GAX1141.00TSE
Issued on February 17, 2021

Optional Product (Specification Symbol: SM)
SM Unit Instruction Manual

- Thank you for purchasing our Tsubaki Gear Motor. The Tsubaki Gear Motor should only be handled by the engineers with expertise in the relevant procedures. This instruction manual describes the SM 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.

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.

⚠ **WARNING**	Due to mishandling, a dangerous condition may occur and there is a possibility of serious injury or death
⚠ **CAUTION**	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.

⚠ WARNING

- 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.
- Ensure complete safety before starting the operation.
- 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.
- 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.
- 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.
- 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.
- Perform wiring connections according to the instruction manual. Failure to do so may cause an electric shock, fire, or failure.
- Do not forcibly bend, pull, or pinch the cables. Doing so may cause an electric shock or fire.
- If a power failure occurs, be sure to turn OFF the power. Failure to do so may cause injury.
- Be sure to turn OFF the power before beginning the maintenance/inspection procedure. Failure to do so may result in an electric shock.
- Do not use this unit in an environment susceptible to electrical noise such as lightning surges. Doing so may cause a fire or failure.

⚠ CAUTION

- We shall not be held responsible for any product modifications by the customer as they are not covered by the warranty.
- Connect wiring properly according to the electrical equipment technical standards and interior wiring code.
- 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 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 SM unit specifications

The SM unit is designed to provide a set of functions that detect the electric power, temperature, and vibration of the gear motor. The purpose of the functions is to visualize the operating status at all times, allowing you to take corrective measures promptly when failure occurs.

Item		Specifications
Applicable motor		0.1 kW to 1.5 kW
Power supply	Rated voltage	Refer to the value indicated in the motor label or product outline drawing.
	Rated frequency	Refer to the value indicated in the motor label or product outline drawing.
	Voltage source capacity	Refer to the standard instruction manual of the gear motor.
	SM unit	24 V DC±10% *1
Frequency range		20 Hz to 120 Hz
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.)
Limit setting		To be set via communication. (Refer to sections 6 and 7 in this manual.)
Warning signal		Transistor output (Sink type and source type.) Operates when a warning occurs.
		Rating 24 V DC±10%, Max. 100 mA *2
Built-in sensor measuring range	Input power *3	0 W to 6,000 W
	Acceleration speed	±156.8 m/s^2
	Temperature	-20°C to +100°C
Built-in sensor sampling cycle	Input power *3	Power frequency [Hz]
	Acceleration speed	800 [Hz]
	Temperature	10 [s]
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 m/s^2 or less

Note) *1 The unit cannot be connected to any DC power distribution network. Use a switching power supply, etc.

*2 When inputting the transistor output directly to the lamp or relay, set the maximum load current to the maximum current or less.

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

This product is intended for industrial use and is not intended to be used in connection with low-voltage distribution lines that supply the electric power to residences.

3 Wiring

3.1 Structural outline

The following describes items (1) to (6) in the detailed drawing of the SM unit below.

(1) Motor power supply terminals: Supply power to the motor by connecting wiring to the 6P terminal block via the earth leakage breaker, magnetic contactor, and thermal relay. (U corresponds to the U-phase, V to the V-phase, and W to the W-phase of the motor, while D, B1, and B2 correspond to the brake.)

(2) SM unit power supply and transistor output terminals: Supply the power when the SM unit is used. Use the transistor output for warning display, etc. (A1 and A2 correspond to 24 V DC and GND, Y+ to the collector of the output transistor, and Y- to the emitter of the output transistor.)

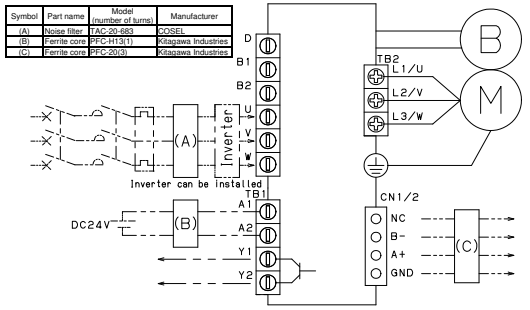
(3) Communication connectors: Use these for parameter setting and sensor value reading. Use the optional communication cable (Model number: M-S05). Communication details are described in section 7 of this manual.

(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 limit. These switches can also be used to change the communication slave addresses. For more details, refer to section 6.2.

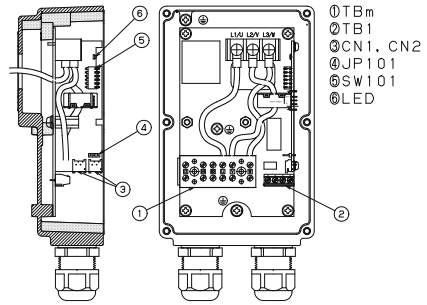
(6) LED: This lamp turns ON in blue, blinks in red, or turns OFF to indicate the motor status. For more details, refer to section 5.1.

Symbol	Part name	Model (number of turns)	Manufacturer
(A)	Noise filter	TAC-20-683	COSEL
(B)	Ferrite core	PFC-H13(1)	Kitagawa Industries
(C)	Ferrite core	PFC-20(3)	Kitagawa Industries

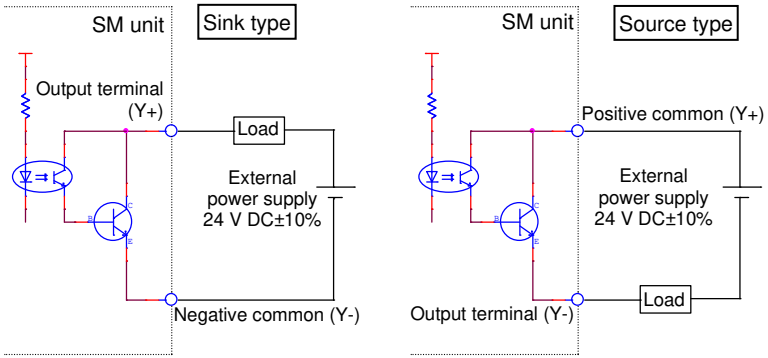


Wiring drawing

Note: The product is EMC tested using this wiring drawing. Check the compliance with the EMC Directive of the entire equipment including this product in the completed status.



Detailed drawing of SM unit



Transistor output wiring drawing

⚠WARNING	● 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. ● 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. ● Be sure to install an earth leakage breaker. Failure to do so may cause an electric shock or fire. ● Install an overload circuit breaker, such as an additional thermal relay to protect the motor. Failure to do so may cause a fire or failure. ● 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.
⚠CAUTION	● Make sure that no excessive force is applied to the inside of the terminal box during wiring. It may cause breakage. ● During wiring, be careful not to make contact with the edge of the board. It may cause a scratch or breakage.

3.2 Terminals

	Terminal name	Screw size	Tightening torque	Connected wire size
TBm	D	M3	0.6 to 0.8 N·m	AWG 18 to 12
	B1			
	B2			
	U			
	V			
	W			
TB1	A1	M3	0.5 to 0.6 N·m	AWG 26 to 16
	A2			
	Y1			
	Y2			

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

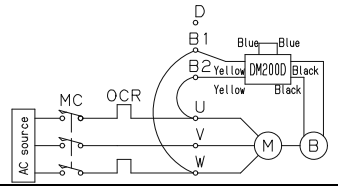
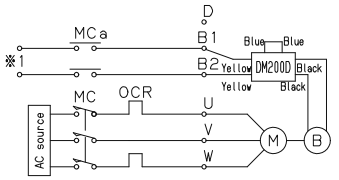
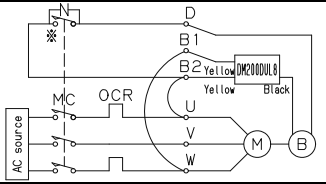
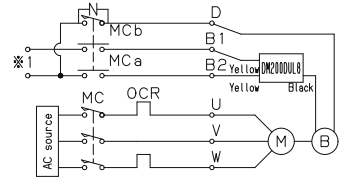
3.3 Wiring a motor with a brake

Wiring	Application
AC internal wiring	General application
AC external operation	When installing a frequency inverter or performing separate brake control. However, braking with a VFD should be at 60 Hz or less. Avoid braking at high speed ranges above 60 Hz, as this can cause abnormal abrasion wear on the brake linings, abnormal heating, and other problems.
DC external wiring	When using in an lifting device (minus load) or when stopping accuracy is required

To change the AC internal wiring to the AC external operation: Remove the two short circuit cables.
To change the DC external wiring to the AC external operation and DC external wiring: Remove the two short circuit cables.

⚠WARNING	● Regarding the wiring connected to the brake, do not change any part other than the short circuit cable. Doing so may cause a personal injury, malfunction, or damage.

● 3-phase 200 V class

	Application	0.1 to 1.5 kW
AC internal wiring	• For general use • Standard wiring	
AC external operation	• General variable frequency drive • Use to control the brake separately Note: The contact on the auxiliary relay (MCa) should be rated for 200 V AC, 7A or more (load resistance).	 *1 Brake supply voltage: 0.1 kW, 0.2 kW: 200 to 254 V AC 0.4 kW, 0.75 kW: 200 to 220 V AC 1.5 kW: 200 to 230 V AC
DC external wiring	• When using in an lifting device or when stopping accuracy is required Note: The auxiliary contact of MC, (or an auxiliary relay) used at * should be rated for 200 V AC, 10 A or more (load resistance).	
AC external operation and DC external wiring	• When using in an lifting device or when stopping accuracy is required Note: The contact should be rated as follows: MCa: 200 V AC, 7A or more (load resistance) MCb: 200 V AC, 10A or more (load resistance)	 *1 Brake supply voltage 0.1 kW, 0.2 kW: 200 to 254 V AC 0.4 kW, 0.75 kW: 200 to 220 V AC 1.5 kW: 200 to 230 V AC

Ⓜ: Motor Ⓑ: Brake MC: Motor starter MCa, MCb: Auxiliary relay

OCR: Overcurrent relay DM200D, DM200DUL8: DC module -N-: Protection device (Varistor)

Note 1: Brake voltage is 90 V DC. (When supplying 200 V AC to the DC module)

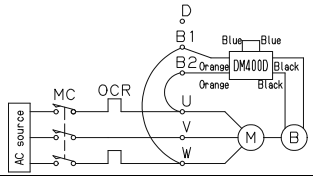
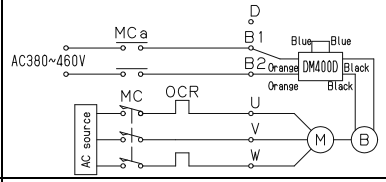
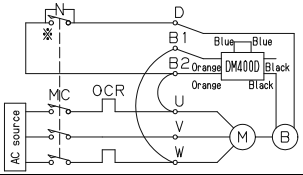
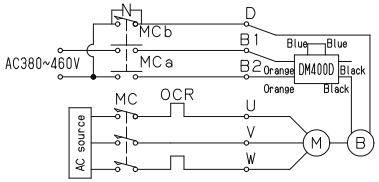
Note 2: When using DC external wiring, connect a varistor between the contacts. (Select a varistor with a varistor voltage of 470 V.)

Note 3: When using DC external wiring, connect a contact between the D and B2 terminals.

Note 4: Brake power must be taken from the primary power supply of the inverter and the brake operation must be synchronized with the motor ON/OFF operation.

Note 5: To turn on or off the MCa, the inverter interlock needs to be operated. For details, refer to the instruction manual of the inverter.

● 3-phase 400 V class

	Application	0.1 to 1.5 kW
AC internal wiring	• For general use • Standard wiring	
AC external operation	• General variable frequency drive • Use to control the brake separately Note: The contact on the auxiliary relay (MCa) should be rated for 400 to 440 V AC inductive loads of 1 A or more.	
DC external wiring	• When using in an lifting device or when stopping accuracy is required Note: The auxiliary contact of MC, (or an auxiliary relay) used at * should be rated for 400 to 440 V AC, 1 A or more (inductive loads) and wired in series of two or three contacts.	
AC external operation and DC external wiring	• When using in an lifting device or when stopping accuracy is required Note: The contacts on the auxiliary relay (MCa or MCb) should be rated for 400 to 440 V AC inductive loads of 1 A or more and wired in series of two or three contacts.	

Ⓜ: Motor Ⓑ: Brake MC: Motor starter MCa, MCb: Auxiliary relay

OCR: Overcurrent relay DM400D: DC module -N-: Protection device (Varistor)

Note 1: Brake voltage is 180 V DC. (When supplying 400 V AC to the DC module)

Note 2: When using DC external wiring, connect a varistor between the contacts. (Select a varistor with a varistor voltage of 820 V.)

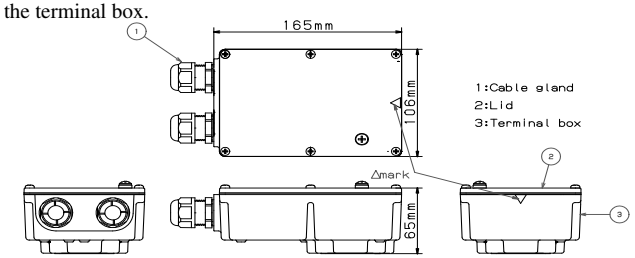
Note 3: When using DC external wiring, connect a contact between the D and B2 terminals.

Note 4: Brake power must be takewn from the primary power supply of the inverter and the brake operation must be synchronized with the motor ON/OFF operation.

Note 5: To turn on or off the MCa, the inverter interlock needs to be operated. For details, refer to the instruction manual for the inverter.

4 Outline drawing

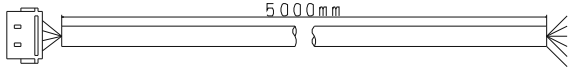
When closing the lid, make sure that the symbol of △ on the lid is correctly aligned with the same symbol on the terminal box.



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

The length of the communication line is 30 m or less.



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

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

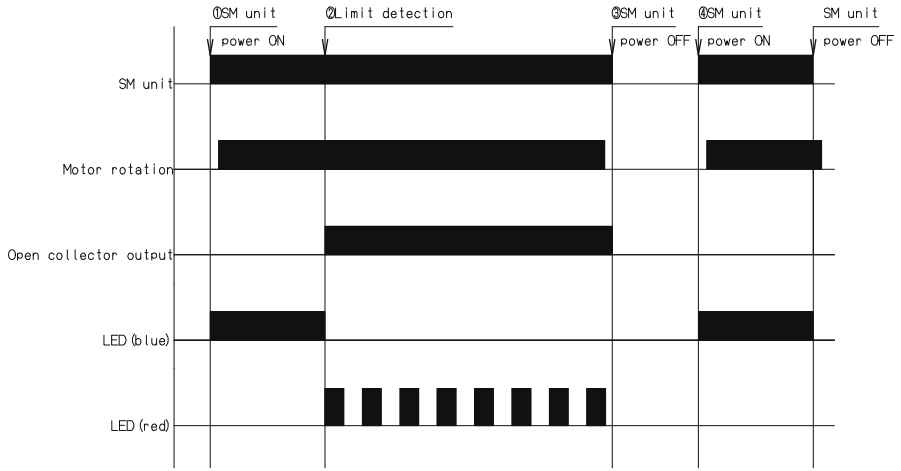
⚠WARNING	● Do not open the lid of the terminal box during operation. Doing so may result in an electric shock. ● Do not leave the lid open during operation. Doing so may cause a fire or failure. ● Be sure to perform the operation while the ground wire is connected to the terminal box and the lid. If the ground wire is not connected, it may cause an electric shock. ● When closing the lid, take care not to pinch the wiring. It may cause an electric shock, injury, or fire.
⚠CAUTION	● 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. ● 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.

5 Description of operation

(1) When the power is supplied to the SM unit, the LED lights up in blue. When the motor power is turned on, the motor starts up and the state where the LED is solid in blue continues during normal operation.
(2) If the motor value exceeds or falls below the set limit during motor operation, the transistor output turns ON and the LED blinks in red. *1
(3) To make the LED light in blue again, turn off the power supplied to the motor and SM unit, and remove the cause of the LED blinking in red, or review the limit setting. *2
(4) To restore the operation, follow step (3) to turn on the power supplied to the motor and SM unit. The motor starts up and the LED lights up in blue.

Note) *1 For the overheat and excessive shock settings, if the limit is exceeded, the transistor output turns ON and the LED blinks in red regardless of whether the motor starts up.
*2 Setting the automatic restoration time or resetting the warning as described in 7.4 eliminates the work to turn on the power supplied to the SM unit again.

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



⚠WARNING	● Install an additional thermal relay to protect the motor. Failure to do so may cause a fire or failure.
⚠CAUTION	● 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. ● 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.

5.1 LED specifications

The LED lighting pattern in each operation status is as follows.

Operation status		Solid/Blink	LED color
Power OFF		×	-
Normal		○	Blue
Warning status	Torque upper limit A	☆ (once)	Red
	Torque upper limit B	☆ (twice)	
	Torque lower limit A	☆ (three)	
	Torque lower limit B	☆ (four)	
	Excessive shock	☆ (five)	
	Overheat	☆ (six)	

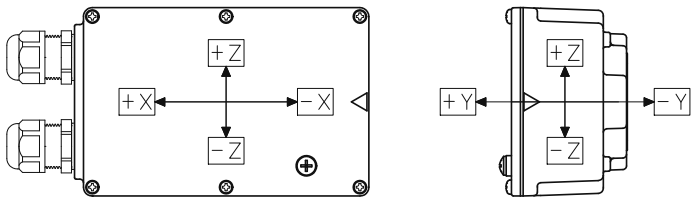
• ○ : Solid
• × : No light
• ☆ ( ) : Blinking The number of times the indicator blinks is indicated in ( ).
Note: The blinking cycle is as follows even in any warning status.
Blinking ⇒ Off (1 s) ⇒ Blinking ⇒ Off (1 s) ⇒ Blinking ⇒ Off (1 s) ⇒, and so on.

When multiple warnings occur at the same time, the status with the highest priority is displayed by the LED.

Operation warning status	Priority
Torque upper limit A	High
Torque upper limit B	|
Torque lower limit A	|
Torque lower limit B	|
Excessive shock	|
Overheat	Low

5.2 Acceleration speed sensor specifications

The directions for each of the X, Y, and Z axes are shown below.



6 Parameters

6.1 Parameter list

Category	Name	Description
Warning function	Output torque upper limit A (1 to 4) *1	The limit to warn you when the output torque exceeds the upper limit
	Output torque upper limit B (1 to 4) *1	Same as above
	Output torque lower limit A (1 to 4) *1	The limit to warn you when the output torque falls below the lower limit
	Output torque lower limit B (1 to 4) *1	Same as above
	Start time (1 to 4)	The time period for disabling warning judgment after startup
	Shock time (Output torque upper limit A) (1 to 4)	The time specified for judging whether or not to warn you when the output torque exceeds the value set in “Output torque upper limit A”
	Shock time (Output torque upper limit B) (1 to 4)	The time specified for judging whether or not to warn you when the output torque exceeds the value set in “Output torque upper limit B”
	Shock time (Output torque lower limit A) (1 to 4)	The time specified for judging whether or not to warn you when the output torque falls below the value set in “Output torque lower limit A”
	Shock time (Output torque lower limit B) (1 to 4)	The time specified for judging whether or not to warn you when the output torque falls below the value set in “Output torque lower limit B”
	Overheat limit	The limit to warn you when the temperature in the terminal box exceeds it
	Excessive shock limit	The limit to warn you when the shock applied to the motor exceeds it
	Warning status	Motor operation status (normal/warning)
	Automatic restoration time	The time period to automatically return from the warning status to the normal status.
Monitoring function	Voltage	Power source voltage (average value)
	Electric current	Motor current (average value)
	Electric power	Motor power consumption
	Temperature	Internal temperature of terminal box
	Acceleration X/Y/Z axes	Motor vibration amount (acceleration) on three axes (instantaneous maximum value)
	Power frequency *2	Power frequency
	Output shaft torque *1	Output shaft torque
Logging function	Number of warnings	Number of times warned
	Warning factor	Warning factor on each log data 1 to 3
	Acquisition interval	Log data acquisition interval when the warning function is activated.
	Log data 1	Data when the warning function was activated previously.
	Log data 2	Data when the warning function was activated two times before.
	Log data 3	Data when the warning function was activated three times before.
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	4-digit number
	MFG number	10-digit number
	Software version	Software version of the SM unit

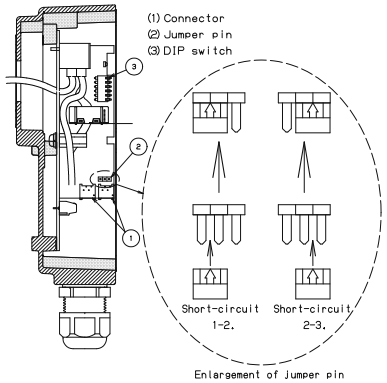
Note) *1 Since the output shaft torque is an estimated value calculated from the electric power and temperature, the actual output shaft torque may vary depending on the equipment and environment to be used. Therefore, be sure to check that an appropriate warning is output at the set limit before operating the equipment.

*2 The power frequency is calculated from the motor current cycle. Therefore, it may differ from the frequency set by the inverter.

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.

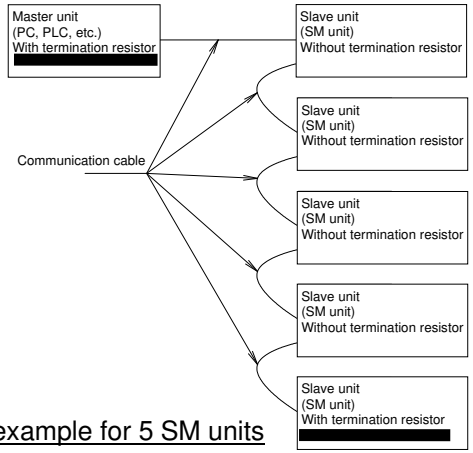
(2) Jumper pin for switching termination resistor

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 SM unit located farthest from the master unit, and also short-circuit “2-3” for the other SM 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

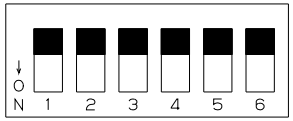


Connection example for 5 SM units

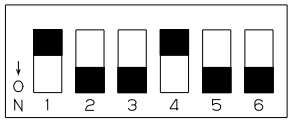
(3) DIP switches for switching the set parameters and slave addresses

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

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



All OFF



Example) 2, 3, 5, and 6 are ON.

- ○: ON
- ×: OFF

DIP switch		Output torque limit setting No.
1	2	
×	×	1
×	○	2
○	×	3
○	○	4

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

The slave address is a number to identify the unit when multiple units are connected to the communication line.
Make sure that the same slave address is not set for more than one slave unit.

⚠WARNING

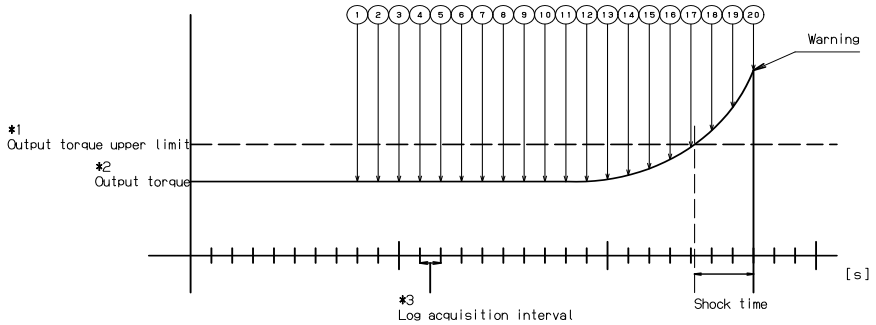
- Before setting a DIP switch, be sure to turn OFF the power. Failure to do so may result in an electric shock.

⚠CAUTION

- 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.
- When setting the parameters, check that each setting is correct. Incorrect setting may cause a failure, breakage, or deterioration.
- When setting the DIP switches, check that each setting is correct. Incorrect setting may cause a failure, breakage, or deterioration.
- Make sure no excessive force is applied during changeover of the DIP switches. It may cause breakage.

6.3 Warning log data

The data immediately before a warning can be recorded and retained for the time period of "set log acquisition interval [sec] × 20 [data units] × 3 [times]".
If the warning function is activated when the log data for three times is already retained, the oldest log data will be deleted while the latest log data will be recorded.

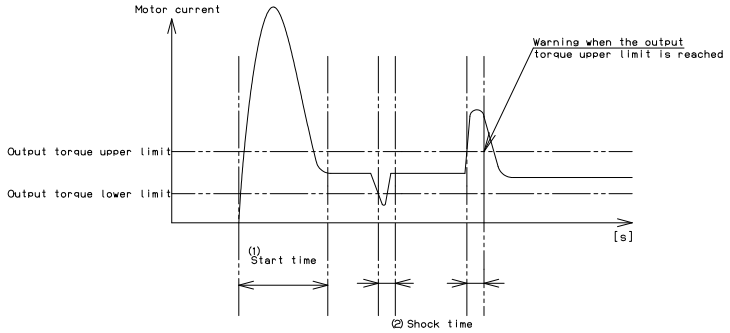


Note) *1 The following six types of parameters can be set: "Output torque upper limits A/B", "Output torque lower limits A/B", "Overheat limit", and "Excessive shock limit".

*2 The following nine types of data can be recorded and retained: "Voltage", "Electric current", "Electric power", "Temperature", "Accelerations X/Y/Z axes", "Power frequency", and "Output shaft torque".

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

6.4 Start time/Shock time



(1) Start time

This setting is provided for disabling the warning function by the SM unit when the motor starts up. The warning function is not activated for the specified period of time after the startup of the motor.
The set start time applies to all the output torque set values. *1

(2) Shock time

This is used as a warning filter. If the actual value exceeds or falls below the specified value continuously for more than the time specified in this parameter, a warning occurs.
Set the shock time for each of "Output torque upper/lower limits A/B". *2
Output torque upper limit A1 → Shock time (Output torque upper limit A) 1
Output torque upper limit B1 → Shock time (Output torque upper limit B) 1
Output torque lower limit A1 → Shock time (Output torque lower limit A) 1
Output torque lower limit B1 → Shock time (Output torque lower limit B) 1
•
•
•
Output torque upper limit A4 → Shock time (Output torque upper limit A) 4
Output torque upper limit B4 → Shock time (Output torque upper limit B) 4
Output torque lower limit A4 → Shock time (Output torque lower limit A) 4
Output torque lower limit B4 → Shock time (Output torque lower limit B) 4

Note) *1 There are no start time settings for the overheat and excessive shock. It is not possible to disable the warning function when the motor starts up.
*2 There are no shock time settings for the overheat and excessive shock. A warning occurs immediately when the set value is exceeded.

⚠WARNING	• Install an additional thermal relay to protect the motor. Failure to do so may cause a fire or failure.

7 Communication

○ Use of personal computer software makes it possible to perform the communication described in this section. The file can be downloaded from the following link.
(https://www.tsubakimoto.jp/power-transmission/reducer-variable-speed-drive/gear-motor/small/)

○ For details about the communication functions, refer to the separate manual, "SM Unit Communication Guideline".
The file can be downloaded from the following link.
(https://tt-net.tsubakimoto.co.jp/tecs/ctlg/ctlg_mlist.asp?bu_code=10_90)

7.1 Specifications

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

Note) *1 Modbus is a registered trademark of Schneider Automation Inc.
*2 These are switched using the DIP switches. (For more details, refer to section 6 in this manual.)

7.2 Command data details

Data name	Description
Number of warnings for clearing	Clears the number of warnings to 0.
Warning reset	Resets the warning status.

7.3 Read data details

Data name	Description	Unit
Output torque upper limits A/B	Each set value	[%]
Output torque lower limits A/B		
Start time SET		[0.1 s]
Shock time SET upper limits A/B		
Shock time SET upper limits A/B		
Voltage	The current value of the data	[0.1 V]
Electric current		[10 mA]
Electric power		[0.1 W]
Temperature		[0.1°C]
Acceleration X axis		[0.01 m/s^2]
Acceleration Y axis		
Acceleration Z axis		
Output shaft torque		[0.1 N•m]
Power frequency		[Hz]
Number of warnings	Number of times warned	times
Warning status	The motor operation status	-
Warning factor	Warning factor	-

Acquisition interval	Log data acquisition interval	[0.1 s]
Login status	The login/logout status	-
Log data	Each data set when the warning occurred previously. (Voltage, electric current, electric power, temperature, acceleration, output shaft torque, and power frequency)	Same as each data set
Product code *1	4-digit number	-
MFG number *1	10-digit 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.

7.4 Set data details

Data name	Description	Unit	Factory default settings (Setting No.) 1	2	3	4	Lower limit	Upper limit
Output torque upper limit A	Stores the set value for each DIP switch number.	[%]	100	120	80	150	*10	200
Output torque upper limit B			80	100	60	130		
Output torque lower limit A			0	0	0	0		
Output torque lower limit B			0	0	0	0		
Start time		[0.1 s]	10	10	10	10	1	300
Shock time (Output torque upper limit A)			10	10	10	10	0	300
Shock time (Output torque upper limit B)			100	100	100	100		
Shock time (Output torque lower limit A)			10	10	10	10		
Shock time (Output torque lower limit B)			100	100	100	100		
Overheat limit	Stores each set value for the warnings.	[0.1°C]	0				*10	1000
Excessive shock limit		[0.01 m/s^2]	0					15000
Log acquisition interval	Stores the sampling time for recording/ retaining the data immediately before a warning.	[0.1 s]	5				1	100
Automatic restoration	Stores the automatic restoration time to return from the warning status to the normal status.	[s]	0				*10	300
Password	Stores the password with 8 to 16 characters.	-	password				-	-

Note) *1 When "0" is set for each value, the warning function is not activated according to the relevant parameter.

8 Troubleshooting

Problem	Inspection item	Inspection result	Possible cause	Action
No warning has been output.	LED status	No light	The power supply of the SM unit is defective.	Supply 24 V DC to the SM unit.
		Solid in blue.	The setting is incorrect.	Review the parameter settings.
				Review the DIP switch settings.
A warning has been output in the normal operation status.	LED status	Blinks in red.	The wiring is incorrect.	Review the wiring between the motor and SM unit.
			The setting is incorrect.	Review the parameter settings.
				Review the DIP switch settings.
Parameter communication has failed.	Communication reading	Possible	No login	Log in to the communication software.
		Not possible	The power supply of the SM unit is defective.	Supply 24 V DC to the SM unit.
			The wiring is incorrect.	Review the wiring of the power supply and communication of the SM unit.
			The setting is incorrect.	Review the DIP switch settings.
				Review the termination resistor settings.

When there is no problem after completion of the above investigations or when a symptom not described above occurs, contact our sales office.

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.

TSUBAKIMOTO CHAIN CO.

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Kyoto 617- 0833, Japan
Website : https://tsubakimoto.com/

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