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OPTIONS FOR ABB DRIVES

Prevention of unexpected start-up (option +Q957) for ACS880 multidrives

User's manual



Prevention of unexpected start-up (option +Q957) for ACS880 multidrives

User's manual

Table of contents



1. Safety instructions



4. Electrical installation



7. Start-up and validation test



Table of contents

1 Safety instructions

Contents of this chapter	7
Use of warnings and notes	7
Instructions for functional safety circuits	8
Electrical safety precautions	9

2 Introduction to the manual

Contents of this chapter	11
Applicability	11
Target audience	11
Exclusion of liability	11
Quick reference guide for taking a safety function into use	12
Related manuals	12
Terms and abbreviations	13

3 Option description

Contents of this chapter	15
Overview	15
Operation principle	16
Fault reaction function	17
Hardware settings	17

4 Electrical installation

Contents of this chapter	19
Wiring	19

5 Parameter settings

Contents of this chapter	21
Inverter unit parameter settings	21

6 Use of the safety function

Contents of this chapter	23
Activating the safety function	23
Resetting the safety function	23

7 Start-up and validation test

Contents of this chapter	25
Validation of the safety functions	25
Competence	25
Validation procedure	25
Validation test reports	26
Start-up and validation test	26



8 Fault tracing

Contents of this chapter 29
Fault tracing 29
Reporting problems and failures related to safety functions 29

9 Maintenance

Contents of this chapter 31
Safety circuit maintenance 31
Proof test interval 31
Functional safety components 32
Competence 32
Residual risk 32
Intentional misuse 32
Decommissioning 33

10 Technical data

Contents of this chapter 35
Safety data 35
 Safety data values 35
 Safety component types 35
 Safety block diagrams 35
 Relevant failure modes 36
 Fault exclusions 36
 Operation delays 36
Ambient conditions 36
Related standards and directives 36
Compliance with the European Machinery Directive 37
Compliance with the Supply of Machinery (Safety) Regulations (UK) 37

Further information



1

Safety instructions



Contents of this chapter

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

Use of warnings and notes

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

The manual uses these warning symbols:



WARNING!

Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.



WARNING!

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



WARNING!

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

Instructions for functional safety circuits

This manual does not contain the complete safety instructions of the drive. It only includes the instructions related to the scope of this manual.

Only a qualified electrical professional who has sufficient knowledge about functional, machine, and process safety is permitted to install, start up and maintain the safety circuit. All user-made changes are on the user's responsibility.



WARNING!

The safety function described in this manual does not isolate the main or auxiliary circuits from the power supply. Before you do work on the drive, or its main or auxiliary circuits, do the steps in section [Electrical safety precautions \(page 9\)](#).



WARNING!

(With permanent magnet or synchronous reluctance [SynRM] motors only)

In case of a multiple IGBT power semiconductor failure, the drive system can produce an alignment torque which maximally rotates the motor shaft by $180/p$ (with permanent magnet motors) or $180/2p$ (with synchronous reluctance [SynRM] motors) degrees regardless of the activation of the Safe torque off function. p denotes the number of pole pairs.



WARNING!

Do the validation test of the safety function at the start-up and also after you make changes to the safety circuit.



WARNING!

Make sure that the functional safety of the machine is maintained in situations where the safety option does not provide protection, for example, during commissioning, system maintenance, fault tracing, or decommissioning.



WARNING!

Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

Electrical safety precautions

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



WARNING!

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

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

Do these steps before you begin any installation or maintenance work.

1. Clearly identify the work location and equipment.
2. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
 - Open the main disconnecting device of the drive.
 - Open the charging switch if present.
 - Open the disconnecter of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
 - If the drive is equipped with a DC/DC converter unit (optional) or a DC feeder unit (optional): Open the DC switch-disconnector ([Q11], option +F286 or +F290) of the unit. Open the disconnecting device of the energy storage connected to the unit (outside the drive cabinet).
 - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
 - In the liquid cooling unit (if present), open the switch-disconnector of the cooling pumps.
 - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
 - Disconnect all dangerous external voltages from the control circuits.
 - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. Use a quality voltage tester. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
 - Before and after measuring the installation, verify the operation of the voltage tester on a known voltage source.
 - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is zero.
 - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is zero.



Important! Repeat the measurement also with the DC voltage setting of the tester. Measure between each phase and ground. There is a risk of dangerous DC voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive power-off. The measurement discharges the voltage.

- Make sure that the voltage between the drive DC terminals (UDC+ and UDC-) and the grounding (PE) terminal is zero. In cabinet-built drives, measure between the drive DC busbars (+ and -) and the grounding (PE) busbar.



WARNING!

The busbars inside the cabinet of liquid-cooled drives are partially coated. Measurements made through the coating are potentially unreliable, so only measure at uncoated portions. Note that the coating does not constitute a safe or touch-proof insulation.

6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person in control of the electrical installation work.



2

Introduction to the manual

Contents of this chapter

This chapter describes the manual in short and gives some general information for the reader. This chapter also contains a quick reference guide for implementing a safety system.

Applicability

This manual is applicable to ACS880 air-cooled and liquid-cooled multidrives which have the option: Prevention of unexpected start-up (option +Q957).

This manual shows the default design of the safety circuit ordered with option code +Q957. The actual design can be different from the default design because of customer-defined modifications. Always refer to the documentation delivered with the drive.

Target audience

This manual is intended for people who install, commission, use and service the safety function. Read the manual before working on the unit. You are expected to know the fundamentals of electricity, wiring, electrical components, electrical schematic symbols, and functional safety.

Exclusion of liability

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

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

Quick reference guide for taking a safety function into use

Task	<input checked="" type="checkbox"/>
Connect the user-defined wiring (if any). Refer to the wiring instructions in this manual and the circuit diagrams delivered with the drive.	<input type="checkbox"/>
Check and/or set the safety function related parameters (as listed in this manual).	<input type="checkbox"/>
Do the validation test to make sure that the implemented system meets the safety requirements. You can find the instructions for the validation test in this manual.	<input type="checkbox"/>
Document the validation test procedure. You can find the guidelines for the validation test report in this manual.	<input type="checkbox"/>

Related manuals

Manual	Code
Drive hardware	
ACS880 multidrive cabinets mechanical installation instructions	3AUA0000101764
ACS880 liquid-cooled multidrive cabinets mechanical installation instructions	3AXD50000048635
ACS880 multidrive cabinets and modules electrical planning instructions	3AUA0000102324
ACS880 liquid-cooled multidrive cabinets and modules electrical planning	3AXD50000048634
Supply units	
ACS880-207 IGBT supply units hardware manual	3AUA0000130644
ACS880-207LC IGBT supply units hardware manual	3AXD50000174782
ACS880-307...+A003 diode supply units hardware manual	3AUA0000102453
ACS880-307...+A018 diode supply units hardware manual	3AXD50000011408
ACS880-307LC...+A018 diode supply units hardware manual	3AXD50000579662
ACS880-907 regenerative rectifier units hardware manual	3AXD50000020546
Inverter hardware	
ACS880-107 inverter units hardware manual	3AUA0000102519
ACS880-107LC inverter units hardware manual	3AXD50000196111
Drive firmware	
ACS880 primary control program firmware manual	3AUA0000085967
ACS880 primary control program quick start-up guide	3AUA0000098062
ACS880 diode supply control program firmware manual	3AUA0000103295
ACS880 IGBT supply control program firmware manual	3AUA0000131562
ACS880 regenerative rectifier control program firmware manual	3AXD50000020827
PC tools	
Drive Composer start-up and maintenance PC tool user's manual	3AUA0000094606
Functional safety design tool user's manual	3AXD10000102417
Safety	
ACS880 multidrive cabinets and modules safety instructions	3AUA0000102301
ACS880 liquid-cooled multidrive cabinets and modules safety instructions	3AXD50000048633
Functional safety; Technical guide No. 10	3AUA0000048753
ABB Safety information and solutions	www.abb.com/safety

Manual	Code
Options	
ACX-AP-x assistant control panels user's manual	3AUA0000085685
Other documents	
Circuit diagrams	Delivered with the drive
Part lists	Delivered with the drive
Safety data report (if ordered with option code +P947)	

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

Terms and abbreviations

Term	Description
Cat.	Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behavior in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability. The categories are: B, 1, 2, 3 and 4. (EN ISO 13849-1)
Control unit	The part in which the control program runs.
Frame, frame size	Physical size of the drive or power module
HFT	Hardware fault tolerance (IEC 61508)
IGBT	Insulated gate bipolar transistor
Inverter unit	Inverter module(s) under control of one control unit, and related components. One inverter unit typically controls one motor.
Mission time	The period of time covering the intended use of the safety function/device. After the mission time elapses, the safety device must be replaced. Note that any mission time values given cannot be regarded as a guarantee or warranty. (EN ISO 13849-1)
PL	Performance level. Levels a...e correspond to SIL (EN ISO 13849-1)
POUS	Prevention of unexpected start-up
SIL	Safety integrity level (1...3) (IEC 61508, IEC 62061, IEC 61800-5-2)
STO	Safe torque off (IEC/EN 61800-5-2)
Supply unit	Supply module(s) under control of one control unit, and related components.
Validation	Confirmation by, for example, analysis that the safety system meets the functional safety requirements of the specific application.
Verification	Confirmation by, for example, testing that the safety system meets the requirements set by the specification.



Option description

Contents of this chapter

This chapter describes the option +Q957, prevention of unexpected start-up, and its settings.

Overview

A drive with option +Q957 uses a safety relay to implement the Prevention of unexpected start-up (POUS) safety function. ABB installs the safety relay to the drive at the factory.

The user must install and connect an operating switch and an indication lamp (optional) on site. These are not included in the delivery. The user can install the operating switch on, for example, a control desk. Refer to the machine-specific C-type standards on whether the indication lamp is required.

When the user sets the operating switch to the open position, the POUS function activates the Safe torque off (STO) function in the inverter units. The Safe torque off function disables the control voltage of the power semiconductors of the inverter unit output stage. This prevents the inverter units from generating the torque required to rotate the motors. With the POUS function, the user can do short-time operations (like cleaning) or maintenance work on the non-electrical parts of the machinery without switching off and disconnecting the inverter units.

Note: The situations in which you can use the POUS function must always be based on a risk assessment. Refer to IEC 60204-1:2016.

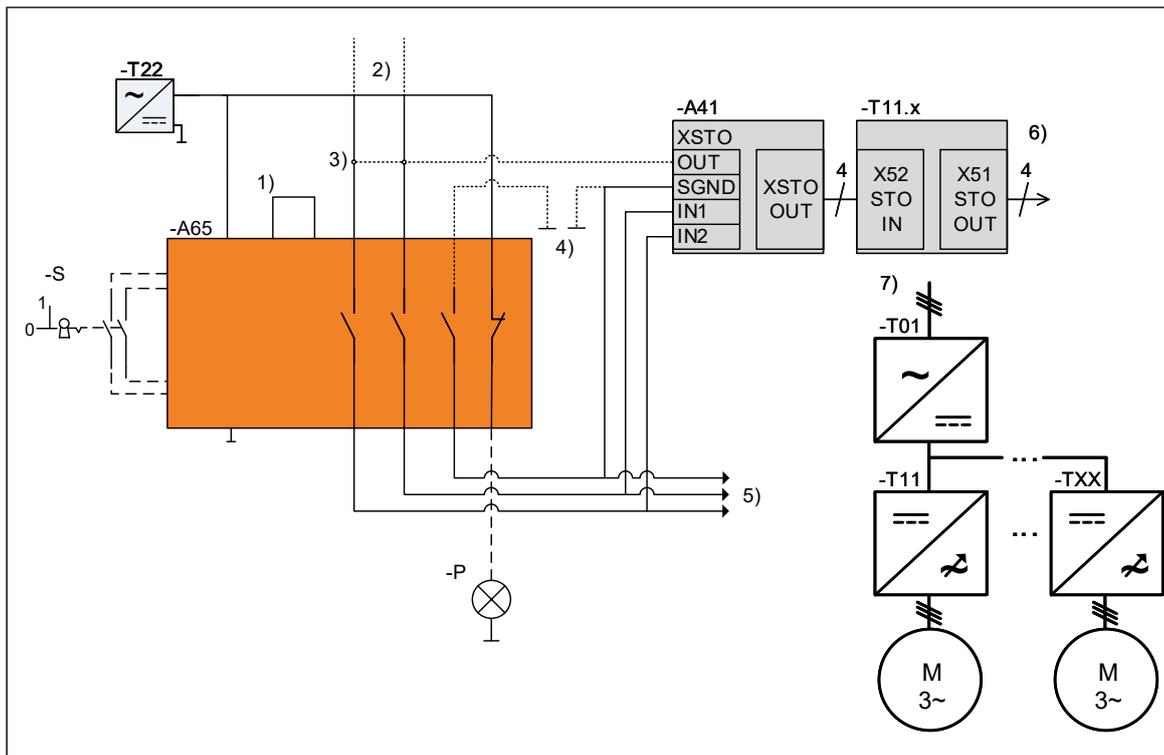
Note: Drives with the Emergency stop, stop category 1 function (option +Q952 or +Q964): If the user activates the POUS function during the emergency stop deceleration ramp, it overrides the emergency stop function. This activates the drive STO function immediately and the motor coasts to a stop. For more information on the emergency stop function, refer to the applicable emergency stop option user's manual.

For a detailed description of the inverter unit STO function, refer to the inverter unit hardware manual.

The design principles of the option +Q957 comply with EN ISO 14118. The STO function complies with IEC/EN 61800-5-2. For a complete list of related standards and European directives, refer to section [Related standards and directives \(page 36\)](#).

Operation principle

The figure shows a simplified operation principle. For a more detailed description, refer to the circuit diagrams delivered with the drive.



---	The dashed line in the figure shows a user-defined installation.
A41	Inverter control unit
A65	POUS safety relay
P	POUS indicator lamp (user-defined)
S	POUS switch (user-defined)
T01	Supply unit
T11 ... Txx	Inverter units
T11.x	Inverter module(s) under inverter unit T11
T22	24 V power supply
1)	Autoreset
2)	Alternative +24 V supply from supply unit with option +Q963 or +Q964
3)	Alternative +24 V supply for Safe torque off (depending on configuration)
4)	Alternative groundings (depending on configuration)
5)	To other inverter control units

6)	To other parallel R8i modules (if any)
7)	Main circuit

Step	Operation
	Initial status: The drive is in operation, but the motor is not running.
1	The user sets the POUS switch [S] to the open position. This activates the POUS function.
2	The POUS safety relay [A65] de-energizes the XSTO inputs IN1 and IN2 of the inverter control unit [A41], which activates the inverter unit STO function. The inverter unit shows an indication.
3	The POUS indication lamp [P] comes on.
4	The user cannot start the motor while STO is active.
5	Normal operation continues after the user: <ul style="list-style-type: none"> • sets the POUS switch [S] to the closed position • resets the inverter units, if they are configured to generate a fault when STO is activated • makes sure that the drive receives the start signal (depends on the configuration, see the firmware manual).

Fault reaction function

Definition: A safety function requires a “fault reaction function” that tries to initiate a safe state if it detects a failure in the safety system.

The fault reaction function of the POUS safety relay trips the system, if it detects a failure in the safety circuit (for example, short circuit between signals, open circuit, or redundancy fault).

If a fault is detected, the fault reaction function:

- activates the POUS request
- activates the drive STO function
- keeps the safe state activated and the POUS indication lamp on until the fault is repaired and the safety function is reset.

The STO function has its own internal fault diagnostics and fault reaction function.

Hardware settings

The hardware settings for the safety function are set at the factory.

The settings in the POUS safety relay [A65] are:

- Cross fault detection is set to *With*
- Start mode is set to *Automatic*.

Note: If the cross fault detection is set to *Without*, the fault diagnostics of the wiring decreases.

For more information, refer to the circuit diagrams delivered with the drive.

4

Electrical installation

Contents of this chapter

This chapter describes the wiring of the safety option done at the factory and contains guidelines for making user connections.

Wiring

**WARNING!**

Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

The operating switch and the indication lamp for the POUS function are not factory-installed. The user must install and connect them to the inverter units on site.

There must be double contacts in the POUS switch [S] and double wiring (redundant two-channel connection) between the button and the POUS safety relay [A65]. The safety relay detects cross faults and faults across one contact from the POUS switch.

Connect the POUS switch to the applicable terminals inside the drive cabinet. For the POUS indication lamp [P], ABB recommends an LED indication lamp. Refer to the circuit diagrams delivered with the drive. Obey the rules below:

1. Use only double-contact switches. ABB recommends approved and lockable switches.
2. Connect the switch with two conductors (two-channel connection). Keep the channels separate.

Note: If you use only one channel in a two-channel implementation, or if the channels are connected together, the cross fault detection of the POUS relay detects a redundancy fault and activates the fault reaction function.

Note: The safety circuit design can be different when modified according to the customer's safety requirements. Refer to the circuit diagrams delivered with the drive.

20 Electrical installation

3. Use shielded, twisted pair cables. ABB recommends double-shielded cable and gold-plated contacts in the POUS switch.
4. Make sure that the sum resistance for one channel (loop resistance) is not more than 70 ohms.
5. Obey the general control cable installation instructions given in the inverter unit hardware manual.



5

Parameter settings

Contents of this chapter

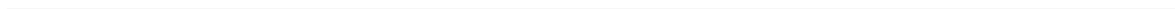
This chapter gives the parameter settings related to the safety function.

Inverter unit parameter settings

The table that follows gives the parameters related to the safety function in the ACS880 primary control program. The parameters are set at the factory.

No.	Name	Default value ¹⁾	Description
31.22	STO indication run/stop	Warning/Warning	Selects which indications are given when the Safe torque off (STO) function is activated. <i>Warning/Warning</i> is the recommended setting.

¹⁾ Value set by ABB at the factory for the default design.



6

Use of the safety function

Contents of this chapter

This chapter describes the use of the safety function with factory default settings.

Activating the safety function

Activate the POUS function only when the motors are stopped.

Activation procedure:

1. Set the POUS switch [S] to the open position.
When POUS is activated, the following indications are shown:
 - the inverter unit control program has the indication *Safe torque off active*
 - the POUS indication lamp is on (if installed).

Note: The POUS indication is not SIL/PL-rated.

If configured with parameter *31.22 STO indication run/stop*, an indication for Safe torque off is shown when the inverter unit STO is activated.

Resetting the safety function



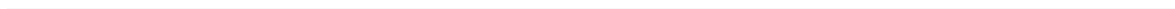
WARNING!

Make sure that the drive does not start accidentally. This can occur with the automatic reset method of the safety function, if a level-triggered start command and the start enable signal are on at the same time.

1. Set the POUS switch [S] to the closed position.
 2. If necessary, reset faults from the inverter units.
-

24 Use of the safety function

A manual reset is not necessary after you deactivate the POUS function. ABB sets the POUS safety relay [A65] to the automatic reset mode at the factory.



7

Start-up and validation test

Contents of this chapter

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

Validation of the safety functions

You must do a validation test to make sure that the safety function operates correctly and according to the safety requirements.

■ Competence

The person who does the validation test of the safety function must be a competent person with expertise and knowledge of the safety function and functional safety, as required by IEC 61508-1 clause 6. This person must document and sign the test procedures and report.

■ Validation procedure

You must do the validation test using the checklist given in this manual and the validation test plan of the complete safety system:

- at the initial start-up of the safety function
 - after changes related to the safety function (wiring, components, safety function -related parameter settings, etc.)
 - after changes related to the power unit or its circuit boards
 - after maintenance work related to the safety function
 - at the proof test of the safety function.
-



The validation test must include at least the following steps:

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

■ Validation test reports

You must store the signed validation 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 validation test reports done due to changes or maintenance in the logbook of the machine.

Start-up and validation test

You must use the Drive Composer PC tool or a control panel to do the start-up and validation test.



Action	<input checked="" type="checkbox"/>
 WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	<input type="checkbox"/>
Initial status	
Make sure that the drive is ready for use, that is, you have done the tasks of the drive start-up procedure. Refer to the hardware manuals.	<input type="checkbox"/>
Make sure that the STO function is configured and validated. Refer to the inverter unit hardware manual.	<input type="checkbox"/>
Checks and settings with no voltage connected	
Stop the drive and do the steps in section <i>Electrical safety precautions (page 9)</i> before you start the work.	<input type="checkbox"/>
After you connect the POUS switch and indication lamp to the drive, do a check of the connections against the applicable circuit diagrams. Do the check also if you made other connections to the safety circuit on site (for example, connected shipping splits of large drives).	<input type="checkbox"/>
Make sure that the POUS request is not on (the POUS switch is in the closed position).	<input type="checkbox"/>

Action	<input checked="" type="checkbox"/>
<u>Inverter units with parallel R8i inverter modules:</u> Make sure that the XSTO.OUT output on the inverter control unit [A41] is chained to the STO inputs of all inverter modules.	<input type="checkbox"/>
Make sure that the hardware settings of the safety function are set as defined in this manual.	<input type="checkbox"/>
Settings with voltage connected	
Close the cabinet doors and power up the drive. Refer to the hardware manual.	<input type="checkbox"/>
Make sure that the parameter settings related to the safety functions are correct. Refer to chapter Parameter settings .	<input type="checkbox"/>
Validation test	
ABB recommends that you monitor at least these signals with the Drive Composer PC tool: <ul style="list-style-type: none"> • 01.01 Motor speed used (rpm) • 01.02 Motor speed estimated (rpm) • 01.07 Motor current (A) • 01.10 Motor torque (%) • 06.18 Start inhibit status word • 23.01 Speed ref ramp input (rpm) • 23.02 Speed ref ramp output (rpm) • 90.01 Motor speed for control (rpm) • <u>When using an encoder, also:</u> 90.10 Encoder 1 speed (rpm) 	<input type="checkbox"/>
Make sure that it is safe to start, run and stop the motors during the test.	<input type="checkbox"/>
Start the drive and make sure that the motors are running. Then stop the motors.	<input type="checkbox"/>
Make sure that the motors are stopped.	<input type="checkbox"/>
Activate the POUS function: set the POUS switch to the open position.	<input type="checkbox"/>
Make sure that the correct warnings and indications are shown. If there is more than one POUS group in the system, make sure that only the correct inverter units indicate POUS.	<input type="checkbox"/>
Make sure that the POUS indication is activated. For example, if you installed a POUS indication lamp, make sure that it comes on. If there is more than one POUS group in the system, make sure that only the correct inverter units indicate POUS.	<input type="checkbox"/>
Make sure that the inverter unit generates none of these faults: <ul style="list-style-type: none"> • STO hardware failure (5090) • Safe torque off 1 loss (FA81) • Safe torque off 2 loss (FA82) If the inverter unit generates these faults, refer to the fault tracing instructions in this manual.	<input type="checkbox"/>
Make sure that you cannot start the inverter units or motors from any control location. Make sure that the inverter units or motors do not start when you switch the start signal off and on, or push the start key of the panel when the panel is in local control mode.	<input type="checkbox"/>
Deactivate the POUS function: set the POUS switch to the closed position. Note: If the POUS function is in the automatic reset mode, the drive can restart automatically when you deactivate the POUS function.	<input type="checkbox"/>
Make sure that the POUS indication lamp goes off and the related warning is no longer shown.	<input type="checkbox"/>
Restart the inverter units and motors. Make sure that they operate normally.	<input type="checkbox"/>
Do the validation test for each POUS group.	<input type="checkbox"/>



28 Start-up and validation test

Action	<input checked="" type="checkbox"/>
Create a backup file of the drive parameters with the Drive Composer PC tool or control panel.	<input type="checkbox"/>
Fill in and sign the validation test report. Store the report in the logbook of the machine.	<input type="checkbox"/>





Fault tracing

Contents of this chapter

This chapter provides general diagnostics and troubleshooting tips.

Fault tracing

This table gives the indications of the DOLD LG 5925 relay:

LED	LED is on	LED is off
Netz	Power supply is connected.	Power supply is not connected, or there is an external error.
K1	Relay K1 is energized.	There is an external error.
K2	Relay K2 is energized.	There is an external error.

For more information, see the data sheet of the relay (www.dold.com).

Use a multimeter to measure the STO circuit connections, if the inverter unit generates one or more of these faults:

- STO hardware failure (5090)
- Safe torque off 1 loss (FA81)
- Safe torque off 2 loss (FA82)

Refer to the circuit diagrams delivered with the drive.

For more fault tracing possibilities, refer to the hardware and firmware manuals of the drive.

Reporting problems and failures related to safety functions

Contact ABB.

A large, bold, black number '9' is centered within a light grey square with rounded corners.

Maintenance

Contents of this chapter

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

Safety circuit maintenance

After the safety function is validated, it must be maintained by periodic proof testing.

If you change the wiring or a component after the start-up, replace a power unit or its circuit boards, or restore parameters to their factory default values:

- Use only ABB-approved spare parts.
- Register the change to the change log for the safety circuit.
- If parameters were restored to the factory default values: Set the parameters related to the safety function.
- Do the validation test of the safety function.
- Document the tests and store the report into the logbook of the machine.

Proof test interval

Proof tests are used to detect failures in the safety function. To do a proof test, use the validation test procedure given in this manual.

Periodic proof testing of the safety function is necessary to maintain the required SIL/PL-level. 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 or 5 years (high or low demand as defined in IEC 61508, IEC/EN 62061 and EN ISO 13849-1). Regardless of the mode of operation, it is a good practice to do the proof test for the safety function at least

once a year. It is also a good practice to include the proof test for the safety function in the routine maintenance program of the machinery.

The person responsible for the design of the complete safety system should also note the Recommendation of Use CNB/M/11.050 published by the European co-ordination of Notified Bodies for Machinery 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 done 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 done 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 have electromechanical outputs. The STO circuit of the inverter unit does not have electromechanical outputs.

Functional safety components

The mission time of functional safety components is 20 years which equals the time during which failure rates of electronic components remain constant. This applies to the components of the standard Safe torque off circuit as well as any modules, relays and, typically, any other components that are part of functional safety circuits.

The expiry of mission time terminates the certification and SIL/PL classification of the safety function. The following options exist:

- Renewal of the whole drive and all optional functional safety module(s) and components.
- Renewal of the components in the safety function circuit. In practice, this is economical only with larger drives that have replaceable circuit boards and other components such as relays.

Note that some of the components may already have been renewed earlier, restarting their mission time. The remaining mission time of the whole circuit is however determined by its oldest component.

Contact your local ABB service representative for more information.

Competence

The person who does the maintenance and proof test activities of the safety function must be a competent person with expertise and knowledge of the safety function and functional safety, as required by IEC 61508-1 clause 6.

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. Thus, the warnings for the residual risks must be given to the operators.

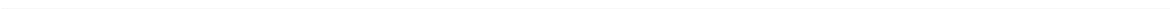
Intentional misuse

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

Decommissioning

When you decommission a POUS group or an inverter unit, make sure that the functional safety of the machine is maintained by other means until the decommissioning is completed.





10

Technical data

Contents of this chapter

This chapter gives the safety data, ambient conditions, and list of standards related to the product.

Safety data

■ Safety data values

Each multidrives delivery is unique. If the customer has ordered safety data calculations (option +P947), ABB calculates the safety data and delivers it separately to the customer.

■ Safety component types

Safety component types as defined in IEC 61508-2:

- POUS safety relay: type A
- inverter unit STO circuit:
 - air-cooled R1i...R7i inverter modules: type A
 - air-cooled R8i inverter modules: type B
 - liquid-cooled R7i...R8i inverter modules: type B.

■ Safety block diagrams

Each multidrives delivery is unique. If included in the customer order, ABB defines the safety block diagram for the safety function and delivers the diagram separately to the customer.

■ Relevant failure modes

Relevant failure modes are:

- internal failures of safety relays and STO. These failures are included in the failure rate value of the function.

■ Fault exclusions

Fault exclusions (not considered in the calculations):

- short and open circuits in the cables of the safety circuit
- short and open circuits in the cabinet terminal blocks of the safety circuits.

■ Operation delays

Total delay for the POUS function: (less than) 100 ms.

Ambient conditions

For the environmental limits for the safety functions and the drive, refer to the inverter unit hardware manual.

Related standards and directives

Standard	Name
IEC 61800-5-2:2016 EN 61800-5-2:2007	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements – Functional
IEC 62061:2021 EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1:2015	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 61508-1:2010	Functional safety of electrical/electronic/programmable electronics safety related systems – Part 1: General requirements
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronics safety related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC 61511-1:2016 + A1:2017	Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements
IEC 61000-6-7:2014	Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations
IEC 61326-3-1:2017	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
EN ISO 14118:2018	Safety of machinery – Prevention of unexpected start-up (ISO 14118:2017)
2006/42/EC	European Machinery Directive

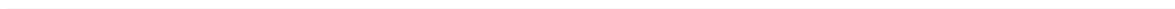
Standard	Name
	Supply of Machinery (Safety) Regulations 2008 (UK)
Other	Machine-specific C-type standards

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 is in the scope of the Machinery Directive as a safety component. This function complies with European harmonized standards such as IEC/EN 61800-5-2. The declaration of conformity is delivered with the drive.

Compliance with the Supply of Machinery (Safety) Regulations (UK)

The drive is an electronic product which is covered by the Electrical Equipment (Safety) Regulations. However, the drive internal safety function of this manual is in the scope of the Supply of Machinery (Safety) Regulations as a safety component. This function complies with designated standards such as EN 61800-5-2. The declaration of conformity is delivered with the drive.



Further information

Product and service inquiries

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

Product training

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

Providing feedback on ABB manuals

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

Document library on the Internet

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