

SIEMENS



Manual

SIMATIC

S7-1500/ET 200MP

Technology module
TM FAST (6ES7554-1AA00-0AB0)

Edition

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support.industry.siemens.com

SIMATIC

S7-1500/ET 200MP Technology module TM FAST (6ES7554-1AA00-0AB0)

Equipment Manual

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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

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

NOTICE

indicates that property damage can result if proper precautions are not taken.

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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified persons are those who, because of their training and experience, are familiar with the installation, assembly, commissioning, operation, decommissioning and disassembly of the product and can recognize risks and avoid possible hazards.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the application described in the catalog and the associated usage information. 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 complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens Aktiengesellschaft. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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.

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Introduction

Purpose of the documentation

This equipment manual includes module-specific information on the function, wiring, programming and operation, diagnostics and technical specifications of the technology module.

Generally applicable information on installation and commissioning of the S7-1500 or ET 200MP is available in System Manual S7-1500, ET 200MP Automation System (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

The specific steps for creating the TM FAST application are described in the programming manual Creating a TM FAST Application (<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

Conventions

Please observe notes marked as follows:

NOTE

A note contains important information on the product described in the documentation, on the handling of the product and on the section of the documentation to which particular attention should be paid.

Recycling and disposal

For environmentally sustainable recycling and disposal of your old equipment, contact a certified electronic waste disposal service and dispose of the equipment according to the applicable regulations in your country

(<https://support.industry.siemens.com/cs/ww/en/view/109976696>).

ID Link for the digital nameplate

The ID Link is a globally unique identifier in accordance with IEC 61406, which you can find in the future as a QR code on your product.

You can recognize the ID Link from the black frame corner at the bottom right of its frame. The ID Link takes you to the digital nameplate of your product.

Scan the QR code on the product or packaging label using a smartphone camera, bar code scanner, or reader app. Open the ID Link.

In the digital nameplate you will find product data, manuals, Declarations of Conformity, certificates, and other helpful information on your product.

Standards

You can find a dated reference to the respective standards or EU Declaration of Conformity on the Internet (<https://sieportal.siemens.com/su/blGuK>).

Document history

The following table shows the most important changes to the documentation compared to the previous edition.

Manual edition	Comments	Firmware version of TM FAST	System logic version
08/2026	The following sections have been revised: - Industrial Cybersecurity (Page 15) - Product overview (Page 19) - Configuring/address space (Page 30) - Technical specifications (Page 56)	V3.0.0	V2.0.0
07/2025	The following sections have been revised: - Industrial Cybersecurity (Page 15) - Product overview (Page 19) - Configuring/address space (Page 30) - Programming (Page 39) - Technical specifications (Page 56) - Parameter data record (Page 62)	V2.0	V2.0.0
05/2023	First edition	V1.0	V1.0.1

1.1 SiePortal

You can find current information on the following topics quickly and easily here:

- **Catalog and Order System**
Ordering system for automation and drive solutions based on Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).
- **Product support**
All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.
- **Application examples**
Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.
- **Services**
Information about Industry Services, Field Services, Technical Support, spare parts and training offers.
- **Forums**
For answers and solutions concerning automation technology.
- **mySiePortal**
Your personal working area in SiePortal for notifications, support requests and configurable documents.

This information is provided by SiePortal on the Internet (<https://sieportal.siemens.com>).

1.2 Open Source Software

Open-source software is used in the firmware of the product described. Open Source Software is provided free of charge. We are liable for the product described, including the open-source software contained in it, pursuant to the conditions applicable to the product. Siemens accepts no liability for the use of the open source software over and above the intended program sequence, or for any faults caused by modifications to the software.

For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices. Please read the information on this on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109740777>).

1.3 S7-1500/ET 200MP Documentation Guide



The documentation for the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require. Changes and supplements to the manuals are documented in a Product Information.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742691>).

Basic information



The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems.

The STEP 7 online help supports you in the configuration and programming.

Examples:

- Getting Started S7-1500
- S7-1500/ET 200MP System Manual
- Online help TIA Portal

Device information



Equipment manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

Examples:

- Equipment Manuals CPUs
- Equipment Manuals Interface Modules
- Equipment Manuals Digital Modules
- Equipment Manuals Analog Modules
- Equipment Manuals Communications Modules
- Equipment Manuals Technology Modules
- Equipment Manuals Power Supply Modules

General information



The function manuals contain detailed descriptions on general topics relating to the SIMATIC S7-1500 and ET 200MP systems.

Examples:

- Function Manual Diagnostics
- Function Manual Communication
- Function Manual Motion Control
- Function Manual Web Server
- Function Manual Cycle and Response Times
- PROFINET Function Manual
- PROFIBUS Function Manual

Product Information

Changes and supplements to the manuals are documented in a Product Information. The Product Information takes precedence over the device and system manuals.

You can find the latest Product Information on the S7-1500 and ET 200MP systems on the Internet (<https://support.industry.siemens.com/cs/de/en/view/68052815>).

Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/86140384>)

Manual Collection fail-safe modules

The Manual Collection contains the complete documentation on the fail-safe SIMATIC modules, gathered together in one file.

You can find the Manual Collection on the Internet.

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

1.3.1 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.

The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in Siemens Industry Online Support:



Industry Online Support International

(<https://support.industry.siemens.com/cs/ww/en/view/109742705>)

Watch this short video to find out where you can find the overview directly in Siemens Industry Online Support and how to use Siemens Industry Online Support on your mobile device:



Quick introduction to the technical documentation of automation products per video (<https://support.industry.siemens.com/cs/us/en/view/109780491>)



YouTube video: Siemens Automation Products - Technical Documentation at a Glance (<https://youtu.be/TwLSxxRQsA>)

Retention of the documentation

Retain the documentation for later use.

For documentation provided in digital form:

1. Download the associated documentation after receiving your product and before initial installation/commissioning. Use the following download options:
 - Industry Online Support International: (<https://support.industry.siemens.com>)
The article number is used to assign the documentation to the product. The article number is specified on the product and on the packaging label. Products with new, non-compatible functions are provided with a new article number and documentation.
 - ID link:
Your product may have an ID link. The ID link is a QR code with a frame and a black frame corner at the bottom right. The ID link takes you to the digital nameplate of your product. Scan the QR code on the product or on the packaging label with a smartphone camera, barcode scanner, or reader app. Call up the ID link.
2. Retain this version of the documentation.

Updating the documentation

The documentation of the product is updated in digital form. In particular in the case of function extensions, the new performance features are provided in an updated version.

1. Download the current version as described above via the Industry Online Support or the ID link.
2. Also retain this version of the documentation.

mySupport

With "mySupport" you can get the most out of your Industry Online Support.

Registration	You must register once to use the full functionality of "mySupport". After registration, you can create filters, favorites and tabs in your personal workspace.
Support requests	Your data is already filled out in support requests, and you can get an overview of your current requests at any time.
Documentation	In the Documentation area you can build your personal library.
Favorites	You can use the "Add to mySupport favorites" to flag especially interesting or frequently needed content. Under "Favorites", you will find a list of your flagged entries.
Recently viewed articles	The most recently viewed pages in mySupport are available under "Recently viewed articles".
CAX data	The CAX data area gives you access to the latest product data for your CAX or CAE system. You configure your own download package with a few clicks: • Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files • Manuals, characteristics, operating manuals, certificates • Product master data

You can find "mySupport" on the Internet. (<https://support.industry.siemens.com/My/ww/en>)

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You can find the application examples on the Internet.
(<https://support.industry.siemens.com/cs/ww/en/ps/ae>)

AI-powered online support chat

The "Automation Knowledge Guide" function is an advanced AI-controlled platform that gives you access to the powerful knowledge base of the Siemens Support Portal (<https://sieportal.siemens.com/en-ww/support>). You do not just receive mechanical answers to your questions, but precise, interactive informational material. This allows you to effectively speed up your research and decision processes.

The following link (<https://support.industry.siemens.com/cs/ww/en/view/109974274>) provides current information on the availability of "Automation Knowledge Guide":

You can also access the entry by means of the "AI powered Online Support Chat" command in the "Help" menu in TIA Portal.

1.3.2 Tool support

Tools

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).

As successor of the SIMATIC Selection Tools, the TIA Selection Tool assembles the already known configurators for automation technology into a single tool.

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/109767888>)

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities on various SIMATIC S7 stations as bulk operations independent of TIA Portal.

The SIMATIC Automation Tool offers a wide range of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Assignment of addresses (IP, subnet, Gateway) and device name (PROFINET device) to a CPU
- Transfer of the date and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- RUN/STOP mode switchover
- CPU localization through LED flashing
- Reading out of CPU error information
- Reading the CPU diagnostic buffer
- Reset to factory settings
- Firmware update of the CPU and connected modules

You can find the SIMATIC Automation Tool on the Internet.

(<https://support.industry.siemens.com/cs/ww/en/view/98161300>)

PRONETA

SIEMENS PRONETA (PROFINET network analysis) is a commissioning and diagnostic tool for PROFINET networks. PRONETA Basic has two core functions:

- In the network analysis, you get an overview of the PROFINET topology. Compare a real configuration with a reference installation or make simple parameter changes, e.g. to the names and IP addresses of the devices.
- The "IO test" is a simple and rapid test of the wiring and the module configuration of a plant, including documentation of the test results.

You can find SIEMENS PRONETA Basic on the Internet:

(<https://support.industry.siemens.com/cs/ww/en/view/67460624>)

SIEMENS PRONETA Professional is a licensed product that offers you additional functions. It offers you simple asset management in PROFINET networks and supports operators of automation systems in automatic data collection/acquisition of the components used through various functions:

- The user interface (API) offers an access point to the automation cell to automate the scan functions using MQTT or a command line.
- With PROFlenergy diagnostics, you can quickly detect the current pause mode or the readiness for operation of devices that support PROFlenergy and change these as needed.
- The data record wizard supports PROFINET developers in reading and writing acyclic PROFINET data records quickly and easily without PLC and engineering.

You can find SIEMENS PRONETA Professional on the Internet.

(<https://www.siemens.com/proneta-professional>)

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and the optimal use of resources

You can find SINETPLAN on the Internet

(<https://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html>).

MultiFieldbus Configuration Tool

MultiFieldbus Configuration Tool (MFCT) is PC-based software and supports the configuration of MultiFieldbus-Devices and DALI-modules. In addition, the MFCT offers convenient options for bulk firmware updating of ET 200 devices with MultiFieldbus-support and reading of service data for many other Siemens devices.

Functional scope of the MFCT

- MultiFieldbus configuration:
Engineering, configuration and diagnostics of MultiFieldbus-devices, provision of the required project files (project, UDT-, CSV- and EDS-file), transfer/export of the files to device and/or data memory.
- DALI configuration:
Device selection and online configuration of DALI modules.
- TM FAST:
Generation and download of FPGA-UPD- and FPGA-DB-files.
- Maintenance:
Topology scan of a Ethernet network, reading of service data, parameter assignment and firmware update.
- Settings:
Language switching German / English, network scanner speed, setting of the network adapter, installation of GSDML-and EDS-files.
- Event diagnostics for CM PTP:
Reading out and analyzing the parameter settings and communication of a CM PTP.

System/installation requirements for MFCT

The MFCT runs under Microsoft Windows and does not require installation or administrator rights.

For MFCT you must also install the following software:

- Microsoft .NET Framework 4.8 (You can find an Offline Installer on the Internet. (<https://support.microsoft.com/en-us/topic/microsoft-net-framework-4-8-offline-installer-for-windows-9d23f658-3b97-68ab-d013-aa3c3e7495e0>))
- NPcap from directory "Misc"
- PG/PC interface from directory "Misc"
- Microsoft C++ Redistributable for x86-systems (you can find the installation data for download on the Internet. (<https://support.industry.siemens.com/cs/ww/en/view/109773881>))

The download of the tool and more information as well as documentation on the individual functions of the MFCT can be found on the Internet. (https://aka.ms/vs/15/release/vc_redist.x86.exe)

Industrial Cybersecurity

2.1 Introduction to industrial cybersecurity

Due to the digitalization and increasing networking of machines and industrial plants, the risk of cyber attacks is also growing. Appropriate protective measures are therefore mandatory, particularly in the case of critical infrastructure facilities.

General information on and measures for the topic of industrial cybersecurity is provided in the System Manual (<https://support.industry.siemens.com/cs/ww/en/view/59191792>).

This section gives an overview of the security-relevant information applying to your SIMATIC device.

2.2 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines, and networks.

In order to protect plants, systems, machines, and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Products and solutions from Siemens form one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For more information on industrial cybersecurity measures, please visit (<http://www.siemens.com/cybersecurity-industry>).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed here (<https://www.siemens.com/cert>).

2.3 Measures for protecting the operational application environment

Purpose and intended application environment

The TM FAST is designed as a technology module for the S7-1500 automation system/ET 200MP distributed I/O system in industrial automation plants. It enables the control of particularly fast processes with short response times.

Classification by security context for the product

An appropriate operational application environment is necessary in order to protect the product from cyber threats. You achieve this by considering the following classification into categories according to the security context and by implementing the necessary measures.

The description of the categories is available in the System Manual S7-1500, ET 200MP (<https://support.industry.siemens.com/cs/ww/en/view/59191792>), in the section "Description of the operational environment (security context)".

Category	Phase of use/Access	Classification	Required measures
Persons	Installing	Instructed Person	• Training on the product • Documented training processes
	Wiring	Instructed Person	
	Configuring, programming	Skilled Person	• Regular training on product, plant, cybersecurity • Documented training processes • Clear roles and responsibilities • Monitoring and checking of employee qualifications
	Testing, commissioning, maintenance	Skilled Person	
	Decommissioning	Instructed Person	• Training on the product • Documented training processes
Physical access	Device with interfaces, wiring	Controlled	• Installation in lockable control cabinets with cylinder locks • Access control with keys, card systems or biometric methods • Monitoring of critical areas with cameras or alarm systems • Physical separation of publicly accessible areas • Accompaniment of non-employees
Communication access	Access via PROFINET IO, PROFIBUS DP	Controlled	• Physical protection of the network infrastructure • Cable protection by laying bus cables in protected cable ducts/channels • Protection of unused ports with port blockers
	Access from the plant network	Limited	• Network segmentation using routers • Communication control by means of firewalls • Deactivation of communications services and ports that are not required • User management/authentication for CPUs/CPs used as gateway

More information

Also consider all aspects of industrial cybersecurity in the S7-1500, ET 200MP System Manual. There you will find detailed descriptions of:

- Comprehensive security concepts
- Secure operation of CPUs and systems
- Overview of the protective functions
- User management and access control
- Network security and communication protection
- Remaining residual risks

2.4 Cybersecurity-relevant information

Note all cybersecurity-relevant information.

Topics with cybersecurity-relevant information	Reference
Operating environment and security measures	
Operating environment and security measures	This section is found in the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Security properties of the product	
Access protection	In addition, observe the information on access protection in the Protection chapter of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Signed firmware update	The topic of a signed firmware update is discussed in the Industrial Cybersecurity section of the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Secure operation	
Corrective measures for known risks	Corrective measures for known risks are published on the Siemens ProductCERT (https://www.siemens.com/cert) website. For more information on SIEMENS ProductCERT, refer to the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792).
Security checks	You can find applicative security measures such as cyclical checking of the configuration via the checksum in the System Manual (https://support.industry.siemens.com/cs/ww/en/view/59191792). The TM FAST application loaded into the FPGA is taken into account during the CRC calculation.
Secure decommissioning Products that contain security-relevant data must be securely decommissioned before disposal or resale.	Deleting TM FAST application from flash memory: Readback of the TM FAST application is not technically possible. You have the following additional options to explicitly delete the application: • Via the commissioning editor in STEP 7 (TIA Portal) • Via the LTMFAST_ControlREC instruction in the user program of the CPU • Via the MultiFieldbus Configuration Tool (MFCT) as of V1.5 (https://support.industry.siemens.com/cs/ww/en/view/109773881) Apart from the application (and, if applicable, I&M data) no further data is retentively saved on the module.

NOTICE
Remove TM FAST Debug Connector after commissioning When commissioning is completed, you must disable the FPGA debug interface and remove the TM FAST Debug Connector.

Product overview

3.1 Properties

Article number

6ES7554-1AA00-0AB0

Firmware version

This equipment manual describes the properties of firmware version V3.0 of the module.

View of the module

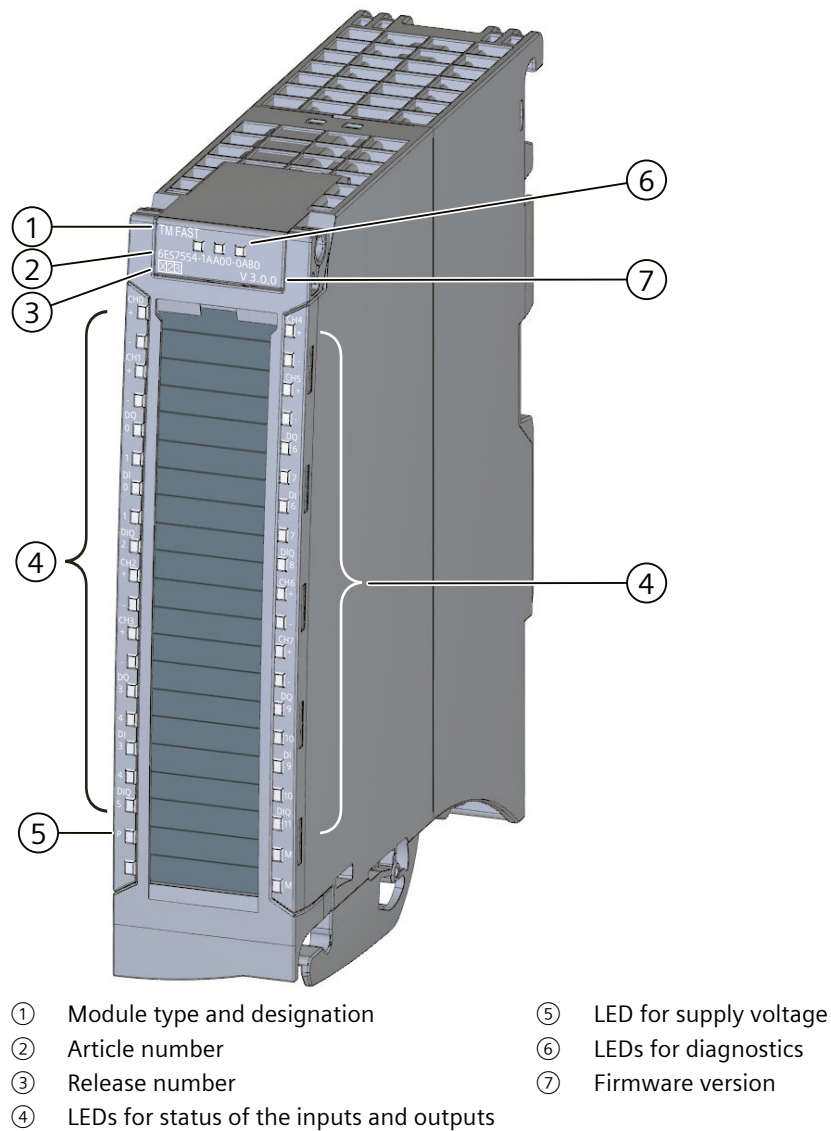


Figure 3-1 View of the TM FAST module

Introduction

The technology module offers the possibility to control particularly fast processes with short response times in the microsecond and nanosecond range. You can define the hardware functionality of the module through application-specific programming of the FPGA in the module. For this purpose, use the Intel Quartus Prime external software. The free Intel Quartus Prime Lite Edition version is sufficient in most cases.

Properties

The technology module has the following properties:

- Eight 24 V digital inputs (input characteristic acc. to IEC 61131, Type 3)
- Eight fast 24 V digital outputs
- Four 24 V digital inputs/outputs
- Eight RS422/RS485 channels (CHm), can also be used as TTL (single-ended) channels, direction can be configured
- Configurable diagnostics
- Configurable input delay of the 24 V digital inputs: 0.001 ms ... 20 ms, or freely programmable using the TM FAST application
- Configurable input delay of the RS422/RS485/TTL inputs: 0.5 μ s ... 1000 μ s, or freely programmable using the TM FAST application
- 32 bytes cyclic input data and 32 bytes cyclic output data for free usage in the TM FAST application.
- Up to 128 bytes acyclic input data and up to 128 bytes acyclic output data for free use in the TM FAST application.
- The functionality of I/O data and inputs/outputs can be completely defined using the TM FAST application

The module supports the following functions:

Table 3-1 Version dependencies of the functions

Function	Firmware version of module	Configurable as of	
		STEP 7 (TIA Portal)	GSD PROFINET IO
Firmware update	V1.0 only	V17 with HSP0368	X
I&M identification data	V1.0 or higher	V17 with HSP0368	X
Parameter reassignment in RUN mode	V1.0 or higher	V17 with HSP0368	X
Isochronous mode	V1.0 or higher	V17 with HSP0368	—
Update of the TM FAST application in the flash memory	V1.0 or higher	V17 with HSP0368	X
Module replacement without PG/PC by updating the TM FAST application via an instruction at an S7-1500 CPU	V1.0 or higher	V17 with HSP0368	—
Signed firmware update	V2.0 or higher	V20 with HSP0368	X

Firmware updates are supported within the same major version of the firmware. Switching to a different major version via firmware update is not possible.

Accessories

The following components are supplied with the technology module and can also be ordered separately as spare parts:

- Shielding bracket
- Shield terminal
- Infeed element
- Labeling strip
- U-connector

Other components

The following components have to be ordered separately:

- Front connectors, including potential jumpers and cable ties
- Additionally required if the shield connection element planned for the module is not sufficient:
 - Shield connection element (article number 6ES7390-5AA00-0AA0)
 - Shield connection clamps (e.g. article number 6ES7390-5CA00-0AA0)
- For TM FAST application development (Page 49) and commissioning:
 - TM FAST Debug Connector (Part number 6ES7554-1AA00-5AA0)
 - Intel FPGA Download Cable (USB blaster), available in specialist stores

See also

For more information on accessories, refer to the System Manual S7-1500, ET 200MP Automation System (<https://support.industry.siemens.com/cs/ww/en/view/59191792>), section System Overview.

Connecting

4.1 Pin assignment

You connect input and output signals to the 40-pin front connector of the technology module. In addition, you connect the supply voltage for supplying the module and the digital outputs to the 4-pin infeed element. Some of the connections can be used as an input or output. You define this in the TM FAST (Page 48) application.

For information on wiring the front connector, connecting the cable shield, etc., see System Manual S7-1500, ET 200MP Automation System

(<https://support.industry.siemens.com/cs/ww/en/view/59191792>), section Wiring.

Shielded cables are usually required depending on the output frequency used and the configured input delay. Shielded cables are not required for input delays of 100 µs and more. If the shield connection element is not sufficient, you can additionally use the S7-300 shield connection terminals specified in section Properties (Page 19).

NOTICE

Electromagnetic compatibility

The high-frequency switching (> 5 kHz) of the 24 V outputs generates electromagnetic feedback effects on the supply network. You have the following options for adhering to the limits that correspond to the current state of the art:

- Use a separate 24 V power supply unit, e.g. SIMATIC PM 1507 24 V/3 A (article number 6EP1332-4BA00), to supply the TM FAST.
- Provide a corresponding filter for the 24 V supply. The interference radiation measurements were made with filters of the type "EPCOS SIFI-C B84113C". Use this filter type or a filter with the same characteristic or a characteristic with greater damping.
- Take appropriate measures already when generating the output signals, e.g. "frequency dithering" of the generated output frequencies.

NOTE

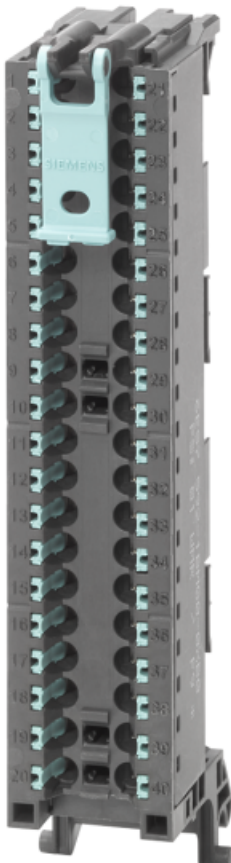
Checking the immunity according to EN 61000-6-2

For fast transients (burst), criterion B applies (at 2 kV according to EN 61000-4-4/IEC 61000-4-4).

Pin assignment for the front connector

The table below shows the pin assignment of the front connector.

Table 4-1 Pin assignment of the front connector

Designation	Signal name		View	Signal name		Designation
RS485/TTL input or output signal ⁴	+CH0	1		21	+CH4	RS485/TTL input or output signal ⁴
RS485 input or output signal ^{1,4}	-CH0	2		22	-CH4	RS485 input or output signal ^{1,4}
RS485/TTL input or output signal ⁴	+CH1	3		23	+CH5	RS485/TTL input or output signal
RS485 input or output signal ^{1,4}	-CH1	4		24	-CH5	RS485 input or output signal ¹
Fast digital output	DQ0	5		25	DQ6	Fast digital output
Fast digital output	DQ1	6		26	DQ7	Fast digital output
Digital input	DI0	7		27	DI6	Digital input
Digital input	DI1	8		28	DI7	Digital input
Digital input/output	DIQ2	9		29	DIQ8	Digital input/output
RS485/TTL input or output signal	+CH2	10		30	+CH6	RS485/TTL input or output signal
RS485 input or output signal ¹	-CH2	11		31	-CH6	RS485 input or output signal ¹
RS485/TTL input or output signal	+CH3	12		32	+CH7	RS485/TTL input or output signal
RS485 input or output signal ¹	-CH3	13		33	-CH7	RS485 input or output signal ¹
Fast digital output	DQ3	14		34	DQ9	Fast digital output
Fast digital output	DQ4	15		35	DQ10	Fast digital output
Digital input	DI3	16		36	DI9	Digital input
Digital input	DI4	17		37	DI10	Digital input
Digital input/output	DIQ5	18		38	DIQ11	Digital input/output
Ground ^{2,3}	M	19		39	M	Ground ³
		20		40		

¹ This terminal must **not** be used when using a TTL signal at the associated +CHm.

² If potential jumpers are inserted between terminals 19 and 39 or 20 and 40

³ Can be used for encoder supplies, digital inputs and digital outputs

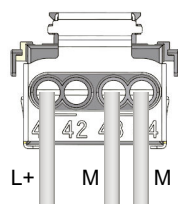
⁴ Bus terminating resistor available

NOTE

Potential jumpers may not be inserted in the front connector between terminals 9 and 29 as well as 10 and 30.

Pin assignment for the infeed element

The infeed element is inserted into the front connector and serves to supply power to the technology module. You must connect the supply voltage to terminal 41 (L+) and terminal 44 (M) for this.



L+ 24 V DC supply voltage
M Ground for supply voltage

Figure 4-1 Power supply element wiring

An internal protective circuit protects the technology module from polarity reversal of the supply voltage. The technology module monitors the connection of the supply voltage.

The PWR LED (Page 51) at terminal 19 indicates the presence of supply voltage.

Behavior of the digital outputs following a wire break at the ground connection of the outputs

Due to the characteristics of the output driver used in the module, a wire break causes approximately 10 mA supply current to drain from the digital outputs via a parasitic diode. This behavior may lead to a high signal state even at outputs that are not set. Depending on the nature of the load, 10 mA may be enough to activate a load with high signal state.

Duplicate wiring of ground

To prevent unintended switching of the outputs in the event of a ground connection wire break, follow these steps:

1. Route the first ground connection from terminal 44 to the ground connection of the central power supply of the system.
2. Route the second ground connection from terminal 43 to the ground connection of the central power supply of the system.

If one of the two ground connection cables is interrupted, the outputs are maintained at the required potential by the remaining ground connection.

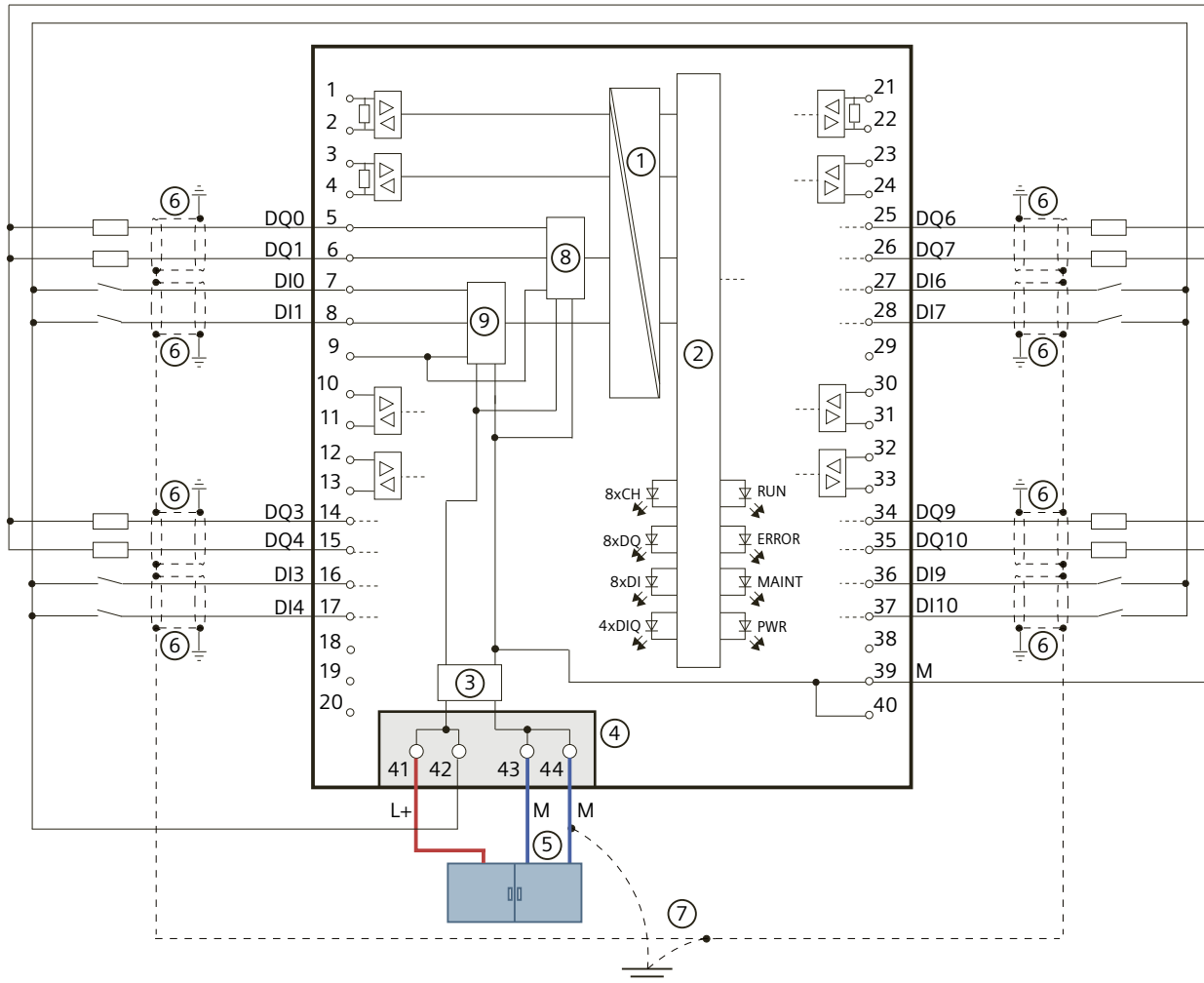
WARNING

Wire break at ground connection

Always connect *two* cables to the ground connection of the central power supply of the system.

Circuit diagram

The figure below shows the circuit diagram of the technology module as an example using digital inputs and outputs:



- ① Electrical isolation
- ② Technology and backplane bus interface
- ③ Input filter for supply voltage
- ④ Supply voltage via infeed element
- ⑤ Duplicate wiring to the ground connection of the central power supply of the system
- ⑥ Shield connection at the front connector
- ⑦ Equipotential bonding
- ⑧ Output circuit
- ⑨ Input circuit

Figure 4-2 Circuit diagram with use of digital inputs and outputs

The following table shows sections of the circuit diagram of the technology module depending on the use of the inputs and outputs:

Use of...	Section of the circuit diagram
RS485 or RS422 input signal ¹ on CHm ² (with twisted-pair cables)	
TTL input signal ¹ on CHm	
TTL output signal ¹ on CHm	
Input signal on DIQm	
Output signal on DIQm	

¹ You specify the signal to be used with the system logic parameter RS485_OR_TTL_DIRECTION.

² Whether the respective internal terminating resistance is used for CH0, CH1 and CH4, is specified by using the system logic parameter RS485_TERMINATION.

NOTE

External resistor required at TTL output

It is recommended to use an additional external 220 Ω resistor to the grounding when using a TTL output signal to improve the signal quality.

You can find more information about the system logic parameters in the Programming Manual Creating a TM FAST Application

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

You can find more wiring examples in the application examples

(<https://support.industry.siemens.com/cs/ww/en/ps/6ES7554-1AA00-0AB0/ae>) and the FAQs (<https://support.industry.siemens.com/cs/ww/en/ps/6ES7554-1AA00-0AB0/faq>) on SiePortal.

Digital inputs DIIm and DIQm

Up to 12 digital inputs are available. Four DIQm can be used either as digital input or digital output. Here, the digital input is permanently connected to the digital output of the DIQm. The digital inputs are not isolated from each other. The digital inputs are electrically isolated from the backplane bus.

RS485/TTL inputs and outputs

Eight RS485/TTL channels are available. These can be used as inputs or outputs. For each channel, set whether it should be used as RS485, RS422 or TTL interface (RS485_OR_TTL_DIRECTION system logic parameter).

The TTL interface is special in that two CHm form a TTL group:

- CH0 & CH1: TTL Group 0
- CH2 & CH3: TTL Group 1
- CH4 & CH5: TTL Group 2
- CH6 & CH7: TTL Group 3

If one channel is to be used as TTL interface, the second channel of the TTL group must also be set as TTL interface. The channels of a TTL group can have different directions.

A RS485 or RS422 signal each uses one pair of lines. A signal with TTL standard uses a single line connected to terminal +CHm (terminal -CHm must not be used). The RS485/TTL inputs/outputs are not isolated from each other. The RS485/TTL inputs/outputs are isolated from the backplane bus.

NOTICE
Considering the delay time after direction switching on an RS485 channel If you have set RS485_bidir for the RS485_OR_TTL_DIRECTION system logic parameter of an RS485 channel, you need to consider the following: When switching direction (between input and output) on an RS485 channel, you must maintain a time interval of at least 1.5 µs between the RS485_OE signal and reception or transmission.

NOTE**Behavior of the RS485/TTL channels (CHm)**

As long as no TM FAST application is loaded into the FPGA and activated, the RS485/TTL channels are switched as outputs and output a low level.

NOTE

In the description of the front connector and the logic, "channel" refers to an RS485/TTL channel. In the diagnostics, however, "channel 0" refers to the entire module.

You can find more information about the system logic parameters in the Programming Manual Creating a TM FAST Application

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

Input delay for digital inputs and RS485/TTL channels

To suppress interference, you can configure an input delay for the digital inputs and RS485/TTL inputs.

When selecting the option "Take over from TM FAST application" you specify for each digital input or RS485/TTL input a self-defined input delay by using the system logic parameters DI_FILTER_USER_VAL_MS and RS485_TTL_FILTER_USER_VAL_MS. You can find more information about the system logic parameters in the Programming Manual Creating a TM FAST Application (<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

NOTE

If you set an input delay < 0.1 ms, you must use shielded cables to connect the respective digital input or RS485/TTL input.

Digital outputs DQm and DIQm

Up to 12 digital outputs are available. Four DIQm can be used either as digital input or digital output.

The digital outputs are:

- Not electrically isolated from one other
- Electrically isolated from the backplane bus
- Protected from overload and short-circuit

Relays and contactors can be connected direct without external circuitry. You can find information on the maximum possible operating frequencies at the digital outputs in the section Technical specifications (Page 56).

Configuring/address space

5.1 Configuring

Introduction

The technology module functions can be controlled and monitored via the user program.

System environment

The technology module can be used in the following system environments:

Possible applications	Components required	Configuration software	In the user program
Central operation with an S7-1500 CPU	- S7-1500 automation system - TM FAST	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	Instructions of the instruction library LTMFAST (Page 39); Controlling the TM FAST application (Page 48) via the cyclic I/O data
Distributed operation with an S7-1500 CPU	- S7-1500 automation system - ET 200MP distributed I/O system - TM FAST	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	Instructions of the instruction library LTMFAST (Page 39); Controlling the TM FAST application (Page 48) via the cyclic I/O data
Distributed operation with an S7-1200 CPU	- S7-1200 automation system - ET 200MP distributed I/O system - TM FAST	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration	Instructions ¹ of the instruction library LTMFAST (Page 39); Controlling the TM FAST application (Page 48) via the cyclic I/O data
Distributed operation with an S7-300/400 CPU	- S7-300/400 automation system - ET 200MP distributed I/O system - TM FAST	STEP 7 (TIA Portal): Device configuration and parameter setting with hardware configuration STEP 7: Device configuration and parameter setting of the module with GSD file	Data records for managing the TM FAST application (Page 67) as well as writing (Page 71) and reading (Page 72) the user-defined acyclic data ¹ ; Controlling the TM FAST application (Page 48) via the cyclic I/O data
Distributed operation in a third-party system	- Third-party automation system - ET 200MP distributed I/O system - TM FAST	Third-party configuration software: Device configuration and parameter setting of the module with GSD file	Data records for managing the TM FAST application (Page 67) as well as writing (Page 71) and reading (Page 72) the user-defined acyclic data ¹ ; Controlling the TM FAST application (Page 48) via the cyclic I/O data

¹ The use of LTMFAST_AppDownload is not possible in this application scenario.

When creating the TM FAST application (Page 48), you should in any case use the external Intel Quartus Prime software to define the functionality of the I/O data and inputs/outputs in

the system and user logic, and to create the FPGA logic. With the MultiFieldbus Configuration Tool software (MFCT) as of V1.5, you then generate a upd or db file from a Intel Quartus Prime binary file.

Hardware Support Package (HSP)

Firmware version V2.0 of the module is integrated as of TIA Portal Version V21. Firmware version V3.0 of the module is integrated as of TIA Portal Version V21.1. Firmware version V3.0 can be configured as firmware version V2.0 without any functional limitations.

You need HSP0368 to use the module in TIA Portal V20. In TIA Portal versions < V20, you can configure firmware version V1.0 of the module and use it with the corresponding range of functions. The Hardware Support Packages (HSP) are available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/72341852>).

Alternatively, they can be accessed for downloading via the menu bar of STEP 7 (TIA Portal): "Options > Support packages > Download from the Internet".

GSD file

The GSD file for the ET 200MP distributed I/O system on PROFINET IO is available for download on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/68189683>).

5.2 Parameters of the configuration software

You can use various parameters to define the properties of the technology module. When parameters are assigned in the user program, the parameters are transferred to the module with the "WRREC" instruction and data record 128 (Page 62).

You set the parameters of the module as follows:

Parameter setting via ...	Basic procedure
Hardware configuration in STEP 7 (TIA Portal)	1. Insert the module from the hardware catalog under "Technology modules". 2. Set the device configuration and the parameters of the module in the hardware configuration. 3. Download the project to the CPU. 4. If required, use the functions of the commissioning editor.
Hardware configuration using GSD file for distributed operation on the PROFINET IO	1. Install the latest PROFINET GSD file. The module is subsequently available in the hardware catalog under "Other field devices > PROFINET IO > I/O". 2. Set the parameters in the hardware configuration. 3. Download the project to the CPU.

The parameters are listed in the following tables.

Parameters of the TM FAST

The following parameter settings are possible. The default settings of the parameters are shown in bold in the "Value range" column.

Table 5-1 Configurable parameters of the configuration software and their defaults

Parameter	Value range
Basic parameters: Diagnostics	
Enable diagnostic interrupt on wire break	• Disabled • Enabled
Error at digital outputs	• Disabled • Enabled
Missing supply voltage L+	• Disabled • Enabled
Basic parameters: TM FAST application	
Load TM FAST application during startup	• Disabled • Enabled
Always activate TM FAST application	• Disabled • Enabled
Reaction to CPU STOP	• Disable all outputs • Take over from TM FAST application
Inputs DI0 - DIQ11	
Input delay DIm	• 0.001 ms • 0.003 ms • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms • Take over from TM FAST application¹
Channels CH0 - CH7	
Input delay	• 0.1 µs • 0.2 µs • 0.5 µs • 1 µs • 2 µs • 5 µs • 10 µs • 20 µs • 50 µs • 100 µs • 200 µs • 500 µs • 1000 µs • Take over from TM FAST application²
Bus terminating resistor ³	• Disabled • Enabled
Isochronous mode	
Processing time input data in user logic ⁴	0... 10 ...4000 µs
Processing time output data in user logic ⁴	0... 10 ...4000 µs

¹ Value is defined in the system logic parameter DI_FILTER_USER_VAL_MS

² Value is defined in the system logic parameter RS485_TTL_FILTER_USER_VAL_MS

³ Takes effect depending on setting of RS485_TERMINATION and RS485_OR_TTL_DIRECTION system logic parameters

⁴ Can be used with firmware version $\geq$ V2.0 and system logic $\geq$ V2.0.0

Description of parameters

Parameter	Description
Basic parameters: Diagnostics	
Enable diagnostic interrupt on wire break	Activates the diagnostic interrupt if there is a wire break of the input signals CH0 to CH7.
Error at digital outputs	Activates the diagnostic interrupt "Error at digital outputs".
Missing supply voltage L+	Activates the diagnostic interrupt "Supply voltage missing".
Basic parameters: TM FAST application	
Load TM FAST application during startup	- Activated: A TM FAST application present in the flash memory is automatically loaded into the FPGA when the module starts up. - Not activated: You must download the TM FAST application into the FPGA by using the LTMFAST_ControlREC (Page 40) instruction (data record 100) or by using the Intel FPGA Download Cable (USB blaster).
Always activate TM FAST application	- Activated: The TM FAST application is activated automatically after it is loaded into the FPGA. - Not activated: You have to activate the TM FAST application by using the LTMFAST_ControlREC (Page 40) instruction (data record 100).
Reaction to CPU STOP	Selection of reaction to CPU STOP: - Disable all outputs: The module switches off all outputs up to the next STOP-RUN transition. After a STOP-RUN transition, the TM FAST application retakes control over the outputs. - Take over from TM FAST application: The module continues to operate. The outputs continue to switch according to the TM FAST application.
Inputs DI0 - DIQ11	
Input delay DIIm	Selects the input delay for the signal at the respective digital input for suppressing interferences. Changes to the signal are only detected if they remain stable for longer than the configured time.
Channels CH0 - CH7	
Input delay	Selects the input delay for the signal at the respective channel for suppressing interferences. Changes to the signal are only detected if they remain stable for longer than the configured time.
Bus terminating resistor	Activates the internal terminating resistor of the RS485 input channel. Only works under the following conditions: - The RS485_bidir or RS422_input is set for the RS485_OR_TTL_DIRECTION system logic parameter of the channel. - For the RS485_TERMINATION system logic parameter of the channel, parameterized is set. Bus termination resistors can be used only for CH0, CH1 and CH4 channels.

Parameter	Description
Isochronous mode	
Processing time input data in user logic	Input of the time span between T_i and $T_{i-latch}$ (Page 36). Specify the time that your TM FASTapplication requires after T_i to forward the data to the feedback interface (FB_IF) (e.g. filter times or SSI telegram time).
Processing time output data in user logic	Input of the time span between $T_{o-latch}$ and T_o (Page 36). Specify the time that your TM FASTapplication requires before T_o to prepare the data from the control interface (CTRL_IF) (e.g. signal propagation times).

You can find additional information about the system logic parameters in the programming manual *Creating a TM FAST Application*

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

5.3 Operation of the commissioning editor

The commissioning editor helps you to conveniently commission the technology module. You control the TM FAST application and read its status information via the commissioning editor.

Explanation of the functions

Parameter	Description
TM FAST module status	
FPGA status	Indicates the current state of the FPGA: - TM FAST application is loaded and active: The TM FAST application was successfully loaded from the flash memory into FPGA and has been activated. - TM FAST application is loaded but not active: The TM FAST application was successfully loaded from the flash memory into FPGA, has not yet been activated though. - No TM FAST application available: There is no TM FAST application in the FPGA, for example in these cases: - Before loading an TM FAST application for the first time. - After the command "Remove TM FAST application from FPGA"
Last error code	Displays the error code (Page 67) of the last error that occurred (in conjunction with the FPGA).
Debug interface status	Display the current state of the debug interface: - Debug interface enabled: The access to the FPGA via TM FAST Debug Connector has been enabled. - Debug interface disabled: The access to the FPGA via TM FAST Debug Connector has been blocked.
Internal temperature	Displays the internal temperature of the module. This value provides the option to check whether the application, in conjunction with the ambient temperature, will overload the module in the long term. A critical temperature range starts from 90 °C.
Command status	Indicates whether the current command is still being processed. If the command is still being processed, click "Read status" again after a few seconds. Only after the current command has been processed is it possible to send a new command.

Parameter	Description
LTMFAST_ControlREC command	
Command	Selects the command for LTMFAST_ControlREC for controlling the TM FAST application: - Load TM FAST application from flash memory to FPGA: An application in the FPGA is removed. Then an application in the non-volatile flash memory is loaded into the FPGA. - Activate TM FAST application in FPGA: The application previously loaded into the FPGA is activated. - Remove TM FAST application from FPGA: An application in the FPGA is removed. - Delete TM FAST application from flash memory: An application existing in the non-volatile flash memory is deleted. - Enable debug interface: Access to the FPGA via TM FAST Debug Connector is enabled (activated). Note: The debug interface is only intended for development and commissioning purposes. - Disable debug interface: Access to the FPGA via TM FAST Debug Connector is blocked.
Currently loaded TM FAST application	
Application ID	Displays the ID of the TM FAST application loaded into the FPGA.
User logic version	Displays the user logic version of the TM FAST application loaded into the FPGA.
LTMFAST_UserWriteREC length	Displays the length of data record 101 in bytes
LTMFAST_UserReadREC length	Displays the length of data record 102 in bytes
Status of the logic in the flash memory	
Application ID	Displays the ID of the TM FAST application present in the flash memory.
User logic version	Displays the user logic version of the TM FAST application present in the flash memory.
Time stamp	Displays the date and time of creation of the upd file or the data block of the TM FAST application that is located in the flash memory.
LTMFAST_UserReadREC	
DWord m	Displays the value in DWord m of data record 102 (Page 72).
Last error code	Displays the error code (Page 72) of the last error that occurred (in conjunction with data record 102).
LTMFAST_UserWriteREC	
DWord m	Inputs the value for DWord m of data record 101 (Page 71).
Last error code	Displays the error code (Page 71) of the last error that occurred (in conjunction with data record 101).

5.4 Address space

Address space of the technology module

Table 5-2 Range of the input addresses and output addresses of the TM FAST

	Inputs	Outputs
Range	32 bytes	32 bytes

You define the contents of the address space in the TM FAST application (Page 48).

5.5 Reaction to CPU STOP

You set the response of the technology module to CPU STOP in the device configuration with the basic parameters (Page 31).

Table 5-3 Reaction of technology module to CPU STOP

	Reaction of technology module
Disable all outputs	The technology module switches off all outputs up to the next STOP-RUN transition. After a STOP-RUN transition, the TM FAST application retakes control over the outputs.
Take over from TM FAST application	The technology module continues to operate. The outputs continue to switch according to the TM FAST application.

In addition, the signal CPU_STOP is available to the TM FAST application so that a STOP of the CPU is detected and a suitable response of the TM FAST application can be programmed in the logic. You can find additional information about the signals in the system logic in the programming manual *Creating a TM FAST Application* (<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

5.6 Isochronous mode

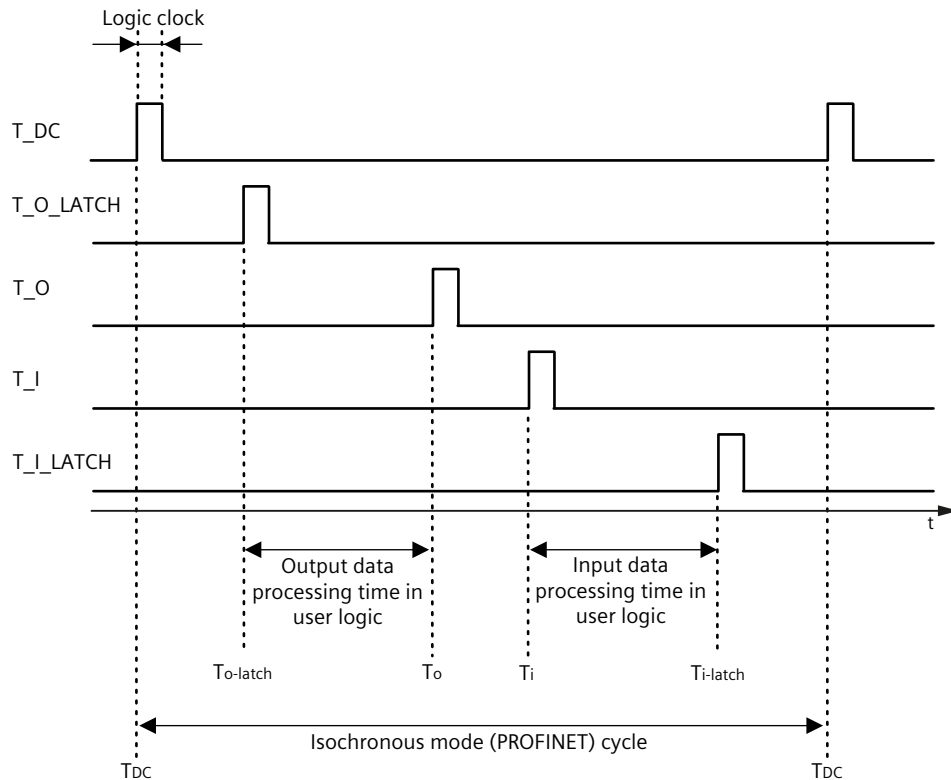
The technology module supports the "Isochronous mode" system function. In isochronous mode, the cycle of the user program, the transmission of the input and output data and the processing in the technology module are synchronized with each other.

Data processing

At time $T_{o-latch}$, the output data of the CPU is available to the user logic (Page 48) in the control interface (CTRL_IF). The TM FAST application needs to prepare the data by the time T_o so it can take effect by the time T_o . The outputs of the module are updated at time T_o .

The TM FAST application reads in the input data at time T_i and must forward it by time $T_{i-latch}$ to the feedback interface of the user logic (Page 48) (FB_IF). At the time $T_{i-latch}$, the input data is fetched from the user logic feedback interface (FB_IF).

The interfaces T_DC , T_I , $T_I_LATCH^1$, T_O and $T_O_LATCH^1$ are available to the TM FAST application. The following figure shows the basic time sequence in an isochronous cycle:



You can set the following parameters in the configuration software:

Processing time input data in user logic ^{1,2} ($T_{i-latch}^1 - T_i$)	Can be adjusted in the device configuration (Page 31). Application example: The time to read an SSI telegram
Processing time output data in user logic ^{1,2} ($T_o - T_{o-latch}^1$)	Can be adjusted in the device configuration (Page 31). Application example: The time it takes to convert a value in ms to a number of logic clocks in order to output a pulse with a given duration.
T_i	Can be adjusted in the project settings for isochronous mode.
T_o	

¹ Can be used with firmware version $\geq V2.0$ and system logic $\geq V2.0.0$

² In isochronous mode, the parameter can affect the isochronous parameters of the sync domain. Because the isochronous mode parameters are not checked in RUN mode, synchronicity violations can occur if you change the parameter in RUN mode. To prevent synchronicity violations, select the option with the most time required in the offline parameter settings.

More information

You can find a detailed description of isochronous mode in the following:

- In the STEP 7 (TIA Portal) information system
- In the PROFINET with STEP 7 Function Manual as a download from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/49948856>).

You can find information about the interfaces in the user logic in the Programming Manual Creating a TM FAST Application

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

Programming

6.1 Programming with STEP 7 (TIA Portal)

6.1.1 Overview of instructions

Introduction

The TM FAST technology module is used with the instructions of the LTMFAST instruction library.

NOTE

Call the LTMFAST_ControlREC instruction cyclically together with the other LTMFAST instructions you use in the same OB, e.g. in OB1.

LTMFAST_ControlREC connects to the module and displays the status of the module. The other LTMFAST instructions are called only as needed. The respective TM FAST is identified by the link to LTMFAST_ControlREC.

NOTE

Whether you need LTMFAST instructions depends on your use case. You do *not* need instructions with the following procedure:

1. Load on a one-time basis, for example, with the firmware update function of the configuration software or with MFCT (<https://support.industry.siemens.com/cs/ww/en/view/109773881>), the desired TM FAST application into the flash memory of the module.
 2. In the hardware configuration of the module, activate the parameters "Load TM FAST application during startup" and "Always activate TM FAST application".
-

LTMFAST Instruction library

Instruction	Short description
LTMFAST_ControlREC (Page 40)	Controls the TM FAST application and provides status information.
LTMFAST_UserReadREC (Page 43)	Reads the user-defined acyclic data of the TM FAST application.
LTMFAST_UserWriteREC (Page 44)	Outputs user-defined acyclic data to the TM FAST application.
LTMFAST_AppDownload (Page 46)	Load the TM FAST application from the CPU into the flash memory of TM FAST.

Download

The LTMFAST instruction library is available for download from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109817062>).

6.1.2 LTMFAST_ControlREC: Update TM FAST application

Description

With the LTMFAST_ControlREC instruction, you manage the TM FAST application in the FPGA and receive its status information.

NOTE

Call the LTMFAST_ControlREC instruction cyclically in OB1 together with the other instructions you use. The input parameter HWID establishes the connection to the TM FAST. A separate instance data block of the instruction is required for each TM FAST.

Startup characteristics

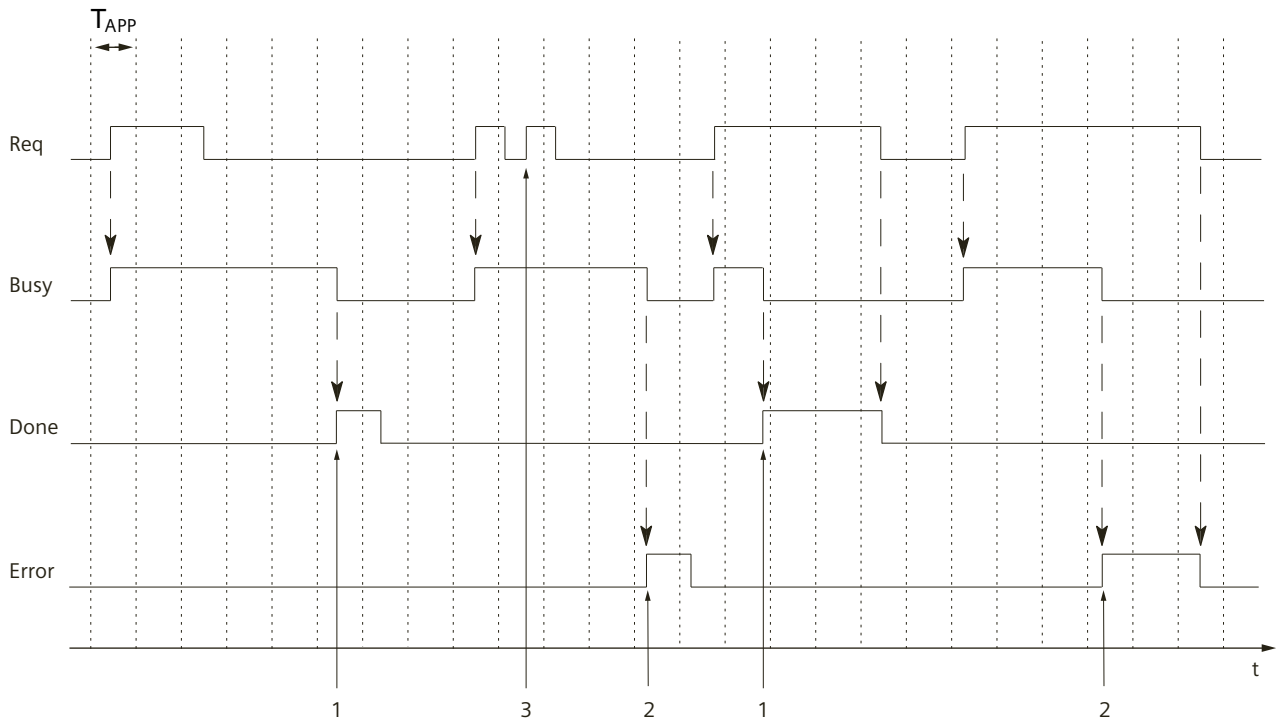
At the first call, the instruction adopts and checks the HWID input parameter.

If startup takes place without errors, the instruction changes to normal operation. In the event of an error, the instruction does not change to normal operation and generates an error message.

Operating principle

Data record 100 (Page 67) is either read only or written and then read with a rising edge at the Req input, depending on the instruction at the Command input. You can only perform a new job when there is no error pending and no job is active.

The figure below shows an example for the reaction of the bits Busy, Done and Error:



- T_{APP} Application cycle
- 1 Job successfully executed
- 2 Error scenario: Job not executed
- 3 New job is ignored, because previous job is not yet completed.

Reaction to error

The Error output indicates whether an error has occurred in the running cycle. In the event of an error, the error code is displayed at the Status output.

Parameter

The following table shows the parameters of the instruction.

Parameter	Declaration	Data type	Default	Description
Req	Input	Bool	False	Starts the job at a positive edge.
HWID ¹	Input	HW_IO	0	Hardware identifier for module from hardware configuration
Command	Input	UInt	0	Command: 0: Read module status

¹ Checked at the first call of the instruction and adopted if needed

6.1 Programming with STEP 7 (TIA Portal)

Parameter	Declaration	Data type	Default	Description
				1: Load TM FAST application from flash memory to FPGA 2: Activate TM FAST application in FPGA 3: Remove TM FAST application from FPGA 4: Delete TM FAST application from flash memory 5: Enable debug interface 6: Disable debug interface 7 to 255: Reserved
FPGAState	Output	Byte	0	FPGA status: 0: No TM FAST application available 1: TM FAST application is loaded but not active 2: TM FAST application is loaded and active 3 to 255: Reserved
ApplicationID	Output	Char array [1...8]		Application ID of the TM FAST application in the FPGA
UserLogic Version	Output	LTMFAST_typeLogic Version		User logic version in the FPGA, e.g. R01.02.03
Debug Interface State	Output	Bool	False	Debug interface status: 0: Debug interface disabled 1: Debug interface enabled
Done	Output	Bool	False	Done = True is displayed for one cycle or until Req is reset: The job was completed without errors.
Busy	Output	Bool	False	Busy = True: The job has not yet been completed.
Status	Output	Word	16#0	Status of the instruction, displayed for one cycle or until Req is reset: see "Status parameter" description
Error	Output	Bool	False	Error = True is displayed for one cycle or until Req is reset: An error has occurred. In this case, Busy and Done are set to False. For detailed information, see Status parameter.

¹ Checked at the first call of the instruction and adopted if needed

Status parameter

Error codes or status information are output as word at the Status output.

Code (W#16#...)	Meaning	Remedy
0000	No error.	—
7000	No job in progress.	—
7001	Writing of data record 100 is not yet completed.	—
7002	Reading of data record 100 is not yet completed.	—
8001	The module specified at the HWID input parameter is not a TM FAST.	Ensure that the hardware identifier of the TM FAST is specified at the HWID input parameter.
8002		
8003	An error has occurred using a system function.	Make sure that the CPU can access the TM FAST.
8004		
8005		

6.1.3 LTMFAST_UserReadREC: Reading acyclic data of the TM FAST application

Description

Use the LTMFAST_UserReadREC instruction to read the user-defined acyclic data from the TM FAST application in the module.

Operating principle

With a rising edge at the Req input, the instruction reads the contents of data record 102 (Page 72) and writes it to UserDataContent parameter. You can only perform a new job when there is no error pending and no job is active.

You can find an example for the reaction of the Busy, Done and Error bits in the section LTMFAST_ControlREC: Update TM FAST application (Page 40),

Reaction to error

The Error output indicates whether an error has occurred in the running cycle. In the event of an error, the error code is displayed at the Status output.

Parameter

The following table shows the parameters of the instruction.

Parameter	Declaration	Data type	Default	Description
Req	Input	Bool	False	Starts the job at a positive edge.
Len	Output	UInt	0	Length of TMFASTUserReadREC (in bytes)
Busy	Output	Bool	False	Busy = True: The job has not yet been completed.
Done	Output	Bool	False	Done = True is displayed for one cycle or until Req is reset: The job was completed without errors.
Error	Output	Bool	False	Error = True is displayed for one cycle or until Req is reset: An error has occurred. In this case, Busy and Done are set to False. For detailed information, see Status parameter.
Status	Output	Word	16#0	Status of the instruction, displayed for one cycle or until Req is reset: see "Status parameter" description
UserDataContent	InOut	DWord array [0...m]	16#0	Content of data record 102
TMFASTControlREC	InOut	LTMFAST_ControlREC		Assignment of the instance data block of the LTMFAST_ControlREC instruction that contains the hardware identifier of the TM FAST used.

Status parameter

Error codes or status information are output as word at the Status output.

Code (W#16#...)	Meaning	Remedy
0000	No error.	—
7000	No job in progress.	—
7001	Initialization in progress.	If the initialization takes unexpectedly long time, check if the Error output of LTMFAST_ControlREC (Page 40) shows an error.
7002	Reading data record 102.	—
8002	An error has occurred when reading data record 102.	Read the description of the WRREC/RDREC in the information system of STEP 7 (TIA Portal). Examples for error codes in the static tag AdditionalErrorID and there remedies: 16#DE80E1A0: Activate the TM FAST application. 16#C080B200: Make sure that the CPU can access the TM FAST.

6.1.4 LTMFAST_UserWriteREC: Output acyclic data to the TM FAST application**Description**

Use the LTMFAST_UserWriteREC instruction to write or read back the user-defined acyclic data to the TM FAST application in the module.

Operating principle

With a rising edge at the Req input, the instruction writes or reads data record 101 (Page 71). You can only perform a new job when there is no error pending and no job is active. You can find an example for the reaction of the Busy, Done and Error bits in the section LTMFAST_ControlREC: Update TM FAST application (Page 40),

Reaction to error

The Error output indicates whether an error has occurred in the running cycle. In the event of an error, the error code is displayed at the Status output.

Parameter

The following table shows the parameters of the instruction.

Parameter	Declaration	Data type	Default	Description
Req	Input	Bool	False	Starts the job at a positive edge.
ActiveRead	Input	Bool	False	Writing or reading data record 101: 0: The content of UserDataContent is written to data record 101 1: Data record 101 is read from TM FAST and written to UserDataContent
Busy	Output	Bool	False	Busy = True: The job has not yet been completed.
Done	Output	Bool	False	Done = True is displayed for one cycle or until Req is reset: The job was completed without errors.
Error	Output	Bool	False	Error = True is displayed for one cycle or until Req is reset: An error has occurred. In this case, Busy and Done are set to False. For detailed information, see Status parameter.
Status	Output	Word	16#0	Status of the instruction, displayed for one cycle or until Req is reset: see "Status parameter" description
UserDataContent	InOut	DWord array [0...m]	16#0	Content of data record 101
TMFASTControlREC	InOut	LTMFASTControlREC		Assignment of the instance data block of the LTMFAST_ControlREC instruction that contains the hardware identifier of the TM FAST used.

Status parameter

Error codes or status information are output as word at the Status output.

Code (W#16#...)	Meaning	Remedy
0000	No error.	—
7000	No job in progress.	—
7001	Initialization in progress.	If the initialization takes unexpectedly long time, check if the Error output of LTMFAST_ControlREC (Page 40) shows an error.
7002	Reading data record 101.	—
7003	Writing data record 101.	—
8002	An error has occurred when reading data record 101.	Read the description of the WRREC/RDREC in the information system of STEP 7 (TIA Portal). Examples for error codes in the static tag AdditionalErrorID and there remedies: 16#DE80E1A0: Activate the TM FAST application. 16#C080B200: Make sure that the CPU can access the TM FAST.
8003	An error has occurred when writing data record 101.	

6.1.5 LTMFAST_AppDownload: Load TM FAST application into the flash memory

Description

The LTMFAST_AppDownload instruction enables you to load the TM FAST application into the flash memory of the TM FAST via your user program of the CPU S7-1500. There are two alternatives available:

- Loading the TM FAST application from an upd file in the "UserFiles" directory on the SIMATIC Memory Card
or
- Load the TM FAST application from a data block

LTMFAST_AppDownload transfers the TM FAST application into the non-volatile flash memory of the addressed TM FAST. You must then load the TM FAST application from flash memory into the FPGA and activate it. Use the LTMFAST_ControlREC (Page 40) instruction for this.

During a module exchange you may ensure that a newly installed TM FAST is loaded with the correct TM FAST application: During the startup of the CPU, you can check with the LTMFAST_ControlREC (Page 40) instruction whether the TM FAST application with the correct application ID is in the module. If there is no TM FAST application or one with an incorrect application ID in the flash memory, it is loaded and activated in the FPGA with LTMFAST_AppDownload into the flash memory and with LTMFAST_ControlREC (Page 40). This enables you to exchange a module without a PG/PC.

You can generate the upd file and the data block with the software MFCT V1.5 or higher (<https://support.industry.siemens.com/cs/ww/en/view/109773881>).

NOTE

Loading the TM FAST application into the flash memory with LTMFAST_AppDownload may take several minutes. The TM FAST application can be loaded much faster via the commissioning editor or via MFCT.

Operating principle

The input parameters UserlogicDB and FilenameSMC are adopted with a rising edge at the Req input. If you load the TM FAST application from an upd file, FilenameSMC must contain the name of the upd file and UserlogicDB = 0. If you load the TM FAST application from a data block, UserlogicDB must refer to the corresponding data block.

You can only perform a new job when there is no error pending and no job is active.

You can find an example for the reaction of the Busy, Done and Error bits in the section LTMFAST_ControlREC: Update TM FAST application (Page 40),

Reaction to error

The Error output indicates whether an error has occurred in the running cycle. In the event of an error, the error code is displayed at the Status output.

Parameter

The following table shows the parameters of the instruction.

Parameter	Declaration	Data type	Default	Description
Req	Input	Bool	False	Starts the job at a positive edge.
HWID ¹	Input	HW_IO	0	Hardware identifier for module from hardware configuration
FilenameSMC	Input	Char		Name of the upd file that is to be loaded from the "UserFiles" subfolder of the SIMATIC Memory Card. The name must not contain any special characters or spaces.
UserlogicDB	Input	DB_ANY	0	Symbolic name of the data block. If you load an upd file from the SIMATIC Memory Card, UserlogicDB = 0 is required.
Done	Output	Bool	False	Done = True is displayed for one cycle or until Req is reset: The job was completed without errors.
Busy	Output	Bool	False	Busy = True: The job has not yet been completed.
Error	Output	Bool	False	Error = True is displayed for one cycle or until Req is reset: An error has occurred. In this case, Busy and Done are set to False. For detailed information, see Status parameter.
Status	Output	Word	16#0	Status of the instruction, displayed for one cycle or until Req is reset: see "Status parameter" description

¹ Checked at the first call of the instruction and adopted if needed

Status parameter

Error codes or status information are output as word at the Status output.

Code (W#16#...)	Meaning	Remedy
0000	No error.	—
7000	No job in progress.	—
7001	Initialization in progress.	—
7002	The data is being read.	—
8001	An error has occurred in the WRREC or RDREC instruction.	Read the description of the WRREC/RDREC in the information system of STEP 7 (TIA Portal) (error code in static tag AdditionalErrorID).
8002	An error has occurred when reading the data block.	- Check the UserlogicDB input parameter. - Check the db file.
8003	An error has occurred when reading the upd file from the SIMATIC Memory Card.	- Check the FilenameSMC input parameter. - Check the upd file. - Ensure that the upd file name does not contain a special character or a space.
8004	An error has occurred when using the read-out data.	Check the upd or db file.
8005	The user logic in the TM FAST application is defective.	Check the upd or db file.
8006	An invalid state has occurred.	If the error permanently occurs, contact support.

6.2 Handling the TM FAST application

6.2.1 Introduction

You can define the hardware functionality of the module by programming a TM FAST application for the FPGA of the module. The TM FAST application consists of system logic and user logic.

NOTE**Delivery state**

In the delivery state the technology module does not include a TM FAST application.

System logic

The system logic is an Intel Quartus project provided by Siemens for download as a framework for developing your own logic (user logic).

The system logic:

- Contains the interface to the SIMATIC S7 system
- Provides the interface for the user logic
- Can be adjusted via various parameters

The USER_LOGIC_VERSION and APPLICATION_ID system logic parameters are used to identify the loaded TM FAST application. The FUNCTION_ID system logic parameter is reserved and must be set to 0. You can read the three system logic parameters using the LTMFAST_ControlREC (Page 40) instruction. You can find more information about the system logic parameters in the Programming Manual Creating a TM FAST Application (<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

More information on the supplementary software components is provided in SiePortal (<https://support.industry.siemens.com/cs/ww/en/view/109817062>).

User logic

The user logic is created with Intel Quartus Prime external software (FPGA development environment): The free Intel Quartus Prime Lite Edition version is sufficient in most cases. The specific steps for creating the TM FAST application are described in the Programming Manual Creating a TM FAST Application

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

More information on the supplementary software components is provided in SiePortal (<https://support.industry.siemens.com/cs/ww/en/view/109817062>).

You have different options for loading a TM FAST application into the module (Page 49).

6.2.2 Update TM FAST application

Depending on the intended use, in principle you have the following options for loading a TM FAST application into the technology module:

During the development of the TM FAST application.

For development and commissioning purposes, you can use the hardware components Intel FPGA Download Cable (USB blaster) and TM FAST Debug Connector (Page 49) as an interface between PC and module. The TM FAST Debug Connector is inserted into the module enclosure from above. You can use the external Intel Quartus Prime software to load the TM FAST application directly into the FPGA via the two hardware components.

Standard usage

You do *not* need LTMFAST instructions with the following procedure:

1. Load on a one-time basis, for example, with the firmware update function of the configuration software or with MFCT (<https://support.industry.siemens.com/cs/ww/en/view/109773881>), the desired TM FAST application into the flash memory of the module.
2. In the hardware configuration of the module, activate the parameters "Load TM FAST application during startup" and "Always activate TM FAST application".

In this case, it is recommended to keep at least one module in stock as a spare part, where the required TM FAST application has already been loaded. The module can then be replaced without PC/PG. Otherwise, if it becomes necessary to exchange the module, you must load the required TM FAST application into the flash memory of the new module using a PC/PG.

Applications with automated loading of the TM FAST application

You can see from the application when the system starts up whether the module contains the required TM FAST application. If needed, you can update the TM FAST application in the RUN state of the CPU. You can find additional information in section LTMFAST_AppDownload: Load TM FAST application into the flash memory (Page 46).

If you store the TM FAST application in an upd file on the SIMATIC Memory Card, it can easily be replaced by an updated version. If you store the TM FAST application in a data block, this makes it easier to back up the project, because no special handling is necessary for the backup of the TM FAST application as part of the project. Only load memory is used in both cases. The data memory of the CPU is not affected by this.

6.2.3 TM FAST Debug Connector

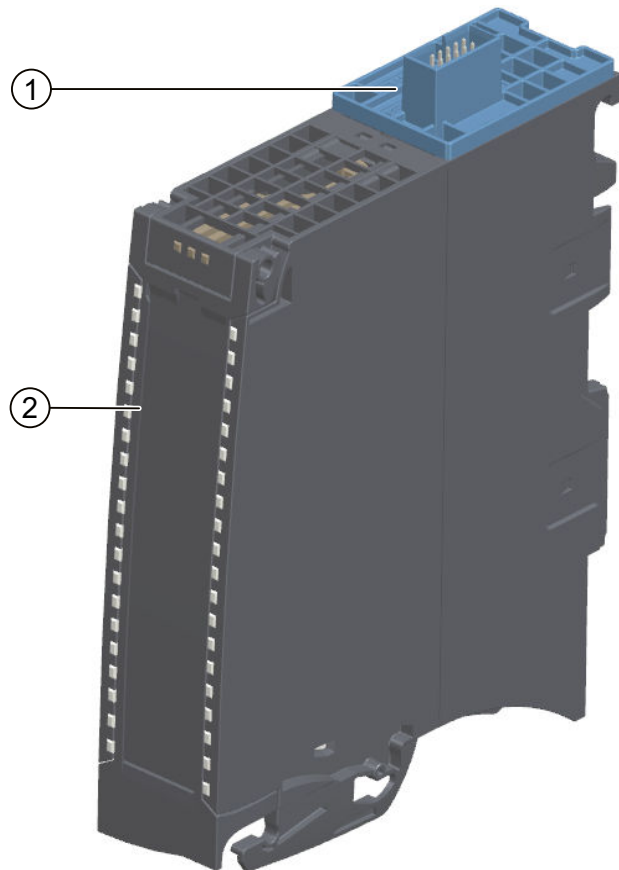
For application development and commissioning, you can load the hardware components (Page 19) Intel FPGA Download Cable (USB blaster) and TM FAST Debug Connector the TM FAST application directly in the FPGA of the module and debug them. For this, insert the TM FAST Debug Connector into the module enclosure from above and activate the FPGA debug interface with the corresponding command in the commissioning editor (Page 34). The MAINT LED display lights up yellow until you disable the FPGA debug interface with the corresponding command in the commissioning editor or by performing a cold restart of the system.

The TM FAST Debug Connector is inserted into the module enclosure from above here.

NOTICE

Remove TM FAST Debug Connector after commissioning

When commissioning is completed, you must disable the FPGA debug interface and remove the TM FAST Debug Connector.



- ① TM FAST Debug Connector
- ② TM FAST

Figure 6-1 View of the module with plugged TM FAST Debug Connector (only for application development and commissioning)

Interrupts/diagnostic alarms

7.1 Status and error displays

LEDs

The figure below shows the LEDs (status and error displays) of the TM FAST.

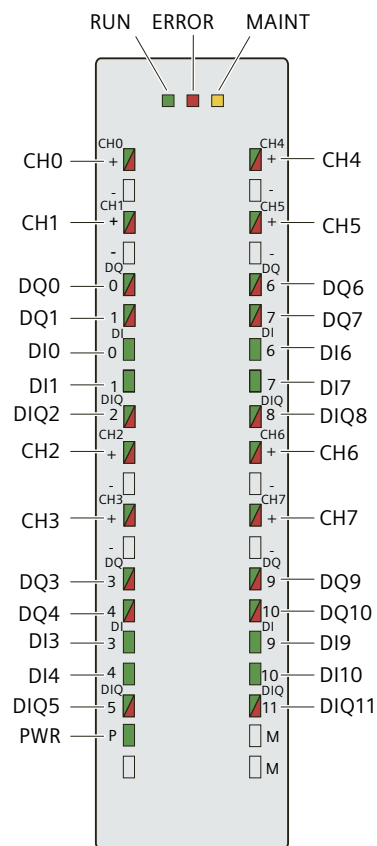


Figure 7-1 LED displays of the TM FAST

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Remedial measures for diagnostic alarms can be found in the section Diagnostic alarms (Page 53).

Table 7-1 Status and error displays RUN/ERROR/MAINT

LEDs			Meaning	Remedy
RUN	ERROR	MAINT		
 Off	 Off	 Off	No voltage or too low voltage on back-plane bus	- Switch on the CPU and/or the system power supply modules. - Check whether the voltage connectors are inserted. - Check whether too many modules are inserted.
 Flashes	 Off	 Off	Technology module not configured	—
 On	 Off	 Off	Technology module configured but no module diagnostics	
 On	 Flashes	 Off	Technology module configured and module diagnostics (at least one error present)	Evaluate the diagnostic alarms and eliminate the error.
 Flashes	 Flashes	 Flashes	Hardware or firmware defective	Replace the technology module.
 On	 Off	 On	FPGA debug interface enabled	Disable the FPGA debug interface (e.g. via the commissioning editor) and remove the TM FAST Debug Connector as soon as the commissioning of the module is completed.

Table 7-2 PWR/ERROR status displays

LEDs		Meaning	Remedy
PWR	ERROR		
 Off	 Off	Supply voltage too low or missing and "Missing supply voltage L+" not activated	- Check the supply voltage. - Make sure that the front connector is correctly inserted. - Activate "Missing supply voltage L+" in the device configuration.
 Off	 Flashes	Supply voltage too low or missing	- Check the supply voltage. - Make sure that the front connector is correctly inserted.
 On	 Off	Supply voltage is present and OK	—
 On	 Flashes	Module diagnostics (at least one error is present)	Evaluate the diagnostic alarms and eliminate the error.

Channel LEDs

The CHm, DIIm LEDs and the LEDs of the DIQm used as digital inputs indicate the current level of the associated signals. The LEDs of digital outputs DQm and of DIQm used as digital outputs indicate the desired state.

The flashing frequency of the channel LEDs is limited to approximately 24 Hz. If higher frequencies are present, the channel LEDs do not indicate the current status but instead flash at 24 Hz.

Table 7-3 CHm/DIm/DQm/DIQm status displays

CHm/DIm/ DQm/DIQm LEDs	Meaning	Remedy
Off	Channel/digital input/digital output at 0 level	—
On	Channel/digital input/digital output at 1 level	—
On (CHm/DQm/DIQm)	Diagnostic alarm: e.g. Error at digital outputs	- Evaluate the diagnostic alarm. - Check the wiring or the connected load.

7.2 Diagnostic alarms

Enabling the diagnostic interrupts

You enable the diagnostic interrupts at the basic parameters.

The technology module can trigger the following diagnostic interrupts:

Table 7-4 Possible diagnostic interrupts

Diagnostic interrupt	Monitoring
- Parameter assignment error - Internal error - Watchdog tripped. Module is defective. - Debug interface activated - Customer application not executable	Monitoring is always active. A diagnostic interrupt is triggered each time an error is detected.
RS422/TTL error	A detected error only triggers a diagnostic interrupt if "Enable diagnostic interrupt on wire break" has been enabled for the device configuration. The diagnostic interrupts are not enabled in the default setting.
Error at digital outputs	A detected error only triggers a diagnostic interrupt if "Error at digital outputs" was enabled during the device configuration. The diagnostic interrupts are not enabled in the default setting.
Supply voltage missing	An error detected only triggers a diagnostics interrupt if "Missing supply voltage L+" has been enabled for the device configuration. The diagnostic interrupts are not enabled in the default setting.

Reactions to a diagnostic interrupt

The following happens when an event occurs that triggers a diagnostic interrupt:

- The ERROR LED flashes red.
Once you have remedied all errors, the ERROR LED goes out.
- The S7-1500 CPU interrupts processing of the user program. The diagnostic interrupt OB (e.g. OB 82) is called. The event that triggered the interrupt is entered in the start information of the diagnostic interrupt OB.
- The S7-1500 CPU remains in RUN even if no diagnostic interrupt OB is present in the CPU. The technology module continues working unchanged if this is possible despite the error.

You can obtain detailed information on the error event in the error organization block with instruction "RALRM" (Read additional alarm information), in the information system of STEP 7 and in function manual Diagnostics

(<https://support.industry.siemens.com/cs/ww/en/view/59192926>), section "System diagnostics in user program".

Diagnostic alarms

The diagnostics are displayed as plain text in STEP 7 (TIA Portal) in the online and diagnostics view. You can evaluate the error codes with the user program. System-wise, the module is modeled with only *one* channel containing all terminals. Therefore, "Channel 0" is always indicated in the diagnostic message independent of the terminal from which the respective diagnostic starts.

NOTE

"Channel 0" means the entire module in the diagnostics. In the description of the front connector and the logic, however, "Channel" refers to an RS485/TTL channel.

The following diagnostics can be signaled:

Table 7-5 Diagnostic alarms, their meaning and remedies

Diagnostic alarm	Error code	Meaning	Remedy
Parameter assignment error	10 _H	Received parameter data record invalid	Check parameter data record
Supply voltage missing	11 _H	Undervoltage	Check supply voltage L+
		Wiring of supply voltage L+ faulty	Check wiring of supply voltage L+
		Supply voltage L+ of the technology module missing	Feed supply voltage L+ to the technology module via terminal 41
		Front connector not inserted correctly	Insert front connector correctly
Internal error	100 _H	Technology module defective	Replace technology module
Watchdog tripped. Module is defective.	103 _H	Firmware error	Run firmware update
		Technology module defective	Replace technology module
Error at digital outputs ¹	10F _H	- Error at digital outputs (LED DQm display lights up red) - Possible causes: - Short-circuit - Overload	- Correct wiring at the digital outputs - Check consumers connected to the digital outputs

¹ The module detects short-circuit and overload only at 24 V outputs and only up to an output frequency of approx. 100 kHz. No diagnostics are output for higher frequencies. However, the module is protected against destruction by short-circuits at the outputs in any case.

² An enabled debug interface is also disabled by a cold restart of the system.

Diagnostic alarm	Error code	Meaning	Remedy
RS422/TTL error	502 _H	- Error at the connection of an RS485/TTL channel - Possible causes: - Wire break - No encoder connected - Cable too long - Short-circuit - Overload - External voltage - Overtemperature - Parameter assignment error	- Check process wiring - Check encoder/sensor - Check parameter assignment
Debug interface activated	10B8 _H	Debug interface only planned for commissioning and service purposes (LED display MAINT lights up yellow)	- Disable the debug interface by using the corresponding TMFASTControlREC command (as soon as no longer required)² - Remove TM FAST Debug Connector as soon as debug interface is disabled
Customer application not executable	10B9 _H	- Communication error with FPGA - TM FAST Application removed from the FPGA	- Check TM FAST application - TM FAST application re-loaded into the FPGA

¹ The module detects short-circuit and overload only at 24 V outputs and only up to an output frequency of approx. 100 kHz. No diagnostics are output for higher frequencies. However, the module is protected against destruction by short-circuits at the outputs in any case.

² An enabled debug interface is also disabled by a cold restart of the system.

NOTE

Common diagnostics of the digital outputs

The digital outputs DQ0, DQ1, DQ3 and DQ4 as well as DQ6, DQ7, DQ9 and DQ10 each have a common diagnostics. If an error occurs at a digital output, its signal starts to pulse.

The status of the digital outputs is made available to the TM FAST application. You can define the behavior of the digital outputs in case of an error in the TM FAST application. You can find additional information about the signals in the system logic in the programming manual Creating a TM FAST Application

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

Technical specifications

The following table shows the technical specifications as of the edition date. You can find a data sheet with up-to-date technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/pv/6ES7554-1AA00-0AB0/td?dl=en>).

Article number	6ES7554-1AA00-0AB0
	SIMATIC S7-1500, TM FAST Field Adaptable High-Speed Technology, programmable with Intel(R) Quartus(R) Prime software, 8xDI, 8xDQ, 4xDIQ 24 V, 8xRS485 DIQ, for extremely short response time of less than 1 µs
General information	
Product type designation	TM FAST
HW functional status	04
Firmware version	V3.0.0
• FW update possible	Yes
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V21.1; configurable with TIA Portal V17 as previous version
• PROFINET from GSD version/GSD revision	GSDML V2.35
Installation type/mounting	
Rail mounting	Yes; S7-1500 mounting rail
Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	19.2 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes
Input current	
Current consumption, max.	100 mA; without load
Power	
Power consumption from the backplane bus	1.3 W
Power loss	
Power loss, typ.	4 W
Address area	
Address space per module	
• Inputs	32 byte
• Outputs	32 byte
Digital inputs	
Number of digital inputs	12; including 4 DIQs
Digital inputs, parameterizable	Yes

Article number	6ES7554-1AA00-0AB0
	SIMATIC S7-1500, TM FAST Field Adaptable High-Speed Technology, programmable with Intel(R) Quartus(R) Prime software, 8xDI, 8xDQ, 4xDIQ 24 V, 8xRS485 DIQ, for extremely short response time of less than 1 µs
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Input voltage - Type of input voltage - Rated value (DC) - for signal "0" - for signal "1" - permissible voltage at input, min. - permissible voltage at input, max.	DC 24 V -5 ... +5 V +11 to +30V -5 V; -5 V continuous, -30 V brief reverse polarity protection 30 V
Input current for signal "1", typ.	2.5 mA
Input frequency - For signal interface 24 V asymmetrical - For signal interface RS 422 symmetrical - For signal interface TTL (5 V) asymmetrical	200 kHz 5 MHz 1 MHz
Input delay (for rated value of input voltage) Minimum pulse width for program reactions	application specific below 1µs possible
for standard inputs parameterizable	Yes; customer defined / 0.001 / 0.003 / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
Cable length shielded, max.	100 m
Digital outputs	
Number of digital outputs	12; including 4 DIQs
Current-sinking	Yes; 8 push-pull outputs
Current-sourcing	Yes
Short-circuit protection	Yes; electronic/thermal
Response threshold, typ.	0.2 A; for DQ; 0.9 A for DIQ
Switching capacity of the outputs with resistive load, max.	0.1 A; 0.3 A for DIQs
Load resistance range - lower limit - upper limit	240 Ω; 80 ohms for DIQs 12 kΩ
Output voltage - Type of output voltage - for signal "1", min.	DC 23.2 V; L+ (-0.8 V), L+ (-1.3 V) for DIQs
Output current - for signal "1" rated value - for signal "1" permissible range, max. - for signal "1" minimum load current	0.1 A; 0.3 A for DIQs 0.12 A; 0.36 A for DIQs 2 mA

Article number	6ES7554-1AA00-0AB0
	SIMATIC S7-1500, TM FAST Field Adaptable High-Speed Technology, programmable with Intel(R) Quartus(R) Prime software, 8xDI, 8xDQ, 4xDIQ 24 V, 8xRS485 DIQ, for extremely short response time of less than 1 µs
for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
"0" to "1", typ. "1" to "0", typ.	420 ns; for DQn 420 ns; for DQn
Switching frequency	
- with resistive load, max. - For signal interface 24 V asymmetrical - For signal interface RS 422 symmetrical - For signal interface TTL (5 V) asymmetrical	200 kHz; 1 kHz for DIQs 200 kHz; 1 kHz for DIQs 2 MHz 200 kHz
Cable length	
shielded, max.	30 m
Encoder	
Interface types	
- TTL 5 V - RS 422 - Sourcing/sinking input - Input characteristic curve in accordance with IEC 61131, type 3	Yes; 8 channels (direction switchable) Yes; 8 channels (direction switchable) Yes Yes
Isochronous mode	
Bus cycle time (TDP), min.	250 µs
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Substitute values connectable	Yes
Alarms	
Diagnostic alarm	Yes
Diagnoses	
- Monitoring the supply voltage - Wire break - Short-circuit - Group error	Yes Yes; for RS485/RS422/TTL Input Yes; Thermal overload protection Yes
Diagnostics indication LED	
- RUN LED - ERROR LED - MAINT LED - Monitoring of the supply voltage (PWR-LED) - Channel status display - for channel diagnostics	Yes; green LED Yes; red LED Yes; Yellow LED Yes; green LED Yes; green LED Yes; red LED

Article number	6ES7554-1AA00-0AB0
	SIMATIC S7-1500, TM FAST Field Adaptable High-Speed Technology, programmable with Intel(R) Quartus(R) Prime software, 8xDI, 8xDQ, 4xDIQ 24 V, 8xRS485 DIQ, for extremely short response time of less than 1 µs
Potential separation	
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• Between the channels and load voltage L+	No
Isolation	
Isolation tested with	707 V DC (type test)
Security	
signed firmware update	Yes
data integrity	Yes; Firmware V3.0.0 or higher
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C
• vertical installation, max.	40 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; restrictions for installation altitudes > 2 000 m, see ET 200MP system manual
Absolute humidity	
• dew point, min.	-60 °C; suitable for dry room applications
Decentralized operation	
to SIMATIC S7-300	Yes
to SIMATIC S7-400	Yes
to SIMATIC S7-1200	Yes
to SIMATIC S7-1500	Yes
to standard PROFINET controller	Yes
Dimensions	
Width	35 mm
Height	147 mm
Depth	129 mm
Weights	
Weight, approx.	300 g

Dimension drawings

The dimensional drawing of the module on the mounting rail, as well as a dimensional drawing with open front panel, are provided in the appendix. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

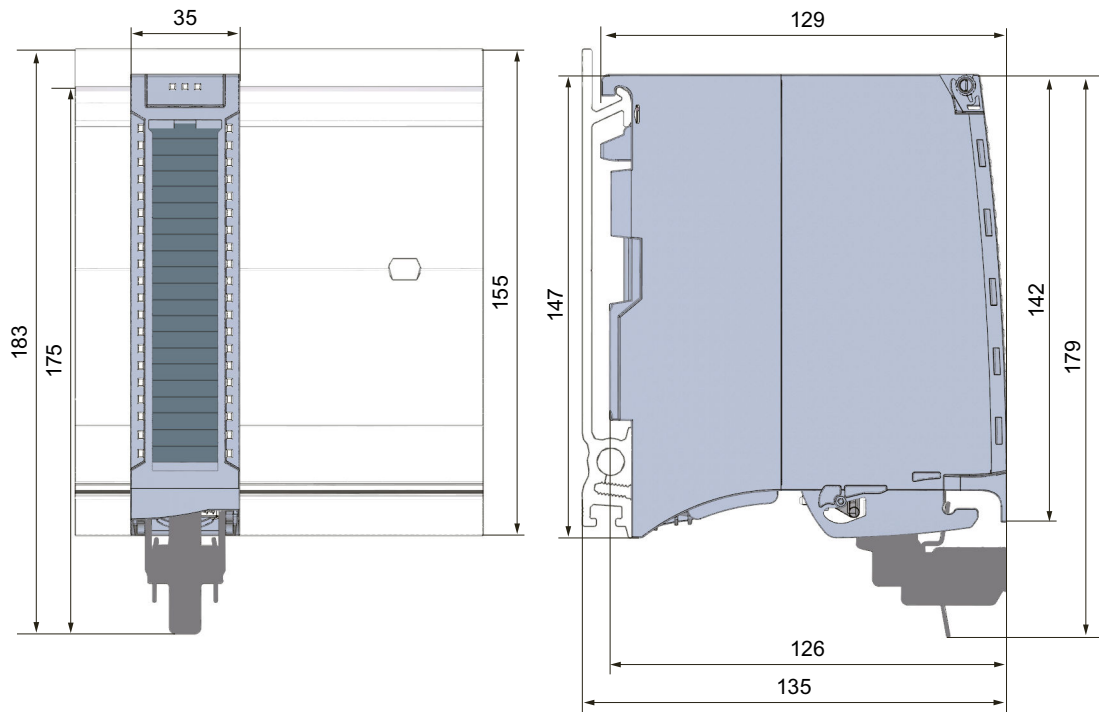


Figure A-1 Dimensional drawing of the TM FAST technology module

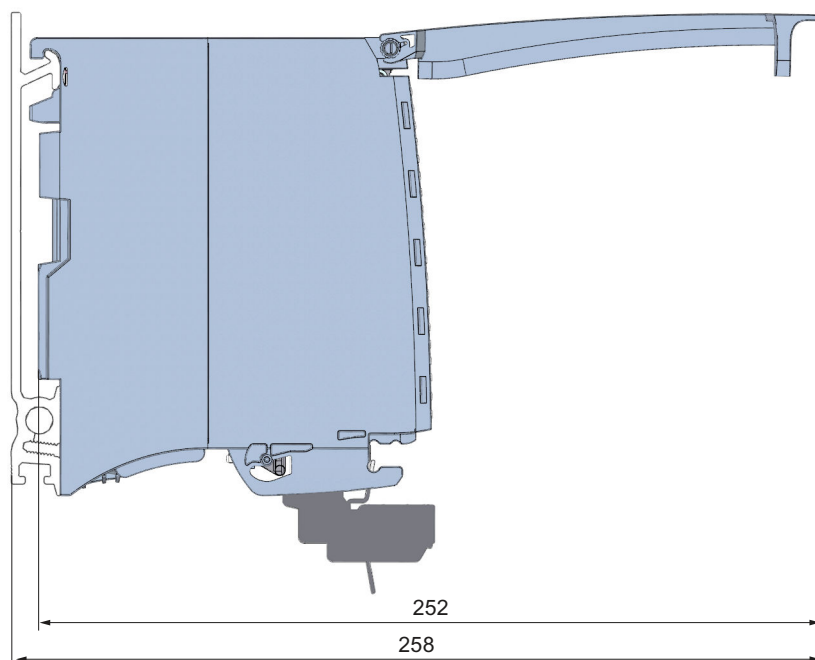


Figure A-2 Dimensional drawing of the TM FAST module in side view with open front cover



Figure A-3 Dimensional drawing of the TM FAST Debug Connector

Parameter data record

B.1 Parameter assignment and structure of the parameter data record

You have the option to change the parameter assignment of the module with the user program while the CPU is in RUN. The parameters are transferred to the module using data record 128, for example with the WRREC instruction.

If errors occur during the transfer or validation of parameters with the WRREC instruction, the module continues operation with the previous parameter assignment. A corresponding error code is then written to the STATUS output parameter.

The description of the WRREC instruction and the error codes is available in the section Parameter validation error with data record 128 (Page 65) or in the online help of STEP 7 (TIA Portal).

NOTE

If you want the module to be set to its startup state after writing data record 128, this must be implemented in the TM FASTapplication (Page 48).

Structure of data record 128

The following table shows the structure of data record 128 for TM FAST. The values in byte 0 to byte 3 are fixed and may not be changed.

Table B-1 Parameter data record 128

Bit →	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte ↓								
	Header							
0	Reserved ¹		Major Version = 0		Minor Version = 2			
1	Length of the parameter data = 28							
2	Reserved ¹							
3	Reserved ¹							
	Basic parameters							
4	Reserved ¹		Reaction to CPU STOP: 0 _B : Disable all outputs	Load TM FAST application during startup ²	Always activate TM FAST application ²	Enable diagnostic interrupt on wire break ²	Error at digital outputs ²	Missing supply voltage L+ ²

¹ Reserved bits must be set to 0.

² You enable the respective parameter by setting the associated bit to 1.

³ Only permissible for CH0, CH1 and CH4 as well as when system logic parameter RS485_TERMINATION = parameterized

⁴ Can be used with firmware version ≥V2.0 and system logic ≥V2.0.0. In isochronous mode, the parameter can affect the isochronous parameters of the sync domain. Because the isochronous mode parameters are not checked in RUN, synchronicity violations can occur if you change the parameter in RUN. To prevent synchronicity violations, select the option with the most time required in the offline parameter settings.

B.1 Parameter assignment and structure of the parameter data record

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	Reserved ¹		1 _B : Take over from TM FAST application	Load TM FAST application during startup ²	Always activate TM FAST application ²	Enable diagnostic interrupt on wire break ²	Error at digital outputs ²	Missing supply voltage L+ ²
	Parameters of the digital inputs DI _m							
5	Reserved ¹				Input delay DI0:			
					0000 _B : 0.001 ms			
					0001 _B : 0.003 ms			
					0010 _B : 0.05 ms			
					0011 _B : 0.1 ms			
					0100 _B : 0.4 ms			
					0101 _B : 0.8 ms			
					0110 _B : 1.6 ms			
					0111 _B : 3.2 ms			
					1000 _B : 12.8 ms			
					1001 _B : 20 ms			
					1010 to 1110 _B : Invalid			
					1111 _B : Take over from TM FAST application (DI_FILTER_USER_VAL_MS system logic parameter)			
6	Parameter DI1: see Byte 5							
7	Parameter DIQ2: see Byte 5							
8	Parameter DI3: see Byte 5							
9	Parameter DI4: see Byte 5							
10	Parameter DIQ5: see Byte 5							
11	Parameter DI6: see Byte 5							
12	Parameter DI7: see Byte 5							
13	Parameter DIQ8: see Byte 5							
14	Parameter DI9: see Byte 5							
15	Parameter DI10: see Byte 5							
16	Parameter DIQ11: see Byte 5							

¹ Reserved bits must be set to 0.

² You enable the respective parameter by setting the associated bit to 1.

³ Only permissible for CH0, CH1 and CH4 as well as when system logic parameter RS485_TERMINATION = parameterized

⁴ Can be used with firmware version ≥V2.0 and system logic ≥V2.0.0. In isochronous mode, the parameter can affect the isochronous parameters of the sync domain. Because the isochronous mode parameters are not checked in RUN, synchronicity violations can occur if you change the parameter in RUN. To prevent synchronicity violations, select the option with the most time required in the offline parameter settings.

B.1 Parameter assignment and structure of the parameter data record

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Parameters of the RS485/TTL channel CHm							
17	Reserved ¹			Bus terminat- ing resistor CH0 ^{2,3}	Input delay CH0:			
					0000 _B : 0.1 μs			
					0001 _B : 0.2 μs			
					0010 _B : 0.5 μs			
					0011 _B : 1 μs			
					0100 _B : 2 μs			
					0101 _B : 5 μs			
					0110 _B : 10 μs			
					0111 _B : 20 μs			
					1000 _B : 50 μs			
					1001 _B : 100 μs			
					1010 _B : 200 μs			
					1011 _B : 500 μs			
					1100 _B : 1000 μs			
					1101 to 1110 _B : Invalid			
					1111 _B : Take over from TM FAST application (RS485_TTL_FILTER_USER_VAL_MS system logic para- meter)			
18	Parameter CH1: see Byte 17							
19	Parameter CH2: see Byte 17							
20	Parameter CH3: see Byte 17							
21	Parameter CH4: see Byte 17							
22	Parameter CH5: see Byte 17							
23	Parameter CH6: see Byte 17							
24	Parameter CH7: see Byte 17							
25...27	Reserved ¹							
	Isochronous mode							
28...29	Processing time input data in user logic ⁴ : WORD: Value range in μs: 0 to 4000 _D							
30...31	Processing time output data in user logic ⁴ : WORD: Value range in μs: 0 to 4000 _D							

¹ Reserved bits must be set to 0.² You enable the respective parameter by setting the associated bit to 1.³ Only permissible for CH0, CH1 and CH4 as well as when system logic parameter RS485_TERMINATION = parameterized⁴ Can be used with firmware version ≥V2.0 and system logic ≥V2.0.0. In isochronous mode, the parameter can affect the isochronous parameters of the sync domain. Because the isochronous mode parameters are not checked in RUN, synchronicity violations can occur if you change the parameter in RUN. To prevent synchronicity violations, select the option with the most time required in the offline parameter settings.

B.2 Parameter validation error with data record 128

If you make the parameter setting in STEP 7 (TIA Portal), the parameter values are checked before they are transferred to the technology module. This process prevents parameter errors.

In other use cases, the technology module checks the transferred data record. If the technology module finds invalid or inconsistent parameter values, it outputs an error code (see below). The new data record is rejected in this case, and work continues with the current parameter values until a valid data record has been transferred.

WRREC

When the CPU is in the operating state RUN, you can change the data record with the instruction WRREC (Write Record). In case of errors, the WRREC instruction returns corresponding error codes in the STATUS parameter.

Example:

Let us assume that an invalid value, e.g. 12, is written to the module for the input delay DI0 when WRREC is executed. As a consequence, the module rejects the entire data record. You can recognize this by evaluating the STATUS output parameter of the WRREC instruction. The STATUS output parameter is output as an ARRAY[1..4] of BYTE data with the value 16#DF80E101:

Example of WRREC STATUS data	Address	Meaning
DF _H	STATUS[1]	Error while writing a data record in central or distributed operation via PROFINET/PROFIBUS (IEC 61158-6)
80 _H	STATUS[2]	Error occurred reading or writing a data record in a central or distributed operation via PROFINET/PROFIBUS (IEC 61158-6)
E1 _H	STATUS[3]	Module-specific error
01 _H	STATUS[4]	Error code from the table below: The "Input delay DI0" parameter has an invalid value.

Error codes

The following table shows the module-specific error codes and their meaning for data record 128.

Error code in the STATUS parameter (hexadecimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	00	Data record number unknown	Enter valid number for data record
DF	80	B1	01	Length of data record incorrect	Enter value 32 _D .
DF	80	B2	00	Slot invalid or not accessible	- Check whether module is inserted or removed. - Check assigned values for parameters of the WRREC instruction.
DF	80	E0	01	Wrong version	- Check byte 0. - Enter valid values.
DF	80	E0	02	Length of the parameter data not correct	Enter value 28 _D .
DF	80	E1	F0	At least one reserved bit is not set to 0.	Set all reserved bits to 0.

B.2 Parameter validation error with data record 128

Error code in the STATUS parameter (hexa-decimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	E1	01	"Input delay DIm" parameter invalid	Enter valid parameter value.
DF	80	E1	02	"Input delay CHm" parameter invalid	Enter valid parameter value.
DF	80	E1	03	"Bus terminating resistor CH2" enabled "Bus terminating resistor CH3" enabled "Bus terminating resistor CH5" enabled "Bus terminating resistor CH6" enabled "Bus terminating resistor CH7" enabled	Enter value 0 for bus terminating resistors CH2, CH3, CH5, CH6 and CH7.

Data record TMAFASTControlREC

C.1 Use and structure of TMAFASTControlREC (data record 100)

With the TMAFASTControlREC data record, you manage the TM FAST application and read the status information of the TM FAST application. The data are transferred to the module using data record 100 (e.g. with the WRREC instruction) or read from the module (e.g. with the RDREC instruction). You can conveniently perform these tasks using the instruction LTMFAST_ControlREC (Page 40) (LTMFAST_typeControlREC_WR and LTMFAST_typeControlREC_RD).

If errors occur during the transmission or validation of the data with the WRREC instruction, you receive a corresponding error code in the STATUS output parameter. You can find a description of the error codes in the section Validation error with data record 100 (Page 70).

Structure of data record 100 (TMAFASTControlREC) for writing

The following table shows the structure of data record 100 for writing.

Table C-1 Write data record 100

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Version = 1							
1	Command:							
	0 _D : Invalid							
	1 _D : Load TM FAST application from flash memory to FPGA ¹							
	2 _D : Activate TM FAST application in FPGA ¹							
	3 _D : Remove TM FAST application from FPGA ¹							
	4 _D : Delete TM FAST application from flash memory ¹							
	5 _D : Enable debug interface							
	6 _D : Disable debug interface							
	7 to 255 _D : Invalid							

¹ This command is only possible without errors when command status = 0 (following table Byte 1).

Structure of data record 100 (TMAFASTControlREC) for reading

The following table shows the structure of data record 100 for reading.

Table C-2 Read data record 100

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Version = 1							
1	Reserved ¹			Command status:	Debug interface status:	FPGA status:		
				0 _B : New com-	0 _B : Debug	000 _B : No TM FAST application available		

¹ Reserved bits must be set to 0.

C.1 Use and structure of TMFASTControlREC (data record 100)

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	Reserved ¹			mand possible	interface dis- abled	001 _B : TM FAST application is loaded but not active		
				1 _B : No new command possible	1 _B : Debug interface enabled	010 _B : TM FAST application is loaded and active		
				011 to 111 _B : Reserved				
2	Reserved ¹							
3	Last error code (see following table) (BYTE)							
4	System logic version in the FPGA: Major (BYTE)							
5	System logic version in the FPGA: Minor (BYTE)							
6	System logic version in the FPGA: Patch (BYTE)							
7	System logic version in the FPGA: Letter (CHAR)							
8	User logic version in the FPGA: Major (BYTE)							
9	User logic version in the FPGA: Minor (BYTE)							
10	User logic version in the FPGA: Patch (BYTE)							
11	User logic version in the FPGA: Letter (CHAR)							
12...19	Application ID in the FPGA (CHAR[8])							
20	Number of bytes of TMFASTUserWriteREC (BYTE)							
21	Number of bytes of TMFASTUserReadREC (BYTE)							
22	Reserved ¹							
23	Reserved ¹							
24	Reserved ¹		Bus terminating resistor for CH0:		Operating mode for CH0:			
			00 _B : Disabled		0000 _B : RS485 channel, bidirectional			
			01 _B : Enabled		0001 _B : RS422 input channel			
			10 _B : Dependent on parameter assignment in data record 128 (Page 62)		0010 _B : RS422 output channel			
					0011 _B : TTL input channel			
					0100 _B : TTL output channel			
			11 _B : Not available		0101 to 1110 _B : Reserved			
		1111 _B : Channel not used						
25	Parameter CH1: see Byte 24							
26	Parameter CH2: see Byte 24							
27	Parameter CH3: see Byte 24							
28	Parameter CH4: see Byte 24							
29	Parameter CH5: see Byte 24							
30	Parameter CH6: see Byte 24							
31	Parameter CH7: see Byte 24							

¹ Reserved bits must be set to 0.

C.1 Use and structure of TMFASTControlREC (data record 100)

Bit → Byte ↓	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
32...35	Internal temperature in °C (REAL)							
36...39	Function ID (DWORD)							
40	User logic version in the flash memory: Major (BYTE)							
41	User logic version in the flash memory: Minor (BYTE)							
42	User logic version in the flash memory: Patch (BYTE)							
43	User logic version in the flash memory: Letter (CHAR)							
44...51	Application ID in the flash memory (CHAR[8])							
52...53	Time stamp of the TM FAST application in the flash memory: Year (LDT)							
54	Time stamp of the TM FAST application in the flash memory: Month (LDT)							
55	Time stamp of the TM FAST application in the flash memory: Day (LDT)							
56	Time stamp of the TM FAST application in the flash memory: Weekday (LDT)							
57	Time stamp of the TM FAST application in the flash memory: Hour (LDT)							
58	Time stamp of the TM FAST application in the flash memory: Minute (LDT)							
59	Time stamp of the TM FAST application in the flash memory: Second (LDT)							
60...63	Time stamp of the TM FAST application in the flash memory: Nanoseconds (LDT)							

¹ Reserved bits must be set to 0.

Last error code

The following table shows the FPGA-specific error codes.

Error code	Meaning	Remedy
00 _H	No error	—
01 _H	Communication with TM FAST application failed	Update TM FAST application
02 _H		
03 _H		
04 _H		
05 _H		
06 _H		
07 _H	TM FAST application cannot be activated	Load TM FAST application into the FPGA
08 _H	TM FAST application cannot be removed from FPGA. Possible reason: Hardware defect	Check hardware
09 _H	No TM FAST application available in the flash memory	Update TM FAST application in the flash memory
0A _H	Communication with TM FAST application failed	Update TM FAST application
0B _H		
0C _H	Function ID ≠ 0	- Set value of function ID to 0 - Set value of FUNCTION_ID to 0 system logic parameter

C.2 Validation error with data record 100

The technology module checks the transferred data record. If the technology module detects invalid or inconsistent values, it outputs an error code (STATUS output parameter of the WRREC/RDREC instruction). You can find information on using WRREC/RDREC in the section Parameter validation error with data record 128 [\(Page 65\)](#).

Error codes

The following table shows the module-specific error codes and their meaning for data record 100.

Error code in the STATUS parameter (hexa-decimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	00	Data record number unknown	Enter valid number for data record
DF	80	B1	01	Length of data record incorrect	Enter valid value for data record length.
DF	80	B2	00	Slot invalid or not accessible	- Check whether module is inserted or removed. - Check assigned values for parameters of the WRREC/RDREC instruction.
DF	80	A7	00	New command not yet possible because previous command is still being processed	Wait until new command is possible (read Byte 1 Bit 4).
DF	80	A9	00	"Command" parameter invalid	Enter valid parameter value.
DF	80	D4	00	Wrong version	- Check byte 0. - Enter valid values.

Data record TFASTUserWriteREC

D.1 Use and structure of TFASTUserWriteREC (data record 101)

The TFASTUserWriteREC data record allows user-defined acyclic data to be transferred to the module and read back. The data are transferred to the module using data record 101 (e.g. with the WRREC instruction) or read from the module (e.g. with the RDREC instruction). You can conveniently perform these tasks using the LTMFAST_UserWriteREC (Page 44) instruction. The structure of the TFASTUserWriteREC depends on the TM FAST application. You define the length of the data record using the system logic parameter WR_REC_DWORD_SIZE. You can select a length of 4, 32, 64 or 128 bytes here. The length can no longer be changed for a loaded TM FAST application. You can find additional information in the programming manual *Creating a TM FAST Application* (<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

If errors occur during the transfer or validation of the data with the WRREC instruction, you will receive a corresponding error code in the STATUS output parameter. You can find a description of the error codes in the section Validation error with data record 101 (Page 71).

D.2 Validation error with data record 101

If errors occur during the transfer or validation of data record 101 with the WRREC instruction, you will receive a corresponding error code in the STATUS output parameter. You can find information on using WRREC/RDREC in the section Parameter validation error with data record 128 (Page 65).

Error codes

The following table shows the module-specific error codes and their meaning for data record 101.

Error code in the STATUS parameter (hexa-decimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	00	Data record number unknown	Enter valid number for data record
DF	80	B1	01	Length of data record incorrect	Enter valid value for data record length. A value of 1, 8, 16 or 32 DWord is allowed. The value must match the value in the system logic parameter WR_REC_DWORD_SIZE.
DF	80	B2	00	Slot invalid or not accessible	- Check whether module is inserted or removed. - Check assigned values for parameters of the WRREC instruction.
DF	80	E1	A0	No enabled TM FAST application in the FPGA	Activate TM FAST application in FPGA.

Data record TMFASTUserReadREC

E.1 Use and structure of TMFASTUserReadREC (data record 102)

Data record TMFASTUserReadREC enables reading user-defined acyclic data from the module, e.g. with the RDREC instruction. You can conveniently perform these tasks using the LTMFAST_UserReadREC (Page 43) instruction.

The structure of the TMFASTUserWriteREC depends on the TM FAST application. You define the length of the data record using the system logic parameter RD_REC_DWORD_SIZE. You can select a length of 4, 32, 64 or 128 bytes here. The length can no longer be changed for a loaded TM FAST application. You can find additional information in the programming manual Creating a TM FAST Application

(<https://support.industry.siemens.com/cs/ww/en/view/109816088>).

If errors occur when reading the data with the RDREC instruction, you will receive a corresponding error code in the STATUS output parameter. You can find a description of the error codes in the section Possible errors with data record 102 (Page 72).

E.2 Possible errors with data record 102

If errors occur when reading data record 102 with the RDREC instruction, you will receive a corresponding error code in the STATUS output parameter. You can find information on using WRREC/RDREC in the section Parameter validation error with data record 128 (Page 65).

Error codes

The following table shows the module-specific error codes and their meaning for data record 102.

Error code in the STATUS parameter (hexa-decimal)				Meaning	Remedy
Byte 0	Byte 1	Byte 2	Byte 3		
DE	80	B0	00	Data record number unknown	Enter valid number for data record
DE	80	B2	00	Slot invalid or not accessible	- Check whether module is inserted or removed. - Check assigned values for parameters of the RDREC instruction.
DE	80	E1	A0	No enabled TM FAST application in the FPGA	Activate TM FAST application in FPGA.