ABB INDUSTRIAL DRIVES

FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) for ACS880 drives
User's manual
FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) for ACS880 drives

User's manual

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Further information
Safety instructions

Contents of this chapter

This chapter contains the safety instructions which you must obey when you install, operate and do maintenance on the safety functions of a drive.

Use of warnings and notes

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

WARNING!
Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.
**WARNING!**
General warning tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.

**WARNING!**
Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.

**ATEX-certified motor thermal protection functions**

Only qualified specialists are permitted to install, control and maintain the ATEX-certified motor thermal protection functions (see EN/IEC 60079-14). Obey all safety regulations required with application of Ex motors in Zone 1/21 (equipment category 2) or Zone 2/22 (equipment category 2 or 3).

**WARNING!**
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

This manual does not contain the complete safety instructions of the drive. It only includes the instructions related to the scope of this manual. The general instructions are given in this section and the option-specific instructions in the applicable chapter.

In addition to this manual:

- For ACS880 single drives, see the drive hardware manual
- For ACS880 air-cooled multidrives, multidrive modules and single drive modules, see *ACS880 multidrive cabinets and modules safety instructions* (3AUA0000102301 [English])
• For ACS880 liquid-cooled multidrives, multidrive modules and single drive modules, see ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]).

---

**WARNING!**

The functions described in this manual do not disconnect the voltage of the main and auxiliary circuits from the drive. Do not do work on the drive, motor cable or motor when they are energized. Before you start the work, do the steps in section *Electrical safety precautions (page 12).*

---

**WARNING!**

If a short-circuit occurs in the output stage of the drive, the STO function does not prevent the intermediate DC current from flowing through and heating up the motor. The system integrator must take this into account when planning the protection of the installation.
Electrical safety precautions

These electrical safety precautions are for all personnel who do work on the drive, motor cable or motor.

---

**WARNING!**

Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

Go through these steps before you begin any installation or maintenance work.

---

1. Clearly identify the work location and equipment.
2. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if present.
   - Open the disconnector of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
   - Close the grounding switch or switches ([Q9], option +F259) if present. Do not use excessive force as the switch has electromagnetic interlocking.
   - If the drive is equipped with a DC/DC converter unit (optional): Open the DC switch-disconnector ([Q11], option +F286) of the DC/DC converter. Open the disconnecting device of the energy storage connected to the DC/DC converter unit (outside the drive cabinet).
   - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - In the liquid cooling unit (if present), open the motor protective circuit breaker(s) of the cooling pumps.
• If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
• Disconnect any dangerous external voltages from the control circuits.
• After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.

3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
   • Use a multimeter with an impedance greater than 1 Mohm.
   • Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
   • Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.
   • Make sure that the voltage between the drive DC busbars (+ and -) and the grounding (PE) busbar is close to 0 V.
   • Make sure that the voltage between the drive DC terminals (R+/UDC+ and UDC-) and the grounding terminal (PE) is close to 0 V.

---

**WARNING!**
The busbars inside the cabinet of liquid-cooled drives are partially coated. Measurements made through the coating are potentially unreliable, so only measure at uncoated portions. Note that the coating does not constitute a safe or touch-proof insulation.
6. If the drive is not equipped with a grounding switch, install temporary grounding as required by the local regulations.
7. Ask the person in control of the electrical installation work for a permit to work.
Introduction to the manual

Contents of this chapter

This chapter gives basic information on the manual.

Applicability

This manual is applicable to the FPTC-02 module and to the Safe motor temperature safety (SMT) function which uses the FPTC-02 module (option +L537+Q971).

Compatibility

The FPTC-02 module is compatible with:

- ACS880-01/11/31 drives
- ACS880-04/04XT/04F/04FXT/M04/14/34 drive modules
- ACS880-104/104LC inverter modules
- ACS880-07/17/37 and ACS880-17LC/37LC cabinet-built single drives
- ACS880-107/107LC inverter units
- FSO-12 and FSO-21 safety functions modules
16 Introduction to the manual

- ACS880 primary control program version 2.10 or later. For the compatibility of other control programs, contact your local ABB representative.

Target audience

The manual is intended for people who install, start-up, use and service the ATEX-certified thermistor protection module of the drive. Read the manual before working on the drive. You are expected to know the fundamentals of electricity, wiring, electrical components, electrical schematic symbols and ATEX/Ex regulations.

Exclusion of liability

ABB is not responsible for the implementation, verification and validation of the overall safety system. It is the responsibility of the system integrator (or other party) who is responsible for the overall system and system safety.

The system integrator (or other responsible party) must make sure that the entire implementation complies with the instructions in this manual, all relevant standards, directives and local electrical code, and that the system is tested, verified and validated correctly.

Related manuals

<table>
<thead>
<tr>
<th>Name</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Drive hardware</td>
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<tr>
<td>ACS880-01 hardware manual</td>
<td>3AUA0000078093</td>
</tr>
<tr>
<td>ACS880-04 drive module packages hardware manual</td>
<td>3AUA0000138495</td>
</tr>
<tr>
<td>ACS880-11 hardware manual</td>
<td>3AXD50000045932</td>
</tr>
<tr>
<td>ACS880-31 hardware manual</td>
<td>3AXD50000045933</td>
</tr>
<tr>
<td>ACS880-14 and -34 single drive module packages hardware manual</td>
<td>3AXD50000022021</td>
</tr>
<tr>
<td>ACS880-04F drive modules hardware manual</td>
<td>3AXD50000034664</td>
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<tr>
<td>ACS880-07 drives (45 to 710 kW) hardware manual</td>
<td>3AUA0000105718</td>
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<td>ACS880-07 drives (560 to 2800 kW) hardware manual</td>
<td>3AUA0000143261</td>
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<tr>
<td>ACS880-17 drives (160 to 3200 kW) hardware manual</td>
<td>3AXD50000020436</td>
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<td>ACS880-17 drives (45 to 400 kW, 60 to 450 hp) hardware manual</td>
<td>3AXD50000035158</td>
</tr>
<tr>
<td>ACS880-17LC drives hardware manual</td>
<td>3AXD50000250295</td>
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<tr>
<td>ACS880-37 drives (160 to 3200 kW) hardware manual</td>
<td>3AXD50000020437</td>
</tr>
<tr>
<td>ACS880-37 drives (45...400 kW, 60...450 hp) hardware manual</td>
<td>3AXD50000035159</td>
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<tr>
<td>ACS880-37LC drives hardware manual</td>
<td>3AXD50000251407</td>
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<td><strong>Inverter hardware</strong></td>
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<td>ACS880-104 inverter modules hardware manual</td>
<td>3AUA0000104271</td>
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<td>ACS880-104LC inverter modules hardware manual</td>
<td>3AXD50000045610</td>
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<td>ACS880-107 inverter units hardware manual</td>
<td>3AUA0000102519</td>
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<tr>
<td>ACS880-107LC inverter units hardware manual</td>
<td>3AXD50000196111</td>
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<td><strong>Drive firmware</strong></td>
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<td>ACS880 primary control program firmware manual</td>
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<td><strong>PC tools</strong></td>
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<td>Drive composer start-up and maintenance PC tool user’s manual</td>
<td>3AUA0000094606</td>
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<td><strong>Safety</strong></td>
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<td>Functional safety; Technical guide No. 10</td>
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<td>Safety and functional safety; A general guide</td>
<td>1SFC001000B0201</td>
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<td>ABB Safety information and solutions</td>
<td><a href="http://www.abb.com/safety">www.abb.com/safety</a></td>
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<td>Motors and drives in potentially explosive atmospheres - What you need to know</td>
<td>3AUA0000037223</td>
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<td><strong>Option manuals</strong></td>
<td></td>
</tr>
<tr>
<td>ACS-AP-x assistant control panels user’s manual</td>
<td>3AUA0000085685</td>
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<tr>
<td>FSO-12 safety functions module user’s manual</td>
<td>3AXD5000015612</td>
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<td>FSO-21 safety functions module user’s manual</td>
<td>3AXD5000015614</td>
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<tr>
<td>FSE-31 pulse encoder interface module user’s manual</td>
<td>3AXD5000016597</td>
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<tr>
<td>FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537 +Q971) user’s manual</td>
<td>3AXD50000027782</td>
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### Terms and abbreviations

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<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>ATEX</td>
<td>Directives 2014/34/EU and 1999/92/EC are commonly referred to as the ATEX directives (from &quot;Atmosphères Explosibles&quot;)</td>
</tr>
<tr>
<td>Cat.</td>
<td>Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behavior in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability. The categories are: B, 1, 2, 3 and 4. (EN ISO 13849-1)</td>
</tr>
<tr>
<td>CCF</td>
<td>Common cause failure (%) (EN ISO 13849-1)</td>
</tr>
<tr>
<td>DC</td>
<td>Diagnostic coverage (EN ISO 13849-1)</td>
</tr>
<tr>
<td>DI</td>
<td>Digital input</td>
</tr>
<tr>
<td>DTC</td>
<td>Direct torque control, a motor control method</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>Ex</td>
<td>An IEC term used in the context of explosive atmospheres (IEC 60079)</td>
</tr>
<tr>
<td>Ex d</td>
<td>Type of protection, flameproof enclosures (EN/IEC 60079-1)</td>
</tr>
<tr>
<td>Ex eb, Ex ec</td>
<td>Types of protection, increased safety (EN/IEC 60079-7)</td>
</tr>
<tr>
<td>Ex motors</td>
<td>Motors used in explosive atmospheres</td>
</tr>
<tr>
<td>FEA-03</td>
<td>Optional I/O extension adapter</td>
</tr>
<tr>
<td>FPTC-02</td>
<td>Optional ATEX-certified thermistor protection module for potentially explosive atmospheres</td>
</tr>
<tr>
<td>FSE-31</td>
<td>Optional pulse encoder interface module for safety encoder</td>
</tr>
<tr>
<td>FSO-21</td>
<td>Safety functions module which supports the FSE-31 module and the use of safety encoders</td>
</tr>
<tr>
<td>FSO-12</td>
<td>Safety functions module which does not support the use of encoders</td>
</tr>
<tr>
<td>HFT</td>
<td>Hardware fault tolerance (IEC 61508)</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MTTF_D</td>
<td>Mean time to dangerous failure: (Total number of life units) / (Number of dangerous, undetected failures) during a particular measurement interval under stated conditions (EN ISO 13849-1)</td>
</tr>
<tr>
<td>PFD_avg</td>
<td>Average probability of dangerous failure on demand (IEC 61508)</td>
</tr>
<tr>
<td>PFH</td>
<td>Average frequency of dangerous failures per hour (IEC 61508)</td>
</tr>
<tr>
<td>PL</td>
<td>Performance level. Levels a...e correspond to SIL (EN ISO 13849-1)</td>
</tr>
<tr>
<td>SAR</td>
<td>Safe acceleration range</td>
</tr>
<tr>
<td>SBC</td>
<td>Safe brake control</td>
</tr>
<tr>
<td>SC</td>
<td>Systematic capability (IEC 61508)</td>
</tr>
<tr>
<td>SFF</td>
<td>Safe failure fraction (%) (IEC 61508)</td>
</tr>
<tr>
<td>SIL</td>
<td>Safety integrity level (1...3) (IEC 61508)</td>
</tr>
<tr>
<td>SILCL</td>
<td>Maximum SIL (level 1...3) that can be claimed for a safety function or subsystem (IEC/EN 62061)</td>
</tr>
<tr>
<td>SMT</td>
<td>Safe motor temperature (EN/IEC 61800-5-2)</td>
</tr>
<tr>
<td>SS1</td>
<td>Safe stop 1 (IEC/EN 61800-5-2)</td>
</tr>
<tr>
<td>SSE</td>
<td>Safe stop emergency</td>
</tr>
<tr>
<td>STO</td>
<td>Safe torque off (IEC/EN 61800-5-2)</td>
</tr>
<tr>
<td>Stop category</td>
<td>There are three categories of stop functions:</td>
</tr>
<tr>
<td></td>
<td>• stop category 0: an uncontrolled stop where power to the machine actuators is removed immediately (STO)</td>
</tr>
<tr>
<td></td>
<td>• stop category 1: a controlled stop where the machine actuators have power for stopping, after which the power is removed (SS1)</td>
</tr>
<tr>
<td></td>
<td>• stop category 2: a controlled stop where the machine actuators continue to have power (SS2)</td>
</tr>
<tr>
<td>T_1</td>
<td>Proof test interval. Defines the probabilistic failure rate (PFH or PFD_avg) for the safety function or subsystem. Performing a proof test at a maximum interval of T_1 is required to keep the SIL capability valid. The same interval must be followed to keep the PL capability (EN ISO 13849) valid. Note that any T_1 values given cannot be regarded as a guarantee or warranty.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_M$</td>
<td>Mission time: the period of time covering the intended use of the safety function/device. After the mission time elapses, the safety device must be replaced. Note that any $T_M$ values given cannot be regarded as a guarantee or warranty. (EN ISO 13849-1)</td>
</tr>
<tr>
<td>Zone</td>
<td>Potentially explosive atmosphere. Hazardous areas are divided into zones, based on the frequency and duration of the occurrence of an explosive atmosphere. (EN/IEC 60079)</td>
</tr>
</tbody>
</table>
Hardware description

Contents of this chapter

This chapter gives a short description of the module.

Product overview

- General

The FPTC-02 module implements the Safe motor temperature (SMT) safety function as defined in EN/IEC 61800-5-2.

The FPTC-02 module is Type Examined as a protective device within the scope of the European ATEX Product Directive. This allows the use of the module in temperature protection of motors in explosive atmospheres (Ex motors).

Inside the module, there is reinforced insulation between the motor thermistor connection and the other terminals of the module. The insulation forms a reliable protective separation between the motor main circuit and the drive control circuits. Thus, the drive control
board is PELV compatible also when the FPTC-02 module and a thermistor protection circuit are installed.

### Operation basics

The module includes two PTC sensor inputs:

- **XFLT** activates the ATEX-certified SIL/PL capable SMT safety function by activating the drive Safe torque off (STO) function. This input is a safety-related input and can be used for protection function purposes.
- **XWRN** generates a warning to the drive. This is not a safety-related input and can only be used for indication purposes.

#### XFLT input (Fault)

When the motor temperature increases to the PTC sensor temperature limit, the sensor resistance increases sharply. This indicates overtemperature to the FPTC-02 module. The FPTC-02 module then activates the SMT function by opening the drive Safe torque off (STO) circuit. This activates the drive STO function.

The STO function disables the control voltage of the power semiconductors of the drive output stage. This prevents the drive from generating the torque required to rotate the motor. If the motor is running when the STO function is activated, it coasts to a stop.

To disable the SMT function, connect a resistor (100 ohm ... 1 kohm 1/4 W wire-wound) to the XFLT input instead of a PTC sensor.

#### XWRN input (Warning)

When the motor temperature increases to the PTC sensor temperature limit, the sensor resistance increases sharply. The FPTC-02 module sends a warning indication to the drive.

For the resistance limits and other technical details of the FPTC-02 module, see the technical data.
## Layout

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<tr>
<td>1</td>
<td>Retaining clips</td>
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<tr>
<td>2</td>
<td>Lock</td>
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</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Diagnostics LEDs</td>
</tr>
<tr>
<td>4</td>
<td>Mounting screw</td>
</tr>
<tr>
<td>XWRN</td>
<td>2-pin detachable terminal block for PTC warning (non-safety related)</td>
</tr>
<tr>
<td>XFLT</td>
<td>2-pin detachable terminal block for PTC fault (safety related)</td>
</tr>
<tr>
<td>XSTO1</td>
<td>2-pin detachable terminal block for STO output 1</td>
</tr>
<tr>
<td>XSTO2</td>
<td>2-pin detachable terminal block for STO output 2</td>
</tr>
</tbody>
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Markings

Module

Type designation label

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<tbody>
<tr>
<td>1</td>
<td>Type</td>
</tr>
</tbody>
</table>
| 2 | Serial number in format RYWWSSSSWS, where:  
R: Component revision  
Y: Last digit of the manufacturing year (for example, 5 = 2015)  
WW: Manufacturing week (for example, 01 = week 1)  
SSSS: Number that starts every week from 0001  
WS: Manufacturing location |
| 3 | ABB MRP code of the module |
| 4 | Combined ABB MRP code, serial number and manufacturing location |
| 5 | RoHS mark |
ATEX markings

The markings on the module show the ATEX classification of the FPTC-02 module.

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>1</td>
<td>Specific marking of explosion protection</td>
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<tr>
<td>2</td>
<td>Equipment group II: Product for surface industry (other than mining applications)</td>
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<tr>
<td>3</td>
<td>Equipment category 2. Parentheses show that the module must be installed outside the potentially explosive atmosphere.</td>
</tr>
<tr>
<td>4</td>
<td>Certified for use in explosive atmospheres caused by: ( G = ) gases, vapors or mists, ( D = ) dust.</td>
</tr>
</tbody>
</table>

Drive

Option +Q971

When the FPTC-02 module is ordered as a factory-installed option, an additional sticker is sometimes attached to the drive/module to signify ATEX classification of the drive Safe disconnection function (+Q971) of the drive/module. This sticker and the ATEX certification reference are not mandatory with the FPTC-02 module.

Specific marking of explosion protection

Equipment group II: Product for surface industry (other than mining applications)

Equipment category 2. Parentheses show that the drive (or inverter unit) must be installed outside the potentially explosive atmosphere.

Certified for use in explosive atmospheres caused by: 
G = gases, vapors or mists, D = dust.

Certificate reference The option code +Q971 is included in the type designation label of the drive. In cabinet-built drives, this is on the cabinet door. In cabinet-built drives, there is no separate ATEX classification label for the Safe disconnection function.

SMT function

When the FPTC-02 module is delivered as an add-on kit, the package contains a sticker to show the ATEX classification of the Safe motor temperature (SMT) function. The user must attach this sticker to the drive/inverter module next to the type designation label.
In the factory-installed options, this sticker is already attached to the drive/inverter module at the factory.

In the cabinet-built drives, this sticker is attached to the cabinet door at the factory.

---

2. Specific marking of explosion protection
3. Equipment group II: Product for surface industry (other than mining applications)
4. Equipment category 2. Parentheses show that the drive (or inverter unit) must be installed outside the potentially explosive atmosphere.
5. Certified for use in explosive atmospheres caused by: G = gases, vapors or mists, D = dust.
6. Certificate reference
Option description and instructions

Contents of this chapter

This chapter describes the Safe motor temperature function implemented with the FPTC-02 module and the drive Safe torque off function and gives instructions for the user.

Overview

To implement the Safe motor temperature (SMT) function, you can connect the FPTC-02 module directly to the drive Safe torque off (STO) circuit, or you can use it together with an FSO module.

The FSO safety functions module (FSO-12 or FSO-21) is an optional device used with the ACS880 drives to implement safety functions. When installed, it reserves the standard STO connection of the drive. Safety functions in the FSO module can open the drive STO circuit, which activates the STO function of the drive.
Note: The Safe motor temperature function is motor-specific. This is the case also in ACS880 multidrives where multiple motors are connected to the drive.

### Drives and modules

The module is available as a factory-installed option (+L537+Q971) or as an add-on kit for ACS880 drives and modules.

To install the kit, the user:

- makes sure that the serial number of the drive/inverter module starts with 1, 4, 7, 8, M or Y
- attaches the included ATEX label for the SMT function to the drive/inverter module to ensure the ATEX compliance of the safety circuit
- installs the option module to an option slot of the drive control unit and sets the applicable drive parameters
- connects the PTC temperature sensors of the motor to the PTC inputs of the option module
- connects the drive STO terminals to the STO output of the option module (or to the FSO module and then configures the FSO module to do the STO function).

### Cabinet-built drives

For cabinet-built ACS880 single drives and ACS880 multidrives, the module is available as factory-installed options:

- +L537+Q971
- +L537+Q971+Q973 (with the FSO-12 module)
- +L537+Q971+Q972 (with the FSO-21 module)
- +L537+Q971+Q972+L521 (with the FSO-21 and FSE-31 modules).

The user connects the PTC temperature sensors of the motor to the PTC inputs of the module.
The ATEX-certified Safe disconnection function

The ATEX-certified Safe motor temperature function described in this manual requires that its Safe torque off function (STO) is certified for use as a Safe disconnection function to protect equipment in potentially explosive atmospheres according to European ATEX Product Directive 2014/34/EU. For more information on the drive STO function, see the applicable hardware manual.

You can use the FPTC-02 module only when serial number of the drive/inverter module starts with 1, 4, 7, 8, M or Y.

**Note:** You do not need a separate ATEX certification (and label) for the Safe disconnection function (+Q971), because the ATEX certificate of the SMT function includes also the ATEX-certified Safe torque off function (STO).

Commissioning the drive for a motor in a hazardous area

Commission the drive according to the requirements and limitations set by the application, the motor manufacturer’s instructions, drive firmware manual, local laws and regulations and this manual.

The certificate of the Ex motor typically requires that you set a minimum limit for the output switching frequency of the drive. Make sure that the Ex motor is operated above the minimum output switching frequency specified by the motor manufacturer.

Resetting the safety function

The ATEX/Ex regulations require that the safety function must be reset manually. When the XFLT input detects a motor overtemperature situation, the FPTC-02 module generates a fault to the drive. The user must reset the drive before it is possible to restart the drive.
When the XWRN input detects a motor overtemperature situation, the FPTC-02 module generates a warning to the drive. This is not a safety-related function and does not need a reset.

If an FSO module is used together with the FPTC-02 module, it is possible that the user must reset the safety function also with a reset button connected to the FSO module. This depends on parameter settings and other safety functions in the FSO module. For more information, see section *FSO module (page 53).*

**Note:** The reset function of the safety function is not SIL classified.

### Indications of the safety function

An indication of the safety function can come from several sources:

1. **LED indications on the FPTC-02 module:**
   - The Fault LED is red when motor temperature is outside the permitted (safe) temperature range (XFLT input).
   - The WARNING LED is red when motor temperature is outside the temperature warning range (XWRN input).
2. **Safe motor temperature fault (XFLT) or motor temperature warning (XWRN) in the drive.**
3. **STO indication in the drive:**
   - The drive STO indication is active when the SMT safety function has activated the drive STO function. The type of the indication is set with parameter 31.22.
4. **STO indication in the FSO module:**
   - The STO LED is green when the safety function has activated the drive STO.
5. **STO indication from the FSO module to the drive:**
   - The FSO module sends an indication to the drive when the FSO module activates the drive STO. The type of the indication is set with parameter FSOGEN.61.

To avoid parallel indications, set the STO indication parameters (31.22 and/or FSOGEN.61) to value *None/No indication* or *Event*. See chapter *Parameter settings* for instructions.
Note: The indications of the safety function are not SIL classified.

Fault reaction function

■ FPTC-02 module

The FPTC-02 module has a fault reaction function. When the module detects an internal fault or a fault in the temperature sensor circuit, it sends a request to the drive control unit to stop modulation, and activates the drive STO function.

■ STO function in the drive/inverter modules

The STO function in the drive/inverter module has internal fault diagnostics and a fault reaction function. The fault reaction function causes a fault trip if it detects a redundancy fault of STO control signals or any internal failure. For more information, see the hardware and firmware manuals of the drive/inverter module.

■ FSO module

The fault reaction function of the FSO module trips the drive if it detects a failure. The FSO module activates the STO or Safe stop emergency (SSE) function. This activates the drive STO function. The drive STO function is active until the fault is repaired.

Note: With the FPTC module, the recommended type of the SSE function is *Immediate STO*, but other safety functions in the FSO module can require that the type is *Emergency ramp*. With both settings, the FSO module always activates the drive STO function immediately in motor overtemperature situations (SMT function activated).

The FSO module goes into the Fail-safe mode. The FSO module LED STATUS/FAULT is red until the fault is repaired. To exit the
Fail-safe mode, remove the cause of the fault and reset the FSO module. To reset the FSO module:

- switch the power off and on, or
- press the *Boot FSO* button on the *Safety view* of Drive composer pro, or
- set drive parameter *96.09 FSO reboot*.

For more information, see the drive firmware manual and the FSO module user’s manual.
Mechanical installation

Contents of this chapter

This chapter contains a delivery checklist and instructions on installing the module.

Necessary tools and instructions

• Torx screwdriver (T10)

For a complete list of tools, see the applicable drive hardware manual.

Unpacking and examining the delivery

1. Open the option package.
2. Make sure that the package contains:
   • FPTC-02 module
   • STO cable
   • ATEX label (with the ATEX classification markings)
   • this manual.
3. Make sure that there are no signs of damage to any of the items.
Installing the module

**WARNING!**
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

1. Stop the drive and do the steps in section *Electrical safety precautions (page 12)* before you start the work.
2. Pull out the lock.
3. Put the module carefully into its position on the drive until the retaining clips lock it into position.
4. Push in the lock.
5. Tighten the screw. The maximum tightening torque is 0.8 N·m (7.1 lbf·in).

**Note:** The screw tightens the connections and grounds the module. It is necessary for fulfilling the EMC requirements and for correct operation of the module.

**WARNING!**
Tightening the screw too much can cause damage to the threads.

See the applicable drive manual for further instructions on how to install the module to the drive.

Do not install the FPTC-02 module on an FEA-03 F-series extension adapter. The diagnostics of the module requires that you install it directly on the drive control unit.
Electrical installation

Contents of this chapter

This chapter contains instructions on wiring the module.

Warnings

**WARNING!**
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

**WARNING!**
Cabinet-built drives: Do not connect, test or measure a drive based on the diagrams in this manual. Each delivery is unique. Before starting the work on the electric circuits of a drive, always refer to the delivery-specific circuit diagrams.
WARNING!
Make sure that the drive is disconnected from the input power during installation. Before you start the work, stop the drive and do the steps in section Electrical safety precautions (page 12).

Necessary tools and instructions

- Screwdriver with a set of suitable bits
- Cabling tools

General wiring instructions

1. For the STO circuit wiring, use the type of cable specified in the applicable drive or inverter unit hardware manual. With an FSO module, use the STO cable that is included in the FSO module delivery.
2. Install only the sensor circuit into the potentially explosive atmosphere.
   The sensor circuit in the Ex Zone must comply with the requirements for the applicable type of protection, such as:
   - Ex d (EN/IEC 60079-1)
   - Ex eb (EN/IEC 60079-7, Ex e in EN 60079-7:2007 and IEC 60079-7:2006)
3. Install the drive or inverter unit, including the components of the ATEX-certified motor thermal protection function, outside the potentially explosive atmosphere.
4. For the sensor connection, ABB recommends to use shielded twisted-pair cable. This type of cable decreases electromagnetic interference in the sensor circuit.
5. Route the sensor cables away from the motor cable. Power cables can cause electromagnetic interference in the sensor circuit.
6. Ground all sensor cable shields to a single grounding point outside the potentially explosive atmosphere. 360-degree
grounding of the cable shields is recommended. Do not connect the cable shields to ground at the sensor end of the cable.

Terminal designations

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XSTO1</td>
<td>STO channel 1</td>
</tr>
<tr>
<td>11</td>
<td>In, +24 V DC in for STO</td>
</tr>
<tr>
<td>12</td>
<td>Out, +24 V DC out for STO</td>
</tr>
<tr>
<td>XSTO2</td>
<td>STO channel 2</td>
</tr>
<tr>
<td>21</td>
<td>In, +24 V DC in for STO</td>
</tr>
<tr>
<td>22</td>
<td>Out, +24 V DC out for STO</td>
</tr>
<tr>
<td>XFLT</td>
<td>PTC FAULT (SMT function)</td>
</tr>
<tr>
<td>T1</td>
<td>In, 0 … +5 V DC</td>
</tr>
<tr>
<td>T2</td>
<td>Out</td>
</tr>
<tr>
<td>XWRN</td>
<td>PTC WARNING (non-safety related)</td>
</tr>
<tr>
<td>T3</td>
<td>In, 0 … +5 V DC</td>
</tr>
<tr>
<td>T4</td>
<td>Out</td>
</tr>
</tbody>
</table>

Wiring

This section shows five methods to connect the FPTC-02 module to the drive STO terminals.

Wiring example 1 (page 43): The STO outputs of the FPTC-02 module are connected directly to the STO terminals of the drive.

- ACS880 drives and modules: In the factory-installed option (+L537+Q971), the wiring is done at the factory according to this example.
- ACS880 cabinet-built drives: In the option +L537+Q971, terminal block [X969] is located between the module and the drive control board (not shown in the figure). See the circuit diagrams delivered with the drive for the actual wiring.

Wiring example 2 (page 44): The STO outputs of the FPTC-02 module are connected to an FSO module, and the STO outputs of the FSO module to the STO terminals of the drive with a two-channel
connection. In this case, the FSO module controls the drive STO function.

- **Cabinet-built drives:** In the option +L537+Q971+Q973/Q972 (+L521), terminal block [X68] is located between the module and the FSO module (not shown in the figure). See the circuit diagrams delivered with the drive for the actual wiring.

**Wiring example 3 (page 45):** An external safety relay is connected between the FPTC-02 module and the drive STO inputs with a two-channel connection.

**Wiring example 4 (page 46):** The STO outputs of the FPTC-02 module are connected directly to the STO terminals of the drive with a one-channel connection.

**Wiring example 5 (page 47):** The STO outputs of the FPTC-02 module are connected to an FSO module, and the STO outputs of the FSO module to the STO terminals of the drive with a one-channel connection.

If you use a one-channel connection, make sure that you can reach the required safety integrity level (SIL).

If you do not use the XFLT input (Fault), connect a resistor (100 ohm … 1 kohm 1/4 W wire-wound) in the XFLT input instead of a PTC sensor.

If you do not use the XWRN input (Warning), disable the motor temperature warning with a parameter setting.

**Note:** Only the XFLT input of the FPTC module is shown in the examples. The XWRN input is not safety-related and does not activate the drive STO function.
**Wiring example 1**

This connection is SIL2 capable (redundancy between STO channels).

---

**Diagram**

---

1. XSTO
   - OUT
   - SGND
   - IN1
   - IN2
   - SLOT 1/2/3

2. FPTC
   - XSTO1
   - 11
   - 12
   - XSTO2
   - 21
   - 22
   - XFLT
   - X100
   - T1
   - T2

---

1. Control unit
2. Potentially explosive atmosphere

---

**a)** If necessary, you can connect an external device (for example, an emergency stop button) between the XSTO input of the control unit and the XSTO1 and XSTO2 outputs of the FPTC module. See [Wiring example 3 (page 45)](page:45).
# Wiring example 2

With an FSO module, two-channel connection. This connection is SIL2 capable (redundancy between STO channels).

<table>
<thead>
<tr>
<th></th>
<th>Control unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Potentially explosive atmosphere</td>
</tr>
</tbody>
</table>
## Wiring example 3

With an external safety relay, two-channel connection. This connection is SIL2 capable (redundancy between STO channels).

1 Control unit
2 External safety relay
3 Potentially explosive atmosphere
## Wiring example 4

One-channel connection. This connection is SIL1 capable (no redundancy between STO channels).

**a)** If necessary, you can connect an external device (eg, an emergency stop button) between the XSTO input of the control unit and the XSTO2 output of the FPTC module.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control unit</td>
</tr>
<tr>
<td>2</td>
<td>Potentially explosive atmosphere</td>
</tr>
</tbody>
</table>
Wiring example 5

With an FSO module, one-channel connection. This connection is SIL1 capable (no redundancy between STO channels).

1 Control unit
2 Potentially explosive atmosphere
Parameter settings

Contents of this chapter

This chapter contains the drive and FSO module parameter settings.

Drive / inverter

Use the Drive composer PC tool or the control panel to set the parameter values.

This table lists the parameters related to the safety function in ACS880 primary control program. For more information, see the drive firmware manual.
### 50 Parameter settings

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.22</td>
<td>STO indication run/stop</td>
<td>Selects which indications are given when one or both Safe torque off (STO) signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs. For more information, see the firmware manual.</td>
</tr>
<tr>
<td></td>
<td>Warning/Warning</td>
<td>The drive generates a warning both when the drive is running and when it is stopped. This parameter value does not have an effect on the SMT function, but this is the recommended setting. For the cabinet-built drives, ABB has set this value at the factory.</td>
</tr>
</tbody>
</table>
Activates FPTC modules installed on the control unit of the drive. With this word, it is also possible to suppress the non-safety related motor temperature warnings (XWRN input). It is not possible to suppress the SMT faults (XFLT input).

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.30</td>
<td>FPTC configuration word</td>
<td>Activates FPTC modules installed on the control unit of the drive. With this word, it is also possible to suppress the non-safety related motor temperature warnings (XWRN input). It is not possible to suppress the SMT faults (XFLT input).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Module in slot 1</td>
<td>1 = Yes: Module installed in slot 1.</td>
</tr>
<tr>
<td>1</td>
<td>Disable slot 1 warning</td>
<td>0 = No (default): Warnings from the module in slot 1 not suppressed. 1 = Yes: Warnings from the module in slot 1 suppressed.</td>
</tr>
<tr>
<td>2</td>
<td>Module in slot 2</td>
<td>1 = Yes: Module installed in slot 2.</td>
</tr>
<tr>
<td>3</td>
<td>Disable slot 2 warning</td>
<td>0 = No (default): Warnings from the module in slot 2 not suppressed. 1 = Yes: Warnings from the module in slot 2 suppressed.</td>
</tr>
<tr>
<td>4</td>
<td>Module in slot 3</td>
<td>1 = Yes: Module installed in slot 3.</td>
</tr>
<tr>
<td>5</td>
<td>Disable slot 3 warning</td>
<td>0 = No (default): Warnings from the module in slot 3 not suppressed. 1 = Yes: Warnings from the module in slot 3 suppressed.</td>
</tr>
<tr>
<td>6…15</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>
### FPTC status word

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.04</td>
<td>FPTC status word</td>
<td>Displays the status of FPTC modules. The word can be used as the source of external events. This parameter is read-only.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Module found in slot 1</td>
<td>1 = Yes: An FPTC module has been detected in slot 1.</td>
</tr>
<tr>
<td>1</td>
<td>Fault active in slot 1</td>
<td>1 = Yes: The module in slot 1 has an active SMT fault.</td>
</tr>
<tr>
<td>2</td>
<td>Warning active in slot 1</td>
<td>1 = Yes: The module in slot 1 has an active motor temperature warning.</td>
</tr>
<tr>
<td>3</td>
<td>Module found in slot 2</td>
<td>1 = Yes: An FPTC module has been detected in slot 2.</td>
</tr>
<tr>
<td>4</td>
<td>Fault active in slot 2</td>
<td>1 = Yes: The module in slot 2 has an active SMT fault.</td>
</tr>
<tr>
<td>5</td>
<td>Warning active in slot 2</td>
<td>1 = Yes: The module in slot 2 has an active motor temperature warning.</td>
</tr>
<tr>
<td>6</td>
<td>Module found in slot 3</td>
<td>1 = Yes: An FPTC module has been detected in slot 3.</td>
</tr>
<tr>
<td>7</td>
<td>Fault active in slot 3</td>
<td>1 = Yes: The module in slot 3 has an active SMT fault.</td>
</tr>
<tr>
<td>8</td>
<td>Warning active in slot 3</td>
<td>1 = Yes: The module in slot 3 has an active motor temperature warning.</td>
</tr>
<tr>
<td>9…15</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>

### Special HW settings

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>95.15</td>
<td>Special HW settings</td>
<td>Contains hardware-related settings that can be enabled and disabled by toggling the specific bits.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EX motor</td>
<td>1 = The driven motor is an Ex motor provided by ABB for potentially explosive atmospheres. This sets the required minimum switching frequency for ABB Ex motors. For non-ABB Ex motors, contact your local ABB representative.</td>
</tr>
</tbody>
</table>

#### Switching frequency limitation

The certificate of the Ex motor typically requires that you set a minimum limit for the switching frequency of the drive.
For ABB Ex motors, use parameter 95.15 to set the required minimum switching frequency. For more information, see the drive firmware manual.

For Ex motors supplied by other motor manufacturers, contact the motor manufacturer for the correct value and your local ABB representative for instructions on how to make the parameter setting in the drive.

### Other recommended settings

ABB recommends that you also set these parameters to improve the safety of the application:

- minimum and maximum speeds (parameter group 30)
- maximum current, power and torque (group 30)
- acceleration and deceleration times
- stall protection (parameters 31.24…31.28)
- motor load curve (parameters 35.50…35.55)
- motor cable protection (parameters 35.60…35.62)

For more information, see the drive firmware manual.

### FSO module

If you use an FSO module (option +Q972 or +Q973) in the safety system configuration, set the parameters according to the system requirements. Example values are shown in this section.

You need the Drive composer pro PC tool to set the FSO module parameters. You also need a password to be able to download the configuration to the FSO module from Drive composer pro. For the default password of the FSO module, see the applicable FSO module user’s manual. For more information on the Drive composer pro PC tool, see *Drive composer start-up and maintenance PC tool user's manual* (3AUA0000094606 [English]).

Follow the configuration steps described in the applicable FSO module user’s manual, chapter *Configuration*. 
There are parameters that you must always set when you use the FSO module, and parameters that are related only to some safety functions. This chapter lists the parameters that are relevant to the option +L537+Q971+Q973 (with FSO-12) and +L537+Q971+Q972 (with FSO-21).

You can use the FSO-21 module (+Q972) also with a safety pulse encoder and the FSE-31 pulse encoder interface module (+L521). If you do, set the parameters listed in section FSE module and safety pulse encoder parameters (page 60).

The example values are factory default values in ACS880 cabinet-built drives delivered with an FPTC module. You must set the parameter values as required by the application. Change the parameter default values when necessary. One FPTC module is connected to the FSO module with a two-channel connection (digital inputs X113:4 and X114:4).

Configure the FSO module so that it opens the drive STO circuit immediately after the safety function request from the FPTC module (stop category 0). With the FPTC module, you cannot use a stop function with a deceleration ramp (stop category 1). The FPTC module always generates a fault and activates the drive STO function immediately in overtemperature situations.

**Note:** Setting parameters related to STO and SS1 can also have an effect on other safety functions. You must take all safety functions into consideration when you configure the FSO module. See the applicable FSO module user’s manual and safety option user’s manual.

**Note:** The factory reset of the FSO module clears the configuration and sets the parameters to the factory default values. These values are not the same as the pre-set values in an FSO module that was ordered as an option (with a plus code). You cannot restart the drive with the factory default values. If you do a factory reset of the FSO module, you must reconfigure the FSO module and set the applicable parameters. See the applicable FSO module user's manual.
### General parameters

These parameters are common to all safety functions in the FSO module.

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSO-GEN.11</td>
<td>Stop completed output</td>
<td>None 1)</td>
<td>Sets the digital output that indicates the completion of any stop function. Active when the FSO module has completed the STO, SSE or SS1 function.</td>
</tr>
<tr>
<td>FSO-GEN.21</td>
<td>Motor nominal speed</td>
<td>1500.0 rpm</td>
<td>Sets the nominal motor speed. Adjust the default value to meet the ratings of the motor in use.</td>
</tr>
<tr>
<td>FSO-GEN.22</td>
<td>Motor nominal frequency</td>
<td>50.00 Hz</td>
<td>Sets the nominal motor frequency. Adjust the default value to meet the ratings of the motor in use.</td>
</tr>
<tr>
<td>FSO-GEN.41</td>
<td>Power-up acknowledgement</td>
<td>Automatic</td>
<td>Sets the power-up acknowledgement method of the FSO module. <strong>Automatic:</strong> You do not need to push a reset button after switching on the FSO module. The FSO module generates the acknowledgement signal automatically after the power-up. <strong>Manual:</strong> The FSO module reads the external acknowledgement signal through the digital input defined by parameter FSOGEN.42. Make sure that the value is Automatic.</td>
</tr>
<tr>
<td>FSO-GEN.42</td>
<td>Acknowledgement button input</td>
<td>None 1)</td>
<td>Sets the digital input for the acknowledgement signal when parameter STO.02 has value Manual. Selects the digital input for the acknowledgement signal when parameter STO.02 has value Manual. In the safety function described in this manual, parameter STO.02 has value Automatic and this parameter has value None (no acknowledgement signal connected to the input).</td>
</tr>
</tbody>
</table>
### Parameters for the STO function

These parameters are related to the STO function of the FSO module. With stop category 0, the FSO module activates the STO function in overtemperature situations. Also, the FSO module can activate the STO function in fault situations.

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STO.02</td>
<td>STO acknowledgement</td>
<td>Automatic</td>
<td>Sets the acknowledgement method used in the STO, SSE and SS1 functions. <em>Automatic:</em> The FSO module resets the STO function automatically after the STO request is removed. <em>Manual:</em> The FSO module reads the external acknowledgement signal through the digital input defined by parameter <em>FSOGEN.42.</em></td>
</tr>
<tr>
<td>STO.11</td>
<td>STO input A</td>
<td>None</td>
<td>Sets the digital input that is connected to the primary input of the STO function. In this example, this parameter has value <em>None.</em></td>
</tr>
</tbody>
</table>

1) The value does not affect the SMT function, but other safety functions in the FSO module can require a certain value.
<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STO.12</td>
<td>STO input B</td>
<td>D1 X113:4 &amp; X114:4</td>
<td>Sets the digital input that is connected to the secondary input of the STO function.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Note:</strong> In a non-redundant system, you can use a one-channel input (for example, D1 X113:4).</td>
</tr>
<tr>
<td>STO.13</td>
<td>Restart delay after STO</td>
<td>2000 ms</td>
<td>Sets the time after which the drive can restart when the FSO module has activated the STO function and opened the drive STO circuit. With this parameter, you can let the drive restart before the motor has stopped (fly-start). This parameter is applicable only if the STO function is requested from STO input A (STO.11) or STO input B (STO.12). STO function: Adjust the value when necessary. If you do not want to use the fly-start feature, set this parameter to the same value as parameter STO.14.</td>
</tr>
</tbody>
</table>
SBC usage

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBC.11</td>
<td>STO SBC usage</td>
<td>None</td>
<td>Sets how the mechanical brake is used together with the STO function. In the safety functions described in this manual, this feature is not used and this parameter has value None.</td>
</tr>
<tr>
<td>Index</td>
<td>Name</td>
<td>Example value</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>SAFEIO.36</td>
<td>DI X113:4 diag pulse on/off</td>
<td>On 1)</td>
<td>Sets the diagnostic pulse of digital input X113:4 on or off. On: The input monitors that it receives test pulses.</td>
</tr>
<tr>
<td>SAFEIO.40</td>
<td>DI X114:4 diag pulse on/off</td>
<td>On 1)</td>
<td>Sets the diagnostic pulse of digital input X114:4 on or off. On: The input monitors that it receives test pulses. <strong>Note:</strong> In a non-redundant system, you can use a one-channel input (for example, DI X113:4). In this case, this parameter has no effect.</td>
</tr>
</tbody>
</table>

1) The safety data is based on the assumption that this diagnostic measure for the wiring is active (On). If pulsing is disabled, you must consider other measures to ensure sufficient diagnostic coverage of the wiring failures.

### Parameters for the SSE function

These parameters are related to the Safe stop emergency (SSE) function of the FSO module. The safety functions described in this manual do not use this function, but the FSO module can activate the SSE function in internal fault situations.

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE.13</td>
<td>SSE function</td>
<td>Immediate STO 1)</td>
<td>Sets the type of the SSE function. <strong>Immediate STO:</strong> The FSO module activates the drive STO function immediately after the SSE request (stop category 0). <strong>Emergency ramp:</strong> The FSO module first ramps down the motor speed and when the speed is below the zero speed limit it activates the STO function (stop category 1). SAR0 parameters define the deceleration ramp (for more information, see the FSO module user's manual).</td>
</tr>
</tbody>
</table>
SBC usage

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBC.15</td>
<td>SSE/SS1 SBC speed</td>
<td>0.0 rpm</td>
<td>Sets the absolute speed below which the FSO module activates the brake (SBC) while ramping. 0.0 rpm: The feature is not in use. In the safety functions described in this manual, this feature is not used. Make sure that the value is 0.0 rpm.</td>
</tr>
</tbody>
</table>

1) With the FPTC module, the recommended value is Immediate STO, but other safety functions in the FSO module can require that the value is Emergency ramp. With both settings, the FSO module always activates the drive STO function immediately in motor overtemperature situations (SMT function activated).

### FSE module and safety pulse encoder parameters

Set these parameters only when you use a safety pulse encoder and the FSE-31 pulse encoder interface module with the FSO-21 module.

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200.231</td>
<td>FSE 3X act and par version</td>
<td>Version 1</td>
<td>Activates the FSE-31 encoder interface and shows the version of the encoder parameter groups (91 and 92).</td>
</tr>
<tr>
<td>200.232</td>
<td>Number of encoders</td>
<td>Single encoder CH1</td>
<td>Shows the number of safety pulse encoders connected to the FSE module.</td>
</tr>
<tr>
<td>S_ENCGEN.01</td>
<td>Safe pulse encoder version</td>
<td>Version 1</td>
<td>Activates the safety pulse encoder and shows the version parameter group S_ENCGEN.</td>
</tr>
<tr>
<td>S_ENCGEN.11</td>
<td>FSE diagnostic failure reaction</td>
<td>STO</td>
<td>Sets the action taken when there is a problem with the FSE module. STO: The FSO module goes into the Fail-safe mode and activates the drive STO function.</td>
</tr>
</tbody>
</table>

Note: This parameter is relevant only when there are no active safety functions.
<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S ENC-GEN.14</td>
<td>Enc speed cross comp tolerance</td>
<td>1.0 rpm</td>
<td>Sets the encoder speed cross comparison tolerance. This defines how much the axle speed of the motor can change within 1 ms. Adjust the default value to meet the motor in use. This parameter is used for the encoder diagnostic. It defines the maximum difference between the speed information from channel A and B of the encoder. If the difference of these two values is more than defined by this parameter, FSO will safely stop the system (STO). The suitable value depends on the configuration (motor and load). Typically this value is between 2 … 10 rpm. A value that is too small will cause an encoder fault (A7D8). A value that is too big will prevent the encoder diagnostic related to this parameter.</td>
</tr>
<tr>
<td>S ENC-GEN.41</td>
<td>Gear numerator or encoder 1</td>
<td>1</td>
<td>Sets the rotation direction for the safety pulse encoder. With this parameter, you can change the rotation direction of the motor. Adjust the default value if necessary.</td>
</tr>
<tr>
<td>91.11</td>
<td>Module 1 type</td>
<td>FSE-31</td>
<td>Sets the type of the safety pulse encoder interface module 1.</td>
</tr>
<tr>
<td>91.12</td>
<td>Module 1 location</td>
<td>2</td>
<td>Sets the slot in which the safety pulse encoder interface module 1 is located.</td>
</tr>
<tr>
<td>92.01</td>
<td>Encoder 1 type</td>
<td>HTL1</td>
<td>Activates or deactivates the communication with the safety pulse encoder interface module 1 and sets the type for the safety pulse encoder.</td>
</tr>
<tr>
<td>92.02</td>
<td>Encoder 1 source</td>
<td>Module 1</td>
<td>Sets the safety pulse encoder interface module that the safety pulse encoder 1 is connected to.</td>
</tr>
</tbody>
</table>
62 Parameter settings

<table>
<thead>
<tr>
<th>Index</th>
<th>Name</th>
<th>Example value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>92.10</td>
<td>Pulses/revolution</td>
<td>2048</td>
<td>Sets the number of HTL pulses per revolution for safety pulse encoder 1. Adjust the default value to meet the safety pulse encoder in use. Make sure that the value is according to the encoder nameplate.</td>
</tr>
</tbody>
</table>
| 92.17 | Accepted pulse freq of encoder 1 | 300 kHz | Sets the maximum pulse frequency range of encoder 1. Adjust the default value to meet the motor and safety pulse encoder in use. You can use this formula to define the value: $r_{\text{max}} \cdot ppr_{\text{enc}} + 10\%$, where  
  - $r_{\text{max}}$: the maximum motor speed (rpm) used in the application (or the motor nominal speed)  
  - $ppr_{\text{enc}}$: pulses/revolution of the safety pulse encoder (parameter 92.10). |

**Notes**

ACS880-07/17/37 and ACS880-17LC/37LC drives with option +Q978:  
In motor overtemperature situations, the FSO module also opens the main contactor/circuit breaker.

ACS880-07/17/37 and ACS880-17LC/37LC drives with option +Q978 or +Q979: The FSO module is configured so that after the safety function activation, the user must reset the FSO module manually with the emergency stop reset button. The user must also reset the FSO module with the emergency stop reset button after motor overtemperature situations. The indication lamp on the reset button is on. Do not change this setting.

**Mechanical brake control**

If you use a mechanical brake with the motor thermal protection circuit, pay special attention to the control of the mechanical brake.
If the motor deceleration by the mechanical brake causes extra heat generation in the Ex zone, make sure that the use of the brake does not increase the temperature too much.

In some cases you cannot use the brake for the motor deceleration when the motor thermal protection circuit has tripped and the motor temperature is too high.

For more information, see the drive firmware manual (or the FSO module user’s manual if you use the Safe brake control (SBC) function of the FSO module).
Start-up and acceptance test

Contents of this chapter

This chapter describes the start-up, acceptance test procedure, and validation of the safety function.

Validation of the safety functions

You must do an acceptance test (validation) to validate the correct operation of safety functions.

Competence

The acceptance test of the safety function must be carried out by a competent person with expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6, and ATEX/Ex regulations. The test procedures and report must be documented and signed by this person.
Validation procedure

You must do the acceptance test using the checklist given in section Start-up and acceptance test:

- at initial start-up of the safety function
- after any changes related to the safety function (wiring, components, safety-function-related parameter settings, etc.)
- after any maintenance work related to the safety function.

The acceptance test must include at least the following steps:

- you must have an acceptance test plan
- you must test all commissioned functions for proper operation, from each operation location
- you must document all acceptance tests
- you must sign and store the acceptance test report for further reference.

Acceptance test reports

You must store the signed acceptance test reports in the logbook of the machine and in the explosion protection document under the scope of the ATEX User Directive 1999/92/EC. The report must include, as required by the referred standards:

- a description of the safety application (including a figure)
- a description and revisions of safety components that are used in the safety application
- a list of all safety functions that are used in the safety application
- a list of all safety-related parameters and their values
- documentation of start-up activities, references to failure reports and resolution of failures
- the test results for each safety function, checksums, date of the tests, and confirmation by the test personnel.

You must store any new acceptance test reports performed due to changes or maintenance in the logbook of the machine and in the explosion protection document under the scope of the ATEX User Directive 1999/92/EC.
Acceptance test

Use the Drive composer PC tool or the control panel to do the acceptance test.

<table>
<thead>
<tr>
<th>Action</th>
<th>Initial status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make sure that the drive is ready for use, that is, you have done the tasks of the drive start-up procedure. See the drive hardware manual.</td>
<td>☐</td>
</tr>
</tbody>
</table>

**WARNING!**

Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

<table>
<thead>
<tr>
<th>Checks and settings with no voltage connected</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop the drive and do the steps in section <em>Electrical safety precautions (page 12)</em> before you start the work.</td>
<td>☐</td>
</tr>
<tr>
<td>Make sure that the necessary ATEX markings are attached.</td>
<td>☐</td>
</tr>
<tr>
<td>Make sure that the classification of the motor thermal protection function corresponds to the Ex classification of the environment and the Ex motor.</td>
<td>☐</td>
</tr>
<tr>
<td>The motor manufacturer selects the PTC sensors for the motor temperature measurement according to the specified temperature class. Make sure that the temperature on-off resistances match those of the module.</td>
<td>☐</td>
</tr>
<tr>
<td>If you have done any changes to the wiring, do a check of the connections against the applicable circuit diagrams.</td>
<td>☐</td>
</tr>
<tr>
<td>Drives with R8i inverter modules: Make sure that the STO OUT output on the inverter control unit [A41] is chained to the STO inputs of all inverter modules. The STO circuit is disabled in spare part modules.</td>
<td>☐</td>
</tr>
<tr>
<td>Make sure that the SIL/PL of the safety function meets the target SIL/PL. If SIL2 is required, make sure that the STO connection between the FPTC module and drive STO is kept redundant.</td>
<td>☐</td>
</tr>
</tbody>
</table>
### Action

**Settings with voltage connected**

- Make sure that you have activated the FPTC module in the correct slot (parameter 35.30).
- Make sure that you have set all the necessary parameters for the safety function. See chapter *Parameter settings*.

**Acceptance test procedure**

- Make sure that you can run and stop the motor freely during the test.
- Start the drive and make sure that the motor is running.
- Cause an overtemperature situation: Increase the resistance in the XFLT input to more than 3.6 kohm (for example, open the circuit by disconnecting the wires).
- Make sure that the correct indications are activated: The SMT fault and other indications depending on the parameter settings and if an FSO module is installed.
- Make sure that the STO is activated and that the motor coasts to a stop.
- Make sure that you cannot start the drive before you have reset the drive.
- Reset the drive. Make sure you cannot reset and restart the drive before the input resistance in the XFLT input decreases to less than 1.6 kohm.
- Restart the drive and the motor. Make sure that they operate normally.
- Cause a short-circuit situation: Decrease the resistance in the XFLT input to less than 50 ohm.
- Make sure that the correct indications are activated: The SMT fault and other indications depending on the parameter settings and if an FSO module is installed.
- Make sure that the STO is activated and that the motor coasts to a stop.
- Make sure that you cannot start the drive before you have reset the drive.
- Reset the drive. Make sure that you cannot reset and restart the drive before the input resistance in the XFLT input increases to more than 50 ohm.
**Action**

<table>
<thead>
<tr>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restart the drive and the motor. Make sure that they operate normally.</td>
<td>☑️</td>
</tr>
<tr>
<td>If in use, test the XWRN input: Connect a resistor (resistance 100 ohm ... 1 kohm) between the XWRN inputs. Make sure that the motor temperature warning indication is activated in motor overtemperature and short-circuit situations.</td>
<td>☐️</td>
</tr>
<tr>
<td>Fill in and sign the acceptance test report which verifies that the safety function is safe and accepted to operation.</td>
<td>☐️</td>
</tr>
</tbody>
</table>
Fault tracing

Contents of this chapter

This chapter shows how to trace faults with fault and warning messages of the drive and LEDs on the module.

Reporting problems and failures related to safety functions

Contact ABB.

FPTC-02 module replacement

If there is a failure in the FPTC-02 module, you have to replace it with a new one. You cannot repair the module.
### Fault and warning messages

Fault and warning messages in the ACS880 primary control program:

<table>
<thead>
<tr>
<th>Code (hex)</th>
<th>Name</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>4990</td>
<td>FPTC not found</td>
<td>A thermistor protection module is activated by parameter 35.30 but cannot be detected. The last digit of the auxiliary code identifies the slot.</td>
<td>Power down the control unit and make sure that the module is correctly inserted in the option slot.</td>
</tr>
</tbody>
</table>
| 4991       | Safe motor temperature 1 | The FPTC-02 module in option slot 1 indicates overtemperature in the XFLT input (safety related).  
1. Motor temperature is too high, or  
2. the thermistor is short-circuited or disconnected. | 1. Make sure that the motor has sufficient cooling.  
2. Make sure that the drive and the motor are compatible with each other.  
3. Make sure that the motor is not overloaded.  
4. Make sure that the drive parameter settings are correct.  
5. Examine the wiring of the temperature sensor. If necessary, repair the wiring.  
6. Measure the resistance of the sensor. If necessary, replace the sensor. |
<p>| 4992       | Safe motor temperature 2 | The FPTC module in option slot 2 indicates overtemperature in the XFLT input (safety related). See 4991. |                                                                      |
| 4993       | Safe motor temperature 3 | The FPTC module in option slot 3 indicates overtemperature in the XFLT input (safety related). See 4991. |                                                                      |</p>
<table>
<thead>
<tr>
<th>Code (hex)</th>
<th>Name</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A497</td>
<td>Motor temperature 1 1)</td>
<td>The FPTC module in option slot 1 has activated a motor temperature warning in the XWRN input (non-safety related). 1. Motor temperature is too high, or 2. the thermistor is short-circuited or disconnected.</td>
<td>1. Make sure that the motor has sufficient cooling. 2. Make sure that the drive and the motor are compatible with each other. 3. Make sure that the motor is not overloaded.</td>
</tr>
<tr>
<td>A498</td>
<td>Motor temperature 2 1)</td>
<td>The FPTC module in option slot 2 has activated a motor temperature warning in the XWRN input (non-safety related). See A497.</td>
<td>4. Make sure that the drive parameter settings are correct. 5. Examine the wiring of the temperature sensor. If necessary, repair the wiring.</td>
</tr>
<tr>
<td>A499</td>
<td>Motor temperature 3 1)</td>
<td>The FPTC module in option slot 3 has activated a motor temperature warning in the XWRN input (non-safety related). See A497.</td>
<td>6. Measure the resistance of the sensor. If necessary, replace the sensor.</td>
</tr>
</tbody>
</table>

1) Editable message text

For the fault and warning messages of the FSO module, see the FSO module user’s manual.
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LEDs

The FPTC-02 module has three diagnostic LEDs.

<table>
<thead>
<tr>
<th>Name</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAULT</td>
<td>Red</td>
<td>The motor temperature is outside the permitted temperature range and the drive STO is active, or there is no PTC sensor connected to the XFLT input (safety-related).</td>
</tr>
<tr>
<td>WARNING</td>
<td>Red</td>
<td>The motor temperature is outside the temperature warning range, or there is no PTC sensor connected to the XWRN input (non-safety-related).</td>
</tr>
<tr>
<td>STATUS</td>
<td>Green</td>
<td>The module is powered up.</td>
</tr>
</tbody>
</table>

Note: When there is no sensor connected to the XWRN input, the WARNING LED is red even if you have suppressed the warnings from the module. You can connect a resistor (100 ohm … 1 kohm 1/4 W wire-wound) in the XWRN input to turn off the WARNING LED.
Contents of this chapter

This chapter contains information for the maintenance and decommissioning of the safety function.

Safety circuit maintenance

After the operation of the safety circuit is tested at start-up, it does not need any scheduled maintenance during its specified lifetime.

It is a good practice to check the operation of the safety function when other maintenance routines are carried out on the machinery. Include this check in the routine maintenance program of the machinery that the drive runs.

If you change any wiring or component after the start-up, replace the FPTC-02 module, modify parameters, or restore parameters to their factory default values:

- Use only ABB-approved spare parts.
- Register the change to the change log for the safety circuit.
• Test the safety function again after the change. Do the start-up and acceptance test of the safety function.
• Document the tests and store the report into the logbook of the machine.

Proof test interval

After the operation of the safety function is validated at start-up, the safety function must be maintained by periodic proof testing. In high demand mode of operation, the maximum proof test interval is 20 years. In low demand mode of operation, the maximum proof test interval is 2 years (high or low demand as defined in IEC 61508, EN/IEC 62061 and EN ISO 13849-1). Regardless of the mode of operation, it is a good practice to check the operation of the safety function at least once a year.

The person responsible for the design of the complete safety function should also note the Recommendation of Use CNB/M/11.050 published by the European co-ordination of Notified Bodies concerning dual-channel safety-related systems with electromechanical outputs:

• When the safety integrity requirement for the safety function is SIL 3 or PL e (cat. 3 or 4), the proof test for the function must be performed at least every month.
• When the safety integrity requirement for the safety function is SIL 2 (HFT = 1) or PL d (cat. 3), the proof test for the function must be performed at least every 12 months.

This is a recommendation and depends on the required (not achieved) SIL/PL. For example, contactors, breakers, safety relays, contactor relays, emergency stop buttons, switches etc. are typically safety devices which contain electromechanical outputs. The FPTC-02 and FSO modules and the STO circuit of the drive do not contain electromechanical outputs.
Competence

The maintenance and proof test activities of the safety function must be carried out by a competent person with expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6 and ATEX/Ex regulations.

Residual risk

The safety functions are used to reduce the recognized hazardous conditions. In spite of this, it is not always possible to eliminate all potential hazards. Therefore the warnings for the residual risks must be given to the operators.

Intentional misuse

The safety circuit is not designed to protect a machine against intentional misuse.

Decommissioning

When you decommission the module, make sure that the safety of the machine is maintained until the decommissioning is complete. Mark clearly on the module that it is decommissioned.
Technical data

Contents of this chapter

This chapter contains the technical data of the module, gives general rules, notes and definitions related to safety functions and lists the related standards and directives. The safety data, relevant certificates and Declarations of Conformity are also included.
**Dimension drawing**

The dimensions are shown in millimeters and inches.

**Isolation areas**

The following figure shows the different isolation areas of the module. Isolation areas A and B and the mounting screw are connected to ground. Isolation area C is in the same potential as the PTC sensor element in the motor.
There is reinforced insulation between:

- isolation areas A and C
- isolation areas B and C.

**Connections**

- **Motor thermistor connection**
  - Maximum wire size: 2.5 mm² (14 AWG)
  - Maximum wire length: 700 m (2300 ft) (1400 m [4600 ft] for the whole loop)
With the specified cable type, detection of a short-circuited PTC sensor or cable is not guaranteed after 100 m (328 ft).

- **Type:** Shielded, twisted-pair cable (Draka JAMAK 1×(2+1)×0.5 mm² or equivalent)
- **Tightening torque:** 0.5 N·m (4.4 lbf-in)
- **Supported standards:** DIN 44081 and DIN 44082
- **Number of PTC thermistors:** 1, 3 or 6 in series (in both inputs)
- **Triggering threshold:** 3.6 kohm ±10%
- **Recovery threshold:** 1.6 kohm ±10%
- **PTC terminal voltage:** < 5.0 V
- **PTC terminal current:** < 1 mA
- **Short-circuit detection:** < 50 ohm ±10% (for the effect of the cable length, see above)

### STO output connection

- **Maximum wire size:**
  - 2.5 mm² (14 AWG) without FSO module
  - 1.5 mm² (16 AWG) with FSO module
- **Maximum wire length:** 30 m (98 ft) for the whole loop
- **Tightening torque:** 0.5 N·m (4.4 lbf-in)
- **Contact rating:** 24 V DC (17 … 30 V), 1 A / channel
- **Maximum breaking capacity:** 1000 VA

### Ambient conditions

For the environmental limits for the safety functions and the drive, refer to the hardware manual of your drive.

### Safety data

The FPTC-02 module is a type A safety component as defined in IEC 61508-2. For the types of the drive/inverter STO and the FSO module, see the applicable hardware manual or FSO user's manual.

The table gives the safety data for the SMT function with different configurations. The calculations are based on the worst case data of the drive Safe torque off (STO) function. The PFH/PFD_{avg} values can be different based on the internal configuration of the FSO module.
Note: The failure rate of the PTC sensor is not included in the calculations.

1. FPTC module + drive STO, two-channel configuration. See Wiring example 1 (page 43).
2. FPTC module + drive STO + FSO module with STO function request, two-channel configuration. See Wiring example 2 (page 44).
3. FPTC module + drive STO + external safety relay, two-channel configuration. See Wiring example 3 (page 45).
4. FPTC module + drive STO, one-channel configuration. See Wiring example 4 (page 46).
5. FPTC module + drive STO + FSO module with STO function request, one-channel configuration. See Wiring example 5 (page 47).

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Two-channel configurations</th>
<th>One-channel configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>SIL / SILCL</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PL</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>SFF (%)</td>
<td>&gt;90</td>
<td>&gt;90</td>
</tr>
<tr>
<td>PFH (1/h) T&lt;sub&gt;1&lt;/sub&gt; = 20 a</td>
<td>5.48E-09</td>
<td>5.54E-09</td>
</tr>
<tr>
<td>PFD&lt;sub&gt;avg&lt;/sub&gt; T&lt;sub&gt;1&lt;/sub&gt; = 2 a</td>
<td>4.81E-05</td>
<td>4.88E-05</td>
</tr>
<tr>
<td>PFD&lt;sub&gt;avg&lt;/sub&gt; T&lt;sub&gt;1&lt;/sub&gt; = 5 a</td>
<td>1.20E-04</td>
<td>1.21E-04</td>
</tr>
<tr>
<td>DC (%)</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>SC</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cat.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>HFT</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CCF</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>T&lt;sub&gt;M&lt;/sub&gt; (a)</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

The MTTF<sub>D</sub> value (EN ISO 13849-1) of the FPTC-02 module:

- 1708 years (two-channel connection)
- 1703 years (one-channel connection)
Safety block diagrams

The components that are included in the safety data calculations are shown in the safety block diagrams below.

**Note:** The failure rate of the PTC sensor is not included in the calculations.

#### Two-channel configurations

This diagram is applicable to configuration 1.

![Two-channel configuration 1 diagram]

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PTC sensor</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FPTC module</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Drive STO</td>
<td></td>
</tr>
</tbody>
</table>

This diagram is applicable to configuration 2.

![Two-channel configuration 2 diagram]

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PTC sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FPTC module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FSO module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Drive STO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This diagram is applicable to configuration 3.

1 PTC sensor
2 FPTC module
3 External safety relay
4 Drive STO

Note: The failure rate of the external safety relay is not included in the calculation.

- **One-channel configurations**

This diagram is applicable to configuration 4.

1 PTC sensor
2 FPTC module
3 Drive STO
This diagram is applicable to configuration 5.

1  PTC sensor
2  FPTC module
3  FSO module
4  Drive STO

**Note:** The failure rate of the safety encoder is not included in the calculation.

**Response times**
- FPTC-02 module: less than 10 ms
- SMT function: the response time of the PTC sensor + FPTC-02 module (< 10 ms) + FSO module (< 50 ms) + drive STO (< 50 ms)

**Relevant failure modes**
- The SMT function activates when not necessary (safe failure)
- The SMT function does not activate when requested

A fault exclusion on the failure mode “short-circuit on printed circuit board” has been made (EN 13849-2, table D.5). The analysis is based on the assumption that one failure occurs at one time. No accumulated failures have been analyzed.

The failures of the PTC sensor (thermistor) are not included in the failure analysis. The customer is responsible for the applicability of the PTC element.
## Related standards and directives

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 50495:2010</td>
<td>Safety devices required for the safe functioning of equipment with respect to explosion risks</td>
</tr>
<tr>
<td>IEC 61800-5-2:2007</td>
<td>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional</td>
</tr>
<tr>
<td>EN ISO 13849-1:2015</td>
<td>Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design</td>
</tr>
<tr>
<td>IEC 61326-3-1:2017</td>
<td>Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications</td>
</tr>
<tr>
<td>IEC 61511-1:2016</td>
<td>Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements</td>
</tr>
<tr>
<td>2006/42/EC</td>
<td>European Machinery Directive</td>
</tr>
<tr>
<td>2014/34/EU</td>
<td>European ATEX Product Directive</td>
</tr>
</tbody>
</table>
Compliance with the European Machinery Directive

The drive is an electronic product which is covered by the European Low Voltage Directive. However, the drive internal safety function of this manual (option +L537+Q971) is in the scope of the Machinery Directive as a safety component. This function complies with European harmonized standards such as EN/IEC 61800-5-2. The declarations of conformity are shown below.

Compliance with the European ATEX Directive

The safety function of this manual (option +L537+Q971) is within the scope of the ATEX product directive 2014/34/EU as a protective system. The function complies with European harmonized standard EN 50495. The declarations of conformity are shown below.
EU Declaration of Conformity


We, Manufacturer: ABB Oy
Address: Hiromti 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11
declare under our sole responsibility that the following products:

Frequency converters and frequency converter components

ACS880-01, -11, -31
ACS880-04, -04XT, -04F, -04FXT, -M04, -14, -34
ACS880-104, -104LC
ACS880-07, -17, -37, -107
ACS880-07LC, -17LC, -37LC, -107LC (frames nxR8i)

identified with serial numbers beginning with 1 or 8
with FPC-02 module
with regard to the safety function

ATEX certified thermistor protection (Safe Motor Temperature) (option code +L537 +Q971)

are in conformity with all the relevant requirements for
protective system of EU Directive for Equipment for Explosive atmospheres 2014/34/EU, and

safety component of the EU Machinery Directive 2006/42/EC, when the listed safety functions are used for safety component functionality

Directive 2014/34/EU

Specific marking of explosion protection

Ex II (2) GD.

The following harmonized standard has been applied:

<table>
<thead>
<tr>
<th>EN 50455:2010</th>
<th>Safety devices required for the safe functioning of equipment with respect to explosion risks</th>
</tr>
</thead>
</table>

1/2
Notified Body: Eurofins Expert Services Oy, Notified Body number 0537, Address: Kivimiehenranta 4, 02130 Espoo, Finland

has assessed the conformity of the "ATEX certified thermistor protection" function and has issued the certificate VTT 15 ATEX 050.

**Directive 2006/42/EC**

The following harmonized standards have been applied:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 61800-5-2:2007</td>
<td>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional</td>
</tr>
<tr>
<td>EN ISO 13849-1:2015</td>
<td>Safety of machinery – Safety-related parts of control systems. Part 1: General principles for design</td>
</tr>
</tbody>
</table>

The following other standards have been applied:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61800-5-2:2016</td>
<td>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional</td>
</tr>
</tbody>
</table>

The products referred in this Declaration of conformity fulfil the relevant provisions of other European Union Directives which are notified in Single EU Declarations of conformity 3AXD10000497305 and 3AXD10000497831.

Person authorized to compile the technical file:
Name and address: Ari Korpela, Hlomitie 13, 00380 Helsinki, Finland

Helsinki, 16 Dec 2019

Signed for and on behalf of:

Peter Lindgren
Vice President, ABB Oy

Tuomo Tarula
Vice President, ABB Oy

3AXD10000466768 rev.G
ATEX certificate

ATEX certificate for the Safe motor temperature function with the FPTC-02 module and ACS880 drive series (VTT 15 ATEX 050).
8. VTT Expert Services Ltd, notified body number 0537, in accordance with Article 21 of the Directive 2014/34/EU of February 2014, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective system intended for use in potentially explosive atmospheres given in Annex II to the Directive.

9. Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50495 (2010)

10. If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

11. This EU-Type examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the Directive 2014/34/EU. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

12. The marking of the equipment or protective system shall include the following:

II (2) GD

Espoo, 26.4.2018
VTT Expert Services Ltd

Jenni Hirvelä  Risto Sulonen
Expert  Senior Expert

Certificate without signatures shall not be valid.
This certificate, including the schedule, may only be reproduced in its entirety and without any change.
Check the latest version of the certificate in the ABB Library.
TÜV Nord certificate

TÜV Nord certificate for the FPTC-02 module and ACS880 drive series is attached below.

Certificate
No. SEBS-A.095525/15 V1.0

TÜV NORD Systems GmbH & Co. KG hereby certifies

ABB Oy
Hiilotie 13
00381 Helsinki
Finland

that the
FPTC-02

as a plug-in module for the ABB industrial drive ACS880 series

with the safety function Safe Motor Temperature (SMT) meets the requirements listed in
the following standards

- IEC 61508 part 1:2010; part 2:2010; capable up to SIL 2
- ISO 13849-1:2006, ISO 13849-2:2012; capable up to PL c (category 1)
- IEC 61800-5-2:2007; capable up to SIL 2
- IEC 62061:2015; capable up to SILcL 2

The module can also be used in safety applications up to SIL 2 according to IEC 61511-1:2004

Base of certification is the report
SEBS-A.095525/15TB in the valid version.

This certificate entitles the holder to use the pictured safety approved mark.

Expiry date: 2020-11-27
Reference No: 8112238954

Hamburg, 2015-11-27

T. Neike

Certification Body SEECERT
TÜV NORD Systems GmbH & Co. KG
Große Bahnstraße 31, 22525 Hamburg, Germany
Further information

Product and service inquiries
Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/searchchannels.

Product training
For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB manuals
Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet
You can find manuals and other product documents in PDF format on the Internet at www.abb.com/drives/documents.