OPTIONS FOR ABB DRIVES

CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971)
User’s manual
List of related manuals

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</tr>
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</tr>
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<td>3AXD50000035866</td>
</tr>
<tr>
<td>ACQ180-01 (0.75 to 250 kW) hardware manual R1-R9</td>
<td>3AXD50000044862</td>
</tr>
<tr>
<td>ACQ180-04 hardware manual</td>
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</tr>
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</tr>
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<td>3AXD50000035867</td>
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</tbody>
</table>

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| ACS-AP-x assistant control panels user’s manual                                                    | 3UA0000085685  |
| CPTC-02 ATEX certified thermistor protection module, Ex II (2) GD (+L537+Q971) user’s manual       | 3AXD50000030058 |
| Manuals and quick guides for I/O extension modules, fieldbus adapters, etc.                       |                |

| Drive PC tool manuals                                                                                |                |
| Drive composer start-up and maintenance PC tool user’s manual                                      | 3UA0000094606  |

| General safety guides                                                                                |                |
| Functional safety, Technical guide No. 10                                                          | 3UA0000048753  |
| Safety and functional safety: A general guide                                                      | 1SFC01000880201 |
| ABB Safety information and solutions                                                                | www.abb.com/safety |
| Potentially explosive atmospheres. The basics you need to know about motors and drives             | 3UA0000037223  |

You can find manuals and other product documents in PDF format on the Internet. See section Document library on the Internet on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.
User’s Manual

CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971)

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Safety

Contents this chapter
The chapter contains the warning symbols used in this manual and the safety instructions which you must obey when you install or connect an option module to a drive. If you ignore the safety instructions, injury, death or damage can occur. Read this chapter before you start the installation.

Use of warnings
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. The manual uses these warning symbols:

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

Safety in installation and maintenance

These instructions are for all who install or connect an option module to a drive and need to open its front cover or door to do the work.

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

- If you are not a qualified electrician, do not do installation or maintenance work.
- Disconnect the drive from all possible power sources. After you have disconnected the drive, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
- Disconnect all dangerous voltages connected to other connectors or parts in reach. For example, it is possible that 230 V AC is connected from outside to a relay output of the drive.
- Always use a multimeter to make sure that there are no parts under voltage in reach. The impedance of the multimeter must be at least 1 Mohm.
Other warnings

WARNING! The Safe torque off (STO) function cannot prevent the intermediate DC current from flowing through, and heating up, the motor in case a short circuit occurs in the output stage of the drive. The supplier must take this into account when planning the protection of the installation.

WARNING! Cabinet-installed drives: Never connect, test or measure a drive based on the diagrams of 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.
Introduction to the manual

Contents of this chapter
This chapter contains general information about the manual.

Applicability
This manual applies to the CPTC-02 module and to the Safe motor temperature (SMT) safety function which uses the CPTC-02 module (option +L537+Q971).

Compatibility
The CPTC-02 module is compatible with:
• ACS580-01/-04, ACH580-01/-04/-31, and ACQ580-01/-04/-31 wall-mounted drives and drive modules to be installed in user-defined cabinet
• ACS580-07, ACH580-07, and ACQ580-07 cabinet-installed drives
• ACS580 standard control program version 1.70 or later
• ACH580 HVAC control program version 2.05 or later
• ACQ580 pump control program version 2.05 or later
Target audience

This manual is intended for people who plan the installation, install, start up, use and service the option module. Before you do work on the module, read this manual and the applicable drive manual that contains the hardware and safety instructions for the product in question.

You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols and ATEX/Ex regulations.

The manual is written for readers worldwide. Both SI and imperial units are shown.

Contents of the manual

The manual consists of these chapters:

- **Safety** contains the safety instructions which you must obey when you install the module.
- **Introduction to the manual** (this chapter) introduces the manual.
- **Hardware description** gives a short description of the module.
- **Option description** describes the Safe motor temperature (SMT) function implemented with the module.
- **Mechanical installation** contains a delivery checklist and instructions on installing the module.
- **Electrical installation** contains instructions on wiring the module.
- **Start-up and acceptance test** contains instructions on starting up the module and the acceptance test for the safety function.
- **Diagnostics** shows how to trace faults with the status LED on the module.
- **Technical data** contains the technical data of the module.
Related documents

- Product manuals (see the inside of the front cover).

Terms and abbreviations

<table>
<thead>
<tr>
<th>Term/abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX</td>
<td>Directives 2014/34/EU (94/9/EC) and 1999/92/EC are commonly referred to as the ATEX directives (from “Atmosphères Explosibles”)</td>
</tr>
<tr>
<td>ACx580</td>
<td>ACS580, ACH580 or ACQ580</td>
</tr>
<tr>
<td>Cat.</td>
<td>Category. 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.</td>
</tr>
<tr>
<td>CCF</td>
<td>Common cause failure (EN ISO 13849-1)</td>
</tr>
<tr>
<td>CCU</td>
<td>Control board type</td>
</tr>
<tr>
<td>CPTC-02</td>
<td>ATEX-certified thermistor protection module, Ex II (2) GD</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>DO</td>
<td>Digital output</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</td>
</tr>
<tr>
<td>Ex d</td>
<td>Type of protection, flameproof enclosures (EN/IEC 60079-1)</td>
</tr>
<tr>
<td>Ex e</td>
<td>Type of protection, increased safety (EN 60079-7:2007 and IEC 60079-7:2006), to be replaced with Ex eb</td>
</tr>
<tr>
<td>Ex eb, Ex ec</td>
<td>Types of protection, increased safety (IEC 60079-7:2015)</td>
</tr>
<tr>
<td>Ex motors</td>
<td>Motors used in explosive atmospheres</td>
</tr>
</tbody>
</table>
## Introduction to the manual

<table>
<thead>
<tr>
<th>Term/abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex nA</td>
<td>Type of protection, non-sparking enclosures (EN/IEC 60079-15:2010), to be replaced with Ex ec</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>HFT</td>
<td>Hardware fault tolerance. (EN/IEC 62061)</td>
</tr>
<tr>
<td>MTTF_D</td>
<td>Mean time to dangerous failure: (The total number of life units) / (the number of dangerous, undetected failures) during a particular measurement interval under stated conditions (EN ISO 13849-1)</td>
</tr>
<tr>
<td>NO</td>
<td>Normally open</td>
</tr>
<tr>
<td>PFD_{avg}</td>
<td>Average probability of dangerous failure on demand</td>
</tr>
<tr>
<td>PFH</td>
<td>Average frequency of dangerous failures per hour</td>
</tr>
<tr>
<td>Safety system</td>
<td>Whole safety system including, for example, human interface, CPTC-02 module, drive and sensors.</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 (levels are: 1, 2, 3, and 4). Corresponds to PL. (EN 62061)</td>
</tr>
<tr>
<td>SMT</td>
<td>Safe motor temperature (EN/IEC 61800-5-2)</td>
</tr>
<tr>
<td>STO</td>
<td>Safe torque off (EN/IEC 61800-5-2)</td>
</tr>
<tr>
<td>PL</td>
<td>Performance level (levels are: a, b, c, d and e). Corresponds to SIL. (EN ISO 13849-1)</td>
</tr>
<tr>
<td>PTC</td>
<td>Positive temperature coefficient</td>
</tr>
<tr>
<td>T1</td>
<td>Proof test interval (IEC 61508). T1 is a parameter used to define the probabilistic failure rate (PFH or PFD) for the safety function or subsystem. Performing a proof test at a maximum interval of T1 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 T1 values stated cannot be regarded as a guarantee or warranty. See also section Proof test interval on page 50.</td>
</tr>
</tbody>
</table>
Zone Potentially explosive atmosphere. Hazardous areas are divided into zones, according to the degree of hazard. The degree of hazard is defined according to the probability of the occurrence of explosive atmospheres.
Exclusion of liability

ABB is not responsible for the implementation, verification and validation of the overall safety system. It is the responsibility of the end user (or other party) who is responsible for the overall system, system safety and ATEX/Ex regulations.

The end user (or other responsible party) must make sure that the entire implementation complies with all relevant standards, directives and local electrical code, and that the system is tested, verified and validated correctly.
Hardware description

Contents of this chapter
This chapter gives a short description of the module.

Product overview

PTC interface

The CPTC-02 module has a motor thermistor connection for supervising the motor temperature and one relay output, which indicates motor overtemperature. To trip the drive at motor overtemperature, the relay output must be connected to the Safe torque off (STO) input of the drive.

The PTC interface of the CPTC-02 module implements the Safe motor temperature (SMT) safety function as defined in EN/IEC 61800-5-2:2007.

Inside the module, there is reinforced insulation between the motor thermistor connection, the relay output and the drive control board interface. The insulation forms a reliable protective separation between the motor main circuit and the drive control circuits. Therefore, the drive control board is PELV compatible also when
the CPTC-02 module and a thermistor protection circuit are installed.

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

- **External power supply interface**

  The module has an external power supply interface, which can be used to power up the drive control board in case the drive power supply fails. If you do not need the back-up power supply, you do not have to connect it because the module is powered from the drive control board by default.

- **Layout**

  ![Diagram](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grounding screw</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>2</td>
<td>Hole for mounting screw</td>
</tr>
<tr>
<td>3</td>
<td>2-pin terminal block for motor thermistor connection</td>
</tr>
<tr>
<td>4</td>
<td>2-pin detachable terminal block for relay output</td>
</tr>
<tr>
<td>5</td>
<td>2-pin terminal block for external power supply</td>
</tr>
<tr>
<td>6</td>
<td>Diagnostics LED</td>
</tr>
</tbody>
</table>
## Hardware description

### Markings

#### Module

#### Type designation label

The type designation label is attached on the back side of the CPTC-02 module. An example label and description of the label contents are shown below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type</td>
</tr>
<tr>
<td>2</td>
<td>Serial number of format RYWSSSSWS, where</td>
</tr>
<tr>
<td></td>
<td>R: Component revision: A, B, C, ...</td>
</tr>
<tr>
<td></td>
<td>Y: Last digit of the manufacturing year: 4, 5, ... for 2014, 2015</td>
</tr>
<tr>
<td></td>
<td>WW: Manufacturing week: 01, 02, ... for week 1, week 2, ...</td>
</tr>
<tr>
<td></td>
<td>SSSS: Integer starting every week from 0001</td>
</tr>
<tr>
<td></td>
<td>WS: Manufacturing location</td>
</tr>
<tr>
<td>3</td>
<td>ABB MRP code of the module</td>
</tr>
<tr>
<td>4</td>
<td>Combined ABB MRP code, serial number and manufacturing location</td>
</tr>
<tr>
<td>5</td>
<td>RoHS mark</td>
</tr>
</tbody>
</table>
ATEX markings

The markings on the module signify ATEX classification of the CPTC-02 module.

![ATEX Markings](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The European Commission mark for Ex products.</td>
</tr>
<tr>
<td>2</td>
<td>Equipment group II: Product for surface industry (other than mining applications).</td>
</tr>
<tr>
<td>3</td>
<td>Category 2 equipment. Brackets indicate 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>
The package of the CPTC-02 module contains a sticker to signify ATEX classification of the Safe motor temperature (SMT) function. The user must attach this sticker next to drive’s type designation label.

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The European Commission mark for Ex products.</td>
</tr>
<tr>
<td>3</td>
<td>Equipment group II: Product for surface industry (other than mining applications).</td>
</tr>
<tr>
<td>4</td>
<td>Category 2 equipment: Brackets indicate that the drive (or inverter module) must be installed outside the potentially explosive atmosphere.</td>
</tr>
<tr>
<td>5</td>
<td>Certified for use in explosive atmospheres caused by: G = gases, vapors or mists, D = dust.</td>
</tr>
<tr>
<td>6</td>
<td>Certificate reference.</td>
</tr>
</tbody>
</table>
Option description

Contents of this chapter
This chapter describes the Safe motor temperature (SMT) function implemented with the CPTC-02 module and gives instructions for the user.

Overview
The ATEX-certified Safe motor temperature function described in this manual requires that the drive includes the ATEX-certified Safe disconnection function (option +Q971) and the CPTC-02 module (option +L537).

To implement the Safe motor temperature (SMT) function, the relay output of the CPTC-02 module must be connected to the Safe torque off (STO) input of the drive.

When the motor temperature rises above the PTC sensor limit temperature, the sensor resistance increases sharply. This indicates overtemperature to the CPTC-02 module. The module switches the drive Safe torque off (STO) circuit off which 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 STO function is activated, it coasts to a stop.

**Note:** You cannot change the stop mode of the STO function (no ramp stop is possible).

For more information on the drive STO function, see the appropriate drive hardware manual.
**Wall-mounted drives and drive modules**

The module is available as an add-on kit (option+L537+Q971). If you intend to retrofit the CPTC-02 module to an installed drive, you need to make sure that the ATEX certification enables the retrofit. Contact your local ABB representative for more information.

The user:
- installs the option module to Option slot 2 of the drive control board,
- connects the PTC temperature sensors of the motor to the PTC input of the option module, and
- connects the drive STO terminals to the relay output of the option module.

**Cabinet-installed drives**

For cabinet-installed drives, the module is available as a factory-installed option +L537+Q971.

The user connects the PTC temperature sensors of the motor to the PTC inputs of the module.
Resetting the safety function

A manual reset is mandatory in an ATEX-certified safety function. The CPTC-02 module generates a fault indication to the drive when motor overtemperature is reached. The user must reset the drive before it is possible to restart the drive.

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 two sources:

1. Overtemperature fault in the drive (fault 4991).
2. 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.

To avoid parallel fault indications, set the STO indication parameter (31.22) to value Warning/Warning. See chapter Start-up for instructions.

Note: The indications of the safety function are not SIL classified.

Switching frequency limitation

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

For ABB Ex motors, use parameter 95.15 to set the required minimum switching frequency (see page 41).

For Ex motors supplied by other motor manufacturers, contact the motor manufacturer for the correct value and use parameters 97.01 and 97.02 to make the parameter setting in the drive (see page 42).
Fault reaction function

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

- **STO function in the drive**
  The STO function in the drive has internal fault diagnostics and a fault reaction function which causes a fault trip in case it detects a redundancy fault of STO control signals or any internal failure. See the hardware and firmware manuals of the drive.
30 Option description
Mechanical installation

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

Necessary tools and instructions
• Screwdriver and a set of suitable bits
For a complete list of tools, see the applicable drive hardware manual.

Unpacking and checking the delivery
1. Open the option package.
2. Make sure that the package contains:
   • CPTC-02 module
   • mounting screw
   • STO cable
   • ATEX label (with the ATEX classification markings)
   • this manual.
3. Make sure that there are no signs of damage.
Installing the module

Install the module to Option slot 2 of the drive control board. See the drive hardware manual.
Electrical installation

Contents of this chapter
This chapter contains instructions on wiring the module.

Warnings

**WARNING!** Obey the safety instructions. See chapter Safety. If you ignore the safety instructions injury or death can occur.

Make sure that the drive is disconnected from the input power during installation. If the drive is already connected to the input power, wait for 5 minutes after disconnecting the input power.

Necessary tools and instructions

- Screwdriver with a set of suitable bits
- Cabling tools
Selecting the location for the drive

Install the drive, the CPTC-02 module, and the STO circuit outside any potentially explosive atmosphere. Consider the ambient conditions specification in the drive hardware manual.

General wiring instructions

1. For the STO circuit wiring, use the type of cable specified in the appropriate drive hardware manual.

2. Wire only the sensor circuit into the potentially explosive atmosphere.

3. The PTC 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 60079-7:2015; Ex e in EN 60079-7:2007 and IEC 60079-7:2006),

4. Route the sensor cables away from the motor cable.

5. We recommend to use a shielded sensor cable to minimize electromagnetic interference from power cables.
Terminal designations

Motor thermistor connection

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>PTC IN PTC connection</td>
</tr>
<tr>
<td>61</td>
<td>PTC IN Ground (earth) potential</td>
</tr>
</tbody>
</table>

Relay output connection

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>RO PTC C Common, C</td>
</tr>
<tr>
<td>63</td>
<td>RO PTC C Normally open, NO</td>
</tr>
</tbody>
</table>

External power supply

The external power supply is needed only if you want to connect an external back-up power supply for the drive control board.

**Note:** Only frames R0...R5 need CPTC-02 for connecting external power supply, frames R6...R9 have corresponding terminals 40 and 41 on the control board.

<table>
<thead>
<tr>
<th>Marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>24V AC/DC + in External 24 V (AC/DC) input</td>
</tr>
<tr>
<td>41</td>
<td>24V AC/DC - in External 24 V (AC/DC) input</td>
</tr>
</tbody>
</table>
**Wiring**

Connect the external control cables to the applicable module terminals. Ground the outer shield of the cables 360 degrees under a grounding clamp on the grounding shelf of the control cables.

1. **Motor thermistor connection example**

![Diagram showing PTC thermistor connection]

- The PTC input is reinforced/double insulated. If the motor part of the PTC thermistor and wiring are reinforced/double insulated, voltages on the PTC wiring are within SELV limits.

- If the motor PTC circuit is not reinforced/double insulated (that is, it is basic insulated), it is mandatory to use reinforced/double insulated wiring between the motor PTC and CPTC-02 PTC terminal.

1) 1…6 PTC thermistors connected in series.
**Relay output connection**

Connect the drive STO circuit to the relay output of the module as shown in this figure. In the cabinet-installed drives, the wiring is done at the factory.

An alternative connection with an external STO switch.
**38 Electrical installation**

**Power supply connection**

<table>
<thead>
<tr>
<th>1)</th>
<th>40</th>
<th>24V AC/DC + in</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>24V AC/DC - in</td>
<td></td>
</tr>
</tbody>
</table>

1) External power supply, 24 V AC/DC

---

**WARNING!** Do not connect the +24 V AC cable to the control board ground when the control board is powered using an external 24 V AC supply.
Start-up and acceptance test

Contents of this chapter

This chapter contains the start-up instructions and the acceptance test for the SMT function.

Note: Only a competent person with expertise and knowledge of the safety function as well as functional safety and Ex/ATEX regulations can do the start-up and adjust the related settings. (IEC 61508-1 clause 6).
Start-up and acceptance test

Start-up

The module is started up through drive parameters. Use the Drive composer PC tool or the control panel to set the parameter values.

1. Power up the drive.
2. If no warning is shown,
   • make sure that the value of both parameter 15.02 Detected extension module and parameter 15.01 Extension module type is CPTC-02.
   If warning A7AB Extension I/O configuration failure is shown,
   • make sure that the value of parameter 15.02 Detected extension module is CPTC-02,
   • set parameter 15.01 Extension module type to CPTC-02.

You can now see the parameters of the extension module in parameter group 15 I/O extension module. See the firmware manual.

In addition, set the parameters in this table.

<table>
<thead>
<tr>
<th>Index</th>
<th>Name / Value</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.</td>
</tr>
<tr>
<td></td>
<td>Warning/Warning</td>
<td>The drive generates a warning. This parameter value does not affect the SMT function, but this is the recommended setting (see section Indications of the safety function on page 28).</td>
</tr>
</tbody>
</table>
35.31 Safe motor temperature enable
Activates (On) or deactivates (Off) the Safe motor temperature (SMT) fault indication (4991).
0 = Off
1 = On
This parameter is automatically set to On, when CPTC-02 module is connected to the drive. If the module is removed from the drive, the parameter remains On, and the drive will trip to a fault. User must set parameter to Off manually and reset the fault to continue operation without the module. When the module is connected again, the parameter is automatically set to On.

95.15 Special HW settings
Defines hardware-related settings that can be enabled and disabled by toggling the specific bits.

<table>
<thead>
<tr>
<th>Index</th>
<th>Name / Value</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 (4 kHz). Note: For non-ABB Ex motors, use parameters 97.01 and 97.02 to define the correct minimum switching frequency. Note: If you have a multimotor system, contact your local ABB representative.</td>
</tr>
<tr>
<td>97.01</td>
<td>Switching frequency reference</td>
<td>Defines the switching frequency of the drive. Note: If you have a multimotor system, contact your local ABB representative.</td>
</tr>
<tr>
<td>97.02</td>
<td>Minimum switching frequency</td>
<td>Defines the minimum limit for the switching frequency. If parameter 95.15 is set to 1, drive sets the value to 4 kHz automatically. For non-ABB Ex motors, consult the motor manufacturer.</td>
</tr>
</tbody>
</table>
### Start-up and acceptance test

<table>
<thead>
<tr>
<th>Index</th>
<th>Name / Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>97.09</td>
<td>Switching frequency mode</td>
<td>Defines the switching frequency mode. Normal = Used switching frequency is selected with parameters 97.01 and 97.02.</td>
</tr>
<tr>
<td>97.18</td>
<td>Hexagonal field weakening</td>
<td>Activates (On) or deactivates (Off) the Hexagonal field weakening. 0 = Off. For ABB Ex motors (parameter 95.15 is set to 1), this parameter is automatically set to Off. For non-ABB Ex motors (when parameter 95.15 bit 0 is not set), set this parameter to Off.</td>
</tr>
</tbody>
</table>
Acceptance test

You need the Drive composer PC tool or the control panel to perform the acceptance test.

Initial status: Make sure that the drive is ready for use, that is, you have done the tasks of the drive start-up procedure, and the CPTC-02 module is installed and started up as instructed in this manual. See the hardware manual.

Action

<table>
<thead>
<tr>
<th>Action</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING! Obey the safety instructions. See chapter Safety. If you ignore the safety instructions injury or death can occur.</td>
<td></td>
</tr>
</tbody>
</table>

Checks and settings with no voltage connected

- Make sure that the ATEX markings are attached in the module and the drive (see section Markings on page 22).
- Make sure that the classification of the motor thermal protection function corresponds to the Ex classification of the environment and the Ex motor.
- 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. See chapter Technical data.
- After you have done the wiring, check the connections against the appropriate circuit diagrams in chapter Electrical installation. For a cabinet-installed drive, check also the circuit diagrams delivered with the drive.

Settings with voltage connected

- Make sure that all parameters relevant to the safety function are set as defined in section Start-up on page 40.

Acceptance test procedure

- Make sure that you can run and stop the motor freely during the test.
- Start the drive and make sure that motor is running.
- Cause an overtemperature situation:
  - increase the resistance in the PTC input above 3.6 kOhm (for example, open the circuit by disconnecting the wires connected to the CPTC-02 module).
## Start-up and acceptance test

### Action

<table>
<thead>
<tr>
<th>Action</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make sure that the correct indications are activated:</td>
<td></td>
</tr>
<tr>
<td>• the SMT fault (4991) and other indications depending on the parameter settings (see section Indications of the safety function on page 28).</td>
<td></td>
</tr>
<tr>
<td>Make sure that the STO is activated and the motor coasts to a stop.</td>
<td></td>
</tr>
<tr>
<td>Make sure that you cannot start the drive before you have reset the drive.</td>
<td></td>
</tr>
<tr>
<td>Reset the drive. Make sure you cannot reset and restart the drive before the input resistance in the PTC input has been decreased below 1.6 kOhm. Reconnect the thermistor to the CPTC-02 module if disconnected earlier.</td>
<td></td>
</tr>
<tr>
<td>Restart the drive and motor and make sure they operate normally.</td>
<td></td>
</tr>
<tr>
<td>Cause a short-circuit situation:</td>
<td></td>
</tr>
<tr>
<td>• connect a jumper wire between the thermistor terminals of the CPTC-02 module.</td>
<td></td>
</tr>
<tr>
<td>Make sure that the correct indications are activated:</td>
<td></td>
</tr>
<tr>
<td>• the SMT fault (4991) and other indications depending on the parameter settings (see section Indications of the safety function on page 28).</td>
<td></td>
</tr>
<tr>
<td>Make sure that the STO is activated and the motor coasts to a stop.</td>
<td></td>
</tr>
<tr>
<td>Make sure that you cannot start the drive before you have reset the drive.</td>
<td></td>
</tr>
<tr>
<td>Restart the drive and motor and make sure they operate normally.</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>
Diagnostics

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 failures
Report any failures of the CPTC-02 module and the drive Safe torque off function to ABB.

CPTC-02 module replacement
If the CPTC-02 module fails to operate, you have to replace it with a new one. You cannot repair the module.
### Faults and warning messages

<table>
<thead>
<tr>
<th>Code (hex)</th>
<th>Name</th>
<th>Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warnings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7AB</td>
<td>Extension I/O configuration failure</td>
<td>Installed option module is not the same as configured by drive parameter.</td>
<td>Check that the installed module is of the same type that the drive has detected (shown by parameter 15.02 Detected extension module) and that has been configured either by the user or drive (parameter 15.01 Extension module type).</td>
</tr>
<tr>
<td><strong>Faults</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4991</td>
<td>Safe motor temperature</td>
<td>The CPTC-02 module indicates overtemperature. 1. Motor temperature is too high, or 2. the thermistor is in short-circuit or disconnected.</td>
<td>1. Check the cooling of the motor. 2. Check the motor load and drive ratings. 3. Check the wiring of the temperature sensor. Repair wiring if faulty. 4. Measure the resistance of the sensor. Replace the sensor if faulty.</td>
</tr>
<tr>
<td>4993</td>
<td>CPTC-02 not found</td>
<td>Safe motor temperature is enabled (35.31) but the CPTC-02 module is not detected (parameter 15.02 Detected extension module)</td>
<td>Power down the control unit and check that the CPTC-02 module is properly inserted in the correct option slot.</td>
</tr>
</tbody>
</table>
The CPTC-02 module has one diagnostic LED.

### Code (hex) | Name | Cause | What to do
--- | --- | --- | ---
5089 | SMT circuit malfunction | Safe motor temperature fault (4991) is generated but drive STO is not activated. Note: If only one STO channel is opened, Safe torque off fault (FA81 or FA82) is generated. | 1. Check connection between the relay output of the CPTC-02 module and the STO terminal. 2. Check CPTC-02 module. Replace if faulty.  

#### LEDs

The CPTC-02 module has one diagnostic LED.

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>The module is powered up.</td>
</tr>
</tbody>
</table>
Maintenance

Contents of this chapter
This chapter gives maintenance instructions.

Maintenance
After the operation of the safety circuit has been tested at start-up, periodic proof testing will be needed during its specified lifetime.

In addition to proof testing, it is a good practice to check the operation of the safety function when other maintenance procedures are carried out on the machinery. Do the acceptance test described in chapter Start-up and acceptance test.

If you change any wirings or components after the start-up, replace the CPTC-02 module, modify drive parameters, or restore parameters to their factory default values, you must:

- Use only ABB-approved spare parts.
- Register the change to the change log for the safety circuit or logbook of the machine.
- Test the safety function again after the change. Obey the rules given in chapter Start-up and acceptance test.
- 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 5 or 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. Do the test as described in chapter Start-up and acceptance test.

The person responsible for the design of the complete safety function should be aware that there might be other testing interval requirements for electromechanical devices which are used in safety circuits. For example, contactors, breakers, safety relays, contactor relays, emergency stop buttons, switches, etc. are typically safety devices which contain electromechanical outputs. The CPTC-02 module 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 operator.

**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.
52 Maintenance
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 is also given.
Installation: Into Option slot 2 on the drive control board

Degree of protection: IP20

Package: Cardboard
Isolation areas

This figure describes the different isolation areas of the module.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reinforced insulation (IEC 61800-5-1:2007)</td>
</tr>
</tbody>
</table>
Connections

- Motor thermistor connection (60…61)
  - Wire size max. 1.5 mm²
  - Length max. 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 (330 ft).
  - Type: Draka JAMAK 1 x (2 + 1) x 0.5 mm² or similar
  - Torque: 0.5 N·m
  - Supported standards: DIN 44081 and DIN 44082
  - Number of PTC thermistors (sensors): 1…6 in series
    - 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%

- Relay output (STO) connection (62…63)
  - Wire size max. 1.5 mm²
  - Length max. 30 m (100 ft) (for the whole loop)
  - Torque: 0.5 N·m
  - Maximum contact rating: 250 V AC / 30 V DC / 5 A
  - Maximum breaking capacity: 1000 VA

- External power supply (40…41)
  - Wire size max. 1.5 mm²
  - 24 V AC / V DC ±10% (GND, user potential)
  - Maximum current consumption: 25 W, 1.04 A at 24 V DC
Ambient conditions

See the drive technical data.

Safety data

The CPTC-02 module is a type A safety component as defined in IEC 61508-2.

The table gives the safety data for the SMT function. The calculations are based on the worst case data of the drive Safe torque off (STO) function. The given safety data applies with proof test interval $T_1 = 20$ years (high demand and continuous mode of operation) and $T_1 = 2$ years or $T_1 = 5$ years (low demand mode of operation).

<table>
<thead>
<tr>
<th>SIL</th>
<th>PL</th>
<th>SFF [%]</th>
<th>$PFH [1/h]$ ($T_1 = 20$ a)</th>
<th>$PFD_{avg}$ ($T_1 = 5$ a)</th>
<th>$PFD_{avg}$ ($T_1 = 2$ a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>c</td>
<td>&gt;60</td>
<td>3.46E-08</td>
<td>7.54E-04</td>
<td>3.01E-04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC [%]</th>
<th>SC</th>
<th>Cat.</th>
<th>HFT</th>
<th>CCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>65</td>
</tr>
</tbody>
</table>

Safety block diagram

The components that are included in the safety data calculations are shown in this safety block diagram. The failure rate of the PTC sensor is not included in the calculations.
**Technical data**

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

**Relevant failure modes**
- The SMT function trips spuriously (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.
General rules, notes and definitions

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

- **Validation procedure**
  You must do the acceptance test using the checklist given in chapter *Start-up and acceptance test*:
  - at initial start-up of the safety function
  - after any changes related to the safety function (circuit boards, wiring, components, settings, etc.)
  - after any maintenance work related to the safety function.

  The acceptance test must include at least the following steps:
  - having an acceptance test plan
  - testing all commissioned functions for proper operation, from each operation location
  - documenting all acceptance tests
  - signing and storing the acceptance test report for further reference.
Acceptance test reports

You must store the signed acceptance test reports in the logbook of the machine. 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.

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.

Ambient conditions

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

Reporting problems and failures related to safety functions

Contact your local ABB representative.
### Related standards and directives

<table>
<thead>
<tr>
<th>Standard</th>
<th>Name</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>EN/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 61326-3-1:2008</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</td>
</tr>
<tr>
<td>2006/42/EC</td>
<td>European Machinery Directive</td>
</tr>
<tr>
<td>2014/34/EU (previously 94/9/EC)</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 (previously 94/9/EC) as a protective system. The function complies with European harmonized standard EN 50495. The declarations of conformity are shown below.
EU Declaration of Conformity

Manufacturer: ABB Oy
Address: Karjantie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11

I, ABB Oy, declare under our sole responsibility that the following products:

- ACH080-01/04/-01
- ACH080-01/04/-04/-07
- ACH080-01/04/-04/-07

are in conformity with all the relevant requirements for:
- the protective system of EU Directive for Equipment for Explosive atmospheres 2014/34/EU, and
- the safety component of the EU Machinery Directive 2006/42/EC, when the listed safety functions are used for safety component functionality.

Specific marking of explosion protection:

Ex i (2) GA

The following harmonized standard has been applied:

EN 50490:2010

Safety device for the safe functioning of equipment with respect to explosion risks

364020100004891960
Note: If the Declaration of Conformity is needed in any other official language of European Union than in English, contact ABB.
ATEX certificate

ATEX certificate for the Safe motor temperature function with the CPTC-02 module and ACx580 drive series.

1. EU-TYPE EXAMINATION CERTIFICATE
2. Equipment or Protective System intended for use in potentially explosive atmospheres
   Directive 2014/34/EU
3. Reference: VTT 15 ATEX 051 Issue 2
4. Equipment: Thermal motor protection system for converter drive ACS580, ACS200 and ACS550 series
   Certified type: ACS580 + LST7 + (PT1) (CPTC-02)
   ACS200 + LST7 + (PT1) (CPTC-02)
   ACS550 + LST7 + (PT1) (CPTC-02)
5. Applicant: ABB Oy Drives
   Hiisimo 13
   FIN-02470 Helsinki
   Finland
6. Manufacturer: ABB Oy Drives
   Hiisimo 13
   FIN-02470 Helsinki
   Finland
   ABB ASLV Drives
   Angrybo 58
   75361 Harjumaa
   Estonia
   ABB Oy Drives
   Drives Service
   Kielitie 14
   FI-14550 Vantaa
   Finland
7. This equipment or protective system and any acceptable variations thereof are
specified in the schedule and possible supplement/s to this Certificate and the
documents therein referred to.

8. VTT Expert Services Ltd, notified body number 0537, in accordance with Article
23 of the Directive 2014/34/EU of February 2014, certifies that the 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 (including 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:

[H] [GD]

Expo, 30.5.2017

VTT Expert Services Ltd

Kestveda
Expert

Selosmäki
Product Manager

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

TÜV Nord certificate for the CPTC-02 module and ACx580 drive series is attached below.

Certificate

No. SEBS-A.09271015 V1.0
TÜV NORD Systems GmbH & Co. KG hereby certifies
ABB Oy
Hommele 13
00381 Helsinki
Finland
that the
CPTC-02
as a plug-in module for the ABB industrial drive ACx580 series
with the safety function Safe Motor Temperature (SMT) meets the requirements listed in the following standards:

- IEC 61008 part 1:2010; part 2:2010; capable up to SIL 2
- ISO 13849-1:2016, ISO 13849-2:2012; capable up to PLC (category 1)
- IEC 61800-5-2:2007; capable up to SIL 2

The module can also be used in safety applications according to IEC 61511-1:2016.

Base of certification is the report SEBS-A.09271015STD in the valid version.

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

Expiry date: 2021-05-11
Reference No.: 9123817488

Hamburg, 2016-05-11

B. Pfaff
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 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 abb.com/drives/documents.