

# Optional Product (Specification Symbol: SC)

## SC Unit Instruction Manual

- Thank you for purchasing our Tsubaki Gear Motor/Hypoid Motor/Croise Motor. The Tsubaki Gear Motor/Hypoid Motor/Croise Motor should only be handled by the engineers with expertise in the relevant procedures. This instruction manual is a publication about SC unit of the product. Before using this product, be sure to thoroughly read and understand the contents of this instruction manual.
- Make sure this instruction manual will reach the customer who actually uses the product.
- Keep this instruction manual available whenever needed for a quick reference before handling the product.
- Reproduction and reprinting of this instruction manual in whole or in part without our express consent are strictly prohibited.

### TSUBAKIMOTO CHAIN CO.

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## 1 Introductory note

Thank you for your continuous support. Please use this instruction manual in combination with the standard instruction manual. Make sure this instruction manual will reach the customer who actually uses the product.

The degree of potential danger and damage that may be caused by improper handling of the product is basically classified using two indications, “WARNING” and “CAUTION”, in this manual. The definitions are as follows.

 <b>WARNING</b>	Due to mishandling, a dangerous condition may occur and there is a possibility of serious injury or death
 <b>CAUTION</b>	Due to mishandling, a dangerous condition may occur and there is a possibility of moderate impairment or minor injury, or only property damage

Note that even the cases indicated by “CAUTION” could lead to serious results depending on the situation.

As both the “WARNING” and “CAUTION” indications include important precautions, be sure to observe the instructions.

 <b>WARNING</b>	
<ul style="list-style-type: none"> <li>● Do not use this product in an explosive, flammable, or corrosive atmosphere and locations exposed to water splashes. Doing so may cause an electric shock, injury, fire, or failure.</li> <li>● Ensure complete safety before starting the operation.</li> <li>● Do not perform live-line operations. Before starting any procedure, confirm that the power is OFF. Failure to do so may result in an electric shock.</li> <li>● Be sure to turn OFF the power before opening the lid of the terminal box. Failure to do so may result in an electric shock.</li> <li>● Installation, wiring connection, inspection, etc. must be performed by engineers with expertise in those procedures. During those procedures, be sure to wear appropriate clothing and protective gear (safety goggles, gloves, safety boots, etc.). Failure to do so may cause an electric shock, injury, fire, or failure.</li> <li>● Ground the PE terminal independently, using the wiring with a diameter compatible with the motor capacity. Also perform a continuity check. Failure to do so may cause an electric shock, injury, fire, or failure.</li> <li>● Perform wiring connections according to the instruction manual. Failure to do so may cause an electric shock, fire, or failure.</li> <li>● Do not forcibly bend, pull, or pinch the cables. Doing so may cause an electric shock or fire.</li> <li>● If a power failure occurs, be sure to turn OFF the power. Failure to do so may cause injury.</li> <li>● Be sure to turn OFF the power before beginning the maintenance/inspection procedure. Failure to do so may result in an electric shock.</li> <li>● Avoid the use in the environment that is easy to receive noise influence such as the thunder serge. Failure to do so may cause fire, or failure.</li> </ul>	

 <b>CAUTION</b>	
<ul style="list-style-type: none"> <li>● We shall not be held responsible for any product modifications by the customer as they are not covered by the warranty.</li> <li>● Connect wiring properly according to the electrical equipment technical standards and interior wiring code.</li> <li>● As the entire device, including the terminal box, is extremely hot during operation or immediately after the operation has been stopped, avoid contact of your fingers or any other objects with the device. Failure to do so may cause a</li> </ul>	

burn or property damage.

- Do not repair, disassemble, or modify the product. Doing so may cause an electric shock, injury, fire, or failure.
- When disposing of this product, handle it as an industrial waste.
- Do not perform an insulation resistance test. It may damage the device.
- Strictly observe the Ordinance on Industrial Safety and Health, Section 1 - General Standards under Chapter 1 of Part 2.

## 2 SC unit specifications

The SC unit points to the function complete set for the purpose of protection and the foresight maintenance of the machinery by stopping a motor at the time of trouble occurrence by detecting electricity and temperature and the vibration of the gear motor.

Item		Specification
Applicable motor		40 W to 0.4 kW
Power supply	Rated voltage	Refer to the value indicated on the motor label or product outline drawing.
	Rated frequency	Refer to the value indicated on the motor label or product outline drawing.
	Voltage source capacity	Refer to the standard instruction manual for the gear motor.
Start time		To be set via communication. (Refer to sections 6 and 7 in this manual.)
Shock time		To be set via communication. (Refer to sections 6 and 7 in this manual.)
Trip set value		To be set via communication. (Refer to sections 6 and 7 in this manual.)
Trip	Interruption method	Motor current self-interruption (Two-phase (U-phase and V-phase) interruption)
	Operation	Interrupted state is retained
	Restoration	Power restart after power interruption (for one second or longer)
	Trip signal	
		*1 Minimum applicable load: 5 V DC, 100 mA
		230 V AC 1.5 A(Inductive load $\cos \phi = 0.4$ ) 24 V DC 1.5 A(Inductive load)
Built-in sensor measurement range	*2 Input power	0 W to 1,000 W
	Acceleration speed	$\pm 156.8 \text{ m/s}^2$
	Temperature	-20°C to +100°C
Operating environment	Location	Indoors
	Ambient temperature	0°C to 40°C
	Ambient humidity	45% to 85% RH (no dew condensation)
	Altitude	1,000 m or less
	Atmosphere	No corrosive gas, dust, and water droplets
	Vibration	4.9 $\text{m/s}^2$ or less

NOTE) \*1 Be careful when the trip signal relay output is directly input into the programmable controller (PLC), as it may cause a contact failure due to minute electric current.

For the input into the PLC, it is recommended that the trip relay coil should be driven by the trip signal, which triggers the input of the relay contact into the PLC.

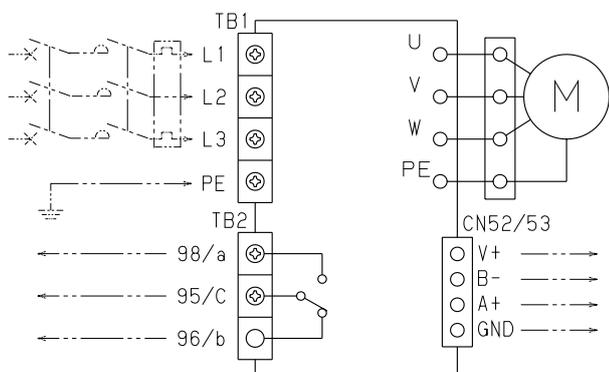
\*2 The power sensor measures the motor input power. It does not indicate the output (power).

### 3 Wiring

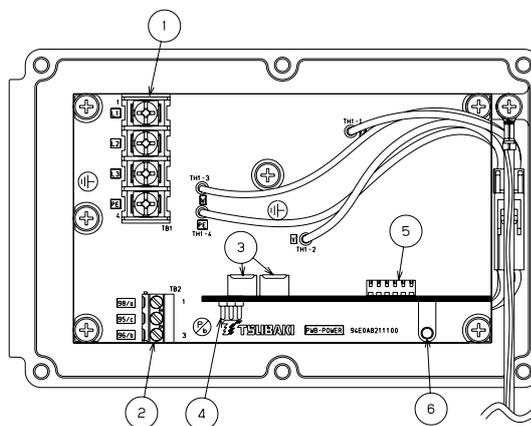
#### 3.1 Structural outline

The following describes items (1) to (6) in the detailed internal drawing of the terminal box below.

- (1) Power supply terminals: Supply power to the motor by connecting wiring to the 4P terminal block via the earth leakage breaker, magnetic contactor, and thermal relay. (L1 corresponds to the U-phase, L2 to the V-phase, and L3 to the W-phase of the motor.)
- (2) Relay output terminals: Use this for displaying warnings, etc.
- (3) Communication connectors: Use these for parameter setting and sensor value reading.  
Use the optional communication cable (Model number: M-S05). Communication details are described in section 7 of this manual.
- (4) Jumper pin: This is a pin for switching the termination resistor in the communication section. For more details, refer to section 6.2.
- (5) DIP switches: Change the position of each switch to select the threshold. These switches can also be used to change the communication slave addresses.
- (6) LED: This lamp turns ON/OFF or blinks to indicate the motor status.



Wiring drawing



- 1 : TB1
- 2 : TB2
- 3 : CN52/CN53
- 4 : JP1
- 5 : SW51
- 6 : LED

Detailed internal drawing of terminal box

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>● Be sure to turn OFF the power before making any changes to the switches and pins. Failure to do so may cause an electric shock or failure.</li> <li>● Put only the necessary parts in the terminal box. Leave the lid closed at any time except during wiring. Failure to do so may cause an electric shock, fire, or failure.</li> <li>● Ground the PE terminal independently, using wiring with a diameter compatible with the motor capacity. Also perform a continuity check. Failure to do so may cause an electric shock, fire, or failure.</li> <li>● Be sure to install an earth leakage breaker. Failure to do so may cause an electric shock or fire.</li> <li>● It is possible that the SC unit alone does not completely protect the motor. For this reason, install an additional overload circuit breaker, such as a thermal relay. Failure to do so may cause a fire or failure.</li> <li>● Do not connect the inverter to the power supply line. It may damage the device.</li> <li>● During wiring, be sure to confirm that all wiring lines are connected correctly. If wiring is connected incorrectly, it may cause a fire, failure, or malfunction.</li> </ul>
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>● Make sure that no excessive force is applied to the inside of the terminal box during wiring. It may cause breakage.</li> <li>● During wiring, be careful not to make contact with the edge of the board. It may cause a scratch or breakage.</li> </ul>

## 3.2 Terminals

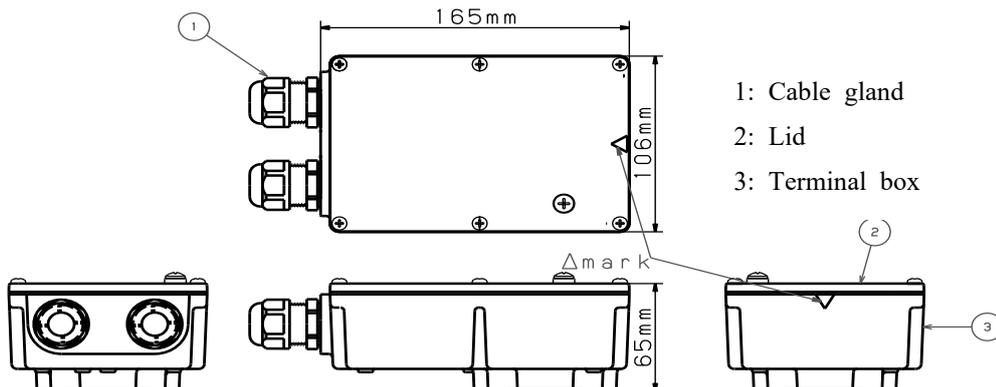
	Terminal name	Screw size	Tightening torque	Others
TB1	L1	M4	1.0 to 1.2 N·m	Applicable crimp terminals • 1.25 - 4 • 2 - 4
	L2			
	L3			
	PE			
TB2	98/a	M3	0.5 to 0.6 N·m	Connected wire size: AWG 26 - 14
	95/c			
	96/b			

**WARNING**

- Tighten the screw of each terminal without any looseness. Failure to do so may cause a short circuit.

#### 4 Outline drawing

When closing the lid, make sure that the symbol of Δ on the lid is correctly aligned with the same symbol on the terminal box.



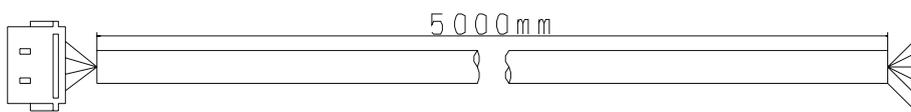
Drawing of terminal box

	Screw size	Tightening torque
Terminal box cover	M4	1.0 N·m
Cable gland	G1/2	2.2 to 3.0 N·m

When a communication cable is used, supply 5 V DC between pin Nos. 1 and 4.

The voltage source capacity is “0.25 VA × number of connected devices”, approximately.

The communication line length is less than 30m.



Communication cable (Optional part [Model number: M-S05])

	Pin No.	Terminal name	Cable color
Communication cable	1	V+	Blue
	2	B-	Green
	3	A+	Brown
	4	GND	Orange
	-	Shield	-

<b>WARNING</b>	<ul style="list-style-type: none"> <li>Do not open the lid of the terminal box during operation. Doing so may result in an electric shock.</li> <li>Do not leave the lid open during operation. Doing so may cause a fire or failure.</li> <li>Be sure to perform the operation while the ground wire is connected to the terminal box and the lid. If the ground wire is not connected, it may cause an electric shock.</li> <li>When closing the lid, take care not to pinch the wiring. It may cause an electric shock, injury, or fire.</li> </ul>
<b>CAUTION</b>	<ul style="list-style-type: none"> <li>If the mist of the cutting fluid enters the inside of the terminal box, it adversely affects the electrical parts. Tighten the screw of the terminal box lid without any looseness.</li> <li>When closing the lid, tuck the packing uniformly so that the electric wires will not come in contact with the board, as it could apply excessive force to the board. Failure to do so may cause an electric shock or failure.</li> </ul>

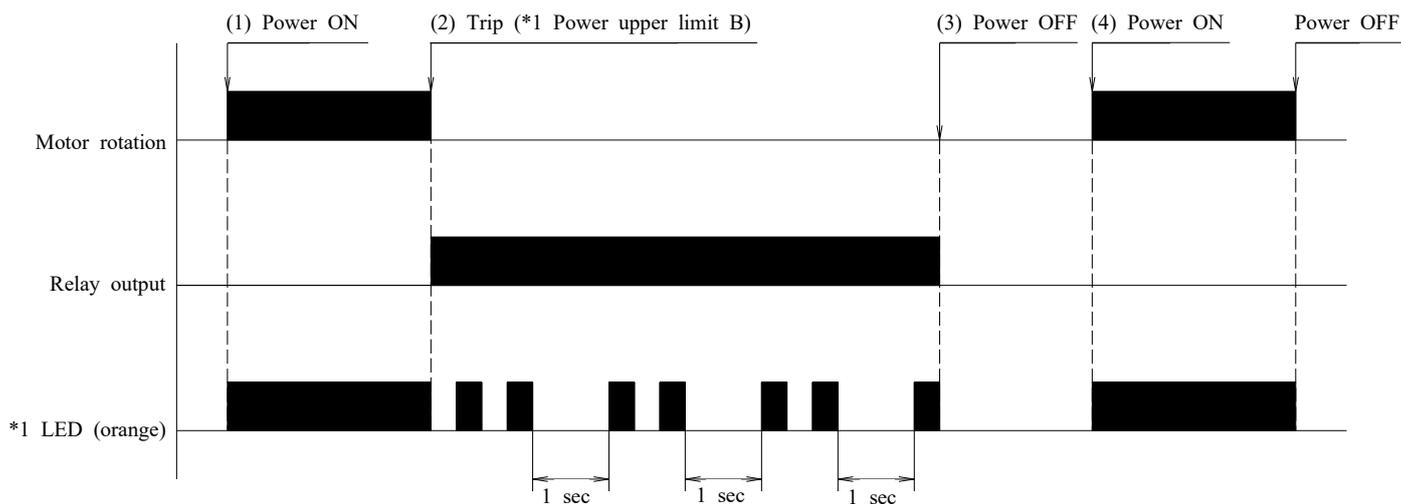
## 5 Description of operation

- (1) When the power is supplied during normal operation, the motor starts up and the LED lights up.
- (2) If the motor value exceeds or falls below the set threshold during operation, the circuit trips and the motor stops, and the relay contact turns ON.

The LED blinks periodically, depending on the type of tripping.

- (3) To reset the tripped circuit, cut off the power supply and remove the cause of tripping.
- (4) To restore the tripped circuit, after removing the cause as described in step (3) above, supply the power again. The motor starts up and the LED lights up.

The following shows the time chart when steps (1) to (4) are performed.



NOTE) \*1 In case of tripping, the LED blinks and goes off repeatedly according to the following cycle.

Blinking (X times) → Off (1 second) → Blinking (X times) → Off (1 second)...

The number of LED blinks in the above time chart is for cases in which electrical power upper limit B has tripped.

The following table shows the number of LED blinks for other cases of tripping.

For details of tripping, refer to section 6.

Operation status		LED (orange)
Power OFF		Off
Power ON (normal)		Lit
Tripped	Electric power upper limit A	Blink (1 time)
	Electric power upper limit B	Blink (2 times)
	Electric power lower limit A	Blink (3 times)
	Electric power lower limit B	Blink (4 times)
	Vibration upper limit	Blink (5 times)
	Temperature upper limit	Blink (6 times)

 WARNING	<ul style="list-style-type: none"><li>● If tripping occurs, be sure to shut off the power. If the power is automatically restored due to an instantaneous power failure or malfunction, etc., it may cause injury or accident.</li><li>● It is possible that the SC unit alone does not completely protect the motor. For this reason, install an additional thermal relay. Failure to do so may cause a fire or failure.</li></ul>
 CAUTION	<ul style="list-style-type: none"><li>● As the surface and inside of the terminal box are extremely hot immediately after the power has been shut off, do not touch the terminal box. It may cause a burn.</li><li>● As there is residual voltage after the power has been shut off, do not touch the board inside the terminal box until the LED goes off. Doing so may result in an electric shock.</li></ul>

## 6 Parameters

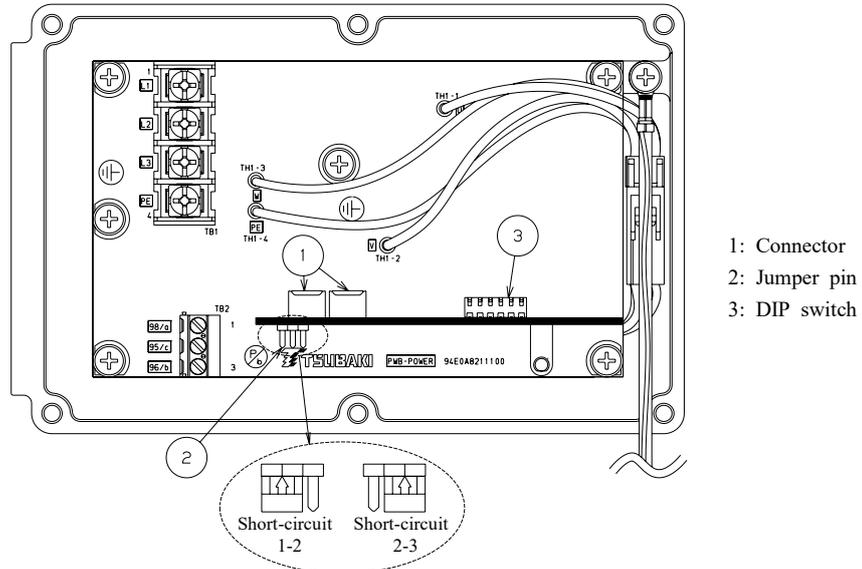
## 6.1 Parameter list

Category	Name	Description
Tripping function	Power upper limit A (1 to 4)	The threshold that triggers tripping when the motor power consumption exceeds it
	Power upper limit B (1 to 4)	Same as above
	Power lower limit A (1 to 4)	The threshold that triggers tripping when the motor power consumption falls below it
	Power lower limit B (1 to 4)	Same as above
	Start time (1 to 4)	The time period for disabling tripping after startup
	Shock time (Power upper limit A) (1-4)	The time specified for judging whether or not to execute tripping when the electric power exceeds the value set in "Power upper limit A"
	Shock time (Power upper limit B) (1-4)	The time specified for judging whether or not to execute tripping when the electric power exceeds the value set in "Power upper limit B"
	Shock time (power lower limit A) (1 to 4)	The time specified for judging whether or not to execute tripping when the electric power falls below the value set in "Power lower limit A"
	Shock time (power lower limit B) (1 to 4)	The time specified for judging whether or not to execute tripping when the electric power falls below the value set in "Power lower limit B"
	Temperature upper limit	The threshold that triggers tripping when the internal temperature of the terminal box exceeds it
	Vibration upper limit	The threshold that triggers tripping when the motor vibration exceeds it
	Motor status	Motor operation status (normal/tripped)
Monitoring function	Frequency	Power frequency (50 Hz or 60 Hz)
	Voltage	Power source voltage
	Electric current	Motor current
	Electric power	Motor power consumption
	Temperature	Internal temperature of terminal box
	Acceleration X/Y/Z axes	Motor vibration amount (acceleration speed) on three axes
Logging function	Log acquisition interval	The time interval for collecting the log data in case of tripping
	Number of trips	The number of trips that have occurred
	Trip factor	The tripping factor for each of log data 1 to 3
	Log data 1	The data of tripping that has occurred previously
	Log data 2	The data of tripping that has occurred before the last occurrence
	Log data 3	The data of tripping that has occurred two times before the last occurrence
Locking function	Password	One-byte alphanumeric characters in character strings of 8 to 16 digits that are required for logging in to change the parameters
Others	Product code	Product-specific 4-digit number
	MFG number	Product-specific 10-digit number
	Software version	Software version of the SC unit

6.2 Setting procedure

The various parameter values can be changed and imported using the optional communication cable (Model number: M-S05).

The following describes items (1) to (3) in the detailed internal drawing of the terminal box below.



Detailed internal drawing of terminal box

(1) Connector for communication cable connection

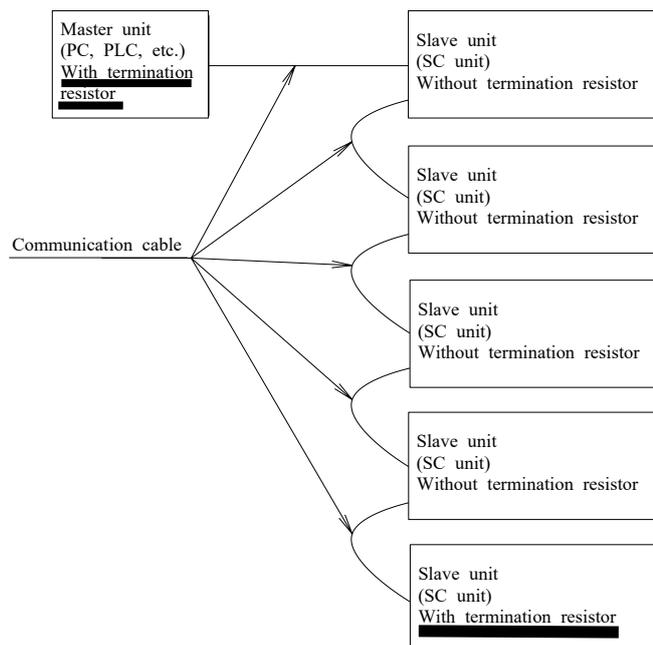
When there is only one unit to be connected, communication can be performed by connecting the cable to either of the two connectors.

(2) Jumper pin for switching termination resistor

When communication is performed for only one unit, short-circuit “1-2”. When communication is performed for multiple units, short-circuit “1-2” of the SC unit located farthest from the master unit, and also short-circuit “2-3” for the other SC units.

When multiple units are connected, make sure that the same slave address is not used for more than one slave unit. Use each DIP switch to set the slave address.

Short-circuit	Termination resistor
1-2	Provided
2-3	None

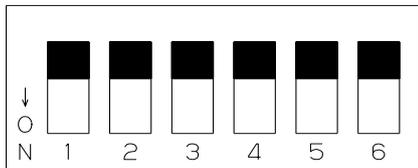


Connection example for 5 SC units

(3) DIP switches for switching the set parameters and slave addresses

Switching can be performed as follows based on the switch combination patterns 1 to 6

- Four patterns of parameters specified (Power upper/lower limit A/B, Start time, and each Shock time)
- Communication slave addresses (0x01 to 0x10)



All OFF



2, 3, 5, and 6 are ON

- ○: ON
- ×: OFF

DIP switch		Set value No.
1	2	
×	×	1
×	○	2
○	×	3
○	○	4

DIP switch				Slave address
3	4	5	6	
×	×	×	×	0x01
×	×	×	○	0x02
×	×	○	×	0x03
×	×	○	○	0x04
×	○	×	×	0x05
×	○	×	○	0x06
×	○	○	×	0x07
×	○	○	○	0x08
○	×	×	×	0x09
○	×	×	○	0x0A
○	×	○	×	0x0B
○	×	○	○	0x0C
○	○	×	×	0x0D
○	○	×	○	0x0E
○	○	○	×	0x0F
○	○	○	○	0x10

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• Before setting a DIP switch, be sure to turn OFF the power. Failure to do so may result in an electric shock.</li> </ul>
 <b>CAUTION</b>	<ul style="list-style-type: none"> <li>• Before starting up the unit, be sure to confirm that each DIP switch is set either to the ON or OFF position all the way through. If there is any switch not set to either position properly, the system may falsely recognize the setting.</li> <li>• When setting the parameters, check that each setting is correct. Incorrect setting may cause a failure, breakage, or deterioration.</li> <li>• When setting the DIP switches, check that each setting is correct. Incorrect setting may cause a failure, breakage, or deterioration.</li> <li>• Make sure no excessive force is applied during changeover of the DIP switches. It may cause breakage.</li> </ul>

6.3 Automatic switching of parameters according to frequency

The parameter to be used is automatically switched according to the power frequency detected by the SC unit.

(Parameters to be switched: Power upper limit A, Power upper limit B, Power lower limit A, Power lower limit B)

Example: When the frequency is 50 Hz and the DIP switch is set to No. 1, tripping occurs when the frequency exceeds/falls below the following values

Power upper limit A\_1 (50 Hz), Power upper limit B\_1 (50 Hz), Power lower limit A\_1 (50 Hz), Power lower limit B\_1 (50 Hz)

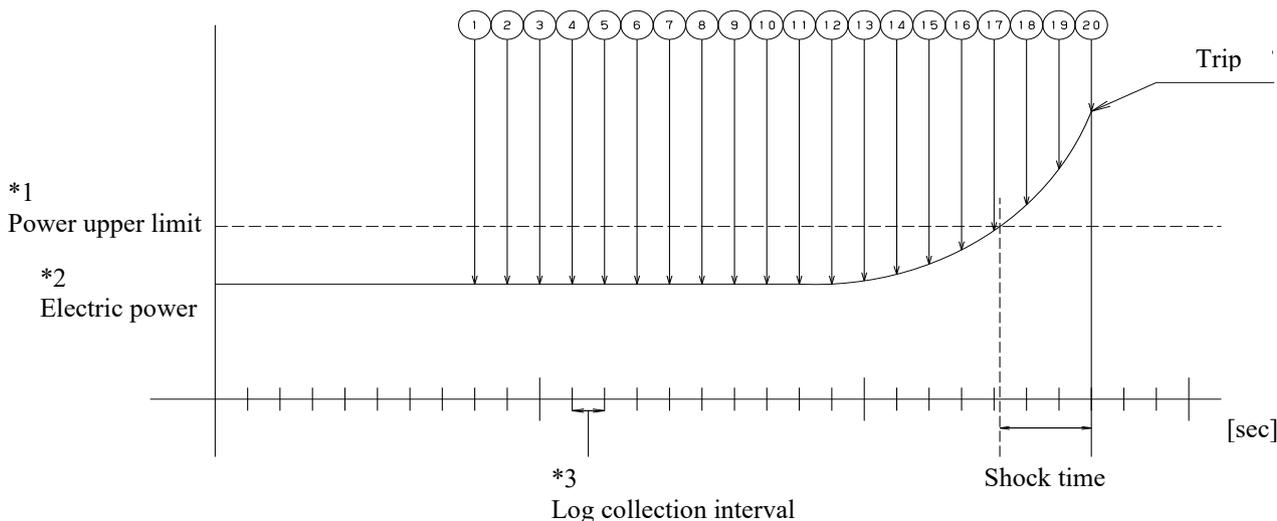
When the frequency is 60 Hz and the DIP switch is set to No. 2, tripping occurs when the frequency exceeds/falls below the following values

Power upper limit A\_2 (60 Hz), Power upper limit B\_2 (60 Hz), Power lower limit A\_2 (60 Hz), Power lower limit B\_2 (60 Hz)

6.4 Tripping log data

The data immediately before tripping can be recorded and retained for the time period of “set log collection interval [sec] × 20 data units × 3 times”.

If tripping occurs when the log data for three occurrences are already retained, the oldest log data will be deleted, while the latest log data will be recorded.

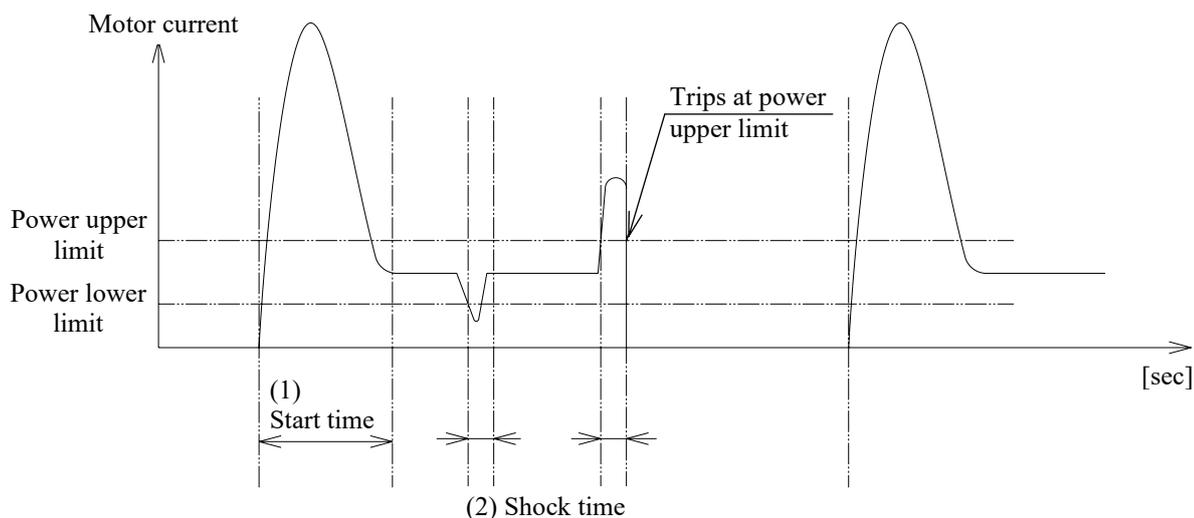


NOTE) \*1 The following six types of parameters can be set: “Power upper limit A”, “Power upper limit B”, “Power lower limit A”, “Power lower limit B”, “Temperature upper limit”, and “Vibration upper limit”.

\*2 The following seven types of data are recorded and retained: “Voltage”, “Electric current”, “Electric power”, “Temperature”, and “Acceleration X/Y/Z axes”.

\*3 The log collection interval can be set via communication. For more details, refer to section 7 in this manual.

## 6.5 Start time/Shock time



## (1) Start time

This setting is provided for disabling tripping triggered by the SC unit during its startup period. Tripping does not occur for the specified period of time after the startup of the motor.

The set start time applies to all the setting values (electric power, temperature, and vibration).

## (2) Shock time

This is used as a tripping filter. If the actual value exceeds/falls below the specified value continuously for more than the time specified in this parameter, tripping occurs.

Set the shock time for each of “Power upper limit A”, “Power upper limit B”, “Power lower limit A”, and “Power lower limit B”. \*1

Power upper limit A1 → Shock time (Power upper limit A) 1

Power upper limit B1 → Shock time (Power upper limit B) 1

Power lower limit A1 → Shock time (Power lower limit A) 1

Power lower limit B1 → Shock time (Power lower limit B) 1

•  
•  
•

Power upper limit A4 → Shock time (Power upper limit A) 4

Power upper limit B4 → Shock time (Power upper limit B) 4

Power lower limit A4 → Shock time (Power lower limit A) 4

Power lower limit B4 → Shock time (Power lower limit B) 4

NOTE) \*1 There is no shock time setting provided for the temperature and vibration. Tripping occurs immediately when the temperature/vibration exceeds/falls below the specified value.

**WARNING**

- It is possible that the SC unit alone does not completely protect the motor. For this reason, install an additional thermal relay. Failure to do so may cause a fire or failure.

## 7 Communication

### 7.1 Specifications

*1 Protocol	Modbus-RTU
Transmission line connection	RS-485
Communication speed	9600 bps
Start bit length	1 bit
Data bit length	8 bits
Stop bit length	1 bit
Parity bit	EVEN
Endian	LSB
*2 Slave addresses	1-16 (0x01 - 0x10)
*3 Default password	<b>password</b> (ASCII code)

NOTE) \*1 Modbus is a registered trademark of Schneider Automation.

\*2 These are switched using the DIP switches. (For more details, refer to section 6 in this manual.)

\*3 The password is required when writing data. Initially, change the default password.

### 7.2 Command data details

Data name	Description
Number of trips for clearing	Clears the number of trips to 0.
Stop	Stops the motor.
Startup	Starts up the motor. However, the motor does not start up if tripping occurs immediately after the issuance of this command.

### 7.3 Status data details

Data name	Description
Power frequency	Judges whether the power frequency is 50 Hz or 60 Hz.

## 7.4 Read data details

Data name	Description	Unit	
Power upper limit	Each set value	[0.1 W]	
Power lower limit			
Start time SET		[0.1 s]	
Shock time SET			
Shock time SET			
Voltage	The current value of the data	[0.1 V]	
Electric current		[1 mA]	
Electric power		[0.1 W]	
Temperature		[0.1°C]	
Acceleration X axis		[0.01 m/s <sup>2</sup> ]	
Acceleration Y axis			
Acceleration Z axis			
Number of trips		The number of trips that have occurred	-
Motor status		The value of the motor operation status	-
Trip factor		The trip factor	-
Login status	The login/logout status	-	
Log data	The data of tripping that has occurred previously (Voltage, electric current, electric power, temperature, and acceleration speed)	[0.1 V] [1 mA] [0.1 W] [0.1°C] [0.01 m/s <sup>2</sup> ]	
*1 Product code	The product-specific number	-	
*1 MFG number	The product-specific number	-	

NOTE) \*1 As these are the product-specific numbers set at the time of shipment from our factory, you will not particularly need to use them.

## 7.5 Set data details

Data name	Description	Unit	Lower limit	Upper limit
Power upper limit A	Stores the set value for each DIP switch number.	[0.1 W]	*1 0	10000
Power upper limit B				
Power lower limit A				
Power lower limit B				
Start time		[0.1 s]	0	300
Shock time (Power upper limit A)				
Shock time (Power upper limit B)				
Shock time (Power lower limit A)				
Shock time (Power lower limit B)	[0.1°C]	*1 0	1250	
Temperature upper limit				
Vibration upper limit	[0.01 m/s <sup>2</sup> ]	0	15000	
Log acquisition interval	Stores the sampling time for recording/retaining the data immediately before tripping.	[0.1 s]	1	100
Password	Stores the password with 8 to 16 characters.	-	-	-

NOTE) \*1 When “0” is set, tripping is not activated according to the relevant parameter.

Note: About the communication function, please refer to "the SC Unit communication guidelines"(Japanese) on separate volume other than this book.

This manual can download the PDF version from a homepage of TSUBAKIMOTO CHAIN CO.

([https://tt-net.tsubakimoto.co.jp/tecs/ctlg/ctlg\\_mlist.asp?bu\\_code=10\\_90](https://tt-net.tsubakimoto.co.jp/tecs/ctlg/ctlg_mlist.asp?bu_code=10_90))

	<b>CAUTION</b>	<ul style="list-style-type: none"> <li>● Set a value suitable for true use. Failure to do so may cause injury, property damage, or failure.</li> </ul>
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## 8 Troubleshooting

Phenomenon	Check item	Check Result	Factor	Treatment
Not tripped	State of the LED	Lighting	Setting mistake	Repair the setting of the parameter.
				Repair setting of the DIP switches.
Trip function acts in a normal driving state	State of the LED	Flashing	Wiring mistake	Repair motor wiring.
			Setting mistake	Repair the setting of the parameter. Repair setting of the DIP switches.
Parameter communication is impossible	State of the LED	Lights - out	Motor power supply abnormality	Supplies specifications power supply.
	Communication reading	Possible	Non-login	Log in.
		Impossible	Communication power supply abnormality	Supply a communication power supply with DC5V.
			Wiring mistake	Repair wiring of the communication.
			Setting mistake	Repair setting of the DIP switches. Repair setting of the terminal resistance.

## 9 Storage and lifetime

### 9.1 Storage orientation

The product is packed and shipped in the orientation best suited for shipping and installation. Maintain the installation direction (e.g., up/down direction) and store the unit with the lid closed.

### 9.2 Storage conditions

The static lifetime of each electrical part is influenced by temperature and humidity.

Therefore, the product should be stored in places that are not subject to direct sunlight with an ambient temperature of 5 to 35°C (20 to 30°C is recommended) and humidity of 30 to 80% RH (40 to 60% RH is recommended). In addition, avoid storage in the following environments:

- (1) Locations subject to dew condensation
- (2) Locations filled with toxic gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.) to prevent corrosion of parts
- (3) Locations exposed to ozone, radiation, or ultraviolet rays
- (4) Locations subject to secondary damage or problems incurred by the Buyer's equipment or machines.

### 9.3 Usage after storage

Non-metallic sections may deteriorate because they are vulnerable to changes in an environment including the temperature and ultraviolet rays. After long-term storage, be sure to perform inspection before starting the operation, and if any deterioration is detected, replace the relevant part with a new one.

#### 9.4 Lifetime

The lifetime of this unit is determined by the aluminum electrolytic capacitor used inside the unit. When the unit is used while being energized continuously with the ambient temperature at 40°C, the unit is designed to last for 5 years or longer. In general, based on the Arrhenius law, it is a characteristic of the aluminum electrolytic capacitor that the lifetime becomes a half the standard if the temperature is 10°C higher, and on the contrary, it becomes double the standard if the temperature is 10°C lower. The lifetime of the aluminum electrolytic capacitor varies depending on the usage environment and operating conditions. If the aluminum electrolytic capacitor is left without being energized for some period, it will deteriorate, even at ambient temperature, at a progress rate of approximately one-fourth of when it is energized. For example, if the aluminum electrolytic capacitor is stored for 10 years at ambient temperature, the lifetime will be approximately 2.5 years shorter than the designed lifetime. The deterioration further accelerates in locations at a high temperature/humidity. We recommend that you replace the entire product before any problems occur.

## 10 Warranty

Tsubakimoto chain Co.: hereinafter referred to as “Seller”

Customer: hereinafter referred to as “Buyer”

Goods sold or supplied by Seller to Buyer: hereinafter referred to as “Goods”

### 10.1 Warranty period without charge

Effective 18 months from the date of shipment or 12 months from the first use of Goods, including installation of Goods to Buyer’s equipment or machines - whichever comes first.

### 10.2 Warranty coverage

Should any damage or problem with the Goods arise within the warranty period, given that the Goods were operated and maintained according to the instructions provided in the manual, Seller will repair and replace at no charge once the Goods are returned to the Seller.

This warranty does not include the following:

- 1) Any costs related to removal of Goods from the Buyer’s equipment or machine to repair or replace parts.
- 2) Cost to transport Buyer’s equipment or machines to the Buyer’s repair shop.
- 3) Costs to reimburse any profit loss due to any repair or damage and consequential losses caused by the Buyer.

### 10.3 Warranty with charge

Seller will charge a fee for any investigation and repair of Goods caused by:

- 1) Improper installation due to not properly following the procedures in the instruction manual.
- 2) Insufficient maintenance or improper operation by the Buyer.
- 3) Incorrect installation of Goods to other equipment or machines.
- 4) Any modifications or alterations of Goods by the Buyer.
- 5) Any repair by engineers other than the Seller or those designated by the Seller.
- 6) Operation in an inappropriate environment not specified in the manual.
- 7) Force Majeure or forces beyond the Seller’s control such as natural disasters and injustices committed by a third party.
- 8) Secondary damage or problems incurred by the Buyer’s equipment or machines.
- 9) Defective parts supplied, or specified by the Buyer.
- 10) Incorrect wiring or parameter setting by the Buyer.

11) The end of life cycle of the Goods under normal usage.

12) Loss or damage not liable to the Seller.

#### 10.4 Dispatch service

Service to dispatch a Seller's engineer to investigate, adjust or trial test Seller's Goods is at the Buyer's expense.



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## TSUBAKIMOTO CHAIN CO.

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