Options for ABB drives

User's manual

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

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List of related manuals

Drive hardware manuals	Code (EN)
ACS880-01 hardware manual	*3AUA0000078093*
ACS880-04 hardware manual	*3AUA0000128301*
ACS880-04 single drive module packages hardware manual	*3AUA0000138495*
ACS880-14 and -34 single drive module packages hardware manual	*3AXD50000022021*
ACS880-04XT drive modules (500 to 1200 kW) hardware manual	*3AXD50000025169*
ACS880-07 (45 to 630 kW) hardware manual	*3AUA0000105718*
ACS880-07 (560 to 2800 kW) hardware manual	*3AUA0000143261*
ACS880-17 hardware manual	*3AXD50000020436*
ACS880-37 hardware manual	*3AXD50000020437*
ACS880-104 hardware manual	*3AUA0000104271*
ACS880-107 hardware manual	*3AUA0000102519*
Drive firmware manuals	
ACS880 primary control program firmware manual	*3AUA0000085967*
Option manuals and guides	
ACS-AP-x assistant control panels user's manual	*3AUA0000085685*
FSO-12 safety functions module user's manual	*3AXD50000015612*
FSO-21 safety functions module user's manual	*3AXD50000015614*
FSE-31 pulse encoder interface module user's manual	*3AXD50000016597*
FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537 +Q971) user's manual	*3AXD50000027782*
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*
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

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

Table of contents

1. Safety

5. Mechanical installation

6. Electrical installation

8. Start-up and acceptance test

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Table of contents

1. Safety

Contents this chapter 9
Use of warnings 9
Safety in installation and maintenance 10
Other warnings 11

2. Introduction to the manual

Contents of this chapter 13
Applicability 13
Compatibility 13
Target audience 14
Contents of the manual 15
Related documents 15
Terms and abbreviations 16
Exclusion of liability 19

3. Hardware description

Contents of this chapter 21
Product overview 21
    Operation basics 22
        XFLT input (Fault) 22
        XWRN input (Warning). 22
Markings 25
    FPTC-02 module 25
        Type designation label 25
        ATEX markings 26
    Drive 27
        Option +Q971. 27
        SMT function 28

4. Option description and instructions

Contents of this chapter 29

ACS880-01/04/04X/14/34/104 drives and modules 30
Cabinet-built drives 30
The ATEX-certified Safe disconnection function (+Q971) 31
Resetting the safety function 32
Indications of the safety function 33
Switching frequency limitation 34
Fault reaction function 35
FPTC-02 module 35
STO function in the drive/inverter modules 35
FSO module 35

5. Mechanical installation

Contents of this chapter 37
Necessary tools and instructions 37
Unpacking and examining the delivery 37
Installing the module 38

6. Electrical installation

Contents of this chapter 41
Warnings 41
Necessary tools and instructions 41
General cabling instructions 42
Terminal designations 43
Wiring 44
Wiring example 1 45
Wiring example 2 46
Wiring example 3 47
Wiring example 4 48

7. Parameter settings

Contents of this chapter 49
Drive/inverter 49
Other recommended settings 52
FSO module 53
General parameters 54
Parameters related to the STO function 57
Parameters related to the SSE function 60

Parameters related to the SS1 function 61
SS1 ramp parameters in the drive/inverter module 63
FSE module and safety pulse encoder parameters 64
Additional notes 66
Mechanical brake control 66

8. Start-up and acceptance test

Contents of this chapter 67
Before you start 67
Acceptance test 68

9. Fault tracing

Contents of this chapter 71
Reporting failures 71
FPTC-02 module replacement 71
Fault and warning messages 72
LEDs 74

10. Maintenance

Contents of this chapter 75
Maintenance 75
Proof test interval 76
Competence 77
Residual risk 77
Intentional misuse 77
Decommissioning 77

11. Technical data

Contents of this chapter 79
Dimension drawing 80
Isolation areas 81
Connections 82
Motor thermistor connection 82
STO relay output connection 82
Ambient conditions 82
Safety data 83
Safety block diagrams 86

Response times 87
Relevant failure modes 88
General rules, notes and definitions 89
Validation of the safety functions 89
Validation procedure 89
Acceptance test reports 90
Competence 90
Ambient conditions 90
Reporting problems and failures related to safety functions 90
Related standards and directives 91
Compliance with the European Machinery Directive 92
Compliance with the European ATEX Directive 92
ATEX certificates 99
TÜV Nord certificate 104

Further information

Product and service inquiries 105
Product training 105
Providing feedback on ABB Drives manuals 105
Document library on the Internet 105

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) feature of ACS880 drives 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! ACS880 cabinet-built 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 gives basic information on the manual.

Applicability

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

Compatibility

The FPTC-02 module is compatible with:

- ACS880-01/04/04X/14/34/104 drives and modules with the option +Q971
- ACS880-07/17/37 cabinet-built single drives
- ACS880 multidrives
- ACS880 primary control program version 2.2 or later
- FSO-12 safety functions module
- FSO-21 safety functions module

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 and instructions* describes the Safe motor temperature function implemented with the module and the drive Safe torque off function.
- *Mechanical installation* contains a delivery checklist and instructions on installing the module.
- *Electrical installation* contains instructions on wiring the module.
- *Parameter settings* lists the parameters related to the safety function.
- *Start-up and acceptance test* contains instructions on starting up the module and the acceptance test for the Safe motor temperature function.
- *Fault tracing* shows how to trace faults with the status LEDs on the module.
- *Technical data* contains the technical data of the module, the safety data and relevant certificates and Declarations of Conformity.

Related documents

- Product manuals, see the inside of the front cover.
- ACS880 cabinet-built drives: Circuit diagrams delivered with the drive.

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”)
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)
DC	Diagnostic coverage (%) (EN ISO 13849-1)
DI	Digital input
DO	Digital output
DTC	Direct torque control
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
Ex nA	Type of protection, non-sparking enclosures (EN/IEC 60079-15:2010), to be replaced with Ex ec
FEA-03	F-series extension adapter module
FPTC-02	ATEX-certified thermistor protection module, Ex II (2) GD
FSE-31	Pulse encoder interface module which can be used in safety applications
FSO	Safety functions module (FSO-12 or FSO-21)

Term/abbreviation	Description
FSO-12	Safety functions module which does not support the use of safety encoders
FSO-21	Safety functions module which supports the FSE-31 module and the use of safety encoders
GND	Ground
HFT	Hardware fault tolerance. (EN/IEC 62061, IEC 61508)
$MTTF_d$	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)
PELV	Protected extra-low voltage (IEC 60364-4-41)
PFD	Probability of dangerous failure on demand (IEC 61508)
PFD_G	PFH_D for low demand mode of operation (IEC 61511)
PFH	Average frequency of dangerous failure [1/h] (Probability of dangerous failures per hour) (IEC 61508, EN/IEC 61800-5-2, EN/IEC 62061)
PL	Performance level (levels are: a, b, c, d and e). Corresponds to SIL. (EN ISO 13849-1)
PTC	Positive temperature coefficient
SAR	Safe acceleration range. In the FSO module, there are two sets of SAR parameters (SAR0 and SAR1) that are used to define and/or monitor the deceleration ramp in safety functions.
Safety system	Whole safety system including, for example, human interface, FPTC-02 module, FSO module, drive and sensors.
SBC	Safe brake control. A safety function in the FSO module.
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. (IEC 61508)

Term/abbreviation	Description
SILCL	SIL claim limit. Maximum SIL that can be claimed for a safety function or subsystem. (EN/IEC 62061)
SMT	Safe motor temperature. (EN/IEC 61800-5-2)
SS1	Safe stop 1 (EN/IEC 61800-5-2). A safety function in the FSO module.
SSE	Safe stop emergency. A safety function in the FSO module.
STO	Safe torque off. (EN/IEC 61800-5-2) In this manual, this term is used in two different contexts: • the STO circuit in the drive (the drive STO function) • the STO safety function in the FSO module.
Stop category 0	Uncontrolled stop (EN/IEC 60204-1)
Stop category 1	Controlled stop (EN/IEC 60204-1)
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 *76*.
XFLT	PTC input for Safe temperature fault in the FPTC module
XWRN	PTC input for motor temperature warning in the FPTC module
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 compliance with 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

The FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD is Type Examined as a protective device within the scope of the European ATEX Product Directive. This enables the use of the module in temperature protection of motors in explosive atmospheres (Ex motors).

The FPTC-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 and the other terminals of the module. 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 FPTC-02 module and a thermistor protection circuit are installed.

Operation basics

The module includes two PTC sensor inputs:

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

XFLT input (Fault)

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

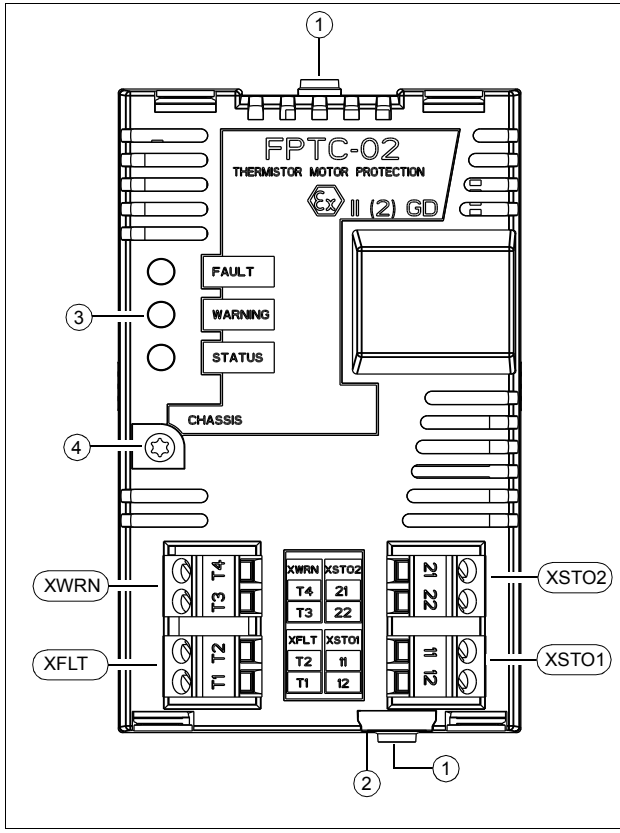
The STO function disables the control voltage of the power semiconductors of the drive output stage. This prevents the drive from generating the torque required to rotate the motor. If the motor is running when the STO function is activated, it coasts to a stop.

XWRN input (Warning)

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

For the resistance limits and other technical details of the FPTC-02 module, see chapter *Technical data*.

Layout


1
FPTC-02
THERMISTOR MOTOR PROTECTION
II (2) GD
FAULT
WARNING
STATUS
3
CHASSIS
4
XWRN
XFLT
T4
T3
T2
T1
XWRN
XSTO2
T4
21
T3
22
XFLT
XSTO1
T2
11
T1
12
21
22
11
12
XSTO2
XSTO1
2
1

Item	Description
1	Retaining clips
2	Lock
3	Diagnostics LEDs (see section *LEDs* on page *74*)
4	Mounting screw
XWRN	2-pin detachable terminal block for PTC warning (non-safety related)
XFLT	2-pin detachable terminal block for PTC fault (safety related)
XSTO1	2-pin detachable terminal block for STO output 1
XSTO2	2-pin detachable terminal block for STO output 2

Markings

FPTC-02 module

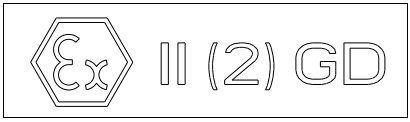
Type designation label

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

Item	Description
1	Type
2	Serial number of format RYWWSSSS, 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
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 FPTC-02 module.



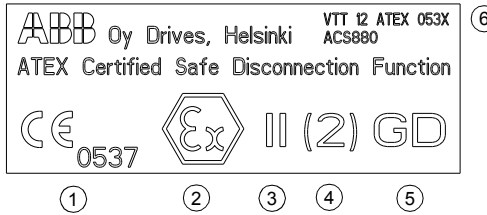
Item	Description
1	The European Commission mark for Ex products.
2	Equipment group II: Product for surface industry (other than mining applications).
3	Category 2 equipment. Brackets indicate that the module must be installed outside the potentially explosive atmosphere.
4	Certified for use in explosive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

Drive

Option +Q971

ACS880-01/04/04X/14/34/104 drives and modules

A sticker is attached to the drive to signify ATEX classification of the drive Safe disconnection function (+Q971) of the drive/inverter module (see page *31*).



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.

ACS880 cabinet-built drives

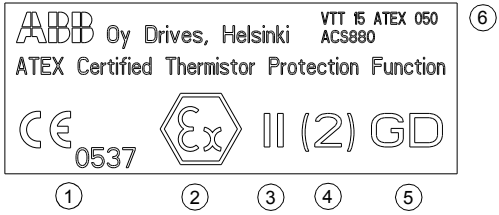
The option +Q971 is included in the type designation label on the cabinet door. There is no separate ATEX classification label for the Safe disconnection function.

SMT function

When the FPTC-02 module is delivered as an add-on kit, the package contains a sticker to signify ATEX classification of the Safe motor temperature (SMT) function. The user must attach this sticker to the drive/inverter module.

In the factory-installed options, this sticker is already attached to the drive/inverter module at the factory.

In the cabinet-built drives, this sticker is attached 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 and instructions

Contents of this chapter

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

Overview

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

The FSO safety functions module (FSO-12 or FSO-21) is an optional device used with the ACS880 drives to implement safety functions. When installed, it reserves the standard STO connection of the drive. In this case, the FSO module activates the STO function of the drive (that is, opens the drive STO circuit) either immediately (stop category 0) or after a deceleration ramp (stop category 1).

Note: The Safe motor temperature function is motor-specific also in the ACS880 multidrives where several motors are connected to the drive.

ACS880-01/04/04X/14/34/104 drives and modules

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

For the kit, the user:

- makes sure that the drive or inverter module is equipped with the +Q971 option and the ATEX label with classification markings (see page *27*)
- attaches the ATEX label for the SMT function (a sticker is included in the module package, see page *28*) to the drive/inverter module to ensure the ATEX compliance of the safety circuit,
- installs the option module to an option slot of the drive control unit,
- connects the PTC temperature sensors of the motor to the PTC inputs of the option module, and
- connects the drive STO terminals to the STO output of the option module (or to the FSO module and configures the FSO module to perform the STO or SS1 function).

Cabinet-built drives

For cabinet-built ACS880-07/17/37 single drives and ACS880 multidrives, the module is available as factory-installed options:

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

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

The ATEX-certified Safe disconnection function (+Q971)

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

When the drive or inverter module is equipped with the option +Q971, its Safe torque off function (STO) is certified for use as a Safe disconnection function to protect equipment in potentially explosive atmospheres according to European ATEX Product Directive 2014/34/EU (previously 94/9/EC). For more information on the drive STO function, see the appropriate drive or inverter module hardware manual.

You can use the FPTC-02 module only with a drive or inverter module which is equipped with +Q971 option and the ATEX label with relevant classification markings (see section *Markings* on page *25*).

Resetting the safety function

The ATEX/Ex regulations require that the safety function must be reset manually. When the XFLT input detects a motor overtemperature situation, the FPTC-02 module generates a fault to the drive. The user must reset the drive before it is possible to restart the drive.

When the XWRN input detects a motor overtemperature situation, the FPTC-02 module generates a warning to the drive. This is not a safety-related function and does not need a reset.

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

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

Indications of the safety function

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

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

To avoid parallel indications, set the STO indication parameters (*31.22* and/or *FSOGEN.61)* to value *None*/*No indication* or *Event*. See chapter *Parameter settings* for instructions.

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

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 *51*).

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

Fault reaction function

FPTC-02 module

The FPTC-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/inverter modules

The STO function in the drive/inverter module 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/inverter module.

FSO module

The fault reaction function of the FSO module trips the drive if it detects a failure. The FSO module activates the STO or Safe stop emergency (SSE) function. This activates the drive STO function and opens the main contactor/breaker. The drive STO function is active until the fault has been repaired.

The FSO module goes into the Fail-safe mode. The FSO module LED STATUS/FAULT is red until the fault has been repaired.

To exit the Fail-safe mode, remove the cause of the fault and reset the FSO module by switching the power off and on, by pressing the Boot FSO button on the Safety view of Drive composer pro or with drive parameter 96.09 FSO reboot.

For more information, see the drive firmware manual and the FSO module user's manual.

5

Mechanical installation

Contents of this chapter

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

Necessary tools and instructions

- Torx screwdriver (T10)

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

Unpacking and examining the delivery

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

Installing the module

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

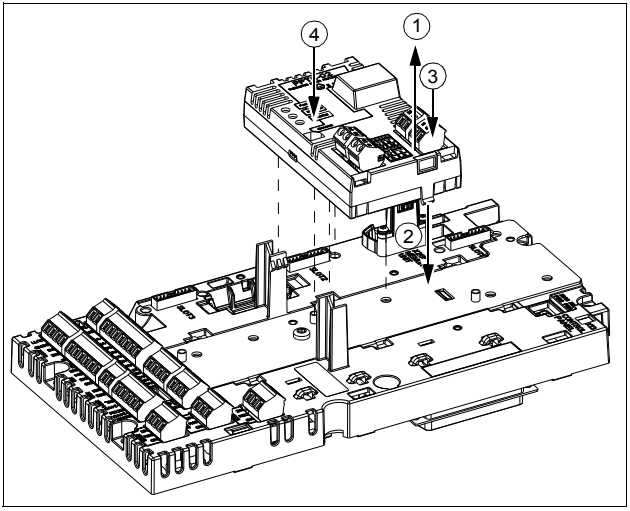
1. Pull out the lock.
2. Put the module carefully into its position on the drive until the retaining clips lock it into position.
3. Push in the lock.
4. Tighten the screw.

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

WARNING! Do not tighten the screw tighter than 0.8 N·m. Too high a torque breaks the thread.

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

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


4
1
3
2

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.

General cabling instructions

1. For the STO circuit wiring, use the type of cable specified in the appropriate drive or inverter module hardware manual (except when an FSO module or other safety relays are installed in the STO command chain).
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 (IEC 60079-7:2015; Ex e in EN 60079-7:2007 and IEC 60079-7:2006),
   - Ex ec (IEC 60079-7:2015; Ex nA in EN/IEC 60079-15:2010).
4. Install the drive (or inverter module), the Safe torque off (STO) circuit, and the protection relay outside the hazardous zone.
5. Route the sensor cables away from the motor cable.
6. We recommend to use a shielded sensor cable to minimize electromagnetic interference from power cables.

Note: The drive STO function has a redundant architecture, that is, both STO channels must be used in the safety function implementation. For more information, see the hardware manual.

Terminal designations

Marking	Description
XSTO1	**STO channel 1**
11	In, +24 V DC in for STO
12	Out, +24 V DC out for STO
XSTO2	**STO channel 2**
21	In, +24 V DC in for STO
22	Out, +24 V DC out for STO
XFLT	**PTC FAULT (SMT function)**
T1	In, 0...+5 V DC
T2	Out
XWRN	**PTC WARNING (non-safety related)**
T3	In, 0...+5 V DC
T4	Out

Wiring

This section presents four ways to connect the FPTC-02 module to the drive STO terminals.

Wiring example 1 (see page *45*): The STO outputs of the FPTC-02 module are connected directly to the STO terminals of the drive.

- ACS880-01/04/14/34/04X/104 drives and modules: In the factory-installed option (+L537+Q971), the wiring is done at the factory according to this example.
- ACS880 cabinet-built drives: In the option +L537+Q971, terminal block [X969] is located between the module and the drive control board (not shown in the figure). See the circuit diagrams delivered with the drive for the actual wiring.

Wiring example 2 (see page *46*): The STO outputs of the FPTC-02 module are connected to an FSO module, and the STO outputs of the FSO module to the STO terminals of the drive with a two-channel connection. In this case, the FSO module controls the drive STO function.

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

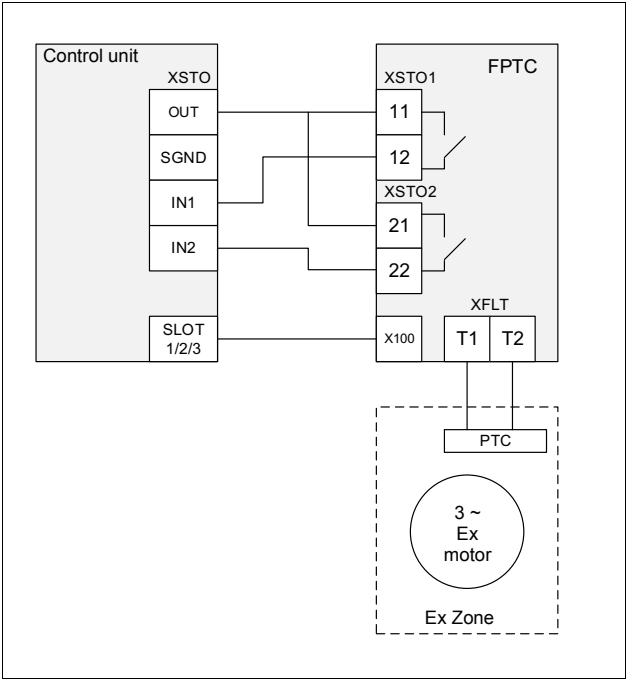
Wiring example 3 (see page *47*): The STO outputs of the FPTC-02 module are connected to an FSO module, and the STO outputs of the FSO module to the STO terminals of the drive with a one-channel connection. If you use a one-channel connection, make sure that you can reach the required safety integrity level (SIL).

Wiring example 4 (see page *48*): An external safety relay is connected between the FPTC-02 module and the drive STO inputs with a two-channel connection.

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

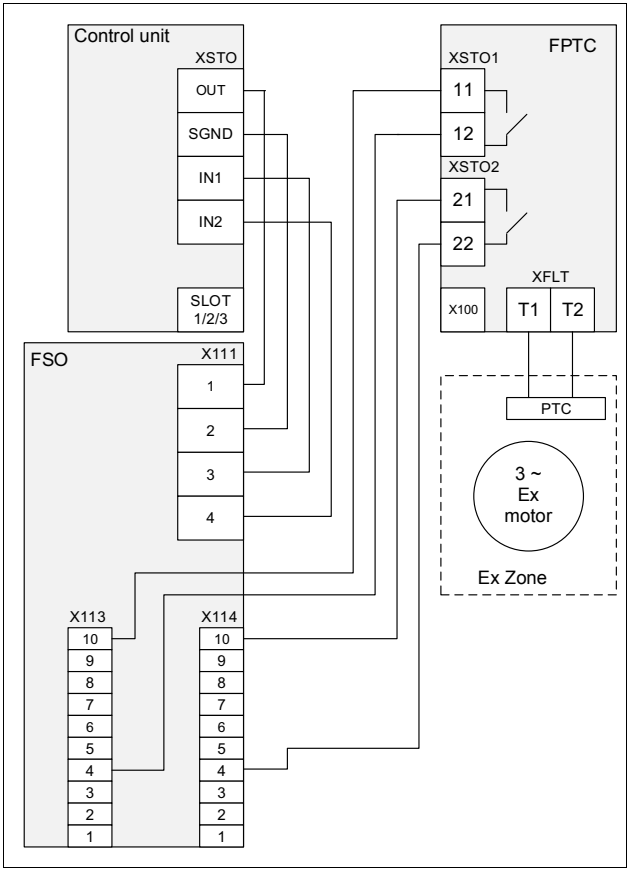
Wiring example 1

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



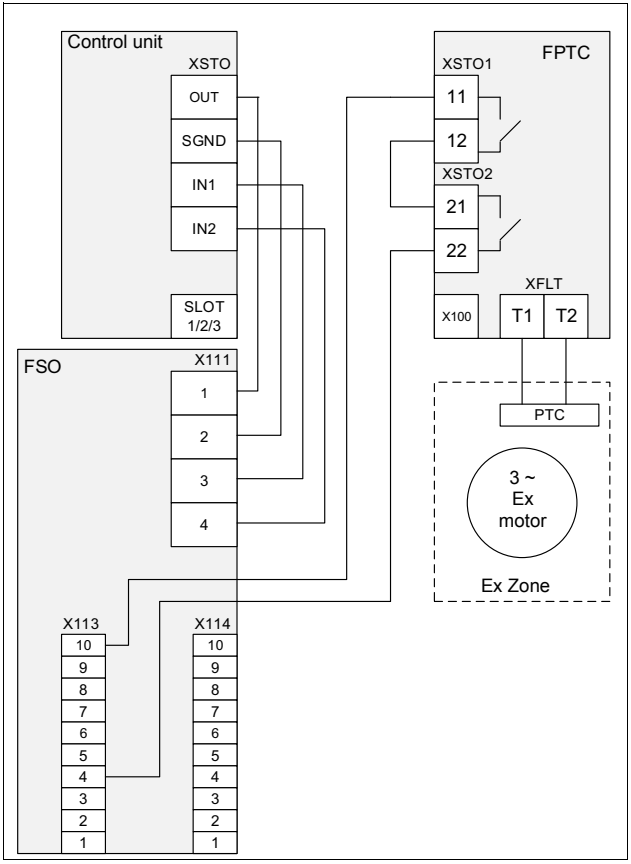
Wiring example 2

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



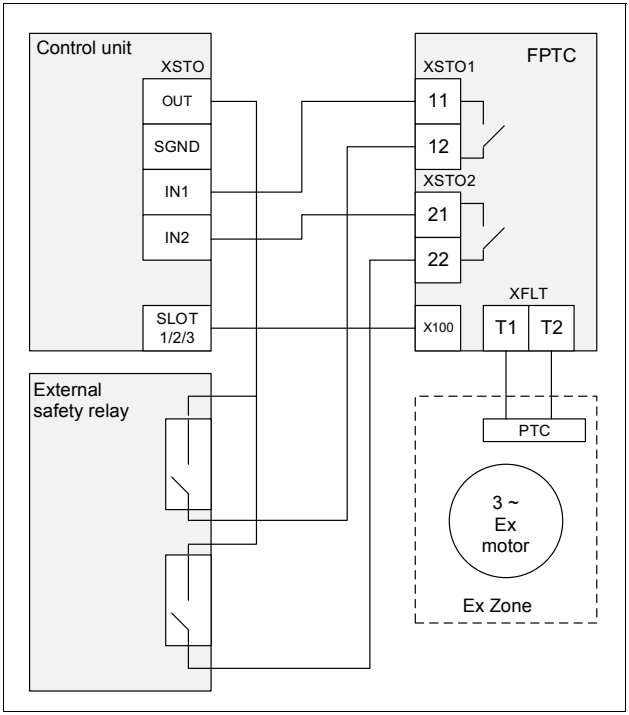
Wiring example 3

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



Wiring example 4

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



7

Parameter settings

Contents of this chapter

This chapter contains the drive and FSO module parameter settings.

Drive/inverter

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

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

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. For more information, see the firmware manual.

Index	Name / Value	Description
	Warning/Warning	The drive generates a warning both when the drive is running and when it is stopped. This parameter value does not affect the SMT function, but this is the recommended setting (see section *Indications of the safety function* on page *33*). For the cabinet-built drives, ABB has set this value at the factory.
35.30	FPTC configuration word	Activates FPTC modules installed on the control unit of the drive. With this word, it is also possible to suppress the non-safety related motor temperature warnings (XWRN input). It is not possible to suppress the SMT faults (XFLT input).

Bit	Name	Description
0	Module in slot 1	1 = Yes: Module installed in slot 1.
1	Disable slot 1 warning	1 = Yes: Warnings from the module in slot 1 suppressed.
2	Module in slot 2	1 = Yes: Module installed in slot 2.
3	Disable slot 2 warning	1 = Yes: Warnings from the module in slot 2 suppressed.
4	Module in slot 3	1 = Yes: Module installed in slot 3.
5	Disable slot 3 warning	1 = Yes: Warnings from the module in slot 3 suppressed.
6…15	Reserved	

Index	Name / Value	Description
35.04	FPTC status word	Displays the status of FPTC modules. The word can be used as the source of eg. external events. This parameter is read-only.

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

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

Bit	Name	Description
0	EX motor	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. **Note**: For non-ABB Ex motors, contact your local ABB representative.

Other recommended settings

We recommend that you also set these parameters to improve the safety of the application:

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

For more information, see the drive firmware manual.

FSO module

If you use an FSO module with the FPTC-02 module, set and check the FSO parameters listed in this section.

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

Follow the configuration steps described in the FSO module user's manual, chapter *Configuration*.

There are parameters that you must set always to keep the certificate valid and parameters that are related only to certain safety functions. This chapter lists the parameters that are relevant to the option +L537+Q971+Q973 (with FSO-12) and +L537+Q971+Q972 (with FSO-21).

You can use the FSO-21 module (+Q972) also with a safety pulse encoder and the FSE-31 pulse encoder interface module (+L521). In this case, set the parameters listed in section *FSE module and safety pulse encoder parameters* on page *64*.

The example values apply to ACS880 cabinet-built drives. One FPTC module is connected to the FSO module with a two-channel connection (digital inputs X113:4 and X114:4, see the example on page *46*).

You can configure the FSO module so that it opens the drive STO circuit either immediately after the safety function request (stop category 0) or after a deceleration ramp (stop category 1). In the first case, the FSO module activates the STO function in the FSO module. In the second case, it activates the SS1 function. Example values are given for both cases.

Always consider which stop category is more appropriate for the motor in overtemperature situations. In the ACS880 cabinet-built drives, the FSO module is configured at the factory so that it activates the STO function (stop category 0).

General parameters

Set these FSO parameters always when you use the FSO module with the FPTC-02 module.

Index	Name	Example value	Description
FSOGEN. 11	Stop completed output	None[1)]	Sets the digital output that indicates the completion of any stop function. Active when the FSO module has completed the STO, SSE or SS1 function.
FSOGEN. 21	Motor nominal speed	1500 rpm	Sets the nominal motor speed. Adjust the default value to meet the motor in use.
FSOGEN. 22	Motor nominal frequency	50 Hz	Sets the nominal motor frequency. Adjust the default value to meet the motor in use.
FSOGEN. 41	Power-up acknowledgement	Automatic	Sets the power-up acknowledgement method of the FSO module. *Automatic*: You do not need to push a reset button after switching on the FSO module. The FSO module generates the acknowledgement signal automatically after the power-up. *Manual:* The FSO module reads the external acknowledgement signal through the digital input defined by parameter *FSOGEN.42*. Make sure that the value is *Automatic*.

Index	Name	Example value	Description
FSOGEN. 42	Acknowledgement button input	None[1)]	Selects the digital input for the acknowledgement signal when parameter *STO.02* has value *Manual*. In the safety function described in this manual, parameter *STO.02* has value *Automatic* and this parameter has value *None* (no acknowledgement signal connected to the input).
FSOGEN. 51	Zero speed without encoder	90 rpm	Sets the general zero speed limit for safety functions when no safety encoder is in use. STO function: No effect. SS1 function: The FSO module activates drive STO function when the drive has decelerated the motor speed below this value. Adjust the default value when necessary.
FSOGEN. 52	Zero speed with encoder [2)]	0 rpm	Sets the general zero speed limit for safety functions when a safety encoder is in use. STO function: No effect. SS1 function: The FSO module activates drive STO function when the drive has decelerated the motor speed below this value. Adjust the default value when necessary.
FSOGEN. 61	STO indication ext request	Warning[1)]	Sets the type of the event that the FSO module generates and sends to the drive after external requests that end to a successful activation of the drive STO function (STO, SSE or SS1). *None, Warning, Event*: You do not have to reset the drive/inverter before you can restart it. *Fault:* You have to reset the drive/inverter before you can restart it.

Index	Name	Example value	Description
FSOGEN. 62	STO indication safety limit	Fault	Sets the type of the event that the FSO module generates and sends to the drive for limit hits during ramp and time monitoring of safety ramps SAR0 and SAR1. STO function: No effect. SS1 function: When the motor speed does not follow the stop ramp or the time limit is exceeded, the FSO module activates the STO function and generates this user-defined event. *None, Warning, Event*: You do not have to reset the drive/inverter before you can restart it. *Fault:* You have to reset the drive/inverter before you can restart it

[1] The value does not affect the SMT function, but other safety functions in the FSO module can require a certain value (see sections *Resetting the safety function* on page *32*, *Indications of the safety function* on page *33* and *Additional notes* on page *66*).

[2] Only with FSO-21 and when a safety encoder is used in the application.

Parameters related to the STO function

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

Index	Name	Example value	Description
STO.02	STO acknowledgement	Automatic[1)]	Sets the acknowledgement method used in the STO, SSE and SS1 functions. *Automatic*: The FSO module resets the STO function automatically after the STO request have been removed. *Manual*: The FSO module reads the external acknowledgement signal through the digital input defined by parameter *FSOGEN.42*.
STO.11	STO input A	None	Sets the digital input that is connected to the primary input of the STO function. In this example, this parameter has value *None*. **Note**: The default value after factory reset is *DI X113:1 & X114:1*. Always check this parameter after factory reset.
STO.12	STO input B	STO: DI X113:4 & X114:4 SS1: None	Sets the digital input that is connected to the secondary input of the STO function. **Note**: The default value after factory reset is *None*. Always check this parameter after factory reset. **Note**: In a non-redundant system, (*Wiring example 3* on page *47*), you can uses a one-channel input (for example, *DI X113:4*).

Index	Name	Example value	Description
STO.13	Restart delay after STO	2000 ms	Sets the time after which the restart of the drive is allowed after the FSO module has activated the STO function and opened the drive STO circuit. With this parameter, you can allow a restart of the drive before the motor has stopped (fly-start). This parameter is valid only if the STO function is requested from STO input A (*STO.11*) or STO input B (*STO.12*). STO function: Adjust the value when necessary. If you do not want to use the fly-start feature, set this parameter to the same value as parameter *STO.13*. SS1 function: No effect.
STO.14	Time to zero speed with STO or modoff [2)]	2000 ms	Sets the time after which the acknowledgement is allowed after coast stop in the STO and SSE functions. Configured to the estimated time in which the motor coasts to a stop from the maximum speed. STO function: This parameter sets the time after which the STO function is completed. Parameter *STO.13* defines the time after which the restart of the drive is allowed. Adjust the value when necessary. SS1 function: This parameter is used only when the motor speed does not follow the ramp settings or the time monitoring limit is exceeded and the FSO module activates the STO function. Adjust the value when necessary. **Note**: The default value after factory reset is *3,600,000 ms*. Always check this parameter after factory reset.

Index	Name	Example value	Description
SBC usage			
SBC.11	STO SBC usage	None	Sets how the mechanical brake is used together with the STO function. In the safety function described in this manual, this feature is not used. Make sure that the value is *None*. See also section *Mechanical brake control* on page *66*.
I/O settings			
SAFEIO. 36	DI X113:4 diag pulse on/off	On [3]	Sets the diagnostic pulse of digital input X113:4 on or off. *On*: The input monitors that it receives test pulses. In this example (see page *22*), the STO/SS1 request is connected to this digital input.
SAFEIO. 40	DI X114:4 diag pulse on/off	On [3]	Sets the diagnostic pulse of digital input X114:4 on or off. *On*: The input monitors that it receives test pulses. In this example (see page *22*), the STO/SS1 request is connected to this digital input. **Note**: In a non-redundant system, (*Wiring example 3* on page *47*), you can use a one-channel input (for example, *DI X113:4*). In this case, this parameter has no effect.

[1] The value does not affect the SMT function, but other safety functions in the FSO module can require a certain value (see sections *Indications of the safety function* on page *33* and *Additional notes* on page *66*).

[2] When a safety encoder is used: This parameter is relevant only if an encoder or FSE module failure occurs. The FSO module goes into the Fail-safe mode and activates the STO function. For more information, see FSO-21 module user's manual.

[3] The safety data (see page *83*) is based on the assumption that this diagnostic measure for the wiring is active (*On*). If pulsing is disabled, you must consider other measures to ensure sufficient diagnostic coverage of the wiring failures.

Parameters related to the SSE function

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

Index	Name	Example value	Description
SSE.13	SSE function	Immediate STO	Sets the type of the SSE function. *Immediate STO*: The FSO module activates the drive STO function immediately after the SSE request (stop category 0). *Emergency ramp:* The FSO module first ramps down the motor speed and when the speed is below the zero speed limit (parameter *FSOGEN.51* or *FSOGEN.52*) it activates the STO function (stop category 1). SAR0 parameters define the deceleration ramp (for more information, see the FSO module user's manual). **Note**: The default value after factory reset is *Emergency ramp*. Always check this parameter after factory reset.
SBC usage			
SBC.15	SSE/SS1 SBC speed	0 rpm	Sets the absolute speed below which the FSO module activates the brake (SBC) while ramping. *0 rpm:* The feature is not in use. In the safety function described in this manual, this feature is not used. Make sure that the value is *0 rpm*. See also section *Mechanical brake control* on page *66*.

Parameters related to the SS1 function

Set these parameters when you want that the motor speed is first decelerated to the user-defined zero speed value.

Index	Name	Example value	Description
SS1.01	SS1 activity and version	Version 1	Activates or deactivates the SS1 function and shows the version of the SS1 function. *Version 1*: Activates version 1 of the SS1 function.
SS1.11	SS1 input A	None	Sets the digital input that is connected to the primary input of the SS1 function.
SS1.12	SS1 input B	STO: None SS1: DI X113:4 & X114:4	Sets the digital input that is connected to the secondary input of the SS1 function. **Note**: The default value after factory reset is *None*. Always check this parameter after factory reset. **Note**: In a non-redundant system, (*Wiring example 3* on page *47*), you can use a one-channel input (for example, *DI X113:4*).
SS1.13	SS1 monitoring method	Ramp	Sets the method used for the SS1 monitoring. Adjust the default value when necessary. Time monitoring: The FSO module monitors that a user-defined deceleration time limit is not exceeded. (See parameter *SS1.14*.) Ramp monitoring: The FSO module monitors that the motor decelerates along a user-defined stop ramp. (See SAR1 ramp parameters *200.112*, *SARx.21*, *SARx.22* and *SARx.02*.)

Index	Name	Example value	Description
SS1.14	SS1 delay for STO	20000 ms	Sets the security delay after which the FSO module activates the drive STO and SBC at the latest, if the motor speed has not gone below the zero speed limit (parameter *FSOGEN.51* or *FSOGEN.52*) yet. Time monitoring: This value sets the security delay that the FSO module monitors. Adjust the default value when necessary. Ramp monitoring: No effect.
SAR1 ramp settings			
200.112	SAR1 ramp time to zero	2000 ms	Sets the target time for the stop ramp SAR1 that is used in the SS1 and function. Adjust the default value when necessary. Target time = The time in which the drive decelerates the motor from speed *200.202 SAR speed scaling* to zero. **Note**: With value *0 ms*, the drive uses the emergency stop ramp set by drive parameter *23.23* (see section *SS1 ramp parameters in the drive/inverter module* on page *63*).
200.202	SAR speed scaling	1500 rpm	Sets a speed value that the FSO module uses as a reference point in ramp parameter calculations (see SAR1 ramp parameters *200.112*, *SARx.21*, *SARx.22* and *SARx.02*). Adjust the default value when necessary.

Index	Name	Example value	Description
SARx.02	SAR initial allowed range	100 ms	Sets the initial allowed range for the SAR0/SAR1 ramp. This parameter moves the location of the maximum monitoring ramp forward on the time axis, when monitoring is started. The slope of the ramp stays the same as defined with parameters *200.202* and *SARx.22*. For more information, see the FSO module user's manual. Time monitoring: No effect. Ramp monitoring: Adjust the default value when necessary.
SARx.21	SAR1 min ramp time to zero	1000 ms	Sets the minimum ramp time for the SAR1 ramp monitoring. Time monitoring: No effect. Ramp monitoring: Sets the minimum stop ramp time for the emergency stop. Adjust the default value when necessary. **Note**: With value *0 ms*, the minimum ramp is not monitored.
SARx.22	SAR1 max ramp time to zero	3000 ms	Sets the maximum ramp time for the SAR1 ramp monitoring. Time monitoring: No effect. Ramp monitoring: Sets the maximum stop ramp time for the emergency stop. Adjust the default value when necessary.

SS1 ramp parameters in the drive/inverter module

You must set these parameters only for the SS1 function.

If FSO parameter *200.112 SAR1 ramp time to zero* is set to *0*, drive parameters define the stop ramp that is used in the SS1 function:

- *21.04 Emergency stop mode* is set to value *Eme ramp stop (Off3)*
- *23.23 Emergency stop time* is set to a suitable value.

Also in this case, the FSO module monitors the actual stop ramp (ramp monitoring or time monitoring). For more information, see the firmware manual.

FSE module and safety pulse encoder parameters

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

Index	Name	Example value	Description
200.231	FSE 3X act and par version	Version 1	Activates the FSE-31 encoder interface and shows the version of the encoder parameter groups (91 and 92).
200.232	Number of encoders	Single encoder CH1	Shows the number of safety pulse encoders connected to the FSE module.
S_ENC GEN.01	Safe pulse encoder version	Version 1	Activates the safety pulse encoder and shows the version parameter group S_ENCGEN.
S_ENC GEN.11	FSE diagnostic failure reaction	STO	Sets the action taken when there is a problem in the FSE module. *STO*: The FSO module goes into the Fail-safe mode and activates the drive STO function. **Note**: This parameter is relevant only when there are no active safety functions.
S_ENC GEN.14	Enc speed cross comp tolerance	1 rpm	Sets the encoder speed cross comparison tolerance. This defines how much the axle speed of the motor can change within 1 ms. Adjust the default value to meet the motor in use.
S_ENC GEN.41	Gear numerator encoder 1	1	Sets the rotation direction for the safety pulse encoder. With this parameter, you can change the rotation direction of the motor. Adjust the default value if necessary.

Index	Name	Example value	Description
91.11	Module 1 type	FSE-31	Sets the type of the safety pulse encoder interface module 1.
91.12	Module 1 location	2	Sets the slot in which the safety pulse encoder interface module 1 is located.
92.01	Encoder 1 type	HTL1	Activates or deactivates the communication with the safety pulse encoder interface module 1 and sets the type for the safety pulse encoder.
92.02	Encoder 1 source	Module 1	Sets the safety pulse encoder interface module that the safety pulse encoder 1 is connected to.
92.10	Pulses/revolution	2048	Sets the number of HTL pulses per revolution for safety pulse encoder 1. Adjust the default value to meet the safety pulse encoder in use. Make sure that the value is according to the encoder nameplate.
92.17	Accepted pulse freq of encoder 1	300 kHz	Sets the maximum pulse frequency range of encoder 1. Adjust the default value to meet the motor and safety pulse encoder in use. You can use this formula to define the value: r_max x ppr_enc + 10%, where • r_max = the maximum motor speed used in the application (or the motor nominal speed) • ppr_enc = Pulses/revolution of the safety pulse encoder (parameter *92.10*).

Additional notes

ACS880-07/17/37 drives with the option +Q978

In motor overtemperature situations, the FSO module also opens the main contractor/circuit breaker.

ACS880-07/17/37 drives with the option +Q978 or +Q979

The FSO module is configured so that after the safety function activation, the user must reset the FSO manually with the emergency stop reset button. In this case, the user must reset the FSO module with the emergency stop reset button also in motor overtemperature situations. Also the indication lamp on the reset button is illuminated.

The compliance of the emergency stop function with the relevant standards requires this setting. Do not change this setting.

Mechanical brake control

If you use a mechanical brake with the thermal motor protection circuit, pay special attention to the control of the mechanical brake.

If the motor deceleration by the mechanical brake causes extra heat generation in the Ex zone, make sure that the use of the brake does not rise the temperature excessively.

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

For more information, see the drive firmware manual (or the FSO user's manual if you use the Safe brake control (SBC) function of the FSO module).

8

Start-up and acceptance test

Contents of this chapter

This chapter contains the start-up instructions and the acceptance test for the safety 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).

Before you start

Make sure that you have completed these start-up tasks for the drive:

- Checks and settings with no voltage connected
- Powering up the drive
- Setting up the drive control program.

See the applicable drive hardware manual.

Make sure you have set the correct parameter values for the safety function. See chapter *Parameter settings*.

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. See the hardware manual.

Action	☑
WARNING! Obey the safety instructions. See chapter *Safety*. If you ignore the safety instructions injury or death can occur.	☐
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 *25*)	☐
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 FPTC module.	☐
After you have done the wiring, check the connections against the appropriate circuit diagrams and examples in chapter *Electrical installation*.	☐
Drives with R8i inverter modules: Check that the STO OUT output on the inverter control unit [A41] is chained to the STO inputs of all inverter modules. The STO circuit is disabled in spare part modules.	☐
Make sure that the SIL/PL of the safety function meets the target SIL/PL. If SIL2 is required, make sure that the STO connection between FPTC module and drive STO is kept separated.	☐
Settings with voltage connected	
Make sure that you have activated the FPTC module in the correct slot (parameter *35.30*).	☐
Make sure that all parameters relevant to the safety function are set as defined in chapter *Parameter settings* on page *49*.	☐
Acceptance test procedure	
Make sure that you can run and stop the motor freely during the test.	☐

Action	☑
Start drive and make sure that motor is running.	☐
Cause an overtemperature situation: • increase the resistance in the XFLT input above 3.6 kohm (for example, open-circuit).	☐
Make sure that the correct indications are activated: • the SMT fault and other indications depending on the parameter settings and if an FSO module is installed (see section *Indications of the safety function* on page *33*).	☐
Make sure that the STO is activated and the motor stops (by coasting or by ramping down to zero speed).	☐
Make sure that you cannot start the drive before you have reset the drive.	☐
Reset the drive. Make sure you cannot reset and restart the drive before the input resistance in the XFLT input has been decreased below 1.6 kohm.	☐
Restart the drive and motor and make sure they operate normally.	☐
Cause a short-circuit situation: • decrease the resistance in the XFLT input below 50 ohm.	☐
Make sure that the correct indications are activated: • the SMT fault and other indications depending on the parameter settings and if an FSO module is installed (see section *Indications of the safety function* on page *33*).	☐
Make sure that the STO is activated and the motor stops (by coasting or by ramping down to zero speed).	☐
Make sure that you cannot start the drive before you have reset the drive.	☐
Reset the drive. Make sure you cannot reset and restart the drive before the input resistance in the XFLT input has been increased above 50 ohm.	☐
Restart the drive and motor and make sure you they operate normally.	☐
If necessary, test the XWRN input: Make sure the motor temperature indication is activated in motor overtemperature and short-circuit situations. Connect a resistor (resistance 50 ohm...3.6 kohm) between the XFLT inputs.	☐
Fill in and sign the acceptance test report which verifies that the safety function is safe and accepted to operation.	☐

9

Fault tracing

Contents of this chapter

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

Reporting failures

You must report any failures of the FPTC-02 and FSO modules and the drive Safe torque off function to ABB.

FPTC-02 module replacement

If the FPTC-02 module fails to operate, you have to replace it with a new one. You cannot repair the module.

Fault and warning messages

The fault and warning messages in the ACS880 primary control program are these:

Code (hex)	Name	Cause	What to do
Faults			
4991	Safe motor temperature 1 (Editable message text)	The FPTC module in option slot 1 indicates overtemperature in the XFLT input (safety related). 1. Motor temperature is too high, or 2. the thermistor is in short-circuit or disconnected.	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.
4992	Safe motor temperature 2 (Editable message text)	The FPTC module in option slot 2 indicates overtemperature in the XFLT input (safety related).	
4993	Safe motor temperature 3 (Editable message text)	The FPTC module in option slot 3 indicates overtemperature in the XFLT input (safety related).	
4990	FPTC not found	A thermistor protection module has been activated by parameter *35.30* but cannot be detected. The last digit of the auxiliary code identifies the slot.	Power down the control unit and check that the module is properly inserted in the correct slot.

Code (hex)	Name	Cause	What to do
Warnings			
A497	Motor temperature 1 (Editable message text)	The FPTC module in option slot 1 has activated a motor temperature warning in the XWRN input (non-safety related). 1. Motor temperature is too high, or 2. the thermistor is in short-circuit or disconnected.	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 sensor if faulty.
A498	Motor temperature 2 (Editable message text)	The FPTC module in option slot 2 has activated a motor temperature warning in the XWRN input (non-safety related). 1. Motor temperature is too high, or 2. the thermistor is in short-circuit or disconnected.	
A499	Motor temperature 3 (Editable message text)	The FPTC module in option slot 3 has activated a motor temperature warning in the XWRN input (non-safety related). 1. Motor temperature is too high, or 2. the thermistor is in short-circuit or disconnected.	

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

LEDs

The FPTC-02 module has three diagnostic LEDs.

Name	Color	Description
FAULT	Red	The motor temperature is outside the allowed temperature range and the drive STO is active, or there is no PTC sensor connected to the XFLT input (safety related).
WARNING	Red	The motor temperature is outside the temperature warning range, or there is no PTC sensor connected to the XWRN input (non-safety related).
STATUS	Green	The module is powered up.

Note: When there is no sensor connected to the XWRN input, the WARNING LED is red even if you have suppressed the warnings from the module. You can connect a resistor (resistance 50 ohm...3.6 kohm) between the XWRN inputs to turn off the WARNING LED.

10

Maintenance

Contents of this chapter

This chapter gives maintenance instructions.

Maintenance

After the operation of the safety circuit has been tested at start-up, it does not need any maintenance during its specified lifetime, but the safety circuit must be tested periodically to keep the SIL/PL capability valid.

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 FPTC-02 module, modify drive or FSO 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 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 also note the Recommendation of Use CNB/M/11.050 published by the European co-ordination of Notified Bodies concerning dual-channel safety-related systems with electromechanical outputs:

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

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

Competence

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

Residual risk

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

11

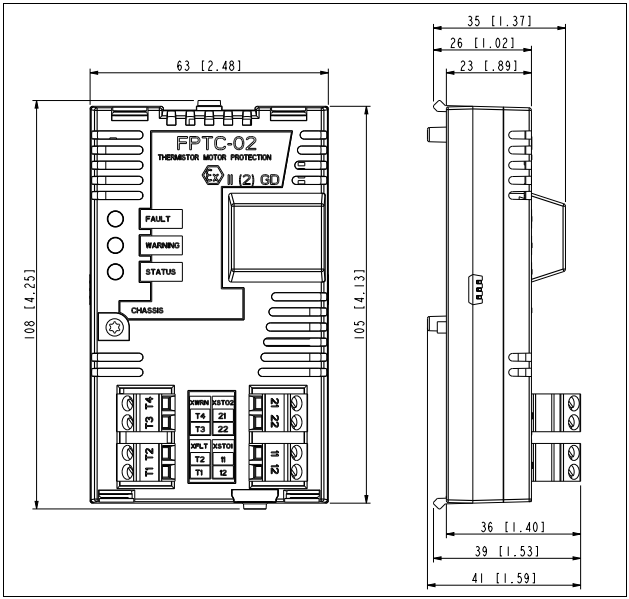
Technical data

Contents of this chapter

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

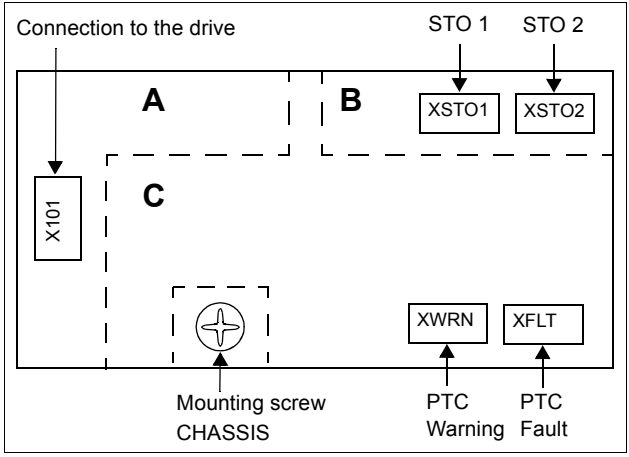
Dimension drawing

The dimensions are in millimeters and [inches].



Isolation areas

This figure describes the different isolation areas of the module. Isolation areas A and B and the mounting screw are connected to ground. Isolation area C is in the same potential as the PTC sensor element in the motor.



Connections

Motor thermistor connection

- Wire size max. 2.5 mm^2
- 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 mm^2 or similar
- Torque: 0.5 N·m
- Supported standards: DIN 44081 and DIN 44082
- Number of PTC thermistors: 1, 3 or 6 in series (in both inputs)
- Triggering threshold: 3.6 kohm
- Recovery threshold: 1.6 kohm
- PTC terminal voltage: < 5.0 V
- PTC terminal current: < 1 mA
- Short-circuit detection: < 50 ohm
  (for the effect of the cable length, see above)

STO relay output connection

- Wire size max. 2.5 mm^2 (with an FSO module: 1.5 mm^2)
- Length max. 30 m (100 ft) (for the whole loop)
- Torque: 0.5 N·m
- Maximum contact rating: 24 V DC (17...30 V), 1 A / channel
- Maximum breaking capacity: 1000 VA

Ambient conditions

See the drive technical data.

Safety data

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

The table gives the safety data for the SMT function with different configurations. The calculations are based on the worst case data of the drive Safe torque off (STO) function. The PFH_D/PFD_G values can be different based on the internal configuration of the FSO module.

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

Two-channel configurations

1. FPTC module + drive STO (see *Wiring example 1* on page *45*)
2. a) FPTC module + drive STO + FSO module with STO function request (see *Wiring example 2* on page *46*), or
   b) FPTC module + drive STO + FSO module with SS1 function request (time monitoring)
3. FPTC module + drive STO + FSO module with SS1 function request (ramp monitoring), without an encoder interface (see **Note 1** below)
4. FPTC module + drive STO + FSO-21 module with SS1 function request (ramp monitoring) + FSE-31 module, with an encoder interface (see **Note 2** below)
5. FPTC module + drive STO + external safety relay (see *Wiring example 4* on page *48*).

One-channel configurations

6. a) FPTC module + drive STO + FSO module with STO function request (see *Wiring example 3* on page *47*), or
   b) FPTC module + drive STO + FSO module with SS1 function request (time monitoring),
7. FPTC module + drive STO + FSO module with SS1 function request (ramp monitoring), without an encoder interface (see **Note 1** below)
8. FPTC module + drive STO + FSO-21 module with SS1 function request (ramp monitoring) + FSE-31 module, with an encoder interface (see **Note 2** below)

Note 1: When ramp monitoring is used in SS1 function, the FSO module monitors the motor speed during the deceleration ramp. Without an encoder, the speed monitoring function of the drive is included in the calculations.

Note 2. When ramp monitoring is used the SS1 function and a safety encoder is used in the application (only the FSO-21 supports the use of safety encoders), speed monitoring during the deceleration ramp is based on the motor speed from the safety encoder. This is why the FSE-31 encoder interface module is included in the calculations. When time monitoring in used in the SS1 function (configurations 2b and 6b), the safety data is the same with and without an encoder interface. The failure rate of the safety encoder is not included in the calculations.

	Two-channel configurations					**One-channel configurations**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
SIL / SILCL	2	2	2	2	2	1	1	1
PL	c	c	c	c	c	c	c	c
SFF (%)	>90	>90	>90	>90	>90	>60	>60	>60
PFH_D (1/h) (T1 = 20a)	5.50 E-09	5.57 E-09	1.22 E-08	9.07 E-09	5.50 E-09	8.28 E-09	1.49 E-08	1.18 E-08
PFD_G (1/h) (T1 = 2 a)	4.82 E-05	5.11 E-05	2.70 E-04	9.82 E-05	4.82 E-05	6.94 E-05	2.88 E-04	1.17 E-04
DC (%)	60	60	60	60	60	0	0	0
SC	2	2	2	2	2	2	2	2
Cat.	1	1	1	1	1	1	1	1
HFT	0	0	0	0	0	0	0	0
CCF	65	65	65	65	65	65	65	65
Lifetime (a)	20	20	20	20	20	20	20	20

3AXD10000454332

The $MTTF_d$ value (EN ISO 13849-1) of the FPTC-02 module:

- 1708 years (two-channel connection)
- 1703 years (one-channel connection)

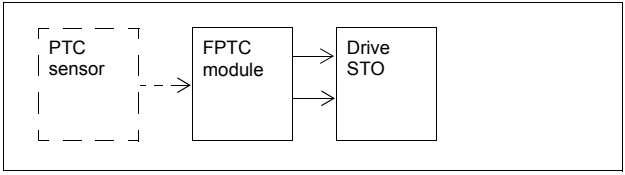
Safety block diagrams

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

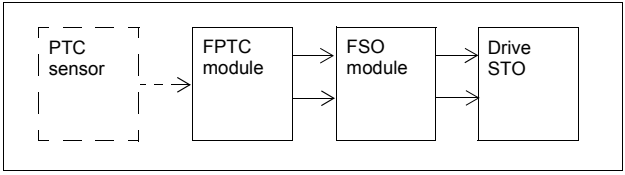
Note: The failure rate of the PTC sensor is not included in the calculations.

Two-channel configurations

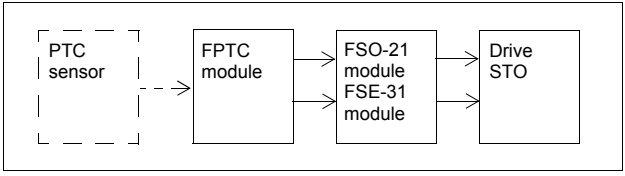
This diagram applies to configuration 1.



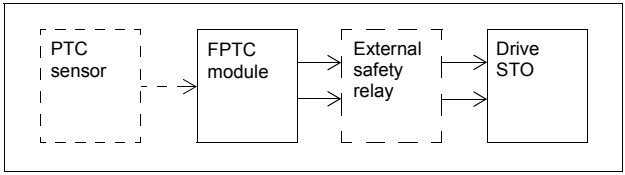
This diagram applies to configurations 2 and 3.



This diagram applies to configuration 4.



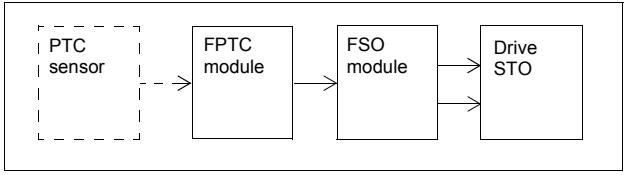
This diagram applies to configuration 5.



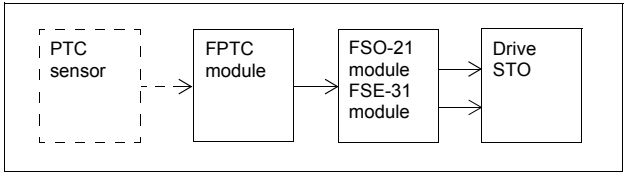
Note: The failure rate of the external safety relay is not included in the calculation.

One-channel configurations

This diagram applies to configurations 6 and 7.



This diagram applies to configuration 8.



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

Response times

- FPTC-02 module: less than 10 ms
- SMT function: the response time of the PTC sensor + FPTC-02 module (<10 ms) + FSO module (<50 ms) + drive STO (<50 ms) + 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, restoring parameter values to factory 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	*Safety devices required for the safe functioning of equipment with respect to explosion risks*
IEC 61508:2010	*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*
EN/IEC 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional*
EN/IEC 62061:2005 +A1:2013	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1:2008	*Safety of machinery – Safety-related parts of control systems –* *Part 1: General principles for design*
EN ISO 13849-2:2012	*Safety of machinery – Safety-related parts of control systems – Part 2: Validation*
IEC 61326-3-1:2008	*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*
IEC 61511:2003	*Functional safety - Safety instrumented systems for the process industry sector*
2006/42/EC	*European Machinery Directive*
2014/34/EU (previously 94/9/EC)	*European ATEX Product Directive*

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

(According to ATEX Directive 2014/34/EU (94/9/EC) & Machinery Directive 2006/42/EC)

We

Manufacturer: ABB Oy, Drives
Address: Hiomotie 13, P.O Box 184, 00381 Helsinki, Finland
Phone: +358 10 22 11

hereby declare under our sole responsibility that the products

ACS880-01 **ACS880-04** (frames R10-R11)

with **FPTC-02** module, identified with option code **+L537 +Q971,**

with regard to the safety function **ATEX certified thermistor protection (Safe Motor Temperature)**,

are in conformity with all the requirements for

protective system of the Council directives for Explosive atmospheres **94/9/EC** (until 19 Apr 2016) and **2014/34/EU** (from 20 Apr 2016), and

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

Directive 2014/34/EU (94/9/EC)

Specific marking of explosion protection

Ex 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*

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" of ACS880 drives and has issued the certificate VTT 15 ATEX 050.

EU Declaration of Conformity

(According to ATEX Directive 2014/34/EU (94/9/EC) & Machinery Directive 2006/42/EC)

Directive 2006/42/EC

The following harmonized standard has been applied:

EN 61800-5-2: 2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional*
EN 62061: 2005 + A1: 2013	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1: 2008 + AC: 2009	*Safety of machinery – Safety-related parts of control systems. Part 1: General requirements*
EN ISO 13849-2: 2012	*Safety of machinery – Safety-related parts of the control systems. Part 2: Validation*
EN 60204-1: 2006 + AC: 2010	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

Other applied standards:

IEC 61508 ed. 2: 2010	Functional safety of electrical / electronic / programmable electronic safety-related systems

The products referred in this Declaration of Conformity fulfil the relevant provisions of the Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC.

Person authorized to compile the technical file:

Name: Juha Martinmaa

Address: P.O. Box 184, 00381 Helsinki, Finland

Helsinki, 9 Nov 2015

Tuomo Hoysniemi
Vice president
ABB Oy

EU Declaration of Conformity

According to ATEX Directive 2014/34/EU (94/9/EC); Machinery Directive 2006/42/EC

We

Manufacturer: ABB Oy, Drives
Address: Hiomotie 13, P.O Box 184, 00381 Helsinki, Finland.
Phone: +358 10 22 11

hereby declare under our sole responsibility that the products

ACS880-04XT **ACS880-04, -14, -34** (nxR8i) **ACS880-104**

ACS880-07 **ACS880-17, -37** (nxR8i) **ACS880-107**

with **FPTC-02** module, identified with option code **+L537 +Q971,**

with regard to the safety function **ATEX certified thermistor protection (Safe Motor Temperature),**

are in conformity with all the requirements for

protective system of the Council directives for Explosive atmospheres **94/9/EC** (until 19 Apr 2016) and **2014/34/EU** (from 20 Apr 2016), and

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

Directive 2014/34/EU (94/9/EC)

Specific marking of explosion protection

Ex 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*

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" of ACS880 drives and has issued the certificate VTT 15 ATEX 050.

EU Declaration of Conformity

According to ATEX Directive 2014/34/EU (94/9/EC); Machinery Directive 2006/42/EC

Directive 2006/42/EC

The following harmonized standard has been applied:

EN 61800-5-2: 2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional*
EN 62061: 2005 + A1: 2013	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1: 2008 + AC: 2009	*Safety of machinery – Safety-related parts of control systems. Part 1: General requirements*
EN ISO 13849-2: 2012	*Safety of machinery – Safety-related parts of the control systems. Part 2: Validation*
EN 60204-1: 2006 + AC: 2010	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

Other applied standards:

IEC 61508 ed. 2: 2010	Functional safety of electrical / electronic / programmable electronic safety-related systems

The products referred in this Declaration of Conformity fulfil the relevant provisions of the Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC.

Person authorized to compile the technical file:

Name: Vesa Tiihonen
Address: P.O. Box 184, 00381 Helsinki, Finland

Helsinki, 4 Nov 2015

Peter Lindgren
Vice President
ABB Oy

3AXD10000466494 Page: 2/2

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

The ATEX-certified Safe disconnection function (+Q971) in the drive (VTT 12 ATEX 053X).

ABB

Declaration of Conformity

(According to ATEX Directive 94/9/EC)

Manufacturer: ABB Oy, Drives

Address: Hiomotie 13, P.O Box 184, 00381 Helsinki, Finland.

hereby declares under our sole responsibility that the products

ACS880-01 **ACS880-04** (frames R10-R11)

with regard to the "**ATEX certified safe disconnection function**", identified with option code **+Q971**

with marking

Ex II (2) GD

to which this declaration relates, are in conformity with the requirements of the Council directive for explosive atmospheres, 94/9/EC of March 1994. The products referred in this Declaration of Conformity fulfil the relevant provisions of the Low Voltage Directive 2006/95/EC, EMC Directive 2004/108/EC and Machinery Directive 2006/42/EC.

The following harmonized standard has been applied:

EN 50495: 2010

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

Other applied standards:

IEC 61508: 2010

Functional safety of electrical / electronic / programmable electronic safety-related systems

EN 61800-5-2: 2007

Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional

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 safe disconnection function" of ACS880 drives and has issued the certificate VTT 12 ATEX 053X.

Helsinki, 1 Oct 2014

Tuomo Hoysniemi

Vice President

ABB Oy

3AXD10000116868

Page: 1/1

Declaration of Conformity

(According to ATEX Directive 94/9/EC)

Manufacturer: ABB Oy, Drives

Address: Hiomotie 13, P.O Box 184, 00381 Helsinki, Finland.

hereby declares under our sole responsibility that the products

ACS880-04, -14, -34 (nxR8i) **ACS880-04XT** **ACS880-104**

with regard to the "**ATEX certified safe disconnection function**", identified with option code **+Q971**

with marking

Ex II (2) GD

to which this declaration relates, are in conformity with the requirements of the Council directive for explosive atmospheres, 94/9/EC of March 1994. The products referred in this Declaration of Conformity fulfil the relevant provisions of the Low Voltage Directive 2006/95/EC, EMC Directive 2004/108/EC and Machinery Directive 2006/42/EC.

The following harmonized standard has been applied:

EN 50495: 2010

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

Other applied standards:

IEC 61508: 2010

Functional safety of electrical / electronic / programmable electronic safety-related systems

EN 61800-5-2: 2007

Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional

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 safe disconnection function" of ACS880 drives and has issued the certificate VTT 12 ATEX 053X.

Helsinki, 5 Jun 2015

Peter Lindgren
Vice President
ABB Oy

3AXD10000116899

Page: 1/1

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

ATEX certificates

ATEX certificate for the Safe disconnection function (+Q971) in the drive (VTT 12 ATEX 053X).

VTT EXPERT SERVICES LTD

EC-TYPE EXAMINATION
CERTIFICATE
VTT 12 ATEX 053X Issue 1

1 (2)

1. **EC-TYPE EXAMINATION CERTIFICATE**

2. **Equipment or Protective System Intended for use in potentially explosive atmospheres Directive 94/9/EC**

3. Reference: **VTT 12 ATEX 053X Issue 1**

4. Equipment: **Safe Disconnection Function for converter drive**

   Certified types: **ACS880-01/-04/-104 +Q971**
   ACS880-01/-04/-104 +Q971 +Q973 (FSO-12)

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

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 9 of the Council Directive 94/9/EC of March 1994, 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

VTT Expert Services Ltd
Kivimiehentie 4, Espoo
P.O.Box 1001, FIN-02044 VTT, Finland

Tel +358 20 722 111
Fax +358 20 722 7042

FINAS
Finnish Accreditation Service
1999 (EN ISO/IEC 17020)
(Typpi A / Type A)

VTT EXPERT SERVICES LTD

SCHEDULE TO EC-TYPE
EXAMINATION CERTIFICATE
VTT 12 ATEX 053X Issue 1

13. **Schedule**

14. **EC-TYPE EXAMINATION CERTIFICATE VTT 12 ATEX 053X Issue 1**

15. Description

Thermal protection is based on ATEX-compliant protection relay. The relay monitors a sensor circuit, and activates the SIL 3 certified "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.

16. Documents

EN_ACS880 ATEX application guide, doc 3AUA0000132231, rev B
FSO Safety data in ATEX-Certified Safe Disconnection Function, doc 3AXD10000113948, rev B
Certificate No.SLA-0055/10, V. 1.1 by TüV Nord
Certificate No.SEBS-A.164608/12 V1.0 by TüV Nord

17. Special conditions for safe use

The drive themselves are to be installed outside potentially explosive atmospheres (article 1, section 2 of the Directive). All manufacturer's instructions shall be followed.

18. Essential Health and Safety Requirements

Assessment using standard referred in point 9 have confirmed compliance with the Directive 94/9/EC, Annex II and particular point 1.5.

Certificate history

Issue	Date	Comment
-	3.5.2013	Prime certificate
1	15.10.2014	Adding safety functions module FSO-12 and deleting two type designations covered by another certificate.

Espoo, 15.10.2014
VTT Expert Services Ltd

Martti Siirola
Senior 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.

ATEX certificate for the Safe motor temperature function with the FPTC-02 module and ACS880 drive series (VTT 15 ATEX 050).

VTT EXPERT SERVICES LTD

EC-TYPE EXAMINATION
CERTIFICATE
VTT 15 ATEX 050

1. **EC-TYPE EXAMINATION CERTIFICATE**

2. **Equipment or Protective System Intended for use in Potentially explosive atmospheres Directive 94/9/EC**

3. Reference: **VTT 15 ATEX 050**

4. Equipment: **Thermal motor protection system for converter drive ACS880 series**

   Certified types: **ACS880 +L537 +Q971 (FPTC-02)**
   ACS880 +L537 +Q971 +Q973 (FPTC-02 and FSO-12)

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

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 9 of the Council Directive 94/9/EC of March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety

VTT Expert Services Ltd
Kivimiehentie 4, Espoo
P.O.Box 1001, FIN-02044 VTT, Finland

Tel + 358 20 722 111

FINAS
Finnish Accreditation Service
ISO/IEC 17020
(Type A / Type A)

VTT EXPERT SERVICES LTD

EC-TYPE EXAMINATION
CERTIFICATE
VTT 15 ATEX 050

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 EC-Type examination certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance to the directive 94/9/EC. 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, 8.12.2015

VTT Expert Services Ltd

Martti Siirola
Senior 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.

VTT EXPERT SERVICES LTD

SCHEDULE TO EC-TYPE
EXAMINATION CERTIFICATE
VTT 15 ATEX 050

1 (1)

13. **Schedule**

14. **EC-TYPE EXAMINATION CERTIFICATE VTT 15 ATEX 050**

15. Description

Thermal protection is based on temperature monitoring FPTC- 02module. 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. FPTC-02 together with the STO-function comprise the "Safe Motor Temperature" (SMT)-function. Safety functions module FSO-12 can be included in the thermal protection function.

16. Documents

FPTC-01/-02, CPTC-02 SMT HW description, 3AXD10000387390, rev A
FPTC-01/-02, CPTC-0 Integrated PTC temperature protection module CONCEPT, 3AXD10000381242, rev A
FPTC and 2xFPTC module for temperature monitoring ACS880 ATEX schedule drawings, 3AXD10000472110, rev A (4 pages)
Certificate No.SLA-0055/10, V. 1.1 by TüV Nord
Certificate No.SEBS-A.164608/12 V2.0 by TüV Nord
Certificate No.SEBS-A.095525/15 V1.0 by TüV Nord

17. Special conditions for safe use

None

18. Essential Health and Safety Requirements

Assessment using standard referred in point 9 have confirmed compliance with the Directive 94/9/EC, Annex II and particular point 1.5.

Espoo, 8.12.2015

VTT Expert Services Ltd

Martti Siirola
Senior 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 FPTC-02 module and ACS880 drive series is attached below.

DAkkS
Deutsche
Akkreditierungsstelle
D-ZE-11074-01-00

TÜV NORD

Certificate

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

TÜV NORD Systems GmbH & Co. KG hereby certifies

ABB Oy
Hiomotie 13
00381 Helsinki
Finland

that the

FPTC-02

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

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

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

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

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

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

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

Hamburg, 2015-11-27

T. Nelke

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

TÜV NORD
TÜV NORD Systems GmbH & Co. KG
Safety Approved
FPTC-02
IEC 61508:2010 SIL2
IEC 61800-5-2:2007 SIL2
ISO 13849-1:2006 PLc
ISO 13849-2:2012 PLc
SEBS-A.095525/15
Voluntary Certification

Further information

Product and service inquiries

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

Product training

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

Providing feedback on ABB Drives manuals

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

Document library on the Internet

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

Contact us

www.abb.com/drives
www.abb.com/drivespartners

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