

# SD 500 Series

ACCESSORIES



Getting Started Manual  
**Safety Stop Optional  
Board (STO)**



# SD500

Series

A C C E S S O R I E S

Getting Started Manual  
Safety Stop Optional  
Board (STO)

**Edition: June 2015**

SD50IM02AI Rev. A



## SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.



This symbol means improper operation may result in serious personal injury or death.



Identifies shock hazards under certain conditions. Particular attention should be given because dangerous voltage may be present. Maintenance operation should be done by qualified personnel.



Identifies potential hazards under certain conditions. Read the message and follow the instructions carefully.

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### Edition of June 2015

This publication could present technical imprecision or misprints. The information here included will be periodically modified and updated, and all those modifications will be incorporated in later editions.

To consult the most updated information of this product you might access through our website [www.power-electronics.com](http://www.power-electronics.com) where the latest version of this manual can be downloaded.

**Revisions**

<b>Date</b>	<b>Revision</b>	<b>Description</b>
12 / 06 / 2015	A	First edition

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# SAFETY INSTRUCTIONS

## IMPORTANT!

- Safety instructions showed in this manual are useful to teach user how to use the product in a correct and safety way with the purpose of preventing possible personal injuries or property damages.
- Safety messages included here are classified as it follows:



## WARNING

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**Be sure to take ESD (Electrostatic Discharge) protection measures when you touch the board.**

Otherwise, the optional board may get damaged due to static charges.

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**Implement wiring change on the optional board after checking that the power supply is off.**

Otherwise, connecting error and damage to the board could occur.

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**Be sure to connect correctly the optional board to the drive.**

Otherwise, connecting error and damage to the board could occur.

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**Do not remove the cover while the power is applied or the unit is in operation.**

Otherwise, electric shock could occur.

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**Do not run the drive with the front cover removed.**

Otherwise, you may get an electric shock due to the high voltage terminals or exposure of charged capacitors.

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**Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.**

Otherwise, you may access the charged circuits and get an electric shock.

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**Operate the switches with dry hands.**

Otherwise, you may get an electric shock.

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**Do not use cables with damaged insulation.**

Otherwise, you may get an electric shock.

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**Do not subject the cables to abrasions, excessive stress, heavy loads or pinching.**

Otherwise, you may get an electric shock.

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## WARNINGS

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### RECEPTION

- Material of Power Electronics is carefully tested and perfectly packed before leaving the factory.
  - In the event of transport damage, please ensure that you notify the transport agency and POWER ELECTRONICS: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24hrs from receipt of the goods.
- 

### UNPACKING

- Make sure received merchandise corresponds with delivery note, models and serial numbers.
  - Each optional board is supplied with a technical manual.
- 

### RECYCLING

- The packing of the boards must be recycled. For this reason it is necessary to separate different materials (plastics, paper, cardboard, wood ...) and settle them in corresponding containers.
  - The residual parts of electrical devices must be collected in a selective manner in order to warranty the correct environmental treatment.
-

# 1. INTRODUCTION

This document is a mounting guide of the STO board (Safe Torque Off) implemented on SD500 drives of Power Electronics.



Figure 1.1 STO Board

The STO function is defined as follows:

*“Power, that can cause rotation, is not applied to the motor. The frequency will not provide energy to the motor, which can generate torque.”*

For three-phase asynchronous motors, that means to stop supplying alternating three-phase power to the stator.

This function corresponds with an Emergency Stop Category 0 according to IEC 60204-1. When the drive is running and the STO function is applied, the motor will freely stop by its own inertia.

Based on the study of each application and a risk assessment, the designer should define the safety function required and each safety level. The STO safety has been designed according to IEC/EN 61800-5-2.

The SD500's STO optional board permits to achieve the safety integrity level SIL2 (PLd).

## 2. DESCRIPTION

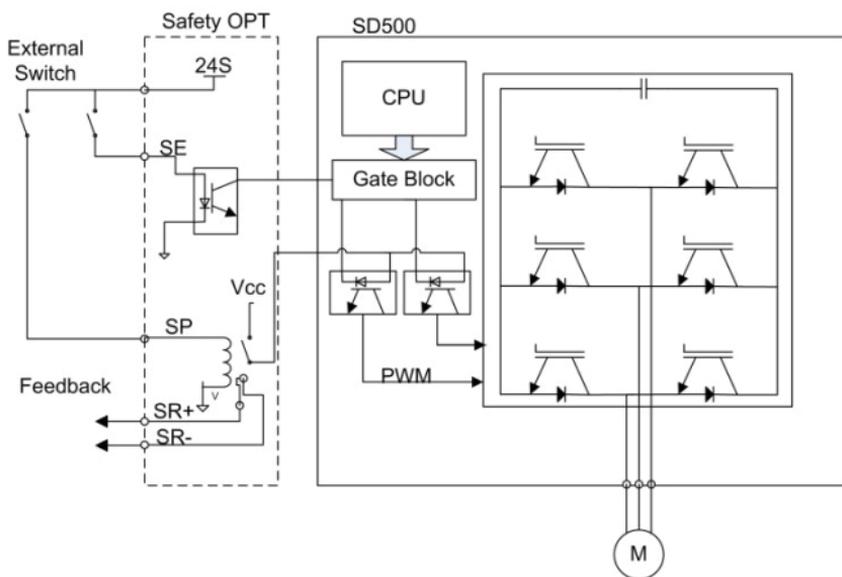
### 2.1. Packing list

The STO Kit is delivered with the following content:

- 1 x STO board
- 2 x Screw
- 1 x Connection wire
- 1 x Technical Manual

### 2.2. Wiring Diagram

The next figure corresponds with the STO board wiring diagram:



SD50ITM0015AI

Figure 2.1 Wiring diagram

## 2.3. Connectors Description

The following figure shows the board connectors.

24S	SE	24S	SP	SR+	SR-
-----	----	-----	----	-----	-----

SD50DTC0019A

Figure 2.2 Connectors description

These connectors are defined as follows:

24S – SE (SFT1)	24S – SP (SFT2)	SR+ – SR-
Short: Normal operation	Short: Normal operation	B Contact Relay Output Terminal
Open: Safety Trip (output disconnect)	Open: Safety Trip (output disconnect)	

The main characteristics of these connectors are:

Terminal		Wire Thickness		Electrical Standard
Variety	Name	mm <sup>2</sup>	AWG	
24S	Safety Input Power	0.33~1.25mm <sup>2</sup> (16~22 AWG) Shield Type Twisted-pair Wire		24Vdc, Max. 10mA
SE	Safety Input 1 (SFT1)			Short: Normal operation (24S-SE or SP). Open: Safety Function Operation (24S-SE or SP).
SP	Safety Input 2 (SFT2)			
SR+, SR-	Complete Output Relay Safety Features			DC24V, 5A below (B contact) Connected to a Digital Input.



### CAUTION

**The length of the safety function wires cannot exceed 30m.**  
Otherwise, the safety function cannot operate correctly.

## 2.4. Operation Description

The SD500's STO optional board permits to achieve two Safety Levels for the STO function by using the two different channels SFT1 and SFT2. Depending on the application, users can select the channel to be used.

### **SFT1 channel operation (terminals 24S and SE)**

When there is a safe stop event, the IGBTs switching stops in the equipment and the control board continues operating normally, showing the equipment's speed. It is necessary to disconnect and reconnect the equipment to delete this fault.

### **SFT2 channel operation (terminals 24S / SP and SR+ / SR-)**

When there is a safe stop event, the rectifier bridge is disabled and the relay contact of the STO board is opened (terminals SR+ and SR-). Once this relay is opened, the equipment trips as F13 "External Trip". It is necessary to close again the 24S/SP circuit and reset the fault in the equipment's display to delete this fault.

**Note:** To ensure a correct operation of the SFT2 channel, the SR+ and SR- terminals must be connected to a digital input of the equipment and this digital input must be set as "EXT TRIP".

### 3. INSTALLATION AND CONNECTION

The STO board is designed for the SD500 series. It is directly located on the control board.

Install the STO board according to the following instructions.



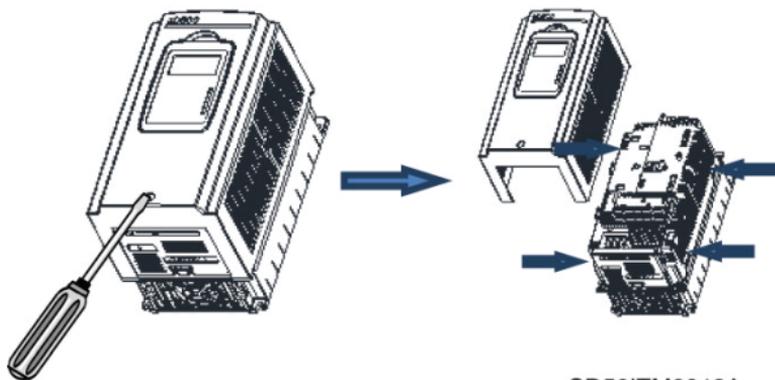
#### CAUTION

**Motor controllers of Power Electronics operate with AC and DC high voltage.**

Make sure the power supply has been disconnected guarantee that DC Link voltage is discharged, before installing the STO board. Otherwise, you may get personal injuries or an accident could occur.

Depending on the SD500 frame the connection between safety card and the inverter should be done as follows:

- 1- Remove the front cover by unscrewing the bottom screw and the internal cover by releasing the four brackets located in the equipment's sides:



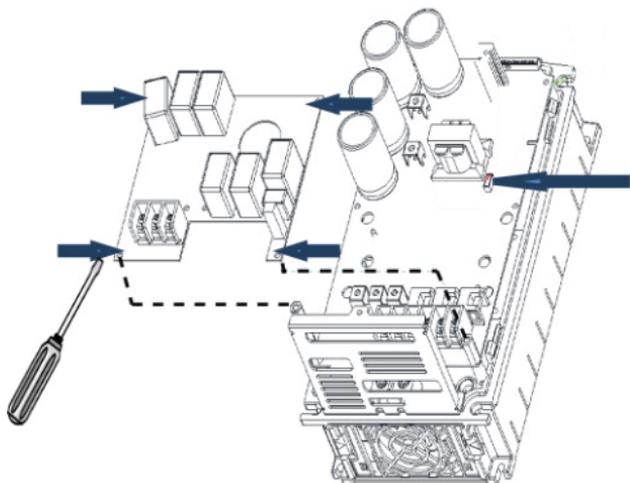
SD50ITM0012A

Figure 3.1 Front cover and inner cover removal

The next steps depend on the drive's frame.

## 3.1. SD500 Frames 1 & 2

2- Remove the EMC filter board.



SD50ITM0004A

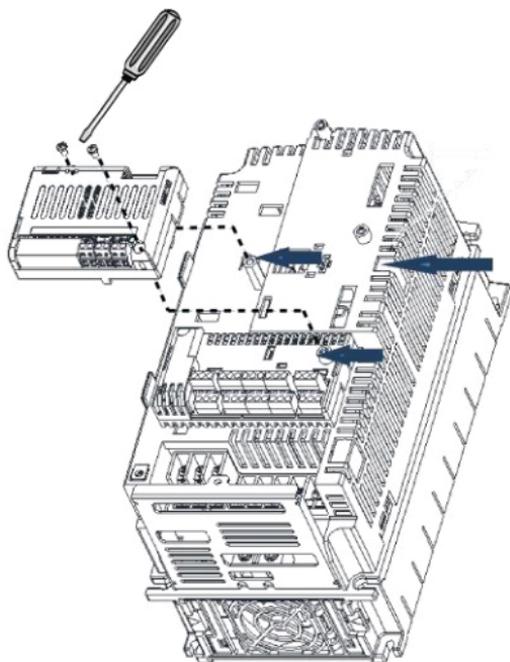
*Figure 3.2 EMC filter removal and STO board connector location*

3- Remove the installed connector and replace it by the provided cable. In the drives' power boards, this connector is called as follows:

Frame	Connector
1	CN5
2	CN6

4- Reassemble the EMC filter board and the inner cover.

5- Screw the STO board to the SD500 and connect the STO board kit wire to the board's connector. Pass the wire through the right side of the inner cover as it is shown in the next figure.



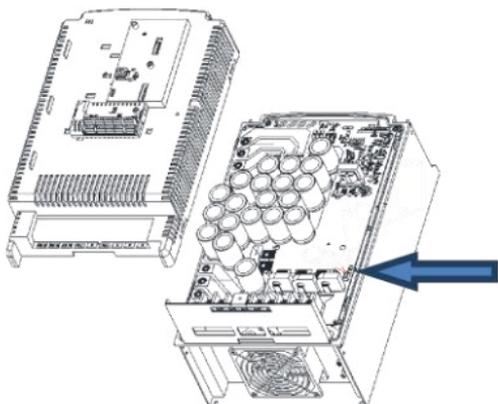
SD50ITM0005A

*Figure 3.3 STO board connection*

6- Screw the front cover.

## 3.2. SD500 Frames 3 & 4

2- Remove the installed connector and replace it by the provided cable.



SD0ITM0006A

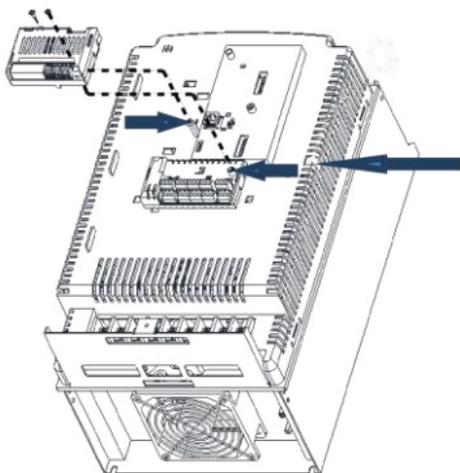
Figure 3.4 STO board connector location

In the drives' power boards, this connector is called as follows:

Frame	Connector
3	CN6
4	CN6

3- Reassemble the inner cover.

4- Screw the STO board to the SD500 and connect the STO board kit wire to the board's connector. Pass the wire through the right side of the inner cover as it is shown in the next figure.



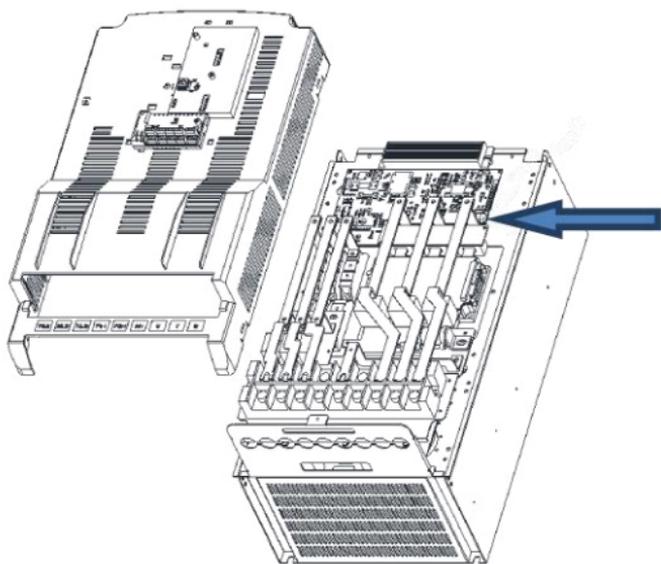
SD50ITM0007A

Figure 3.5 STO Board connection

5- Screw the front cover.

### 3.3. SD500 Frames 5 & 6

2- Remove the installed connector and replace it by the provided cable.



SD50ITM0009A

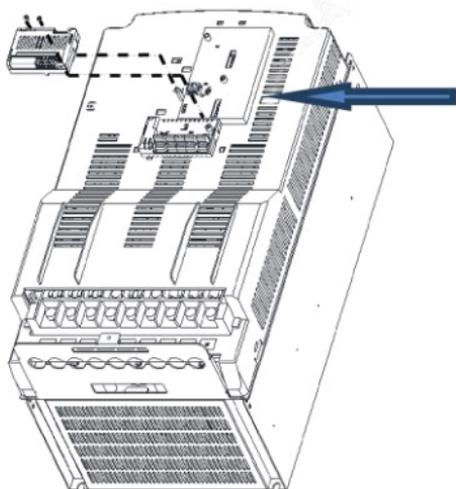
Figure 3.6 STO board connector location

In the drives' power boards, this connector is called as follows:

Frame	Connector
5	CN9
6	CN9

3- Reassemble the inner cover.

4- Screw the STO board to the SD500 and connect the STO board kit wire to the board's connector. Pass the wire through the right side of the inner cover as it is shown in the next figure.



SD50ITM0010A

*Figure 3.7 STO board connection*

5- Screw the front cover.

## 4. CONFIGURATION

To ensure the correct operation of the relay feedback, user has to set one of the next parameters as “EXTERNAL TRIP”.

### 4.1. Group 4 – G4: Inputs

Parameter	Name / Description	Range	Function	Set on RUN				
3 DI1= START (+) Digital I/P 1	G4.1.3 / Multifunction Digital Input 1 Configuration	NONE MRefPID-H MRefPID-M MRefPID-L	Digital Inputs configuration for individual use. <table border="1"> <thead> <tr> <th>OPTION</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr> <td>EXT TRIP</td> <td>Allows an extreme fault generation in order to stop the drive through digital inputs (NO). Is advisable to invert the digital input logic configured as Extreme Fault and set it as contact (NC). See parameter [G4.1.16]</td> </tr> </tbody> </table>	OPTION	FUNCTION	EXT TRIP	Allows an extreme fault generation in order to stop the drive through digital inputs (NO). Is advisable to invert the digital input logic configured as Extreme Fault and set it as contact (NC). See parameter [G4.1.16]	NO
OPTION	FUNCTION							
EXT TRIP	Allows an extreme fault generation in order to stop the drive through digital inputs (NO). Is advisable to invert the digital input logic configured as Extreme Fault and set it as contact (NC). See parameter [G4.1.16]							
4 DI2= START(-) Digital I/P 2	G4.1.4 / Multifunction Digital Input 2 Configuration	START (+) START (-) RESET EXT TRIP						
5 DI3= DIS START Digital I/P 3	G4.1.5 / Multifunction Digital Input 3 Configuration	DIS START INCH 1 SPEED-L SPEED-M SPEED-X						
6 DI4= EXT TRIP Digital I/P 4	G4.1.6 / Multifunction Digital Input 4 Configuration	XCEL-L XCEL-M 3 WIRE CTR/REF 2 UP						
7 DI5= SPEED-L Digital I/P 5	G4.1.7 / Multifunction Digital Input 5 Configuration	DOWN RESERVED POT CLEAR						
8 DI6= SPEED-M Digital I/P 6	G4.1.8 / Multifunction Digital Input 6 Configuration	AnalogHLD PIDOPLoop RESERVED Pre-Excit						
9 DI7= SPEED-H Digital I/P 7	G4.1.9 / Multifunction Digital Input 7 Configuration	Speed/Torq ue ASR GAIN2 ASR P/PI ThermalIn						
10 DI8= INCH 1 Digital Input 8	G4.1.10 / Multifunction Digital Input 8 Configuration	INCH (+) INCH (-) Tq OFFSET						

# 5. MODBUS ADDRESSES LIST

Programming Parameters:

Param.	Screen	Description	Address	Range	Modbus Range
G4.1.3	3 DI1= START (+)	Multifunction Digital Input 1 Configuration	45441	None	0
				START (+)	1
				START (-)	2
				RESET	3
G4.1.4	4 DI2= START(-)	Multifunction Digital Input 2 Configuration	45442	EXT TRIP	4
				DIS START	5
				INCH 1	6
				SPEED-L	7
G4.1.5	5 DI3= DIS START	Multifunction Digital Input 3 Configuration	45443	SPEED-M	8
				SPEED-H	9
				SPEED-X	10
				XCEL-L	11
G4.1.6	6 DI4= EXT TRIP	Multifunction Digital Input 4 Configuration	45444	XCEL-M	12
				3 WIRE	14
				CTR/REF 2	15
				UP	17
G4.1.7	7 DI5= SPEED-L	Multifunction Digital Input 5 Configuration	45445	DOWN	18
				RESERVED	19
				POT CLEAR	20
				AnalogHLD	21
G4.1.8	8 DI6= SPEED-M	Multifunction Digital Input 6 Configuration	45446	PIDOPLoop	23
				RESERVED	33
				Pre-Excit	34
				Speed/Torque	35
G4.1.9	9 DI7= SPEED-H	Multifunction Digital Input 7 Configuration	45447	ASR GAIN2	36
				ASR P/PI	37
				ThermalIn	39
				INCH (+)	46
G4.1.10	10 DI8= INCH 1	Multifunction Digital Input 8 Configuration	45448	INCH (-)	47
				Tq OFFSET	48

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