

# Modicon TM5

## Safety Logic Controller SLC100/200 FS

### Hardware Guide

Original instructions

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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# Table of Contents

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	<b>Safety Information</b> .....	<b>5</b>
	<b>About the Book</b> .....	<b>7</b>
<b>Chapter 1</b>	<b>Functional Safety Information</b> .....	<b>13</b>
	IEC 61508 and Safety Integrity Level (SIL) .....	<b>14</b>
	Functional Safety Certification .....	<b>15</b>
	Training .....	<b>19</b>
<b>Chapter 2</b>	<b>TM5CSLC100FS and TM5CSLC200FS</b> .....	<b>21</b>
	General Information on Safety Logic Controllers .....	<b>22</b>
	Safety Logic Controller Presentation .....	<b>23</b>
	Safety Logic Controller Characteristics .....	<b>25</b>
	Safety Logic Controller Memory Key .....	<b>28</b>
<b>Chapter 3</b>	<b>Operating and Connection Elements</b> .....	<b>35</b>
	Safety Logic Controller Description .....	<b>36</b>
	Logic Processor LED Indicators .....	<b>38</b>
	Logic Processor Selection Switch and Confirmation Button .....	<b>42</b>
	Safety Terminal Block Presentation .....	<b>44</b>
	Integrated Power Supply .....	<b>47</b>
	Sercos III Interface .....	<b>49</b>
<b>Glossary</b>	.....	<b>55</b>
<b>Index</b>	.....	<b>57</b>



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# Safety Information

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## Important Information

### NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

## **DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

## **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

## **CAUTION**

**CAUTION** indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

## **NOTICE**

**NOTICE** is used to address practices not related to physical injury.

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## PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

## QUALIFICATION OF PERSONNEL

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment. The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

## INTENDED USE

The products described or affected by this document, together with software, accessories, and options, are programmable logic controllers (referred to herein as “logic controllers”), intended for industrial use according to the instructions, directions, examples, and safety information contained in the present document and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the product is used as a component in an overall machine or process, you must ensure the safety of persons by means of the design of this overall system.

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

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# About the Book

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## At a Glance

### Document Scope

This manual describes the Safety Logic Controllers SLC100 Sercos III (TM5CSLC100FS) and SLC200 Sercos III (TM5CSLC200FS). These controllers help you to achieve the safety requirements codified in the IEC 61508 standard. The present document also provides part descriptions, specifications and wiring diagrams.

Schneider Electric takes no responsibility for the solutions adopted by you or any customer concerning the circuits, the electrical schematics, and the chosen configuration parameters of the application. The implemented circuits and electrical diagrams and the choice of the system configuration parameter values, including those of TM5CSLC100FS and TM5CSLC200FS, are fully under your control and responsibility.

### Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V1.2.5.

The technical characteristics of the devices described in the present document also appear online. To access the information online, go to the Schneider Electric home page at [www.se.com](http://www.se.com).

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

### Related Documents

Document title	Reference
Modicon TM5/TM7 I/O Safety Modules Hardware Guide	<a href="#">EIO000000861 (ENG)</a> <a href="#">EIO000000862 (GER)</a>
PacDrive TM5 / TM7 Safety Flexible System, System Planning and Installation Guide	<a href="#">EIO000001064 (ENG)</a> <a href="#">EIO000001066 (GER)</a>
Modicon M262 Logic/Motion Controller, Programming Guide	<a href="#">EIO000003651 (ENG)</a> <a href="#">EIO000003652 (FRE)</a> <a href="#">EIO000003653 (GER)</a> <a href="#">EIO000003654 (SPA)</a> <a href="#">EIO000003655 (ITA)</a> <a href="#">EIO000003656 (CHS)</a> <a href="#">EIO000003657 (POR)</a> <a href="#">EIO000003658 (TUR)</a>

Document title	Reference
How to Configure the Firewall for PacDrive LMC Controllers, User Guide	EIO0000004198 (ENG) EIO0000004199 (GER)
EcoStruxure Machine Expert, CommonToolbox, Library Guide	<a href="#">EIO0000004219 (ENG)</a>

You can download these technical publications and other technical information from our website at [www.schneider-electric.com/en/download](http://www.schneider-electric.com/en/download).

## Product Related Information

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

**Failure to follow these instructions will result in death or serious injury.**

### DANGER

#### POTENTIAL FOR EXPLOSION

- Only use this equipment in non-hazardous locations, or in locations that comply with Class I, Division 2, Groups A, B, C and D.
- Do not substitute components which would impair compliance to Class I, Division 2.
- Do not connect or disconnect equipment unless power has been removed or the location is known to be non-hazardous.
- Do not use the USB port(s), if so equipped, unless the location is known to be non-hazardous.

**Failure to follow these instructions will result in death or serious injury.**



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## WARNING

### LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.<sup>1</sup>
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

<sup>1</sup> For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

## WARNING

### UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The Safety Logic Controller system is built to the following safety integrity levels: SIL 3 according to EN/IEC 61508, SILcl 3 according to EN/IEC 62061, in accordance with the applicable standards. However, the definitive SIL and PL of the application depends on the number of safety components, their parameters, and the connections that are made, as per the risk analysis.

The module must be configured in accordance with the application-specific risk analysis and all the applicable standards.

Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your adaptation.

## WARNING

### UNINTENDED EQUIPMENT OPERATION

- Perform an in-depth risk analysis to determine the appropriate safety integrity level for your specific application, based on all the applicable standards.
- Do not exceed SIL 3 ratings in the application of this product.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

For reasons of Internet security, TCP/IP forwarding is disabled by default. Therefore, you must manually enable TCP/IP forwarding. However, doing so may expose your network to possible cyberattacks if you do not take additional measures to protect your enterprise. In addition, you may be subject to laws and regulations concerning cybersecurity.

## WARNING

### UNAUTHENTICATED ACCESS AND SUBSEQUENT NETWORK INTRUSION

- Observe and respect any an all pertinent national, regional and local cybersecurity and/or personal data laws and regulations when enabling TCP/IP forwarding on an industrial network.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfuction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

Standard	Description
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive (2006/42/EC)* and *ISO 12100:2010*.

**NOTE:** The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.



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# Chapter 1

## Functional Safety Information

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### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
IEC 61508 and Safety Integrity Level (SIL)	14
Functional Safety Certification	15
Training	19

## IEC 61508 and Safety Integrity Level (SIL)

### Introduction

The TM5CSLC100FS and TM5CSLC200FS Safety Logic Controllers are part of a Safety-Related System certified according to IEC 61508 by TÜV NORD.

### IEC 61508 Description

The IEC 61508 is a technical standard concerning the functional safety of electrical, electronic or programmable electronic safety-related systems.

A safety-related system is a system that is required to perform one or more specific functions to ensure that risks are kept at or below an acceptable level. Such functions are defined as safety functions.

A system is defined “functionally safe” when random, systematic, and common cause equipment or machine failures do not lead to malfunctioning of the system and do not result in injury or death of humans, spills to the environment, and loss of equipment and production.

### Description of the Safety Integrity Level (SIL)

Safety-related functions are executed to help achieve and maintain the defined safe state of a system. The IEC 61508 specifies four levels of safety performance for a safety-related function. These are called Safety Integrity Levels (SIL), ranging from 1 (the lowest) to 4 (the highest). The TM5CSLC100FS and TM5CSLC200FS Safety Logic Controllers are certified for use in SIL 3 applications in which the de-energized state is the defined safe state.

## Functional Safety Certification

### Introduction

The TM5CSLC100FS and TM5CSLC200FS Safety Logic Controllers are certified

- by TÜV NORD
- for use in applications up to and including SIL 3 according to IEC 61508 and IEC 62061.

This certification verifies that the Safety Logic Controllers are compliant with the following standards:

- IEC 61508: Functional safety of electrical/electronic/programmable electronic safety-related systems, Parts 1 to 4, 2010, up to SIL 3
- ISO 13849-1: Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design, 2015, up to PL e (Category 4)
- IEC 62061: Safety of machinery - Functional safety of safety-related electrical, electronic, and programmable electronic control systems, 2005 (A1:2013), up to SILcl 3

**NOTE:** Using Safety Logic Controller equipment is a necessary but insufficient precondition for the certification of a SIL 3 application. A SIL 3 application must also fulfill the requirements of the IEC 61508, IEC 61511, IEC 61131-2, and other application standards.

### Functional Safety Parameters

The Functional Safety parameters according to EN ISO 13849 are as follows:

- Performance Level for
  - SDI (safety-related digital input) to SDO (safety-related digital output): up to PL e
  - SAI (safety-related analog input) to SAO (safety-related analog output): up to PL e
- Category: up to 4

### Classification of the Schneider Electric Products

The Safety Logic Controllers are dedicated to perform safety-related functions. The Safety Logic Controller system consist of the controller supporting the Sercos III fieldbus network. The controller then interfaces with the Sercos III Bus Interface, TM5/TM7 Safety-Related I/O modules, and other safety-related devices such as drives and third-party devices. However, it also supports other modules, enabling you to add non-safety-related parts to your SIL 3 project.

Therefore, the Schneider Electric products must be distinguished into:

- safety-related modules and
- non-safety-related modules

In contrast to the safety-related modules, non-safety-related modules are not used to perform safety-related functions. They are certified as non-interfering modules for use with the Safety Logic Controller. A detected error in one of these modules does not interfere with the execution of the safety-related functions.

## Safety-Related Products of the Safety Logic Controller System

The Safety Logic Controller system is comprised of the following safety-related products:

Type	Module Reference
Safety Logic Controller, SLC 100 Sercos III, 24 Vdc	TM5CSLC100FS
Safety Logic Controller, SLC 200 Sercos III, 24 Vdc	TM5CSLC200FS
Safety-related Module 2DI 24 Vdc Sink	TM5SDI2DFS
Safety-related Module 4DI 24 Vdc Sink	TM5SDI4DFS
Safety-related Module 20DI 24 Vdc Sink	TM5SDI20DFS
Safety-related Module 2DO 24 Vdc, 0.5 A	TM5SDO2TFS
Safety-related Module 2DO 24 Vdc, 2 A	TM5SDO2TAFS
Safety-related Module 4DO 24 Vdc, 0.5 A	TM5SDO4TFS
Safety-related Module 2DO	TM5SDO2TRFS
Safety-related Module 4DO 24 Vdc, 2 A	TM5SDO4TAFS
Safety-related Module 6DO 24 Vdc, 0.2 A	TM5SDO6TBFS
Safety-related Module 2DI (2 test (pulse) outputs), 2DO 24 Vdc, 6 A	TM5SDM4DTRFS
Safety-related Module 6DI, 2DO 24 Vdc	TM5SDM8TBFS
Safety-related Module 2x2AI 4-20 mA 24 bits	TM5SAI4AFS
Safety-related Module 2x2AI Thermocouple J/K/N/S/R/C/T	TM5STI4ATCFS
Safety-related Counter Module DC1 7 kHz 24 Vdc Sink	TM5SDC1FS
Safety-related Power Distribution Module PS 1DO 24 Vdc	TM5SPS10FS
IP67 Block, 8 DI, 24 Vdc	TM7SDI8DFS
IP67 Block, 8 DI, 4 DO, 2 A	TM7SDM12DTFS
TM5 Bus Base for safety-related Electronic modules, safety coded, internal I/O supply interconnected	TM5ACBM3FS
Safety-related Terminal Block, 12-pin, safety coded	TM5ACTB52FS
Memory Key, 8 MB <sup>(1)</sup>	TM5ACSLCM8FS
<b>(1)</b> A memory key is required for operation of the Safety Logic Controller, and is sold separately. For more information concerning the role of the memory key in the Safety Logic Controller system, refer to Safety Logic Controller Memory Key ( <i>see page 28</i> ).	

Only modules certified as safety-related modules are allowed to perform safety functions. Make certain that neither inputs nor outputs of non-safety-related modules are used for safety-related inputs or outputs.



**⚠ DANGER****IMPROPERLY CONFIGURED SAFETY-RELATED SYSTEM**

- Use only safety-certified products for use in a safety-related system.
- Use only Schneider Electric authorized products in a Safety Logic Controller system.

**Failure to follow these instructions will result in death or serious injury.**

**NOTE:** The Sercos III Bus Interface, required for communication with TM5 Safety-related modules, is considered a non-interfering module and does not contribute nor detract from the safety function of the controller. The safety layer part of the Sercos III communication is managed inside the Safety-related modules and not in the Sercos III Bus Interface.

**Available Bus Interface**

The following Schneider Electric bus interface is available:

Module Type	Module Reference
Sercos III Bus Interface	TM5NS31

**NOTE:** The Sercos III Bus Interface, required for communication with the safety-related expansion modules, is considered a non-interfering module and does not contribute nor detract from the safety-related function of the controller. The safety layer part of the Sercos III communication is managed inside the safety-related modules and not in the Sercos III Bus Interface.

For more information on safety-related product architectures, refer to TM5 / TM7 Safety-Related System I/O Architecture (*see PacDrive TM5 / TM7 Safety Flexible System, System Planning and Installation Guide*).

**⚠ DANGER****IMPROPER SAFETY-RELATED SYSTEM**

- Use only modules designated as safety-related modules to perform safety-related functions.
- Make sure that neither inputs nor outputs of non-safety-related modules are used for safety-related outputs.

**Failure to follow these instructions will result in death or serious injury.**

**Probabilities of Failure**

For SIL 3 applications, IEC 61508 defines the following probabilities of failure on demand (PFD) and probabilities of failure per hour (PFH) depending on the mode of operation:

- PFD  $\geq 10^{-4}$  to  $< 10^{-3}$  for low demand mode of operation
- PFH  $\geq 10^{-8}$  to  $< 10^{-7}$  for high demand mode of operation

### Defined Safe State and Life Span

For more information on the defined safe state of modules in the case of detected errors as well as on the life span, refer to Defined Safe State and Life Span (*see Modicon TM5/TM7, I/O Safety Modules, Hardware Guide*).

## Training

### Introduction

As stated in the IEC 61508, Part 1, App. B, all persons involved in a Safety Lifecycle activity must have the appropriate training, technical knowledge, experience, and qualifications relevant apply the products specified in the present document. Training, technical knowledge, experience, and qualifications should be assessed in relation to each particular application.

**NOTE:** Make sure you possess all information and skills required to install, run, and maintain Safety-Related Systems correctly.



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# Chapter 2

## TM5CSLC100FS and TM5CSLC200FS

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### What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
General Information on Safety Logic Controllers	22
Safety Logic Controller Presentation	23
Safety Logic Controller Characteristics	25
Safety Logic Controller Memory Key	28

## General Information on Safety Logic Controllers

### General Overview

Safety Logic Controllers manage the tasks within a safety-related application and provide the following functionalities:

- configuration management
- parameter management
- execution of the safety-related application program

**NOTE:** The safety-related modules must be connected through a Sercos III Bus Interface.

### Configuration Management

The configuration management monitors the safety-related configuration of the application in the Safety Logic Controller and provides the following functions:

- Helps ensure a consistent, safety-related configuration.
- Verifies the module types, as well as the hardware and firmware versions, with those specified in the Safety Logic Controller application.
- Verifies the configuration at startup and periodically during operation.

### Parameter Management

When replacements are needed, the parameter management system helps to ensure that newly installed modules are assigned correct parameters that apply to the application in the Safety Logic Controller.

The parameter management provides the following functions:

- Helps to ensure consistent parameters on the safety-related I/O modules.
- Verifies the parameters with those specified in the Safety Logic Controller application.
- Independently performs complete parameter downloads.

### Memory Key

The memory key on the Safety Logic Controller supports the following features:

- holds the safety-related application that is loaded at boot-up.
- storage medium for the application, configuration, and parameters.
- application transfer of safety-related functions to another Safety Logic Controller.

**NOTE:** A memory key is required for operation of the Safety Logic Controller. For more information concerning the role of the memory key in the Safety Logic Controller system, refer to Safety Logic Controller Memory Key (*see page 28*).

## Safety Logic Controller Presentation

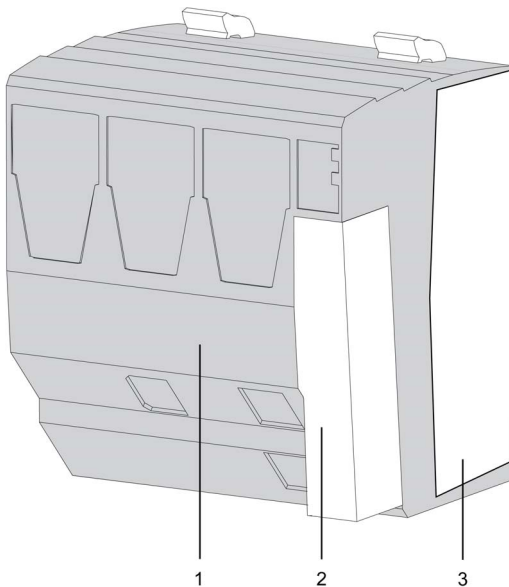
### Features

The table below describes the features of TM5CSLC100FS and TM5CSLC200FS :

Feature	TM5CSLC100FS	TM5CSLC200FS
System module	Safety CPU Standard	Safety CPU Plus
Maximum I/O modules via Sercos III interface	20 safety-related modules	100 safety-related modules
Interfaces	Sercos III, controlled node, integrated 2x switch	
Application memory	exchangeable application memory: memory key	
Dimensions (W x H x D)	87.5 x 99 x 75 mm (3.44 x 3.89 x 2.92 inches)	

### Ordering Information

The figure below presents TM5CSLC100FS and TM5CSLC200FS in combination with the required accessories:



The table below presents the references for the Safety Logic Controllers and the terminal block:

Number	Reference	Description	Color
1	TM5CSLC100FS	SLC 100 Sercos III	red
	TM5CSLC200FS	SLC 200 Sercos III	
2	TM5ACTB52FS <i>(see page 44)</i> <sup>(1)</sup>	TM5 terminal block, 12-pin, safety coded	red
3	TM5ACLPR10 <sup>(1)</sup>	TM5 Locking plate	white
<i>(1) Included in delivery of TM5CSLC100FS/TM5CSLC200FS</i>			

**NOTE:** A memory key is required for operation of the Safety Logic Controller, and is sold separately. For more information concerning the role of the memory key in the Safety Logic Controller system, refer to Safety Logic Controller Memory Key *(see page 28)*.



## Safety Logic Controller Characteristics

### Introduction

This section describes the characteristics of TM5CSLC100FS and TM5CSLC200FS:

### DANGER

#### FIRE HAZARD

Use only the correct wire sizes for the maximum current capacity of the power supplies.

**Failure to follow these instructions will result in death or serious injury.**

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the characteristics tables.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

### General Characteristics

The table below provides general characteristics of TM5CSLC100FS and TM5CSLC200FS :

General Characteristics	
Status indicators	<ul style="list-style-type: none"> <li>● Controller state</li> <li>● Sercos III</li> <li>● Memory key</li> </ul>
Diagnostics	Diagnostics for controller functions, Sercos III and memory key are indicated by status LED.
Cooling	convection
Power consumption	5.1 W
Certifications and standards	<ul style="list-style-type: none"> <li>● CE</li> <li>● CSA, Class I., Div. 2</li> <li>● cULus</li> <li>● EN 62061</li> <li>● EN ISO 13849-1</li> <li>● IEC 61508</li> </ul>

### Operating Conditions

The table below lists the operating conditions for TM5CSLC100FS and TM5CSLC200FS:

Operating Conditions		
Mounting orientation	horizontal or vertical	
Operating temperature	horizontal installation	0...+55 °C (+32...131 °F)
	vertical installation	0...+45 °C (+32...113 °F)
Relative humidity	5...95%	
Installation at altitudes above sea level:	Up to 2000 m (up to 6561 ft)	no derating
	> 2000 m (>6561 ft)	reduction of ambient temperature by 0.5 °C per 100 m (32.9 °F per 328 ft)
EN 60529 Protection	IP20	

### Storage and Transport Conditions

The table below lists the storage and transport conditions for TM5CSLC100FS and TM5CSLC200FS:

Storage and Transport Conditions	
Temperature	-25...+70 °C (-13...+158 °F)
Relative humidity	5...95%

### Controller Characteristics

The table below lists the controller characteristics for TM5CSLC100FS and TM5CSLC200FS:

Controller	
Fastest task class cycle time	2 ms
Memory Key slot	1x
Real-time clock	<ul style="list-style-type: none"> <li>● non-volatile memory</li> <li>● resolution 1 second</li> </ul>
Modular interface slots	none
Processor	Intel XSCALE 266 MHz

### Fieldbus Characteristics

The table below lists the fieldbus characteristics for TM5CSLC100FS and TM5CSLC200FS:

Fieldbus	
Type	Sercos III

Fieldbus	
Design	<ul style="list-style-type: none"> <li>● internal 2x switch</li> <li>● 2x shielded RJ45 port</li> </ul>
Cable length	maximum 100 m (328 ft) between two stations (segment length)
Transfer rate	100 MBit/s Full Duplex

### Power Supply Characteristics

The table below lists the power supply characteristics for TM5CSLC100FS and TM5CSLC200FS:

Power supply	
Rated voltage	+ 24 V (-15% / +20%)
Reverse polarity reaction	yes
Fuse	integrated, cannot be exchanged

### Functionality Characteristics

The table below lists the functionality characteristics for TM5CSLC100FS and TM5CSLC200FS:

Functionality	TM5CSLC100FS	TM5CSLC200FS
Number of supported safety-related I/O devices	maximum 20	maximum 100

### Safety-Related Characteristics

The table below lists the safety-related characteristics for TM5CSLC100FS and TM5CSLC200FS:

Characteristic	Value
Category according to EN ISO 13849	CAT 4
Maximum performance level according to EN ISO 13849	PL e
Maximum safety integrity level according to IEC 62061	SIL 3
Maximum safety integrity level according to IEC 61508	SIL 3
PFH	$<1 \cdot 10^{-9}$
PFD	<ul style="list-style-type: none"> <li>● <math>&lt;1 \cdot 10^{-5}</math> at a proof test interval of 10 years</li> <li>● <math>&lt;2 \cdot 10^{-5}</math> at a proof test interval of 20 years</li> </ul>
PT	maximum 20 years
DC	>90%
SFF	>90%
MTTFd	>100 years
Life time (see Modicon TM5/TM7, I/O Safety Modules, Hardware Guide)	20 years

## Safety Logic Controller Memory Key

### Presentation

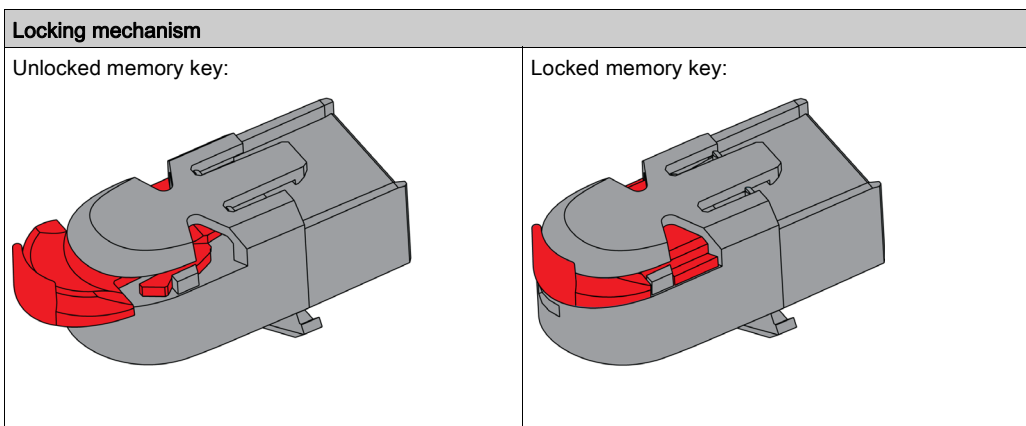
A memory key is required for operation of the Safety Logic Controller, and is sold separately. The table below presents the reference for the memory key:

Reference	Description	Color
TM5ACSLCM8FS	Safety Logic Controller memory key, 8 Mb	Gray and red

### Functions of the Memory Key

The memory key is required to load the program, parameters and configuration into the Safety Logic Controller when it boots up. In addition, you can use the key to store the program, the parameters, and the system configuration and transfer the data to another Safety Logic Controller.

The memory key is equipped with a mechanical locking mechanism to help prevent removal during operation:



### First Insertion and Confirmation of the Memory Key

Before applying power to the Safety Logic Controller for the first time, you have to insert the memory key.

To confirm the first insertion of a memory key, proceed as follows:

Step	Action	Result
1	Ensure that the Safety Logic Controller is not under power.	-
2	Insert the memory key in the Safety Logic Controller and apply power to the Safety Logic Controller.	The <b>FW-ACKN</b> LED illuminates.

Step	Action	Result
3	Move the selection switch to <b>SK-XCHG</b> and press the confirmation button.	The <b>ENTER</b> LED illuminates. The memory key insertion is confirmed.
4	Engage the mechanical locking mechanism.	-
5	Open EcoStruxure Machine Expert - Safety, connect to the Safety Logic Controller and set a new password for the Safety Logic Controller (refer to EcoStruxure Machine Expert - Safety User Guide).	<b>NOTE:</b> To allow the connection between EcoStruxure Machine Expert - Safety and the Safety Logic Controller via the Sercos bus, appropriate Ethernet settings have to be applied on the standard controller. Refer to the <i>M262 Programming Guide</i> , chapter <i>Ethernet Services</i> for information on IP forwarding (see <i>Modicon M262 Logic/Motion Controller, Programming Guide</i> ) settings. For PacDrive, refer to the User Guide <i>How to Configure the Firewall for PacDrive LMC Controllers</i> (see <i>How to Configure the Firewall for PacDrive LMC Controllers, User Guide</i> ). The <i>CommonToolbox Library Guide</i> (see <i>EcoStruxure Machine Expert, CommonToolbox, Library Guide</i> ) provides information on related IEC application functions.
6	Download your valid safety-related application on the Safety Logic Controller (refer to EcoStruxure Machine Expert - Safety User Guide).	-
7	Execute a complete validation of the Safety Logic Controller functional safety system.	-

## WARNING

### UNINTENDED EQUIPMENT OPERATION


- Ensure that the Safety Logic Controller is stopped before attempting to insert or remove the memory key.
- Each time the memory key is used (inserted/replaced), carefully verify that the loaded safety application is the one that was intended for the particular system.
- Conduct a complete functional test of the system, composed of the Safety Logic Controller plus all input and output hardware connected to it, after using the memory key to overwrite your safety-related application.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

**NOTE:** You can verify your safety-related application by examining the project CRC and the date that were saved with the application on the memory key. For more information, refer to the EcoStruxure Machine Expert - Safety User Guide.

### Removing a Memory Key

Removing a memory key results in a boot status change (the LED indicators **F**, **I** and **L** illuminate) and a disabling of the safety-related functions. In addition, removing the memory key during operation can corrupt the data on the memory key.

<b> WARNING</b>
<b>INTERRUPTION OF SAFETY-RELATED FUNCTION AND POSSIBLE LOSS OF MEMORY KEY DATA</b>
<ul style="list-style-type: none"> <li>• Do not remove the memory key when the Safety Logic Controller is in a RUN state.</li> <li>• Engage the locking mechanism while the key is inserted in the Safety Logic Controller.</li> </ul>
<b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b>

To remove the memory key, proceed as follows:

Step	Action
1	Ensure that the Safety Logic Controller is STOPPED or that power has been removed.
2	Disengage the mechanical locking mechanism.
3	Pull the memory key out of the Safety Logic Controller. <b>NOTE:</b> The Safety Logic Controller requires a valid memory key to operate.

### Copying to a Memory Key

Copying to a memory key is a function that allows you to copy the configuration data from the Safety Logic Controller to another memory key. The application and parameters are not copied to the memory key.

**Pre-requisite 1:** The Safety Logic Controller is operational, therefore, with an existing memory key.

**Pre-requisite 2:** You have another memory key, already containing an application valid for the present Safety Logic Controller.

To transfer the configuration data to another memory key, proceed as follows:

Step	Action	Result/Comment
1	Set the selection switch to <b>SK-COPY</b> position and press the confirmation button. <b>NOTE:</b> Refer to Logic Processor Selection Switch and Confirmation Button ( <i>see page 42</i> ).	<b>Result:</b> The <b>ENTER</b> LED illuminates and the <b>SKEY</b> LED flashes. The existing memory key configuration data is saved to an internal, temporary file on the Safety Logic Controller to be later transferred to the other memory key, and the <b>FW-ACKN</b> LED flashes when the action is completed.
2	Dis-engage the mechanical locking mechanism and replace the existing memory key by the other memory key. <sup>(1)</sup> <b>NOTE:</b> Do not move the selection switch. It remains on the position <b>SK-COPY</b> .	A maximum of 30-second delay is provided for this step. The <b>FW-ACKN</b> LED flash frequency increases after 20 seconds to signal the end of that delay.
3	Press the confirmation button <sup>(2)</sup> .	The internal, temporarily saved configuration file is transferred to the memory key.
4	Move the selection switch to <b>SK-XCHG</b> and press the confirmation button.	<b>Result:</b> The <b>ENTER</b> LED illuminates. The memory key replacement is confirmed ( <i>see page 32</i> ).
5	Engage the mechanical locking mechanism.	-
6	Execute a complete validation of the Safety Logic Controller functional safety system.	-
<p>(1) If no memory key is inserted after 30 seconds, the Safety Logic Controller switches to boot status (the LED indicators <b>F</b>, <b>I</b> and <b>L</b> illuminate).</p> <p>(2) If the other memory key is not acknowledged after 30 seconds, the function ends, that is, in case the function is triggered inadvertently, the copy function ends automatically after 30 seconds.</p>		

## WARNING

### UNINTENDED EQUIPMENT OPERATION

- Ensure that the Safety Logic Controller is stopped before attempting to insert or remove the memory key.
- Each time the memory key is used (inserted/replaced), carefully verify that the loaded safety application is the one that was intended for the particular system.
- Conduct a complete functional test of the system, composed of the Safety Logic Controller plus all input and output hardware connected to it, after using the memory key to overwrite your safety-related application.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

**NOTE:** You can verify your safety-related application by examining the project CRC and the date that were saved with the application on the memory key. For more information, refer to the EcoStruxure Machine Expert - Safety User Guide.

### Confirming Memory Key Insertion

The following procedure authorizes the safety-related application stored on the memory key to be used with the Safety Logic Controller. In addition, after confirmation, the application on the memory key is compared with that in execution memory, and if they are different, the application on the memory key is transferred to the Safety Logic Controller.

To confirm the insertion of a memory key, proceed as follows:

Step	Action	Result
1	Ensure that the Safety Logic Controller is STOPPED.	-
2	Insert the memory key in the Safety Logic Controller. <b>NOTE:</b> The Safety Logic Controller requires a valid memory key to operate.	The <b>FW-ACKN</b> LED illuminates.
3	Move the selection switch to <b>SK-XCHG</b> and press the confirmation button.	The <b>ENTER</b> LED illuminates. The memory key replacement is confirmed ( <i>see page 32</i> ).
4	Engage the mechanical locking mechanism.	-
5	Execute a complete validation of the Safety Logic Controller functional safety system.	-

## WARNING

### UNINTENDED EQUIPMENT OPERATION

- Ensure that the Safety Logic Controller is stopped before attempting to insert or remove the memory key.
- Each time the memory key is used (inserted/replaced), carefully verify that the loaded safety application is the one that was intended for the particular system.
- Conduct a complete functional test of the system, composed of the Safety Logic Controller plus all input and output hardware connected to it, after using the memory key to overwrite your safety-related application.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

**NOTE:** You can verify your safety-related application by examining the project CRC and the date that were saved with the application on the memory key. For more information, refer to the EcoStruxure Machine Expert - Safety User Guide.



## Creating a Memory Key Backup

The procedure described in Copying to a Memory Key (*see page 30*) can also be used to create a memory key backup by using a second memory key with an identical safety-related application. After executing the procedures, two identical memory keys are available.

## Formatting the Memory Key

The following procedure allows you to format the memory key. Only use this procedure if your firmware update was not successful or the memory has a detected error.

A formatting of the memory key deletes the current memory key data, including your password.

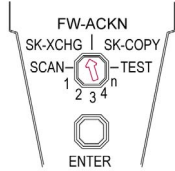
### NOTICE

#### LOSS OF MEMORY KEY DATA

- Create a memory key backup before formatting the memory key.
- Connect to the EcoStruxure Machine Expert - Safety software to assign a new password.

**Failure to follow these instructions can result in equipment damage.**

To format the memory key, proceed as follows:

Step	Action	Comment / Result
1	Ensure that the Safety Logic Controller is stopped.	-
2	Move the selection switch to the unlabeled position between <b>SK-XCHG</b> and <b>FW-ACKN</b> .	
3	Press the confirmation button for a minimum of 20 to 30 s to receive a confirmation.	<p>After 20 s, the <b>ENTER</b> LED illuminates.</p> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• When you have released the confirmation button, the <b>ENTER</b> LED remains illuminated for another second.</li> <li>• When you press the confirmation button for less than 20 s, it has no effect.</li> <li>• When you press the confirmation button for longer than 30 s, the <b>ENTER</b> LED flashes for 5 s to display a detected error.</li> </ul> <p><b>Result:</b> The LED will indicate that there is no valid application on the key</p>

Step	Action	Comment / Result
4	Follow the procedures necessary to add a valid application to the key.	-

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# Chapter 3

## Operating and Connection Elements

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### Information

This chapter provides information on operating and connection elements, as well as the LED indicators of the Safety Logic Controller.

### What Is in This Chapter?

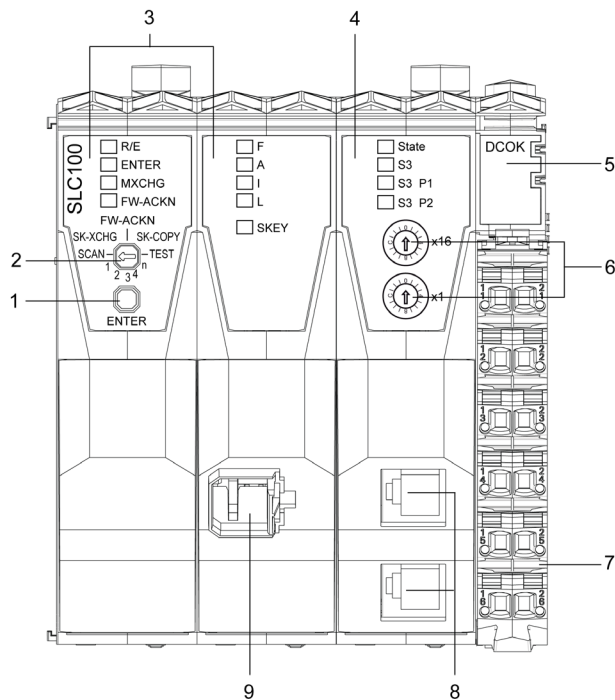
This chapter contains the following topics:

Topic	Page
Safety Logic Controller Description	36
Logic Processor LED Indicators	38
Logic Processor Selection Switch and Confirmation Button	42
Safety Terminal Block Presentation	44
Integrated Power Supply	47
Sercos III Interface	49

## Safety Logic Controller Description

### Description

The LED indicators, buttons and switches are integrated to operate the Safety Logic Controller. The following figure presents the operating and connection elements:



N°	Description	Refer to
1	Confirmation button	Confirming a Function ( <a href="#">see page 43</a> )
2	Selection switch	Description of the Selection Switch Functions ( <a href="#">see page 42</a> )
3	Logic processor	Logic Processor LED indicators ( <a href="#">see page 38</a> )
4	Sercos III interface	Sercos III interface ( <a href="#">see page 49</a> )
5	Integrated power supply	Integrated Power Supply ( <a href="#">see page 47</a> )
6	Sercos address switches	Sercos Address ( <a href="#">see page 51</a> )
7	Terminal block for Safety Logic Controller power supply	Safety-Related Terminal Block Presentation ( <a href="#">see page 44</a> )

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N°	Description	Refer to
8	Sercos III connection with 2 x RJ45	Sercos III RJ45 Ports ( <i>see page 52</i> )
9	Memory key slot / slot cover	Safety Logic Controller Memory Key ( <i>see page 28</i> )

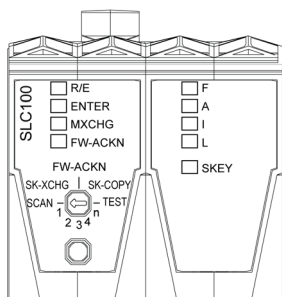
These components enable you to perform the following operations:

- module replacement
- firmware update
- memory key replacement, including a possible transfer of module configuration from the previous memory key
- support for the replacement of Safety Logic Controller







## Logic Processor LED Indicators

### Description of the LED Indicators for the Logic Processor

The figure and table present the LED indicators for the logic processor of the TM5CSLC100FS and TM5CSLC200FS:



LED indicator	LED color	LED status	Description	Instructions / information for the user
R/E	N/A	off	Boot phase	-
	green	on	Application found and executed	
		flashing	Application exists but is not being processed	
	orange	on	EcoStruxure Machine Expert - Safety software is in RUN (Debug) state	
		flashing	EcoStruxure Machine Expert - Safety software is in STOP (Debug) state or HALT (Debug) state, application stopped	
		fast flashing	No application found on the memory key	
ENTER <sup>(1)</sup>	green	on	Waiting for confirmation	-
		1x flash every 0.8 s	Confirmation of correct entry	
		flashes (1 Hz) for 5 s	Operator error detected	
<p>(1) When a module scan is being executed, the <b>ENTER</b>, <b>MXCHG</b>, and <b>FW-ACKN</b> LED indicators are flashing.</p> <p>(2) When the controller is in error state, the states of the other LED indicators (<b>R/E</b>, <b>ENTER</b>, <b>MXCHG</b>, and <b>FW-ACKN</b>) are not updated.</p>				

LED indicator	LED color	LED status	Description	Instructions / information for the user
MXCHG <sup>(1)</sup>	orange	off	Valid module configuration	-
			Replacement of one module detected	Select the position <b>1</b> on the selection switch and press the confirmation button <b>ENTER</b> .
			Replacement of two modules detected	Select the position <b>2</b> on the selection switch and press the confirmation button <b>ENTER</b> .
			Replacement of three modules detected	Select the position <b>3</b> on the selection switch and press the confirmation button <b>ENTER</b> .
			Replacement of four modules detected	Select the position <b>4</b> on the selection switch and press the confirmation button <b>ENTER</b> .
			Replacement of more than four modules detected	Select the position <b>n</b> on the selection switch and press the confirmation button <b>ENTER</b> .
			Missing module detected	-
FW-ACKN <sup>(1)</sup>	orange	off	Valid firmware configuration	-
		flashing	Firmware update successful	Select the position <b>FW-ACKN</b> on the selection switch and press the confirmation button <b>ENTER</b> .
		on	Memory key was exchanged	Select the position <b>SK-XCHG</b> on the selection switch and press the confirmation button <b>ENTER</b> .
<p>(1) When a module scan is being executed, the <b>ENTER</b>, <b>MXCHG</b>, and <b>FW-ACKN</b> LED indicators are flashing.</p> <p>(2) When the controller is in error state, the states of the other LED indicators (<b>R/E</b>, <b>ENTER</b>, <b>MXCHG</b>, and <b>FW-ACKN</b>) are not updated.</p>				

LED indicator	LED color	LED status				Description	Instructions / information for the user
		F	A	I	L		
F A I L	red					These four LEDs indicate first the boot status, then, when the system is running, the general state of the controller.	-
		x	-	x	x	<ul style="list-style-type: none"> <li>● Boot phase</li> <li>● Loading of the firmware</li> <li>● Memory key is missing</li> <li>● Project CRC (Cyclic Redundancy Check) is wrong or not defined</li> <li>● Safety Logic Controller cycle time is exceeded</li> </ul>	If the LED status persists: <ul style="list-style-type: none"> <li>● Refer to the Safe logger for additional diagnostic information on the error.</li> <li>● Verify if the memory key is plugged correctly.</li> <li>● Re-download the corresponding project, and verify the project CRC.</li> <li>● Verify the cycle time and increase it if necessary.</li> </ul>
		x	x	x	x	Hardware test (max. approx. 5 s)	-
		x	X	x	X	Initialization and start-up of the firmware	
		-	-	-	X	Pre-operational state	
		-	-	-	-	Operational state	
		x	x	x	x	Controller in error state <sup>(2)</sup>	
		x = illuminated X= brightly illuminated - = off				alternating flashing of FI and AL	
SKEY	orange	off				No access to the memory key	-
		flashing				Access to the memory key	

(1) When a module scan is being executed, the **ENTER**, **MXCHG**, and **FW-ACKN** LED indicators are flashing.  
 (2) When the controller is in error state, the states of the other LED indicators (**R/E**, **ENTER**, **MXCHG**, and **FW-ACKN**) are not updated.

### Testing the LED Indicators for the Logic Processor

Follow this procedure to test the LED indicators:

Step	Action
1	Position the selection switch to <b>TEST</b> .



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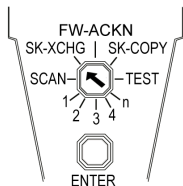
Step	Action
2	Press the confirmation button. <b>Result:</b> All LED indicators on the logic processor illuminates for as long as you press the confirmation button.

## Logic Processor Selection Switch and Confirmation Button

### Overview

Whenever you make a change in the configuration (module or memory key replacement, or firmware update), you need to acknowledge the change on the Safety Logic Controller using the selection switch and the confirmation button.

The following figure presents the selection switch and the confirmation button:



### Description of the Selection Switch Functions

The following table describes the selectable functions:

Selection switch position	Function	Description
FW-ACKN	Firmware update	To acknowledge the firmware update on one or more modules <sup>(1)</sup>
SK-XCHG	Memory key replacement <i>(see page 30)</i>	To confirm the memory key replacement <sup>(1)</sup>
SK-COPY	Memory key copy <i>(see page 30)</i>	To copy of the configuration data from the memory key <sup>(1)</sup>
SCAN	Scan	To perform a module scan
TEST	Test <i>(see page 40)</i>	To perform a LED indicator test
1, 2, 3, 4, n	Module(s) replacement	To confirm the replacement of 1, 2, 3, 4 or more than 4 module(s)
<b>(1)</b> Triggers an automatic restart.		

## Confirming a Function

To confirm a configuration change, proceed as follows:

Step	Action
1	Select the desired function by means of the selection switch. <b>NOTE:</b> If you do not place the selection switch properly, the LED <b>ENTER</b> flashes for 5 s to display a detected error. <b>Example:</b> To replace one specific module, place the selection switch on <b>1</b> . If the selection switch is not set to <b>1</b> when only one module was replaced, an error is detected and the LED <b>ENTER</b> flashes for 5 s.
2	Press the confirmation button for 0.5 to 5 s to receive a confirmation. <b>Result:</b> After 0.5 s, the LED <b>ENTER</b> is illuminated.
3	Release the confirmation button. <b>Result:</b> The LED <b>ENTER</b> remains illuminated for additional 0.8 s.
<b>NOTE:</b> If you release the confirmation button before 0.5 s, it has no effect. If you press the confirmation button longer than 5 s, the LED <b>ENTER</b> flashes for 5 s to display a detected error.	

## Safety Terminal Block Presentation

### TM5ACTB52FS Features

The safety-related modules and the Safety Logic Controllers are wired by means of the TM5ACTB52FS Safety terminal block:

Features	
Type of terminal block	12-pin, safety coded terminal block
Features	<ul style="list-style-type: none"> <li>● tool-free wiring with push-in technology</li> <li>● simple wire release using lever</li> <li>● allows labeling of each terminal</li> <li>● allows plain text labeling</li> <li>● test access for standard probes</li> <li>● potential for customer coding</li> </ul>

### Ordering Information

The following figure presents the TM5ACTB52FS Safety terminal block:



The following table presents the reference for the Safety terminal block:

Reference	Description	Color
TM5ACTB52FS	24 Vdc / 230 Vac, 12-pin terminal block for safety-related modules and Safety Logic Controllers, safety coded	red

** DANGER****INCOMPATIBLE COMPONENTS CAUSE ELECTRIC SHOCK OR ARC FLASH**

- Do not associate components of a slice that have different colors.
- Verify that correct terminal blocks (minimally, matching colors and correct number of terminals) are installed on the appropriate electronic modules.

**Failure to follow these instructions will result in death or serious injury.**

**Characteristics**

This section describes the characteristics of the TM5ACTB52FS Safety terminal block, you can also refer to TM5 Environmental Characteristics (*see Modicon TM5/TM7, I/O Safety Modules, Hardware Guide*).

** DANGER****FIRE HAZARD**

- Use only the correct wire sizes for the maximum current capacity of the I/O channels and power supplies.
- For relay output (2 A) wiring, use conductors of at least 0.5 mm<sup>2</sup> (AWG 20) with a temperature rating of at least 80 °C (176 °F).
- For common conductors of relay output wiring (4 A), or relay output wiring greater than 2 A, use conductors of at least 1.0 mm<sup>2</sup> (AWG 16) with a temperature rating of at least 80 °C (176 °F).

**Failure to follow these instructions will result in death or serious injury.**

** WARNING****UNINTENDED EQUIPMENT OPERATION**

Do not connect wires to unused terminals and/or terminals indicated as “No Connection (N.C.)”.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

** WARNING****UNINTENDED EQUIPMENT OPERATION**

Do not exceed any of the rated values specified in the characteristics tables.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The following table lists the characteristics of the TM5ACTB52FS:

Characteristics		
Type of terminal block		Push-in terminal block
Distance between contacts	left - right	4.2 mm / 0.16 in
	above - below	10.96 mm / 0.43 in
Contact resistance		≤ 5 mΩ
Maximum current carrying capacity of the connector		10 A / contact <b>NOTE:</b> The electrical characteristics of the individual modules must be respected.
Connection cross section	solid wire	0.08 mm <sup>2</sup> ... 2.5 mm <sup>2</sup> / AWG 28 ... 14
	multi-wire	0.25 mm <sup>2</sup> ... 2.5 mm <sup>2</sup> / AWG 24 ... 14
	with wire cable ends	0.25 mm <sup>2</sup> ... 1.5 mm <sup>2</sup> / AWG 24 ... 16
	-	Up to 2x 0.75 mm <sup>2</sup> (AWG 2 x 24 ... 2 x 18) with double wire cable ends
Cable type		Copper wires only

**  DANGER**

**LOOSE WIRING CAUSES ELECTRIC SHOCK**

Do not insert more than one wire per connector of the spring terminal blocks unless using a double wire cable end (ferrule).

**Failure to follow these instructions will result in death or serious injury.**

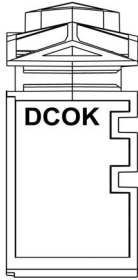
## Integrated Power Supply

### Presentation

A power supply is integrated in the Safety Logic Controller TM5CSLC100FS and TM5CSLC200FS.

### LED indicators

The following figure presents the status LED indicators for integrated power supply:



The following table describes the LED status for the integrated power supply:

LED indicator	LED color	LED status	State description
DCOK	green	on	Power applied to the controller
		off	No power applied to the controller

### Wiring Diagram

#### **⚠ DANGER**

##### **FIRE HAZARD**

Use only the correct wire sizes for the maximum current capacity of the power supplies.

**Failure to follow these instructions will result in death or serious injury.**

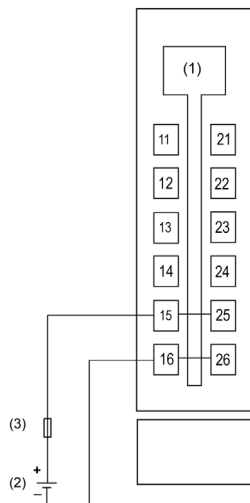
#### **⚠ DANGER**

##### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OVERHEATING AND FIRE**

- Do not connect the modules directly to line voltage.
- Use only isolating PELV systems according to IEC 61140 to supply power to the modules.
- Connect the 0 Vdc of the external power supplies to FE (Functional Earth/ground).

**Failure to follow these instructions will result in death or serious injury.**

The following figure presents the wiring diagram of the power supply for the Safety Logic Controller:



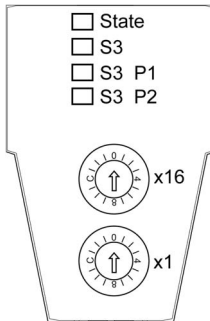
- 1 Internal electronics
- 2 PS1: External isolated power supply 24 Vdc (-15% / +20%)
- 3 External fuse, Type T slow-blow, 1 A, 250 V



## Sercos III Interface

### LED Indicators for the Sercos III Interface

The following figure presents the LED indicators for the Sercos III interface of the TM5CSLC100FS and TM5CSLC200FS:



The following LED indicators are provided:

- **State**
- **S3**
- **S3 P1**
- **S3 P2**

### State LED Indicator

The **State** LED is a green (status) / red (error) dual LED indicator:

The following table describes the **State** LED indicator:

LED color	LED status	State description
-	off	No supply voltage applied or device is inoperable.
green	on	No detected error, bus interface is initialized and ready for operation.
green	flashing (12.5 Hz)	Initialization phase (booting of the I/O modules or setting up the I/O functional groups).
green	flashing (4 Hz)	Recoverable error detected, such as missing I/O module (this LED indicator is reset when the error state is corrected).
green	flashing (0.66 Hz)	New or modified configuration data (I/O modules or bus interface) have been received but not yet stored in the flash memory.
red	flashing (8 Hz)	Unrecoverable error detected (for example, lack of resources, error detected in the firmware data flow).

**NOTE:** After applying power to the bus interface, several red flashing signals are displayed. These signals are not error indications, but indication of the initialization process.

**NOTE:** If the firmware update is unsuccessful (corrupted file, interruption of the update, etc.), the bus interface restarts with the previous version of the firmware.

### S3 (Sercos III) LED Indicator

The following table describes the **S3** LED indicator:

LED color	LED status	State description	Instructions
-	off	Power is removed or there is no communication due to a connection interruption.	Apply power or verify physical connections
green	on	Active Sercos III connection without a detected error in the Communication Phase 4 (CP4).	n.a.
green	flashing (4 Hz, 125 ms)	The device is in Loopback mode. Loopback describes the situation in which the Sercos III telegrams have to be sent back on the same port on which they were received. Possible causes: <ul style="list-style-type: none"> <li>● line topology</li> <li>● Sercos III ring break</li> </ul>	Close the ring.
red	on	Sercos III diagnostic class error has been detected on port 1 and/or Sercos III communication is no longer possible on the ports (for example due to an encoder error).	Reset condition <ul style="list-style-type: none"> <li>● clear the detected device errors</li> <li>● acknowledge the detected error in the menu</li> <li>● switch from CP2 to CP3 alternatively.</li> </ul> <b>NOTE:</b> Diagnostic messages pending in the system are not acknowledged by this.
red/green	flashing (4 Hz, 125 ms)	Detected communication error. Possible causes: <ul style="list-style-type: none"> <li>● improper functioning of the telegram</li> <li>● detected CRC (Cyclic Redundancy Check) error</li> </ul>	Reset condition <ul style="list-style-type: none"> <li>● The configuration indicates the detected error</li> <li>● acknowledge the detected error.</li> <li>● switch from CP2 to CP3 alternatively.</li> </ul> <b>NOTE:</b> Diagnostic messages pending in the system are not acknowledged by this.
<b>(1)</b> IdentifyDevice is a parameter in EcoStruxure Machine Expert.			

LED color	LED status	State description	Instructions
orange	on	The device is in a communication phase CP0 up to and including CP3. Sercos III telegrams are received.	n.a.
orange	flashing (4 Hz, 125 ms)	Device identification	Triggered by using the parameter <code>IdentifyDevice</code> <sup>(1)</sup> or the DriveAssistant tool.
<b>(1)</b> <code>IdentifyDevice</code> is a parameter in EcoStruxure Machine Expert.			

### S3 P1/S3 P2 LED Indicators

The following table describes the **S3 P1** (Port 1) and **S3 P2** (Port 2) LED indicators:

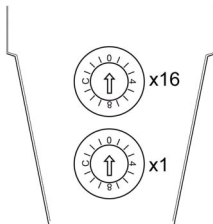
LED color	LED status	State description
-	off	no cable connected
green	flashing	active Sercos III communication
green	on	link, but no telegrams / communication (for example controller is booting)

### Sercos Address

The Sercos address is set by two switches. Positioning the switches at 0 triggers the auto-addressing feature.

**NOTE:** Only Sercos addresses between 1 and 255 are allowed.

The following figure presents the Sercos address switches:



**NOTE:** The Sercos address is in hexadecimal notation. Set the address (1...255 dec) manually by the two Sercos address switches.

The following table describes the Sercos address, set with the 2 hexadecimal switches:

Sercos address	Description
0 dec (0 hex)	<p>Auto-addressing (not a valid address)</p> <ul style="list-style-type: none"> <li>For PacDrive LMC controllers, the setting 0 is recognized when the value <code>SerialNumberController</code> or <code>TopologyAddress</code> or <code>ApplicationType</code> is selected for the parameter <code>IdentificationMode</code><sup>(1)</sup>.</li> <li>For Modicon TM262M• controllers, the setting 0 is recognized, when the value <code>Topology mode</code> is selected for the parameter <code>IdentificationMode</code><sup>(1)</sup>.</li> </ul>
1-255 dec (1-FF hex)	<p>Manual addressing</p> <ul style="list-style-type: none"> <li>For PacDrive LMC controllers, this setting is recognized when the value <code>SercosAddress</code> is selected for the parameter <code>IdentificationMode</code><sup>(1)</sup>.</li> <li>For Modicon TM262M• controllers, this setting is recognized when the value <code>Sercos mode</code> is selected for the parameter <code>IdentificationMode</code><sup>(1)</sup>.</li> </ul>
<p><b>(1)</b> <code>IdentificationMode</code> is a parameter in EcoStruxure Machine Expert.</p>	

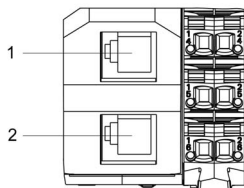
**Example:**

In order to set the Sercos address 190 (dec) / BE (hex), set the two hexadecimal switches as follows:

- Switch x1 = E
- Switch x16 = B

**Sercos III Ports**

The following figure presents the RJ45 connectors of the Safety Logic Controller:



- 1** Sercos III PORT A (**P1**)
- 2** Sercos III PORT B (**P2**)

The following table lists the pin assignments for the RJ45 connectors:

Pin	Assignment
1	RXD (Receive Data)
2	RXD\
3	TXD (Transmit Data)
4	Termination
5	Termination
6	TXD\
7	Termination
8	Termination

For more information about the Sercos III ports, refer to Fieldbus Characteristics ([see page 26](#)).





## B

### bus base

A bus base is a mounting device that is designed to seat an electronic module on a DIN rail and connect it to the TM5 bus for Safe Logic Controllers. Each bus base extends the TM5 data and the power buses and the 24 Vdc I/O power segment. The electronic modules are added to the TM5 system through their insertion on the base bus. The bus base also supplies the articulation point for the terminal blocks.

## D

### DC

diagnostic coverage

Fractional decrease in the probability of dangerous hardware failures resulting from the operation of the automatic diagnostic tests

(definition IEC 61508)

The fraction of the possible dangerous failures  $\lambda_D$  is divided into failures which are detected by diagnostics and failures which remain undetected.

$$\lambda_D = \lambda_{DD} + \lambda_{DU}$$

The diagnostic coverage (DC) defines the fraction of the dangerous failures which are detected.

$$\lambda_{DD} = \lambda_D \cdot DC$$

$$\lambda_{DU} = \lambda_D \cdot (1-DC)$$

The definition may also be represented in terms of the following equation, where DC is the diagnostic coverage,  $\lambda_{DD}$  is the probability of detected dangerous failures and  $\lambda_D$  total is the probability of total dangerous failures:

$$DC = \frac{\sum \lambda_{DD}}{\sum \lambda_{Dtotal}}$$

## M

### MTTFd

mean time to failure - dangerous

## P

### PFD

probability of failure on demand  
(definition IEC 61508)

For a single channel system the average probability of a failure on demand is calculated as follows:

$$PFD(t)_{AV} = \frac{1}{2} \lambda_{DU} \cdot t$$

For a dual channel system the average probability of a failure on demand is calculated as follows:

$$PFD(t)_{AV} = \lambda_{DUCH1} \cdot \lambda_{DUCH2} \cdot t^2 + CC$$

For a dual channel system, also the Common Cause effect (CC) must be considered. The common cause effect ranges from 1% to 10% of  $PFD_{CH1}$  and  $PFD_{CH2}$  ( $=1/RRF$ ).

### PFH

probability of dangerous failure per hour  
(definition IEC 61508)

### PT

proof test interval

## S

### SFF

safe failure fraction





## C

certification

TM5ACBM3FS, 44

characteristics

TM5ACBM3FS, 44

TM5CSLC100FS, 25

TM5CSLC200FS, 25

confirmation button

TM5CSLC100FS, 42

TM5CSLC200FS, 42

connection elements

TM5CSLC200FS, 36

connection elements

TM5CSLC100FS, 36

## I

IEC 61508

defined safe state, 14

Emergency Shutdown (ESD), 14

ESD (Emergency Shutdown), 14

Safety Integrity Level (SIL), 14

SIL (Safety Integrity Level), 14

IEC61508

functional safety, 14

integrated power supply

TM5CSLC100FS, 47

TM5CSLC200FS, 47

intended use, 6

## L

LED

TM5CSLC100FS, 38

LED indicators

TM5CSLC100FS, 23

TM5CSLC200FS, 23, 38

## M

memory key

TM5ACSLCM2FS, 23

TM5ACSLCM8FS, 23

memory key

TM5ACSLCM2FS, 28

TM5ACSLCM8FS, 28

## O

operating conditions

TM5ACBM3FS, 44

operating elements

TM5CSLC200FS, 36

operating elements

TM5CSLC100FS, 36

ordering information

TM5CSLC100FS, 23

TM5CSLC200FS, 23

## P

PFD (probability of failure on demand), 17

PFH (probability of failure per hour), 17

power consumption

TM5ACBM3FS, 44

probability of failure on demand (PFD), 17

probability of failure per hour (PFH), 17

## Q

qualification of personnel, 6

## S

selection switch

TM5CSLC200FS, 42

selection switch

TM5CSLC100FS, 42

Sercos III interface  
    TM5CSLC200FS, *49*  
Sercos III interface switch  
    TM5CSLC100FS, *49*  
storage conditions  
    TM5ACBM3FS, *44*

## T

TM5ACTB52FS, *23*  
    safety terminal block, *44*  
transport conditions  
    TM5ACBM3FS, *44*