



CM680 Series

High Performance Book-Type VFD

STO-FUNCTION MANUAL

V1.0



Introduction

This manual provides operational guidance for the STO (Safe Torque Shutdown) function in CM680 series VFDs, covering safety precautions, STO input circuit principles, terminal wiring, and troubleshooting.

Please read this user manual carefully and understand all information before using the STO safety function. For other functions and specifications, refer to the complete user manual for the CM680 series.

For any questions about STO usage, please contact our technical team for assistance.

Safety Precautions

- Wiring work must be performed by qualified personnel in compliance with the STO application guidelines in this manual and widely accepted control system safety design principles.
- When routing DI inputs for STO, the two channels must be routed through separate paths; otherwise, the cable must be shielded with dual shielding.
- If you stop the running drive using the STO function, the drive will gradually stop. If this does not apply to your actual operating conditions, use the correct shutdown mode in the system instead of STO mode.
- When STO is used to disable torque output, the high-voltage components of the motor and driver remain energized. During servo maintenance, disconnect the power supply and ensure the servo is completely de-energized.
- Customers must perform STO function diagnostics every three months. Run the STO once to check if the motor stops.

1.STO Terminal Layout and Definition

The wiring port layout for the STO safety function of the CM680 VFD is shown in the figure below.

Upper Layer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	PE	EGND	485+	485-	COM	+24V	DCM	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8

Lower Layer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	STO1	STO2	+24V	DCM	FM	CME	DO1	DO2	A01	A02	GND	AI1	AI2	AI3	+10V

Figure 1-1 Layout Diagram of STO Terminal

Pin No.	Definition	Description
Lower 1	STO1	Control Input STO1
Lower 2	STO2	Control input STO2
Lower layer 3	+24V	+24V power supply inside the VFD
Lower layer 4	DCM	+24V reference ground inside the VFD

Table 1-1 STO Terminal Signal Definition Table

2. Specifications and Connections of the STO Input Circuit

The STO controls the current output of the driver through two hardware circuit inputs, with the principle and circuit connections as follows:

(1) STO Terminal Function Principle

Table 2-1 STO Terminal Function Description Table

Signal		Input/Output Status			
STO	STO1	H	H	L	L
	STO2	H	L	H	L
VFD output status		Ready to complete	Output stop	Output stop	Output stop
Fault warning		None	Err077	Err072	Err076
Fault description		None	STO2 failure	STO1 failure	STO failure

Explain :

- H: The input is powered by 24V.
- L: The input is disconnected from the 24V power supply.

(2) External 24V connection example

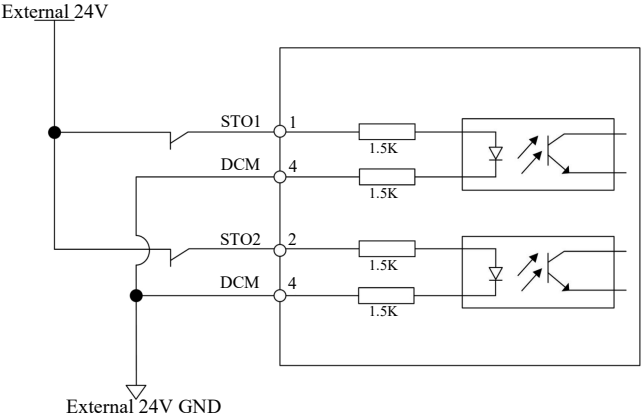


Figure 2-1 STO External 24V Connection

(3) Internal 24V connection example

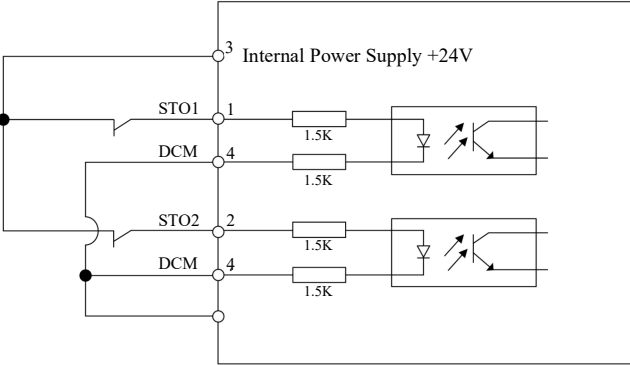


Figure 2-2: 24V Internal Connection in STO

(4) When STO is not in use, the STO circuit short-circuit example

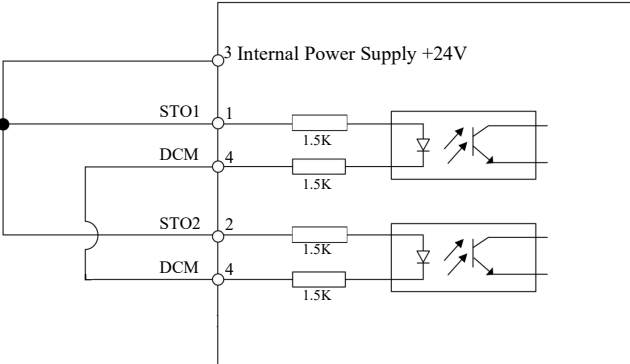


Figure 2-3 Shorting of STO Input

Note :

- When the STO function is not required, the internal +24V must be short-circuited to STO1 and STO2, as shown in the diagram above. This is the default factory wiring configuration for proper VFD operation.
- The maximum distance between the STO input and the operating contact is 30 meters.

3.STO Action Sequence

The STO function blocks PWM signal transmission to the VFD's power stage through STO1 and STO2. If either of the two optical couplers (STO1 or STO2) is disconnected, the VFD ceases output. The sequence diagram is shown below:

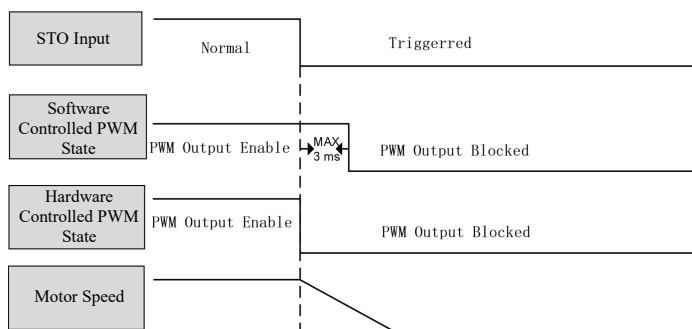


Figure 4-1 STO Action Timing Sequence

4.STO Fault Reset

When the VFD displays Err076 fault and all specified conditions are met, the safety state can be cleared. After the driver automatically resets, normal operation resumes.

- Both requests for STO1 and STO2 must be in the 'H' state simultaneously;
- Function code F9-54=1 (locks the STO function of the VFD; select '1' to keep it unlocked).
- The VFD's start or operation command must be invalid;
- No faults that could cause danger exist.

When both STO1 and STO2 return to high level simultaneously, the VFD resumes its ready state (rdy).

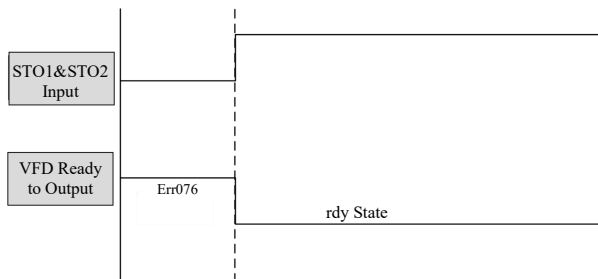


Figure 4-1 STO Reset Sequence

5. STO Self-checking

When using STO for the first time or during debugging, perform the self-check as outlined in the table below to verify its functionality.

Table 5-1 STO Function Self-check Table

Confirm	Inspection Item
First time using STO	1. Ensure the STO terminal circuit is properly connected and securely fastened to the terminal. 2. Ensure the STO terminals are securely fastened to the driver.
	1. If the VFD displays the “ Err076 ” error upon power-on, it indicates an abnormality in the short-circuited terminals. 2. Turn off the power and verify the STO circuit connection by referring to the circuit diagram.
Subsequent debugging	Motor debugging when the VFD is powered on but not running: After power-on, the VFD displays the “rdy” status normally. 1) When STO1 and STO2 are disconnected, the VFD displays the standard “Err076” error. 2) When STO1 and STO2 are activated, the VFD resumes its normal “rdy” status. 3) When STO1 is disconnected, the VFD displays the standard “Err072” error. 4) Connect STO1, and the VFD will automatically return to the “rdy” status. 5) When STO2 is disconnected, the VFD displays the standard “Err077” error. 6) Connect STO2, and the VFD will automatically return to the “rdy” status.
	Motor commissioning during VFD startup Before powering on the VFD to operate the motor, ensure the motor can start and stop normally. After the motor starts, the VFD will display the “ run ” status normally. 1) Disconnect STO1 and STO2 to ensure the motor stops immediately, and the VFD displays the “Err076” error. 2) When STO1 and STO2 are activated, the motor remains stationary while the VFD displays the “rdy” status normally. 3) Start the motor and verify its proper rotation, then the VFD should return to the “run” state.
	If any issues occur during the debugging process, carefully inspect the STO terminals and connected circuits for abnormalities.



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