TS3000 series Robot Controller

INSTRUCTION MANUAL

OPERATOR'S MANUAL
FOR
TS3SFB UNIT

Notice

- Make sure that this instruction manual is delivered to the final user of Toshiba Machine's industrial robot.
- Before operating the industrial robot, read through and completely understand this manual.
- After reading through this manual, keep it nearby for future reference.

TOSHIBA MACHINE CO., LTD.

Preface

Structure of TS series robot controller instruction manuals:
These instruction manuals were published in parts according to the application and purpose, and the name and outline of each manual are as follows:

[Safety Manual]

This manual contains the important information to use the robot safely and correctly. Be sure to read through and understand this manual before operating the robot. Also, strictly observe the descriptions made in the manual.

[Operator's Manual]

This manual deals with the TS series robot controller operating procedures. Read through this manual before operating the robot, and refer to it as necessary.

[Robot Language Manual]

This manual refers to the robot language called "SCOL." When you have to create a program based on this language, read through the manual.

[Interface Manual]

This manual describes the external signals for the robot. Concerning the interface conditions between the robot and peripheral equipment, specifications, timing, etc., refer to the manual when necessary.

[Installation & Transport Manual]

This manual describes the transport, unpacking, and installation of the robot and controller. Be sure to read through this manual before unpacking the shipment containing the robot.

[Maintenance Manual]

This manual deals with the daily and regular inspections to be made on the robot and controller. Read through this manual to use the robot safely over long years to come.

[Communication Manual]

This manual describes the serial communication between the robot controller and other equipment. Refer to this manual when connecting the robot controller with a host computer, optical sensor, etc., via a serial cable.

[User Parameter Manual]

This manual describes the setting procedures of the robot controller. Refer to this manual when you perform the setting of communication, I/O, and motion conditions.

[Alarm Manual]

This manual describes the contents, causes, and remedies of alarms. Refer to this manual when an alarm occurs.

Cautions on Safety

This manual contains the important information on the robot and controller to prevent injury to the operators and persons nearby, to prevent damage to assets, and to assure correct use.
Make sure that the following details (indications and symbols) are well understood before reading this manual. Always observe the information that is noted.

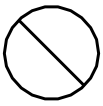
[Explanation of indications]

Indication	Meaning of indication
 **DANGER**	This means that "incorrect handling will lead to fatalities or serious injuries."
 **CAUTION**	This means that "incorrect handling may lead to personal injuries *1) or physical damage *2)."

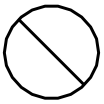
*1) Injuries refer to injuries, burns, electric shocks, etc., which do not require hospitalization or long-term medical treatment.

*2) Physical damage refers to damages due to the destruction of assets or resources.

[Explanation of symbols]

Symbol	Meaning of symbol
	This means that the action is prohibited (must not be done). Details of the actions actually prohibited are indicated with pictures or words in or near the symbol.
	This means that the action is mandatory (must be done). Details of the actions that must be done are indicated with pictures or words in or near the symbol.
	This means danger. Details of the actual danger are indicated with pictures or words in or near the symbol.
	This means caution. Details of the actual caution are indicated with pictures or words in or near the symbol.

[Operation]

 **DANGER**	
 Prohibited	• During operation, NEVER enter the dangerous area of the robot. Otherwise, you will be injured seriously. • DO NOT leave in the working range any machinery or materials that will hinder the operation. If the equipment goes wrong, a person nearby will be injured or involved in an accident. • Anyone other than the operator MUST NOT approach the equipment. Should they negligently touch the dangerous part of the equipment, they will get injured or involved in a serious accident. • NEVER perform an inappropriate operation that is not described in the instruction manual. Otherwise, the equipment will start by mistake, resulting in personal injury or serious accident.
 Danger	• If you feel even a little that you are exposed to danger or that the equipment works abnormally, press the EMERGENCY stop pushbutton switch to stop the equipment. If the equipment is used as it is, you will be injured or involved in a serious accident. When this happens, ask our after-sale service agent for repair. • During operation, be sure to close the equipment cover. Should the cover be opened during operation, you will be struck by an electric shock or get injured. • Only a well-trained and qualified person is allowed to perform the operation. Should the equipment be operated improperly, it will start by mistake, causing a personal injury or serious accident. • If the equipment has malfunctioned, turn the power off, identify and remove the cause of the abnormality, maintain the peripheral equipment, and completely restore the malfunctioned equipment. Then start the equipment at a slow speed. If the equipment starts, leaving the abnormality as is, you will be involved in a serious accident.

CAUTION	
Prohibited	• DO NOT change the data of the system structure file. Otherwise, the robot will move abnormally, resulting in damage or an accident.
Mandatory	• In principle, the teaching operation should be performed outside the dangerous area of the robot. If it should inevitably be performed within the dangerous area, strictly observe the following matters. (1) The teaching operation should always be performed by two (2) persons. One person performs the job and the other person watches outside the dangerous area. Also, both persons should try to prevent mis-operation with each other. (2) The operator should do the job in an attitude ready to press the EMERGENCY stop pushbutton switch at any time. Also, they should perform the job at a position from which they can evacuate immediately at the time of an emergency after confirming the robot working range and shields nearby. (3) The supervisor should keep watch on the job at a position where they can see the entire robot system and operate the EMERGENCY stop pushbutton switch at the time of an emergency. Also, they should keep anyone from entering the dangerous area. Unless the operator or other person follows the instructions of the supervisor, an accident will be caused. • If an abnormality has been generated or the POWER LED lamp on the control panel remains off after the main power switch of the equipment was turned on, turn off the main power immediately and confirm the wiring. Otherwise, you will be struck by an electric shock or a fire will break out. • Unless the robot operates toward a designated direction at manual guide, turn off the servo power. Otherwise, the robot will be damaged or you will be involved in an accident. When this happens, call the after-sale service agent. • Pushbutton operations of the control panel and teach pendant should be confirmed visually. Otherwise, you will be involved in an accident due to mis-operation. • After the power is turned on, be sure to reset a program to start an automatic operation. If the program is executed continuously, the robot will interfere with the peripheral equipment, resulting in damages or accidents.

CAUTION	
 Mandatory	• Before operating the equipment, perform the following inspection. (1) Make sure that the visual appearances of the robot, controller, peripheral equipment and cables are in good condition. (2) Make sure that no obstacle stands in or near the working range of the robot and peripheral equipment. (3) Make sure that the emergency stop and other safety devices operate properly. (4) Make sure that no abnormal noise or vibration is involved in the robot operation. If the above prior inspection is skipped, the equipment will be damaged or you will be involved in an accident.
 Caution	• The speed of test operations is initially set at 25% of the maximum robot speed. • The speed of automatic operation is initially set at 100% of the maximum robot speed.

Table of Contents

1 Overview

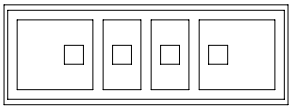
This manual describes the TS3SFB unit, an optional unit for a TS3000 series controller. The unit can be used to configure a safety-related block, thereby allowing the controller to satisfy the requirements of Safety Category 3 (ISO-138491) required for ANSI and the CE marking. The controller with the standard specification satisfies the requirements of Safety Category 2.

2 Types of Connection Lines

2.1 Power input/output ACIN2 (See 1. In 2.1 "Outline drawings.")

This connector supplies power to the TS3SFB unit, and outputs power through contactors.
The AC cable for connecting the TS3SFB unit to a TS3000 series controller is available as an accessory. (The standard length is 3 m.)

AC cable (drawing No.: M249418)
Model No. on the TS3SFB unit side: F32MSP-04V-KX*, manufactured by JST
Model No. on the connection cable side: F32FSS-04V-KX*, manufactured by JST



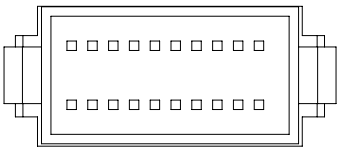
Connector connected to the AC cable

Pin No.	Signal name	I/O
1	R2	Input
2	S2	Input
3	R3	Output
4	S3	Output

2.2 Signal input/output SAFE (See 2. In 2.1 "Outline drawings.")

This connector inputs an emergency stop signal, an enable switch signal for the teaching pendant, and a safety input switch signal to the TS3SFB unit, and outputs a feedback signal received from the safety relay module to the TS3000 series controller.
The signal cable for connecting the TS3SFB unit to the TS3000 series controller is available as an accessory. (The standard length is 3 m.)

SIG cable (drawing No.: M249419)
Model No. on the TS3SFB unit side: J21DPM-20V-KX*, manufactured by JST
Model No. on the connection cable side: J21DF-20V-KX*, manufactured by JST

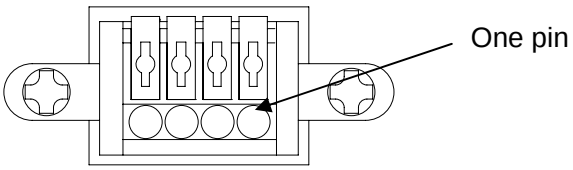


Connector connected to the SIG cable

Pin No.	Signal name	I/O	Function
A1	P24V	Input	Power for the safety relay module
B1	IN-EMG1	Input	Emergency stop switch input 1-1
A2	OU-EMG1	Input	Emergency stop switch input 1-2
B2	EMS1	Output	Emergency stop switch detection 1
A3	P24V	Input	Power for the safety relay module
B3	IN-EMG2	Input	Emergency stop switch input 2-1
A4	OU-EMG2	Input	Emergency stop switch input 2-2
B4	EMS2	Output	Emergency stop switch detection 2
A5	P24V	Input	Power for the safety relay module
B5	IN-ENA1	Input	Safety switch input 1-1
A6	OU-ENA1	Input	Safety switch input 1-2
B6	ENA1	Output	Safety switch signal detection 1
A7	P24V	Input	Power for the safety relay module
B7	IN-ENA2	Input	Safety switch input 2-1
A8	OU-ENA2	Input	Safety switch input 2-2
B8	ENA2	Output	Safety switch signal detection 2
A9	EMG-RM	Output	Detection of safety relay module for emergency stop switch
B9	GND	Input	Ground for safety relay module
A10	ENA-RM	Output	Detection of safety relay module for safety switch
B10	GND	Input	Ground for safety relay module

2.3 Signal input/output RESET (See 3. In 2.1 "Outline drawings.")

This connector inputs a reset signal to each safety module in the TS3SFB unit.
The connector on the connection cable side is available as an accessory.
Model No. common to the TS3SFB unit side and connection cable side:
ML-4000-ASV-4PGY*, manufactured by SATO PARTS Co., Ltd.

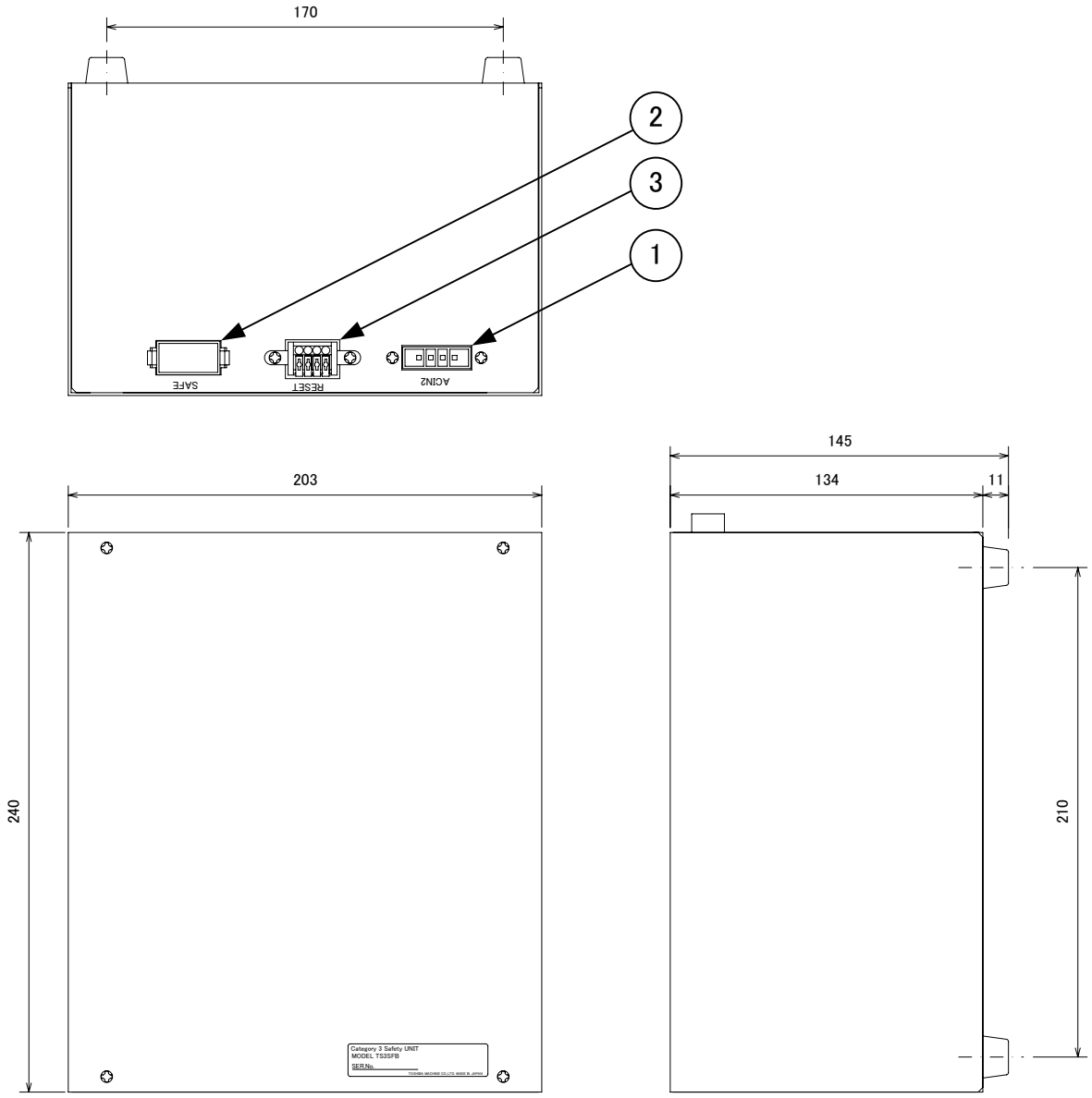


Connector for inputting a reset signal to each safety module

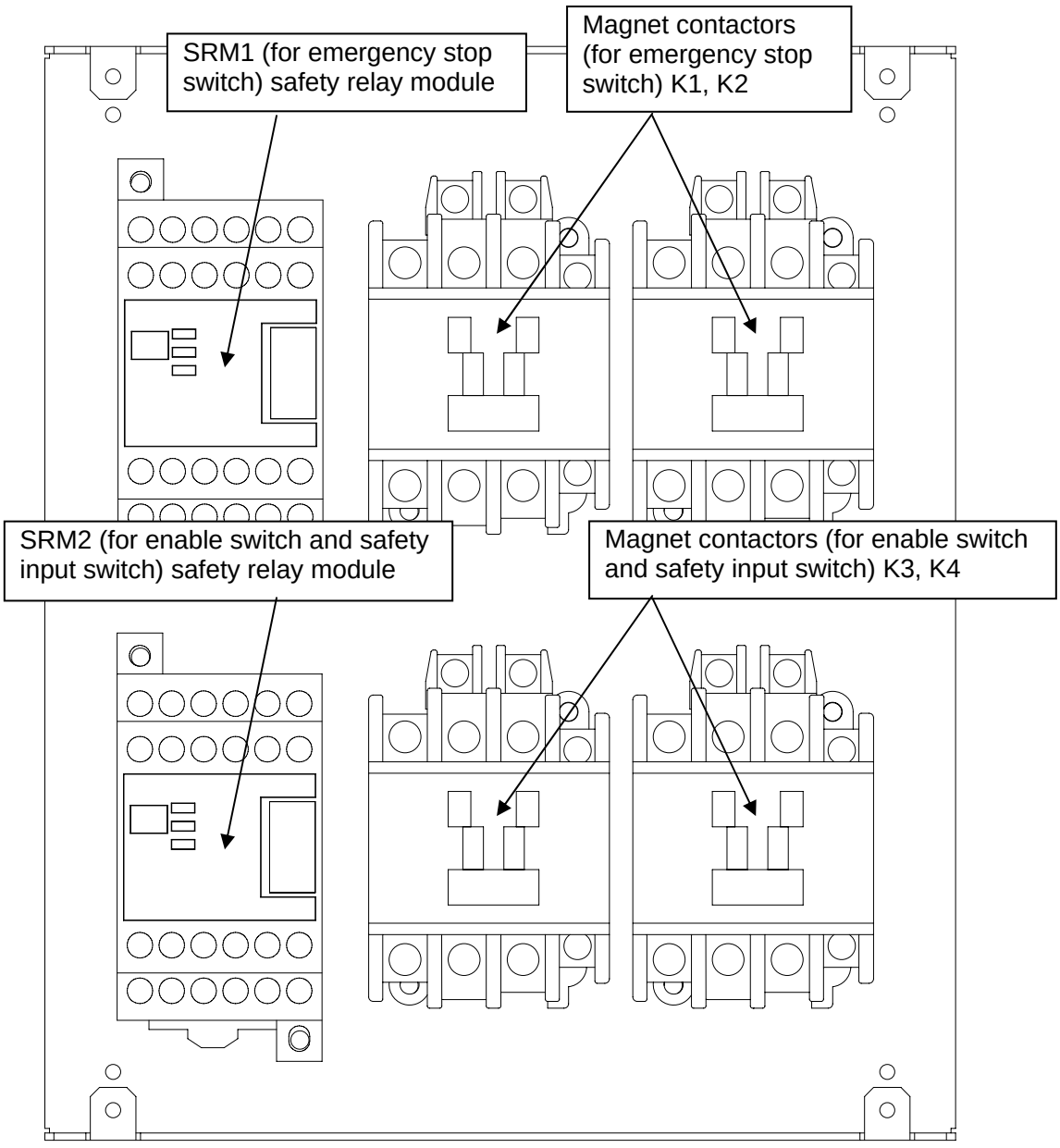
Pin No.	Signal name
1	RESET1-1 (input to the safety relay module for the emergency stop switch)
2	RESET1-2 (input to the safety relay module for the emergency stop switch)
3	RESET2-1 (input to the safety relay module for the safety switch)
4	RESET2-2 (input to the safety relay module for the safety switch)

3 Unit Outline Drawings

3.1 Outline drawings

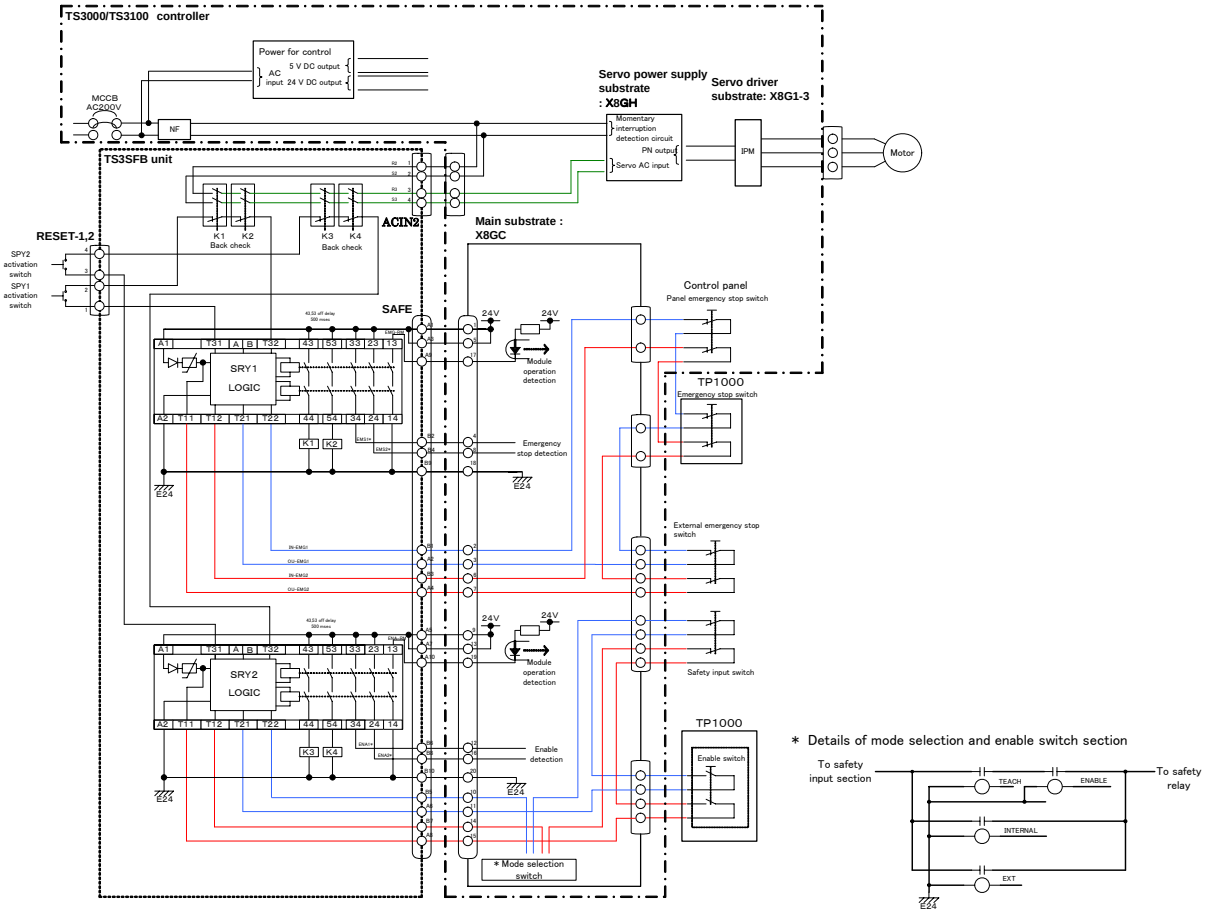


3.2 Detailed internal drawings



Safety relay modules (SRM1, SRM2):	G9SA-321-T075 24V DC	manufactured by IDEC
Magnet contactors (K1 to K4):	SC-4-1/G 24V DC 1b	manufactured by Fuji Electric Holdings Co., Ltd.

4 Block Diagram of the Internal Circuit



Pins 43-44 and 53-54 of the safety relay modules SRM1 and SRM2 are used for off delay output.

5 Operation Timings

5.1 Activation

When the RESET1 and RESET2 switches are pressed with the emergency stop switches, enable switches, and safety input switches turned off, the safety relay module is reset. After this reset, the contacts of the K1 to K4 contactors are closed. Then, AC power is supplied to the servo power supply section on the X8GH (power supply module). However, no voltage is charged to the servo driving capacitor. When the servo ON command signal is input after that, voltage charging starts and motor excitation becomes possible.

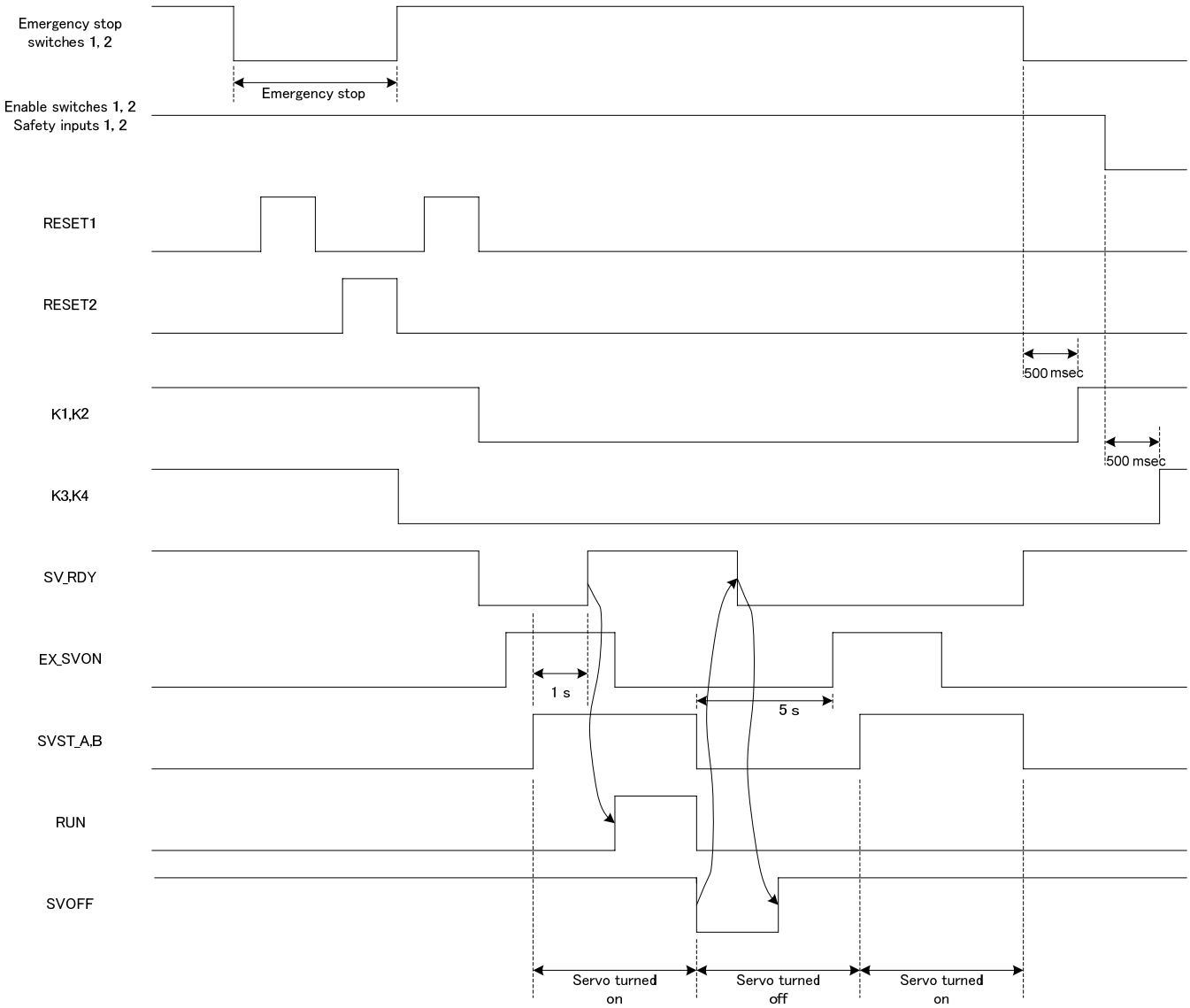
5.2 Stop

When the emergency stop switches, enable switches, and safety input switches are pressed, a deceleration stop starts, after which a brake signal is input and the motor excitation is canceled. The contacts of the K1 to K4 contactors are opened with a delay of 500 ms after an emergency stop signal is input. Then, the AC power of the servo power supply section can be turned off. The delay time of 500 ms is set by the safety relay module.

5.3 Reactivation

When the emergency stop switches, enable switches, and safety input switches are pressed, the safety relay module is placed in a state in which it is not reset and an error is indicated. When this happens, the servo cannot be turned on.
If both 008-014 Emergency Stop SW ON and 008-281 Emergency SW relay ON are generated together, the safety relay module for the emergency stop switches is in a state in which it is not reset. Press RESET1 with all the emergency stop switches turned off.
If both 008-017 Safety SW ON and 008-280 Safety SW relay ON are generated together, the safety relay module for the safety switches is in a state in which it is not reset. Press RESET2 with all the enable switches and safety input sections turned off.
In the teaching mode, press RESET2 with the enable switches on the teaching pendant neutralized.

5.4 Timing diagram



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