SIEMENS

SIMATIC

FM 456-2 Application Function Module
Installation, Hardware, and Startup

Manual

This manual has the order number:
6ES7 456-2AA00-8BA0

05/99
Edition 01

Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

Danger

indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage **can** result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage can result if proper precautions are not taken.

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

Warning

This device and its components may only be used for the applications described in the catalog or the technical descriptions, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Trademarks

SIMATIC®, SIMATIC HMI® and SIMATIC NET® are registered trademarks of SIEMENS AG.

Some of other designations used in these documents are also registered trademarks; the owner's rights may be violated if they are used by third parties for their own purposes.

Copyright Siemens AG 1998 All rights reserved

The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights, including rights created by patent grant or registration of a utility model or design, are reserved.

Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Siemens AG
Bereich Automatisierungs- und Antriebstechnik
Geschaeftsgebiet Industrie-Automatisierungssysteme
Postfach 4848, D- 90327 Nuernberg

© Siemens AG 1998
Technical data subject to change.

Important Notes

Purpose of the Manual

The information in this manual will enable you to:

- Design a configuration from the M7-400 range and build it into an S7/M7-400 programmable logic control system.
- Look up operating instructions, functional descriptions and technical data for specific modules.

Audience

The manual is intended for the following readers:

- Users who plan and design the scope of a programmable logic controller.
- Users who require detailed technical data.
- Service and maintenance engineers who have to install and maintain programmable logic controllers.

Scope of This Manual

The manual applies to the following M7-400 modules:

Product	Order Number	From Release
FM 456-2	6ES7 456-2AA00-0AB0	1
FM 456-2 with MS-DOS	6ES7 456-2AA00-0AB1	1

This manual contains descriptions of all the modules that are valid at the time of issue of this manual. We reserve the right in the case of new modules and new releases of modules to provide product information sheets containing up-to-date information about those modules.

Note

The structure of an S7-/M7-400 system is described in *manual /1/*. Familiarity with the content and requirements of *manual /1/* is a prerequisite for integrating M7-400 application function modules into a S7/M7-400 system.

What is New in the FM 456-2?

In comparison to the FM 456-4, the preceding product, the FM 456, shows the following alterations:

Feature	FM 456-4 (old)	FM 456-2 (new)
Processor	80486DX, 75 MHz	Pentium, 120 MHz
SRAM, buffered	64 Kbytes	256 Kbytes
Reading and writing of records	only SD0 and SD1 system records	all system and user records
Main memory	suitable for expansion with 16 MB RAM	16 MB RAM installed
Operating system	• M7-SYS up to V2.0 inclusive • M7-SYS RT up to V4.0 inclusive	• M7-SYS RT from V5.0
Width	25 mm (1”)	50 mm (2”)
OSD (Flash EPROM)	yes	no

Approvals

The following approvals have been granted for the S7-400/M7-400:

UL recognition mark
Underwriters Laboratories (UL) to
standard UL 508, report E 85972

CSA certification mark
Canadian Standard Association (CSA) to
standard C 22.2 No. 142, report LR 63533

FM approval
according to Factory Mutual Approval Standard
Class Number 3611, Class I, Division 2, Group A, B, C, D.

For further information, please refer to Chapter 1 of the *reference manual /1/*.

CE Marking

CE

This product complies with the requirements of the EU directives which are listed in Chapter 1 of *reference manual /1/*.

Area of Use

The following areas of use apply to the S7-400/M7-400 systems in accordance with this CE mark:

Area of use	Requirements for	
	Interference emission	Interference resistance
Industry	EN 50081-2: 1993	EN 50082-2: 1995

Observe the Installation Guidelines

The installation guidelines and safety notes given in the manual *S7-400, M7-400 Programmable Controllers* must be observed when commissioning and operating the S7-400/M7-400 systems.

How to Use This Manual

This manual provides the information you need to install M7-400 application function modules in an S7/M7-400 controller.

Product Overview

Chapter1 provides an overview of the M7-400 function modules.

Configuring, Addressing

You will find the information you need for this in *manual /1/*.

Installation and Startup

Chapter 2 shows you how to install the M7-400 application function modules and prepare them for startup.

Replacing Modules

Chapter 3 describes how to replace M7-400 application function modules.

Functions, Technical Data

Chapter 4 provides a detailed description of the FM 456-2 application function module. You will also find the technical data in this section.

Ordering Information

Chapter 5 contains ordering information for M7-400 components as well as I/O modules and accessories not described in this manual.

Bibliography

Appendix A contains references to further literature that may be helpful in certain cases.

Index

At the end of the manual is a comprehensive index to give you quick access to the information you require.

Feedback on documentation

We need your help to enable us to provide you and future users with optimum documentation. Should you have any remarks on this *manual,* please fill out the remarks form at the end of the manual and return it to the address shown on the form. Please also indicate your personal opinion of the manual.

SIMATIC Customer Support Hotline

Available 24 hours a day, worldwide:

Nuremberg

SIMATIC BASIC Hotline

Local time: Mon. through Fri. 7.00 a.m. to 5.00 p.m.

Phone:	+49 (911) 895-7000
Fax:	+49 (911) 895-7002
E-mail:	simatic.support@ nbgm.siemens.de
GMT	+01.00

Johnson City

SIMATIC BASIC Hotline

Local time: Mon. through Fri. 8.00 a.m. to 5.00 p.m.

Phone:	+1 423 461-2522
Fax:	+1 423 461-2231
E-mail:	simatic.hotline@ sea.siemens.com
GMT	–5.00

Singapore

SIMATIC BASIC Hotline

Local time: Mon. through Fri. 8.30 a.m. to 5.30 p.m.

Phone:	+65 740-7000
Fax:	+65 740-7001
E-mail:	simatic@ singnet.com.sg
GMT	+8:00

SIMATIC Premium Hotline

(subject to charge, with SIMATIC Card only)

Time: Mon. through Fri. 0.00 a.m. to 12.00 p.m.

Phone:	+49 (911) 895-7777
Fax:	+49 (911) 895-7001
GMT	+01.00

SIMATIC Training Center

We offer a number of courses to help you become familiar with the SIMATIC S7 programmable logic controller. Please contact your regional training center or the central training center in Nuremberg, Germany, for details.
Phone: +49 (911) 895-3154.

SIMATIC Customer Support Online Services

SIMATIC Customer Support provides you with comprehensive additional information in SIMATIC products by means of its online services:

- You can obtain general current information on the **Internet** at http://www.ad.siemens.de/simatic
- Current product information leaflets and downloads which you may find useful for your product:
  - On the **Internet** at `http://www.ad.siemens.de/support/html_00/`

    To access the mailbox, use a modem with up to V.34 (28.8 kbps) capability whose parameters you should set as follows: 8, N, 1, ANSI, or dial in using ISDN (x.75, 64 kbps).

Contents

Product Overview

1

In this Chapter

1.1 Overview

Introduction

In this section, you will learn what the FM 456-2 application function module is and what it has to offer.

What Is an FM 456-2?

The FM 456-2 is an application function module from the M7-400 family of automation computers that is used in the S7/M7-400 programmable logic controller.

The FM 456-2 application function module is an automation computer with PC-HW architecture for inserting in your S7/M7-400 programmable logic controller rack.

The FM 456-2 is a freely programmable module (application function module) that can be expanded or combined to form large configurations:

- Programmable module with Pentium, 120 MHz; a memory card and up to two interface modules can be plugged in at the front.
- EXM 478 expansion module, each for fitting 3 interface submodules such as IF 962-VGA, IF 962-COM, IF 962-LPT.
- MSM 478 mass storage module with diskette drive, hard disk and “LPT1” parallel interface.
- ATM 478 AT adapter module for installing a short AT module.

Position of an FM 456-2 in the S7 System

Within an S7/M7-400 system an FM 456-2 can be expanded with monitor, keyboard and mass memory. Integration into the system is performed by the M7 system software.

You can use an FM 456-2 to provide flexibility in meeting specific requirements, such as application technology tasks (controlling, positioning, metering, ...), communications, data storage, etc. This considerably reduces the load on the S7/M7-400 CPU.

Configuration of an S7-400 with FM 456-2

An FM 456-2 with or without expansion modules can be installed in addition to the S7-400 components. Figures 1-1 and 1-2 illustrate sample configurations:

- FM 456-2 fitted with IF 962-COM and IF 961-CT1 interface submodules, without expansion modules as application function module in the S7-400 system
- FM 456-2 fitted with IF 962-COM and IF 962-VGA interface submodules, an EXM 478 expansion module fitted with IF 961-DIO interface submodule and an MSM 478 mass storage module as automation computer in the S7-400 system

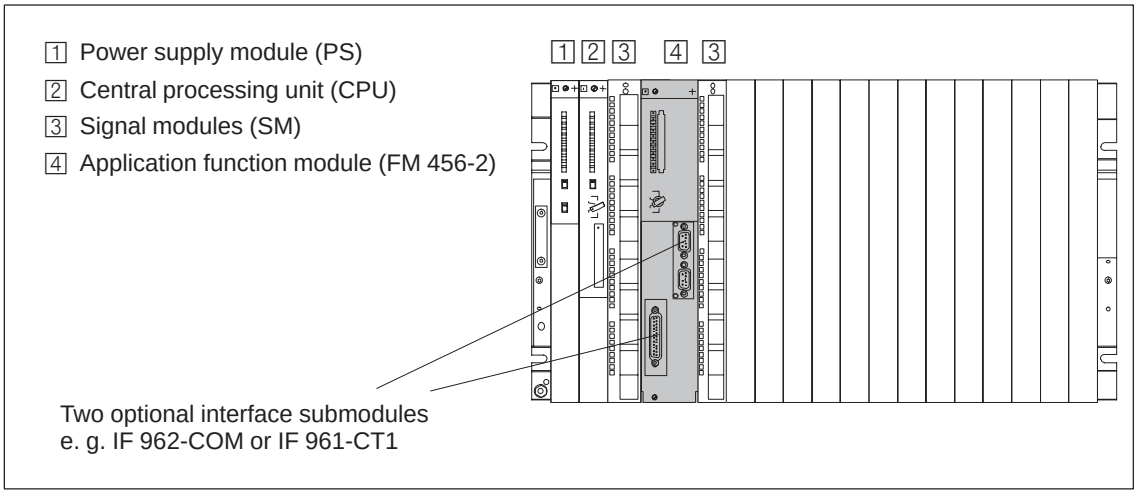


Figure 1-1 FM 456-2 as Application Function Module in the S7-400 System

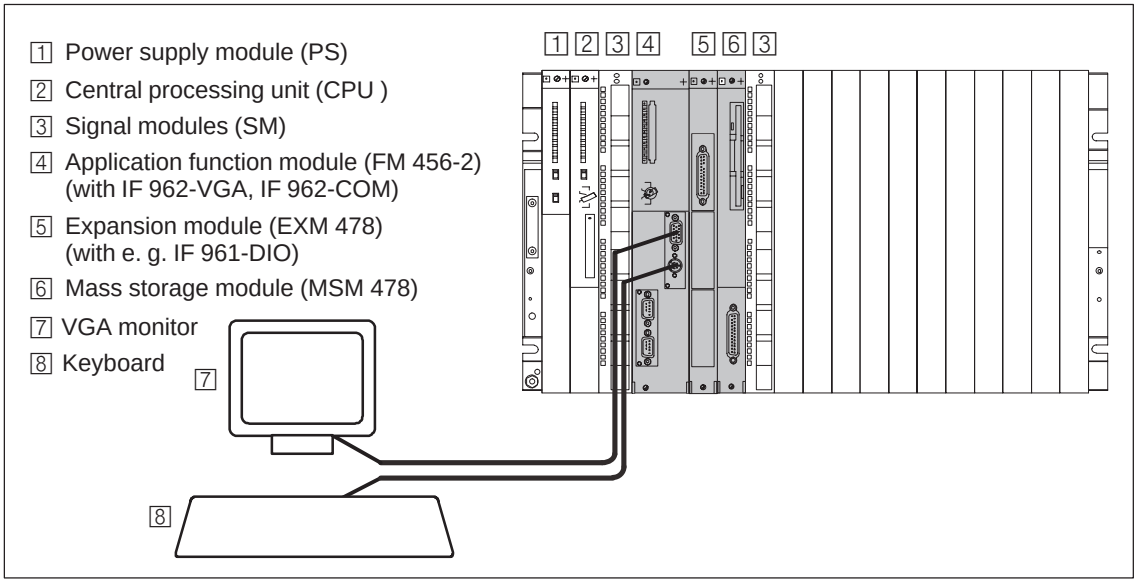
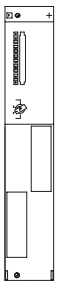
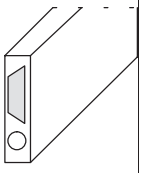


Figure 1-2 FM 456-2 as Automation Computer in the S7-400 System

M7-400 Components

An M7-400 can be equipped or expanded in various ways. The following tables provide an overview of the components in the M7-400 family of automation computers.

Table 1-1 Components in the M7-400 Automation Computer Family

Components	Function	Illustration
Application function module FM 456-2	... basic module with PC-HW architecture. ... provides space for up to 2 interface submodules.	
Expansion module EXM 478	... provides space for 3 interface submodules for connecting to, for example, process I/O, VGA monitor, PG/PC keyboard, printer etc.	
AT adapter module ATM 478	... provides space for a short AT module.	
Mass memory module MSM 478	... provides storage for programs and data on a hard disk and 3.5″ diskette. ... contains an “LPT1” parallel interface, for example to connect a printer.	
Interface submodules Process modules (IF 961) System modules (IF 962) Communications modules (IF 964 Profibus-DP and CP 1401 TCP/IP)	... make the connection from the process or peripherals to the FM 456-2.	

1.2 Applications

Tasks of an FM 456-2

An FM 456-2 is used as a programmable module in an S7-400 programmable logic controller in conjunction with an S7/M7-400 CPU. The following are a few typical tasks or functions for an FM 456-2:

- Technological functions (controlling, positioning, counting)
- Process data acquisition
- Mass storage functions
- Data exchange with the S7/M7 CPU
- Data exchange with PG/PC
- Control of local peripherals
- Event-driven program processing
- Communications

Areas of Application of an FM 456-2

The FM 456-2 can be used in any application where special technical requirements, high-speed control or special tasks such as communications, data storage etc. are to be implemented.

- Plastics technology
- Process systems
- Textile industry
- Machine tools
- Packaging systems
- ...

User-Defined Functionality

The functionality of an FM 456-2 is defined by the user. This is achieved through the programming capability of the module. Powerful M-7 system software and STEP 7 development and generation software that is easy for the engineer to use are available for the implementation of the user's application.

System software

The FM 456-2 can be used with the M7-SYS RT system from release V5.0.

1.3 Inserting the FM 456-2 in the S7-400 Racks

Inserting in S7-400 Racks

The FM 456-2 application function module can be inserted in different racks of the S7/M7-400 system.

Table 4-4 shows which modules can be inserted in the different racks.

Table 1-2 Insertion Options for M7-400 Modules

Modules	Racks			
	UR1, UR2 as central unit	UR1, UR2 as expansion unit	CR2	ER1, ER2
Application function module (FM 456-2)	●	●1)	●	-
Expansion module (EXM 478)	●*)	●*)1)	●*)	-
AT adapter module (ATM 478)	●*)	●*)1)	●*)	-
Mass storage module (MSM 478)	●*)	●*)1)	●*)	-

1) Not with 460-1 / 461-1 local link
*) Can only be plugged on in conjunction with the application function module.

1.4 Module Overview

Overview of Types of Application Function Modules

Table 1-3 Overview of M7-400 Application Function Modules

Description	Remarks
FM 456-2 application function module	Pentium, 120 MHz, 16 MByte DRAM main memory installed, 256 Kbyte SRAM with buffer, with option of connecting expansion modules

Overview of Memory Cards

Table 1-4 Overview of Memory Cards for the M7-400 Application Function Modules

Description	Remarks
Flash EPROM, 4 Mbyte	Memory cards with various memory capacities.
Flash EPROM, 8 Mbyte	
Flash EPROM, 16 Mbyte	

Expansion modules

Table 1-5 Expansion Modules for the M7-400 Application Function Modules

Description	Remarks
EXM 478 expansion module	Provides space for 3 interface submodules
ATM 478 AT adapter module	Provides space for a short AT module
MSM 478 mass storage module	3.5” diskette drive, hard disk, ”LPT1” parallel interface

M7-400 Interface Submodules

Table 1-6 Overview of M7-400 Interface Submodules

Description	Remarks
IF 961-AIO	Analog input/output
IF 961-CT1	Counter connection
IF 961-DIO	Digital input/output
IF 962-COM	2 serial interfaces
IF 962-LPT	Printer interface
IF 962-VGA	Connection for VGA monitor and keyboard
IF 964-DP	SINEC L2-DP interface (Profibus)
CP 1401	TCP/IP interface

Information about additional interface submodules can be found in the catalogs.

Installation and Startup

2

This section provides you with some brief information about the necessary steps to start up an FM 456-2.

The startup activities can be divided into several steps, which should be carried out in the order shown:

1. Installing and switching on the hardware
2. Load operating system, adapt BIOS setup if necessary
3. Load user software into the FM 456-2 from PG/PC, test and commission. Adapt S7/M7 software to the FM 456-2 functions.

The activities you must carry out in step 1 of the startup process are shown below in the correct order in form of a checklist. The checklist contains notes on where you can find detailed information on each point.

Refer to *manuals /2/ and /3/* for information on activities in steps 2 and 3 of the startup process.

In this Chapter

2.1 Installation Checklist and Switch-on Test

Installation Checklist and Switch-On Test

This section explains the procedure for installing and starting up the M7-400 components step by step. Please proceed as described below:

1. Check that the power supply to the rack is correctly dimensioned.

   (Chapter 2 and /1/)

2. Plug the interface modules into the FM 456-2 and the EXM 478 expansion modules.

   (Section 2.3)

3. If you want to use an ATM 478 adapter module, you must install the appropriate short AT module in the ATM 478 before the next step.

   (Section 2.4)

4. If appropriate, assemble the FM 456-2 with its expansion modules into a complete unit before installing in the rack.

   (Section 2.5)

5. Switch off the power supply (PS).

6. Fit the pre-assembled module or module assembly onto the rack and secure with the screws.

   (Section 2.6)

7. Insert the key in the operating mode switch.

   (Section 2.6)

8. Connect a PG or a PC if necessary to install the system software.

   (Section 2.11)

9. Connect the necessary operator equipment and peripherals.

   (Section 2.10)

10. Switch on the peripherals.

11. Switch the power supply (PS) on again.

12. Check that the status and fault displays respond correctly.

    (Section 2.12)

2.2 Module Accessories

The module packaging contains the basic accessories you need to install the modules in the rack. There are optional accessories for some modules.

Accessories

The accessories for the modules are listed and briefly explained in Table 2-1.

Table 2-1 Accessories for the Modules

Module	Accessories Provided (Basic Accessories)	Accessories not Provided	Purpose of Accessories
FM 456-2 application function module	2 keys	–	The key serves to actuate the mode switch for the FM 456-2
	1 module cover (fitted)	–	Cover for unused submodule slot
	–	Memory Card	For storing the user program with the FM 456-2 in the power off condition
		12 module covers including screws	Covers for unused submodule slots.
EXM 478 expansion module	2 connecting clips	–	For fixing the EXM 478 in a module assembly.
	2 module covers (fitted)	–	Cover for unused submodule slot.
ATM 478 AT adapter module	2 connecting clips	–	For fixing the ATM 478 in a module assembly, top and bottom.
MSM 478 mass storage module	2 connecting clips	–	For fixing the MSM 478 in a module assembly, top and bottom.

2.3 Installing Interface Submodules

The EXM 478 expansion module has three card slots to accept interface submodules. The FM 456-2 application function module has two card slots.

Warning

The modules can become damaged.

If the interface module is inserted or removed with the power on, the FM 456-2, the expansion module or the interface submodule may be damaged.

Never insert or remove the interface submodule with the power on. Always switch off the power supply (PS) before inserting or removing interface submodules.

Observe the ESD rules when installing an interface submodule.

Installing Interface Submodules

Proceed as follows to install an interface submodule in a card slot:

1. Hold the interface submodule on the long sides of the front plate.
2. Insert the PCB end of the interface submodule in the upper and lower guides of the card slot as shown in Figure 2-1.
3. Slowly push the interface submodule into the slot until the connector on the interface submodule latches into the slot and the front plate lies flush against the edge of the slot.
4. Secure the front plate with the two fitted, captive M2.5 x 10 slot-headed screws on the left frame of the card slot.

Warning

The interface submodules and the connected equipment can become damaged.

The interface submodules and the equipment connected to them may be destroyed if the submodules are connected to the wrong front plugs.

Label the front plugs so that the associated interface submodule can be clearly identified.

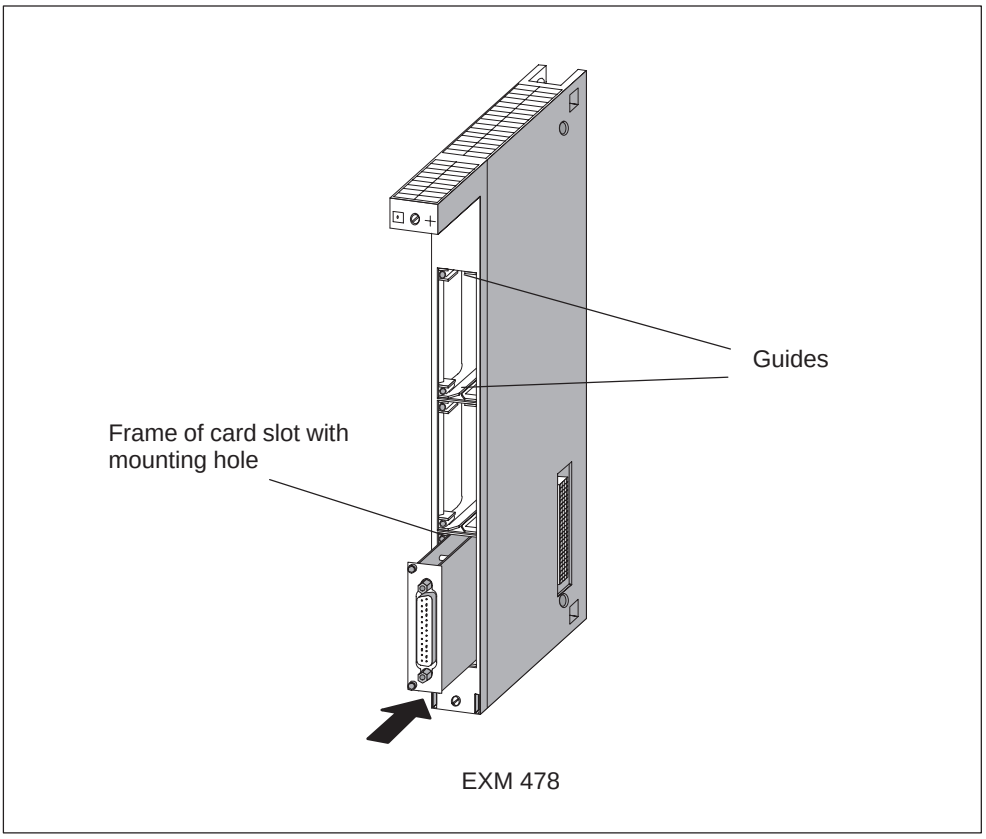


Figure 2-1 Inserting an Interface Submodule in an Expansion Module

Covers for the Unused Card Slots

When the application function modules and expansion modules are delivered, only the upper card slot is open. All other card slots are covered. The cover is secured to the frame of the card slot with screws.

Slacken the screws and remove the cover to insert more than one interface submodule in an expansion module.

2.4 Installing a Short AT Card

The ATM 478 AT adapter module can accept a short AT card. An AT module can only be installed if the ATM 478 AT adapter module is not mounted. Only short AT cards with a slot in the mounting bracket can be installed (see also the chapter on M7-400 expansion in the *reference manual*).

Warning

The modules can become damaged.

If the interface module is inserted or removed with the power on, the FM 456-2, the expansion module or the AT card may be damaged.

Never insert or remove the AT card with the power on. Always switch off the power supply (PS) before inserting or removing AT cards.

Observe the ESD rules when installing an AT card.

Installing the AT Card

Proceed as follows to install an AT module in an ATM 478 AT adapter module:

1. If the ATM 478 AT adapter module is installed in the rack, you must remove the module assembly and extract the ATM 478 AT adapter module from this assembly.
2. Remove the cover from the upper left side of the ATM 478 (see Figure 2-2).
3. Remove the mounting bracket for the AT module from the upper front of the ATM 478 by undoing the screw (see Figure 2-2).
4. Insert the AT card into the slot from the front (see Figure 2-2).
5. Press the AT card through the side opening and at the front downward into its connector until it engages. Ensure that the AT module support plate slides under the metal spring on the front of the ATM 478 (see Figure 2-2).
6. Fit the mounting bracket over the angled part of the support plate of the AT card and screw it onto the support plate of the AT card and to the ATM 478 (see Figure 2-2).
7. Fit the cover to the upper left side of the ATM 478.

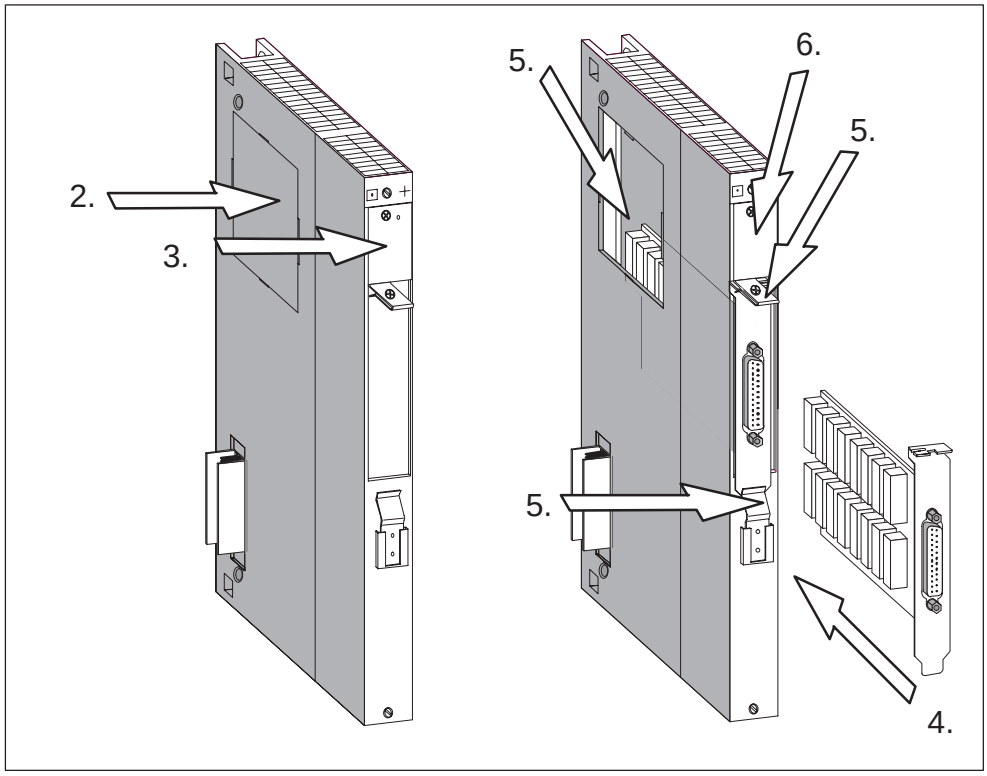


Figure 2-2 Installing an AT card in an ATM 478 AT adapter module

2.5 Fitting Expansion Modules to an FM 456-2

Before installing your M7-400 in the module rack, you must pre-assemble the FM 456-2 application function module with all necessary expansion modules.

This section provides information that you will need to pre-assemble expansion modules, such as an EXM 478 expansion module, an ATM 478 AT adapter module and an MSM 478 mass storage module, to an application function module to form a module assembly.

Assembly Sequence

Carry out assembly in the following sequence:

1. Remove the covers over the plugs and sockets on the modules.
2. Remove the connecting clips that are fitted at the top and bottom of the module.
3. Remove the module covers.
4. Position the modules on a level surface and interconnect them.
5. Clip the modules together with connecting clips at the top and bottom.

The individual steps for fitting expansion modules are illustrated on the following pages.

Removing the Connector and the Socket Covers

Situated on the right-hand side of the application function module is a 120-pin socket for connecting expansion modules to the ISA bus. This socket is protected by a screw-mounted metal cover (see Figure 2-3).

The EXM 478, ATM 478 and NSM 478 expansion modules contain

- The matching connector on the left side,
- An expansion socket on the right side so that other expansion modules can be plugged in.

Remove the transport protection from the expansion plugs and the covers from the expansion sockets of the module that are to accept other expansion modules.

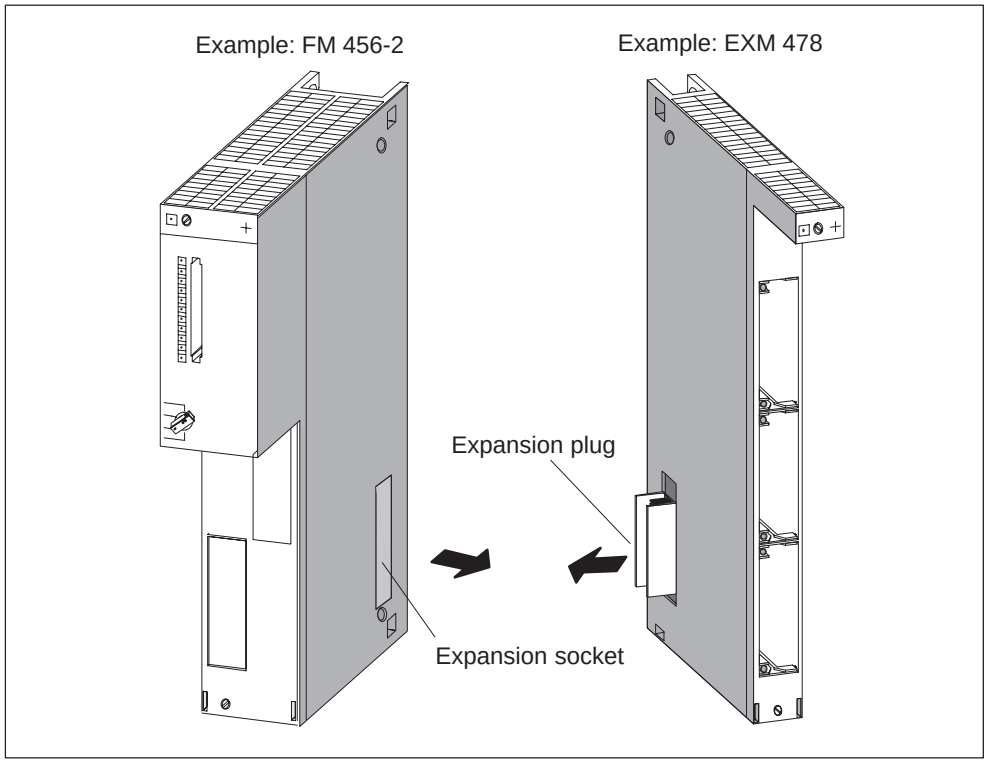


Figure 2-3 Locations of the Expansion Socket and Plug with Associated Covers

Removing the Connecting Clips

Connecting clips are fitted at the top and bottom of expansion modules. Pull these off upward and downward respectively.

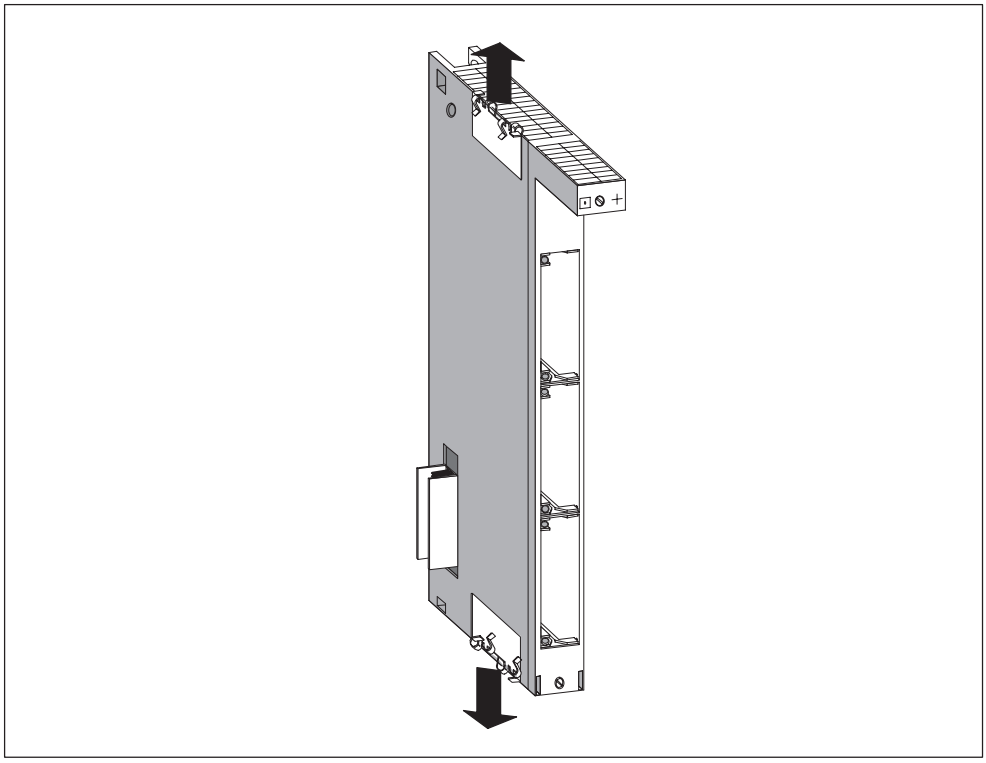


Figure 2-4 EXM 478 Expansion Module Fitted with Connecting Clips

Removing the Cover

On the modules with a cover (for example FM 456-2, EXM 478 and MSM 478), remove the cover before interconnecting the modules or fitting a module in the rack.

Proceed as follows:

1. Press the locking lever down (1).
2. Swivel the cover forward and off (2).

Figure 2-5 shows how to remove the cover.

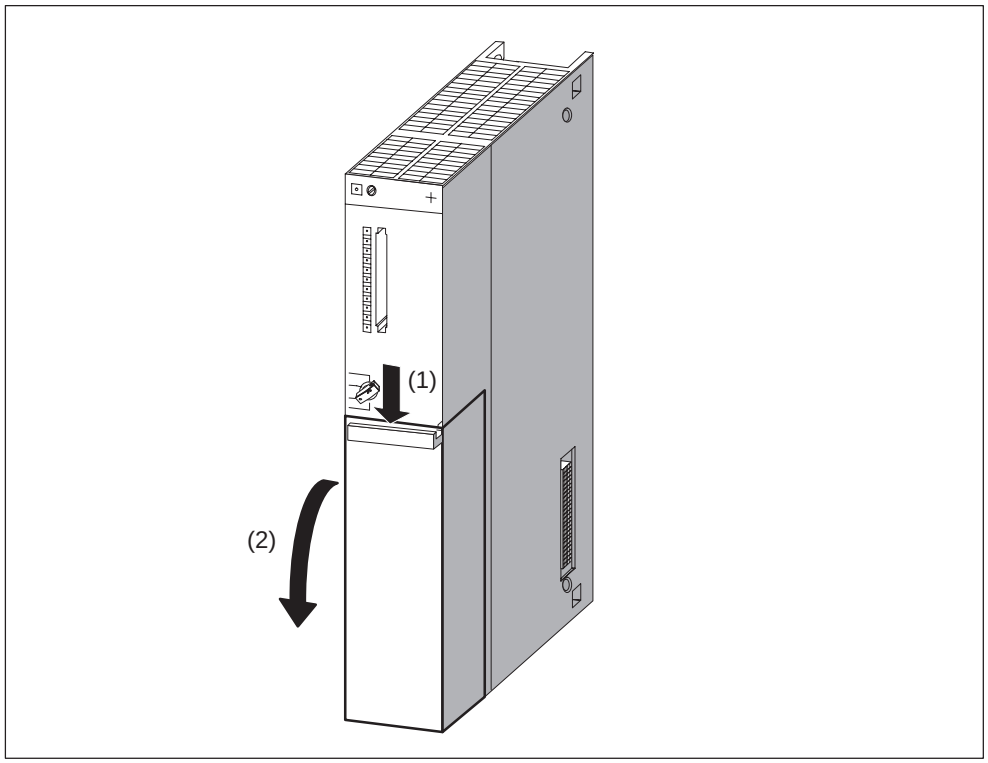


Figure 2-5 Removing the Cover

Interconnecting the Modules

Take the application function module and first expansion module, position them on a level surface (see Figure 2-6) and press them carefully together so that all pins of the expansion module plug are **precisely** inserted into the socket on the FM 456-2.

Then plug the other modules successively in to the assembled group (see Figure 2-6). All the expansion modules are then connected to the ISA bus of the application function module.

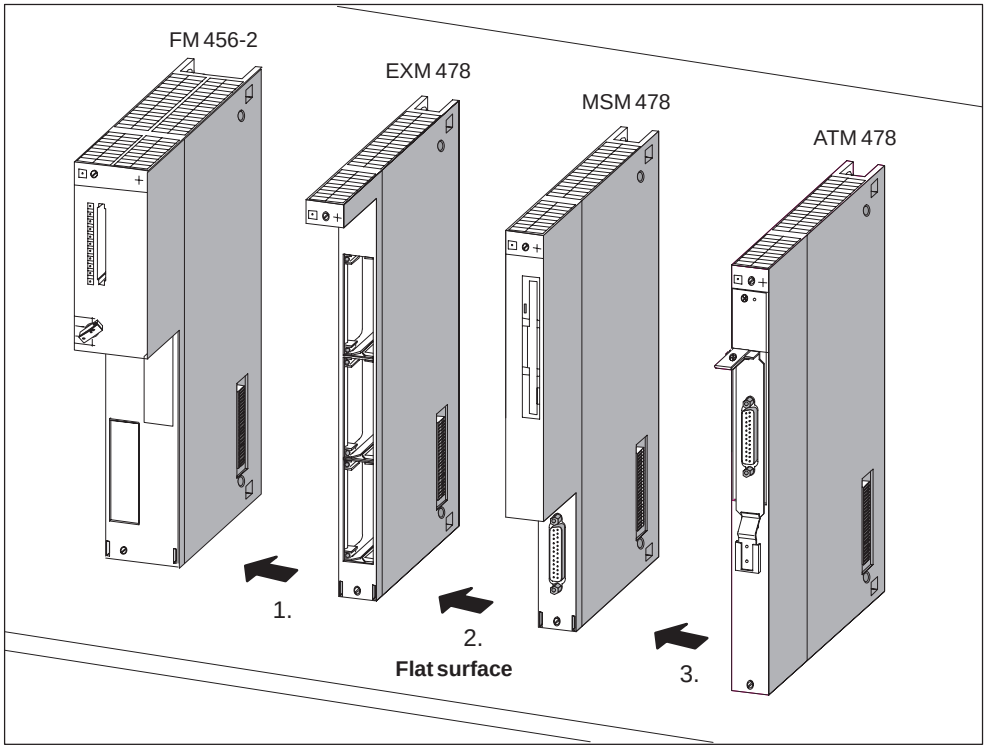


Figure 2-6 Interconnecting an FM 456-2 and Expansion Modules

Note

Only particular combinations of the expansion modules are allowed. See the chapter on M7-400 expansion in *manual /1/*, section “Permissible Combinations”.

Note

The connector pins can be damaged.

If the modules are not exactly lined up for interconnecting, the pins can be damaged. Line up the modules precisely when interconnecting.

Clipping the Modules Together

After interconnection, the modules are clipped together with the two connecting clips provided (see Figure 2-7) to prevent twisting or loosening. This is carried out as follows:

1. Push the connecting clip from the top between the two modules to be clipped together as shown in Figure 2-8 so that the bent end pieces of the clip touch the module housing cover.
2. Then position the connecting clip so that each bent end piece is above a grid slot of the module housing cover. The first bent end piece should be above the fifth grid slot, seen from the rear of the module.
3. Then push the two rectangularly bent end pieces of the connecting clip downwards to clip them together. Figure 2-8 shows the connecting clips after clipping together.
4. Carry out steps 1 to 3 in a similar manner for the bottom of the modules to be clipped together.

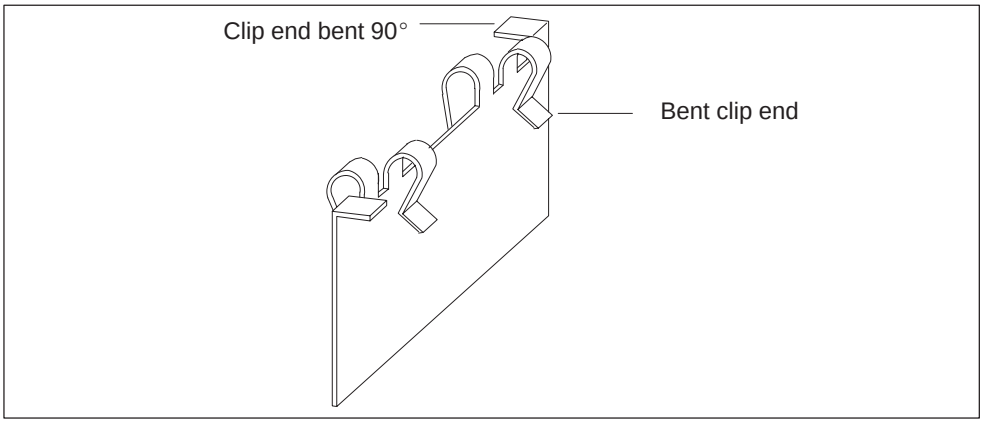


Figure 2-7 Connecting Clip

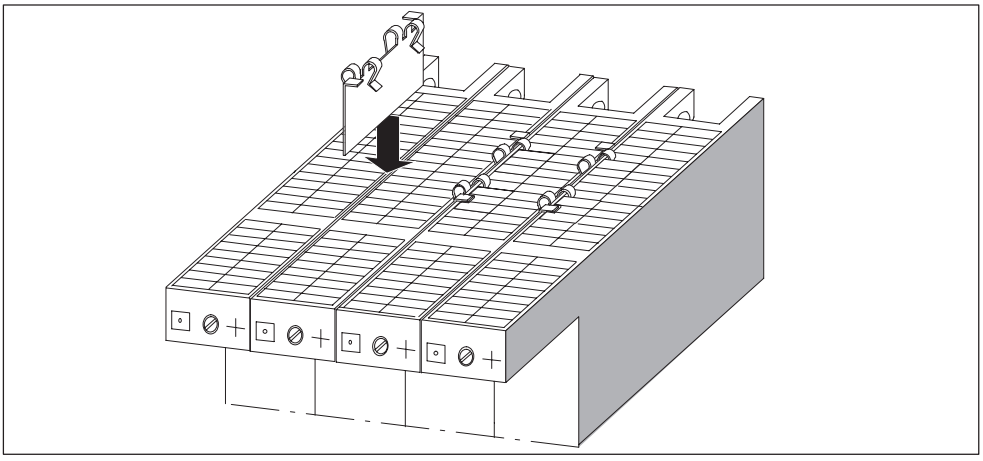


Figure 2-8 Fixing the Modules Together with the Connecting Clips

2.6 Installing a Module Assembly in the Module Rack

Installation Sequence

To install a module or module assembly in a module rack, proceed in the following sequence:

1. Disconnect the power supply module from the mains supply.
2. Remove the blanking covers from the slots into which you wish to plug modules (module assemblies). To do this, grasp the blanking cover at the marked positions and pull it off towards the front.
3. Remove the cover from the module if this has not already been done.
4. Hang the module (see Figure 2-9) or the module assembly (see Figure 2-10) onto the rack and swing it downwards without applying pressure from above (1).
5. Screw the module or all modules in a module assembly to the rack at the top and bottom with a torque of 0.8 - 1.1 Nm (see Figure 2-11).
6. Replace the module cover(s) if necessary.
7. Insert the key in the mode switch on the FM 456-2 after all modules have been fitted.

The individual steps for mounting the modules are illustrated in the following pages.

Removal of the modules is described in Section 3.

Fitting the Module Onto the Rack

Fit the module or module assembly onto the rack (1) and swing it downwards without applying pressure from above (2).

Figures 2-9 and 2-10 show how to fit a module or module assembly onto a module rack and swing it into place.

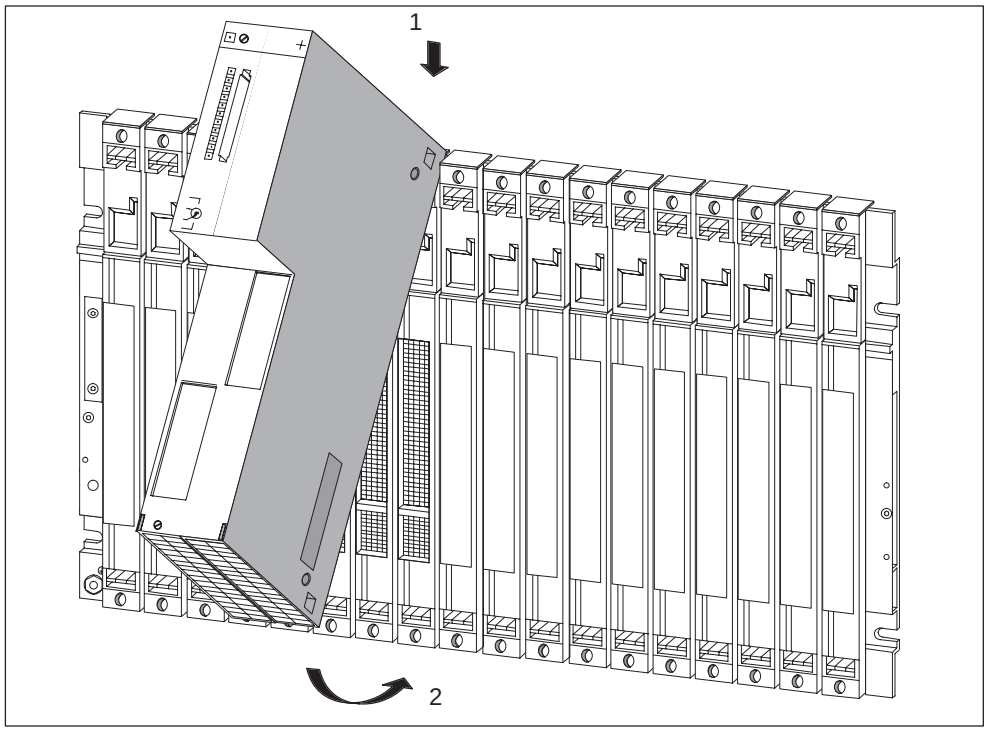


Figure 2-9 Fitting an FM 456-2 Application Function Module onto the Rack and Swinging it into Place

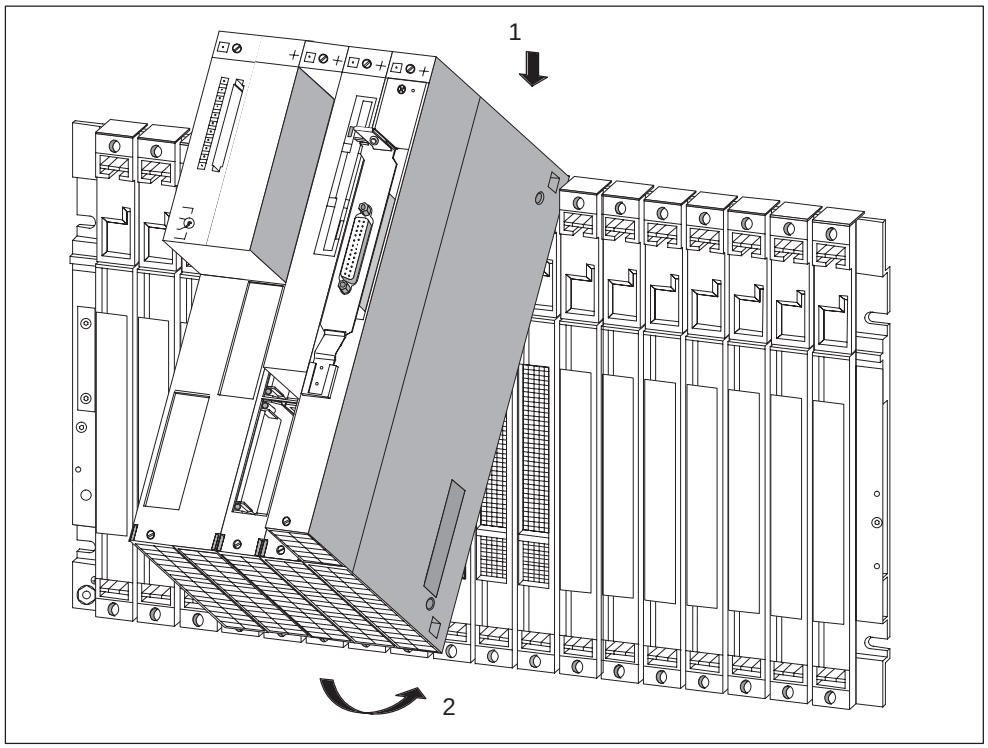


Figure 2-10 Fitting a Module Assembly Consisting of FM 456-2 and Expansion Modules onto the Rack and Swinging it into Place

Screwing the Modules On

Figure 2-11 shows how to screw the modules on.

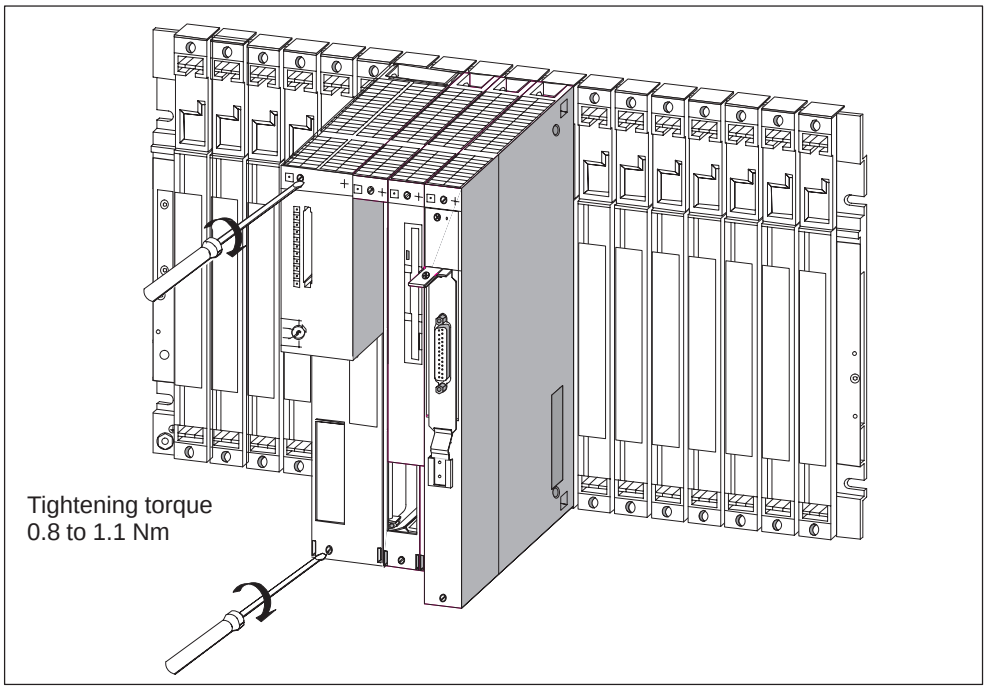


Figure 2-11 Screwing the Modules On

Inserting the Key in the Mode Switch

Figure 2-12 shows how to insert the key in the FM 456-2 with the switch set to STOP. You can remove the key in the STOP or RUN settings.

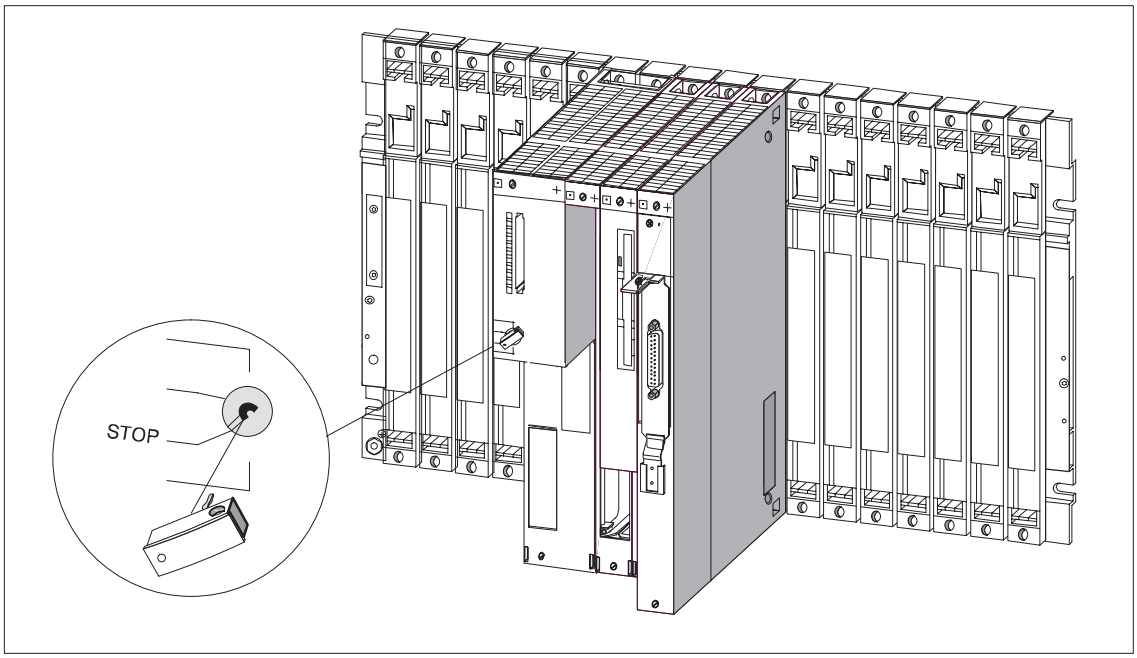


Figure 2-12 Inserting the Key in the Application Function Module

2.7 Inserting/Removing a Memory Card

Purpose of the Memory Card

By using a memory card, you can

- Store the operating system, user programs and data (similar to using a diskette);
- Transport the programs and data stored on the memory card;
- Retain the programs and data, even during Power Off.

Inserting/Removing the Memory Card

A memory card should only be inserted or removed when no access to the memory card is taking place, in other words, the “SD” indicator on the FM 456-2 must be OFF. Figure 2-13 shows how to insert a memory card in an FM 456-2.

Warning

Data may be lost when the memory card is inserted or removed.

If write access to the memory card occurs when the memory card is being inserted or removed, data consistency cannot be guaranteed.

If you are not certain whether write access to the memory card is still possible, then remove it only when the power is off.

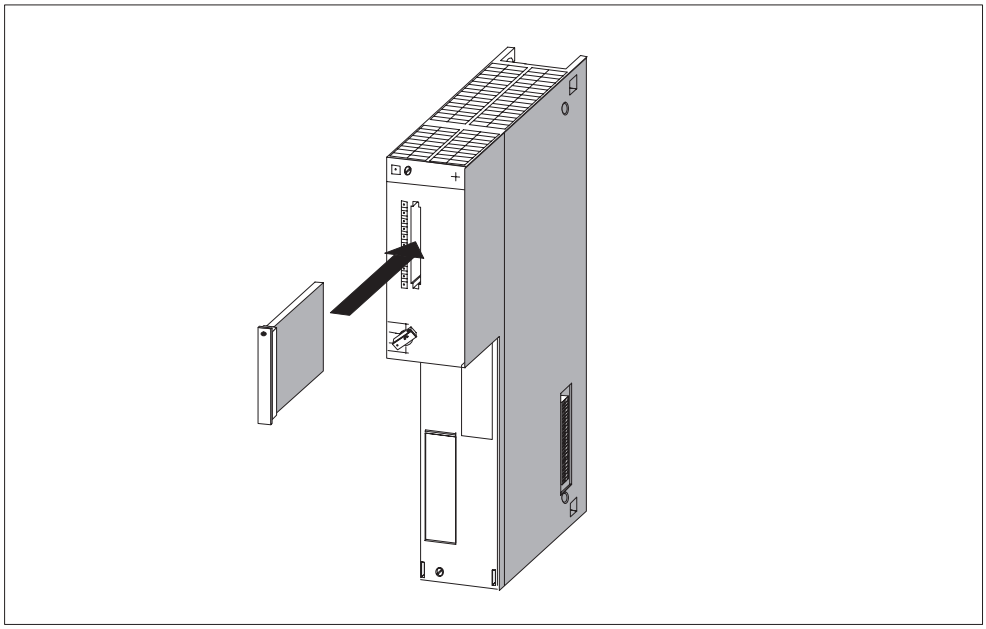


Figure 2-13 Inserting a Memory Card into an FM 456-2

2.8 Connecting a Module Assembly

The individual modules and interface submodules of a module assembly can be connected via commercially available cables and connectors.

Requirements

The connector housings and cables must meet the following requirements:

- Connector housing: The height and width of the connector housing must not exceed 43 mm and 19 mm respectively. It must have a 45° side outlet for the cable. These requirements are met by the connector housings of cables and lines listed in the chapter on spare parts and accessories of the *reference manual /1/*.
- Cables: Only cables which have a braided shield may be used. The shield must have a low-resistance connection to the housing ground.

Components to be Connected

A module assembly can comprise the following components to be connected:

- Application function module and interface submodules
- EXM 478 expansion module with interface submodules
- ATM 478 AT adapter module with short AT card
- MSM 478 mass storage module with parallel interface

Connecting Interface Submodules

The interface submodules are equipped with subminiature D female or male connectors. To connect devices to the interface submodules, you must fabricate cables with the appropriate mating connectors or obtain preassembled, commercially available cables.

The pin assignments of the subminiature D connectors can be found in the description of the relevant interface submodule in the chapter on interface submodules of the *reference manual /1/*.

Connecting the Mass Storage Module

Pin assignments of the parallel interface of the MSM 478 mass storage module can be found in the chapter on M7-400 expansion of the *reference manual /1/*.

Connecting the Short AT Card

The interface pin assignments of short AT cards which you intend to use can be found in the corresponding documentation.

2.9 Preparing for Operation

Listed briefly in this section is information on the steps required for preparing an FM 456-2 for operation:

You will learn

- The sequence in which preparations must be made by means of a checklist
- How to connect operator panels and peripherals
- How to connect a programming device via the COM interface
- How to check the status and error display by switching on for the first time.

All other information which is important for preparing for operation applies (except for the reset) both to the S7-400 and M7-400 modules and is described in *installation manual /1/*.

Checklist for Preparing for Operation

You should proceed as follows:

1. Ensure that the power is switched off.
2. Insert the backup batteries in the power supply module (see *Chapter 7* on maintenance in the *installation manual /1/)*.
3. Set the key of the mode switch to STOP.
4. Connect the required operator panels and peripherals (see *Section 2.10*)
5. Switch on the peripherals.
6. Switch on the power supply (PS) of the rack.
7. Set the key of the mode switch to RUN.
8. Check that the status and error indicators are correct (see *Section 2.12*).

Connecting the PROFIBUS-DP

For information on the Configuration of a PROFIBUS subnet, see Chapter 5, “Networking” of the *installation manual /1/*. For starting up a PROFIBUS subnet, see Section 8.7.6 of the *installation manual /1/*.

Steps for Full Startup

The following steps must still be carried out for a full startup of the FM 456-2:

1. Configure your FM 456-2 with the S7 software.
2. Transfer the operating system.
3. Execute the BIOS setup.
4. Load the user software from the PG/PC to the FM 456-2, test it and start it.

A description of the BIOS setup can be found in the chapter on CPUs for the M7-400 in the *reference manual /1/*. For other activities, refer to the *M7-SYS user manual*.

2.10 Connecting the Operator Panels and Peripherals

The operator panels and peripherals which can be connected to your FM 456-2 depend on its configuration.

Extensive information on all connection options of the FM 456-2 can be found in the appropriate sections of the technical data.

To prepare for operation, you need either a PC/PG or the M7-400 configuration with monitor, keyboard, expansion module, and mass storage module as well as interface submodules.

For reasons of noise immunity of the entire system, we recommend that you use the standard connecting cables available from Siemens for connecting the peripherals.

Connecting a VGA Monitor

To be able to connect a VGA monitor to the FM 456-2, an IF 962-VGA interface submodule must be fitted in the card slot of the FM 456-2 or of a corresponding expansion module. Connect the monitor to the 15-pin high density subminiature D socket of the IF 962-VGA interface submodule (up to 2.5 m).

Connecting a Keyboard

Connect the keyboard to the 6-pin mini DIN circular socket on the IF 962-VGA interface submodule

Notes for Setting Up Monitors

Please observe the following notes when setting up monitors.

- Ensure that the clearance between two monitors in asynchronous operation is at least 15 cm, otherwise video interference may occur.

  Exception: monitors with a mu-metal shield.

- Provide sufficient space between the monitor and extraneous magnetic sources.
- Do not set up the monitors in steel shelving or on steel benches. Magnetization of the surrounding sheet steel can result in false colors or video shifting.
- Avoid setting up monitors in the vicinity of transformers, radio transmitters, magnets and power cables.
- The effects of extraneous magnetic fields can be attenuated by using a mu-metal shield.

Special Conditions when Using Office Monitors

Additionally, you should observe the following notes when setting up office monitors:

- Office monitors with an internally metallized plastic housing should not be used in an environment subject to electromagnetic interference, because the internal metal surface cannot be subsequently connected to the external ground bus. The required isolation of the electronics ground from the housing ground of the monitor - essential for an environment subject to electromagnetic interference - is not possible with most office monitors.
- You can only use such monitors in conjunction with conventional VGA cables. Connection to the M7-400 is therefore only possible with limitations, because you can only cover short distances with these cables.

Connecting Printers

You can connect printers with a serial or parallel interface.

- A printer with a parallel interface should be connected with the appropriate connecting cable (see ordering information) to the IF 962-LPT interface submodule.
- A printer with a serial interface should be connected with the appropriate cable (see ordering information) to the COM interface submodule.

We recommend the use of Siemens printers.

Note

Only a connection cable with screen grounded at both ends may be used to connect between an M7-400 component and a printer.

Connecting a Mouse

Connect the mouse to the IF 962-COM interface module.

A PS2 mouse must not be connected separately. If a PG keyboard is connected, the trackball occupies the PS2-mouse interface.

Maximum Cable Lengths

Given in the table are the maximum cable lengths for connecting the individual devices. A precondition is a hardware configuration with interference immunity.

Table 2-2 Maximum Cable Lengths for Operator Panels and Peripherals

Device	Maximum Length
Keyboard via • IF 962-VGA	2.5 m (8 ft. 3 in.)
Monitor (connection via VGA cable) via • IF 962-VGA	25 m (82 ft.)
Printer via • IF 962-LPT (parallel interface)	3 m (10 ft.)
RS232 interface e.g. terminal, printer • IF 962-COM	10 m (33 ft.)

2.11 Connecting a Programming Device or PC to the COM Interface

If you operate your FM 456-2 without monitor, keyboard and mass storage, you need a PG or a PC to install the software. You can find out how to install this software from the *M7-SYS manual*.

Connecting an FM 456-2 to the PG or to a PC via the COM interface

Connect the 9-pin subminiature D connector of the COM port on your IF 962-COM interface module to the connector of a free COM port on your PG/PC. The following methods of connection may be used:

- Connection using control cables
- Connection without control cables

Connection with Control Cables

When the interface control cables are used for data traffic via the COM interface, you need a null modem cable.

This may be necessary when, for example, you enter a console divert in the autoexec.bat of your FM 456-2.

```
:
CTTY COM1
:
```

If the free COM interface of your PG/PC has a 9-pin subminiature D connector, you can use Table 2-3 below for the pin assignments of the null-modem cable.

This cable can also be procured pre-assembled (see V.24 cables in Chapter 5, ordering information).

Table 2-3 “Null-modem” Connector Cable for Connecting FM 456-2 via IF 962-COM to the COM Port of a PG/PC using a 9-Pin Sub-D Connector

Signal	Pin	Connection	Pin	Signal
E1 / GND	U	Connected to	U	E1 / GND
M5 / DCD	1	_	1	
D2 / RxD	2	Connected to	3	D1 / TxD
D1 / TxD	3	Connected to	2	D2 / RxD
S1 / DTR	4	Connected to	6	M1 / DSR
E2 / GND	5	Connected to	5	E2 / GND
M1 / DSR	6	Connected to	4	S1 / DTR
S2 / RTS	7	Connected to	8	M2 / CTS
M2 / CTS	8	Connected to	7	S2 / RTS
M3 / RI	9	_	9	M3 / RI
9-pin Sub-D socket (COM1 to IF 962-COM)		Pin “U” = housing (screen) Length: maximum 10 m (33 ft.)	9-pin Sub-D socket (COMx on PG/PC)	

If the free COM interface of your PG/PC has a 25-pin Sub-D socket, you can use Table 2-4 below for the pin assignments of the null-modem cable.

Table 2-4 “Null-modem” Connector Cable for Connecting FM 456-2 via IF 962-COM to the COM Port of a PG/PC using a 25-Pin Sub-D Socket

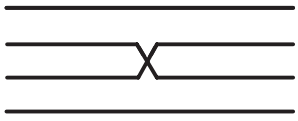
Signal	Pin	Connection	Pin	Signal
E1 / GND	U	Connected to	U	E1 / GND
M5 / DCD	1	_		
D2 / RxD	2	Connected to	2	D1 / TxD
D1 / TxD	3	Connected to	3	D2 / RxD
S1 / DTR	4	Connected to	6	M1 / DSR
E2 / GND	5	Connected to	7	E2 / GND
M1 / DSR	6	Connected to	20	S1 / DTR
S2 / RTS	7	Connected to	5	M5 / CTS
M2 / CTS	8	Connected to	4	S2 / RTS
M3 / RI	9	_	22	M3 / RI
9-pin Sub-D socket (COM1 to IF 962-COM)		Pin “U” = housing (screen) Length: maximum 10 m (33 ft.)	25-pin Sub-D connector (COMx on PG/PC)	

Connection Without Control Cables

If the data traffic via the COM interface is to be controlled exclusively via the data lines, a connecting cable as described below is sufficient for connecting your FM 456-2 to a PG/PC.

If the free COM interface of your PG/PC has a 9-pin Sub-D connector, you can use Table 2-5 for the pin assignments of the connecting cable.

Table 2-5 Pin Assignments of the Cable for Connecting an FM 456-2 via IF 962-COM to the COM Interface of a PG/PC with 9-pin Sub-D Connector

Signal	Pin	Connection	Pin	Signal
E1 / GND	U		U	E1 / GND
D2 / RxD	2		2	D2 / RxD
D1 / TxD	3		3	D1 / TxD
E2 / GND	5		5	E2 / GND
9-pin Sub-D socket (COM1 to IF 962-COM)		Pin “U” = housing (screen) Length: maximum 10 m (33 ft.)	9-pin Sub-D socket (COMx on PG/PC)	

If the COM interface of your PG/PC has a 25-pin Sub-D socket, you can use Table 2-6 for the pin assignments of the connecting cable.

Table 2-6 Pin Assignments of the Cable for Connecting an FM 456-2 via IF 962-COM to the COM Interface of a PG/PC with 25-pin Sub-D Socket

Signal	Pin	Connection	Pin	Signal
E1 / GND	U		U	E1 / GND
D2 / RxD	2		2	D1 / TxD
D1 / TxD	3		3	D2 / RxD
E2 / GND	5		7	E2 / GND
9-pin Sub-D socket (COM1 to IF 962-COM)		Pin “U” = housing (screen) Length: maximum 10 m (33 ft.)	25-pin Sub-D connector (COMx on PG/PC)	

2.12 Switching On the FM 456-2 for the First Time

When the supply voltage is switched on, all status and error indicators of the FM 456-2 light up briefly. If the mode switch is set to STOP, the STOP status/error indicator lights up after switching on. Otherwise the module boots up. In the event of a fault, the INTF indicator lights up.

If this does not happen with your module, please consult your Siemens contact at a maintenance and repair center or the SIMATIC Hotline.

The preparation for operation is now completed within the scope of this manual.

You will find the further startup steps, for instance installation of the operating system and the user program, in the *M7-SYS* manual.

Replacing Modules

3

This chapter tells you how to replace interface submodules, application function modules or expansion modules and short AT modules. All other important information for replacing modules applies to both S7-400 and M7-400 modules and is described in *manual /1/*.

Warning

The modules can be damaged.

If interface submodules are inserted or removed with power applied, the application function module, expansion modules and interface submodules can be damaged.

Never insert or remove interface submodules with power applied. Always switch off the power supply (PS) before inserting or removing interface submodules. Observe the ESD rules when inserting or removing M7 modules and interface submodules.

Note

No module in the S7-400 system may be replaced while data is being exchanged via the MPI interface of the S7/M7-400 CPU!

Pull out the plug on the MPI interface if you are not certain!

Tool

You will require a cylindrical screwdriver with 3.5 mm wide blade for replacing the modules and memory submodule.

In this Chapter

3.1 Replacing the Interface Submodule

Removing the Interface Submodule

You can replace the interface submodule with another without removing the associated application function module or expansion module. To do this, proceed as described below:

1. Switch the central module and all function modules in your S7/M7-400 system to STOP with the key switch.
2. Switch off the load supply voltage to the modules.
3. Set the standby switch on the power supply module to the ⏻ position (output voltage 0 volts).
4. Loosen the screws retaining the Sub-D connectors and pull out all plugs.
5. Loosen the two captive slotted screws fixing the front plate of the interface submodule to the left hand frame of the module card slot sufficiently to pull these out about 6 mm (1/4 inch).
6. Pull the interface submodule carefully out of the guide of the card slot (see Figure 3-1).

Caution

There is the risk of injury to persons and damage to property.

As the surface temperature of the modules can reach up to 70 °C, there is the risk of burning. Therefore always grasp the front plate of the interface module at the long sides.

Interface modules contain electrostatically sensitive devices which can be damaged when being touched.

Observe the ESD rules when fitting the interface modules.

Warning

The interface submodules and the connected equipment can be damaged.

When you replace several interface modules simultaneously and you mix up the front plugs, the interface modules can be damaged.

Label the front plugs so that the associated interface submodule can be clearly identified.

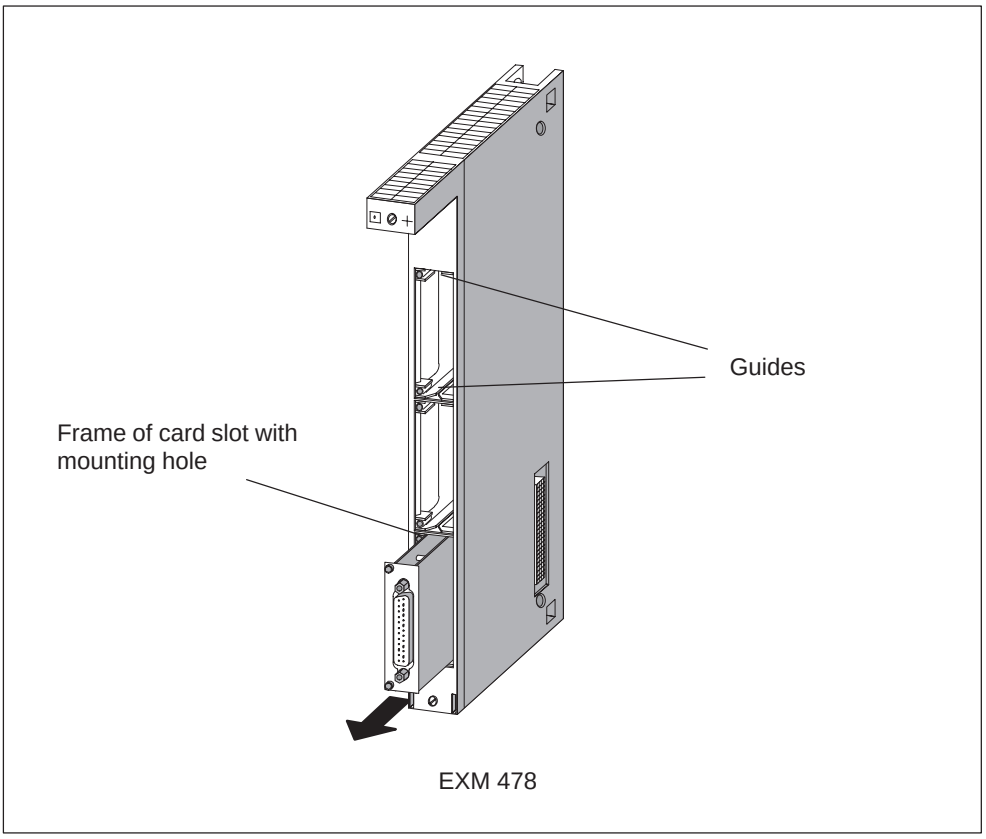


Figure 3-1 Pulling the Interface Submodule out of the Card Slot of an Expansion Module

Fitting the Interface Submodule

Fit the new interface submodule in the reverse order. Further information can be found in Section 2.3, “Installing Interface Submodules” on page 2-4.

3.2 Replacing an Application Function Module or Expansion Module in a Module Assembly

Removing the Module

Proceed as follows to remove a module from a module assembly:

1. Switch the central module and all function modules in your S7/M7-400 system to STOP with the key switch.
2. Switch off the load supply voltage to the modules.
3. Set the standby switch on the power supply module to the ⏻ position (output voltage 0 volts).
4. If necessary, remove the covers from the modules. Figure 3-2 shows how to remove the cover.
   - Press the locking lever downwards (1).
   - Swing the cover off forwards (2).

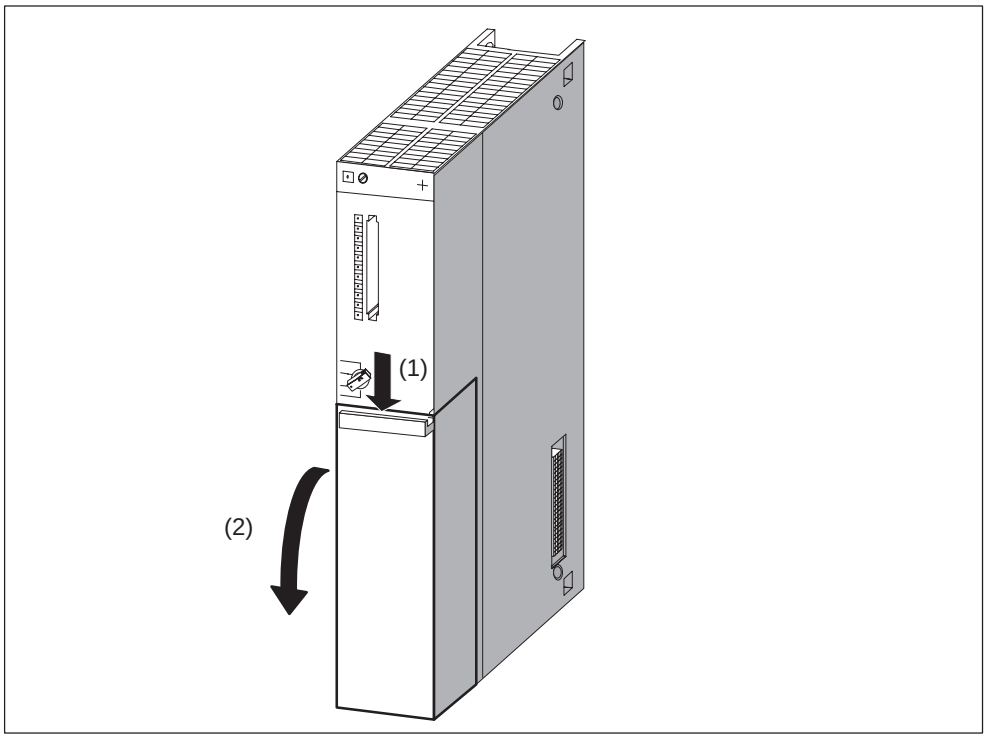


Figure 3-2 Removing the Cover

5. Unplug the interface module connectors from the module group, including those to all interface submodules.

6. Undo the fixing screws on the module or module group. Figure 3-3 shows the position of the fixing screws on a module.

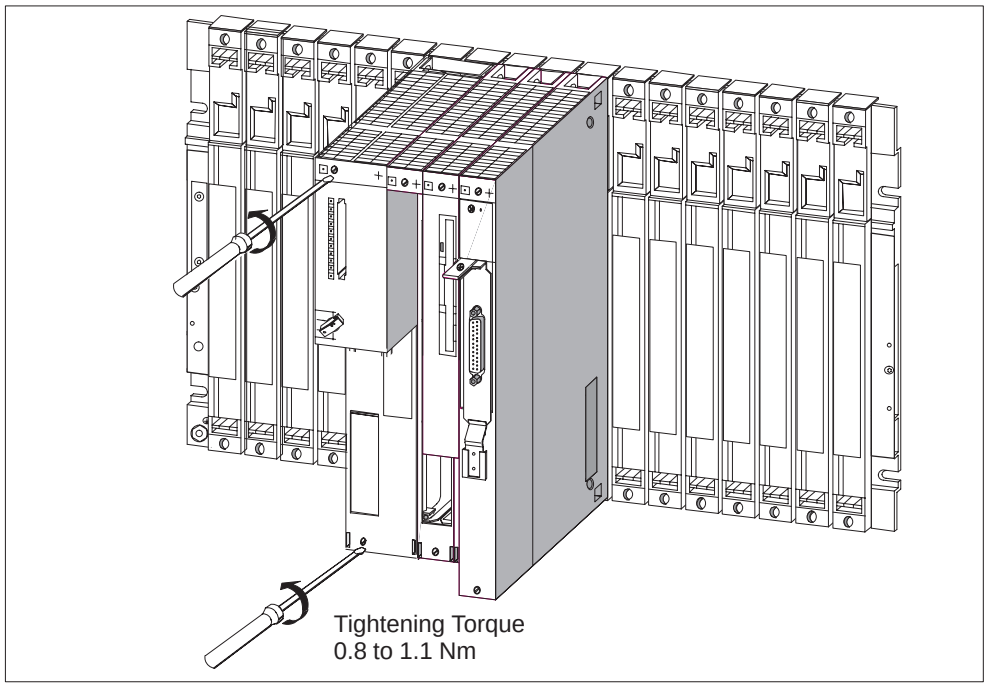


Figure 3-3 Unscrewing the Modules

7. Swing out the module group and remove it upwards (Figures 3-4 and 3-5).

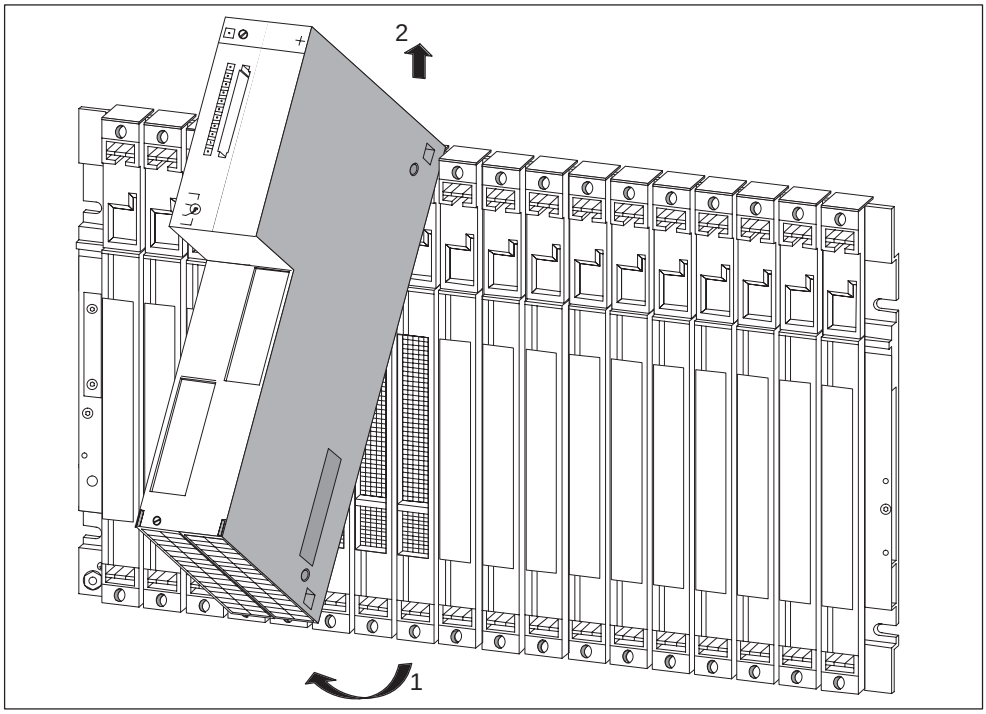


Figure 3-4 Swinging the Module Group Out and Removing Upwards

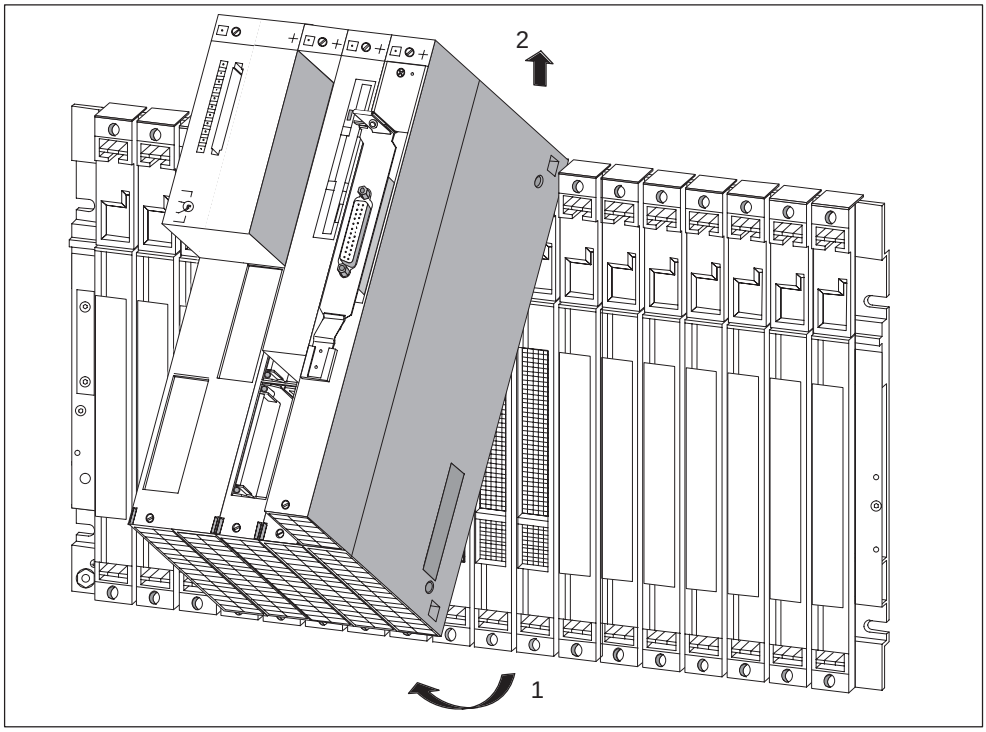


Figure 3-5 Swinging the Module Group with FM Module and Expansion Modules Out and Removing Upwards

8. Place the module group on a flat surface (Figure 3-6).

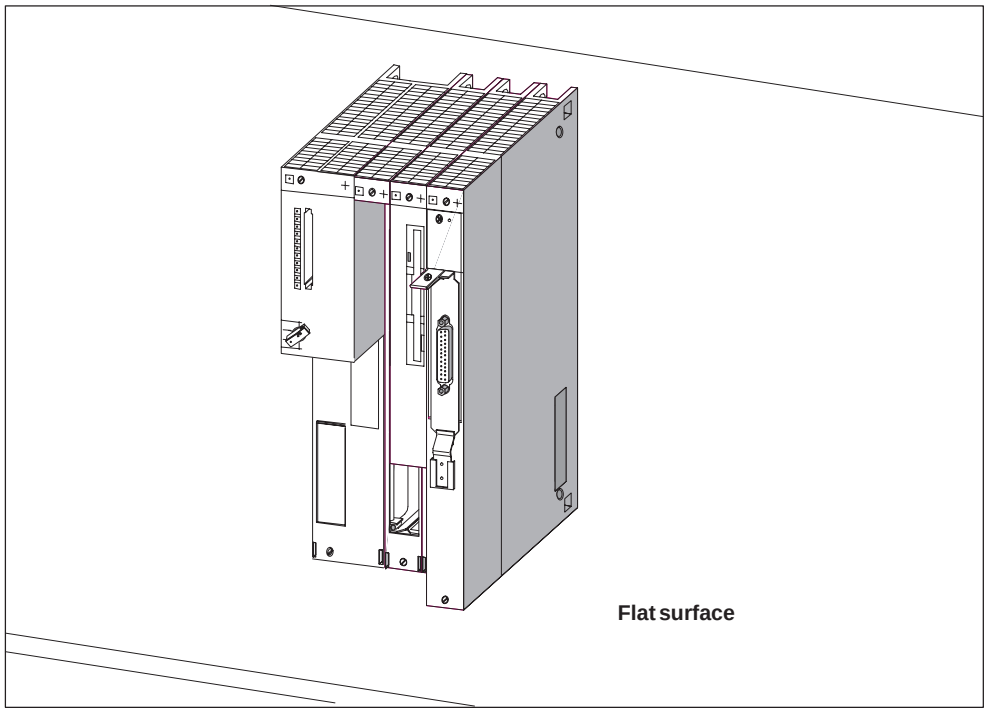


Figure 3-6 Module Group with Application Function Module and Expansion Modules

9. Remove the left and right connecting clips from the top and bottom of the module assembly (Figure 3-7).

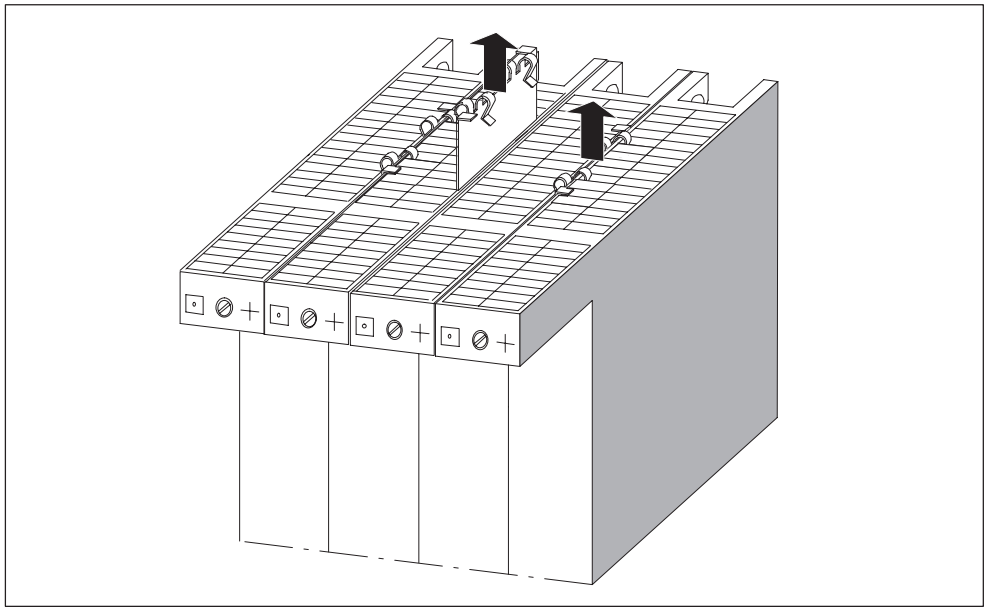


Figure 3-7 Remove the Connecting Clips Between the Modules

10. Pull the adjoining modules carefully away from the module to be replaced. When doing so, hold the modules to be separated above the bus connectors and pull them apart at the module sides, so that the ISA bus-connection is disconnected (Figure 3-8).

Warning

The plug pins can be damaged.

If the modules are not kept aligned while pulling them apart, the plug pins may be damaged.

Keep the modules aligned when pulling them apart.

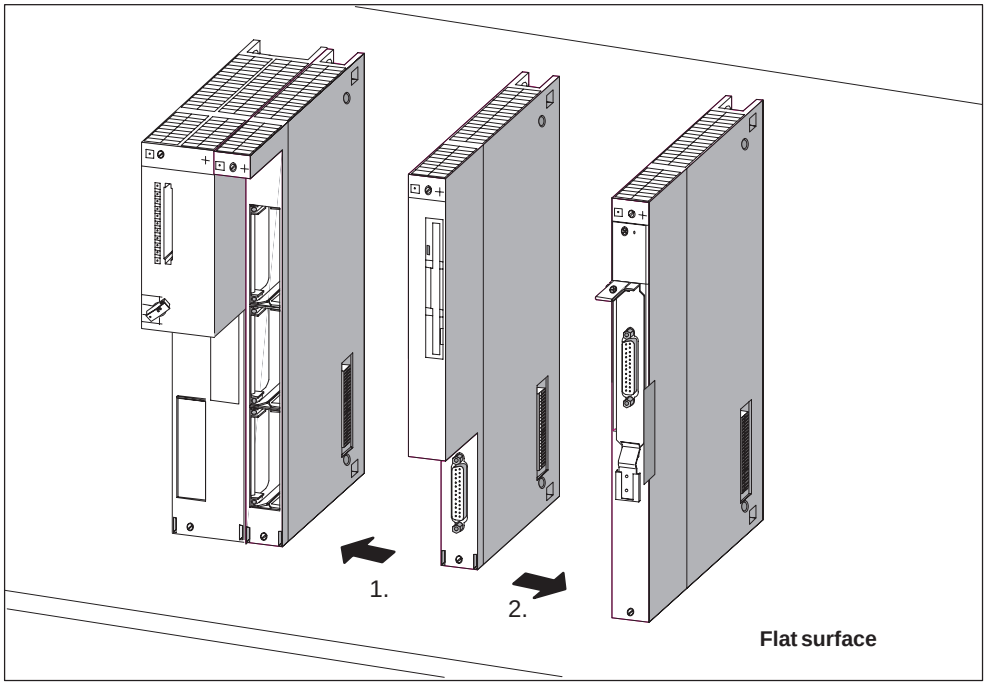


Figure 3-8 Pulling the Modules Apart, For Example to Replace the Mass Storage Module

Installing the Module

Fit the new module in the reverse order. Further information can be found in Section 2.5 “Fitting Expansion Modules to an FM 456-2” and 2.6 “Installing a Module Assembly in the Module Rack”.

Behavior of the M7-400 After Changing a Module

If no fault is present, the central module goes into the RUN mode following replacement of a module. If the central module remains in the STOP mode, you can display the cause of the fault with STEP 7 (see *STEP 7* user manual).

Note

If data media such as Memory Card or hard disk have been renewed when replacing a module, it may be necessary to carry out the BIOS setup again, re-install the operating system, user programs etc. (see the appropriate section of the *M7-SYS* user manual).

3.3 Replacing the Short AT Module

Removing the AT Module

Before you can remove a short AT module, you must remove the module assembly and take the ATM 478 AT adapter module out of the assembly (see Section 3.2, Page 3-4).

Then proceed as follows (see Figure 3-9):

Warning

The modules can be damaged.

If AT modules are inserted or removed with power applied, the application function module, expansion modules and AT modules can be damaged.

Never insert or remove AT modules with power applied. Always switch off the power supply (PS) before inserting or removing AT modules.

Observe the ESD rules when inserting or removing AT modules.

1. Remove the cover from the top left hand side of the ATM 478 (see Figure 3-9).
2. Unscrew and remove the fixing bracket from the AT module carrier plate (see Figure 3-9).
3. Push the AT module slightly upwards (3.) so that its carrier plate slides out from under the retaining spring (4.) on the front of the ATM 478. Then pull the AT module upwards out of its connector, grasping it from the front and through the side opening (see Figure 3-9).
4. Pull the AT module out of its slot from the front (see Figure 3-9).

Installing the AT Module

Install the new AT module in the AT adapter module in the reverse order (see Section 2.4 “Installing a Short AT Card”).

Then reinstall the AT adapter module in the module assembly and refit this to the rack (see Sections 2.5 “Fitting Expansion Modules to an FM 456-2” and 2.6 “Installing a Module Assembly in the Module Rack”).

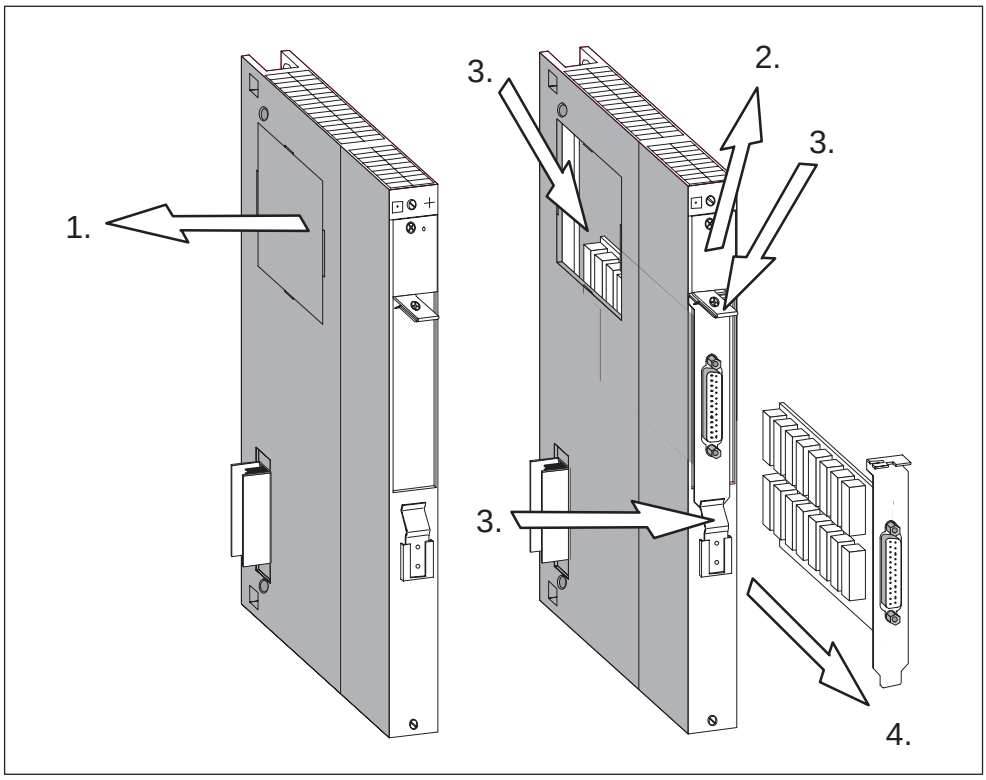


Figure 3-9 Removing an AT Module from an ATM 478 AT Adapter Module

FM 456-2 Functions and Technical Data

4

In this Chapter

4.1 Performance Features

Table 4-1 gives you an overview of the most important performance features of the FM 456-2 application function module.

Table 4-1 Performance Features of the FM 456-2 application function module

Performance Features	FM 456-2
Processor	Pentium 120 MHz
Main memory installed	16 Mbytes, 3.3 V EDO RAM
Second-Level Cache	256 Kbytes
Submodule slot for memory card	yes
Submodule slot for interface submodules	2
Connection of expansions	max. 3
“Watchdog”	yes

The FM 456-2 application function module contains a 2 × 8 MBytes, 3.3 V EDO DRAM main memory when being delivered.

4.2 Overview of Hardware Elements

This section provides you with information you will need about the individual elements of an FM 456-2 application function module when carrying out startup and during operation. You will need this information to be able to respond to displays, to start up and to use an FM 456-2 and to be able to handle other components (for example, memory cards, expansion modules).

General View

Figure 4-1 shows the front and rear view of the FM 456-2 without covering flap. The positions of the indicators, operator controls and other elements required for operation can be seen from this figure.

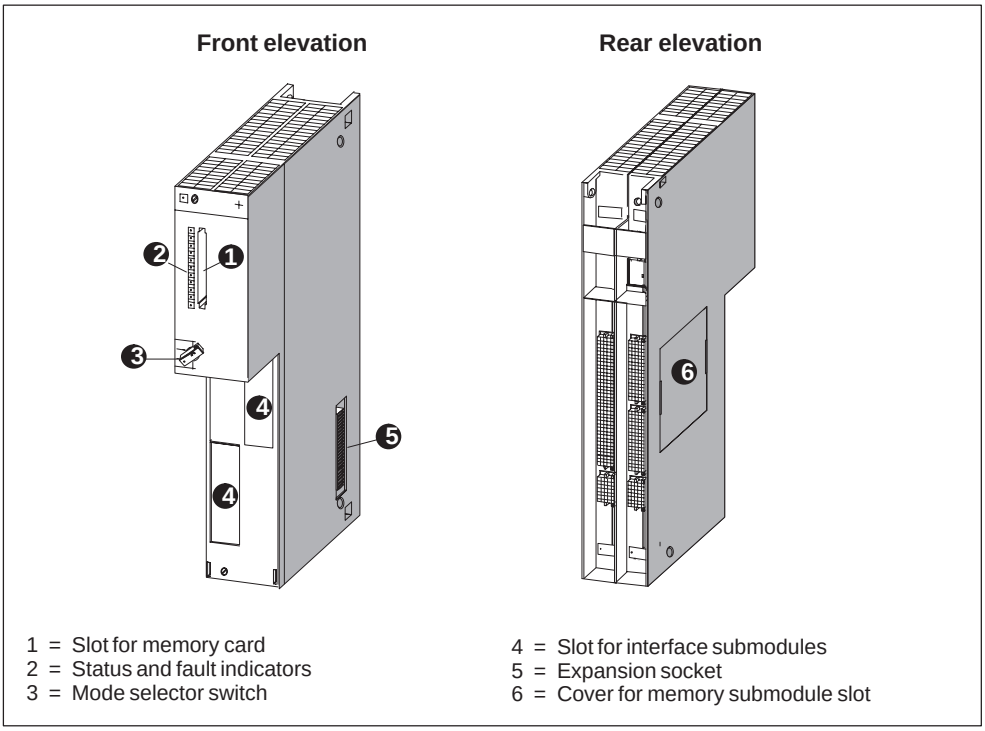


Figure 4-1 Front and Rear View of an FM 456-2 Without Covering Flap

FM 456-2 Elements

Table 4-2 Elements of the FM 456-2

Element	Function
Mode selector switch	The mode selector on the FM 456-2 is in the form of a key switch (see Section 4.3).
Status and fault indicators	The status and fault indicators show the operating status of the FM 456-2 (see Section 4.4).
Module slot for memory card	A full-size S7 memory card can be inserted in the module slot. During start-up, the system and user software can be loaded into working memory from this memory card (see Section 4.5).
Expansion socket	M7-400 expansion units can be connected via this expansion socket (see Section 4.6).
Slots for interface submodules	Interface submodules can be inserted in these slots (see Section 4.7).

4.3 Mode Selector

Mode Selector

The mode selector on the FM 456-2 is in the form of a key switch.

The following illustration shows the location and positions of the mode selector.

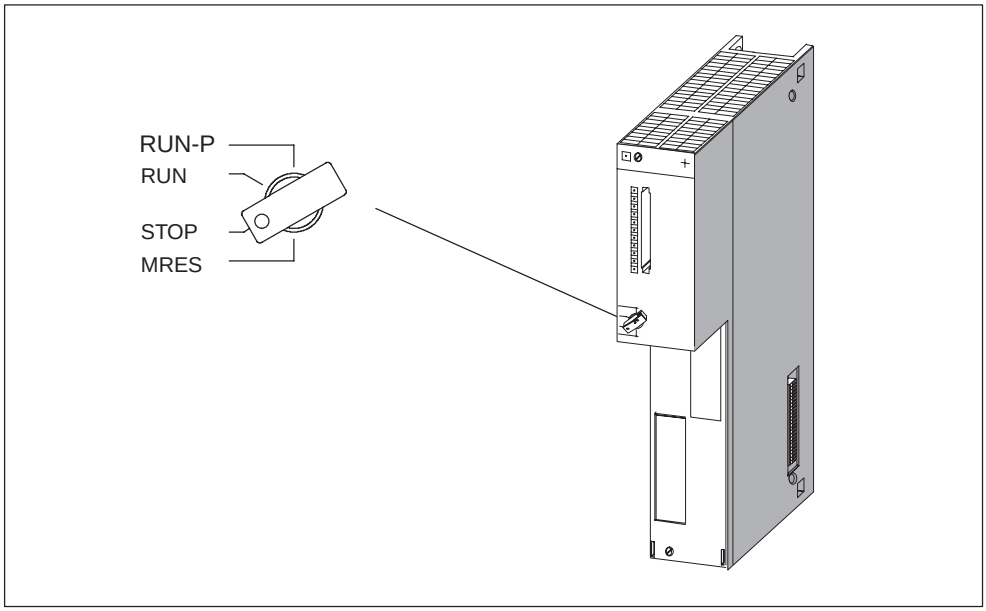


Figure 4-2 FM 456-2 Mode Selector

The settings of the mode selector can be examined by the software. The significance of the individual switch positions can thus vary depending on the program.

Mode Selector Positions

Table 4-3 FM 456-2 Mode Selector Positions

Mode Selector Position	Explanation
RUN-P	The FM 456-2 processes the user program. Write and read access to the CPU are possible. The key cannot be removed when in this position.
RUN	The FM 456-2 processes the user program. Read access only to the CPU is possible. The key can be removed in this position to prevent unauthorized change of mode.

Table 4-3 FM 456-2 Mode Selector Positions

Mode Selector Position	Explanation
STOP	The user program on the FM 456-2 cannot access the I/O modules. The user program cannot control the process. The key can be removed in this position to prevent unauthorized change of mode.
MRES	Spring-return position of the key switch for software-controlled reset of the FM 456-2 (hardware reset).

Activating MRES

To effect a hardware reset via MRES, proceed as follows:

1. Turn the mode selector to the STOP position.

   Result: The STOP indicator lights up

2. Turn the mode selector to MRES and hold it in this position.

   Result: The STOP indicator goes out for 1 second, lights up for 1 second, goes out for 1 second and then lights up steadily.

3. Turn the mode selector back to the STOP position, to the MRES position again and back to the STOP position within 3 seconds.

   Result: The STOP indicator flashes for at least 3 seconds at 2 Hz (general reset being carried out) and then lights up again.

4. If the STOP indicator does not flash or other indicators light or flash, steps 2 and 3 must be repeated.

Note

The resetting of the module by activating MRES is controlled by the system software. If this has not been started, the FM 456-2 must be reset, if necessary, by switching the power on and off. If a keyboard is connected to the FM 456-2, it is possible to initiate a cold start via the hotkeys CTRL+ALT+HOME.

4.4 Status and Fault Indicators

Status and Fault Indicators

The FM 456-2 is provided with the following status and fault indicators:

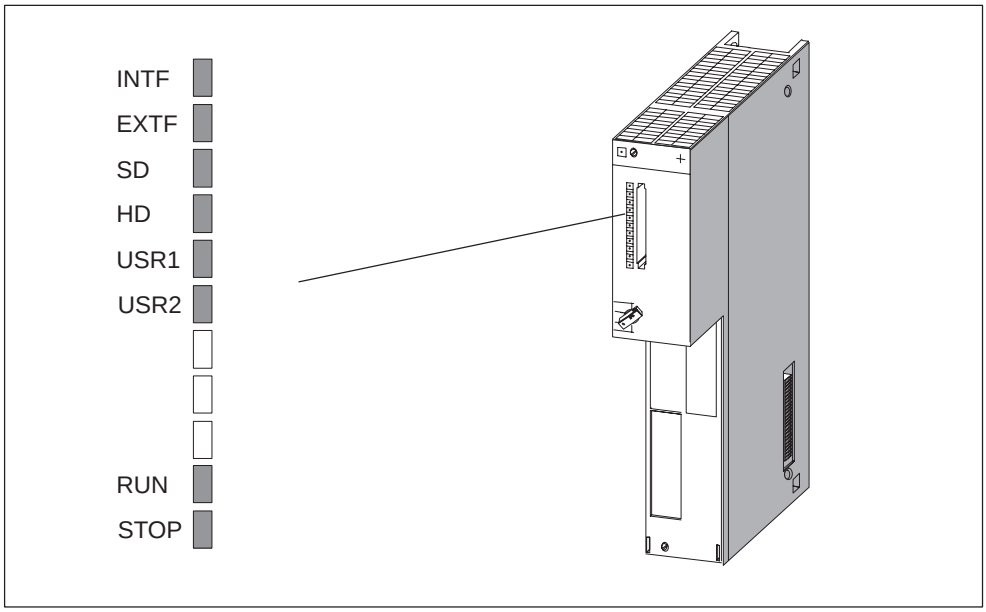


Figure 4-3 Status and Fault Indicators on the FM 456-2

Meaning of Status and Fault Indicators

The status and fault indicators are explained in Table 4-4 in the order in which they are arranged on the FM 456-2 application function module.

Table 4-4 Meaning of the Status and Fault Indicators on the FM 456-2

Indicator	Meaning	Description
INTF (red) EXTF (red)	Internal or external alarm	lights in the event of • Hardware faults • Firmware faults • Parameter assignment faults • Computational faults • Timer faults • Memory card faults • I/O faults. Use the PG to determine the exact nature of the fault (read diagnosis buffer).

Table 4-4 Meaning of the Status and Fault Indicators on the FM 456-2

Indicator	Meaning	Description
SD(green)	Access to memory card	Lights when read or write access to the memory card occurs.
HD (green)	Access to hard disk	Lights when read or write access to the hard disk on the mass storage module occurs.
USR1 (yellow)	Special indicator for the user program (user)	Can be allocated by the user (see programming manual).
USR2 (yellow)	Special indicator for the user program (user)	
RUN (green)	"**RUN**" status indicator	Lights if the system software is loaded and user programs are running (write accesses to the I/O are enabled)
STOP (yellow)	"**STOP**" status indicator	• Lights when the user program of the programmable module is not controlling the process (write accesses to the I/O are not enabled) • Flashes when a memory reset is requested or is being performed.
All indicators light briefly as a self-test following an MRES (see Page 4-5) or switching on of the power supply.		

4.5 Memory Card

The FM 456-2 application function module provides a facility to use memory cards as data medium or mass storage. This section provides you with information on how to use this facility.

Note

If a power failure occurs during write access to the memory card, the entire content of the memory card may be corrupted under worst case conditions.

Please note that, unlike a diskette, the memory card with flash EPROM is only suitable for a limited number of write operations.

A memory card simulates a diskette drive from which the operating system can be booted. It can also be used for changing user software and data.

For the FM 456-2, memory cards with flash EPROM are available (see Section 5, "Ordering Information").

Drive Assignment and Boot Sequence

The memory card is addressed by the operating system in the same way as a conventional drive.

The drive assignment and the boot sequence can be set in the BIOS setup (see chapter on central processing units for M7-400, BIOS setup of the *reference manual /1/*.

Formatting

Memory cards can be formatted with PG/PC or M7-400. Read the relevant sections in the *M7-SYS /2/* user manual.

Note

The memory capacity specified for the memory card is the actual physical memory capacity (gross). Formatting reduces the gross memory capacity to approximately 80% (net) that is then available to the operating system for storing data/programs.

UNDELETE:
Files which were deleted from the memory card **cannot** be restored using UNDELETE programs.

4.6 Expansion Socket

The FM 456-2 application function module is provided with an expansion socket, allowing you to connect up to three M7-400 expansion modules. The ISA bus is extended via the expansion socket.

Which Expansion Modules Can Be Connected?

One EXM 478 extension module with up to three interface submodules, one MSM 478 mass storage module with diskette and hard disk drive or one ATM 478 AT adapter module for short AT cards can be connected directly to the FM 456-2 application function module.

A total of up to 3 expansions can be connected in series to the CPU.

If three EXM 478 expansion modules are connected, up to 11 interface modules can be operated together with the slots on the relevant application function module.

Assembly Rules

The rules for the sequence of assembly and the possible combinations of expansion modules can be found in the chapter “M7-400 Expansion Modules” in *manual /1/*.

4.7 Slots for Interface Submodules

Definition

The submodule slot is a receptacle for a submodule. The FM 456-2 application function module has a slot for the memory card and two slots for interface submodules.

Figure 4-4 shows the position of the two slots for interface submodules on the FM 456-2 application function module.

Slot Numbering

Each slot for an interface submodule has a submodule slot number assigned to it. The submodule slot number depends on the module slot and on the arrangement of the slot on the expansion module or the CPU. You can see the submodule slot numbers in Figure 4-5.

You require these submodule slot numbers for configurations that you undertake in the BIOS setup or for determining the I/O addresses of an interface module (see the chapter “Expansions for M7-400” in the *reference manual /1/*).

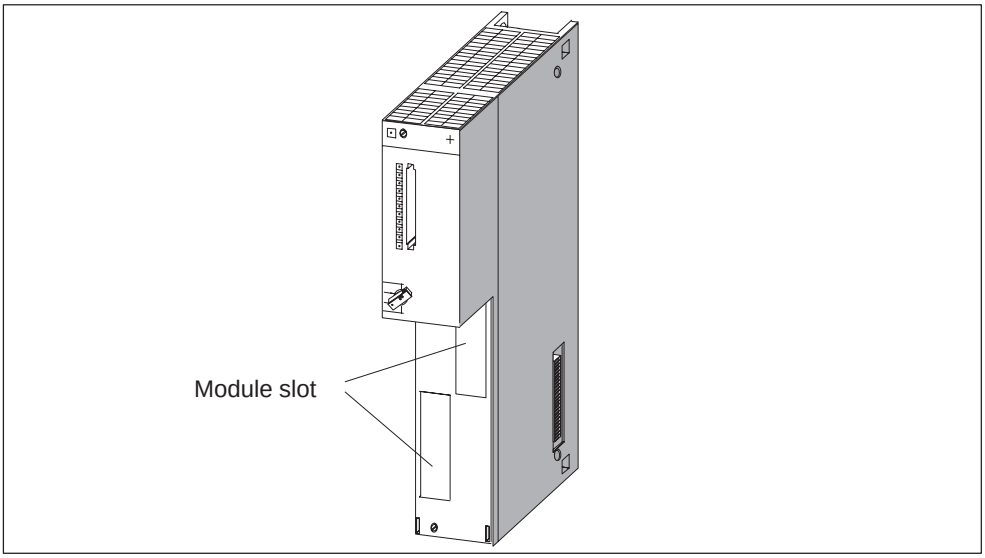


Figure 4-4 Position of the Module Slots for Interface Submodules on the FM 456-2 Application Function Module

Figure 4-5 shows the numbering of the interface submodule slots.

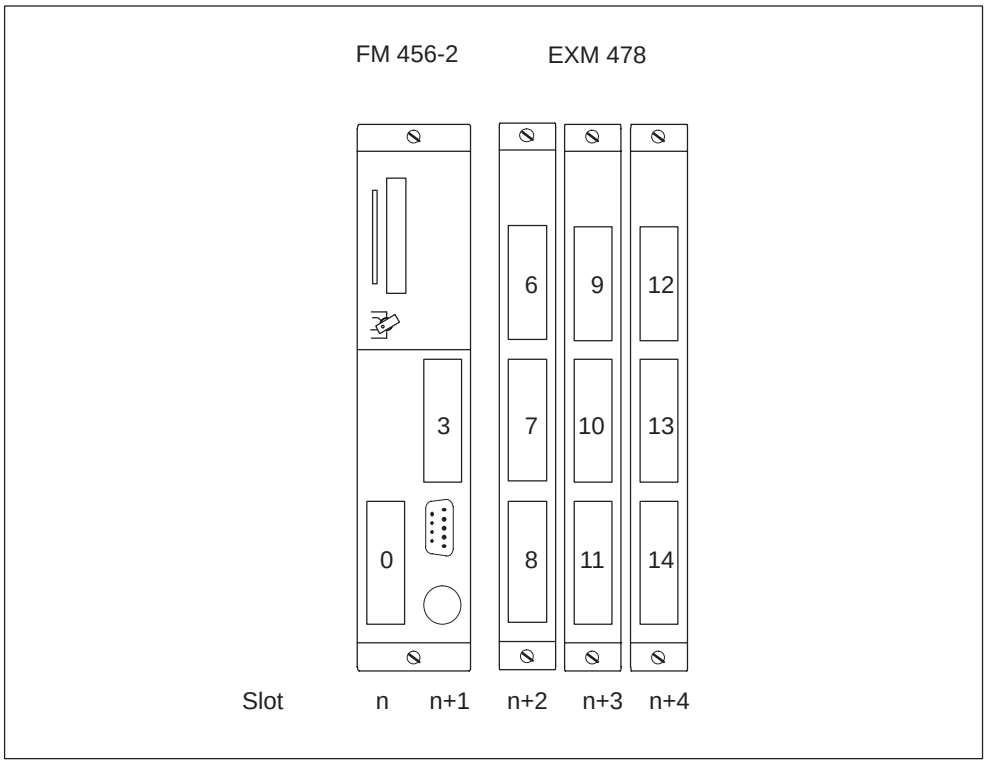


Figure 4-5 Submodule Slot Numbers on the FM 456-2 and EXM 478

Preferred Slot for IF 964-DP

If the IF 964-DP interface module is inserted in the preferred slot number 3 or if no IF 964-DP interface module is used, the whole main memory up to 16 Mbytes can be used.

If the IF 964-DP interface module is inserted in another slot, only up to 15 Mbytes can be used.

Determining the Basic Address for the Interface Submodule

The method of determining the basic addresses for the interface modules is given in the chapter “M7-400 Expansion Modules” in *manual /1/*, in the section “Addressing the EXM 478 Expansion Modules”.

Module Cover

Unused slots are protected by module covers.

4.8 Watchdog

Method of Operation

The FM 456-2 contains a watchdog for monitoring user programs. This is called on a cyclic basis by the system software. If the cyclic operation fails (for instance, if the software “hangs”), the module is reset after the watchdog period has expired. The cause of the reset is stored and is evaluated by the diagnosis software.

4.9 Buffering

The S7-400 rack is buffered centrally by the back-up battery in the power supply module.

If central buffering is present, the time and date and the SRAM (256 Kbytes) is buffered on the FM 456-2 application function module.

Note

Note that the data content will be lost if the central buffering fails or the module is unplugged from the rack.

BIOS Setup

The BIOS setup data, excluding time and date, is stored in the BIOS flash EPROM and is therefore independent of the central buffering. The BIOS setup is retained if the central buffering fails or the FM 456-2 is removed from the rack.

4.10 BIOS Setup

The BIOS setup for the FM 456-2 offers the same functions as for the CPU 488-3 and the CPU 486-3. Thus the descriptions in the chapter “CPUs for the M7-400, the BIOS setup” of the *reference manual /1/* are also valid for the FM 456-2.

This sections shows only the BIOS setup windows which differ from those of the CPUs.

Cold Start

After switch-on or cold starting the application function module, the BIOS (Basic Input Output System) starts a ”Power On Self Test” (POST) and outputs the results in the POST window.

```
                    PowerBIOS  Version 1.00
      Copyright (C) 1984 – 1996 Award Software Intl., Inc.
           03/13/96 – Intel–82430HX-3A59I000 01 0000
               Siemens AG FM456-2  M7-BIOS A2.11
------------------------------------------------------------------
CPU Type                   Pentium 120MHz
Math CoProcessor                 Internal
Base Memory                        640 Kb
Extended Memory                  15360 Kb
BIOS Shadow RAM                   Enabled
Video Shadow RAM                  Enabled
PS2 Mouse                        Disabled
Floppy Drives                     1 Found
Hard Drives                IBM–DBOA–2540
Serial Ports                      2 Found
Parallel Ports                    1 Found
Testing Base Memory                640 Kb
Testing Extended Memory          15360 Kb
------------------------------------------------------------------
Press CTRL–ALT–ESC to enter setup
```

Warm Start

The following window appears after a warm start of the FM 456-2 with MS-DOS. This indicates an accelerated system power up.

```
                    PowerBIOS  Version 1.00
      Copyright (C) 1984 – 1996 Award Software Intl., Inc.
           03/13/96 – Intel–82430HX-3A59I000 01 0000
               Siemens AG FM456-2  M7-BIOS A2.11
      Press CTRL-ALT-ESC to enter setup
```

4.11 Address and Interrupt Assignments

This section contains detailed information in tabular form about I/O address area mapping, memory and interrupt assignments in the FM 456-2 application function module.

Memory Assignment

The main memory is assigned as follows in the FM 456-2:

Table 4-5 Main Memory Assignment

Address	Content
1 MB to 15 MB *) or to 16 MB	User memory area
E 8000H to F FFFFH	BIOS
E 0000H to E 7FFFH	Free (32 K)
D 4000H to D FFFFH	Free (48 K)
D 0000H to D 3FFFH	Reserved for CP 1401 (16 K)
C F000H to C FFFFH	Free (16 K)
C C000H to C EFFFH	Memory card, otherwise free (12 K)
C 8000H to C BFFFH	Reserved (32 K)
C 0000H to C 7FFFH	Shadow VGA BIOS (32 K)
A 0000H to B FFFFH	VGA (128 K)
0 0000H to 9 FFFFH	640 K system area

*) If the interface submodule IF 964-DP is not plugged in the preferred slot (see page 4-10)

Keeping Memory Areas Free

The memory areas that are not always marked as “free” should be kept free when using a memory manager.

SRAM Area

The size of the SRAM with battery backup is 256 Kbytes (net for data blocks 244 Kbytes). If the battery is removed and inserted again when there is no power connected, the SRAM content will be lost. This is indicated by the BAF LED.

Memory Areas for AT Cards

AT cards which are inserted in the expansion module ATM 478 can occupy the following memory areas:

Area	M7 RMOS32	M7 RMOS32 with MS-DOS	
		Without EMS	With EMS
D 0000H to E 7FFFH	96 K	96 K	32 K[2)]
C 8000H to C BFFFH	16 K	16 K	16 K
C C000H to C EFFFH[1)]	12 K	12 K	12 K
C F000H to C FFFFH	4 K	4 K	4 K

1) The area is only available if no memory card is present.

2) If the driver software under MS-DOS requires expanded memory (EMS), the memory manager EMM386 occupies 64 K in the area D0000H to E7FFFH because it must be operated in EMS mode.

I/O Address Area

Addressing of the ISA-compatible input/output components is carried out in the I/O area at addresses from 0100_H to $03FF_H$. The addresses determined by the ISA architecture are used. Unlike the original AT, the I/O addresses are fully decoded in the FM 456-2 module, so that addresses above $03FF_H$ can be used for addressing M7-400-specific hardware.

Address Area for AT Modules

The following address area is available for addressing AT modules in the ATM 478 AT adapter module:

- 0200_H to $03FF_H$
- except the area from $03E0_H$ to $03E3_H$ and
- except the area occupied by the installed interface submodules (see the chapter “Interface Submodules” in *reference manual /1/*).

Interrupt Assignment

Table 4-6 Interrupt Assignment

Interrupt	Function
NMI	Group signal for fault signals
IRQ0	System timer
IRQ1	Reserved for keyboard
IRQ2	Cascading of the 2nd interrupt controller
IRQ3	Reserved for COM2, otherwise free
IRQ4	Reserved for COM1, otherwise free
IRQ5	Reserved for LPT2, otherwise free
IRQ6	Reserved for floppy disk drive, otherwise free
IRQ7	Reserved for LPT1, otherwise free
IRQ8	Real time clock
IRQ9	Software interrupt, diverted to IRQ2
IRQ10	Reserved for IF 964-DP or free
IRQ11	Reserved for CP1401 or free
IRQ12	PS2 mouse, otherwise free
IRQ13	Numeric coprocessor
IRQ14	Hard disk
IRQ15	S7 system interrupt

4.12 Technical Data

Features and Technical Data of the FM 456-2

The following table shows the features and technical details of the FM 456-2 application function modules.

Note

The “General technical data” of the S7/M7-400 logic controllers applies (see *reference manual /1/*), unless otherwise specified in this section.

6ES7 456-2AA00-0AB0 **ES7 456-2AA00-0AB1** (with MS-DOS)	
Features	
Processor	Pentium 120 MHz
Main memory	16 Mbytes
Buffered memory (SRAM)	256 Kbytes
Second-Level Cache	256 Kbytes
Slots for interface modules	2
Option for connection of expansion modules	max. 3

Technical Data	
Supply voltage	5 V DC
Current consumption (without interface submodules)	
• typ.	2.2 A
• max. permissible	2.7 A
Power loss	
• without interface submodules	max. 13.5 W
• with interface submodules	max. 16.5 W
Forced ventilation necessary	no
Dimensions WxHxD (mm)	50 x 290 x 219
	(2” x 11.5” x 8.62”)
Weight	1.3 kg (2.87 lb.)

Ordering Information

5

In this Chapter

5.1 M7-400 Application Function Modules

Table 5-1 Order Numbers for M7-400 Application Function Modules

Product	Description	Order Number
FM 456-2	Application function module (Pentium, 120 MHz, with 16 Mbytes main memory, 256 Kbytes SRAM)	6ES7 456-2AA00-0AB0

5.2 M7-400 Expansion Modules

Table 5-2 lists all the expansion modules that can be used with the M7-400 application function modules.

Table 5-2 Order Numbers for M7-400 Expansion Modules

Product	Description	Order Number
ATM 478	AT adapter module (to accept a short AT module)	6ES7 478-2CA00-0AC0
EXM 478	Expansion module (to accept 3 interface submodules)	6ES7 478-2AC00-0AC0
MSM 478	Mass storage module (3.5” diskette drive and ≥ 520 Mbytes hard disk and 1 LPT1 parallel interface)	6ES7 478-2BA00-0AC0

5.3 M7-400 Interface Submodules

Table 5-3 lists all the interface submodules that can be used with M7-400 application function modules.

Table 5-3 Order Numbers for M7-400 Interface Submodules

Product	Description	Order Number
IF 961-AIO	Analog I/O interface submodule for analog inputs and outputs	6ES7 961-2AA00-0AC0
IF 961-CT1	Counter 1 interface submodule (connection for incremental encoder)	6ES7 961-3AA00-0AC0
IF 961-DIO	Digital I/O interface submodule for digital inputs and outputs	6ES7 961-1AA00-0AC0
IF 962-COM	COM interface submodule for connecting up to two serial devices (for example, mouse, terminal)	6ES7 962-3AA00-0AC0
IF 962-LPT	Interface submodule with parallel interface (for example, printer)	6ES7 962-4AA00-0AC0
IF 962-VGA	Interface submodule with standard VGA and keyboard interface	6ES7 962-1BA01-0AC0
IF 964-DP	Interface submodule for connecting distributed I/Os (via Profibus)	6ES7 964-2AA00-0AB0
CP 1401	Communications processor Ethernet (H1) with TCP/IP protocol	6GK1 140-1NA00

5.4 Memory Card

Table 5-4 lists all the memory cards that can be used with M7-400 application function modules.

Table 5-4 Order Numbers for Memory Card

Description	Order Number
Memory Card, flash-EPROM, 5 V, 4 Mbytes	6ES7 952-1KM00-0AA0
Memory Card, flash-EPROM, 5 V, 8 Mbytes	6ES7 952-1KP00-0AA0
Memory Card, flash-EPROM, 5 V, 16 Mbytes	6ES7 952-1KS00-0AA0

5.5 Connecting Cables

Table 5-5 lists the connecting cables.

Table 5-5 Order Numbers for Connecting Cables

Description	Order Number
V.24 cables (RS232, "Null-Modem"), 10 m (33 ft.) 9-pin Sub-D female connectors at both ends	9AB4 173-2BN10-0CA0
Printer connecting cable for • Serial interface (COM, 10 m (33 ft.)) • Parallel interface (Centronics)	 9AB4 173-2BN10-0CA0 9API 901-0AL00

5.6 Spare Parts and Accessories

Table 5-6 lists spare parts and accessories.

Table 5-6 Order Numbers for Spare Parts and Accessories

Description	Order Number
Key for FM 456 (mode switch)	6ES7 911-0AA00-0AA0
12 module covers	6ES7 398-0BA00-0AA0
6 connecting clips	6ES7 498-6BA00-0AA0

5.7 Documentation

Table 5-7 lists all the documentation that can be ordered in addition to this manual.

Table 5-7 Order Numbers for Documentation

Description	Langugage	Order Number
FM 456 Application Function Module Installation, Hardware, and Startup Manual	English French	6ES7456-2AA00-8BA0 6ES7456-2AA00-8CA0
S7-400, M7-400 Programmable Controllers Installation and Hardware Manual	German English French	6ES7498-8AA02-8AA0 6ES7498-8AA02-8BA0 6ES7498-8AA02-8CA0
S7-400, M7-400 Programmable Controllers Module Specifications Reference Manual		
System Software for M7-300/400 Program Design Programming Manual	German English	6ES7802-0FA14-8AA0 6ES7802-0FA14-8BA0
System Software for M7-300/400 System and Standard Functions Reference Manual		
System Software for M7-300/400 Installation and Operation User Manual		
ProC/C++ for M7-300/400 Writing C Programs User Manual	German English	6ES7812-0CA01-8AA0 6ES7812-0CA01-8BA0
ProC/C++ for M7-300/400 Debugging C Programs User Manual		
CFC for S7 and M7 Graphical Interconnection of Technological Functions Manual	German English French	6ES7813-0CA02-8AA0 6ES7813-0CA02-8BA0 6ES7813-0CA02-8CA0

Bibliography

A

For programming and startup of the M7-400 application function modules you will need the following manuals in addition:

No.	Manual	Content	Order Number
/1/	*S7-400, M7-400 Programmable Controllers* Installation and Hardware Manual Module Specifications, Reference Manual	Configuration, installation and preparation for startup	6ES7498-8AA02-8AA0
/2/	*M7-SYS, System Software for M7-300/400* Program Design System and Standard Functions Installation and Operation	Writing C Programs for M7 CPU/FM modules with the M7-SYS RT. programming package.	6ES7802-0FA14-8AA0
/3/	*STEP 7* Programming with STEP 7 Configuring Hardware with STEP 7	Operating STEP 7, Configuring hardware with STEP 7	included in STEP 7 documentation package

Rules for Handling Electrostatically Sensitive Devices (ESD)

B

Introduction

This appendix explains

- What lies behind the term “electrostatically sensitive devices”
- What precautions must be observed when handling electrostatically sensitive modules.

Contents

You will find the following information about electrostatically sensitive modules in this appendix:

B.1 What Does ESD Mean?

Definition

All electronic modules are equipped with highly integrated devices or components. Because of their technology, these components are very sensitive to overvoltages and therefore to static electrical discharges.

The abbreviation **ESD** is used internationally for these **E**lectrostatically **S**ensitive **D**evices. In Germany these are referred to as EGB (Elektrostatisch Gefährdeten Baugruppen).

Electrostatically sensitive devices are identified with the symbol shown below:

Caution

Electrostatically sensitive devices can be destroyed by voltages well below those that you can normally detect. These voltages occur when you touch a component or the connections of a module without having first ensured that you are electrostatically discharged. The damage that can be caused to a module by overvoltage cannot usually be recognized immediately, but only becomes apparent after a lengthy period of operation.

B.2 Electrostatic Charging of Persons

Charging

Any person whose electrical potential is not equalized to that in their environment can become electrostatically charged.

Figure B-1 shows the maximum electrostatic voltage with which a person can become charged when coming into contact with the materials shown. These values correspond to the figures in IEC 801-2.

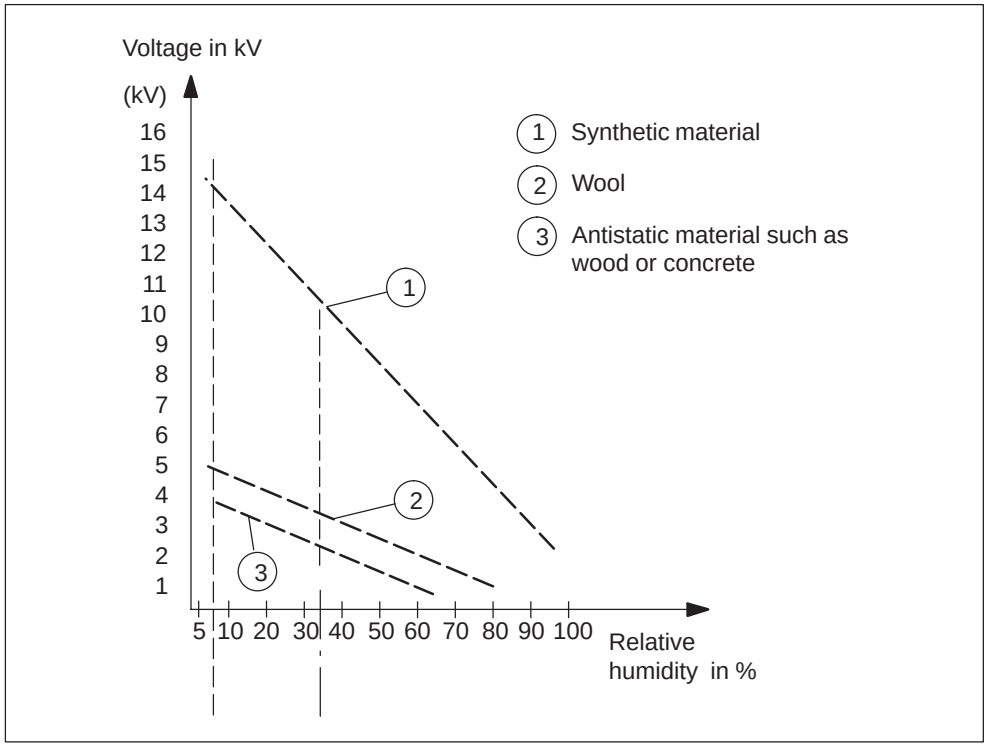


Figure B-1 Electrostatic Voltages with which a Person May Become Charged

B.3 Basic Precautions Against Electrostatic Discharge

Ensure a Good Ground

When handling electrostatically sensitive modules, ensure that persons, workplace and packaging are effectively earthed. This will avoid static charging.

Avoid Touching Components Directly

Only touch electrostatically sensitive components if this is unavoidable (for example during maintenance work). Hold the module so that you do not touch either the module pins or the printed circuit tracks. In this way, the electrical discharge energy will not be able to reach sensitive components and cause damage.

If you have to take measurements on a module, first discharge any static about your body before carrying out the work. This can be done by touching a grounded metallic object. Use only grounded measuring instruments.

Index

K

L

M

P

S

T

W

Siemens AG
A&D AS E 81

Oestliche Rheinbrueckenstr. 50
D-76181 Karlsruhe
Federal Republic of Germany

From:
Your Name: _
Your Title: _
Company Name: _
Street: _
City, Zip Code_ _
Country: _
Phone: _

Please check any industry that applies to you:

- ❐ Automotive
- ❐ Chemical
- ❐ Electrical Machinery
- ❐ Food
- ❐ Instrument and Control
- ❐ Nonelectrical Machinery
- ❐ Petrochemical
- ❐ Pharmaceutical
- ❐ Plastic
- ❐ Pulp and Paper
- ❐ Textiles
- ❐ Transportation
- ❐ Other _ _ _ _ _ _ _ _ _ _ _

Remarks Form

Your comments and recommendations will help us to improve the quality and usefulness of our publications. Please take the first available opportunity to fill out this questionnaire and return it to Siemens.

Please give each of the following questions your own personal mark within the range from 1 (very good) to 5 (poor).

1. Do the contents meet your requirements? ☐
2. Is the information you need easy to find? ☐
3. Is the text easy to understand? ☐
4. Does the level of technical detail meet your requirements? ☐
5. Please rate the quality of the graphics/tables: ☐

Additional comments: