

OPTIONS FOR ABB DRIVES

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

User's manual



List of related manuals

Drive hardware manuals and guides

	Code (English)
Drive/converter/inverter safety instructions	3AXD50000037978
ACS580-01 (0.75 to 250 kW) hardware manual R0-R9	3AXD50000018826
ACS580-01 (0.75 to 250 kW) hardware manual R1-R9	3AXD50000044794
ACS580-04 drive modules (200 to 500 kW) hardware manual	3AXD50000015497
ACS580-07 drives hardware manual	3AXD50000045815
ACH580-01 (0.75 to 250 kW) hardware manual R0-R9	3AUA0000076331
ACH580-01 (0.75 to 250 kW) hardware manual R1-R9	3AXD50000044839
ACH580-04 drive modules (250 to 500 kW) hardware manual	3AXD50000048685
ACH580-07 hardware manual	3AXD50000045816
ACH580-31 hardware manual	3AXD50000037066
ACQ580-01 (0.75 to 250 kW) hardware manual R0-R9	3AXD50000035866
ACQ580-01 (0.75 to 250 kW) hardware manual R1-R9	3AXD50000044862
ACQ580-04 hardware manual	3AXD50000048677
ACQ580-07 hardware manual	3AXD50000045817
ACQ580-31 hardware manual	3AXD50000045935

Drive firmware manuals and guides

ACS580 standard control program firmware manual	3AXD50000016097
ACH580 HVAC control program firmware manual	3AXD50000027537
ACQ580 pump control program firmware manual	3AXD50000035867

Option manuals and guides

ACS-AP-x assistant control panels user's manual	3AUA0000085685
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	3AUA0000094606
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General safety guides

Functional safety; Technical guide No. 10	3AUA0000048753
Safety and functional safety; A general guide	1SFC001008B0201
ABB Safety information and solutions	www.abb.com/safety
Potentially explosive atmospheres. The basics you need to know about motors and drives	3AUA0000037223

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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Further information



1

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.





2

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

Term/abbreviation	Description
ATEX	Directives 2014/34/EU (94/9/EC) and 1999/92/EC are commonly referred to as the ATEX directives (from “Atmosphères Explosibles”)
ACx580	ACS580, ACH580 or ACQ580
Cat.	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.
CCF	Common cause failure (EN ISO 13849-1)
CCU	Control board type
CPTC-02	ATEX-certified thermistor protection module, Ex II (2) GD
DC	Diagnostic coverage (%) (EN ISO 13849-1)
DI	Digital input
DO	Digital output
EMC	Electromagnetic compatibility
Ex	An IEC term used in the context of explosive atmospheres
Ex d	Type of protection, flameproof enclosures (EN/IEC 60079-1)
Ex e	Type of protection, increased safety (EN 60079-7:2007 and IEC 60079-7:2006), to be replaced with Ex eb
Ex eb, Ex ec	Types of protection, increased safety (IEC 60079-7:2015)
Ex motors	Motors used in explosive atmospheres

Term/abbreviation	Description
Ex nA	Type of protection, non-sparking enclosures (EN/IEC 60079-15:2010), to be replaced with Ex ec
GND	Ground
HFT	Hardware fault tolerance. (EN/IEC 62061)
MTTF _D	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)
NO	Normally open
PFD _{avg}	Average probability of dangerous failure on demand
PFH	Average frequency of dangerous failures per hour
Safety system	Whole safety system including, for example, human interface, CPTC-02 module, drive and sensors.
SC	Systematic capability (IEC 61508)
SFF	Safe failure fraction (%) (IEC 61508)
SIL	Safety integrity level (levels are: 1, 2, 3, and 4). Corresponds to PL. (EN 62061)
SMT	Safe motor temperature (EN/IEC 61800-5-2)
STO	Safe torque off (EN/IEC 61800-5-2)
PL	Performance level (levels are: a, b, c, d and e). Corresponds to SIL. (EN ISO 13849-1)
PTC	Positive temperature coefficient
T1	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.

Term/abbreviation	Description
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.

3

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

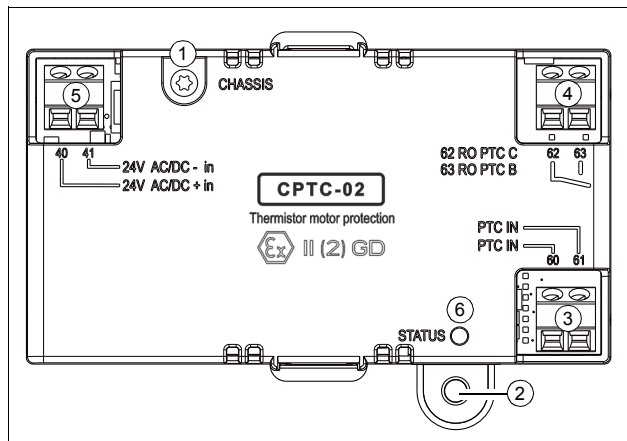
the CPTC-02 module and a thermistor protection circuit are installed.

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



Item	Description
1	Grounding screw

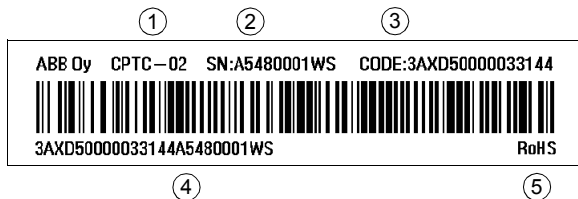
Item	Description
2	Hole for mounting screw
3	2-pin terminal block for motor thermistor connection
4	2-pin detachable terminal block for relay output
5	2-pin terminal block for external power supply
6	Diagnostics LED

Markings

Module

Type designation label

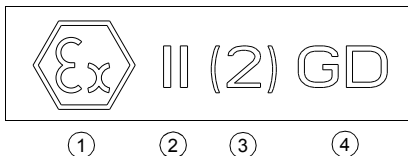
The type designation label is attached on the back side of the CPTC-02 module. An example label and description of the label contents are shown below.



Item	Description
1	Type
2	Serial number of format RYWWSSSSWS, where R: Component revision: A, B, C, ... Y: Last digit of the manufacturing year: 4, 5, ... for 2014, 2015 WW: Manufacturing week: 01, 02, ... for week 1, week 2, ... SSSS: Integer starting 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

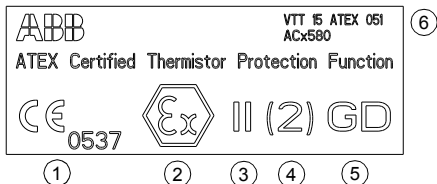
The markings on the module signify ATEX classification of the CPTC-02 module.



Item	Description
1	The European Commission mark for Ex products.
2	Equipment group II: Product for surface industry (other than mining applications).
3	Category 2 equipment. Brackets indicate that the module must be installed outside the potentially explosive atmosphere.
4	Certified for use in explosive atmospheres caused by: G = gases, vapors or mists, D = dust.

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.



Item	Description
1	CE marking with Notified Body identification: The manufacturer declares that the product conforms with European Council ATEX Directive 2014/34/EU (previously 94/9/EC). Notified Body: VTT Expert Services Ltd.
2	The European Commission mark for Ex products.
3	Equipment group II: Product for surface industry (other than mining applications).
4	Category 2 equipment: Brackets indicate that the drive (or inverter module) 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.

4

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.

5

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.



6

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),
 - Ex ec (EN/IEC 60079-7:2015; Ex nA in EN/IEC 60079-15:2010).
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

Marking		Description
60	PTC IN	PTC connection
61	PTC IN	Ground (earth) potential

Relay output connection

Marking		Description
62	RO PTC C	Common, C
63	RO PTC C	Normally open, NO

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.

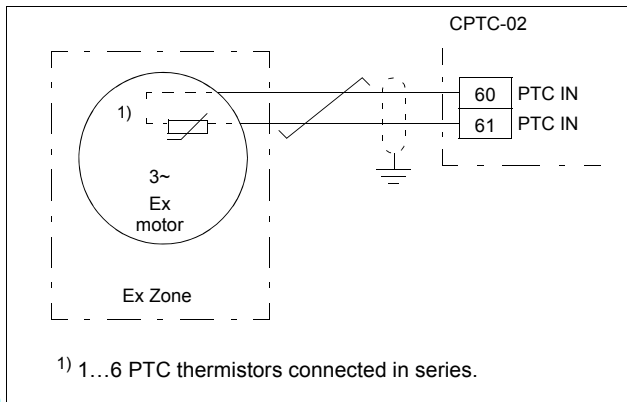
Marking		Description
40	24V AC/DC + in	External 24 V (AC/DC) input
41	24V AC/DC - in	External 24 V (AC/DC) input



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.

■ Motor thermistor connection example

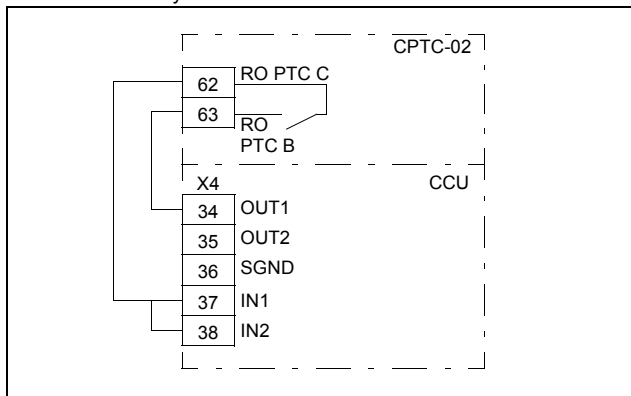


The PTC input is reinforced/double insulated. If the motor part of the PTC thermistor and wiring are reinforced/double insulated, voltages on the PTC wiring are within SELV limits.

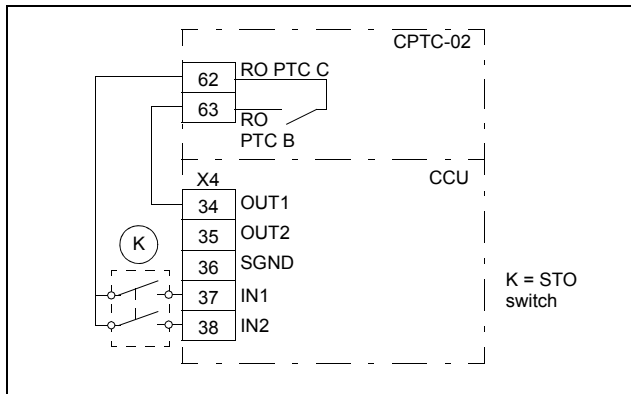
If the motor PTC circuit is not reinforced/double insulated (that is, it is basic insulated), it is mandatory to use reinforced/double insulated wiring between the motor PTC and CPTC-02 PTC terminal.

Relay output connection

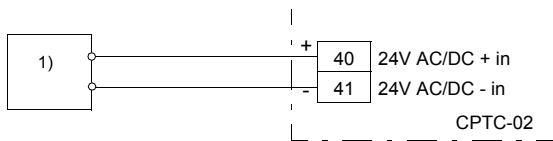
Connect the drive STO circuit to the relay output of the module as shown in this figure. In the cabinet-installed drives, the wiring is done at the factory.



An alternative connection with an external STO switch.



■ Power supply connection



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.



7

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

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.

Index	Name / Value	Description
31.22	STO indication run/stop	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.
	Warning/Warning	The drive generates a warning. This parameter value does not affect the SMT function, but this is the recommended setting (see section <i>Indications of the safety function</i> on page 28).

Index	Name / Value	Description						
35.31	Safe motor temperature enable	<p>Activates (On) or deactivates (Off) the Safe motor temperature (SMT) fault indication (4991).</p> <p>0 = Off 1 = On</p> <p>This parameter is automatically set to <i>On</i>, when CPTC-02 module is connected to the drive. If the module is removed from the drive, the parameter remains <i>On</i>, and the drive will trip to a fault. User must set parameter to <i>Off</i> manually and reset the fault to continue operation without the module. When the module is connected again, the parameter is automatically set to <i>On</i>.</p>						
95.15	Special HW settings	<p>Defines hardware-related settings that can be enabled and disabled by toggling the specific bits.</p> <table border="1"> <thead> <tr> <th>Bit</th> <th>Name</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>EX motor</td> <td> <p>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).</p> <p>Note: For non-ABB Ex motors, use parameters 97.01 and 97.02 to define the correct minimum switching frequency.</p> <p>Note: If you have a multimotor system, contact your local ABB representative.</p> </td> </tr> </tbody> </table>	Bit	Name	Description	0	EX motor	<p>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).</p> <p>Note: For non-ABB Ex motors, use parameters 97.01 and 97.02 to define the correct minimum switching frequency.</p> <p>Note: If you have a multimotor system, contact your local ABB representative.</p>
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97.01	Switching frequency reference	<p>Defines the switching frequency of the drive.</p> <p>Note: If you have a multimotor system, contact your local ABB representative.</p>						
97.02	Minimum switching frequency	<p>Defines the minimum limit for the switching frequency.</p> <p>If parameter 95.15 is set to 1, drive sets the value to 4 kHz automatically.</p> <p>For non-ABB Ex motors, consult the motor manufacturer.</p>						




Index	Name / Value	Description
97.09	Switching frequency mode	Defines the switching frequency mode. Normal = Used switching frequency is selected with parameters 97.01 and 97.02 .
97.18	Hexagonal field weakening	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 <i>Off</i> . For non-ABB Ex motors (when parameter 95.15 bit 0 is not set), set this parameter to <i>Off</i> .

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	<input checked="" type="checkbox"/>
 WARNING! Obey the safety instructions. See chapter Safety . If you ignore the safety instructions injury or death can occur.	<input type="checkbox"/>
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)	<input type="checkbox"/>
Make sure that the classification of the motor thermal protection function corresponds to the Ex classification of the environment and the Ex motor.	<input type="checkbox"/>
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 .	<input type="checkbox"/>
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.	<input type="checkbox"/>
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.	<input type="checkbox"/>
Acceptance test procedure	
Make sure that you can run and stop the motor freely during the test.	<input type="checkbox"/>
Start the drive and make sure that motor is running.	<input type="checkbox"/>
Cause an overtemperature situation: <ul style="list-style-type: none"> 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). 	<input type="checkbox"/>



44 Start-up and acceptance test

Action	<input checked="" type="checkbox"/>
Make sure that the correct indications are activated: <ul style="list-style-type: none"> the SMT fault (4991) and other indications depending on the parameter settings (see section <i>Indications of the safety function</i> on page 28). 	<input type="checkbox"/>
Make sure that the STO is activated and the motor coasts to a stop.	<input type="checkbox"/>
Make sure that you cannot start the drive before you have reset the drive.	<input type="checkbox"/>
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.	<input type="checkbox"/>
Restart the drive and motor and make sure they operate normally.	<input type="checkbox"/>
Cause a short-circuit situation: <ul style="list-style-type: none"> connect a jumper wire between the thermistor terminals of the CPTC-02 module. 	<input type="checkbox"/>
Make sure that the correct indications are activated: <ul style="list-style-type: none"> the SMT fault (4991) and other indications depending on the parameter settings (see section <i>Indications of the safety function</i> on page 28). 	<input type="checkbox"/>
Make sure that the STO is activated and the motor coasts to a stop.	<input type="checkbox"/>
Make sure that you cannot start the drive before you have reset the drive.	<input type="checkbox"/>
Reset the drive. Make sure you cannot reset and restart the drive before the input resistance in the PTC input has increased above 50 Ohm (ie, you have removed the jumper wire connected earlier).	<input type="checkbox"/>
Restart the drive and motor and make sure they operate normally.	<input type="checkbox"/>
Fill in and sign the acceptance test report which verifies that the safety function is safe and accepted to operation.	<input type="checkbox"/>





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

Code (hex)	Name	Cause	What to do
Warnings			
A7AB	Extension I/O configuration failure	Installed option module is not the same as configured by drive parameter.	Check that the installed module is of the same type that the drive has detected (shown by parameter <i>15.02 Detected extension module</i>) and that has been configured either by the user or drive (parameter <i>15.01 Extension module type</i>).
Faults			
4991	Safe motor temperature	The CPTC-02 module indicates overtemperature. 1. Motor temperature is too high, or 2. the thermistor is in short-circuit or disconnected.	<ol style="list-style-type: none"> 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.
4993	CPTC-02 not found	Safe motor temperature is enabled (<i>35.31</i>) but the CPTC-02 module is not detected (parameter <i>15.02 Detected extension module</i>)	Power down the control unit and check that the CPTC-02 module is properly inserted in the correct option slot.

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, <i>Safe torque off fault</i> (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.

Color	Description
Green	The module is powered up.

9

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.

10

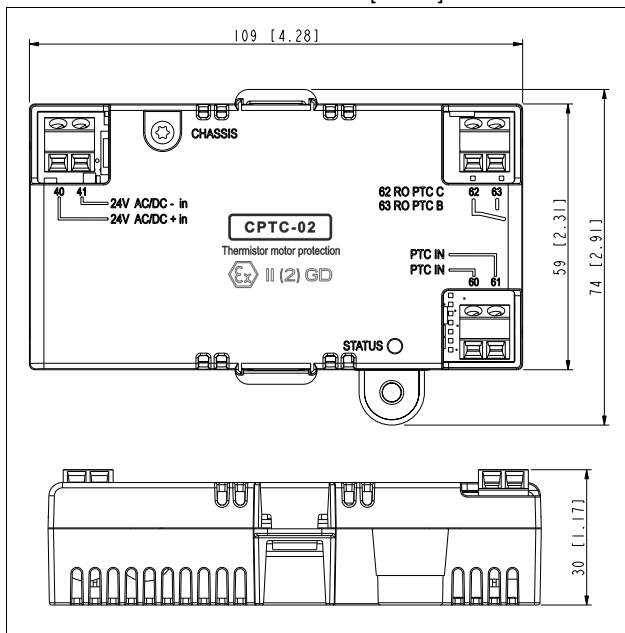
Technical data

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.

Dimension drawing

The dimensions are in millimeters and [inches].



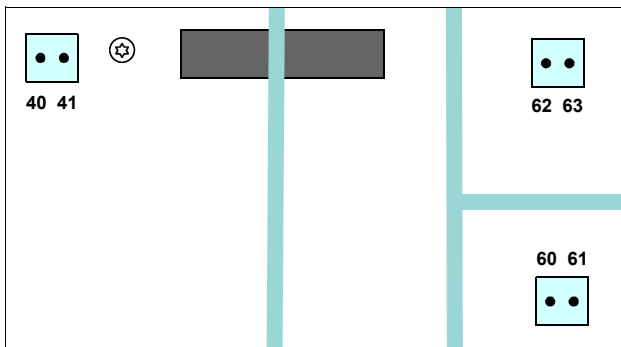
Installation: Into Option slot 2 on the drive control board


Degree of protection: IP20

Package: Cardboard

Isolation areas

This figure describes the different isolation areas of the module.



Symbol	Description
	Reinforced insulation (IEC 61800-5-1:2007)

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 $T1 = 20$ years (high demand and continuous mode of operation) and $T1 = 2$ years or $T1 = 5$ years (low demand mode of operation).

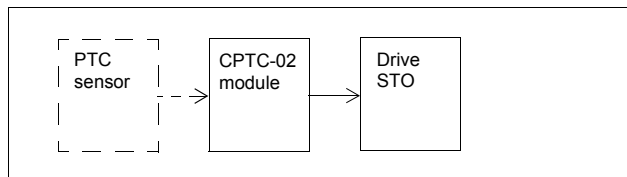
SIL	PL	SFF [%]	PFH [1/h] ($T1 = 20$ a)	PFD _{avg} ($T1 = 5$ a)	PFD _{avg} ($T1 = 2$ a)
2	c	>60	3.46E-08	7.54E-04	3.01E-04

DC [%]	SC	Cat.	HFT	CCF
0	2	1	0	65

3AXD10000473876 Rev D

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.



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

Standard	Name
EN 50495:2010	<i>Safety devices required for the safe functioning of equipment with respect to explosion risks</i>
IEC 61508:2010	<i>Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 1 – General Requirements Part 2 – Requirements for electrical/electronic/programmable electronic safety-related systems</i>
EN/IEC 61800-5-2:2007	<i>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional</i>
EN ISO 13849-1:2015	<i>Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design</i>
EN ISO 13849-2:2012	<i>Safety of machinery – Safety-related parts of control systems – Part 2: Validation</i>
EN 60204-1:2006 + A1:2009 + AC:2010	<i>Safety of machinery - Electrical equipment of machines - Part 1: General requirements</i>
IEC 61326-3-1:2008	<i>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</i>
IEC 61511-1:2016	<i>Functional safety - Safety instrumented systems for the process industry sector</i>
2006/42/EC	<i>European Machinery Directive</i>
2014/34/EU (previously 94/9/EC)	<i>European ATEX Product Directive</i>

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

ATEX Directive 2014/34/EU and Machinery Directive 2006/42/EC

We

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

declare under our sole responsibility that the following products:

Frequency converters

ACS580-01/-04/-07

ACH580-01/-31/-04/-07

ACQ580-01/-31/-04/-07

identified with serial numbers beginning with 1, 4 or 8

with **CPTC-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

 II (2) GD

The following harmonized standard has been applied:

EN 50495:2010

*Safety devices required for the safe functioning
 of equipment with respect to explosion risks*

3AXD10000495381

1 (2)



Notified Body: VTT Expert Services Ltd, Notified Body number 0537

Address: Kivimiehentie 4, P.O.Box 1001, 02044 Espoo, Finland

has assessed the conformity of the "ATEX certified thermistor protection" function and has issued the certificate VTT 15 ATEX 051.

Directive 2006/42/EC

The following harmonized standard has been applied:

EN 61800-5-2:2007	<i>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional</i>
EN ISO 13849-1:2015	<i>Safety of machinery – Safety-related parts of control systems. Part 1: General principles for design</i>
EN ISO 13849-2:2012	<i>Safety of machinery – Safety-related parts of the control systems. Part 2: Validation</i>
EN 60204-1: 2006 + A1:2009 + AC:2010	<i>Safety of machinery – Electrical equipment of machines – Part 1: General requirements</i>

Other applied standards:

IEC 61508:2010, parts 1-2	<i>Functional safety of electrical / electronic / programmable electronic safety-related systems</i>
---------------------------	--

The products referred in this Declaration of conformity fulfil the relevant provisions of other European Union Directives, notified in the following Single EU Declaration of conformity document:

3AXD10000497690	<i>ACS580 frequency converter</i>
-----------------	-----------------------------------

Person authorized to compile the technical file:

Name and address: Timo Pasanen, Hiomotie 13, 00380 Helsinki, Finland.

Helsinki, 11 Apr 2018

Manufacturer representative:


 Vesa Kandell
 Vice President, ABB Oy

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.



EU-TYPE EXAMINATION
CERTIFICATE
VTT 15 ATEX 051 Issue 2

1 (2)



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, ACH580 and ACQ580 series**

 Certified types: **ACS580 +L537 +Q971 (CPTC-02)
ACH580 +L537 +Q971 (CPTC-02)
ACQ580 +L537 +Q971 (CPTC-02)**
5. Applicant: **ABB Oy Drives
Hiomotie 13
FIN-00381 Helsinki
Finland**
6. Manufacturers: **ABB Oy Drives
Hiomotie 13
FIN-00381 Helsinki
Finland**

**ABB AS/LV Drives
Aruküla tee 59
Rae vald
75301 Harjumaa
Estonia**

**ABB Oy Drives
Drives Service
Kiitoradantie 14
FI-01530 Vantaa
Finland**



7. This equipment or protective system and any acceptable variations thereto 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 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, 30.6.2017

VTT Expert Services Ltd



Kari Koskela
Expert



Risto Sulonen
Product Manager

Certificate without signatures shall not be valid.

This certificate, including the schedule, may only be reproduced in its entirety and without any change.

13. **Schedule**14. **EU-TYPE EXAMINATION CERTIFICATE VTT 15 ATEX 051 Issue 2**15. **Description**

Thermal protection is based on temperature monitoring CPTC-02 module. Safe disconnection is achieved by using "Safe Torque Off"(STO)-function which is integrated in the standard drive as an internal hardware-solution. Power that can cause rotation is not applied to the motor. The safety related part of the adjustable speed electrical power drive system PDS (SR) will not provide energy to the motor which can generate torque. CPTC-02 together with the STO-function comprises the "Safe Motor Temperature" (SMT)-function.

16. **Documents**

FPTC-01/-02, CPTC-02 SMT HW description, 3AXD10000387390, rev B
 FPTC-01/-02, CPTC-02 Integrated PTC temperature protection module CONCEPT, 3AXD10000381242, rev B
 ACx580 ATEX schedule drawings with CPTC temperature monitoring, 3AXD10000510416 rev B (4 pages)
 CPTC-02 Safety data calculation for ACS580/ACH580/ACQ580, 3AXD1000047386, rev B
 Certificate No. SEBS-A.082710/15 V.1.0 by TÜV Nord
 Certificate No. SEBS-A.1012331/16 V1.0 by TÜV Nord
 Certificate No. SEBS-A.1012332/16 V1.0 by TÜV Nord
 Certificate No. SEBS-A.1012333/16 V1.0 by TÜV Nord

17. **Special conditions for safe use**
None18. **Essential Health and Safety Requirements**

Assessment using standard referred in point 9 have confirmed compliance with the Directive 2014/34/EU, Annex II and particular point 1.5.

Certificate history

Issue	Date	Comment
-	8.6.2016	Prime certificate
1	8.7.2016	The introduction of new converter series type ACQ580
2	30.6.2017	Updating of schedule drawings and other documents

Espoo, 30.6.2017

VTT Expert Services Ltd



 Kari Koskela
 Expert



 Risto Sulonen
 Product Manager

Certificate without signatures shall not be valid.

This certificate, including the schedule, may only be reproduced in its entirety and without any change.

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.082710/15 V1.0

TÜV NORD Systems GmbH & Co. KG hereby certifies

ABB Oy
Hiomotie 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 61508 part 1:2010; part 2:2010; capable up to SIL 2
- ISO 13849-1:2015, ISO 13849-2:2012; capable up to PL c (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.082710/15TB in the valid version.

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

Expiry date: 2021-05-11
Reference No: 8112617495

Hamburg, 2016-05-11

B. Puff

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 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.



abb.com/drives



3AXD50000030058C

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