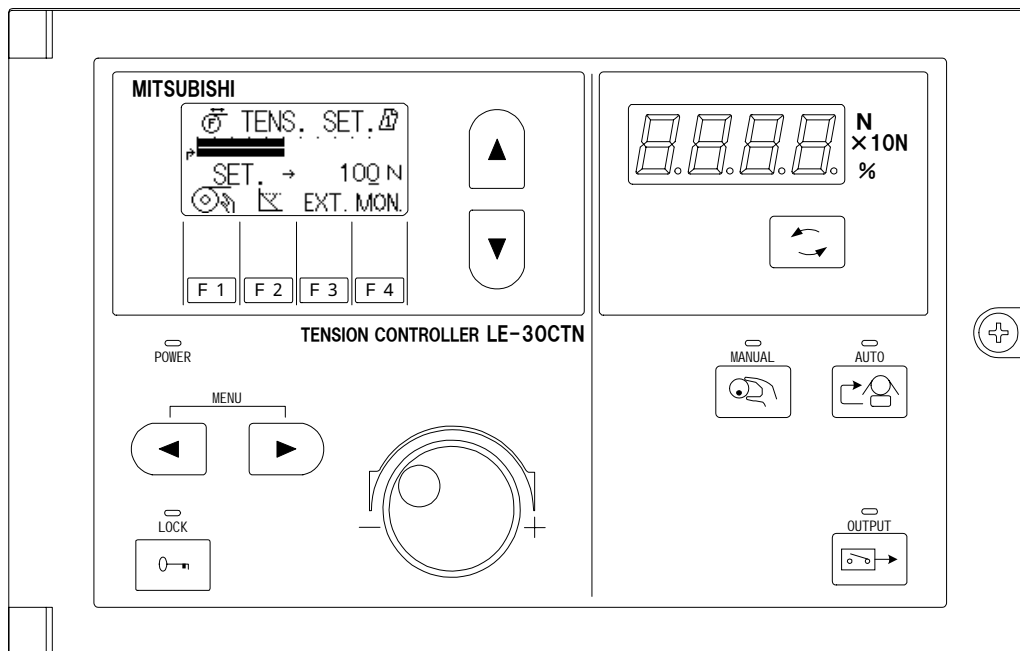


MITSUBISHI

TENSION CONTROLLER

MODEL LE-30CTN

INSTRUCTION MANUAL





Cautions on Safety



(Make sure to read this page before using the unit.)



To assure safety	
<ul style="list-style-type: none"> • Make sure the user thoroughly read this instruction manual before using the unit, and pay attention in assuring safety while using the unit. • The unit is manufactured under the severe quality control. When a severe accident or loss is expected in the equipment used due to failure of the unit, provide a backup function or the fail-safe function in the system. 	



In this manual, cautions of safety are classified into "DANGER" and "CAUTION".



	Danger: When the unit is handled incorrectly, a dangerous situation may occur and the possibility of death or serious injury is expected.
	Caution: When the unit is handled incorrectly, a dangerous situation may occur and the possibility of medium or slight injury is expected or property damage exclusively is expected.



Even an item is classified as "CAUTION", its contents are important and it may lead to a serious result depending on the situation. Make sure to observe every item.



	Danger Turn off all the phases of the external power supply before starting installation and wiring.
	Otherwise, electrical shock or damage in the unit may occur. Make sure to turn off all the phases of the external power supply before starting installation and wiring.



	Danger Design the installation plan using the wire size suitable to the current capacity.
	Use the wire size suitable to the current capacity to supply the power to the load. If a wire having smaller current capacity is used, the insulation sheath will be melted and insulation will become defective. In this situation, electrical shock or a short-circuit may occur, and fire may occur.


	Danger Perform grounding (grounding resistance 100Ω or less).
	Otherwise, electrical shock may occur. Perform grounding (grounding resistance 100Ω or less) to the unit using a wire of 2 mm ² or more, otherwise, electrical shock may occur. Never share the grounding with a strong electric system.



	Danger Set up the emergency stop circuit independently of the product.
	Otherwise, the unit may become out of order and an accident may occur when malfunction occurs in the tension controller. Make sure to assemble the emergency stop circuit outside the tension controller.


	Danger Never open the covers while the power is supplied to the unit or when the unit is operating.
	Never supply the power to the unit nor operate the unit while the main body cover and the terminal cover are open. When the covers are open, a high voltage area may be exposed and electrical shock may occur.



	Danger Never use the unit in an atmosphere where inflammation or explosion can occur.
	Otherwise, inflammation or explosion may occur.


	Danger Never touch a switch with a wet hand.
	Never touch a switch with a wet hand, otherwise, electrical shock may occur.

	Caution Separate the wiring of the strong electric system from the wiring of the weak electric system.
	Separate the wiring of the strong electric system from the wiring of the weak electric system, and make sure that noises are not superimposed on the wiring of the weak electric system. Otherwise, the unit may not operate correctly.

	Danger Never drop cutting chips and wire chips while screw holes are tapped and wiring work is performed.
	Damage, fume, fire, malfunction or others may be caused in the unit.

	Caution Confirm the ambient environments.
	Never install the unit with an environment where dusts, soot, conductive dusts or corrosive gas is present or a place exposed to high temperature, condensation or wind and rain. Otherwise, the unit may be damaged, malfunction or be deteriorated.

	Danger Never modify nor disassemble the unit
	Never modify nor disassemble the unit. Otherwise, the unit may become defective or an accident such as fire, damage, etc. may occur.

	Caution Do not use any unused terminals for any external lines.
	Correctly connect the AC power cable to the specified terminal, and do not use any unused terminals for any external lines. Improper connection may seriously damage the product.

Caution

- We shall not be responsible for any damage caused by repair, disassembly, modification, etc. performed by a third party other than MITSUBISHI or a company specified by MITSUBISHI.
- The cautions on safety and the specifications described in the instruction manual are subject to change without notice.

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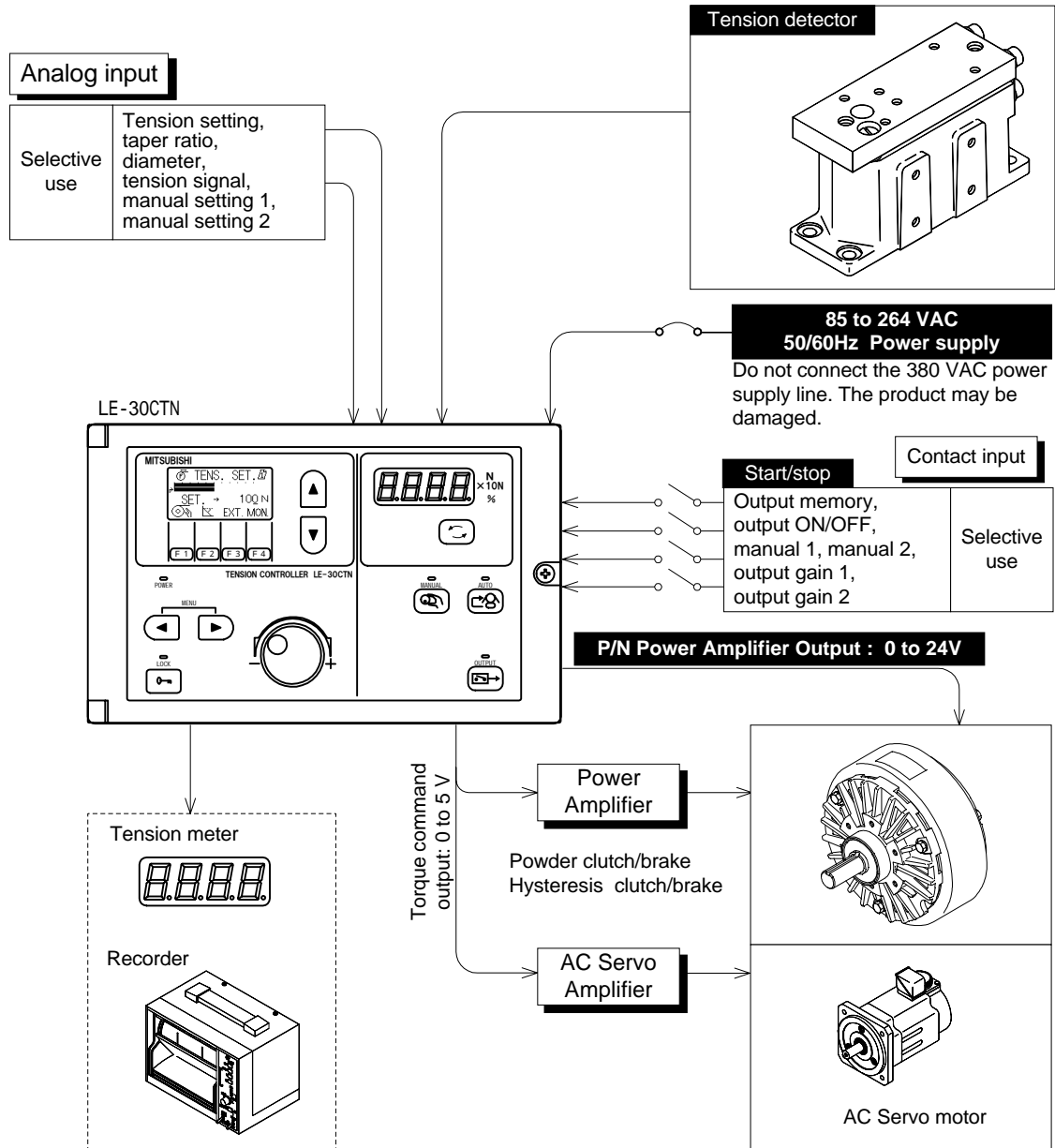
1. Outline

1.1 Functions and features

The LE-30CTN tension controller receives signal from the LX-TD or LX-TD-909 tension detector to automatically control the tension of the long material at the unwinder, feed reel, and winder. This controller therefore generates a control voltage of 0 to 24 V to control the powder clutch/brake and the hysteresis clutch/brake, or generates the torque command voltage of 0 to 5 V to send to the servo amplifier.

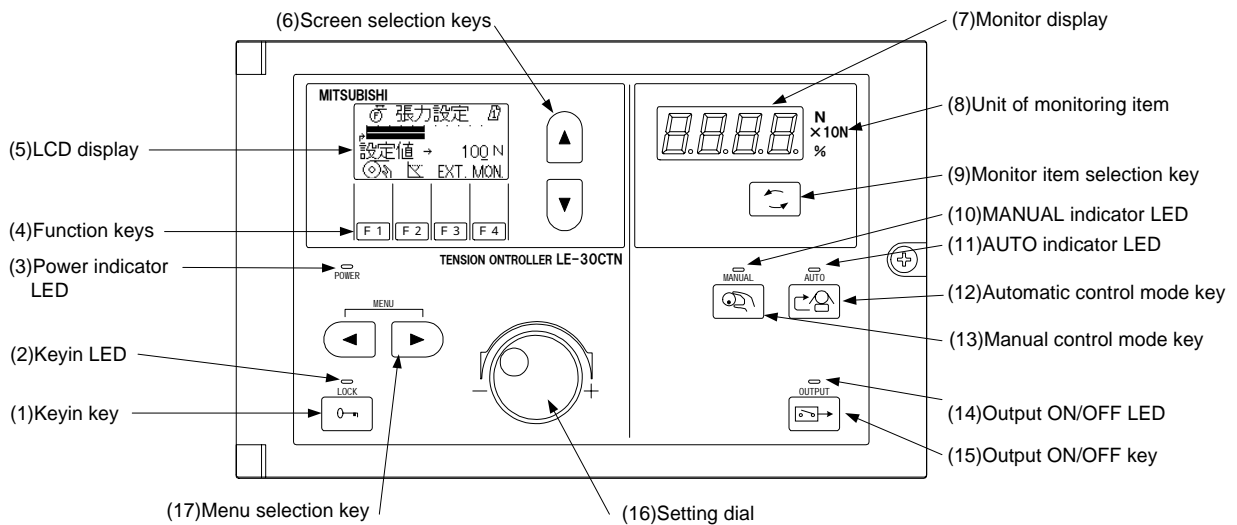
Features

- (1) The menu function enables storage and reading of 8 types of operation data.
- (2) The optional memory cassette enables reading of operation data and writing of data in the other LE-30CTN tension controller.
- (3) The controller has a weak excitation function for the powder clutch/brake. This function will improve the torque rising operation in low-speed operation mode or during the initial start-up of machine.
- (4) The controller automatically judges the polarity of the detector signal, therefore, wiring is performed with ignoring the specification (compression or tension).
- (5) The dot matrix type liquid crystal display is adopted for this controller, it has the capability of displaying Chinese characters.



The external units shown in the above figure can be connected to the input/output terminals of this tension controller. The tension detector, actuator, and some command input switches (white-black inverted characters) should always be connected. However, connection of other units is not always necessary.

1.2 Panel configuration



[1] Keyin key(1)

Prohibits the operator from changing the set values.-----Refer to Sec. 8.2.

[2] Function keys(4)

Used for switching the screen shown on the liquid crystal display. The function of each key depends on the displayed screen.-----Refer to Sec. 3.2.2.

[3] Screen selection keys(6)

Used for switching the screen shown on the liquid crystal display or moving the cursor upward or downward.

[4] Monitor item selection key(9)

Switches the item to be displayed on the monitor display(7). Pressing this key will switch the monitor item between "tension (N or x 10N)" and "output (%)".

[5] Output ON/OFF key(15)

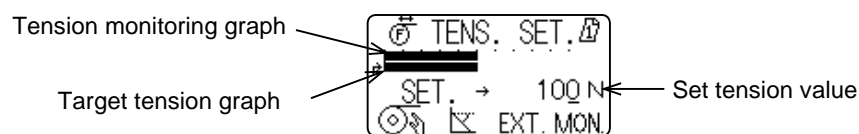
Turns the control output on and off.

[6] Menu selection key(17)

Selects a menu item. Use this key to read out the operation data of the selected menu item.-----Refer to Sec. 8.1.

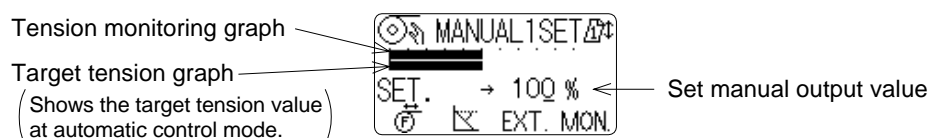
[7] Automatic control mode selection key(12)

Switches the control mode to the automatic control mode. When switched to the automatic control mode, the tension setting screen will appear on the liquid crystal display, and the AUTO indicator LED(11) will light. In this mode, you can set the tension value using the setting dial(16).



[8] Manual control mode selection key(13)

Switches the control mode to the manual control mode. When switched to the manual control mode, the manual setting screen will appear, and the MANUAL LED(10) will light. In this mode, manual operation is possible.



Using the setting dial(16), the user can control output within the range of 0 to 100%. For the set output of 0 to 100%, the following voltage will be output:

Powder clutch/brake control output (PP - PN) -----0 to Approx. 30 V

Power amplifier and AC servo amplifier control output (TOUT - AOC) -0 to 5 V

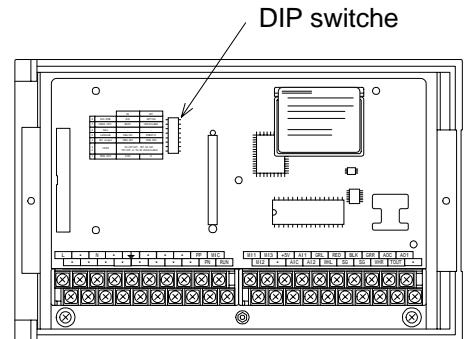
[9] Power switch

The controller main body has no power switch. For this reason, install a switch that can open and close all the phases on the power wiring side.

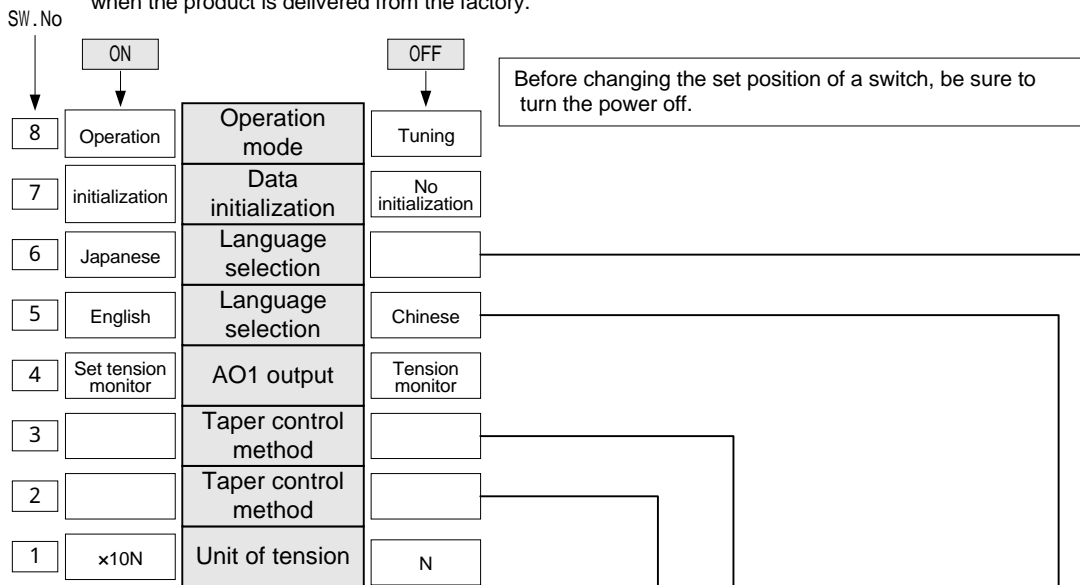
1.3 Functions of DIP switches

- Open the door of the panel, and you can see a printed circuit board on the main body side. At the upper left section of this printed circuit board, there are 8-pole DIP switches.
- When the power is turned on, the set conditions of these switches will be read out.
- Each switch has the following function:

- No.1 - - - - Sets the tension unit to(N) or (×10N).
- No.2 - - - - Sets the taper control method.
- No.3 - - - - Sets the taper control method.
- No.4 - - - - Sets the function of the AO1 output.
 - Set tension monitor - - - - - Outputs the target tension value in the automatic control mode.
 - Tension monitor - - - - - - - Outputs the material tension value detected by the tension detector.
- No.5 - - - - Sets the language to be displayed on the liquid crystal display.
- No.6 - - - - Sets the language to be displayed on the liquid crystal display.
- No.7 - - - - Resets data to the initial values for factoring default settings.
- No.8 - - - - Sets the operation mode or the adjustment mode.



SW. No.6 is set ON and other SWs are set OFF when the product is delivered from the factory.



Item \ SW.No	2	3
No taper control	ON	ON
External reel diameter signal method	ON	OFF
Reel diameter internal calculation method	OFF	ON
No taper control	OFF	OFF

Setting for taper control method

Language \ SW.No	5	6
English	ON	OFF
Chinese	OFF	OFF
Japanese	ON	ON
	OFF	ON

Setting for language

⚠ DANGER

- Before setting the DIP switches, be sure to externally cut off the power of all the phases. If the powers to all the phases are not cut off, you may get an electric shock, or the product may be seriously damaged.

2. Installation and Wiring

2.1 Installation

DANGER

- Never drop cutting chips or wire chips while screw holes are tapped and wiring work is performed. Otherwise, damage, fume, fire, malfunction or other may be caused in the unit.
- Make sure to turn off all the phases of the power supplies outside before starting installation and wiring. Otherwise, electric shock or serious damage to the unit may occur.

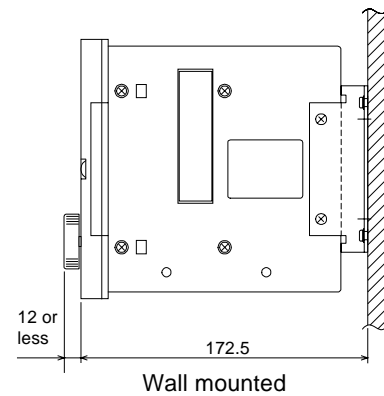
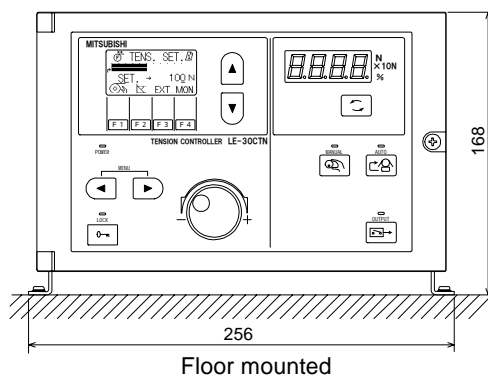
CAUTION

- Never install the controller in a environment with dust, soot, conductive dusts or corrosive gas or a place that is exposed to high temperature, condensation, wind or rain. Never install the unit directly in a place in which vibration or impact is applied. Otherwise, damage, malfunction or deterioration may be caused.

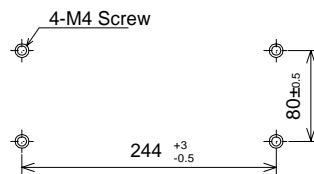
- The tension controller can be floor, wall or panel mounted.

CAUTION

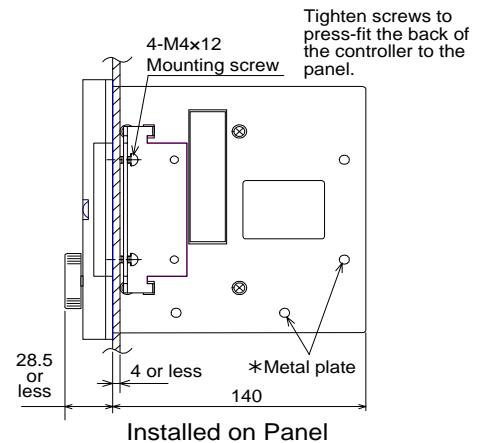
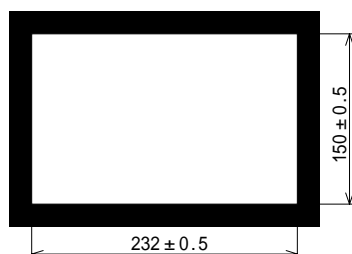
- Never mount the controller with the front surface face pointing upwards.



Dimensions of screw holes for floor or wall mounting.



Panel cutting dimensions for panel mounting



Perform grounding (grounding resistance 100Ω or less) either position marked with * in which the main unit mounting plate is not fixed.

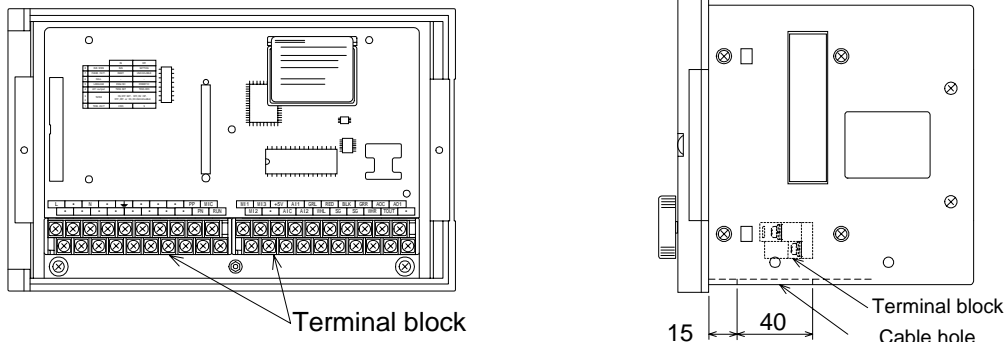
CAUTION

- When you install the controller to the floor or wall, be sure to use the screws supplied with the controller to fix the plate to the controller main body. If you use screws 10 mm or longer, the screws may contact the inner parts of the controller main body.
Screw tightening torque = 0.5 to 0.8 N m.
- Using a screw hole where no screw is tightened to fix the mounting plate, perform grounding (grounding resistance 100Ω or less) of the sheet metal area.

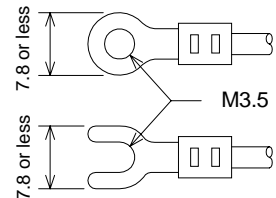
2.2 Wiring

1. Wiring method and cautions

- Open the front door. The terminal board for the connection of external units is located inside the box.
- Distribute the cables to the outside through the cable holes at the lower section of the box.



- Use the crimp-style terminals. Dimensions shown in the right figure.
- Apply a torque of 0.5 to 0.8 Nm to each terminal, and carefully tighten each terminal so that abnormal operation cannot be caused.
- Use the shielded cables for the analog input/output line signal and the winding roll pulse input line, and perform grounding (grounding resistance 100Ω or less) on the signal receiving side.
- Do not insert both the input/output cable and the power cable into the same duct. Do not bind these cables together.
- Generally, set the cable length to 10 m or less to protect the controller from noises.



DANGER

- Before installing the controller or performing the wiring work, be sure to externally cut off the power of all the phases. If the power of all the phases is not cut off, you may receive an electric shock, or the product may be seriously damaged.
- For the grounding terminal of the product and for the sheet metal area of the casing, be sure to perform grounding (grounding resistance 100Ω or less) using wires of 2 mm² or more. If grounding is not performed properly, you may get an electric shock.
- Determine each cable diameter depending on the current capacity. If a cable is too thin, the insulating sheath of the cable may melt. Use of such a cable may cause electric shocks, electric leakage, or fires.
- At the completion of wiring, be sure to attach the terminal cover supplied with the product to prevent electric shocks, and then supply power to the product.

CAUTION

- Correctly connect the AC power cable to the specified terminal, and do not use any unused terminals for any external lines. Improper connection may damage the product.
- Separate the low power cables from the high power cables, and do not connect both types of cables to the same grounding terminal. The noise of the high power cable may be superimposed on the low power cable, hence abnormal operation may be caused.
- Even if the cable is too long, do not insert the remaining part of the cable into the casing of this tension controller to prevent abnormal operation.
- Do not lay the AC power cable on the panel to prevent abnormal operation.

[Note] This product is an electronic equipment in which a micro computer (CPU) is built in. If the CPU has become out of order, caused by insertion of conductive foreign objects or abnormal noise into the main body, the output of this product is fixed. When disorder of the CPU is caused by noise, the product can be recovered to the normal status by turning off the power and turning it on again.

2. Basic wiring

- To control the tension using the LE-30CTN tension controller, perform at least the following wiring.
 - Connect the AC power supply line of 100 ~ 240 VAC and 50 / 60 Hz between terminals L and N. When maximum output between PP and PN is readed, the power consumption will be 400 VA.

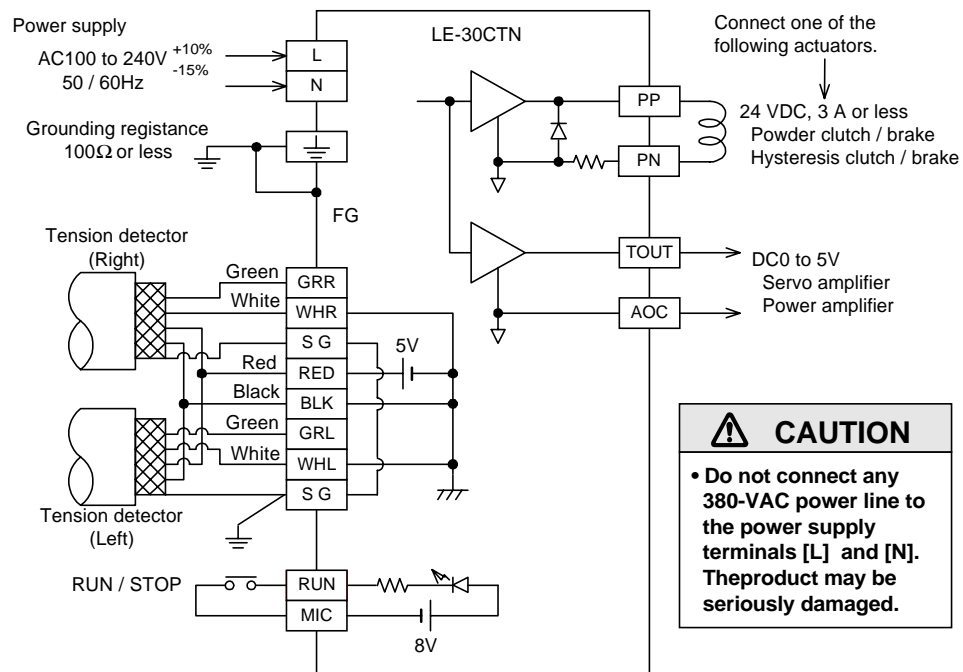
⚠ CAUTION

- Do not connect any 380-VAC power line to the power supply terminals [L] and [N]. The product may be seriously damaged.

- Perform grounding (grounding resistance 100Ω or less) to the grounding terminal and the metal plate.
 - Connect the tension detector.
 - If the powder clutch/brake or the hysteresis clutch/brake is used, connect the actuator between terminals [PP] and [PN]. If the rated current of the powder clutch/brake is 3 A or more, connect the [TOUT] - [AOC] signal line to the input terminal of the power amplifier that is optimum for the rated current of the powder clutch/brake, and connect the powder clutch/brake to the output terminal of the power amplifier.
- If the torque controllable servomotor is used, connect the [TOUT] - [AOC] signal line to the torque command terminal of the servo amplifier.
- Connect the start/stop signal line to the [RUN] and [MIC] terminals.

Caution: To perform automatic operation, be sure to turn the [RUN] input signal OFF and ON according to the machine operation status (run or stop). If this signal is kept at the ON status, restarting the operation of the stopped machine may apply extremely strong tension to the material, and the material may fracture.

- To use various functions, refer to Sec. 5 and subsequent sections.



3. Wiring of tension detector

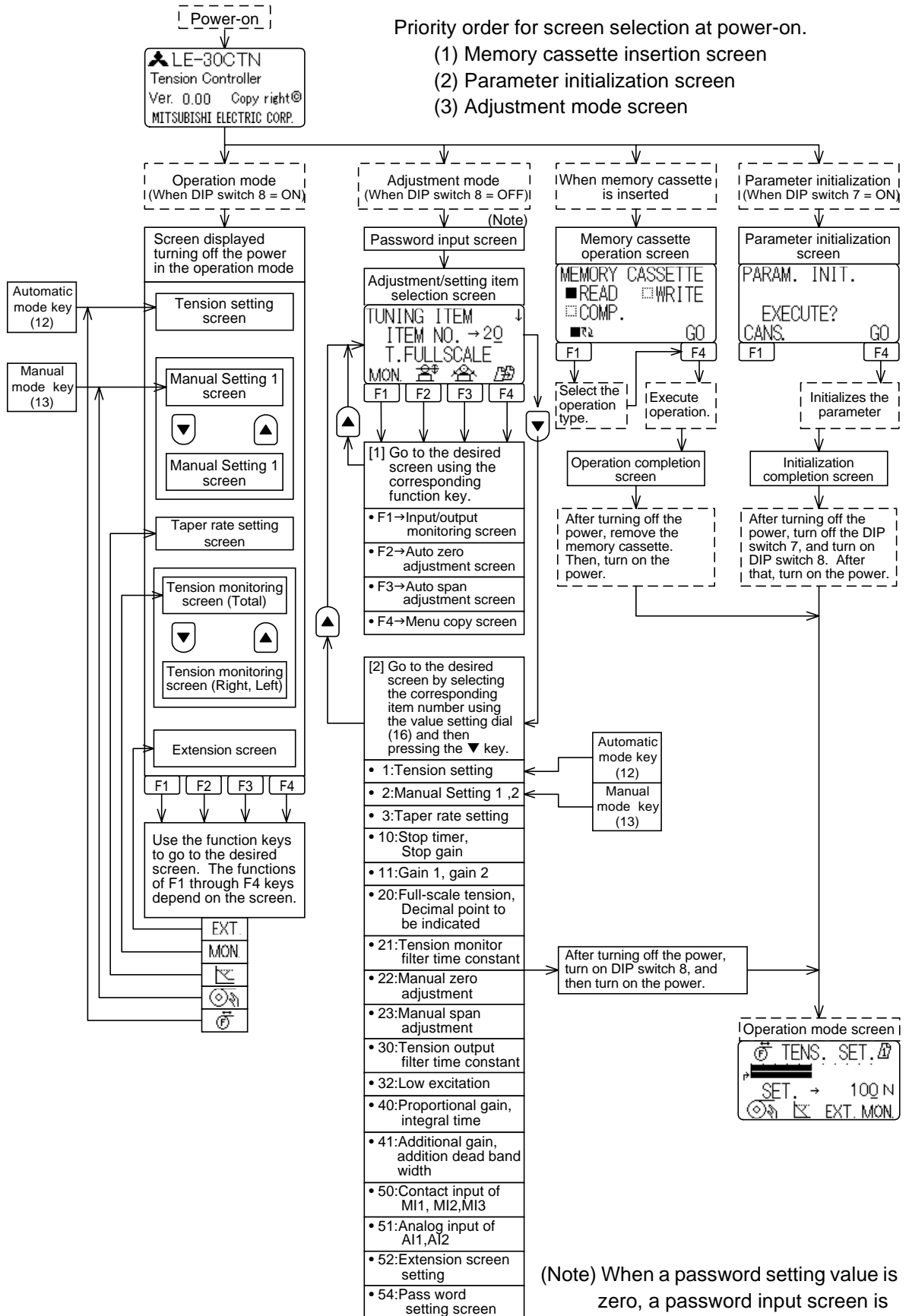
- While ignoring the loading direction (compression or tension), connect the cable of the tension detector as shown in the above figure. The loading direction will be automatically detected.
- If only one tension detector is used, short-circuit the unused line between the input terminals ([GRR] and [WHR] or between [GRL] and [HWL]).

3. Screen system and method of change screen

3.1 Screen System

1. Overall of screen system

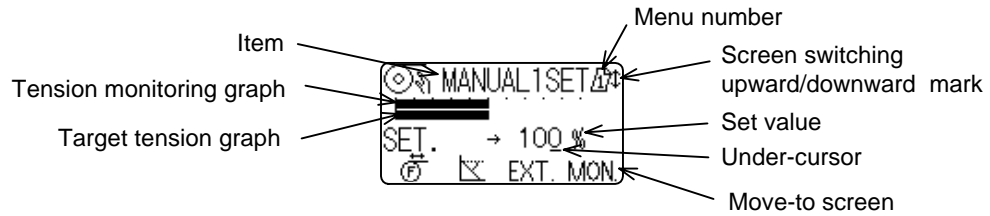
- The screens shown on the LCD display are shown below. To change screen, use the corresponding function key (F1 through to F4 keys) or the screen selector keys (▲ and ▼ keys).



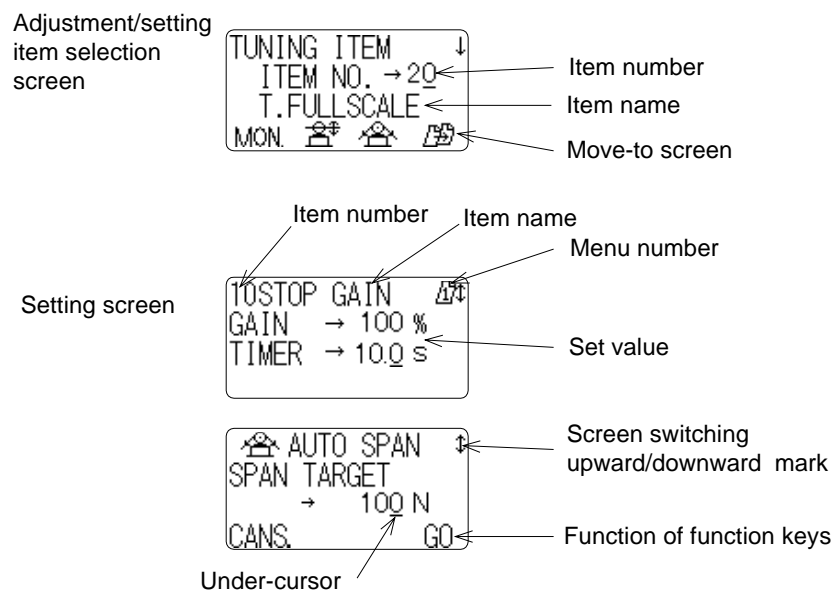
2. Items displayed on screen

- On the LCD display, the following items will be displayed.

(1) Operation mode screen



(2) Adjustment mode screen



- Tension monitoring graph ----- Displays the current tension while regarding the full-scale tension as 100%.
- Set tension graph ----- Displays the set tension in the automatic control mode while measuring the full-scale tension as 100%.
- Menu number ----- Displays the menu number. This number will appear only if the screen is stored in the menu function memory.
- Screen switching upward/downward mark -- Displays the [\updownarrow] mark only if the screen selector keys(6) can switch the screen upward and downward.
- Under-cursor ----- Displays the under-cursor only if the set value can be changed. If changing the set value is not possible, this cursor will not appear.
- Move-to screen ----- Displays a pictogram to show the move-to screen. Using the corresponding function key, you can go to this screen.
- Item number ----- Displays the corresponding item number.

3.2 Method of change screen

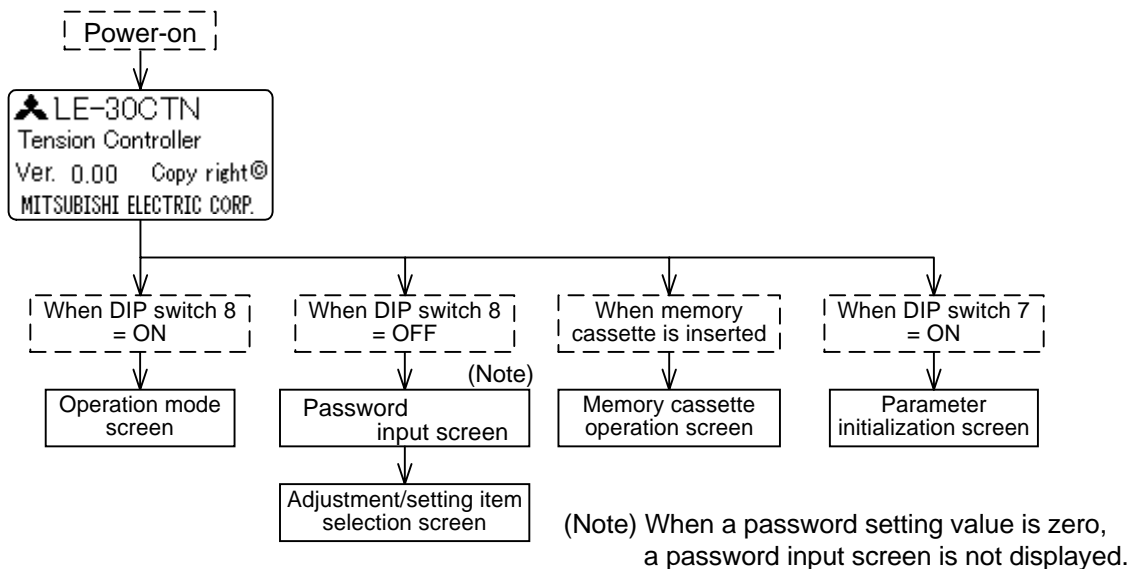
1. Initial screen displayed at power-on

- The initial screen displayed just after power-on depends on the memory cassette insertion condition, ON/OFF status of DIP switch 7, and ON/OFF status of DIP switch 8 as shown below.

- (1) When the memory cassette is inserted. -----Memory cassette operation screen
- (2) When DIP switch 7 is ON.-----Parameter initialization screen
- (3) When DIP switch 8 is OFF.-----Adjustment mode screen
- (4) When DIP switch 8 is ON.-----Normal operation mode screen

- If two or more modes are set, the following priority order will be observed to display the screen.

- [1] Memory cassette operation mode
- [2] Parameter initialization mode
- [3] Adjustment mode



2. Functions of function key(4)

- There are four function keys(F1 through to F4) for the LCD, and the functions assigned to these function keys are displayed on the bottom line of the screen using the pictograms. Pressing a function key will execute the corresponding function.
- The functions assigned to the function keys depend on the screen currently displayed.

	----- Moves to the tension setting screen.
	----- Moves to the manual setting screen.
	----- Moves to the taper setting screen.
	----- Moves to the extension screen.
	----- Moves to the tension monitoring screen or input/output monitoring screen.
	----- Moves to the auto zero adjustment screen.
	----- Moves to the auto span adjustment screen.
	----- Moves to the menu copy screen.
	----- Execute the operation command.
	----- Cancels the operation command.
	----- Set the function.
	----- Switches the selected item.

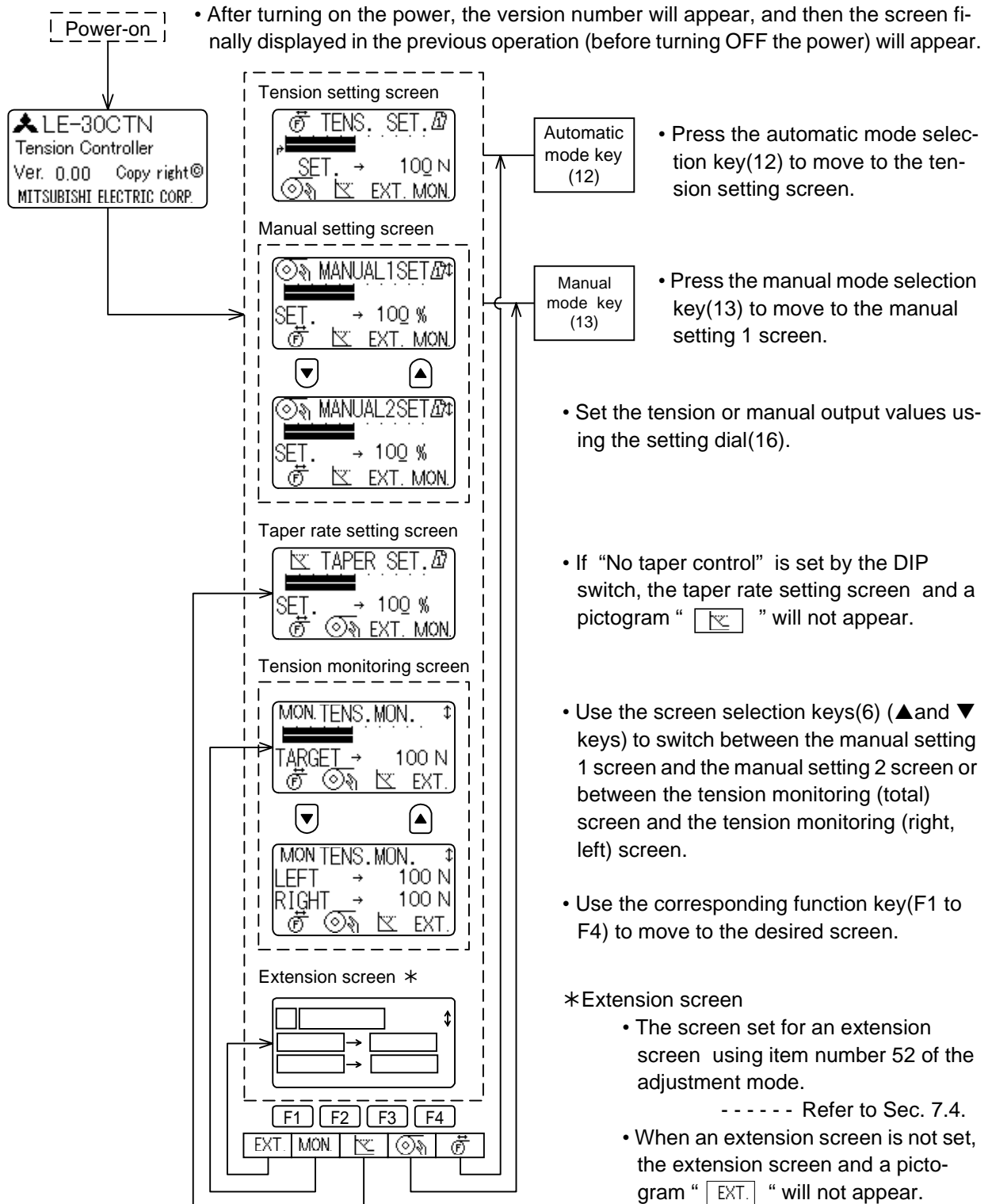
3. Moving to another screen

-----Use one of the following methods to move to another screen.

- (1) Moving to another screen using function keys (F1 through to F4 keys)
 - Press a function key to move to the screen assigned to that function key.
- (2) Moving to another screen using screen selection keys(6) (▲ and ▼ keys)
 - If the symbol [↕] appears at the upper right section of the screen, you can switch the screen upward or downward using the screen selector keys(6).
 - If two types of items are set for one screen, pressing the screen selector key will switch the item.

4. Normal operation mode

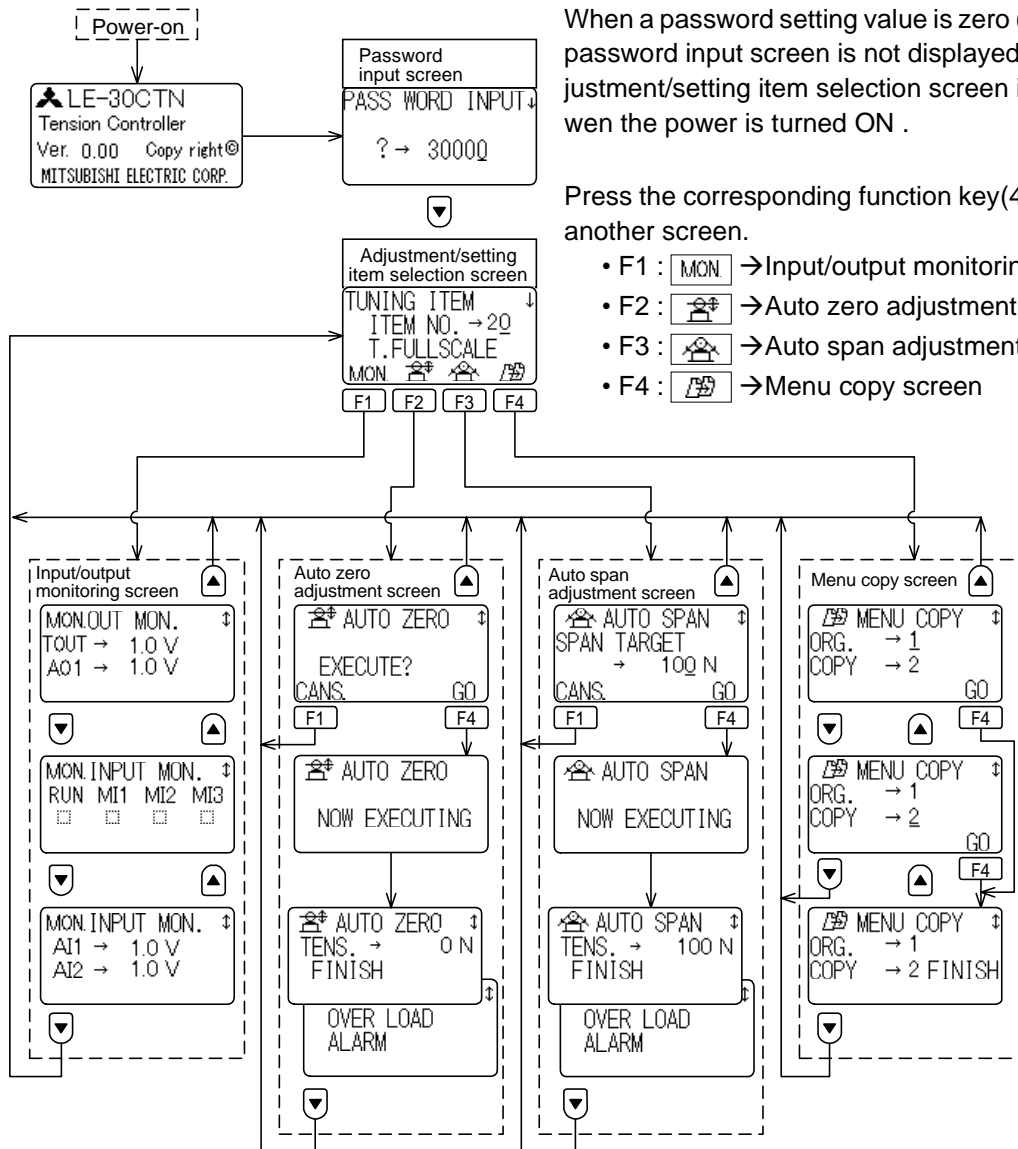
-----Turn on DIP switch 8, and then turn on the power.



5. Adjustment mode

--- Turn OFF DIP switch 8, and then turn ON the power.

(1) To switch the screen using function keys



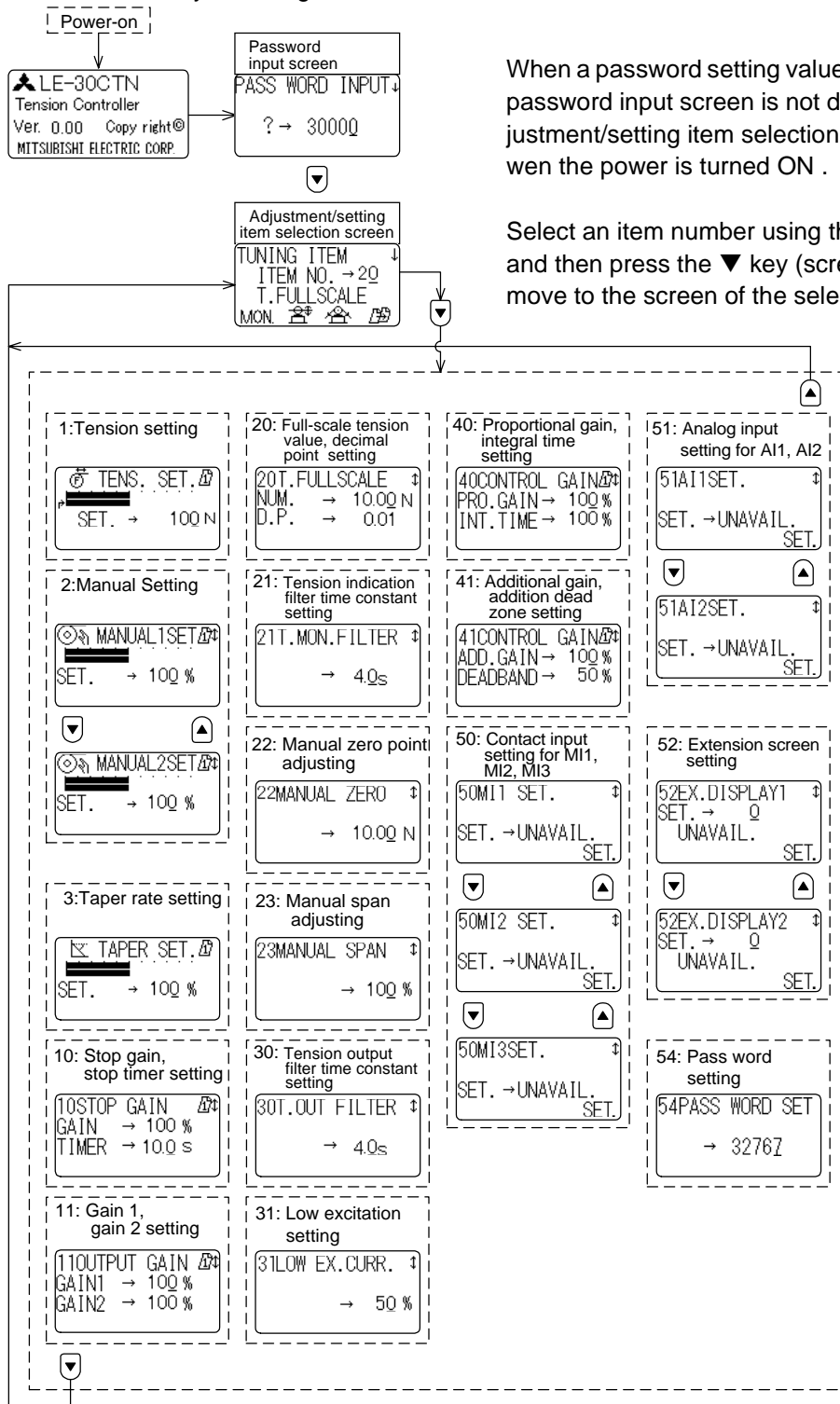
When a password setting value is zero (default), the password input screen is not displayed, and the adjustment/setting item selection screen is displayed when the power is turned ON.

Press the corresponding function key(4) to move to another screen.

- F1 : → Input/output monitoring screen
- F2 : → Auto zero adjustment screen
- F3 : → Auto span adjustment screen
- F4 : → Menu copy screen

- Use the screen selection keys(6) (▲ and ▼ keys) to move to another screen. If the uppermost screen is displayed, pressing the ▲ key will return the system to the adjustment/setting item selection screen. If the lowermost screen is displayed, pressing the ▼ key will return the system to the adjustment/setting item selection screen.

(2) To switch the screen by selecting an item number



When a password setting value is zero (default), the password input screen is not displayed, and the adjustment/setting item selection screen is displayed when the power is turned ON.

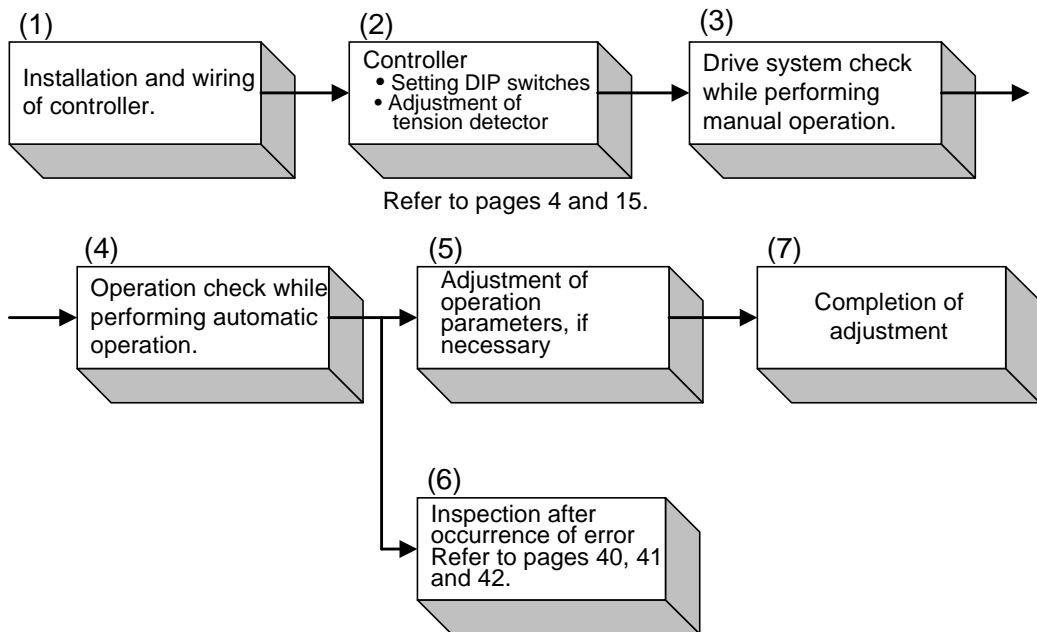
Select an item number using the setting dial(16), and then press the ▼ key (screen selection key) to move to the screen of the selected item.

- Set an item number using the value dial(16).
- If the selected item has only one screen, pressing the ▼ or ▲ keys will return the system to the adjustment/setting item selection screen.
- If the selected item has two or more screens, use the ▼ and ▲ keys to switch the screen. If the uppermost screen is displayed, pressing the ▲ keys will return the system to the adjustment/setting item selection screen. If the lowermost screen is displayed, pressing the ▼ key will return the system to the adjustment/setting item selection screen.
- If a screen has two or more items, pressing the ▼ or ▲ key will move the under-cursor to the next or previous item. However, if the cursor is at the uppermost item, pressing the ▲ key will return the system to the adjustment/setting item selection screen. If the cursor is at the lowermost item, pressing the ▼ key will return the system to the adjustment/setting item selection screen.

4. Adjustment and Initial Setting

4.1 Flowchart of test run and adjustment

- Before starting automatic operation, check and adjust the controller as follows.

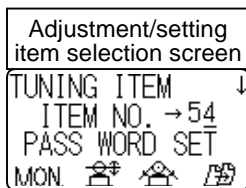


4.2 Password setting

- In the adjustment mode, a password can be set for sifting to an adjustment/setting item selection screen.
- When a password is set, the password input screen is displayed when the the power is turned ON in the adjustment mode (DIP.SW8 is turned OFF). The screen cannot be moved to the adjustment/setting item selection screen without inputting the password set in this screen.

1. Password setting ----- Item number: 54

- In an adjustment mode (power ON with DIP. SW8 OFF), select item No.54 to set.
- When a password setting is not necessary, alteration from the default (=0) is not required.



On the adjustment/setting item selection screen, set the item number to [54], and then press the ▼ key.



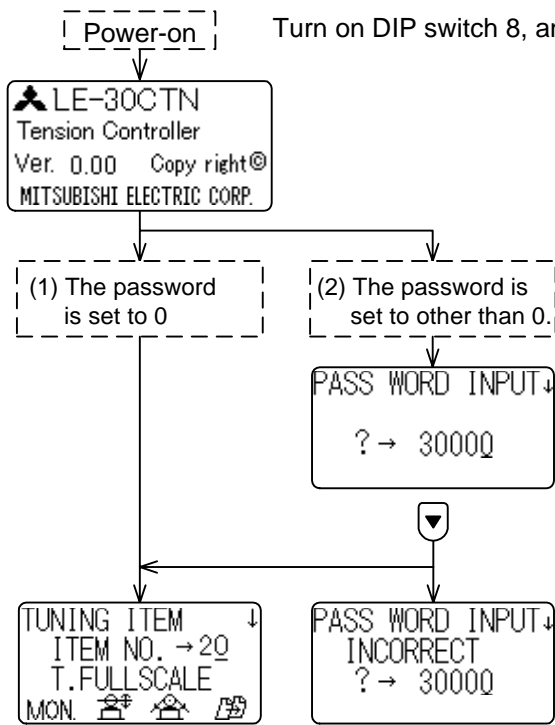
Set the value on a password setting screen.

- Setting range - - 0 to30000 - - - Initial value=0

- As to the password, “4095” is predetermined. Thus, the value set through above-mentioned operation and “4095” are effective as the password.

2. Moving to the adjustment mode screen

- (1) When the password is not set (the default is remained as 0), the adjustment/setting item selection screen is displayed wen the power is turned ON in an adjusting mode (DIP.SW is turned OFF).
- (2) When the password is set to other than zero, the password input screen is displayed when the the power is turned ON in the adjustment mode (DIP.SW8 is turned OFF). The screen cannot be moved to the adjustment/setting item selection screen without inputting the password set in this screen.



Turn on DIP switch 8, and then turn on the power.

(1) When the password is not set (the default is remained as 0).

The adjustment/setting item selection screen is displayed and various adjustments/settings are available.

(1) When the password is set to other than 0.

[1] The password input screen is displayed.

[2] Input the password set on the password setting screen and then press the ▼ key.

- When the password is valid, the adjustment/setting item selection screen is displayed and various adjustments/settings are available.

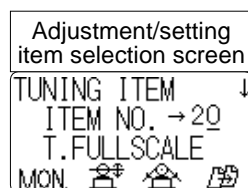
- When the password is invalid, "INCORRECT" is displayed. Input the correct password and then press the ▼ key.

4.3 Adjustment of tension detector

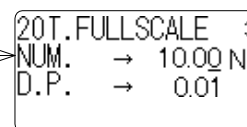
1. Full-scale tension value and decimal point setting

----- Item number: 20

- Set the full-scale tension value and the position of the decimal point. The full-scale tension value should be higher than the maximum tension value for control. (The full-scale tension should be approximately 1.2 to 1.5 times higher than the maximum tension.)
- The set full-scale tension value will be used as the maximum tension value in setting analog input signals and in monitoring output tension values.
 - Analog input signal (AI1, AI2, AI3)
 - Input voltage of 0 to 5 V = Tension setting of 0 to full-scale value
 - Output signal (AO1) --- Output voltage of 0 to 5 V = Monitor value of 0 to full-scale value
- Setting range
 - Full-scale tension value ----- 1 to 2000 (N, ×10N) --- Initial setting = 500
 - Decimal point ----- 0.01, 0.1, 1 ----- Initial setting = 1
- Set these values considering the unit of tension set by DIP switch 1 and the maximum tension value for control.
- Setting method----- In the adjustment mode (turn OFF DIP switch 8, and then turn ON the power to enter the adjustment mode), select item number 20. The following screen will appear. Using this screen, set the full-scale tension value and the position of the decimal point.



Using the value setting dial(16), set the item number to [20], and then press the ▼ key.



Using the ▲ or ▼ key, move the under-cursor to the desired item, and then set the value using the value setting dial(16).

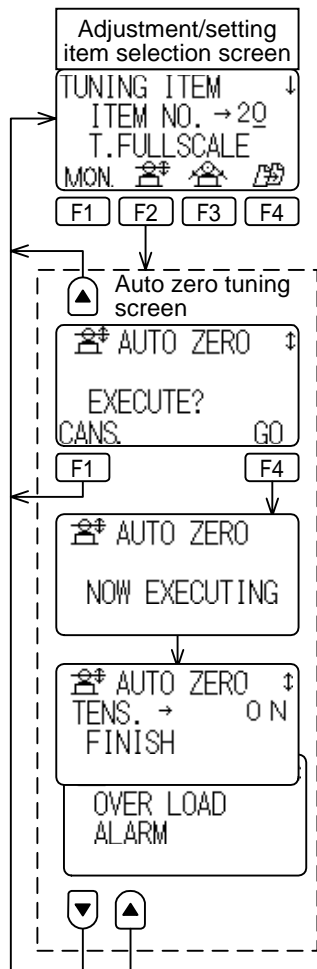
- At the change of full-scale tension value, be sure to adjust the zero point and the span.

2. Adjustment of zero point and span for tension detector

- - - Turn OFF DIP switch 8, and then turn ON the power to enter the adjustment mode.

(1) Zero point adjustment for tension detector

- Correct the zero point of the tension detector (tare weights of the detector roller, bearing, etc.). For this correction, be sure to install the detector roller, and do not thread the material into the machine.



[1] Press the [F2] function key to move to the auto zero tuning screen.

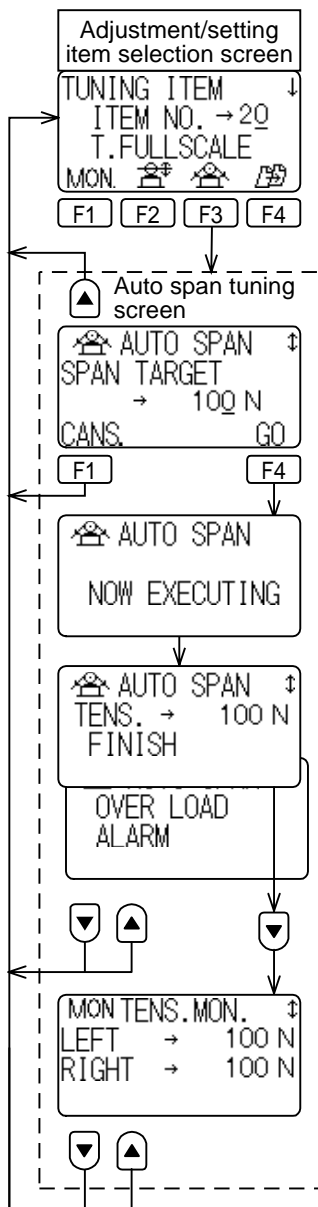
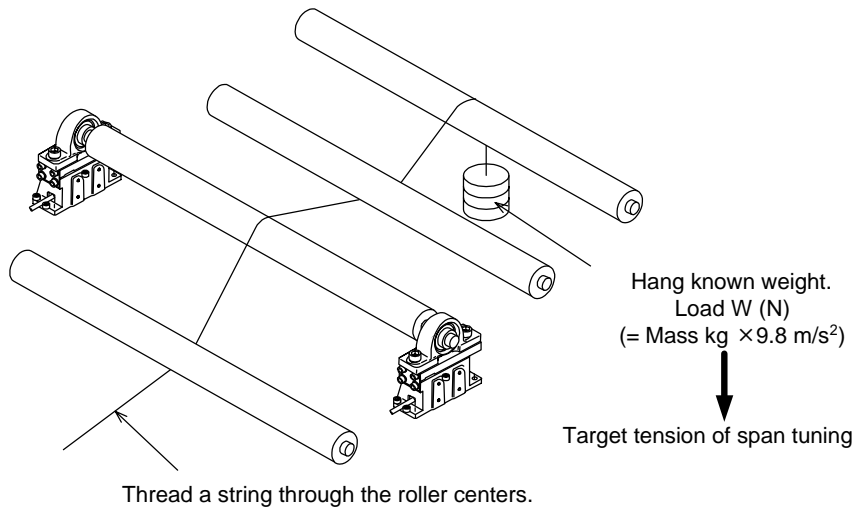
[2] Do not thread the material into the machine, but apply the tare weights of the detector roller, bearing, etc., and then press the [GO] key.

[3] The message "NOW EXECUTING" will be displayed for approximately 2 minutes.

[4] The message "FINISH" or an error message will appear. If an error message appears, check the problem while referring to pages 40 and 42.

(2) Span adjustment for tension detector

- The material tension (load detected by the tension detector) depends on the installation direction of the detector or the material-threading angle. To correctly detect the material tension, correct the span.



[1] Press the [F3] function key to move to the auto span adjustment screen.

[2] Hang known weight W (N) from the detector roller. Apply a static load close to the full-scale tension value. (The static load should be in the range of 1/3 to 100% full-scale tension, and the full-scale tension should be in the range of 20 to 80% of the rated load of the tension detector.)

[3] Enter a numeric value equivalent to load W (N), and then press the [GO] key.

(ex) If the weight hung from the roller is 10 kg, enter 98 (N)
----10 kg × 9.8 m/s² (gravitational acceleration).

If the applied weight is changed during adjustment, further modification may not be possible, or an error may be caused.

[4] The message “NOW EXECUTING” will be displayed for approximately 2 seconds.

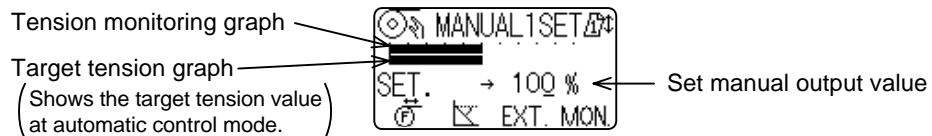
[5] The message “FINISH” or an error message will appear. If an error message appears, check the problem while referring to pages 40 and 42.

4.4 Automatic operation check

- Basic setting for automatic operation is completed when the full-scale tension value is set and the zero point and span of the tension detector are adjusted. Turn ON DIP switch 8 (to enter the operation mode), and then check basic operation while following the procedure below.

1. Drive system operation check in manual operation mode

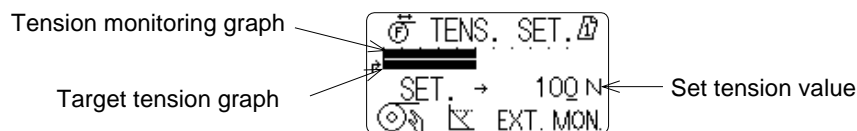
- (1) Turn on the power. → The power indicator LED(3) will light.
- (2) Press the manual control mode selection key(13) to enter the manual mode.
→ The MANUAL indicator lamp(10) will light, and the manual setting 1 screen will appear.



- (3) Start the machine, and check operation while changing the set manual output value using the value setting dial(16).
 - [1] Check operation of the machine.
 - [2] Check that the tension monitoring graph shown on the LCD and the monitor value shown on the monitor display(7) vary depending on the change to the set value.
 - [3] Check other operations.

2. Operation check in automatic operation mode

- (1) Turn on the power. → The POWER indicator LED(3) will light.
- (2) Press the automatic control mode selection key(12) to enter the automatic mode.
→ The AUTO indicator LED(13) will light, and the tension setting screen will appear.



- (3) Start the machine, and then turn ON the [RUN] input signal to start automatic operation. Check operation while changing the set tension value using the value setting dial.
 - [1] On the LCD display(5), check that the tension monitoring graph is positioned at the same point as the set tension graph.
 - [2] Check that the set tension value displayed on the LCD display(5) is equal to the monitored tension value displayed on the monitor display(7).
 - [3] Check that changing the set tension value can vary the other values displayed.
 - [4] Check other operations.

Caution: To perform automatic operation, be sure to turn the [RUN] input signal OFF and ON according to the machine operation status (run or stop). If this signal is kept at the ON status, restarting the operation of the stopped machine may apply extremely strong tension to the material, and the material may fracture.

5. Automatic Operation and Functions

- Basic setting for automatic operation is completed when adjustment and initial setting described in Sec. 4 are completed.
- This section describes automatic operation and functions necessary for starting or stopping the machine.
- Set or use each function whenever necessary.

5.1 Operation at starting or stopping machine

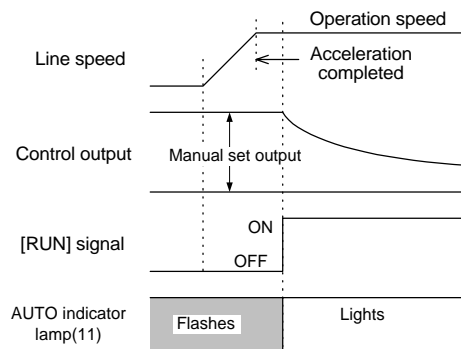
1. Operation at starting machine

- Turn ON or OFF the [RUN] input signal depending on the operation status of the machine (started or stopped).
- When the [RUN] input signal is OFF, the set manual value will be output or the value stored in the memory will be output. ----- Refer to Sec. 5.2.
- In the automatic control mode, turning on the [RUN] input signal will start automatic operation from the output value set for the previous operation. The automatic operation will be continually perform while the [RUN] input signal is left at the ON status .
- At the start of the machine, turn ON the [RUN] input signal after the completion of acceleration to fix the output during acceleration and to minimize the change in the tension.

----- Refer to the following figure.

The user can also use the function of manual output 1 to perform the same operation.

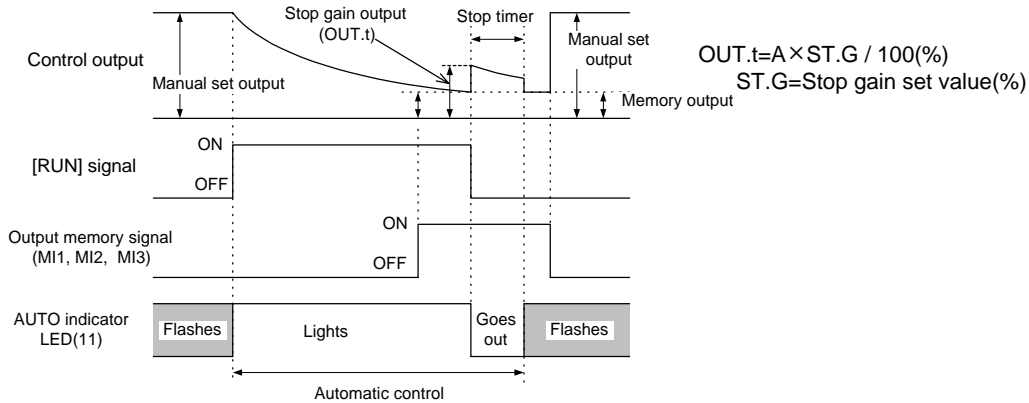
----- Refer to Sec. 6.1.2.(4).



2. Operation at stopping machine

----- When the machine is stopped, the tension may be changed by the inertia of the reel. To prevent such change in the tension, set the stop timer and the stop gain.

- When the [RUN] input signal is turned OFF during the automatic operation, the stop timer will be activated.
- When the stop timer is activated, the output value will be sent out depending on the stop gain set value and by multiplying the output just before [RUN] input signal was turned OFF by the stop-gain set value. From this output value, automatic control will continue after the activation of the stop timer.
- After the end of the stop timer, the output value stored in the memory (output just before turning off the [RUN] input signal) or the output value set by manually setting 1 or 2 functions will be output depending on the ON/OFF status of the output memory signal (assigned to the MI1, MI2, or MI3). ----- Refer to Sec. 5.2.
- When the stop timer is activated, the AUTO indicator LED(11) and the MANUAL indicator LED(10) will extinguish.
- When manual operation (the manual control mode selector key(13) is on), the stop timer will not function.



- The following formula expresses calculation of the control output value to be output just after starting the stop timer (the maximum value is limited to 100%).
- The output value to be output just after starting the stop timer is calculated by the following formula (the maximum value is limited to 100%).

$$OUT.t = A \times ST.G / 100(\%)$$

OUT.t = Control output value just after starting the stop timer (%)

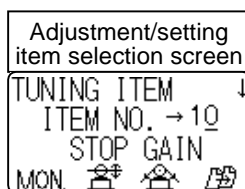
A = Control output value just before starting the stop timer (%)

ST.G = Stop gain set value (%)

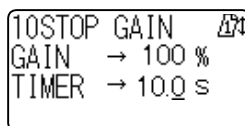
3. Stop timer and Stop gain setting

--- Item number: 10

- In the adjustment mode (power ON with DIP. SW8 OFF), select item number 10, and then set the stop timer and the stop gain.
- If it is not necessary to correct the inertia while stopping the machine; it is not necessary to change the initial values.



On the adjustment / setting item selection screen, set the item number to [10], and then press the ▼ key.



• Setting range:

- Stop timer - - - - - 0 to 30 sec - - - - - Initial value = 0 sec
- Stop gain - - - - - 5 to 400% - - - - - Initial value = 100%

- Normally, set the stop gain to 100% or more at unwinding, and to 100% or less at winding.

5.2 Output setting for stoppage

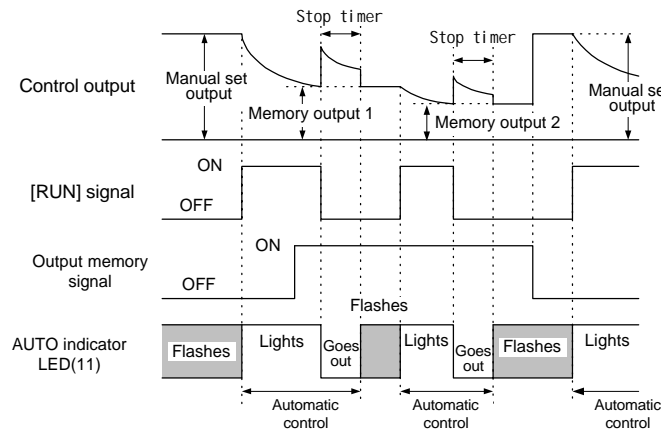
1. Switching between manual output 1 and 2

- When the [RUN] signal is OFF, the manual set value 1 will be output.
- When manual output signal 2 is input, the manual set value 2 will be output.
- To switch the manual output signal, select item number 50 in the adjustment mode, and then assign the functions to the input contact terminals (MI1, MI2, or MI3). - - - - - Refer to Sec. 6.1.2.

2. Output memory function

- When the [RUN] input signal is turned OFF while the output memory signal is ON, the output value sent out just before the [RUN] input signal turning OFF will be stored in the memory. After end of the stop timer, this memory value will be output during the [RUN] input signal is OFF .
- When the output memory signal is ON, if the [RUN] input signal is repeatedly turned ON and OFF, the output value sent out at just before final turning-OFF of the [RUN] input signal will be stored in the memory.
- Turning off the power will not reset the memory value.
- When the power is turned ON while the output memory signal is ON, the output value stored in the memory is output.
- When the [RUN] input signal is turned ON while the output memory signal is ON, automatic control will be restarted using the output value stored in the memory.
- When the [RUN] input signal is OFF, if the output memory signal is turned OFF, the manual set value 1 or 2 will be output.
- To use the output memory signal, select item number 50 in the adjustment mode, and then assign the function to the input contact terminal (MI1, MI2, or MI3).

----- Refer to Sec. 6.1.2.



3. Switching between manual output value and memory value

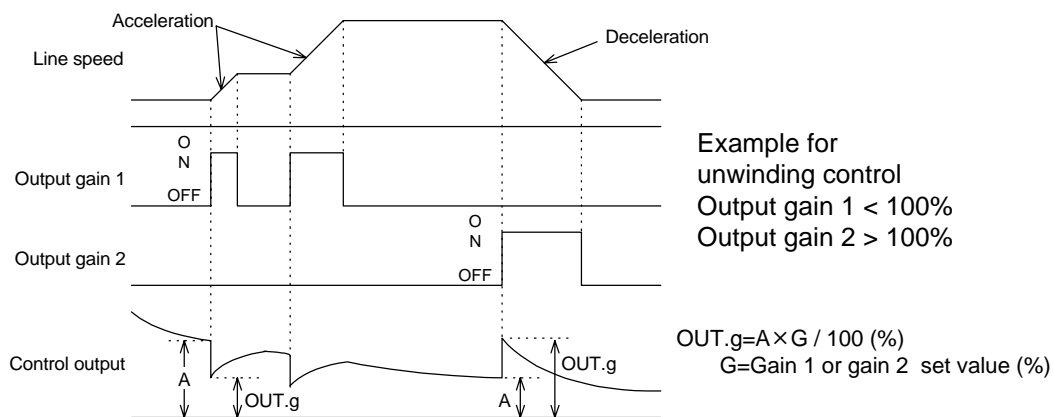
- Generally use these values as follows.
 - (1) After replacing the reel, if the operation is restarted from the initial diameter, the output memory signal will be turned OFF, and the manual set value will be used for operation. In this case, the manual set value will be output depending on the initial diameter of the reel (full diameter for unwinding, and reel diameter for winding).
 - (2) Stop and restart the machine without replacing the reel, the output value stored in the memory will be used.

5.3 Correction for acceleration and deceleration

1.Functions of gain 1 and gain 2

----- If the machine is rapidly accelerated or decelerated, the material tension may be changed due to inertia of the material. To minimize such change in the tension, gain 1 and gain 2 will be used.

- In the automatic control mode, if the output gain 1 signal or the output gain 2 signal is turned ON, the output value will be multiplied by the set gain value, and then the automatic control will be restarted using the multiplied output value.
- To use the output gain 1 and 2 signals, select item number 50 in the adjustment mode, and then assign the function to the input contact terminal (MI1, MI2, or MI3). ----- Refer to Sec. 6.1.2.
- During the manual operation, the functions of gain 1 and gain 2 will not be valid.
- If it is not necessary to correct the inertia for acceleration or deceleration, it is not necessary to set the gain function.



- The control value for the output just after the powered is turned ON for the gain 1 or 2 signal is calculated by the following formula (the maximum value is limited to 100%):

$$OUT.g = A \times G / 100 (\%)$$

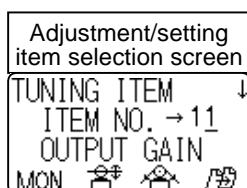
OUT.g = Control output value just after turning on the gain signal (%)

A = Control output value just before turning on gain signal (%)

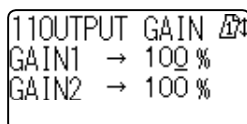
G = Gain 1 or 2 set value (%)

2. Gain 1 and Gain2 setting -----Item number: 11

- In the adjustment mode (power ON with DIP. SW8 OFF), select item number 11 to set these values.
- If it is not necessary to correct the inertia for acceleration or deceleration, it is not necessary to change the initial values.



On the adjustment/setting item selection screen, set the item number to [11], and then press the ▼ key.



• Setting range

- Gain 1 ----- 5 to 400% ----- Initial value=100%
- Gain 2 ----- 5 to 400% ----- Initial value=100%

5.4 Taper control function

1. Outline of taper control

- Taper control is used to change the tension depending on the variation in reel diameter.
- Taper control is mainly used for winding operation. As the reel diameter increases, the controller reduces the tension to prevent the material from winding too tight or too loose on the reel.
- Following two methods are presently available to determine the current reel diameter.

[1] Reel diameter internal calculation method

- If the tension is kept constant during automatic control, the control output will be changed in proportion to the reel diameter. While judging the increase in the control output as an increase in the winding diameter, the controller will judge the reel diameter.
- This method does not need the reel diameter signal, however, a mechanical loss, change in the actuator torque characteristic, etc. may affect the taper control.

[2] External winding diameter signal method

- The external analog voltage signal that is in proportion to the reel diameter is used for taper control. Taper control which is proportional to a winding diameter is available.

2. Selection of taper control method

- Select the taper control method by DIP switch 2 and 3.

Item	SW.No	
	2	3
No taper control	ON	ON
External reel diameter signal method	ON	OFF
Reel diameter internal calculation method	OFF	ON
No taper control	OFF	OFF

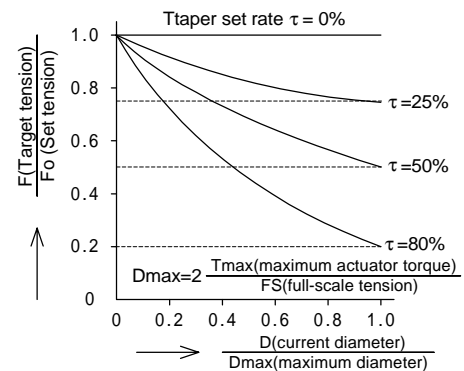
3. Reel diameter internal calculation method

- Tension characteristics - - - - Refer to the figure as right.

[1] While regarding the tension obtained at 0 mm reel diameter (virtual winding diameter) as 100% (set tension), the controller reduces the target tension as the reel diameter increases.

Since the reel diameter is larger than 0 mm when starting the winding operation, the target tension will be smaller than the set tension at starting operation.

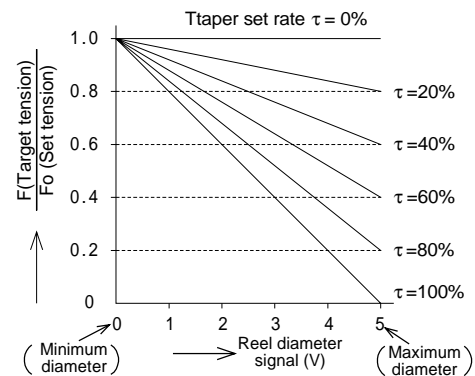
[2] When the control output of this controller is 100%, the torque generated by the actuator will be regarded as T_{max} . The target tension is reduced depending on the winding diameter as shown in the right figure.



4. External reel diameter signal method

- The reel diameter signal function is assigned to the AI1 or AI2 input terminals. Depending on the obtained reel diameter, 0 to 5 V signal will be associated (0 V for minimum diameter, 5 V for maximum diameter).
- The target tension will be subject to change depending on the winding diameter signal as shown in the right figure (linear characteristic).
- To use the reel diameter signal, select item number 51 in the adjustment mode, and then assign it to the reel diameter signal function to the AI1 or AI2 terminal.


- - - - - Refer to Sec. 6.2.

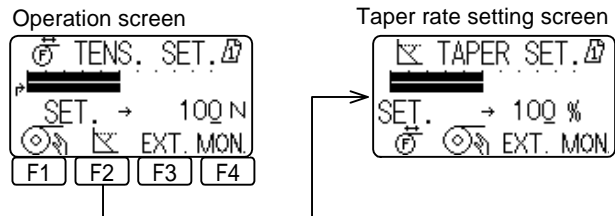


5. Taper rate setting

- Set the taper rate using one of the following methods.

[1] Set the taper rate using the taper rate setting screen.

- On the normal operation mode screen, press the function key  to move to the taper rate setting screen, and then set the taper rate using the setting dial(16).



(ex.) From tension setting screen in automatic operation mode to taper rate setting screen.

[2] Set the taper rate using the external analog voltage signal.

- Assign the taper rate setting signal to either [AI1] or [AI2], and set the taper rate using this signal.

- Reel diameter internal calculation method

----- Input voltage = 0 to 5 V → Taper rate = 0 to 80%

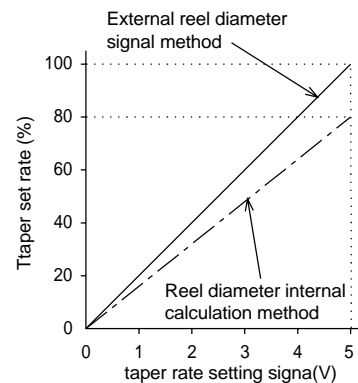
- External reel diameter signal method

----- Input voltage = 0 to 5 V → Taper rate = 0 to 100%

- To use the taper rate setting signal, select item number 51 in the adjustment mode, and then assign the taper rate setting signal function to the [AI1] or [AI2] terminal.

----- Refer to Sec. 6.2.

- When the taper rate setting signal function is assigned to either [AI1] or [AI2], the taper rate cannot be set by using the setting dial(16) on the panel.



5.5 Adjustment of control gain

- If the tension is not stabilized during automatic control, adjust the proportional gain or the integral time.
- When starting the machine, or after changing the set tension value, if it takes a long time to obtain the target tension, adjust the additional gain or dead band width.

1. Proportional gain and integral time - - - - - Item number: 40

- If the tension is not stabilized during automatic control, adjust the proportional gain or the integral time.

[1] Proportional gain

- The proportional gain corrects the output in proportion to the deviation between the target tension value and the operating tension value.
- When a large value is set, the target tension is reached faster but fluctuation easily occurs.
- Setting range- - - - 0 to 100% - - - Initial value = 50%
- When this value is changed by +12%, the correction of output will be twice as larger as the previous correction.

[2] Integral time

- The integral time determines the time responsibility against the deviation between the target tension value and the operating tension value.
- When a small value is set, the controllability is improved but fluctuation easily occurs.
- When a large value is set, the control is stabilized but the response at the time when the unit is activated, the tension set value is changed, etc. is deteriorated.
- Setting range- - - - 0 to 100% - - - Initial value = 50%
- When this value is changed by +12%, the time constant will be twice as large as the previous value.

- Gradually change the integral time and the proportional gain in turns.
- Setting screen

```
40CONTROL GAIN/INT. TIME
PRO. GAIN → 100 %
INT. TIME → 100 %
```

2. Additional gain and dead band width - - - - Item number: 41

- The dead zone gain and dead band width are not required to be changed in normal cases. However, adjust these values if it takes too a long time to reach the target tension when starting the system, changing the tension settings, etc.

[1] Additional gain

- If the current tension value is out of the dead band width of the target tension, the additional gain set here will be added to the proportional gain.
- When a large value is set, the time required until the deviation enters the dead band range can be made shorter. However, if the set value is too large, fluctuation easily occurs. Enter a value with which appropriate response can be obtained when combined with the dead band width and the proportional gain.
- Setting range- - - - 0 to 100% - - - Initial value = 0%

[2] Dead zone width

- The dead zone width specifies the deviation between the current tension and the target tension generated when the proportional gain is changed over.
- When a small value is set, the additional gain will be added to the proportional gain for a longer time, and the responsibility becomes faster but fluctuation easily occurs.
- Setting range- - - - 0 to 50% - - - - Initial value = 50%
("±%" of full-scale tension value)

- Setting screen

```
41CONTROL GAIN/DEADBAND
ADD. GAIN → 100 %
DEADBAND → 50 %
```

6. Functions of Input/Output Signals

6.1 Contact input signals

1. Run / stop signal - - - - - [RUN] – [MIC]

- Turn ON and OFF this signal according to the run or stop operation for the machine.
- In the automatic control mode, when the [RUN] input signal is turned ON, the automatic operation will be started.
- For the operation of this signal, refer to Sec. 5.1.

Caution: To perform automatic operation, be sure to turn the [RUN] input signal OFF and ON according to the machine operation status (run or stop). If this signal is kept at the ON status, restarting the operation of the stopped machine may apply extremely strong tension to the material, and the material may fracture.

2. General contact signals - - - - - { [MI1], [MI2], [MI3] } – [MIC]

- Select item number 50 in the adjustment mode, and then assign the following functions to the general contact signals (MI1, MI2, and MI3).
- When the following functions are not necessary, it is not necessary to assign the following functions.

(1) Output memory signal

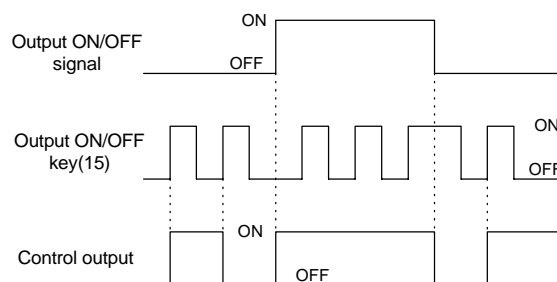
- Signal to store the output value when the [RUN] input signal is turned OFF. For a detailed description, refer to Sec. 5.2.2.

(2) Output gain 1, output gain 2 signals

- Signals to correct the tension changed from the inertia of the reel during the acceleration or deceleration. For a detailed description, refer to Sec. 5.3.

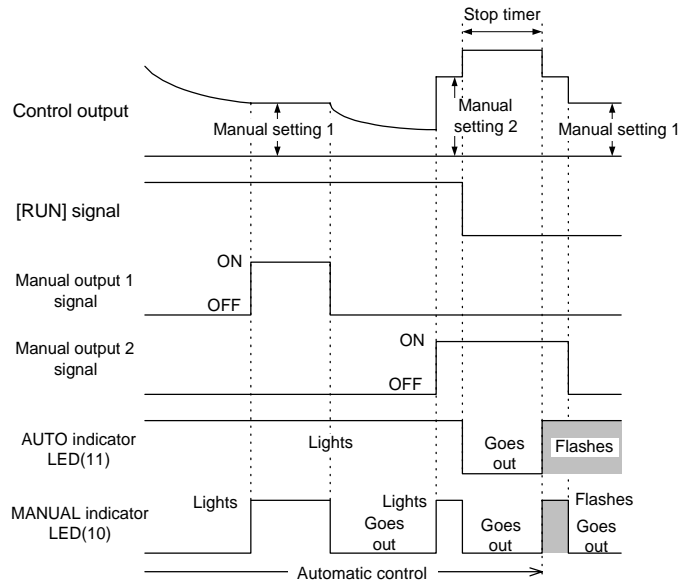
(3) Output ON/OFF signal

- When this signal is turned ON, the control output will be sent out irrespective of the ON/OFF status of the output ON/OFF key(15) on the panel.
- When this signal is turned OFF, the output ON/OFF key(15) on the panel will be enabled. Pressing the output ON/OFF key(15) will turn ON or OFF the control output.
- When the control output is turned On, the OUTPUT ON/OFF indicator LED will light.



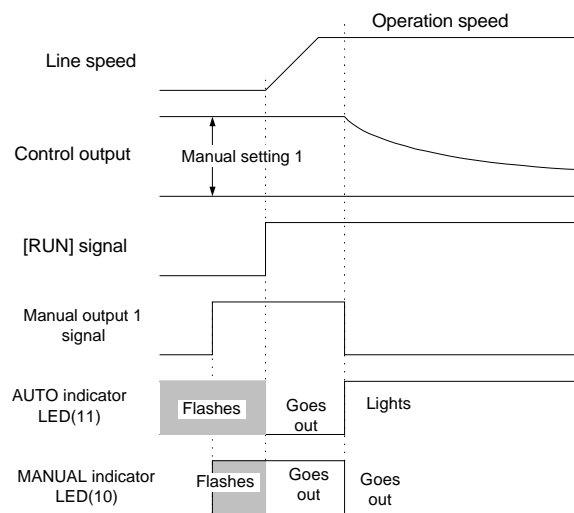
(4) Manual output 1/ Manual output 2 selection signal

- Signals to switch the manual output to manual output 1 or manual output 2.
- When these signals are OFF, the manual output 1 will be selected.
- During automatic control, when the manual output signal 1 or 2 is turned ON, the control output will be fixed to manual output 1 or 2.
- During automatic control, when these signals are turned OFF, automatic control will be started using the output obtained when turning OFF the signal.



- At starting the machine, by using manual output signal 1 and [RUN] input signal as shown in the following sequence diagram, the control output can be fixed during acceleration, and change in the tension can be reduced during acceleration at starting the machine.

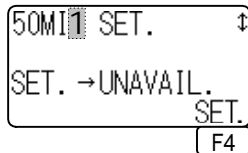
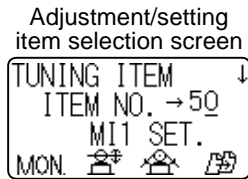
----- Refer to Sec. 5.1.1.



3. Function setting

----- Item number: 50

- In the adjustment mode (power ON with DIP. SW8 OFF), select item number 50, and then set the function of the input contact signal (MI1, MI2, or MI3).



On the adjustment/setting item selection screen, select item number 50, and then press the ▼ key.

After selecting MI1, MI2, or MI3 with a screen selection keys (6) (▲ and ▼ keys), select a function for MI1, MI2, or MI3 using the setting dial(16), and then the function is selected by pressing the [SET] key.

When the function already set is specified, the function will be displayed as “UNAVAIL”.

- Turn the setting dial(16). The following items will appear in the following order, and the displayed functions are assigned to the MI1, MI2, or MI3.
 - (1) Output memory
 - (2) Output gain 1
 - (3) Output gain 2
 - (4) Output ON/OFF
 - (5) Manual output 1
 - (6) Manual output 2

6.2 Analog input signals

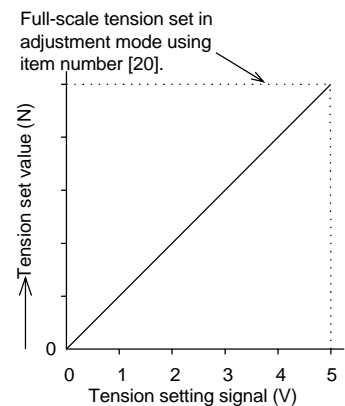
1. Functions of analog input signals

----- { [AI1], [AI2] } – [AIC]

- Select item number 51 in the adjustment mode, and then assign the following functions to the analog input signals (MI1, MI2, and MI3).
- When the following functions are not necessary, it is not necessary to assign the following functions.

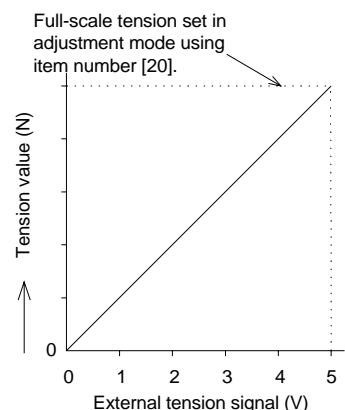
(1) Tension setting signal

- Enter the signal to set the tension for automatic operation using the external analog voltage.
- For the input voltage range 0 to 5 V, the tension set range will be 0 to full-scale tension.
- When the function of the tension setting signal is assigned to the [AI1] or [AI2], the tension cannot be set by using the setting dial(16) in the panel.



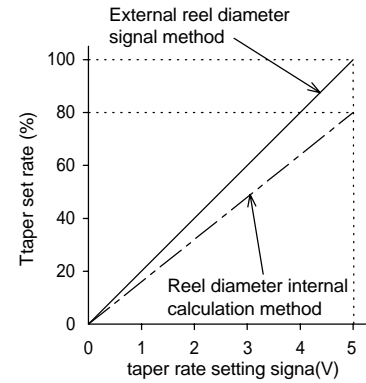
(2) External tension signal

- Input the tension signal excluding the signal of the LX-TD tension detector.
- For the input signal range 0 to 5 V, the tension range will be 0 to full-scale tension.
- When the function of the external tension signal is assigned to the [AI1] or [AI2], the input signal from the tension detector to the [GRL] – [WHL], or [GRR] – [WHR] will be ignored.



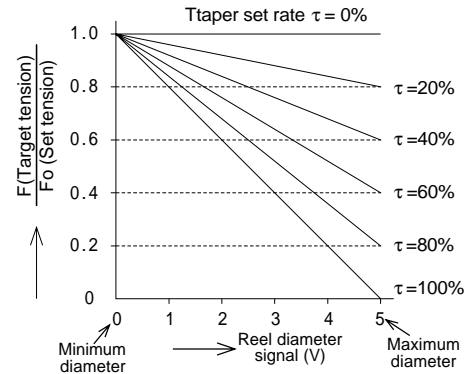
(3) Taper rate setting signal

- Enter the signal to set the taper rate for taper control using the external analog voltage.
 - Reel diameter internal calculation method
 - - - Input voltage = 0 to 5 V → Taper rate = 0 to 80%
 - External reel diameter signal method
 - - - Input voltage = 0 to 5 V → Taper rate = 0 to 100%
- When the taper rate setting signal function is assigned to the [AI1] or [AI2], the taper rate cannot be set from using the setting dial(16) on the panel.



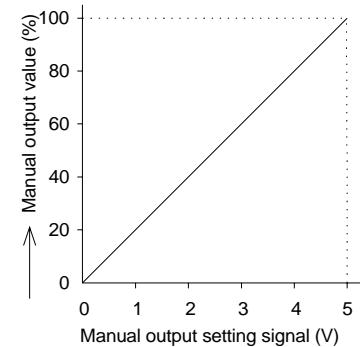
(4) Reel diameter signal

- Enter the reel diameter signal when the external reel diameter signal method is used.
- Enter the voltage range 0 to 5V for the minimum diameter to maximum diameter.



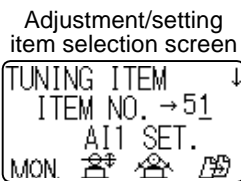
(5) Manual output setting signals 1 and 2

- Set the manual output using the external analog voltage.
- For the input voltage range 0 to 5 V, the output range will be 0 to 100%.
- When the function of the manual output setting signal is assigned to the [AI1] or [AI2], the manual output 1 or 2 cannot be set using the value setting dial(16) on the panel.

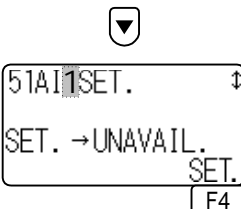


2. Function setting -----Item number: 51

- In the adjustment mode (power ON with DIP. SW8 OFF), select item number 51, and then set the function of the analog input signal (AI1, AI2).



On the adjustment/setting item selection screen, select item number 51, and then press the ▼ key.



After selecting AI1 or AI2 with a screen selection keys (6) (▲ and ▼ keys), select a function for AI1 or AI2 using the setting dial(16), and then the function is selected by pressing the [SET] key. When the function already set is specified, the function will be displayed as “UNAVAIL”.

- From turning the dial(16), the following items will appear in the following order, and the displayed functions are assigned to the [AI1] or [AI2].
 - (1) Tension setting signal
 - (2) External tension signal
 - (3) Taper rate setting signal
 - (4) Reel diameter signal
 - (5) Manual output setting signal 1
 - (6) Manual output setting signal 2

6.3 Output signals

1. Powder clutch/brake control output - - - - - [PP] – [PN]

- Control output for powder clutch/brake of 24 VDC and 3 A or less.

2. Control the output for the power amplifier and AC servo amplifier - - - - [TOUT] – [AOC]

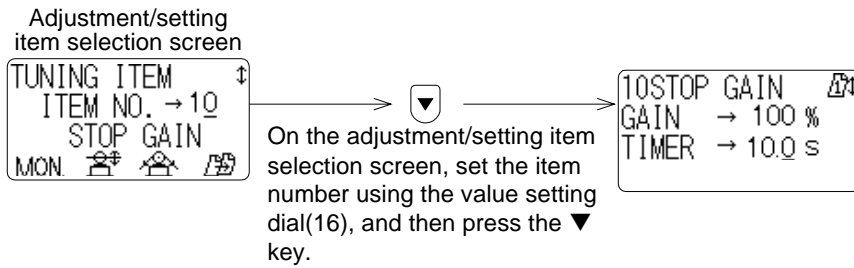
- (1) To use the powder clutch/brake having a rated current of 3 A or more, input this signal to the power amplifier compatible with the rated current of the powder clutch/brake, and connect the powder clutch/brake to the output terminal of the power amplifier.
- (2) To control a servomotor in torque control mode, input this signal to the torque setting input terminal of the servo amplifier.

3. Tension monitoring output - - - - - [AO1] – [AOC]

- The monitoring output signal outputs voltage in proportion to the target tension value for automatic control or the material tension value detected by the tension detector.
- Set the signal type by DIP switch 4.
 - DIP switch 4 = ON - - - - - Tension set (target tension) monitoring output
 - DIP switch 4 = OFF - - - - - Tension monitoring output
- For the output voltage range 0 to 5 V, the tension range will be 0 to set full-scale tension value.

7. Setting Items and Functions

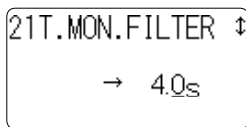
- In the adjustment mode (power ON with DIP. SW8 OFF), set the following functions.
- When the following functions are not necessary, it is not necessary to change the initial values.



7.1 Filter time constant setting

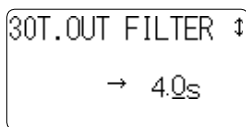
1. Tension display filter time constant ----- Item number: 21

- Set the display filter to indicate the operation tension on the monitor display(7).
- When this value is increased, the responsibility of the display may be deteriorated. When the indicated value fluctuates, and is difficult to read, increase this value to easily read the value.
- Setting range - - - - 0.2 to 4.0 sec- - - - - Initial value = 2.0 sec
- Setting screen



2. Tension output filter time constant ----- Item number: 30

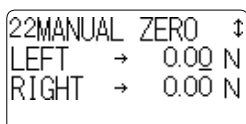
- Set the filter time constant for the output of the tension monitor (AO1 or AOC).
- Setting range - - - - 0.2 to 4.0 sec- - - - - Initial value = 2.0 sec
- Setting screen



7.2 Adjusting the zero point or span of the tension detector

1. Manual zero point adjustment - - - - - Item number: 22

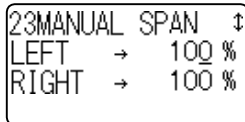
- When the zero point of the tension detector is shifted from the right point after stopping the machine, the zero point indicated on the display can be manually adjusted .
- The correction value setting here will be added to the tension signal output from the tension detector, and automatic control will be performed using this corrected tension signal.
- When the auto zero tuning or auto span tuning is performed, the correction value will be reset to zero.
- Setting range - - - - - - 1000 to +1000 (N, ×10N) - - - - -Initial value = 0
- Setting screen



2. Manual span adjustment

- - - Item number: 23

- When an error message “OVERLOAD”, “UNBALANCE”, or “LESS LOAD” may appear and tuning may not be completed after the auto span tuning, the span can be manually adjusted.
- When the load at span tuning is “Wt” and the displayed load is “Wd”, set the following correction value.
 - Manual span correction value = $(Wt / Wd) \times 100 \%$
- When the auto zero tuning or auto span tuning is performed, the correction value will be reset to 100%.
- Setting range - - - - 50 to 300 %- - - - - Initial value = 100 %
- Setting screen

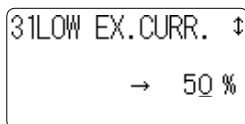


23MANUAL SPAN ↓
LEFT → 100 %
RIGHT → 100 %

Caution : After the manual span adjustment, test run can be performed. However, at this status, the control accuracy may not be ensured, or the tension detector may be overloaded. For this reason, be sure to check the error message, and solve the problem. After that, when the auto span adjustment is completed, restart to operation.

7.3 Low excitation when turning OFF the output ----- Item number: 31

- Even if the control output is turned OFF by the output ON/OFF key(14) on the panel or the input contact signal having the output ON/OFF function, this signal (weak excitation signal) will not completely drop the output to zero, but will weakly excite the powder clutch/brake.
- Low excitation is effective to the starting torque at a low speed or to improvement the torque when starting.
- When the material is removed, low excitation will be output so that the reel can be rotated (5 to 10% normally).
- Setting range
 - Low excitation setting - - - - - 0 to 50 % - - - - - Initial value = 0 %
- Setting screen

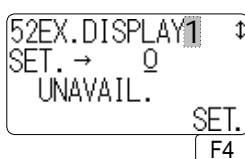


31LOW EX.CURR. ↓
→ 50 %

7.4 Extension screen setting (Addition of operation mode screen)

- - - - - Item number: 52

- Normally, adjustment item setting screens can be displayed in the adjustment mode only. However, by setting the extension screen, up to 2 adjustment item setting screens can be added to the operation mode screens, thus can be displayed in the normal operation mode.
- Screens having an adjustment item number can be set to the extension screens, and can be displayed in the operation mode.
- Set the item number using the setting dial(16) and then press the [SET] key. The adjustment item setting screen corresponding to the set item number can be set as a extension screen.
- When the corresponding screen is already set, the setting will be displayed as “UNAVAIL” (0).
- Setting screen



52EX.DISPLAY1 ↓
SET. → 0
UNAVAIL.
SET.
F4

- Press the [EXT.] function key to display the extension screen in the operation mode. When 2 screens are added, use the screen selection keys(6) to switch the displayed screen.
- On the bottom line of the extension screen, pictograms showing the functions of the function keys will appear.

8. Other Functions

8.1 Menu function

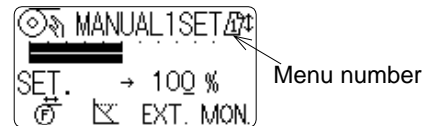
- 8 types of operation data can be stored or read, and also the data can be copied between different menu numbers by using the menu function .
- This menu function is useful to process materials having different operation conditions.

1. Switching menu number

- Press the ► key of the menu selection key(17) and the menu number will be incremented by one, and press the ◀ key and the menu number will be decremented by one. The operation data corresponding to the menu number will be valid.

When the menu number is “8”, pressing the ► key will go to menu 1. When the menu number is “1”, pressing the ◀ key will go to menu 8.

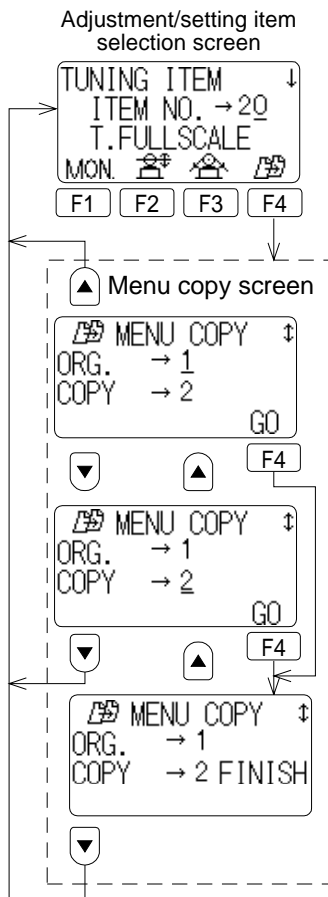
- The menu number will appear at the upper right section of the liquid crystal display. (The menu number will be displayed only when the screen data can be stored in the menu function.)



2. Data storage

- In the list of setting items, the items marked with ○ in the “Menu” can be stored. ----- Refer to Sec. 12.3.
- The data displayed on the screen can be stored by assigned the displayed menu number.
- Initial setting value is preliminarily stored for each menu number.

3. Data copy between menus



- [1] Turn OFF DIP switch 8, and then turn ON the power to enter the adjustment mode.
- [2] Press the [F4] function key to move to the menu copy screen.
- [3] Set the original menu number by the ► or ◀ key of the menu selection key(17).
- [4] Set the copy destination menu number by the setting dial(16).
- [5] Press the [GO] key.

8.2 Keyin function

- Use the keyin function to protect the set values from being changed by mistaken operation.
- In the list of setting items, the items marked with O in the “Keyin” column can be set the keyin function.
----- Refer to Sec. 12.3.

[1] keyin method

- Display the corresponding item on the LCD display(5), and then press and hold the keyin key(1) for 5 seconds or more.
- When the keyin function is activated, the keyin indicator LED(2) will light, but the under-cursor positioned at the last digit of the set value that indicates the value can be changed will disappear.

[2] How to cancel keyin function

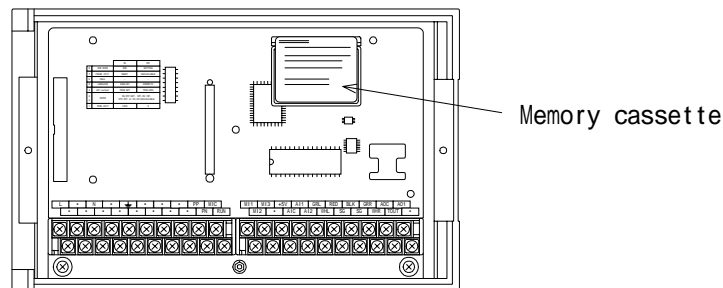
- Press and hold the keyin key(1) for 5 seconds or more again to cancel the keyin function. When canceled, the keyin indicator LED(2) will extinguish.

8.3 Memory cassette

- Excluding the external input signal data, all the set data can be written, read, and compared between the LE-30CTA tension controller and the memory cassette.

1. Applicable memory cassette

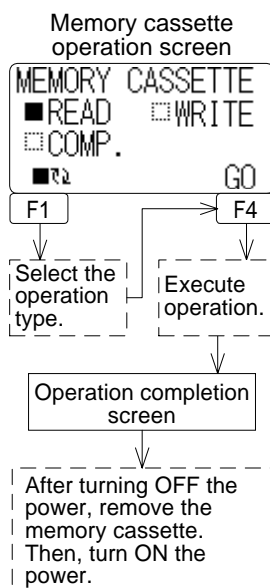
- Place the FX-EEPROM-4 or FX-EEPROM-8 memory cassette in the position shown in the following figure.



⚠ DANGER

- Before removing or installing the memory cassette, be sure to externally cut OFF the power to all the phases. If power to all the phases are not cut OFF, you may receive an electric shock, or the product may be seriously damaged.

2. How to write, read, and compare data



[1] Set the memory cassette, and then turn ON the power to enter the memory cassette operation mode.

[2] Press the [F1] function key to switch the operation type, and then determine the operation type with the display of [■].

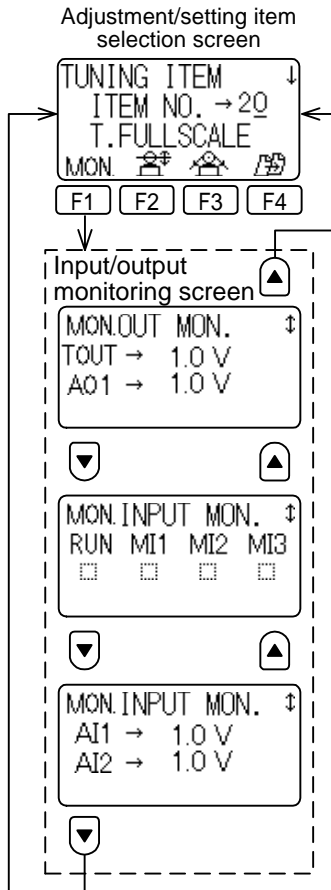
- READ- - - Reads out the data from the memory cassette to the tension controller.
- WRITE- - - Writes the set data of the tension controller in the memory cassette.
- COMP.- - - Compares the data of the tension controller with the data stored in the memory cassette.

[3] Press the [GO] key to perform the specified operation.

[4] Turn OFF the power, and then remove the memory cassette.

8.4 Monitoring of input/output signals

- In the adjustment mode, the conditions of the input signals can be monitored using the LCD display. (The signal conditions cannot be monitored in the operation mode.)



[1] Turn OFF DIP switch 8, and then turn ON the power to enter the adjustment mode.

[2] Press the [F1] function key to move to the input/output monitoring screen.

[3] Using the screen selection keys(6), go to the screen of the item to monitor.

• Output signal monitoring screen

- Monitor the voltage of the control output [TOUT] and the tension monitoring or tension set monitoring output [AO1].

• Contact input signal monitoring screen

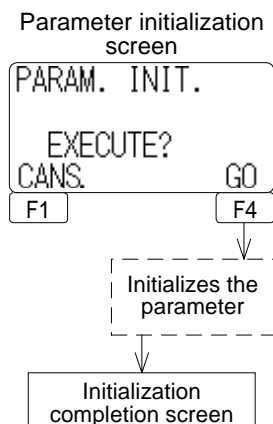
- Monitor the ON / OFF statuses of the run/stop signal [RUN] and the general contact signals [M1],[M2], and [M3]. When a signal is in the ON status, the symbol [■] will appear.

• Analog input signal monitoring screen

- Monitor the voltages of the general analog input signals [AI1] and [AI2] signals.

8.5 Parameter reset

- A parameters can be reset to the default factory parameter setting. Carefully use this function because all the parameter will be reset and the system will be reset to the initial factory setting.



[1] Turn ON DIP switch 7, and then turn ON the power to enter the parameter initialization mode.

[2] Press the [GO] key to initialize the parameter.

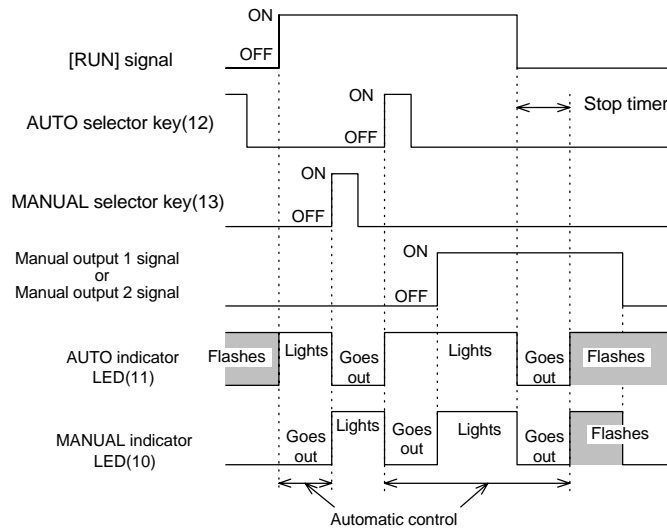
8.6 Status of the AUTO and MANUAL indicator LEDs

(1) AUTO indicator lamp(11)

- This LED will light in the automatic control mode. However, even in the automatic control mode, when the stop timer is activated, this LED will go out.
- This LED will flash when the [RUN] input signal is turned OFF.

(2) MANUAL indicator lamp(10)

- This LED will light in the manual control mode or manual output 1 or 2 is set by the external contact signal. However, even in this condition, when the [RUN] input signal is turned OFF, this LED will flash.
- This LED will extinguish when the stop timer is activated.



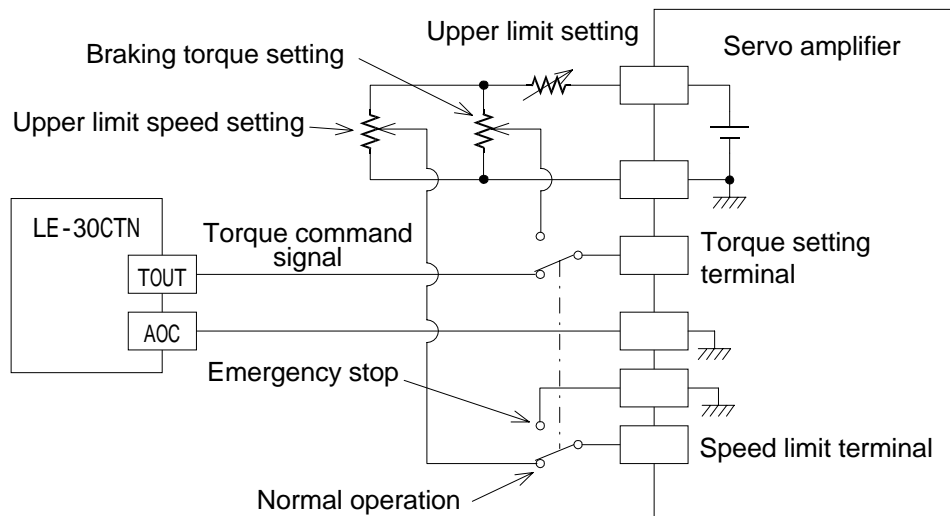
9. To Use AC Servomotor

- Using the control output signal [TOUT] – [AOC], the torque controllable AC servomotor can be used with this tension controller.

(1) Wiring example

- Input the following signals to the torque setting terminal or the speed control terminal of the servo amplifier.

	Torque setting terminal	Speed limit terminal
During operation and during normal stop	[TOUT] – [AOC] signal of LE-30CTN	Upper speed limit setting signal
Emergency stop	Braking torque setting signal	0V



(2) Setting

- Set the following items for the servomotor.
 - [1] Control mode - - - - - Set the torque control mode.
 - [2] Output torque - - - - - Set the output torque so that the output torque of the servomotor is equal to the rated torque when the torque command signal is 5 V.

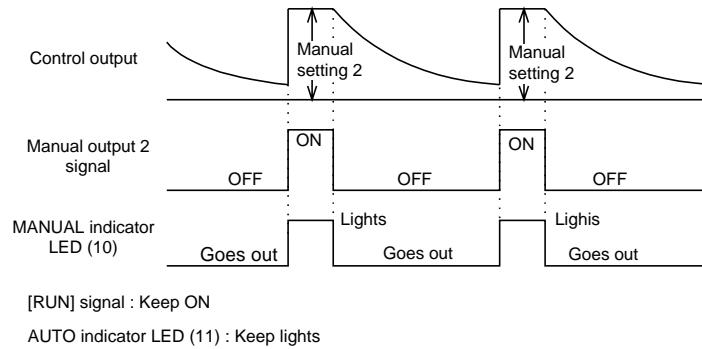
Note

- For a detailed description of wiring or setting, refer to the instruction manual of the servo amplifier.
- Select the optimum servomotor considering the machine operation conditions, such as necessary operation speed range and operation torque range.

10. To Use two-reel switching

- Using the function of manual output 2, two-reel switch over operation in the two-reel operation can be made.

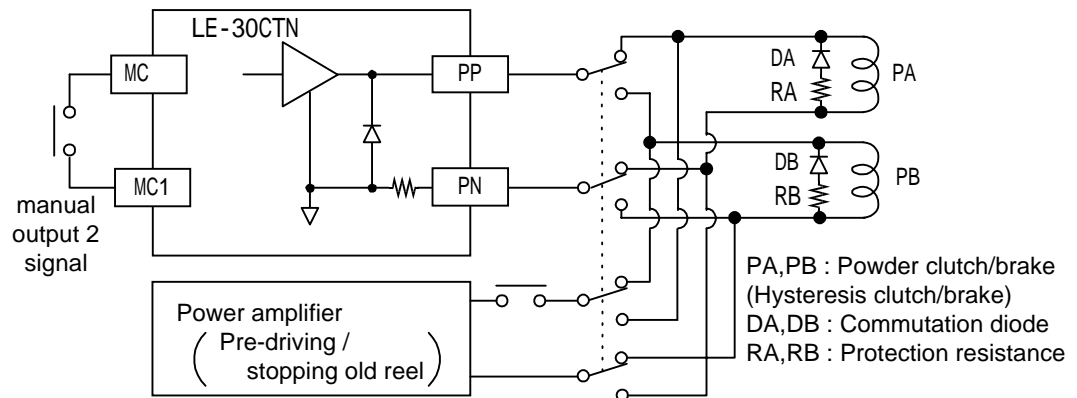
- In the adjustment mode, select item number 50, and assign the manual output 2 signal function to the input contact terminals (MI1, MI2 or MI3).
- Set the optimum output value for the new reel at the end of switch over operation to the manual setting 2.
- In the automatic operation, turn ON or OFF the manual output 2 signal as shown in the following sequence diagram.



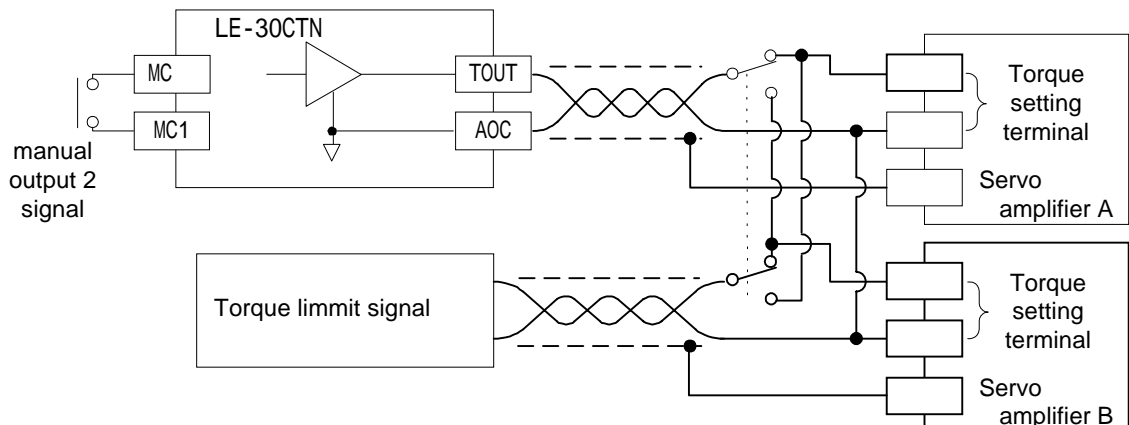
- Automatic control is performed during the manual output 2 signal is at the OFF status.
- Turn ON the manual output 2 signal when the controlled reel is switched from old reel to new reel.
- When the manual output 2 signal is turned ON, the control output is reset to the manual setting 2 and keep that value during the manual output 2 signal is at the ON status.
- When the manual output 2 signal is turned OFF, automatic control will be started using the output of the manual setting 2.

- Wiring example

- When a powder clutch and a brake are used.



- When AC servo motor is used (As to the use of the servo motor, refer to Page 36.)



11. Inspection and Maintenance

11.1 Initial inspection

1. Confirmation of selection

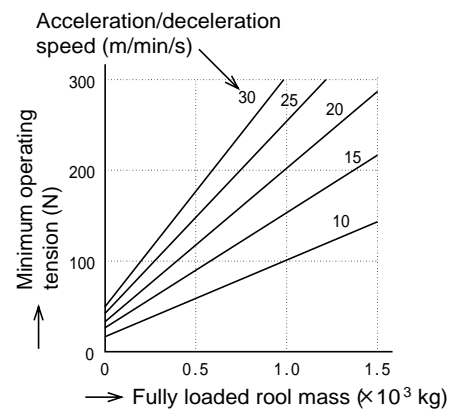
- Before starting operation, check that the selected tension detector, actuator, power amplifier, servo amplifier, etc. are optimal for operation.
- The actuator capacity is determined based on the “line speed × operating tension”. The LE-30CTN tension controller, however, can set the higher tension than this operating tension. If such a high tension is set for operation, the actuator may be overloaded and burned out.
For this reason, be sure to check whether the operator knows the upper limit of the operating tension, and request the operator not to set any high tension that may overload the actuator.
- If the set tension is too low, the tension may fluctuate due to the inertia of the reel at the starting or stopping operation or during acceleration or deceleration, and such fluctuation of the tension may cause difficulty in operation.
For this reason, check whether the operator knows the minimum operation tension.
- The minimum drive tension which can be driven in torque control method can be calculated approximately using the following formula.

$$\frac{f}{W+0.2} > 8.5 \left(\frac{V}{t}\right)$$

f : Minimum operating tension (N)

W : Fully loaded reel mass ($\times 10^3$ kg)

$\left(\frac{V}{t}\right)$: Acceleration/deceleration speed (m/min/s)



2. Operation sequence check

- Check the operation sequence and the emergency stop sequence.
- Especially when the servo motor is used as an actuator, the motor may become out of order if the material is cut. (The motor will rotate at the upper limit operation speed set for the speed limit terminal.) Set the upper limit speed using the upper limit speed setting resistor as described in page 37. In addition, set the material cut detector so that the motor speed can be reduced to zero after detection of material cut.

3. Wiring check

- Erroneous connection of the power terminal (Pay attention to the phase order in the motor system also.), contact of the input/output cable with the power cable, and short-circuit of the output cable may cause serious damage.
- Before turning on the power, make sure that the power and ground are connected correctly and that the input/output cable is wired correctly.
- Never perform the megger test (measurement of insulation resistance).

11.2 Maintenance

1. Periodical check

- Periodically check the following items.

- [1] Check that the inside of the panel is not abnormally heated by a heat generating substance or direct sunlight.
- [2] Check that there is not any dust or conductive dust in the panel.
- [3] Check the wires and terminals for looseness and other problems.

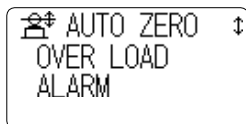
2. Tension detector

- It is recommended that the zero point and the span should be adjusted again by periodical inspection. Especially when a tension detector used has a larger rated load compared with the actual tension, the mechanical stress of the tension detector may contribute considerably to aging deterioration.

11.3 Error display

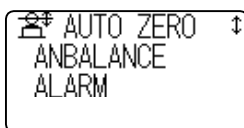
- When an error message appears on the LCD display, solve the problem as follows.

1. At zero tuning of tension



The detector roller may be too heavy for the rated load of the tension detector.

Check the mass of the detector roller. If necessary, reduce the mass of the detector roller, or select the tension detector again and replace with another type of detector.



[1] The difference between the signal voltages output from the right and left detectors exceeds 50% of the output voltage of the rated load.

Check the specifications of the right and left tension detectors, and also check the right and left detector rollers for heart gap, etc.

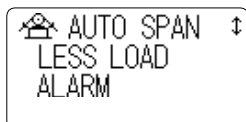
[2] When only one detector is used, press the [▼] key. The span adjustment will be completed.

2. At span tuning of tension detector



An extremely large static load is applied during span tuning.

The rated load of the tension detector may be too small for the operation tension. Check the full-scale set value and the rated load of the tension detector.



[1] An extremely small static load (30% or less of the full-scale set value) applied during span adjustment. Increase the load, and then apply the static load again.

[2] The rated load of the tension detector may be too large for the operation tension. Check the rated load of the tension detector.



[1] The difference between the signal voltages output from the right and left detectors exceeds 50% of the output voltage of the rated load.

Check that the rope hanging the weight is at the center of the detector roller. Also check the specifications of the right and left tension detectors, and check the distance directly from the center for the right and left detector rollers, etc.

[2] When only one detector is used, press the [▼] key. The span adjustment will be completed.

11.4 Unusual check

- When an error occurs during the test run or actual operation, solve the problem referring to the following table.

Item	Problem	Disposal
Power supply	When the power is turned on, the power indicator LED(3) is not lit.	<ul style="list-style-type: none"> • Make sure the supply voltage between the terminals [PSL] and [PSN] is 100 to 240VAC (+10% to -15%), 50/60 Hz. If this value is not correct, perform the correct wiring. • The fuse may be melted by insertion of foreign objects or abnormal loads. If simply replacing the fuse may not solve the problem. Contact our service department.
Abnormal tension	When restarting after stopping the material, the tension reading goes beyond the scale from the beginning.	<ul style="list-style-type: none"> • Turn ON or OFF the [RUN] input signal depending on the run/stop status of the machine . If the [RUN] input signal is kept at on status, restarting operation may send out the maximum control output, and an extremely high tension may be applied. • When stopping the machine, if the turning-OFF timing of the [RUN] input signal is delayed, the control output may be extremely increased, and an extremely high tension may be applied at starting operation. To prevent this problem, be sure to turn OFF the [RUN] input signal when stopping the machine.
	Fluctuating tension control	<ul style="list-style-type: none"> • Check whether similar fluctuations occurs during manual operation. • Fluctuations during manual operation is generally caused by changes in tension as a result of machine vibration ,mechanical loss,etc. In this case please check the machine. • If fluctuations do not occur during manual operation, this is generally caused by high control gain set by the LE-30CTN tension controller. In this case, please adjust the control gain factor refer to Sec. 5.5.
	After replacement of the material, an extremely high or low tension is applied.	<ul style="list-style-type: none"> • Check that the output set for the OFF status of the [RUN] input signal is optimum for the reel diameter of the replaced material. • Check that the output memory fluctuation is canceled after stopping the machine. ----- Refer to Sec. 5.1, 5.2.
	On the display, the tension value or the unit of the tension flashes.	<ul style="list-style-type: none"> • The tension signal from the tension detector is too high. The applied load may exceed the rated load of the tension detector. Lower the tension set value. • Check the rated load of the tension detector. If no problem is detected, increase the full-scale tension value. (After changing the full-scale tension value, be sure to tune the zero point and the span.)
Abnormal output	The output increases while the machine halts.	<ul style="list-style-type: none"> • The [RUN] input signal may not be turned OFF. • While the machine is stopped, be sure to turn off the [RUN] input signal.
	The control output signal will not be output.	<ul style="list-style-type: none"> • Turn on the control output using the output ON/OFF key(15) on the panel. If this keying cannot turn on the control output, check the rated current of the clutch/brake (should be 3 A or less) and the wiring condition (should not be shorted,etc.). • When the load line is shorted, eliminate the cause. After that, keep the power at the OFF status for a few minutes, and then turn on the power again. • Disconnect the powder clutch/brake line, and check that the voltage is output between [PP] and [PN]. If no voltage is output, the LE-30CTN tension controller is defective. • When [TOUT] and [AOC] are used, check that the load resistance is 1 kΩ or more.
Abnormal input signal	The contact signal and the analog voltage signal are not input properly.	<p>Referring to Sec. 8.4, check the following items</p> <ul style="list-style-type: none"> • Compare the ON/OFF status of the input contact signal with the status shown on the monitor screen. In addition, check the input contact for poor contact. If the input signal is properly turned ON and OFF but the ON/OFF status is not displayed on the monitor, the LE-30CTN tension controller is defective. • Compare the voltage of the analog input terminal with the voltage value displayed on the monitor. Also check that noise is not influencing the input line.

Item	Problem	Disposal
Zero/span tuning impossible	Tuning of the zero point is not possible.	<ul style="list-style-type: none"> • Check that the voltage is approximately 5 VDC between the terminals [RED] and [BLK]. If no voltage is output, disconnect the wire, and check the voltage. No voltage is output after disconnecting the wire, the LE-30CTN tension controller is defective. If voltage is output after disconnecting the wire, the external wiring or the tension detector is defective. • Disconnect the cable of the tension detector, and then short the lines between the [WHR] and [GRR] terminals and between the [WHL] and [GRL] terminals. In this condition, if zero point adjustment is not possible, the LE-30CTN is defective. • Without threading the material through the machine, check the voltage between the white and green lines of the tension detector. If the voltage obtained is out of the ± 120 mVDC range, the selected tension detector is not appropriate (the tare weight is 80% or more of the rated value). In this case, check the mass of the detector roller, and if necessary, reduce the mass of the detector roller, or replace the tension detector with the optimum detector. If the above voltage is in the range of ± 120 mVDC, but zero point adjustment is not possible, the LE-30CTN tension controller is defective.
	Tuning of the span is not possible.	<ul style="list-style-type: none"> • Perform zero tuning at first. Measure the voltage between [WHR] and [GRR] terminals and between [WHL] and [GRL] terminals. • When span tuning is not possible even if the difference between the voltage measured when the material tension is set to 0 and the voltage measured when the material tension is set to full scale value is 30mV or more, the LE-30CTN is defective . • When the difference in voltage is less than 30mV, the tension load applied on the tension detector is insufficient and the tension detector selected is not appropriate. Even if the span tuning is normally completed, the tension detection error increases. Use a tension detector having a less rated load. • If the load is changed while the span is adjusted, adjustment may become disabled .
Others	Changing a set item or set value is not possible.	<ul style="list-style-type: none"> • When the run/stop signal [RUN] is on, some items cannot be change the setting, and items can be change the setting in the adjustment mode only. • Refer to Notes [2] and [3] in Sec. 11.3.

12. Specifications

12.1 Input/output specifications

Item	Terminal name	Specifications			
Power supply	Input	L	<ul style="list-style-type: none"> • 100 to 240 VAC (-15% to +10%) , 50/60 Hz • Power consumption: 400 VA (at 24 VDC, 3A) • Allowable instantaneous power interruption: 10 ms 	<ul style="list-style-type: none"> • Power fuse: 250 V, 8 A \hat{I}^2, built in • Rush current: 30A, 300ms 	
		N			
	Output	RED	<ul style="list-style-type: none"> • 5 VDC, power supply for tension detector • Connect the lead wires of RED=red(+) and BLK=black (-). • The right and left LX-TD type tension detectors (2 detectors in total) can be connected. 		
		BLK			
		+5V AIC			<ul style="list-style-type: none"> • Service power supply for the external variable resistor • 5 VDC, 50 mA or less
Contact signals	Input	MIC	<ul style="list-style-type: none"> • Contact input common terminal 		
		RUN	<ul style="list-style-type: none"> • Run/stop --- ON = automatic operation, OFF = stop 		
	MI1	<ul style="list-style-type: none"> • Select one from the following functions • Output memory • Output gain 2 • Manual output 	<ul style="list-style-type: none"> • Output gain 1 • Output ON/OFF • Manual output 2 	Assign the function to each terminal using item number 50 in the adjustment mode.	
	MI2				
	MI3				
Analog signals	Input	GRL	Left	<ul style="list-style-type: none"> • Tension detector inputs. Connect the lead wires of GR=green and WH=white. • To use the right or left side only, short the line between the GR and WH on the unused side. • The controller will automatically judge the load type of compression or tension. 	8 VDC 4.5 mA/terminal
		WHL			
		GRR			
		WHR			
	AIC	<ul style="list-style-type: none"> • Analog input common terminal 			
	AI1	<ul style="list-style-type: none"> • Select one from the following functions • Tension setting signal • External tension signal • Manual setting signal 1 • 0 to 5 VDC voltage signal or 10kΩ variable resistor 	<ul style="list-style-type: none"> • Winding diameter signal • Taper rate setting signal • Manual setting signal 2 	Assign the function to each terminal using item number 51 in the adjustment mode.	
	AI2				
	Output	AOC	<ul style="list-style-type: none"> • Analog output common terminal 		
TOUT		<ul style="list-style-type: none"> • Control output: 0 to 5 VDC / for power amplifier and AC servo amplifier 		Load resistance: 1 k Ω or more	
AO1		<ul style="list-style-type: none"> • Output for tension monitoring or tension set monitoring, 0 to 5 VDC, • Set the function using DIP switch. 			
PP		<ul style="list-style-type: none"> • For 24VDC powder clutch/brake or hysteresis clutch/brake • 0 to 24 VDC, 3 A or less 			
PN					

12.2 Environmental specifications

Ambient temperature	• 0 to 40°C ---during operation	
Ambient humidity	• 35 to 85% RH (no condensation) ---during operation	
Vibration resistance	• In accordance with JIS C0040---10 to 55Hz 0.5mm (4.9m/s ² max) 2 hours in each axis direction.	
Impact resistance	• In accordance with JIS C0041---98m/s ² 3 times in each axis direction.	
Noise resistance	• By noise simulator with 1,000Vp-p noise voltage, 1 μ s noise width and 30 to 100Hz.	
withstand voltage	• 1,500V AC, 1 minute	Entire terminals as a whole andbetween the ground terminal.
Insulation resistance	• 5M Ω or more by 500V DC megger	
Grounding	• Grounding resistance 100 Ω or less. (Grounding shall not be performed together with any high power system.)	
Operation atmosphere	• Free from corrosive or flammable gas and conductive dust, less dust.	

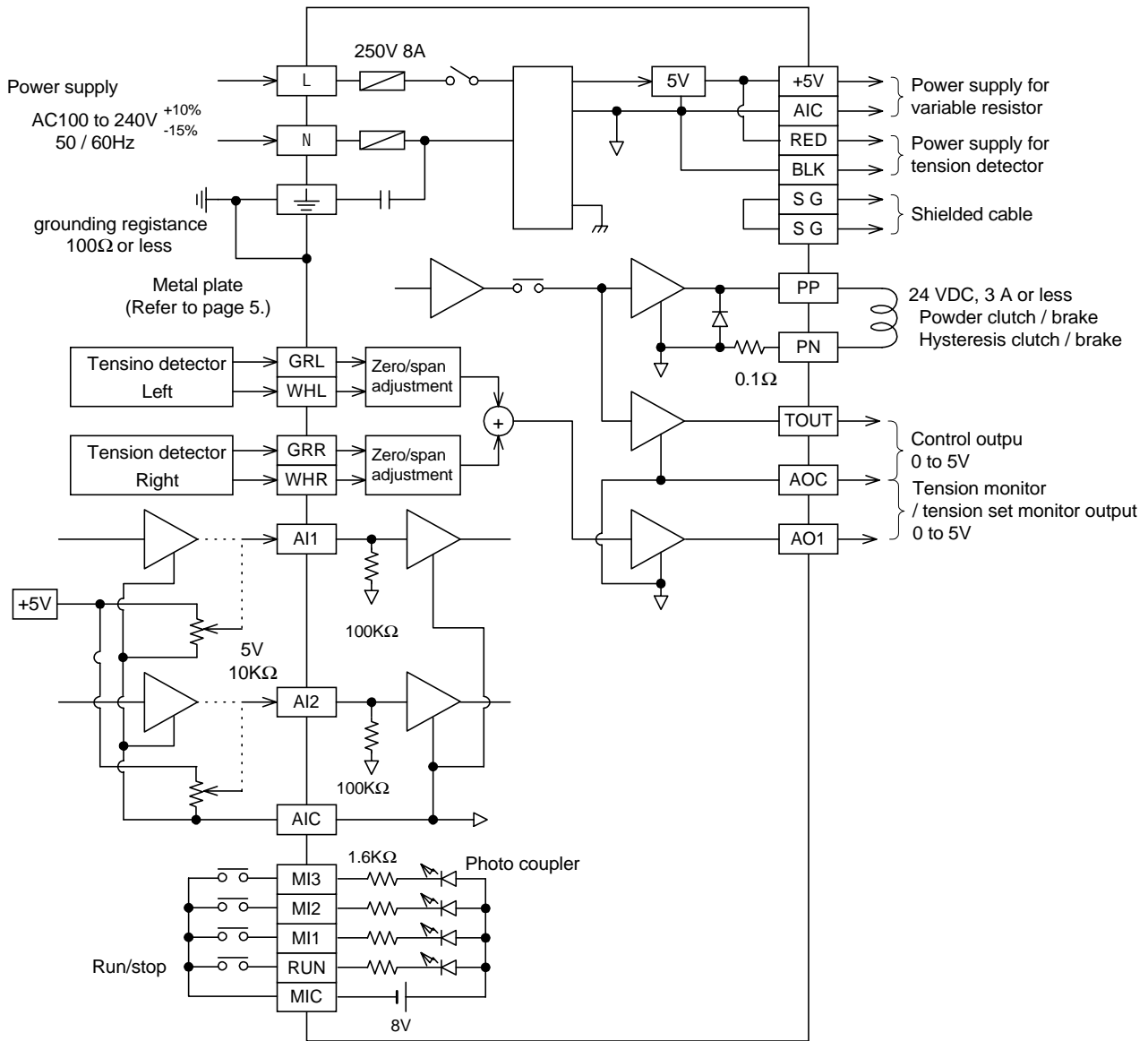
12.3 Set item list

Items of setting	Unit	Range of setting		Initial value	Management of setting		Setting during operation	Keyin	Item No.	
		Minimum	Maximum		Menu	System				
Tension	Tension setting value	N, × 10N	1	Full-scale tension	200	○	×	○	○	1
	Full-scale value	N, × 10N	1	2000	500	×	○	×	○	20
	Decimal point	—	0.01, 0.1, 1		1	×	○	×	○	
	Zero point tuning	—	0	0	0	×	○	×	×	24
	Span adjustment target value	N, × 10N	1 to full-scale tension (1/3 of full-scale value or more is needed.)		500		○	×	×	25
	Manual zero point adjusting	N, × 10N	-999	+999	0	×	○	×	○	22
	Manual span adjusting	%	50	300	100	×	○	×	○	23
Tension display filter time constant	s	0.2 to 4.0		2.0	×	○	○	○	21	
Tension output filter time constant	s	0.2 to 4.0		2.0	×	○	○	○	30	
Manual output setting 1	%	0	100	20	○	×	○	○	2	
Manual output setting 2	%	0	100	20	○	×	○	○		
Taper rate (internal calculation method)	%	0	80	0	○	×	○	○	3	
Taper rate (external signal method)	%	0	100	0	○	×	○	○		
Gain 1	%	5	400	100	○	×	○	○	11	
Gain 2	%	5	400	100	○	×	○	○		
Stop timer	s	0.0	30.0	0.0	○	×	○	○	10	
Stop gain	%	5	400	100	○	×	○	○		
Low excitation setting value	%	0	50	0	×	○	○	○	31	
Control gain	Proportional gain	%	0	100	50	○	×	○	○	40
	Integral time	%	1	100	50	○	×	○	○	
	Additional gain	%	0	100	0	○	×	○	○	41
	Dead band width	%	0	50	50	○	×	○	○	
Selection item	MI1 contact input setting	—	<ul style="list-style-type: none"> • Output memory • Output gain 1 • Output gain 2 • Output ON/OFF • Manual output • Manual output 2 		Not set	×	○	×	○	50
	MI2 contact input setting				Not set	×	○	×	○	
	MI3 contact input setting				Not set	×	○	×	○	
	A11 analog input setting	—	<ul style="list-style-type: none"> • Tension setting signal • Winding diameter signal • External tension signal • Taper rate setting signal • Manual setting signal 1 • Manual setting signal 2 		Not set	×	○	×	○	51
	A12 analog input setting				Not set	×	○	×	○	
Operation screen additional setting 1	—	10	53	0	×	○	×	×	52	
Operation screen additional setting 2		10	53	0	×	○	×	×		
Password setting	—	0	30000	0	×	○	○	○	54	

(Note)

- [1] The data marked with [○] in the “menu” column for the “Management of setting” column can be stored in the menu function or read out from the menu function.
- [2] The data marked with [○] in the “menu” column for the “Management of setting” column can be set in the adjustment mode only. Setting the item in the other modes is not possible.
- [3] The data marked with [×] in the “Setting during operation” column cannot be changed while the run/stop signal [RUN] is ON.
- [4] The items marked with [○] in the “Keyin” column can be set the keyin function.

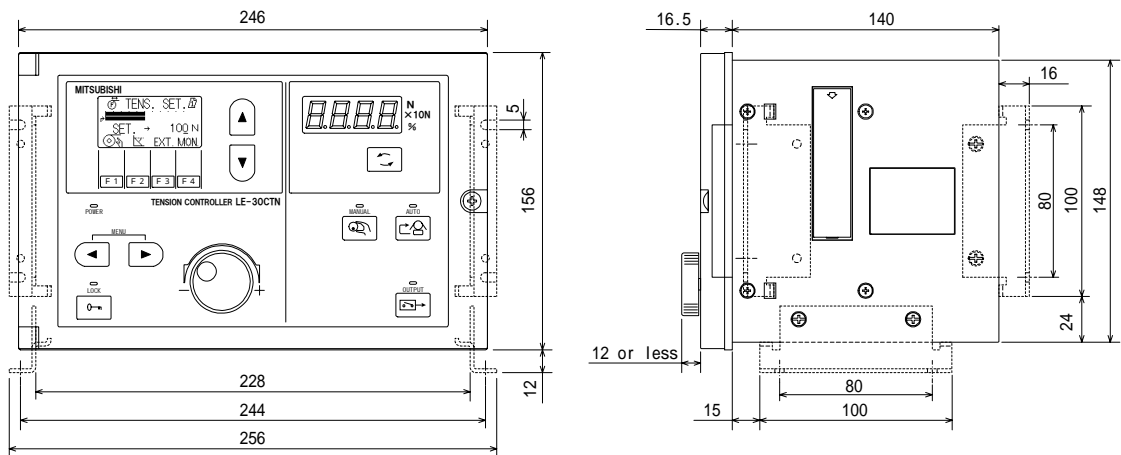
12.4 External wiring diagram and terminal arrangement



L	•	N	•	⏏	•	•	•	•	PP	MIC
•	•	•	•	•	•	•	•	•	PN	RUN

MI1	MI3	+5V	AI1	GRL	RED	BLK	GRR	AOC	AO1
MI2	•	AIC	AI2	WHL	SG	SG	WHR	TOUT	•

12.5 dimensions



Weight : Approx. 3.5 kg
 Color : Munsell 7.5Y 7.5/1

Accessories

- Main unit mounting plates -----One pair
- Screws fixing main unit and mounting plates -----M4×10, 4screws (*)

*Screws of 10 mm or more are not applicable because such screws may make contact with parts inside the main unit.

Use these attached screws to fix the main unit and mounting plates.



Z990D33401A2

TENSION CONTROLLER
MODEL **LE-30CTN**