to the "new" one.

The IO device takes the device name from the SIMATIC Micro Memory Card after the supply voltage is switched off and on. The station can be addressed again and will operate as before the replacement.

For IM 153-4AA01-0XB0 you can also replace the device without removable media / PD. Instead of being assigned a device name from the removable medium or programming device, the IO device is now assigned a device name by the IO controller. The IO controller uses the configured topology and the correlations derived from the IO devices. The configured target topology must agree with the actual topology.

Node flash test

If you use more than one IO device, the "Assign device name" dialog also displays more than one IO device. In this case, you should compare the MAC address of the device with the indicated MAC address and select the proper IO device.

The identification of IO devices in a system is facilitated by a node flash test. To activate the flash test:

1. Select one of the indicated IO devices from the "Assign device name" dialog box.

2. Select the flash period you want to use.

3. Press the "Flash on" button.

The LINK LED flashes on the selected IO device. If PROFINET IO is looped, both LINK LEDs will flash.

6.2.4   Configuring ports of the IM 153-4 PN

Introduction

The IM 153-4 PN interface module can diagnose both of its ports: X1 P1 and X1 P2.

Requirement

● The ports must be configured in HW Config.

● The port diagnostics must be released.

Configuring ports in HW Config

Configure both ports of the IM 153-4 PN in HW Config in the "Properties of the IM 153-4 PN port..." dialog:

● Addresses tab:
  Specify the diagnostic address of each port.

● Topology tab:

  Specify a "Port interconnection".

● Options tab:

  To enable the port diagnostics, select the following for "Connection" under "Transmission Medium / Duplex": "Automatic Settings (monitor)".

Reference

See *STEP 7* Online Help.

6.2.5 Commissioning ET 200M for PROFINET IO

Introduction

Your automation system is commissioned depending on the current plant configuration. The following procedure describes the commissioning of the ET 200M on an I/O controller.

Requirements for the ET 200M on PROFINET IO

Actions	Reference
ET 200M installed	Chapter "Installation (Page 59)"
ET 200M wired	Chapter "Connecting (Page 71)"
The SIMATIC Micro Memory Card is inserted	Chapter "Service and maintenance (Page 103)"
Device name for I/O device assigned	Chapter "Commissioning (Page 89)"
ET 200M configured	Chapter "Commissioning (Page 89)"
Supply voltage to the I/O controller is switched on	I/O Controller Manual
I/O controller is switched to RUN mode	I/O Controller Manual

Commissioning the ET 200M

1. Switch on the supply voltage for the ET 200 M.

2. If necessary, switch on the supply voltage for the load.

Note

Changes of the backplane bus

If you change the backplane bus (e.g., number of modules), a Power Off/Power On of the supply voltage for the ET 200M is required.

6.2.6 Startup of ET 200M on PROFINET IO

Principle of operation

The diagram below shows the startup sequence of the ET 200M on PROFINET IO:

```
                        ○
                        │
                        ▼
        ┌───────────────────────────────┐
        │ Switch on supply voltage       │
        │ for I/O device                 │
        └───────────────────────────────┘
                        │
                        ▼
        ┌───────────────────────────────┐
        │     I/O device sets outputs to │
        │         "0" and accepts the    │
        │     configured device name of  │
        │     the SIMATIC Micro Memory   │
        │                 Card           │
        └───────────────────────────────┘
                        │
                        ▼
        ┌───────────────────────────────┐
        │ LED "ON" lit                   │
        │ LED "BF" flashing              │
        │                                │
        └───────────────────────────────┘
                        │
                        ▼
        ┌───────────────────────────────┐
        │ I/O device receives            │
        │ connect frame and              │
        │ startup data records           │
        │ from the I/O controller        │
        └───────────────────────────────┘
                        │
                        ▼
        ┌───────────────────────────────┐
        │ LED "BF" goes out;             │
        │ inputs and outputs             │
        │ are enabled;                   │
        │ data exchange is possible      │
        └───────────────────────────────┘
```
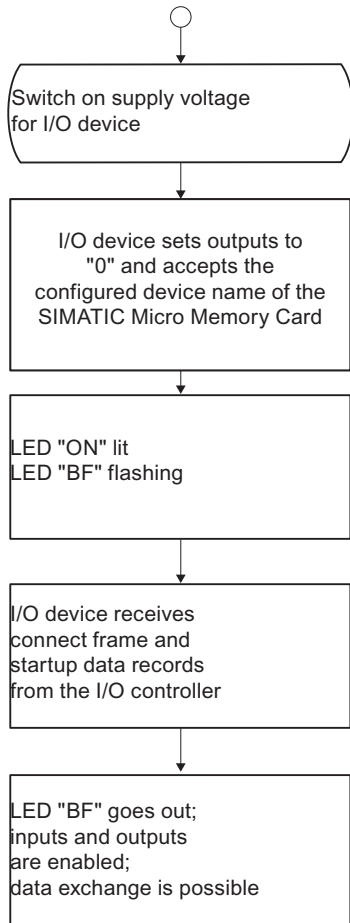
Figure 6-5   Startup of ET 200M on PROFINET IO

Maintenance and service

<div style="text-align: right; font-size: 2em;">7</div>

7.1 Wiring of the ET 200M

Scope of maintenance

The ET 200M is a maintenance-free DP slave.

Maintenance is limited to the replacement or exchanging of modules or components.

7.2 Replacing the Power Supply Module

Initial Situation

The power supply module you want to replace is installed and wired. You want to install a new power supply module of the same type.

Slot numbering

If you have provided the Power Supply Modules in your system with slot numbering, when replacing modules you must remove the numbering from the old Power Supply Modules and then reuse it in the new Power Supply Modules.

Removing the Power Supply Module

To remove the power supply module, proceed as follows:
1. Operate the supply isolating switch in order to de-energize the power supply module.
2. Remove the cover.
3. Disconnect all the wiring.
4. Undo the fixing screws of the power supply module.
5. Swing the power supply module out.

Installing the New Power Supply Module

To install the new power supply module, proceed as follows:
1. Check the setting of the voltage selector switch.
2. Hook the new power supply module of the same type onto the rail and swing it down into place.
3. Screw the power supply module on securely.
4. Wire the power supply module.
5. Connect the power supply module to the line voltage.
6. Close the cover.

Response of the ET 200M After Module Replacement

If there is an error after replacing the module, with *STEP 5* or *STEP 7* you can view the cause of the error in the diagnostics buffer.

7.3   replacing the IM 153-1

Initial Situation

The IM 153-1 is installed. A new IM 153-1 of the same type should be installed.

Slot numbering

If you have provided the modules in your system with slot numbering, when replacing modules you must remove the numbering from the old module and then reuse it in the new module.

Pull out the bus connector

You can remove the bus connector **with worn-through bus cable** from the PROFIBUS DP interface without having to interrupt the data traffic to the bus.

Note

A data communication error may occur on the network.

A bus segment must always be terminated at both ends with the terminating resistor. For example, this is not the case when the last slave with the bus connector is deactivated. As the terminating resistor in the bus connector obtains its voltage from the node, the function of the terminating resistor is affected.

Ensure that the nodes to which the terminating resistor is connected are always supplied with voltage.
Tip: Use the PROFIBUS terminator as an active bus connector.

Removing a Module

To remove the module, proceed as follows:

1. Switch the on / off switch of the power supply module to position 0 (⏻: output voltages 0 V).

2. Tighten the bus connector.

3. Disconnect the wiring.

4. Loosen the fixing screws of the IM 153-1.

5. Swing out the IM 153-1.

Installing a New Module

Install the new module as follows:

1. On the IM 153-1 set the same DP address as you had on the old IM 153-1.

2. Insert the new IM 153-1 and swing it down.

3. Screw the module on securely.

4. Wire the IM 153-1.

5. Screw the bus connector firmly into place.

6. Put the standby switch of the power supply module into the 1 position (output voltages to rated value).

Response of the ET 200M After Module Replacement

If there is a fault after replacing the module, with *STEP 5* or *STEP 7* in the diagnostics buffer you can view the cause of error.

7.4 Replacing the IM 153-2 or IM 153-2 FO

Initial Situation

The IM 153-2 / -2 FO is installed. A new IM 153 -2 / -2 FO of the same type should be installed.

Slot numbering

If you have provided the modules in your system with slot numbering, when replacing modules you must remove the numbering from the old module and then reuse it in the new module.

IM 153-2: Pull out the bus connector

You can remove the bus connector **with worn-through bus cable** from the PROFIBUS DP interface without having to interrupt the data traffic to the bus.

Note

A data communication error may occur on the network.

On both ends, the bus segment must always be connected to the terminating resistor. For example, this is not the case when the last slave with the bus connector is deactivated. As the terminating resistor in the bus connector obtains its voltage from the node, the function of the terminating resistor is affected.

Ensure that the nodes to which the terminating resistor is connected are always supplied with voltage.
Tip: Use the PROFIBUS terminator as an active bus connector.

IM 153-2 FO: Removing the fiber-optic cable

When you remove the FOC from the IM 153-2 FO, then **all following DP slaves are also no longer available for the DP master!**

⚠ CAUTION
Do not look directly into the opening of the optical transmit diodes. The emitted light beam could damage your eyes.

Replacing In the redundant system

Note

Always switch off the power before you replace the IM 153 -2 / -2 FO!

If you carry out a replacement in an energized state, the specified switchover times cannot be guaranteed and the I/O modules could fail for a certain time and output "0".

If you replace the IM 153 -2 / -2 FO in a redundant configuration, the following applies:

"ACT" LED is on:	"ACT" LED is off:
The IM 153 -2 / -2 FO is the active one of the two IM 153 -2 / -2 FO.	The IM 153 -2 / -2 FO is the passive one of the two IM 153 -2 / -2 FO.
	This IM 153 -2 / -2 FO can be replaced without performing a switchover in the ET 200M.

Removing a Module

To remove the module, proceed as follows:

1. **In the Case of Redundancy:** The IM 153 -2 / -2 FO that is to be replaced must always be deactivated!
   Switch off the assigned power supply module or disconnect it on the IM 153 -2 / -2 FO.

   > ⚠ **WARNING**
   >
   > If in redundant mode, the two IM 153-2 are connected to a power supply module, then when disconnecting the 24 V supply of an IM 153-2, this could bring about a short circuit of the non-insulated (loose) cable ends.
   > In the event of a short circuit of the power supply, the second IM 153-2 and with that its ET 200M always fails completely.
   >
   > Therefore, when disconnecting the supply voltage, always work extremely carefully and insulate the two cable ends until you connect to the new IM 153-2.

   No redundancy: Switch the on / off switch of the power supply module to position 0 (⏻: output voltages 0 V).

2. Remove the bus connector or the FOC.

   In the case of fiber-optic cables: Fold out the handle for the plug adapter and with that remove the plug adapter from the IM 153-2 FO.

3. Disconnect the wiring.

4. Loosen the fixing screws of the IM 153 -2 / -2 FO.

5. Swing out the IM 153 -2 / -2 FO.

Installing a New Module

Install the new module as follows:

1. On the IM 153 -2 / -2 FO, set the same DP address as you had on the old IM 153 -2 / -2 FO.

2. Insert the new IM 153 -2 / -2 FO and swing it down.

3. Screw the module on securely.

4. Wire the IM 153 -2 / -2 FO.

5. Screw the bus connector firmly into place.

6. Put the standby switch of the power supply module into the 1 position (output voltages to rated value).

Response of the ET 200M After Module Replacement

If there is a fault after replacing the module, with *STEP 5* or *STEP 7* in the diagnostics buffer you can view the cause of error.

In the case of redundancy

Note

If the active IM 153 -2 / -2 FO ("ACT"-LED on) is to be replaced, the I/O modules then continue to run uninterrupted if

- on the passive IM 153 -2 / -2 FO neither the BF LED is lit or is flashing nor the SF LED flashes at 0.5 Hz.
- with a flying redundancy system, from which it is evident from the master diagnosis that both IM are available (in this case the BF LED can flash).

Have you replaced an active IM 153 -2 / -2 FO ("ACT"-LED on)?	Have you replaced a passive IM 153 -2 / -2 FO ("ACT"-LED off)?
The in the ET 200M the other IM 153-2 / -2 FO is switched to and this also maintains the data traffic to its DP master.	No change in data traffic: the active IM 153 -2 / -2 FO maintains the data traffic to its DP master.
Does the new IM 153 -2 / -2 FO have a different version to that of the one that has not been replaced?	
If, after replacement, the IM 153 -2 / -2 FO that has just been replaced goes to "STOP" (all LEDs flashing), then the versions are not compatible. In this case, you must switch off the ET 200M and update both IM 153-2 / -2 FO or use a compatible version. Contact your Siemens representative.	

See also

Diagnostics with LED display (Page 185)

7.5 Replacing IM 153-4 PN

Initial situation

The IM 153-4 PN is installed. A new IM 153-4 PN of the same type should be installed.

Slot numbering

If you have provided the modules in your system with slot numbering, when replacing modules you must remove the numbering from the old module and then reuse it in the new module.

Requirement

When replacing the interface module, you must switch off the supply voltage on the defective module.

CAUTION
Removing the IM 153-4 PN interface module
When you switch off the supply voltage to an ET 200M on PROFINET IO, the integrated switch will also cause a failure of all downstream IO devices.

Removing a module

To remove the module, proceed as follows:
1. With the on / off switch of the power supply module to 0 (⏻: output voltages 0 V).
2. Remove the PROFINET cable connector.
3. Remove the cable connector for the supply voltage.
4. Remove the SIMATIC Micro Memory Card from the module slot.
5. Loosen the fixing screws of the IM 153-4 PN.
6. Swivel out the IM 153-4 PN.

Installing a new module

Install the new module as follows:
1. Hang up the new IM 153-4 PN and swivel it downward.
2. Screw the module on securely.
3. Insert the PROFINET cable connector.
4. Take the SIMATIC Micro Memory Card containing the device name from the "old" interface module and insert it in the module slot of the "new" interface module.
5. Insert the cable connector for the supply voltage.
6. Put the standby switch of the power supply module into the 1 position (output voltages to rated value).

Replacement for IM 153-4 PN (order number 6ES7153-4AA01-0XB0)

The IM153-4AA01 interface module is compatible with the IM153-4AA00 interface module and can replace this.

If a replacement is necessary, an IO device already in operation in has to be reset to the factory settings by using "Reset to factory settings" in *STEP 7* via Target system / Edit Ethernet nodes.

Response of the ET 200M after module replacement

If a fault is present after module replacement, you can use *STEP 7* to evaluate the cause of the fault in the corresponding diagnostic data record.

7.6 Replace modules without the function "Change During Operation"

Removing a Module

Proceed as follows when removing modules without "Module change during operation":

1. Switch off the load voltage to the module.

2. Switch off power supply for the IM 153-x.

3. Remove the labeling strip from the module.

4. Open the front door.

5. Unlock the front connector and pull it off the module:

   – With 20-pin front connector: To do this, use one hand to press the unlocking button down (5) and use your other hand to remove the front connector via the gripping surface (5a).

   – With 40-pin front connector: Remove the fixing screw from the middle of the front connector. Pull the front connector out while holding the grips.

6. Undo the module fixing screw(s).

7. Swing the module up and off the rail.
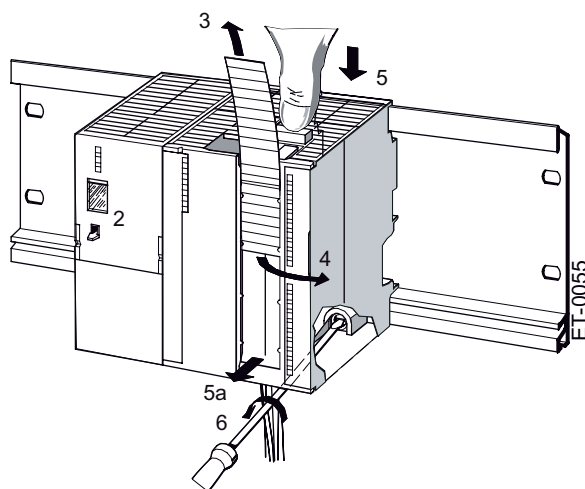
Removing the Front Connector Coding Key

Prior to installing the new module, you must remove the front connector coding key from the new module. Reason: This part is already available in the wired front connector (refer to the following figure).

Figure 7-1   Removing the Front Connector Coding Key

Installing a New Module

Proceed as follows when installing a new module:

1. Hook the new module of the same type onto the rail and swing it down into place.

2. Screw the module on securely.

3. Push the labeling strip of the old module into place on the new module.
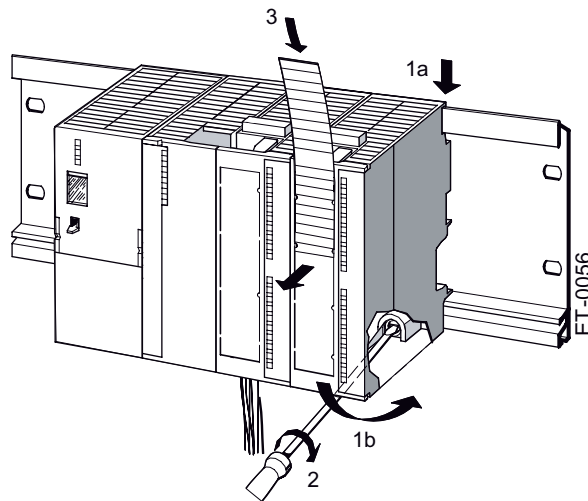
Putting a New Module into Service

Put the new modules into service as follows:

1. Open the front door.

2. Bring the front connector back into its operating position.
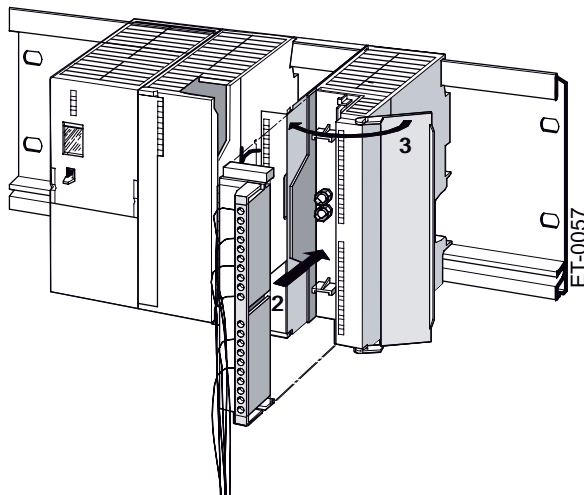
3. Close the front door.

4. Switch on the power supply for the IM 153-x.

5. Switch the load voltage back on.

Response of the ET 200M After Module Replacement

After replacing modules the IM 153-x, and if there are no faults, the IM 153-x starts data transfer. If the IM 153-x remains in STOP-, you can view the error cause with *STEP 5* or with *STEP 7*.

7.7 Replace modules with the function "Change During Operation"

Requirements

You can replace the modules while operating the ET 200M if the ET 200M
- on the rail with active bus modules for the function "Module Change During Operation"
- and the ET 200M is configured for "Module Change During Operation".

> ⚠ **WARNING**
>
> Inserting output modules can lead to uncontrolled system states!
>
> This also applies if you insert input / output modules tilted on the bus module.
>
> When inserting an output module, the outputs set by the user program become active immediately!
>
> We therefore advise you to set the outputs to "0" in the user program when removing the output module.
>
> If modules are not removed and inserted properly, neighboring modules via the backplane bus can fail.

Removing a Module

When removing modules with "Module Change During Operation" proceed as follows:
1. Release the fixing screw(s) on the module.
2. Swing the module out.
3. Open the front door.
4. Unlock the front connector and remove it.
   - With 20-pin front connector: To do this, use one hand to press the unlocking button down (4) and use your other hand to remove the front connector via the gripping surface (4a).
   - With 40-pin front connector: Release the fixing screw in the centre of the front connector. Use the gripping surface to pull out the front connector.
5. Pull the labeling strips out of the module.
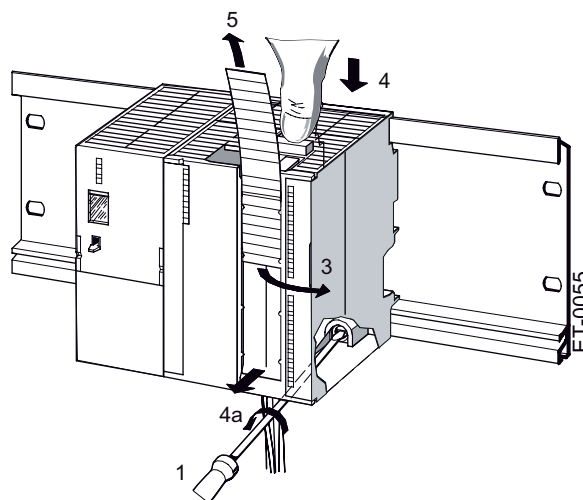
Remove the front connector encoding device

Prior to installing the new module you must remove the top part of the front connector encoding on the module. Reason: This part is already available in the wired front connector (refer to the following figure).

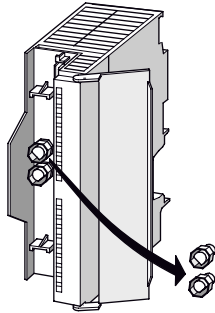Figure 7-2   Remove the front connector encoding device

Installing a New Module

Proceed as follows to install a new module:

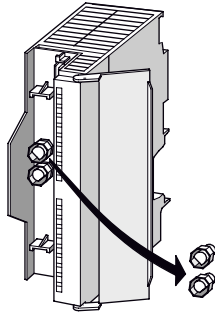1. Insert the front connector in the module and put it in the operating position.

2. Suspend the new module and push it downwards.

3. Screw the module on securely.

4. Slide the labeling strips of the removed module into the newly installed module.

Response of the ET 200M after module replacement

Table 7- 1   Response of the ET 200M when removing or inserting modules

Removing/ inserting	Actual = set configuration?	Response of the ET 200M
Removing a module	–	The IM 153-x reports via diagnostics the removal of a module. The diagnostic event corresponds to the removal interrupt. The IM 153-x also enters the removal of a module in the module diagnosis.
Inserting a module	Yes	When inserting a configured module, the IM 153-x deletes the entry in the module diagnosis, so that the module is not addressed by the IM 153-x. If the ET 200M is in user data mode, then the IM 153-x reports a diagnostic event in accordance with the insertion interrupt. The inserted module is configured accordingly and assumed in the ET 200M. Any parameters for the module transferred from the user must then be transferred again from the user to the ET 200M.
	No	The IM 153-x ignores the inserted module. The IM 153-x reports a diagnostic event in accordance with the insertion interrupt. In the diagnosis the entry remains after the module has been removed.

See also

Identifier-related diagnosis (Page 198)

Interrupts (Page 206)

7.8 Replacing the bus module

Removing the bus module

Only remove bus modules if they are de-energized!

Proceed as follows when removing the bus module:

1. With the on / off switch of the power supply module to 0
   (⏻: output voltages 0 V).

2. Remove the modules on the bus module that is to be replaced, on all the bus modules on the right, as well as the module directly to the left.

3. The bus modules are locked together. On the bus module that is to be replaced, press down the lock of the bus module on the right, and push the bus module(s) on the right to the right.

4. On the bus module on the left, press down the lock of the bus module that is to be replaced and push this one to the right.

5. Using a screwdriver push the lock down towards the rail.

6. Lift the bus module off the rail. You can also pull the bus module out from the right side of the rail.

| BM IM/PS | BM 2 x 40 | BM 1 x 80 |
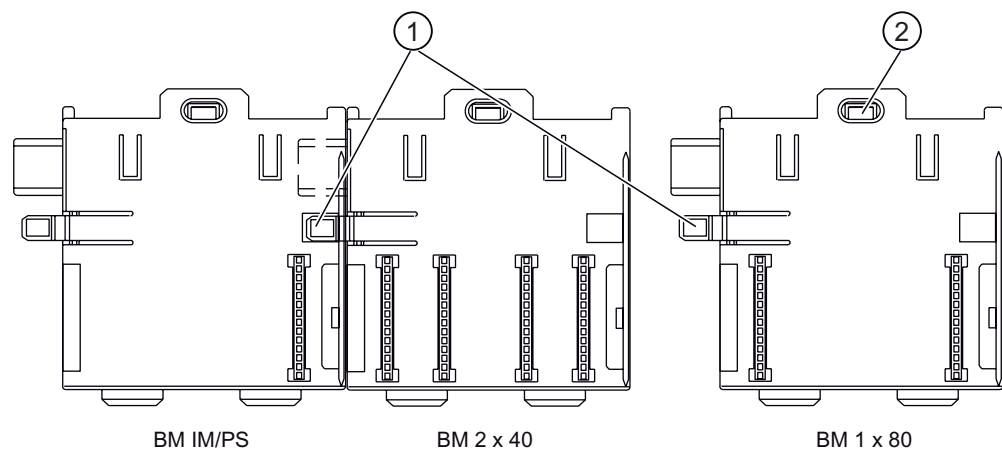
① Lock holding the bus modules together
② Lock holding the module to the rail

Installing a New Bus Module

You fit the new bus module as described in chapter "Installing Active Bus Modules and Modules (Configuration with Active Bus Modules) (Page 66)".

7.9 Exchanging fuses in digital output modules

Fuses for Digital Outputs

The digital outputs of the following digital output modules are safeguarded (in channel groups) against a short circuit by means of uses:

- Digital output SM 322; DO 16 x AC120/230V
- Digital output SM 322; DO 8 x AC120/230V

Replacement fuses

If you must change the fuses, then, for example, you can use the following fuses:

- Fuse 8 A, 250 V
  (e.g. Wickmann 19 194-8 A; Schurter SP001.013; Littlefuse 217.008)
- Fuse holder (e.g. Wickmann 19 653)

Position of the Fuses

The digital output modules have one fuse per channel group. The fuses are located at the left side of the digital output module. The figure shows you where to find the fuses on the digital output modules.
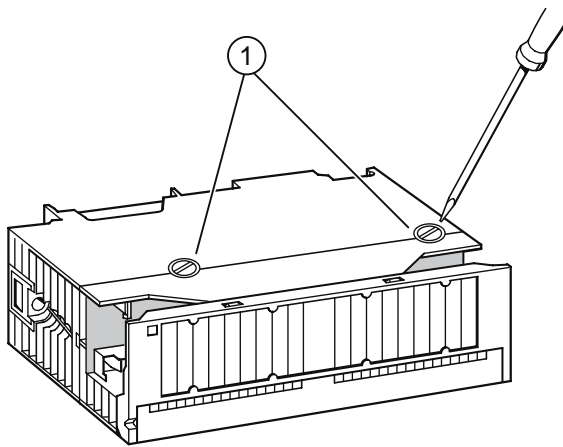
① Fuses

Figure 7-3   Location of the fuses on digital output modules

Replacing Fuses

The fuses are located at the left side of the module.

1. You uninstall the digital output modules as described in chapter "Replace modules without the function "Change During Operation" (Page 110)".

2. Remove the fuse holder from the digital output module.

3. Replace the fuse.

4. Screw the fuse holder back into the digital output module.

5. You fit the digital output modules as described in chapter "Replace modules without the function "Change During Operation" (Page 110)".

7.10 Updating the IM 153-x

7.10.1 When should you update the IM 153-x?

After performance or (compatible) function enhancements you should update the interface module IM 153-x to the latest firmware version.

7.10.2 Update of the IM 153-1 / -2Ax0x

Please contact your Siemens representative if you wish to update the IM 153-1 and the IM 153-2Ax0x.

7.10.3   Update of the IM 153-2Bx00

Where can I obtain the latest firmware version?

You can order the latest firmware from your Siemens partner, or download it from the Internet (http://support.automation.siemens.com/WW/view/en/15350678).

Tip:

- Prior to the update note down the current version of your firmware.

- If you encounter problems with the new firmware, you can also download the previous (current) firmware from the Internet and transfer it to the interface module again.

Principle

An update is possible with IM 153-2 as of order number 6ES7153-2Bx00-0XB0. You will require *STEP 7* (V5.2 or higher) for this purpose.

There are 3 ways in which you can perform an update:

- from PD / PC via PROFIBUS DP (direct)

- from PD / PC via PROFIBUS DP and CPU

- via SIMATIC Micro Memory Card

After a successful update the former firmware version of the IM 153-2 must be covered over with a sticker showing the updated version of the firmware.

Requirements

For update via PROFIBUS-DP

- The IM 153-2 in the station that is to be updated must be available online.

- The files with the current (new) version of the firmware must be available in the file system of your PD / PC.

for update via SIMATIC Micro Memory Card

- The update files must be available on the SIMATIC Micro Memory Card.

Example configuration

Update from PD / PC via PROFIBUS DP (direct)

The PG / PC with the update files is directly connected to the PROFIBUS interface of the IM 153-2 (refer to the following figure).

Note

If no STEP 7 project containing the respective IM 153-2 is available, then the update can also take place via the online view (available nodes) in *STEP 7*.

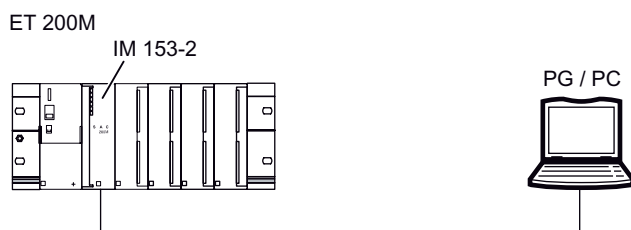---

ET 200M

IM 153-2

PG / PC

Figure 7-4   Update via PROFIBUS DP (PD / PC direct on the IM 153-2)

Update from PD / PC via PROFIBUS DP and CPU

The PD / PC with the update files is connected to the MPI interface of the CPU. The IM 153-2 is connected to the 2nd interface of the CPU via the PROFIBUS DP (see the following figure). In the STEP 7 project, the IM 153-2 must be linked to the CPU (e.g. CPU 315-2 DP).

CPU 315-2 DP

PG / PC

ET 200M
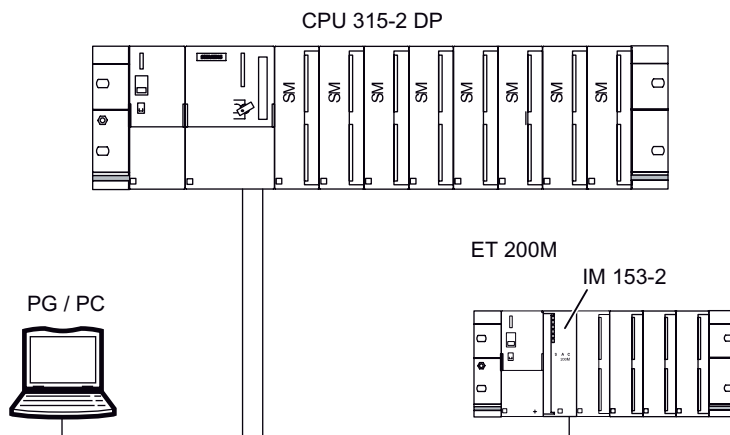
IM 153-2

Figure 7-5   Update via PROFIBUS DP (PD / PC via CPU to the IM 153-2)
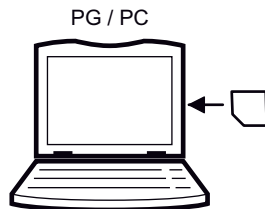
Update via SIMATIC Micro Memory Card

The following SIMATIC Micro Memory Cards are available for the update:

Table 7- 2   Available SIMATIC Micro Memory Cards for an update of the IM 153-2

Type	Order numbers
SIMATIC Micro Memory Card 2M	6ES7953-8LL20-0AA0
SIMATIC Micro Memory Card 4M	6ES7953-8LM20-0AA0
SIMATIC Micro Memory Card 8M	6ES7953-8LP20-0AA0

Carry out an update via SIMATIC Micro Memory Card as follows:

1. Use *STEP 7* and your programming device to transfer the update files to a SIMATIC Micro Memory Card. The data saved on the SIMATIC Micro Memory Card is then overwritten by the update files.

PG / PC

2. Switch off the IM 153-2 and insert the SIMATIC Micro Memory Card with update.

ET 200M   IM 153-2
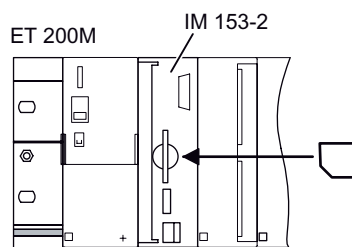
3. Switch on the power.

   – The IM 153-2 automatically detects the SIMATIC Micro Memory card with the update files and starts the update.

   – During the update the SF and the BF LEDs light up.

   – After the update is concluded the BF LED flashes at 0.5 Hz.

4. Switch off the IM 153-2 and insert the SIMATIC Micro Memory card with update.

   To eject the SIMATIC Micro Memory card, push in the ejector with a small screwdriver or ball-point pen.

Update in the Redundant System

When the update of the active IM 153-2 takes place via PROFIBUS DP, the concluding reset automatically triggers the changeover procedure between the two IM 153-2s. We recommend that you then carry out an update of the second IM 153-2 in the redundant system. The update must be conducted separately for each IM 153-2.

Restart After Update

Update via PROFIBUS DP

In the *STEP 7* user interface, it is possible to set whether

- the IM 153-2 should automatically perform a reset after a successful update, in order to start off using the new firmware.

> ⚠ **CAUTION**
>
> If the "activate firmware after download" field is checked there is a brief station failure of the ET 200M. If no provisions have been made for this case, then the update causes the CPU to STOP on account of rack failure.

- the IM 153-2 must be reset by switching off the supply voltage. Then, when the supply voltage is switched on again the IM 153-2 will start up using the new firmware.

Update via SIMATIC Micro Memory Card

After the update the IM 153-2 remains in a state that can only be reset by switching off the supply voltage. After a successful update, the next time the supply voltage is switched on the IM 153-2 starts up with the new firmware.

Update unsuccessful

If the update fails, the next time the supply voltage is switched off / on the IM 153-2 starts up with the former (old) firmware.

7.10.4   How to update the IM 153-2Bxx1

Where can I obtain the latest firmware version?

You can order the latest firmware from your Siemens partner, or download it from the Internet (https://portal.automation.siemens.com/apps/meta-search_p/index.ad.nwa.EN.html?q=15350678).

Tip:

- Prior to the update note down the current version of your firmware.

- If you encounter problems with the new firmware, you can also download the previous (current) firmware from the Internet and transfer it to the interface module again.

Principle

Updating an IM 153-2 as of order number 6ES7153-2Bxx1-0XB0 depends on the configuration of the IM 153-2:

Configuration as IM 153-2Ax0x

The update is carried out from the PD / PC via the PROFIBUS DP (direct) and is conducted via the online view (available nodes) in *STEP 7*. To do this, the PG / PC with the update files is directly connected to the PROFIBUS interface of the IM 153-2.

Configuration as IM 153-2Bx00

There are two ways in which you can perform an update:

- from PD / PC via PROFIBUS DP (direct)

- from PD / PC via PROFIBUS DP and CPU

You will require *STEP 7* (V5.2 or higher) for this purpose.

Configuration as IM 153-2Bxx1

There are two ways of updating:

- from PD / PC via PROFIBUS DP (direct)

- from PD / PC via PROFIBUS DP and CPU

You will require *STEP 7* (V5.4 or higher)

After a successful update the former firmware version of the IM 153-2 must be covered over with a sticker showing the updated version of the firmware.

With the interface modules IM 153-2Bxx1-0XB0 it is possible to update the firmware of both interface modules while the redundant mode is running. The update takes place with support from *STEP 7* and has no interaction on the running application. The firmware in a redundant system is updated from the PD / PC via PROFIBUS DP (direct).

Conditions for an update via PROFIBUS DP

- The IM 153-2 in the station that is to be updated must be available online.
- The files with the current (new) version of the firmware must be available in the file system of your PD / PC.

You must also comply with the following conditions in order to **update a redundant system**:

- Both interface modules are IM 153-2Bxx1-0XB0 and are configured as such.
- The station with redundant IM 153-2 is run
  - at S7-400H
  - with software redundancy with DPV1 mode
  - on any redundant DP masters with GSD as of rev. 5

An update, supported by *STEP 7*, of both interface modules in a redundant system is **not** possible if

- an IM 153-2 in the station is using an older version
- the interface module IM 153-2Bxx1-0XB0 is being used as a spare part for older versions (e.g. -2AA02-)

Example configuration

See chapter "Update of the IM 153-2Bx00 (Page 118)."

Restarting after update

In the *STEP 7* user interface, it is possible to set whether

- the IM 153-2 should automatically perform a reset after a successful update, in order to start off using the new firmware.

> ⚠ **CAUTION**
>
> If the "activate firmware after download" field is checked there is a brief station failure of the ET 200M. If no provisions have been made for this case, then the update causes the CPU to go to STOP on account of rack failure.

- the IM 153-2 must be reset by switching off the supply voltage. Then, when the supply voltage is switched on again the IM 153-2 will start up using the new firmware.

If the update concludes successfully, with the first reset or switch off / on of the supply voltage, the start up of the interface module IM 153-2Bxx1 takes **around 60 seconds longer** than it would with a normal start up.
All further start ups will take the usual time.

Update unsuccessful

If the update fails, the next time the supply voltage is switched off / on the IM 153-2 starts up with the former (old) firmware.

7.11   Saving data and updating the IM 153-4 PN

Storage medium

A SIMATIC Micro Memory Card is used as the storage medium for the IM 153-4 PN. The MMC can be used as a portable data medium.

On a SIMATIC Micro Memory Card you can save **either** technology data (device name) **or** data for a firmware update.

Service life of a SIMATIC Micro Memory Card

The service life of a SIMATIC Micro Memory Card depends essentially on the following factors:

● Number of deletion or programming operations

● external influences, such as ambient temperature

At an ambient temperature up to 60 °C, the useful life of a SIMATIC Micro Memory Card is 10 years at a maximum of 100,000 delete/write operations.

Plug-in SIMATIC Micro Memory Cards

The following memory modules are available:

Table 7- 3   Available SIMATIC Micro Memory Cards

Type	Order number
SIMATIC Micro Memory Card 64k	6ES7953-8LF20-0AA0
SIMATIC Micro Memory Card 128k	6ES7953-8LG11-0AA0
SIMATIC Micro Memory Card 512k	6ES7953-8LJ20-0AA0
SIMATIC Micro Memory Card 2M	6ES7953-8LL20-0AA0
SIMATIC Micro Memory Card 4M	6ES7953-8LM20-0AA0
SIMATIC Micro Memory Card 8M	6ES7953-8LP20-0AA0

A SIMATIC Micro Memory Card 64k is sufficient for saving the device name. The SIMATIC Micro Memory Cards with at least 2 MB of storage capacity are required when conducting a firmware update.

Inserting/replacing the card

The SIMATIC Micro Memory Card supports hot-swapping. The chamfered corner of the SIMATIC Micro Memory Card prevents it from being inserted the wrong way round (polarity reversal protection).

The module slot is located on the front of the IM 153-4 PN.

1. Is a SIMATIC Micro Memory Card already inserted in the module slot?

   If so, press the ejector (using a ballpoint pen or small screwdriver, if necessary) and remove the card from the module slot.

2. Insert the desired SIMATIC Micro Memory Card in the module slot.

Position of the module slot for the SIMATIC Micro Memory Card on the IM 153-4 PN:
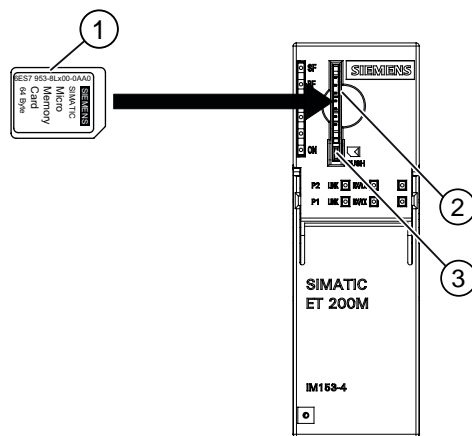
①   SIMATIC Micro Memory Card

②   Module slot

③   Ejector

Figure 7-6   Position of the module slot for the SIMATIC Micro Memory Card on the IM 153-4 PN

Where can I obtain the latest firmware version?

You can order the latest firmware from your Siemens partner, or download it from the Internet (http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo2&aktprim=99&lang=en).

Tip:

- Prior to the update note down the current version of your firmware.

- If you encounter problems with the new firmware, you can also download the previous (current) firmware from the Internet and transfer it to the interface module again.

Principle

An update is possible with IM 153-4 PN as of order number 6ES7153-4AA00-0XB0. For this you require *STEP 7* V5.4 SP 2 or higher.

There are two ways of updating:

● from PG/PC via PROFINET IO (direct)

● viaSIMATIC Micro Memory Card

After a successful update, the former version of the IM 153-4 PN firmware must be covered over with a sticker showing the updated version of the firmware.

Requirements

Update via PROFINET IO

● The IM 153-4 PN in the station that is to be updated must be available online.

● The files with the current (new) version of the firmware must be available in the file system of your PD / PC.

for update via SIMATIC Micro Memory Card

● The update files must be available on the SIMATIC Micro Memory Card.

NOTICE
When the firmware is updated, the stations in a line can fail.

Note

A firmware update with SIMATIC Micro Memory Card is not possible for interface modules that were started with the "Prioritized startup" parameter.

Example configuration

Update from PD / PC via PROFINET IO (direct)

The PG / PC with the update files is directly connected to the PROFINET interface of the IM 153-4 PN (refer to the following figure).

Note

If no *STEP 7* project containing the respective IM 153-4 PN is available, the update can also take place via the online view (available nodes) in *STEP 7*.
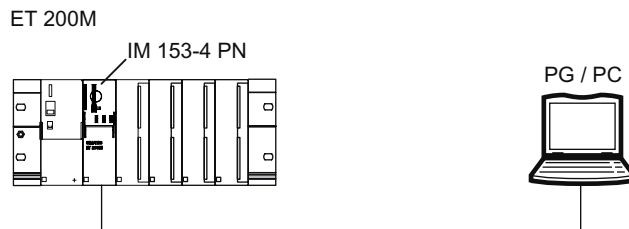

Figure 7-7   Update via PROFINET IO (PG / PC directly on IM 153-4 PN)

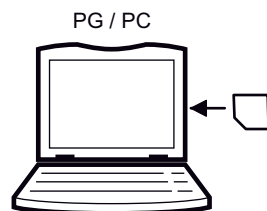### Update via SIMATIC Micro Memory Card

The following SIMATIC Micro Memory Cards are available for the update:

Table 7- 4   Available SIMATIC Micro Memory Cards for an update of the IM 153-4 PN

Type	Order numbers
SIMATIC Micro Memory Card 2M	6ES7953-8LL20-0AA0
SIMATIC Micro Memory Card 4M	6ES7953-8LM20-0AA0
SIMATIC Micro Memory Card 8M	6ES7953-8LP20-0AA0

To perform an update via SIMATIC Micro Memory Card, proceed as follows:

1. Use *STEP 7* and your programming device to transfer the update files to a SIMATIC Micro Memory Card. The data saved on the SIMATIC Micro Memory Card is then overwritten by the update files.

2. Switch off the voltage to the IM 153-4 PN.

3. Remove the existing SIMATIC Micro Memory Card containing the device name from the module slot.

   To eject the SIMATIC Micro Memory Card, push in the ejector in the lower section of the module slot with a small screwdriver or ball-point pen.

4. Insert the SIMATIC Micro Memory Card containing the update in the module slot.
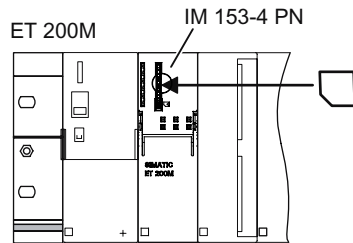
5. Switch on the power.

   – The IM 153-4 PN automatically detects the SIMATIC Micro Memory Card with the update files and starts the update.

   – During the update the SF and the BF LEDs light up.

   – After the update is concluded the BF LED flashes at 0.5 Hz.

6. Switch off the voltage to the IM 153-4 PN and remove the SIMATIC Micro Memory Card with update.

7. Re-insert the SIMATIC Micro Memory Card containing the device name into the module slot and then switch on the supply voltage.

Restart after update

Update via PROFINET IO

In the *STEP 7* user interface, it is possible to set whether

● the IM 153-4 PN should automatically perform a reset after a successful update in order to start up using the new firmware.

> ⚠ **CAUTION**
>
> If the "activate firmware after download" field is checked there is a brief station failure of the ET 200M. If no precautions have been taken for this case, then the update causes the CPU (of the IO controller) to go to STOP mode due to a rack failure.

● The IM 153-4 PN must be reset by switching off the supply voltage. Then, when the supply voltage is switched on again, the IM 153-4 PN will start up using the new firmware.

Update via SIMATIC Micro Memory Card

If the update was successful, the IM 153-4 PN starts up with the new firmware and is then ready for operation.

Update unsuccessful

If the update fails, the next time the supply voltage is switched off and on the IM 153-4 PN starts up with the current ("old") firmware.

Functions   8

8.1   Support for I/O modules with expanded input data

The IM 153-2BAx2 interface module supports I/O modules with expanded input data
(> 16 bytes). For more detailed information, refer to the documentation on the respective
modules.
Expanded output data are not supported.

For the ET 200M, this means that:

● The I/O module in use must support provision of expanded input data.

● The IM 153-2BAx2 supplies the substitute value "0" in the expanded input data of an I/O
  module that is starting up or that has been removed.

● The total amount of input data must not exceed the following values:

  – 128 bytes per slot

  – 244 bytes per IM 153-2BAx2. i.e., per ET 200M

  These limits are checked during configuration.

● "Standard" and expanded input data are internally consistent but not consistent relative to
  each other.
  The following figure illustrates this point.
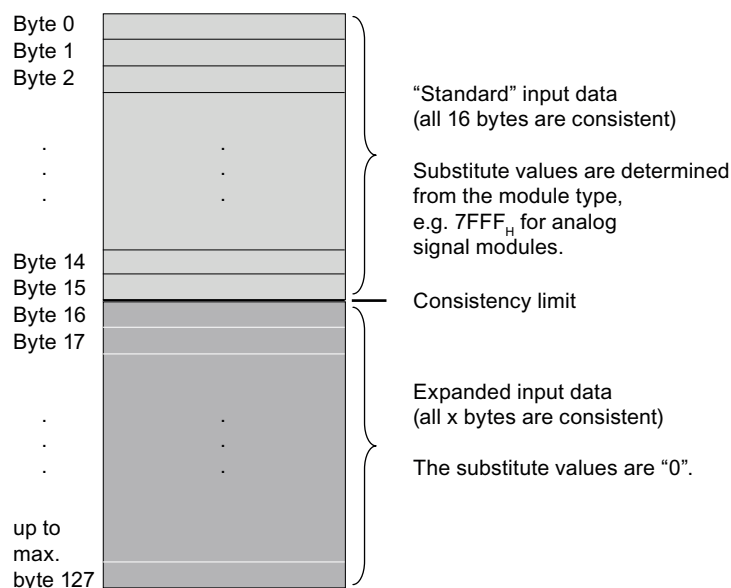
The expanded input data are updated in longer time intervals than the "standard" input
data.

8.2 Time stamping the input signals with IM 153-2

8.2.1 Principles

It is possible to time stamp with IM 153-2

- within an S7-400 automation system

  – with *STEP 7* whilst using the FB 62 (FB TIMESTMP) with 10 ms precision or as a highly precise time stamping with 1 ms precision

    (refer to the online help for *STEP 7*)

  – with the PCS 7 system solution whilst using the FB 90 (FB IM_DRV) with 10 ms precision

    You´ll find a detailed description for time stamping with 10 ms precision and for time synchronization in the PCS 7 function manual "Process control system PCS 7 10 ms time stamping (http://support.automation.siemens.com/WW/view/en/15231179)".

- outside of an S7-400 automation system, with precisions of up to 1 ms

Controlling

You can use the time stamping for selected input signals, and for those that are of relevance to your application. On an ET 200M, the input signals of maximum 128 digital inputs can be time stamped. For a better load distribution on the PROFIBUS DP and in the IM 153-2 we recommend distributing these signals if necessary over several IM 153-2.

The IM 153-2BAx2 interface module supports time stamping of input signals from a maximum of 32 digital inputs per slot. The existing limit of a maximum of 128 time-stamped channels (DI) per ET 200M is retained.

You can specify the following digital input modules for the time stamping:

- 6ES7321-7BH01-0AB0 (1 ms)
- 6ES7321-7TH00-0AB0 (10 ms)
- 6ES7321-7RD00-0AB0 (10 ms)
- 6ES7326-1BK01-0AB0 (30 ms)

The figures shown in brackets specify the maximum possible precision. You should also note the installation guidelines for the respective accuracy class.

Marginal conditions

The precision of the time stamping is influenced by the following marginal conditions:

- The number of time-stamped input signals in an ET 200M influences the precision of the time stamping, e.g. more time-stamped input signals reduce the precision of the time stamping.

- Process interrupts as well as reading / writing data records reduce the precision of the time stamping.

  The specified precisions for time stamping (10 ms or 1 ms) will however remain.

- In the case of synchronous operation, the precision of the time stamping always corresponds to the DP cycle time.

Operating principle

The IM 153-2 provides changed input signals with the respective current time and saves this in a buffer (message list). Such a message list is a data record with maximum 20 messages about time-stamped signal changes. Up to 15 data records can be saved in the IM 153-2.

A **signal message** provides the following information:

- Slot number of the (reported) DI module (4 ... 11)

- Channel number of the DI module

- Signal status (incoming, outgoing)

- Time of the signal change

When there are time-stamped signals or a data record is full, the IM 153-2 generates a process interrupt to the DP master. The buffer is evaluated with "read data record".

In the case of events that influence the time stamping (STOP of the time stamping, time message frame failure, ...) special messages are generated.

A **special message** provides the following information:

- Slot number of the IM 153-2 (always "2")

- Code of the special message (e.g. STOP of the time stamping)

- Characteristic of the special message (e.g. incoming / outgoing)

- Time of the special message

Parameter assignment

With the configuration you establish which digital input data of the IM 153-2 is going to be monitored. For the time stamping, these are signal changes on the digital inputs.

Two signal edges are always stamped. In doing so, the following assignment can be configured:

- "rising edge" (0 → 1) as "incoming signal"
  As a result, the "falling edge" (1 → 0) is the "outgoing signal".

- "falling edge" (1 → 0) as "incoming signal"
  As a result, the "rising edge" (0 → 1) is the "outgoing signal".

Note

There are no parameters for setting the time stamping precision. To achieve the respective precision however, the specified conditions and rules must be complied with.

8.2.2 Functionalities

8.2.2.1 Time stamp with 10 ms precision

Requirements

- The 10-ms time stamping of digital input signals must be consistently supported by all the hardware and software components: from the IM 153-2 via an automation system with its components up to, if necessary, the operator station for the unit visualization.

- The synchronization interval must be set at 10 seconds.

Example structure for time stamping signal changes with IM 153-2
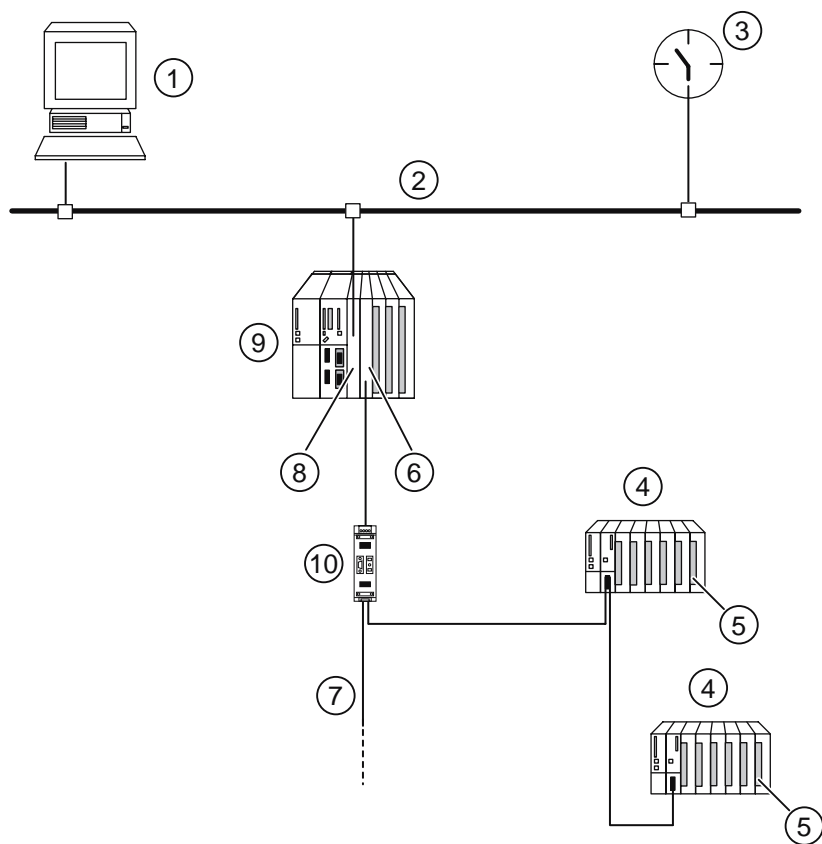
①	Operator station (OS) for unit visualization
②	Industrial Ethernet
③	Time sender (SICLOCK)
④	ET 200M Distributed I/O
⑤	SM 321 digital input module (6ES7321-7BH…)
⑥	CP 443-5 (DP master)
⑦	PROFIBUS DP
⑧	CP 443-1
⑨	S7-400 automation system
⑩	Optional: RS 485 repeater

Figure 8-1   Example structure for time stamping signal changes with IM 153-2

8.2.2.2   Highly precise time stamp with 1 ms precision

Controlling

The following configuration must be authorized for the highly precise time stamping with 1 ms precision:

- Automation system with highly precise time synchronization

    To do this a clock master, e.g. SICLOCK TM must be available in the automation system.

- ET 200M with IM 153-2 (as of 6ES7153-2BAx1-0XB0)
- no RS 485 repeater between the DP master and the ET 200M on which input signals are to be time stamped
- Only digital input modules can be used in the ET 200M.
- Only signals from the DI module 6ES7321-7BHxx-0AB0 can be time stamped.
    - The input delay of all digital inputs for time stamping must be configured identical to the minimum value (100 µs).
    - Process interrupts must be deactivated.
- Input signals that should receive a time stamp must be lined up as seamlessly as possible as of slot 4, channel 0.
- The start-up time of the ET 200M must be waited for (at least 10 seconds).
- The physics of the encoder must be observed. Different transitions of the input signals (rise time, spikes, ...) can have different effects on the precision of the time stamping.

Restrictions

During the following events, the time stamping precision could worsen:

- Processing diagnoses
- Firmware update
- Reading the I&M data
- other acyclic services

Scope

The precision of the time stamping applies throughout the line.

8.2.2.3 Time synchronization for time stamping

Requirements

The following requirements apply to the time synchronization for time stamping:

- There must be a clock master, e.g. SICLOCK TM available in the automation system. It must work with synchronization intervals of 10 s.

- The time message frame must be forwarded:
  - via Ethernet e.g. to a CP 443-1
  - on PROFIBUS DP e.g. via an integrated DP master or CP 443-5 Extended

- For the IM 153-2 (as of 6ES7153-2BAx1-0XB0) a synchronization interval of 10 s must be configured.

Time synchonrization for highly precise time stamping with 1 ms precision

You must realize the time synchronization for the highly precise time stamping with the following hardware components and settings:

- **Time master:** SICLOCK TM (as of FW V3.3.0090) with GPS synchronization

  Parameters to be set for SICLOCK TM:

Path / tab		Parameter (with number from the SICLOCK parameter menu)	Value
Synchronization / Redundancy	Synchronization	Mode (218)	Ramp
		Step pos. (219)	Micro step
		Step neg. (220)	
Inputs	Input mode	Input type (230)	DCF
	Input E1	E1 active / passive	TTY passive
		DCF alarm (239)	5
Ethernet	LAN general	LAN timeout (349)	0.5 s
	LAN 1-5	Adr1 protocol (e.g. 350)	Layer 2 - S5
		Adr1 send (e.g. 351)	10 s
		Adr1 def. (e.g. 352)	broadcast
	Adr1 is given as an example. Other LAN-connections / addresses have other parameter numbers accordingly.		
	LAN extra	SNTP server (550)	off

- **Ethernet:** CP 443-1 as of FW V2.6; 6GK7443-1EX11-0XE0

  Parameters to be set for Ethernet CP:

Parameter	Value
Forward time	from LAN to station
Switch on the time synchronization in SIMATIC procedure	

- **PROFIBUS DP:** as of CP 443-5 Extended V6.0; 6GK7443-5DX04-0XE0
  (synchronization not via integrated DP interface, but via external DP master)

  Parameters to be set for external DP master:

Parameter	Value
Time synchronization	from station to LAN

- **CPU,** CPU 41x

  Parameters to be set for CPU 41x:

Path / tab		Parameter	Value
Diagnostics / clock > synchronization	Type of synchronization	In the PLC	none or as slave

Setting example
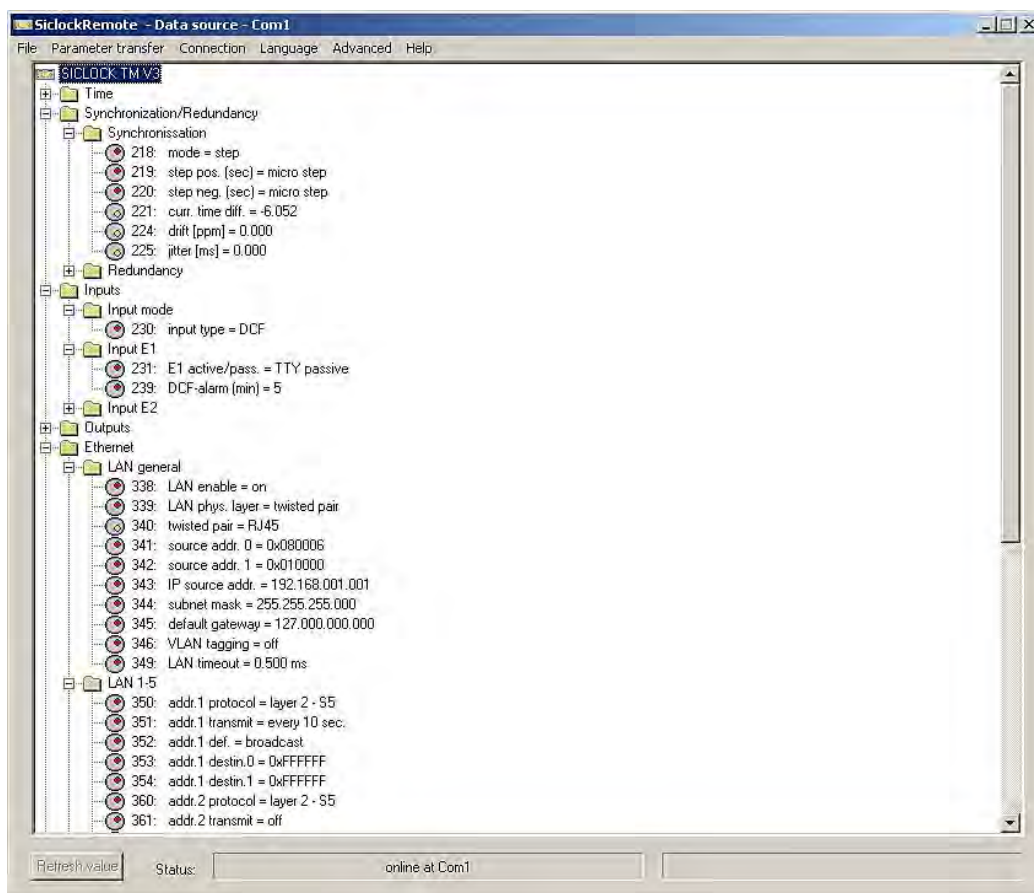
Figure 8-2   SICLOCK TM parameter menu
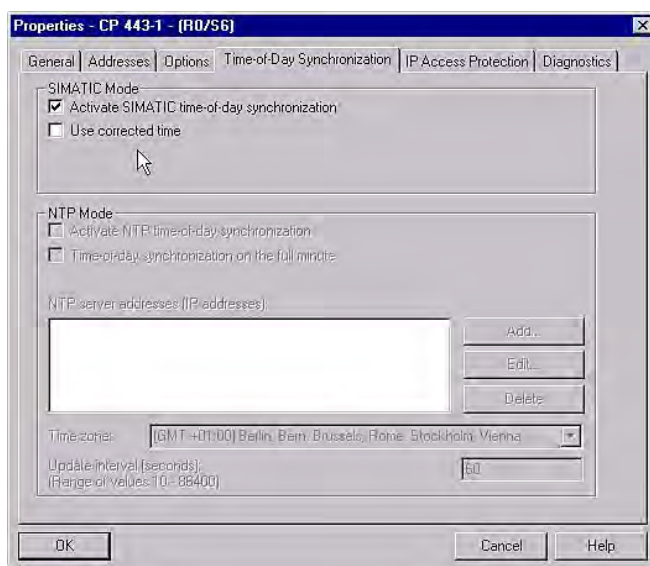
Figure 8-3   CP 443-1 properties
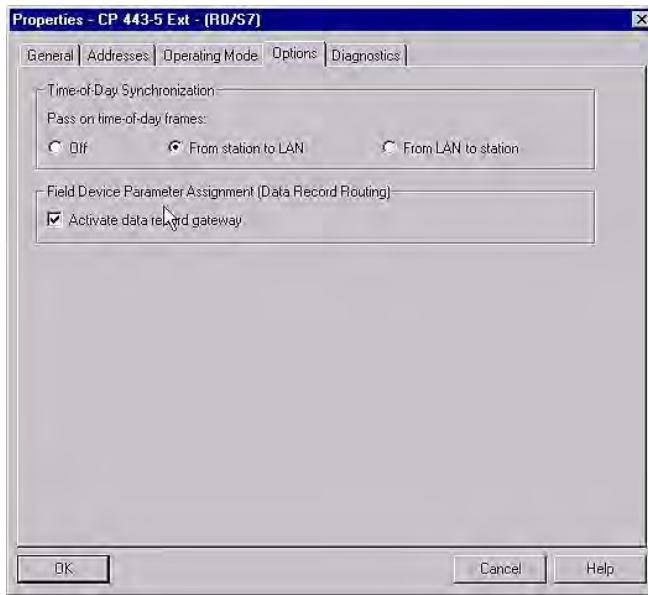
Figure 8-4   CP 443-5 Extended properties
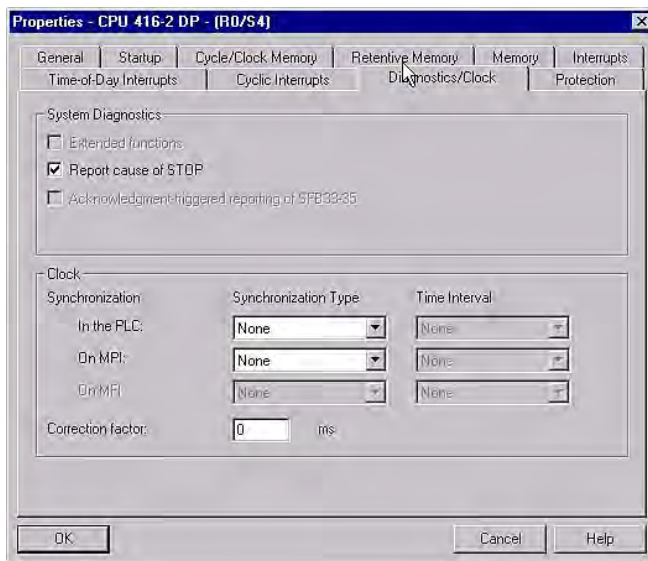
Figure 8-5   CPU properties
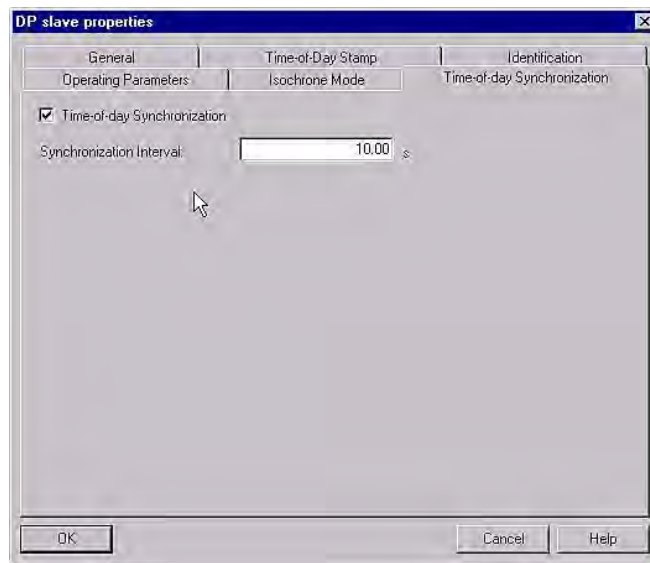
Figure 8-6   DP slave properties

8.2.2.4 Time stamping in the redundant system

The IM 153-2 supports the function time stamping even in the redundant system S7-400H.

Time stamping of signal changes in an S7-400H

Both IM 153-2 save the messages of the time-stamped signals. This way, after a changeover process from active to passive IM 153-2 the "new" active IM 153-2 prepares the current messages for further processing.

Note

During the changeover between the two IM 153-2 the signal changes are not time stamped. This time is communicated by the special message "Changeover with redundant BEGIN / END".

You will find more information on time stamping in redundant systems in the "PCS 7 documentation (http://support.automation.siemens.com/WW/view/en/10806846/130000)" documentation.
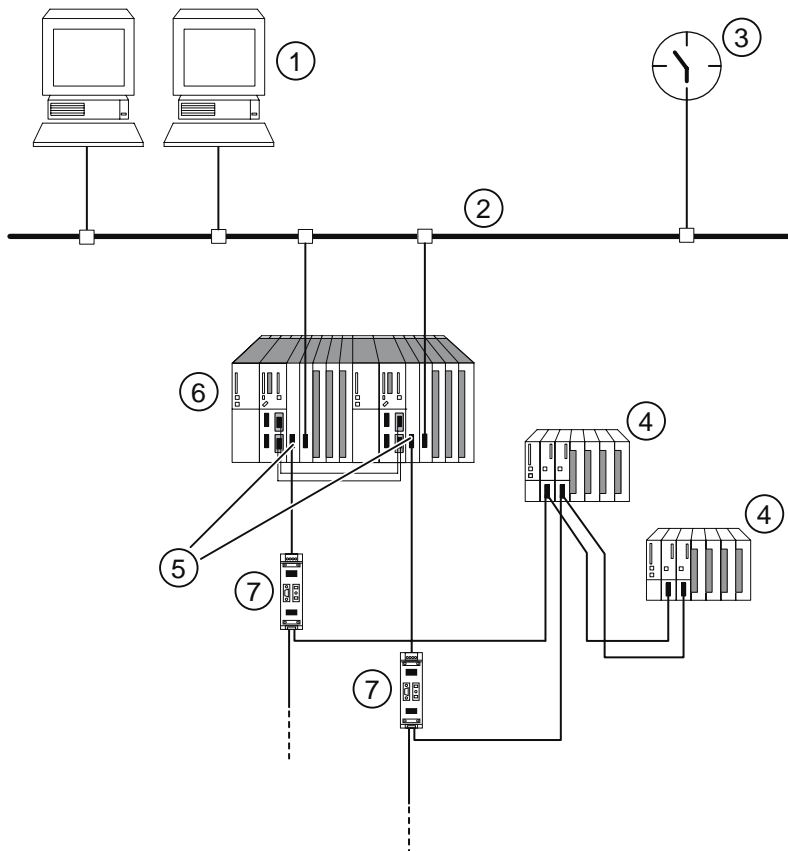
---

① WinCC Operator station (OS) for unit visualization
② Industrial Ethernet
③ Time master (SICLOCK)
④ ET 200M distributed I/O with 2 x IM 153-2
⑤ redundant DP master system
⑥ S7-400H automation system
⑦ Optional: RS 485 repeater

Figure 8-7   Example structure with 2 x IM 153-2 for redundancy in an H system

8.2.3 Time stamping within the S7-400

8.2.3.1 With STEP 7 in customer applications

In customer applications a time stamping of digital input signals with a precision of 10 ms and 1 ms is possible. In doing so, the rules and requirements listed above under "Functionalities (Page 132)" apply. In the unit, a time synchronization must take place. The FB 62 (FB TIMESTMP) is an essential component for time stamping as an interface to the IM 153-2.

The evaluation of the time-stamped signals takes place via the user program (customer application). You´ll find more information on this in the *Online-help for STEP 7*. The following figure shows the storage location of the FB 62 in the standard library of *STEP 7*.
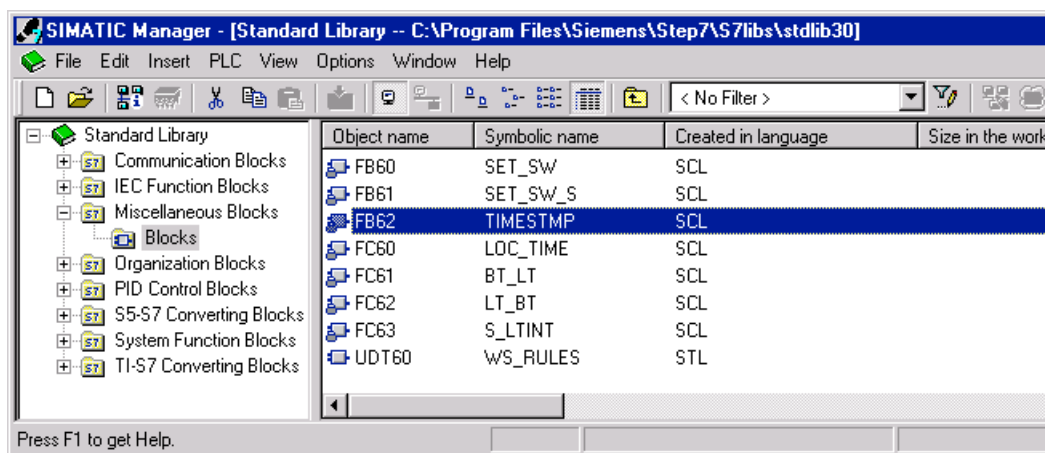
Figure 8-8   Storage location of the FB 62 in STEP 7

8.2.3.2 With the PCS 7 system solution

The 10-ms time stamping of signal changes is consistently supported in the *PCS 7* by all the hardware and software components: by IM 153-2 via an S7-400 up to the Operator Station with WinCC for unit visualization.
Essential components for the time stamping are

* the driver block FB 90 (FB IM_DRV) as an interface to the IM 153-2

* WinCC for the visualization

You´ll find a detailed description for time stamping with 10 ms precision and for time synchronization in the "Process control system PCS 7 10 ms time stamping (http://support.automation.siemens.com/WW/view/en/15231179)" manual.

Example structure for time stamping signal changes with IM 153-2
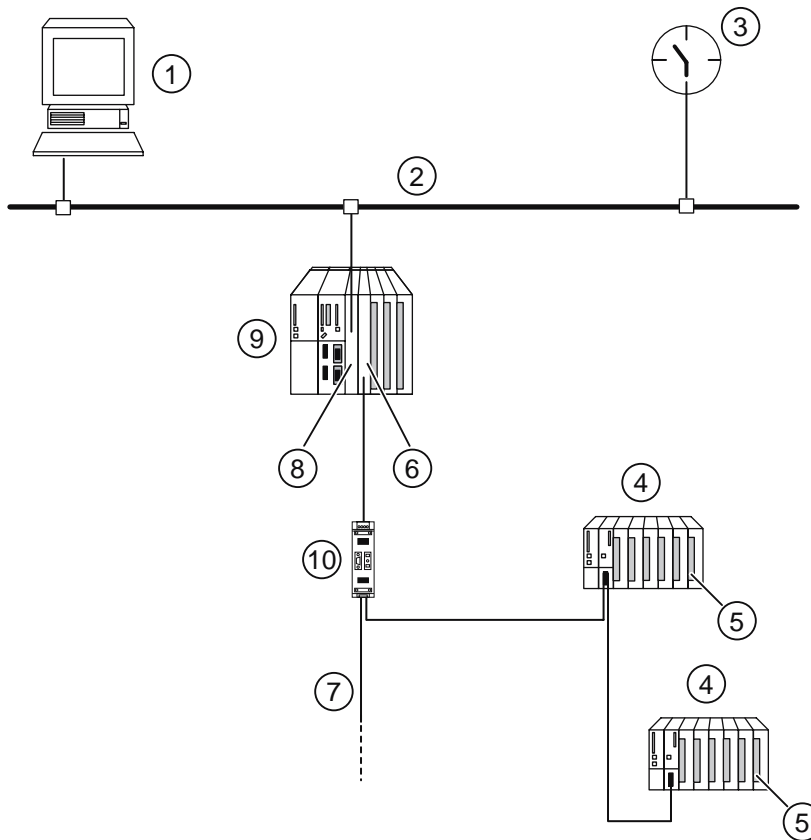
①   WinCC Operator station (OS) for unit visualization

②   Industrial Ethernet

③   Time master (SICLOCK)

④   ET 200M Distributed I/O

⑤   SM 321 digital input module (6ES7321-7BH…)

⑥   CP 443-5 (DP master)

⑦   PROFIBUS DP

⑧   CP 443-1

⑨   S7-400 automation system

⑩   Optional: RS 485 repeater

Figure 8-9   Example structure for time stamping signal changes with IM 153-2

8.2.4   Time stamping outside of S7-400

8.2.4.1   Prerequisites

With the interface module IM 153-2Bxx1, time stamping is also possible outside of an S7-400 automation system.

The above principles and rules apply - if complied with, precisions of up to 1 ms can be achieved.

Synchronization interval for the time: 10 s

Demands on the ET 200M and DP master

ET 200M:

- IM 153-2 as of order number 6ES7153-2Bxx1-0XB0
- suitable DI modules
- IM 153-2 must be configured via GSD rev. 5 (e.g. enabling of interrupts)
- for IM 153-2 the DPV1 mode must be activated
- Synchronization interval in accordance with the setting on the clock master

DP master:

- must fulfill requirements in accordance with DPV1
- must be able to process interrupts
- must be able to process data records (read / write)
- must be able to send / forward time message frames or a clock master must be available in the same PROFIBUS DP line

Sample configuration: Integrated DP master forwards the time received by the CPU
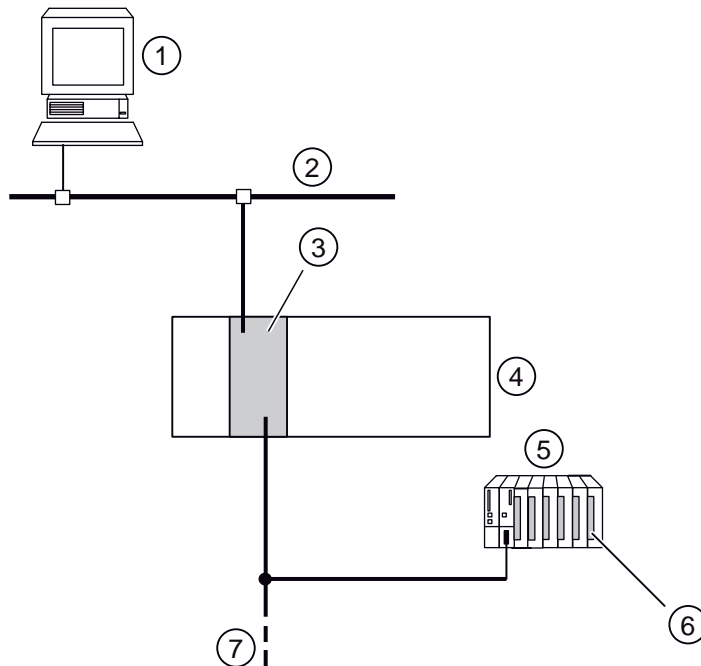
①   Operator station (OS) for unit visualization

②   Industrial Ethernet

③   CPU with
   - integrated clock as clock master
   - integrated DP master

④   Automation system

⑤   ET 200M Distributed I/O

⑥   Digital input group; e.g. SM 321-7BH…

⑦   PROFIBUS DP

Figure 8-10   Sample configuration: Integrated DP master forwards the time received from the CPU (clock master)

Sample configuration: Communication processor as DP master and DP clock master
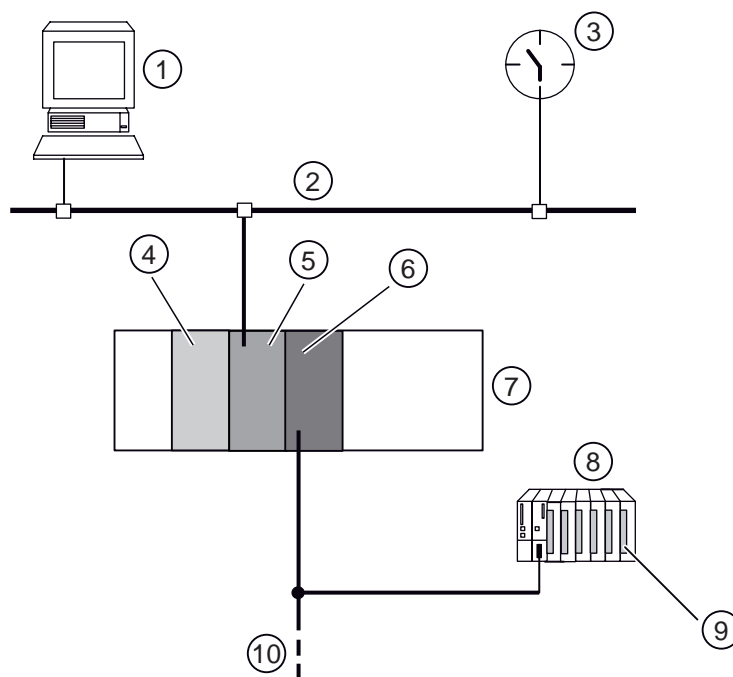
①   Operator station (OS) for unit visualization

②   Industrial Ethernet

③   Time master e.g. SICLOCK

④   CPU

⑤   Communication processor for connection to an Industrial Ethernet

⑥   Communication processor as DP master and DP clock master

⑦   Automation system

⑧   ET 200M Distributed I/O

⑨   Digital input group; e.g. SM 321-7BH…

⑩   PROFIBUS DP

Figure 8-11   Sample configuration: Communication processor as DP master and DP clock master

Sample configuration: Communication processor as DP master as well as a separate time master
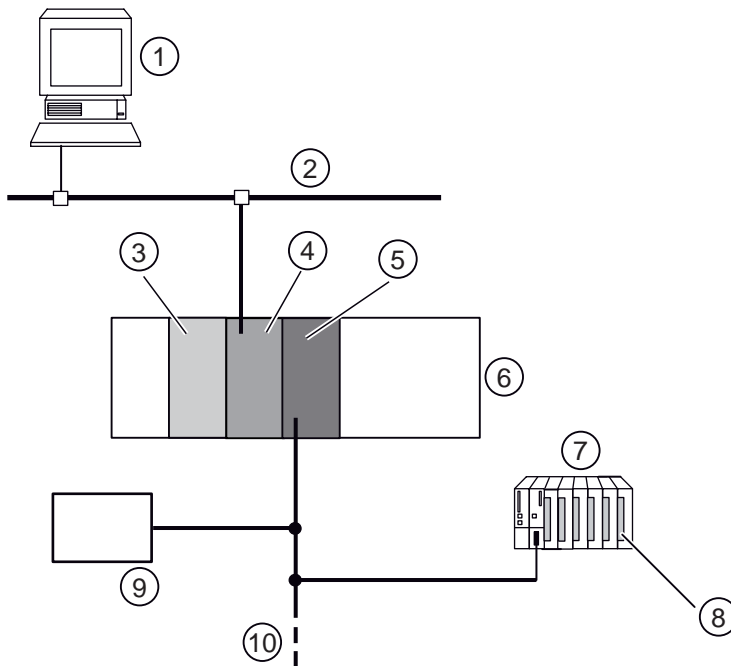
①　　　Operator station (OS) for unit visualization

②　　　Industrial Ethernet

③　　　CPU

④　　　Communication processor for connection to an Industrial Ethernet

⑤　　　Communication processor as DP master

⑥　　　Automation system

⑦　　　ET 200M Distributed I/O

⑧　　　Digital input group; e.g. SM 321-7BH…

⑨　　　Time master

⑩　　　PROFIBUS DP

Figure 8-12　　Sample configuration: Communication processor as DP master as well as a separate time master

8.2.4.2   Operating principle

- The 240 data record is the configured data record for the time stamping on the ET 200M. It defines which modules and which input channels of which type can be called upon by the IM 153-2 for the time stamping.
  When accepting the data record 240 the consistency of the data record with the configured structure of the slave is checked.

  As soon as this data record 240 is transmitted correctly to the IM 153-2 the time stamping is activated.

- If the input signal on one of the monitored inputs changes, this event is time stamped by the IM 153-2 and stored in one of hte data records 100 to 114.

- Then the IM 153-2 triggers a process interrupt.

- The master reacts with a diagnosis requirement to the slave.

- The IM 153-2 responds to this with a diagnostic frame. This diagnostic frame includes, among other things, the number of the data record that includes the time-stamped messages.

- Because of this diagnostic frame the associated run level "process interrupt" is launched in the user program. Within this run level, the user must be able to tell which data record is to be read with messages from the IM 153-2. Depending on the application case, the user must also ensure multiple calls on this run level.
  In your CPU´s manual, look up DPV1-blocks, e.g. "RALRM".

- The user program monitors entries in the run level "process interrupt". As soon as an entry is detected, the data record is read from the IM 153-2. A block in accordance with DPV1 also serves to do this.
  Refer to DPV1-blocks, e.g. "RDREC" in your CPU´s manual.

- In accordance with the requirements of your application, the data record is saved or further processed. Every single signal message comprises 12 bytes, a data record can include up to 20 messages.
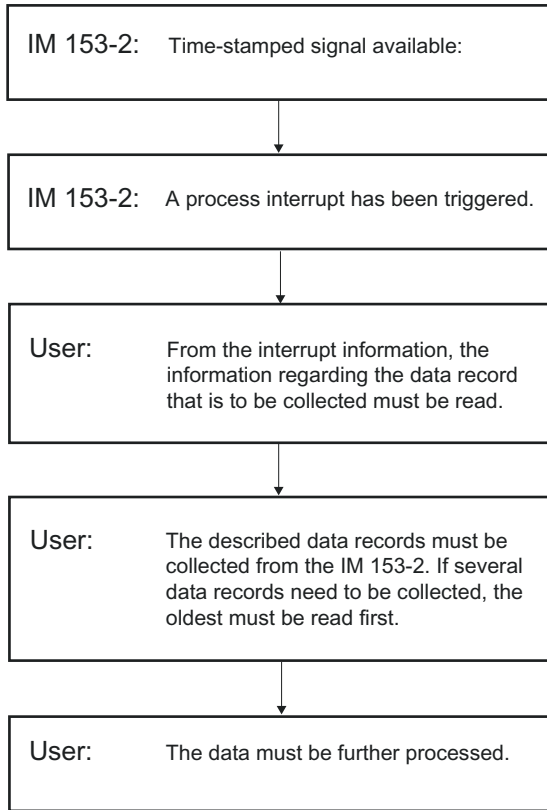
Order of events

```
IM 153-2:    Time-stamped signal available:

IM 153-2:    A process interrupt has been triggered.

User:        From the interrupt information, the
             information regarding the data record
             that is to be collected must be read.

User:        The described data records must be
             collected from the IM 153-2. If several
             data records need to be collected, the
             oldest must be read first.

User:        The data must be further processed.
```

Figure 8-13   Processing time-stamped signals

8.2.4.3   Brief introduction to commissioning the time stamping

If you use the DPV1 blocks "RALMR" and "RDREC", then commission an ET 200M with time stamping of the input signals as follows:

Step	Activity	Description
1.	Provide the DP master with the GSD file.	The information as to which DPV1 slave (IM 153-2BAx1) it must expect on the PROFIBUS DP, is obtained by your DP master from the GSD file. The GSD file for the IM 153-2BAx1 can be found in the Internet (http://support.automation.siemens.com/WW/view/en/113498).
2.	Integrate the slave with the DP master.	Add the IM 153-2 to the DP line of your master system and enter the used modules as of slot 4 of the ET 200M.
3.	Set the mode of synchronization and synchronization interval for the master and slave.	Master: • Type of synchronization: Master • Synchronization interval: e.g. 10 s Slave: • Time synchronization: active • Synchronization interval: e.g. 10 s The synchronization intervals for master and slave must be the same.
4.	Commission the ET 200M on the PROFIBUS DP.	• Transfer the settings to the master. • Connect the master and slave. • Check the set slave address. • Switch the unit on. After start-up the slave communicates with the master without interruption i.e. the LED "ON" lights up and the LED "BF1" is off. If this is not the case, you should either read and evaluate the diagnostics data from the slave or use a PROFIBUS monitor to analyze the communication.
5.	Enable the time stamping.	The time stamping is activated by writing the data record 240 on the IM 153-2. The data record 240 essentially stipulates • at which slots which channels are supposed to be time stamped • which signal change (0 → 1 or 1 → 0) leads to an incoming or outgoing message

Step	Activity	Description
6.	Diagnose imminent signal messages and save the information. Ensure that when a process interrupt is received the block "RALRM" is active. You must wire this block.	When signal messages arrive the slave sends a process interrupt to the master. The master then asks for a diagnosis from the slave. The slave responds with the diagnostic frame. Based on this diagnostic frame, the block "RALRM" must be started via the user program. This block reads TINFO and AINFO in the memory. The relevant information for this is: • diagnostic address of the slave • number of the data record • number of messages in the data record the new bit is set from the "RALRM" block to "1" after the data transmission.
7.	With the "RDREC" block, read the signal messages from the reported data record. You must wire this block.	You must ensure that the "RDREC" block is processed in the user program. In the case of imminent messages (signaled by the new bit from the "RALRM" block) this reads the reported data record (100 to 114) and saves it in the specified target range (e.g. DB 46). Before the "RDREC" block is active, the following values from "RALRM" must be changed: • diagnostic address of INT → DINT • data record number of BYTE → INT
8.	Reset the NEW bit on the "RALRM" block.	If the values of the data record are read and are to be saved for further processing, the NEW bit on the "RALRM" block must be reset. You must carry out this step.
You can now read further data records (steps 6 to 8).		

8.2.4.4   Time synchronization

For the time synchronization with time stamping outside of S7-400 the requirements specified in the chapter "Time synchronization for time stamping (Page 135)" apply.

The parameters for the IM 153-2 must be set via the GSD file.

8.2.4.5   Configuring the time stamping

For configuring the time stamping of input signals the IM 153-2 makes available an interface in the form of the data record 240. There you can choose your requirements accordingly,
● whether the time stamping should be generally activated / deactivated
● on which slot a module is inserted, the input signals of which should be stamped
● which signals receive a time stamp (via "DI n Enable": time stamping activated / deactivated)
● which signal change will be stamped in which way (via "DI n Edge": "rising" edge as an incoming signal or "falling" edge as an incoming signal).
   The unselected edge is automatically the outgoing signal, i.e. **both** changes of a signal are given a time stamp.

With DS_WRITE the data record 240 is transferred to the IM 153-2 for the configuration of the time stamp.

Structure of the data record 240 for configuring the time stamp of the input signals

The telegram with the data record DS 240 has 4 bytes **head data**:

Byte									Content/meaning
0	0	1	0	1	1	1	1	1	5Fh (write data record)
1	0	0	0	0	0	0	0	0	00h (slot of the IM 153-2)
2	1	1	1	1	0	0	0	0	F0h (Number of the data record)
3	0	0	0	0	1	0	0	0	e.g. 08h (Number of the following byte)

Figure 8-14   Head data of the telegram with the data record 240 for the configuration

The **configuration data** in the data record 240 for configuring the time stamp is structured as follows:
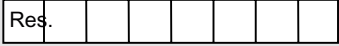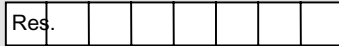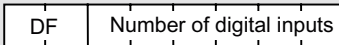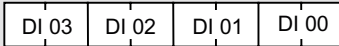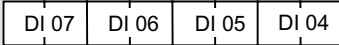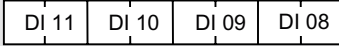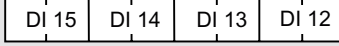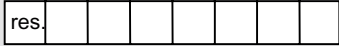
Figure 8-15   Structure of the data record 240 for the configuration

The configuration data in the data record 240 for configuring the time stamp for **IM 153-2BAx2** is structured as follows:
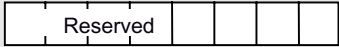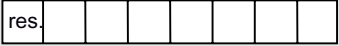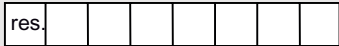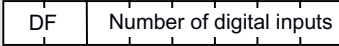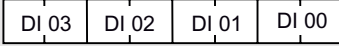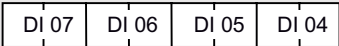
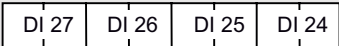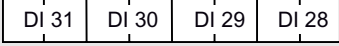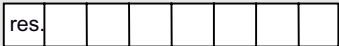| Byte		Content / meaning
4	Reserved	Version ID (= "2")
5	res.	Number of slots (1 to 12); "0": Time stamping deactivated
6	res.	Slot number (4 to 15)
7	DF — Number of digital inputs	Data format (DF): Number of DI: 00: Without value status 1 ... 32 01: With value status 1 bit (after S7) 10: Reserved 11: Reserved
8	DI 03 — DI 02 — DI 01 — DI 00	Control byte with control bits DI n = 00: Time stamping deactivated 10: Time stamping deactivated 11: Time stamping activated Message incoming with edge 0 → 1 01: Time stamping activated message incoming with edge 1 → 0
9	DI 07 — DI 06 — DI 05 — DI 04	Control byte with control bits
10	DI 11 — DI 10 — DI 09 — DI 08	Control byte with control bits
⋮	⋮	
14	DI 27 — DI 26 — DI 25 — DI 24	Control byte with control bits
15	DI 31 — DI 30 — DI 29 — DI 28	Control byte with control bits

Starting from here: new slot number (same as above starting with byte 6)

Byte		Content / meaning
16	res.	Slot number (4 to 15)
⋮	⋮	
⋮	⋮	

etc. up to last slot number and the associated control bytes

Figure 8-16   IM 153-2BAx2: Structure of data record 240 for parameter assignment

Parameterizing the edges

● Time stamp with edge 0 → 1:
  With a signal change on the digital input of 0 → 1 a signal message with signal status 80h (incoming) is stored in the data record (DS 100 to 114).

● Time stamp with edge 1 → 0:
  With a signal change on the digital input of 1 → 0 a signal message with signal status 80h (incoming) is stored in the data record (DS 100 to 114).

Example

For a fully connected ET 200M (8 digital inputs with in each case 16 digital inputs) the data record 240 has a total of 50 bytes for the configuration of the time stamp.

Return values on DS_WRITE

Possible return values on writing a data record can be obtained in accordance with the DPV1 standard.

8.2.4.6   Structure of the process interrupt

Structure of the alarm information

The process interrupt is structured in accordance with the DPV1 standard.

Table 8- 1   Contents of the diagnostic frame (example)

Value	Meaning
00 0C 00h	Station status
05h	Master address (e.g. B 5)
80 1Eh	Manufacturer ID
43 00 00h	Module diagnostics (variable length, here 3 bytes)
07 82 00 00 00 00 00h	Module status (variable length, here 7 bytes)
08 02 02 20 00 67 01 0Dh	Interrupt part with time stamping

Table 8- 2   Contents of the interrupt section (example)

Value	Meaning
08h	● Bit 7 … 6: Code for the interrupt ● Bit 5 … 0: Length of interrupt section
02h	Interrupt type
02h	Slot
20h	● Bit 7 … 3: Interrupt sequence number ● Bit 2 … 0: Types of interrupt

Value	Meaning
00h	Status of time stamping
67h	Data record number of the data record to be fetched (64h to 72h = DS 100 … 114)
01h	Number of messages in the data record (01h to 14h = 1 … 20)
0Dh	fixed value

Table 8- 3   Status of time stamping

Bit	Contents	Meaning
7 … 6	0	Evaluation unnecessary
5	Place the time stamping again 0: No new placement carried out 1: New placement taking place	If the bit 5 is set (= 1), then the history of the still unread buffer (data records) must be deleted, as the time stamping has been placed again. New placement of the time stamping is necessary when starting up / restarting and changing over to redundant mode. With the events specified, you must install this deletion in the user program.
4 … 0	0	Evaluation unnecessary

Return values on DS_READ

Alongside the possible return values (in accordance with DPV1 standard) on reading a data record, in connection with the time stamping the following return value can be supplied:

Table 8- 4   Return value on DS_READ

Code	Meaning
0x80B0	• A data record outside of the value range of DS 100 ... DS 114 is requested. • The IM 153-2 has not yet been configured (DS 240 missing).

8.2.4.7 Structure of the IM 153-2 messages

The IM 153-2 makes available 15 data records for saving stamped input signals (signal messages) and special messages (DS 100 to DS 114). A maximum of 20 signal and special messages each consisting of 12 bytes can be saved in a data record.

Structure of the message frame header

Each message frame with a data record has 4 bytes of header data:

Table 8- 5   Header data of the IM 153-2 message frame (example)

Byte	Contents	Meaning
0	5Eh	Read data record
1	00h	IM 153-2 slot
2	64h	Number of the data record (e.g. 100 dec.)
3	0Ch	Number of the following bytes (e.g. 12 dec.)

Structure of the signal message

A signal message can come from modules on the slots 4 to 11. It is structured as follows:

Table 8- 6   Structure of the signal message

Meaning	Number of bytes	Remarks	
Slot number of the DI module	1	Together with the channel number for addressing the digital signal	
		Range of values:	
		0 … 3	Unassigned
		4 … 11	Slot number of the DI module
		12 … 255	Unassigned
Channel number of the DI module	1	Together with the slot number for addressing the digital signal	
		Range of values:	
		0 … 15	Channel number of the DI module
		16 … 255	Unassigned
Signal status	1	Bit 7	**1**: Signal incoming **0**: Signal outgoing
		Bit 6 … Bit 0	Unassigned
Reserved	1	Unassigned	
Time of the signal change	8 (2 DW)	Time stamp in ISP-format (refer to table below for structure)	

Structure of a special message

A special message always comes from the IM 153-2 (slot 2). It is structured as follows:

Table 8- 7   Structure of a special message

Meaning	Number of bytes	Remarks			
Slot number of the IM 153-2	1	Always "**2**" in the case of a special message			
Code of the special message	1	01h	Start-up data (a)		
		02h	Time message frame failure: the following signal messages have, among others, a precision that is less than 10 ms (b)		
		03h	not used		
		04h	Time difference between message frame and internal clock > 10 ms (c) (message always occurs as a message pair)		
		05h	STOP of the time stamping (b)		
		06h	Buffer overflow: the following signal messages are lost until the buffer is clear again (b)		
		07h	Changeover in the case of redundancy (a)		
		08h	Loss of information in the case of redundancy (b) (internal error)		
Property for special message	1	01h	(a) BEGIN	00h	(a) END
		01h	(b) INCOMING	00h	(b) OUTGOING
		01h	(c) internal time of the IM 153-2 at the moment of synchronization	00h	(c) Synchronization time to which the internal clock of the IM 153-2 is set
		From the message pair of the special message (c) it can be seen whether the internal clock has been put back or forward and how great the time difference was during at the synchronization.			
Reserved	1	Unassigned			
Time of the special message	8 (2 DW)	Time stamp in ISP-format (refer to table below for structure)			

Structure of a time stamp in the ISP format

A time stamp in the ISP format is structured as follows:

Table 8- 8   Structure of a time stamp in the ISP format

Byte	Contents	range
0 … 3	Seconds as of 01.01.1900; 0:00:00,000 o´clock	in accordance with 01.01.1900 … 06.02.2036
4 … 7	Fractions of a second in multiples of $1/(2^{32})$ s	0 … < 1 s

8.2.4.8 Significance of special messages

With an activated time stamping, the IM 153-2 can supply the following special messages:

- If all 15 data records of the IM 153-2 are full, then the IM 153-2 cannot save any further messages. The messages are lost.

  The IM 153-2 enters the last message, the special message "Buffer overflow INCOMING". When a data record is clear, the IM 153-2 enters the first message in the data record - the special message "Buffer overflow OUTGOING". Messages that occur between the buffer overflow and the clearance of a data record are lost.

- During start up / restart / cold start the IM 153-2 again outputs process interrupts for those data records that were occupied before the start up, but have not yet been collected.

  In the first free data record the IM 153-2 enters the following messages:

  – Special message "Start-up data BEGIN"

  – Signal changes that occur immediately before a master STOP ("INCOMING" or "OUTGOING" in accordance with the configured edge)

  – Current signal status for all input signals that are to be stamped ("INCOMING" or "OUTGOING" in accordance with the configured edge)

  – Special message "Start-up data END"

With redundant mode

In redundant mode it also applies that:

- during a changeover between active and passive IM 153-2 the time stamping is interrupted. With the special message "Changeover with redundant BEGIN / END" the period of interruption is displayed.

- If the communication between the two IM 153-2 is interrupted in redundant mode, the special message "Loss of information in the case of redundancy INCOMIING" is output. As soon as the communication between the active and passive IM 153-2s is possible again, the special message "Loss of information in the case of redundancy OUTGOING" is output. It is not possible to adjust this afterwards, as changing over to the error state of the interface module IM 153-2 could lead to message loss.
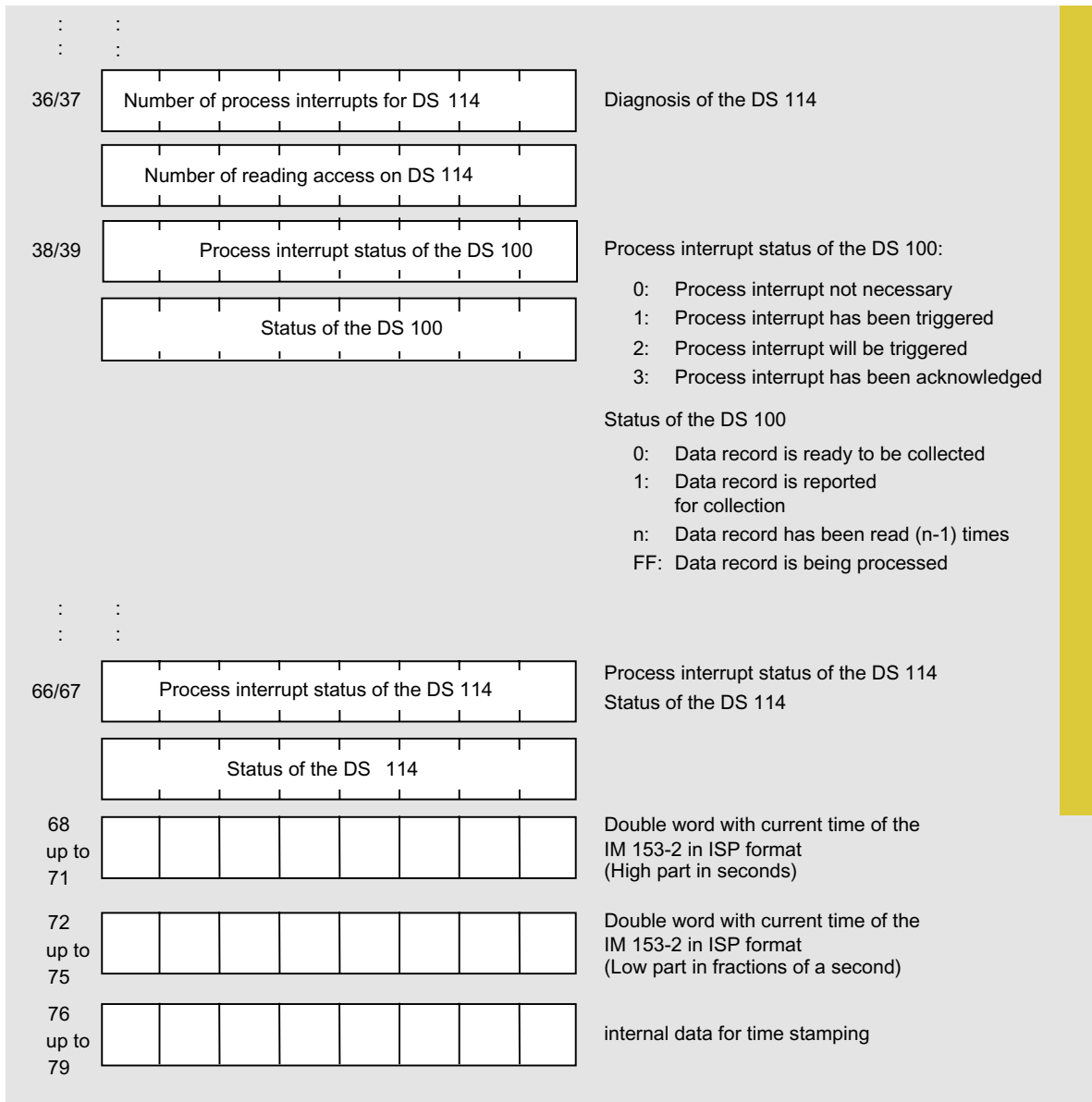
8.2.4.9 Diagnosis for time stamping

You can obtain information on the status of the time stamping by reading the data record 240 from the IM 153-2 interface module. You read via DS_READ-240.

Structure of the data record 240 for the diagnosis

The **diagnosis data** in the data record 240 for diagnosing the time stamp is made up of 80 bytes is structured as follows:

Byte		Content/meaning
0		internal data for time stamping: State machine
1		Bit 7 = 1: Time message frame receiving
		Bit 6 = 1: Startup completed
		Bit 5 = 1: I/O data received
		Bit 4 = 1: Update takes place
		Bit 3 = 1: Start takes place
		Bit 2 = 1: Parameter available
		Bit 1 = 1: Configuration received
		Bit 0 = 1: IM 153-2 is initialized
2		Bit 7 = 1: Left IM / = 0: Right IM
		Bit 6 = 1: Partner IM available
		Bit 5 = 1: Internal buffer overflow (change buffer)
		Bit 4 = 1: Overflow of the message buffer
		Bit 3/2 = 00: Time stamping on passive IM
		= 01: Time stamping on active IM
		= 10: Start of the time stamping after changeover to passive IM
		= 11: Start of the time stamping after changeover to active IM
		Bit 1 = 1: Startup data ended
3		Number of the data record, which is currently being edited by the IM 153-2
4		Number of stamped input signals in the current data record
5 up to 7		3 bytes with information regarding the startup data In case of redundancy
8/9	Number of process interrupts for DS 100	Diagnosis of the DS 100
	Number of reading access on DS 100	If the time stamping works properly, the counter increments in accordance with the frequency of the signal changes.
10/11	Number of process interrupts for DS 101	Diagnosis of the DS 101
	Number of reading access on DS 101	

Figure 8-17   Structure of the data record 240 for the diagnosis (part 1)

Key for highlighting the bytes:

Status information (for the user)

Information for the creator of the user program (programmer)

all   Information for the service personnel

Figure 8-18   Structure of the data record 240 for the diagnosis (part 2)

Return values on DS_READ-240

Possible return values on reading a data record can be obtained in accordance with the DPV1 standard.

8.3   Clock synchronization on the I/O bus

Properties

The interface module IM 153-2 as of 6ES7153-2Bxx1-0XB0 supports the time synchronization on the I/O bus.

- The IM 153-2 sends the current time to the I/O bus after its time synchronization has been cleared with the configuration.

- The synchronization on the I/O bus takes place in the synchronization interval that has been set on the PROFIBUS DP.

- In view of the time received on the PROFIBUS DP, the precision deteriorates only slightly. The precision of 10 ms is always guaranteed.

Operating steps for activation

The activation of the time synchronization on the I/O bus can be carried out as follows:

PROFIBUS DP:

1. Complete the PROFIBUS DP with a time master.

2. Activate the time synchronization in the properties of the DP master.

Note

In the H system you must insert a time master in both the PROFIBUS DP systems and activate the time synchronization.

Configuring the IM 153-2:

1. In HW-Config, open the dialog **DP slave properties > Time-of-day Synchronization**.
2. Activate the **Time-of-day Synchronization** check box.
3. As a synchronization interval, enter the effective synchronization interval that is set on PROFIBUS DP (e.g. 10 s).
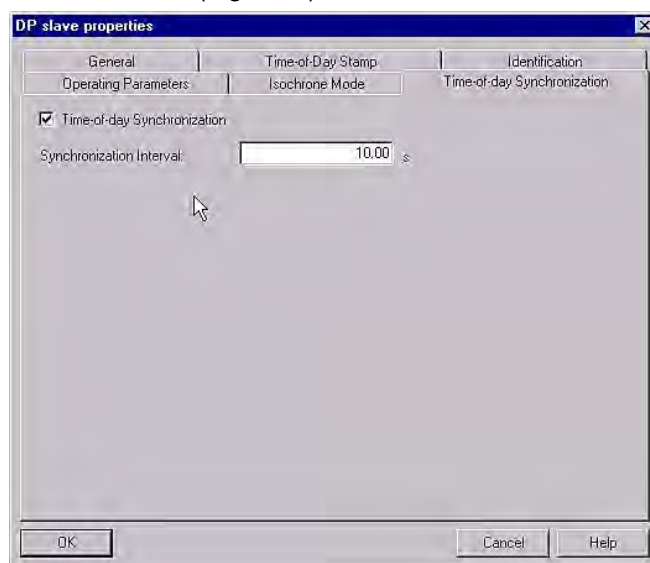

Figure 8-19   Dialog box DP slave properties > Time-of-day Synchronization

8.4   Redundancy with IM 153-2

Use

You can operate the interface module IM 153-2 redundantly
- on the SIMATIC S7-400H (e.g. CPU 417-4H)
- with GSD file on any DP master (e.g. S5-115H)

   When configuring with a GSD file, the redundant operation of the IM 153-2 interface module can take place only in DPV0 mode. This operating mode is set differently dependent on the configuration tool.
- with software redundancy

   For the basic package *STEP 7*, the optional software *SIMATIC S7 Software Redundancy* is required. The optional software includes an online help in which the use and function of the software redundancy is described.
- to standard

   Specification slave redundancy V1.2, Nov. 2004 of the PROFIBUS user organization; order no: 2.212
   - System Redundancy (SR)
   - Flying Redundancy (FR)

Conditions for the ET 200M

- Configuration with active bus modules

   The configuration with active bus modules 6ES7195-7HD10-0XA0 or 6ES7195-7HD80-0XA0 ensures a greater availability of the ET 200M.
- 2 x IM 153-2 on bus module BM IM/IM

   The arrangement specifications named in the chapter "Installation (Page 59)" apply to the active bus modules and interface modules used.
- Software redundancy and system redundancy (SR) are possible with the IM 153-2 / -2 FO as of 6ES7153-2AA02-0XB0 / -2AB01-0XB0
- Flying redundancy (FR) is possible with IM 153-2 / -2 FO as of 6ES7153-2Bxx1-0XB0
   - The redundant master system must be configured in accordance with the demands on H systems.
   - The GSD file of the IM 153-2 (GSD rev. 5) must be imported to the configuration tool.

   Note

   STEP 7 offers no support for configuring an H system with flying redundancy.

- In redundant mode the function SYNC / FREEZE is not activated.

   Note

   If the function SYNC / FREEZE is nevertheless activated in a redundant system, the user bears the responsibility for the behavior of the H system (e.g. when changing over).

- In a redundant system, you can only use the IM 153-2 interface module on DP masters that support the "fail safe" parameter. The IM 153-2 will not run on DP masters that do not support this parameter, and the BF LED flashes.
   Tip: You can see in the GSD-file of the DP master whether this "fail safe" is supported.

Example configuration of a redundant DP master system and IM 153-2

The following figure shows an example configuration on an S7-400H. For the S7-400H the ET 200M is a one-channel switched (distributed) I/O. For detailed assembly instructions for H systems, refer to the"S7-400H automation system, fault-tolerant systems (http://support.automation.siemens.com/WW/view/en/1186523)" manual.
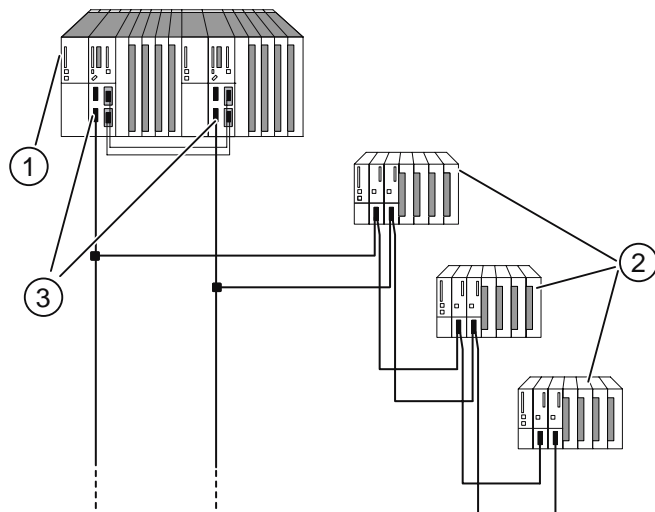
①   S7-400H automation system

②   ET 200M distributed I/O with 2 x IM 153-2

③   redundant DP master system

Figure 8-20   Redundancy with 2 x IM 153-2 in an H system

Compatible versions

If you use the ET 200M in a redundant configuration, for both IM 153-2s or IM 153-2 FOs you must use compatible versions.

Compatible versions of the interface module IM 153-2 / IM 153-2 FO can be swapped during "Module Change During Operation" without switching off the I/O modules.
For more information, refer to the chapter "Arrangement of the modules for the function "Change During Operation" and / or "Redundancy" (Page 44)".

Note

The functionalities are restricted to those of the respective lower order number or the lower version.

S7-400H as DP master

You require *STEP 7* as of V5.0 as well as the software package *SIMATIC S7 H-systems* for configuring the S7-400H system.

DP master 1 and DP master 2:

● work off the same user program.

● have the same configuration and parameterization for the IM 153-2 interface module.

S5-115H / -155H as DP master

If the IM 153-2 interface module is being used on an S5 H system, the you must configure two DP master systems in the *COM PROFIBUS*.

Voltage supply for the IM 153-2 interface module

In order to ensure availability in redundant mode with 2 x IM 153-2, we recommend that each IM 153-2 is using its own power supply module.

8.5 System modification during operation

System modifications

System modification in RUN is possible with the IM 153-2 in the redundant and in the non-redundant structure:

- In the redundant system
  - with IM 153-2AA02 as of version 05
  - with IM 153-2AB01 as of version 04
  - with IM 153-2Bx00
  - with IM 153-2Bxx1
- In the non-redundant system
  - with IM 153-2Bx00
  - with IM 153-2Bxx1

8.5.1 System modification in a non-redundant system

A detailed description of this function and its parameterization in non-redundant systems can be found in the function manual "Modifying the system during operation via CiR (http://support.automation.siemens.com/WW/view/en/14044916)".

8.5.2   System modification in a redundant system

Configuring with *STEP 7 / PCS 7*

Information on using this function in the redundant structure can be found in the "S7-400H automation system, fault-tolerant systems (http://support.automation.siemens.com/WW/view/en/1186523)" manual and in the online help for the H-optional package for *STEP 7*.

Configuring with a GSD file

Principle

As of IM 153-2Bx00 it is also possible to modify the system whilst running by configuring with a GSD file. In this case, modules are added to or removed from an ET 200M during operation. Existing modules and modules which are not to be modified are unaffected.

During such a reconfiguration, the two IM 153-2 work temporarily with different configuration data. The redundant operating mode for the unaffected modules is, however, retained.

Requirements

- "Module change in operation" must be enabled during configuration. This must take place equally for both IM 153-2 of the redundant system. If this is not the case, an IM 153-2 does not start up, i.e. redundant operation is not possible.

Note

If "Module Change During Operation" is not cleared, the configuration and parameter settings between the two IM 153-2 must be identical.

- The "Start-up at preset configuration ≠ actual configuration" and "Module Change During Operation" parameters must be cleared with both IM 153-2s.

- The slots for modules which are to be added must be available on the active backplane bus. Adding or removing active bus modules is not possible during operation.

Controlling

- The configuration of the currently active IM 153-2 applies to the I/O modules of an ET 200M.

- If there is a difference in the configuration of the two IM 153-2, the passive IM 153-2 supplies as input data the fixed value "zero" for all inputs. Only when the configuration is equal does the passive IM 153-2 start to deliver the true input data again.

Configuration modification procedure

Reconfiguration is performed in the following way (example):

1. Make the appropriate modifications to the configuration offline (remove or add module).

   Note

   The parameters of a module can only be changed by making **two** configuration modifications in RUN:

   1. Remove the module.

   2. Add the module with new parameters.

---

2. Switch one master of the redundant system to passive (all slaves are active at the other master).

3. Load the configuration in the master on the passive line and restart the master →
   The parameters and configuration data are loaded in the slave.

4. Switch over to the line with the new configuration →
   The previously loaded configuration now becomes effective. Removed modules are taken out of the data communication and added modules with the new parameters are included in the data communication.

5. The changes are checked by the user.
   If the changes are OK, the new configuration must also be loaded in the second master.
   If the changes are not OK, the previous status can be restored by switching over to the second master (with the old configuration). In this case, the old configuration must be loaded on the first master again.

   Note

   A reconfigured module can be removed and inserted both before and after system modification during operation (RUN). It is first available for the process when it is really inserted and the IM 153-2 that contains the configuration for the module is active.

NOTICE

It is the user's responsibility to ensure that the configuration within the master system is uniform. It is not shown when the two IM 153-2 are running with different configurations. If the two masters in the redundant system have different configurations, a system modification during operation is carried out whenever a switchover is performed.

Interrupts and diagnoses that are generated by the IM 153-2 for an I/O module will be reported by the passive IM 153-2 to the master, even if this module is not available in the configuration of the passive IM 153-2. The user himself must decide to which extent the interrupts and diagnoses from the passive IM 153-2 should be ignored during the period of differing configuration data.

8.6   Isochrone mode

8.6.1   What is Isochronous?

Basics

Reproducible (e.g. equidistant) response times will be realized in the SIMATIC with an equidistant DP bus cycle, the synchronization of the user program to the DP bus cycle and the isochrone transmission of the input / output data to the I/O modules. The isochrone parts of the user program will be worked off via the synchronous cycle interrupts (OB 61 to OB 64) to the DP bus cycle. The input / output data will be transferred at defined and isochronic intervals via the backplane bus of the DP slave and to the I/O modules and then switched through isochronically up to the "terminal".

This means that in the isochrone mode, the synchronization of all up until now freely running individual cycles is carried out, from the user program in the CPU via the DP cycle on the PROFIBUS subnet, the cycle in the DP slave right up to the cycle in the I/O modules of the DP slaves.

Properties

- In equidistant mode, during start up the transition in the data exchange can be delayed by up to 150 DP cycles compared with operation without the isochrone mode.

- The maximum jitter amounts to 5 µs, if the equidistance cycle of the DP master (clock on the PROFIBUS DP) does not exceed a jitter of 1.3 µs.

  The jitter of the I/O modules of the ET 200M cannot be taken into consideration due to the existing variety.

- In the case of asynchronous events (e.g. inserting and removing, diagnoses and interrupts of the I/O modules) during a cycle the response of the IM 153-2 to the I/O can fail or a greater jitter can occur. It is possible to eliminate the influence of asynchronous events on the jitter by configuring "Back-up periods".

  In order to work with diagnoses and interrupts without cycle failure, the equidistance cycle Tdp must be increased by at least 0.5 ms. Every further increase of the equidistance cycle improves the performance of asynchronous events. As a general guideline for each asynchronous event that is to be processed simultaneously (diagnosis, interrupt, data record) the equidistance cycle must be increased by in each case 0.5 ms.

  After cycle failure, the isochrone mode is automatically reset.

- Nothing can be gained from switching off the response monitoring in isochrone mode.

Note

The output of the IM 153-2 to the I/O modules or the input of the I/O modules to the IM 153-2 takes place in isochrone mode only without active bus modules.

With active bus modules, there is a time offset depending on the slot used by the I/O module in the ET 200M.

Overlapping of Ti and To

A reduction of the system reaction time is attained with the overlapping of Ti and To, meaning that the time from the occurence and detection of an event via the processing up to outputting of a reaction at the outputs is reduced.

This function is only possible with the IM 153-2BAx1 interface modules. Hence these interface modules are capable (with cycle times ≥ 0.5 ms) of supplying data isochronically to the I/O modules via the PROFIBUS DP or of collecting data from the I/O modules.

Requirements

The following requirements must be fulfilled:

- For equidistance cycle ≥ 0.625 ms:
  - Interface module IM 153-2; order number 6ES7153-2BA00-0XB0 as of E01
  - as of *STEP 7* V5.2 or GSD rev. 4

- For equidistance cycle ≥ 0,5 ms:
  - Interface module IM 153-2; order number 6ES7153-2BAx1-0XB0 as of E01
  - as of *STEP 7* V5.4 or GSD rev. 5

- The transmission rate of the PROFIBUS DP is at least 1.5 Mbps (shorter equidistance times can be achieved with higher transmission rates).

- The maximum equidistance cycle is 32 ms.

- The equidistant master must be a DP master of class 1, i.e. a PD / PC cannot be an equidistant master.

- In equidistant mode only one DP master (class 1) can be active on the PROFIBUS DP. Programming devices or PCs (Class 2) can also be connected.

- The isochrone mode can only be activated on the ET 200M if the equidistant bus cycle is enabled on the DP master system and at least one module has been configured with synchronization support.

If the ET 200M is being run on a non-S7 DP master, a stable equidistant operation is then only ensured if the DP master fulfils the following requirements:

- The DP master must be configured with interrupt mode "delayed".
  This way the data transfer is not interrupted. A diagnostic frame is inserted into the next free time window for acyclic jobs.

- The DP master must be working with the repeat strategy "retry next cycle".
  The repetition of a message frame therefore does not take place in the same cycle in which the fault occurred, but in the cycle following.

- The DP master must support the modified target rotation time procedure (in acc. with IEC 61784-1:2002 Ed1 CP 3/1) for further active subscribers.

Otherwise, asynchronous events (such as process interrupts, diagnoses) can cause cycle failures or larger jitters. You can usually assume such failures / greater jitters will occur if asynchronous events occur very frequently.

Optimizing the equidistant time

- An optimization of the periods for the equidistant bus cycle can be achieved through the correct plugging sequence of the I/O modules:

    – Plug the output modules with the longest processing time on the left in the ET 200M.

    – Plug the input modules with the longest processing time on the right in the ET 200M.

    Detailed information can be found in the technical data for the module concerned.

- The greatest delay (configurable) with the digital input / output modules essentially determines the length of the equidistant DP cycle.

    Tip: In isochrone mode, ensure the same delay on all digital modules in the ET 200M station.

- The smaller the input delays are that you set for the digital input modules, the shorter the possible equidistance times will be.

    Tip: If possible, for the digital input modules set an input delay of 0.1 ms.

- In the case of modules which support clock synchronism, the processing time at the module must also be taken into consideration.

- The achievable, minimum equidistant time in the station depends on the number of modules in the ET 200M.

    You can also achieve small equidistance times if you distribute the modules of an ET 200M (with a large number of modules) between two ET 200M stations.

- The equidistance time is reduced if you increase the transmission rate.

    Tip: Set the greatest possible Baud rate.

8.6.2 Configuring the isochrone mode

Procedure

1. Settings on the CPU:

   "Object properties" of the CPU > tab "Synchronous cycle interrupts"

   – Set the CPU synchronous cycle interrupt

   – Select the DP master system being used

   – Select the desired process image partition

   – Recommendation for the delay time:

   Use the default settings.

Memory	Interrupts	Interrupts	Cyclic interrupts	Diagnostics / clock	Degree of
General	Boot	Synchronous cycle interrupts		Cycle / clock memory	Retentive memory

	Priority	DP master system no.	Process image partition(s) (e.g.: 1.4)	Time delay	
OB 61:	25	1 ▼	1	3.000	ms
				Guideline	

Figure 8-21   Synchronous cycle interrupts dialog box

2. Settings on the DP master system:

   "Object properties" of the DP master > tab "General" > button "Properties" > tab "Parameters" > button "Properties" > tab "network settings" > button "Options"

   – Enabling equidistance on the DP master system

   – Set the length of the equidistant DP cycle (max. 32 ms)

   – Set "Times Ti and To same for all slaves" (causes a synchronization of the input / output data for the various DP slaves)

   – The times Ti and To can be set separately.

Recommendation: Adopt the standard settings for Ti and To.

Constant bus cycle time	Network subscriber	Cables

☑ Active equidistant bus cycle

Optimize DP cycle (and Ti, To if necessary):   [Recalculate]

┌─ Number of PDs / OPs / TDs etc. on PROFIBUS ──────────────────┐

Configured: [0]   Overall: [0]

└───┘

                                  Blocks:

Equidistant DP cycle: [8.000 ▲▼] ms   [0.125] ms   [Details …]

(min = 6.000 ms;   max. = 32.000 ms)

┌─ Synchronization of the slaves ──────────────────────────────┐

☑ Times Ti and To are the same for all slaves
    (if not: Set in properties – slaves)

                                   Blocks:

Time Ti (read process values):   [3.5000 ▲▼] ms   [0.0625] ms

(min = 3.4375 ms;   max. = 3.5625 ms)

                                   Blocks:

Time To (output process values):   [3.5000 ▲▼] ms   [0.0625] ms

(min = 0.8125 ms;   max. = 3.5625 ms)

Figure 8-22   Options dialog box

Note

With the button "Recalculation" you can calculate with *STEP 7* a value for the equidistant DP cycle, which takes into account the current PROFIBUS DP.
This value is then automatically entered in the fields "Equidistant DP cycle", "Time Ti (…)" and "Time To (…)".

---

3. Settings on the DP slave:

    "Object properties" of the DP slave > tab "Isochrone mode"

    – Enable "Synchronize DP slave to constant bus cycle time for DP cycle".

    – Enter the times Ti and To (if "Times Ti and To same for all slaves" has not been set on the DP master system). Recommendation: Adopt the standard settings for Ti and To.

    – Select the modules to be synchronized and in the "Addresses" tab assign the process image partition that has been defined in the CPU.
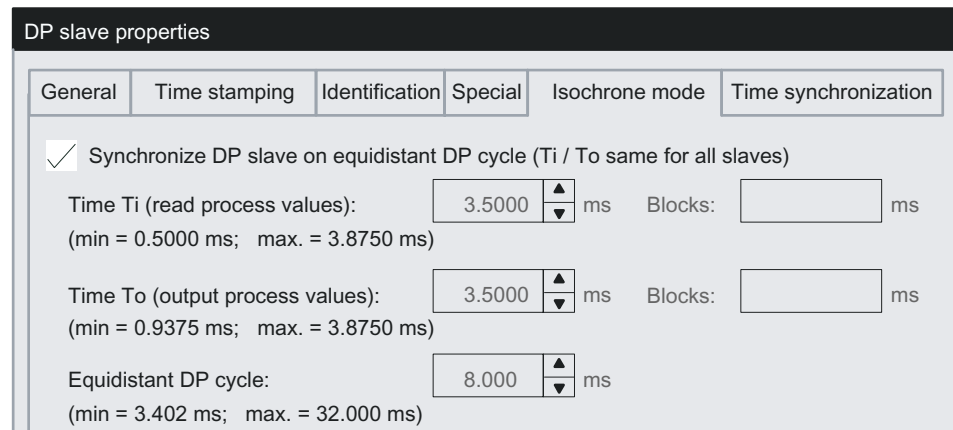
Figure 8-23   DP slave properties dialog box

Note

If, in the "Edit" menu you click on "Isochrone mode", you will be shown a configuration overview of the isochrone modules.

Note

An ET 200M with analog input / output modules does **not** work in isochrone mode if the format of the analog values has been configured as **SIMATIC S5**.

---

4. Setting up a user program:

    – Setting up the OB 61.

    – At the beginning of the OB 61 the SFC 126 must be called in order to update the part process image of the inputs.

    – At the end of the OB 61 the SFC 127 must be called in order to update the part process image of the outputs.

    – Here, use the part process image that has been configured in the CPU ("Synchronous cycle interrupts" tab).

Configuring overlapping of Ti and To

With IM 153-2BAx1 in isochrone mode you can also configure an overlapping of the Ti and To.

Configuring with STEP 7:

The configuration takes place as described above. In addition you can configure an overlapping of the Ti and To.

To do this, carry out the following deviating settings:

1. Parameterization of the DP master system:

   Disable the **Times Ti and To are the same for all slaves** check box.

2. Parameterization of the DP slave:

   For each slave enter the times for Ti and To separately.

   An overlapping Ti and To is given if Ti + To > Tdp. *STEP 7* checks the values you have entered for feasibility.

To locate reserves you can visualize the chronological sequences with the aid of a calculation table. In the result you can optimize the sequences accordingly. The table can be found on the Internet (http://support.automation.siemens.com/WW/view/en/23876584).

Note

Liability disclaimer

Siemens AG shall not be held liable for any damages resulting from the use of the calculation table; particularly for damage to persons, property or assets that are considered consequential damages resulting directly or indirectly in connection with the use of the calculation table.

We offer no support for the application of the calculation table.

Parameterization with GSD configuring:

If you have configured the IM 153-2BAx1 via the GSD file, you can use a calculation table to optimally adapt the configuration being used. The table can be found on the Internet (http://support.automation.siemens.com/WW/view/en/23876584).

Note

Disclaimer of liability

Siemens AG shall not be held liable for any damages resulting from the use of the calculation table; particularly for damage to persons, property or assets that are considered consequential damages resulting directly or indirectly in connection with the use of the calculation table.

We offer no support for the application of the calculation table.

Time when using active bus modules

> **Note**
>
> With IM 153-2 (6ES7153-2BAxx-0XB0) the use of active bus modules for an isochronic operation is not intended as the synchronization conditions for this application case are only fulfilled module-granular.
> However, if active bus modules are to be used, the user must incorporate in each case a time of 0.5 ms for Ti and To and therefore an equidistant DP cycle of 1 ms.

Additional information

For further information about the isochronous mode please refer to the *STEP 7* Online Help and the "Isochronous (http://support.automation.siemens.com/WW/view/en/15218045)" Function Manual.

8.7 Identification and maintenance data (I&M data)

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
- troubleshooting 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 on the module and can only be read.

Maintenance data (M data) is system-dependent information, like for example, location and date of location. M data is created during the configuration and written to the module.

The modules can be uniquely identified in online mode by means of the I&M data.

8.7.1   I&M data for PROFIBUS DP

As of IM 153-2Bx00 this data is available on the ET 200M.

Note

Only one DP master can access the I&M data of an ET 200M at any one point.

Reading and writing the I&M data with STEP 7

In *STEP 7* the I&M data are displayed in the tabs "Module state – IM 153-2" and "DP Slave properties" (see online help for *STEP 7*).

In the HW Config you can enter the modules M data (e.g. in a dialog box during the configuration).

The access to the I&M data takes place in accordance with the IEC 61158-6 standard.

In the H system the interface module from which the I&M data is to be read must be available online.

Reading and writing the I&M data without STEP 7

If you wish to use the I&M data without using *STEP 7*, you must carry out the data access in accordance with the specifications of the PROFIBUS Guideline – Order No. 3.502, Version 1.1 May 2003.

In the H system the interface module from which the I&M data is to be read must be addressed (slot 245 or 246). Slot 245 labels the left interface module, slot 246 the right interface module on the BM IM/IM.

Example for reading the I&M data

The user can access specific I&M data via **Read data record**. A two-level access is necessary for this:

1. Data record 248 has a directory in which the associated data record numbers are given for the various
   indices (refer to the following table).

Table 8- 9   DS 248 configuration for the ET 200M

Contents	Length (bytes)	Coding (hex)
Header information		
ID of the contents list	2	00 01
Index of the contents list	2	00 00
Length of the following blocks in bytes	2	00 08
Number of blocks	2	00 05
Block information for the I&M data		
SZL-ID	2	F1 11
relevant data record number	2	00 E7
Length of the data record	2	00 40
Index	2	00 01
SSL-ID	2	F1 11
relevant data record number	2	00 E8
Length of the data record	2	00 40
Index	2	00 02
SSL-ID	2	F1 11
relevant data record number	2	00 E9
Length of the data record	2	00 40
Index	2	00 03
SSL-ID	2	F1 11
relevant data record number	2	00 EA
Length of the data record	2	00 40
Index	2	00 04
8-byte block information for additional data record objects		
	Σ: 48	

2. You can find the part assigned to the respective index
   of the I&M data under the associated data record number (see table below: *Configuration of the I&M-data*).

All data records which contain I&M data have a length of 64 bytes.

The data records are structured in accordance with the following principle.

Table 8- 10   Data record structure with I&M data

Contents	Length (bytes)	Coding (hex)
Header information		
SSL-ID	2	F1 11
Index	2	00 0x
Length of the I&M data	2	00 38
Number of blocks with I&M data	2	00 01
I&M data		
Index	2	00 0x
I&M data for the respective index (see following table)	54	

Configuration of the I&M-data

The data structure of the I&M data corresponds to the specifications of the PROFIBUS Guideline - Order No. 3.502, Version 1.1 May 2003.

Table 8- 11   Configuration of the I&M-data

I&M data	Access	Default	Description
Identification data 0: Index 1 (data record 231)			
MANUFACTURER_ID	read (2 bytes)	2A hex (= 42 dec)	This is where the name of the manufacturer is saved. (42 dec = SIEMENS AG)
ORDER_ID	read (20 Byte)	depending on the module	This is where the order number of the module is saved.
SERIAL_NUMBER	read (16 Byte)	depending on the module	Storage location of the module's serial number. The number allows the unambiguous identification of the module.
HARDWARE_REVISION	read (2 bytes)	depending on the module	This is where the version of the module is saved. Increments when the version number or firmware of the module alters.
SOFTWARE_REVISION	read (4 Byte)	Firmware version	Shows the module's firmware version. If the firmware version increments, then the version of the module also increases (HARDWARE_REVISION).
REVISION_COUNTER	read (2 bytes)	0000 hex	reserved
PROFILE_ID	read (2 bytes)	F600 hex	Generic device
PROFILE_SPECIFIC_TYPE	read (2 bytes)	0005 hex	on interface modules
IM_VERSION	read (2 bytes)	0101 hex	Shows the I&M data version. (0101 hex = Version 1.1)

I&M data	Access	Default	Description
IM_SUPPORTED	read (2 bytes)	000E hex	Shows information about the I&M data. (Index 2 to 4)
Maintenance data 1: Index 2 (data record 232)			
TAG_FUNCTION	read / write (32 bytes)	–	Here enter a unique identification (applicable throughout the system) for the module.
TAG_LOCATION	read / write (22 bytes)	–	Enter the location of the module here.
Maintenance data 2: Index 3 (data record 233)			
INSTALLATION_DATE	read / write (16 Byte)	–	Enter the installation date and, if necessary, the respective time for the module.
RESERVED	read / write (38 Byte)	–	reserved
Maintenance data 3: Index 4 (data record 234)			
DESCRIPTOR	read / write (54 Byte)	–	Enter a comment regarding the module here.

Changes in view of the former I&A data

Some of the content in the identification data for the I&A data has been amended in accordance with the PROFIBUS Guideline. The access mechanism to the I&A data has been supplemented in accordance with the PROFIBUS Guideline.

8.7.2   I&M data for PROFINET IO

Reading of identification data

In *STEP 7*, the identification data are displayed in the "Module Information - IM 153" and "Properties ..." tabs (see *STEP 7* Online Help).

You can directly access specific identification data by selecting **Read data record**. Obtain the corresponding part of the identification data under the associated data record index.

The data records are structured as follows:

Table 8- 12   Basic structure of data records with I&M data

Contents	Length (bytes)	Coding (hex)
Header information		
BlockType	2	I&M0: 0020 I&M1: 0021 I&M2: 0022 I&M3: 0023
BlockLength	2	I&M0: 0038 I&M1: 0038 I&M2: 0012 I&M3: 0038
BlockVersionHigh	1	01
BlockVersionLow	1	00
Identification data		
Identification data (see table below)	I&M0 / Index AFF0: 54 I&M1 / Index AFF1: 54 I&M2 / Index AFF2: 16 I&M3 / Index AFF3: 54	

The data structures in the data records correspond to the PROFINET IO definitions.

Table 8- 13   Structure of I&M data

I&M data	Access	Default	Description
Identification data 0: (data record index AFF0 hex)			
VendorIDHigh	read (1 bytes)	00 hex	This is where the name of the manufacturer is saved. (42 dec = SIEMENS AG)
VendorIDLow	read (1 bytes)	2A hex	
Order_ID	read (20 bytes)		Order number of the module
IM_SERIAL_NUMBER	read (16 bytes)	-	Serial number (device specific)
IM_HARDWARE_REVISION	read (2 bytes)	1	Corresponding hardware version
IM_SOFTWARE_REVISION	read	Firmware version	Indicates the firmware version of the module.
• SWRevisionPrefix	(1 byte)	V, R, P, U, T	
• IM_SWRevision_Functional_ Enhancement	(1 byte)	00 - FF hex	
• IM_SWRevision_Bug_Fix	(1 byte)	00 - FF hex	
• IM_SWRevision_Internal_ Change	(1 byte)	00 - FF hex	

I&M data	Access	Default	Description
IM_REVISION_COUNTER	read (2 bytes)	-	Provides information on parameter modifications on the module.
IM_PROFILE_ID	read (2 bytes)	0000	Generic device
IM_PROFILE_SPECIFIC_TYPE	read (2 bytes)	0005 hex	on interface modules
IM_VERSION	read	0101 hex	Provides information about the version of the identification data. (0101 hex = Version 1.1)
• IM_Version_Major	(1 byte)		
• IM_Version_Minor	(1 byte)		
IM_SUPPORTED	read (2 bytes)	000E hex	Provides information about the available identification data. (I&M1 to I&M3)
Maintenance data 1: (data record index AFF1 hex)			
IM_TAG_FUNCTION	Read / write (32 bytes)	-	Define a unique identifier for the module in this record.
IM_TAG_LOCATION	Read / write (22 bytes)	-	Define the installation location of the module.
Maintenance data 2: (data record index AFF2 hex)			
IM_DATE	Read / write (16 bytes)	YYYY-MM-DD HH:MM	Enter the installation date of the module here.
Maintenance data 3: (data record index AFF3 hex)			
IM_DESCRIPTOR	Read / write (54 bytes)	-	Define a comment describing the module in this record.

Further explanations about identification and maintenance data can be found in the "From PROFIBUS DP to PROFINET IO (http://support.automation.siemens.com/WW/view/en/19289930)" programming manual under chapter "Identification and maintenance".

8.8 Direct data exchange

As of *STEP 7* V 5.0 you can configure direct communication for the PROFIBUS nodes. The IM 153-x interface modules can take part in the direct data exchange as a sender (publisher).

Principle

Direct communication is characterized by the fact that the PROFIBUS DP subscribers "listen in" to find out which data a DP slave is sending back to its DP master.

This mechanism allows the "listening node" (recipient) direct access to deltas of input data of remote DP slaves.

During configuration in *STEP 7*, you use the respective I/O input addresses to specify the address area of the receiver where the sender's data are to be read.

Example

The figure below gives an example of the direct data exchange relationships you can configure with an ET 200M as the sender and the nodes that can "listen in" as possible receivers.
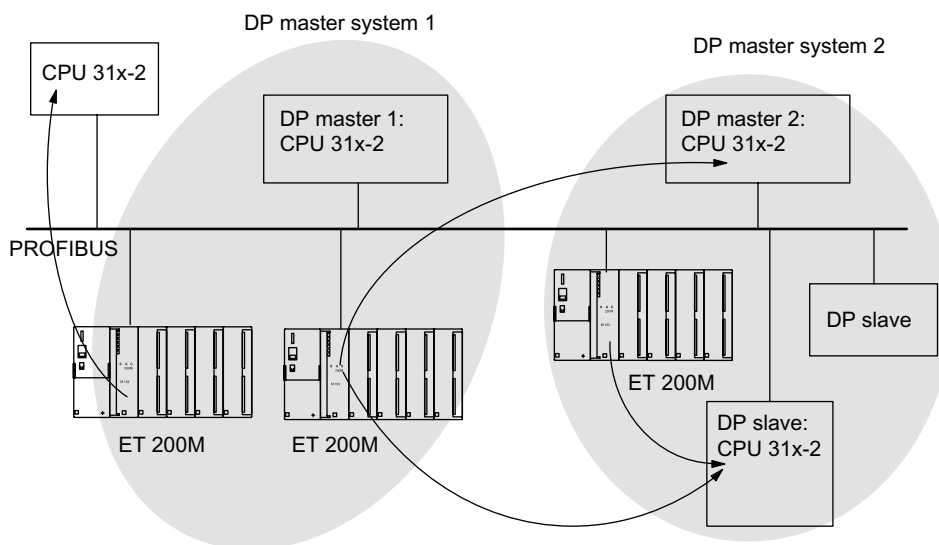
Figure 8-24   Direct data exchange with the IM 153-x

Note

The interface module IM 153-2 supports as of 6ES7153-2BA01-0XB0, firmware version V4.0.0, the safety related I-Slave-Slave-Communication via PROFIBUS DP for the fail-safe module. For information on this functions, refer to the "S7 distributed safety, configuring and programming (http://support.automation.siemens.com/WW/view/en/22099875)" manual.

8.9 SNMP

The Simple Network Management Protocol (SNMP) is the standardized protocol for diagnosing and configuring the Ethernet Network infrastructure. SNMP-based applications can be operated parallel to applications with PROFINET on the same network.

Properties

The IM 153-4 PN supports the SNMP Ethernet service. LLDP-MIB and MIB-2 (RFC1213) are supported. R / W objects can be changed using SNMP tools and are saved in the module.

Following replacement with a factory-new module, the R / W objects of the interface module are set to factory settings.

Resetting SNMP parameters to factory settings

NOTICE
When factory settings are restored, the stations in a line can fail.

"Reset to factory settings" is only possible if the IO device is not exchanging data with an IO controller.

To reset retentively-stored SNMP parameters to factory settings (*STEP 7* V5.4 SP 2 and higher), select **Target system > Ethernet > Edit Ethernet node** and press the **Reset** button under **Reset to factory settings**.

The following data is **not** deleted when resetting:

- The MAC address
- I&M data

Note

With the IM153-4AA01 interface module it is possible to reset to factory settings also during the data exchange with a controller. The station is unavailable during this resetting.

The maintenance data 1, 2 and 3 (I&M1, I&M2 and I&M3) are also reset with this interface module.

Note

Deleting the device name

The device name is deleted after resetting to factory settings

Having deleted the device name you can then assign a new device name. Open the properties dialog box of the interface module in HW Config. Confirm the properties dialog box without entering a device name in the "Assign device name" field.

Interrupt, error and system messages

<div style="text-align: right; font-size: 3em;">9</div>

9.1 PROFIBUS DP

9.1.1 Diagnostics with LED display

Status and error displays of the IM 153-1

SF	SF	Group	error	Red
BF	BF	Error on the	PROFDP	Red
ON	ON	Supply voltage available	Green

Table 9- 1

LEDs			Meaning	Remedy
SF	BF	ON		
off	off	off	No voltage on the IM 153-1 or there is a hardware fault with the IM 153-1.	Switch on the power supply module or replace the IM 153-1.
*	*	On	There is voltage on the IM 153-1.	—
*	flashes	on	IM 153-1 is incorrectly configured - no data exchange is taking place between the DP master and the IM 153-1. Causes: • Configured and set PROFIBUS address is incorrect • Faults on the bus	• Check the IM 153-1. • Check the configuration and parameter settings. • Check the PROFIBUS address on the IM 153-1 and in the STEP 7 project. • Check the cable length with reference to the baud rate. • Check the settings for the terminating resistors.
*	on	on	no connection to the DP master (search baud rate) Causes: • the bus communication via PROFIBUS DP to the IM 153-1 has been interrupted	Check the bus configuration. • Check to see if the bus connector is inserted properly. • Check whether the bus cable to the DP master is defective. • Switch off and on the on / off power switch for the 24 V DC on the power supply module.
on	flashes	on	The configured structure of the ET 200M doesn´t tally with the actual structure of the ET 200M	Check the PROFIBUS address and the configuration of the ET 200M to see if a module is missing, faulty or if there is a non-configured module. Check the configuration (e.g. with *COM PROFIBUS* or *STEP 7*).

LEDs			Meaning	Remedy
SF	BF	ON		
on	off	on	inadmissible PROFIBUS address Is the SF LED of an SM / FM also lit? • If so: Error or diagnosis in an S7 300 module • If not: IM 153-1 is faulty.	On the IM 153-1 set a valid PROFIBUS address (1 to 125) Check the SM / FM with the diagnostics. Replace the S7-300 module or the IM 153-1 or contact your Siemens representative.
off	off	on	There is data exchange between the DP master and the ET 200M. The preset configuration and actual configuration of the ET 200M match.	—
* not relevant				

Status and error displays of the IM 153-2

IM 153-2AA02/-2AB01   IM 153-2Bx00   IM 153-2Bxx1

SF	Group error	Red
BF / BF 1	Error on the PROFIBUS DP	Red
BF 2	Error on the underlaid bus (irrelevant for ET 200M)	Red
ACT	Module active (only in redundant mode)	Yellow
ON	Supply voltage available	Green

Table 9- 2

LEDs				Meaning	Remedy
SF	BF / BF1	ACT	ON		
off	off	off	off	No voltage on the IM 153-2 or there is a hardware fault with the IM 153-2.	Switch on the power supply module or replace the IM 153-2.
*	*	*	on	There is voltage on the IM 153-2. IM 153-2 is functioning.	—
on	off	off	off	IM 153-2 is undergoing a hardware reset after switching on	—
on	on	on	on	Hardware test after switching on	—
on	on	off	off	The operating system update is running	—
off	flashes at 0.5 Hz	off	off	The operating system update has concluded successfully	with IM 153-2Bx00: remove the SIMATIC Micro Memory card and switch off the IM 153-2.
on	flashes at 0.5 Hz	off	off	external error, e.g. unsuitable operating system or SIMATIC Micro Memory card	Use a suitable operating system for the update. Do not remove the SIMATIC Micro Memory card during the update (only with IM 153-2Bx00).
on	flashes at 2 Hz	off	off	internal error, e.g. when writing the update files	Repeat the update process. If the LEDs indicate an error, the internal memory is faulty.

LEDs				Meaning	Remedy
SF	BF / BF1	ACT	ON		
*	flashes	off	on	IM 153-2 is incorrectly configured - no data exchange is taking place between the DP master and the IM 153-2. Causes: • PROFIBUS address is incorrect • Faults on the bus.	• Check the IM 153-2. • Check the configuration and parameter settings. • Check the PROFIBUS address on the IM 153-2 and in the STEP 7 project. • Check the cable length with reference to the baud rate. • Check the settings for the terminating resistors.
*	on	off	on	no connection to the DP master (search baud rate) Causes: • the bus communication via PROFIBUS DP to the IM 153-2 has been interrupted	Check the bus configuration. • Check to see if the bus connector / FOC is inserted properly. • Check whether the bus cable / FOC to the DP master is defective. • Switch off and on the on / off power switch for the 24 V DC on the power supply module.
on	flashes	off	on	The configured structure of the ET 200M doesn´t tally with the actual structure of the ET 200M	Check the configuration of the ET 200M to see if a module is missing, faulty or if there is a non-configured module. Check the configuration (e.g. with *COM PROFIBUS* or *STEP 7*).
on	off	off	on	inadmissible PROFIBUS address Is the SF LED of an SM / FM also lit? • If so: Error or diagnosis in an S7 300 module • If not: IM 153-2 is faulty.	On the IM 153-2 set a valid PROFIBUS address (1 to 125) Check the SM / FM with the diagnostics. Replace the S7-300 module or the IM 153-2 or contact your Siemens representative.
*	off	on	on	The IM 153-2 is exchanging data with the DP master and the I/O modules of the ET 200M. In redundant mode this IM 153-2 is the **active** one of the ET 200M.	—
*	off	off	on	There is voltage on the IM 153-2. In redundant mode this IM 153-2 is the **passive** one, i.e. no data exchange with the I/O modules.	—
flashes at 0.5 Hz **	off	off	on	In redundant mode, this IM 153-2 is the **passive**, and is not ready for a fault-free changeover (e.g. associated CPU in STOP mode).	Switch the H system to redundant mode.

LEDs				Meaning	Remedy
SF	BF / BF1	ACT	ON		
flashes	flashes	flashes	flashes	The IM 153-2 in the current operating mode is not compatible with the redundant IM 153-2.	You will find information on compatibility between the versions of IM 153-2 in the chapter "Arrangement of the modules for the function "Change During Operation" and / or "Redundancy" (Page 44)" as well as in appendix "Compatibilities between the IM 153-x (Page 241)".
* not relevant					
** After the transition to the redundant mode the SF LED flashes for a further 20 s.					

9.1.2 Diagnosis with STEP 7 or STEP 5

Slave diagnosis

The slave diagnosis behaves in accordance with the IEC 61784-1:2002 Ed1 CP 3/1 standard. It can be read using *STEP 7* or *STEP 5* for all DP slaves (dependent on the DP master) which behave in accordance with the standard.

Possibilities for reading the diagnosis

Table 9- 3   Reading the diagnosis with STEP 7 and STEP 5

Automation system with DP master	Block or tab in *STEP 7*	Application	See ...
SIMATIC S7 / M7	"DP slave diagnosis" tab	Show slave diagnosis in clear text on the *STEP 7* interface	"Diagnose hardware" in the online help for *STEP 7*
	SFC 13 "DPNRM_DG"	Read out slave diagnostics information (stored in the data area of the user program)	Refer to chapter "Structure of the diagnostics (Page 191)" SFC refer to the reference manual "System and Standard Functions for S7-300/400 (http://support.automation.siemens.com/WW/view/en/1214574)"
	SFC 59 "RD_REC"	Read data records of the S7 diagnosis (stored in the data area of the user program)	
	FB 125 / FC 125	Evaluate the slave diagnosis	on the Internet (http://support.automation.siemens.com/WW/view/en/387257)
	SFB 52	Read data record from the DP slave	*STEP 7* online help
	SFB 54	Receive interrupts from the interrupt OBs	
SIMATIC S5 with IM 308-C as DP master	FB 192 "IM308C"	Reading out slave diagnostics information (storing in the data area of the user program) **Note**: not for enhanced diagnostics	Refer to chapter "Structure of the slave diagnostics (Page 191)" FB refer to the "ET 200 Distributed I/O System (http://support.automation.siemens.com/WW/view/en/1142470)" manual
SIMATIC S5 with S5 95U as a DP master	FB 230 "S_DIAG"		

Note

For more information on reading out diagnostics information, refer to the "SIMATIC software, programming with STEP 7 V5.x. (http://support.automation.siemens.com/WW/view/en/18652056)" manual.

Example for reading the S7 diagnosis with SFC 13 "DPNRM_DG"

Here you will find an example of how to use the SFC 13 to read the slave diagnosis for a DP slave in the *STEP 7* user program.

Assumptions

The following assumptions apply to this *STEP 7* user program:

- The diagnosis address of the ET 200M is 1022 ($3FE_H$).

- The slave diagnosis should be stored in the DB 82:
  as of address 0.0, length 64 bytes.

- The slave diagnosis consists of 64 bytes.

STEP 7 user program

STL	Description
CALL SFC 13	
REQ :=TRUE	Read request
LADDR :=W#16#3FE	Diagnosis address of the ET 200M
RET_VAL := MW 0	RET_VAL of SFC 13
RECORD :=P#DB82.DBX 0.0 BYTE 64	Data record for the diagnosis in the DB 82
BUSY :=M2.0	Reading process runs through several OB 1 cycles

Example for reading the slave diagnosis 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

The following assumptions apply to this *STEP 5* user program:

● The IM 308-C connection as a DP master occupies the frames 0 ... 15 (number 0 of the IM 308-C).

● The DP slave has the PROFIBUS address 3.

● The slave diagnosis should be stored in the DB 20. You can also use any other data block for this.

● The slave diagnosis consists of 29 bytes.

STEP 5 user program

STL			Description
	:A	DB 30	
	:SPA	FB 192	
Name	:IM308C		
DPAD	:	KH F800	Default address area for the IM 308-C
IMST	:	KY 0, 3	IM no. = 0, PROFIBUS address of the DP slave = 3
FCT	:	KC SD	Function: Read slave diagnosis
GCGR	:	KM 0	is not evaluated
TYPE	:	KY 0, 20	S5 data area: DB 20
STAD	:	KF +1	Diagnosis data as of data word 1
LENG	:	KF –1	Diagnosis length = joker length (all permissible bytes)
ERR	:	DW 0	Error code storage in the DW 0 of the DB 30

9.1.3   Structure of the diagnosis

9.1.3.1   Structure of slave diagnosis

Structure of the slave diagnostics for IM 153-1AAx3; -2AA02; -2AB01; -2Bx00; -2Bxx1
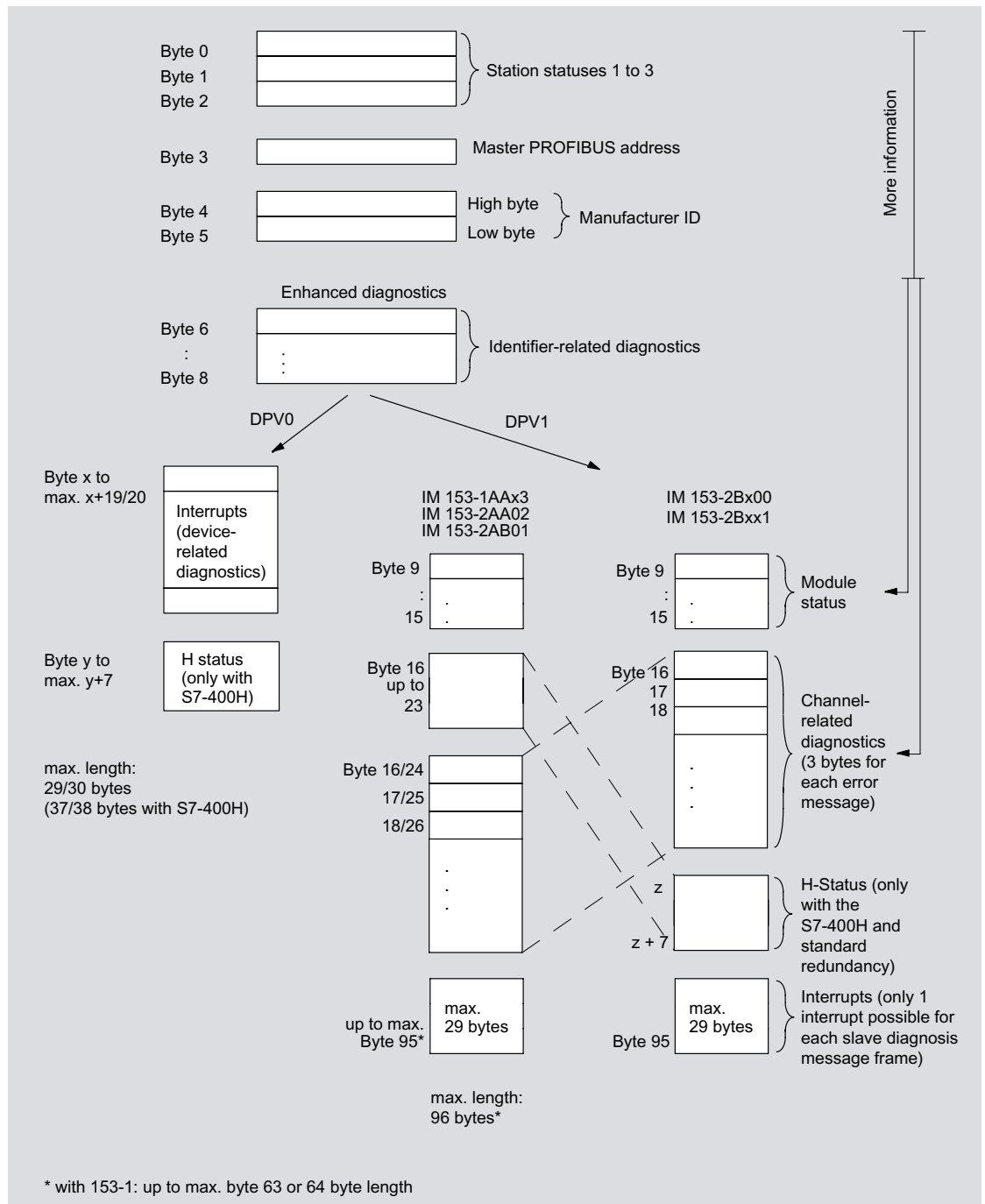
Figure 9-1   Structure of the slave diagnostics for IM 153-1AAx3; -2AA02; -2AB01; -2Bx00; -2Bxx1

Diagnostics with the IM 153-2BAx2

The IM 153-2 interface module (order number 6ES7153-2BAx2-0XB0 and higher) supplies the same diagnostics information as the existing IM 153-2 interface module. The maximum length of the diagnostics is now 130 bytes. Due to the 12 available slots, the IM 153-2BAx2 has a partially expanded diagnostic structure. In addition, the length of the diagnostic interrupt has been expanded.

The following changes have been made in the diagnostics:

- The identifier-related diagnostics information comprises 3 bytes, same as previously. Byte 8 contains an additional 4 bits for the new slots (slots 12 to 15).

- The module status is 1 byte longer and now comprises 8 bytes. Slots 12 to 15 now contain 2 new bits each.

- The diagnostic interrupt can have a maximum of 63 bytes.

Structure of the slave diagnostics with IM 153-2BAx2

Byte 0	
Byte 1	Station status 1 to 3
Byte 2	
Byte 3	Master PROFIBUS address
Byte 4	High-Byte
Byte 5	Low-Byte — Manufacturer ID

Expanded diagnostics

Byte 6
:
Byte 8 — Identifier-related diagnostics

DPV1

Byte 9
:
Byte 15 — Module status
Byte 16

Byte 17
Byte 18
Byte 19 — Channel-specific diagnostics (3 bytes per error message)
.
.
.

Byte z
Byte z + 7 — H Status (only with the S7-400H and standard redundancy)

Byte 129 — Max. 63 Byte — Interrupts (only 1 interrupt per slave diagnostic frame is possible)

☐ Newly assigned bits

Figure 9-2   Structure of the slave diagnostics with IM 153-2BAx2

Slave diagnosis in accordance with standard

The IM 153-x makes available to you the slave diagnosis in accordance with the standard. Observe the differences in the diagnostic frame in dependence on the version of the IM 153-x and of the general version.

In dependence on the DP master and the configuration the interface module
IM 153-1 as of 153-1AA03, module version 02, GSD-Version V1.18;
IM 153-1 as of 153-1AA83, module version 01, GSD-Version V1.18;
IM 153-2 as of 153-2AA02, module version > 06, GSD-Version V1.9;
IM 153-2 FO as of 153-2AB01, module version > 05 , GSD-Version V1.5;
IM 153-2 as of 153-2BA00, module version ≥ 01, GSD-Version V1.0;
IM 153-2 FO as of 153-2BB00, module version ≥ 01, GSD-Version V1.0
IM 153-2 as of 153-2BA01, module version ≥ 01, GSD-Version V1.0;
IM 153-2 as of 153-2BA81, module version ≥ 01, GSD-Version V1.0;
 provide an enhanced diagnosis. Here, in the diagnostic frame you will find detailed information in the form of the module status and channel-specific diagnoses (refer to figure above).

Information on "enhanced diagnosis"

To be able to use the channel-related diagnosis, you must enable the diagnostic interrupts for each I/O module of the configuration.

When configuring the IM 153-x you can enable or block the diagnostic, process and removal insertion interrupts and you can do this independently of the enabling of "enhanced diagnosis".

Via the DPV1 parameter (as of GSD rev. 3) you can block or enable the individual blocks of the enhanced diagnosis. Blocked diagnoses will be removed from the diagnostic frame.

Important: If you have enabled "enhanced diagnosis" during the configuration and a diagnostic interrupt is triggered for a module only whilst the ET 200M is running, a channel error will not be immediately entered in the diagnostic frame. Only after the triggering of the first diagnostic interrupt of the module, generated after enabling, is a channel error entered in the diagnostic frame .
In order to delete channel errors from the diagnostic frame you must switch off the "enhanced diagnosis" in the configuration.

IM 153-2Bx00 and IM 153-2Bxx1

With IM 153-2Bx00 and IM 153-2Bxx1 the enhanced diagnosis is available as default in the DPV0 / DPV1 mode. It can be deselected (switched off) in blocks during the configuration.

9.1.3.2 Station statuses 1 to 3

Definition

The stations status 1 to 3 provides an overview of the status of a DP slave.

Station status 1

Table 9- 4   Structure of station status 1 (Byte 0)

Bit		Meaning	Cause / remedy
0	1:	The DP slave cannot be addressed by the DP master. The bit in the DP slave is always 0.	• Is the correct PROFIBUS address set on the DP slave? • Bus connector / FOC connected? • Voltage on DP slave? • RS 485 repeater set correctly? • Has a reset been performed on the DP slave (switch off / switch off)?
1	1:	DP slave is not ready for the data exchange.	• Wait for the DP slave to complete start-up.
2	1:	The configuration data sent to the DP slave by the DP master does not match the actual configuration of the DP slave.	• Correct station type or correct configuration of the DP slave entered in the configuration software?
3	1:	External diagnostics available.	• Evaluate the identifier-related, module status and / or channel-related diagnosis. As soon as all errors are remedied the bit 3 is reset. The bit is reset when there is a new diagnostic message in the bytes of the diagnostics indicated above.
4	1:	The requested function is not supported by the DP slave.	• Check the configuration.
5	1:	The DP master cannot interpret the response of the DP slave.	• Check the bus configuration.
6	1:	DP slave type does not correspond to the software configuration.	• Was the configuration software set for the correct station type?
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 PROFIBUS address of the DP master that configured the DP slave is located in the "Master PROFIBUS address" diagnostic byte.

Station status 2

Table 9- 5   Structure of station status 2 (Byte 1)

Bit		Meaning
0	1:	The DP slave must be reconfigured.
1	1:	The slave is in start-up phase.
2	1:	The bit in the DP slave is always "1".
3	1:	Response monitoring has been enabled for this DP slave.
4	1:	The DP slave has received the "FREEZE" control command.
5	1:	The DP slave has received the "SYNC" control command.
6	0:	The bit is always at 0.
7	1:	The DP slave is deactivated, that is to say, it has been removed from the current processing.

Station status 3

Table 9- 6   Structure of station status 3 (Byte 2)

Bit		Meaning
0 to 6	0:	The bits are always at "0".
7	1:	There are more channel-specific diagnostic messages than can be represented in the diagnostic frame.

9.1.3.3   Master PROFIBUS address

Definition

The PROFIBUS address of the
DP master is stored in the master PROFIBUS address diagnostic byte:

- which the DP slave has configured and

- has read and write access to the DP slave.

The master PROFIBUS address is located in byte 3 of the slave diagnosis.

FF_H in byte 3

If the value FF_H in byte 3 is given as the master PROFIBUS address, the DP slave is not configured by the DP master.

9.1.3.4 Manufacturer ID

Definition

The manufacturer ID contains a code that describes the type of the DP slave.

Manufacturer ID

Table 9- 7 Structure of the manufacturer ID (Bytes 4, 5)

Byte 4	Byte 5	Manufacturer ID for
80$_H$	1D$_H$	IM 153 / IM 153-1
80$_H$	1E$_H$	IM 153-2
80$_H$	71$_H$	IM 153-2 FO

9.1.3.5 Evaluating the slave diagnosis

The following figure shows a procedure for evaluating the slave diagnosis in a systematic manner. If, during the configuration, you have not deselected any diagnosis, the specified byte addresses shall apply. If individual diagnoses have been deselected, move the byte addresses accordingly.
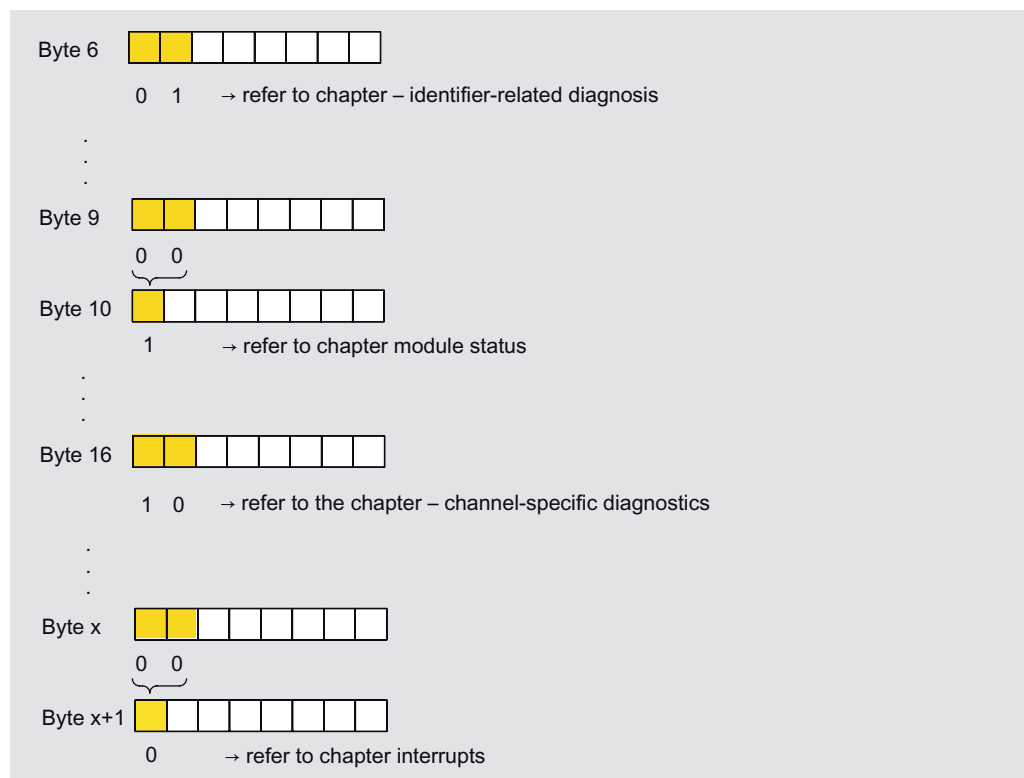
Figure 9-3 Evaluating the slave diagnosis

9.1.3.6   Identifier-related diagnosis

Definition

The identifier-related diagnosis states whether modules of the ET 200M are faulty. The ID-related diagnosis starts at byte 6 and comprises 3 bytes.

Structure of the identifier-related diagnosis

The module status for the ET 200M is structured as follows:
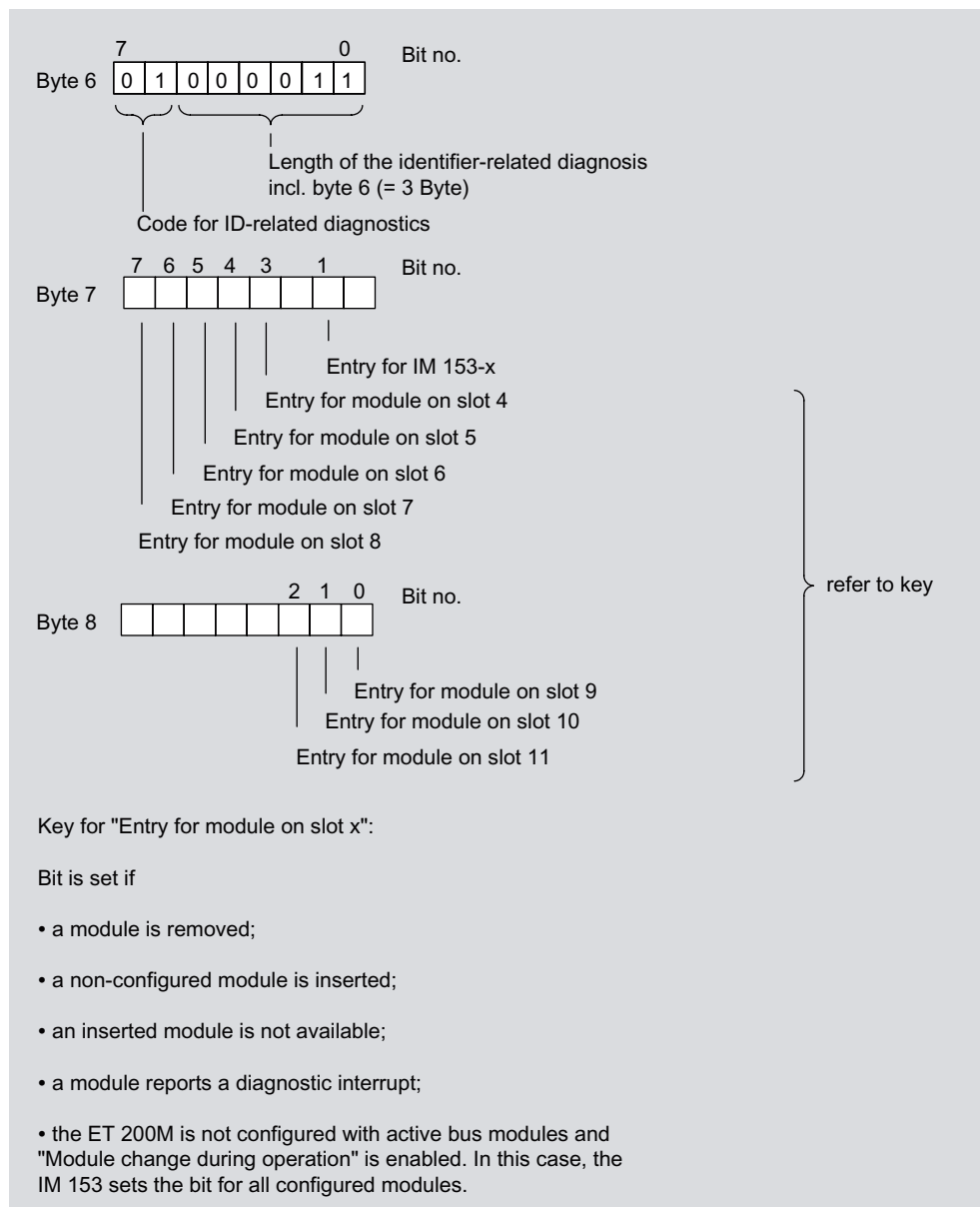
Figure 9-4   Structure of the identifier-related diagnosis

9.1.3.7 Module status

Definition

The module status reflects the status of the configured modules and represents a detailed ID-specific diagnosis with respect to the configuration. The module status starts with the diagnostics and consists of a maximum of 7 bytes.

The module status is then only included in the diagnostic frame if you have enabled "enhanced diagnosis" in the configuration.

Module status

The module status for the ET 200M is structured as follows:
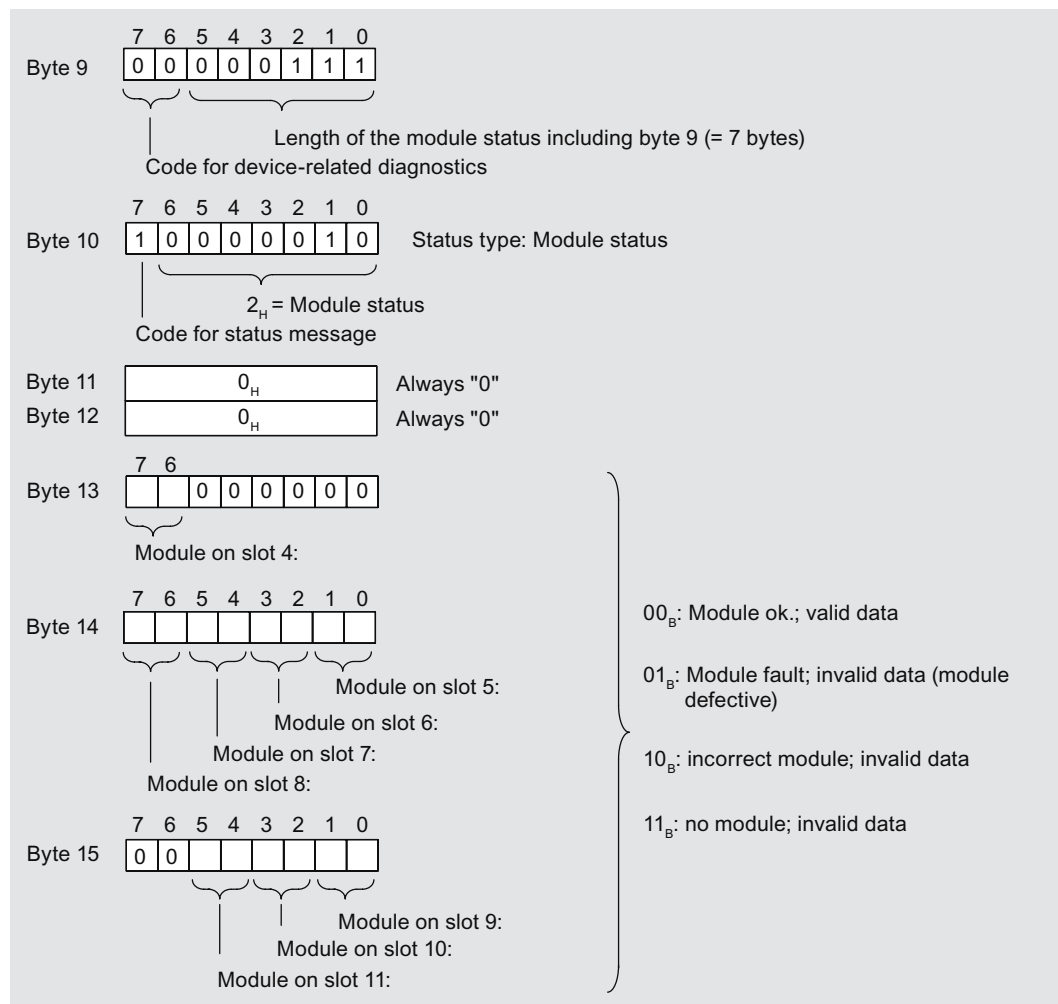
Figure 9-5   Configuration of the module status for the ET 200M

9.1.3.8   Channel-specific diagnostics

Definition

The channel-related diagnosis gives information about channel errors of modules and represents detailed information for the identifier-related diagnosis.

The channel-related diagnosis starts according to the module status or the H status.

The channel-related diagnosis does not influence the module status.

Important: the diagnostic interrupt must be switched on for each module!

Channel-releated diagnostics

The channel-related diagnosis is then included in the diagnostic frame only if you have enabled "enhanced diagnosis" in the configuration. The maximum number of channel-related diagnoses is restricted by the maximum overall length of the slave diagnosis of 64 bytes with IM 153-1 or 96 bytes with IM 153-2. The length of the slave diagnosis depends on the number of current channel-specific diagnosis.

Tip: If, when configuring the ET 200M, you block the interrupts, then up to 29 bytes interrupt part is also available for the channel-related diagnoses.

Note

Errors that affect all the channels of a module (e.g. the supply voltage of the module fails) will be portrayed in the channel-related diagnosis only on channel 0.

This then reduces the number of channel-related diagnoses and prevents a "diagnostic overflow".

Structure of the channel-related diagnostic
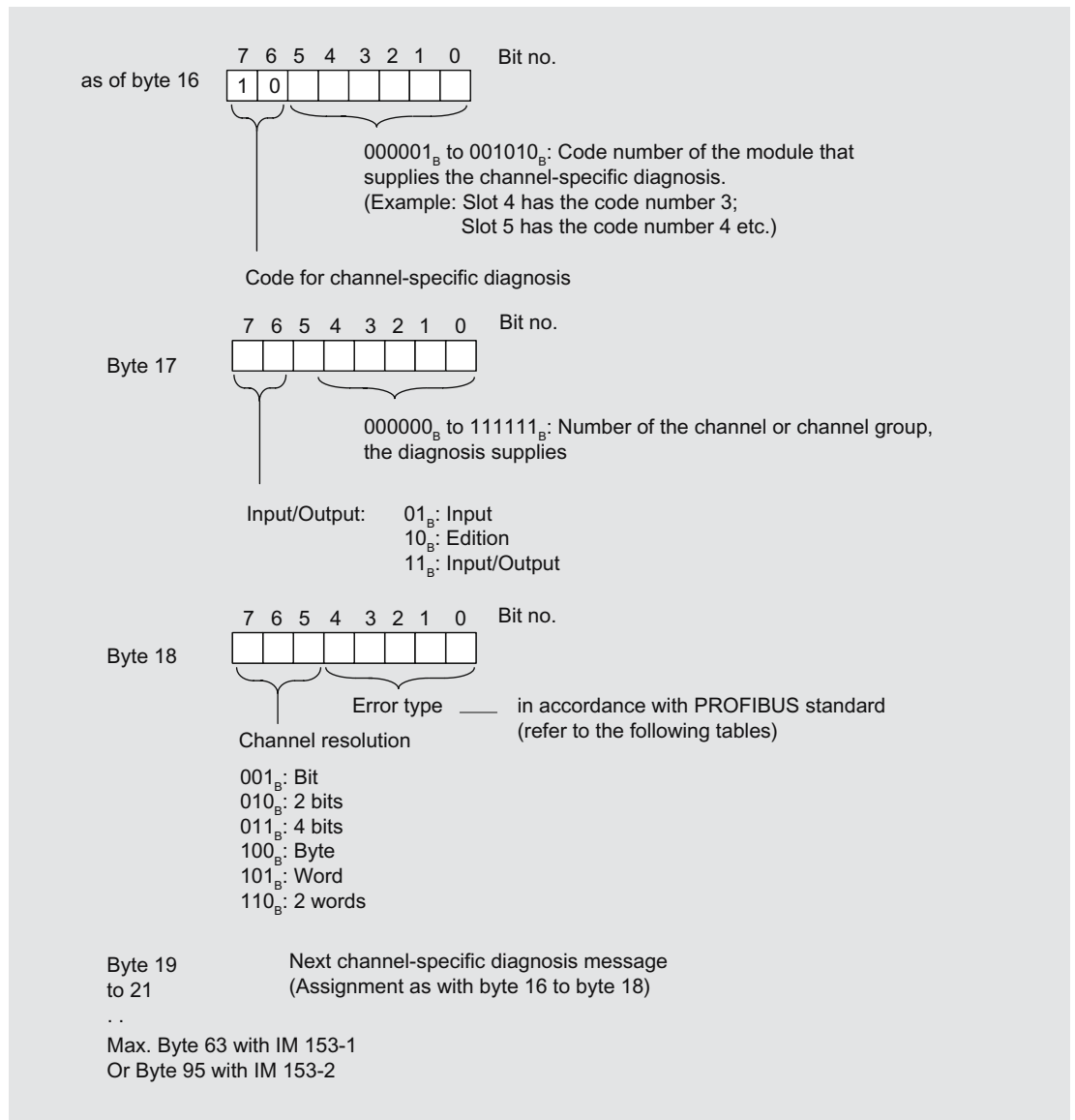
Figure 9-6   Structure of the channel-related diagnostics

Overflow of channel-related diagnoses

If there are more channel-related diagnoses than can be shown in the slave diagnosis, then the bit 7 "diagnosis overflow" is set in the station status 3.

The channel-related diagnoses that are not transferred with the message frame are not lost. They follow on to the slave diagnosis as soon as other channel-specific diagnoses that are entered in the diagnostic frame have gone.

Once the "diagnosis jam" has been worked off, the bit 7 "diagnostic overflow" is reset.

Channel-specific error messages

Table 9- 8   Error type of the channel-related diagnosis in accordance with the PROFIBUS standard

Error type		Error text	Meaning	Remedy
00000ᴮ	0ᴰ	reserved		
00001ᴮ	1ᴰ	Short circuit	Short circuit, e.g.: • Sensor lines short circuited in accordance with P potential • Sensor lines short circuited in accordance with M potential • Output lines short circuited in accordance with P potential • Output lines short circuited in accordance with M potential • Output lines short circuited in accordance with ground	Correction of the process wiring, M circuit, P circuit
00010ᴮ	2ᴰ	☐Low voltage	Supply voltage is below the tolerance range	Correction on the power supply, HART: analog output current established
00011ᴮ	3ᴰ	Overvoltage	Supply voltage is above the tolerance range	Correction on the power supply
00100ᴮ	4ᴰ	Overload	the output stage is overloaded	Correction tuning of module / actuator, HART: analog output saturated
00101ᴮ	5ᴰ	Excess temperature	the output stage is overloaded and has become too hot	Correction tuning of module / actuator
00110ᴮ	6ᴰ	Wire break	Wire break, e.g.: • Signal line to a sensor interrupted • Signal line from an actuator interrupted • Sensor power line interrupted	Correction of the process wiring
00111ᴮ	7ᴰ	High limit exceeded	Value is above the over range	Correction tuning of module / actuator
01000ᴮ	8ᴰ	Low Limit exceeded	Value is below the under range	Correction tuning of module / actuator
01001ᴮ	9ᴰ	Fault	Error, e.g.: • Load voltage on output • Encoder supply • Hardware error in the module • Shield welded on or jammed • Life span of the switching element reached	Exchange the module
01010ᴮ to 01111ᴮ	10ᴰ to 15ᴰ	reserved		

Table 9- 9   Error type of the channel-related diagnostic - manufacturer-specific

Error type		Error text	Meaning	Remedy
10000$_B$	16$_D$	Parameter configuration error	Parameter configuration error, e.g.: • Module cannot evaluate the parameter (unknown, inadmissible combination, ...) • Module not configured • User calibration does not correspond to the configuration • Calibration error	Correction of the parameterization
10001$_B$	17$_D$	Encoder or load voltage missing	The following voltages could me missing: • external supply voltage • Voltage to operate the module	Correction of the process wiring
10010$_B$	18$_D$	Fuse faulty	The user´s exchangeable fuse has failed	Replace the fuse
10011$_B$	19$_D$	Communication error	With F technology (PROFIsafe): • Error with the consecutive number (sign of life) • Error in the user data CRC • User data timeout	Check the communication paths
10100$_B$	20$_D$	Ground error	Ground error, e.g.: • The permissible common mode voltage for isolated channels has been exceeded • The M line is broken in the case of isolated channels	Correction of the process wiring
10101$_B$	21$_D$	Reference channel fault	Error on the reference channel	Replace the reference channel module
10110$_B$	22$_D$	Hardware interrupt lost	Hardware interrupt has become lost	Correction tuning of program / process / module
10111$_B$	23$_D$	Warning	There could be a warning, if limit values like: • Speed • Load current are exceeded	Correction tuning of program / process / module
11000$_B$	24$_D$	Switch off	There could be a switch off: • Power switch is triggered on account of short circuit, asymmetry, contact to earth • Thermistor triggered • Quick stop • fail-safe switch off	Remedy the cause of switch off and acknowledge
11001$_B$	25$_D$	fail-safe switch off	Trigger / cause for fail-safe switch of is given	Remedy the cause of switch off
11010$_B$	26$_D$	External error	External (process-side) error, e.g.: • Sensor error • Actuator error • Sensor data is incorrect	Replace sensor / actuator / correct process wiring
11011$_B$	27$_D$	Unclear error	Unclear errors are those that are not specified in any more detail	different, depending on cause of error
11100$_B$	28$_D$	reserved		

Error type		Error text	Meaning	Remedy
11101_B	29_D	Error 1 in actuator / sensor	Error 1 in a an HMI device that is connected to a module.	Correction in actuator / sensor depending on error message, HART: Primary value outside of limits
11110_B	30_D	Error 2 in actuator / sensor	Error 2 in a an HMI device that is connected to a module.	Correction in actuator / sensor depending on error message, HART: Secondary value outside of limits
11111_B	31_D	Channel temporarily unavailable	e.g. due to calibration, firmware update, manual mode, etc.	Different, depending on the cause; e.g., wait until the initiated function (calibration, FW update) is finished.

See also

Structure of slave diagnosis (Page 191)

9.1.3.9 H status (only with S7-400 H and normal redundancy)

Requirements

The IM 153-2 supplies the H status if
- an S7-400H DP master is being worked on (IM 153-2Ax0x, IM 153-2Bx00, IM 153-2Bxx1)
- standard redundant mode is being operated in (IM 153-2Bxx1 with GSD as of rev. 5)

Structure of the H status
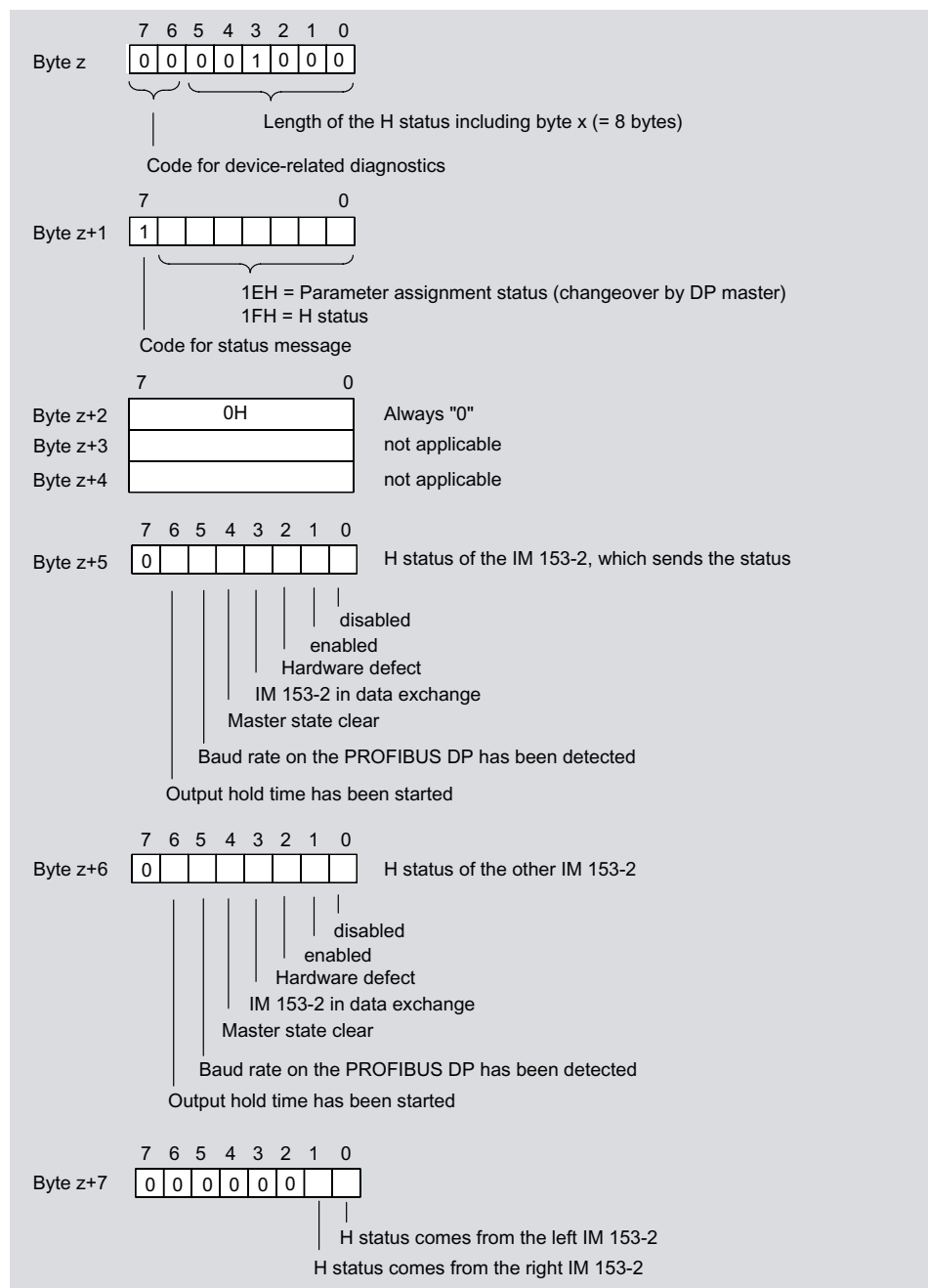
Figure 9-7   Structure of the H status

9.1.3.10   Interrupts

Definition

The interrupt part of the slave diagnosis gives information about the interrupt type and the cause of interrupt that has caused the slave diagnosis to trigger.

The interrupt part encompasses a maximum of 29 bytes. A maximum of 1 alarm can be reported for each slave diagnosis.

Position in the diagnosis telegram

The position of the interrupt part in the slave diagnosis depends on the configuration of the diagnosis frame and on the number of channel-related diagnoses. The interrupt part is always the last part in the diagnosis frame

Contents

The contents of the interrupt information depend on the interrupt type:

With **diagnosis interrupts** (as of byte x+4) the diagnostics data record 1 for SIMATIC S7 (e.g. 16 bytes) is sent as additional interrupt information. For digital and analog modules you will find the meaning of the bytes in the figures below.

With **hardware interrupts** the length of the additional interrupt information is 4 bytes. The meaning of these bytes can be found in the following figures. With end of cycle interrupts, these bytes are always FF$_H$.

With **removal / insert interrupts** the length of the additional interrupt information is 5 bytes. The meaning of these bytes can be found in the following figures.

Removing and inserting interrupts

In order to be able to insert and remove modules during operation you must configure the ET 200M with active bus modules. With the switch "Removing and inserting interrupts" you can configure whether the removal or insertion events are to be reported as an interrupt in the diagnostics frame. If you block "Removing and inserting interrupts", then in an active bus module configuration it is still possible to insert and remove modules. These events will then be portrayed exclusively on the identifier-related diagnosis and module status. Information on the behavior of the older IM 153-x versions can be found in the "Compatibilities between the versions of IM 153-2 / -2 FO (Page 243)" and "Compatibilities between the versions of IM 153 and IM 153-1 (Page 241)" appendices.

In a configuration with active bus modules, each removal and insertion of modules causes the station to fail.

Note

If you insert or remove a dummy module DM 370, then no inserting or removing interrupt is triggered.

Diagnostic interrupt

If there is a diagnosis event for channel / channel group 0 of a module, alongside a channel error there could **also** be a module error. The entry is generated also in this case if the diagnosis for the channel / channel 0 of the module has not been enabled.

Structure of the interrupt part

The interrupt part for the ET 200M is configured as follows (with IM 153-x without module status an channel-related diagnosis the byte x = byte 9):

The bytes x to x+3 inform you of the **interrupt type**.
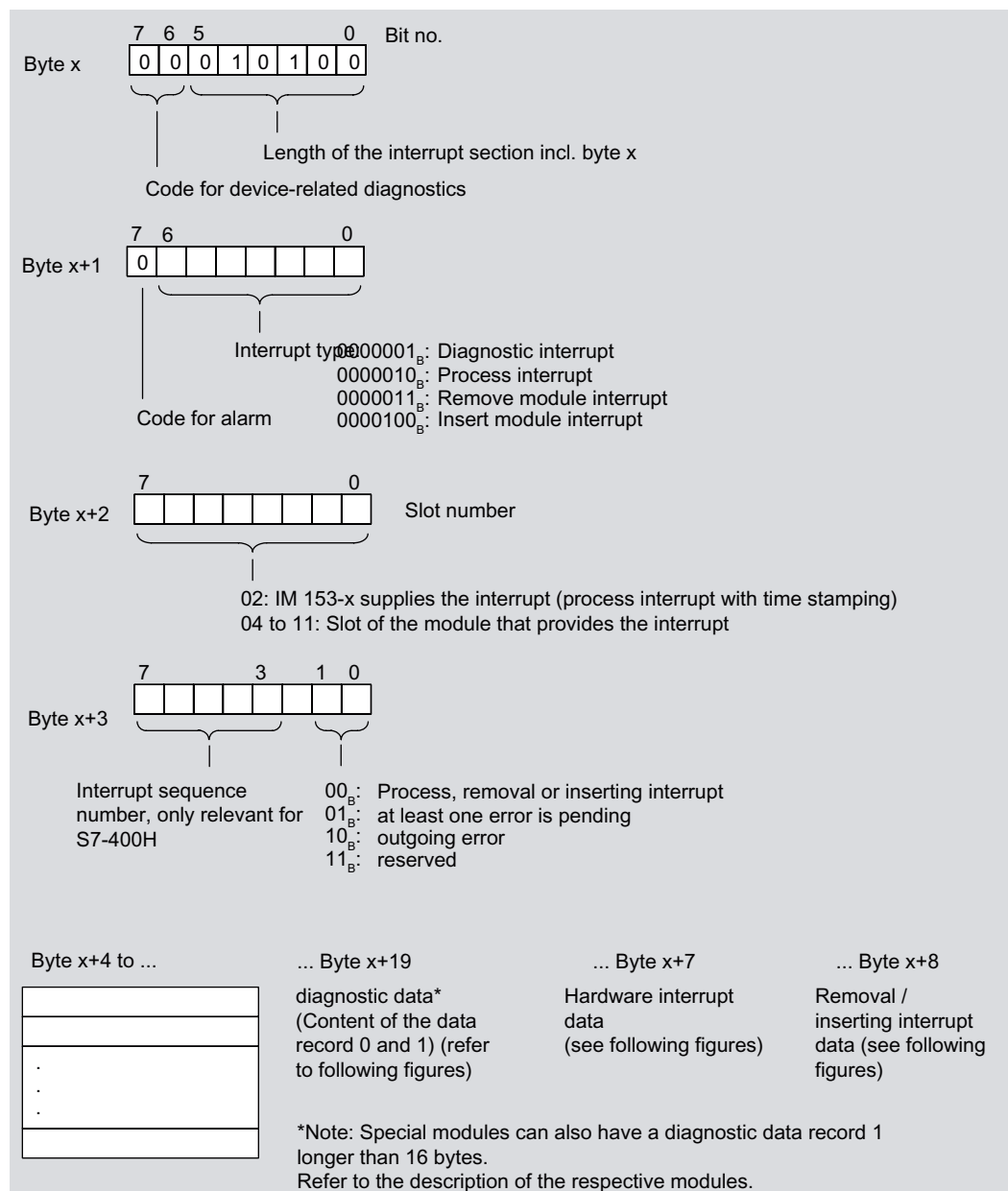
Figure 9-8   Structure of the interrupt status of the interrupt part

Additional interrupt information

The bytes x+4 to x+7 inform you of the **interrupt cause**. They correspond to the **diagnostic data record 0** in *STEP 7*.

The bytes x+4 to x+7 as well as x+8 to x+19 correspond to the **diagnostic data record 1** in *STEP 7*.

```
          7 6 5 4 3 2 1 0
Byte x+4 [ | | | | | | | ]
                        |
                        Module fault, i.e. an error has been detected
                      Internal error in the module
                    External error: Module can no longer respond
                  Channel error in the module
                external auxiliary voltage missing, i.e.:
                Load voltage supply missing or too low
              Front panel connector not plugged in
            Module not configured
          Programming error

          7 6 5 4 3 2 1 0
Byte x+5 [0 0| | | | | | ]
                 _____/
                Module class:
                0100 for IM 153-x....set with message for time stamping
                1111 for digital module ....as of byte x+8 refer to following figures
                0101 for analog module ....as of byte x+8 refer to following figures

                1000 for FM    } You will find diagnostic data in the description of
                1100 for CP    } the respective module

              Channel information exists
            User information exists

          7 6 5 4 3 2 1 0
Byte x+6 [0| | | | | | | ]
                        |
                        Memory module or measuring range module
                        (with analog modules) incorrect or missing
                      Communication problem
                    Operating mode    0: RUN
                                      1: STOP
                  Cycle monitoring tripped
                Internal supply voltage failed
              Battery exhausted
            Entire backup failed

          7 6 5 4 3 2 1 0
Byte x+7 [0| | | | | | | ]
                        |
                        Rack failed
                      Processor failure
                    EPROM fault
                  RAM fault
                ADC/DAC error
              Fuse blown
            Hardware interrupt lost
```

Figure 9-9   Additional interrupt information for diagnostic interrupts of digital and analog modules

Interrupt details of modules with digital inputs
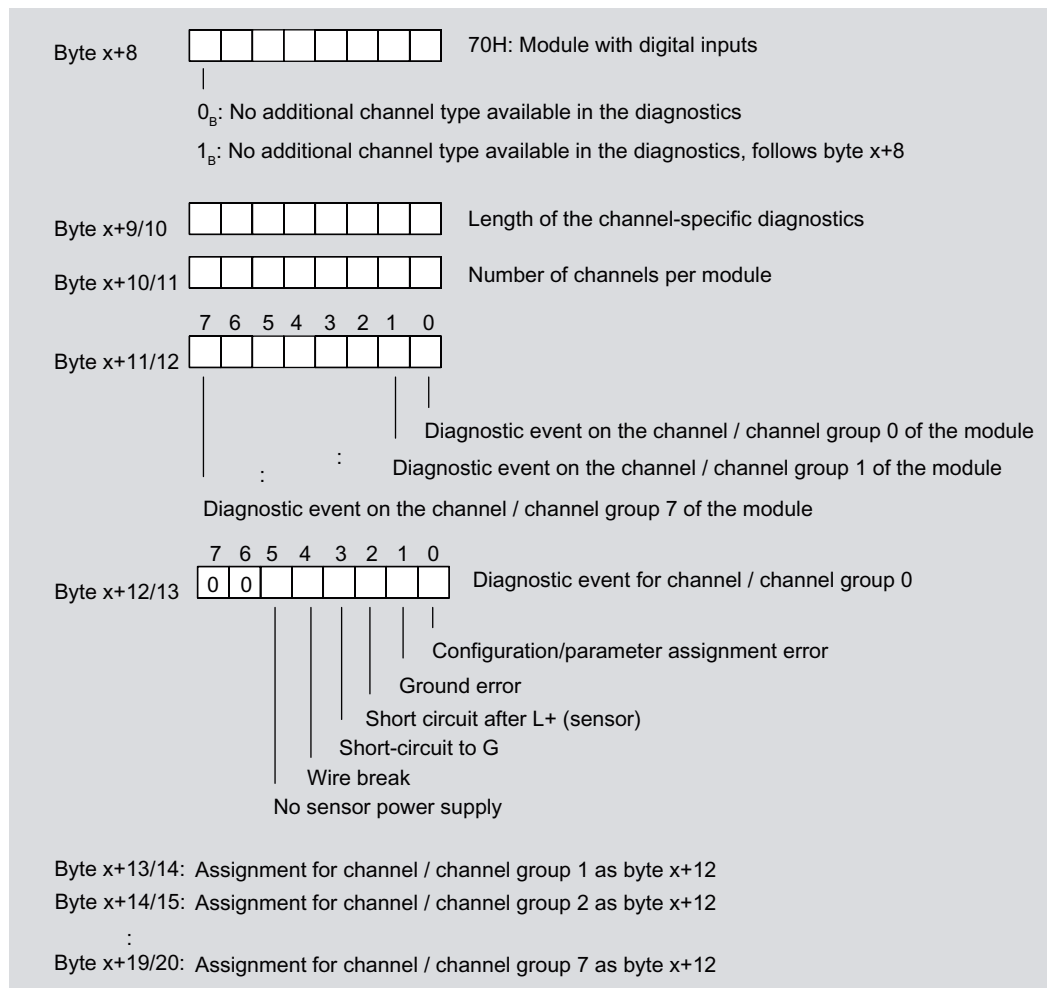
Figure 9-10   Structure as of byte x+8 for diagnostic interrupt (digital inputs)

Interrupt details of modules with digital outputs

Byte x+8 — 7 ... 0

72H: Module with digital outputs

0_B: No additional channel type available in the diagnostics

1_B: an additional channel type available in the diagnostics, follows byte x+8

Byte x+9/10 — 7 ... 0

Length of the channel-specific diagnostics

Byte x+10/11 — 7 ... 0

Number of channels per module

Byte x+11/12 — 7 6 5 4 3 2 1 0

Diagnostic event on the channel / channel group 0 of the module

Diagnostic event on the channel / channel group 1 of the module

:

:

Diagnostic event on the channel / channel group 7 of the module

Byte x+12/13 — 7 6 5 4 3 2 1 0 — (bit 5 = 0)

Diagnostic event for channel / channel group 0

Configuration/parameter assignment error

Ground error

Short-circuit to L+

Short-circuit to G

Wire break

external load voltage missing

Excess temperature

Byte x+13/14: Assignment for channel / channel group 1 as byte x+12

Byte x+14/15: Assignment for channel / channel group 2 as byte x+12

:

Byte x+19/20: Assignment for channel / channel group 7 as byte x+12

Figure 9-11   Structure as of byte x+8 for diagnostic interrupt (digital outputs)

Interrupt details of modules with analog inputs

Figure 9-12   Structure as of byte x+8 for diagnostic interrupt (analog inputs)

Interrupt details of modules with analog outputs
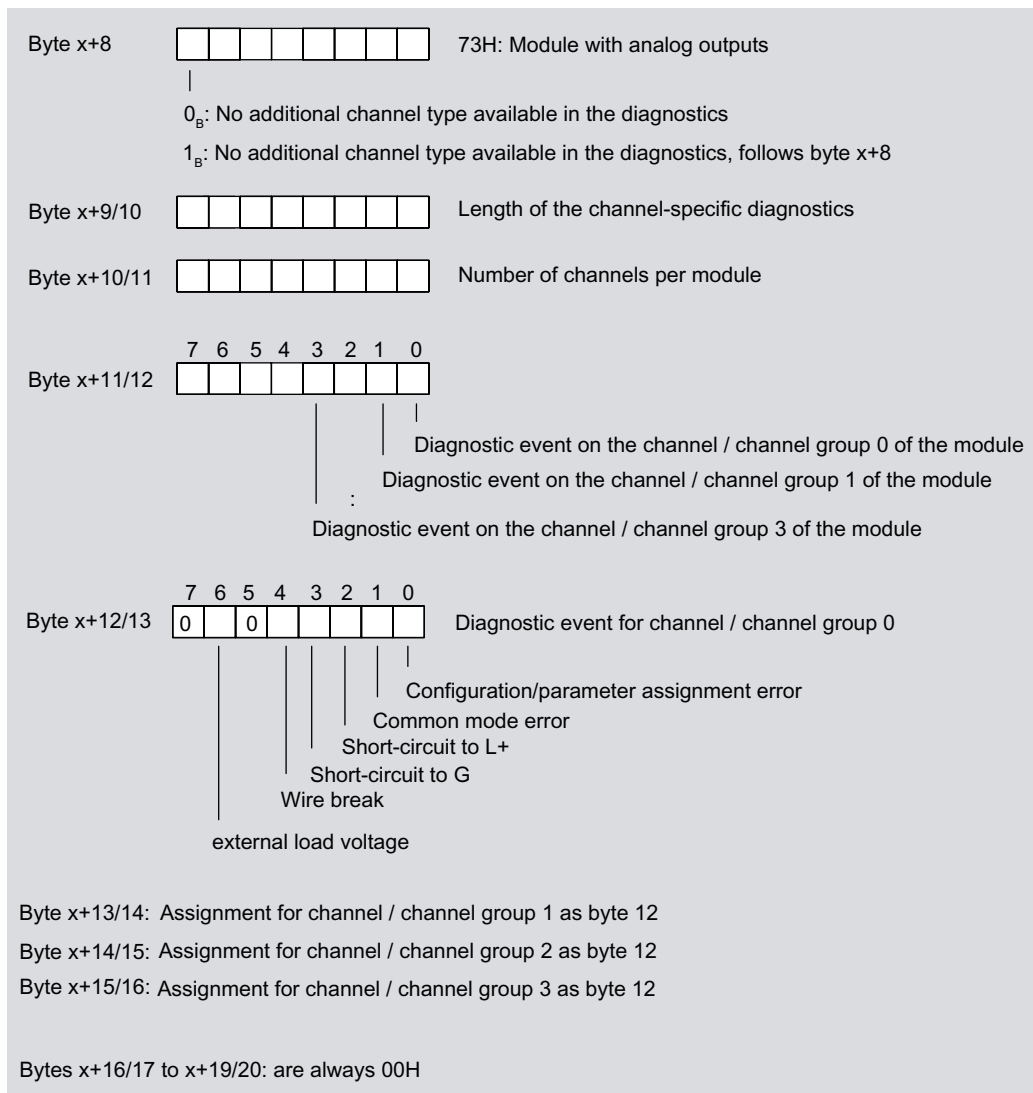
Figure 9-13   Structure as of byte x+8 for diagnostic interrupt (analog outputs)

Interrupt details for input or output modules with HART

Byte x+8   65H: HART input or output channel

0_B: No additional channel type available in the diagnostics

1_B: No additional channel type available in the diagnostics, follows byte x+8

Byte x+9/10   [1]   Length of each channel-specific diagnostic in bits

= 16 Bit

Byte x+10/11   Number of channels per module

Byte x+11/12   (bits 7 6 5 4 3 2 1 0)

- Diagnostic event at channel 0 of the module
- Diagnostic event at channel 1 of the module
- Diagnostic event at channel 2 of the module
- Diagnostic event at channel 3 of the module

Byte x+12/13   (bits 7 6 5 4 3 2 1 0)   Error type on channel 0: Byte x+12 to x+13

- Programming error
- HART communication error
- Short circuit P circuit
- Short circuit M circuit
- Wire break
- No load voltage
- Overflow
- Underflow

Byte x+13/14   (bits 15 14 13 12 11 10 9 8)

- HART primary variable outside the limits
- HART auxiliary variable outside the limits
- HART analog output current saturated
- HART analog output current defined
- HART further status available
- reserved for HART
- HART configuration changed
- HART field device error

Byte x+14/15 to x+15/16:   Error type on channel 1: Refer to byte x+12 to x+13

Byte x+16/17 to x+17/18:   Error type on channel 2: Refer to byte x+12 to x+13

Byte x+18/19 to x+19/20:   Error type on channel 3: Refer to byte x+12 to x+13

Figure 9-14   Structure as of byte x+8 for diagnostic interrupt (input or output module with HART)

Hardware interrupt with time stamping of digital input signals

If the IM 153-2 reports a hardware interrupt, this means that at least one data record contains messages concerning time-stamped signal changes or special messages.

The DP master CPU can read the data record(s) and evaluate them with the FB 90 "IM_DRV" (see *PCS 7* documentation).

In the same way, it is possible to evaluate with the FB 62 "FB TIMESTMP".

```
                7  6  5  4  3  2  1  0
Byte x+4      [  ][ ][ ][ ][ ][ ][ ][ ]          Status of time stamping

                          |
                     not applicable
                Place the time stamping again
                0: No new placement carried out
                1: New placement taking place
        not applicable


                7  6  5  4  3  2  1  0
Byte x+5      [ ][ ][ ][ ][ ][ ][ ][ ]           Data record number, if a data record is to be
                                                 retrieved

                7  6  5  4  3  2  1  0
Byte x+6      [ ][ ][ ][ ][ ][ ][ ][ ]           Number of message blocks
                                                 1 to 20 included in the data record

Byte x+7        reserved
```
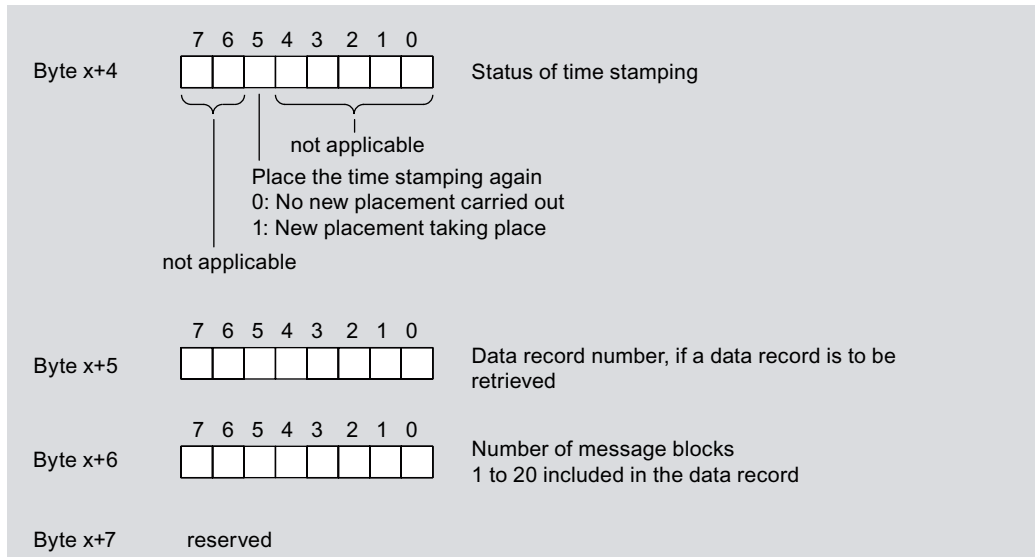
Figure 9-15   Structure as of byte x+4 for hardware interrupt (time stamping)

Hardware interrupt of analog input modules

```
                7  6  5  4  3  2  1  0
Byte x+4      [ ][ ][ ][ ][ ][ ][ ][ ]
                                    |  |
                                    |  Limit value exceeded – channel 0 of the module
                                    Limit value exceeded – channel 1 of the module
                      :
              Limit value exceeded – channel 7 of the module


                7  6  5  4  3  2  1  0
Byte x+5      [ ][ ][ ][ ][ ][ ][ ][ ]
                                    |  |
                                    |  Low limit value – channel 0 of the module
                                    Low limit value – channel 1 of the module
                      :
              Low limit value – channel 7 of the module

Bytes x+6 and x+7:    Module-specific information;
                      refer to the description of the respective modules
```

Figure 9-16   Structure as of byte x+4 for hardware interrupt (analog inputs)

Hardware interrupt of digital input modules
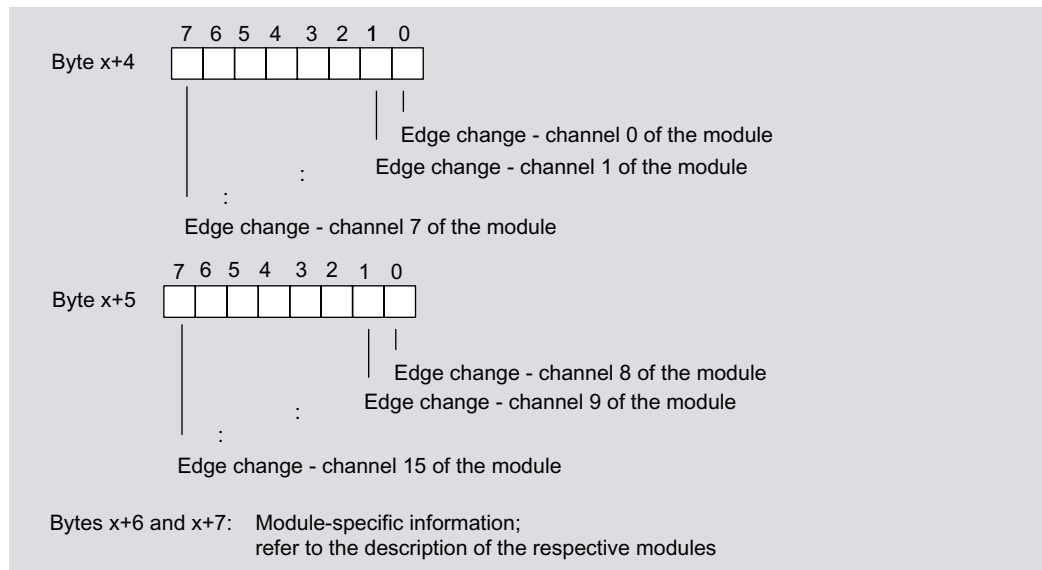
Figure 9-17   Structure as of byte x+4 for hardware interrupt (digital inputs)

Removing / insertion interrupt

Bytes x+4 to x+8 show the code of the module that has been inserted or removed. The codes for the individual modules can be found in the GSD file. You can see whether or not the module has been inserted or removed from the interrupt type in byte x+1.
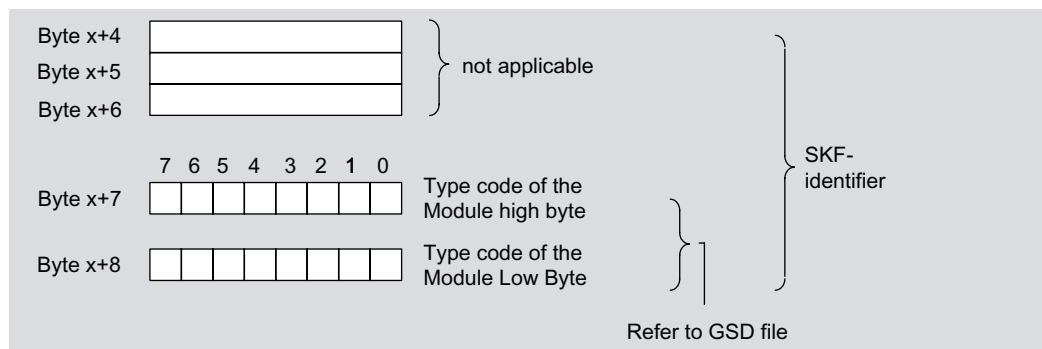
Figure 9-18   Structure as of byte x+4 for removing / inserting interrupt

See also

Structure of slave diagnosis (Page 191)

Arrangement of the modules for the function "Change During Operation" and / or "Redundancy" (Page 44)

9.1.3.11 Evaluating interrups from station diagnosis

The structure of the station diagnosis is the same as the structure of the interrupt section.

Interrupts with S7 / M7 DP master or DPV1 master

The ET 200M supports the following interrupts:

● Diagnostic interrupt

● Hardware interrupt

● Removing / insertion interrupt

These interrupts can be evaluated using an S7 / M7 DP master or DPV1 master. In the event of an interrupt, interrupt OBs are executed automatically in the master CPU (refer to the "System and Standard Functions for S7-300/400 (http://support.automation.siemens.com/WW/view/en/1214574)" programming manual).

Inserting / removing interrupts with S7 / M7 DP master or DPV1 master

If you use the ET 200M with "Change during Operation" on an S7 / M7 DP master or a DPV1 master, the system behaves as follows:

● When removing a module the IM 153-x reports a removing interrupt on the DP master which executes the OB 83. In the OB 83 you program the desired response to the removing event.
With I/O access the OB 122 (I/O access error) is called in the DP master CPU.

● If you insert a module that corresponds to the configuration, the IM 153-x reports an inserting interrupt on the DP master (call OB 83 with respective diagnostic buffer entry) and configures the module in accordance with the saved configuration.

● If you insert a module in a non-configured slot, the ET 200M behaves as follows:

  – In S7 mode the IM 153-x does not report an inserting interrupt.

  – In DPV1 mode the IM 153-x reports an inserting interrupt.

● If you insert a different module than configured:

  – then the IM 153-x reports an inserting mode to the DP master (call OB 83 with respective diagnostic buffer entry); but ignores this non-configured module.

  – The module diagnosis is stopped, and you can read out the slot in which the wrong module is inserted.

  – the SF LED indicates the error.

Note

If you insert or remove a dummy module DM 370, then no inserting or removing interrupt is triggered.

⚠ WARNING

Faults when removing and inserting will be tolerated for up to 1 second. This means, that in such a case the output values will not change within the tolerance time.

Interrupts with a different DP master

If the ET 200M is being operated with a different DP master, these interrupts will be shown as device-related diagnostics of the ET 200M. You must continue to process the respective diagnostic events in the user program of the DP master.

Saving the Diagnosis

In dependence of byte x+1, transfer the contents of the device-specific diagnosis to a data block, as

- The interrupts are updated cyclically.

- the contents of the diagnosis as of byte x+3 are dependent upon whether S7 diagnosis or hardware interrupt or removal or insertion interrupt has been reported.

Note

In order to evaluate diagnostics and hardware interrupts via the device-specific diagnosis with a different DP master you must note:

- the DP master should be able to save the diagnosis messages, i.e. the diagnosis messages should be stored within the DP master in a ring buffer. If the DP master cannot save the diagnosis messages, e.g. then always only the last incoming diagnosis message will be saved.

- You must scan the relevant bits in the device-related diagnostic data in your user program at regular intervals.

- With an IM 308-C connection as a DP master you cannot use the hardware interrupts within the device-specific diagnosis, as only incoming - and not outgoing - interrupts can be reported. E.g. the bit "Upper limit exceeded" is then only reset when the bit "Lower limit exceeded" is set. End of cycle interrupts are not supported by the IM 308 C as end of cycle interrupts are updated to "1" with each end of cycle (the level of the signal does not change).

Inserting / removing interrupts with other DP masters

If you use the ET 200M with "Change during Operation" on a different DP master, you must note that this **cannot** evaluate the inserting and removing interrupts. You can evaluate the inserting or removing events in the code- and device-specific diagnosis of the IM 153-x.

Tip: Evaluate the module status in the enhanced diagnosis.

See also

9.2 PROFINET IO

9.2.1 Diagnostics using LED display on IM 153-4 PN interface module

LED display

The figure below shows the position and arrangement of the LED display on the IM 153-4 PN interface module:
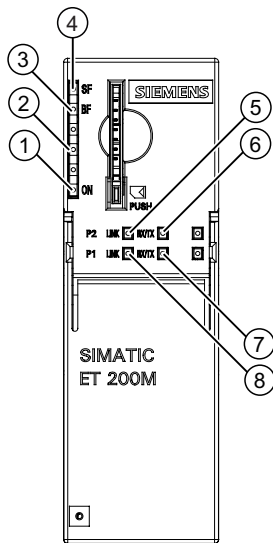
①	ON	Supply voltage 1L+ (green LED)
②	MT	Maintenance (yellow LED)
③	BF	Bus monitoring, red LED
④	SF	Group error, red LED
⑤	LINK	PROFINET IO Port 2, connection active (green LED)
⑥	RX/TX	PROFINET IO Port 2, data exchange (yellow LED)
⑦	RX/TX	PROFINET IO Port 1, data exchange (yellow LED)
⑧	LINK	PROFINET IO Port 1, connection active (green LED)

Status and error displays SF, BF, ON, LINK, RX/TX

Table 9- 10   Status and error displays of the IM 153-4 PN

LEDs				Meaning	Remedy
SF	BF	MT	ON		
off	off	off	off	There is no voltage at the interface module, or the interface module has a hardware defect.	• Switch on the 24 VDC supply voltage at the interface module.
*	*	*	On	There is voltage at the interface module.	—
*	Flashes at 0.5 Hz	*	on	Faulty or no connect message frame - no data transfer between the IO controller and the interface module (IO device), although the device is physically connected to the switch. Causes: • Incorrect device name • Configuration error • Programming error • The IO controller is disconnected, defective or the bus cable to the controller is missing. • The backplane bus is not functional.	• Check the interface module. • Check the configuration and parameter settings. • Check the device name. • Assign a valid device name to the interface module. • Check the IO controller • Check to see if the backplane bus has been configured correctly (all modules inserted, terminating resistor installed)
*	on	*	on	The IO device is not connected to a switch.	• Establish a connection to the IO controller (via a switch). • Assign a valid device name to the interface module. • Check the bus configuration. • Check that the bus connector is correctly inserted. • Check whether the bus cable to the IO controller is interrupted.
on	*	*	on	The configured structure of the ET 200M does not match the actual structure of the ET 200M.	• Check the structure of the ET 200M, whether a module is missing or defective, or whether an unconfigured module has been inserted. • Check the configuration (using *STEP 7*, for example), and correct the parameter assignment errors.
				• There is an error in an I/O module, or the interface module is defective. • Diagnostics data available	• Replace the interface module, or get in touch with your Siemens contact partner. • Remove error, e.g. wire break
on	on	*	on	A new SIMATIC Micro Memory Card is currently being formatted.	• Wait until the formatting sequence is complete. This may take several minutes. If the LED behavior changes, the formatting process is complete.

LEDs				Meaning	Remedy
SF	BF	MT	ON		
off	off	*	on	Data exchange is taking place between the IO controller and the ET 200M. The preset configuration and actual configuration of the ET 200M match.	—
on	on	*	off	FW update busy	—
off	Flashes at 0.5 Hz	*	off	FW update successfully completed	—
on	Flashes at 0.5 Hz	*	off	external error during FW update (incorrect FW, for example)	• Use the correct FW for the update.
on	Flashes at 2 Hz	*	off	internal error during FW update (possible read/write error)	• Repeat the FW update.
*	*	on	on	• Loss of synchronization • Network error	Also see Maintenance interrupts (Page 222)
LINK		RX/TX			
off		off		There is no connection to the IO controller (no IO controller available on the network)	• No uniform transmission rate • Autonegotiation not successful
on		*		Autonegotiation completed and PROFINET transmission rate accepted	—
on		on		Transmission/reception is in progress	—
* not relevant					

9.2.2 Diagnostic messages of the electronic modules

Actions after a diagnosis message

Every diagnostic message leads to the following actions:

- The SF LED on the interface module is lit.
- There can be more than one diagnostic message at the same time.
- Diagnostics data are reported as diagnosis interrupts and can be read from data records.
- Following a diagnostic message, the message is saved in the diagnostic buffer of the I/O controller.
- Next, OB 82 will be called. If OB 82 is not available, the I/O controller goes to STOP mode.
- Acknowledgment of the diagnostic interrupt to enable new interrupts.

9.2.3   Evaluating the interrupts of the ET 200M

Introduction

The I/O device initiates interrupts when certain errors occur. The interrupt evaluation is dependent on the utilized I/O controller.

Evaluating interrupts with I/O controller

The ET 200M supports the following interrupts:

- Diagnostic interrupts
- Hardware interrupts
- Removal / insertion interrupts
- Maintenance interrupts

In the event of an interrupt, interrupt OBs are executed automatically in the CPU of the IO controller (refer to the "SIMATIC software, programming with STEP 7 V5.x. (http://support.automation.siemens.com/WW/view/en/18652056)" manual).

Information on the cause and class of the error is already available based on the OB number and start information.

To obtain detailed information about the error event, call the error OB using SFB 54 "RALRM" (read additional interrupt information).

Triggering of a diagnostics interrupt

In case of an incoming or outgoing event (for example, a wire break), the module triggers a diagnostics interrupt if "Enable: Diagnostics interrupt" is set.

The CPU interrupts processing of the user program and executes the OB 82 diagnostic block instead. The event that triggered the interrupt is entered in the OB 82 start information.

Triggering a hardware interrupt

If a hardware interrupt occurs, the CPU interrupts the user program execution and executes hardware interrupt block OB 40. The event that triggered the interrupt is entered into the OB 40 start information.

Note

Hardware interrupts should not be used for technological purposes (cyclic generation of hardware interrupts, for example), because these can become lost in the entire system.

Triggering a removal / insertion interrupt

The CPU interrupts processing of the user program and processes the OB 83 diagnostic block instead. The event that triggered the interrupt is entered in the OB 83 start information.

Triggering a maintenance interrupt

The CPU interrupts processing of the user program and executes the OB 82 diagnostic block instead. The event that triggered the interrupt is entered in the OB 82 start information.

9.2.4 Maintenance interrupts

Introduction

The PROFINET interfaces of the IM 153-4 PN support the diagnostic and maintenance concept in PROFINET in accordance with IEC 61158-6-10. The goal is early detection and correction of potential faults.

For the IM 153-4 PN, maintenance interrups signal the user when network components must be checked or replaced.

Maintenance interrupts

The IM 153-4 PN signals a maintenance interrupt to the higher-level diagnostic system when the following events occur:

Maintenance interrupts	Event	Message / Meaning

Level 1:
Maintenace required
	Loss of synchronization	• No synchronization frame received
		  After parameter assignment or during operation, the sync master did not receive a synchronization frame within the timeout period.
		• Jitter lies outside the limits
		  – The maximum permissible jitter has been exceeded during synchronization.
		  – A sync slave has been synchronized by the sync master again.

	Network error	• Frames rejected [1] The integrated switch has rejected 3 frames due to network overload.
Level 2: **Maintenace demanded**	Network error	• Frames rejected [1] The integrated switch has rejected 10 frames due to network overload.
[1] These diagnostic messages are deleted automatically after 1 second.		

System alarms in *STEP 7*

The maintenance information is generated in *STEP 7* with the following system alarms:

• Maintenance required - symbolized by a yellow wrench for each port

• Maintenance demanded, symbolized by an orange wrench for each port

See also

Evaluating the interrupts of the ET 200M (Page 221)

9.2.5 Channel diagnostics

The PROFINET interfaces of the IM 153-4 PN support the diagnostics concept and maintenance concept in PROFINET IO in accordance with the standard IEC61158-6-10.

Diagnostic interrupts use the channel-specific diagnosis according to IEC 61158-6 as interrupt information.

PROFINET IO also permits the reading of diagnostic states via standardized data records. For example, the diagnostic state of a module can be read using the data record C00A hex.

The data record is read by calling SFB 52 RDREC (read data record).

9.2.6 Error types for modules

For detailed information about the error types for modules of the ET 200M, refer to chapter "Identifier-related diagnosis (Page 198)".

9.2.7 Diagnostics of incorrect configuration states of ET 200M on PROFINET IO

Incorrect module configuration states

The following incorrect ET 200M configuration states lead to a failure of the ET 200M I/O device or prevent data exchange:

- Number of modules exceeds maximum configuration
- Faulty backplane bus, for example, defective active bus module

9.2.8 Diagnostics events triggered by a STOP of the I/O controller

If communication diagnostics of the PROFINET interface ports is triggered when the IO controller is in STOP state, these diagnostics will not be signaled after startup of the IO controller.

Technical Specifications 10

Technical Specifications

The technical specifications contain

- standards and approvals valid for the ET 200M,
- the technical data of the IM 153-x interface module,
- the dimensioned drawing of the IM 153-x interface module and
- the block diagram of the IM 153-x interface module.

Reference Manual

In the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" reference manual you will find

- The technical specifications of the modules.
- the general technical data like specifications for noise immunity of the modules as well as mechanical and climatic ambient conditions.
- the mechanical and climatic ambient conditions for SIPLUS S7-300 modules (for use in other operating conditions "outdoors").

10.1 Standards and Approvals

CE Label

The ET 200M distributed IO device meets the requirements and protection objectives of the following EU directives and complies with the harmonized European standards (EN) that have been published for programmable controllers in the Official Journal of the European Communities:

- 73/23/EEC Low-Voltage Directive (for electrical equipment)
- 89/336/EEC Electromagnetic Compatibility Directive (EMC Directive)
- 94/9/EU "Devices and protection systems for use as prescribed in potentially explosive areas" (Guidelines for Explosion Protection)

The EC Declarations of Conformity are available to the relevant authorities at the following address:

Siemens Aktiengesellschaft
Industry Sector
IA AS RD ST
Postfach 1963
D-92209 Amberg

UL Approval

Underwriters Laboratories Inc. according to

- UL 508 (Industrial Control Equipment)

CSA Certification

Canadian Standards Association according to

- C22.2 No. 142 (Process Control Equipment)

or

Underwriters Laboratories Inc. according to

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)

or

Underwriters Laboratories Inc. according to

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)
- UL 1604 (Hazardous Location)
- CSA-213 (Hazardous Location)

HAZ. LOC.

APPROVED for use in

Class I, Division 2, Group A, B, C, D Tx;
Class I, Zone 2, Group IIC Tx

Note

Currently valid certifications can be found on the rating of the relevant module.

FM certification

Factory Mutual Research (FM) according to
Approval Standard Class Number 3611, 3600, 3810

APPROVED for use in

Class I, Division 2, Group A, B, C, D Tx
Class I, Zone 2, Group IIC Tx

⚠ WARNING
Personal injury and material damage can be incurred.
In potentially explosive environments, there is a risk of injury or damage if you disconnect any cable connections while the ET 200M is in operation.
In explosive environments, always isolate the ET 200M before you disconnect connectors.

⚠ WARNING
Explosion hazard
Components may no longer qualify for Class I, Div. 2 if they are substituted.

⚠ WARNING
This device is only appropriate for use in Class I, Div. 2, Gruppe A, B, C, D, or in non-hazardous areas.

according to EN 60079-15:2005 (Electrical apparatus for potentially explosive atmospheres; Type of protection "n")

II 3 G Ex nA II T5

Tick-mark for Australia

The ET 200M distributed I/O system satisfies the requirements of the standard (AS/NZS 2064 (Class A)).

Pollutant concentration

The ET 200M distributed I/O system satisfies the requirements of the standard (ISA-571.04 serverity level G1;G2;G3).

IEC 61131

The ET 200M distributed IO device meets the requirements and criteria of the IEC 61131-2 standard (programmable controllers, Part 2: Equipment Requirements and Tests.)

PROFIBUS standard

The ET 200M distributed I/O system is based on the standard
(*IEC 61784-1:2002 Ed1 CP 3/1*).

PROFINET standard

The ET 200M distributed I/O system is based on the standard (*IEC 61158*).

PNO

PNO Certificate No.:

Interface module	Certificate Number
IM 153-1	Z00577
IM 153-2	Z00289
IM 153-2 FO	Z00289

Marine approvals

Classification Societies:

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

Industrial applications

SIMATIC products are designed for industrial applications.

Table 10- 1   Industrial applications

Area of Application	Requirements	
	Emitted Interference	Noise Immunity
Industry	EN 61000-6-4 : 2001	EN 61000-6-2 : 2001

Use in residential areas

If you use the ET 200M in residential areas, you must ensure that the radio interference emissions comply with limit value class B in accordance with EN 55011.

The following measures are recommended to ensure the interference complies with limit value class B:

● Install the ET 200M in grounded switching cabinets/boxes

● Use of noise filters in the supply lines

⚠ **WARNING**

There is a risk of injury or of damage to assets.

In potentially explosive environments, there is a risk of injury or damage if you disconnect any connectors while the ET 200M is in operation.

In explosive environments, always isolate the ET 200M before you disconnect connectors.

Laser protection classes authorization (for the IM 153-2 FO)

Class 1 in accordance with EN 60825-1: 1994+A11: 1996 or IEC 60825-1: 1993 including amendment 1:1997

In the case of an intentional / unintentional opening of the accessible FOC radiation in accordance with degree of endangering 1 as per EN 60825-2: 1994 or IEC 60825-2: 1993.

10.2 Parameters of the IM 153-x

Parameter assignment

You configure the IM 153-x or the ET 200M with *STEP 7* or *COM PROFIBUS*. If you use a different configuration tool, you must integrate the GSD file.

Table 10- 2   Parameters of the IM 153 x

Parameters	Range of values	Default	Scope
DPV1 mode	block / enable	enable	ET 200M
Start up at preset ≠ actual configuration?	yes/no	No	ET 200M
"Module change during operation"?	yes/no	No	ET 200M
Diagnostic Interrupt	block / enable	enable	ET 200M
Process interrupt	block / enable	enable	ET 200M
Removing / insertion interrupt	block / enable	enable	ET 200M
Analog-value format	SIMATIC S7 / SIMATIC S5	SIMATIC S7	ET 200M

Parameters	Range of values	Default	Scope
Enhanced diagnostics	yes/no	No	ET 200M **No**: 29 bytes; **Yes**: 64 bytes with IM 153-1 or 96 bytes with IM 153-2 diagnostic frame
Module diagnostics	block / enable	enable	ET 200M
Module status	block / enable	enable	ET 200M
Channel-specific diagnostics	block / enable	enable	ET 200M

Parameters for time stamping

Configure the time stamping with *STEP 7* for the ET 200M in the DP slave properties and then in addition for the respective digital input modules in the module properties.

Table 10- 3   Parameters for time stamping

Parameters	Range of values	Default	Scope
Time stamping	yes/no	No	ET 200M Module Channel
RLO edge detection	rising edge / falling edge	Rising edge	ET 200M Module Channel
Time interval for time synchronization	1 s to 60 s (value must correspond with the setting in the time master)	10 s	ET 200M

Parameters for clock synchronism

Configure the isochrone mode with *STEP 7* for the ET 200M in the DP slave properties and then in addition for the respective digital input modules in the module properties.

Table 10- 4   Parameters for clock synchronism

Parameters	Range of values	Default	Scope
Synchronize the slave to the DP cycle	block / enable	Disable	ET 200M
Time Ti (read process values)	(Values will be specified by *STEP 7*)	(Value will be specified by *STEP 7*)	ET 200M
Time To (output process values)	(Values will be specified by *STEP 7*)	(Value will be specified by *STEP 7*)	ET 200M

10.3　Technical specifications of the IM 153-x

General technical specifications

In the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" reference manual you will find for the interface module IM 153-x

- all the general technical data that applies for both the S7-300 and the ET 200M and

- the deviating technical data and tests for the interface module IM 153-x for expanded environmental conditions ("outdoor") with the order numbers 6ES7153-1AA8x-0XB0 and 6ES7153-2BA81-0XB0.

Technical specifications of the IM 153 interface modules

The technical specifications for all functions of the various IM 153-x versions are included in the following table. Check, together with the table "Properties and functions of the variants" of IM 153-x in chapter "IM 153-x: Variants and properties (Page 17)" to see which version of your IM 153-x supports these functions.

Technical Specifications	IM 153-1	IM 153-2	IM 153-2 FO
Manufacturer ID	$801D_H$	$801E_H$	8071_H
GSD file	SIEM801D.GSD	SIEM801E.GSD	SIEM8071.GSD
• for DPV1	SI01801D.GSG	SI01801E.GSG (for IM 153-2AA0x) SI02801E.GSG (for IM 153-2BA00) SI03801E.GSG (for IM 153-2BAx2) SI04801E.GSG (for IM 153-2BAx2)	SI018071.GSG (for IM 153-2AB0x) SI028071.GSG (for IM 153-2BB00)
Dimensions and weight			
Dimensions W x H x D (mm)	40 x 125 x 117		
Weight, c.	360 g		
PROFIBUS DP interface			
Baud rates	Up to 12 MBaud		9,6; 19,2; 45,45; 93.75; 187.5; 500 kBaud; 1.5; 12 MBaud
Baud rate detection	yes		
Interface	RS 485		FOC
FREEZE capability	yes		
SYNC capability	yes		
PROFIBUS addresses	1 to 125 permissible		
System modification in RUN mode	No	yes	

Technical Specifications	IM 153-1	IM 153-2	IM 153-2 FO
Time synchronization / time stamping	No	yes	
• Accuracy class	—	10 ms / 1 ms	
• Time resolution	—	466 ps	
• Number of digital input signals	—	Max. 32 per slot Max. 128	Max. 128
• Message buffer	—	15 message buffers with in each case max. 20 messages	
• Time interval for sending the message buffers when there is a message	—	1 s	
• Time stamping	—	• Per digital input • Per digital input module • total ET 200M	
• Time stamp in the case of	—	rising / falling edge as incoming or outgoing signal	
• Time format	—	RFC 1119 Internet (ISP)	
Voltages, currents, electrical potentials			
Rated voltage	DC 24 V (DC 20.4 to 28.8 V)		
Current consumption at 24 V	Max. 350 mA	Max. 550 mA max. 600 mA (for IM 153-2BAx2)	Max. 500 mA
Inrush current	2.5 A	2.5 A (for IM 153-2AA0x and IM 153-2BA00) 3.5 A (for IM 153-2BAx1) 3.0 A (for IM 153-2BAx2)	3.5 A
Power on the I/O bus (to supply the I/O modules)	—	max. 1.5 A	—
I^2t	0.1 A²s		
Recommended external fusing for supply lines	In a configuration with grounded reference potential a fuse is required for redundant interface modules (recommendation: 2.5 A).		
Power dissipation, type	3 W	5 W (for IM 153-2AA0x and IM 153-2BA00) 4 W (for IM 153-2BAx1) 5.5 W (for IM 153-2BAx2)	4.5 W (for IM 153-2AB0x and IM 153-2BB00)

Dimensioned drawing IM 153-1 / -2 / -2 FO

You will find a dimensioned drawing with the rail for the active bus module in the reference manual "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)".
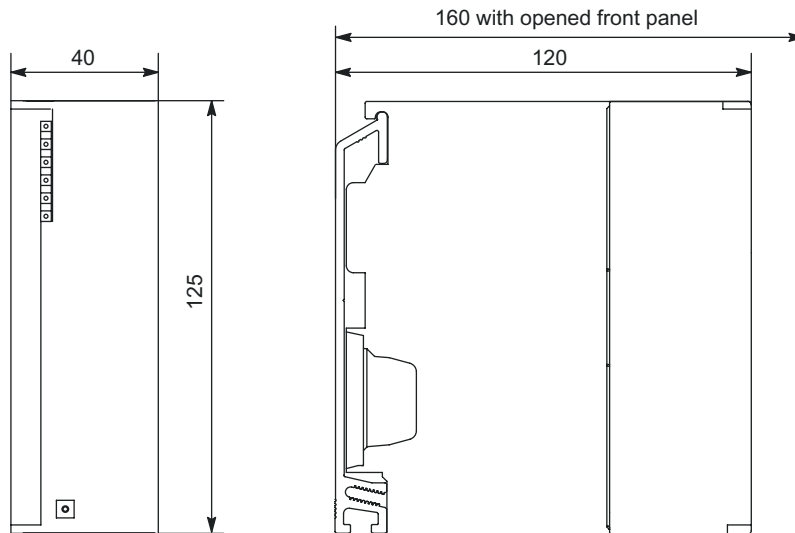
Figure 10-1   Dimensioned drawing of the interface modules IM 153-1, IM 153-2 and IM 153-2 FO

Block diagram IM 153-1 / -2 / -2 FO
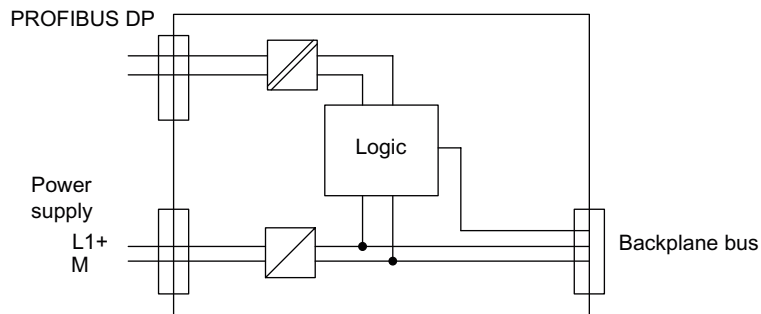
Figure 10-2   Block diagram of the interface modules IM 153-1 and IM 153-2
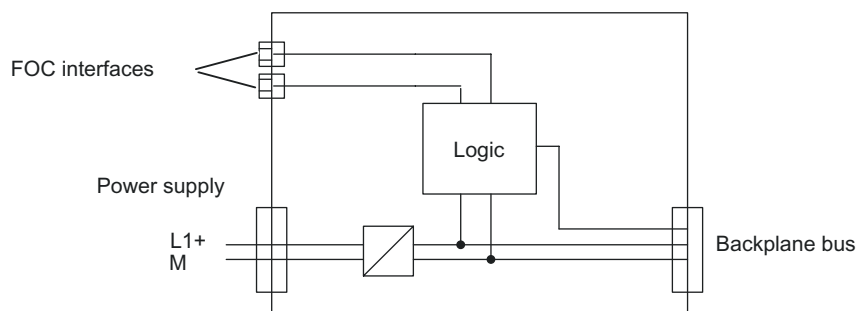
Figure 10-3   Block diagram of the IM 153-2 FO

10.4　Technical specifications of the IM 153-4 PN interface module

Order Number

6ES7153-4AA01-0XB0

Properties

The IM 153-4 PN interface module has the following properties:

- It interconnects the ET 200M with PROFINET IO.
- A maximum of 12 modules can be operated with the IM 153-4 PN
- It prepares the data for the inserted modules.
  The following settings can be made: SM, CP, non-assignable FM
- It supplies the backplane bus
- Integrated switch with 2 ports
- Transfer and backup of the device name on SIMATIC Micro Memory Card
- Firmware update using a SIMATIC Micro Memory Card or PROFINET IO
- The reference potential M of the rated supply voltage of the IM 153-4 PN to the rail (protective conductor) is connected by means of an RC combination, thus permitting an ungrounded configuration
- Supported Ethernet services
  - ping
  - arp
  - Network diagnostics (SNMP): LLDP-MIB / MIB-2
  - Resetting SNMP parameters to the factory settings
  - I&M data
- Interrupts
  - Diagnostic interrupts
  - Hardware interrupts
  - Removal / insertion interrupts
  - Maintenance interrupts
- Port diagnostics
- Port disabling
- Support for real-time communication (RT Class 1 and Class 2).
- Maximum address space of 200 bytes I/O data.
- Data records for I/O modules
- As of 6ES7153-4AA01-0XB0:
  - Isochronous real-time communication
  - Minimum updating time 250 μs with IRT
  - Prioritized startup
  - Device replacement without removable media / programming device
  - Changing IO devices during operation (changing partner ports)

Isochronous real-time communication

Synchronized transmission method for the cyclic exchange of IRT data between PROFINET devices.

A reserved bandwidth is available within the send cycle for IRT IO data. The reserved bandwidth ensures that IRT data can be transferred at reserved synchronized intervals, without being influence by other higher network loads (e.g. TCP/P communication, or additional real-time communication).

The "high flexibility" IRT option enables the best possible flexibility. It is not necessary to configure the topology.

For further information please refer to the STEP 7 Online Help and the "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)" manual.

Prioritized startup

Prioritized startup denotes PROFINET functionality for accelerating the startup of IO devices for RT and IRT communication within a PROFINET IO system.

The function reduces the time that the correspondingly configured IO devices require to recover the cyclic exchange of user data in the following situations:

- after power has returned
- after station recovery
- after activation of IO devices

Note

Ramp-up time depends on the number and type of modules. Also note that the minimum ramp-up time increases by 1.5 seconds if you are using the active backplane bus.

For further information please refer to the STEP 7 Online Help and the "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)" manual.

Device replacement without removable media / programming device

IO devices having this function can be replaced easily:

- You do not require any removable storage medium (for example, SIMATIC Micro Memory Card) with saved device names.
- The device name does not have to be assigned using the programming device.

Instead of being assigned a device name from the removable medium or programming device, the IO device is now assigned a device name by the IO controller. The IO controller uses the configured topology and the correlations derived from the IO devices. The configured target topology must agree with the actual topology.

For further information please refer to the STEP 7 Online Help and the "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)" manual.

Changing IO devices during operation (changing partner ports)

Functionality of a PROFINET device. If the IO controller and the IO device support this function, then an IO device port "changing partner ports" from other devices can be assigned by means of configuration, so that at all times via this port at a specific time communication can take place with one of these changing IO devices. However, it is only the changing device that may be physically linked with the changing port that is currently being communicated with.

This functionality is, for example, essential for tool change when using industrial robots.

To realize the quickest possible tool change, it is also practical to configure a "prioritized startup" for the devices in the tools together with setting a fixed transmission mode with disabled autonegotiation and specific wiring rules.

For further information please refer to the STEP 7 Online Help and the "PROFINET System Description (http://support.automation.siemens.com/WW/view/en/19292127)" manual.

Dimensioned drawing
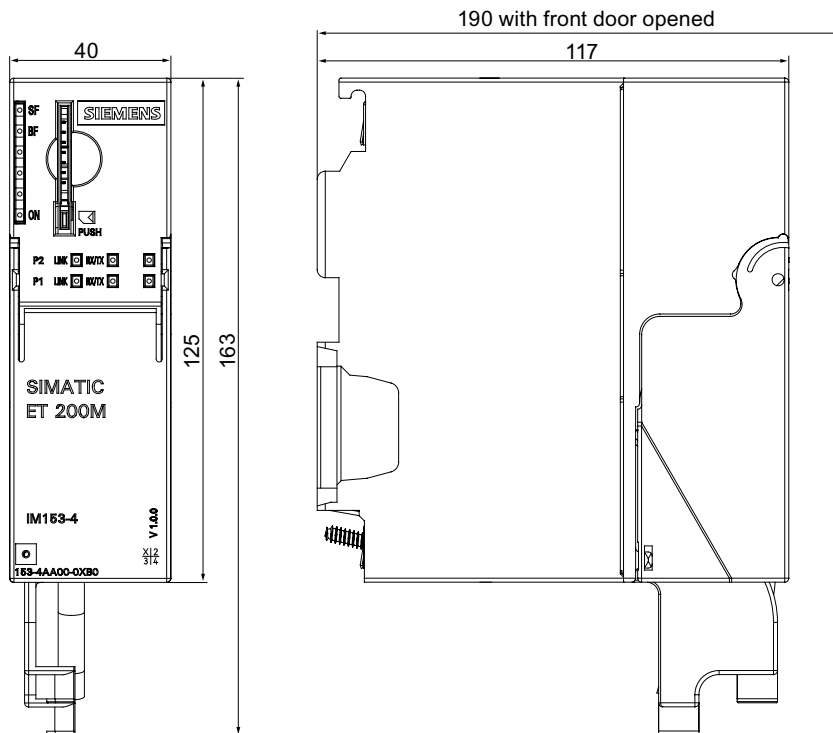
Figure 10-4   Dimensioned drawing of the IM 153-4 PN interface module

Block diagram
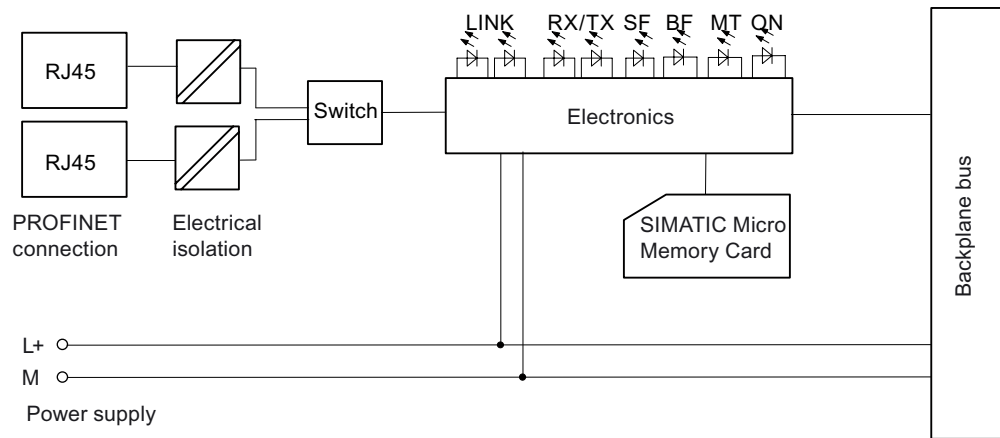
Figure 10-5   Block diagram of the IM 153-4 PN interface module

Technical specifications of the IM 153-4 PN (6ES7153-4AA01-0XB0)

Dimensions and weight	
Dimensions W x H x D (mm)	• 40 x 125 x 117 • 40 x 125 x 190 (with front door opened)
Weight	Approx. 215 g
Module-specific specifications	
Data transmission rate	• 10 Mbps for Ethernet services • 100 Mbps full duplex for PROFINET IO
Transmission procedure	100BASE-TX
Send clock	250 µs to 4000 µs in 125 µs increments
Autonegotiation	yes
Autocrossing	yes
Bus protocol	• PROFINET IO • TCP/IP • IRT with high flexibility
Supported Ethernet services	• ping • arp • Network diagnostics (SNMP): LLDP-MIB / MIB-2 • Reset SNMP parameters to factory settings
PROFINET interface	2x RJ45
Manufacturer ID (vendor ID)	002A$_H$
Device ID (DeviceID)	0302$_H$

Voltages, currents, potentials	
Rated supply voltage of electronics (L+)	24 VDC
• Incorrect polarity protection	yes
• Voltage failure bypass	Min. 5 ms
Galvanic isolation	
• Between the backplane bus and electronic components	No
• Between Ethernet and electronic components	yes
• Between the supply voltage and electronic components	No
Permissible potential difference (relative to rail)	75 VDC / 60 VAC
Insulation test voltage	500 VDC
Current consumption from rated supply voltage (L+)	max. 600 mA
Current consumption from backplane bus	Max. 1.5 A
Power loss of the module	max. 6 W
Status, alarms, diagnostics	
Interrupts	yes
Diagnostic function	yes
• Group error • Bus monitoring PROFINET IO	Red LED "SF" Red "BF" LED
• Monitoring of the supply voltage of the electronics	Green "ON" LED
• Maintenance requirement (maintenance)	yellow "maint" LED
• Existing connection to network	One green "LINK" LED per port
• Transmitting / receiving data on the network	One yellow "RX/TX" LED per port

10.5   Response time of the ET 200M

Response Time - A Definition

The response time is the time between detection of the input signal and the modification of the associated output signal.

Duration

The response time depends on the bus structure and on the DP master / IO controller. Refer to the DP master / IO controller manual for basics for calculating the response time.

Factors

The response time for the ET 200M depends on the following factors:

● Processing the data through the ET 200M

● Delay of the inputs and outputs (refer to the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" reference manual.

ET 200M

The time for processing the data within the ET 200M has a typical value of 1 ms. It is in this time that the data processing takes place in the IM 153x and the data transfer between the IM 153-x and the inserted modules.
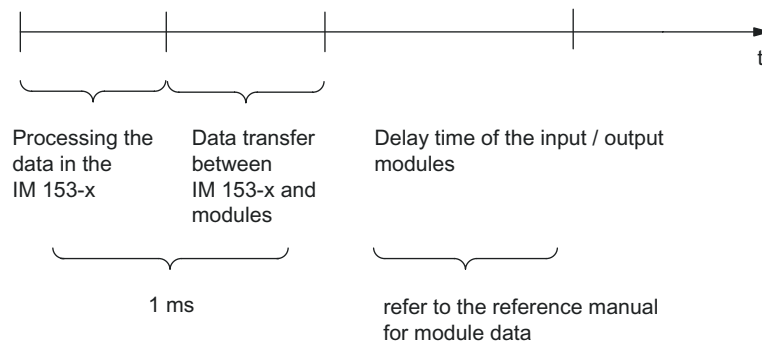
Figure 10-6   Response time of the ET 200M

Switchover Time in the Case of Redundancy

The switchover times, dependent on the mode and configuration amounts to:

DP master system	ET 200M with IM 153…	Switchover time	Configuration
S7-400H	-2AA02	70 ms	any configuration
	-2AB01	30 ms	… without F-, FM- or HART modules.
	-2Bx00 -2Bxx1	30 ms	any configuration
		30 ms	… without F-, FM- or HART modules.
S7-software redundancy; S5-115H / 155H	-2AA02	70 ms + 2 DP-cycles	any configuration
	-2AB01	30 ms + 2 DP-cycles	… without F-, FM- or HART modules.
	-2Bx00 -2Bxx1	30 ms	any configuration
		30 ms	… without F-, FM- or HART modules.

If the response monitoring time is set greater than 30 ms or 70 ms, the switchover time corresponds to the set monitoring time.

Delay time of the input / output modules

The delay time of the input / output modules can be derived from the technical specifications of the modules (refer to the "S7-300 automation system, module specifications (http://support.automation.siemens.com/WW/view/en/8859629)" reference manual).

10.6 Using the ET 200M in the potentially explosive area zone 2

See product information "Use of subassemblies/modules in a zone 2 hazardous area (https://portal.automation.siemens.com/apps/meta-search_p/index.ad.nwa.EN.html?q=19692172)".

See also

Use of subassemblies / modules in a zone 2 hazardous area (https://portal.automation.siemens.com/apps/meta-search_p/index.ad.nwa.EN.html?q=19692172)

Compatibilities between the IM 153-x
A

This chapter includes the most important information that you must know if you are "changing over" from an old IM 153-x to a new or different IM 153-x.

A.1 Compatibilities between the versions of IM 153 and IM 153-1

The versions of IM 153-1

Table A- 1   Properties and variants of the IM 153-1

Functions / properties	Interface module with order number 6ES7153-1AA..					
	00	01	02	03	82	83
Min_slave_interval between two slave list cycles	1 ms	0,1 ms	0,1 ms	0,1 ms	0,1 ms	0,1 ms
SYNC, FREEZE	–	x	x	x	x	x
Module change during operation	–	–	x	x	–	–
Direct data exchange	–	–	as of E07	x	as of E06	x
Enhanced diagnostics • 64 byte diagnostic frame	–	–	–	x as of E02	–	x
Extended range of environmental conditions (outdoors)	–	–	–	–	x	x
RC network with 10 MΩ for unearthed configuration	- (1 MΩ)	- (1 MΩ)	as of E08	x	as of E07	x
DPV1-mode	–	–	–	as of E05	–	as of E03
E = module version						

Compatibility between 153-1AA00- and 153-1AA01-…

The IM 153-1, order number 6ES7153-1AA01-0XB0 is partially upwards compatible. This means that the configuration and the user programs for the IM 153-1, order number 6ES7153-1AA01-0XB0 can also be used for the IM 153, order number 6ES7153-1AA00-0XB0, **apart from** if you are working with SYNC and FREEZE in these user programs. Note also the different min_slave-intervals (refer to table above).

Retrofitting to 153 1AA02 ...

The IM 153-1 with order number 6ES7153-1AA01-0XB0 can be retrofitted to the IM 153-1 with order number 6ES7153-1AA02-0XB0.

Contact your Siemens representative for this.

Behavior with inserting / removing interrupt

up to 153-1AA03, module version 01	as of 153-1AA03, module version 02
The ET 200M is set up on active bus modules. The removal/insertion interrupt is disabled at parameter assignment.	The ET 200M is set up on active bus modules. The removal/insertion interrupt is disabled at parameter assignment.
The removal or insertion of a module results in station failure.	It is still, however, possible to remove and insert modules. An interrupt is not reported, but the events are displayed in the diagnosis.

Startup Characteristics When Response Monitoring is Switched Off

The IM 153-1 **as of** 6ES7153-1AA02-0XB0, module version **05** has a different behavior when the DP normal master is restarted with a switched off response monitoring:

If the response monitoring is switched off, in the event of a DP master failure the outputs of the ET 200M maintain their set values.

When the DP master starts again **without resetting the DP slave** these output values remain until the new output data is received from the DP master.
Without resetting the DP slave means that the DP slave is not enabled for other DP masters. In the parameter assignment message frame, the bit 6 of the "Octet 1: station_status, unlock_req" has the value "0" (e.g. with the DP master of the SIMATIC 505).

In the case of previous versions: When restarting the DP master, the outputs of the ET 200M are briefly set to "0" until they are reset by the DP master.

If the **response monitoring switched on** is set, the IM 153-1AA02 as of E05 behaves like the predecessor versions.

Configuration of the IM 153-1 with the general ID format (AKF)

You can also configure the IM 153-1 as of order number 6ES7153-1AA03-0XB0, module version 02, with the general ID format AKF. This configuration assumes detailed knowledge of the structure of the AKF. You must use the code 0x00 for the slots 1 to 3.

⚠ WARNING
If you conduct the configuration with the general ID format AKF, the quality of the comparison of the preset and actual configuration when the DP slave starts up or when removing or inserting modules is very low. Since there is no type ID available for the comparison, an incorrect configuration cannot be easily detected!

See also

Configuration of an ET 200M with ungrounded reference potential (Page 54)

RC Network with 1 MΩ for Configuration with ungrounded reference potential (Page 246)

A.2 Compatibilities between the versions of IM 153-2 / -2 FO

The versions of the IM 153 2 / -2 FO

Functions / Properties	Interface module with order number 6ES7153-…								
	2AA..			2BA..			2AB.. (FO)		2BB.. (FO)
	00	01	02	00	01/81	02/82	00	01	00
RS 485 interface	x	x	x	x	x	x	–	–	–
Fiber-optic interface	–	–	–	–	–	–	x	x	x
12 modules can be operated after the interface module	–	–	–	–	–	x	–	–	–
SYNC, FREEZE	–	–	–	x	x	x	–	–	x
Module change during operation	x	x	x	x	x	x	x	x	x
Direct data exchange	–	–	x	x	x	x	–	x	x
Direct data exchange with F-modules	–	–	–	–	x	x	–	–	–
Enhanced diagnostics									
• 96-byte diagnostic frame	–	–	x as of E07	x	x	– [3]	–	x as of E06	x
• 130-byte diagnostic frame	–	–	–	–	–	x	–	–	–
Forwarding of parameter assignment data from the PG/PC (e.g. for HART modules)	–	x	x	x	x	x	x	x	x
Support for I/O modules with expanded input data	–	–	–	–	–	x	–	–	–
Support for 64-channel DI/DO	–	–	–	–	–	x	–	–	–
Configurable FM in an ET 200M	–	x	x	x	x	x	x	x	x
Time synchronization on the PROFIBUS DP	–	–	x	x	x	x	x	x	x
Time-of-day synchronization on the I/O bus	–	–	–	–	x	x	–	–	–
Time stamping of input signals	–	–	x	x	x	x	x	x	x
• In case of redundancy	–	–	as of E07	x	x	x	–	as of E06	x
• with 1 ms precision	–	–	–	–	x	x	–	–	–
• outside of S7-400	–	–	–	–	x	x	–	–	–
• For maximum of 32 DI per slot	–	–	–	–	–	x	–	–	–
Redundancy [1]	–	–	x	x	x	x	-	x	x
• Flying redundancy	–	–	–	–	x	x	–	–	–
System modification in RUN mode									
• In the redundant system	–	–	x	x	x	x	–	x	x
• In the non-redundant system	–	–	–	x	x	x	–	–	x
Clock synchronism [1]	–	–	–	x	x	x	–	–	x

Functions / Properties	Interface module with order number 6ES7153-...								
	2AA..			2BA..			2AB.. (FO)		2BB.. (FO)
	00	01	02	00	01/81	02/82	00	01	00
Identification and maintenance data (I&M)	–	–	–	x (I&A)	x	x	–	–	x (I&A)
Update via PROFIBUS DP	–	–	–	x ^{2}	x	x	–	–	x ^{2}
Update via SIMATIC Micro Memory Card	–	–	–	x	–	–	–	–	x
RC network with 10 MΩ for unearthed configuration	- (1 MΩ)	as of E03	x	x	x	x	x	x	x
DPV1 mode	–	–	as of E09	x	x	x	–	as of E08	x
IQ-sense	–	–	–	x (as of FW V3.0.1)	x	x	–	–	x (as of FW V3.0.1)
E = module version									
^{1} SYNC, FREEZE should not be used for these functions.									
^{2} not when operating with the bus module BM IM/IM 6ES7195-7HD00-0XA0									
^{3} supports expanded diagnostics with the 96-byte diagnostic frame in the spare part scenario									

Retrofitting

You can retrofit the IM 153-2 with order number 6ES7153-2AA02-0XB0; module version **06** to the module version **07** - this is subject to a fee.

You can retrofit the IM 153-2 FO with order number 6ES7153-2AB01-0XB0, module version **05** to module version **06** - this is subject to a fee.

Contact your Siemens representative for this.

Behavior with inserting / removing interrupt

up to 153-2AA02, module version 06 153-2AB01, module version 05	as of 153-2AA02, module version 07 153-2AB01, module version 06
The ET 200M is set up on active bus modules. The removal/insertion interrupt is disabled at parameter assignment.	The ET 200M is set up on active bus modules. The removal/insertion interrupt is disabled at parameter assignment.
The removal or insertion of a module results in station failure.	It is still, however, possible to remove and insert modules. An interrupt is not reported, but the events are displayed in the diagnosis.

Configurable FM in a configuration with IM 153-2

For the distributed use of the FM 353 / 354 / 355 with full S7 functionality you can use the following CPUs and FMs only as of the specified order numbers and module versions.

CPUs and FMs not listed in the table (e.g. CPU 316-2 DP) can be used as of the respective first module version.

Table A- 2   Restrictions for DP master CPUs and FM for IM 153-2

Module	as of order no.	... with module version	Operating system update is possible as of version module
CPU 315-2 DP	6ES7315-2AF01-0AB0	03	01
CPU 413-2 DP	6ES7413-2XG01-0AB0	02	01
CPU 414-2 DP	6ES7414-2XG01-0AB0	02	01
	6ES7414-2XJ00-0AB0	04	03
CPU 416-2 DP	6ES7416-2XK00-0AB0	04	03
	6ES7416-2XL00-0AB0	04	03
FM 353	6ES7353-1AH01-0AE0	01	–
FM 354	6ES7354-1AH01-0AE0	01	–
FM 355C	6ES7355-0VH10-0AE0	01	–
FM 355S	6ES7353-1VH10-0AE0	01	–

Configuration of the IM 153-2 with the general ID format (AKF)

You can also configure the IM 153-2 as of order number 6ES7153-2AA02-0XB0, module version 07, and 6ES7153-2AB01-0XB0, module version 06, with the general ID format AKF. This configuration assumes detailed knowledge of the structure of the AKF. You must use the code 0x00 for the slots 1 to 3.

> ⚠ **WARNING**
>
> If you conduct the configuration with the general ID format AKF, the quality of the comparison of the preset and actual configuration when the DP slave starts up or when removing or inserting modules is very low. Since there is no type ID available for the comparison, an incorrect configuration cannot be easily detected!

Functionality of the Previous Version

If you insert the IM 153-2Bx00 interface module

- on a bus module BM IM/IM (6ES7195-7HD00-0XA0),
- configure as an IM 153-2AA02 / -2AB01 with *STEP 7*,
- configure with GSD revision 2,

then it has the functionality of an IM 153-2AA02 / -2AB01.

See also

> Configuration of an ET 200M with ungrounded reference potential (Page 54)
>
> RC Network with 1 MΩ for Configuration with ungrounded reference potential (Page 246)
>
> Redundancy with IM 153-2 (Page 162)
>
> What is Isochronous? (Page 168)

A.3 RC Network with 1 MΩ for Configuration with ungrounded reference potential

The principle of the ET 200M structure with ungrounded reference potential can be found in chapter "Configuration of an ET 200M with ungrounded reference potential (Page 54)".

IM 153-x with a resistance of 1 MΩ

The following IM 153-x have in the RC network a resistance of 1 MΩ:

- IM 153-1
  up to and including 153-1AA02, version 07
  up to and including 153-1AA82, version 06

- IM 153-2
  up to and including 153-2AA01, version 02

①   Ground bus
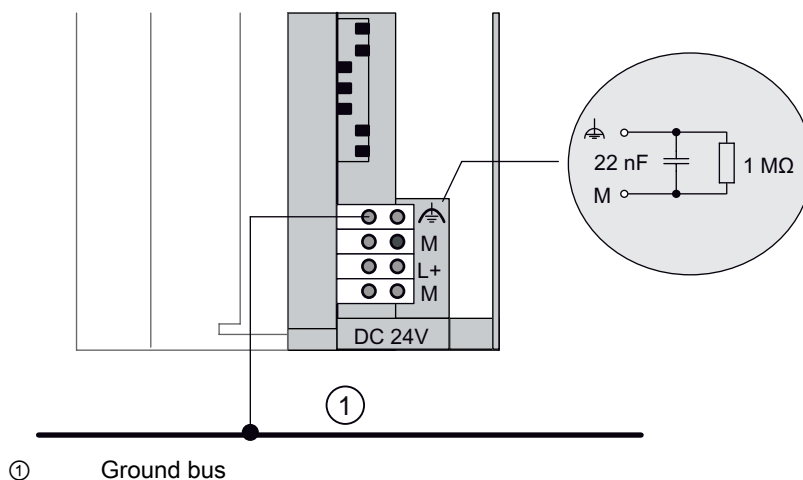
The following applies for this IM 153-x:

> **Maximum 18 nodes** can be operated on the PROFIBUS DP in an unearthed structure on a power supply.
>
> With more than 18 nodes you must use an additional power supply.

Subsequent Versions

> All later versions have a resistance of 10 MΩ in the RC network.

Order Numbers for the ET 200M

B

ET 200M components

Table B- 1   ET 200M components

Accessories and spare parts for the ET 200M	Order number
Active bus modules	
• Bus module BM IM/IM (…7HD) for redundancy with 2 x IM 153-2AA02 / -2AB01	6ES7195-7HD00-0XA0
• Bus module BM IM/IM (…7HD) for redundancy with 2 x IM 153-2Bx00 / -2Bxx1	6ES7195-7HD10-0XA0
• Bus module BM IM/IM (…7HD) outdoor for redundancy with 2 x IM 153-2Bx00 / -2Bxx1	6ES7195-7HD80-0XA0
• Bus module BM PS/IM (…7HA) for power supply and IM 153	6ES7195-7HA00-0XA0
• Bus module 2 x 40 (…7HB) for one or two 40 mm wide S7-300 modules	6ES7195-7HB00-0XA0
• Bus module 1 x 80 (…7HC) for an 80 mm wide S7-300 module	6ES7195-7HC00-0XA0
Covers (including 4 backplane bus covers and 1 bus module cover)	6ES7195-1JA00-0XA0
Explosion-proof partition	6ES7195-1KA00-0XA0
Mounting rail	
• 160 mm	6ES7390-1AB60-0AA0
• 482.6 mm	6ES7390-1AE80-0AA0
• 530 mm	6ES7390-1AF30-0AA0
• 830 mm	6ES7390-1AJ30-0AA0
• 2000 mm	6ES7390-1BC00-0AA0
Rail for the "module change during operation" function	
• 482.6 mm	6ES7195-1GA00-0XA0
• 530 mm	6ES7195-1GF30-0XA0
• 620 mm	6ES7195-1GG30-0XA0
• 2000 mm	6ES7195-1GC00-0XA0
Bus connector with FastConnect	
• with vertical cable departure, up to 12 MBaud, without PG socket	6ES7972-0BA52-0XA0
• with vertical cable departure, up to 12 MBaud, with PG socket	6ES7972-0BB52-0XA0
• with diagonal cable departure, up to 12 MBaud, without PG socket	6ES7972-0BA60-0XA0
• with diagonal cable departure, up to 12 MBaud, with PG socket	6ES7972-0BB60-0XA0

Accessories and spare parts for the ET 200M		Order number
Bus connector with screw-type terminal		
• with vertical cable departure, up to 12 MBaud, without PG socket		6ES7972-0BA12-0XA0
• with vertical cable departure, up to 12 MBaud, with PG socket		6ES7972-0BB12-0XA0
• with diagonal cable departure, up to 12 MBaud, without PG socket		6ES7972-0BA41-0XA0
• with diagonal cable departure, up to 12 MBaud, with PG socket		6ES7972-0BB41-0XA0
FC-bus cable for PROFIBUS DP		
• Standard		6XV1830-0EH10
• Earth cable		6XV1830-3FH10
• Trailing cable		6XV1830-3EH10
Bus cable for PROFIBUS DP		
• Standard		6XV1830-0AH10
• Earth cable		6XV1830-3AH10
• Trailing cable		6XV1830-3BH10
• Festoon attachment		6XV1830-3GH10
Industrial Ethernet FC RJ45 Plug 90 (RJ45 plug for Industrial Ethernet with robust metal housing and integrated cutting/clamping contacts for connecting the Industrial Ethernet FC installation cables; with 90° cable outlet		
• 1 unit • 10 units • 50 units		6GK1901-1BB20-2AA0 6GK1901-1BB20-2AB0 6GK1901-1BB20-2AE0
Industrial Ethernet Fast Connect Installation cables		
• Fast Connect standard cable • Fast Connect trailing cable • Fast Connect marine cable		6XV1840-2AH10 6XV1840-3AH10 6XV1840-4AH10
Industrial Ethernet Fast Connect stripping tool		6GK1901-1GA00
Fiber-optic cable		
• SIMATIC NET PROFIBUS plastic fiber optic, duplex wire (50 m ring)		6XV1821-2AN50
• SIMATIC NET PROFIBUS plastic fiber optic, standard cable	By the meter	6XV1821-0AH10
	50 m ring	6XV1821-0AN50
	100 m ring	6XV1821-0AT10
• SIMATIC NET PROFIBUS PCF Fiber Optic, standard cable various lengths from 50 m to 300 m		6XV1821-1Cxxx
Plugs for fiber-optic cable		
• Package with 100 Simplex connectors and 5 polishing sets		6GK1901-0FB00-0AA0
• Package with 50 plug adapters		6ES7195-1BE00-0XA0
PROFIBUS terminator		6ES7972-0DA00-0AA0

Manuals on *STEP 7* and SIMATIC S7

The order data for these manuals can be found in the ST 70 catalog.

Table B- 2   Manuals on STEP 7 and SIMATIC S7

Manual	Contents
S7-300 CPU 31xC and CPU 31x automation systems • "Structures (http://support.automation.siemens.com/WW/view/en/13008499)". • "Technical specifications (http://support.automation.siemens.com/WW/view/en/13008499)"	among others • Description of the PROFIBUS DP interface for the CPU 31x-2 DP, CPU 31xC-2 DP • Structure of a PROFIBUS DP network • Bus connector and RS 485 repeater
"S7-300 automation system, hardware and installation: CPU 312 IFM – 318-2 DP (http://support.automation.siemens.com/WW/view/en/15390415)"	
"S7-300 Automation Systems, ET 200M Ex I/O Modules (http://support.automation.siemens.com/WW/view/en/1096709)"	Mechanical configuration, Ex digital modules, Ex analog modules, HART analog modules
"Principles of explosion protection (http://support.automation.siemens.com/WW/view/en/12521844)"	Product overview, planning, commissioning, repair and maintenance
"S7-300 automation system, ET 200M distributed I/O device, fail-safe signal modules (http://support.automation.siemens.com/WW/view/en/19026151)"	Product overview; configuration options; configuring and parameter assignment; addressing and installing; wiring; fault reactions and diagnostics; digital, analog, and isolation modules
"ET 200M distributed I/O device, HART analog modules (http://support.automation.siemens.com/WW/view/en/22063748)"	Configuration, commissioning and operation; parameters; diagnostics and interrupts; HART analog modules; data record interface and user data
"Isochronous (http://support.automation.siemens.com/WW/view/en/15218045)"	Description of the system property "Isochronous mode"
"Changing the parameter settings in RUN mode (http://support.automation.siemens.com/WW/view/en/14835140)"	Requirements, steps, and specific details for individual modules
"M7-300 automation system, hardware and installation, CPU data (http://support.automation.siemens.com/WW/view/en/1177102)"	among others • Description of the PROFIBUS DP interfaces in M7-300 • Structure of a PROFIBUS DP network • Bus connector and RS 485 repeater
"S7-400, M7-400 automation systems, installation (http://support.automation.siemens.com/WW/view/en/19537233)"	among others • Description of the PROFIBUS DP interfaces in S7-400 and M7-400 • Structure of a PROFIBUS DP network • Bus connector and RS 485 repeater
"SIMATIC software, programming with STEP 7 V5.x. (http://support.automation.siemens.com/WW/view/en/18652056)"	among others, description of the addressing and the diagnostics in SIMATIC S7
"System and Standard Functions for S7-300/400 (http://support.automation.siemens.com/WW/view/en/1214574)"	Description of the SFCs in *STEP 7*
"Communication with SIMATIC (http://support.automation.siemens.com/WW/view/en/25074283)"	Introduction to the communication options in SIMATIC

Manual	Contents
"SIMATIC NET PROFIBUS networks (http://support.automation.siemens.com/WW/view/en/1971286)"	• Introduction to PROFIBUS networks • Network configuration • Components for PROFIBUS networks
Configuration manuals (http://support.automation.siemens.com/WW/view/en/10806846/133300)	• Introduction to the PCS 7 system philosophy • Description of the configuration of a system with PCS 7
"S7-300 automation system, ET 200M distributed I/O device, fail-safe signal modules (http://support.automation.siemens.com/WW/view/en/19026151)"	Description and technical data of the S7-300 I/O modules in the intrinsically safe area
FM 35x manual (http://support.automation.siemens.com/WW/view/en/10805177/133300)	Description and technical data of the function modules FM 35x (a separate manual for each FM)

Manual for the ET 200 in SIMATIC S5

In order to program and commission an ET 200M with *COM PROFIBUS* you require the following manual with the order number 6ES5998-3ESx2.

Table B- 3   Manual for the ET 200 in SIMATIC S5

Manual	Contents
"ET 200 Distributed I/O System (http://support.automation.siemens.com/WW/view/en/1142470)"	• Description of the master switching of the IM 308-C for S5-115U, S5-135U and S5-155U • Description of the S5-95U with PROFIBUS DP master interface • Handling the FB IM308C
"COM PROFIBUS (http://support.automation.siemens.com/WW/view/en/1498610)"	• Handling *COM PROFIBUS* Electronic manual on CD-ROM and constituent of the *COM PROFIBUS* (as of version 5.x)

Technical Literature

Table B- 4   Technical Literature

Technical guide	Contents
"Decentralizing with PROFIBUS DP" - structure, configuration and use of the PROFIBUS DP with SIMATIC S7 - Josef Weigmann, Gerhard Kilian Publicis MCD Verlag, 1998 order number: A 19100-L531-B714	Textbook to help you get started in areas of the PROFIBUS DP and realization of automation tasks with PROFIBUS DP and SIMATIC S7. Using SIMATIC S7 the use of PROFIBUS DP is shown using lots of practice-orientated application examples.
"Plastic fiber-optic cables" "Fundamentals, components, installation" Weinert, Andreas Publicis MCD Verlag, Order number: A 19100-L531-B693	Introduction to the physical basics of signal transmission with plastic FOC. Reference to editing and installing plastic FOC.

Glossary

Automation system

An automation system is a → programmable logic controller that comprises at least one → CPU, several input and output modules, and operator control and monitoring devices.

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

The backplane bus is a serial data bus that the modules use to communicate with each other. It is also used to supply the modules with the necessary voltage. The modules are connected through bus connectors.

Baud rate

The baud rate is the data transfer speed, indicating the number of transferred bits per second (baud rate = bit rate).

ET 200 supports baud rates between 9.6 kBaud and 12 MBaud.

Bus

Shared data transmission path by which all nodes are connected. It has two defined ends.

With ET 200 the bus can either be a two-wire or a fiber-optic cable.

Bus node

This device 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

→ Segment

Changing IO devices during operation (changing partner ports)

Functionality of a PROFINET device. A PROFINET device that supports this function can communicate during operation with changing communication partners at the same port.

Configuration

The process of assigning modules to mounting racks/slots and addresses. A distinction is made between the actual configuration (= actually inserted modules) and the desired configuration. The desired configuration is preset for *STEP 7*, *COM PROFIBUS* (or *COM ET 200 Windows*). This enables the operating system to detect any incorrect parts during startup.

CPU

Central Processing Unit. It is part of the S7 automation system and contains control and processing units, memory, operating system and the programming device interface.

Device names

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 to setting the PROFIBUS address of a DP slave.

When it ships, an IO device does not have a device name. The IO device can only be addressed by an 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.

The device name can alternatively be written directly in the programming device on the SIMATIC Micro Memory Card (for the ET 200pro IO device).

Device replacement without removable media / programming device

IO devices having this function can be replaced easily:

- You do not require any removable media (e.g. Micro Memory Card) with saved device names.

- The device name does not have to be assigned using the programming device.

Instead of being assigned a device name from the removable medium or programming device, the IO device is now assigned a device name by the IO controller. The IO controller uses the configured topology and the correlations derived from the IO devices. The configured target topology must agree with the actual topology.

Diagnostic interrupt

Modules with diagnostics capabilities use diagnostic interrupts to report detected system errors to the CPU.

In SIMATIC S7 / M7: If interrupts are enabled the module will trigger a diagnostic interrupt when an error is detected or when an error disappears (e.g. wire breakage). The CPU then interrupts the user program or any lower priority classes and starts processing the diagnostic interrupt block (OB 82).

In SIMATIC S5: The diagnostic interrupt is simulated in the device-specific diagnostics. Cyclic scanning of the relevant bits in the device-specific diagnostics will enable you to detect errors such as wire breakage.

Diagnostics

The detection, localization, classification, visualization and further evaluation of errors, disturbances and messages.

Diagnostics provides monitoring functions which are executed automatically when the system is in RUN. This increases plant availability by reducing commissioning times and down times.

Distributed IO devices

are input/output units, set up at a distance from the CPU instead of being used within the unit. They include:

● ET 200M, ET 200S, ET 200S, ET 200eco

● DP/AS-I Link

● S5-95U with PROFIBUS-DP slave interface

● other Siemens or non-Siemens DP slaves

PROFIBUS DP connects the distributed IO devices to the DP master.

DP master

A → master that performs to the standard IEC 61784-1:2002 Ed1 CP 3/1 is called DP master.

DP slave

A → slave that is operated by the PROFIBUS using the PROFIBUS DP protocol and that performs to the standard IEC 61784-1:2002 Ed1 CP 3/1 is called DP slave.

DP standard

is the ET 200 distributed I/O system's bus protocol that complies with the standard IEC 61784-1:2002 Ed1 CP 3/1.

Equipotential bonding

Electrical connection (equipotential bonding conductor) that places electrical equipment parts and non-equipment related conductive parts at equal or nearly equal potential to prevent interfering or hazardous voltage between them.

Fault-tolerant system

A fault-tolerant system (also called H system, an abbreviation of the German 'Hochverfügbares System') consists of two or more CPUs or two or more separate devices, such as PCs (master / reserve). The user program is processed identically in master and reserve.

Fiber-optic cable

Fiber-optic cables are made from fibere-optics or plastic and have an extremely high transmission rate. They are resistant to electromagnetic interference and practically tap-proof.

FREEZE

is a control command that is issued by the DP master to a set of DP slaves.

Upon receiving the FREEZE control command the DP slave freezes the inputs at their current states and transfers them to the DP master in cycles.

After each received FREEZE the DP slave freezes the input state again.

The DP slave will cyclically transfer the input data to the DP master only after the DP master has issued the UNFREEZE control command.

Functional grounding

This grounding method is used to ensure that the electrical product is functioning as expected. Functional grounding short-circuits any noise voltage that might render a product impermissible.

Ground

Conductive ground has an electrical potential of zero.

Close to ground electrodes the ground's potential might be different from zero. The term "reference ground" is frequently used to describe this situation.

Ground-free

No galvanic connection to → ground

Grounding

Grounding involves connecting an electrically conductive part with the ground electrode through a grounding system.

GSD file

The properties of a PROFINET device are described in a GSD file (Generic Station Description), which contains all required information for the configuration.

You can integrate PROFINET devices in STEP 7 using a GSD file similar to PROFIBUS devices.

In the case of the PROFINET IO the GSD file is in XML format. The structure corresponds to ISO 15734, the worldwide standard for device specifications.

For PROFIBUS, the GSD file is in ASCII format (according to IEC 61784-1:2002 Ed1 CP 3/1).

Hardware interrupt

A hardwareinterrupt is triggered by interrupt-enabled S7-300 modules when a specific event occurs within the process. The hardware interrupt is reported to the CPU. Depending on the interrupt priority the associated organization module will be processed.

In SIMATIC S7 / M7: Assigning parameters to a top and bottom threshold, for example, defines a working range. If the process signal (e.g. temperature) of an analog input module leaves this working range, the module will trigger a process interrupt (if interrupts are enabled). The CPU then interrupts the user program or any lower priority classes and starts processing the process interrupt block (OB 40).

In SIMATIC PCS 7: If the IM 153-2 reports a process interrupt, this means that at least one data record contains messages concerning time-stamped signal changes or special messages. The DP master CPU can read and evaluate the data record(s).

In SIMATIC S5: The process interrupt is simulated in the device-specific diagnostics. Cyclic scanning of the relevant bits in the device-specific diagnostics will enable you to detect process interrupts, such as upper threshold exceeded.

I&M data

→ Identification and maintenance data

I/O bus

Part of the → S7-300 backplane bus in the automation system. Optimized for rapid signal exchange between the IM 153-x and the signal modules. The I/O bus is used to transfer → user data (such as the signal module's digital input signals) and system data (such as the signal module's default parameter datasets).

I/O modules, single-channel

A single-channel I/O module scenario means that – unlike redundant I/O modules – the I/O module is available only once for each process signal. The connection can be unidirectional or in series.

Identification and maintenance data

Identification data (I data) contain module information some of which is also printed on the module housing. I data are read-only.

Maintenance data (M data) contain system-specific information, such as location and date of installation etc. M data are created and written to the module during configuration.

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
- Troubleshooting a system

I&M data enable modules to be uniquely identified online.

Industrial Ethernet

Industrial Ethernet (previously SINEC H1) is a technology that allows data to be transferred fail-safe 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.

IP 20

Degree of protection in accordance with DIN 40050: protection to prevent finger contact and intrusion of particles larger than 12mm Ø.

Isochronous

Clock synchronism causes all affected cycles (e.g. user program cycle, DP bus cycle, signal processing cycle in the DP slaves) to run synchronously and for the same length of time. Thus, process response times will also be of the same length and can be reproduced.

Isochronous real-time communication

Synchronized transmission method for the cyclic exchange of IRT data between PROFINET devices.

A reserved bandwidth is available within the send cycle for IRT IO data. The reserved bandwidth guarantees that IRT data can also be transferred at reserved, synchronized intervals while other, higher network loads are active (for example TCP/IP communication, or additional real-time communication).

Isolated

For isolated I/O modules the reference potentials of the control and load circuits are electrically isolated, e.g. by using an optocoupler, relay contact or transmitter. Input and output circuits can be rooted.

LAN

Local Area Network; interconnects multiple computers within a company. The geographical topology of a LAN is limited to the local premises and is only available to the operating company or institution.

LLDP

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.

Load power supply

Power supply for signal and function modules, including any attached process I/O modules.

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 consists of:

- 3-byte vendor identifier and

- 3-byte device identifier (consecutive number).

The MAC address is generally shown on the front of the device, for example: 08-00-06-6B-80-C0

Mass

The mass is the total of all interconnected, inactive product parts which will not carry hazardous contact voltage even when a fault or error occurs.

Master

If a master has ownership of the token it can send data to other nodes and request data from other nodes (=active node).

→ DP masters include CPU 315-2 DP and IM 308-C.

Master-slave process

Bus access method where only one node is → DP master, and all other nodes are → DP slaves.

MIB

An MIB (Management Information Base) is a data base of a device. SNMP clients access this data base in the device. The S7 device family supports, among others, the following standard MIBs:

- MIB II, standardized in the RFC 1213

- LLDP MIB, standardized in the international standard IEE 802.1AB

- LLDP PNIO-MIB, standardized in the international standard IEE 61158-6-10

Non-isolated

For non-isolated I/O modules the reference potentials of the control and load circuits are electrically connected.

Parameter assignment

By assigning parameters you set a module's behavior.

Parameter assignment master

Each DP slave has a parameter assignment master. During startup the parameter assignment master provides the DP slave with the parameterization data. It has read-write access to the DP slave and can change a DP slave's configuration.

PLC

→ Programmable logic controller

Prioritized startup

Prioritized startup denotes PROFINET functionality for accelerating the startup of IO devices for RT and IRT communication within a PROFINET IO system.

The function reduces the time that the correspondingly configured IO devices require to recover the cyclic exchange of user data in the following situations:

- after power has returned
- after station recovery
- after activation of IO devices

Product version

Any product with an order number has a product version. Reasons for revising the product version include upward-compatible function enhancements, production-related changes (new parts and components) and fault corrections.

PROFIBUS

Process Field BUS: a process and field bus protocol defined in the PROFIBUS standard IEC 61784 1:2002 Ed1 CP 3/1. This standard specifies the operational, electrical and mechanical properties of a bit-serial field bus system.

PROFIBUS is a bus system that connects PROFIBUS compatible automation systems and field devices on a cell and field level. PROFIBUS is available with the following protocols: DP (= Dezentrale Peripherie, distributed IO devices), FMS (= fieldbus message specification) or TF (= technological functions).

PROFIBUS address

Each bus node must receive a PROFIBUS address to identify it uniquely on the PROFIBUS DP.

PC / PD or the ET 200 Handheld have the PROFIBUS address "0".

DP masters and DP slaves use a PROFIBUS address in the range between 1 and 125.

PROFIBUS DP

PROFIBUS bus system with DP protocol. DP is the abbreviation of the German term 'dezentrale Peripherie' (distributed I/O). The ET 200 distributed I/O system is based on standard IEC 61784-1:2002 Ed1 CP 3/1.

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: www.profibus.com

PROFINET

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

PROFIBUS DP, the established field bus, and

- Industrial Ethernet, the communications 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.

See PROFIBUS International

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 IO

Within the framework of PROFINET, PROFINET IO represents 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 implemented by the PROFINET standard for automation devices on the one hand, and on the other hand by the engineering tool STEP 7. In other words, you have the same application view in STEP 7, regardless of whether you configure 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 used to address connected IO devices. That means: the IO controller exchanges input and output signals with assigned field devices. The IO controller is usually the controller running the automation program.

PROFINET IO Device

Distributed field device which is assigned to one of the IO controllers (remote IO, valve blocks, frequency converters, switches.)

Programmable logic controller

Programmable logic controllers are electronic control systems that are stored as programs in the control device. Thus, neither setup nor wiring of the device depend on the control system's function. The programmable logic controller is structured like a computer: it consists of a CPU with memory, I/O modules and an internal bus system. IO devices and programming language are aimed at control technique requirements.

Programming device

Programming devices are essentially compact and mobile PCs that are suitable for industrial purposes. They are equipped with special hardware and software for programmable logic controllers (SIMATIC).

Punch value

Punch values are values issued to the process due to faulty signal output modules. Alternatively they are used for faulty signal input modules in the user program instead of process values. Punch values can be pre-configured by the user (e.g. maintaining the old value).

Redundant systems

Redundant systems are characterized by multiple (redundant) occurrences of important automation components. Failure of a redundant component will not cause program processing to be interrupted.

Reference potential

Potential that is used to view and/or measure voltages for each circuit involved.

Response monitoring

is a slave parameter. If a DP Slave is not addressed during the response monitoring time, it will switch to safe mode and set its outputs to "0".

Response Time

The response time is the average time interval between an input modification and the relevant output modification.

S7 diagnosis

You can use the user program to request S7 diagnosis for any module in the SIMATIC S7 / M7 module range. The S7 diagnosis structure is the same for central and distributed modules.

The diagnostic data of a module are located in the data records 0 and 1 in the module's system data area. Data record 0 contains 4 bytes of diagnostic data that indicate the current module state. Data record 1 also contains module-specific diagnostic data.

Data records 0 and 1 are part of the slave diagnosis.

Segment

The bus line between two terminating resistors forms a segment. A segment contains between 0 and 32 → bus nodes. Segments can be linked via the RS 485 repeater.

Signal module

Signal modules (SM) are the interface between the process and the automation system. Digital input and output modules (I/O module, digital) as well as analog input and output modules (I/O module, analog) are available.

Slave

Before a slave can exchange data with a → master it must be prompted to do so by the master.

By slaves we mean, for example, all DP slaves such as ET 200X, ET 200M, ET 200S, etc.

SNMP

SNMP (Simple Network Management Protocol) is the standardized protocol for diagnosing and also configuring the Ethernet Network infrastructure.

In the office area and in automation technology, devices support a wide range of manufacturers on the Ethernet SNMP.

SNMP-based applications can be operated parallel to applications with PROFINET on the same network.

The scope of the supported functions varies depending on the device type. A switch, for example, has more functions than a CP 1616.

STEP 7

Programming language used to create user programs for SIMATIC S7 control systems.

Switch

PROFIBUS is based on a line topology. Communication nodes are interconnected by means of a passive line, namely 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.

If a node is to be interconnected with several other communication nodes, this communication node is connected to 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

is a control command that is issued by the DP master to a set of DP slaves.

The SYNC control command is used by the DP master to instruct the DP slave to freeze the output states at the current value. The DP slave stores the output data for the subsequent frames, while the output states remain unchanged.

After each received SYNC control command the DP slave sets the outputs that were stored as output dates.

Cyclic updating of the outputs will continue only after the DP master has issued the UNSYNC control command.

System modification in RUN mode

Modifying a system in RUN mode enables you to change certain configuration settings while the system is running. Processing is paused for only a few seconds. During this time process outputs will retain their current values, which in process-related systems has virtually no effect on the process itself.
A system modification in RUN mode can only be carried out in a distributed I/O scenario.

Terminating resistor

is a resistor that is used to adjust the bus connector performance. Terminating resistors are always required at cable and segment ends.

For ET 200 the → bus connector is used to turn terminating resistors on or off.

Time stampingTime stamping

Specifies date and time in messages.

If configured for time stamping, binary input signals are time-stamped when changes occur. After they have been changed all configured binary input signals must be time-stamped at a preset accuracy level, such as 10 ms, across the entire system. Therefore, when 2 sensors (from two different stations) are triggered simultaneously in different PROFIBUS DP master systems, the time stamp difference for these signal changes must not exceed the preset accuracy (10 ms in this case).

Time synchronization

Time synchronization ensures that all clocks in a system are set to the same time. In addition, in a configured cycle, a time master distributes the time to all the other components in the automation system that possess a clock. The components then use the distributed time to set their respective clocks.

Update

After performance or (compatible) function enhancements you should update the interface module IM 153-2 to the latest firmware version.

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