

TENSION CONTROLLER

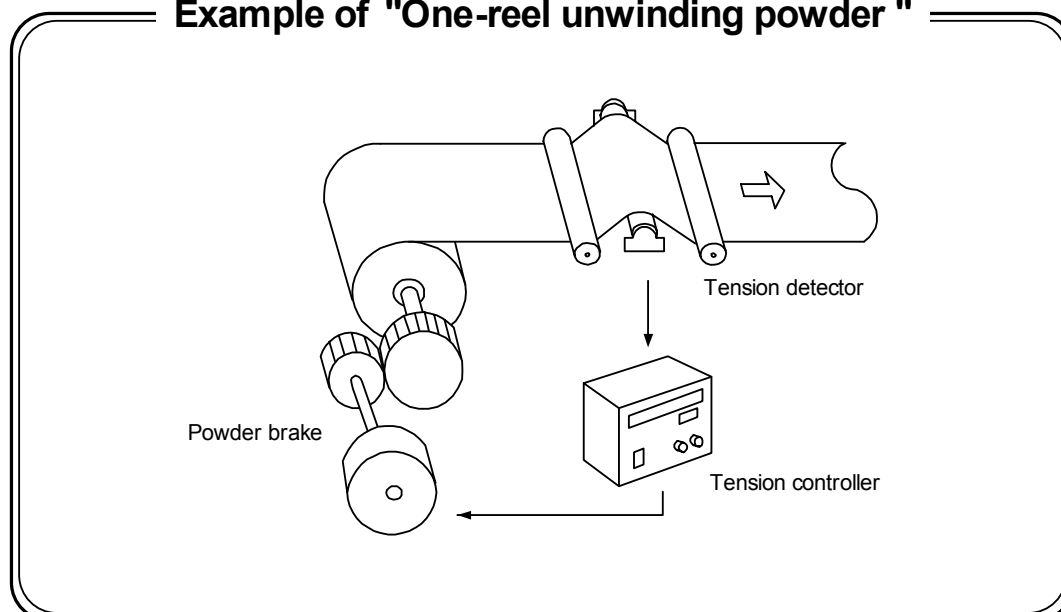
MODEL LE-40MTB-E

INSTRUCTION MANUAL

Introduction:

- This instruction manual describes the minimum necessary operations and functions for the optimum adjustment of machines by using the LE-40MTB tension controller in Sections 1 through 5 taking "One-reel unwinding powder" shown below as an example. Before start setting any systems, thoroughly read these five sections first.
- When mechanism other than "One-reel unwinding powder" is used, read Section 6 "Mechanism other than one-reel unwinding powder" for setting. For the basic items such as the initialization, wiring as well as zero and span adjustment, read Sections 1 through 5.
- When using functions other than the above, read Section 7 "Use of extensive functions" and after.
- Note that this instruction manual is applicable to **system ROM version 5.00 or later**.

Example of "One-reel unwinding powder "




Cautions on Safety


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

To assure safety


- 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 mm² 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 .

 **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 touch a switch with a wet hand .


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


 **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 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 .

 **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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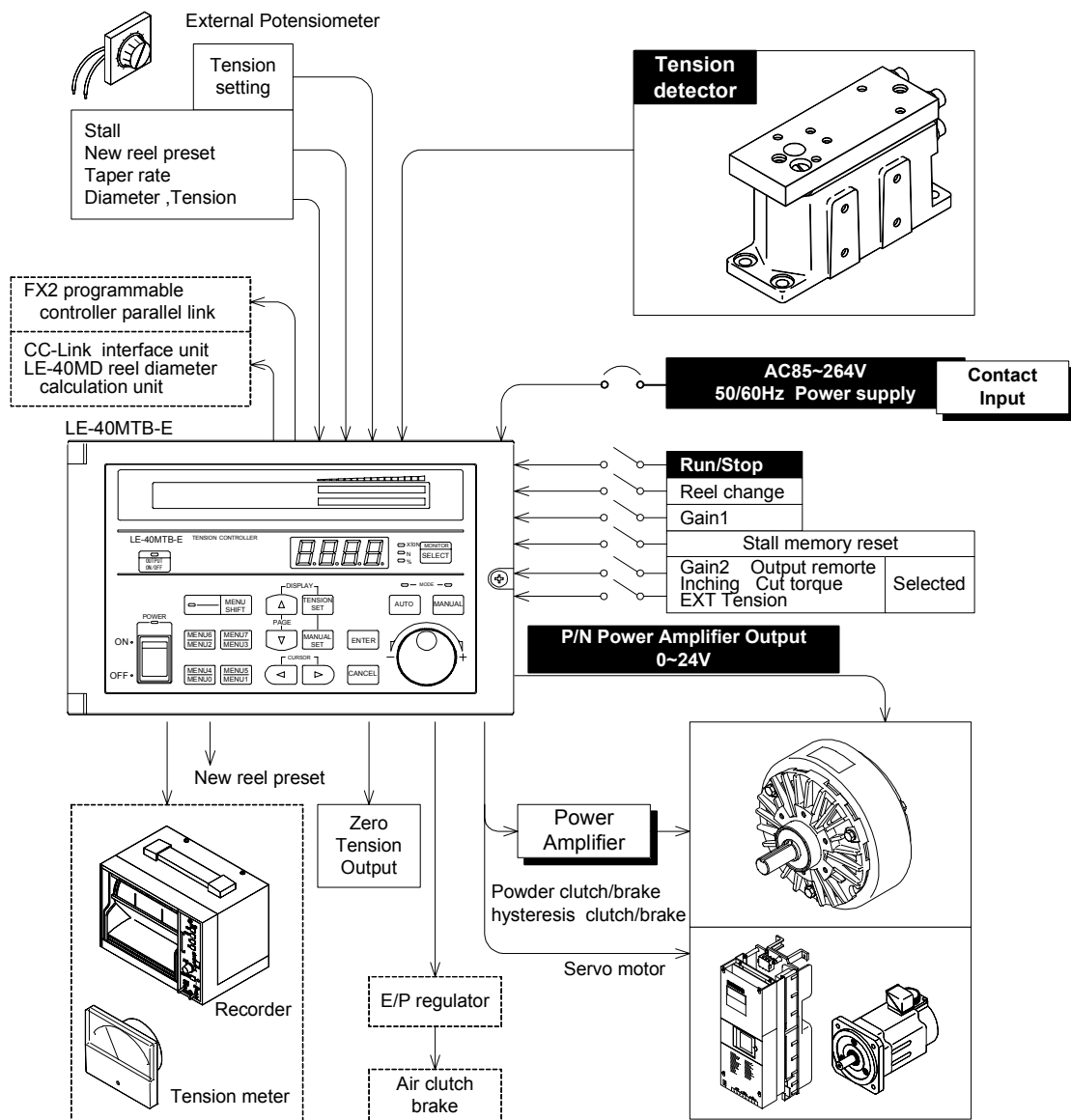
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1. Outline

1.1 Outline of unit

The tension controller LE-40MTB-E automatically controls the tension of a long material during unwinding, use of the feed reel and winding, and is used together with the fine displacement tension detector. The applicable actuators are powder clutch/brake, hysteresis clutch/brake, servo motor (torque mode), and air clutch/brake.

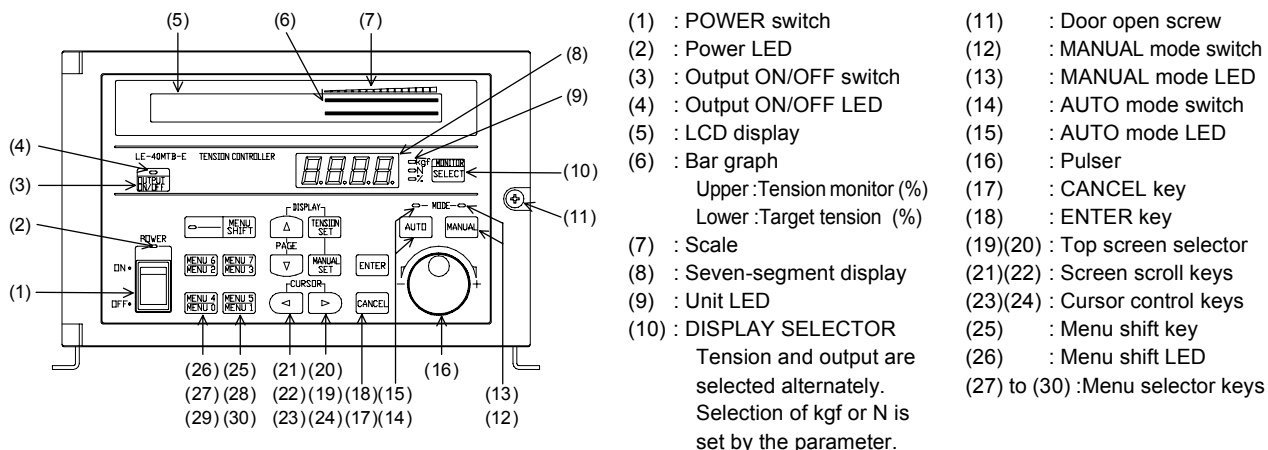
- The operator can make various settings including the operating constants such as for tension and manual torque, and the mechanical constants for reel diameters in a similar manner to operate a volume controller with the pulser dial on the panel.
- Functions such as auto-zero adjustment and span adjustment of the tension detector and the automatic adjustment of control gains for automatic control are also available.
- The operation data can be read or write using the optional memory cassette.
- Menu selection from "0" through "7" on the panel allows the operator to select and use eight kinds of operation data.
- The tension controller can be connected to the CC-Link interface unit, and also equipped with a parallel link function with FX2 series programmable controller.
- If connected to the optional LE-40MD reel diameter calculation unit, it performs precise taper control to prevent the material from being wound too tight.



The above external devices may be connected to the input/output terminals of the tension controller. The tension detector, actuator and some of the command input switches (those indicated with white letters on a black background) are mandatory. Other devices are connected as necessary.

1.2 Panel configuration

The figure below shows the configuration of the panel of the tension controller LE-40MTB-E.



1. POWER switch and OUTPUT ON / OFF switch

Turn on the POWER switch and the OUTPUT ON/OFF switch to light the LEDs provided on the upper portion of the both switches.

(Note) Use OUTPUT ON/OFF switch or OUT REMOTE input without using the POWER switch when the output is turned on and off.

• Allowable power switch cycles : 20,000 times

2. DISPLAY SELECTOR switch

The monitored operating tension value is always displayed in the bar graph on the upper right of the screen.

Under the bar graph, the operating tension or control output is displayed in numeric.

The control output or the operating tension is displayed on the seven-segment display in the same way. The type of contents displayed is changed every time the Tension/Output selector switch is pressed. The type of contents displayed on the seven-segment display is indicated by the LED provided on the left side of the selector switch.

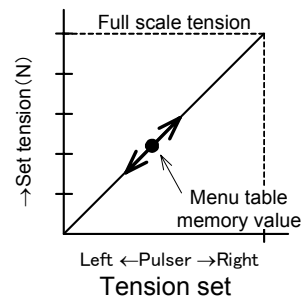
The unit of tension ($\times 10\text{N}$ or N) is specified by the setting of the parameter.

3. Automatic operation (Basic operation)

Pressing the automatic mode switch starts automatic operation.

However, that automatic control will not take place unless the start/stop input (MC1) is turned on.

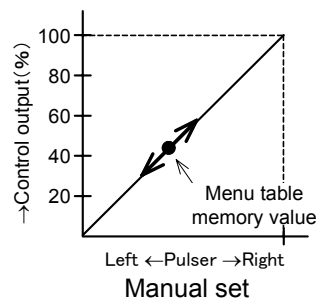
The operation takes place at the memorized tension corresponding to the designated menu number. With the tension set screen displayed, the tension setting can be changed at the rate of 50 units per each turn of the pulse dial. Set the full-scale tension during the initial setting process. When the equipment carries out the taper tension control commensurate with the reel diameter, the actual target tension will be the value subtracted the taper tension from this tension setting. Thus, the equipment carries out automatic control so that the detected tension meet with the target tension.



4. Manual operation

Pressing the manual mode switch allows manual operation of the equipment. The operation takes place at the memorized control output corresponding to the designated menu number. With the "manual set" screen displayed, the manual operation control output can be changed at the rate of 50 units per each turn of the pulser.

Zero to 100% setting corresponds to the SA-SN output of zero to 5V both in servo and powder modes.



2. Mounting, connection and wiring

2.1 Caution on mounting

DANGER



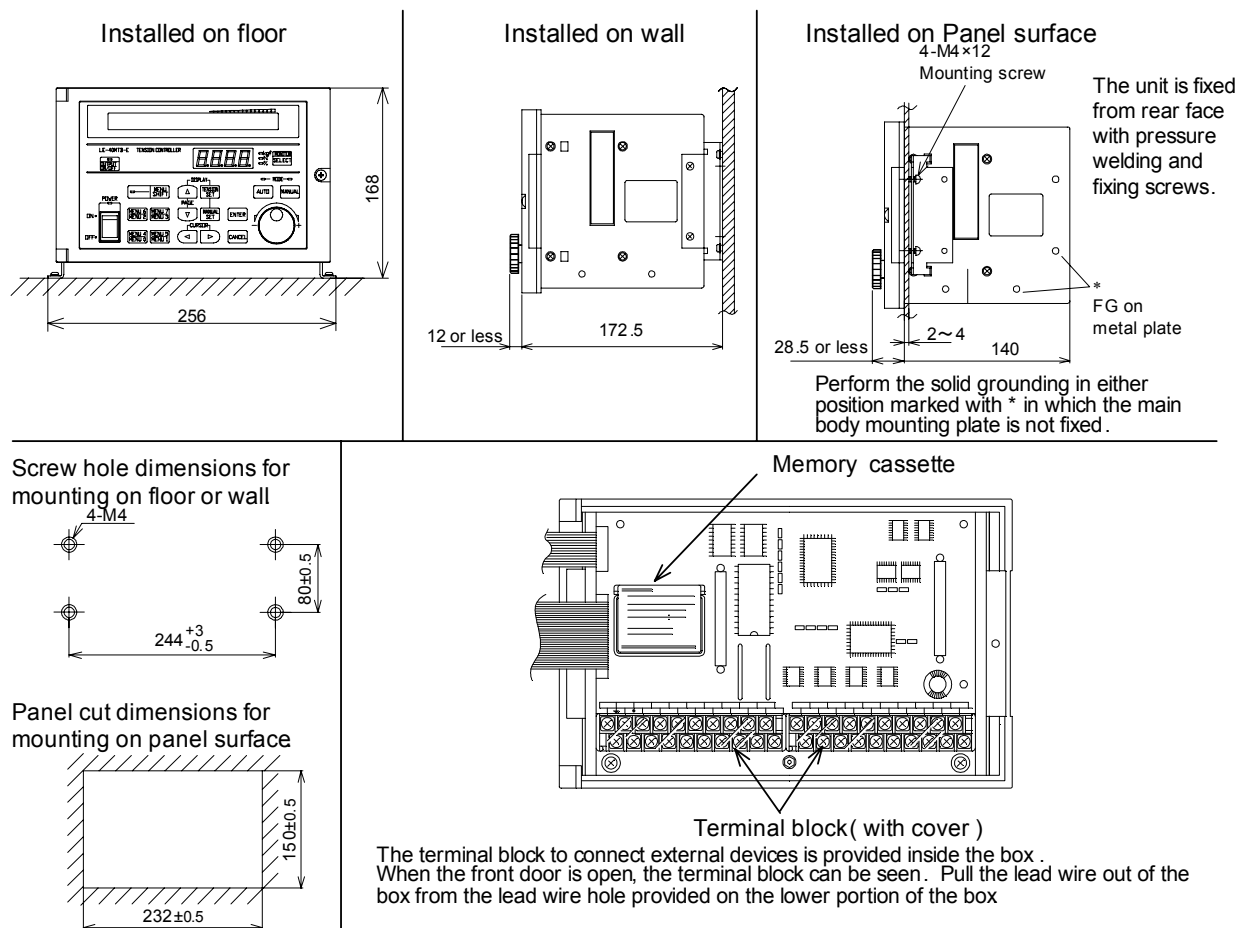
- Never drop cutting chips and wire chips while screw holes are tapped and wiring work is performed. Otherwise, damage, fume, fire, malfunction or others may be caused in the unit.
- Make sure to turn off all the phases of the power supplies outside before starting installation and wiring.
- Make sure to turn off all the phases of the power supplies outside also before attaching or removing the memory cassette. Otherwise, electric shock or damage in the unit may occur.
- Make sure to attach the terminal block cover offered as an accessory to the unit to prevent electrical shock before supplying the power after the wiring work.

CAUTION

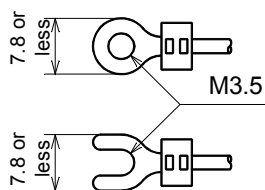


- Never install the unit in a place with dusts, soot, conductive dusts or corrosive gas or a place exposed to high temperature, condensation, wind or rain. Never install the unit directly in a place in which vibration or impact is applied. Otherwise, damage, malfunction or deterioration may be caused.

The tension controller can be installed on the floor, wall or panel surface.



General description on wiring work



- Use crimp-style terminals whose dimensions are as shown in the figure on the left.
 - The terminal tightening torque shall be 0.5 to 0.8 N•m (5 to 8 kgf•cm). Tighten the terminals securely so that malfunction will not be caused.
 - Perform Class 3 grounding to the analog I/O cables and the winding shaft pulse input cable with shielded cables on the signal receive side.
 - Never let the I/O cables pass through a duct together with other power cables. Never bind the I/O cables together with other power cables.
 - Generally, the allowable wiring length shall be 10 m or less to assure safety against noise.
- General description on wiring work

2.2 Wiring

DANGER

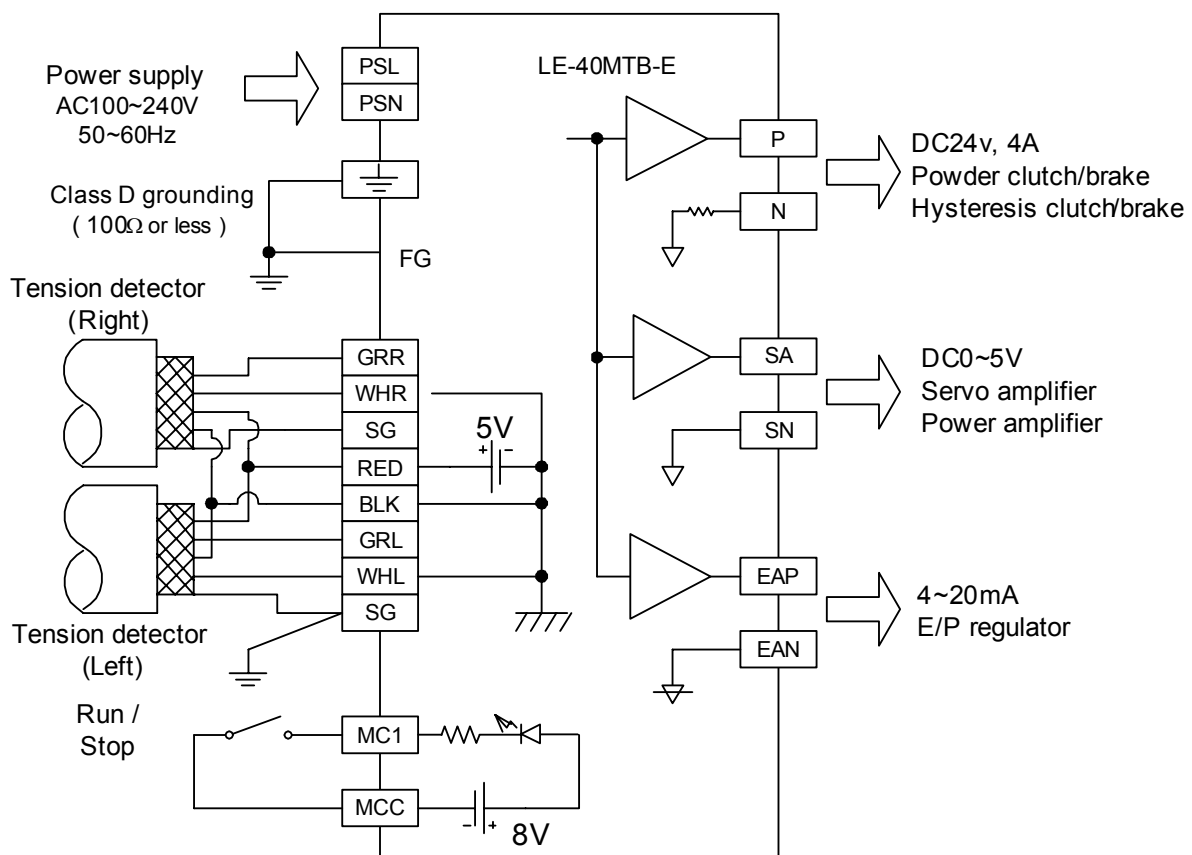


- Set the emergency stop circuit outside the tension controller. If the tension controller performs malfunction, the unit may become out of order and an accident may occur in the case in which the emergency circuit is built in the unit. Connect the AC power supply to the terminals PSL and PSN as shown in the figure above.
- If the AC power supply is connected to the I/O terminal or DC supply terminal, the tension controller will be burn out. Do not use the spare terminal for an external device. Otherwise, the unit may be damaged. Perform the solid grounding to the ground terminal and FG using a wire of 2mm² or more.
- Never perform grounding together with the strong power system. Otherwise, malfunction may be caused.

The minimum connection required for the one-reel unwinding are as follows :

1. Connect AC100 to 240V 50/60 Hz power supply to power supply terminals PSL and PSN. The power consumption is 400VA when the output of the power amplifier is at the maximum .
2. Perform the solid grounding to the ground terminals and metal plate according to Class D grounding.
3. Connect the tension detector.
4. If the actuator is a powder type, connect it between terminals P and N. If it is a torque-controllable servomotor, connect it between terminals SA and SN. If it is an electric-pneumatic regulator of 4-20mA, connect it between terminals EAP and EAN.
5. Connect the Run/stop signals to the terminal MC1.

When using other functions, refer to Section 6 and after.



Wiring of Tension Detector

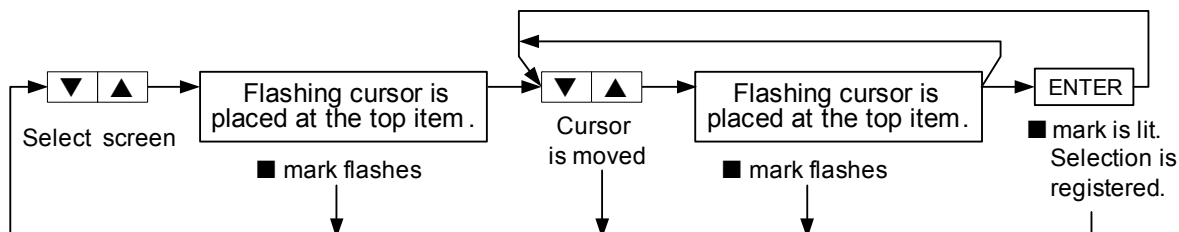
- The figure on the right shows the connection diagram when the load is applied to the detector in the compression direction. When the load is applied in the tension direction, exchange the terminals GRR and WHR each other as well as the terminals GRL and WHL each other.
- When one tension detector is used, connect it to the right side. And make sure to short-circuit the terminals GRL and WHL on the left side.

3. Operation

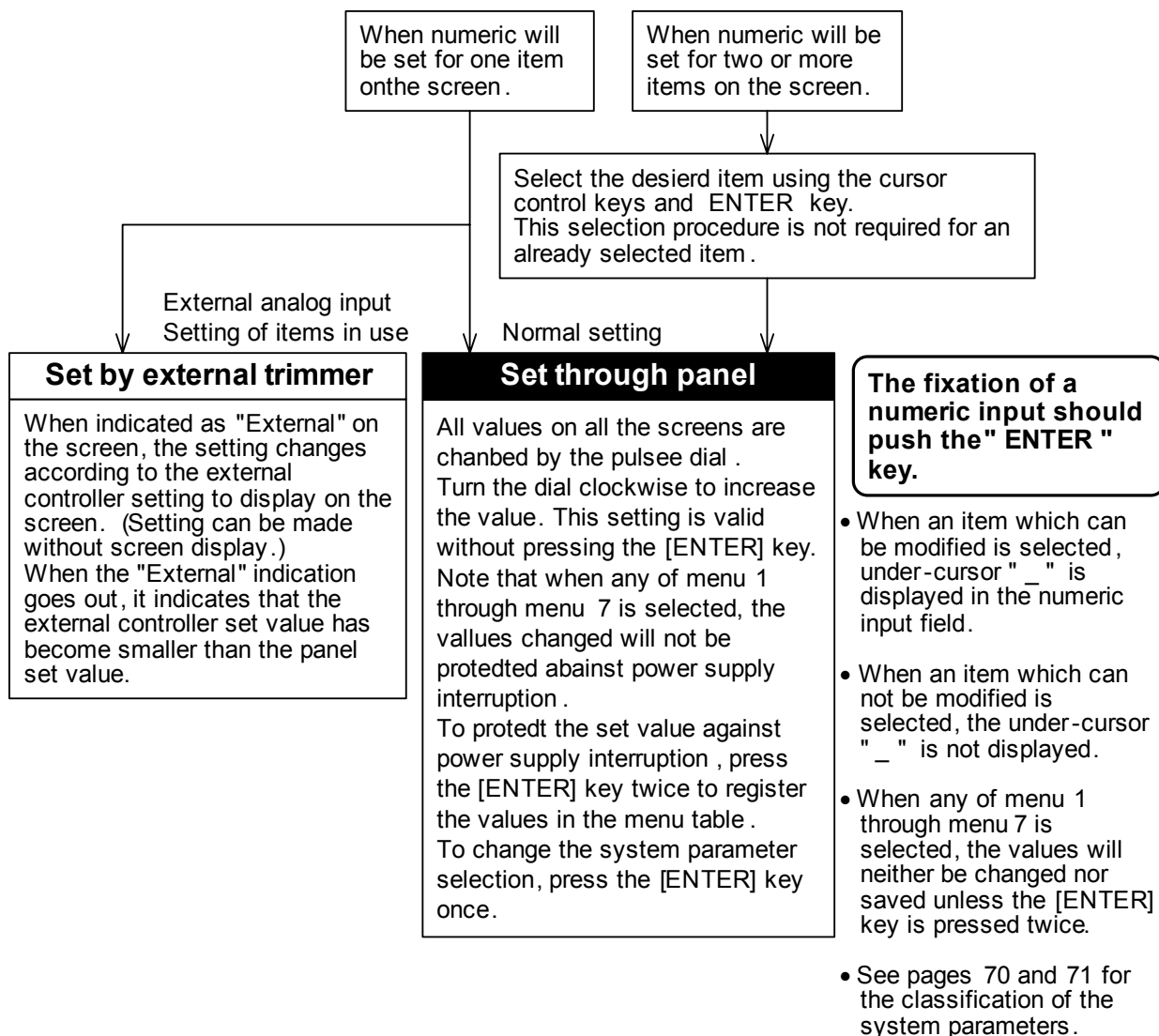
3.1 Setting and change of settings

1. Selection of item on screen

When two or more items are displayed on the screen, one of them can be selected using the following procedure. The selected item is marked with "■", and held in the memory even while the power is interrupted. When the menu items cannot be displayed on one screen, they can be scrolled and displayed using the cursor control keys (▼ ▲).



2. Modification of set value on screen

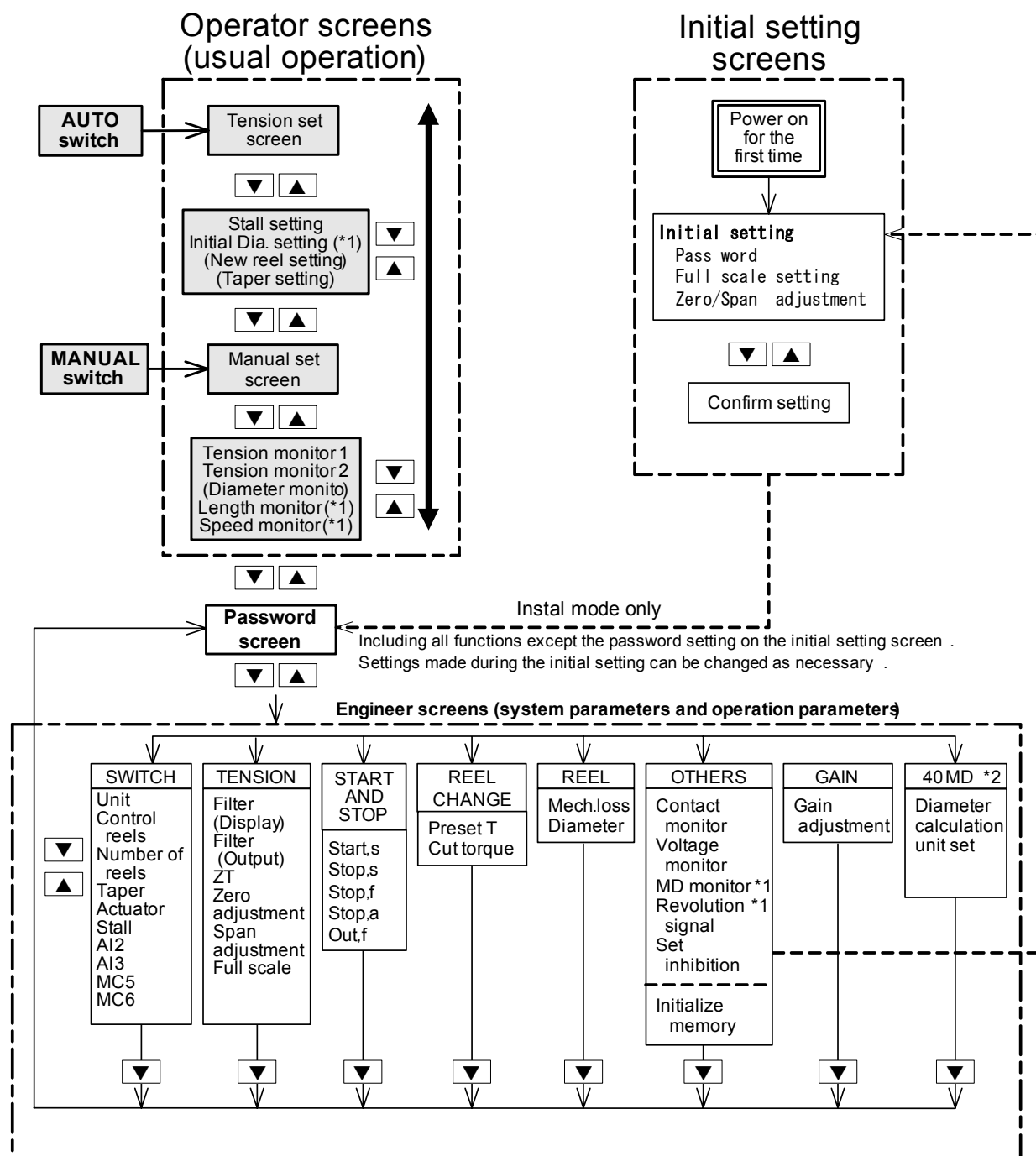


3.2 Overall flow of screen

The figure below shows the overall configuration of screen displays.

The data can be read in turn using the ▼ and ▲ keys.

Four major screens are available. Those are the initial setting screen, operator screen of usual operation, engineer screen for system setting and memory cassette data transfer screen. This section shows the overall flow of the operator screen that is used in usual operation and the engineer screen. For other screens, refer to the relevant sections.



*1 It is displayed exclusively when the LE-40MD is connected.

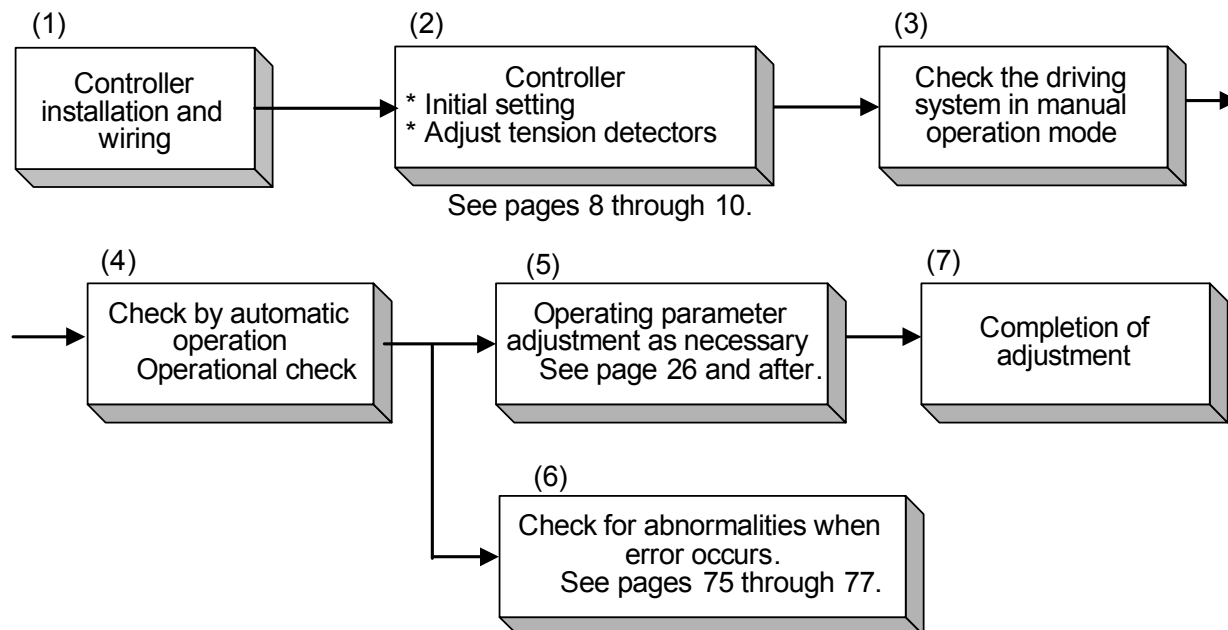
*2 It is displayed and can be set when the LE-40MD is not connected or when the LE-40MD is connected but not turn on.

However, the set value is invalid. (The set value is valid when the LE-40MD is connected.)

4. Basics of adjustment and operation

4.1 Adjustment flow for trial operation

Carry out the following start-up adjustment as the preparatory step for the automatic operation.



4.2 Initial setting

Select the items using the and keys.

Press the [Enter] key to finalize the setting.

Then, switch the screens using the and keys.

When the setting of the items marked with "■" is not changed, switch the screens using the and keys without pressing the [Enter] key.



When the power is turned on, the version display screen appears for a few seconds.

START THE INITIAL
OR CHANGE TO M



The password "4095" is originally registered. When a password other than this is used, enter the new password on the "Password registration" screen and press the [Enter] key to register it. Both the newly registered password and the original value "4095" are valid.

PASS W. ENT.
SET→##### ENTER PASS WORD



TNSN. UNIT SELECT TENSION UNIT
□ ×10 N : ■ N



CNTL. PART SELECT REEL OR ROLL
☒ UNWIND : ☐ WIND : ☐ FEED

REEL NUM. SELECT REEL NUMBER
☒ 1 REEL : ☐ REELS

TAPER SELECT TAPER TENSION CONTROL
☒ OFF : ☐ ON

TPR. DIA. SELECT TAPER SIGNAL
☒ INT. : ☐ EXT. : ☐ LINK

TAPER MD. SELECT TAPER MODE
☒ LINEAR : ☐ NON - LINEAR

DIA. SET SET DIAMETER
☒ MIN. DIA → ### mm φ : ☐ MAX. DIA → ### mm φ

ACTUATOR SELECT ACTUATOR
☒ POWDER : ☐ AC SERVO MOTOR

STALL MD. SELECT STALL SETTING MODE
☐ KEY SET : ☒ MAN. VOL.

STALL RST SELECT STALL MEMORY RESET MODE
☐ MC4 only : ☒ MC4+OUT SW.

A12 SELECT A12 ANALOG INPUT
☐ DIA. : ☐ STALL : ☐ NEW R. : ☐ TAPER : ☐ TNSN.

A13 SELECT A13 ANALOG INPUT
☐ DIA. : ☐ STALL : ☐ NEW R. : ☐ TAPER : ☐ TNSN.

MC5 SELECT MC5 INPUT
☐ GAIN2 : ☐ INCHNG : ☐ OUT RMT. : ☐ CUT TRQ.

MC6 SELECT MC6 INPUT
☐ GAIN2 : ☐ INCHNG : ☐ OUT RMT. : ☐ CUT TRQ.

- When using the NRO (new reel output), select "Multi-reel" mode. (See page 24 and after)

- Normally, the taper control is not used for unwinding control.

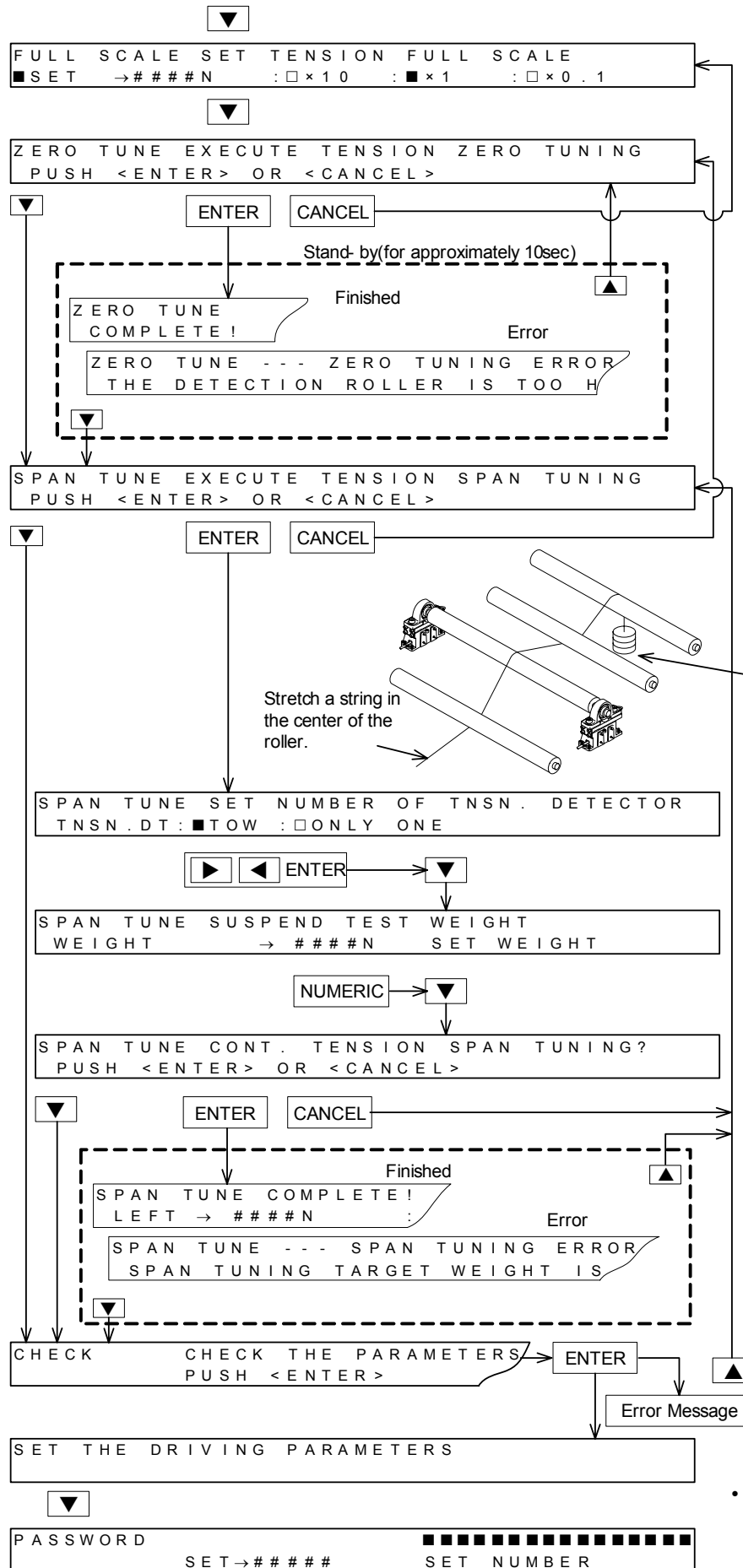
- This is to select whether to use the internal signals of the tension controller or to receive the external reel data to calculate the reel diameter for the taper control. Receiving the external reel diameter results in better taper control accuracy. See page 28 for details. Select "EXT" when using the LE-40MD diameter calculation unit

- Select "POWDER" when using hysteresis or air clutch/brake.
- When using an AC servo, if it is not desired to reverse the direction of torque control between resurrection and power run, select "POWDER".
- This is to select the input method of the stall settings. See page 13 for the details related to stall.

- This is to select the input method for resetting the stall memory. The output on/off switch can also control stall memory reset.

- This is to select AI ☐ (analog) input and MC ☐ (contact) input. See page 26 and after for the use of these functions. These settings can be made on screens other than the initial setting. It is all right if these settings are made later on.

4.3 Adjustment of zero and span for tension detector



- This is to set the fullscale tension (maximum mechanical tension) and the number of display digits. For example, if desired to have "50.0N" displayed, select " 500 " and " × 0.1 ".
- Zero adjustment should be made with the tare weight of the detection reel and without material.
- If unable to make zero adjustment, check the system referring to pages 75 and 77.
- If the tension full scale is changed, carry out the zero/span adjustment again.

- Install the tension detectors on both ends of the detection reel as shown in the left figure. For a short detection reel, only one tension detector may be used. Use the following screen to select one or two tension detectors.

- Suspend weight W (N). The weight should be a static load as close to the full-scale tension value as possible (Should be between 1 to 1/3 of the full scale).

- When, for example, a mass of 10 kg is suspended, multiply it by the gravitational acceleration (9.8) to make it 98N.
- Do not alter the load during the adjustment. Otherwise, the system may not be able to adjust or may generate an error.
- By the display unit setting the system shows the value in the magnitude of "N" or "×10N". When one tension detector is used, the left display shows zero. When two detectors are used, the left and right readings are balanced.
- When unable to adjust the span, check the system referring to pages 75 and 77.

- If an error message appears, the system can not complete the adjustment. Set the system again.

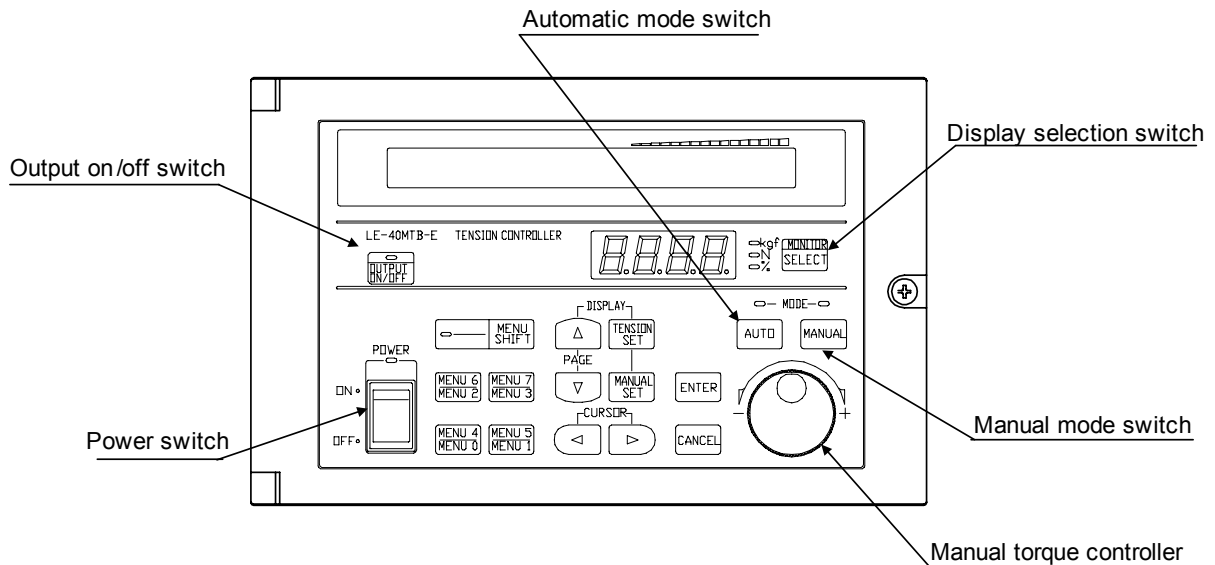
- **Initial setting completed**
The system setting screen appears hereafter. Set the parameters as necessary.

Having completed the steps described up to the preceding pages, the minimum necessary processes shown in (1) and (2) below would be finished as the system controls the tension.

- (1) Controller installation and wiring
- (2) Initial setting (zero span adjustment of the tension detectors in particular)

Now, check the drive system in manual operation mode in step (3). Follow the procedure below.

- Press the power on/off switch to connect the system to the power supply.
- Press the manual mode switch. Use the pulser dial in manual operation to check the system operation.



When completing the system check in manual operation mode perform operational check by the automatic operation in step (4) following the procedure below.

- Set the tension controller. See page 18 for the operator screen.

TNSN .	SET	MENU#		MNT.	→ ■■■■■■
	SET →	###N			→ ■■■■■■

- Press the automatic mode switch to enter automatic mode.
- Turn on the MC1 contact input to start automatic operation.

This completes the basic adjustment for operation.

Where a different mechanism or other functions are used, refer to Section 6 and after.

If any problem in the operation, refer to Section 10.

5. Basic knowledge for operation

5.1 Entering Run / stop signals (use of MC1)

The minimum necessary preparation for tension control is described in "Adjustment flow for trial operation" on page 10.

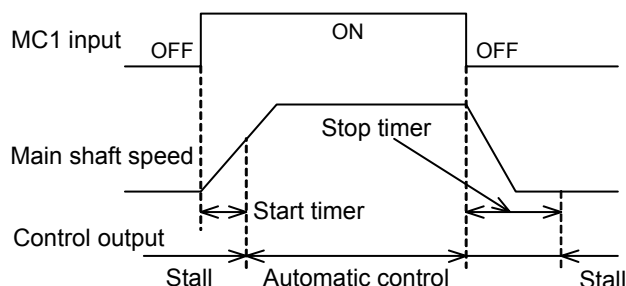
This section explains the use of start/stop (MC1) contacts essential to the step (4) operational check in automatic mode.

1. Run / stop (MC1 input)

----- Usually on during operation

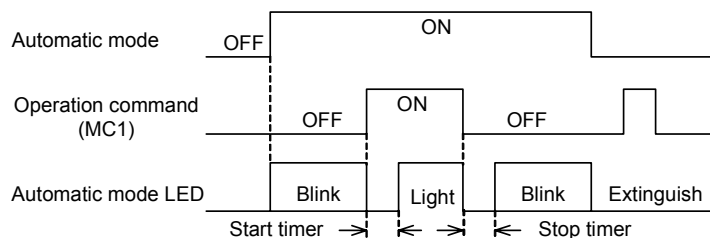
- The contacts interlocked with the Run/stop operation of the machine (such as the feed motor Run/stop) are connected. Press the automatic mode switch to enter automatic mode. With the MC1 input made and after a lapse of time set in the start timer, the automatic control will start. See the figure on the right.

- When this input is turned off, the stop gain and the stop bias become valid until the stop timer times up. After that, the stall values become valid.
(The start timer and stop timer will be discussed later. See the next page for more about the stall.)



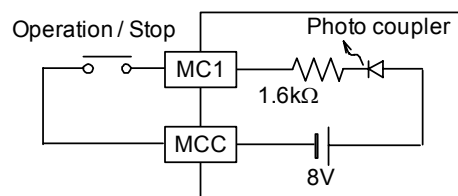
2. Automatic mode indicator lamp

- The lighting conditions of the automatic mode switch, start/stop input (MC1) and the state of the automatic mode indicator are as the figure on the right.



3. Connection

- Use a micro signal switch commensurate with DC8V 4mA as the input contacts. Connect the contacts across MC1 and MCC.



5.2 Use of stall setting (output when operation is stopped)

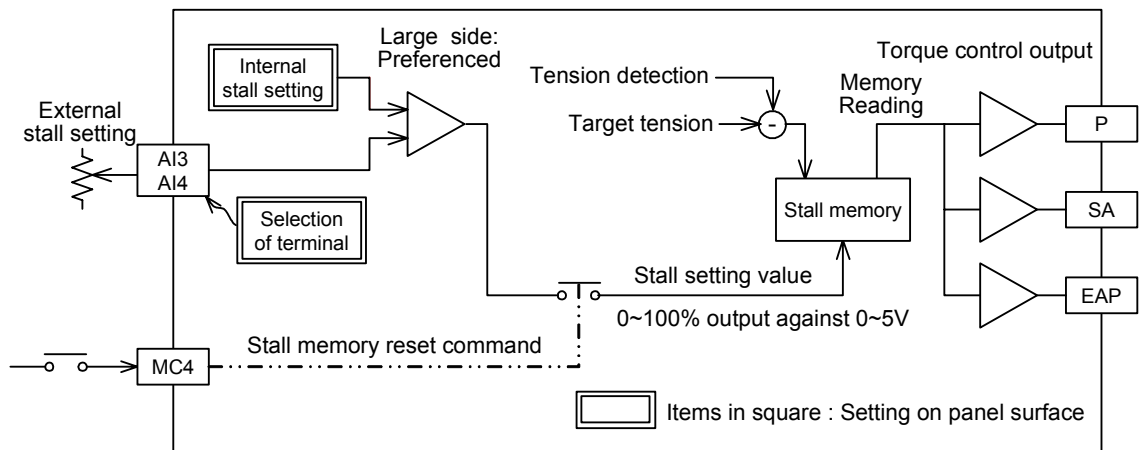
Stall output is a constant torque given during the automatic control to the machine while it is stationary. At this stage, the feedback control does not take place. This torque is the initial torque for the machine to start with in the automatic control.

- When Run/stop signal MC1 is turned off to stop the material, the stall memory retains the control output values used immediately before the stop. The system resumes the operation using the memorized control output values to stabilize the tension in the material.

The stall memory function is a part of the basic functions, no need to be specially set.

- When changing materials, for example, the stall memory is reset to the output values appropriate to the initial material diameter. These output values are called the stall setting value.

The system uses an EEPROM memory to keep the stall memory values even when the power supply is turned off. No reset operation takes place even when the power supply is turned off or automatic or manual modes switching is performed.



1. Entering stall setting value

- Two methods are available to enter the stall setting value as follow.
 - Setting by key input on the operator screen.
 - Setting by external analog input.
- To enter the stall setting value by key input on the operator screen, use the “STALL SET” screen.

[illegible]

- To change the stall setting value input by the external analog input setting, refer to page 38.

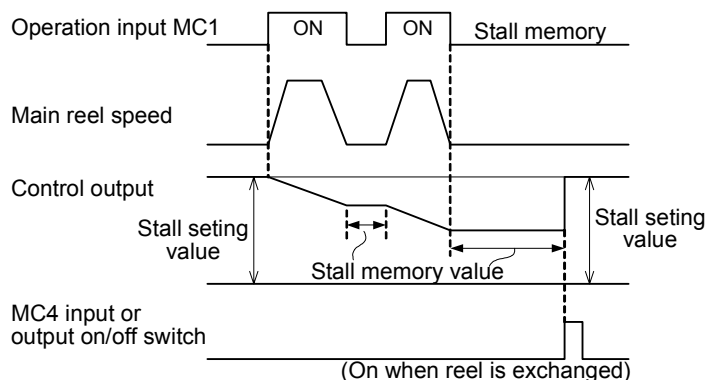
2. Resetting stall memory value

- Two methods are available to reset the stall memory value as follows:
- An output on/off switch is used to reset the stall memory value.
- Stall memory reset input MC4 contacts are used for reset.

In either case, the switch is normally turned on when the reel is changed.

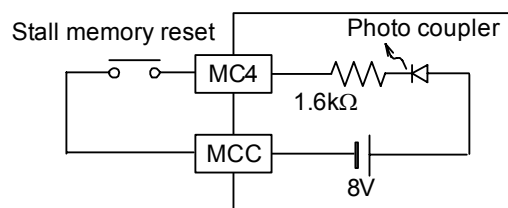
• When the initial setting "MC4 + OUT. SW" at the "STALL RESET" screen is selected (see page 9), the control output is switched from "ON" to "OFF" by the output on/off switch on the panel at the time of changing the material. The stall memory value will be preset to the stall setting value.

- When MC4 is kept "on" for approximately 0.5 second or longer, the stall memory value is preset to the stall setting value.



3. Connection

- To reset the stall memory externally, the MC4 contacts are used.
- Use a micro signal switch commensurate with DC8V 4 mA as the input contact.
- If the stall memory reset input MC4 and MCC are short-circuited, the stall output is always the same as the stall setting value.
- If a signal interlocked with the reel shaft release signal and shaft removal signal is connected to the MC4 contacts, the stall memory can be reset automatically when changing the material.



4. Resetting stall memory only by MC4

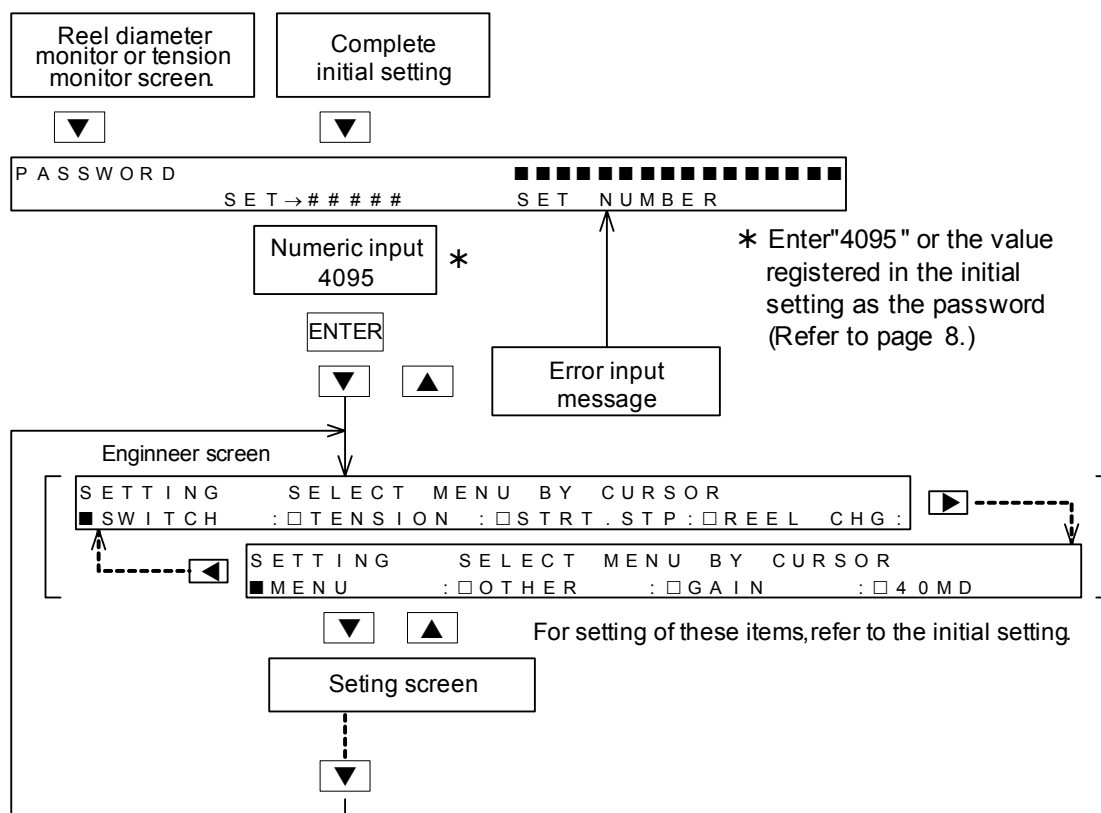
----- A special use of stall function

- The system can be set so as to reset the stall memory value only by the MC4 contacts without using the output on/off switch.
- Use the "STALL RST" screen within "SWITCH" on the initial setting screen or the engineer screen.



5.3 Calling up engineer screen

- Follow this operation to make changes from the state of initial setting.
- Enter the password on the password screen. Press the enter key to enter the engineer screen.



Standard of volume set output

The control output by the manual torque and the stall setting are set by the following standard.

	Feed control	Feed control
Manual torque	$N = \frac{D}{D_{max}} \cdot \frac{F}{F_{max}} \times 100$	$N = \frac{F}{F_{max}} \times 100$
Stall New reel preset	$N = \frac{D_0}{D_{max}} \cdot \frac{\tilde{F}_0}{F_{max}} \times 100$	$N = \frac{\tilde{F}}{F_{max}} \times 100$

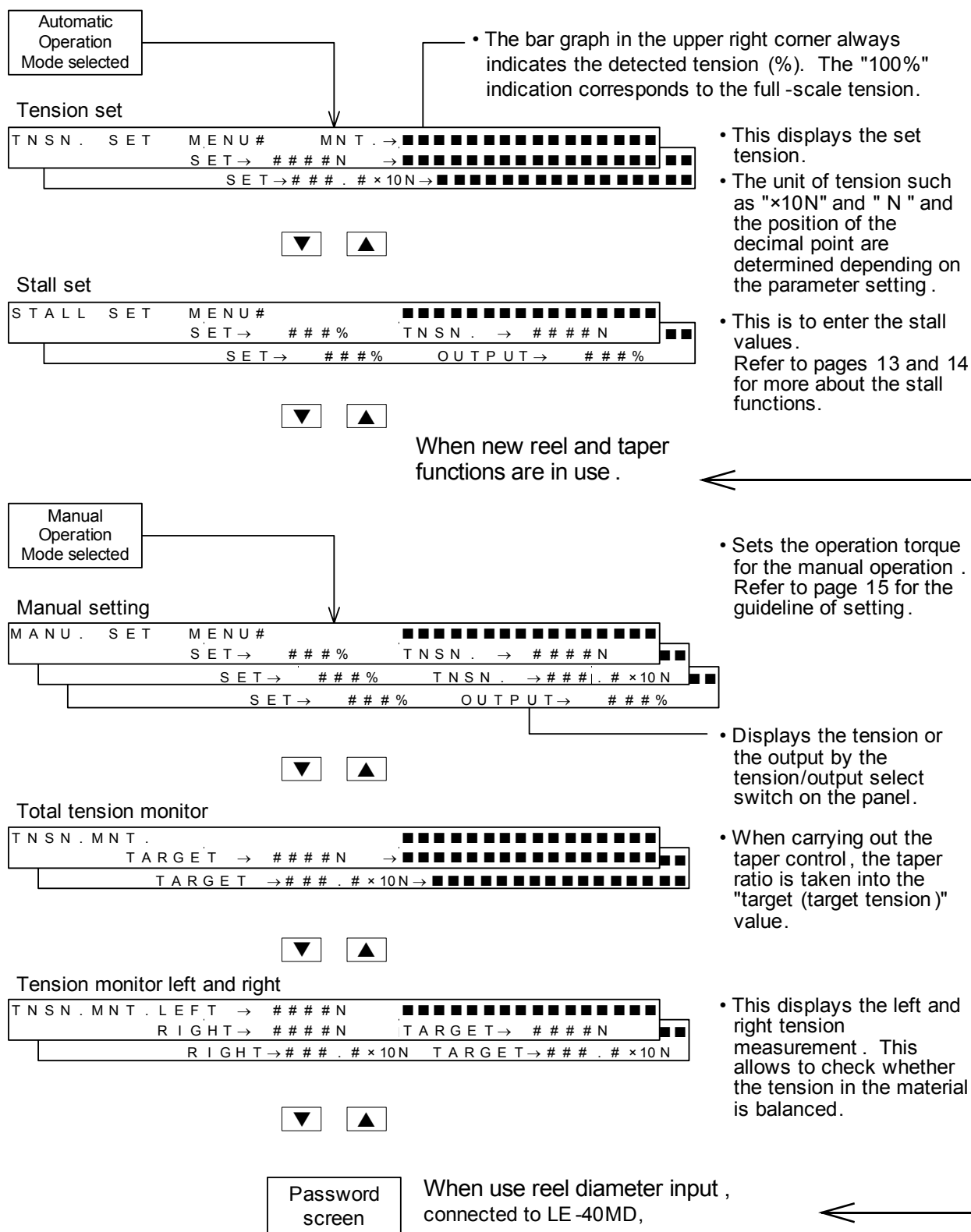
Dmax : Maximum diameter
D : Diameter
F : Control tension
D0 : Initial diameter
F : Average drive tension

$$F_{max} = \frac{\text{Ratings torque of actuators}}{\text{The maximum use torque of actuators}} \times \text{The maximum drive tension}$$

- Obtaining stall value and new reel torque by operating actual machine
Operate the machine in automatic control mode with the target tension . Display the output on the output indicator (4-digit, 7-segment display).
Read the output value where the reel diameter is close to the initial diameter . It is recommended to use this value as the stall value .

5.4 Display of operator screen

The usual operations (setting operations) are performed on the following screen.



The values are changed and valid by the pulser dial.

Note that in the screen shown MENU1 ~ MENU 7, the values changed will not be protected against power supply interruption. To protect the set values against power supply interruption, press the [ENTER] key twice to register the values in the menu table.

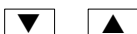
- The unit of tension (N or $\times 10\text{N}$) and the decimal point position are determined by setting the parameter.
- The DISPLAY SELECTOR (TENSION /OUTPUT) switches over the tension display and output display.
- On the screen of Tension set, Stall set, New reel set, Taper ratio, the internal setting or the external setting which is effective is displayed on the screen. When the external setting is effective, "EXT." is displayed on the screen, and the internal setting is effective, registered menu title is displayed on the screen. (Refer to page 37~39.)

Initial diameter set (When connected to LE -40MD)

INIT.DIA.	MENU#	
SET→ ### mm φ	TNSN →### N	
SET→ ### mm φ	OUTPUT→ ### %	



New reel set (When “REELS” mode is selected.)

[illegible]

Linear taper set (When “TAPER” is set to “ON”.)

[illegible]

Nonlinear taper set (When "NON-LINEAR" is selected.)

[illegible]

Reel diameter monitor

(When use reel diameter input or “LINK” is selected in “TPR.DIA” screen.)

D I A . M N T .	
D I A . → ### # mm φ	T N S N . → ### # N
D I A . → ### # mm φ	O U T P U T → ### %

Reel diameter monitor

(Y1,Y2,Y3 are displayed when "DIA." is selected in "Y MODE" screen.)

D I A . M N T . ■■■■■■■■■■■■■■■■■■■■
D I A . → # # # # m m φ Y 1 : □ Y 2 : □ Y 3 : □

D I A . → # # # # m m φ T N S N . → # # # . # k g f

D I A . → # # # # m m φ O U T P U T → # # # %



Measurement length monitor

(Y1,Y2,Y3 are displayed when "LENGTH" is selected in "Y MODE" screen.)

LEN.MNT. ■■■■■■■■■■■■■■■■■■■■
LENGTH→#####m Y1:□ Y2:□ Y3:□

LENGTH→#####m TNSN.→###.#kgf
LENGTH→#####m OUTPUT→####%



Line velocity monitor

SPD.MNT.					
LINE SPEED→	###m/min	TNSN.→	##.#kgf		
LINE SPEED→	###m/min	OUTPUT→	###%		

6. To use other than one - reel unwinding powder

6.1 Use of AC servo motor

The system is equipped with the SA-SN terminals for controlling an AC servomotor or a vector inverter motor that can control torque.

The SA terminal can be connected to some servo amplifiers for the simultaneous multi-reel operation.

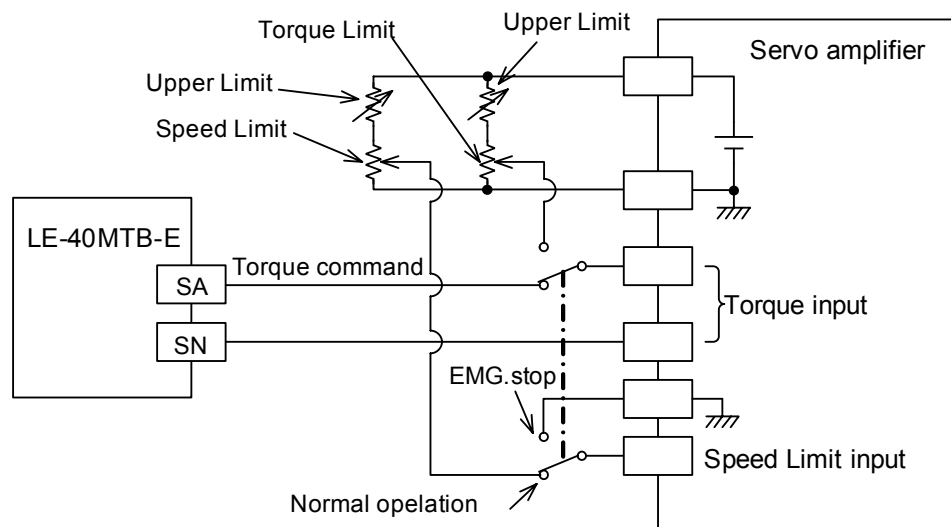
1. Wiring (example)

■ Provide the torque command input of the servo amplifier with the following input.

During operation and during normal stop : Torque command SA of the tension controller
Emergency stop : Output from the braking torque controller

■ Provide the speed limit input of the servo amplifier with the following input.

During operation and during normal stop : Upper speed limit setting
Emergency stop : Set the speed limit input to zero.



2. Setting

- For the setting, use the "ACTUATOR" screen within "SWITCH" on the initial setting screen or the engineer screen.
- In servo mode, the control values of -100% to 100% correspond to the SA output of -5 to 5V. In powder mode, the control values of 0 to 100% correspond to the SA output of 0 to 5V. The powder mode is completely no problem if the torque is in one direction.

ACTUATOR	SELECT	ACTUATOR
<input type="checkbox"/> POWDER	:	<input checked="" type="checkbox"/> AC SERVO MOTOR

Select "AC SERVO MOTOR".

Handling of servo motor

Setting and changing servo amplifier parameters

With the servo-on input terminal turned off, turn on the servo amplifier power supply. Change the settings of the following parameters.

- Put the servo loop in torque mode.
- Set the system so that the servo motor output torque is equal to the rated torque when the 5V torque command is issued.

For more details of the wiring and setting, observe the servo amplifier instruction manual.

Basic operation check

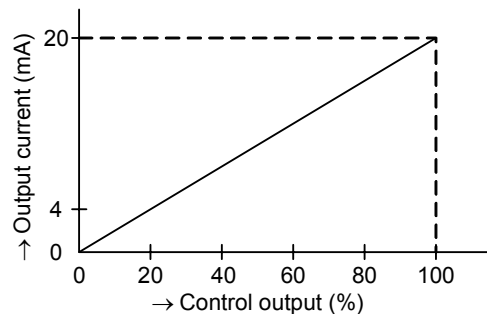
- Use the upper speed controller to set the speed limit input. Enter the torque command while the tension controller is in the manual operation. Then, check if the motor rotates in the correct direction. Note, however, that the unwinding motor rotates in the correct direction when it reverses, because the material during the unwinding operation pulls it.
- Check that the output torque is adjustable manually to produce the specified torque even when paper is running through the system. In the manual operation, however, the dial readings of zero to 10 on the manual torque controller correspond to the output of 0 to 5 V in the manual operation.

6.2 Use of E/P regulator

When using an air clutch/brake instead of the powder clutch/brake or the hysteresis clutch/brake, the control output of 4 to 20 mA (load resistance to be 470Ω or less) can be supplied to the electric-pneumatic regulator.

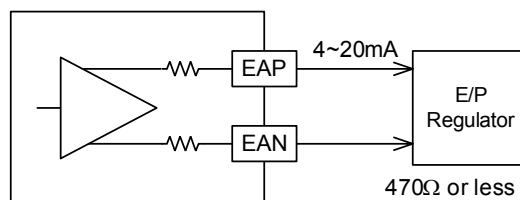
The control output of 0 to 100% at this stage corresponds to 4 to 20 mA.

Adjust the zero/span of the electric-pneumatic regulator so that the specified output may be generated in response to the control output of 0 to 100%.



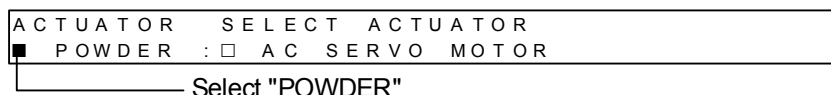
1. Wiring

- When using an electric-pneumatic regulator of 4 to 20 mA input current type, connect it as per the figure shown on the right.
- When using an electric-pneumatic regulator of 0 to 5V voltage input type, connect it between terminals SA and SN.



2. Setting

- Use the "ACTUATOR" screen within "SWITCH" on the initial setting screen or the engineer screen to set or change the settings.
- Use this output in powder mode. It can not be used in AC servo mode.



6.3 Use for winding operation

The basic setting and connection are the same as those for the unwinding operation described in up to section 5. Items particular to the winding operation are described below.

Winding control

- The taper control takes place in normal cases to prevent the material from winding too tight. Refer to page 28 and after for the taper control.
- The direction of increasing and decreasing tension in the material in acceleration and deceleration becomes opposite of that for the unwinding control. Refer to pages 26 and 27 for details.
- For the winding operation, the stall setting value and the new reel preset value when switching two reels are relatively small due to a small initial diameter. Refer to page 15 and other relevant sections.
- The winding machine or two-reel switch-over winding machine tends to get effect of significant mechanical loss. To minimize the effect of such mechanical loss, mechanical loss setting is recommended for such machines.

1. Setting

- Use the "CNTL.PART" screen within "SWITCH" on the initial setting screen or the engineer screen to set or change settings.

CNTL. PART				SELECT REEL OR ROLL			
<input type="checkbox"/>	UNWIND	:	<input checked="" type="checkbox"/>	WIND	:	<input type="checkbox"/>	FEED

Select "WIND"

6.4 Use for both winding and unwinding operation

When the LE-40MD is not used, there will be no functional differences between the selection of "UNWIND" (unwinding) and "WIND" (wining) in the LE-40MTB-E. Therefore, for the switch-over type that functions both as the winder and unwinder, there will be no problem in the winding or unwinding operation.

However, observe the following.

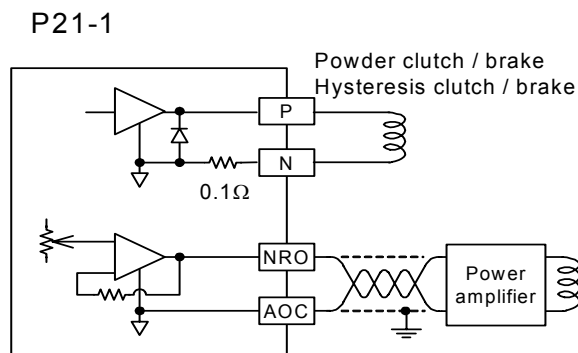
- When using the LE-40MD, see the instruction manual for the LE-40MD.
- The taper control to prevent excessively tight winding is not necessary for the unwinding operation. It is therefore recommended that the taper ratio be controlled externally. Refer to page 28 and after for the taper control.
- The inertia compensation in the acceleration and deceleration operation needs to be changed in between winding and unwinding. Use of gains 1 and 2 is recommended. Refer to pages 26 and 27.
- When performing the taper control with the real diameter over the unwinding operation of the spindle-less machine, as the taper reel diameter external, input the winding diameter to A12, 3 input terminals. This allows the taper control to take place on the unwinding side in response to the changes in the reel diameter. Refer to page 28 and after for the taper control.

6.5 Feed reel control

The basic settings and connection are the same as those described up to section 5. Items particular to the feed reel control are described below.

When using an auxiliary brake/clutch for the feed reel, it is convenient to adjust the output manually using the new reel preset output NRO.

1. Connection (powder)

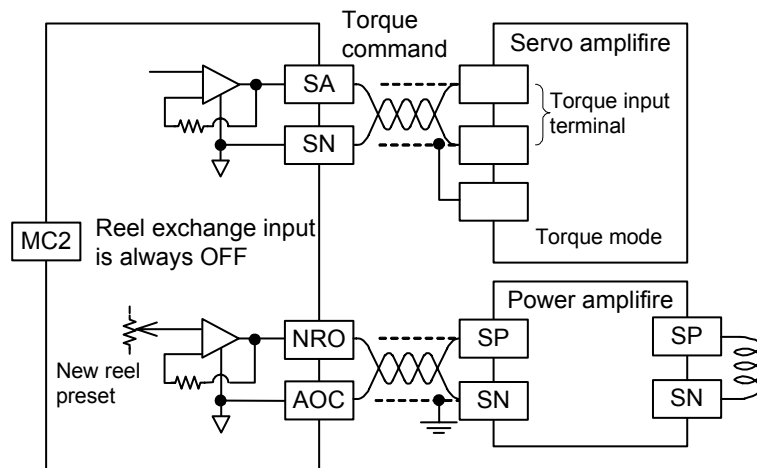


Connect the powder clutch (out feed)/brake (in feed) of DC24V system 4A or less. (The same with the hysteresis clutch/brake in the same manner.)

When the NRO output is used, use the following setting. See page 9.

In feed : Unwinding, multiple reels
Out feed : Winding, multiple reels

2. Connection (servo)



When the servo motor operates both at the resurrection and power running sides, the control may become unstable near zero. In such case, use an auxiliary clutch or brake for the feed reel so that the control output is used either for the resurrection side only or power running side only.

3. Setting

- For the feed reel control, use the "CNTL.PART" screen within "SWITCH" on the initial setting screen or the engineer screen to set as follows:
- When the NRO is used, select "UNWIND" (unwinding) or "WIND" (winding).

CNTL. PART SELECT REEL OR ROLL			
<input type="checkbox"/> UNWIND	:	<input type="checkbox"/> WIND	:

Select "FEED"

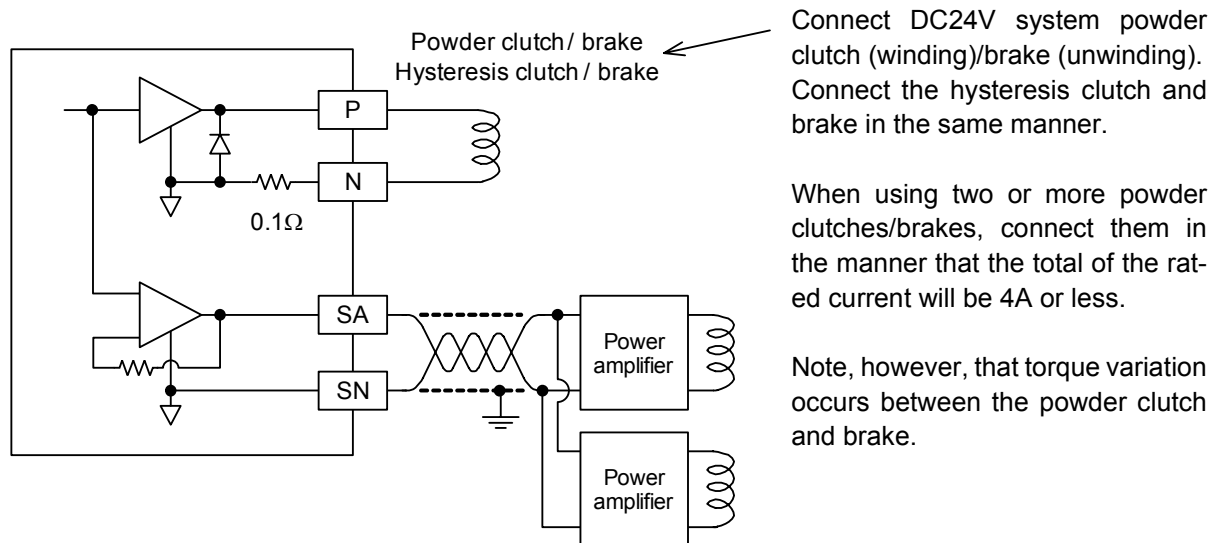
6.6 Simultaneous multi-reel control

When controlling multiple reels by the tension detection from one-reel, the basic setting and connection are the same as those described up to section 5. This section therefore describes the connection related only.

This example is applicable to :

- Cutters to cut off several sheets at one time.
- The machine using two powder brakes simultaneously or one of the two powder brakes because the machine cannot be controlled by one powder brake due to the wide range of torque control.

1. Connection

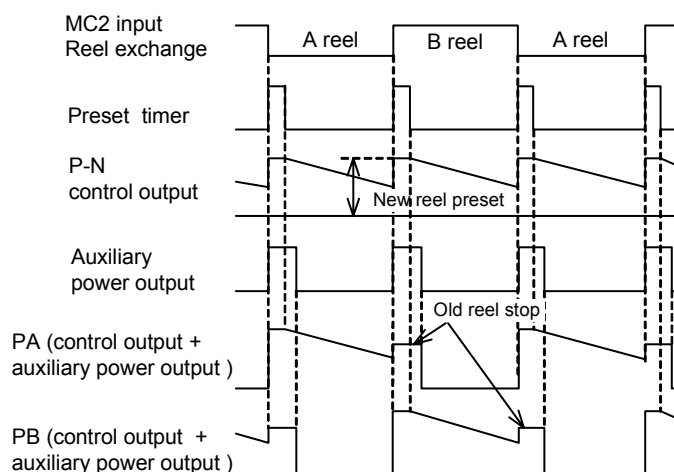


- When the P-N output is insufficient, up to 10 pcs. power amplifiers for powder clutches and brakes can be connected to terminals SA-SN.
- Two or more servo amplifier can also be connected. Note, however, that the load resistance should be 1 kΩ or greater.
- If the torque variations between the reels need to be restricted, connect an adjusting resistor.
- When connecting an adjusting resistor between terminals P-N, the capacity and resistance should be appropriate.
- When the power amplifier and servo amplifier are connected, adjust the gain on the power amplifier or the servo amplifier as much as possible.

6.7 Powder unwinding, two-reel switching

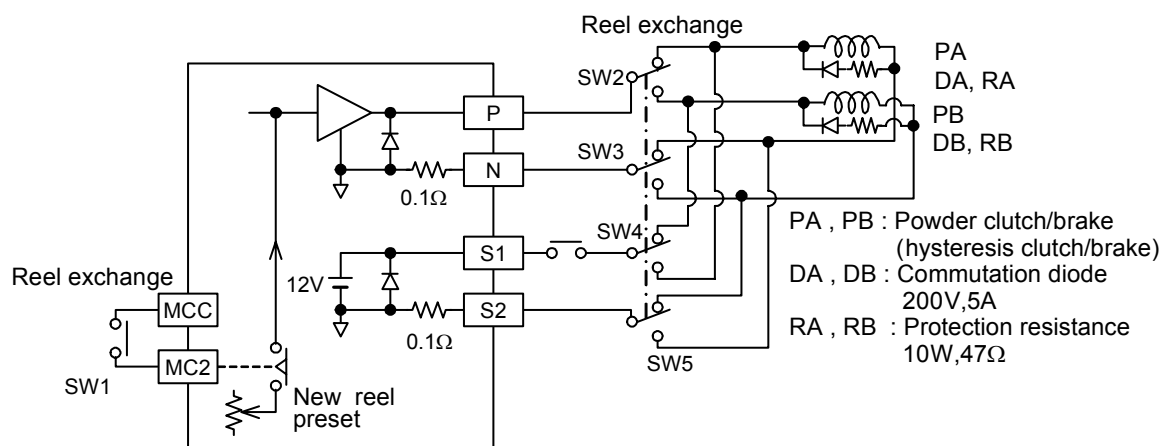
In the two-reel operation, the contacts interlocking with the reel change are connected to MC2. When this contact input changes from ON to OFF or OFF to ON, the control output is preset to the new reel preset value. When the preset timer times up, the automatic control starts here. Interlock this signal with the cutter operation. Switch SW1 at the same time as SW2 and SW3.

At this stage, as the previous reel is stopped, turn on the auxiliary power supply in a few seconds but not later than 10 seconds.



PA and PB is control output for powder to A/B shaft.

1. Connection of switch-over 2-reel powder



2. Setting

- Use the "REEL NUM." (number of reels) screen within "SWITCH" in the initial setting screen or the engineer screen to set reel switch-over or change the setting. Select "REELS" (multiple reels).

REEL NUM.	SELECT	REEL NUMBER
<input type="checkbox"/> 1 REEL	:	<input checked="" type="checkbox"/> REELS

Select "REELS" (multiple reels)

- Use the "NEW R.SET" (new reel set) screen on the operator screen to set or change the new reel preset value. Refer to the guideline for controller setting on page 15 to determine the settings.

NEW R. SET	MENU #	SET →	### %	TNSN →	#### N
		SET →	### %	OUTPUT →	### %

- Use the "PRESET T" screen within "REEL CHANGE" on the engineer screen to set or change the preset time. Include a margin in the preset value so that the tension feedback will not take place while the tension is unstable after switching the reels.

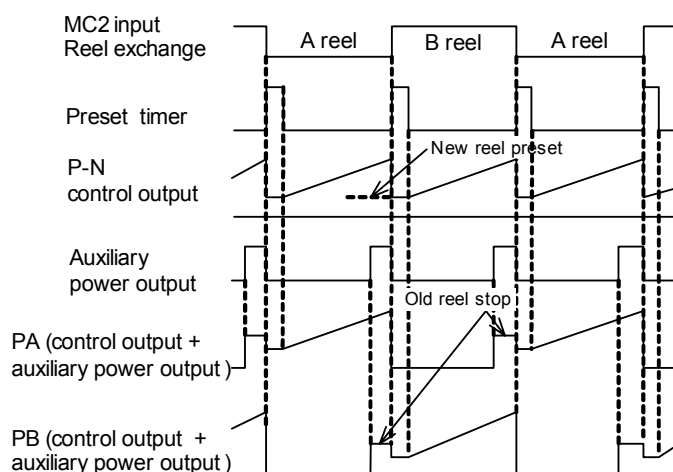
PRESET T	MENU #	SET PRESET TIMER
		SET → ### s

6.8 Powder winding, two-reel switching

In the two-reel operation, the contacts interlocking with reel change are connected to MC2. When this contact input changes from ON to OFF or OFF to ON, the control output is preset to the new reel preset value. When the preset timer times up, the automatic control starts here. Interlock this signal with the cutter operation. Switch SW1 at the same time as SW2 and SW3.

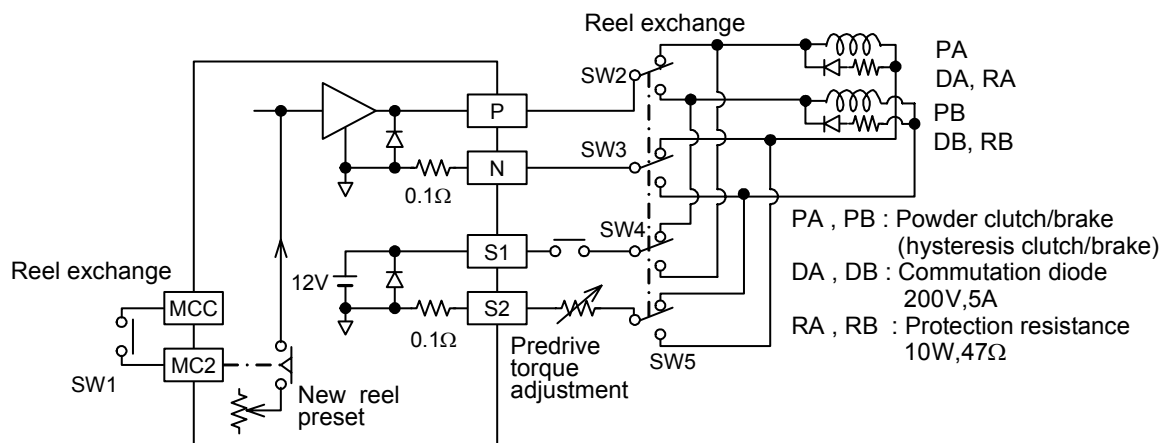
For the preparatory drive of the new reel, turn on the auxiliary power supply in a few seconds but not later than 10 seconds immediately before switching the reels.

In the two-reel winding operation, the mechanical loss cancel torque MLA and MLB are changed over. When it is OFF, the mechanical loss cancel value set to the reel A becomes valid. When it is ON, the mechanical loss cancel value set to the reel B is valid. This is effective when the mechanical loss of the reel A differs greatly from that of reel B. See page 35.



PA and PB is control output for powder to A/B shaft.

1. Connection of switch-over 2-reel powder



2. Setting

For setting the new reel preset value and preset time, refer to Section 6.7 "Powder unwinding, two-reels switching" on the previous page.

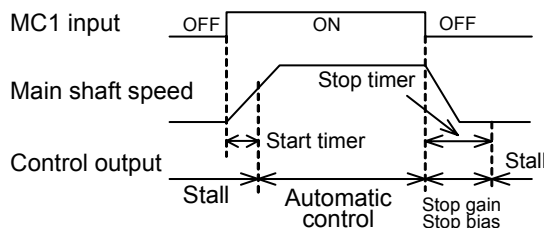
7. Use of extensive functions

7.1 Control of excessive sag or tension in material during start and stop

The following control is possible to limit the tension variation due to material inertia during machine start and stop.

1. Outline

- The start timer is used to reduce the tension variation by shock at the time of starting. The control output from starting the operation (after turning on MC1) to entering the automatic control is fixed to the stall value.
- The stop timer, stop gain and stop bias are used to limit the tension variation by material inertia when the machine is decelerated to halt.



- During the time after the Run/stop input MC1 changes from ON to OFF and before the stop timer times up, the following stop gain and stop bias are valid. After that, the output before stop (stall memory value) are generated.

Stop gain : The control output is adjusted to 5 to 400% of the control output immediately before stop.

Stop bias : While the above stop gain is in effect, 0 to 50% of the rated output can be added. This limits the tension variation by machine inertia when the control output is small.

The control output by the total of the stop gain and the stop bias is controlled to 100% or less.

- Two types of the control output in the stop timer operation can be selected as follows. The feedback control is selected at the time of shipping from the factory.

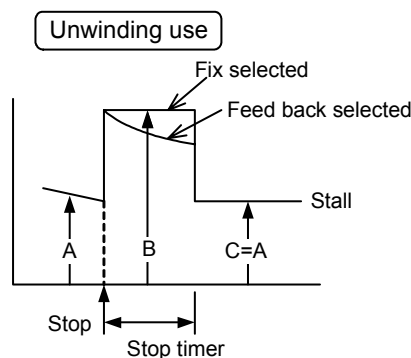
(1) The feedback control takes place while the stop timer is in operation.

- This is selected when non-abrupt stop.

(2) The output is fixed while the stop timer is in operation.

- This is selected when the tension during the stop in (1) above is zero.

Select "Feedback" or "Fixed" on the "Stop T set" screen to select (1) or (2), respectively.



A : Output prior to stop

$$B = A \times \frac{\alpha}{100} + Tr \times \frac{\beta}{100} \leq Tr$$

α : Stop gain
 β : Stop bias
 Tr : Rated output
 $C(=A)$: Stall memory value

2. Setting

STRT . TSET MENU# SET START TIMER
 SET → # . # s

- Set the start timer.



Good to "FEED BACK"

STOP . TSET MENU# SET STOP TIMER
 SET → # . # s : ☒ FEED BACK : ☐ FIXED

- Select the output for the stop timer.



STOP . GAIN MENU# SET STOP GAIN
 SET → # # %

- Set the stop gain.



STOP . BIAS MENU# SET STOP BIAS
 SET → # # %

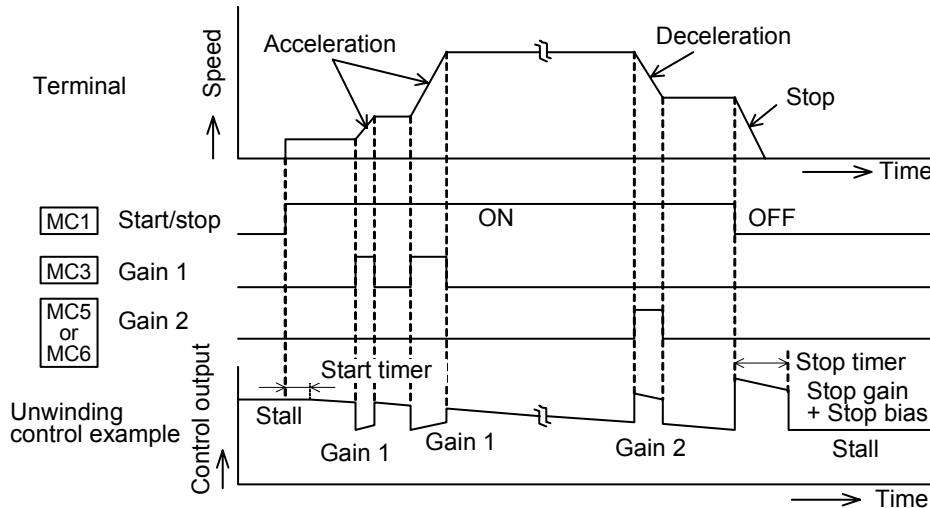
- Set the stop bias.

- For the unwinding operation, set the stop gain to 100% or more so as not to let the tension become zero.
- For the winding operation, set the stop gain to 100% or less and the stop bias to zero to avoid excessive tension in the material.
- Refer to Section 11.6 "Minimum operating tension" to calculate the actual settings. An approximate value is entered in general. A longer time is recommended.

7.2 Control of excessive sag or tension in material during acceleration and deceleration

The following control is possible to limit the tension variation by material inertia during abrupt acceleration or deceleration of the machine.

1. Setting



Gain 1 : While the input at terminal MC3 is on, the control output is 5 to 400% of the control output before the MC3 was turned on. This function makes the acceleration inertia compensation or deceleration inertia compensation possible.

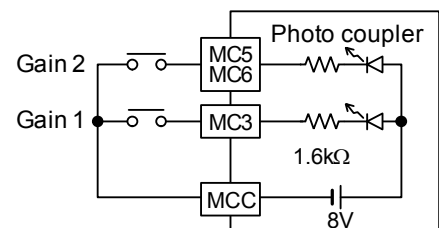
In the unwinding control, for example, the acceleration inertia compensation is possible by turning on the MC3 input with controlling gain 1 at 100% or less during the acceleration. The deceleration inertia compensation is possible by turning it on and controlling the gain at 100% or more.

Gain 2 : While terminal MC5 or MC6 is on, the gain 2 settings are valid in the similar manner as described above.

As an example, gain 1 may be used during acceleration and gain 2 during deceleration.

2. Connection

- Use the micro signal switch commensurate with DC8V 4mA as the input contacts.
- Connect the gain 1 contact signal to MC3. Connect the gain 2 contact signal to MC5 or MC6, whichever is used.



3. Setting

- Use the "OUT.GAIN" screen within "START / STOP" on the engineer screen to change the setting value of gain 1 and gain 2.

Use the numeral input keys to set the data

OUT . GAIN	MENU #	SET OUTPUT GAIN
■ GAIN 1 →	### %	: □ GAIN 2 → ### %

- Use the "MC5" or "MC6" setting screen within "SWITCH" on the initial setting screen or the engineer screen to set the gain 2 contact or change settings.

MC 5	SELECT MC 5 INPUT
■ GAIN 2	: □ INCHNG : □ OUT RMT . : □ CUT TRQ .

Select "GAIN2"

7.3 Control of excessive winding tension

1. Outline of taper control

Such control as to increase/decrease the working tension, depending on the change in winding diameter is called "Taper tension control", in which the tension is controlled in accordance with the preset pattern, to suit the change in winding diameter. This function is mainly used to prevent the material from winding too tight or too loose on the reel.

Following three methods are presently available to determine the current reel diameter:

- (1) By calculating internal reel diameter.
- (2) By entering the reel diameter externally through analog voltage (high precision taper tension control is possible).
- (3) Method of reading from the LE-40MD reel diameter calculation unit (See the instruction manual for the LE-40MD).

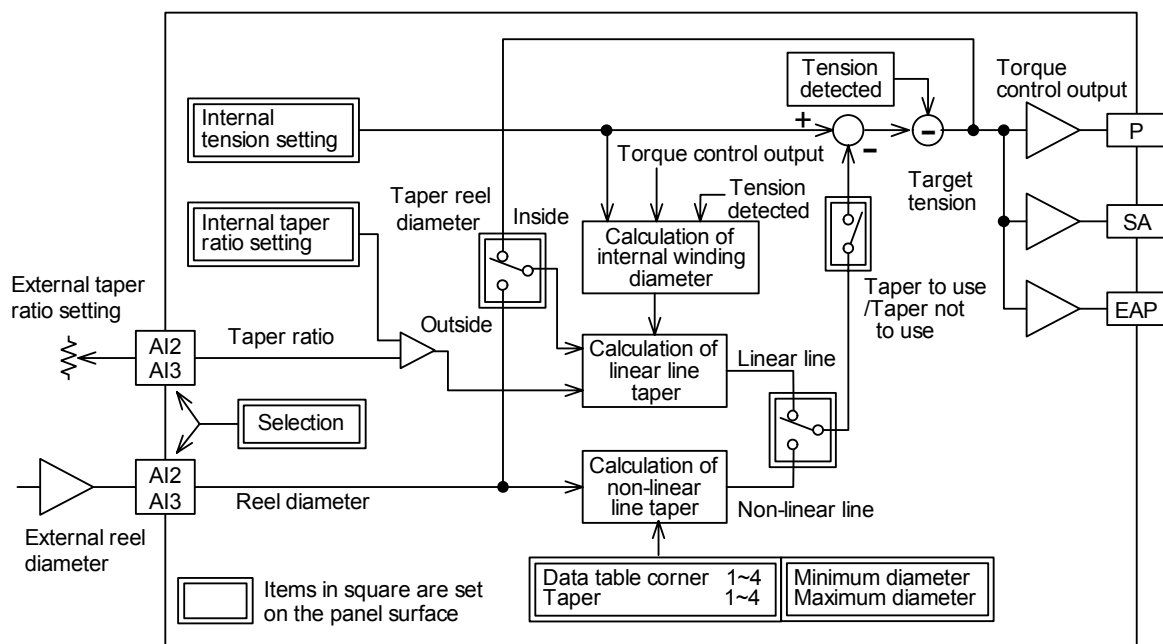
In the internal reel diameter calculation, the reel diameter is calculated based on the torque control output. Since it is not necessary to enter the reel diameter, the accuracy is not very high.

Two methods are available to set the taper ratio as follows :

- (1) By setting the taper ratio (pulser dial entry) internally.
- (2) By entering the taper ratio externally through analog voltage.

Two methods are available to enter the taper curves as follows :

- (1) Linear line taper control.
- (2) Non-linear line taper control.



7.4 External reel diameter taper control

Entering the reel diameter externally results in high precision taper tension control.

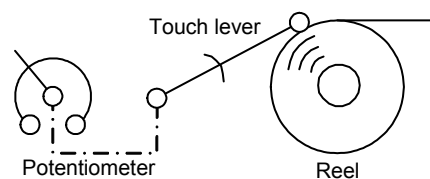
Two methods are available to set the taper ratio as follows:

- (1) Setting the taper ratio by pulser dial entry (see page 29).
- (2) Setting the taper ratio externally through analog voltage.

Two methods are available to enter the taper curves as follows:

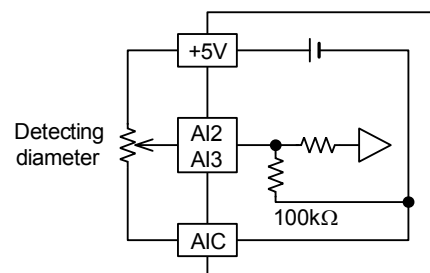
- (1) Linear line taper control.
- (2) Non-linear line taper control.

When touch lever is used



1. Connection

- Use the externally installed potentiometer as shown in the figure above to enter the reel diameter signal of 0V (minimum diameter) to 5V (maximum diameter) to terminals AI2 or AI3.
- When the external analog input is valid, "EXT." appears on the "DIA.MNT." (reel diameter monitor) screen.



2. Setting

- For setting the external reel diameter taper, select "ON" on the "TAPER" screen on the initial setting screen or the engineer screen. Then select "EXT." (external) on the "TPR.DIA." (taper reel diameter) screen.

TAPER	SELECT TAPER TENSION CONTROL
<input type="checkbox"/> OFF	: <input checked="" type="checkbox"/> ON
Select "ON"	
TPR.DIA.	SELECT TAPER SIGNAL
<input type="checkbox"/> INT.	: <input checked="" type="checkbox"/> EXT.
Select "EXT"	
TAPER MD.	SELECT TAPER MODE
<input checked="" type="checkbox"/> LINEAR	: <input type="checkbox"/> NON - LINEAR

- Select which taper to use, the linear line taper or non-linear taper.
See the next page.

- To change the reel diameter input values by the external analog input, change the data on the "AI2" or "AI3" setting screen within "SWITCH" on the initial setting screen or the engineer screen.

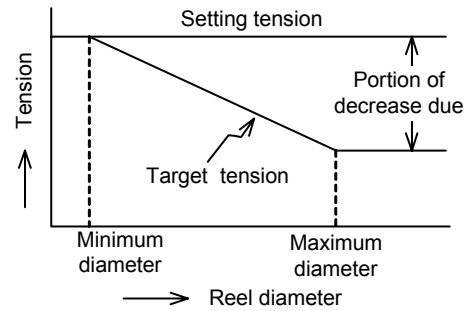
AI2	SELECT AI2 ANALOG INPUT
<input checked="" type="checkbox"/> DIA.	: <input type="checkbox"/> STALL : <input type="checkbox"/> NEW R. : <input type="checkbox"/> TAPER : <input type="checkbox"/> TNSN.
Select "DIA"	

- To change the maximum or minimum value of the reel diameter, change the data on the "DIA.SET" screen within "REEL" on the initial setting screen or the engineer screen.
- The minimum and maximum diameters should be the machine specifications, and basically not changed according to the material.

DIA. SET	SET DIAMETER
<input checked="" type="checkbox"/> MIN. DIA → ### mm φ	: <input type="checkbox"/> MAX. DIA → ### mm φ

3. Linear line taper

- When the non-linear taper "LINEAR" is selected, the system enters in the linear line taper mode. The control takes place according to the taper ratio on the panel or to the taper ratio determined by the external controller, whichever is larger.
The taper ratio entered is the reduction rate from the set tension.
- The tension characteristics appears to be linear against the reel diameter signals as shown in the right figure.
- To set the taper ratio by key entry, use the taper set screen on the operator screen. For the taper ratio setting by the external controller, see page 38.

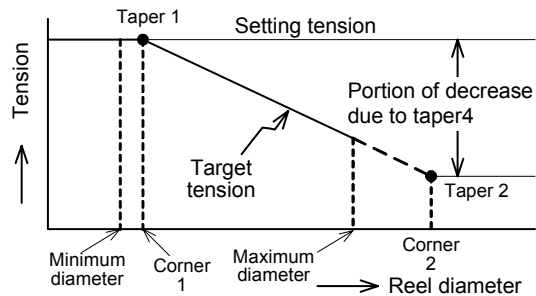
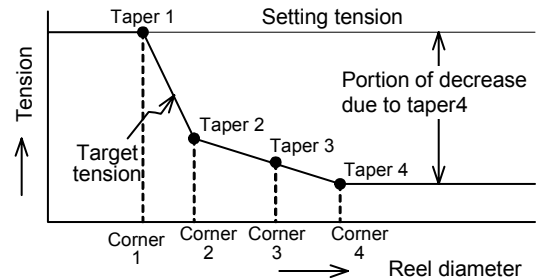
[illegible]

4. Non-linear line taper

- When the non-linear line data is set through the panel, the taper tension control takes place as follows:
Set the taper data as follows:

$$\text{Corner 1} < \text{corner 2} < \text{corner 3} < \text{corner 4}$$
- When the 4-stage non-linear line taper control is not necessary, for instance, when the tension is constant from the minimum diameter to corner 1 and the linear line taper is given from corner 1, set the taper as shown in the right figure (Corner 1, Taper 1) (Corner 2, Taper 2). The linear line taper control may take place from corner 1 to corner 2.
Set the data as follows:

$$\text{corner 1} \geq D_{\min}, \text{ corner 2} \geq D_{\max}$$
 Not necessary to set data to corners 3 and 4.



TAPER SET ■■■■mmφ→□TPR.1 ■■■%: □CNR2 ■■■mmφ→

↑ □◀

TAPER SET ■■■■mmφ→■TPR.4 ■■■%

□TPR.3 ■■■%: □CNR4 ■■■mmφ→

5. Display

The "TARGET" value in which the taper ratio is taken can be confirmed on the "TNSN.MNT." (tension monitor) screen of the operator screen.

[illegible]

7.5 Change of control gains

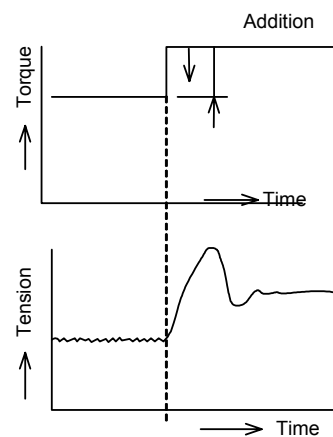
The gains can be adjusted during operation. Adjust the auto-gain in the manual operation or automatic operation. To perform fine adjustment, adjust the manual gain. No need to change the gain if the tension is stable.

1. Automatic gain adjustment

- In the operational condition, when the specified output is added to the output in actual operation, the tension shows step-like changes. The control gain can be adjusted automatically based on the response characteristic of that tension.

Set the additive output on the automatic gain adjustment screen.

The right figure shows the operating characteristics of the automatic gain adjustment in the manual operation.



- To execute automatic gain adjustment
 - (1) Operate the machine at the initial value of the control gain.
 - (2) Select "AUTO" on the "GAIN" screen within "Gain" on the engineer screen.

```
GAIN      SELECT AUTO / MANUAL GAIN TUNING
█ AUTO    : □ MANUAL
```

Select "AUTO"



```
AUTO GTUNE  SET OFFSET OUTPUT
            SET→  ### %   OUTPUT→  ### %
```

Additional output

Output monitor of now



- Set the additive output (percent value for the maximum output) as large as possible on the premises it does not adversely affect the material. Press the enter key to set the value.
- When adjusting the automatic gain, the output increases instantaneously. When handling the material easily elongated or ruptured, set the additive output to a small value for adjustment.

```
AUTO GTUNE  EXECUTE AUTO GAIN TUNING
PUSH <ENTER> OR <CANCEL>
```

ENTER

```
AUTO GTUNE  EXECUTING AUTO GAIN TUNING
PUSH <CANCEL> AT STOP
```

Stand-by (for approximately 10sec)

```
AUTO GTUNE
AUTO GAIN TUNING COMPLETE!
```

- When errors generated during the automatic gain adjustment, add as large a torque as possible. An error will also be generated if accurate response waveforms cannot be obtained. Adjust the manual gain in such a case.

- (3) Repeat the above steps two to three times for a higher accuracy.

1. Manual gain adjustment

- When fine adjustment of the gain is required, first set the integral time, then adjust the proportional gain according to the following procedure.
- The dead zone gain and dead zone width are not required to be changed in normal cases. However, adjust these values if it takes too long time to reach the target tension when starting the system, switching to a new reel, changing the tension settings.
- Select "MANUAL" on the "GAIN" screen within "GAIN" on the engineer screen.

GAIN		SELECT AUTO / MANUAL GAIN TUNING	
<input type="checkbox"/> AUTO	:	<input checked="" type="checkbox"/> MANUAL	

▼

Select "MANUAL"

Set the value to as large a value as possible as long as the follow-up action is not too slow when changing the tension setting, or no hunting occurs while nearing the minimum diameter.
(Guideline: A value smaller by approximately 20% than the value at which hunting occurs.)

Reduce this value if deviation between the target tension and the actual tension remains.

MANU. GTUNE MENU #		MANUAL GAIN TUNING	
<input checked="" type="checkbox"/> PROP. GAIN → # # # %	:	<input type="checkbox"/> INTG. TIME → # # # %	:

MANU. GTUNE MENU #		MANUAL GAIN TUNING	
<input type="checkbox"/> ADD GAIN → # # # %	:	<input checked="" type="checkbox"/> DEAD ZONE → # # # %	:

Not necessary to change in normal cases. If required to change, change the dead zone gain first to obtain the optimum value. Then, reduce the dead zone width to a smaller value.

[1] Integral time (Initial set value: 50%)

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 hunting easily occurs. When a large value is set, the control is stabilized but the responsibility at the time when the unit is activated, the new axis is changed over, the tension set value is changed, etc. is deteriorated.

Set a large value with which the follow-up delay generated when the tension set value is changed is acceptable and hunting does not occur with a value near the minimum diameter.

[2] AProportional gain (Initial set value: 50%)

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 hunting easily occurs.

Set a value with which overshoot slightly remains when the target tension is changed.

The dead zone gain and the dead zone width are not required to be set (so that they remain in the initial setting) usually. However, if it takes considerable time to reach the target tension value when the unit is activated, the new axis is changed over, the tension set value is changed, etc., adjust them together with the integral time and the proportional gain.

[3] Dead zone width (Initial setting: 50%)

The dead zone width specifies the deviation generated when the proportional gain is changed over. When a small value is set, the responsibility becomes faster but hunting easily occurs.

[4] Dead zone gain (Initial setting: 0%)

When the deviation is larger than the dead zone width, the dead zone gain set here is added to the proportional gain to increase the gain.

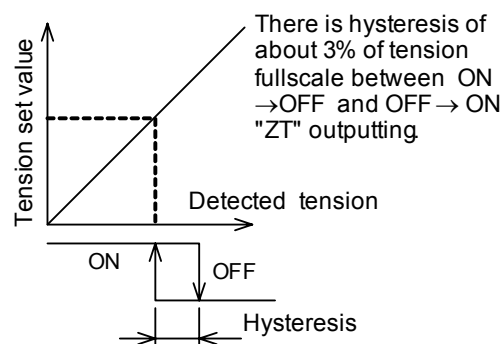
When a large value is set, the time required until the deviation enters the dead zone range can be made shorter. However, if the set value is too large, hunting easily occurs. Enter a value with which appropriate responsibility can be obtained when combined with the dead zone width and the proportional gain.

7.6 Output of contact when running out of materials

This contact output can be used to detect an abnormality such as material running out.

The contact output will be turned on when the detected tension is smaller than the set parameter. When the parameter is set to zero, the contact output is OFF normally. If an abnormality occurs in the internal program, this contact output will be turned ON regardless of the settings or tension values.

The zero tension detection takes place with respect to the tension monitor display value. The zero tension detection timing therefore changes depending on the tension display filter setting.



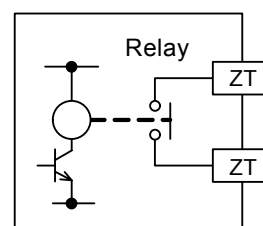
1. Connection

The capacity of the zero tension output contacts is as follows:

AC 250V 0.5A

DC 30V 0.5A

Connect loads matching with the capacity.



2. Setting

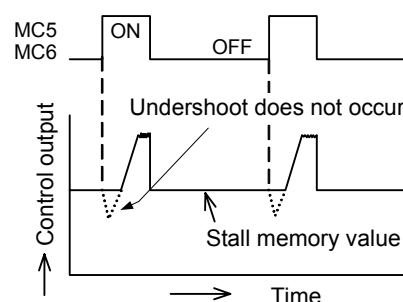
To use the zero tension output, set it on the "ZERO TNSN." screen within "TENSION" on the engineer screen.

ZERO TNSN. SET ZERO TENSION DETECT LEVEL	
SET → ###N (0 = NOT USED)	
SET → ###. # × 10 N (0 = NOT USED)	

7.7 Use for machines with frequent inching operation

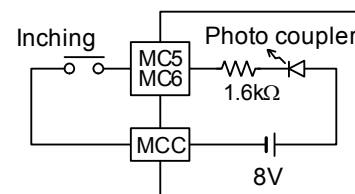
This function is used to control the loss of tension by machine inching.

When this input is ON, the control output will not be smaller than the stall memory value.



1. Connection

- Use a micro signal switch commensurate with DC8V 4 mA as the input contact.
- Connect the inching signals to the terminal MC5 or MC6 set as follows.



2. Setting

- To set the inching function, use the "MC5" or "MC6" setting screen within "SWITCH" on the initial setting screen or the engineer screen.

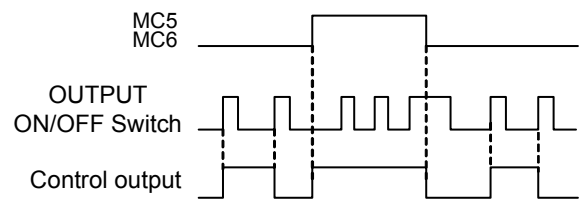
MC 5	SELECT MC 5 INPUT
<input type="checkbox"/> GAIN 2	<input checked="" type="checkbox"/> INCHNG : <input type="checkbox"/> OUT RMT : <input type="checkbox"/> CUT TRQ

Select "INCHNG"

7.8 Externally turns ON or OFF control output

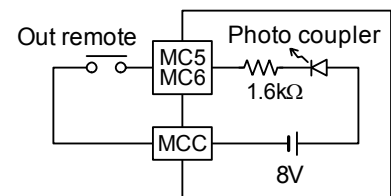
Turning ON or OFF this input allows remote control of the control output.

This takes precedence over the output on/off switch on the panel.



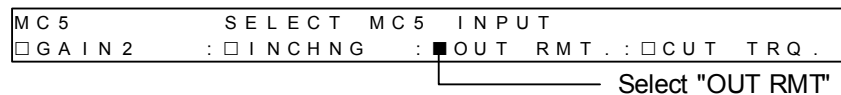
1. Connection

- Use a micro signal switch commensurate with DC8V 4 mA as the input contacts.
- Connect the "OUT remote" to terminal MC5 or MC6 set as follows.



2. Setting

- To set the "OUT RMT." (out remote), use the "MC5" or "MC6" setting screen within "SWITCH" on the initial setting screen or the engineer screen.

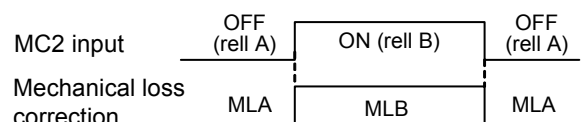


7.9 Setting of mechanical loss with two-reel switching

In automatic operation mode, the control output plus mechanical loss will be generated. In manual operation mode, the manual control value plus mechanical loss will be generated.

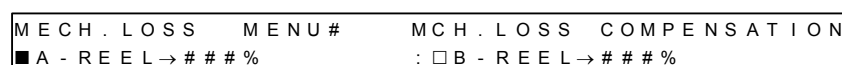
In the two-reel winding operation, the system switches between mechanical loss correction torque MLA and MLB. If off, the mechanical loss cancel value for reel A setting is valid. If on, the mechanical loss cancel value for reel B setting is valid.

This setting is recommended in the case of the great mechanical loss in single reel winding.



1. Setting

- To set the mechanical loss, use the "MECH.LOSS" (mechanical loss) screen within "REEL" on the engineer screen.



7.10 Use of cut torque

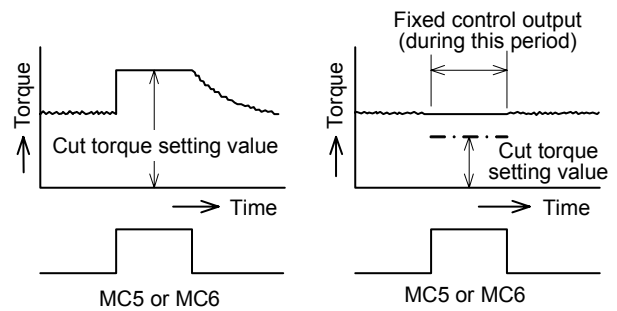
In the automatic paper-jointing control, this function facilitates the material cutting while the cutter is in operation by fixing material tension at a greater value.

When the MC5 or MC6 contact input is ON, the control output is fixed and maintained at a constant level.

The lower limit of the control output is limited to the cut torque setting value.

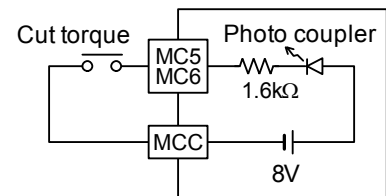
When the reel change signal is entered, the value changes to the new reel preset value.

The reel change signal takes precedence over the cut torque. However, turn off the cut torque before the new reel preset timer times up.



1. Connection

- Use a micro signal switch commensurate with DC8V 4 mA as the input contacts.
- Connect the cut torque to the terminal MC5 or MC6 set as follows.



2. Setting

- Use the "MC5" or "MC6" setting screen within "SWITCH" on the initial setting screen or the engineer screen to set or change the cut torque setting.

MC 5	SELECT	MC 5	INPUT
<input type="checkbox"/> GAIN 2	:	<input type="checkbox"/> INCHNG	:
<input type="checkbox"/> OUT RMT .	:	<input checked="" type="checkbox"/> CUT TRQ .	:

Select "CUT TRQ."

7.11 Reduction of variation in tension readout

To reduce variation in the tension readout, select "Display filter" within "Tension" on the engineer screen. Increase the value to make the response slower. This makes the tension reading more stable and comfortable when it varies quickly.

MNT . FLT .	SET	TENSION	MONITOR	FILTER
<input type="checkbox"/> 1 / 4 s	:	<input checked="" type="checkbox"/> 1 / 2 s	:	<input type="checkbox"/> 1 s
			:	<input type="checkbox"/> 2 s
			:	<input type="checkbox"/> 4 s

8. Use of external analog signals

When entering settings externally by analog voltage, prohibit the settings change from the panel. This makes the setting value change only by the external analog input (controller installed externally) valid.

Notes

Regarding the tension setting , stall setting, new reel presetting and taper ratio setting , the setting through the panel or the setting by external analog input , whichever is greater , takes precedence in shipping -setting condition. By prohibiting change of the setting value from the panel on the "Setting prohibited" screen, only the external analog input (controller installed externally) is made valid.

If prohibited to change setting value from the panel, the setting value from the panel will be fixed at the value immediately before the prohibition.

1. Setting

To set setting prohibition, use the "INH.ENT." screen within "OTHERS" on the engineer screen.

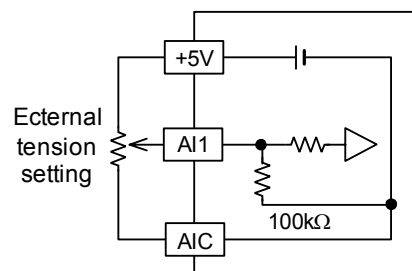
INH. ENT. INHIBIT PANEL ENTRY	
<input type="checkbox"/> TNSN. SET :	<input checked="" type="checkbox"/> STALL SET :
<input type="checkbox"/> NEW RSET :	<input type="checkbox"/> TAPER SET :

If "Stall set" prohibition has made valid the stall setting change from the panel will be prohibited. The setting value will be fixed at the value immediately before the prohibition.

8.1 Varies set tension

1. Connection

- Instead of setting the tension from the panel, input signal of 0 to 5V can be used for the tension setting.
When the input of 0 to 5V is given the tension setting value becomes 0 to 100%.
- Connect the signal to the terminal A11 as per the figure at right.
The tension setting from the panel or the tension setting by the external input, whichever is greater, becomes valid. See the notes above.



2. Display

If the external analog input is valid message "EXT." appears on the "Tension set" screen as shown below. If "EXT." is gone, the key setting is greater and is therefore valid

[illegible]

3. Change over the tension setting method

- By setting “EXT.TENS.” to the MC5 or MC6, turning on or off the MC5 or MC6 can switch over the tension setting method as follows.
 - ON -----External input is valid.
 - OFF-----Setting from the panel is valid.

MC5	SELECT MC5 INPUT
<input type="checkbox"/> INCHNG	: <input type="checkbox"/> OUT RMT. : <input type="checkbox"/> CUT TRQ. : <input checked="" type="checkbox"/> EXT. TENS.

Select " EXT.TENS. "

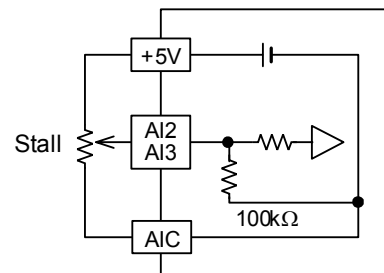
8.2 Enters reel diameter data

Refer to page 30 Section 7.4 "External reel diameter taper control".

8.3 Varies stall

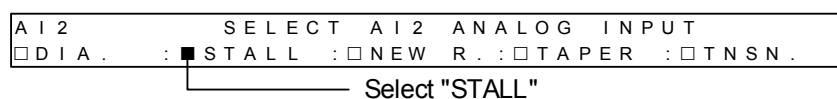
1. Connection

- Given 0 to 5V input, the stall setting value becomes 0 to 100% output. Connect this signal to the terminal A12 or A13.
- When the stall memory reset input [MC4] is turned ON or the output on/off switch on the panel changes from ON to OFF, this value is preset in the stall memory value.
- This input is valid if it is greater than the internal stall settings. See the notes on the page 37.



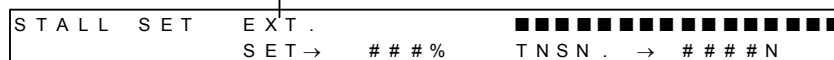
2. Setting

- To change the stall setting input to the setting by the external analog input, use the "A12" or "A13" setting screen within "SWITCH" on the initial setting screen or the engineer screen.



3. Display

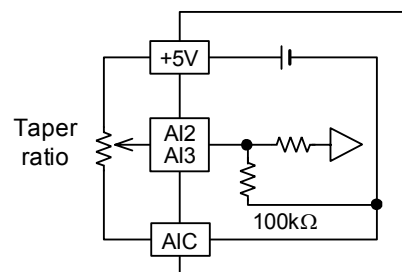
When the external analog input is valid message "EXT." appears on the "Stall set" screen as shown below. If "EXT." is gone, the key setting value is greater and is therefore valid



8.4 Varies taper ratio

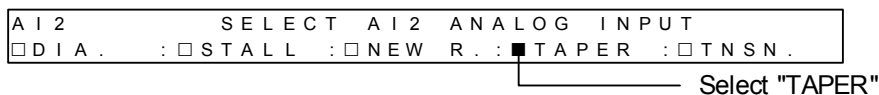
1. Connection

- Given 0 to 5V input by, for example, an external controller, the taper ratio setting value becomes 0 to 80% when the reel diameter is set internally or 0 to 100% when the reel diameter is set externally. Connect this input to the terminal A12 or A13.
- This input is valid if it is greater than the taper ratio setting value by the key entry. See the notes on the page 37.



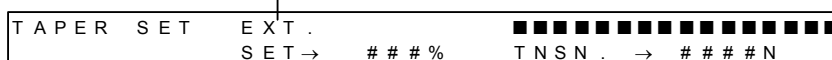
2. Setting

- To change the stall setting value input to the setting by the external analog input, use the "A12" or "A13" setting screen within "SWITCH" on the initial setting screen or the engineer screen.



3. Display

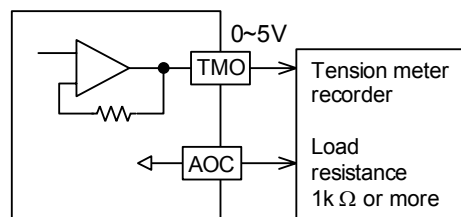
When the external analog input is valid message "EXT." appears on the "Taper set" screen as shown below. If "EXT." is gone, the key setting value is greater and is therefore valid



9. Other functions

9.1 Records tension data

Corresponding to the tension detection from zero to full scale, the output from 0 to 5V is generated. The full scale tension is set by the parameter.



1. Connection

- Connect this signal between TMO and AOC.
- The load resistance should be 1 kΩ or greater.

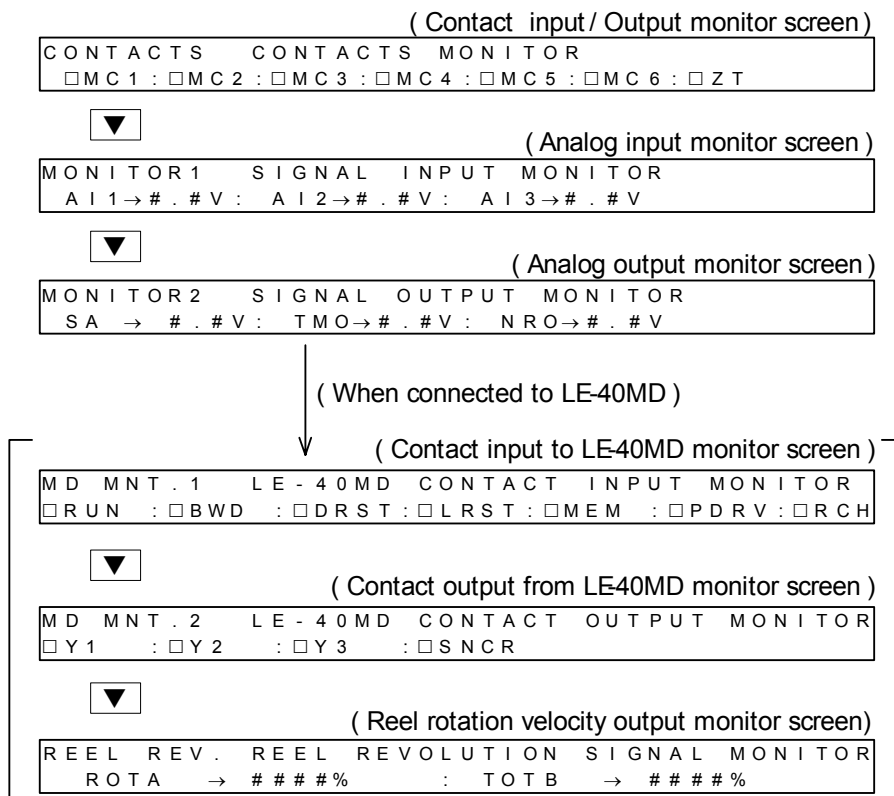
2. Setting

- The output filter can be adjusted to 1/4, 1/2, 1, 2 or 4 seconds by the parameter.
- To change the response characteristic of the TMO tension monitor output, select "TMO FLT." within "TENSION" on the engineer screen. Increasing the value slows the response characteristic.

TMO FLT.	SET	TMO OUTPUT FILTER
<input type="checkbox"/> 1 / 4 s	<input checked="" type="checkbox"/> 1 / 2 s	<input type="checkbox"/> 1 s : <input type="checkbox"/> 2 s : <input type="checkbox"/> 4 s

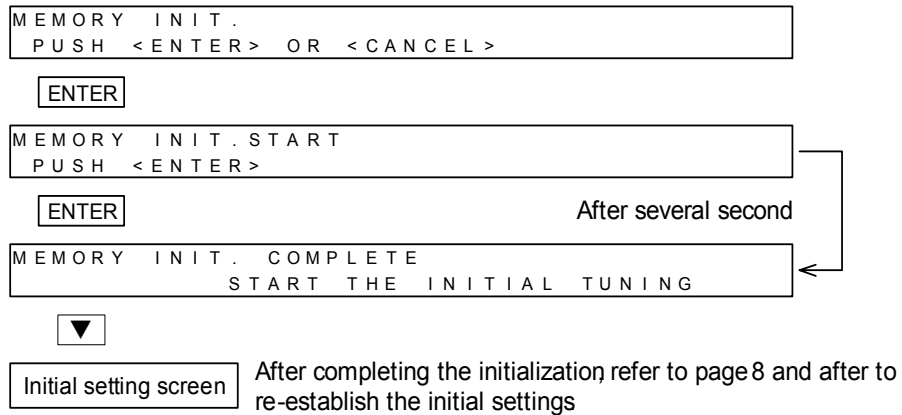
9.2 Monitors input and output condition

To check condition of the contacts and analog data input and output, use the "CONTACTS" screen or similar one within "OTHERS" on the engineer screen.



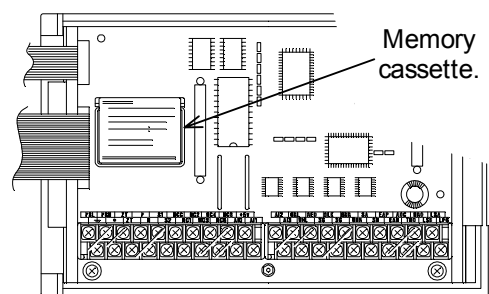
9.3 Returns all settings to the initial factory settings

To reset all the settings to the factory settings, use the "MEMORY INIT." screen within "OTHERS" on the engineer screen. Note that the data having been established will disappear.



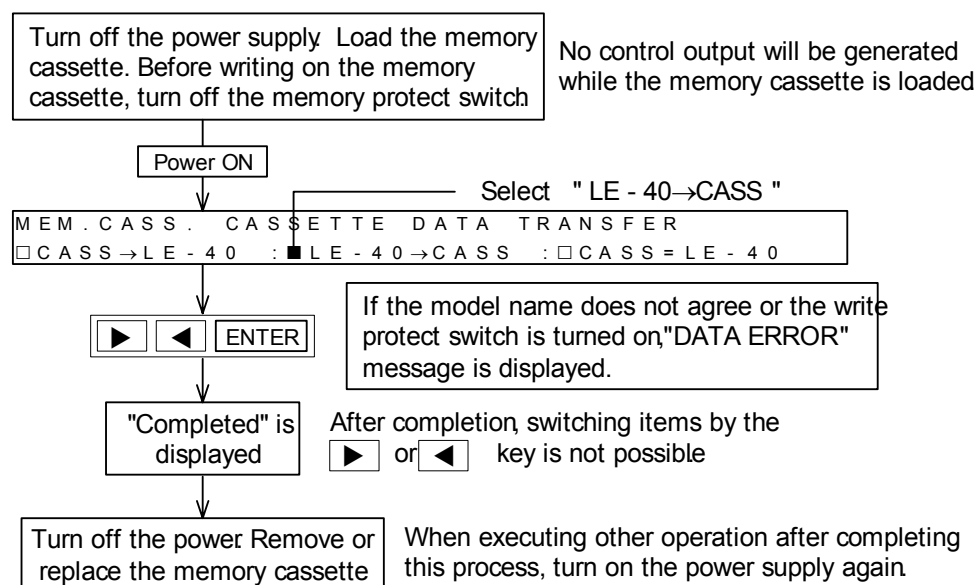
9.4 Copies data settings to other controller

- All the set data saved in the tension controller except the external input from the trimmer or others and internal monitor values can be written, read and compared between the memory cassette FX-EEPROM - 4 (or FX-EEPROM-8).
- By transferring the data from the memory cassette in which the operation constants and parameters in accordance with each material to the tension controller, the unit can be activated easily at a local site.



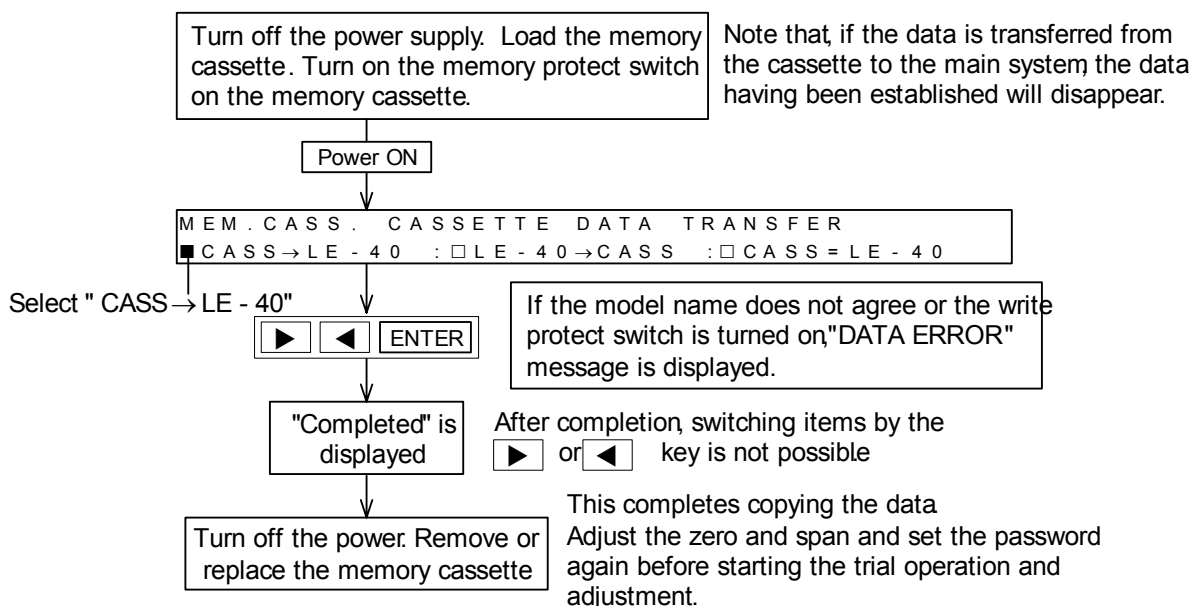
1. Storing data on cassette

Read the data from the original controller to copy the settings.



2. Writing data on cassette

Writes the settings of the original controller on the new controller.



9.5 Model LE-40Md reel diameter calculation unit

Used with the LE-40MTB-E tension controller, the LE-40MD reel diameter calculation unit enhances the functions during the reel shaft control.

The LE-40MD reel diameter calculation unit, using the rate calculation method based on the reel shaft pulse and the measure roll pulse, detects the reel diameter without contacting mechanically.

The unit also detects the line speed and measures length to output the command for the reel shaft rotational speed and timing detection signals together with the reel diameter information.

- Based on the reel diameter data, high-precision taper tension control (linear line and non-linear line taper tension control) commensurate with the reel diameter is available.
- By output of the reel shaft rotational speed, constant- slip control of the winding powder clutch becomes available.
- According to the output of the four- point timing detection including peripheral velocity synchronization (reel diameter or length measurement) and the new shaft pre-drive output, two-reel switchover control can be done relatively easily.
- The electronics gear function extends the range of selection of pulse encoder for measure pulse, giving more freedom to the mechanism design.

For details of the setting, see the instruction manual for LE-40MD reel diameter calculation unit.

When the LE=40MD is not connected

The set menu shown below is valued when the LE-40MD is used together. Make sure to set the pre-drive time to "0" using the "PDRV SET" screen within "40MD" on the engineer screen when the LE-40MD is not used. Set the pre-drive time to "0" also when the multi-reel changeover is not preformed even if the LE=40MD is used.

(Predrive setting screen)

P D R V	S E T	S E T	P R E D R I V E	P A R A M E T E R
■ P D	T I M E R	→	### S e c	: □ P D B I A S → ### %

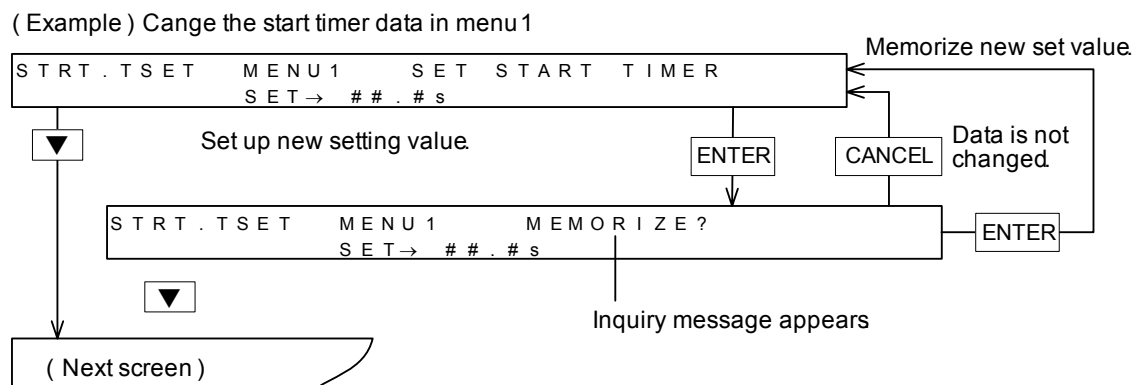
When using materials with different settings, the menu function is recommended to use.

Eight data set values can be stored in the memory for the items marked with "MENU #" (pointed out by * in the figure below) on the screen. This allows the operator to select eight operation patterns stored in the memory through the key operation on the panel.



1. Data setting

- Setting and changing data in each menu screen is possible only when the MC1 input signal is off (during operation stop).
- Menu 0
Call up the screen that carries the item to be set. Select menu according to the method described above. By using the pulser dial to set the setting values, the new setting is automatically memorized.
- Menu 1 through 7
Call up the screen that carries the item to be set. Select one from menu 1 through menu 7 according to the method described above. After setting the set values using the pulser dial, press the [ENTER] key twice to save the new setting.
- Operation to save settings for menu 1 through menu 7



2. Menu switch over

- Menu 0 through menu 3 can be switched over by pressing the

MENU 4
MENU 0

 through

MENU 7
MENU 3

 keys while the menu shift indicator LED (green) is OFF.
- Menu 4 through menu 7 can be switched over by pressing the

MENU 4
MENU 0

 through

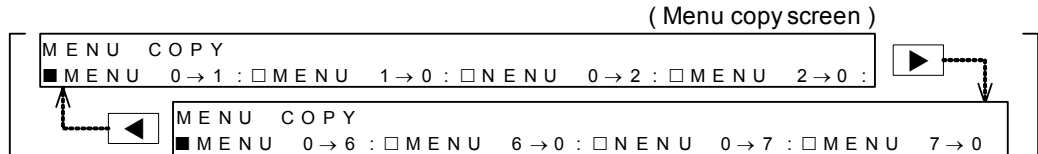
MENU 7
MENU 3

 keys while the [MENU SHIFT] indicator LED (green) is ON. Then the menu shift indicator LED goes out.
- The initial condition is set to menu 0.

3. Menu copy

Data can be copied between menu 0 and menu 1 through menu 7.

- [1] Copy the menu on the "MENU COPY" screen in the "MENU" of the engineer screen.
- [2] Select the screen to be copied with the ◀ and ▶ keys.
- [3] Press the [ENTER] key to complete the copy process.
- [4] After the execution, the menu of the copy destination appears on the display.



4. Registration of menu titles

Menu 1 through menu 7 can be registered with desired titles.

- [1] To copy the menu, use the "MENU REG." (menu registration) screen in "MENU" on the engineer screen.
- [2] Select a menu from menu 1 through menu 7 with the ◀ and ▶ keys. Press the [ENTER] key to determine the menu number to be registered with a new title.
- [3] Select the letters to change with the ◀ and ▶ keys, further select letters, numeric figures or symbols with the pulser dial. Up to 6 letters can be registered.
(See the table on the right for the letters and symbols available.)

LCD character table

□ ! " # \$ % & ' () * + , - . /
0 1 2 3 4 5 6 7 8 9 < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [\] ^ _
a b c d e f g h i j k l m n o
p q r s t u v w x y z { } → ←
□ □ □ □ □ □ □ □ □ □ □ □ □ □
□ □ □ □ □ □ □ □ □ □ □ □ □ □
□ . 「 」 、 ・ ヲ アイウエオヤユヨツ
ー アイウエオカキクケコサシスセソ
タチツテトナニヌネノハヒフヘホマ
ミムメモヤユヨラリルレロワン °

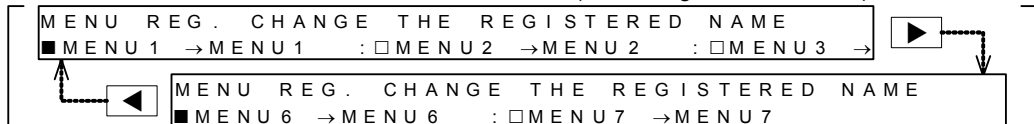
- [4] Press the [ENTER] key to register. → The registered title appears on each screen.

(Example)

Registered title

STRT . TSET F i l m A SET START TIMER
SET → # # . # s

(Menu registrationscreen)



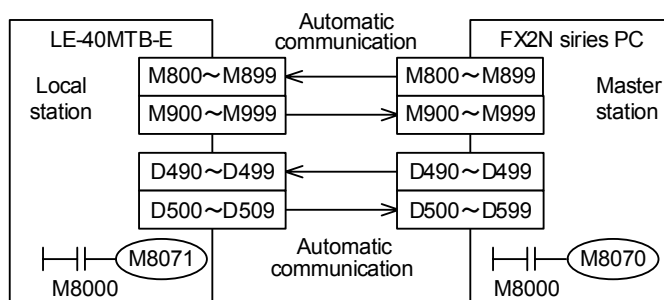
9.7 Execution of Fx programmable controller link

1. Outline

- The tension controller LE-40MTB-E can perform the parallel wire link with the Mitsubishi MELSEC-F (FX2N) series programmable controller.
- When the tension controller LE-40MTB-E is linked to the programmable controller, the data setting can be performed from the programmable controller to the tension controller, and the control status of the tension controller can be monitored in the programmable controller.
- In the parallel wire link, the contact information and the data can be linked by simply connecting a pair of twisted pair cables to the RS-485 board FX2N-485BD which is connected to the LE-40MTB-E and the programmable controller.
Compared with the conventional analog link, the number of cables used is smaller and the system of higher reliability can be achieved at a lower cost by the parallel link.

2. Transmission signal configuration

- The wire link function of the FX2N Series programmable controller is built in the LE-40MTB-E.
- The local stations are already set in the LE-40MTB-E by the system program.
- The internal contacts and data can be easily transferred by updating or reading the internal contacts and data registers in the link area on the programmable controller side.



The devices whose data is for Menu 0 exclusively are saved on the LE-40MTB-E side.

3. Handling the link data

- When the link data is saved on the LE-40MTB - E side, the data device whose data is for Menu 0 exclusively is saved. Other data devices are not saved. When the data other than Menu 0 must be saved, save such data on the master programmable controller side.
- When the data is written in the LE - 40MTB through link, it is written directly in the control table (Refer to the users manual.). Accordingly, the data in the menu table is not updated. Because saving of the data for Menu 0 is controlled in the control table, the data area for Menu 0 is saved automatically. But because saving of the data for other menus is controlled in the menu table, the data obtained through link is not saved automatically. When you want to save the data for other than Menu 0 in the LE-40MTB-E, you must perform the manual operation (Press the [ENTER] key twice).
- When the switch-over menu No. data (Set value No. 70) is updated on the master programmable controller side while the LE-40MTB-E is stopped, the menu can be switched over through link.
- For all the link data, the priority is given to the last data. When the data currently set is updated through the link, the updated data becomes effective immediately after the LE - 40MTB-E receives it. When two or more set values are transferred in the same timing at the same time, the priority is given to the one having a larger data register No. in the link area. (The data whose device No. is larger will be processed later.)

- The contact data is an OR command. Accordingly, it becomes effective if the input on the main unit side is turned on. Pay rigid attention.

The time required to transfer the contact data is as follows.

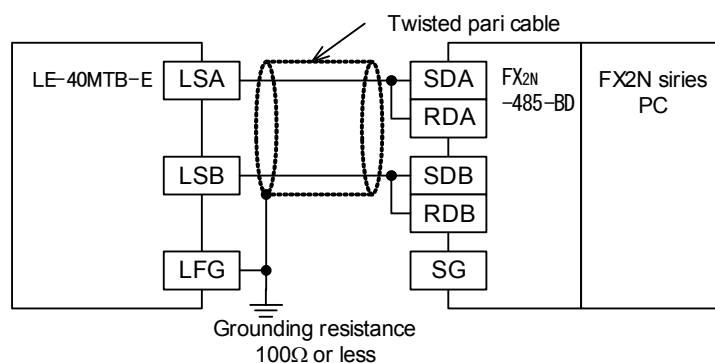
Required time (ms) \div 100 + (Operation cycle in the master programmable controller)

- Because the high-speed parallel run mode is not supported, do not use it. Accordingly, do not turn on the M8162.

4. Connection

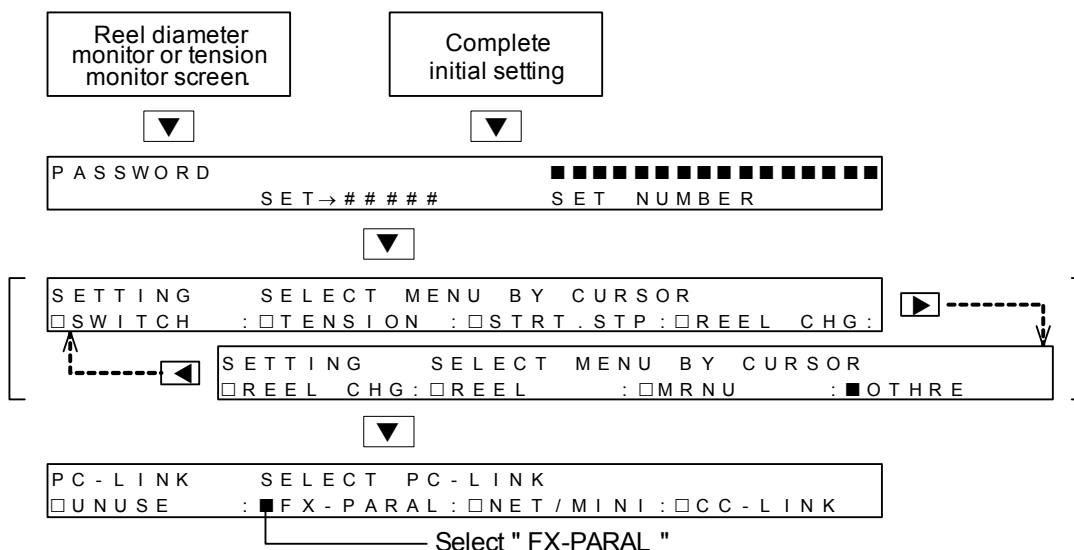
The RS-485 board FX2N-485BD is required for the parallel wire link.

Connect between the LE-40MTB-E and the wire link adaptor with the twisted pair cables. Perform the solid grounding at [LFG] in the LE-40MTB-E. The allowable maximum cable length is 10 m.



5. Setting

To execute parallel link with the LE-40MTB-E, use the " PC-link " screen in " Other " on the engineer screen for setting.



6. Linking the contact devices

- From the Programmable controller to the LE - 40MTB-E

By turning on and off the internal contacts M800 to M806 on the programmable controller side, the contact command inputs MC1 to MC6 in the LE-40MTB-E can be operated. The OR command is entered in the input terminals in the LE-40MTB-E. The M807 is used to transfer the data devices.

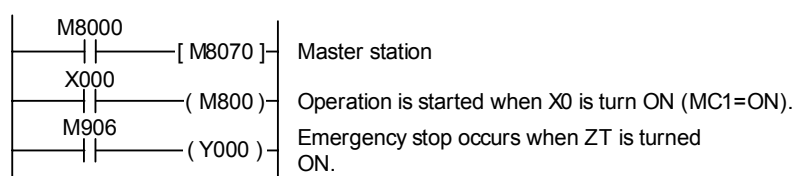
- From the LE-40MTB-E to the programmable controller

By monitoring the internal contacts M900 to M906 on the programmable controller side, the I/O status of the contacts in the LE-40MTB-E can be monitored. The M907 is used to transfer the data devices.

Device No.	Set item
M800	MC1
M801	MC2
M802	MC3
M803	MC4
M804	MC5
M805	MC6
M806	MANUAL/AUTO
M807	Sending to word data is completed.

Device No.	Monitor item
M900	MC1
M901	MC2
M902	MC3
M903	MC4
M904	MC5
M905	MC6
M906	ZT
M907	Sending to word data is completed.

(Example of program)



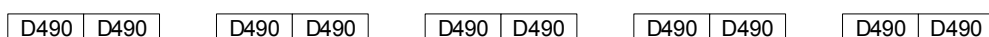
7. Linking the data devices

- From LE-40MTB-E to the programmable controller

By monitoring the data in the D500 to D599 in the programmable controller, the data shown in the table below can be monitored.

BFM No.	Monitor item
#0	Total tension monitor
#1	Left tension monitor
#2	Right tension monitor
#3	Reel diameter monitor
#4	Target tension monitor
#5	SA output monitor
#6	TMO output monitor
#7	NRO output monitor
#8	40MD ROTA monitor
#9	40MD ROTB monitor

- From the programmable controller to the LE-40MTB-E



Ten points of 16 bits, D490 to D499, can be transferred from the programmable controller to the LE-40MTB-E. It means that when the number of data to be sent to the LE-40MTB-E becomes 11 or more, data transfer is impossible. To solve this problem, a set value No. is assigned to a data device having an even number, and the contents of the data is assigned to a data device having an odd number. Then, up to five data can be sent at a time. And all the data in the table can be sent by sending it on the time sharing basis.

Data is transferred in the following way.

- [1] The data is set to the D490 ~ D499.
- [2] The M807 is turned on at the programmable controller.
- [3] The LE - 40MTB-E receives the data.
- [4] When receiving is completed, the M907 is turned on.
- [5] The programmable controller receives the M907.
- [6] The M807 is turned off at the programmable controller.
- [7] The LE-40MTB-E receives "OFF" of the M807.
- [8] The M907 is turned off.
- [9] "OFF" of the M907 is received.
- [10] Data transfer is completed. The next data will be transferred.

When four or less data is sent, set "0" to the data to be sent to all the remaining buffer memories having an even number. When data devices will not be transferred, set "0" to the data in the D490 to D499.

While the operation/stop [MC1] is turned on, the system setting data is neglected even if it is transferred. Make sure to transfer the data while the [MC1] is turned off.

The decimal point is neglected in any data.

The time required to transfer five data is as follows.

$$\text{Required time (ms)} = 100 + (\text{Operation cycle in the master programmable controller}) \times 4$$

Set value No.	Set item	Variable setting	System setting
1	Tension setting	○	
2	Stall value setting	○	
3	Initial diameter setting **	○	
4		○	
5	New reel preset value setting	○	
6	Taper ratio setting	○	
7	Corner 1 setting	○	
8	Taper 1 setting	○	
9	Corner 2 setting	○	
10	Taper 2 setting	○	
11	Corner 3 setting	○	
12	Taper 3 setting	○	
13	Corner 4 setting	○	
14	Taper 4 setting	○	
15	Manual setting	○	
16	Start timer setting	○	
17	Stop timer setting	○	
18	Stop gain setting	○	
19	Stop bias setting	○	
20	Gain 1 setting	○	
21	Gain 2 setting	○	
22	New reel preset timer setting	○	
23	Old reel cut torque setting	○	
24	Mechanical loss setting for reel A	○	
25	Mechanical loss setting for reel B	○	
26	Measurement length LOUT L1 setting **	○	
27	Measurement length LOUT L2 setting **	○	
28	Measurement length LOUT L3 setting **	○	
29	Reel diameter DOUT Y1setting **	○	
30	Reel diameter DOUT Y2 setting **	○	
31	Reel diameter DOUT Y3 setting **	○	
32	Reel rotation velocity coefficient R CURR. setting **	○	
33	Reel rotation velocity bias R BIAS setting **	○	
34	Start gain R GAIN (ROUT gain) setting **	○	
35	Start timer R TIMER (ROUT timer) setting **	○	
36	Predrive time PD TIME setting **	○	
37	Predrive bias PD BIAS setting **	○	
38	Reel diameter electronic gear DIA.GEAR setting **	○	
39	Velocity electronic gear SPD.GEAR setting **	○	
40	Reel diameter setting **	○	
41			
42			
43			
44			
45	Proportional gain setting	○	
46	Integral time setting	○	
47	Dead zone gain setting	○	
48	Dead zone width setting	○	
49			

Set value No.	Set item	Variable setting	System setting
50	Memory switch setting 1 *		○
BIT0	Unit of tension (N / ×10N)		
BIT1	Control reel (winding / unwinding)		
BIT2	(intremediate reel / winding reel)		
BIT3	Number of reels (multiple reels / one reel)		
BIT4	Taper control (used / unused)		
BIT5	Broken line taper (broken line / straight line)		
BIT 6	Taper diameter signal (external / internal)		
51	Memory switch setting 2 *		○
BIT0	Actuator (servo / powder)		
BIT1	Automatic control gain (manual / automatic)		
52	AI2 setting *		○
BIT0	Reel diameter		
BIT1	Stall setting		
BIT2	New reel preset		
BIT3	Taper tatio		
BIT4	Tension		
53	AI3 setting *		○
BIT0	Reel diameter		
BIT1	Stall setting		
BIT2	New reel preset		
BIT3	Taper tatio		
BIT4	Tension		
54	MC5 setting *		○
BIT0	Gain 2		
BIT1	Inching		
BIT2	Out remote		
BIT3	Cut torque		
55	MC6 setting *		○
BIT0	Gain 2		
BIT1	Inching		
BIT2	Out remote		
BIT3	Cut torque		
56	Full scale tension setting		○
57	Tension decimal point setting *		○
BIT1	×1 (×10N) / ×10 (N)		
BIT2	×0.1 (×10N) / ×1 (N)		
BIT3	×0.01 (×10N) / × 0.1 (N)		
58	Tension display time constant setting *	○	
BIT0	1/4 s		
BIT1	1/2 s		
BIT2	1 s		
BIT3	2 s		
BIT4	4 s		
59	Tension output time constant setting *	○	
BIT0	1/4 s		
BIT1	1/2 s		
BIT2	1 s		
BIT3	2 s		
BIT4	4 s		

Set value No.	Set item	Variable setting	System setting
60	Zero tension setting		○
61	Maximum diameter setting		○
62	Minimum diameter setting		○
63	Reel pulse number REEL.PLS. setting **		○
64	Reel diameter calculate cycle D CYCLE setting **		○
65	Maximum reel rotation velocity R MAX setting **		○
66			
67			
68			
69			
70	Switch-over menu No.		○

* : ON /OFF = 1 / 0

** : Valid when the diameter calculation unit LE-40MD is used.

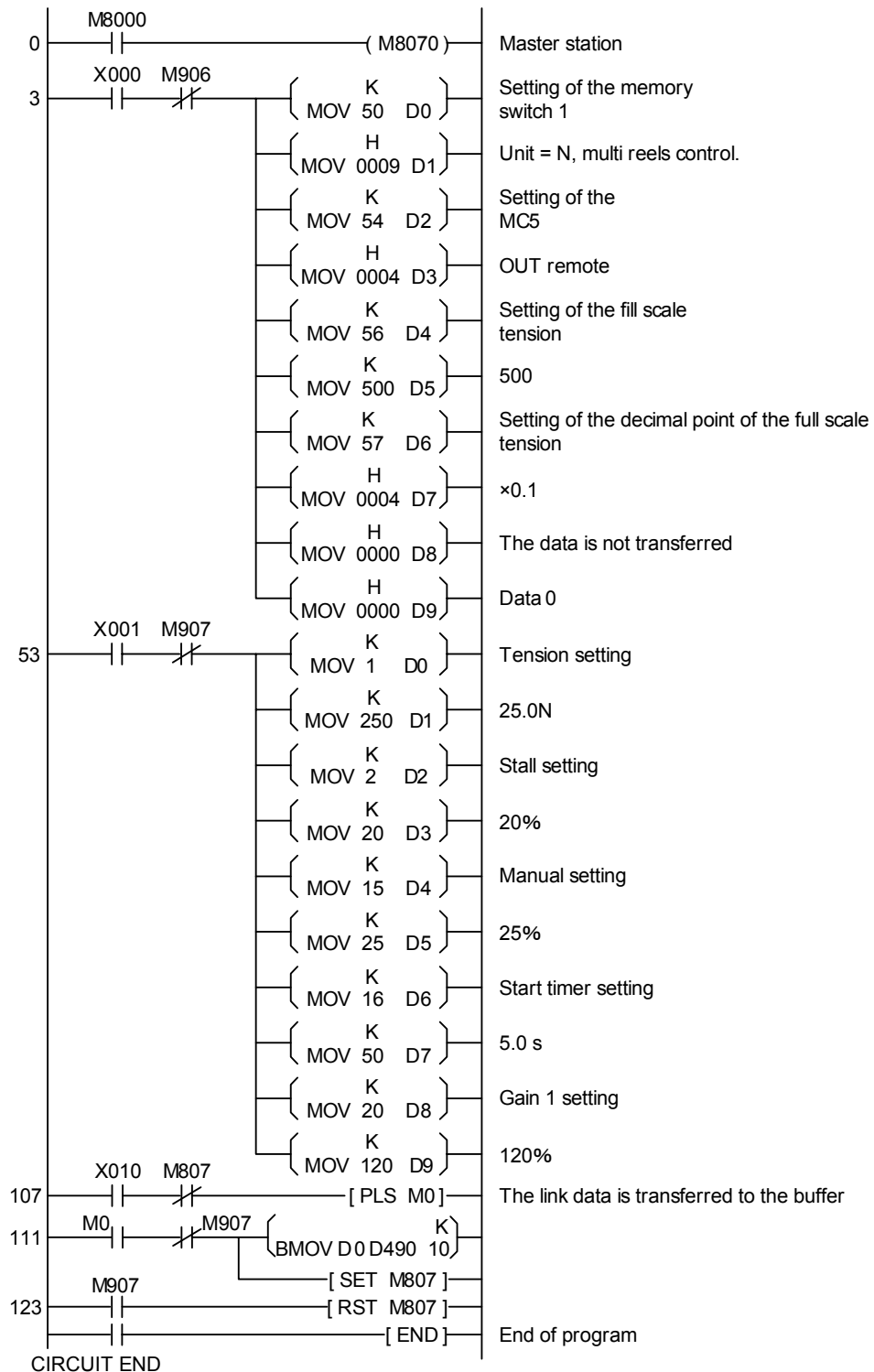
7. Example of program

After the data processing is completed in the LE-40MTB-E, the X0 is turned on while the M907 is turned off, then all set value are transferred at a time to the temporary buffers for link.

After the data processing is completed in the LE-40MTB-E, the X1 is turned on while the M907 is turned off, then the set values other than X1=ON are transferred to the temporary buffers for link.

When the X0 is turned on, the data is transferred from the temporary buffers for link D0`D10 to the link data transfer area D490`D499, then the sending start flag M807 is turned on.

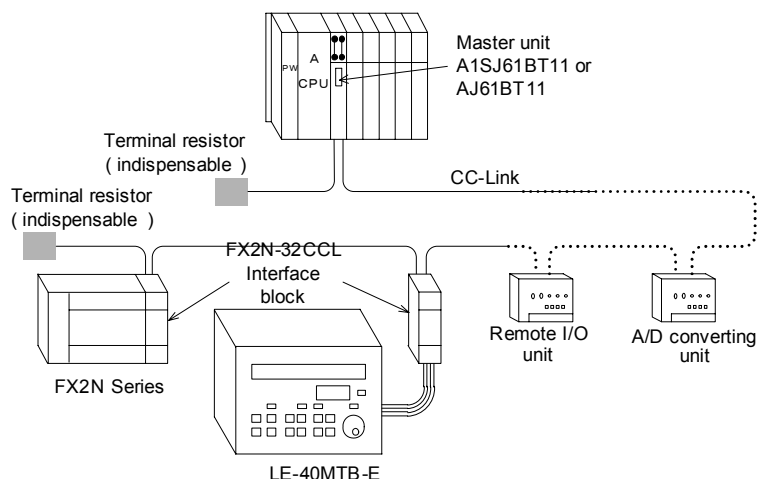
When the receiving completion flag M907 is turned on by the LE-40MTB-E, sending is completed.



9.8 Execution of CC-Link

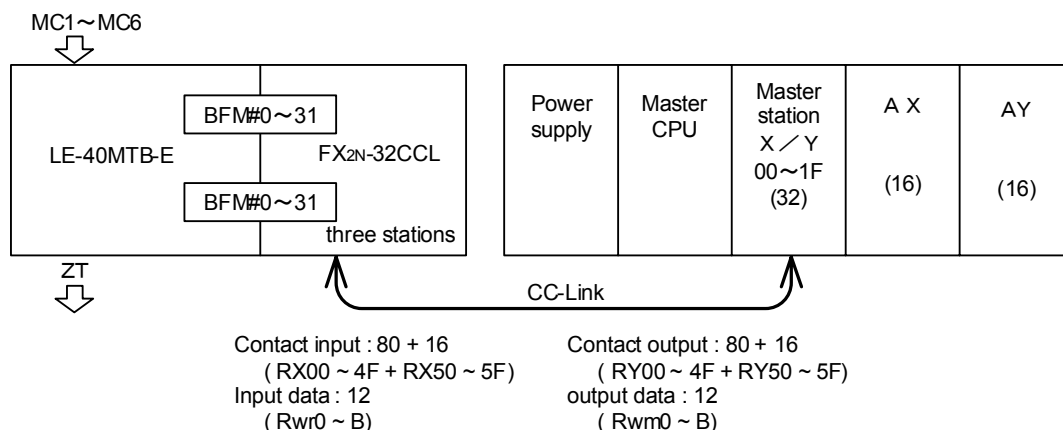
1. Outline

- When the tension controller LE-40MTB-E is linked to the CC-Link network, the data for the tension controller can be set on the master programmable controller and the control status of the tension controller can be monitored on the master programmable controller. The contact signal information and the data can be linked each other by simply connecting the FX2N-32CCL type CC-Link interface block for the FX2N series programmable controller to the extension connector of the LE-40MTB-E.



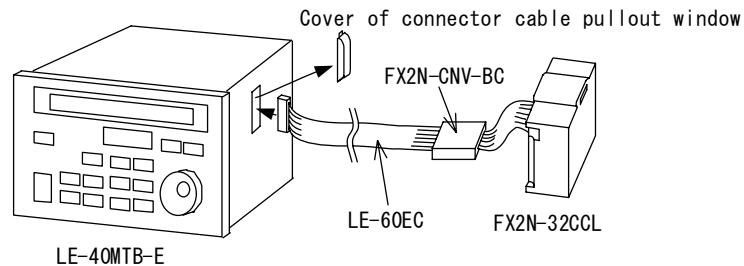
2. Transmission signal configuration

- By connecting the LE-40MTB-E tension controller to the FX2N-32CCL type interface block, the LE-40MTB-E works in the same way as the remote device station on the CC-Link network. The system program of the LE-40MTB-E is programmed to gain access automatically by executing FROM/TO commands against the buffer memory of the FX2N-32CCL. Therefore, the data can be sent and received by accessing this remote device station (FX2N-32CCL for LE-40MTB-E) through the program of the master programmable controller.
- The number of available stations for the FX2N-32CCL are four. The LE-40MTB-E occupies three stations of them, so duplication of the station numbers must be avoided for other remote device stations, remote I/O stations and remote stations.
The number of connected devices, the transmission speed, and the transmission distance are based on the common specifications of the CC-Link system. Refer to User's manuals of FX2N-32CCL and CC-Link master unit for the details.



3. Connection and Wiring

- Remove the cover of the window for pulling out the extension block connector cable provided on the right side of the LE-40MTB-E. Insert the LE-60EC type extension cable for the extension block sold separately into the connector provided inside the connector cable pull-out window. Connect the FX2N-32CCL type interface block to the connector with the lock lever provided on the opposite side.
- Refer page 7 to 9 of FX2N-32CCL type interface block User's manual for the details of the power cable and the connection cable to the CC-Link.

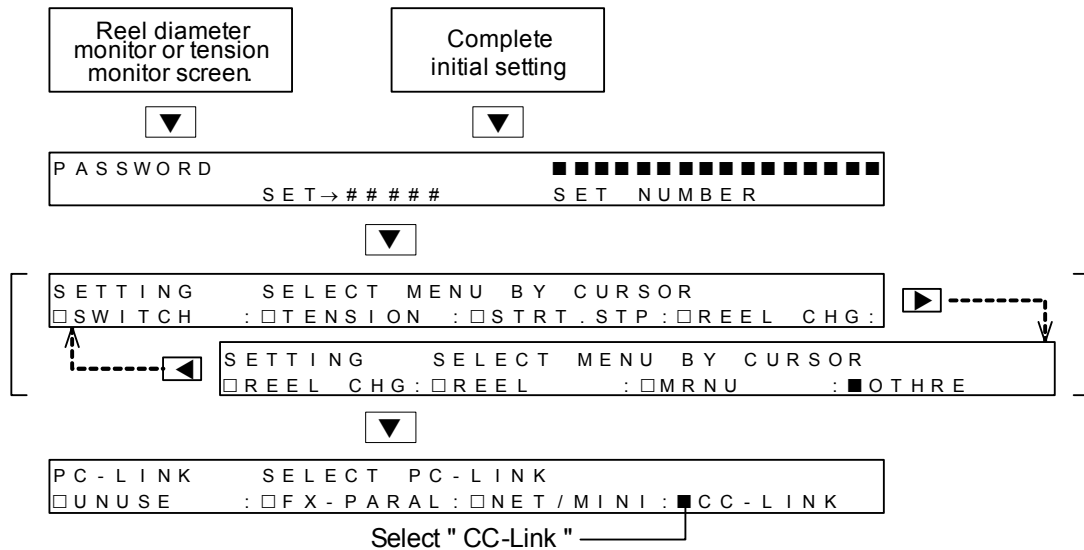


4. Setting the Station Numbers

- The local station numbers are required to be set to assign the address of the local stations to the master unit in the network. When the station numbers are set, the buffer memory is assigned for each local station on the master unit side. Set the station numbers of #1 to #64 using the station number setting switches on the FX2N-32CCL.
- Next, set the occupied station number using the occupied station number setting switches on the FX2N-32CCL. This number can be set to one to four for the FX2N-32CCL. However, the number of data devices to be linked to the LE-40MTB-E is limited to ten because of the specifications of the relation with other programmable controller link. Four devices per station can be linked in the FX2N-32CCL, therefore, set the occupied station number to three when connecting with the LE-40MTB-E. Note that ten data devices can be linked to the LE-40MTB-E at the maximum. Even if the occupied station number are set to four, the number of data devices to be linked remains ten.
- For example, when "#15" is set, three stations "#15, #16 and #17 are occupied. Never use a number which is already set for an other station.
Make sure to turn off the LE-40MTB-E when setting the station number and the occupied station number. If the setting is carry out with the LE-40MTB-E on, "L ERR" on the FX2N-32CCL blinks and the system considers it as an error.

5. Setting

To execute the CC-Link with the LE-40MTB-E, use the "PC-link " screen in " Other " on the engineer screen for setting.



5. Handling the link data

- When the link data is written into the LE-40MTB-E, the data whose data are for Menu 0 and for system data (items marked with ○ and ● in the system column of the table on page 81 and 82) exclusively are saved. Other data are not saved. When the data other than Menu 0 must be saved, save such data on the master programmable controller side.
- When the data is written in the LE-40MTB-E through link, it is written directly in the control table. Accordingly, the data in the menu table where the data of MENU 1 to MENU 7 are memorized are not updated. Because saving of the data for Menu 0 is controlled in the control table, the data area for Menu 0 is saved automatically. But because saving of the data for other menus is controlled in the menu table, the data obtained through link is not saved automatically.
- When you want to save the data for other than Menu 0 in the LE-40MTB-E, you must perform the manual operation. (Press the [ENTER] key twice. Refer to page 46 for the details.)
When there are more than eight menus, keep the data in the master programmable controller and use MENU 0 in the LE-40MTB-E.
- When the switch-over menu No. data (Set value No. 70) is updated on the master programmable controller side while the LE-40MTB-E is stopped (MC1 = OFF), the menu can be switched over through link.
- For all the link data, the priority is given to the last data. When the data currently set is updated through link, the updated data becomes effective immediately after the LE-40MTB-E receives it. When two or more set values are transferred in the same timing at the same time, the priority is given to the one having a larger data register No. in the link area. (The data whose device No. is larger will be processed later.)
- The contact data is an OR command. Accordingly, it becomes effective if the input on the LE-40MTB-E side is turned on. To control ON-OFF of the contact signal through the link, set the LE-40MTB-E input to OFF.

6. Linking the Contact Devices

- When the occupied station number of the FX2N-32CCL is set to three, the contact device can be linked with 80 points (work) + 16 points(system) for each input and output. However, the number of the contact devices which LE-40MTB-E can handle is eight each for input and output as shown in the table below.
- To access this device from the master programmable controller, read and write the buffer memory in the master unit by FROM/TO commands. The remote input (RX) reads and writes the numbers which correspond to the remote station numbers of the buffer memories #224(E0H) to #351 (15FH). The remote output reads and writes the numbers which correspond to the remote station numbers of buffer memories #352 (160H) to #479(1DFH).
- For example, if the host number of the FX2N-32CCL connected to the LE-40MTB-E is set to 1, RX0 to RX7 gain access to the buffer memory #224(E0H) and RY0 to RY7 gain access to the buffer memory #352(160H).

Device No.	Set item
RY0(M800)	MC1
RY1(M801)	MC2
RY2(M802)	MC3
RY3(M803)	MC4
RY4(M804)	MC5
RY5(M805)	MC6
RY6(M806)	MANUAL/AUTO
RY7(M807)	Sending to word data is completed.

Device No.	Monitor item
RX0(M900)	MC1
RX1(M901)	MC2
RX2(M902)	MC3
RX3(M903)	MC4
RX4(M904)	MC5
RX5(M905)	MC6
RX6(M906)	ZT
RX7(M907)	Sending to word data is completed.

7. Linking the Data Devices

- To access the data device from the master programmable controller, read and write the buffer memory in the master unit by FROM/TO commands in a similar way to the contact device.
- The remote register for write (RWw) to the remote is arranged in the buffer memories #480(1E0H) to #735(2DFH), and the remote register for read (Rwr) from the remote is arranged in the buffer memories #736(2E0H) to #991(3DFH).

- Transmission data from the LE-40MTB-E is written periodically (400ms/once) in the remote registers #0 to #9 of the FX2N-32CCL.

By reading out the remote register assigned to set the host number of the remote station from the master unit, the LE-40MTB-E's status can be monitored. For example, when the host number of the FX2N-32CCL is set to 1, the data from the LE-40MTB-E is transmitted to the buffer memories #736(2E0H) to #745(2E9H) in the master unit.

- The data is sent to the LE-40MTB-E by writing data in the remote register #0 to #9 of the FX2N-32CCL. Because the LE-40MTB-E can process up to five data (up to ten devices) at a time, the data should be written in combination with two operations by the two contact devices, such as the numeric data transmission completion flag and receipt completion flag. Though up to five data can be sent at a time, all the data in the table can be sent by sending it on the time sharing basis.

- By using the remote registers #0 to #9 of the FX2N-32CCL, the data setting numbers of the written data will be allocated to the even remote registers and the setting data will be allocated to the odd remote registers. Then, by operating the contact device for the numeric data transmission completion flag and receipt completion flag, the LE-40MTB-E writes the data into the specified setting value. For example, the host number of the FX2N-32CCL is set to 1, the data to the LE-40MTB-E will be written into the buffer memories #480 (1EOH) to #489(1E9H) of the master unit.

Data is transferred in the following way.

- [1] The data is sent to the buffer memories #0 to #9 in the local station.
- [2] The M807 in the remote station is turned on by the master station.
- [3] The LE-40MTB-E sends/receives the data.
- [5] The master station receives the M907.
- [4] When sending/receiving is completed, the M907 in the local station is turned on.
- [6] The M807 in the remote station is turned off by the master station.
- [7] The LE-40MTB-E receives "OFF" of the M807.
- [9] "OFF" of the M907 is received.
- [8] The M907 is turned off.
- [10] Data transfer is completed. The next data will be transferred.

When four or less data is sent, set "0" to the data to be sent to all the remaining remote registers having an even number. When data devices will not be transferred, set "0" to the data in the sending remote registers for the local station.

While the operation/stop [MC1] is turned on, the system setting data is neglected even if it is transferred. Make sure to transfer the data while the [MC1] is turned off.

The decimal point is neglected in any data.

- From LE-40MTB-E to the master programmable controller

BFM No.	Monitor item
#0	Total tension monitor
#1	Left tension monitor
#2	Right tension monitor
#3	Reel diameter monitor
#4	Target tension monitor
#5	SA output monitor
#6	TMO output monitor
#7	NRO output monitor
#8	40MD ROTA monitor
#9	40MD ROTB monitor

- From the master programmable controller to LE-40MTB

Set value No.	Set item	Variable setting	System setting
1	Tension setting	○	
2	Stall value setting	○	
3	Initial diameter setting **	○	
4		○	
5	New reel preset value setting	○	
6	Taper ratio setting	○	
7	Corner 1 setting	○	
8	Taper 1 setting	○	
9	Corner 2 setting	○	
10	Taper 2 setting	○	
11	Corner 3 setting	○	
12	Taper 3 setting	○	
13	Corner 4 setting	○	
14	Taper 4 setting	○	
15	Manual setting	○	
16	Start timer setting	○	
17	Stop timer setting	○	
18	Stop gain setting	○	
19	Stop bias setting	○	
20	Gain 1 setting	○	
21	Gain 2 setting	○	
22	New reel preset timer setting	○	
23	Old reel cut torque setting	○	
24	Mechanical loss setting for reel A	○	
25	Mechanical loss setting for reel B	○	
26	Measurement length LOUT L1 setting **	○	
27	Measurement length LOUT L2 setting **	○	
28	Measurement length LOUT L3 setting **	○	
29	Reel diameter DOUT Y1setting **	○	
30	Reel diameter DOUT Y2 setting **	○	
31	Reel diameter DOUT Y3 setting **	○	
32	Reel rotation velocity coefficient R CURR. setting **	○	
33	Reel rotation velocity bias R BIAS setting **	○	
34	Start gain R GAIN (ROUT gain) setting **	○	
35	Start timer R TIMER (ROUT timer) setting **	○	
36	Predrive time PD TIME setting **	○	
37	Predrive bias PD BIAS setting **	○	
38	Reel diameter electronic gear DIA.GEAR setting **	○	
39	Velocity electronic gear SPD.GEAR setting **	○	
40	Reel diameter setting **	○	
41			
42			
43			
44			
45	Proportional gain setting	○	
46	Integral time setting	○	
47	Dead zone gain setting	○	
48	Dead zone width setting	○	
49			

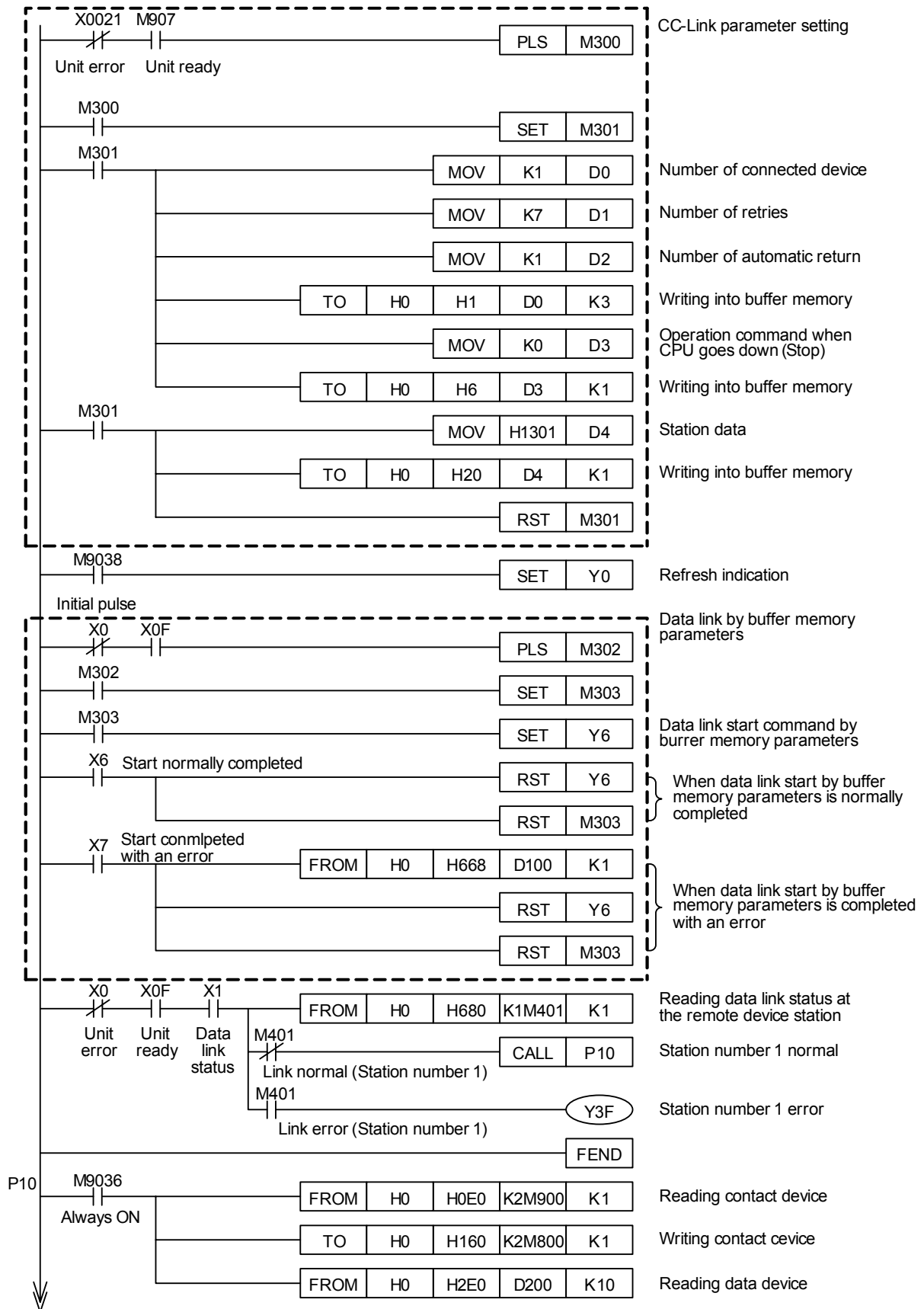
Set value No.	Set item	Variable setting	System setting
50	Memory switch setting 1 *		○
BIT0	Unit of tension (N / ×10N)		
BIT1	Control reel (winding / unwinding)		
BIT2	(intremediate reel / winding reel)		
BIT3	Number of reels (multiple reels / one reel)		
BIT4	Taper control (used / unused)		
BIT5	Broken line taper (broken line / straight line)		
BIT 6	Taper diameter signal (external / internal)		
51	Memory switch setting 2 *		○
BIT0	Actuator (servo / powder)		
BIT1	Automatic control gain (manual / automatic)		
52	AI2 setting *		○
BIT0	Reel diameter		
BIT1	Stall setting		
BIT2	New reel preset		
BIT3	Taper tatio		
BIT4	Tension		
53	AI3 setting *		○
BIT0	Reel diameter		
BIT1	Stall setting		
BIT2	New reel preset		
BIT3	Taper tatio		
BIT4	Tension		
54	MC5 setting *		○
BIT0	Gain 2		
BIT1	Inching		
BIT2	Out remote		
BIT3	Cut torque		
55	MC6 setting *		○
BIT0	Gain 2		
BIT1	Inching		
BIT2	Out remote		
BIT3	Cut torque		
56	Full scale tension setting		○
57	Tension decimal point setting *		○
BIT1	×1 (×10N) / ×10 (N)		
BIT2	×0.1 (×10N) / ×1 (N)		
BIT3	×0.01 (×10N) / × 0.1 (N)		
58	Tension display time constant setting *	○	
BIT0	1/4 s		
BIT1	1/2 s		
BIT2	1 s		
BIT3	2 s		
BIT4	4 s		
59	Tension output time constant setting *	○	
BIT0	1/4 s		
BIT1	1/2 s		
BIT2	1 s		
BIT3	2 s		
BIT4	4 s		

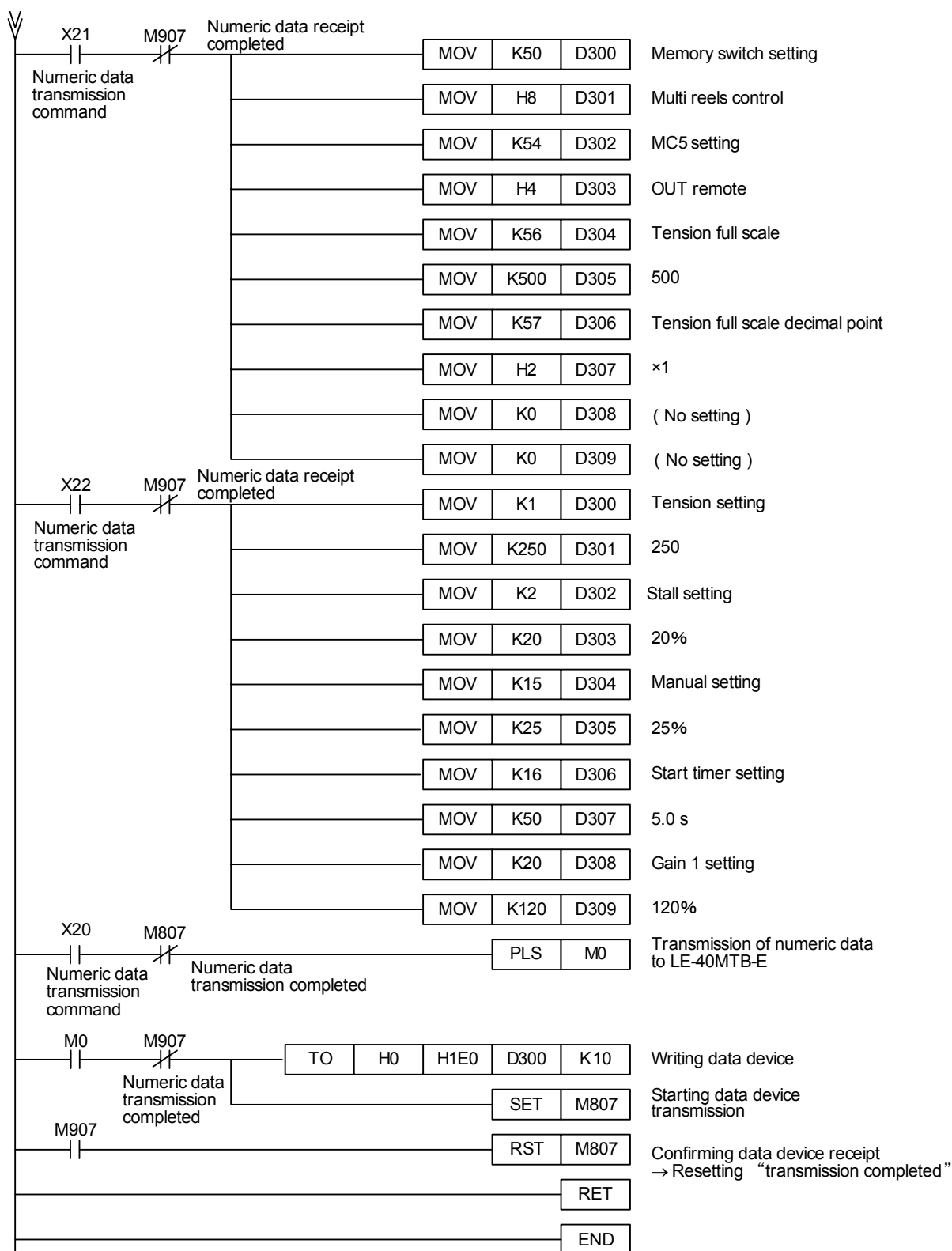
Set value No.	Set item	Variable setting	System setting
60	Zero tension setting		○
61	Maximum diameter setting		○
62	Minimum diameter setting		○
63	Reel pulse number REEL.PLS. setting **		○
64	Reel diameter calculate cycle D CYCLE setting **		○
65	Maximum reel rotation velocity R MAX setting **		○
66			
67			
68			
69			
70	Switch-over menu No.		○

* : ON /OFF = 1 / 0

** : Valid when the diameter calculation unit LE-40MD is used.

8. Example of program





This referential program is made by a master I/O structure based on the structural figure of the transmission signal structure on page 62. Data link start of the CC-Link shows the start with the buffer memory parameters.

To start with the EEPROM parameters, enter the parameters in the EEPROM in advance and then read out the parameters. Refer to FX2N-32CCL model CC-Link interface User's manual or Master unit manual.

10. Inspection and Maintenance

10.1 Initial inspection

1. Confirmation of selection

- Before starting operation, make sure that the tension detector, actuator, power-amplifier, servo amplifier and E / P regulator are selected correctly.
- The P-N output of the tension controller LE-40MTB-E is designed as 24 VDC, 4 A or less.
The actuator capacity is selected based on the line speed multiplied by the operating tension.
A larger tension can be set in the LE-40MTB-E. However, in the case, the actuator may be burned out.
Make sure that the operator is instructed appropriately as to the allowable maximum operating tension.
- If the set tension is too small, the tension fluctuation become too large compared with the operation tension when the unit is started or stopped, and operation may be difficult.
Make sure that the operator is instructed appropriately as to the allowable minimum operating tension also. The guideline of the minimum operating tension is shown below.

2. Operation sequence

- Check the operation sequence and emergency stop sequence.
Especially when the servo motor is used as actuator, the motor may become out of order if the material is cut.
Use the material cut detector and the zero tension detection output of the LE-40MTA-E together, and set the speed limit input of the motor to 0 when the material is cut.

3. Wiring check

- Erroneous connection of the power terminal (Pay attention to the phase order in the motor system also.), contact of the DC I/O 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 I/O cable is wired correctly.
- Never perform the megger test (measurement of insulation resistance).

10.2 Maintenance

- Check periodically the following items:
The temperature inside the panel is not abnormally high due to heat generating substance or direct sunlight.
Dusts and conductive dusts are not inserted into the panel.
Incorrect wiring, loose terminals and other abnormality are not detected.
- It is ideal to adjust the zero point and span in the tension detector again at each periodic 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.
- The zero tension relay offers the service life of 500,000 (five hundred thousands) times against the load of 35 VA or less. Accordingly, no problem will occur in the zero tension relay if it is not actuated abnormally frequently.

10.3 Error display

The table below shows the error messages displayed on the screen and the countermeasures.

Type	Message	Trouble shooting	
Hardware	OUTPUT OFF	Turn on the OUTPUT ON/OFF switch on the panel or OUT remote switch.	
	AUX.OUT.IS SHORT	Open the auxiliary power output terminal(S1~S2) and check the output voltage. If the output voltage is DC 12V, check the load (less 2A or not) and outer wiring. If the output voltage is not obtained, the LE-40MTB-E is defective.	
System parameter	REEL ERROR	Check *2 and *3 of selection item described in page 81.	When completion of the initial setting is confirmed or when the AUTO switch is pressed while the operation /stop input is turned off, error check is performed.
	SET PARAMETER	The minimum diameter and maximum diameter must be set in accordance with the reel diameter input of 0~ 5V.	
Tension detector Zero/Span adjustment	THE DETECTION ROLLER IS TOO HEAVY!	It is thought that the mass of the tension detection roller is heavier than the rated load of the tension detector. Check the mass of the detection roller. It is necessary to select the detector again if necessary. Refer to page 76 for details.	
	SPAN TUNING TARGET WEIGHT IS TOO LIGHT!	The weight at the span adjustment is too light in 1/3 or less of the tension full scales. Make the weight heavy and execute the span adjustment again.	
	DETECTED LOAD IS TOO LIGHT!	The output voltage of the tension detector is too low. Because the rated load of the tension detector is larger than that of the drive tension, it is necessary to select the tension detector again. Refer to page 76.	
	CHANGE WH _ - GR _ CONNECT WIRE!	The wiring for the tension detector is opposite. Exchange the terminals [GRR] and [WHR]each other as well as the terminals [GRL]and [WHL]each other. Refer to the part of the tension detector on page 14 for details.	
	NO LOAD TO THE DETECTION ROLLER!	Put the weight on the tension detection roller and execute the adjustment again.	
	DETECTED LOAD IS TOO HEAVY!	The output voltage of the tension detector is too high. Because the rated load of the tension detector is smaller than that of the drive tension, it is necessary to select the tension detector again. Refer to page 76.	
Data transfer between memory cassette	CASSETTE TYPE ERROR	Use the memory cassette FX-EEPROM-4/8 sold separately.	
	WRITE PROTECT ON. TURN OFF SW	Turn off the write protect switch in the memory cassette.	
	DATA ERROR	After writing or reading, data is automatically collated. If this error message is displayed,replace the memory cassette.	
Reel diameter calcuration (LE-40MD)	OUT OF GEAR RATIO RANGE	The teaching result of the velocity gear is out of the electronic gear set range. Check the specifications of the measure pulse rate, reel pulse number per rotation, gear ratio.	

10.4 Unintended operation

Check the abnormality of the major components during trial operation and adjustment and during actual operation using the following procedure.

Item	Problem	Disposal
Power supply	When the POWER switch is turned ON, the POWER LED 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.
Tension display and abnormal tension	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.)
	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 [MC1] input signal depending on the run/stop status of the machine. If the [MC1] 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 [MC1] 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 [MC1] input signal when stopping the machine.
	The output increases while the machine halts.	<ul style="list-style-type: none"> • The [MC1] input signal may not be turned OFF. • While the machine is stopped, be sure to turn off the [MC1] input signal.
	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. • Reset the stall memory.
	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-40MTB-E tension controller. In this case, please adjust the control gain factor refer to Sec. 7.5.
Actuator	Output cannot be obtained in the manual mode.	<ul style="list-style-type: none"> • Make sure that the OUTPUT ON/OFF switch is turned on. • When 0 to 24 V output is obtained between the terminals [P] and [N] by the manual torque setting, check the wiring to the powder clutch/brake. When no abnormality is detected, the clutch/brake is defective or selected inappropriately. • If the output voltage is not obtained in the no-load condition when the power is changed from off to on, the LE-40MTB-E is defective. If the short-circuit protection function between the terminals [P] and [N] is actuated, the unit becomes the normal condition when the wiring is corrected and the power is turned on again. • If 0~5V output is not obtained between the terminals [SA] and [SN] and the terminals [NRO] and [AOC], remove the external load (1kΩ or more) and check whether 0~5V is obtained. • If 4~20mA output is not obtained between the terminals [EAP] and [EAN], remove the E/P regulator (470Ω or less), connect the ammeter between the terminals [EAP] and [EAN], then check whether 4~20mA output is obtained. • While the memory cassette is attached, the control output is not generated.

Item	Problem	Disposal
Input signal	The contact signal and the analog voltage signal are not input properly.	<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-40MTB-E 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.
Others	Material gets loose during acceleration or deceleration.	<ul style="list-style-type: none"> • The material tends to get loose if the acceleration/deceleration time is too short or the material inertia is too high. Use gain 1 or gain 2 to compensate the inertia during acceleration and deceleration.
	Material is displaced or gets too tight during winding.	<ul style="list-style-type: none"> • The taper control is recommended.

Check the system as per the following procedure if the zero/span adjustment would not complete.

Item	Problem	Disposal
Tension detector	Zero adjustment is not possible.	<ul style="list-style-type: none"> • If the voltage between the terminals [RED] and [BLK] is not approximately 5.0 VDC, remove the wiring of this terminal and measure the voltage. If the specified voltage is not obtained, the LE-40MTB-E is defective. • If the specified voltage is obtained, the external wiring or tension detector is defective. • Remove the wiring in the tension detector. Short-circuit the terminals [WHR] and [GRR] as well as the terminals [WHL] and [GRL]. If zero adjustment is not possible still, the LE-40MTB-E is defective. • Connect the terminals [RED] and [BLK] exclusively to the tension detector. If the voltage between the white and green cables in the tension detector is 120 mVDC (150mV DC x 0.8) or less with which the current is not applied in the material and zero adjustment is not possible, the LE-40MTB-E is defective. If the measured voltage exceeds 120mV, the tension detector selected is not appropriate. (The tare weight is 80% or more of the rated load.)
	Check the wiring in accordance with page 5.	
	Span adjustment is not possible.	<ul style="list-style-type: none"> • Perform zero adjustment at first. Connect the terminals [RED] and [BLK] exclusively to the tension detector. Measure the voltage between the white and green cables in the tension detector. • When span adjustment 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 (150mVDC x 0.2) or more, the LE-40MTB-E 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 adjustment 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.
	Check the wiring in accordance with page 5.	

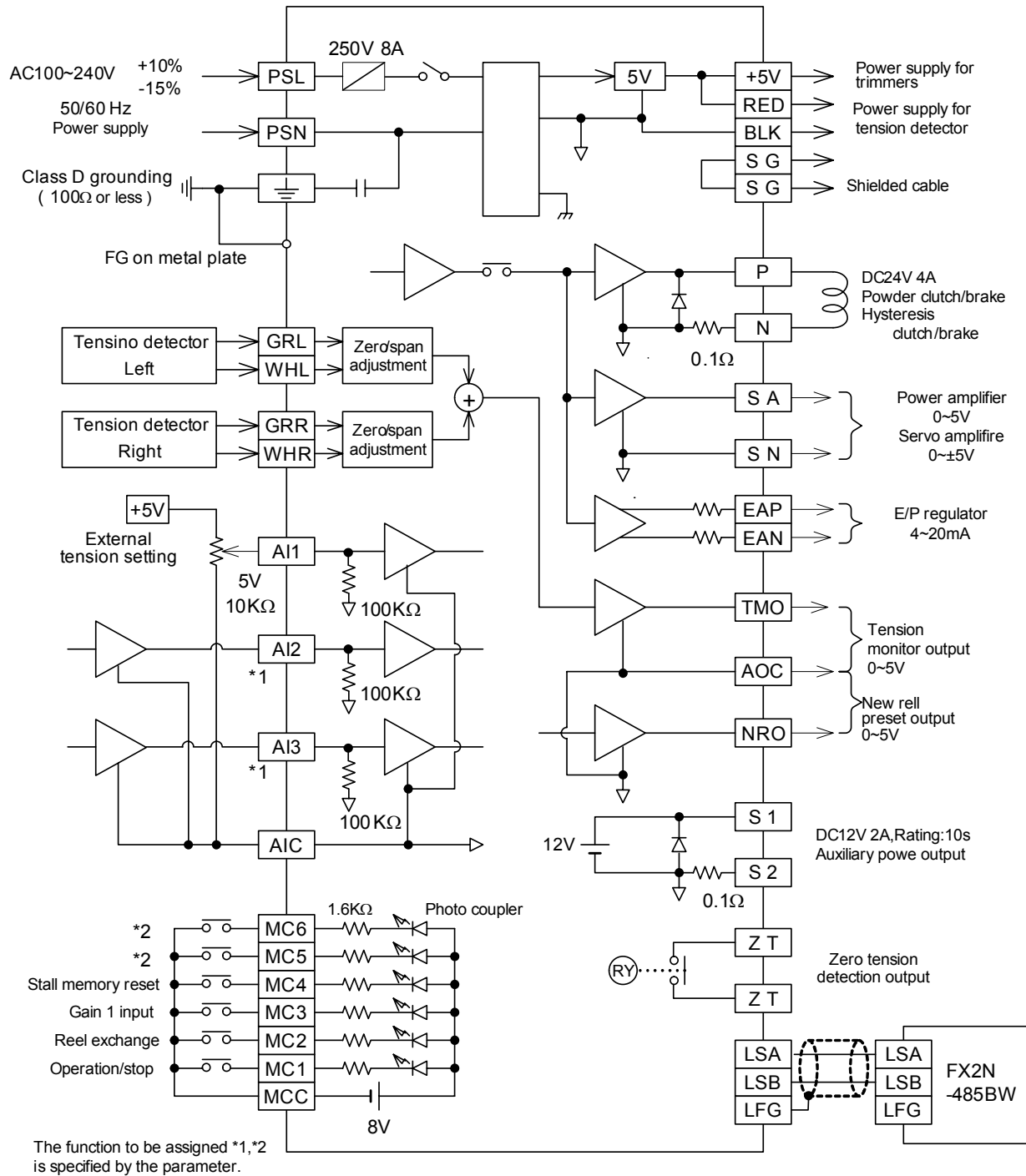
11. Specifications

11.1 I / O Specifications

Items		Terminal	Specifications		
Power supplies	Input	PSL	100 ~ 240V AC +10 ~ -15% 50/60 Hz 400VA		
		PSN	Power fuse (250V 8A) built in Allowable instantaneous power interruption:10ms		
	Output	S1(+)	Auxiliary power supply: 12 VDC, 2 A, Rating: 10 s		
		S2(-)			
		RED(+)	Power supply for tension detectors		
		BLK(-)			
		+5V(+)	Service power supply for external trimmer 5V DC, 50mA or less		
		AIC(-)			
Contact signals	Input	MCC	Contact input common terminal	8V DC, 4mA/terminal	
		MC1	Operation/stop ON=Automatic operation, OFF=Stop		
		MC2	Reel exchange signal OFF=Reel A, ON=Reel B		
		MC3	Gain 1 Gain 1 is effective during ON.		
		MC4	Stall memory reset One-shot input for approx. 0.5 s		
		MC5	Gain2 : Gain 2 is effective during ON. Inching : Lower output limit is effective. Stall memory update is stopped. OUT remote : Control output is ON during ON. Cut torque : Lower output limit is effective during ON (for cutter).		
		MC6	EXT tension : ON ----- External input is valid. OFF----- Setting from the panel is valid. Each function is assigned by parameter.		
	Output	ZT	• Zero tension detection output. Set value : 0~1999 N (199.9 kgf)		
		ZT	• Output becomes ON when tension does not exceed set value. • Output is always OFF when "0" is set. (However, output becomes ON regardless of set value and tension when watch dog timer is actuated.) • 250V AC, 0.5A or 30V DC, 0.5A		
	Analog signals	Input	GRL	Left	Tension detector signal. GR=green, WH=white • Number of detectors(one or two) is specified by parameter. • Connection varies depending on load type(compression or tension). • When one detector exclusively is used,terminals[GRL] and [WHL] must be short-circuited.
WHL					
GRR					
WHR			Right		
AI1			External tension setting 0 ~ 5 VDC corresponding to 0 ~ full-scale tension		
AIC			Internal resistance : 100 kΩ Recommended trimmer: 10 kΩ		

Items		Terminal	Specifications		
Analog signals	Input	AI2	Diameter : Reel diameter signal for external taper control. 0 ~ 5 V corresponding to minimum value to maximum value. Stall : External stall setting signal. 0 ~ 5 V corresponding to 0 ~ 100% output torque. New reel : New reel preset 0 ~ 5 V corresponding to 0 ~ 100% output torque. Taper ratio: External taper ratio setting 0 ~ 5 V corresponding to: • 0 ~ 80% (internal diameter taper) • 0 ~ 100% (external diameter taper) Tension : Auxiliary tension input 0 ~ 5V corresponding to 0 to full-scale tension • Function is specified by parameter. • Internal resistance:100kΩ		
		AI3			
	Output	SA	Control signal output • Powder mode : 0 ~ 5 VDC	For power amplifier servo amplifier	
		SN	• AC servo mode : 0 ~ ±5 VDC • Load resistance : 1 kΩ or more		
		NRO	New reel preset output • Effective exclusively when "REELS" mode is selected.		
		AOC	• 0 ~ 5 VDC • Load resistance : 1 kΩ or more		
		TMO	Tension monitor output • Filter can be adjusted by parameter.	For tension meter recorder	
		AOC	• 0 ~ 5 VDC • Load resistance : 1 kΩ or more		
		EAP	Control signal output for E/P regulator • 4 ~ 20 mADC	For air clutch air brake	
		EAN	• Load resistance : 470 Ω or less		
		P	Power output for 24 VDC system powder clutch/brake and hysteresis clutch/brake.		
		N	• 0 ~ 24 VDC, 4 A or less		
	Interface signals		LSA	For parallel link connection of FX2 series programmable controller.	
			LSB		
LFG					
Connector			Serial port for connecting MELSEC NET/MINI-S3 interface unit, CC-Link interface unit or LE-40MD reel diameter calculation unit.		

11.2 I / O interface



PSL	PSN	ZT	P	SI	MCC	MC2	MC4	MC6	+5V

AI2	GRL	RED	BLK	GRR	SA	EAP	AOC	NRO	LSA
AI3	WHL	SG	SG	WHR	SN	EAN	TMO	LSB	LFG

11.3 Various setting values

The items indicated with white letters on a black ground must be always set. Another items are set in accordance with the function used.

Set items	Set values	Unit	Set range		Initial value	Memory *1		Setting during operation *3	Mainly refer page
			Minimum	Maximum		Menu	Syst.		
Tension	Tension setting	Tension set value (N)	N	0.1, 1 or 10 ~ FS tension	—	⊙		○	18
		Tension set value(×10N)	N	0.01, 0.1 or 1 ~ FS tension	—	⊙		○	18
	Full scale tension	Full scale value	—	1 1999	500		●	×	12
		Decimal point (N)	—	0.1, 1.0 or 10	×1		●	×	12
		Decimal point (×10N)	—	0.01, 0.1 or 1	×0.1		●	×	12
	Tension detector	Zero adjustment	—	0 0	0		● *2	×	12
		Span adjustment target value	N ×10N	1 digit ~ FS tension (1/3 or more of FS tension)	500 50.0		● *2	×	12
	Filter	Display time constant	s	1/4, 1/2, 1, 2, or 4	1/2		○	○	35
		TMO output time constant	s		1/2		○	○	42
	Zero tension detection value	Zero tension (N)	N	0 1999	0		○	×	36
		Zero tension (×10N)	×10N	0 199.9	0.0		○	×	36
	Manual setting	Manual set value	%	0 100	—	⊙		○	18
Taper	Linear taper	Taper ratio(int. diameter)	%	0 80	0	⊙		○	31
		Taper ratio(ext. diameter)	%	0 100	0	⊙		○	32
	Non-linear taper	Corner 1~4	mmφ	0 2000	0	⊙		○	33
		Taper 1~4	%	0 100	0	⊙		○	33
Start	Stall	Stall set value	%	0 100	20	⊙		○	15
	Timer	Start timer	s	0.0 10.0	4.0	○		○	28
Output gain	Gain 1	Gain 1	%	5 400	100	○		○	29
		Gain 2	%	5 400	100	○		○	29
New reel /old reel switch-over	New reel preset value	New reel preset value	%	0 100	50	⊙		○	25
		Preset timer	s	0.0 30.0	4.0	○		○	25
		Old reel cut torque	%	0 100	10	○		○	38
Stop control	Stop timer	Stop timer	s	0.0 100.0	6.0	○		○	28
		Stop gain	%	5 400	100	○		○	28
		Stop bias	%	0 50	0	○		○	28
Mechanical loss correction	Reel A	Powder mode	%	0 100	0	○		○	37
		AC servo mode	%	—50 100	0	○		○	37
	Reel B	Powder mode	%	0 100	0	○		○	37
		AC servo mode	%	—50 100	0	○		○	37
Reel diameter	Minimum diameter	Minimum diameter	mmφ	0 2000	100		●	×	32
		Maximum diameter	mmφ	Minimum set diameter 2000	1000		●	×	32
Control gain	Manual setting	Proportional gain (P gain)	%	0 100	50	○		○	35
		Integral time	%	1 100	50	○		○	35
		Dead zone gain	%	0 100—P gain	0	○		○	35
		Dead zone width	%	0 100	50	○		○	35
	Automatic gain setting	Addition torque	%	0 100	20	○		○	34
Password		—	—	0 32767	4095			○	10

When LE-40MD reel diameter calculation unit is connected, refer to the instruction manual of the LE-40MD.

*1 : Classification in memory column

Menu refers to the data saved in the menu table memory.

System refers to the data saved as common data in the system memory.

*1 : Symbol in memory column

⊙ : Data set on the operator screen.

○ : Data set on the engineer screen displayed after the password is entered.

● : Data set on the engineer screen displayed after the password is entered or displayed for initial setting.

*2 : The initial adjustment constants are saved in the system memory.

*3 : The setting of the item marked with " × " on the " Setting during operation " column cannot be changed while the MC1 input is turned on.

11.4 Selection item and analog data

1. Selection item ----- The items cannot set during operation.

Set item	Description	Initial set	Memory *1		Setting during operation *4	Mainly refer page
			Menu	System		
Selection item	Control while stop timer	feed back / Fixed	feed back	○	×	26
	Unit of tension	×10N / N	N	●	×	8
	Control reel	Unwinding / Winding / Feed	Unwinding	●	×	9
	Number of reels	One reel / Multi reels	One reel	●	×	9
	Taper control	OFF / ON	OFF	●	×	29
	Taper signal	Internal / External	Internal	●	×	29
	Taper mode	Linear / Nonlinear	Linear	●	×	30
	Actuator	Powder / Servo	Powder	●	×	9
	Stall reset	MC4 / MC4+OUT SW.	MC4+OUT SW.	●	×	14
	AI2/AI3 setting	Diameter / Stall / New reel preset / Taper ratio / Ext. tension	Not set	●	×	68 *2
	MC5/MC6 setting	Gain 2 / Inching / OUT remote / Cut torque / Ext. tension	Not set	●	×	67 *3
	Number of detectors	2 / 1	2	●	×	9
	Pc-link	Unuse/FX-parallel/NET/MINI/CC-link		●	×	47
	Automatic gain	Automatic / Manual	Manual	○	○	32
	Registration of menu titles	Menu mane of the menu1~menu7.		○		45

*1 : Refer to the note in the previous page.

*2 : Setting of MC5, MC6

When the control reel is set to one reel or the feed reel, never set the [cut torque] to MC5 or MC6.
Set the [cut torque] exclusively when multiple reels are selected.

*3 : Setting of AI2, AI3

When the control reel is set to the feed reel, never set the[taper ratio]or the[diameter] to AI2 or AI3.
Set the[taper ratio] or the[diameter] exclusively when the control reel is set to[winding] or[unwinding]
When the taper signals set to [external], make sure to set the winding diameter to AI2 or AI3.
When the control reel is set to one reel or the feed reel, never set the [new reel preset] to AI2 or AI3.
Set the [new reel preset] exclusively when multiple reel are selected.

*4 : The setting of the item marked with " × " on the " Setting during operation " column cannot be canged while th MC1 input is turned on.

2. Analog data

Name		Unit	Digital data for analog value of 0~5V	Increment	Remark
Internal	Manual torque	%	0 ~ 100	1	
	Tension setting	N	0 ~ full scale tension	1	
		×10N		0.1	
External	Tension setting(AI1)	N	0 ~ full scale tension	1	Terminals AI2 and AI3 are set by parameters.
		×10N		0.1	
	Tension detector (auxiliary)	N	0 ~ full scale tension	1	
		×10N		0.1	
	Taper ratio setting	%	0~80%(0=Settension):Int.diameter	1	
			0 ~100%(0=Set tension):Ext.diameter		
	Stall setting	%	0 ~100%	1	
	New reel preset	%	0 ~100%	1	
Diameter input	mmφ	min. diameter ~ max. diameterAO2000	11		

- These inputs are always valid even if set screen is not displayed.
- These analog values are digitized by 12-bit A/D converter.

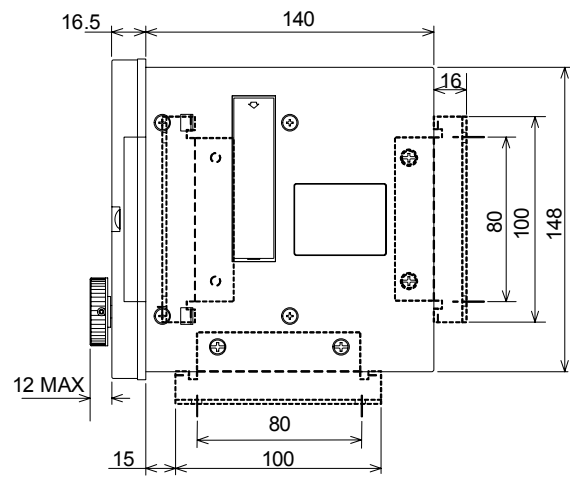
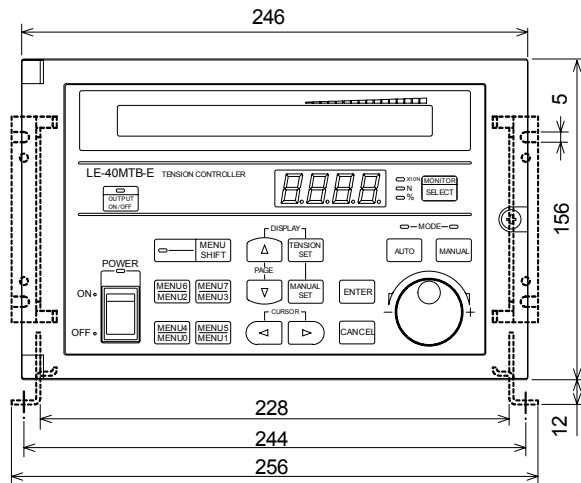
3. Monitor data

The monitor data contains the following items, and is not saved if power is interrupted.

- Tension monitor, total(N,×10N)
- Tension monitor, left (N,×10N)
- Tension monitor, right (N,×10N)
- Control output(0~100%)
- Tension, target (N,×10N)
Value based on the set tension while taking the decrease ratio of the taper tension into account.
- Reel diameter input(min. diameter ~ max. diameter)

11.5 Outside dimensions and general specification

1. Outside dimensions



Accessories

Main unit mounting legs : One pair
Screws fixing main unit and mounting legs : M4 × 10 ,4screws

Weight : Approximately 3.5 kg
Painting color : Munsell 7.5Y 7.5/1

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

When the unit is installed on the floor or wall, use these screws to fix the main unit and mounting legs.

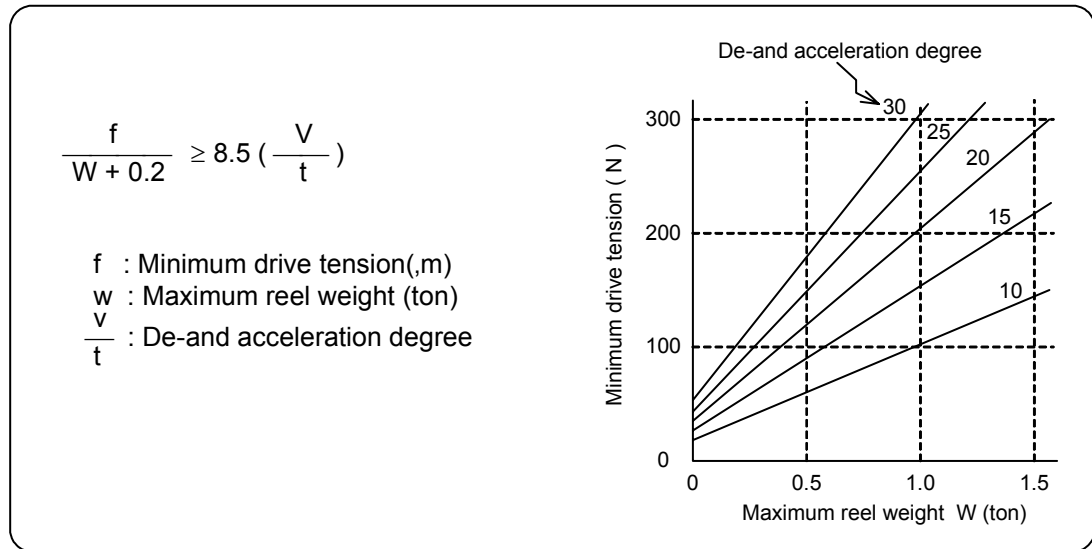
2. General and environmental specifications

Ambient temperature	0 ~ 40°C during operation	
Ambient humidity	80% RH or less (no condensation) during operation	
Vibration resistance	10 to 55 Hz, 0.5mm (4. 9m / s ² maximum), 2 hours in each of three axis directions .	
Impact resistance	98m / s ² , 3 times in each of three axis directions.	
Supply noise resistance	By noise simulator with 1,000 Vp-p noise voltage, 1 μs noise width and 30 to 100 Hz cycle.	
Withstand voltage	1,500V AC, 1 minute	Entire terminals as a whole and between the ground terminal.
Insulation resistance	5MΩ or more by 500V DC megger	
Grounding	Solid grounding (100Ωor less)	
Operating atmosphere	No corrosive gas and little dust	
Power switch cycles	Less than 20,000 times	

11.6 Supplement

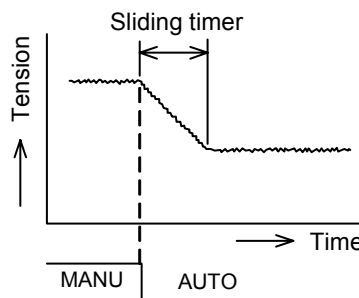
1. Rough estimate of minimum drive tension

The minimum drive tension which can be driven in torque controller can be requested by next outline type. When this is graphed, it is a right picture.



2. Sliding timer

The function is used to execute the operation smoothly, for prevention of undershoot due to sudden decrease of tension when the mode is changed from manual control mode to the automatic control mode. It is determined automatically during operation.



The sliding timer is determined automatically in accordance with the following equation.

Sliding timer

$$= \left\{ \left(\text{Tension detected during manual operation} \right) - \left(\text{Target tension for automatic operation} \right) \right\} / \text{full-scale tension} \times 25 \text{ sec.}$$

TENSION CONTROLLER
MODEL **LE-40MTB-E**